THE "SPHERE SYSTEM PHILOSOPHY"

The SPHERE 1 computer system was designed to provide an uncompromising computer system at minimal cost.

The keyword to our design is the word "SYSTEM". Every phase of the design has been influenced by the "SYSTEM" philosophy. To justify the system title, a "COMPUTER" must perform an application acceptably. Recently the cost of peripherals and software have substantially exceeded the cost of the computer, but without them, a computer can not perform much of anything acceptably.

With the onset of the micro-processor, real design innovations have been possible, but without the system philosophy, a micro-processor can only reduce the processor cost. Peripherals, memory, and software continue to be expensive.

The SPHERE 1 computer is uniquely cost effective because it utilizes real design innovations to reduce the amount of circuitry required throughout the system. The SPHERE add-on memory board will support 4, 8, 12, or 16K of dynamic random access memory (instead of four 4K memory boards and a mother board). Our power supply has been placed in a separate chassis to eliminate a common source of heat. This allows the system to run cooler and eliminates the need for an expensive fan. The system uses a standard TV for a 512 character display. The use of the TV and other common components has reduced the cost and allowed more machine versatility. Further cost reductions have been achieved by replacing the front console (lights and switches) with the TV terminal and a program in Read Only Memory (ROM) that performs the same function, only better. The CPU card is packaged to provide all of the basic functions required by a useful system, thereby eliminating unnecessary extra PC BOARDS.

In order to insure a full offering of high quality peripherals from the onset, we have selected manufacturers who already have peripherals which interface to our product. This philosophy has allowed us, in the case of our disk, to select already running software (namely a disk operating system) which we may offer to our users immediately. Other peripherals that are available with our system include a low cost line printer and a paper tape reader/perforator. These devices are interfaced to the system via a single interface module which also serves as a programmable digital Input/Output port. The SPHERE system also supports its own set of terminals, the lowest cost terminals available today.

The Program Development System (PDS) includes an EDITOR, and MINI ASSEMBLER, and a debugging package. It also includes CRT display and audio cassette software drivers, plus a cassette loader and dumper. Although most computer processing occurs at the character (8 BIT) level, it is sometimes desireable to use 16 bit arithmetic so we have provided an extended 16 bit instruction set in the PDS system. This package rounds out the "SYSTEM" concept for our smallest systems.

There are proponents of various computer languages everywhere. Each language is suited more or less to a specific group of applications. Although the advent of the micro-processor really dictates some new philosophies in computing language, the BASIC language seems to come closest to this philosophy. Because of its widespread use we have selected it to be our first computer language.

The FLOPPY DISK OPERATING SYSTEM (FDOS) is supplied on all systems purchased with a disk unit. FDOS is an extended PROGRAM DEVELOPMENT SYSTEM. It provides for named files, an extended editor, a full assembler, and debugging system. This system includes a comprehensive 300 page programming manual.

The software supplied to make the Sphere System a useful "SYSTEM" is attractive; however, the real contribution that SPHERE offers is one of commitment. The SPHERE "SYSTEM" concept demonstrates only the surface of the real technological advances that are possible when true design innovation is combined with foresight and state-of-the-art technology. The SPHERE "SYSTEM" concept is the commitment. Watch and see.

Program Development System

PDS represents a unique approach to the software of a low cost computer system. By the addition of software routines located in a 1K PROM even the smallest system is capable of doing useful work as well as performing all of the functions of a switch panel and display lights. The software, consisting of a debugger, assembler, editor, 16 bit arithmetic, and ASCII conversion routines, allows for development of user software in much the same way as large disk based systems.

The SPHERE Debugging Aid (SDA) is designed to aid in program development, as well as replace the usual switch panel and display lights function. It allows the user to easily view and alter the contents of memory or CPU registers from the keyboard - CRT display.

The Mini-Assembler allows the user the ability to input source assembly language programs and output unrelocatable binary object code. It can handle up to 62 symbolic addresses, different operand sizes and octal, decimal and hexadecimal operands. The operation codes are entered in hexadecimal (i.e. ADDA immediate is "8B").

Included are instructions to perform 16 bit multiply and divide as well as BINARY - ASCII conversion. It also includes instructions to perform I/O from the CRT - keyboard or the audio cassette or modem. The input-from-keyboard instruction includes a built in CRT based editor allowing scrolling and text insertion and deletion based on a cursor, allowing easy text manipulation.

THE ONE CARD COMPUTER

The logical approach to the solution of any problem is to determine the minimum requirement for a satisfactory result. In the case of a small computer, an absolute minimum would include a reasonable amount of memory, a capable CPU, Input/Output capability, a real-time clock, read only memory program which if used in conjunction with a terminal can replace the computer's switch panel and display lights, and finally it ought to have a convenient Bus structure to easily attach other modules.

The SPHERE ONE CARD COMPUTER includes all of the above features plus a few that also deserve attention. Below each of the principal features are listed:

1) The CPU
The MOTOROLA 6800 microprocessor is the most advanced microprocessor available today. It reduces the necessity for support components and includes features not found on computers of many times the size. The IBM 370 for example will not store all of its registers automatically upon receipt of an interrupt as the 6800 will. The 6800 system resembles the architecture of the Digital PDP - 11 in many ways. These include instructions that "PUSH" data onto a STACK temporarily and when temporary storage is no longer required the data may be "POPed" off of the stack. The 6800 doesn't have as many registers as the 8080; however, the 6800 has several addressing modes which in most cases completely outweigh its lack of registers. These modes are particularly advantageous when tables are processed. However, when three or four counters are being incremented or decremented the 8080 is faster, but in either case the 6800 is easier to program.

2) Memory
This system uses the 2107A type 4K by 1 dynamic random access memory. This memory was used because it is the least expensive memory available and would lower the cost of the system. All refresh circuitry for the system is included on the CPU board.

3) I/O
If this board is used in a stand alone situation a CPU must communicate to the outside world. Therefore, the system is supplied with 16 programable I/O lines as an option. Four additional lines which may be used as programed interrupts are also supplied on the board.

4) Real-time clock
A stand alone process control system and many other systems require the capability of monitoring the progress of an activity. The SPHERE system has a real-time clock which will interrupt the system at a set interval. This interval is a function of the refresh clock which is set at 1 ms. The interrupt may occur at 1x, 2x, 4x, 8x, or 16x the refresh rate. The interval may also be set externally. The rate is determined by a wire strap.

5) EPROM
The Erasable Programmable Read Only Memory used by the system is the 1702 A. Programers for this EPROM are commonly available so that users may find programing the system for a stand alone application a reasonable task. When delivered with a SPHERE system the EPROM contains a Program Development System (PDS) which is described under "SOFTWARE".

