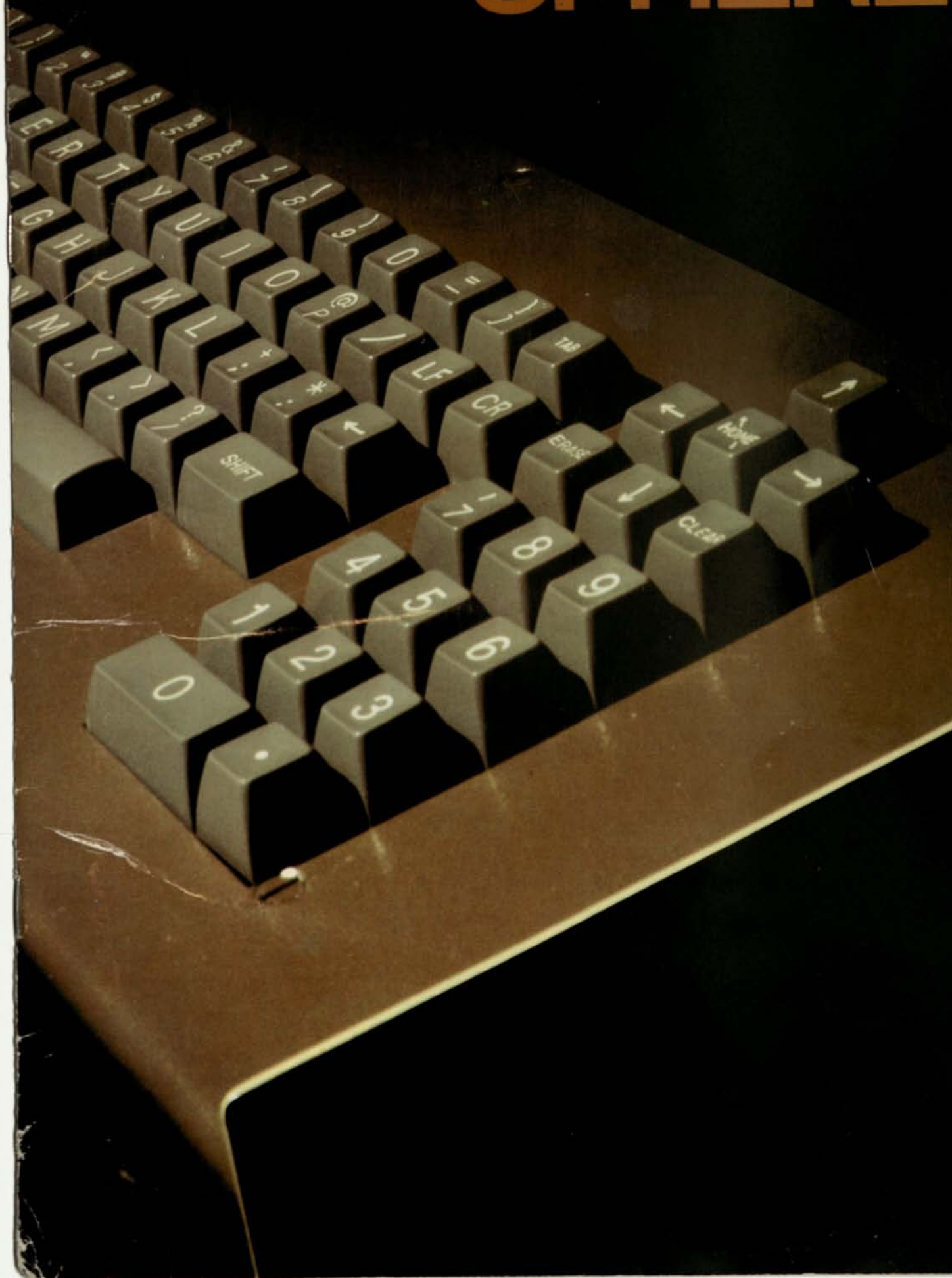


SPHERE

COMPUTER SYSTEMS



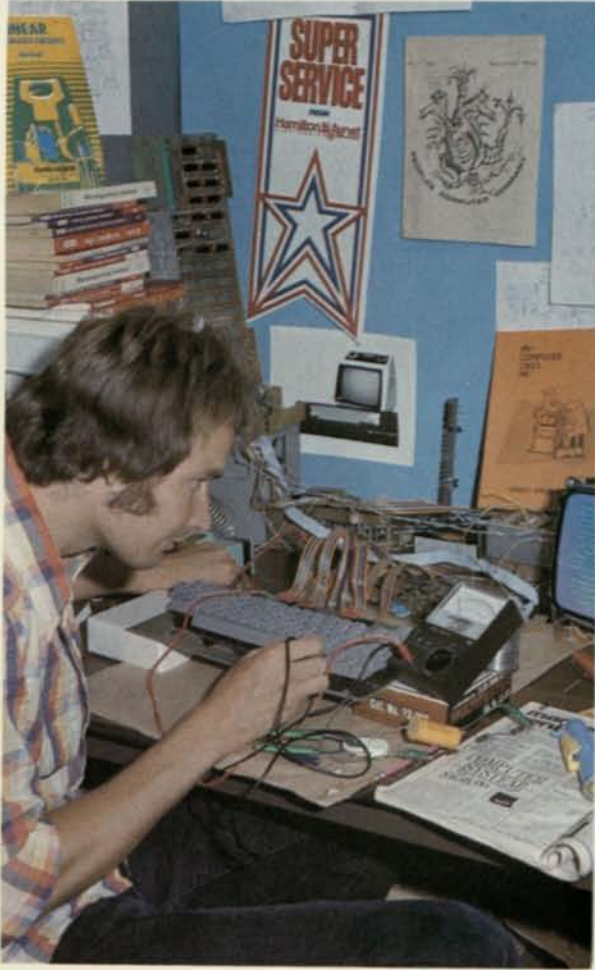
WHEN NO COMPROMISE IS MADE . . .

