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**North Star  
Computers Inc.**

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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.\* The North Star MICRO-DISK SYSTEM includes a version of extended disk BASIC, developed by North Star in 1976. The North Star reputation is based on the quality, performance and reliability of both the hardware and software delivered to date.

North Star offers the HORIZON, a complete S-100 bus computer, as well as S-100 memory products (RAM-32-A and RAM-16-A), a hardware floating point board (FPB), and a Z80A® processor board. 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 quite 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 used in OEM systems and are also sold at authorized computer dealers throughout the United States and many foreign countries.

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.

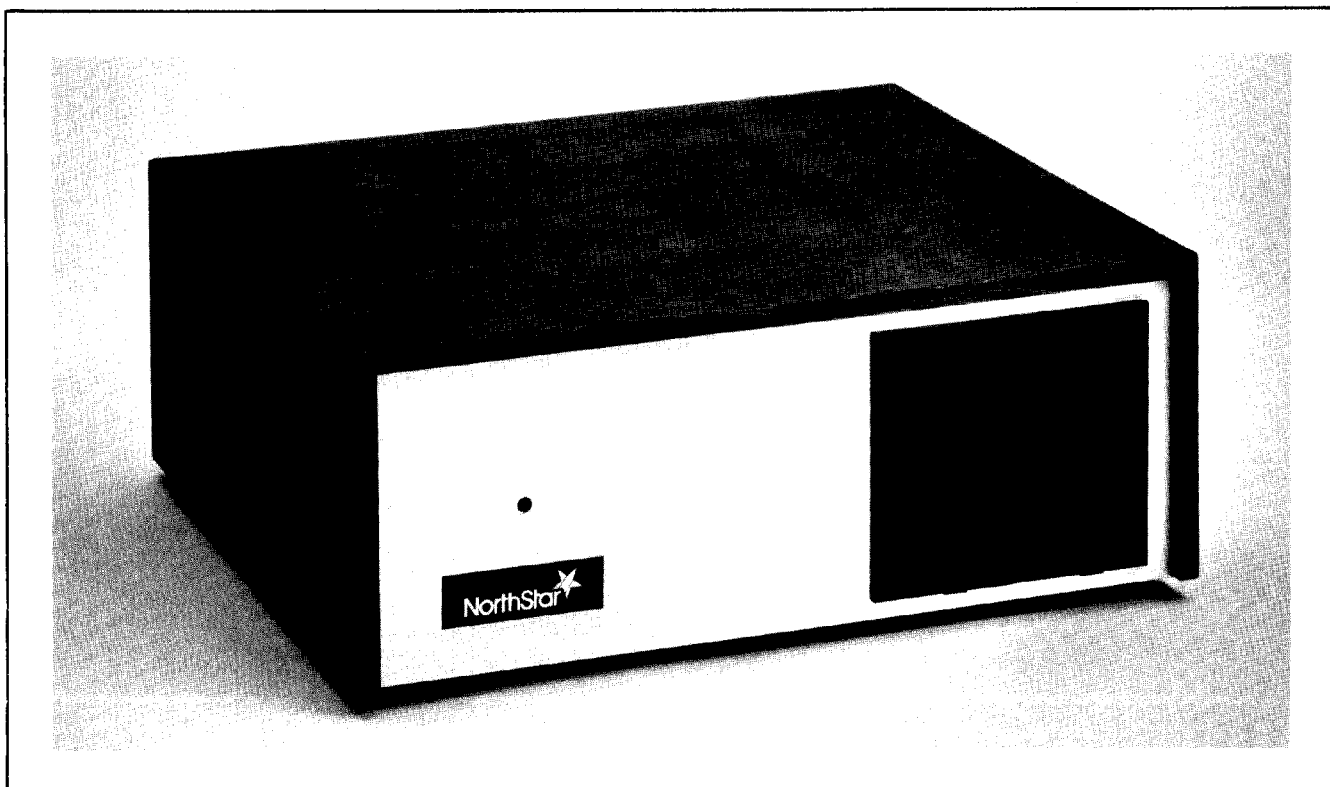
HORIZON® is a registered trademark of North Star Computers, Inc.