6) BUS structure
The BUS is driven by tri-state TTL buffers which are apable of driving 35 standard TTL devices. The BUS is connected to this board via three 14 pin dual-in-line connectors which will transmit and receive information over 3 14 conductor flat ribbon cables. Eight data, 16 address, BUS and control lines are transmitted bidirectionally to and from the CPU, memory, and peripherals. I/O devices, buffer, and status registers are addressed as memory locations at the top (HIGH ORDER LOCATIONS) of memory in much the same as the digital PDP-11. This means that about 35,000 devices could be attached to the system (theoretically). It also means that any machine instruction may operate on device buffer and status registers as they would to memory.

This limits the maximum memory on SPHERE systems to 56K instead of the theoretical 64K because the high order 8K is reserved for device status and buffer registers.

7) Power-on reset

When power is applied to this board, circuitry forces a reset to the processor until the system power has had time to stabilize. The system will immediately thereafter jump to a specific location in the read only memory (EPROM) to begin meaningful processing.

SYS 1/KIT HOBBIEST ($860)

This computer system is capable of satisfying the needs of the user who wishes to program, develop, and debug programs for light process control, experimenting, and some educational purposes. As with all SPHERE "SYSTEMS", the computer was designed to perform a useful function. It was not intended to be a useless computer with a lot of money spent on front console.

All SPHERE systems are shipped with software and a commitment that software developed in the future by SPHERE or one of its users will be available at minimal cost. The PDS SYSTEM in included in the read only memory of this system. It and other software which is available is described under the heading "SOFTWARE".

Expandability has been considered from the onset. Some of these considerations include additional memory to 64K, inter-computer communications, a full line of peripherals, home and industry utility, and lowering cost while increasing performance in the future. Below are listed the modules contained in the system:

1) CPU1   This module contains all of the features listed under "THE ONE CARD COMPUTER".

2) KBD1   This module includes a standard typewriter style alph-numeric keyboard layout with an adding machine style numeric keypad located to the right. Above the numeric keypad is a star shped cursor control keypad which includes HOME and ERASE functions. The keyboard module also includes 2-key rollover (single key read until released, regardless of other keys pressed), complete interface from keyboard to CPU bus with additional interfacing to the bus for 10 general purpose digital I/O lines which may be used at the user's discretion. This module includes an attractive keyboard chassis. This chassis houses the keyboard and all of the modules in this system plus 3 slots for future expansion. A maxium of seven additional KBD1 modules may be added later.

3) CRT1   This module contains the necessary electronics to display 512 characters on a television or video monitor. The 64 character ASCII character set is displayed in a matrix of 32 characters by 16 lines. Each character is displayed in a matrix of dots, 5 dots wide and 7 dots high. To display a character a computer program simply moves the desired character into a memory position which is also the display refresh buffer. The refresh buffer is located in the high-order 8K of memory. It consists of 512 bytes of static RAM that is organized to be accessed by the CPU and CRT simultaneously without degrading the access time to either CPU or CRT (dual port memory). Output from this module to the video monitor appears as a composite video signal or separate horizontal, vertical, and video signals. Etches for RF modulator (adjustable from channels 1-3) have been left on the PC board, and schematics have been provided; however, components have not been supplied because this type of circuit requires FCC testing and approval. Instructions for TV modification are included with purchase.

4) PWR 1   The power supply has been designed expressly for the SPHERE 1 system.
It produces 5 volts at 5 amps, 12 volts at 3 amps, -5 volts at 400 mA,
and -12 volts at 400 mA. Ratings may be improved with the addition
of capacitors. The circuits are highly under rated which should allow
the system to run cooler. The power supply includes zener over voltage
and reverse voltage protection. All supplies are current-limited,
however over current-protection for the 5 volt supply may allow a
power transistor ($1.50) to burn out. The 12 volt supply also allows
this to happen. This occurs because of a cost trade-off ($40.00 to
protect $3.00 in transistors) vs performance (will probably never occur).
The power supply is contained in a separate chassis which includes a
3 prong wall plug, power cord, cable to the rest of system, and a fuse
to protect the system.

5) BCB1   Each of the system modules is connected via a system bus. The bus
consists of 3 flat ribbon cables containing 14 conductors each. Every
other conductor is grounded to eliminate cross talk (electrical noise).
Each cable is connected to each board via a 14 pin dual-in-line (DIP)
connector. Each board has 3 standard 14 pin IC sockets where each of
the three bus cables attach.

6) PCB1   Power is bussed to each of the boards of the system via a separate 14
conductor ribbon cable. This cable is attached to each board via a
14 pin dual-in-line connector.

7) OPR1   The operator/reference manual set is designed to introduce the SPHERE 1
system to the new computer user. It describes in detail how each instruction
works. It also describes in detail, interrupts, stack operations, Input/Output,
peripheral device characteristics, memory organization, projected device
reserved locations and limited characteristics, and execution timing.
Programming examples are included to illustrate various hardware features
and a section is included to introduce programming concepts to the first
time computer user. Appendixes are included to aid program development.
Although this manual set is comprehensive, some users may require further
information so references are amply provided. The manual set is loose
bound to receive updates and includes sections where SWAP newsletters,
kit assembly instructions, manuals, and maintenance manuals may be kept.
Kit assembly instruction manuals are a part of the package; however, each
module in kit form contains an associated kit assembly manual which may be
kept in this binder. SPHERE has introduced its user group to promote inter-
changes of ideas, useful circuits, comments, gripes, software (from games to
statistical packages), announcements (i.e.user has 10 Amp 5 volt power
supply for $15.00 type!). The SWAP newsletter will not be governed by
the marketing arm of the company. Hopefully the users will completely
govern this group in the future. SWAP membership is included with any
"SYSTEM" purchase or with the purchase of the OPR1 manual set. Future
membership fees will be determined by users.

SYS 2/KIT INTELLIGENT

This system was specifically designed to solve the needs of three different users.
1) The user who wishes to communicate to other devices over serial lines such as a telephone.
2) The user who wishes to utilize this device as a stand alone computer, and use the communications facility to save and restore programs and data using a standard teletype.
3) The user who wishes to use a standard audio cassette to save and restore programs.
This system includes all of the features found in SYS 1/KIT plus the following:

1) COM1   This module contains the ability to accept data in 8 bit parallel format from the CPU and transmit it serially with 1 or 2 start bits and a stop bit. Seven or eight data bits may be transmitted with optional even or odd parity. At the same time data in similar format may be received serially. The data will be checked for proper parity (if desired) and false start bits will be rejected. Communications may occur at several standard rates. These rates are strap-selectable with each board pre-strapped at 300 bits per second. Although other rates are available on this module, the standard rates are 110, 150, 300, 600, 1200, 2400, 4800, and 9600 Baud. Baudot Code teletypes can be supported with minor modification if 20% speed degredation is acceptable. X-on and X-off functions are provided by an on board relay. No cables are supplied.