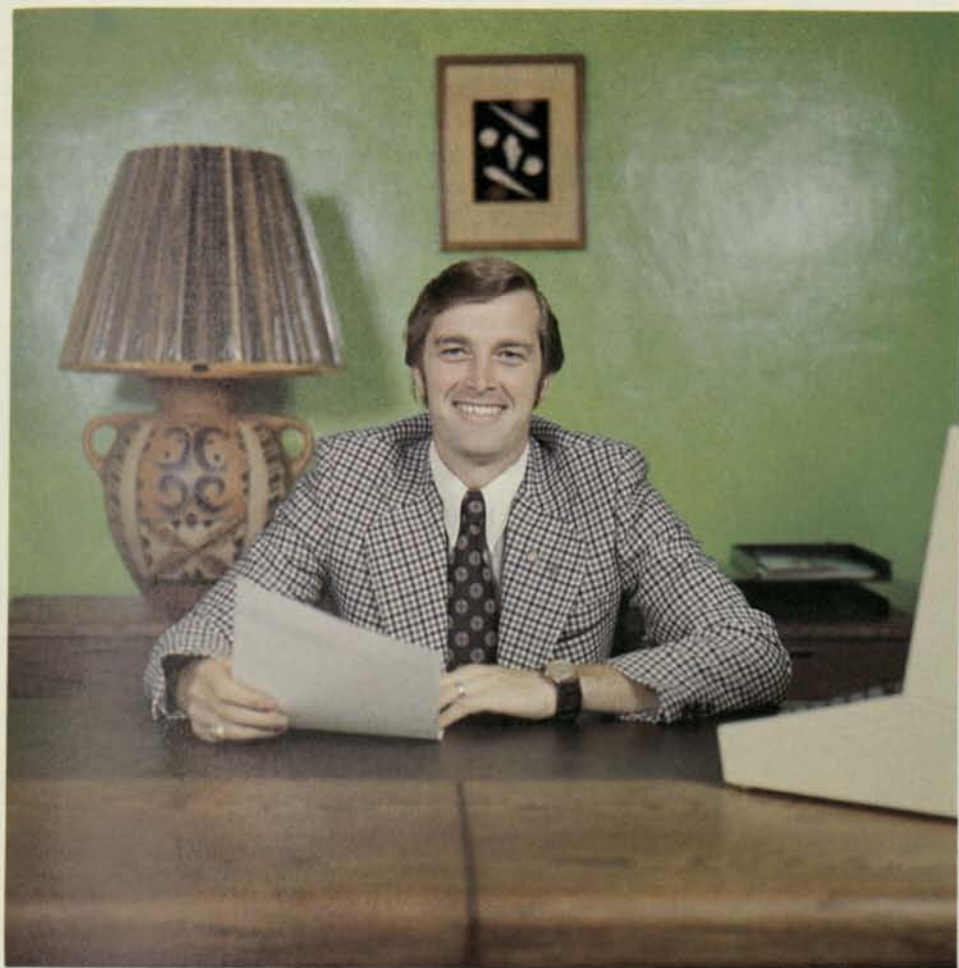
Design innovation can create a compact computer system with the same features and capabilities as a large, powerful, high cost model. This is the SPHERE I. The result is a multi-application device for problem solution wherever you need it.



THE SPHERE SYSTEM . . . EVERYONES COMPUTER.

The SPHERE COMPUTER SYSTEM introduces a new generation of problem solving devices. Thanks to microprocessor technology. This versatile, productive, compact unit fits in anywhere - in the classroom, in the office, at home, in research and engineering, in the accounting department, in manufacturing and anywhere else there is a need to solve problems. It's everyone's computer.





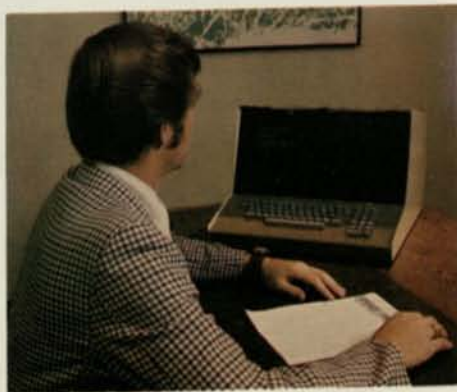
SPHERE I . . . THE VERSATILE SOLUTION.

The SPHERE I takes the lead. Design innovation along with microprocessor technology has given birth to a new generation in computers. In the past a computer was big, expensive, difficult to operate and required repair specialists. The SPHERE I computer is versatile in that . . . IT SOLVES PROBLEMS SWIFTLY, DOES NOT REQUIRE EXTENSIVE SCHOOLING TO OPERATE, NEEDS VERY LITTLE SERVICING AND IS, ABOVE ALL, EXTREMELY INEXPENSIVE. All this is done without compromising quality. It's versatile in that you can perform virtually any application whether you are a parts man with an inventory problem, a medical technician making a critical chemical analysis, a secretary, an accountant, a hobbyist who marvels at computer capabilities, a businessman, an OEM, or whoever you are. The SPHERE I is the ideal solution.



RESPONSIVE . . . IT'S THERE WHEN YOU NEED IT!

No longer will you need to wait for batch runs or time share delays. The SPHERE I is the personal computer. You direct the job, run through the typewriter keyboard for easy data entry and program correction. There's no need for expensive monthly computer service bills, wasted time, or incorrectly run applications. The new generation of computers is here to solve these problems and to provide you with in-house computer service. SPHERE I takes the lead as the versatile solution.



IT'S THAT SIMPLE . . .

EASE OF OPERATION: Since you have got to be able to understand a computer to use it, we have made all of our SPHERE SYSTEMS for easy data entry. A typewriter keyboard, along with cursor editing and numeric keypad allow ease of program development or correction, thereby saving time spent trying to get input data. So that you're not left out in the dark, comprehensive manuals are included. The operator reference package includes any and all information that would be pertinent to gaining a working knowledge of mini-computers and their operations and applications. Software is not slighted either. Our Program Development System is complete with: editor, de-bugger, mini-assembler, binary to ASCII, and ASCII to binary conversion, and with an extended instruction set. An extended BASIC compiler complements the package so that you can perform the same functions as a big computer. Software is aided by a BASIC language text.



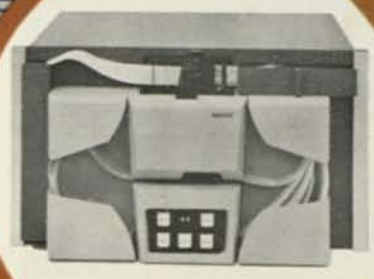
SPHERE BASIC includes all the features of Standard Dartmouth BASIC plus string, matrix and file manipulation. SPHERE'S Disk Operating System was designed for program development. The SPHERE SYSTEM approach makes it that simple.

COMPONENT SIMPLICITY: The SPHERE I is a real mini-computer, not a stripped micro-processor. On one module you get a complete computer: the Motorola 6800 central processor, 4K Random Access Memory, 1K PROM, 16 lines of digital I/O and a real-time clock.

Micro is size and price, but macro in computing performance! Simplicity is a SPHERE by-word. Five modules make up the entire system. With these modules the computer becomes a user-programmable intelligent terminal. The terminal has been designed with ample room for expansion to 64K of memory. Your computer is a high technology, high capabilities device designed to give you maximum computing (problem-solving) ability at the lowest dollar outlay.



CAS/I



102659843

COM/I
MODULE

Copyright 1975 - Sphere Corp.

SPHERE PRODUCT SPECIFICATIONS

For The SPHERE I:

Electrical Requirements:

Voltage: 107 VAC (min) to 125 VAC (max)
Frequency: 60 Hz
Circuit: Standard Outlet
Power: 200 Watts
Dimensions: Width 18 inches
Depth 19 inches
Height 12½ inches
Weight 35 lbs.

Processor Specifications:

CPU: Motorola 6800 Microprocessor.
Memory: 4K Random Access Memory, expandable to 64K (via 16K memory boards)
I/O: Up to 1024 lines of digital I/O.
Real-Time Clock: Selectable at 512, 256, 128, or 64 interrupts per second.
Read Only Memory: Up to 1K bytes of Erasable Read Only Memory is available for dedicated applications. SPHERE supplies several software packages for the PROM.
Keyboard: Includes a standard typewriter-style alpha-numeric keypad. Also a star-shaped cursor control keypad, which includes home and erase functions, is supplied. Two-key rollover, and 10 general purpose digital I/O lines are standard features on the keyboard.
BUS Structure: Up to 35 devices are connected by three 14-conductor flat ribbon cables. Eight data, and 16 address control lines are transmitted bi-directionally to and from the CPU, memory, and peripherals.
Read Only Memory: Up to 1K bytes of Erasable Read Only Memory is available for dedicated applications. SPHERE supplies several software packages for the PROM.
CRT: The 64 character ASCII character set displayed in a matrix of 32 characters by 16 lines. Character format is 5 x 7 dot matrix.
Communications: Serial communications allows data to be transmitted with 1 or 2 start bits and a stop bit. Rates are selectable at 110, 150, 300, 600, 1200, 2400, 4800, and 9600 baud.
MODEM: A complete originate/answer modem with maximum operating speed of 600 baud and standard modem features the ability to directly interface to an audio cassette and/or an acoustic coupler.