Z80A® is a registered trademark of ZILOG Corporation.

\*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 S-100 bus computer manufacturers. The wide availability of S-100 compatible products allows users many options when configuring Z80 or 8080 computer systems.

# **Complete HORIZON Computer With 32K RAM, Up To Four Mini Disk Drives, 4MHz Z80A Processor, Serial And Parallel I/O Ports, And Extended BASIC:**

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



### Assembled or Kit

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 voltmeter is required, and an oscilloscope is recommended.

### What About Performance?

The North Star Z80A processor board operates at 4 MHz—twice the speed of an 8080. Our RAM memory board lets the Z80A execute at full speed (no wait states), and includes parity checking. The disk controller board can control up to four drives. Expanded descriptions of these North Star boards are included in this catalog.

The North Star controller and disk drives set the standard for floppy disk performance and reliability. The HORIZON can load a 10K byte program in less than 2 seconds, and each double density diskette can store 180K bytes. Two-sided quad capacity disk drives are also available as an extra cost option allowing 360K bytes to be stored on each quad capacity diskette. That is a total of 1.4 million bytes of on-line storage with four drives. Double density and quad capacity drives may be mixed and matched in any system.

### And Software, Too

HORIZON includes North Star extended disk BASIC, Disk Operating System (DOS) and Monitor 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 in other sections of this catalog. The HORIZON software diskette includes a comprehensive monitor and memory test for hardware and software maintenance. Pascal is also available from North Star for the HORIZON and is described elsewhere in this catalog.

The amount of application software now written to operate with North Star BASIC and DOS is extensive. Many independent companies, as well as the North Star user groups, offer a wide range of application programs. FORTRAN, COBOL, editor-assembler development systems, word processing systems, business applications (payroll, mailing list, inventory and data base management, accounting and order entry), and games are available. See the North Star Newsletter for details.

### 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 32K and 16K RAM boards
- second, third and fourth disk drives
- hardware floating point arithmetic board
- 1K PROM option (on processor board)

### 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.

### 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 basic HORIZON for the Z80A processor board, the 32K RAM board, and the disk controller board. The I/O circuitry and disk drive power regulation circuitry are included on the motherboard. A real-time clock is also included on the motherboard. The serial and parallel input/output interfaces may be used 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 12 amps at 8 volts and 6 amps at  $\pm 16$  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. The assembled metal cover versions of the HORIZON computer are Underwriters Laboratories listed.

### Specifications

A.C. POWER: 115 volts, 250 watts, 60 Hz (Domestic)  
230 volts, 250 watts, 50 Hz (International)

### Environmental Limits

TEMPERATURE—operating 40°F to 100°F (4°C to 40°C)  
RELATIVE HUMIDITY—20% to 80% no condensation

### Dimensions

20" x 7.25" x 17.50"

### HORIZON-1-32K

HORIZON comes complete with 4 MHz Z80A processor board, 32K RAM board, disk controller board, one mini disk drive, power supply and cooling fan, motherboard with two serial I/O interfaces, an 8-bit parallel I/O interface, twelve 100-pin edge connectors, chassis, and choice of wood or blue metal cover.

HRZ-1-32K-D (DOUBLE DENSITY and 32K RAM)  
HRZ-1-32K-Q (QUAD CAPACITY and 32K RAM)  
HRZ-1-48K-D (DOUBLE DENSITY and 48K RAM)  
HRZ-1-48K-Q (QUAD CAPACITY and 48K RAM)  
HRZ-1-64K-D (DOUBLE DENSITY and 64K RAM)\*  
HRZ-1-64K-Q (QUAD CAPACITY and 64K RAM)\*

### HORIZON-2-32K

Same as HORIZON-1 with two mini disk drives included.