2) MOD1   This module contains a complete ORIGINATE/ANSWER modem. The device has additionally been adapted to operate with an audio cassette. The modem will operate at a maximum speed of 600 Baud. It has been designed with particular emphisis on accousticly coupled lines rather than Direct Access Arrangements (DAA's). The SH, RING, +V DH, DA, DR, and $\overline{GND}$ signals are provided for the CBT type of DAA, however. A speaker and a microphone are all that are required to complete the acoustic coupler. No cableing is provided with this unit.

3) CAS1   This module contains the interface for an audio cassette. The cassette's AUX or MIC jack may be used as computer output and the AUX SPKR jack may be used as computer input. When used with a COM1 module, this unit will enable the use of a cassette as a non-volatile data storage system.
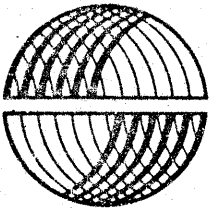
SPHERE

corporation

To Prospective SPHERE 1 Users:

    SPHERE CORP. is now delivering their product line of reliable, high quality, low cost computer system. From the ground up, the SPHERE 1 system is a new breed of beast. We emphasize the word system because that is the byword and the key to our philosophy here at SPHERE.

    We have not sacrificed quality at any point in our design to lower the cost of our system. Low cost has been achieved in two ways, true design innovation, and high volume.

    To insure a full peripheral offering from the onset, we are using tested peripherals and interfaces manufactured by ourselves and other firms, products which have met our performance criteria in the field. Here we have judged the manufacturers reputation and the significant cost/performance ratio to be worth our confidence in their peripherals. Although not mentioned in this brochure, several exciting developments are under way. From software there is a network operating system, RPG II, and an integrated data base system. From hardware there are unique developments in process control for the home and industry and an ultra low - cost mass storage system. These developments will be out by the first quarter of 1976.

    60 to 90 day delivery may be expected on all orders, however, the tremendous interest in this product may delay future orders somewhat.

    It is possible that you will have questions after reading the enclosed information. Feel free to call us at (801) 292-8466.

    We are looking forward to your order.

Best wishes for your future.

Michael D. Wise
President

MDW:dm

The SPHERE I computer system was designed to provide an uncompromising computer system with low cost achieved by true design innovation.

Some cost reductions were achieved by replacing hardwired logic functions with the microprocessor. For example, the control console (switch panel and lights) is not needed when the user can inspect or change memory and start or halt programs using a terminal attached to the computer. By elimination of the slow and costly console on the computer, a low-cost terminal was attached directly to the system making it useable for about the same price as an unuseable computer with a console. The console entails far more logic to implement than the microprocessor itself, therefore its elimination not only lowers costs but increases reliability. The terminal and other peripherals also utilize this same design philosophy to replace much of their hardwired logic with microprocessor intelligence. This further lowers the SPHERE I system cost while maintaining highest quality.
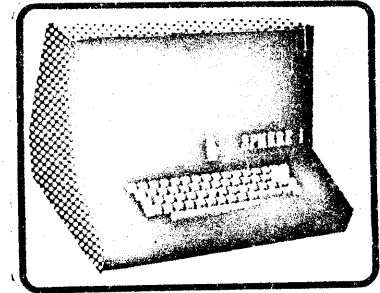
In development, the system hardware, software, expansion, maintainance, appearance, utility, and cost were considered in concert. As a result, the system can support direct memory access devices, intercomputer communications and memory sharing, prioritized vectored interrupts, slow memories, and much more. It has been designed wherever possible with common components to reduce cost. This will also allow the owner who does not select a maintainance plan to easily find these parts locally if any should fail.

The SPHERE system is based on the Motorola 6800 microprocessor which is the most technologically advanced, readily available microprocessor on the market today.

The peripheral selection includes floppy disks, printers, paper tape punches and readers, additional terminals, digital I/O, and more are being added on a regular basis. All of the peripherals and their interfaces are first quality industry-compatible devices with appropriate checking circuitry and associated software. A 650 page applications, systems & interfacing manual plus suppliment is available for interface requirements. As the system was designed with great concern for the environment in which it might operate, options such as more protected power supplies and sealed environment cabinets have been included as well.

All systems are supplied with concise manuals and software built into the basic price. With the basic system, read-only memory contains drivers for peripherals, and an expanded instruction set including multiply, divide, and binary to base (octal, decimal, and hexidecimal), and base to binary conversion. The read-only memory also contains a debugging system and a mini-assembler. When the disk system is purchased, the user will receive FDOS which is a disk operating system that has been delivered and is in operation. FDOS includes an editor, file structuring, and a full assembler with an operators manual and a 300 page programming manual. Also available by September with any processor purchase is a full extended BASIC language with documentation.

For those who might desire to gain entry into the world of general purpose computing at the very lowest cost, various configurations of the systems will be provided in kit form.

PROCESSOR MODULE (CPU1)   The SPHERE I processor module is designed to perform all of the basic functions required by a computer system. The module also has the capability to operate in stand-alone mode in process control applications or as a component in intelligent terminals, word processing terminals, communication devices, and other hardware requiring intelligence.   To more easily facilitate this stand-alone capability, 16 digital I/O lines have been supplied as an option on this board.   The board also has a Motorola M6800 microprocessor, 1K of reprogrammable read-only memory, 4K of dynamic random access memory with refresh circuitry for all dynamic memory on the system, and a real-time clock.   The instruction time varies from 2 to 12 microseconds, the longest saves all machine registers and transfers control to a designated subroutine.   The system has a single bus structure with peripherals accessed as memory locations which simplify hardware design, eases interfacing, and reduces cost.   It allows the processor or any device to communicate directly with memory or any other device which greatly expands the system's flexibility.   The bus and power are connected between modules or peripherals by flat ribbon cable with 14 PIN dual-in-line connectors.

DISPLAY MODULE (CRT1)   Up to eight display modules may be connected directly onto the SPHERE I processor bus.   Each display board contains 512 characters of memory for data which is displayed in a 16 line by 32 character format. The display's memory is accessed from the computer as if it were the computer's memory therefore display is instantaneous and unique effects can be achieved.   Each module is independent of the other and may display different information.   The display module uses a standard television set as its display device.   Provisions have been made to connect the module with a standard antenna and avoid tampering with the internal circuitry of the TV.

KEYBOARD (KBD1)   Up to eight keyboards may be connected to the central processor bus.   Each keyboard has 73 keys which include all special characters, upper case alphabet, all control functions (via the control key), a numeric key pad and cursor control pad.   The keyboard encoding scheme includes two key rollover.   All keys are a new high reliability type.   In addition to its normal functions, the keyboard, eight digital I/O lines, and two control lines are contained on the keyboard and are interfaced directly to the processor bus.