For the Peripherals:

Disk: *256,256 Byte(Diskette)
*77 Tracks/Diskette
*26 Sectors/Track
*128 Bytes/Sector
*Uses IBM 3740 initialized type media
*Fully IBM Format Compatible
*360 RPM rotational speed
*10 track-to-track access time
*5 Sector Read/Write time
*83 Average latency time
*Power — 115/220 V, 50/60 Hz, 200 Watts
*Dimensions — 8¼" x 17" x 17" (2 drives)
*Weight — 50 lbs. (2 drives)

Line Printer:

*Print Method — Impact Dot Matrix
*Character Height — 0.105" 7 vertical pins on 10° slant
*Character Width — 0.075" 5 x 7 Matrix
*Character Spacing — 10 characters/inch
*Line Width — 80 characters
*Font — 64 character ASCII subset standard; 96 character set, optional

Print Mechanism:

*Head Motion — Print head moves uniformly in both directions
*Print Speed — 110 characters/second
*Throughput — 65 lines/minute. Bi-directional Printing

Paper Mechanism:

*Media — 8½" roll paper, up to 5" in diameter; 9½" wide 4-ply fanfold paper, optional
*Line Spacing — 6 lines/inch
*Feed Rate — 100 millisecond single space 600 line/minute Slew

Ribbon Mechanism:

*Media — Standard ½" wide nylon ribbon on 2" spools

Input Power:

*Voltage — 100, 110, 117, 235 VAC + 10%, 50 or 60 Hz
*Weight — 331 lbs.
*Power — 350 watts maximum
*Size — 18" x 8" x 22"

For Other SPHERE Products:

Sphere also manufactures: (Product Sheets are available.)
Full Color and B/W Video Graphic Terminal Systems
Large capacity Disks
Mass Storage Systems
Digital Cassette Units
Reel-to-reel tape drives
Other computers
Intelligent Components for OEM use



SPHERE

791 South 500 West Bountiful, Utah 84010 (801) 295-1368

SPHERE BASIC

**a Quick
Reference**

791 SOUTH 500 WEST
BOUNTIFUL, UTAH 84010
(801) 292-8466

The BASIC programming information on this card serves as a handy reference. It can be folded for use as a pocket reference or mounted at your terminal location.

COMMANDS

NOTE: Commands are executed immediately; they do not require statement numbers.

Full Name	Example	Purpose
APPEND	APP PROG 1	Appends named program to current program.
CATALOG	CAT	Lists the names and lengths of user library programs and files.
DELETE	DEL 100	Deletes all statements after and including the specified one.
	DEL 100,200	Deletes all statements between and including the specified ones.
GET	GET SAMPLE	Retrieves the named program from user's library and makes it the current program.
KILL	KIL SAMPLE	Deletes the specified program from the user's library (does not modify current program).
LENGTH	LEN	Lists the current program length.
LIBRARY	LIB	Lists the names and lengths of system library programs and files.
LIST	LIS	Produces a listing of current program.
	LIS 150,200	Lists the current program, optionally starting at a specified statement number and optionally stopping at a specified statement.
	LIS 200,P	The addition of a "P" at the end of any list format causes the listing to be paginated into 11-inch sheets.
NAME	NAM SAMPLE	Assigns the name to the current program; name may consist of 1 to 6 printing characters.
RENUMBER	REN	Renumbers program from 10 in intervals of 10.
	REN 50	Renumbers program from specified statement number in intervals of 10.
	REN 50,n	Renumbers program from specified statement number in intervals of n.
	REN m,n,p,q	Renumbers program starting at new statement number m, at intervals of n, with renumbering starting at statement p and ending at statement q.
RUN	RUN	Starts program execution.
	RUN 50	Starts program execution at specified statement.
SAVE	SAV	Saves the current program in user's library.
SEARCH	SCR	Erases current program (but not program name).

OPERATORS

Symbol	Sample Statement	Purpose/Meaning/Type
=	100 A = B + C * 0 110 LET A = 0	Assignment operator; assigns a value to a variable. LET is optional.
↑	120 PRINT X ^ 2	Exponentiate (as in X ²).
*	130 LET C5 = (A * B) * N2	Multiply.
/	140 PRINT T5 / 4	Divide.
+	150 LET P = R1 + 10	Add.
-	160 X3 = R3 - P	Subtract.

NOTE: The numeric values used in logical evaluation are: "true" = any nonzero number; "false" = 0.

=	170 IF D = E THEN 600	expression "equals" expression
≠	180 IF D6 = (2 * D) THEN 710	expression "does not equal" expression
≠	180 IF D6 < (2 * D) THEN 700	expression "does not equal" expression
>	190 IF X > 10 THEN 620	expression "is greater than" expression
<	200 IF R6 < P7 THEN 640	expression "is less than" expression
>=	210 IF R6 >= P7 THEN 710	expression "is greater than or equal to" expression
<=	220 IF X2 <= 10 THEN 650	expression "is less than or equal to" expression
AND	230 IF G2 AND H5 THEN 900	expression 1 AND expression 2 must both be "true" for statement to be "true"
OR	240 IF G2 OR H5 THEN 910	If either expression 1 OR expression 2 is "true," statement is "true"
NOT	250 IF NOT G5 THEN 950	Expression is "true" when expression (G5) is "false"
MAX	260 LET B = A2 MAX C3	Evaluates for the larger of the two expressions.
MIN	270 LET B1 = A7 MIN A9	Evaluates for the smaller of the two expressions.

STATEMENTS

Name	Example	Purpose
CHAIN	300 CHAIN PROG	GETs and RUNs the program specified. The current program is destroyed, except for COMMON variables.
COMMON	360 COM A,B1,C(20),CS(72)	Declares variables to be in COMMON; they can then be accessed by other programs. Must be lowest numbered statement.
DATA	370 DATA 99, 10 7, "HI"	Specifies data; read from left to right.
DIM	380 DIM A(72)	Specifies maximum string or matrix size.