HRZ-2-32K-D (DOUBLE DENSITY and 32K RAM)  
HRZ-2-32K-Q (QUAD CAPACITY and 32K RAM)  
HRZ-2-48K-D (DOUBLE DENSITY and 48K RAM)  
HRZ-2-48K-Q (QUAD CAPACITY and 48K RAM)  
HRZ-2-64K-D (DOUBLE DENSITY and 64K RAM)\*  
HRZ-2-64K-Q (QUAD CAPACITY and 64K RAM)\*

\*Note that in 64K HORIZON configurations, 8K of address space is reserved for the bootstrap PROM and memory-mapped I/O.

# 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 and MICRO-DISK SYSTEM. Versions of BASIC using the North Star Hardware Floating Point Board (FPB) execute faster and require about 700 bytes less memory.

North Star extended disk BASIC includes the following features:

- Strings and substrings (limited only by available RAM)
- String operators (concatenation and relationals)
- Multi-dimensional 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
- Error trapping capability

The set of North Star BASIC commands includes:

RUN	LIST	SCR	REN
DEL	EDIT	PSIZE	CONT
LOAD	SAVE	BYE	APPEND
AUTO	CAT	MEMSET	NSAVE

The set of North Star BASIC statements includes:

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

Built-in functions include:

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

North Star BASIC was implemented for a wide range of applications. The formatted output capability is similar to the FORTRAN 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 eight 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 (BCD). 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 10, 12 or 14 digits of precision.

North Star BASIC occupies about 12K of RAM, excluding the space for the BASIC program and data. BASIC loads and executes at 2D00 hex in the standard version. Versions of BASIC with non-standard origins are available on special order.

## 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

At 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. Alternately, the DOS may be set for "turnkey" start up of any specified program.

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 and parallel ports. Also, several common I/O configurations have been interfaced to the DOS and are available for nominal cost (MDS-PERS).

The North Star DOS occupies 3.25K of RAM and has its origin at 2000 hex in the standard version. Versions of the DOS with non-standard origins are available on special software orders. The system is supported in both double density and quad capacity versions, and support for single density continues.

# 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
ID	Assign input device number for the Monitor

The Monitor occupies 2.5K of RAM and is normally loaded just above the DOS at 2DOOH. Copies of the Monitor are supplied, assembled at several different origins.

## North Star Pascal

Pascal, one of the most popular languages to embody the principles of structured programming, is available from North Star for use with the HORIZON and the MICRO-DISK SYSTEM.

### A Complete System

North Star Pascal is a complete program development system. Pascal source programs are prepared using the screen-oriented editor. They are compiled and linked into fast-executing P-code, and executed by a simulator for an "ideal" Pascal processor called the P-machine. At run-time, compiled P-code versions of Pascal programs execute about 10 times faster than equivalent programs under typical interpreter systems.

The Pascal system available from North Star is a special version of the popular "UCSD Pascal" implementation, developed at the Institute for Information Systems at the University of California, San Diego. The language implemented is based on the Standard Pascal language.

North Star Pascal runs under its own disk operating system, and does not use the North Star DOS. However, Pascal programs may access and manipulate disk files created under DOS or BASIC.

### Advanced Features

North Star Pascal features block control structure, long variable names, formatted numeric output, local variables in procedures and functions, and provision for pre-compiled library routines. The language includes a full set of operators and functions for manipulating data of the elementary data types REAL, INTEGER, BOOLEAN, and CHARACTER. Complete string-handling facilities are also provided. New data types may be defined by the programmer for special applications. Extensive data-structuring facilities in the language permit organization of data into multi-dimensional arrays, records, sets, or files. Data files on diskette may be accessed sequentially or in random fashion. The availability of special pointer variables in North Star Pascal promotes convenient manipulation of complex dynamic data structures such as trees and lists.

Internal representation of INTEGER quantities is 16-bit binary, providing an INTEGER range of -32767 to 32767. REAL numbers are stored internally in 32-bit binary floating-point form, resulting in 7.1 digit precision.

(Continued, page 17)

## Other Software

BASIC, DOS, MONITOR and Pascal are only a few of the numerous software packages available to HORIZON users. A large number of other useful and entertaining software packages are available through the North Star Software Exchange (NSSE) program, and from independent software vendors. All registered HORIZON and MDS users periodically receive the North Star Newsletter, which keeps them up-to-date on newly-available software and additional HORIZON features.

