



NORTH STAR ★ COMPUTERS
PRODUCT CATALOG

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NORTH STAR ★ COMPUTERS

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INTRODUCTION

North Star Computers is located in Berkeley, California and was incorporated in June, 1976. The company offers the HORIZON[™] computer and other high performance microcomputer products, both hardware and software, at low cost. The initial company products were the hardware floating point board (North Star FPB) and the complete floppy disk subsystem (North Star MICRO-DISK SYSTEM) for S-100 computers*. Both of these products include a version of extended BASIC, developed by North Star in 1976. The fine North Star reputation is based on the quality, performance, and reliability of both the hardware and software delivered to date.

In addition to the products noted above, North Star now offers a complete S-100 bus computer, called HORIZON, an S-100 memory board (RAM-16-A), and a Z80A processor board (ZPB-A). North Star BASIC is an integral part of the HORIZON computer and, in fact, the entire MICRO-DISK SYSTEM is contained in the HORIZON computer. Due to the wide usage of our MICRO-DISK SYSTEM and North Star BASIC, the application software available for the HORIZON is now extensive.

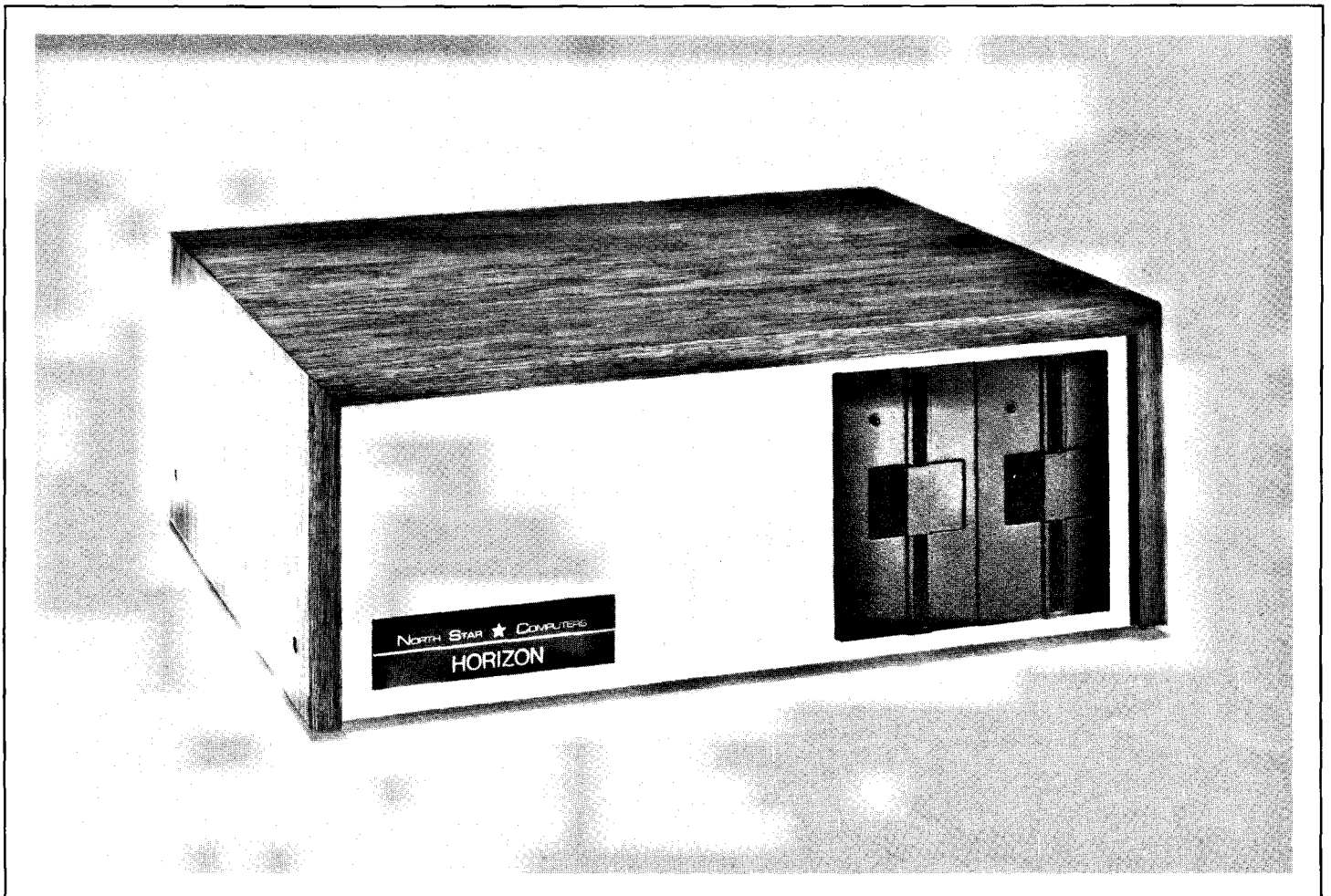
All North Star products include a limited 90 day warranty, described in detail in the documentation provided with each product. North Star products are sold throughout the United States and in many foreign countries as well. Products may be ordered directly from North Star if a convenient local dealer cannot be found.

North Star intends to maintain its reputation for delivering top quality microcomputer products by continuing to use only the best components available. Only factory-prime integrated circuits and sockets are used. Printed circuit boards are made from the finest materials and have solder mask on both sides. North Star disk drives are manufactured by the floppy disk industry leader: Shugart Associates.

