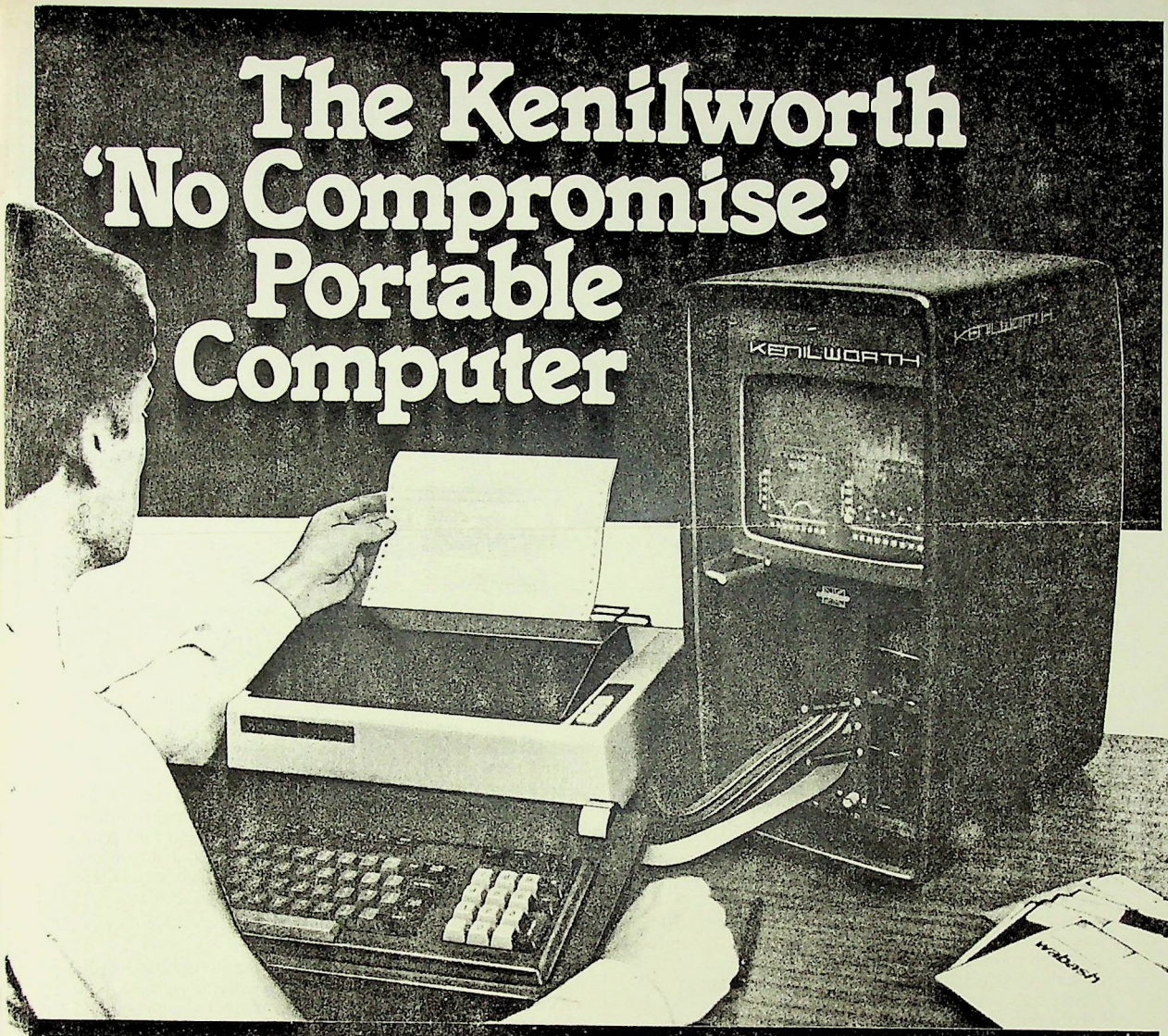
The Kenilworth 'No Compromise' Portable Computer



The
KENILWORTH
portable computers are 'no compromises' data processing or computational tools.

Built in two distinct models:

KENILWORTH 83G

This is the cost effective CP/M machine
with all the features the business person needs.

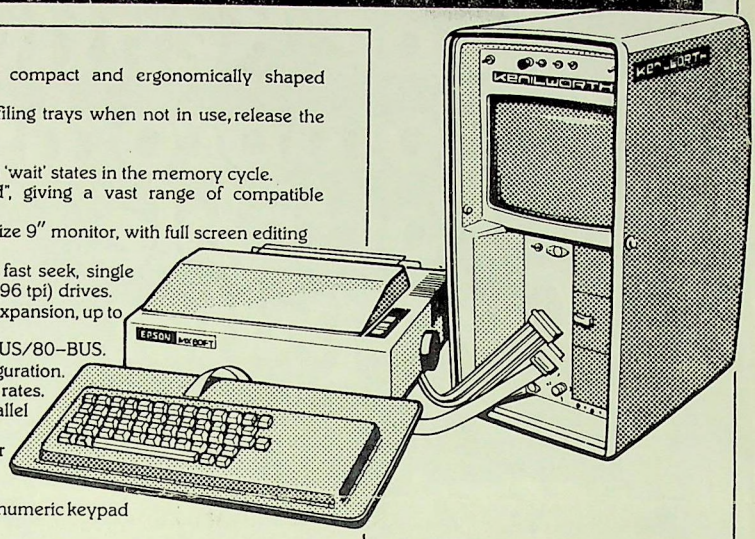
KENILWORTH 83N

This is the high resolution colour graphics machine that really gets the results flowing for the engineer, scientist, or business executive who requires not only the power of a modern microcomputer, but the ability to give a polished, professional display of those results.

Kenilworth 83G & 83N

Both models have the following features:

Overall size	19″ x 14.5″ x 9.5″. Really compact and ergonomically shaped to carry.
Desk "footprint"	14″ x 9.5″. As small as your filing trays when not in use, release the keyboard and away you go.
Weight	28 lb. Robust and portable.
Processor	Z80A running at 4 Mhz with no 'wait' states in the memory cycle.
Operating system	CP/M, the "Industry Standard", giving a vast range of compatible software.
Screen	80 column x 25 lines on a full size 9″ monitor, with full screen editing under CP/M.
Disk storage	0.75 Megabyte on dual TEAC, fast seek, single sided, double density, 80 track (96 tpi) drives.
Power supply	100 watt, plenty of capacity for expansion, up to 10 Amps on the 5V. line.
Motherboard	5 slots organised on the NASBUS/80–BUS. 1 or 2 spare according to configuration.
Input/Output	RS232 Serial, selectable Baud rates. Z80A PIO giving 2 x 8 bit parallel ports and handshake.
Cassette Interface	High speed CUTS standard for compatibility with earlier NASBUS/80–BUS products.
Keyboard	Standard 'QWERTY' layout with numeric keypad and cursor control keys.



Special features of the KENILWORTH 83N

The CP/M has been implemented with full screen editing and emulates the facilities normally found on dedicated video terminals. As an option it is also available with a NASDOS compatible system to take advantage of the large range of system software.

As a professional graphics machine it excels because of the flexibility of hardware configuration. It utilises to maximum effect the 48K graphics memory, which is on a totally independent page from the main processor memory, and the exceptional graphics software package. The built in screen can be used in two main modes:

1. Full software selection between 48 columns x 16 lines (screen 1), 80 columns x 25 lines (screen 2), or high resolution monochrome with grey scales (screen 2). The resolution is selectable under software control between 392 x 256 pixels, and 784 x 256 pixels.
2. With the internal monitor locked in 48 column mode, and an external monitor software selectable as 1. above. The external monitor can be a High Resolution TTL input colour monitor, or composite video input monochrome (or both!). On an external colour monitor 392 x 256 pixels can be displayed in 8 colour mode or 784 x 256 pixels in 4 colour mode. The software provides for an astonishing 4913 different shades of colour to be generated using a mosaic technique, to avoid the limitations of using TTL monitors. It can then use the internal monitor as a 'command screen' for the High Resolution Colour Graphics providing a very powerful dual screen CAD type facility.

Special features of the KENILWORTH 83G

Dual Z80A processors. The main processor handles the discs under CP/M, while the second controls keyboard and screen.

Main Processor:

64K dynamic RAM – fully available to the user, as the 2K disc boot ROM is automatically phantomed out of the main memory address map once it has loaded the CP/M system, thus giving the user access to the maximum possible amount of memory. The Serial and Parallel ports together with the high speed CUTS tape interface are also under its control.

Second Processor:

As it is dedicated to controlling the screen and keyboard, all the facilities of an intelligent terminal are built in with no main processor overhead thus providing a number of sophisticated video facilities. Full cursor control functions are included, offering comprehensive on-screen editing capability. The display format of 80 columns x 25 lines, is the convenient and accepted standard. Characters may be displayed in either inverse or normal video and a built in programmable character generator provides both Pixel Graphics (160 x 75 pixels) and the ability for the user to define specialised character sets. In controlling the keyboard it provides soft function keys, and a 64 character input buffer with 2 key roll-over, ensuring that no key entries are missed. The video output of the KENILWORTH 83G can also connect directly to any monitor with 1V. peak to peak Composite Video input for demonstrations, etc.

Prices

KENILWORTH 83G	£1725.00	+ VAT
KENILWORTH 83N	£1775.00	+ VAT
KENILWORTH 83N Educational Special (Single disc NASDOS)		£1350.00 + VAT

Options

1. Double sided disc drives giving 1.5 Mbyte of storage. £250.00 + VAT
2. Switchable CP/M or NASCOM compatible operating systems, on the KENILWORTH 83N model only £85.00 + VAT
3. Optional pages of 64K RAM up to a maximum of 0.5 Megabyte.
4. Extra RAM as 'Pseudo Disc' to give superfast operation.
5. Soft, lightweight bag with shoulder and hand straps and pockets for discs, manual, etc.

KENILWORTH
Computers Ltd

KENILWORTH COMPUTERS LTD
19 TALISMAN SQUARE
KENILWORTH CV8 1JB
WARWICKSHIRE
TEL: (0926) 512348

~~16 The Square, Kenilworth, Warwickshire CV8 1EB~~ Telephone: (0926) 512348

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Computers Limited
~~16, The Square, Kenilworth, Warwickshire CV8 1EB.~~
Telephone: (0926) 512348
19 Talisman Square, KENILWORTH CV8 1JB, Warwickshire.

31st October 1984

Mr R Smith
138 Hottye Road
EAST GRINSTEAD
West Sussex

Dear Mr Smith

Following our conversation, I have pleasure in confirming a price for a Kenilworth 83G, less disk drives, of £1425 + VAT.

The system disk would be omitted and the CPU board would have SIMON fitted. This would not utilise the fast seek facilities offered by most of the half height drives, but would be Galaxy compatible.

If you require any further details please do not hesitate to contact me.

Yours sincerely

pp David Searle

Registered in England No. 1693364 Directors: G. D. Searle · S. M. Searle (Company Secretary)
Registered Office: Curtis House, 12, Poplar Road, Solihull, West Midlands. B91 3AD

GALAXY 2 COMPUTER SYSTEM

WHATEVER REQUIREMENTS YOU HAVE

The cost-effective solution to your computer needs for only £1,495*

For just £1,495 the Galaxy 2 provides the basic requirements for a small business system:

- **Central Processor Unit with 64K of RAM**
- **Twin disk drives (400K storage per drive)**
- **Keyboard and 12" monitor**

But unlike many other small-business systems the Galaxy System is specially designed for expansion and flexibility to meet changing requirements. It uses the world's best selling micro processor, the Z80A, and is based on industry-standard 80-Bus boards. The business system uses only 3 boards in the 5 spaces available, so extra cards can be "plugged-in" to expand the system; for example to expand the memory, or to give a colour facility, or to develop the Galaxy for the particular requirements of education, research, software development etc.

It has a CP/M operating system which gives access to the largest range of software available for any machine. In particular, Gemini can offer QUIBS; a small-business package developed especially for the Galaxy.

The Galaxy has industry-standard interfaces (parallel and serial), and Gemini Microcomputers can supply a full range of compatible hardware including a Winchester sub-system and printer.

The Galaxy offers the most cost-effective way of obtaining a basic unit which is capable of developing to meet your particular requirements; now and tomorrow.

Features include:

- Twin Z80 Processors
- 64K Dynamic RAM
- 800K Disc Based Storage
- 80 x 25 Screen Format
- Dual Printer Interfaces
- Modular Design
- Extra Disc Drives Easily Added
- Winchester Expansion Available
- Net Working System Available
- Additional Slots for 2 Cards
- 12" Green or Amber Monitor

**Price is exclusive of VAT*

MULTIBOARD COMPUTERS

Gemini Microcomputers 18 Woodside Road, Amersham, Bucks Tel: (02403) 28321.

GALAXY COMPUTER SYSTEM

The cost effective solution to your computer needs

SPECIFICATION

Processors:	Twin Z80A at 4MHz (No wait states)
Memory: Z80-1:	64K dynamic RAM 2K phantom ROM
Memory: Z80-2:	4K monitor ROM 2K workspace RAM 2K screen RAM 2K character generator ROM 2K character generator RAM
Keyboard:	64 character input buffer Full ASCII encoding 87 key 2-key rollover Caps lock function Edit key User definable function keys Numeric key pad
Video:	80 x 25 display format Inverse video 160 x 75 pixel graphics Programmable character set Programmable special functions
Monitor:	High resolution 12" monitor Amber or green phosphors available
Disk:	2 x 5.25" drives 400K storage per drive Double density
Serial I/0:	RS232 interface Programmable baud rates Cuts cassette interface
Parallel I/0:	Centronics parallel interface
Other I/0:	Light pen input IV P-to-P video output
Software Included:	CP/M 2.2 operating system
Networking:	GALAXY computer systems can be linked into the Gemini MultiNet networking system. The system utilises the GM836 network board attached to the parallel interface connection on the CPU card. Data is transmitted between units at 250 Kbaud.
Winchesters:	The GALAXY 2 can be expanded to accommodate the GM835 Winchester sub-system, available in either 5 or 10 Megabyte versions.
High Capacity Disks:	The GALAXY 2 is also available with 2 double sided drives giving a total of 1.6 Megabytes of formatted storage – (model ref. GM905). **£1695**

Gemini Microcomputers reserve the right to amend all specifications without notice.

Memory
The GALAXY 2 is supplied with a full 64K bytes of dynamic memory as standard. The disk boot ROM is automatically phantomed once it has loaded the CP/M system giving the user access to the maximum possible amount of memory.

Disk Storage
Twin Micropolis 1115 drives are supplied integrally in the GALAXY 2. These proven double density drives offer a total of 800K bytes of on-line storage. Because of the adoption of the latest generation of disk controller components the user is guaranteed the highest possible data integrity and reliability.

Video
By utilising a second Z80 Microprocessor GALAXY 2 is able to provide a number of sophisticated video facilities. Full cursor control functions are included, offering a comprehensive on-screen editing capability. The display format is 80 x 25, a convenient and accepted standard. Characters may be displayed in either inverse or normal video and a built-in programmable character generator provides GALAXY 2 with both pixel graphics and the ability for the user to define specialised character shapes.
The second Z80 also controls the keyboard and provides a 64 character input buffer. This ensures that no key entries are missed. And to complete the extensive video capabilities a light pen interface is provided.

Input/Output
GALAXY 2 provides a comprehensive range of input and output facilities. Both parallel and serial printers are catered for via Centronics and RS232 interfaces respectively. A cassette interface is also included as well as the light pen interface. The specially designed 87 key keyboard includes software programmable function keys and a numeric key pad. The video output of GALAXY connects directly to the video monitor supplied.

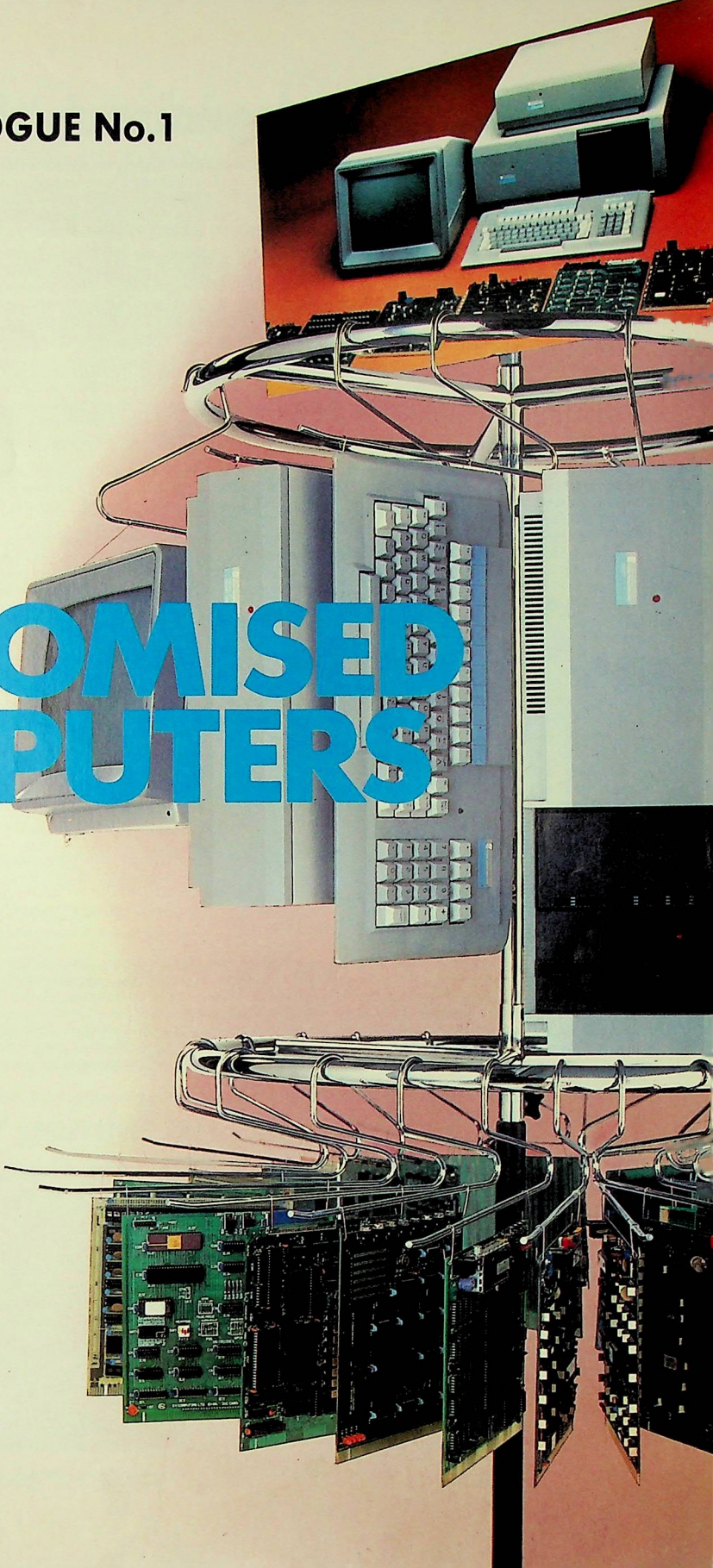
Your Local Gemini Distributor Is:

Gemini Microcomputers

18 Woodside Road Amersham Bucks HP7 0BH England.
Tel: (02403) 28321 Telex: 837788

SYSTEMS CATALOGUE No.1

CUSTOMISED COMPUTERS



MULTIBOARD COMPUTERS

Gemini Microcomputers

company background

When you are looking for the best long term means of capitalising on today's generation of computers, don't confuse GEMINI with other micro manufacturers. The Gemini MultiBoard range of systems utilises an industry standard 80-BUS structure. The first specification for 80-BUS was produced in 1978. The version which is now adopted by Gemini and a number of other companies was established in 1980. Unlike alternative BUS structures, the 80-BUS was specifically designed to support systems using the Z80 microprocessor. The Z80 still continues to be the worlds largest selling microprocessor.

The latest addition to Gemini's range of products, available in the last quarter of 1984, is a 16-bit co-processor board using the 8088 microprocessor. This board can be retrospectively plugged into a MultiBoard system, and using CP/M-86 will allow the user of any MultiBoard system to have access to the ever growing library of 16 bit software. The future will hopefully also see the implementation of Concurrent CP/M and MSDOS and so allow the user access to a vast range of software packages that covers virtually every conceivable requirement that a computer user may have. Due to the popularity of its first MultiBoard system in 1980, Gemini have continually improved and advanced their products and now manufacture a number of major computer systems, and a growing number of 80-BUS compatible boards and peripherals.

These facts underline the Gemini MultiBoard philosophy - one of expansion. The MultiBoard systems allow for a totally flexible approach to the configuration of computer systems, thereby allowing each system to be tailored to individual needs. Since it is assumed that many users will at some stage wish to change the configuration of their system, we believe that the majority of competitive systems (Single Board Computers) offer limited features in expansion capability or flexibility. With the MultiBoard system your system can grow with your requirements. With it your requirements may be met by as few as one board, or as many as 10 or even more. With Multiboard, an almost unlimited number of system permutations are possible.

Gemini Microcomputers Limited, a British company, have over the last four years developed a comprehensive range of powerful and versatile Z80 based microcomputers designed to meet the broad range of business, educational, and scientific computing needs. In this brochure you will find details of our four separately identifiable ranges being namely Gemini 2, Gemini 3, Gemini 4 MultiNet and the Multi-Format-BIOS Systems (M-F-B).

All of these systems are based upon 3 major 80-BUS boards - the GM 813, providing the Z80A microprocessor, 64K of RAM together with the I/O system; the GM 832 provides the industry standard 80 x 25 screen display driven by its own Z80B microprocessor and providing 256 x 256 pixel graphics, user definable character attributes and comprehensive on-board software; and the GM 829 card which provides the interface to floppy drives and a SASI interface for connection to the winchester drive. This board supports a mixture of 4 floppy drives (be they 3 ½", 5 ¼" or/and 8").

All systems are built with expansion as a major consideration. Each system contains a 6 card frame, which, depending on the system, may provide the user with up to 3 spare slots. The standard Gemini 2 is a CP/M based personal computer supplied with twin 800K drives. The Gemini 3 is a Winchester version, and is available in either 10.8 or 16.2 MB capacities, and is fitted with an 800K floppy for back-up purposes. This unit has 2 spare card slots for the addition of other 80-BUS boards. The Gemini 2 and 3 microcomputers are both ideal small business systems, dedicated personal computers, development systems, or nodes within a network. This combination of high performance, low cost systems with a BUS structure, with an easy, and vast upgrade path together with readily available software provides you with cost-effective, easy to implement solutions to both present and future processing needs.