The NSSE library consists of user-developed, public-domain software that has been transferred onto diskette. For a nominal copying charge of \$10.00 per diskette, these software packages are available from your North Star dealer. NSSE diskettes include utility programs, math and matrix routines, several utility packages, a PILOT system assembler source code, and many computer games.

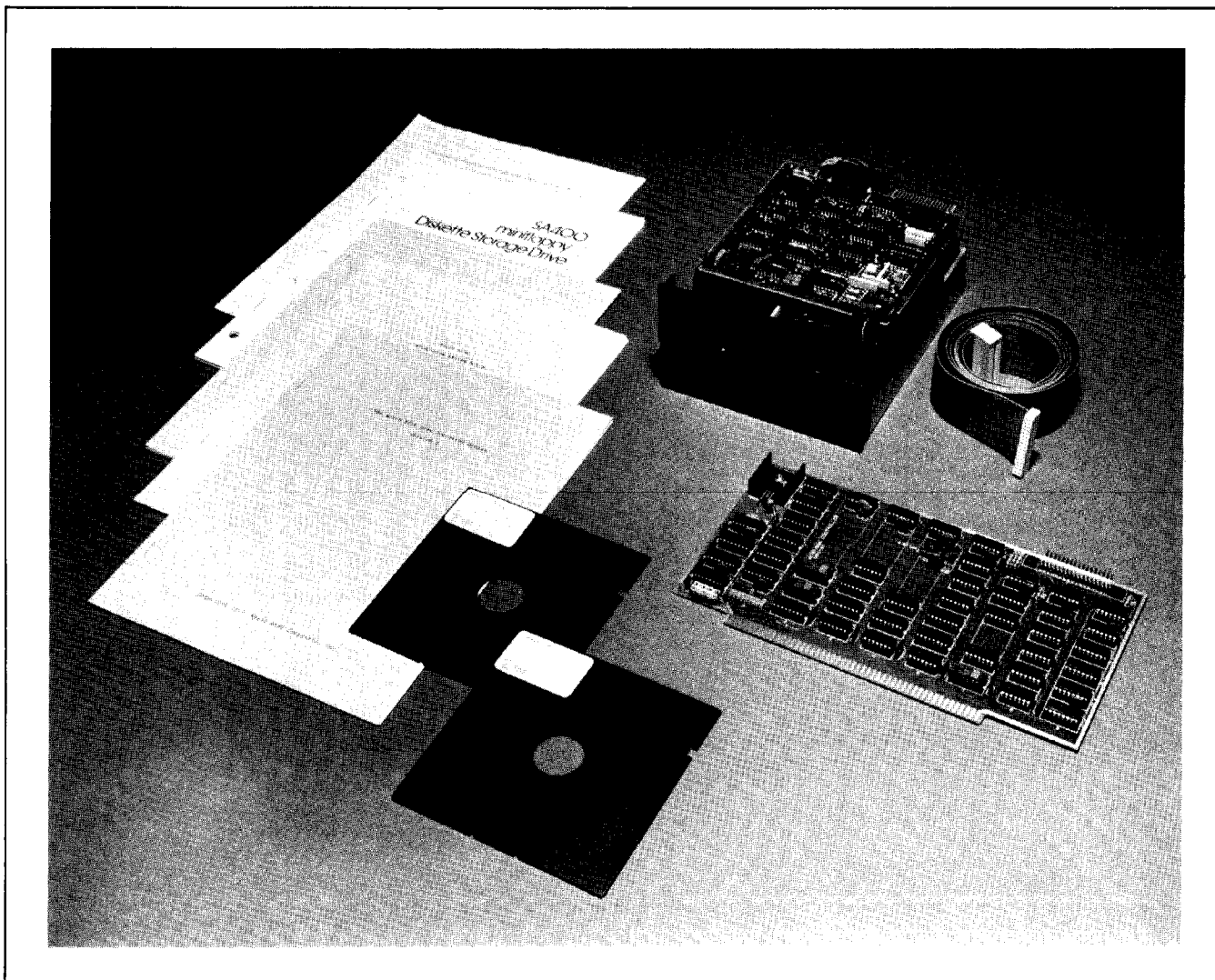
In addition to the software exchange, independent software vendors supply hundreds of useful packages which can run on a HORIZON. These include complete packages for nearly every small business computer application, as well as tax packages, stock market analysis and word processing. Time sharing systems are available through these independent vendors. Furthermore, the popular CP/M operating system is available as well as several assembly language development systems and high-level languages such as FORTRAN and COBOL.