The following pages give expanded descriptions of currently available North Star products. For more information about a particular product, a documentation packet may be purchased. Documentation packets include all hardware and software documentation normally distributed with the product. Please consult the price list on page 12 in this brochure.

*S-100 bus computers are those microcomputers whose circuit boards attach to the backplane or "motherboard" with 100 connector pins and conform to standards followed by MITS, IMSAI, Processor Technology and other S-100 bus computer manufacturers. The wide availability of S-100 bus compatible products allows users many options when configuring 8080 or Z80 computer systems.

COMPLETE **HORIZON** COMPUTER
WITH 16K RAM BOARD,
ONE MINIFLOPPY DISK DRIVE,
4MHz Z80A PROCESSOR,
SERIAL I/O PORT, AND
EXTENDED BASIC: \$1599



The **HORIZON** Computer is a complete, high-performance microcomputer system with integrated floppy disk memory. To begin programming in North Star extended disk BASIC, merely plug in a CRT or hard-copy terminal. Operating a HORIZON is simple: there is only an on/off switch and a restart button. The North Star software is loaded from diskette within seconds after power-on.

KIT OR ASSEMBLED

If your application requires an attractively packaged, disk-based computer system with high performance and low cost, then the HORIZON is for you — whether you purchase it assembled and tested or choose to follow our precise assembly instructions and build it from a kit. Assembly from a kit entails mechanical assembly of the chassis and power supply, and soldering of components to printed circuit boards. No disk-drive assembly is required. Use of a volt meter is required, and an oscilloscope is recommended.

WHAT ABOUT PERFORMANCE?

The North Star Z80A processor board operates at 4MHz — twice the speed of an 8080. Our 16K RAM memory board lets the Z80A execute at full speed (no wait states). The disk controller board can control up to three drives, and is the same board that has been delivered with our popular MICRO-DISK SYSTEM. Expanded descriptions of these North Star boards follow.

The Shugart minifloppy disk drives set the standard for floppy disk performance and reliability. HORIZON can load a 10K byte program in less than 2 seconds, and each diskette can store 90K bytes.

AND SOFTWARE, TOO

HORIZON includes North Star extended disk BASIC and Disk Operating System (DOS) on diskette. Our BASIC, now in widespread use, has everything you always wanted in a BASIC and more, including: strings, formatted output, disk files and a powerful line editor. Full descriptions of North Star BASIC and DOS appear on pages 4 and 5. The HORIZON software diskette also includes a comprehensive monitor and memory test for hardware and software maintenance.

The amount of application software now written to operate with North Star BASIC and DOS is extensive. Many independent companies, as well as the two North Star user groups, offer a wide range of application programs. Editor-assembler development systems, documentation preparation systems, business applications (payroll, mailing list, inventory, accounting and order entry), and games are available. See the North Star Newsletters for details.

S-100 COMPATIBLE

HORIZON is an S-100 bus computer. The HORIZON motherboard has slots for up to twelve S-100 circuit boards. Three of these slots are used in a standard HORIZON for the Z80A processor board, the 16K RAM board, and the disk controller

board. The serial I/O port and disk drive power regulation circuitry are included on the motherboard. A real-time clock is also included on the motherboard. Additional inexpensive serial and parallel input/output interfaces may be added to the motherboard for printer, second terminal, or modem requirements. The HORIZON power supply is more than adequate to power a full complement of twelve S-100 boards, with a minimum of 15 amps at 8 volts and 6 amps at ± 16 volts. Although conservatively rated, the HORIZON power supply is one of the most powerful ever offered with a microcomputer system. A universal power supply option is available for other than U.S. standard service.

EXPAND YOUR HORIZON

HORIZON is designed for use in a wide range of application environments. HORIZON can be expanded and upgraded in many ways, with products from North Star as well as other S-100 product manufacturers. HORIZON options available from North Star include:

- additional 16K RAM boards
- parity option for each HORIZON 16K RAM board
- second and third minifloppy disk drives
- hardware floating point arithmetic board
- additional serial I/O port (on motherboard)
- parallel I/O port (on motherboard)
- 1K PROM option (on processor board)

For descriptions and prices on the above options, see later sections of this catalog.

DOCUMENTATION AND SUPPORT

Professionally prepared manuals are included with each HORIZON computer covering operating procedures, maintenance, theory of operation, assembly and troubleshooting for both the hardware and software. The North Star Newsletter, which describes application notes and new software releases, is periodically mailed to each registered North Star product owner. Software updates are offered for a nominal copying charge.

HORIZON-1

Complete HORIZON computer with 4MHz Z80A processor board, 16K RAM board, disk controller board, one Shugart minifloppy disk drive, power supply and cooling fan, motherboard with serial I/O interface, three 100-pin edge connectors, aluminum chassis, and choice of wood or blue metal cover.

KIT: \$1599 ASSEMBLED: \$1899

HORIZON-2

Same as HORIZON-1 except two Shugart minifloppy disk drives are included. Conversion to a HORIZON-2 may be accomplished at any time by purchasing an additional drive (HRZ-DRV) from North Star.

KIT: \$1999 ASSEMBLED: \$2349

NORTH STAR EXTENDED BASIC

The programming language BASIC is an integral part of North Star products, although there are many uses for these products which do not involve BASIC. North Star extended BASIC will operate on both Z80 and 8080 computer systems. North Star BASIC is not available as a separate product, but is only sold for use with the HORIZON computer, MICRO-DISK SYSTEM, and hardware floating point board. (North Star BASIC does not require the FPB. Versions of BASIC using the FPB execute faster and require about 700 bytes less of memory.)