The Gemini 4 MultiNet system comprises a central winchester based fileserver, and up to 31 workstations. The workstations can be either our standard MultiNet station, or a Gemini 2 or 3 which has been retrospectively upgraded to operate in the network.

One of the great problems in the microcomputer industry is the incompatibility of floppy disks. The answer to this problem is solved with the M-F-B. This system allows the formatting of disks, and the transfer of data between one microcomputer and another. The existing library of formats now covers more than 300 machine type and format combinations, and new ones are being added all the time. Systems are available with the new micro drives i.e. 3.5" where required.

From reading the contents of this brochure we are sure you will agree that the Gemini range of systems provides a comprehensive range of solutions for the majority of microcomputer applications. On the following pages detailed specifications of the complete range are provided. For those of you who are interested in our systems at the component level, in addition to this brochure we also produce a MultiBoard Catalogue which reviews in greater depth the comprehensive and diverse range of MultiBoard products and are available from Gemini or your local dealer.

Dealers and OEM's

The majority of Gemini MultiBoard systems and peripherals are sold by our dealer network. Our dealer network, currently comprising of some 50 companies, has been responsible for the sale of our products into most major companies within the U.K. An ever increasing amount of our sales are destined for export to Western Europe and further as interest, and our overseas dealer network grows.

Gemini does not normally sell directly, although we have a limited number of direct OEM accounts. These sales are invariably to companies purchasing our range of products in volume in order to build their own computer systems, or build into microprocessor controlled machines. As a result of our OEM business it can be seen from our MultiBoard catalogue that we supply a range of cases into which a users' own configuration of system can be built. If the volume of business is of a large enough scale then it is possible for us to produce metalwork, build and repackage systems to specific requirements.

If you wish to find out more about the Gemini MultiBoard range of computers and associated peripherals, our sales staff will be only to happy to supply you with the name of your nearest dealer.

Maintenance and Warranty

All Gemini products, excluding disk drive heads (90 days) are supplied with a one year warranty. This warranty states that any goods purchased from Gemini or from one of our authorised dealers, if declared faulty, and returned to us, will within the first 12 months be repaired or replaced (at our discretion), and returned to the customer free of charge. All goods must be returned to us by the commissioning dealer.

A third party maintenance contract is available on all Gemini Microcomputer systems. The maintenance contract, supplied by one of the U.K.'s leading microcomputer engineering companies, will provide the user with a visit by an engineer on-site within 24 hours of the report of a fault. Details and pricing of such a contract are available on application from your local dealer.

Manuals and Documentation

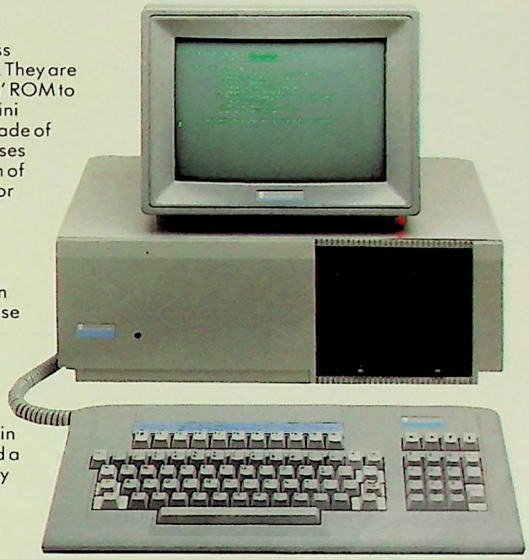
All Gemini systems are supplied with comprehensive hardware and software manuals. System catalogues are bound in an A4 folder, these are supplied along with a Digital Research CP/M Manual and a number of other documents such as the CP/M license, circuit diagrams, and guarantees etc. The manual contains an explanation of the specific Gemini system purchased and describes how to use it, written in a refreshingly friendly style, keeping explanations simple and straightforward. The manual does not set out to teach the user how to 'drive' CP/M, but lists the specific features of the machine and departures from the normal CP/M machine, such as screen editing and the utility programs which are all covered in detail. The in-depth information on how to use CP/M is left to the CP/M guide.

We believe that this approach is more than adequate for the user interested in running typical business applications software but may fall somewhat short of the documentation required to gain an in-depth understanding of the machine. We have overcome this by making all the additional documentation for the individual cards and software available at very modest prices through our dealer network. The user intending to use the Gemini as a development tool need not be worried by the lack of heavy technical documentation as the optional card and software manuals are all easily available and most comprehensive.

The Gemini 80-BUS range of boards, if purchased individually, are all supplied with circuit diagrams and hardware and software manuals where applicable.

the 'new look' gemini systems

For those of you who already know the Gemini systems, you will notice from this brochure the radical change in the appearance of our family of microcomputers.
We have now upgraded all of our systems to use only high-capacity 800K floppy disk drives, and we no longer provide the 400K option. Similarly, we now only supply the higher capacity 10.8 and 16.2 MB Winchester drives.
The monitor is a significant improvement on its predecessor, with an improved resolution CRT, and is presented in a much more aesthetically pleasing enclosure.
The major changes are not purely that we have re-packaged them in hopefully a much more attractive looking enclosure, but are also of a practical nature. The colour is totally different from the original beige and black, but we still maintain the rugged metal case, with the facia of the new systems now being made of plastic.
The keyboard perhaps shows the most drastic change to the systems. An advance in keyboard design technology provided us with the opportunity to produce a new low profile unit, meeting the international DIN specification. Its facilities have however not changed. With a full 87 key key-pad, a separate numeric keypad and cursor control keys, the keyboard now has a maximum of 90 user programmable function keys, and the addition of a legend strip enables key configuration details to be displayed.
The keyboard is now interfaced to the system by a serial connection, but parallel versions are also available for use by existing MultiBoard users.
We not only supply the keyboard in a standard QWERTY layout for use in English, but also layouts in German, Swedish and Danish are available, together with an (AZERTY) version in French.
We hope that you find the appearance of the NEW Gemini family as attractive as their performance and price.

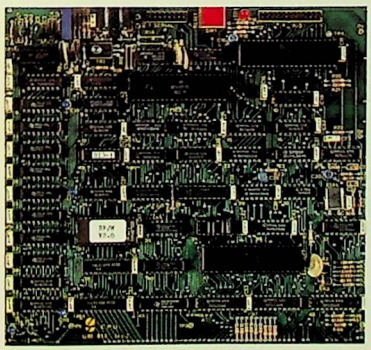


Gemini 2 & 3
The Gemini desk top computer systems can be used in education, small business applications, wordprocessing, stock control, and a host of other environments. They are supplied with a full 64K bytes of dynamic memory as standard, and a 'disk boot' ROM to load CP/M automatically when a disk is inserted into the master drive. All Gemini systems are based on a multi-board design allowing easy expansion and upgrade of all systems. Each system is supplied with a 6 card frame of which the Gemini 2 uses only three, and the Gemini 3 and Multinet only 4, so all allowing for the addition of further boards; for example to expand the memory, or to give a colour facility, or to develop the Gemini for particular requirements of education, research, software development etc.

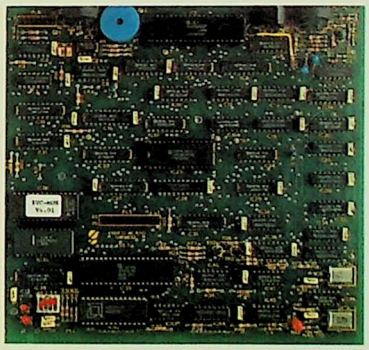
Gemini 2
The Gemini's disk drives are the twin Micropolis 1115 disk drives. These proven double density drives each offer a total of 800K bytes of on-line storage. Because of the use of the latest generation of disk controller components the user is guaranteed the highest possible data safety and reliability.
By utilising a second Z80 Microprocessor, the Gemini is able to provide a number of sophisticated video facilities. Full cursor control functions are included, offering a comprehensive on screen editing facility. Two text modes are supplied, 80 characters x 25 lines, or 40 x 25. Characters may be displayed in either inverse, normal, blinking, half-tone video, or half-tone background, and a built in programmable character generator provides the Gemini with the ability to define specialised character shapes. A high resolution graphic mode providing 256 x 256 pixel graphics is also supplied.
The second Z80 also controls the keyboard and provides a 128 character input buffer. This ensures that no key entries are missed. To complete the extensive video capabilities a light pen input is provided.
The range of input and output ports includes both Centronics and RS232 to cater for both parallel and serial printers. There is also a cassette interface. The video output connects directly to the 12" green screen monitor.

Gemini 3
In place of one of the floppy disk drives is a Winchester hard disk. The Gemini is available in a choice of two Winchester configurations either 10.8 or 16.2 Megabyte versions, together with a 800K floppy disk drive, providing a vast amount of on-line storage.
While the Gemini 3 looks and costs like a desk top microcomputer, it performs like a medium size minicomputer.

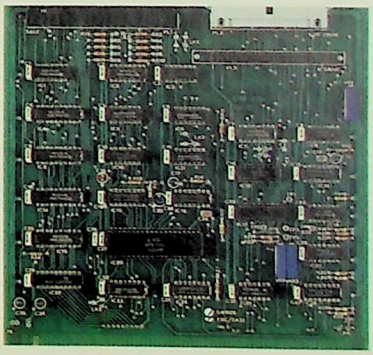
the backbone of gemini multiboard systems



GM 813 CPU/64K RAM BOARD



GM 832 SVC BOARD



GM 829 FDC/SASI BOARD

gemini 4 multinet network system

The underlying philosophy of MultiNet is to enable as many people as possible to have access to their own microcomputer for the lowest possible cost.
There are three main software components to the MultiNet Network, and these respectively fulfill the requirements of the fileserver, standard workstations, and workstations fitted with local disk drives, otherwise known as Superstations.

How is this achieved?
By providing a central 'fileserver'.

What is the fileserver and what does it do?
The fileserver is the master station of the network, and is a complete microcomputer that is equipped with a Winchester hard disk drive for data storage. This hard disk comprises 'central file' storage for everyone using the network, and the necessary interfaces to allow the connection of printers so that they may be shared by all workstations on the network.
Whilst the network is in operation, the fileserver itself may not be used as a workstation on the network, but is responsible for the transmission and receipt of data to and from the network workstations, and control of the central printer resources.

For printer connection, the server is supplied as standard with an RS232 Serial interface. For Centronics parallel type printers a GM816 Multi I/O board must be added to the fileserver.
The server is fitted with the Gemini GM 836 network interface board which contains the circuitry necessary to allow the connection of the hardware to the network. A unique network workstation address is provided on this board by a selectable 5 way DIL switch. For data protection an 800K 5 ¼" floppy disk drive is also fitted into the server cabinet for back-up and data transfer purposes.
Connection of the server and any workstation on the network is via a simple, low cost, single twisted pair cable and a variant of RS422 differential transmission is used.

The server continuously searches all stations on the network to give each user immediate access to its files, application software programs or any shared printer.
Data is transmitted serially at a rate of 250K baud, very fast for a system of this sort. All data packages transmitted end with a CRC (checksum) to detect any errors during transmission. On the receipt of a data packet, the receiving station checks that the packet has been received correctly, and if an error has occurred, signals this to the fileserver, at which point it will retransmit the package.
In use each active workstation is served from its own RAM buffer in the server, reducing disk access, and by doing so, increasing the availability of data, hence increasing the operating speed of the network. If several stations require disk access simultaneously, each station sends and transmits data to and from its buffer in packets, allowing time for other stations to send and receive likewise.
Under normal conditions, system response is very rapid, and is not held up by stations accessing the line for anything other than disk or shared printer access. Each station is connected by an umbilical cord of this cable, via a 3 pin socket, to a wall mounted junction box. The maximum overall length of the network cable is in the region of 600m (2000 feet) and up to 31 workstations may be connected to the cable at any point along its length.

workstations

The standard MultiNet workstation is a compact unit complete with detachable keyboard, and separate video monitor. Each station is fully intelligent, that is, they are capable of operating, and in fact appears to the user as, a complete Gemini CP/M microcomputer
The system utilises the Gemini GM813 and GM832 boards, thus providing the user with a complet Gemini system without disk drives, Following the standard Gemini philosophy, an expansion slot is provided, allowing another 80-BUS board to be added to provide further facilities such as allowing for the addition of local disk drives.

The colour workstation is one of the newer Gemini products. This workstation includes the 'Pluto' high resolution colour graphics display board, and also allows the addition of the 'Mini Palette' board. The rear panel of the workstation is fitted with a number of RS232 ports to support the connection of a colour monitor, colour plotter, and a digitizer pad, and therefore allowing the user immediate access to the Pluto Tool Kit program produced by Gemini called 'Qwikdraw', a simple, yet effective way of producing high quality colour graphics via a digitizer pad and pen.
The operating software is automatically downloaded from the fileserver when the workstation is switched on. Once the user is logged into the network, he is provided with a virtual CP/M 2.2 system. Each user has access to his own set of files, which no other user can access. This protection is further ensured by the provision of a 'password' facility. In addition, there are many applications where it is necessary to share files between users on a 'read only' basis, and this facility is provided by allocating disk areas where files may be read by all users.
Each standard workstation will allow the attachment of a serial printer for local printing, whilst still giving it the facility of also using the server to spool print.
The addition to a standard Gemini 2, 3, M-F-B or compatible 80-BUS system of the Gemini GM836 network interface board, will provide you with a superstation. When logged onto the network the software determines whether any CP/M system call is to be handled locally or via the network. All facilities of the network can thus be accessed by this type of user, with the advantages of also having local floppy or hard disk drives and printer — a must for people who wish to create and download software to a network user area without effecting the network operation, or for swift back-up of essential data from the network.
The network will also allow the connection of the Quantum Computer Systems and Kenilworth Portable Computer range of microcomputer systems — both of these ranges of systems utilise Gemini 80-BUS boards.

multi~format~BIOS

First came the computer.....then came the floppy disk.....then came floppy disk incompatibility.....THEN CAME THE M-F-B.
As microcomputers have become less expensive, departmental budgets are now able to afford the purchase of such a machine. Data Processing departments have however always striven to maintain some compatibility within company computer purchasers, and have attempted to discourage the indiscriminate purchase of the newest, most attractive, most powerful or most easily portable machine. But, human nature being what it is, this sound advice is not always heeded.
As a result, the purchase made, a growing number of machines are found throughout the company, and a growing problem of disk size and format incompatibility is found. Gone are the times when a disk could be taken from one machine and put into another machine for it to work immediately. Whereas the majority of microcomputer uses are 'the same', you can guarantee that the disks won't be, particularly now with the advent of the 3.5 inch rigid microfloppy disk. Perhaps the only common denominator between these systems will be that they run or can run the CP/M family of operating systems, or their lookalikes.
One of the original benefits of CP/M was program and data portability which was achieved by the fairly universal use of the IBM3740 8 inch disk format variations. Add to this the IBM PC, the ever increasing number of MSDOS formats, and the microfloppy disks, and it is obvious that this variety has made it difficult and expensive for software houses, and others with a number of computer systems, to supply disks for all the possible formats.
As a result Gemini designed and manufactured the Multi-Format-BIOS range of systems. Our aim was to provide the link between man and his preferred machine, and the other computer users in a business.
The M-F-B system provides the ability to format and transfer data between any of the microcomputer formats currently available within its library. We currently have over 300 machine type and format combinations recorded, and new ones are being added all the time.
This system will copy files from one CP/M type to another such as CP/M-80, CP/M-86, CCPM/86, MP/M, MP/M 86 or Turbo Dos. Additional software is also available to allow the copying from IBM PC-DOS disks, and also a number of mini-computer and mainframe interchange formats are available.
The M-F-B is two things. In its own right it, like the full range of Gemini MultiBoard systems, is a state-of-the-art 8 bit microcomputer, available in a variety of configurations, the top end being supplied with five drives — one 16 megabyte Winchester, one 48 TPI and one 96 TPI 5.25" floppy drives, an 8" double-sided and a 3.5" double sided microfloppy disk drive. The system is supplied with an augmented CP/M operating system which allows the disks other than the Winchester to be used in many different formats and densities. The system will also support the addition of half-megabyte "RAM Disk" boards if required.
The BIOS is table-driven, there being a table entry for each logical drive on the system. These tables define the physical characteristics of each drive (size, tracks, step rate etc), together with the format to be used. To reconfigure the BIOS for alternative formats, only these tables need to be changed by the SETUP program.
The BIOS will support most current soft-sectored formats, but cannot handle those formats that depend on unique hardware features such as variable speed drives.
To support the M-F-B, four programs (namely SETUP, ANALYSE, WHIG and UPDATE) are supplied. These allow the addition of new formats to the library; determine the physical characteristics of an unknown format; display the current BIOS configuration; and enable the alphabetical sorting of a file, or the merging of two data files together. With the M-F-B system comes a six-month free format update service
Apart from the examples mentioned above, business uses for the M-F-B are more varied, an example could be the transfer of the Chairman's Secretary's output from her Osborne to the format used in the central Word Processing department, or the collection of area sales figures sent in by Regional Sales Managers (using various computers) for merging into one matrix.
If you are the head of a Data Processing department seeking a solution to ever increasing incompatibility amongst departmental computers, or the M.D. of a software house looking for a way to prevent further loss of sales due to the fact that you can not supply software on the required disk format, then look no further.....The next microcomputer purchase that your company will make is that of a Gemini Multi-Format-BIOS system.

quantum 2000 systems

The Quantum 2000 range of microcomputer systems is an example of the kind of system that our OEM customers are producing using the extensive range of 80-BUS boards.
A CP/M based range of systems, the Quantum series are based on the three main circuit boards found in the Gemini range of products. Primarily, packaged in a larger case, the basic Quantum system is fitted with three 5.25" floppy disk drives, providing an on-line storage of 2.4 MB. Winchester disk drives are also available in 10.8 or 16.2 MB. options. The monitor for the system is in a pedestal unit, and sits next to the central processing unit.
Quantum also produce a network system. Similarly to the Gemini it can support up to 31 stations over a maximum distance of 2000 feet.
The fileserver on the Quantum consists of a Quantum 2000 computer with a Winchester drive and a cyclops terminal.

This special terminal is fitted with a switch which will allow it to be used either as a workstation, or as a monitor for the fileserver. When used as a monitor it will allow the fileserver to be used as a normal Quantum 2000 for purposes of file maintenance e.g. for adding a new piece of software to the system. When the network is actually operating it will display the user areas currently being accessed by each terminal. A flick of the switch will then allow it to be used as a workstation. The Cyclops workstations are simply Quantum 2000 computers without disk drives.
Each has its own 64K memory and its own serial printer port should a local printer be required. Each Cyclops behaves as a normal Quantum 2000 system. The central processing unit of all systems is fitted with an 8 card frame of which in a standard system only three are used, so providing the user with a great deal of available board space for the addition of other 80-BUS boards. Gemini and Quantum computers, if fitted with a network interface board, can be used as workstations on the network.

kenilworth

The Kenilworth is another example of an OEM client using the Gemini MultiBoard range of 80-BUS boards, in this instance to produce a very professionally finished portable microcomputer.
Unlike so many portables that are as space consuming as a desk top computer, the Kenilworth, when not in use, is as small as your filing tray; release the keyboard and away you go. This system, very compact and ergonomically shaped to aid ease of carrying, has an overall size of 19" x 14.5" x 9.5" and weighs 28 pounds.
Fitted with an 80 x 25 screen display on a 9" monitor full screen editing under CP/M is provided via a standard QWERTY layout keyboard with a numeric keypad and cursor control keys. The disk storage is provided on dual TEAC fast seek single or double sided double density 96TPI drives, offering a maximum possible storage of 1.5 MB.
Using the 80-BUS range of boards the system is supplied with all I/O facilities as provided on the Gemini and Quantum range of systems.

multiboards

Expansion of Gemini systems is possible in a number of ways, below are just one or two examples, and below that a selection of 80-BUS boards which enable your MultiBoard system to be used for applications such as Process Control, Batch Counting, Robotics, Colour Graphics Display, CAD/CAM, CNC; in Manufacturing, Telecommunications, Instrumentation, Laboratory Testing, Security Systems, Plant Control, Data Collection and Distribution as well as every-day office procedures. These are not hypothetical uses of the Gemini MultiBoard family.....these are uses that we know they are being put to. There are a lot more however of which we do not!

Ways in which Gemini systems can be expanded:
Colour graphics can be provided with either the GM837 or the IO828 'Pluto' card from I.O. Research The basic number of colours provided by the IO828 can be dramatically increased by the addition to Pluto of a Mini-Palette board.
Using a 16 bit processor and 192K of on-board RAM, the Pluto has the ability to draw at speeds over 160,000 pixels per second. Providing an 8 colour display with a resolution of 640H x 576V a software selectable interlaced display can be used to combine two full colour screens of memory together.
Inbuilt Pluto functions enable it to draw lines, rectangles, circles and arcs; flood fills and pattern fills of complex shapes and much more. This makes it extremely quick and easy to draw charts, graphs and diagrams, by simply sending Pluto a few commands.
Additional boards in the Pluto family allow a display of 256 simultaneous colour shades from a choice of 16.7 million.
Supplementary floppy disks or hard disks can be added to the existing Gemini systems. The GM829 will support up to 4 floppy drives and provides a SASI interface for connection to Winchester drive sub-systems.
Additional parallel and serial I/O can be added. The GM816 Multi I/O board provides parallel I/O plus a real-time clock, the addition of the GM818 daughter board will provide RS232 serial I/O. Alternatively, if only serial I/O is required then the GM848 will suffice.