A list of vendors marketing HORIZON-compatible software is available from North Star.

# Complete Floppy Disk System For S-100 Computers

That's right, complete.

The North Star MICRO-DISK SYSTEM is a complete floppy disk system for Z80 or 8080 computer systems which follow the S-100 bus conventions. For a disk-oriented computer system which can execute BASIC or Pascal, all that is needed is the computer, memory, an I/O terminal, and the North Star MICRO-DISK SYSTEM. Just turn on the power and begin executing our extended disk BASIC within seconds.





## The Drives:

### Double Density

North Star is established as the leader in micro computer floppy disk systems. The double density drive is hard-sectored for 512 byte records. Each diskette can store 180K 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 250K bits per second. These figures mean that 16K bytes of data can be transferred in less than one second, and that a single diskette can hold over 100 typical BASIC programs. The drive comes assembled and tested, even in systems purchased in kit form.

### Quad Capacity

The quad capacity drive is compatible with the double density drive and operates with the same controller. The drive uses both sides and is therefore formatted as 70 tracks with 10 sectors per track. The DOS determines the side selection automatically. Track-to-track access has been enhanced to 5ms with all other specifications remaining the same as its double density counterpart.

### 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 four double density or quad capacity drives can be controlled, with or without interrupts. The controller allows transfer of between one and ten 512 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.

### Basic, DOS And Monitor

The North Star Disk Operating System, Monitor and extended disk BASIC are included on diskette with the MICRO-DISK SYSTEM. See the sections on software for expanded descriptions of DOS, Monitor and BASIC.

### 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. 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 options are available on special orders.

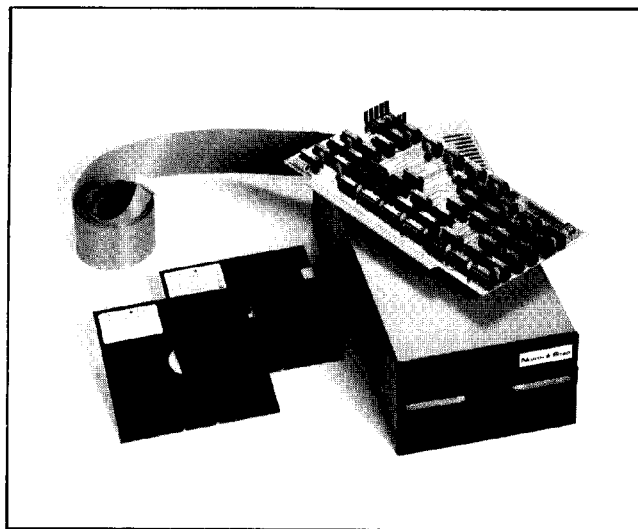
### Power

CONTROLLER: .7 amp @ +8 volts  
DRIVE: .5 amp (typ) @ +5 volts, .7 amp (max)  
.9 amp (motor on) @ +12 volts, 1.6 amps  
(motor start-up)

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. The North Star MICRO-DISK Power Supply is included in the MDS cabinet and requires standard 115V AC power. One power supply will provide power for one drive.

### Mounting

The controller occupies a single slot on the computer motherboard. The drive itself measures 5.75" x 3.25" x 8" and may be mounted horizontally or vertically. If external mounting is preferred, the single drive cabinet (MDS-CAB-PS) is available. The drives may also be mounted in the Additional Drive Cabinet.