END	390 END	Terminates the program; the last statement in a program must be an END statement.
FOR	NEXT 440 FOR J = 1 TO N STEP 3	Executes statements between FOR and NEXT the specified number of times (a loop), incrementing the variable by a STEP number (or by 1 if STEP is not given).
GO TO	450 GO TO 900	Transfers control (jumps) to specified statement number.
GO TO	OF 460 GO TO n OF 100,10,20	Transfers control to the nth statement of the statements listed after "OF".
GOSUB	470 GOSUB 800	Begins executing the subroutine at specified statement (see RETURN).
IF	THEN 490 IF A#10 THEN 350	Logical test; transfers control to statement number if "true."
IMAGE	500 IMAGE 6D,AA,SD,5DE	Used to specify the format of a PRINT USING statement.
INPUT	510 INPUT X\$,Y2,B4	Allows data to be entered from terminal while a program is running.
LET	520 LET A = B = C = 0	Assigns variable a value; LET is optional.
NEXT	530 NEXT J	Marks the end of the FOR loop.
PRINT	540 PRINT A,B,CS	Prints the specified values; 5 fields per line when commas are used as separators, 12 when semicolons are used.
	550 PRINT	Causes the terminal to advance one line.
	560 PRINT #3:A	See "Files" section.
	570 PRINT A, TAB(15);B	Insertion of TAB, LIN and SPA (See "FUNCTIONS" section) causes the corresponding carriage control to take effect in the output list.
	580 PRINT USING "3A";A\$	Prints the specified data according to the specified format. The format can be a string, a string variable or the statement number of an IMAGE statement containing the format string (200). The format is optionally followed by a semicolon and an expression list (A,B4).
	590 PRINT USING A\$;A,B4	
	600 PRINT USING 200; N,A\$	
READ	610 READ A,B,C	Reads information from DATA statement.
	620 READ#3:A	See "Files" section.
REM	630 REM ANY TEXT***	Inserts non-executable remarks in a program.
RETURN	660 RETURN	Subroutine exit; transfers control to the statement following the matching GOSUB.
STOP	670 STOP	Terminates the program; may be used anywhere in program.

FUNCTIONS

Functions return a numeric result; they may be used as expressions or parts of expressions. PRINT is used for examples only; other statement types may be used.

Full Name	Example	Purpose
DEF FN	300 DEF FNA (X) = (M * X) + B	Allows the programmer to define functions; the function label (A) must be a letter from A to Z; the argument (X) is a dummy variable.
ABS (X)	310 PRINT ABS (X)	Gives the absolute value of the expression (X).
EXP (X)	320 PRINT EXP (X)	Gives the constant e raised to the power of the expression value (X); in this example, e ¹ X.
INT (X)	330 PRINT INT (X)	Gives the largest integer ≤ the expression (X).
LOG (X)	340 PRINT LOG (X)	Gives the natural logarithm of an expression; expression must have a positive value.
RND (X)	350 PRINT RND (X)	Generates a random number greater than or equal to 0 and less than 1; the argument (X) may have any value.
SQR (X)	360 PRINT SQR (X)	Gives the square root of the expression (X); expression must have a positive value.
SIN (X)	370 PRINT SIN (X)	Gives the sine of the expression (X); X is real and in radians.
COS (X)	380 PRINT COS (X)	Gives the cosine of the expression (X); X is real and in radians.
TAN (X)	390 PRINT TAN (X)	Gives the tangent of the expression (X); X is real and in radians.
ATN (X)	400 PRINT ATN (X)	Gives the arctangent of the expression (X); X is real and the result is in radians.
LEN (X)	410 PRINT LEN (A\$)	Gives the current length of a string (A\$), i.e., number of characters.
SGN (X)	420 PRINT SGN (X)	Gives: 1 if X > 0, 0 if X = 0, -1 if X < 0.
TAB (X)	430 PRINT TAB (X);A	Tabs to the specified position (X), then prints specified value (A).

SPECIAL CHARACTERS

NOTE: Superscript "C" indicates a control character (Press ctrl and character simultaneously.)

Key	Function
↵	Terminates program.
⌫	Deletes a line being typed.
⏎	Causes the terminal to advance one line.
↶	1. Must follow every command, statement or data entry. 2. Causes the terminal typeface to return to the first print position.
⏪	Backspace. Deletes as many preceding characters as ←'s are typed in.

STRINGS

NOTES

1. A string is 1 to 72 characters enclosed in quotes; it may be assigned to a string variable (an A to Z letter followed by a S).
2. Each string variable used in a program must be dimensioned (with a DIM or COM statement) if it has a length of more than one character. The DIM sets the physical or maximum length of a string.
3. Substrings are described by subscripted string variables. For example, if AS = "ABCDEF", AS(2,2) = B, AS(1,4) = "ABCD", and AS(3) = "CDEF".

Full Name	Example (Abbreviation)	Purpose
DIM	10 DIM AS (27)	Declares maximum string length in characters.
LET	20 LET AS = "TEXT 1"	Assigns the character string in quotes to a string variable. LET is optional.
LEN	30 PRINT LEN (BS)	Gives the current length of the specified string.
<	105 IF AS < CS THEN 600	String operators. They allow comparison of strings, and substrings, and transfer to a specified statement if the comparison is true. Comparison is made in ASCII codes, character by character, left to right until a difference is found. If the strings are of unequal length, the shorter string is considered smaller if it is identical to the initial substring of the longer.
#	110 IF BS#XS THEN 650	
>	115 IF NS(2,2) > BS(3,3) THEN 10	
<	120 IF NS < BS THEN 999	
>=	125 IF PS(5,8) >= YS(4,7) THEN 10	
<=	130 IF XS <= ZS THEN 999	
INPUT	205 INPUT NS	Accepts as many characters as the string can hold (followed by a return). The characters need not be in quotation marks if only one string is input.
INPUT	210 INPUT NS, XS, YS	Inputs the specified strings; input must be in quotes and separated by commas.
READ	215 READ PS	Reads a string from a DATA statement; each string read must be enclosed in quotes.
READ=	220 READ=5,AS,BS	Reads strings from the specified file.
PRINT=	310 PRINT=2,AS,CS	Prints strings on a file.

MATRICES

Name	Sample Statement	Purpose
DIM	10 DIM A (10,20)	Allocates space for a matrix of the specified dimensions.
MAT IDN	15 MAT X=IDN(m,n)	Establishes an identity matrix (with all ones down the diagonal). A new working size (m,n) may be specified.
MAT ZER	20 MAT B=ZER	Sets all elements of the specified matrix equal to 0.
	25 MAT D=ZER(m,n)	A new working size (m,n) may be specified after ZER.
MAT CON	30 MAT C=CON	Sets all elements of the specified matrix equal to 1.
	35 MAT E=CON(m,n)	A new working size (m,n) may be specified after CON.
INPUT	40 INPUT A(5,5)	Allows input from the terminal of a specified matrix element.
	45 MAT INPUT A(4,7)	Allows input of a matrix from the terminal; a new working size may be specified.
MAT PRINT	50 MAT PRINT A	Prints the specified matrix on the terminal.
	55 PRINT A(X,Y)	Prints the specified element of a matrix on the terminal; element specifications X and Y can be any expression.
	60 PRINT =2,A(1,5)	Prints matrix element on the specified file number.
	65 MAT PRINT =2,3,A	Prints matrix on a specified file and record.
	70 MAT PRINT USING AS, N, M	Prints the matrix data according to the specified format. The format string (AS) is the same as PRINT USING except it must not contain any string specifications. The matrices (N,M) are printed in row by row order.
MAT READ	80 MAT READ A	Reads matrix from DATA statements.
	85 MAT READ A(5,5)	Reads matrix of specified size from DATA statements.
	90 READ A(X,Y)	Reads the specified matrix element from a DATA statement.
	95 MAT READ =3,A(I,J)	Reads matrix from the specified file.
	100 MAT READ =3,5,A	Reads matrix from the specified record of a file.
MAT+	110 MAT C=A+B	Matrix addition; A and B must be the same size.
MAT-	120 MAT C=A-B	Matrix subtraction; A, B, and C must be the same size.
MAT*	130 MAT C=A*B	Matrix multiplication; No. columns in A must equal No. rows in B.
MAT=	140 MAT A=B	Establishes equality of two matrices; assigns values of B to A.
MAT TRN	150 MAT B=TRN (A)	Transposes an m by n matrix to an n by m matrix; matrix cannot be transposed into itself.
MAT INV	160 MAT C=INV (B)	Inverts a square matrix into a square matrix of the same size; matrix may be inverted into itself.