North Star extended disk BASIC includes the following features:

- Strings and substrings (length limited only by available RAM)
- String operators (concatenation and relationals)
- Multi-dimensioned arrays
- Multi-line user-defined functions
- Formatted output facility
- Multiple input/output devices
- Machine language CALL with argument passing
- Direct memory read and write
- Boolean operators (AND, OR, and NOT)
- IF-THEN-ELSE and ON-GOTO statements
- Program renumber command
- Calculator mode (direct statement) operation
- Powerful line editor
- Program load and store from disk
- Sequential and random access disk files

The set of North Star BASIC commands includes:

RUN	LIST	SCR	REN
DEL	EDIT	NULL	CONT
LOAD	SAVE	BYE	

The Set of North Star BASIC statements includes:

LET	GOTO	PRINT	DIM
FOR	NEXT	INPUT	EXIT
STOP	REM	READ	DATA
RESTORE	GOSUB	INPUT1	LINE
DEF	FNEND	OUT	END
IF	ON	RETURN	FILL
CHAIN	CREATE	OPEN	CLOSE
WRITE			

Built-in functions include:

ABS	SGN	SIN	COS	ATN
RND	SQRT	LOG	EXP	FREE
INT	LEN	VAL	STR\$	CALL
EXAM	INP	CHR\$	TYP	TAB
ASC				

North Star BASIC was implemented for a wide range of applications. It was patterned after Hewlett-Packard BASIC, and in most cases is a superset of HP BASIC. The formatted output capability is more similar to the FORTRAN method than the PRINT USING method. Thus, values may be printed in fixed or variable length fields, and dollar sign, commas and decimal points may be automatically included in the output.

The disk file processing features of North Star BASIC have been designed to allow a maximum of flexibility. Up to four files on disk can be "OPEN" at one time. Both numeric and string values may be written to disk files. Also, BASIC can access individual bytes in a disk file for applications where this is necessary. Random file accessing allows the BASIC program to set a file pointer to a specified byte address within a file before reading or writing.

The number representation in North Star BASIC is binary-coded-decimal. This representation means that no invisible conversion errors occur when the values used are within the precision of BASIC. Note that this is not true of binary representation implementations of BASIC. The standard North Star BASIC has 8 digits of precision, but special orders may be made for versions of BASIC with 6, 10, 12, or 14 digits of precision. See "Special Software Orders" on page 13.

North Star BASIC occupies about 11K of RAM, excluding the space for the BASIC program and data. BASIC loads and executes at 2A00 hex in the standard version. See the "Special Software Orders" section for ordering versions of BASIC with non-standard origins.

DISK OPERATING SYSTEM

The North Star Disk Operating System (DOS) is supplied on diskette with the HORIZON computer and with the MICRO-DISK SYSTEM. The DOS provides access to the information on diskettes either through COMMANDS typed from the computer terminal, or through SUBROUTINES called by software. The operations provided implement a named file system. That is, all files on the diskette can be referenced by the use of symbolic names of up to 8 characters. The DOS commands include:

CR	create a file
DE	delete a file
LI	list file directory
TY	set file type
LF	load file to RAM
SF	save file from RAM
GO	load file and execute
CF	copy file to file
IN	initialize diskette
DT	disk test
CD	copy entire diskette
CO	compact file space
RD	read from disk
WR	write to disk
JP	jump to RAM address

After power-on, the bootstrap PROM program loads DOS from the diskette into RAM. At this point the DOS awaits the typing of one of the commands. For example, typing GO BASIC will load BASIC into RAM and begin its execution.

The DOS has been designed to allow convenient modification for interfacing to any computer I/O terminal configuration. 256 bytes of space have been reserved in the DOS for your I/O routines, and step-by-step instructions are included describing how to make your I/O routines part of the DOS. Of course, DOS diskettes shipped with HORIZON will be initially set up to communicate with the HORIZON serial port. Also, several common I/O configurations have been interfaced to the DOS and are available for nominal cost (MDS-PERS). See "Special Software Orders" on page 13.

The North Star DOS occupies 2.5K of RAM and has its origin at 2000 hex in the standard version. Versions of the DOS with non-standard origins may be purchased as a special software order.

MONITOR

The North Star Monitor is a program which provides the user with certain maintenance and debugging functions which would normally be provided in a limited way on systems which include a control panel. The Monitor is included on diskette with each HORIZON computer. The Monitor is intended to be used in conjunction with the North Star Disk Operating System (DOS).

Commands to the Monitor are entered via the terminal using a format consistent with the DOS commands. Command editing facilities compatible with the North Star BASIC editing features are included in the Monitor.

The following list summarizes the commands available:

CM	Compare memory block contents
FM	Fill memory block
MM	Move memory block contents
SM	Search memory block
TM	Test memory block
DH	Display memory hexadecimal
DA	Display memory with ASCII interpretation
DS	Display memory and substitute values
JP	Jump to program
OS	Return control to the DOS
IL	Perform initial load from bootstrap PROM
OD	Assign output device number for the Monitor

All printed output from the Monitor is formatted to fit into sixty-four character lines. The Monitor occupies 2.5K of RAM. Three copies of the Monitor are supplied, assembled at locations 0, 2A00 hex, and F400 hex.

COMPLETE FLOPPY DISK SYSTEM FOR S-100 COMPUTERS

\$699

That's right, complete.