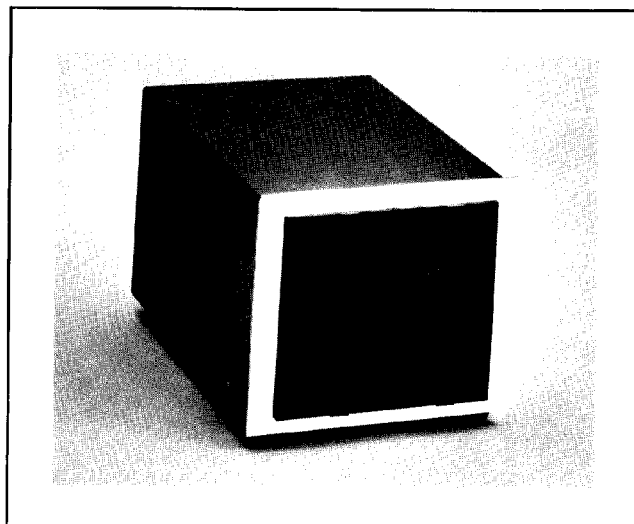
### Micro-Disk System

MDS-A-D (DOUBLE DENSITY)  
MDS-A-Q (QUAD CAPACITY)  
MDS-CAB-PS (Blue metal cabinet for one drive with power supply)

### Additional Drive Cabinet

An additional drive cabinet (ADC) may be ordered which can be used to add the third and fourth drives to a HORIZON system or MDS. The ADC is compatible with the HORIZON cabinet and comes with a built-in power supply capable of powering one or two drives. An ADC-0 may be used to house previously acquired drives (MDS-DRV). The cabinet comes in a wood or blue metal cover, with dimensions of 9" x 8" x 13.5". The ADC comes with a universal power supply and may be set for either 115 or 230 volts, 50 or 60 Hz.

ADC-1-D (with one double density drive)  
ADC-2-D (with two double density drives)  
ADC-1-Q (with one quad capacity drive)  
ADC-2-Q (with two quad capacity drives)  
ADC-0 (kit version with no drives)



# North Star RAM Boards Offer A Full Set Of Features

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

## High Speed

The North Star RAM boards (RAM-16-A and RAM-32-A) are designed using prime, 200ns dynamic RAM chips. This means that the processor can compute at full speed, even when it is a 4MHz Z80A. Of course, the North Star 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 is achieved with the North Star parity checking circuitry. Parity checking is a valuable feature for applications where maximum reliability is required. If a memory error occurs, a status flip/flop is set and an interrupt can inform the processor immediately. The error status light is also lit.

## Addressability

The RAM board address is selected with an on-board DIP switch to start on any 8K boundary in the address space.

## Bank Switching

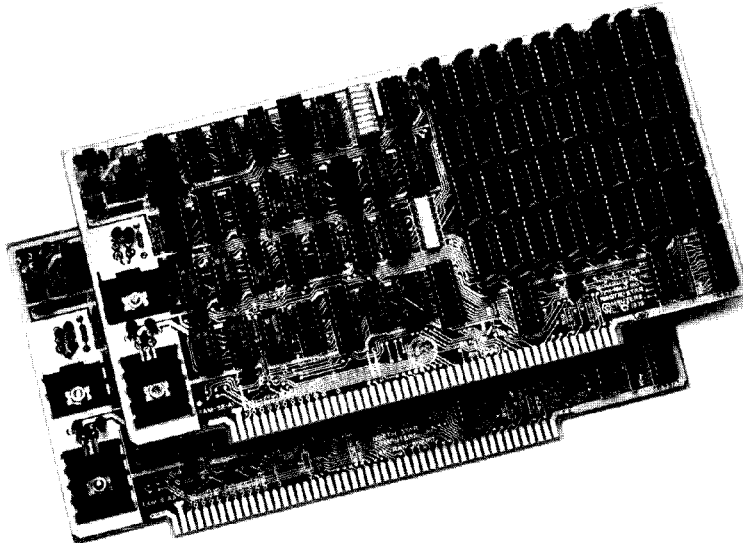
An additional feature of North Star RAM boards is the ability to perform bank switching. The bank switching capability allows expansion of the total amount of RAM in a system beyond 64K. Bank switching will also facilitate software applications such as time-sharing.