Some of these represent the means by which the expansion is possible, but are just a small selection from the range of over 25 cards

GM813 CPU/64K RAM BOARD	Controlled by a 4MHz processor, Z80 CPU, 64K of RAM, 2 parallel ports, 1 serial RS232, cassette interface, extended addressing, memory page mode capability. Total memory capability of 2 Megabytes!
GM811 CPU BOARD	An industry standard 4MHz, Z80 controller board with parallel and RS232 serial I/O together with a variable Bytewide memory capacity. Cassette Interface.
GM832 SUPER VIDEO CARD	Controlled by a 6MHz Z80B, high resolution graphics mode of 256 x 256, line/circle draw, polygon fill, 80 x 25 display or 40 x 25. Includes foreign character sets and full keyboard support.
GM888 CPU BOARD	A NEW CARD featuring the 8MHz Intel 8088 16-bit processor to provide a dual processor environment. Real time clock and battery back-up. 8087 arithmetic board socket. This board can support CP/M-86, Concurrent-DOS and MSDOS.
GM862 256K RAM CARD	A NEW CARD supporting both page mode and extended addressing facilities and can be used with all the Gemini CPU cards.
GM833 512K RAM-DISK CARD	Provides 'pseudo disk' facility. Appears to CP/M as an extremely high speed disk drive — over 30 times faster than a conventional floppy in certain applications. Multiple boards can be supported to 8 MB!
GM829 FDC/SASI BOARD	Combines floppy disk controller and SASI board. Supports up to 4 floppy drives (3½", 5¼" or 8") software supplied. Allows connection of floppy or Winchester hard disk sub-systems such as GM825 or GM835
GM837 COLOUR GRAPHICS BOARD	256 x 256 graphic resolution in 16 colours. Output to either PAL UHF or RGB.
GM816 MULTI I/O BOARD	3 Z80A PIOs providing 6 bi-directional 8-bit data ports. CTC and battery backed clock. Daughter board provision
GM848 SERIAL I/O BOARD	Utilises two Z80A SIO chips to provide 4 synchronous/asynchronous serial channels and PIO with software selectable baud rates between 75 and 9600 baud.
GM836 NETWORK INTERFACE BOARD	Small add-on board which provides RS422 communication protocol for networking of MultiBoard systems.
PLUTO COLOUR GRAPHICS	A range of high resolution boards. The 'Pluto' combines 192K RAM with a fast 16 bit processor. 640 x 576 pixels with 8 colours running at 8MHz. Expandable to 256 colours simultaneously.

technical specification

Processors	Twin Z80 Main Processor - 4 MHz Video Processor - 6 MHz (No wait states)
Memory - Z80-1	64K Dynamic RAM 2K Phantom ROM
Memory - Z80-2	8K Monitor ROM 8K Screen / Character / Graphics RAM 2K Workspace RAM
Keyboard	64 Character Input Buffer Full ASCII Encoding 87 Key n Key Rollover Caps-Lock Function Edit Key 90 User Definable Function Keys Numeric Key Pad
Video	80 x 25 or 40 x 25 Display Format Inverse, Blinking, Half Tone Video, Half Intensity Background 256 x 256 Pixel Graphics Programmable Character Sets Programmable Special Functions Line / Circle Draw Polygon Fill Software Clock Foreign Character Sets
Monitor	High Resolution 12" Monitor Green Phosphors
Serial I/O	RS232 Interface Programmable Baud Rates Cuts Cassette Interface
Parallel I/O	Centronics Parallel Interface
Other I/O	Light Pen Input 1 V P-to-P Video Output
Software Included	CP/M 2.2 Operating System and Utilities MFB Software (MFB Only)
DISK DRIVES	
Gemini 2	2 x 5.25" Drives 800K Storage Per Drive Formatted Double Density
Gemini 3 & 4	1 x 5.25" Winchester Hard Disk 10.8, 16.2 MB Capacities Formatted 1 x 800K Double Sided Drive Formatted
M-F-B SYSTEM	
GM 916	5MB + 96TPI DS + 48TPI DS 5.4MB 5.25" Drives
GM 921	As above but 16MB
GM 922	96TPI SS + 96TPI DS + 48TPI DS 5.25" Drives 8" SS + DS Drives Available 3.5" DS Drives Available
GM 825	Floppy Drive Unit Sub-System (In Case with PSU) 1 or 2 800K 5.25" Options
GM 835	Winchester Drive Sub-System (In Case with PSU) Winchester Capacities As Above
Network	RS422 Communication 250 KBaud Data Transfer Rate

software

The principal advantages of a Z80 based system is the abundance of software that is available. The majority of packages available operate under the CP/M disk operating system. With CP/M, software becomes machine independent, providing the user with literally the widest range of software available.
However, due to the increase in the market place of the 16 bit microcomputer new operating systems have been developed, and therefore an increasing volume of 16 bit software under these systems is becoming available.

As a result of current demand, Gemini have produced a 16 bit co-processor card which can support CP/M-86, Concurrent CP/M and MSDOS, and may therefore allow the Gemini MultiBoard range of computers to support software written under these operating systems, and provide the user with an even greater library of software from which to choose.
Listed below is some software currently available on the Gemini family.

Languages	**MBasic**, C Basic, Comal-80, PL/I, Pascal, Fortran-80, Cobol, **APL, Compas**, UCSD.....
Databases	**DBase II**, Dataflex, Superfile, Cardbox, Brainstorm, Friday.....
Micropro	**Wordstar**, Calcstar, **Spellstar**, Star Index, Supersort, Infostar, **Mailmerge, Wordstar Professional....**
Graphics	Graphitas, **Qwikdraw, Cad-8, Gem-Graphpac.....**
Communications	BSTMS, Bisync 3780/3720, **Easylink.....**
Gemini	**Gempen** - Text Editor & Formatter **Gemdebug** - Z-80 Debugger **Gemzap** - Z-80 Assembler

Software with **Bold Titles** are available from Gemini.

MULTIBOARD COMPUTERS

Gemini Microcomputers

Gemini Microcomputers Ltd., 18 Woodside Road, Amersham, Bucks.
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Gemini Microcomputers reserve the right to amend all specifications without notice.

Your Local Gemini Dealer is:

Designed and printed by The Print Centre, Chesham, Bucks.

NEW PRODUCT INFORMATION

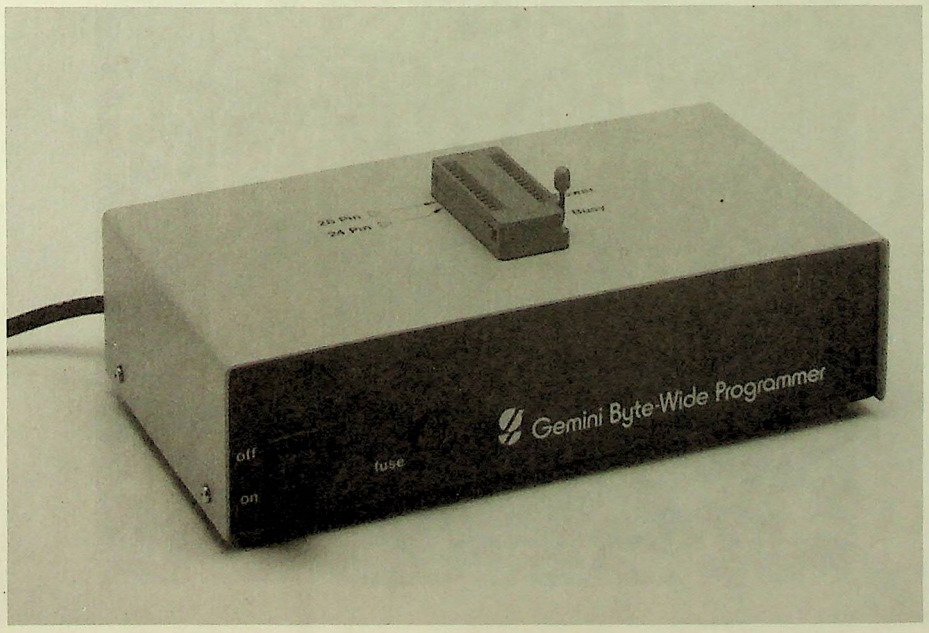
GM860 — BYTEWIDE EPROM PROGRAMMER

* Programs from 2716 up to 27256 EPROMs
* Supports high-speed Intelligent Programming Algorithm
* Self-contained Unit
* Connects to Parallel Port

The Gemini GM860 Bytewide EPROM Programmer is capable of programming 2716, 2732, 2732A, 2764, 27128 and 27256 EPROMs. For EPROMs of 2764 and larger the GM860 utilises the approved high-speed Intelligent Programming Algorithm to drastically reduce the programming time of these devices.

The GM860 Programmer is supplied in a compact enclosure containing its own mains-powered PSU unit to generate the various programming voltage requirements. Power-On and Socket-Busy indicators inform the user of the programmer's status. Connection is to the host system's PIO, and a cable is supplied to utilise the parallel printer socket fitted to the Gemini and Quantum computer systems.

Comprehensive CP/M software is included to read, write and verify EPROMs to and from disk files.



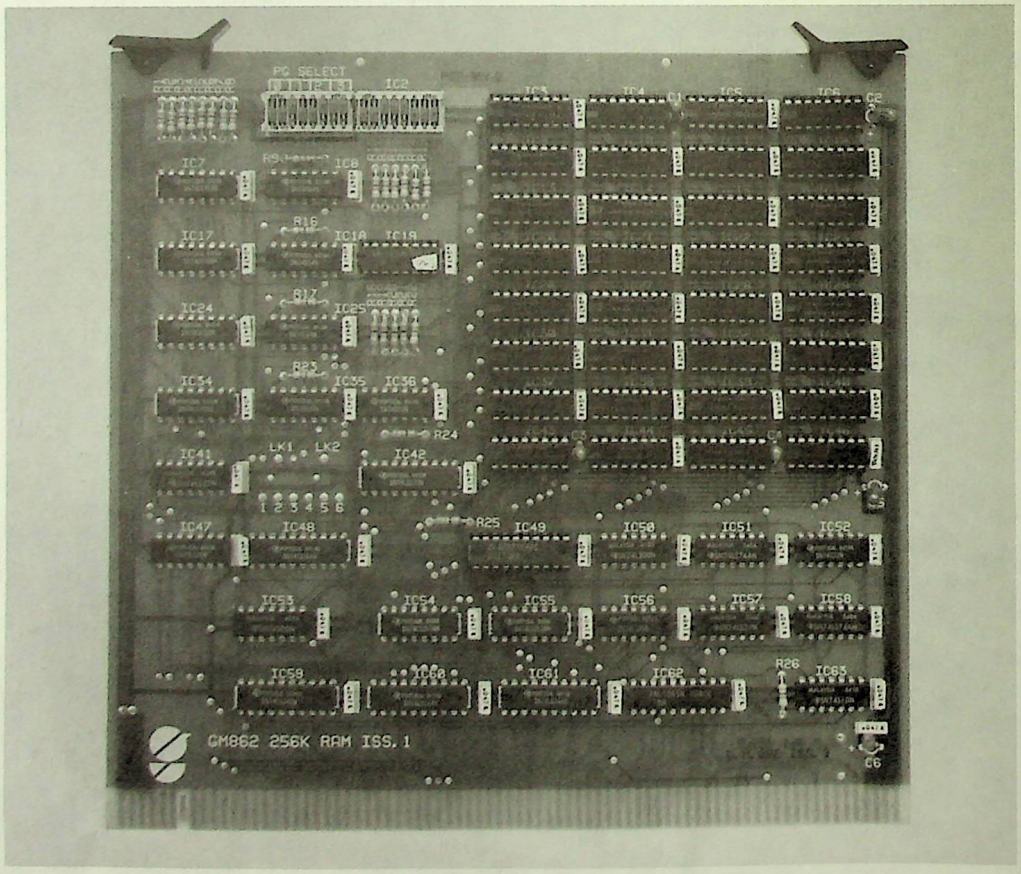
GM862 256K DYNAMIC RAM BOARD

* 256K Dynamic RAM
* Page Mode Operation
* Extended Addressing Operation
* Special ´Common Area´ Mode
* Can Use Multiple Boards - Up to 2 MBytes

The Gemini GM862 is a dynamic random access memory board with a capacity of 256K bytes. It supports the two standard 80-BUS memory expansion techniques of memory-mapped Extended Addressing and Page-Mode. In addition, when used in Page Mode, the GM862 can be configured so that only the lower 56K or 60K of memory is paged, leaving the top 8K or 4K of memory common to all four pages.

The configuration of the board is totally flexible. Each of the four 64K banks of memory on the card can be assigned to a particular Page and a particular Extended Address. These are defined by the settings of the on-board switches.

With the Gemini GM811 CPU board, only one GM862 may be used, but with the Gemini GM813 CPU board, with its on-board ´Memory-mapper´ or the 8088 processor based GM888 CPU board, with its additional address lines, a total of 2 MBytes of memory can be accessed by installing multiple GM862 boards in the system.



PROVISIONAL

GM853 — EPROM BOARD
GM863 — STATIC RAM BOARD

* Up to 512K of Firmware
* Available with 32K or 64K of Battery-Backed Static RAM
* Page Mode Operation
* Supports Extended Addressing

The Gemini GM853/GM863 EPROM/STATIC RAM board contains 8 ´BYTEWIDE´ sockets to accept many different types of memory device ranging from 64Kbit (8K x 8) up to 512Kbit (64K x 8). The board supports the 80-BUS extended addressing mode, and may also be set to any one of the four pages of the Gemini Page Mode system.

The 8 ´bytewide´ sockets are divided into two banks of four, and each bank may contain different size memory devices to the other. Additionally either bank may be provided with optional battery back-up.

The GM853/863 is available in three different forms to suit varying system requirements:

GM853	-	8 ´bytewide´ sockets
GM863-32	-	32K of battery-backed static RAM plus 4 ´bytewide´ sockets
GM863-64	-	64K of battery-backed static RAM

PROVISIONAL

GM888 — 16-BIT PROCESSOR BOARD

* 8 MHz 8088 16-Bit CPU
* Allows Dual Processor 80-BUS System
* Real Time Clock with Battery Back-Up
* Optional 8087 Arithmetic Co-Processor

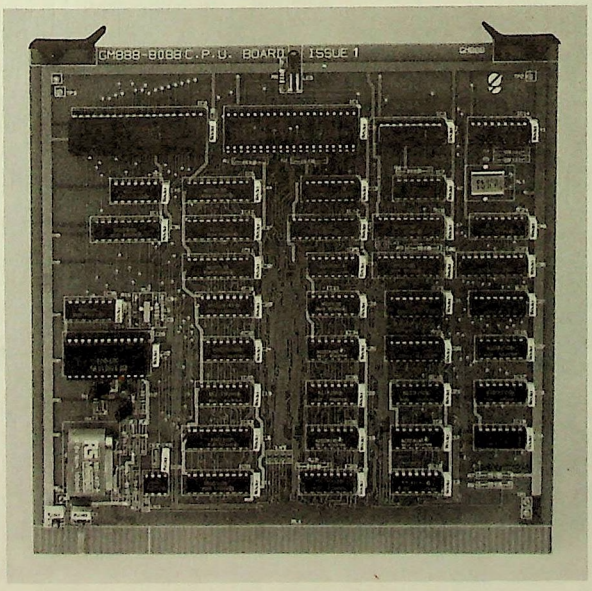
The Gemini GM888 board contains an Intel 8088 16-bit processor together with a Real Time Clock with battery back-up and a socket for the fitting of an optional 8087 high-speed arithmetic co-processor. An 80-BUS I/O port is allocated to allow the operating system or user program to switch between using the 8088 CPU on the GM888 and the Z80A on the host CPU board (ie, GM811 or GM813).

On-board firmware is restricted to a minimal ´bootstrap´ program. This approach means that the operating system is not committed to one particular choice, but may be CP/M-86, Concurrent CP/M, MS-DOS (a variant of IBM PC-DOS), or any future 8088 compatible operating system. Gemini have already implemented CP/M-86.

The GM888 board is based on the 8MHz version of the 8088 CPU, and it is interfaced to the 4MHz 80-BUS via a ´state-machine´. This interface maps the 8088 control signals to Z80 equivalents so that the board may be used with the existing Gemini MultiBoard range. An apparent overall CPU clock-rate of approximately 6MHz is achieved, out-performing the 4.77MHz rate of the IBM PC quite considerably.

The on-board battery-backed Real Time Clock provides time and date information which may be used by certain operating systems. It also provides regular interrupts, which may be utilised by Concurrent CP/M for task switching, and a small area of battery-backed memory, which may be used to hold system configuration information.

The addition of this board to a Gemini MultiBoard system will allow the user to run both existing CP/M-80 applications programs as well as software written for the 16-bit operating systems mentioned above.



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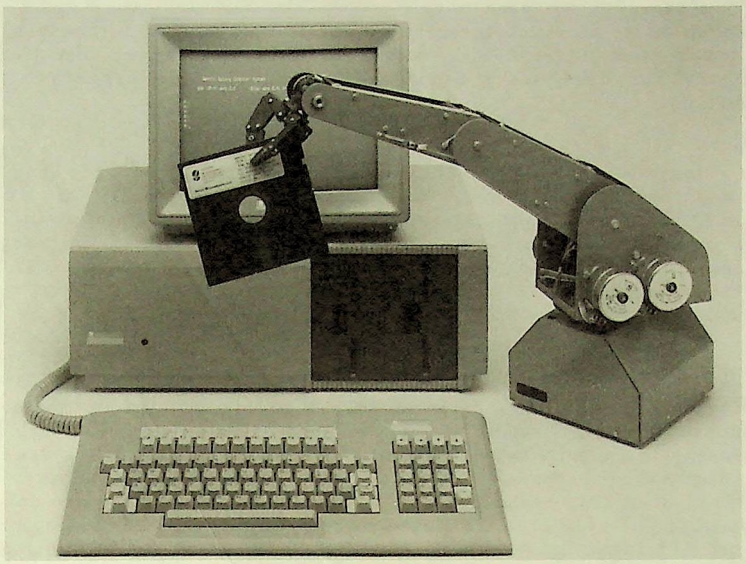


GEMINI ROBOT CONTROLLER

This controller package was designed by a member of the Robot Group at Edinburgh University's Department of Artificial Intelligence, which is today the leading UK university laboratory working on high level methods of robot programming. The Gemini Robot Controller embodies the result of two years work investigating the performance limits of Colne Robotics' Armdroid 1 robot, and its programming.

The Armdroid, which could be considered a "toy robot" in terms of its size, strength and accuracy, is nevertheless a working model of a typical factory assembly robot, and within its reduced scale demonstrates the abilities, and the problems, of its bigger brothers. Someone who has successfully programmed an Armdroid to do a few tasks, and worked at making the repeated performance of those tasks reliable, has become familiar with most of the major problems of using robots for assembly and "pick & place" in industry.

There is no advanced technology in the Armdroid and it could have been built with pre-war technology. This is also true of its bigger brothers in industry, and the reason they were not built so long ago is that we lacked the technology to control such a complex device - the computer. It is the computer which makes it possible to program a robot to do something.

The method currently employed to program "senseless" robots to do things (i.e. robots without senses, such as touch or vision) is known as "teaching". A senseless robot is only capable of following an automatic preprogrammed sequence of movements. A movement can be defined by its starting position, its ending position, and some quality of the movement, such as "slowly".

Looked at in this way, a robot program is basically a sequence, or list, of positions. The problem of programming the robot becomes the problem of creating this list of positions. There are two parts to this. The first is defining a particular position. This is done by moving the robot, under manual control, to the particular position, and then effectively declaring "this is it!". The computer knows exactly how the motors were moved to bring the robot to that position, and can then work out how to get the robot to that position from any other position.

The second part of programming the robot has to do with the impossibility of getting the robot program right first time. Many changes and experiments are required to get any but the simplest robot program working. Many more are required to get it to work reliably. It is therefore necessary to have powerful and simple methods for making changes to the list - adding positions, deleting positions, changing positions.

In the Gemini Robot Controller a variety of powerful and simple methods are available for moving the robot under manual control, and for making changes to the existing list of positions. Care has been taken to make sure that all facilities are available all the time, in the same way.

This is known as a "modeless interface", and is the easiest for people to learn, as well as being the most general and powerful. This interface, and the facilities provided, embody the designer's familiarity with a wide variety of robots and programming methods.

Types of Motion

There are various ways in which a robot could be moved from one position to another. The most useful is known as "joint interpolated motion". This is the kind of motion where all the motors start together and stop together, regardless of how far each individual motor might have to move. This is the most useful kind of motion for two reasons: it is capable of moving betwen the most widely separated positions; and small joint interpolated movements are approximately straight lines. For these reasons, robot programs based on joint interpolated movement require less positions to be "taught" than other kinds of motion.

Speed of Motion

Joint interpolated motion is unfortunately a difficult kind of motion to achieve, especially for stepper motor robots (like the Armdroid). The Gemini Robot Controller utilises a unique joint interpolated motion algorithm which allows the Armdroid to move with unusual speed and smoothness. The acceleration and deceleration ramps are tailored to protect against step loss - the major hazard when stepper motors are driven hard.

The robot will, of course, be able to move downwards (assisted by gravity) much faster than when lifting a heavy weight upwards. Since it would become tedious to have to continuously change the speed when programming and yet to fail to do so would result in unnecessarily slow programs (running at the speed of the slowest movement), the Gemini Robot Controller chooses its own speed, based on the type of movement in question. The user is able to change both the speeds from which the controller makes its automatic selection, and may also override the speed of any particular movement. In this way programs with optimally tailored speeds of movement can be created with the minimum of difficulty.

Other Robots and Other Things

The Gemini Robot Controller is primarily intended to drive an Armdroid, without any sensory feedback. It has been designed, however, in such a way as to make it as simple as possible to drive other stepper motor robots, or indeed, other devices using stepper motors (such as laser mirror platforms, telescopes, etc), and to make it possible to add sensory feedback.

This results from three design features. The first is that all important parameters are defined in a special OPTIONS section, so that they may easily be changed. The second is that the routine which moves the robot in joint interpolated motion is written as a monolithic machine code routine, with all the flexibility obtained by the supplied parameters. The interface to this routine is basically the position to be moved to, and the allowable maximum speed.