The North Star MICRO-DISK SYSTEM is a complete floppy disk system for 8080 and Z80 computer systems which follow the S-100 bus conventions (Altair, IMSAI, SOL etc.). For a complete, disk-oriented computer system which can execute BASIC, all that is needed is the computer, 16K bytes of memory (RAM), an I/O terminal, and the North Star MICRO-DISK SYS-



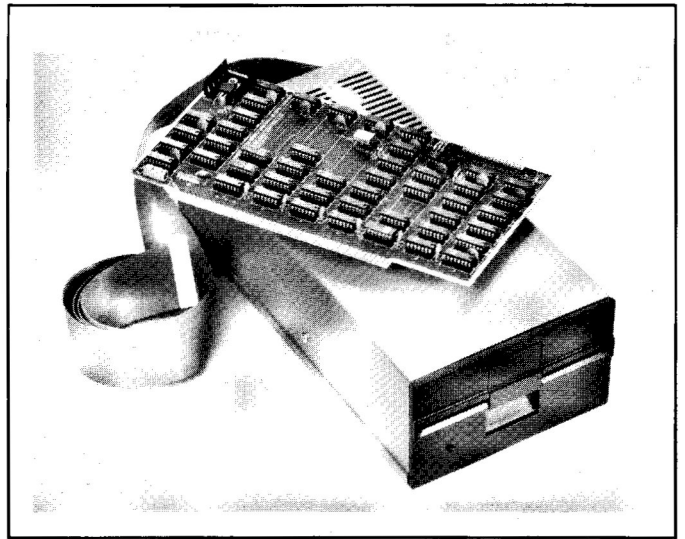
TEM. Just turn on the power and begin executing our extended disk BASIC within a few seconds.

THE DRIVE: At the heart of the North Star MICRO-DISK SYSTEM is the Shugart SA-400 minifloppy disk drive. Shugart is established as the leader in floppy disk drive manufacturing and has delivered over 100,000 floppies. The minifloppy is a compact, economical version of their standard drive. Hard-sectored for 256-byte records, each diskette can store 89.6K bytes of information, formatted as 35 tracks with 10 sectors per track. Track-to-track access is 40ms and latency is 100ms. The data transfer rate is 125K bits per second. These figures mean that 8K bytes of data can be transferred in less than one second, and that a single diskette can hold over 50 typical BASIC programs. The drive comes assembled and tested, even in systems purchased in kit form.

THE CONTROLLER: The North Star MICRO-DISK controller board interfaces the disk drive to the computer system. The controller is a single PC board that plugs directly into the S-100 bus. Commands and data are transferred under software control by the technique of memory-mapped I/O (no I/O ports or DMA are used). Up to three drives can be controlled, with or without interrupts. The controller allows transfer of between one and ten 256-byte blocks of data between the diskette and RAM in a single revolution. Cyclic redundancy error checking is done for each block read from disk. The controller automatically turns the drives on and off to minimize head and diskette wear. The controller consists of Schottky and low-power Schottky small and medium scale integrated circuits and includes its own crystal-controlled clock.

BASIC AND DOS: The North Star Disk Operating System and extended disk BASIC are included on diskette with the MICRO-DISK SYSTEM. See pages 4-5 for expanded descriptions of DOS and BASIC. A comprehensive monitor program for hardware and software maintenance is also provided on diskette.

BOOTSTRAP PROM: The controller includes on-board PROM memory, pre-programmed to permit power-on start-up of the computer. The PROM program loads the DOS from drive number 1 into memory and then branches to the loaded DOS. Much of the low-level software for the DOS is contained on the PROM. The on-board PROM and the memory-mapped I/O together use 1K of the computer address space, starting at E800 hex in the standard version. Non-standard origins may be purchased as a special software order.



POWER: The power requirement of the controller board is .7 amps at 8V. The power requirements for a single disk drive are:

5V .5AMP (typ), .7AMP (max)
12V .9AMP (motor on), 1.6AMP (motor startup)

Each drive is supplied with a power regulation PC card that mounts to the back of the drive. (Note: In HORIZON systems, the power regulation is done with circuitry supplied on the motherboard.) The drive can be powered by tapping unregulated power from the computer. In typical configurations, the following computers provide sufficient power for at least one drive: IMSAI 8080, Altair 8800B, SOL-20, and POLY 88. Alternatively, the North Star MICRO-DISK Power Supply (MDS-PS) is available as an added option. The MDS-PS uses standard 115V AC power. One MDS-PS will provide power for one drive.

MOUNTING: The controller occupies a single slot on the computer motherboard. The drive itself measures 5.75" by 3.25" by 8" and may be mounted horizontally or vertically. If external mounting is preferred, the North Star MICRO-DISK Cabinet (MDS-CAB) is available as an added option. Each cabinet will hold one disk drive and one power supply.

MICRO-DISK SYSTEM

KIT: \$699 ASSEMBLED: \$799

Power Supply: Kit: \$39 Kit. Assembled: \$49
Cabinet: \$39

HIGH SPEED 16K RAM BOARD WITH A FULL SET OF FEATURES \$399

No other memory board can surpass the features of our 16K S-100 bus RAM board at any price.

HIGH SPEED: The North Star 16K RAM board (RAM-16-A) is designed using prime, 200ns dynamic RAM chips. These chips are of the industry standard 4027 type. This means that the processor can compute at full speed, even when it is a 4MHz Z80A. Of course, the 16K RAM will also operate with 8080 processor boards as well. The dynamic memory refresh is done by on-board electronics making refresh invisible to the processor.