SERIAL COMMUNICATIONS AND CASSETTE MODULE (COM1, CAS1)   The communications module is designed to provide asyncronous communications for the computer system.   This communication may occur on any standard frequency.   Frequency may be either strapped or is the peripheral interface module is purchased, the rate may become programmable.   Up to eight of these units may be connected to the processor bus.   An option on the COM module is the cassette module.   This option allows the system to communicate directly to an audio cassette unit and includes a full modem.   This modem may take place at rates to 500 kbps in EIA, TTL, or current loop mode.   If a cassette is being used as an input or output device on this modem a signal is provided which will turn on the cassette prior to operation and turn it off within $\frac{1}{2}$ second of any transmisson completed.

POWER SUPPLY (PWR1, PWR2)   These power supplies are fully regulated with foldback current limiting and overvoltage protection.   PWR2 is a high reliability supply.

MEMORY (04K, 08K, 16K)   These memories are based on a popular and available 4K dynamic RAM.   Each is based on the 16K board which allows memory to be implemented in 4K increments.   The board may be addressed on any 4K boundary.

THE FLEXIBLE DISK SUBSYSTEM   The
SPHERE I floppy disk subsystem
contains numerous unique features
which have been designed to provide
capability uncommon even in much
larger systems. It interfaces to the
SPHERE I system via the peripheral
interface module and disk cable
assembly and is fully supported by the
Flexible Disk Operating System (FDOS)
package. The flexible disk used is
media and format compatible to the
IBM 3540 and 3740 with a maximum data
storage capacity of 256,256 bytes per diskette. A single controller handles
up to four drive units which may be individually write-protected. This
controller contains two 128-byte input and output buffers which enable
asynchronous byte transfers to or from the CPU. Hardware track seek and
seek verification as well as CRC generation and verification insure data
validity.
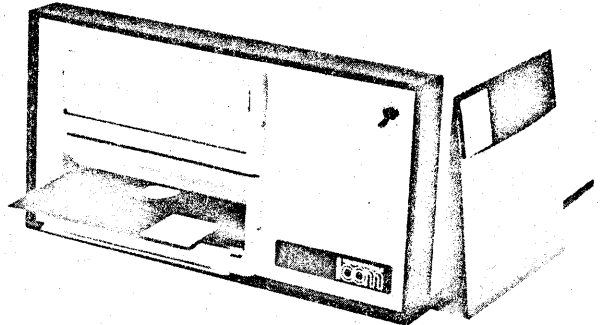
LINE PRINTER The SPHERE I line printer
produces 80 columns of 5 X 7 dot matrix
characters at 110 characters per second
or 65 lines per minute. The impact head
prints bidirectional on $8\frac{1}{2}$ inch roll paper
using a conventional teletype ribbon. The
line printer was designed for reliability
and extremely low cost required by small
scale data handling systems. This system
features the ability to print double wide
characters for headings and other applications. An adjustable width tractor
feed mechanism is available for use with fan-fold forms. Up to four highly
legible copies may be produced.
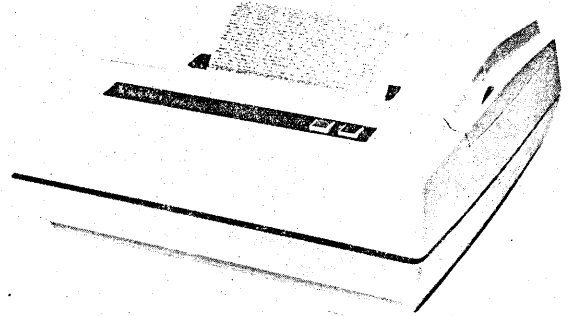
PAPER TAPE READER/PERFORATOR This combination reader/punch photoelectically
reads up to 150 characters per second and perforates asynchronously up
to 30 characters per second. Roll tape, chad box, controls, everything is
conveniently out front; making this combo a truly inviting, low-cost I/O
alternative.

32-CHARACTER TERMINAL This is the lowest cost alpha-numeric terminal
available on the market today. It includes our standard 73-key keyboard
and 32-character plasma display. This terminal is interfaced in parallel
to the SPHERE I processor.

512-CHARACTER TERMINAL This terminal is effectively identical in appearance
to the SPHERE I system; however, no processor module is included. This
terminal is interfaced in parallel to the SPHERE I processor.

LOW-LEVEL SOFTWARE SUPPORT The system has been provided with an assembler, editor, debugging aid, and drivers for the CRT built into read-only memory. Even the smallest system that has no communications or cassette capability, is fully capable of supporting itself. But rather than leaving it at that, the system has been provided with additions to the language that make it as versatile as a 16-bit computer. These include 16 bit arithmetic (add, subtract, multiply, divide, and compare) as well as conversion from ASCII representations of numbers to binary and visa versa. When cassette capability is added, data and programs may be stored for later retrival. All of these features make the system much faster and easier to work with as far as the programmer is concerned.

THE EXTENDED BASIC LANGUAGE The BASIC language is supplied to purchasers of the SPHERE I system whether or not they have purchased sufficient memory from us to support the BASIC language. SPHERE I BASIC includes many of the features found in popular BASIC languages, including string manipulation, matrix manipulation, machine language subroutine calls, trig functions, and disk file I/O.

FLEXIBLE DISK OPERATING SYSTEM (FDOS) SPHERE I FDOS is a complete program development system which provides those high-speed software development tools usually available only on larger mini-computer systems. Program storage and backup is maintained on low-cost, reusable, compact diskette cartridges which are readily available from a number of sources. FDOS contains such single command operations as disk-to-disk program editing and assembling, disk-to-memory program loading; named files; disk-to-remote or cassette; cassette or remote to disk; and disk to disk transfering. The resident portion of FDOS is located in PROM memory located on the CPU board. It contains a disk resident assembler and editor debugging system and basic language compiler. FDOS has been designed with simplicity as the keyword to insure continues reliability and uncomplicated use. FDOS is up and running now.

SWAP (SPHERE WORKING APPLICATION PROGRAMS) SPHERE recognizes the importance of application programs written by users and desires to provide a vehicle for distribution of these programs. Until users have gained enough numbers to determine their desires and needs, SPHERE will underwrite SWAP's operation on an interim basis.
SPHERE will distribute a quarterly SWAP newsletter. The newsletter will contain brief abstracts which have been submitted to SWAP at 96 East 500 South, Bountiful, Utah 84010. In addition, letters to SPHERE or SWAP will be considered for publication. An attempt will be made to publish representative letters on an impartial basis.
In an effort to stimulate application program submittal, SPHERE will reward exceptional submissions with up to $1,000 certificates to purchase SPHERE equiptment and peripherals. These awards will be at SPHERE's discretion and according to SPHERE's judgement. Awards will be published in the quarterly newsletter. These award announcements will be made for exceptional work in the following areas: languages and operating systems, statistical and engineering packages, business applications, educational packages, and other applications including games.