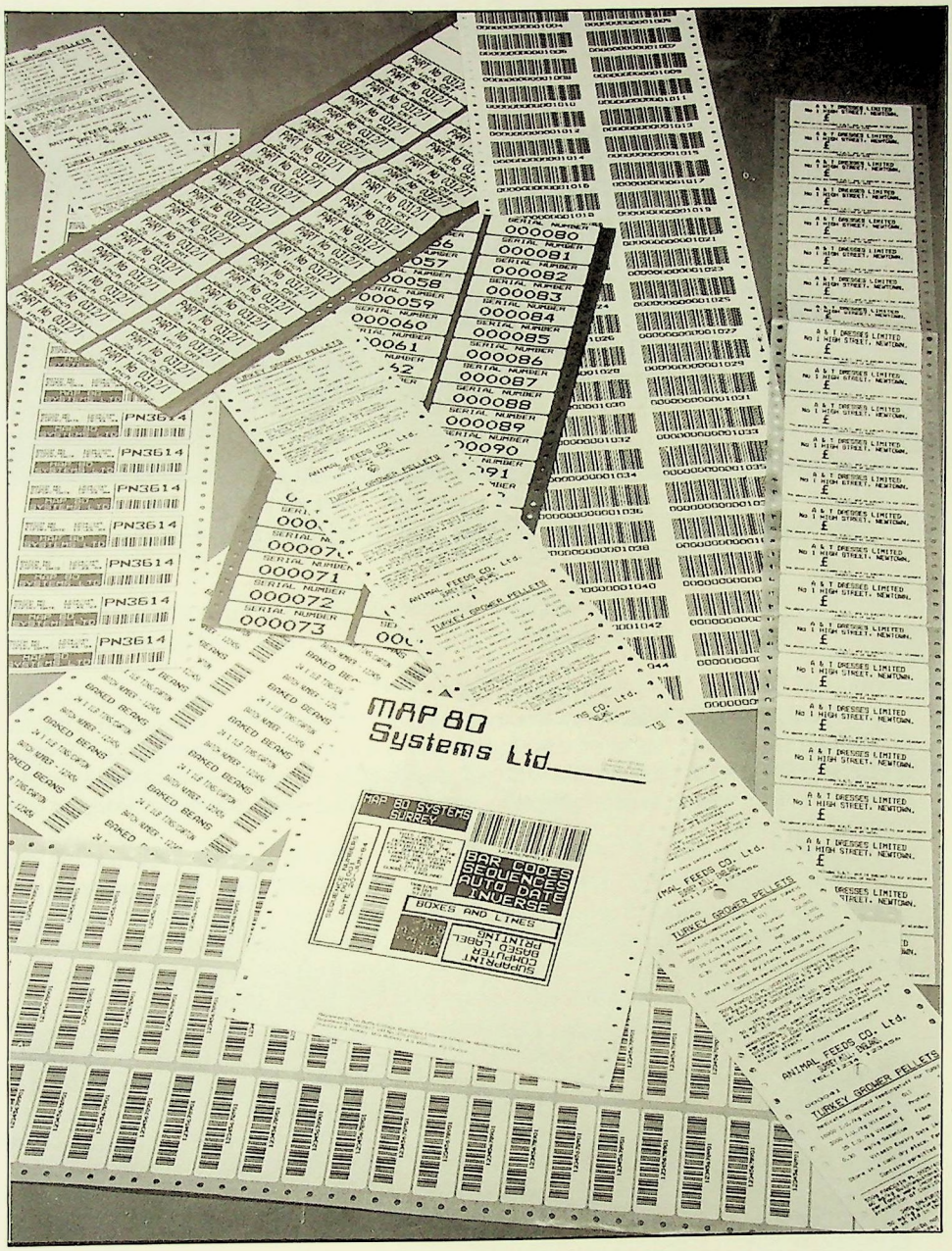
Thus the difficult business of moving the robot is hidden behind a simple and convenient high level interface. This enables the third design feature, which is that the rest of the controller is written in standard interpreted Microsoft BASIC, and is thus available to the user to modify or extend.

Does It Work?

Proof of the pudding is in the eating. While the controller is not yet finished, the current demonstration version has been used in the Department of Artificial Intelligence to drive a unique design of parallel stepper motor robot, built rather like a flight simulator platform. It was capable of driving this unusual form of robot straight away, and required two lines of code to be changed to optimise it for this robot.

The Gemini Robot Controller is a computer program, and is provided with full documentation of the user interface and facilities. This includes some documentation of the internal structure of the program, since it is intended that advanced or specialised users should be able to make modifications and additions to the controller.

Gemini Microcomputers reserves the right to amend any specification without notice.



COMPUTER LABELLING SYSTEMS

EASIPRINT 300

The *EASIPRINT* system, a computer based label printer is available in a variety of configurations, and has been developed with todays in house label printer in mind. It offers to the user a number of functions designed to assist in the easy construction of label formats which, when complete, can be permanently stored on disk and later recalled for printing or amendments.

The system is offered with a variety of printers to suit your particular requirements and budgets, starting with an inexpensive dot matrix printer up to a fast sophisticated line printer capable of printing many thousands of labels an hour. The latter being ideally suited to the high volume user such as the Animal Feed Miller who needs to be able to change data and produce labels quickly.

For those who need a more complex label, perhaps with sequential bar coding, box drawing and inverted print we offer our *SUPAPRINT* system. This has a graphics printing capability and additional software enabling complex labels to be easily produced. Facilities include sequential bar-coding, line and box drawing, reverse image, vertical and inverted print, large character sizes, print queing etc.

Unlike most label systems that are dedicated to only printing labels, both the *EASIPRINT* and *SUPAPRINT* systems can be used for many other applications as the system utilises the CP/M 2.2* operating system for which there are many thousands of programmes available. These include word processing spreadsheets, stock control, payroll, and others too numerous to mention.

Applications for the system can be found in most areas of industry, especially those where many different label shapes and sizes are required, and or the ability to quickly change label data is important.

FEATURES :

- Fast printing of self adhesive and *FEED MILL* type labels.
- Permanent storage of labels on disk with ability to recall.
- Sequential numbering in either ascending or descending order.
- Last used sequence number stored for future use.
- Up to eight sizes of print.
- Free format label up to 7.7 by 11.5 inches.
- Print queing facility for unattended operation.
- Utilises *CP/M 2.2 thus allowing other software packages to be run.
- Capable of word processing, stock control, payroll, spreadsheets etc.
- Sequential and standard printing of Bar codes of various types.
- Graphics capability allowing easy production of complex labels.
- Easy to create and amend labels using integral 12″ green display.
- Each data disk is capable of holding 350 labels.
- Unlimited number of data disks allows vast label storage.
- Auto date entry with offset facility for expiry dates etc.
- Italics, bold print, and underline.
- Simple to operate keyboard with single key entry of functions.
- Multiple labels printed across the web to increase throughput.
- Various printer options to suit your applications and budget.
- Two printers can be used in many cases to increase throughput.
- Some printers can be fitted with multiple tractor feeds.
- Line and box drawing, vertical and inverted print, reverse image.

* CP/M 2.2 is a registered trademark of Digital Research Incorporated

EASIPRINT 160

EASIPRINT - 160

This is the smallest system in the range using an 80 column, dot matrix printer, and is aimed at the lower volume or occasional user. The full flexibility of the system is retained however, thus offering all the features of a very powerfull desk top micro-computer in addition to its sophisticated labelling capability.

SPECIFICATION :

Computer	—	MAPCOM
Operating system	—	CP/M 2.2
Printer	—	EPSON FX80
Print speed (at 10cpi)	—	160 CPS
Print sizes	—	4
Max. label size	—	7.7″ by 11″

OPTIONS :
Second printer, Business software, Word processing, etc.

EASIPRINT - 300

The *EASIPRINT 300* is our standard system utilising a fast heavy duty line printer for the user that demands high quality, high volume, label production at the press of a button. The printer has a full 13.2 inch carriage width and therefore can take full advantage of the line printing action especially when printing multi labels across the web.

SPECIFICATION :

Computer	—	MAPCOM
Operating system	—	CP/M 2.2
Printer	—	CI-300
Print speed (at 10cpi)	—	300 LPM Draft
	—	110 LPM NLQ
Print sizes	—	8
Max. label size	—	7.7″ by 11″

OPTIONS :
Second printer, Business software, Word processing, etc.

SUPAPRINT - 300

If more complex labels are required then a graphics card is fitted to the line printer and with additional software we have our *SUPAPRINT 300* system. This system offers Bar-Coding, line and box drawing, reverse image, vertical and inverted print, variable character sizes, and many other features.

SPECIFICATION :

Computer	—	MAPCOM
Operating system	—	CP/M 2.2
Printer	—	CI-300
Print speed (at 10cpi)	—	300 LPM Draft
	—	110 LPM NLQ
Print sizes	—	Various
Max. label size	—	13.2″ by 9.9″

OPTIONS :
Business software, Word processing, etc.

All the above systems can be enhanced in various ways from our comprehensive range of products which include Winchester hard disks, silicon disks, CP/M Plus etc. Should your application be somewhat special then we would be happy to discuss this with you and supply a system that exactly suited your needs.

FOR FURTHER DETAILS OR TO ARRANGE A DEMONSTRATION CONTACT US AT:-

MAP 80 Systems Ltd

CHERTSEY COMPUTER CENTRE
1 WINDSOR STREET,
CHERTSEY, SURREY.
Telephone: (09328) 68044

MAPCOM

The MAP 80 computer has been designed with total expandability in mind. It can be used as a general business computer to perform such tasks as word-processing, accounts, payroll etc. but can also be used as a dedicated controller for all types of industrial processes.

STANDARD FEATURES INCLUDE:-

- Z80A CPU (4MHz)
- 64K of RAM
- Fast memory mapped 80 Column by 25 Line display
- 12" Green screen monitor
- Centronics parallel interface
- Two serial RS232 channels with full modem control
- Dual 1 MByte 5¼" floppy disk drives
- 91 key, 8 bit ASCII keyboard with 19 key numeric pad
- 15 fully programmable function keys
- CP/M 2.2 operating system
- Four bus expansion slots

MAP 80 Systems Ltd

Chertsey Computer Centre
No 1 Windsor Street Chertsey Surrey KT16 8AY
Telephone: CHERTSEY (09328) 64663

TECHNICAL DATA

STANDARD SPECIFICATION

CPU	Z80A CPU operating at 4MHz without wait states
MEMORY	64K of dynamic RAM
SCREEN	80 Column by 25 Line memory mapped screen providing standard ASCII set plus inverse/ graphics, or optional user character set
MONITOR	12" Green screen
INTERFACE	Centronics parallel interface and two serial RS232 channels using standard Z80, PIO, SIO, CTC chip set
DISK SYSTEM	Dual, Half height, 1 MByte 5¼" 96TPI, 80 track double sided drives driven by a WD 2797 floppy disk controller
KEYBOARD	Total of 91 keys 15 Software programmable function keys Numeric key pad Cursor keys
OPERATING SYSTEM	Digital Research's CP/M 2.2
EXPANSION	Three standard 80 bus slots provide expansion for a wide range of add on cards

OPTIONAL EXTRAS

RAM	Extra memory boards providing additional memory for virtual disk on drive "P".
SOFTWARE	Full implementation of banked CP/M Plus (CP/M 3) (Requires RAM expansion)
WINCHESTER	Hard disk option using extra card and Winchester controller also providing 8" capability
MULTI USER	High speed RS422 multi-drop serial interface allows high speed communication
OTHER I/O	Multi-line bi-directional analogue and digitial I/O

Fully compatible with other Nasbus and 80 Bus products
Custom and OEM services available

CP/M is a registered trade mark of Digital Research Inc.

MAP 80 Systems Ltd

Chertsey Computer Centre
No 1 Windsor Street
Chertsey
Surrey KT16 8AY
Tel: (09328) 64663

AUTHORISED DEALER:-

MAP 80 Systems Ltd

Unit 2, Stoneylands Road,
Egham, Surrey TW20 9QR.
TEL: (0784) 37674.

R. Smith, Esq.
138 Holtye Road
East Grinstead
Sussex.
01892 667090

18th March, 1985.

Dear Rod,

Thank you for the disks. This is the first time I have come across this type of format and ASSIGN cannot cope with either for the same reason. I will be modifying things to cope with it in future and will send you a copy once I have done it.

You are getting a bit confused over skew. Interrogate shows the physical sector layout on the disk, ie, the order in which the sectors are laid down at format time; this has nothing to do with the order in which sectors are read. The skew here refers to the number of sectors between sequential sector numbers, ie, a skew of 2 is laid down:- Ø,x,x,1,x,x,2,x,x,3 etc. Normally, if Interrogate shows that sectors are not laid down sequentially then a logical skew is applied by the BIOS. With a logical skew (the one entered in the ASSIGN data), the skew factor here is the number added to the previous sector in order to produce the actual physical sector number read, for example, an IBM 3740 8" SS SD:-

BDOS calls for sector	Ø, 1, 2, 3, 4, 5
A skew factor of 6 will read physical sectors	Ø, 6, 12, 18, 24, (1) wrap around
A skew factor of 1 will read	Ø, 1, 2, 3, 4, 5
which is no skew	

A MAP disk has sectors laid down non-sequentially but has no logical to physical translation; sectors are read 1,2,3,etc, correctly regardless of sector layout as established at format time. The Merlin disk has sectors laid out 1,2,3,4,5,6,7,8,9, 10. If it has a logical to physical translation this can only be discovered by examination, there is no way that Interrogate can find it.

I hope that the above will be of some help to you.

With regards,

Yours sincerely,

A. Watk

Tony Watkins.

Registered office: as above. Registered No. 1662817. VAT No. 370 2130 01.
Directors: P.G. Rothery, M.G. Rothery T Eng (CEI), A.S. Watkins, P.J. Chance MI Elec IE.

MAP 80 Systems Ltd

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UNIT 2
Slough Lands Rd
Egham Surrey
TW20
9QR.

WITH COMPLIMENTS.

M

Registered Office: Bottle Cottage, Bath Road, Littlewick Green, Nr. Maidenhead, Berks.
Registered No. 1662817 VAT No. 370 2130 01
Directors: P.G. Rothery M.G. Rothery A.S. Watkins P.J. Chance

F L A G L A N D B A S E

Solo NOTs Unit

ROD SMITH
138 Holtye Rd
East Grinstead
Sussex RH19 3EA
England

18/09/84

Regarding your report of 6:16 hours we received for your week ending 06/09/84:

*** THANK YOU ***

Thank you for sending in your "AO-1 form" report as referenced above.

Please feel free to contact me if I can be of assistance to you in your Solo NOTs auditing.

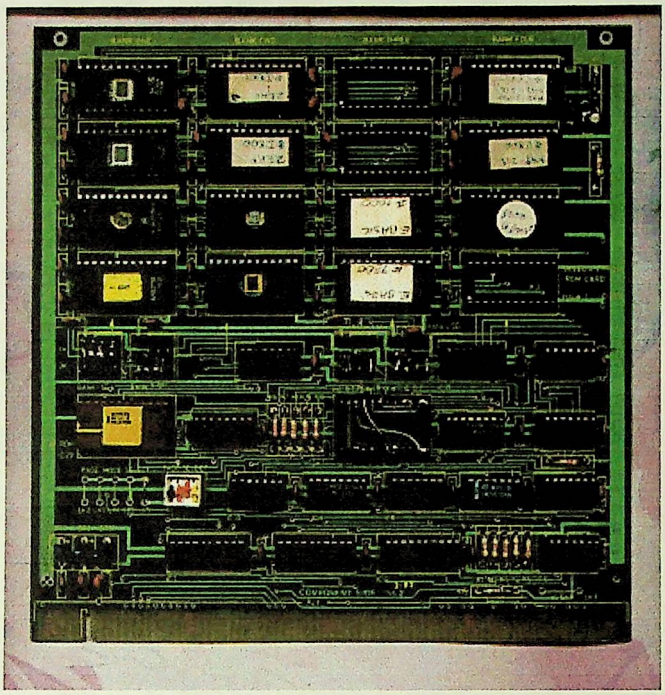
If you have not mailed your worksheets yet, please do so. They are due every two weeks. If they are already in the mail great! Keep up the good work!

Solo NOTs Home D of P

SVC 195
Ch. ~~[illegible]~~ 125

Prolog.

Gemini G803 ROM Board



When NASCOM eventually ended up as part of Gemini Microcomputers this board was one of the "80-BUS" items. It housed four banks of four EPROMS each and a 8k BASIC ROM position. Each of the four EPROM banks could be selected as either 2708 (1k x 8) or 2716 (2k x 8) types.

Like the RAM (B) board described elsewhere this board also supported the paging system.

NASCOM - The Company

* LOTS OF UPDATES - 17 Feb 1999 *

You had better keep checking this page if you are interested. A little of what follows is "estimated guesswork". Everything is liable to change here as I find out more...

NASCOM Microcomputers was originally set up as a small subsidiary of the Nasco Ltd component distribution company.
It was originally set up by John Marshall (later Managing Director) in November 1977. Considering that the new company had little cash, it did very well.

Kerr Borland joined on the marketing side in January 1978 and became Nascom Sales Director. He left again in late 1979/early 1980 to form a new company (called Product Launch). His interest in the fledgling Nascom appeared to have waned once the company had got started. However, his new company was doing some of Nascom's promotional work! Later still, if my information is correct, he appears to have started the rather short-lived Arfon Microelectronics. Arfon's first products were a speech board (for various machines) and a light pen which was compatible with Nascom's (Lucas's) IVC card. They also produced a range of peripherals for the Commodore VIC 20 before they finally went into receivership.

The NASCOM computers were produced in the UK only. The user base, however, spread into Europe and Scandinavia.

The NAS-BUS was created to add expansion to the NASCOM computers. (Unfortunately, due to lack of board space, a separate buffer board had to be designed for the NASCOM-1.) The idea was, in view of the popularity of the NASCOM system, to produce a UK competitor to the S100 bus. The new bus would be simpler and cheaper to manufacture than the S100 system - and wouldn't need any licensing agreements!

Unfortunately the company was doing too well. They funded the NASCOM-2 without external finance but were immediately beset with component sourcing difficulties. This problem was so severe that Nascom provided a 16k dynamic RAM board with every NASCOM-2 sold instead of fitting the 8k of static

RAM which had been intended.

The expected return on the new NASCOM-2 computer failed to materialise in time. Their main City backer decided not to allow further working capital.

On 27th May 1980 Nascom had called in the receivers. Production of the NASCOM computers was cut back and a planned "System 80" was cancelled. Stocks of the Nascom products to dealers became severely restricted, although the demand was still present.

There was discussion of Nascom being taken over by another company, but that failed to materialise. Meanwhile, the receivers were causing further problems. They effectively prevented the NAS- prefix being used for all Nascom and Nascom-compatible products.

At this time, the whole Nascom "thing" was being kept going by a group of (ex) Nascom dealers. One of them even acted as postbox and paperwork centre for the newsletter previously run from the Nascom offices. (The newletter changed its name from INMC News to INMC80 News at this time to create a clean break from Nascom). The receiver appeared to have no interest in the NAS-BUS as a possible standard so the original specification was tidied up and renamed 80-BUS. One of the dealers, Dave Hunt, instigated the design of a two-card system which could be used as a substitute for the NASCOM-2 if the receiver failed to find a buyer. This was to become the Gemini system. The new Gemini company was, once again, headed by John Marshall, who had been ousted from Nascom of course.

This was a very tense period for the NASCOM fans. If you already had a computer you were OK, but depended on your dealer for all support. If you were trying to get one then good luck! There were very few machines around. Expansion boards also became a problem. You couldn't expand a NASCOM-1 without a buffer board, and those were very hard to find.

Nascom was finally sold to Lucas Logic (August? 1981), being renamed Lucas Nascom. At almost the same time the Gemini Multibus was launched. Now the user had a choice of systems on the same bus! However, the two systems differed in one very important aspect. The Gemini system was designed, from the beginning, to support the CP/M operating system. A new monitor program RP/M was written (by the same author as the Nascom monitors of course!) which let cassette-loaded CP/M programs run on a diskless system. Also, the two-board design allowed for a "proper" screen display system on

the second board to allow CP/M programs to run correctly.

The NAS-BUS had been renamed 80-BUS by Gemini and (it says in 80-BUS news) some 10 manufacturers were producing over 20 bus-compatible cards between them. Probably because of its close affiliation, the old newsletter changed its name again. Now it became 80-BUS News as it was supporting both Nascom and Gemini systems.

Strangely enough (what a coincidence), August 1981 saw the launch of a new user magazine named Micropower. This appears to have been started by a software company, Program Power, who had been distributing Nascom software. So now we had two parallel systems and two magazines. Program Power and Lucas Logic versus 80-BUS News and Gemini/Microvalue.

In December 1981 Lucas Logic (I can't think of them as Nascom now) launched the NASCOM-3 rather quietly. It was a fully cased computer similar to the NASCOM-2 with 8k RAM. I say similar, as I have seen a report that the main board was different but I have never actually seen one to find out! Micropower changed its name to Nascom Newsletter in November 1982. I suspect that this was to give Lucas rather more control over it as some of the articles were drifting toward the 80-BUS!

The 80-BUS computer used processor cards which were heavily based on the NASCOM-2, but in the same square format as the expansion cards. It was, of course, compatible with the NASCOM-2 some users could turn their "old" NASCOM systems into nice new Gemini systems just by changing the processor card! The new system was really aimed at the business sector, supporting CP/M in the "big" version.

Quite a few boards were advertised under the 80-BUS banner. The ones that I know of, or have seen advertised are listed in the hardware section.

I'm not sure what happened next. Like many people I was distracted by another machine and the NASCOM-1 went into storage.

By February 1984 there only seems to have been one outlet for the Gemini Microcomputers components. That was Micro Value. This may have been the sales arm of Gemini, Gemini themselves or just a company set up to exploit the 80-BUS. The last issue of 80-BUS News that I have is January-February 1984 but it makes no mention of being the last issue. The Nascom Newsletter published its last issue in June of the same year. The editorial states that "...the

number of hobbyist users is dropping off rapidly. The natural life-cycle of a microcomputer I suppose."

In a January 1985 magazine there are no more Gemini components advertised. Micro Value appears to have stopped advertising.

Thus the short life of the NASCOM systems ends. Started in 1978 using the new Z80 processor (only launched in 1977) and fading away in less than 7 years. By now, of course, Sinclair had launched the ZX80, ZX81 and Spectrum. Commodore had the KIM, VIC 20, PET and 64. The outcome was easily predictable: why build an expensive computer when you can buy a seemingly better-specified ready-built computer cheaper? You could buy ready-built boards but this only made the price difference worse.

Today I doubt if you could produce any of the NASCOM machines and make a profit. Even providing it as a kit and using the existing NASBUG monitor (I doubt if Microsoft would make you a present of the 8k BASIC code though!).