PARITY ERROR CHECKING: True system integrity can be achieved by adding the North Star parity checking option on the 16K RAM board. The parity option is a valuable feature for applications where great reliability is required. If a memory error occurs, a status flip/flop is set and an interrupt can inform the processor immediately. Or, if you prefer, the error status light can be lit.

ADDRESSABILITY: The 16K RAM Board starting address can be selected with an on-board DIP switch to start on any 8K boundary in the address space.

BANK SWITCHING: An additional feature of the North Star 16K RAM board is the ability to perform bank switching. The bank switching capability allows expansion of the total amount of RAM in a system beyond 64K. Bank switching will also facilitate software applications such as time-sharing.

POWER:

.6 amps @ + 8 volts, unregulated

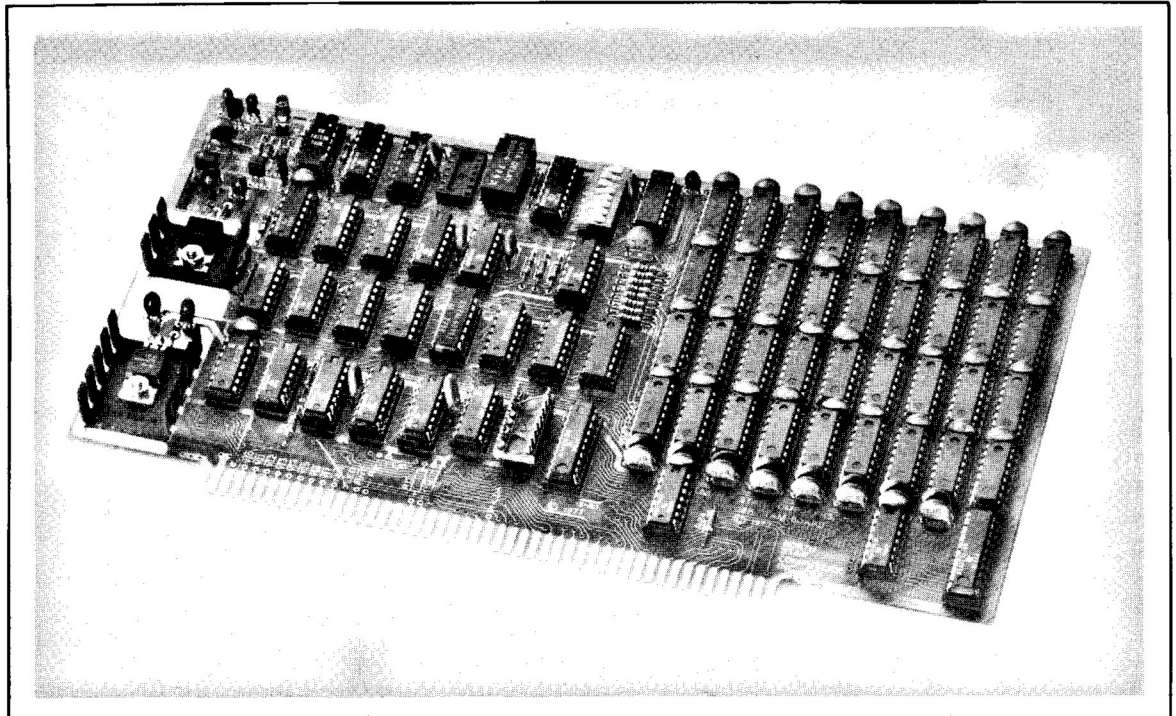
.4 amps @ +16 volts, unregulated

.1 amps @ -16 volts, unregulated

16K RAM BOARD

KIT: \$399 ASSEMBLED: \$459

Parity Option: Kit: \$39 Assembled: \$59



DOUBLE YOUR PROCESSING POWER WITH THE NORTH STAR Z80A PROCESSOR BOARD

\$199

The North Star Z80A processor board brings the Z80A micro-processor to the S-100 bus. The Z80A is an enhanced version of the Zilog Z80, certified to run at 4MHz by the manufacturer. The Z80A runs compatible programs at least twice as fast as an 8080. Even greater speed advantages can be obtained when the extended Z80A instruction set is used. The North Star Z80A processor board (ZPB) can run in systems either with or without front panels. The ZPB is fully compatible with ALTAIR and IMSAI type front panels. An auto-jump feature permits a branch to any 16-bit address in the computer at power-on and reset. In the HORIZON computer, this feature is used to start the bootstrap disk load PROM on the disk controller board. In other systems, the feature might be used to start a PROM monitor or other bootstrap procedure.

The ZPB includes space to add 1K bytes of EPROM (2708 type) as an option, making it possible to permanently store programs on the board. This feature would not normally be required in a HORIZON system, but might be used to contain a monitor or bootstrap program in other applications which might require it.