FILES

Full Name	Example (Abbreviation)	Purpose
OPEN	OPE MYFILE,80	Opens a file with a specified name and number of records.
	OPE MYFILE,80,20	Opens a file with a specified name and number of records of a specified size.
KILL-FILES	KIL MYFILE 10 FILES BUG, GANG	Deletes specified file. Declares which files will be used in a program. Up to 4 FILES statements with a total of 16 files per program. Files must have been previously OPENed.
PRINT#	50 PRINT #N,A,B	Prints the specified values (A,B) on a specified file (N) at the current position. Files are numbered from 1 as they appear in the FILES statements.
	60 PRINT=X,Y,A,B,CS	Prints the specified values on a specified record (Y) of a file (X).
	70 PRINT =3,5	Erases the specified record of a file.
	80 PRINT =3,N,A,B,END	Places an end-of-file marker in the specified record of the specified file.
	90 PRINT=X0,END	Places an end-of-file marker on a specified file (X0) at the current position.
READ#	100 READ=1,A,B2	Reads the next values of a specified file into the specified variables.
READ#	110 READ=2,3,A,B	Reads values from the beginning of a specified record of a file into specified variables.
	120 READ=3,5	Resets the pointer for a file to a specified record.
IF END#	140 IF END=N THEN 800	Transfers control to a specified statement if an end-of-file occurs on a specified file.



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:

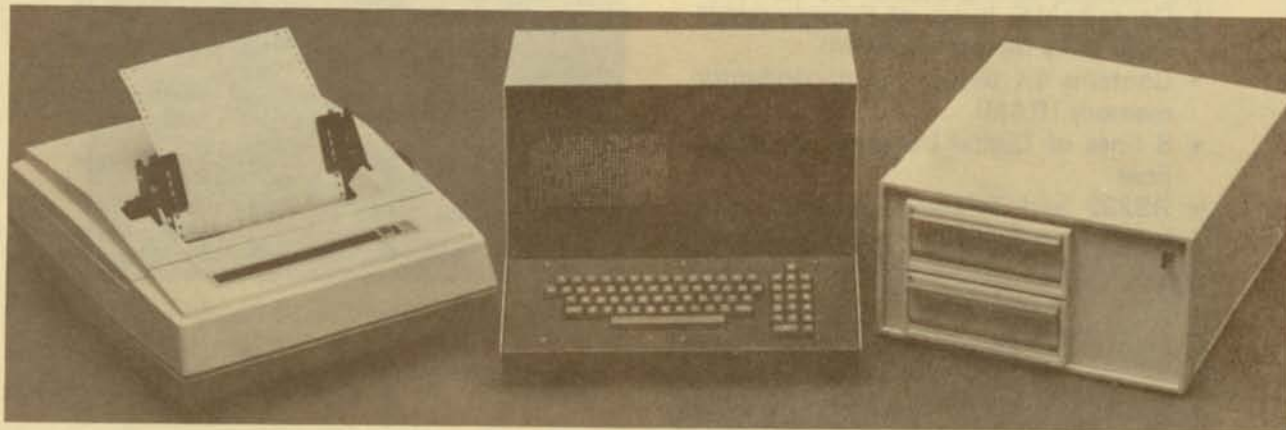
KIT BUILDER: **SPHERE SYSTEM 310:** you are the one who wants to put a computer together to learn all about it and save some money, too.

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)

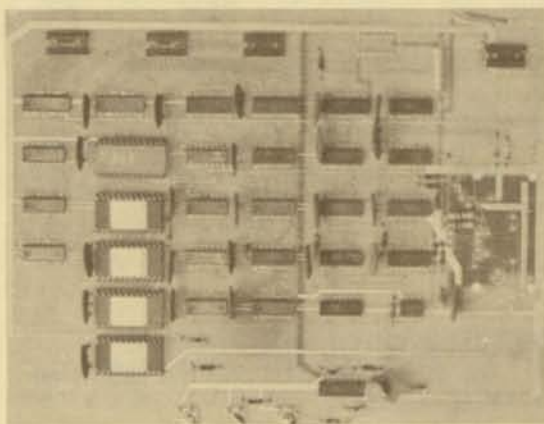
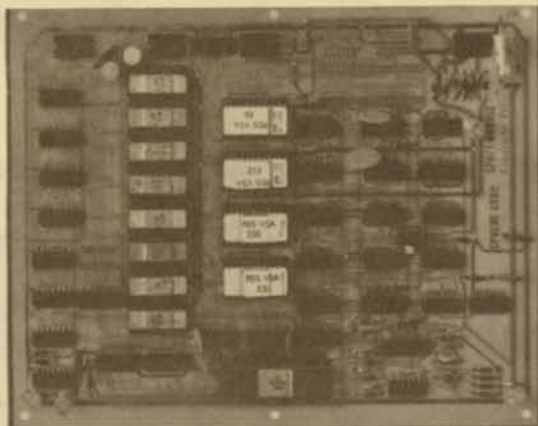
- All of System 310 plus the following:
- PIM Module
- LINE PRINTER 80 column — 110 characters per second
- DUAL FLOPPY DISC MEMORY (256,256 bytes Memory on each disc)
- Disc Operating System
- Basic Language
- 16K Memory (Total 20K Memory)

*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.



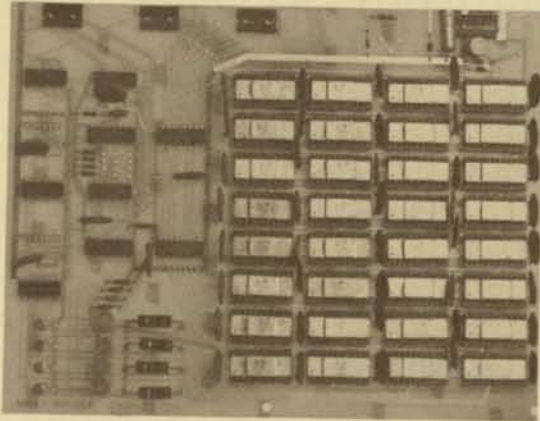
Cathode Ray Tube Module (Video Interface) (CRT)

- 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.



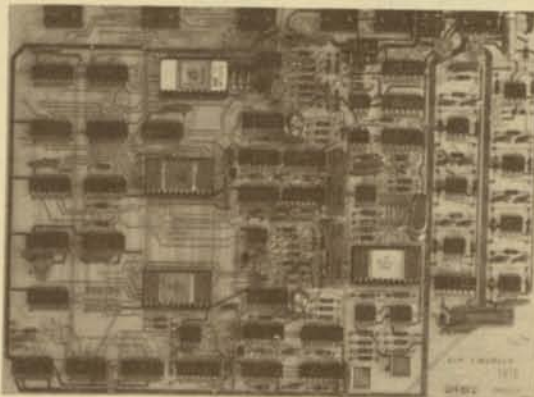
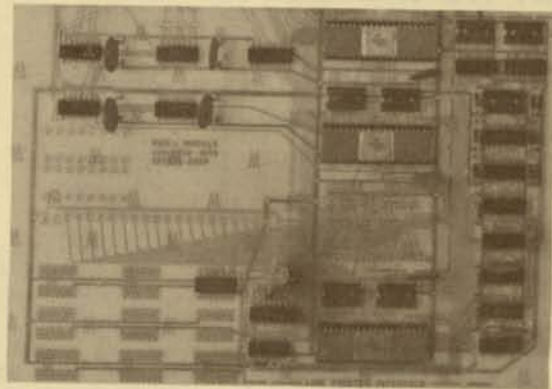


MEMORY (MEM)

- 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
80 — KBD2/A	\$220.00	KBD2/A	\$140.00

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

	ASSEMBLED	KIT
122 — 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. — Mont-
gomery County, Maryland

Computer Mart Corporated — Boston, *Waltham*
Massachusetts

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

Comunicaciones 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.