It would be interesting to re-cycle the old Nas-bus/80-BUS as a microcontroller interface though. Any takers?

Gemini	Galaxy 2	-	GM903 - Complete system with 2 floppy drives
Gemini	Quantum 2000	-	Complete system
Gemini	19in Frame	not NASCOM	Gemini GM610
Gemini	3 Slot Motherboard	all	Gemini GM656
Gemini	5 Slot Motherboard	all	Gemini GM654
Gemini	8 Slot Motherboard	all	Gemini GM655
Gemini	3 Slot Motherboard	all	Gemini GM656
Gemini	5 board frame	not NASCOM	Gemini GM662
Gemini	6 Slot Motherboard	all	Gemini GM682
Gemini	64k RAM board	-	Gemini GM802 - 64k dynamic RAM
Gemini	ROM board (90k)	1/2	Gemini G803 - sold without EPROMs!
Gemini	Disk controller	-	Gemini G805 - 48TPI cased system connected via the PIO
Gemini	3A Power Supply	-	Gemini G807
Bits&PCs	EPROM programmer	-	for 2708 & 2716. Later sold under the Gemini name as G808
Gemini	Floppy Disk board (92k)	2	Gemini G809 (dated May 1982) - 48/96TPI - replaced by GM829?
Gemini	CPU board	-	Gemini G811 - with 4 RAM/EPROM sockets (no RAM fitted)
Gemini	IVC	-	Gemini G812 - Intelligent Video Controller - 80 char/25 lines
Gemini	CPU/64k RAM board (192k)	-	Gemini G813 - with RAM and CP/M compatible

Gemini	IEEE488 board	-	Gemini EV814
Gemini	Multi I/O board	-	Gemini G816 - with 6 I/O ports, 4 CTC, RTC
Gemini	6A Power Supply	-	Gemini G817 - switch mode type
Gemini	Twin Serial Port	-	Gemini G818 - daughter board to fit G816 I/O board
Gemini	RTC board	-	Gemini G822 - Real-time clock kit - plugs into PIO
IO Research	A-D board	-	8-bit A-D converter. Later sold under the Gemini name as GM824
Gemini	Floppy drive unit	-	Gemini GM825-1S or GM825-2S - 1 or 2 5.25in floppy drive unit
Gemini	Static RAM board	-	Gemini MP826 - 32k static RAM with battery backup
Gemini	87 key keyboard	-	Gemini GM827 - with user-definable function keys + numeric pad
Gemini	Disk Controller board	-	Gemini G829 - for 4 mixed 5.25in and 8in + SCSI HDD (Someone said that this was also used in the Lucas Logic "Winchester" hard disk drive!)
Gemini	SVC	-	Gemini G832 - Super Video Controller (enhanced IVC)- 80 char/25 lines
Gemini	RAM-disk board	-	Gemini GM833 - 512k dynamic RAM. Virtual disk operation
Gemini	"Winchester" drive	-	Gemini GM835 - 5.4Mb (!) hard disk drive subsystem (1450 UK Pounds in 1983!)
Climax	Colour vector graphics	-	256x256 display. 16 colours. Much cheaper than PLUTO! Available as a kit at first. Later sold under the Gemini name as GM837.
Gemini	Prototyping	-	Gemini GM839

	card (58k)		
Gemini	14 Slot Motherboard	-	Gemini MP840
Gemini	80-BUS card extender (164k)	all	Gemini GM841
Gemini	10A Power Supply	-	Gemini G843 - switch mode type
Gemini	Floppy/SCSI	-	Gemini G849 - also supports 1.2M drives - up to 8 devices
IO Research	PLUTO colour graphics	-	on-board processor. 640x576 display. 192k RAM
Gemini	Monitor	-	Gemini Phoenix - 12in green or amber phospher
Belectra	Arithmetic board	not NASCOM-1	HSA-88B. A rather large (and expensive!) maths processor. Used a Am9511A number cruncher.
Costgold Research	8088 processor board	not NASCOM-1 ?	Costgold CA802 / Gemini GM888?
Costgold Research	80286 processor board	not NASCOM-1 ?	No number(s) known yet

Alan, No sales lists yet.

You will find a list of components amongst this lot. If you could say what you are looking for - I could try a more in-depth search. My trouble at the moment is that many modern companies are calling themselves Gemini computers, it is hard to sieve through them.

Margaret.

2885595

An Independent Review of the Gemini Galaxy 2

by Mr. D. R. Hunt

Introduction

The Galaxy 2 computer by Gemini Microcomputers is the result of progressive development from the earlier Galaxy 1 computer, incorporating a number of improvements which further enhance the performance of the machine. Gemini have retained the modular card approach with the Galaxy 2, an approach which has always been the province of 'professional' computer design. The 'single board' approach adopted by many computer designers has advantages in terms of production cost, but disadvantages in terms of flexibility, expansion and repair. The single board approach is probably suitable for the business user where, once the specification of the machine has been decided, there would be little likelihood of needing expansion. However, Gemini have produced a modular machine equal to or better in performance than most popular single board computers, and at a very competitive price. Because of its modular design many permutations of the basic machine may be manufactured without the extra cost involved in manufacturing 'specials', and with all the advantages of expansion and flexibility as we shall see later. This makes the Galaxy 2 not only competitive in the business market, but ideal in the system development or laboratory situation, an area where many single board computers could not compete.

Specification

The basic specification of the machine is similar to many other machines using the CP/M operating system; a high capacity twin disk system, Z80A processor, 64K of RAM, 80 by 25 VDU type display, etc. Unlike many other CP/M machines, however, the Galaxy 2 has an internal bus with three slots spare conforming to the popular 80–BUS/Nasbus standard, allowing expansion with cards manufactured by a number of other companies.

Appearance

The Galaxy comes complete with all leads and necessary connectors to plug in directly. A quality 12" green or amber screen monitor is also supplied. The Galaxy case is steel measuring 18" by 12" by 7", attractively finished in cream and matt black paint. The paint finish is a high temperature baked resin finish and is particularly hard wearing, very easy to keep clean and not prone to scratches. In these days of flimsy vacuum formed plastic cases it is a delight to see the solid and robust case of the Galaxy, which whilst boxy in shape is both pleasantly and conveniently proportioned. The solid case makes the Galaxy feature as one of the very few computers you could actually stand on without damage. Not a major sales point perhaps, but one that should appeal to the educationalists or to users where hard physical use (or abuse) of a computer takes place. The separate keyboard case is also of steel construction, finished in a similar fashion to the main computer case, and is sufficiently low profile for experienced typists to find it comfortable in use.

The only features on the front face of the computer are the vertically mounted twin disk drives and an LED power on indicator. The back panel has all the necessary sockets and connectors. A DB25 connector is provided for direct connection to RS232 printers or a modem, a 36 way Amphenol type connector for direct connection to printers using the parallel 'Centronics' protocol. A DB15 connector is provided for keyboard connection and DIN sockets for external tape I/O and light pen connection and a PL259 socket for the video output. The power and reset switches are also mounted on the back panel, along with the quick release fan filter and a blanked off hole approximately 1" by 2.5" to allow connection to be made to any expansion cards fitted by the user which require leads to external equipment, etc. All connectors on the back panel are clearly labelled and an adequate description of each is provided in the manual.

The Keyboard

The keyboard is separately detachable and mounted in a steel case. Connection is made by a multiway 36" coiled cable which expands to about 80". This makes for neat and tidy connection, but unfortunately the connector on the keyboard is on the right hand side of back panel of the keyboard case which means that if the cable is laid 'naturally', it runs from the left hand side of the computer across to the keyboard connector on the other side of the keyboard case. This means that more of the cable is in view than would be strictly necessary had the keyboard connector been fitted to the left hand side. The keyboard is of high quality with a light yet positive touch and is a full function keyboard with a standard QWERTY layout. Ten function keys, four cursor control keys and a numeric pad are also provided. An unusual feature of the function keys is that the cursor and numeric pad keys may also be programmed as function keys. Additionally, the functions can also be shifted so that each programmable key may serve a dual function. This gives access to no less than 60 fully programmable function keys if required. This feature would commonly be used with programe such as WORDSTAR, where the numeric pad would be reprogrammed as the WORDSTAR cursor keys. The only criticism of the keyboard as such is the cursor keys themselves which are, in my opinion, badly positioned and psychologically in the wrong order. The order could be changed by reprogramming but this should not be necessary on a machine like the Galaxy. Programming the function keys from the keyboard is simple from within the CP/M command mode (and often from within programs) and a utility program is provided to store the reprogrammed key patterns for instant recall at a later date.

The Disk Drives

The drives fitted as standard are the Micropolis 1115F-V 96 track per inch, single sided 80 track drives working in a double density MFM format. These drives are extremely solidly built and use such advanced techniques as phase locked motor speed control and an internal dedicated processor. They are widely recognised as being one of the best and most reliable drives available. The Micropolis drives give a formatted space of 400K, which, when system tracks and directory areas are taken into account, leave the user with 388K of useable disk space per drive. A factory option is to fit the Micropolis1115FVI drives which are of similar specification but double sided, providing a useable space of 788K per drive. The drives are loaded in the conventional manner with flap doors; no spring disk eject mechanism is fitted. A small point is that with the drives mounted vertically, there is no obvious 'up' when inserting disks in the disk drives, and although obvious to the experienced user, it is only too easy for the inexperienced to put a disk into the drive 'upside down' and to suffer a failure of the system to boot. A point not covered in the manual.

An interesting point if the double sided 1115F-VI drives are fitted is that the Galaxy could be used to read disks from many other machines (including Gemini's earlier double density machines). As the drive head step pitch is the now standard 96 tracks per inch, and as the standard pitch of many double density machines is 48 tracks per inch, it is apparent that if the Micropolis drives were arranged to double step, then the data could be read. This of course would require software patches in the low level disk primitives in the Gemini BIOS which would not be the easiest thing to undertake but not outside the scope of many proficient machine code programmers. Note that Gemini are not likely to provide support for this sort of thing unless demand warrants it, but it might be worth asking if only to indicate that the demand existed.

Powering up

The Galaxy 2 auto boots on power up when a system disk is inserted in drive A, an almost foolproof idea accompanied by a flashing instruction, displayed in inverse video, on the monitor which says 'Insert disk in drive A'. Should the disk system fail to boot because a disk with no system or incorrect system was inserted, then a message to that effect is displayed. If a correct disk is inserted and the system fails to boot then it is possible to cause the Galaxy to revert to the very simple internal ROM monitor which is capable of carrying out diagnostic procedures. Only the bare essentials of the diagnostics are covered in the manual and for more sophisticated checks it is necessary to revert to the individual card manuals which are available from Gemini as an optional extra. In any event, unless the user has a very thorough working knowledge of the internals of the machine, he would be advised to consult Gemini through their country wide dealer network if problems are encountered.

Video Output

Computers of modular design are often associated with separate terminals as display devices, not so with the Galaxy. A separate card takes care of the video and feeds its output to the back panel socket for connection direct to a standard monitor display. The 25 line by 80 column display is to professional standards and the video card contains within its command set a sub-set which emulates the Lear Siegler ADM-3A terminal. However, whilst the Lear Siegler terminal is a serial device and hence somewhat slow, the video card plugs straight on to the system bus and is commendably fast. One reason for the choice of the Lear Siegler instruction sub-set is that much popular CP/M software is designed for use with this particular terminal and very little, if any, patching is usually required. However, the video card improves on the Lear Siegler instruction set in many ways, and much proprietary software can be further improved as regards speed by the incorporation of the extended commands of the video card. The video card also features a user programmable character set and also limited 160 by 75 pixel graphics.

The Galaxy is supplied with a standard monitor, the Phoenix P12, a 12" green or amber screen monitor of Italian origin. Unlike the Galaxy, this has a plastic case, in a colour which matches the colour scheme of the Galaxy. The Phoenix monitor has logic rather than analogue inputs and is therefore free from that faint patterning which often accompanies analogue monitors although this was just discernible when displaying inverse video. The monitor was extremely sharp to the edges and almost free of picture 'breathing' when switching rapidly from normal to inverse video. Picture geometry was excellent. When supplied the monitor picture was a little undersize and slightly to one side. Not many users would notice this, although it is easily adjusted if required.

Internal Layout

Internally the layout of the Galaxy is simple and compact. At the rear of the case is the fan and power supply unit. The fan ran reasonably quietly and was certainly an improvement over the fans fitted to earlier Galaxy 1's. The power supply is a switch mode one, fully RF screened and with impressive mains supply filtering. No effects of mains glitches were observed even under the 'dirtiest' of mains conditions. The drives are fitted to the front panel immediately in front of the power supply and solidly secured to a sub-chassis on the base of the computer case. To the left of the drives is a card cage which contains 5 card slots. The three lower slots contain the three modular cards needed for the standard Galaxy, the upper two are empty and are available for expansion. As mentioned earlier a blanked off hole is provided on the back panel adjacent to the card cage to allow entry for leads which might need to be connected to any envisaged expansion cards. Air flow through the case is dictated by the position of the ventilation slots on the sides and to the front of the case top wrapper. There are no slots on the top of the case, so the computer is reasonably safe against spilt coffee, etc. Having removed the top cover, it is only too easy to replace it the wrong way round and so restrict the ventilation although no harm seems to come if this accidentally happens, indicating more than adequate cooling.

The standard Galaxy is fitted with three cards, the CPU/RAM card, the disk controller card and the video card. As is to be expected, all three cards are engineered to the highest standards, the pc layout whilst compact, is orderly and neat, with gold flashed connectors, pc solder resist and component legend screening on the fibreglass boards. The boards are flow soldered with the ICs socketed where necessary. Good quality components are used throughout.

The CPU Card

The CPU card contains the main processor, a 4MHz Z80A. The clock speed is 4MHz without wait states. The board also incorporates 64K of 4164 dynamic RAM and the 2K simple monitor/boot EPROM. A Z80A PIO device takes care of the parallel I/O, normally used for the 'Centronics' protocol parallel interface, whilst a WD8250 serial controller provides RS232 I/O and full modem control. A number of links are provided for reconfiguring the board for specialist purposes which are fully detailed in an optional manual for the card. All I/O to the bus is fully buffered with considerable expansion in mind. The RAM and ROM are paged and can be selected and deselected from software. The software is so arranged that the EPROM is normally paged out of the system on boot up, leaving the whole of the 64K RAM available for CP/M. The RAM is similarly paged, with extended addressing to 2M byte. This means that implementation of CP/M Plus (CP/M 3.x) will present no particular problems as the additional RAM required for this operating system could be provided by the inclusion of the Gemini GM802 64K expansion RAM card, which already exists within the Gemini range of expansion cards.

The Disk Controller Card

The disk controller card features the Western Digital WD1797 three chip disk controller set, and incorporates software controlled clock rate select for 5.25" or 8" drives. Connectors are provided for the standard 5.25" and 8" drive connectors, whilst a third connector is used for the SASI interface to Winchester hard disks. This card is extremely flexible in its own right, although normally only used to drive the internal 5.25" drives, 8" drives and a Winchester drive can be fitted externally and because of the software selectable clock rates and the SASI interface, given the correct software, they can all be used together from the one card!! A further extension to the disk system is the option of fitting Gemini GM833 512K RAM-DISK cards which are organised as a port driven memory plane (not page mode). This is intended to be used exactly like an additional 512K disk drive (or more with multiple cards), and the Gemini CP/M BIOS is designed to cope with this. The disadvantage of course is that data is lost on power down, so good discipline is required to ensure that the virtual disk is always adequately backed up. However, in use the virtual disk card is incredibly fast and is a boon when used in large data base programs where updating large disk based indices inevitably slows down work. Naturally the virtual disk may be used with the existing 5.25" drives, and of course the 8" and Winchester drives as well. A truly flexible configuration.

The Video Card

The video card, as already mentioned, handles all the video processing under the control of a 6845 video processor. The card also features the second Z80A mentioned in the advertising for internal control of the video processor and to provide the very flexible range of video card commands. As the video card is not memory mapped, I/O from the bus is via three ports, one for input and output, one for status and one for reset. The keyboard is also connected to the video card. The card carries a 4K EPROM which is the operating system for the Z80A handling all output to the video and all input from the keyboard and a further 2K EPROM is fitted for the 128 character fixed character set. A total of 6K of RAM is provided on this card, 2K for the video display, 2K for the programmable character set, 1/2K for the function keyboard tables, 64 bytes of keyboard buffer, 128 bytes of video input buffer and the remainder as workspace, leaving about 1K free. It is possible to further extend the range of commands to the video card by writing programs for use in this 1K of spare memory, however, because of the extreme difficulty of debugging programs in this area, this is best left to experts. On power up the fixed character set is complimented and then loaded to the programmable character generator providing 128 normal characters and 128 inverse video characters. Individual characters within the programmable set may be reprogrammed at will or complete character sets changed as required. The preset function key definitions are down loaded from the EPROM into the RAM table on power up, and may be changed by keyboard entry or by program from disk. The function key table space is allocated dynamically. Normally, each function key would be assigned the few bytes it needs in the table space, however, it is possible to program one key with almost all the 1/2K available at the expense of programming space for the other keys. The 64 byte keyboard buffer allows a useful type ahead facility.

Twin Z80s?

The Gemini advertising boasts that the Galaxy features two Z80A processors, which whilst strictly true does not present the full picture. The second Z80A certainly speeds video operations and greatly enhances the flexibility of the video card, however, it would be difficult in the extreme and probably be a self defeating exercise to try and make the second processor share in some multi-processor role. In view of this, as each drive contains a dedicated processor, the 6845 and the WD1797 are also both dedicated processors and the keyboard contains a further derivative of the 8045 family, why not advertise that the machine contains no fewer than seven processors?

CP/M Operating System

The Galaxy uses the familiar CP/M version 2.2 as its operating system. Little need be said here about CP/M and its utility programs as these have all been adequately covered elsewhere. However, the Galaxy features a number of small but significant improvements related to the BIOS. Many, criticisms have been levelled at CP/M as an operating system, not the least of which refer to its 'unfriendliness'. Some criticism is justified, as is probably the case for any operating system, but CP/M comes in for a lot of unjustified criticism, which is not the fault of Digital Research, but the fault of the programmers who wrote the BIOSes for various machines. Gemini amply demonstrate what can be done to confound the critics, and deserve the highest praise for both the orderly approach and the manner in which they have removed much of the supposed unfriendliness of CP/M without touching a byte of CP/M itself.

Perhaps the worst areas of CP/M are its very bald and unhelpful disk error trapping. Now as the disk access routines are in the BIOS and as stated, the BIOS is the province of the system programmer and not Digital Research, scope exists to improve things. With the Galaxy the days of 'BDOS ERROR ON DRIVE x', a very unhelpful statement, are gone. In the event of a disk read/write error, the Galaxy BIOS traps it and attempts to reread it four times, if that fails, then the heads are drawn back to track O, repositioned, and the read attempted another four times. Only after this is an error reported with a message indicating the type of error, the track and sector where the error occurred and a polite request to the user to either try again, accept the error anyway or boot the system. In the odd instances where disk errors have occurred and been reported, the fault can often be cleared by removing and replacing the disk in the drive and then requesting a retry.

Another notable improvement is the 'on screen' editing using the cursor controls. An invaluable feature, particularly for careless two finger typists such as the author. The CP/M input works normally until the EDIT key is depressed, whereupon the cursor changes from its normal underline symbol to a solid inverse video block, indicating edit mode. The cursor can then be moved around the screen at will and incorrect input lines edited. This feature was found to be particularly useful with MBASIC, as most editing could be achieved without recourse to the somewhat cumbersome internal Microsoft editor. The screen editing suffers from two limitations, the edit line must not exceed one displayed line, 80 characters, and it can only be used with programs that use the CP/M buffered line input mode. These features are all under the control of the programmer who wrote the original BIOS, and not a function of the Galaxy hardware, so it is pertinent to ask why these features do not seem to have appeared on other machines?

In common with most implementations of CP/M, there are a number of default modes, whether to run a program on start up, what type of output device to select, etc, which, whilst selectable by the user, are often poorly documented (if at all) and usually hard to find. Likewise the hardware also has a number of defaults which need to be declared on start up, such as the speed of the UART, etc. Gemini overcame this problem by supplying a small utility program, CONFIG.COM, which allows all the defaults to be set in the most simple manner. This program is a delight to use and works by using a menu of the options available and then allowing the particular option to be set using the screen editing. The program is self documenting and explains the consequences of any particular default set up.

Utility Programs

Gemini also supply a number of other utility programs (over and above those normally supplied with CP/M). FORMAT.COM is a disk formatting program, allowing the user to format his own disks for use in the Galaxy. Format programs are a vital necessity, and it surprises me that some manufacturers can actually supply machines without a format program and then cash in selling 'own brand' formatted disks at exorbitant prices. The format program takes about two minutes to run in all and carries out a thorough check of the disk validity. Any disk errors are reported, it being up to the user to reject the disk or try reformatting it. As far as disk tolerance is concerned, the Galaxy seemed to be happy with the most decrepit of disks. Even well worn disks originally supplied as single density were found to format, verify and run correctly without error.

Among the other utilities is a disk backup program. With disks of 400K capacity, backing up a disk using the CP/M PIP program can be a tedious business. The backup program accomplishes the feat in about 110 seconds (less for a disk containing less data), having fully verified the copy.

As mentioned previously, a utility is supplied to save the user defined function keys, further utilities are provided for cassette tape read and write.

Documentation

The documentation for the Galaxy itself comes bound in an A4 folder along with a CP/M manual and a number of other documents such as the CP/M license, circuit diagrams, the software manual for the video card, guarantees, etc. The Guide to the Galaxy (with apologies to Richard Adams) is an explanation of the machine and how to use it, written in a refreshing and friendly style, keeping explanations simple and straightforward. The Galaxy manual does not set out to teach the user how to 'drive' CP/M, but lists the specific features of the machine and departures from the normal CP/M machine, such as the screen editing and the utility programs which are all covered in detail. The blow by blow account of how to use CP/M, is left to the CP/M guide. This approach is more than adequate for the user interested in running typical applications software but falls somewhat short of the documentation required to gain an in depth understanding of the machine. Gemini overcome this shortcoming by supplying all the additional documentation for the individual cards and software at very modest prices through their dealer network. The user intending to use the Galaxy as a development tool need not be worried by the lack of heavy technical documentation as the optional card and software manuals are all easily available and most comprehensive.