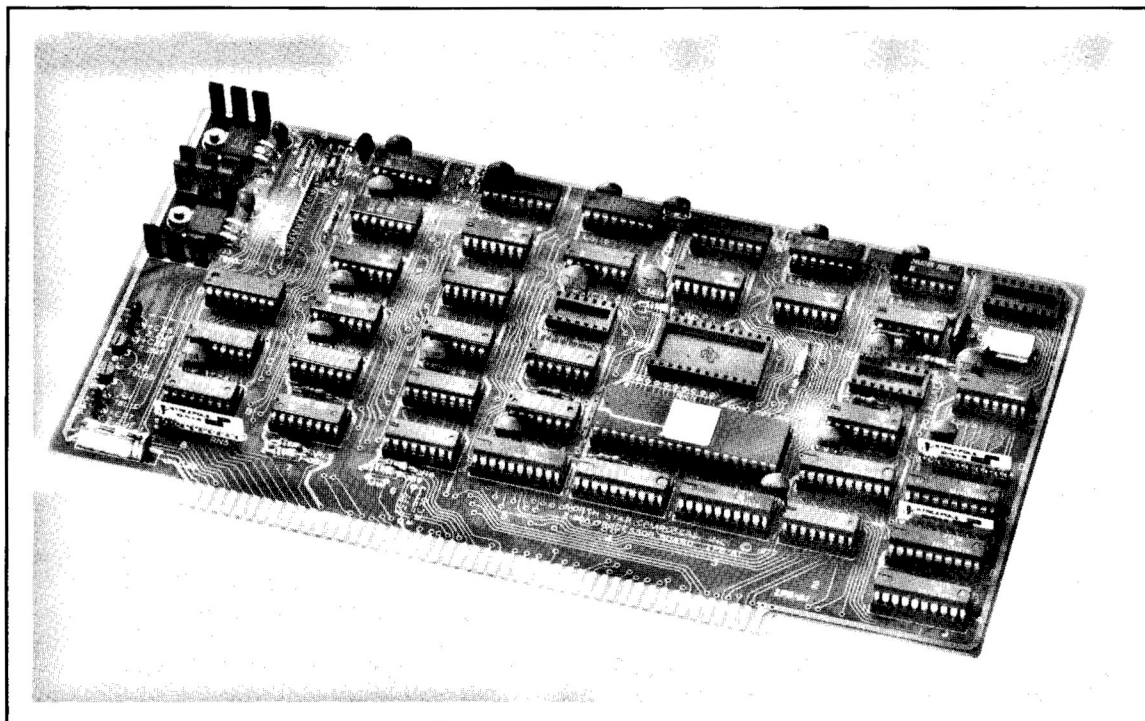
The ZPB also implements an 8-level vectored interrupt capability, and has a jumper option for adding a wait state to all memory used in the computer.

The power requirement for the ZPB is .7 amps at 8 volts, unregulated.

Z80A PROCESSOR BOARD

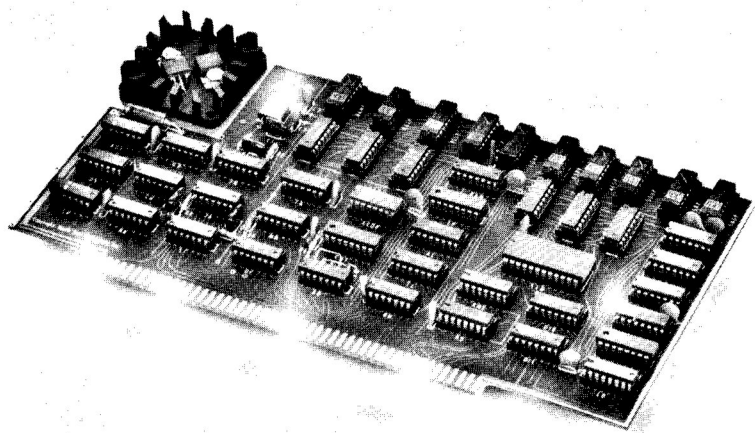
KIT: \$199 ASSEMBLED: \$259

Prom option: Kit: \$49 Assembled: \$69



HARDWARE FLOATING POINT BOARD FOR HIGH SPEED NUMBER CRUNCHING

\$259



The North Star hardware floating point board (FPB) is a single circuit board which performs floating point add, subtract, multiply and divide with up to 14 digits of precision. The FPB will perform floating point operations approximately 50 times faster than the best 8080 software or firmware. A typical 10 digit multiplication, when performed by the FPB, computes in 111 microseconds. The time is 5.5 milliseconds when the same operation is performed by the best 8080 software. Number representation for arguments and results is BCD (binary-coded-decimal).

The FPB floating point unit is implemented using primarily Schottky and low-power Schottky small and medium scale TTL integrated circuits. The FPB implements a high-speed micro-programmed processor specially designed to perform fast floating point arithmetic. The FPB waits for a command from the 8080 or Z80 program to start a floating point calculation. The command indicates both the operation desired and the precision. Then the FPB receives the floating point values one byte (two digits) at a time, computes the result, and returns the result along with a status byte indicating any overflow or underflow conditions. The method of communication between the FPB and the computer permits values to be passed at the rate of 6 microseconds per byte using an 8080, and proportionately faster if a higher speed computer is used.

The FPB is delivered with a version of North Star BASIC. If the FPB is to be used in conjunction with the HORIZON computer or MICRO-DISK SYSTEM, then BASIC will be delivered on diskette. Otherwise a non-disk version of North Star BASIC

will be delivered on paper tape. Use of the FPB can speed up North Star BASIC by as much as a factor of 10 when extensive mathematical calculations are being performed. See page 4 for a full description of North Star BASIC.

Models of the FPB are available for the S-100 bus (FPB-A) and for the SBC/80 bus (FPB-B). Both models will operate with 8080 or Z80 microprocessors.

POWER:

FPB-A: 1.7 amps @ +8 volts, unregulated

FPB-B: 1.7 amps @ +5 volts, regulated

The following timing table gives FPB execution times for the four operations at each of the allowed precisions.