J. Ribble
51 Davenport St.
Cambridge, Mass. 02140

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UTAH 84010

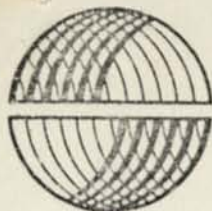
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North Salt Lake, Utah 84054

SPHERE
CORPORATION



**Special to
April 20, 1976
A Sphere System 320
at Old System 2 Price.**

SAVE — SAVE — SAVE
\$999⁰⁰



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 supplement 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 hexadecimal), 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.

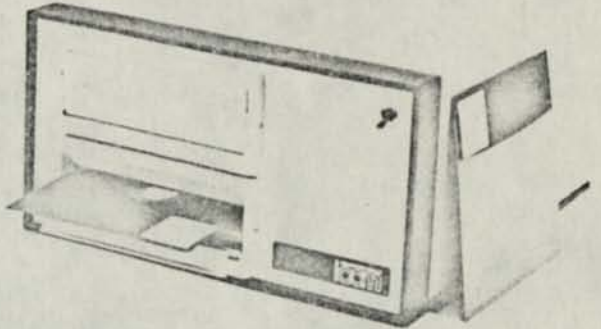
KEYBOARD (KBD1) Up to eight keyboards may be connected to the central processor bus. Each keyboard has 73 keys which include all special characters, upper case alphabet, all control functions (via the control key), a numeric key pad and cursor control pad. The keyboard encoding scheme includes two key 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 asynchronous 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 transmission completed.

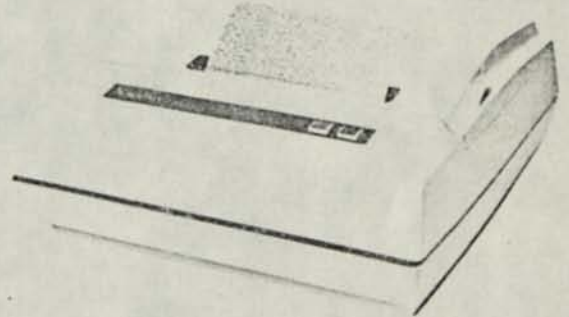
POWER SUPPLY (PWR1, PWR2) These power supplies are fully regulated with foldback current limiting and overvoltage protection. PWR2 is a high reliability supply.

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 8½ 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 photoelectrically 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 retrieval. 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 transferring. 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 equipment 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	***PRICES***			
		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/ASM ¹	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*****					
04K1/KIT	4K Memory Board	242	232	CPU1	31
04K1/ASM	Assembled 4K Memory	312	300	CPU1	31
08K1/KIT	8K Memory Board	415	400	CPU1	48
08K1/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 04K or 08K modules	180	170	04K 08K	18
*****COMMUNICATIONS*****					
COM1/KIT	Asynchronous (EIA, TTL, TTY) I/O	91	72	CPU1	12
COM1/ASM	Assembled COM1/KIT	151	112	CPU1	12
COM1/ASM ¹	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	2964	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	1/2 PIM1	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	1/2 PIM1	1
LCB1/ASM	Cable Assembly for line printer	99	75	1/2 PIM1	1
PCB1/ASM	Power Cable (from power to 4 boards)	20	15		
BCB1/ASM	Buss Cable (3 required)	15	10		N/A
TCB1/ASM	Cable Assembly for Read/Punch	60	55	1/2 PIM1	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

PRELIMINARY
 Specifications and Prices
 Subject to Change
 Without Notice

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), <i>CRT1, PCB1</i> , OPR1/MAN, and membership in SWAP.	860	550	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 maintenance 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 maintenance cost (Plan 1 is 65% of amount).

SPHERE CORP.

ORDER FORM

SOLD TO: _____

DATE: _____

ZIP _____

CUSTOMER PHONE NO. _____

SHIPPING INSTRUCTIONS:

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 calendar day on invoice amount. (18 1/4% per year max.)

TOTAL
 UTAH RESIDENTS
 ADD 4 1/2% SALES TAX
 SHIPPING
 TOTAL
 AMOUNT ENCLOSED
 OR TO BE CHARGED
 TO MY CREDIT CARD.

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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.

BANK CARD INFORMATION

Sign your name as it is on your credit card _____
 Credit Card _____
 Number _____

Interbank _____
 Number _____

BankAmericard _____
 Master Charge _____
 Expiration _____
 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)

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 desirable 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.

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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 "POPped" 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 programmed 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.

SPHERE SYSTEMS

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 is 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 shaped 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 maximum 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) BCBI

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) PCBI

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 interchanges 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 degradation 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 emphasis on acoustically coupled lines rather than Direct Access Arrangements (DAA's). The SH, RING, +V DH, DA, DR, and 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.

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 desirable 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.

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SPHERE SYSTEMS

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- 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 shaped 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 maximum of seven additional KBD1 modules may be added later.
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4) PWRI

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 400mA, and -12 volts at 400mA. 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) BCBI

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) PCBI

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 interchange 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 (\$999)

This system was specifically designed to solve the needs of two 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 audio cassette.

The communications facility is implemented as a single module (PC board) which contains a standard asynchronous communications interface and a modem. Serial communications to other devices such as a teletype or other computer may take place without the use of a modem; therefore, the modem portion of the board is listed as a separate module (CAS1).

This system includes all of the features found in SYS1/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 degradation is acceptable. X-on and X-off functions are provided by an on board relay. No cables are supplied.
- 2) CAS1 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 emphasis on acoustically coupled lines rather than Direct Access Arrangements (DAA's). The SH, RING, +V, DH, DA, DR, and 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. Provisions for use of this module with an audio cassette are readily available. The cassette's AUX or MIC jack may be used as computer output, and the AUX SPKR jack may be used as computer input. No cabling is provided with this unit.

.... A SPECIAL INVITATION

Please be advised of the SPHERE DEMONSTRATION SEMINARS to be held at the following times and HOLIDAY INN locations.

Date	City	Address	Time
10/25	Chicago	# 1 Mid-City Plaza	7-10 P.M.
10/28	Toronto, Ont.	Queen Elizabeth Bldg Exhibition Pl.	All Show Hrs.
10/29	Toronto, Ont.	Queen Elizabeth Bldg Exhibition Pl.	All Show Hrs.
10/30	Toronto, Ont.	Queen Elizabeth Bldg Exhibition Pl.	All Show Hrs.
10/31	Boston,	# 5 Blossom Street	7-10 P.M.
11/1	New York	440 West 57 th Street	3-6 P.M.
11/3	Washington, D.C.	1501 Rhode Island Ave. N.W.	7-10 P.M.
11/5	Columbus, O.	328 W. Lane Ave.	7-10 P.M.
11/6	Indianapolis	500 W. Washington Downs	7-10 P.M.