Expansion

By using an internal bus structure conforming to the popular 80-BUS/Nasbus standard, and by providing three additional card slots within the machine, Gemini have allowed for considerable expansion. Gemini's own range of expansion is quite large and includes 5.4 Mbyte and 10.8 Mbyte hard disks. But the overall range is quite impressive, coming from E V Computing, Microcode, Climax Computers, Nascom and IO Research amongst others. The exceptionally high resolution Pluto colour card sub-system by IO Research is one such, whilst colour graphics at a more modest price (and resolution) is provided by the Climax colour card. Real time clocks are provided by both Gemini (two versions) and from E V, whose clock makes ingenious use of the Z80 on the video card, displaying real time in the top corner of the screen. A collection of various I/O cards are available from Gemini, E V, Nascom and IO Research, whilst battery backed RAM is available from Microcode. A full implementation IEEE488 card is available from E V and a High Speed Arithmetic Processor is now available from Belectra. The already broad range covers most needs and the main problem appears to be finding out about the various expansion facilities on offer. Also a number of new cards will be added before the end of this year.

Network System

One of the more impressive features of the Gemini is the Network system, which can be installed retrospectively into a Galaxy. Essentially the Gemini MultiNet network system consists of a file server and up to 31 stations. The file server is based on a standard Galaxy 2 but substitutes a 5 or 10 MB Winchester drive in place of floppy in drive, A. A small Network controller card is connected to the PIO on the CPU card and thence to an additional three pin connector on the back panel. Each station appears to the user as a separate disk based CP/M computer of very similar specification to the Galaxy 2 using the Winchester disk of the file server for disk access. Although the file server is normally supplied as a complete entity it is possible to up-grade an existing Galaxy into a Network file server by feeding an external Winchester sub-system (GM835) and an internal Network card (GM836UPG) and, of course, the necessary software. Gemini supply workstations for use on the Network which are similar in style to the Galaxy, but physically smaller, as they do not require an on-board disk. As with the file server the Galaxy 2 can be converted for use as a workstation with the advantage of retaining a local floppy disk capability. Gemini Dealers are able to carry out either conversions.

In use the Network is extremely reliable and the software is delightfully "bug" free. The speed is surprising; when only one station is requiring access the workstation actually responds faster than the normal Galaxy 2 due to the 250K baud network data rate and use of RAM spooling buffers on the file server. Naturally, the response times get longer with heavy usage. However, a 10 station Network is not markedly slower than a normal disk system. In terms of cost a Network becomes viable at about four systems, being cheaper than four separate Galaxy machines.

Conclusions

Over all the Gemini Galaxy is a complete machine from a number of angles. Complete in the respect that it can be purchased and plugged in and it will go. Complete in the respect that the machine is robust enough and with enough expansion capability to be of serious use as a development tool from both the hardware and software aspects. Complete in that it would appeal to the serious business user and the computing enthusiast alike. All in all, a very capable all rounder with only a small number of niggles and at a very realistic price.

D/D.
48TPI.
1 Side
first=1.
1024 Bytes.
8 Sectors
INDEX

Serial
1 - R Det.
2 - ~~GND~~ +5V.
3 - Serial in - (3)
4 - Clocks.
5 - Serial out (2)
6 - 12VNEG
7 - CTS (Pin 5)
8 - DSR - 4
9 - RTS
10 - GND
11 - DTR
12 - +12V.
13 - GND
14 - GND
15 - GND
16 - +5V.

D/D.
48TPI
1 Side
1st = 1
256 Bytes.
26 Sectors
NO INDEX

D/Den.
2 Sides.
96 TPI.
first = 1.
256 bytes.
16 Sectors.
INDEX PRESENT.
GAPS 65/38/67.

Serial

Sectors.

6 13 4 11 2 9

16 7 14 5 12 3

10 1 8 15

LOBRY
HONEY KORKY

D/D.
48TPI.
2 SIDES.
1ST SECT. = 1.
256 bytes.
26 Sectors.
INDEX PRESENT.
GAPS: 64/37/69.

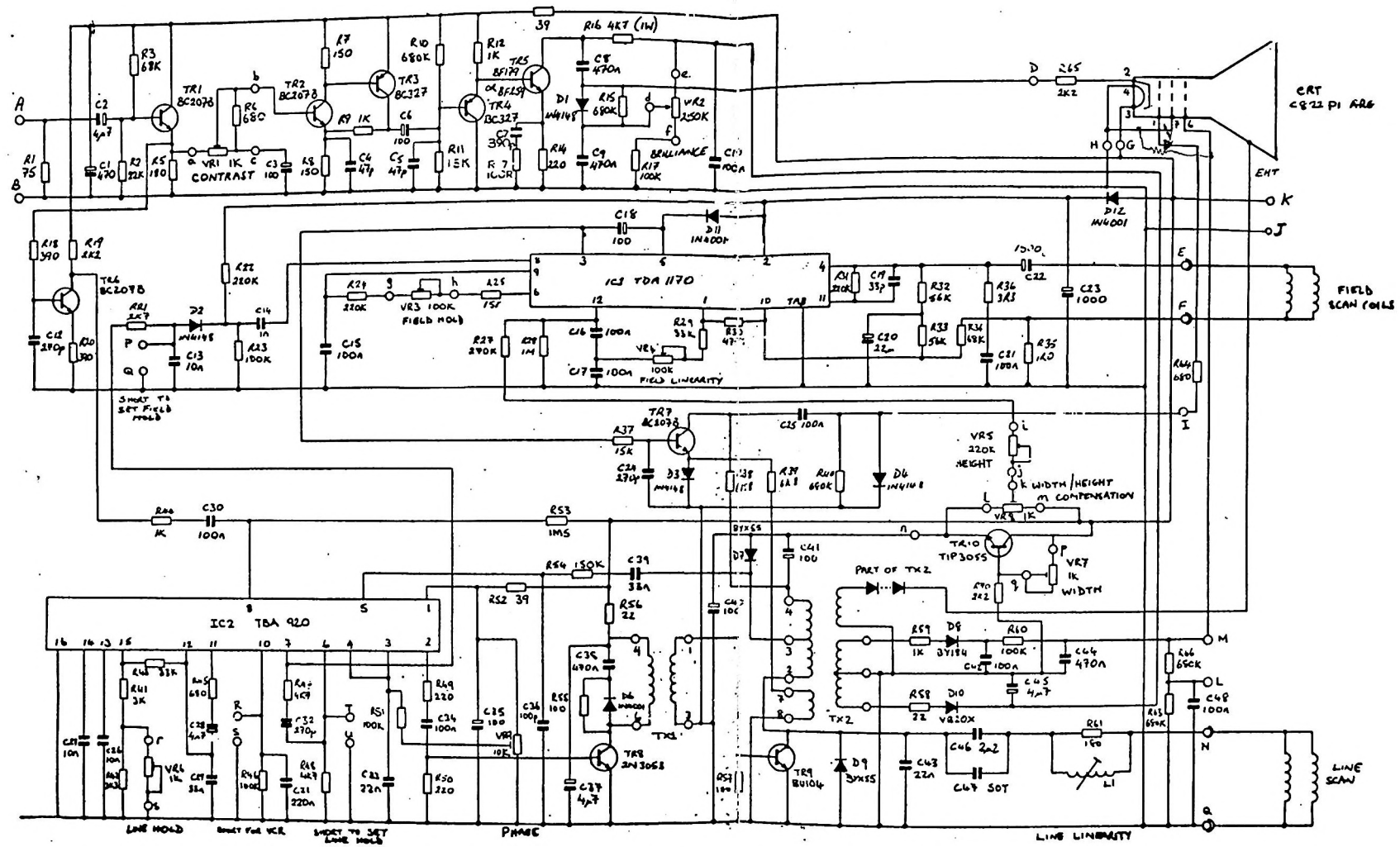
Sectors.

1 14 2 15 3 etc.

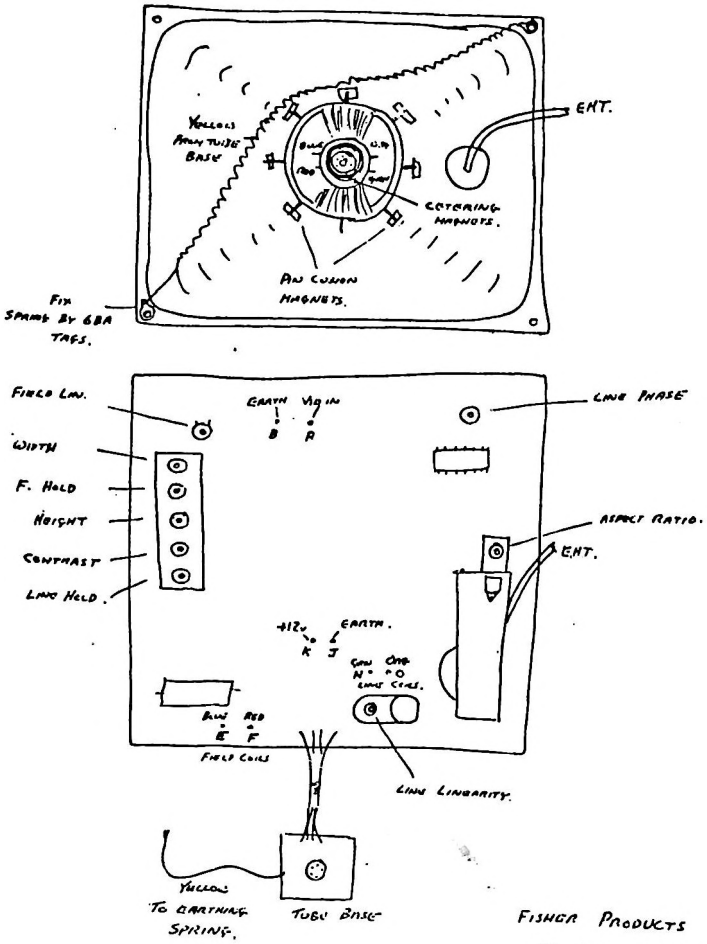
Side change on Sect'
2K blocks

8 Pud
8 Sel.
1024
index y
85. 37. 68

1 - 8.


CONTRAST
BRILLIANCE
IC1 TDA 1170
FIELD HOLD
FIELD LINEARITY
VR5 220K HEIGHT
WIDTH/HEIGHT COMPENSATION
IC2 TBA 920
LINE HOLD
PHASE
LINE LINEARITY
CRT C822 PI ARB
EHT
FIELD SCAN COILS
LINE SCAN

VIDEO MONITOR LAYOUT FOR CONNECTIONS.



ASSEMBLY INSTRUCTIONS FOR 7" MONITOR

To connect the tube to the video printed board, locate the tube over the board such that the line output transformer is to the left of the tube neck, the wiring is then as follows:

Supply in pin J earth
K +ve

Fit tube base to tube, the yellow wire provides aquadag earthing via the spring which should be fitted diagonally across the bulb part of the tube.

Scan coils	Line	pin D	to orange
		N	to green
	Field	E	to blue
		F	to red

Video input to pin A, return earth to pin B

To set up the monitor a cross-hatch generator, computer generated cross-hatch or a page of print will be useful. To facilitate these adjustments the tube should be held away from the PCB so that all eight of the scan coil plastic lugs are accessable so as to fit the magnets.

SET UP PROCEEDURE

Fire-up the system from the power source that it will finally be used from or one of equal voltage. Allow a few minutes to warm up. With a suitable video input (pins A & B) adjust brightness (external pot.) and contrast (VR1) to obtain a picture, which should be stabilised by the hold pots. , VR3 & VR6. At this stage the picture will probably be very distorted.

Begin by reducing the height (VR5) and width (VR7) to produce a small picture, then by rotating the centering magnets, around the rear of the scan coils and rotating the scan coils, obtain a square picture, well centred.

To correct pin cushion distortion fit a small magnet onto one of the plastic lugs around the front of the scan coils, start at one corner and rotate the magnet to push in that corner of the picture. Continue for all four corners and then attempt the side, top & bottom magnets. You may find that no correction is required at one point or that the magnet is not powerful enough: if this is the case then use the thicker magnet. Once the tube is roughly set up, adjust height, width, field linearity (VR4), line linearity (core next to line O/P transformer), and the scan coil magnets to correct the picture further.

Given enough time and paitience a perfectly square and sharp picture may be produced. Good luck, but if you have problems contact: -

FISHER PRODUCTS
187b, WOODHOUSE ROAD, LONDON, N 12. 01-368 5188

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*****************************************
*                                       *
* GENERAL OPERATING INSTRUCTIONS FOR THE *
*        MAP 256K DYNAMIC RAM CARD      *
*                                       *
*****************************************
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MAP 80 Systems Ltd.,
Chertsey Computer Centre,
No 1 Windsor Street, 10
CHERTSEY
Surrey Tel 09328 64663

Issue 2 - March 1983

256K DYNAMIC RAM BOARD

INTRODUCTION

The MAP 80 256K Ram board has been designed around the 80-BUS system and
is therefore compatible with the NASCOM and GEMINI range of products. Howev
er due to the requirement to provide MEM EXT and to disable RAM in the lower
4k this card is not suitable for use with a NASCOM 1. The board utilises t
he 4864 64k dynamic ram chip arranged in four blocks of 64k bytes thus allowi
ng the board to be supplied in four sizes i.e. 64/128/192/256k bytes.This al
so means that expansion of the smaller sizes is only a matter of addi
ng additional ram chips, since decoding for the full 256k is provided even wi
th the smallest configuration. Up to eight MAP 80 256k ram boards can used
in one system giving up to 2 megabytes on line.
To facilitate the use of memory which is outside the addressing range of t
he Z80 processor, circuitry has been included to allow full memory mapping a
nd flexible page mode operation thus offering the end user a wide range
of options depending on how the board is configured.

COMMISSIONING

Carefully unpack your MAP 256 K RAM and examine it for any mechanic
al

Gemini Microcomputers Ltd

18 Woodside Road Amersham Bucks England HP7 0BH
Tel (02403) 28321 Telex 837788

Production of a catalogue such as the Multiboard Microsystem takes a lot of time and can really only be produced once a year. Our new catalogue will be published in November of this year and, as an interim measure, we have produced a number of supplements which are collated with this letter. One of the appended documents is a new end-user price list which came into effect on the 1st September. This list excludes one or two items which may be of interest to those with Nascom systems and concentrates solely on Gemini's board based systems. We have included the prices of compatible cards which are made by other manufacturers and all of these are available through our dealer network.

There is also a four page leaflet which contains details of five new products which are currently in the early stages of production.

In addition there are a number of comments that need to be made concerning the contents of Catalogue No. 4 and these are as follows.

Page 5

The GM812 IVC board has now been discontinued.
The GM832 SVC board is now in full production.

Pages 6 and 7

The GM827 range of high profile keyboards are now being phased out.
The GM821 keyboard is now obsolete.

The above keyboards have been replaced with the GM852 series. This is a low profile fully enclosed version. The standard units are supplied with serial interface but parallel versions will be available for the foreseeable future.

The boards are made available with an English layout, one for German, one for Danish, one for Swedish and an Azerty layout for French. The keyboard is connected to the GM832 SVC.

Page 8

The GM803 EPROM/ROM board has been discontinued. It will in due course be replaced by the GM863.

A new high capacity 256K RAM board is available. This is GM862.

Page 9

The MP826 32K Static RAM board will be superceded by either the GM853-32 or GM853-64 Static RAM board.

Page 11

The GM835 Winchester Drive sub system is now available with a 16 Mbyte Winchester Drive.

Toshiba half height 5.25" double sided 96 TPI drives are now available. Epsom SMD 140 range of double sided 3.5" drives are available.

Page 13

We have now produced a system catalogue which gives full details of the revised range of products. The main enclosures have been changed, the monitor is different and the GM852 low profile keyboard has now been adopted as standard. Galaxy ST is no longer available.

Page 16

The IO828 PLUTO Colour Graphics board is now available only in the high speed high resolution version.

The Mini Palette which is also manufactured by IO Research allows one to expand the number of colours available.

Gemini have taken over the production of the CC837 board and have re-titled it the GM837 Colour Graphics Display.

Page 17

Gemini have taken over production of the 8 bit A/D board previously manufactured by IO Research. This has now been re-designated GM824.

Page 19

The GM848 is now in production.

Page 25

The GM687 and GM688 Enclosures are in the process of being modified. The back panels have been changed to allow the inclusion of a large removable back plate in order to facilitate the various types of I/O that different customers require.

Gemini will continue to develop more 80-BUS products during 1985. The product range is we believe unparalleled and with a Europe wide dealer and distributor network we are confident that more and more people will adopt the MultiBoard approach.

Yours faithfully

J A MARSHALL
Managing Director

GEMINI GALAXY MFB REVIEW

It isn't contagious. In fact it might even be good for you. But it is an epidemic. It starts with someone in the Finance Department and spreads through into Insurance, Property, Buying, Corporate Planning, Sales and Personnel. Regional offices become affected quite quickly. Suddenly it is evident that there has been an outbreak of small computers - and not only in the office, because senior executives have contrived one to use at home or have bought a portable model. Typewriters grow interfaces and computers masquerading as Word Processors are connected to them, and soon Secretaries can't do without them.

Then at a Board Meeting, under Any Other Reasonable Business, the Administration Director (the man who said last month that the head office photocopy output would stretch from London to Vladivostock if laid end to end) tables a paper showing that there are 78 microcomputers of fifteen different makes in Head Office alone and that they have been purchased without any attempt to ensure compatibility. The Computer Director reminds his colleagues that there are mainframe computers spread around the business and that anything a toy computer can do can be done more efficiently with a mainframe. The Chairman, slightly put out because he has just requisitioned a micro for one of his personal assistants, appoints a Study Group to report in four months time on the use of small computers in the business. A week later an IBM PC appears in, of all places, the Computer Department where it is passed off unsuccessfully as "just another VDU".

This might be an allegory but it is a fact that all over Britain managers with enough clout to sign a chit for the money involved are right now talking to dealers or consultants about requirements for problem-solving or improved efficiency which will end up with the delivery of a small computer, some software and maybe a printer. The average initial spend is about £3,000, and in most companies the purchases are uncoordinated and will result in a proliferation of different types of machines with different disk sizes and formats. Perhaps the only thing many of them will have in common is that they run or can run the CP/M family of operating systems or their lookalikes.

The time will come (and our allegorical Study Group will labour the point) when the inability to take a disk out of one computer and run it in another will be increasingly frustrating. The quality of general purpose programs, such as financial modelling and database management, is increasing rapidly and one can foresee perhaps in a year or two the emergence of really useful integrated programs of which Lotus 1-2-3 and the Perfect Software family are the current beginners. At this point, for the majority of uses, all small computers will be "the same" - but you can bet that disks won't be, particularly now that the 3.5 inch semi-rigid disk is becoming more widely available and laser-disks with a capacity of up to a gigabyte are around several corners.

The Galaxy MFB system, and its future developments, will provide the link between the man or woman and his/her preferred machine and the other computer users in a business. Human nature will dictate that no matter how desirable it may be to standardise on one machine in any organisation, it is always more fun to have the newest or most beautiful or most powerful or most easily portable machine. Moreover, with the present dynamic state of the market, whatever is "standard" today will be tomorrow's museum-piece because the time it takes to create a standard is just long enough to ensure its obsolescence.

The MFB is two things. In its own right it is a state-of-the-art 8-bit microcomputer with four disk drives - one 5 megabyte Winchester, two double-sided 5.25 inch mini-floppy drives and one single-sided 8 inch drive with an augmented CP/M operating system which allows the disks other than the Winchester to be used in many different formats and densities. It is also a powerful translator using the included software. Although there is a "standard" (sorry!) configuration, an MFB system can be ordered with any combination of 5.25", 8" and 3.5" drives (up to four in addition to the Winchester) plus a half-megabyte "memory disk" if required. A 16-bit combined processor and memory add-on card will be available soon as an option.

Although one can imagine someone wanting five disk drives all reading and writing different formats just for the hell of it (the sort of person who puts plastic Oldsmobile tail fins on a Bentley Mulsanne perhaps), the most obvious use for the MFB is in the computer industry for the production of software in many different formats. This is where many of the MFBs are already in use. Another obvious use is in publishers and literary agents offices to receive the incoming work from authors and to copy it across to the disk format used by the editorial staff or by the typesetting machines. In business, uses are not so clearly definable. Examples could be: Transfer of a capital project analysis created on a DEC PC by a project accountant to Altos 8" format for the Central Finance team to work up a series of "what if" analyses: Transfer of the Chairman's Secretary's output from her Osborne to the format used in the central Word Processing department: Collection of area sales analyses sent in by Regional Sales Managers (using various types of microcomputer) in a spreadsheet format to be merged into one matrix. Of course the MFB does not only function as a translator but will run programs utilising the physical disks in the predefined logical format.

The MFB software, so far as a commercial rather than a technical user is concerned, will set up the operating system to define up to four disk drives (in addition to the Winchester drive) as logical drives B through E using the Setup program. Setup uses a disk definition library which is supplied with the MFB which currently contains over 60 formats, and it is necessary only to consult an on-screen listing of the defined formats, select one as the logical drive and Setup will allocate the correct physical drive provided of course that you have the appropriate physical drive in the system. The "standard" configuration augmented by one 3.5" drive will cover substantially all requirements. The hardware requirement for a particular format will in several cases result in a physical drive being allocated to more than one logical drive. For example, Superbrain QD format and IBM PC standard format will both be allocated to a 48 track-per-inch double sided drive. IBM 3740 and IBM S34 formats will both be allocated to the 8" drive. Copying data or programs between logical drives assigned to the same physical device requires an intermediate transfer to the Winchester or the Memory Drive (if fitted). Copying can take place either by using CP/M's PIP program or by a byte transfer method. Several non-CP/M formats are currently supported.

With the MFB system comes a six-months free format update service supplied by Timeclaim Limited who are main distributors for the MFB system. Timeclaim intend to bring into the format library all formats with a reasonably wide use. However the MFB user is able to define new formats for the library. If the computer for which the format is required runs CP/M (either 80 or 86) and the MFB user has access to a running system then much of the information necessary to set up the format is available from CP/M's STAT program. The MFB software package also includes utilities which enable the user to have a high

percentage success rate in setting up a format for a disk which arrives with absolutely no information as to its origin (other than size of course). The Analyse program will supply details on number of tracks used, number of bytes per sector, sectors per track and whether single or double-sided and various other technical details necessary to set up the format. If Analyse produces incomplete or logically conflicting data then a further utility program can be used to examine the disk sectors to deduce the remainder of the required information.