SPHERE CORP.   MODULE PRICE LIST

CATALOG NUMBER	DESCRIPTION	FULL	INTRO[1]	P/R[2]	MAINT[3]
PROCESSORS AND ACCESSORIES					
CPU1/KIT	CPU w/4K RAM, 1K Programmed EPROM & Clock	$522	$421		$63
CPU1/ASM	Assembled CPU1/KIT	622	522		63
CPU1/ASM1	CPU1/ASM plus 16 digital I/O	652	552		67
16D/KIT	16 Digital I/O CPU add on	35	27	CPU1	4
CRT DISPLAY					
CRT1/KIT	32 Char x 16 line std. TV Interface	161	141	CPU1	19
CRT1/ASM	Assembled CRT1/KIT	207	180	CPU1	19
KEYBOARD					
KBD1/KIT	73 Key Keyboard & Interface	100	86	CPU1	14
KBD1/ASM	73 Key Keyboard & Interface Assembled	160	130	CPU1	14
MEMORY					
O4K1/KIT	4K Memory Board	242	232	CPU1	31
O4K1/ASM	Assembled 4K Memory	312	300	CPU1	31
O8K1/KIT	8K Memory Board	415	400	CPU1	48
O8K1/ASM	Assembled 8K Memory Board	506	485	CPU1	49
16K1/KIT	16K Memory Board	764	740	CPU1	85
16K1/ASM	Assembled 16K Memory Board	884	850	CPU1	85
4KX1/KIT	4K Memory expansion for O4K or O8K modules	180	170	O4K O8K	18
COMMUNICATIONS					
COM1/KIT	Asyncronous (EIA, TTL, TTY) I/O	91	72	CPU1	12
COM1/ASM	Assembled COM1/KIT	151	112	CPU1	12
COM1/ASM1	COM1/ASM plus cassette I/O	219	172	CPU1	18
CAS1/KIT	Cassette I/O Interface	90	70	COM1	6
PERIPHERALS					
PIM1/KIT	Interface Module(64 digital I/O lines)	120	100	CPU1	12
PIM1/ASM	Assembled PIM1/KIT	160	137	CPU1	12
DSK1/ASM	1 IBM compatible floppy disk	2399	2350	DCB1	190
DSK2/ASM	2 IBM compatible floppy disks	3099	2864	DCB1	250
DSK3/ASM	3 IBM compatible floppy disks	4414	4265	DCB1	391
DSK4/ASM	4 IBM compatible floppy disks	5114	4945	DCB1	460
LPT1/ASM	65 lpm line printer	1200	1100	LCB1	137
PPT1/ASM	Paper Tape reader(150 cps)/punch(30cps)	1700	1600	½PIM1	170
32T1/ASM	32 position ASCII terminal Parallel	630	566	CPU1	52
32T1/KIT	32 position ASCII terminal Interface	526	466	CPU1	52
51T1/ASM	512 position ASCII terminal to CPU	879	786	CPU1	78
CHASSIS					
RAC1/KIT	Attractive Desktop Display & Chassis	252	240		18
ENV1/ASM	Environment Sealed Chassis	1032	N/A		N/A
POWER SUPPLIES					
PWR1/KIT	System Power Supply (Hobby)	96	80		6
CABLES					
DCB1/ASM	Cable Assembly for disk	40	30	½PIM1	1
LCB1/ASM	Cable Assembly for line printer	99	75	½PIM1	1
PCB1/ASM	Power Cable (from power to 4 boards)	20	15		1
BCB1/ASM	Buss Cable (3 required)	15	10		N/A
TCB1/ASM	Cable Assembly for Read/Punch	60	55	½PIM1	1
MANUALS					
APP1/MAN	Applications & Interfacing(650+ pages)	25	25		N/A
OPR1/MAN	Operator/Reference package	40	40		N/A

NOTES APPEAR AT END OF PRICE LIST

CATALOG NUMBER	DESCRIPTION	***PRICES*** FULL	INTRO[1]	MAINT[3]
SYS1/KIT	HOBBIEST -- This computer system is capable of satisfying the needs of the user who wishes to program, develop, and debug programs for light process control, experimenting and some educational purposes. It is capable of full expansion as the user requires. The system consists of the following modules: CPU1. KBD1, PWR1, ECB1(3), CRT1, PCB1 OPR1/MAN, and membership in SWAP.	860	650	103
SYS1/ASM	This is SYS1 in assembled form. It also includes an attractive desk chassis with TV and other hardware.	1400	1120	121
SYS2/KIT	INTELLIGENT -- This system includes all the features found in SYS1 plus the additional feature of serial communications and audio cassette capability. The software contained in read-only memory provided the user with full stand alone programming capabilities. Users may easily implement remote loading, polling, data editing, data entry, and other functions found in intelligent terminals.	999	750	121
SYS2/ASM	SYS2 in assembled form also includes attractive desk-top chassis with TV and other hardware	1499	1220	139
SYS3/KIT	"BASIC" language system includes all the features found in the above systems plus an additional 16K of memory which provides ample space for the BASIC compiler and user programs. BASIC is a fully extended language which includes matrix operators and the capability of CALLing assembler subroutines.	1765	1345	206
SYS3/ASM	SYS3 in assembled form. Also includes attractive desk-top chassis with TV and other hardware.	2250	1755	224
SYS4/KIT1	A REAL "CLASSIC" This system includes all of the features found in the above kits plus a 65 line-per-minute, 80 column printer, 2 IBM compatible floppy disks, and a disk operating system which handles file maintainance and provides an editor, assembler, debugging facility, and the BASIC language with file handling extensions. This system is operational now and BASIC will be available in September	6100	5250	607
SYS4/KIT2	Same as kit 1 except attractive desk-top display (RAC1) with TV added.	6340	5453	625
SYS4/ASM	This is SYS4/KIT2 in assembled form. This is the lowest cost dual disk system ever offered to the public and will out perform systems many times more expensive.	7995	6595	625

1. Prepaid systems ordered by September 1975.
2. Prerequisite column.
3. Plan 2 maintainance cost (Plan 1 is 65% of amount).

SPHERE CORP.   ORDER FORM

SOLD TO: _____   **DATE:** _____

_____

_____   SHIPPING INSTRUCTIONS:

_____ ZIP _____

CUSTOMER PHONE NO. _____

QTY	CATALOG NUMBER	DESCRIPTION	PRICE	TOTAL
			.	.
			.	.
			.	.
			.	.
			.	.
			.	.
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PAYMENT

INDIVIDUALS—must include cashiers check, money order, or complete bank card information below. Other checks will clear before shipment.

COMPANIES: Special offers are available on a quantity OEM basis in kits, assembled units, or our one card computer. All orders are subject to credit approval. Invoices older than 10 days will be charged at .05% per calender day on invoice amount.(18¼% per year max.)