Your attendance will be most cordially appreciated!



SPHERE

corporation

791 South 500 West Bountiful, Utah 84010 (801) 292-8466

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**Announcing!! The world's most advanced,
low cost, computer system available today!!**

The MICRO-SPHERE 200



OUR INTRODUCTORY OFFER:

\$680.00 UNTIL JANUARY 20, 1976

IF CASH ACCOMPANIES YOUR ORDER

SPECIAL FEATURES:

- Completely Assembled and Tested (Ready to use; not a kit.)
- 4k RAM (EXPANDABLE TO 8k)
- CASSETTE LOADER
- Sphere Cassette Operating System (SCOS)
supports file handling and Advanced Program
Development, System, an aid for developing your
programs.
- 16 Line by 21 Character Alpha Numeric Character
Generator (128 by 128 B & W Dot Matrix Graphic System)
- Monte Carlo Games Package
- Operators Manual
- Attractive Mar-Resistant Plastic Case

— MICROPROCESSOR INSTRUCTION SET —

ABA	Add Accumulators	CLR	Clear	PUL	Pull Data
ADC	Add with Carry	CLV	Clear Overflow	ROL	Rotate Left
ADD	Add	CMP	Compare	ROR	Rotate Right
AND	Logical And	COM	Complement	RTI	Return from Interrupt
ASL	Arithmetic Shift Left	CPX	Compare Index Register	RTS	Return from Subroutine
ASR	Arithmetic Shift Right	DAA	Decimal Adjust	SBA	Subtract Accumulators
BCC	Branch if Carry Clear	DEC	Decrement	SBC	Subtract with Carry
BCS	Branch if Carry Set	DES	Decrement Stack Pointer	SEC	Set Carry
BEQ	Branch if Equal to Zero	DEX	Decrement Index Register	SEI	Set Interrupt Mask
BGE	Branch if Greater or Equal Zero	EOR	Exclusive OR	SEV	Set Overflow
BGT	Branch if Greater than Zero	INC	Increment	STA	Store Accumulator
BHI	Branch if Higher	INS	Increment Stack Pointer	STS	Store Stack Register
BIT	Bit Test	INX	Increment Index Register	STX	Store Index Register
BLE	Branch if Less or Equal	JMP	Jump	SUB	Subtract
BLS	Branch if Lower or Same	JSR	Jump to Subroutine	SWI	Software Interrupt
BLT	Branch if Less than Zero	LDA	Load Accumulator	TAB	Transfer Accumulators
BMI	Branch if Minus	LDS	Load Stack Pointer	TAP	Transfer Accumulators to Condition Code Reg.
BNE	Branch if Not Equal to Zero	LDS	Load Stack Pointer	TBA	Transfer Accumulators
BPL	Branch if Plus	LDX	Load Index Register	TPA	Transfer Condition Code Reg. to Accumulator
BRA	Branch Always	LSR	Logical Shift Right	TST	Test
BSR	Branch to Subroutine	NEG	Negate	TSX	Transfer Stack Pointer to Index Register
BVC	Branch if Overflow Clear	NOP	No Operation	TXS	Transfer Index Register to Stack Pointer
BVS	Branch if Overflow Set	ORA	Inclusive OR Accumulator	WAI	Wait for Interrupt
CBA	Compare Accumulators	PSH	Push Data		
CLC	Clear Carry				
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MPU INSTRUCTION SET

The MC6800 has a set of 72 different instructions. Included are binary and decimal arithmetic, logical, shift, rotate, load, store, conditional or unconditional branch, interrupt and stack manipulation instructions.

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Accumulator (ACCX) Addressing

Immediate Addressing

Direct Addressing

Extended Addressing

Indexed Addressing

Implied Addressing

Relative Addressing

The Micro-Sphere 200 Series computer is the most **ADVANCED**, low-cost computer SYSTEM available today. Together with a TV and up to three cassette recorders you can have big computer performance at a rock bottom price.

The system features a 6800 type micro-computer with 4000 characters (4K Bytes) of internal Random Access Memory (RAM) Storage. The memory is easily expandable to 8000 total characters with the addition of an optional second 4K of RAM, with even more memory to be made available shortly. The 4K bytes of memory is equivalent to 6-8 pages of close typewritten material.

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The keyboard uses highly reliable keyswitches to insure user satisfaction. It is full alpha-numeric including an integrated numeric key pad. The cassette interface uses the "Kansas City" standard which means that you can use even the least expensive cassette recorders with your system satisfactorily though we suggest that you do use high quality tapes with your system.

You may use your own TV without modification as the system display device, or you may purchase one from Sphere.

The power requirement is a single 110 volt AC outlet. The unit uses less power than an ordinary 100 watt light bulb. All fuses, jacks, switches, and interface signals are provided on an easy-access panel at the rear of the cabinet.

The Micro-Sphere is supplied with a built-in loading program from cassette, which is in one of the several standard or optional Read Only Memory (ROM) Integrated Circuits (IC). ROM IC's are pre-programmed with specific non-eraseable information. This feature greatly reduces program loading time and inconvenience, ROM's also save valuable RAM storage. RAM's lose all stored memory whenever the computer power is turned off, while ROMs retain all programs indefinitely.

The Micro-Sphere is unique in that 16,384 different dots on your TV screen can form any number of pictures or designs which you have instructed your computer to display. These images can be changed by the computer program at a rate that appears as real-life movement, such as aircraft flight simulation, "walk-through" inspection of architectural mock-ups, time-lapse stock market graphic analysis, or even computer generated art forms, or space flight simulation where you can guide your spacecraft to the moon, planets or the universe.

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The mouse may also be used in the place of a joy stick for flight simulation or to enter hand movements for ping-pong or other games of skill.

The Sphere Cassette Operating System (SCOS) is supplied on tape and provides Assembler, Edit, and Debugging functions to the computer when read in to RAM from the Cassette. Sub-routines for floating point and trig functions are included in the SCOS cassette and may also be purchased as an option in ROM. Sub-routines are included in SCOS which provide all necessary alpha-numeric character generation for your TV using approximately 400 bytes of RAM. An optional character generator ROM can be purchased to reduce RAM usage to 50 bytes. SCOS also supports file handling.

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Sphere Corp. has included in the basic price of the Micro-Sphere 200 the Monte Carlo games package on cassette, which allows you to play blackjack, roulette, and other games just for fun.