FPB EXECUTION TIMES ^{1,2,3}							
PRECISION DIGITS:	2	4	6	8	10	12	14
ADD							
best	1	1	1	1	1	1	1
typical	8	8	9	9	10	10	11
worst	10	10	10	11	11	12	12
SUBTRACT							
best	4	4	4	4	4	4	4
typical	8	8	9	9	10	10	11
worst	15	16	17	18	19	20	21
MULTIPLY							
best	5	5	5	5	5	5	5
typical	18	34	55	80	111	146	186
worst	51	125	228	382	527	720	933
DIVIDE							
best	7	7	7	7	7	7	7
typical	39	70	109	156	211	274	370
worst	62	139	229	340	470	621	779

1. Times given in microseconds
2. Execution times are a function of the input values
3. Times listed do not include transmission of input values and result

Floating point number representation:

- Byte 1: bit 7 = sign (1 = negative number, 0 = positive number)
bits 6-0 = exponent in excess 64 binary representation
bits 7-0 = zero represents the zero value
- Byte 2: bits 3-0 = least significant digit of value in BCD coding
bits 7-4 = next least significant digit of value
- Byte N: bits 7-4 = most significant digit of value in BCD coding
bits 3-0 = next most significant digit of value

All values are normalized.

FLOATING POINT BOARD

FPB-A KIT: \$259 ASSEMBLED: \$359

FPB-B Kit: \$299 Assembled: \$399

TOP QUALITY CRT TERMINAL FROM SOROC TECHNOLOGY \$995



North Star offers the SOROC IQ 120 CRT Display terminal for users who wish to purchase an entire system from North Star. The SOROC IQ 120 is widely recognized as an ideally cost-effective, full function CRT terminal. Standard features include 24 line by 80 character display with addressable cursor, upper and lower case ASCII character set, and high quality keyboard with cursor controls and numeric pad. The IQ 120 has a standard RS-232 interface compatible with the HORIZON serial port, and can communicate at standard baud rates up to 19,200 characters per second. An auxiliary RS-232 port is also included in the standard IQ 120.

The SOROC IQ 120 is made available through North Star by a special agreement with SOROC Technology, and is fully assembled and tested. The SOROC 90-day limited warranty is honored at the SOROC factory in Southern California.

The SOROC IQ 120 power requirements are 115V AC, 60 Hz, 130 watts. Versions for 50 Hz and/or 230V AC are available for nominal additional cost.

SOROC IQ 120 CRT TERMINAL: \$995

Special versions for non U.S. Standard Service: \$1025

Terminal-Computer Cable: \$25

SHORT FORM CATALOG AND PRICE LIST

Before ordering any of the North Star microcomputer products, please read the following descriptions carefully to determine ordering options and prices. Please note that these prices are subject to change without notification.

HORIZON COMPUTER CONFIGURATIONS		KIT	ASSEMBLED
HRZ-1-16K	The HRZ-1-16K includes chassis, cover, 12-slot S-100 motherboard with serial input/output interface and three 100-pin edge connectors, cooling fan, power supply, Z80A processor board (ZPB-A), complete single drive MICRO-DISK SYSTEM (MDS-H), 16K RAM board (RAM-16-A), DOS, MONITOR, and BASIC on diskette and full documentation. Specify choice of wood or blue metal cover. For assembled systems, specify at time of order any desired options (e.g., extra edge connectors, additional RAM boards, optional I/O interfaces).	\$1599	\$1899
HRZ-2-16K	HRZ-2-16K is the same as HRZ-1-16K except that 2 drives are included. See above for details.	1999	2349
HRZ-1-0K	Same as HRZ-1-16K but with no 16K RAM board. See above for details.	1299	1549
HRZ-0-0K	HORIZON chassis, cover, motherboard with serial I/O and three 100-pin edge connectors, cooling fan, power supply, processor board, and documentation. Specify choice of wood or blue metal cover. Note that the HRZ-0-0K is not a complete computer and requires additional equipment to become usable.	599	799
HRZ-0-0K-NZ	Same as the HRZ-0-0K except that the processor board is not included. Requires additional equipment to become usable. Normally purchased in order to replace a previously purchased chassis and motherboard while retaining other existing circuit boards.	439	589
HRZ-EC	100-pin edge connector for plugging a circuit board into the motherboard. Also includes two card guides. One HRZ-EC is needed for each additional circuit board to be installed in a HORIZON. May only be ordered assembled when specified at the time of order of an assembled HORIZON.	6	8

HORIZON INPUT/OUTPUT OPTIONS		KIT	ASSEMBLED
HRZ-SIO	Optional additional serial input/output interface which mounts on the HORIZON motherboard. Includes all necessary integrated circuits and sockets, plus the back panel connector. May only be ordered assembled when specified at the time of order of an assembled HORIZON.	\$39	\$59
HRZ-PIO	8-bit parallel input/output interface option which mounts on the HORIZON motherboard. Includes all parts and sockets plus back panel connectors and plugs. May only be ordered assembled when specified at the time of order of an assembled HORIZON.	39	59

DISK OPTIONS FOR HORIZON		KIT	ASSEMBLED
HRZ-DRV	The additional drive plus necessary parts to convert a HORIZON-1 to a HORIZON-2. Includes drive, power regulation circuitry, cabling and connector.	\$400	\$450
HRZ-CABLE	Cable set for adding a third drive to HORIZON. Includes internal cable and back-panel connector, and external plug and cable. An MDS-DRV and MDS-PS must also be purchased to add a third drive. Note that this third drive will be mounted external to the HORIZON, and a cabinet (MDS-CAB) may also be desired.	49	N.A.
MDS-H	Special version of MICRO-DISK SYSTEM for adding a disk system to one of the HRZ-0 configurations. The cabling and power regulation are slightly different for use in a HORIZON than those provided with an MDS-A. See description of MDS-A below.	699	799
HRZ-D1KIT	Kit for adding a previously purchased MICRO-DISK SYSTEM (MDS-A) to one of the HRZ-0 configurations. Includes the necessary motherboard parts and cabling and connectors.	19	N.A.
HRZ-D2KIT	Kit for adding a previously purchased MDS-DRV to a HORIZON-1 for conversion to a HORIZON-2. Included are the necessary motherboard parts and cabling and connectors.	19	N.A.