SHIPMENT

All costs of shipment are to be paid by purchasing party. Shipment will be made according to shipment instructions on a "best efforts" basis. No claims for lost or damaged shipments will be accepted by this corporation.

TOTAL	.
UTAH RESIDENTS ADD 4½% SALES TAX	.
SHIPPING	.
TOTAL AMOUNT ENCLOSED OR TO BE CHARGED TO MY CREDIT CARD.	.

BANK CARD INFORMATION

Sign your name as it
is on your credit card _____   BankAmericard ____
                                            Master Charge ____

Credit Card   Interbank   Expiration
Number _____   Number _____   Date _____

MAIL TO: SPHERE CORP. 791 South 500 West, Bountiful, Utah, 84010

WARRANTEE (Assembled Units)   Warrantee units which fail due to defects

in material or workmanship within 90 days of shipment will be repaired

or replaced at our option when delivered at 791 South 500 West, Bountiful,

Utah with return shipment prepaid. Suspect modules may be sent.

KITS WARRANTEE (All Expensive Repairs)   Any part which fails due to

defect within 90 days of shipment will be replaced. Replacement parts

will be sent when failing parts are sent with $5 handling fee. User

must fill out and mail warrantee registration upon delivery or warrantee

will be voided.

KIT MAINTAINANCE   Assembled kits may qualify for assembled maintainance

plans after qualification requirements are met. A qualification fee will be

required.

MAINTAINANCE PLAN 1 (Warrantee Extension)   Units which fail will be

repaired in accordance with warrantee conditions.

MAINTAINANCE PLAN 2 (Site Repair Plan)   Designated site personell will be

trained to work with our personell over the phone to resolve failures using

minimal tools and spare boards kit. Your personell will not require electronics

background. Parts required to repair units that do not appear in spares kit will

be shipped immediately upon availability. Spares kit must be purchased.

TIME AND MATERIALS MAINTAINANCE   Time and material maintainance is

available and will be billed as indicated below:

1. Any system under warrantee or maintainance plan:

    Transportation at actual cost plus $15 an hour.

2. All other systems and expenses:

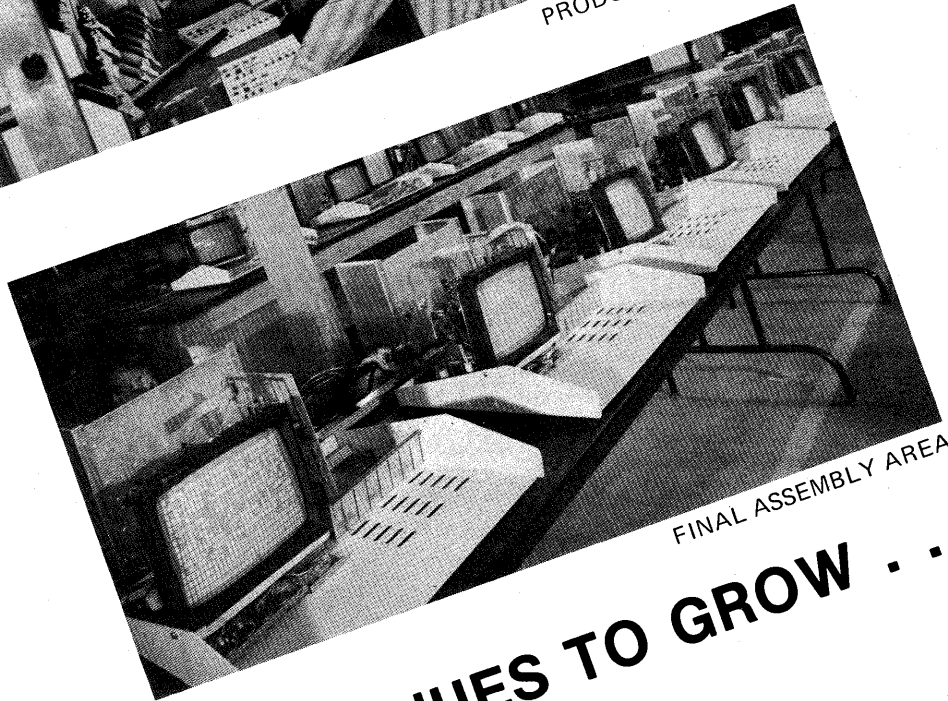   Transportation at actual cost plus $35 an hour (min. $200)
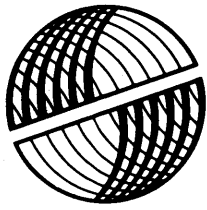
SPHERE
CORPORATION

NEW BUILDING

PRODUCTION AREA

FINAL ASSEMBLY AREA

CONTINUES TO GROW . . .

After talking to thousands of potential and existing computer users like you, we have found that what you want is a computer that has these features:

- A **KEYBOARD** to input your programs.

- A **PROCESSOR** with software that lets you program immediately with power-on.

- A **CRT** to **DISPLAY** your programs so you can see what you are doing.

- **MEMORY** for rapid access of **STORED DATA** and **PROGRAM OPERATIONS**.

- An **AUDIO CASSETTE** to save for **FUTURE** access all of the data you have generated.

- **INPUT/OUTPUT** (serial and parallel) for communication with the **outside real-world devices** such as printers, teletypes, telephones, security devices, security monitoring, etc.

These same people say they like a SPHERE COMPUTER SYSTEM because of the **complete COMPUTING POWER** that the **SYSTEM** has to offer.

The advantage of a SPHERE SYSTEM is that in **ONE package** you can get all the fundamental Computer Features that will allow you to input your programs through the keyboard, process your information, and produce meaningful output.

ALL YOU NEED for your desired computing power FROM ONE SUPPLIER. COMPATIBLE, RELIABLE, POWERFUL.

We have at SPHERE even more options for even greater computing power. See the price list for the details.

As we were conversing with you we found that there are about four general categories of computer users. The categories and the SPHERE SYSTEMS developed to accommodate them are the following:

KIT BUILDER: SPHERE SYSTEM 310: you are the one who wants to put a computer together to learn all about it and save some money, too.

HOBBIEST: SPHERE SYSTEM 320: the one who wants a spare time challenge with ample programming power to do fun, constructive things.

PROGRAMMER: SPHERE SYSTEM 330: you are interested in programming for fun or profit. You receive full language, and complete hardware. No kidding around for you.

DATA HANDLER: SPHERE SYSTEM 340: to store, retrieve and process mass amounts of information. You mean business.