There are of course limitations to the use of the MFB system. Disks created by controllers which do not use the FM or MFM recording formats are not supported. There are few of these around now but as an example the MFB cannot read or write Apple disks. The nearly-redundant Hard Sectored disk cannot be handled. The MFB Manual, which is very clear and well-written, points out that the Torch operating system cannot be supported nor can the Sirius since the disks rotate at varying speeds. There are also one or two systems in which the logical location of sectors ("skew") within tracks is different from track to track and this is not supported since the MFB software reads the skew for each format from a table and applies it to each track on the disk. However some naughty manufacturers which do not supply disk formatting programs with their operating systems will find that MFB users are happily formatting disks without having to pay a full price to the manufacturer or his distributors for Official formatted disks.

So, back to our business (four months later) by which time there are 89 microcomputers now of 20 different makes. Did the Computer Director or the Administration Director go to the Which Computer Show and did they see a Galaxy MFB in action? If they did then one of the 89 ought to be an MFB. Hopefully they did and the Study Group's report to the Chairman would simply consist of the sentence "We have solved the incompatibility problem so far as the majority of present (and all future) small computers is concerned". If they didn't, you can bet that a storm is brewing of considerably greater proportions than that when the Personnel Director proposed changes in the Company Car policy.....

PRODUCT NEWS

ADDENDUM TO CATALOGUE

MPI are constantly adding to the wide range of packages they have on offer; consequently the catalogue quickly becomes outdated.

This addendum is meant to cover the new products MPI have acquired in the period since the brochure was printed.

Please ask if further details are required on any of these packages.

DBASE 2 - Database generator Powerful English like language for designing and implementing relational databases. (CP/M, Cromix CP/M-86, MP/M, CDOS)

CO3 - Protocol emulation packages for ICL CO3 Interactive and Bulk Protocols. (CP/M)

BISYNC/80 - Protocol emulation packages for HASP, 2780, 3270 and Async protocols. (CP/M)

MILESTONE - Pert and Critical Path Analysis package. (CP/M and CP/M-86)

PEARL-3 - CBASIC code generator. Application generator for CBASIC. Menu led generation of business applications. (CP/M, MP/M, CDOS, CP/M-86 and CROMIX)

LEVEL 2 COBOL - Microfocus Level 2 ANSI '74 Cobol. This Cobol has been certified by the American GSA to the Federal High Level. (CP/M, CP/M-86, MP/M-86, CROMIX, MP/M)

CORAL 66 - Microfocus Coral 66 Compiler (CP/M, MP/M)

PERSONAL PEARL - Database generator (CP/M, MP/M)

CP/M TUTOR - Menu driven tutorial course on (CP/M)

PMATE - Word processing package with text buffers and a 'garbage' stack (CP/M, MP/M, CROMIX, CDOS)

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Gemini Microcomputers Ltd

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Dear Sir,

Further to your recent enquiry regarding the Gemini Microcomputer range of products, enclosed please find a compilation of data.

Gemini Microcomputers have over the last four years developed a range of computer systems and associated peripherals. In the enclosed brochures you will find details of our four main ranges, namely; Galaxy 2, Galaxy 3, Galaxy 4 and the M-F-B. I have also included write-ups prepared by independant reviewers which give far greater detail than the data sheets could possibly achieve.

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Gemini Microcomputers is a British company and the design and manufacture of our systems and boards is carried out within the UK. Our products are distributed through a nationwide dealer network and our sales staff will happily put you in contact with our nearest outlet. Gemini products are distributed throughout Western Europe and a steadily increasing percentage of our sales are destined for Export.

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Gemini systems are based on the Z80 microprocessor, but there is currently in development a co-processor card which will accomodate the Intel 8088 processor and this will allow the Galaxy user not only to run CP/M programmes, but also in due course CP/M 86 together with Concurrent CP/M and probably MSDOS. This new board is designed to be plugged into the system retrospectively.

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Yours faithfully,

Ross Boxshall
Sales Executive

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```
L FA22,FBC0
FA22  3A 3B FA  SCAN:  LD    A,(FA3B)     ;:;z
FA25  B7               OR    A            ;7
FA26  20 10            JR    NZ,FA38      ;.
FA28  2A 3E FA         LD    HL,(FA3E)    ;*>z
FA2B  7E               LD    A,(HL)       ;
FA2C  B7               OR    A            ;7
FA2D  28 11            JR    Z,FA40       ;(.
FA2F  23               INC   HL           ;£
FA30  22 3E FA         LD    (FA3E),HL    ;">z
FA33  F6 80            OR    80           ;v.
FA35  32 3B FA         LD    (FA3B),A     ;2;z
FA38  3E FF            LD    A,FF         ;>.
FA3A  C9               RET                ;I
FA3B  00               NOP                ;.
FA3C  00               NOP                ;.
FA3D  00               NOP                ;.
FA3E  3D               DEC   A            ;=
FA3F  FA[CD 44         CALL FA44          ;zMD CALL FA44 ; RET
FA42  FA][C9][0E       RET                ;zI.
FA45  6B]              LD C,6B            ;k LD C,6B ;"k - STATUS CHECK.
FA46  CD B4 FB         CALL  FBB4         ;M4{
FA49  CD C4 FB         CALL  FBC4         ;MD{
FA4C  B7               OR    A            ;7
FA4D  C8               RET   Z            ;H
FA4E  E1               POP   HL           ;a
FA4F  0E 4B            LD    C,4B         ;.K
FA51  CD B4 FB         CALL  FBB4         ;M4{
FA54  CD C4 FB         CALL  FBC4         ;MD{
FA57  18 DA            JR    FA33         ;.Z
FA59  CD 22 FA  BLINK: CALL  FA22         ;M"z
FA5C  B7               OR    A            ;7
FA5D  28 05            JR    Z,FA64       ;(.
FA5F  CD 91 FB         CALL  FB91         ;M.{
FA62  18 0F            JR    FA73         ;..
FA64  21 48 08         LD    HL,0848      ;!H.
FA67  CD 0F FA         CALL  FA0F         ;M.z
FA6A  CD 91 FB         CALL  FB91         ;M.{
FA6D  2A 35 F3         LD    HL,(F335)    ;*5s
FA70  CD 0F FA         CALL  FA0F         ;M.z
FA73  47               LD    B,A          ;G
FA74  3A 37 F3         LD    A,(F337)     ;:7s
FA77  B8               CP    B            ;8
FA78  78               LD    A,B          ;x
FA79  CB BF            RES   7,A          ;K?
FA7B  C0               RET   NZ           ;@
FA7C  21 00 09         LD    HL,0900      ;!..
FA7F  CD 0F FA         CALL  FA0F         ;M.z
FA82  CD 91 FB         CALL  FB91         ;M.{
FA85  2A 35 F3         LD    HL,(F335)    ;*5s
FA88  CD 0F FA         CALL  FA0F         ;M.z
FA8B  FE 04            CP    04           ;.
FA8D  CC 05 FB         CALL  Z,FB05       ;L.{
FA90  4F               LD    C,A          ;O
FA91  CD BB FB         CALL  FBBB         ;M;{
FA94  FE 03            CP    03           ;.
FA96  C8               RET   Z            ;H
FA97  FE 0D            CP    0D           ;.
FA99  20 E1            JR    NZ,FA7C      ;a
FA9B  0E 5A            LD    C,5A         ;.Z
FA9D  CD B4 FB         CALL  FBB4         ;M4{
FAA0  11 F7 FE         LD    DE,FEF7      ;.w
```

KBD SCAN & SAVE CHAR

FF = CHAR READY.

FA3B = CHARACTER STORAGE.

GET CHARACTER

CALL SCAN

CHAR?

NO, GO TO FA64

; YES, GO GET IT

40.07

F666

T. 28

USER CURSOR PS. 28

SET CURSOR

; EDIT MODE?

; RESTORE CHARACTER.

; NOT EDIT MODE

EDIT MODE

CONTROL-D?

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2. General

The GM832 SVC is an enhanced version of the Gemini IVC. The design philosophy is unchanged, but the implementation has been altered to provide a pixel graphics mode, as well as an on-board buzzer, several attribute modes, and built-in foreign character sets, together with an increase in the operational speed of the card. (Although the IVC was not particularly slow!).

This document details the additional facilities provided by the SVC, and their corresponding control codes. All other functions remain as detailed in the IVC Software Manual provided.

3. Hardware

The SVC uses an on-board Z80B running at 6MHz to control the display in response to commands passed to it by the Host system. The display memory is shared between the on-board Z80 and the display controller, and a hardware based approach is used to ensure that there is no conflict between the two when accessing the shared memory. (This hardware arbitation scheme provides a significant speed increase when compared to the software arbitration used in the IVC). This results in an interference-free display that can be updated at a high rate.

The SVC display memory is 8kbytes in size, and its usage varies with the selected display mode. The various standard modes are illustrated below:

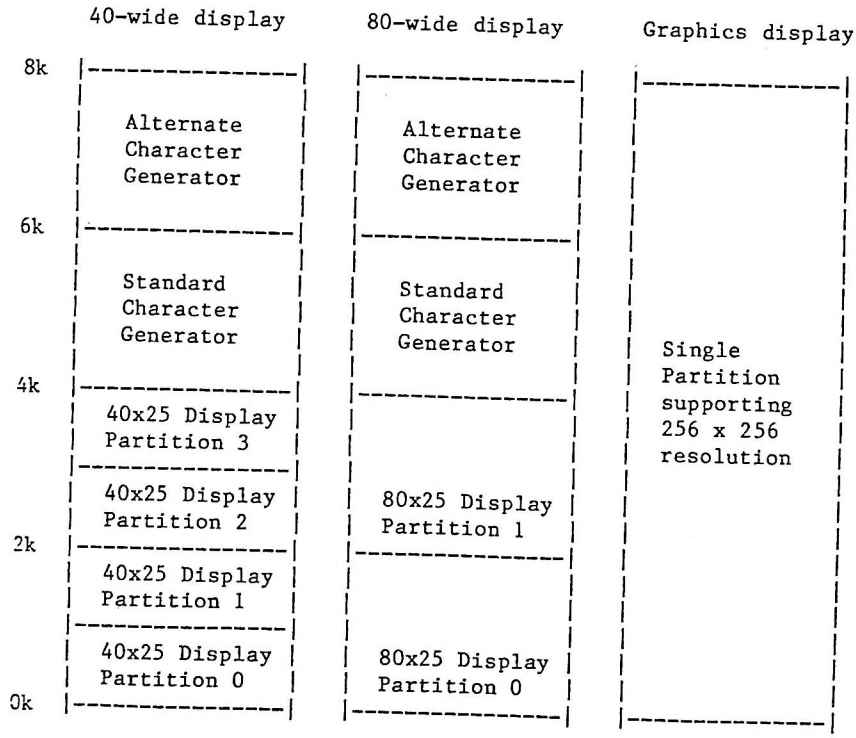

Fig. Display memory image

4. Software

The SVC monitor is a development of the IVC monitor, which has been extended to cover the enhanced hardware features of the SVC. As such it is upwards compatible with the IVC, and all the Control and Escape sequences of the IVC are supported by the SVC. In order that systems and application software may distinguish between the IVC and the SVC, the first release of the SVC software is version 4.0. The IVC software curently stands at version 2.1, and, although the IVC is now discontinued, a future release of the software is envisaged which will incorporate some of the enhancements present in the SVC monitor.

4.1. Alphanumeric mode

In alpha mode the SVC supports multiple display partitions (or windows) together with a programmable character gererator that supports all possible 256 characters. In addition various attributes, (blink, half intensity, half-tone background) are also supported.

The display windows, (2 in 80 character/line mode, 4 in 40 character/line mode), are fixed, and the window that the SVC is displaying on the screen, and the window that the SVC is writing characters into, may be set independently under software control. Using this feature a "Help menu" could be set up in an alternative window, and switched to instantly whenever required.

The initial character set that is loaded into the programmable character generator is held within the monitor ROM. The basic character set (English) can be modified to suit various foreign languages, and the selection is made by 3 on-board switches. If the required language is not available then, as on the IVC, the complete character set may be downloaded by a user program.

On power-up the main character generator is initialised with the selected character set, and the alternate character generator is loaded with the inverse of the main set. Thus, until the initial settings are modified by software, outputing a character with its most significant bit (msb) set to the SVC will result in that character being displayed in inverse video.

The SVC supports four character attributes that are 'switched on' by setting the most significant bit of a displayed character. Under software control the effect of the msb can be set to be any combination of the available attributes. The four character attributes are:

1) Use the alternate character generator. (Normally used to provide inverse video).
2) Provide a half-tone background to the character.
3) Display the character in reduced intensity.
4). Blink the character.

NOTE: As only one bit is available as an attribute bit, all characters with this bit set will display the same set of attributes.

4.2. Graphics mode

In graphics mode the SVC offers a 256 x 256 resolution display. The software supports this mode with the basic functions of pixel set, reset and test, together with with various graphics primitives such as line and circle drawing, and a powerful polygon fill function. It also supports a limited text facility using the default English character set from the monitor EPROM. The full range of the alpha-mode escape sequences are not supported in this mode, although a few (e.g. Cursor addressing) are.

Although the graphics screen runs with 8-bit resolution, the SVC software works internally with 16-bit coordinates. As a result any plots that run off the screen do not wrap-round, but will re-appear in the correct place when they come back within the bounds of the display coordinates. The origin (0,0) is at the bottom left of the screen.

5. On-board switches

A four-pole DIL switch will be found on the SVC. This is used to define the keyboard in use, and the default character set. The switches should be set as follows:

SWITCH 2	3	4	
ON	ON	ON	English
ON	ON	OFF	Swedish
ON	OFF	ON	Danish
ON	OFF	OFF	German
OFF	ON	ON	French
OFF	ON	OFF	USA
OFF	OFF	ON	English
OFF	OFF	OFF	English

Fig. Selection of character set

Switch 1

OFF	Keyboard is GM827 (Rotec with function keys)
ON	Keyboard is GM821 (Cherry with no function keys).

6. Additional Escape Sequences supported by the SVC

Code Sequence	Function
1B 0C	[<ESC> ^L] Cursor home. This sequence moves the cursor to the home position at the top left of the screen.
1B 32	[<ESC> "2"] Select 40 wide display format. The in-built 40-character wide screen format is selected.
1B 34	[<ESC> "4"] Select Graphics mode. The SVC is switched into "Graphics mode" where the display now supports a pixel graphics screen offering a resolution of 256 x 256. Characters can still be written to the screen, but the display only supports 32 characters per line. Individual character attributes are not supported, and nor are most of the character orientated Escape sequences. (e.g. Clear-to-end-of-line is not supported).
1B 3E...	[<ESC> ">" NN ..... 00] Dowload and set a 'soft key' display. This allows a defined number of lines to be locked at the bottom of the screen. These lines will not be scrolled or cleared during the normal use of the display. Optionally the data for the locked lines may be included in the Escape sequence. The byte NN specifies how many lines are to be locked, where NN = the number of lines + ASCII '0' (30H). i.e. NN = '3' (33H) is a request for 3 lines to locked. If NN ='0', or is out of the range of the screen, then that is taken by the SVC as an instruction to unlock the bottom lines of the display, and the Escape sequence terminates. However, if NN represents a valid number of lines, then all following bytes received by the SVC will be down-loaded sequentially into the locked area. The load is terminated when either the area is full, or a NULL (0) is received. For example this Escape sequence can be used to set up a 'soft key' display area at the bottom of the screen to show the current definitions of the programmable function keys on the Gemini Keyboard. Note that control characters in the range 00-1Fh are not normally displayed by the SVC, so this part of the character set could be re-programmed to suit the display, and the appropriate control characters (excluding 00) downloaded as part of the ESC > ... sequence.
1B 52...	[<ESC> "R" Xlo Xhi Ylo Yhi] GRAPHICS mode only Resets the pixel X,Y. The display origin (0,0) is at the bottom left of the screen. N.B. The block graphics version still applies when in alpha mode.
1B 53...	[<ESC> "S" Xlo Xhi Ylo Yhi] GRAPHICS mode only Sets the pixel X,Y. (See ESC R above).

1B 54... [<ESC> "T" Xlo Xhi Ylo Yhi] GRAPHICS mode only
Tests the pixel X,Y. The requested graphics point is tested. If the pixel is OFF a byte of 00 is returned, if the pixel is ON a byte of 01 is returned, and if the coordinates are not within the display area a byte of 02 is returned. (See ESC R above).

1B 61 .. [<ESC> "a" NN]
Set/reset attributes. This sequence is used to select the attributes that apply when bit 7 of a displayed character is set. The lower 4 bits of the byte NN are used as follows:

BIT	effect	
0	BLINK.	Setting this bit will cause all selected characters on the display to blink at a regular rate.
1	HALF INTENS	Setting this bit will cause all selected characters on the display to be shown with reduced intensity.
2	HALF TONE	If this bit is set, all the selected characters will be displayed with a half-tone background.
3	ALT. SET	This is the default setting, and selects the alternate character generator. If this has not been re-programmed, this results in the character being displayed in inverse video. (If necessary this can be set up again using <ESC> "H".)

1B 62 .. [<ESC> "b" CC]
Read back the currently programmed character set. This sequence allows the bit-patterns in the character generators to be read back to the Host system. Either the pattern for a single character can be read, or the entire contents of the character generator may be requested. The response is controlled by the parameter CC. As usual the most-significant bit of CC controls which character generator is accessed. (Setting the msb selects the alternate character generator). The lower 7 bits of CC select the character pattern required. If the character 00 is requested, then the entire PCG contents are returned, (2048 bytes). Otherwise the 16 bytes associated with the specified character are returned. N.B. all 16 are returned, although there are normally only 10 active lines on the display.

1B 64 .. [<ESC> "d" CC] GRAPHICS mode only.
Graphics screen dump. The entire graphics screen memory (8192 bytes) is returned to the HOST, starting with the top left-hand corner of the display. If CC = 'p' or 'P' then the SVC performs the necessary translation to suit a dump for a dot-matrix printer running in graphics mode.
i.e. If the 'P' option is selected, then the display is read out in lines 8 dots high. (Each byte returned represents 8 dots in the Y-axis, and a single dot in the X-axis.) Otherwise each byte represents 8 dots in the X-axis, and one dot in the Y-axis.

1B 67 .. [<ESC> "g" CC]
Select language character set. This sequence re-programs the normal character generator with the language character set selected by the lower 3 bits of the byte CC.

CC	
00	English
01	Swedish
02	Danish
03	German
04	French
05	USA
06	English
07	English

NOTE. This should be followed by an ESC H if the correct inverse character set is required as well.

1B 6C ... [<ESC> "l" Xlo Xhi Ylo Yhi PEN] GRAPHICS mode only
Draw a line. Draws a line from the current graphics coordinates to the specified point X,Y using the pen type requested. The PEN options are:

```
00000000 - No change.
XXXXXX01 - Pen down. (Turns pixels on.)
XXXXXX10 - Pen up.   (Turns pixels off.)
XXXXXX11 - Xor.      (Complements pixels.)
```

1B 6D ... [<ESC> "m" Xlo Xhi Ylo Yhi] GRAPHICS mode only
Move. Moves the graphics cursor to the point X,Y.

1B 6F ... [<ESC> "o" Rlo Rhi PEN] GRAPHICS mode only
Circle. Draws a circle on the display of radius R, centred on the current graphics coordinates using the pen type specified by PEN. (See <ESC> "l".) A true circle is drawn (in terms of the pixels), but its exact appearance will be determined by the Width and Height settings of the video monitor in use.

1B 70 .. [ESC "p" NN] ALPHA mode only
Select display/update partitions (or windows). This sequence selects which partition (or window) of the display memory is updated by the incoming characters, and which window is actually displayed on the screen. Bits 0 and 1 of NN select the window to be updated, while bits 2 and 3 select the window to be displayed.

1B 74 ... [<ESC> "t" NN ...]
Screen clock option. This sequence allows the SVC software clock to be set, read, enabled and disabled.
ESC t E - Enables the clock display.
ESC t D - Disables the clock display update.
ESC t = X Y - Defines the position of the clock on the screen.
ESC t HHMMSS - Sets the clock to HH MM SS.
ESC t ? - Returns the current time in the format HHMMSS.
(See the CLOCK section).

1B 77 [<ESC> "w"] GRAPHICS mode only

Graphics fill. This sequence will fill in a bounded area of the graphics screen starting at the current graphics cursor. The fill proceeds outward from the starting point and will turn ON all pixels within the bounded area, whatever its shape. The fill routine requires a reasonable amount of workspace if it is to handle complex shapes, and so it utilises the 1kbyte USER AREA within the SVC. If a user downloads a program to the SVC (see ESC L), then the fill routine automatically adjusts itself to use 3/4 of the remaining space. i.e. if a 512-byte user program is downloaded, then the fill routine will use the last 384-bytes of the user area for its workspace. Due allowance for this should be made by the user program. (N.B. the space is only used if an "ESC w" is received, otherwise it is left untouched.)

The fill routine can fill quite complex shapes with as little as 128 bytes of workspace.

7. Software Clock

The SVC supports a software clock by decrementing an internal counter once per displayed frame (50 times a second). Every time the counter reaches zero it is reset to 50, and an ASCII clock is incremented. The ASCII clock is held as HH:MM:SS, and each pair of characters is incremented by a common routine. The gives the clock the idiosyncrasy that the hours will count up from 00 to 59 before resetting, a feature that will only be noticed by those who burn the midnight oil. On power-up the clock is zeroed, but subsequent resets should not disturb the current setting.

The Escape sequence ESC t..... is provided to support the clock. The various possibilities are listed below:

ESC t = X Y - defines where on the screen the clock will appear. The default position is at the right-hand end of the top line of the display, although this may be changed by sending the ESC t = X Y sequence, where X and Y are the desired screen position for the clock display. The parameters required in the positioning sequence (= X Y) are identical those of the "ESC = X Y" cursor addressing sequence.

ESC t HHMMSS - Initialises the clock display to HH:MM:SS. The characters represented by H,M and S should be ASCII numeric characters.

ESC t ? - results in the current contents of the clock being returned to the Host system as 6 ASCII characters in the form HHMMSS.

ESC t E - Enables the display of the clock. As a result, once per second immediately following the internal update of the clock, the clock is copied across into the display memory at the defined address. If the screen display is static, then the clock will just appear to 'tick' away like any digital clock. However, if the display is scrolling, then the clock will disappear off the top of the screen as the line it is written to scrolls. It will re-appear at its defined place when it is next updated, one second later. (This effect could be prevented by 'locking' the top line of the display. (See ESC M.))

ESC t D - Disables the display of the clock. Note that this does not remove the clock from the display, it only stops the screen update of the clock. Thus there will be a stationary display on the screen until the screen is cleared or the line is scrolled off the top.

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12) Password file protection
13) Date and time file stamping capability (requires RTC)
14) Larger disk and file handling capacity
15) 29 additional BDOS calls
16) Extended BDOS capability by easily attached RSXs
17) Winchester, 5"/8" floppy and virtual disk support
18) Mixed drive/formats (Direct copy 96tpi to 48tpi etc.)
19) Full source code of BIOS supplied for user customisation
20) PLUS PLUS PLUS !!!!!!!!!!!!!!!!!!!!

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NAP 80 Systems Ltd

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CPU

(CENTRAL PROCESSOR UNIT)

FEATURES :

1) Z80A Processor running at 4MHz without wait states
2) 64k of dynamic RAM
3) Two fully programmable serial channels
4) PIO giving two 8 bit bi-directional I/O channels
5) 8 bit keyboard port providing "type ahead" under CP/M
6) Utilises CTC and SIO for complete flexibility
7) Full memory mapping up to 1 Megabyte
8) Extended memory addressing
9) Full support of address line A19
10) Software support under CP/M 2.2 and CP/M Plus
11) 8" by 8" Plug in card
12) Compatible with other 80-Bus and Nas-Bus products
13) Use with our VFC to give a two card 64k CP/M system

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MPI

(MULTI-PURPOSE INTERFACE)

FEATURES :

1) Floppy disk controller
2) 3", 5", and 8" capability, software selectable
3) Link selectable MAP 80/Nascom formats
4) SASI/Winchester interface
5) Fully programmable RS232 serial channel
6) RS422/RS485 high speed multi drop serial channel
7) Available in various configurations
8) Software support under CP/M 2.2 and CP/M Plus
9) 8" by 8" Plug in card
10) Compatible with other 80-Bus and Nas-Bus products
11) Use with our CPU and VFC to run Winchester etc.

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RAM

(RANDOM ACCESS MEMORY)

FEATURES :

1) Up to 256k bytes of dynamic RAM in blocks of 64k
2) Can be paged in 32k or 64k blocks
3) Memory mapping in 4k blocks with MAP 80 CPU card
4) Easily expandable
5) The only RAM card on the 80-Bus suitable for CP/M Plus
6) Available in various configurations
7) Software available to allow use as virtual disk
8) Software support under CP/M 2.2 and CP/M Plus
9) 8" by 8" Plug in card
10) Compatible with other 80-Bus and Nas-Bus products (Not N1)
11) Use with our CPU/VFC to run CP/M Plus and/or virtual disk

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VFC

(VIDEO/FLOPPY CONTROLLER)

FEATURES :

1) 80 Column by 25 Line flicker free display
2) Fast memory mapped screen
3) Video RAM paged in/out to allow full use of system ram
4) On board relocatable software including CP/M boot
5) On board character generator giving 256 characters
6) Selection of ASCII set and inverse video by software
7) Facilities provided for second EPROM character generator
8) ADM-3A Emulation
9) Parallel 8 bit keyboard port
10) Video switch to select external video (e.g. Nascom)
11) Composite or direct drive video output
12) Floppy disk controller for most 5 1/4" drives
13) Available in various configurations
14) Software support under CP/M 2.2 and CP/M Plus
15) 8" by 8" Plug in card
16) Compatible with other 80-Bus and Nas-Bus products
17) Use with our CPU to give a two card 64k CP/M system

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RACPAK

(RACK MOUNTED MODULAR SYSTEM)

FEATURES :

1) 19" 5U Rack mounted in attractive housing
2) 10 Slot terminated backplane
3) Dual switch mode power supplies
4) Mountings for up to 4 half height floppy disk drives
5) Mountings for various winchester drives
6) Backplate pre-punched for D type connectors etc
7) Available in various configurations
8) Software support under CP/M 2.2 and CP/M Plus
9) Software support for MP/M and CP-NET
10) Ideally suited for R & D use
11) Standard system supplied with the following :
    CPU, VFC, 2 x 1Mbyte Floppies, CP/M 2.2, Monitor, Keyboard
12) All CPU I/O wired to backplate (See CPU sheet)
13) Easily expanded or configured to suit application

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MAPCOM

(MODULAR COMPUTER SYSTEM)

FEATURES :

1) Attractive structural foam housing with separate keyboard
2) Integral 12" green screen monitor
3) Fast memory mapped 80 column by 25 line display
4) Dual 1 MByte half height 5" Floppy disk drives
5) Two serial RS232 channels with full modem control
6) Parallel interface
7) 117 key keyboard with programmable function keys
8) Software support under CP/M 2.2 and CP/M Plus
9) Software support for MP/M and CP-NET
10) 4 Bus expansion slots with standard configuration
11) Standard system supplied with the following :
    CPU, VFC, 2 x 1Mbyte Floppies, CP/M 2.2, Monitor, Keyboard
12) See CPU and VFC sheets for full details of facilities
13) Easily expanded or configured to suit application

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SPI

(SERIAL/PARALLEL INTERFACE)

FEATURES :
1) Four fully programmable RS232 serial channels
2) Full baud rate coverage
3) PIO giving two 8 bit bi-directional I/O channels
4) Utilises CTC and SIO for complete flexibility
5) Software support under CP/M 2.2 and CP/M Plus
6) 8" by 8" Plug in card
7) Compatible with other 80-Bus and Nas-Bus products

RTC

(REAL TIME CLOCK)

FEATURES :
1) Full calendar inc. Leap year with hours, mins, and secs
2) Battery backup from on baord battery
3) Uses PIO but still allows permanent use of printer
4) Full software support under CP/M 2.2 and CP/M Plus
5) Accurate timekeeping during reset, and power up/down

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80-BUS - a functional description

The Multiboard range of 8"x8" cards have been designed so that they may be used together in a wide variety of configurations. All of the cards have a 77 way PCB edge connector which carries signals to the 80-BUS specification, as detailed below. Cards are simply connected together by soldering the edge connectors supplied with the cards into a motherboard, and then plugging the cards into the connectors. The motherboard provides interconnection of each of the edge connector pads on each card to the same pad on every other card. The only exceptions to this are the `daisy chain' lines, and details of these are given in the specification.

Power is supplied to the cards by connecting the relevant supply rails to the motherboard. Each power supply rail occupies two or more bus lines, and in these cases should therefore be connected to all of the relevant bus lines, this is particularly true of the Ground (0V) rail.

80-BUS has many similarities to Nascom's Nasbus. The Nasbus, unlike many other bus systems, has had a very ordered development. However, when we started developing the Multiboard range of cards it became apparent that a new revision to the Nasbus specification was urgently required. After a great deal of careful thought and many hours of deliberation the following document was drawn up. It expands on the third issue of the Nasbus functional specification giving timing and other details never previously published and also attempts to anticipate some of the possible future developments of the bus.

The original Nasbus specification made provision for the extra address and data lines of 16 bit processors. Careful consideration reveals that the bus would not be suitable for this, and so a number of new signals have been defined for the lines made free. The importance of good ground signals can not be overemphasised, and so extra ground lines have also been added.

When defining this bus a great deal of thought went into deciding whether or not to maintain the NAS MEM, NAS IO, and DBDR signals. These signals are particular to Nascom 1 (and NAS IO also to Nascom 2) and are unlikely to be required by any future cards. They therefore constitute a `nuisance'. However, for the sake of compatibility, to avoid the S100 situation, and with pressure from INMC80, the Nascom Users' Club, it was decided that 80-BUS would maintain support for these signals.

Because of the above considerations 80-BUS remains fully Nascom 1 and 2 compatible. It is Gemini Microcomputers intention to allow any manufacturer who produces a card that fully complies with the 80-BUS specification to advertise accordingly. Cards should be submitted for approval. The 80-BUS is a Z80 bus and no attempt has been made to make it compatible with any other processor.

One final point relevant to the design of 80-BUS compatible cards is that all cards, including the bus master, should provide a means for being switched out of the memory map under software control. This may be by means of implementing the Page Mode structure, or by some alternative method. This condition also applies to any I/O card that is memory mapped.

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Nasbus is a trademark of Lucas Logic Limited (Nascom Microcomputers Division).

80-BUS pin allocation

PIN		SIGNAL	DESCRIPTION
1		GND	Ground
2		GND	Ground
3		GND	Ground
4		GND	Ground
5		CLOCK	System clock
6	*	/NMI SW	A low on this line initiates a short pulse on line 21
7		RSFU	Reserved for future use
8		AUX CLK	4MHz clock signal (optional)
9	*	/RAM DIS	Ram disable
10	*	/RESET SW	Reset switch
11	*	/NAS MEM	Memory decode to Nascom 1
12	*	/NAS IO	I/O decode to Nascom 1 and 2
13	*	/DBDR	Data bus drive, used to change the direction of the data bus buffers on the Nascom buffer board or Gemini `Supermum'.
14	*	/RESET	50uS reset pulse, resets entire system.
15		/HALT	Z80 halt signal
16		/BAI	DMA
17		/BAO	daisy chain
18		/BUSRQ	Z80 bus request
19		IEI	Interrupt
20		IEO	daisy chain
21	*	/NMI	Z80 NMI line, (not used by Nascom 1)
22	*	/INT	Z80 interrupt line
23	*	/WAIT	Z80 wait line
24		/RFSH	Z80 refresh signal
25		/M1	Z80 opcode fetch signal
26		/IORQ	Z80 input/output signal
27		/MREQ	Z80 memory signal
28		/WR	Z80 write signal
29		/RD	Z80 read signal
30		A0	
31		A1	
32		A2	
33		A3	
34		A4	
35		A5	
36		A6	
37		A7	
38		A8	Z80 16 bit
39		A9	address bus
40		A10	
41		A11	
42		A12	
43		A13	
44		A14	
45		A15	
46		A16	Optional implementation
47		A17	for extended
48		A18	addressing.
49		GND	Ground to seperate the data and address busses.
50		D0	
51		D1	
52		D2	
53		D3	Bidirectional data bus.
54		D4	
55		D5	
56		D6	
57		D7	

58	RSFU	Reserved for future use
59	INT 0	Interrupt
60	INT 1	request
61	INT 2	lines
62	INT 3	
63	/PWRF	Powerfail warning
64	AUX PWR	Backup power
65	NDEF 1	Not to
66	NDEF 2	be defined
67	GND	Ground to seperate power and signal lines.
68	-5V	
69	-5V	
70	-12V	
71	-12V	
72	keyway	
73	+12V	
74	+12V	
75	+5V	
76	+5V	
77	+5V	
78	+5V	

Notes
---

1) * is an open collector line.
2) IEI to be linked to IEO on cards not using the interrupt daisy chain.
3) /BAI to be linked to /BAO on cards not using the DMA daisy chain.
4) Bus drivers must be able to drive 75/15 U.L.
5) Bus receivers must not load the bus past 1/0.25 U.L.
6) Bus master to pull up all open collector lines with 2k2.
7) Bus master to pull up the following lines with 10k, /HALT, /MREQ, /IORQ, /RD, /WR, /M1, /RFSH.
8) Bus timing reference point is pin 6 of the Z80. As the bus is in essence a buffered Z80, the timing of bus signals is as the Zilog/Mostek Z80 data book. All Z80 signals are buffered onto the bus with 20nS +/- 10nS buffers, the sole exception being the bus clock which should be 20nS (+/- 10nS) ahead of the Z80 clock (pin6). The timing of other signals is detailed in the description of the particular signal. All expansion card timing must, however be referenced to the bus.
9) Cards using /BAI, /BAO, IEI & IEO should pull them up with 2k2.
10) Bus termination. Long buses may require termination. 220R on each line to a 2.6V low impedance source should solve 99% of problems.
11) Grounding. The ground line to the PSU should be as short as possible and as thick as possible.
12) The names of the various bus signals are as detailed above, please do not change them or abbreviate them, ie AUX CLK not AUX CLOCK or A CLOCK etc.

Comments

The following is a line by line description of the bus and should help resolve any ambiguities.

Lines 1-4, GND.

The quality of the system ground cannot be overemphasised. Ground noise problems were at the root of the now infamous Nascom "Memory plague". The faster that systems go the more critical the noise problem will become. Noise problems will manifest themselves as a generally unreliable system with a predilection to do "odd" things.

Line 5, CLOCK.

This line is important as all the bus timing is derived from it. It should spend at least 46% of its time below VOL (0.4V) and at least 46% of is time above VOH (2.4V), it has the other 8% spare to go up and down. The clock on the bus should be 20nS (+/- 10nS) ahead of the clock on pin 6 of the Z80.

Line 6, /NMI SW.

Provision has been made on the bus for an NMI switch and this line is to be held high by the bus master. Grounding it will initiate a short pulse on line 21 and the Z80 /NMI input. Users are cautioned that switch bounce may cause more than one NMI.

Line 7, RSFU.

This line is reserved for allocation at a later date, please do not use.

Line 8, AUX CLK.

This line is a new allocation. Many boards (eg disk controllers) require a 1, 2 or 4 MHz signal. This was easily provided when the CPU clock was 2 or 4 MHz, however the advent of the 6 MHz Z80 changes the situation. Any bus master not running at either 2 or 4 MHz must provide a 4 MHz clock on this line. Designers of expansion cards should take note of this and provide a link to allow the board to use this line instead of line 5.

Line 9, /RAM DIS.

This signal is intended to prioritise memory. Normally this signal would be generated by memory on the bus master, an EPROM card or any other high priority memory when a memory read took place. A RAM card would normally gate /RAM DIS with the output buffer, so that in the event of /RAM DIS being asserted the output buffer would fail to be enabled, this would have the effect of "overlaying" RAM with EPROM/ROM. /RAM DIS should not inhibit a write cycle; it should also remain high for any cycle apart from a memory read.

Line 10, /RESET SW.

A high to low on this line will initiate a reset cycle. It is intended that a switch be connected between this line and ground. The actual RESET line is line 14.

Line 11, /NAS MEM.

This signal is only used by Nascom 1 and is asserted when a Nascom memory address is detected. It would normally be provided by a memory board and would typically be 0000H to 0FFFH or F000H to FFFFH. This is an obsolete signal and no new boards that require it should be designed. This line used to be called MEMEXT.

Line 12, /NAS IO.

This line used to be called IOEXT and many people persist in still calling it that, even though the two are different. In its original form (note that it was active high) it would be taken high to indicate an I/O address external to the Nascom, in its current form it is taken low to indicate a Nascom I/O address, that is to say that it looks for a Nascom I/O address as opposed to looking for an external address. /NAS IO should be taken low within 50nS of a Nascom I/O address and /IORQ, (referenced to the bus). In its original form the onboard ports on the Nascom would remain enabled for a short fraction of an external I/O cycle (the time taken to detect an external address and assert IOEXT) and this was the cause of many obscure problems. If you have problems a good test is to write a short machine code routine to continuously write 80H to port 08H. If the breakpoint register display comes up you have a problem, if not you don't. /NAS IO is a obsolete signal utilised by Nascom 1 and 2 and all new designs should incorporate full I/O decoding.

Line 13, /DBDR.

This signal is used by the Buffer board and Supermum with Nascom 1. It controls the direction of the data bus buffers. When an expansion card outputs data to the bus this line must be taken low, normally this is the same signal as used to turn on the output buffers. Despite being only used by expanded Nascom 1s it is felt that this signal must be provided on all expansion cards. While /DBDR should ideally go low before the data bus driver is enabled, it must be low within 30nS of the data bus driver being enabled and must release /DBDR within 30nS of the data bus drivers being disabled.

Line 14, /RESET.

This line is the "cleaned up" version of line 10. It is important that the falling edge of the reset pulse on this line be synchronised with the falling edge of /M1, and the bus master must provide the appropriate logic to take care of this. The last issue of the Nasbus specification called for a 10uS reset pulse. This has now been extended to 50uS as chips in the 179X family require a 50us pulse. Deep investigation of the matter has yet to yield a 179X chip that can tell the difference between a 10uS pulse and a 50uS pulse. N2 owners who are concerned by this should substitute a 10nF capacitor for C1 (1nF). Supermum owners need not worry as this has been taken care of.

Line 15, /HALT.

Z80 halt signal. Up to this point in time nobody has used it, but it is there.

Lines 16 17 18, /BAI /BAO /BUSRQ.

/BAI and /BAO are the DMA daisy chain. If an expansion card wishes to take control of the bus (an expansion card is any bus card which is not a bus master) it asserts /BUSRQ; the bus master will respond by taking /BAO low. The mother board connects line 17 to 16 between each slot, ie line 17 of the bus master will go to 16 of the adjacent card, line 16 at the bus master is not used although it can be a test point. Between all subsequent cards line 17 goes to line 16 (for full connection details see the section on daisy chains). Cards that do not use the DMA facilities should connect 17 to 16. /BAO will be fed into the /BAI of any potential DMAing device, and the /BAO of the same device will go into the /BAI of the next and so on. If a potential DMAing device has not asserted the /BUSRQ line it will pass on the signal. When the signal reaches the device which originally asserted the /BUSRQ line it will hold /BAO high, at this point it will have taken contol of the bus. The highest priority device is that nearest the bus master.(CPU card).

Lines 19 20, IEI IEO.

Interrupt daisy chain for vectored interrupts. The IEI input of the highest priority device is held high, the IEO output of that device goes to the IEI input of the device with the second highest priority, the daisy chain is continued until the device with lowest priority is reached, its IEO is not connected. It is recommended that line 20 of the bus master is linked to line 19 of the adjacent card and so on down the bus. As the interrupt daisy chain does not involve the Z80 it is possible to move the bus master from slot to slot and vary the level of interrupt priority of the devices on the bus master. The DMA daisy chain however does involve the Z80, and the bus master must always be to one side of the expansion cards which may generate a /BUSRQ. If the motherboard is linked in the recommended manner the device with highest interrupt priority is nearest to the bus master. If the daisy chain is connected the other way arround a problem could arise as the Z80-DMA can also generate interrupts. For further details on connections see the section on daisy chains.

Line 21, /NMI.

A short pulse will be generated on this line by the bus master from a low on line 6 (/NMI SW). On Nascom 1.the NMI is used in the single step feature and is not available.

Line 22, /INT.
Used for the Z80 maskable interrupt. For full details see the book "Z80 family program interrupt structure" available from Zilog.

Line 23, /WAIT.
Used to insert wait states into Z80 machine cycles. Expansion cards that require wait states should provide them.

Line 24, /RFSH.
Used to control the refreshing of dynamic RAM. It should be noted that a refresh cycle is a memory cycle and designers should take appropriate steps. The I register contents will appear as the top eight bits on the address bus during a refresh cycle.

Line 25, /M1.
Z80 /M1 used to indicate an opcode fetch, also used (in conjunction with /IORQ) to indicate an interrupt acknowledge cycle.

Line 26, /IORQ.
Used to indicate a Z80 I/O cycle. The port address will be on the bottom eight address lines (A0 to A7). The top eight will have the contents of the A register on them. If /IORQ is asserted with /M1 it indicates an interrupt acknowledge cycle and the Z80 will expect to receive an interrupt vector.

Line 27, /MREQ.
Used to indicate a Z80 memory cycle.

Line 28, /WR.
Used to indicate a Z80 write cycle, asserted in conjunction with /IORQ or /MREQ.

Line 29, /RD.
Used to indicate a Z80 read cycle, asserted in conjunction with /IORQ or /MREQ. It should be noted that /RD is not asserted during an interrupt acknowledge.

Lines 30 to 45, A0 to A15.
Z80 address lines, should be tristated during a /BUSAK.

Lines 46,47,48, A16, A17, A18.
Optional implementation for extended addressing, should be tristated during a /BUSAK.

Line 49, GND.
An additional ground line to reduce system noise. Must be implemented on both the mother board and on expansion boards.

Lines 50 to 57, D0 to D7.
Z80 data lines, should be tristated during /BUSAK.

Line 58, RSFU.
This line is reserved for allocation at a later date. Please do not use.

Lines 59 60 61 62, INT 0 1 2 3.
Interrupt request lines, used to generate interrupt vectors from devices that are not capable of generating their own interrupts. These lines would be monitored by an interrupt controller which would be capable of generating interrupt vectors, the controller must be capable of being programed with the sense of a particular line (i.e. whether its active high or

active low) and the vector. A device unable to generate a vector would assert one of these lines when it required to interrupt, expansion cards availing themselves of this facility should provide it via links so that the particular line can be selected by the user.

Line 63, /PWRF.

Powerfail warning. This line is to be taken low 100mS before the power rails drop by more than 5% and held low until 100mS after the power on reset. For use by backup memory etc. An optional signal which would be provided by the power supply circuitry if implemented.

Line 64, AUX PWR.

An auxilary +5 volt supply for the use of backup devices. Absolute maximum current when the main power supplies are off is 100mA. Implementation is optional.

Lines 65 66, NDEF1 NDEF2.

Not to be defined. These are lines for users to allocate as they require, there are only two restrictions and one provision.

a)TTL levels only, ie no voltage greater than 5 volts and no voltage less than 0 volts.

b) No transition until 100nS after the previous transistion, ie don't put a 16MHz clock on this line.

c) A link must be provided to disable the use of NDEF 1,2.

Line 67, GND.

An additional ground line to separate the power lines from the rest of the bus.

Lines 68,69, -5 volt supply.

Lines 70,71, -12 volt supply.

Line 72, Keyway

Lines 73,74, +12 volt supply.

Lines 75,76,77,78, +5 volt supply.

Daisy chains

```
/BAI  16 ---------X- 16 ---------X- 16
                I               I
/BAO  17 -X--------- 17 -X--------- 17


IEI   19 ---------X- 19 ---------X- 19
                I               I
IEO   20 -X--------- 20 -X--------- 20

     SLOT 2          SLOT 1          SLOT 0
       Expansion cards       Bus Master
```

X = Cut of bus track
I = Link between tracks