CRT DISPLAY TERMINAL		PRICE
SOROC-120	24 line by 80 character CRT Display Terminal, for use with HORIZON or other RS-232 compatible computers. Fully assembled. Does not include cable.	\$995
CABLE-232	Cable for connecting an RS-232 terminal device to the HORIZON computer. Includes 5 foot ribbon cable containing two 25-pin RS-232 connectors.	25
SOROC-120F	Same as SOROC-120 except for non U.S. standard service. Specify 50 or 60 Hz operation and 115V or 230V operation. Fully assembled. Does not include cable.	1025

FOR DIRECT MAIL ORDERS, include check or money order for full amount or use VISA or Master Charge. Uncertified checks require 6 weeks processing. California residents add sales tax. Delivery is stock to 60 days.

PRODUCTS FOR HORIZON OR OTHER S-100 COMPUTERS		KIT	ASSEMBLED
RAM-16-A	16K byte dynamic RAM board. Includes printed circuit board, all parts and sockets, and documentation.	\$399	\$459
RAM-16-PAR	Parity checking option for RAM-16-A. Includes all parts and sockets necessary to add parity checking circuitry to the RAM-16-A. May be ordered assembled only in conjunction with an assembled RAM-16-A or HORIZON order.	39	59
ZPB-A	Z80A processor board. Includes printed circuit board, all parts and sockets, and documentation.	199	259
ZPB-PROM	1K byte erasable PROM option which mounts on ZPB-A board. Includes one 2708 EPROM chip plus additional support parts and sockets. May be ordered assembled only in conjunction with an assembled ZPB-A or assembled HORIZON order.	49	69
FPB-A	Hardware floating point board for S-100 bus computers. Includes printed circuit board, all parts and sockets, BASIC, and documentation. Specify choice of paper tape or diskette version of BASIC.	259	359
FPB-B	Hardware floating point board for SBC/80 computers. Includes printed circuit board, all parts and sockets, BASIC software on paper tape, and documentation.	299	399
MDS-A	MICRO-DISK SYSTEM. Includes controller board, a single minifloppy disk drive, power regulation, cables, DOS and extended BASIC software on diskette, and documentation. If ordered assembled, be sure to specify if MDS-PS or MDS-CAB options are desired.	699	799
MDS-DRV	Second or third drive for MDS-A system. Includes one drive, power regulation, and connector for adding drive to existing cable.	400	450
MDS-PS	Power supply for single drive for MDS-A or MDS-DRV. Includes transformer, all parts, fuse and fuse holder, switch and power cord to 115V socket. May be ordered assembled only when ordered with MDS-A with cabinet or an MDS-DRV with cabinet.	39	49
MDS-CAB	Cabinet for a single disk drive for MDS-A or MDS-DRV. Also holds an MDS-PS if needed. Includes blue metal base and cover, and mounting hardware.	39	39
DISKETTE	Blank diskette compatible with HORIZON and MICRO-DISK SYSTEM. Includes diskette and protective envelope.	N.A.	4.50
MDS-A-ND	Same as MICRO-DISK SYSTEM (MDS-A) but with no disk drive. For use with a previously purchased SA-400 minifloppy disk drive.	449	549
DOCUMENTATION		PRICE	
HRZ-DOC	Complete HORIZON documentation pack, including all hardware and software manuals.	\$20	
MDS-DOC	Complete MICRO-DISK SYSTEM documentation pack, including hardware and software manuals.	10	
RAM-16-DOC	Complete RAM-16-A and RAM-16-PAR documentation pack.	5	
ZPB-DOC	Complete ZPB-A documentation pack, including Z80A technical manual.	10	
FPB-A-DOC	Complete S-100 floating point board (FPB-A) documentation pack. Includes hardware and BASIC manuals. Specify choice of disk or paper tape BASIC manual.	10	
FPB-B-DOC	Complete SBC/80 bus floating point board (FPB-B) documentation. Includes hardware and BASIC manuals.	10	
SPECIAL SOFTWARE ORDERS		PRICE	
MDS-PERS	Standard versions of the DOS and BASIC on diskette which have been I/O configured for commonly available S-100 microcomputer systems. Currently available configurations include: IMSAI SIO, SOL-20 with SOLOS, POLY 88 with 4.0 monitor, POLY VT1, and Processor Technology VDM with 3P+S. Licensed for use with HORIZON or MDS only.	\$10	
SOFT-SPEC	Special orders may be made for specifying non-standard precision for disk versions of BASIC, and for specifying non-standard origins for the disk PROM, DOS, and disk BASIC. All such orders <i>must</i> be made on a "Special Order Form" which may be requested from the dealer or from North Star. No special orders placed any other way will be accepted. The prices for special software orders range from \$10 to \$75. Licensed for use with HORIZON or MDS only.	—	

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