THE SPHERE 300
SERIES OF SYSTEMS:
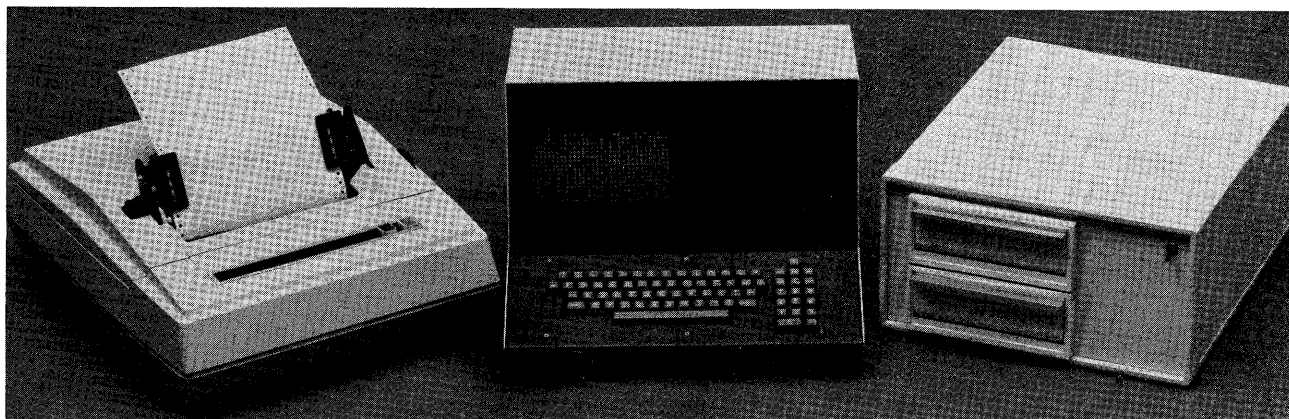
THIS IS THE SYSTEM 340 WITH PRINTER AND FLOPPY DISC

SYSTEM 310 (Formerly System 1)

- CPU/2 Module
- CRT Module
- KEYBOARD
- METAL BASE
- Low Profile Kit Cover
- ALL Hardware and cables included
- POWER SUPPLY
- PDS — Program Development System

SYSTEM 320 (Formerly System 2)

- CPU/2 Module
- CRT Module
- KEYBOARD
- SIM Module
- METAL BASE — attractive desk top metal chassis with card rack
- POWER SUPPLY

SYSTEM 330 (Formerly System 3)

- All of the above in System 320
- 16K of Memory (Total 20K Memory)
- BASIC Language on cassette tape

SYSTEM 340 (Formerly System 4)

- All of System 310 plus the following:
- PIM Module
- LINE PRINTER 80 column — 110 characters per second
- DUAL FLOPPY DISC MEMORY (256,256 bytes Memory on each disc)
- Disc Operating System
- Basic Language
- 16K Memory (Total 20K Memory)

NOTE: All assembled systems come with 9" video monitor installed. Kit prices do not reflect a 9" video monitor and housing.

MODULES

Central Processing Module
    (CPU/2)

- Uses Motorola or AMI 6800 micro-processor
- Contains 1K bytes of Programmable Read Only Memory (PROM)
- Contains 4K bytes of semi-conductor memory (RAM)
- 8 lines of Digital I/O and 2 interrupt lines
- RS232 and Teletype (20 mil) serial interface
- Real Time Clock
- Power-On reset
- High drive buffered bus (30 TTL loads)
- All of the above on one 8″ by 10″ board for Reliability, Simplicity, and Low Cost.
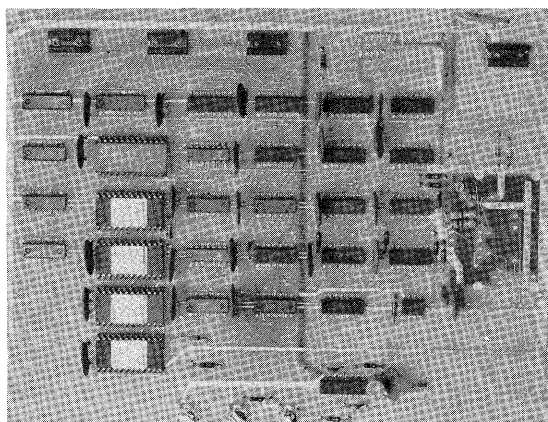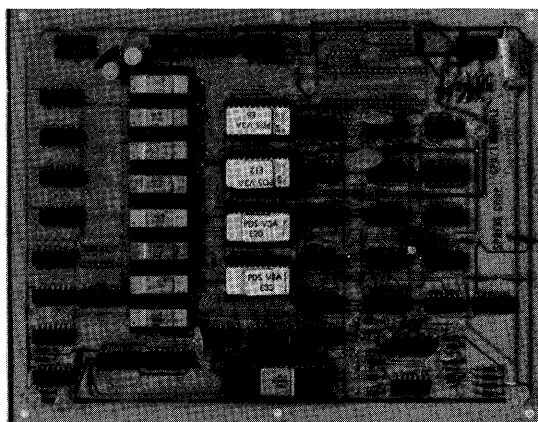
Cathode Ray Tube Module (Video Interface)
    (CRT)

- Single printed 8″ by 10″ circuit board
- Display 16 Lines of 32 Characters (5 by 7 dot matrix forms each character)
- Contains 512 ASCII coded characters of buffered memory for display buffer
- Up to 8 Modules may be used on a single system
- Accesses own memory without slowing the processor.
- Can operate with Video Monitor or R.F. (T.V.)

KEYBOARD
    (KBD/2)

- 63 Character fully decoded ASCII
- Mechanical shift Lock
- Single connector tie in to all other CPU/2 boards
- Newly developed, with guaranteed high reliability.
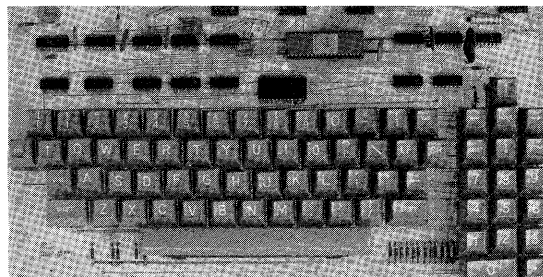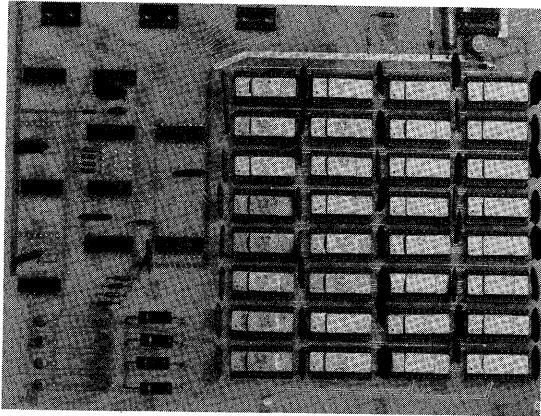
MEMORY
(MEM)

- Maximum 16K Dynamic RAM possible (Positioned in 4K increments)
- Starting address is strap selectable on 4K Boundaries.
- 8" by 10" Board can be populated in 4K, 8K, 12K and 16K increments

Printer Interface Module
(PIM)