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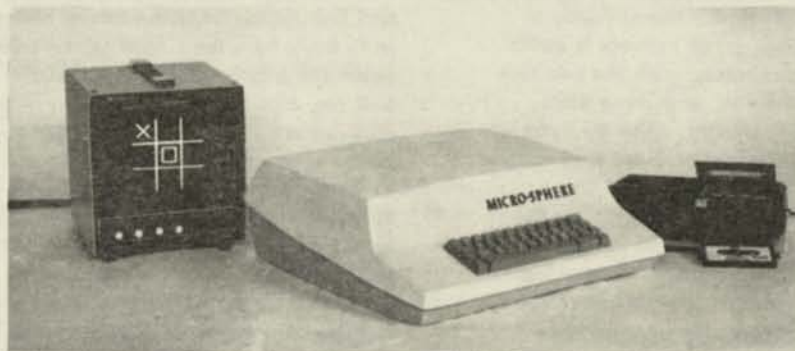
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**Announcing!! The world's most advanced,
low cost, computer system available today!!**

The MICRO-SPHERE 200



OUR INTRODUCTORY OFFER:

\$680.00 UNTIL JANUARY 20, 1976

IF CASH ACCOMPANIES YOUR ORDER

SPECIAL FEATURES:

- Completely Assembled and Tested (Ready to use; not a kit.)
- 4k RAM (EXPANDABLE TO 8k)
- CASSETTE LOADER
- Sphere Cassette Operating System (SCOS) supports file handling and Advanced Program Development, System, an aid for developing your programs.
- 16 Line by 21 Character Alpha Numeric Character Generator (128 by 128 B & W Dot Matrix Graphic System)
- Monte Carlo Games Package
- Operators Manual
- Attractive Mar-Resistant Plastic Case

— MICROPROCESSOR INSTRUCTION SET —

ABA	Add Accumulators	CLR	Clear	PUL	Pull Data
ADC	Add with Carry	CLV	Clear Overflow	RDL	Rotate Left
ADD	Add	CMP	Compare	ROR	Rotate Right
AND	Logical And	COM	Complement	RTI	Return from Interrupt
ASL	Arithmetic Shift Left	CPX	Compare Index Register	RTS	Return from Subroutine
ASR	Arithmetic Shift Right	DAA	Decimal Adjust	SBA	Subtract Accumulators
BCC	Branch if Carry Clear	DEC	Decrement	SBC	Subtract with Carry
BCS	Branch if Carry Set	DES	Decrement Stack Pointer	SEC	Set Carry
BEQ	Branch if Equal to Zero	DEX	Decrement Index Register	SEI	Set Interrupt Mask
BGE	Branch if Greater or Equal Zero	EOR	Exclusive OR	SEV	Set Overflow
BGT	Branch if Greater than Zero	INC	Increment	STA	Store Accumulator
BHI	Branch if Higher	INS	Increment Stack Pointer	STS	Store Stack Register
BIT	Bit Test	INX	Increment Index Register	STX	Store Index Register
BLE	Branch if Less or Equal	JMP	Jump	SUB	Subtract
BLS	Branch if Lower or Same	JSR	Jump to Subroutine	SWI	Software Interrupt
BLT	Branch if Less than Zero	LDA	Load Accumulator	TAB	Transfer Accumulators
BMI	Branch if Minus	LDS	Load Stack Pointer	TAP	Transfer Accumulators to Condition Code Reg.
BNE	Branch if Not Equal to Zero	LDS	Load Stack Pointer	TBA	Transfer Accumulators
BPL	Branch if Plus	LDX	Load Index Register	TPA	Transfer Condition Code Reg. to Accumulator
BRA	Branch Always	LSR	Logical Shift Right	TST	Test
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SPECIAL INTRODUCTORY PRICES FOR MICRO-SPHERE 200 WITH OPTIONS

No.	Description	Price/Each	Total
200	MICRO-SPHERE 200 - SYSTEM PRICE INCLUDES "A" ITEMS BELOW	\$ 860.00	\$ 860.00
"A" ITEMS	6800 type Micro-Processor unit 4K of Memory (RAM) Cassette Loading System (ROM) Sphere Cassette Operating System (SCOS) Cassette 1 time license fee@ \$137.50 Includes Floating Point and Trig Package Cassette copy @ 12.50 Monte Carlo Games Package (Cassette) First Cassette Interface 128 by 128 B&W Dot Matrix Graphics Display Alpha-Numeric Keyboard Attractive Mar-Resistant Plastic Case Operators Manual	\$150.00 \$10.00	Incl. Incl.
OPTIONS AVAILABLE THROUGH FACTORY INSTALLATION. * To install options after purchase is \$35.00 per shipment to our plant.			
"B" ITEMS	Second 4K of memory (RAM) Character Generator (ROM)	\$180.00 \$25.00	\$180.00 \$25.00
"C" ITEMS	Second Cassette Interface Extended Business Basic (ROM) Includes Business Basic Manual Floating point & Trig package (ROM)	\$50.00 \$400.00	\$50.00 \$400.00
	Third Cassette Interface	\$50.00	\$50.00
OPTIONS FOR PURCHASE NOT NEEDING FACTORY INSTALLATION.			
	Extended Business Basic on Cassette (Requires 2nd 4K of RAM and Character Generator in ROM.) Includes Business Basic Manual, Floating Point & Trig Package	\$100.00	\$100.00
	9" TV for use with Micro-Sphere 200	\$150.00	\$150.00
	"Mouse" Graphics Input Device (Available in May 1976)	2 ea. \$150.00	\$150.00
	Operators Manual (SCOS)	\$10.00	\$10.00
	Business Basic Manual	\$10.00	\$10.00
	Maintenance Manual	\$40.00	\$40.00
	Empty Cassette Tapes	3 for \$10.00	\$10.00
200A	INCLUDES MICRO-SPHERE 200 PLUS ALL OF "A" ITEMS ABOVE REGULAR \$860.00 - SPECIAL INTRODUCTORY CASH PRICE 'TIL JAN. 20, 1976	\$680.00	\$680.00
200B	INCLUDES MICRO-SPHERE 200 PLUS ALL OF "A" & "B" ITEMS ABOVE REGULAR \$1215.00 - SPECIAL INTRODUCTORY CASH PRICE 'TIL JAN. 20, 1976 and we include EXTENDED BASIC on Cassette at NO EXTRA CHARGE !	\$985.00	\$985.00
200C	INCLUDES MICRO-SPHERE 200 PLUS ALL OF "A" & "B" & "C" ITEMS ABOVE REGULAR \$1645.00 - SPECIAL INTRODUCTORY CASH PRICE 'TIL JAN. 20, 1976 EVERYTHING IS IN ROM !!	\$1415.00	\$1415.00

ALL UNITS ARE COMPLETELY ASSEMBLED AND READY TO USE!!

SPECIAL INTRODUCTORY ORDER FORM

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A. Item Purchase Total	
B. Utah Residents add 4.75% tax	
C. Postage, handling, shipping and insurance add 2% of A	
D. Full Warranty = 10% of A.	
E. Order Total	
F. Down Payment = 25% of E.	
G. COD Balance	

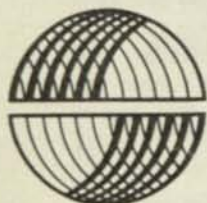
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SPHERE generally offers 60-90 day delivery on its products, however, parts availability may delay delivery beyond that time.
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Sphere announces a computer that the first-time computer user can really use!

Sphere feels that you may have been misled. You have been told how useful computers are. But in many cases they merely have blinking lights and flip switches. To get any real computer power you really need, a keyboard, cassette, I/O, Terminal and more memory, and of course, that means BIG Dollars.

Sphere builds useful systems that do not require extra add-ons. Here is a remarkable new product that Sphere is introducing to you. We are making a special offer to people on our mailing list. When our ads hit in February, the price will be \$860.00. If you order your MICO-SPHERE 200 before January 20, 1976, we will offer this unique computer system to you for \$680.00 CASH WITH ORDER. Look at the product-feature — and the savings available now, and no other product will compare.

It is not a kit. It is completely assembled, tested, and ready to use. Plug it in and test your skills. We bet the Micro-Sphere can win. Please refer to complete and exciting details inside.