- 4 PIA chips provide 64 Lines of
- Digital I/O
- Provides Line Printer and Floppy Disk interface
- Each I/O Line has addressing for Real world Devices
- 8" by 10" Board
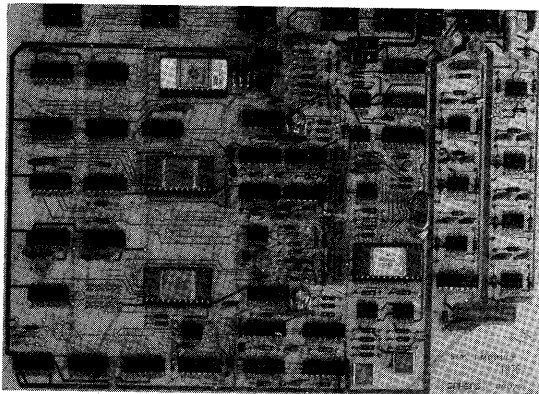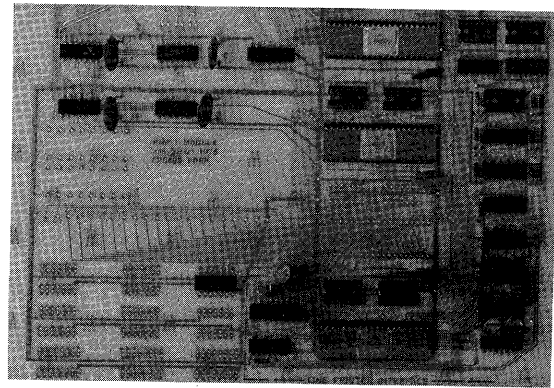
SERIAL INTERFACE MODULE
(SIM)

The Serial Interface Module is another link from the Computer to the outside world. It is designed to accommodate many interfaces in several different combinations. The SIM also allows you to select which options best fill your communication needs and you pay for only those capabilities you desire.

You can order any of the following:

OPTION 1 Dual Cassette

OPTION 2 Cassette & Serial Interface

OPTION 3 Cassette and Modem

OPTION 4 Modem Alone

OPTION 5 Serial Interface Alone

OPTION 6 Single Cassette Alone

Note: Serial Interface Consists of TTY, or TTL, or RS232

PRICE LIST

SYSTEM 300 SERIES COMPUTERS

System 310A*	$1590.00	System 310K*	$1019.00	
System 320A	$1769.00	System 320K	$1190.00	(999)*
System 330A	$2579.00	System 330K	$1925.00	
System 340A	$7995.00	System 340K	$6100.00	

★ON SALE $999⁰⁰ UNTIL APRIL 20, 1976

OPTIONAL MODULES

CPU/2A	$750.00	CPU/2K	$525.00
CRT/A	$259.00	CRT/K	$169.00

MEM (A only)

4K	$260.00
8K	$480.00
12K	$660.00
16K	$790.00

PIM/A	$280.00	PIM/K	$220.00
KBD2/A	$220.00	KBD2/A	$140.00

SIM Several configurations of the SIM Module are available. These are the Available Options.

	ASSEMBLED	KIT
DUAL CASSETTE	$310.00	$189.00
ONE CASSETTE & SERIAL INTERFACE	$490.00	$240.00
ONE CASSETTE & MODEM	$560.00	$290.00
MODEM ONLY	$388.00	$189.00
SERIAL INTERFACE only†	$290.00	$125.00
ONE CASSETTE ONLY	$255.00	$150.00

LINE PRINTER w/roller feed	$1325.00
w/tractor feed	$1575.00
LCB cables	99.00

DUAL FLOPPY DISC	$3099.00
extra discs	$15.00
DBC Cables	$99.00

DISPLAY CABINET 1: 32 x 16 Monitor mounted, Terminal top, back, front, Plexiglas Front Cover	$390.00
POWER SUPPLY 2:	$220.00

*A = Assembled; K = Kit Form
†Serial Interface = TTL, RS232, TTY (20ma Current Loop)

MOST POPULAR COMPUTER BOOK LIST

101 Basic Computer Games by Digital Equipment	$ 7.50
What To Do After You Hit Return by P. C. C.	$ 6.95
My Computer Likes Me When I Speak Basic by Bob Albrecht	$ 2.00
BASIC by Albrecht, Finkel, and Brown	$ 3.95
Introduction to Microcomputers by Adam Osborne	$ 7.50
Motorola 6800 Programming manual	$12.00
Motorola 6800 Applications manual	$25.00
Motorola 6800 Introduction to Microprocessors	$ 2.00
Micro-Computer Dictionary and Guide by Charles Sippl	$17.95
Computer Chess by Monroe Newborn	$15.00

DISTRIBUTORS:

Please Contact One Of Our Distributors

Computer Way — Huntington Beach, California

Bargain Electronics — LaMeda, California

Comput-O-Mat Systems — Rye, New York

The Computer Workshop, Inc. — Montgomery County, Maryland

Computer Mart Corporated — ~~Boston,~~ *Waltham* Massachusetts

The Computer Mart of New York — New York City, New York

Communicaciones S.A. — San Jose, Costa Rica

Computer Country — Denver, Colorado

WARRANTEE

WARRANTEE (Assembled Units)

Warrantee units which fail due to defects in material or workmanship within 90 days of shipment will be repaired or replaced at our option when delivered at 940 North 400 East, North Salt Lake, Utah, with return shipment prepaid. Suspect modules may be sent. Send all correspondence to P.O. Box 213, Bountiful, Utah 84010.

KITS WARRANTEE (All Expensive Repairs)

Any part which fails due to defect within 90 days of shipment will be replaced. Replacement parts will be sent when failing parts are sent with $5.00 handling fee. Warrantee period begins 10 days after shipment from factory.

ORDER FORM

Item	Description	Quantity	Price/Each	Total	
1					
2					
3					
4					

NAME _____
please print clearly

STREET_____

CITY _____

STATE _____ ZIP_____

PHONE NO. _____

BANK CARD NO. _____ EXP. DATE: _____

MC _____ BAC_____

SIGNATURE_____

|		
A. Item Purchase Total		
B. Utah Residents add 4.75% tax		
C. Postage, handling, shipping and insurance add 2% of A		
E. Order Total		

Sphere generally offers 60-90 day delivery after full payment is received. (Cashier's check clears immediately, personal check 1-2 week delay.) Parts availability may possibly delay delivery beyond the normal time.

Orders may be cancelled after 120 days without penalty. Sphere's only obligation is to deliver the product.

SPHERE CORPORATION

940 North 400 East
North Salt Lake, Utah 84054
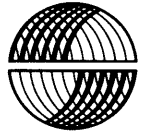
Special to
April 20, 1976
A Sphere System 320
at Old System 2 Price.
$999⁰⁰

SAVE — SAVE — SAVE