## Power

- .6 amp @ +8 volts, unregulated
- .4 amp @ +16 volts, unregulated
- .1 amp @ -16 volts, unregulated

## Ram Boards

- RAM-16-A
- RAM-32-A



# Double Your Processing Power With the North Star Z80A Processor Board

The North Star Z80A processor board brings the 4MHz Z80A microprocessor to the S-100 bus. 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-A) can run in systems either with or without front panels. The ZPB-A is fully compatible with S-100 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-A 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-A 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.

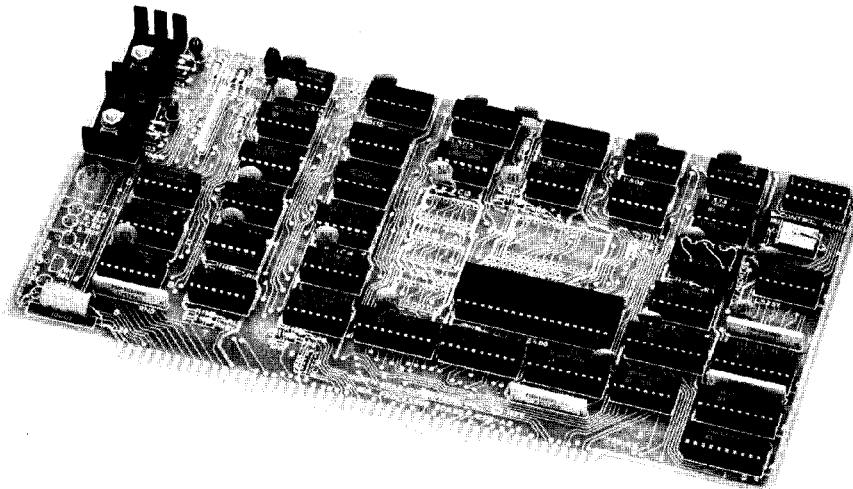
## Power

.7 amp @ +8 volts, unregulated

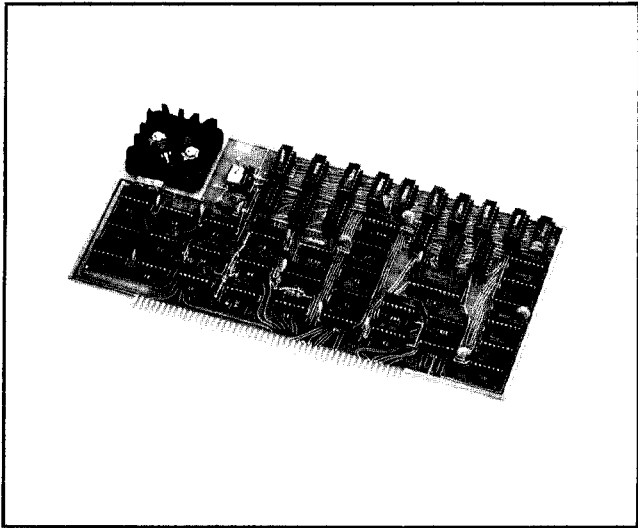
## Z80A Processor Board

ZPB-A

ZPB-PROM (option)



# Hardware Floating Point Board For High Speed Number Crunching



The North Star hardware floating point board (FPB-A) is a single S-100 bus 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 25 times faster than the best Z80A software or firmware. A typical 10 digit multiplication, when performed by the FPB, computes in 111 microseconds. The time is 2.7 milliseconds when the same operation is performed by the best Z80A software. Number representation for arguments and results are BCD (binary-coded-decimal).

The FPB implements a high-speed microprogrammed processor specially designed to perform fast floating point arithmetic. The FPB waits for a command from the Z80A or 8080 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 computer permits values to be passed at the rate of 3 microseconds per byte using a Z80A, and proportionately slower if a lesser speed computer is used.

A version of BASIC which uses the FPB is provided with HORIZON and MICRO-DISK SYSTEMS. 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.

## Power

1.7 amps @ +8 volts, unregulated

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

FPB Execution Times <sup>1, 2, 3</sup>							
PRECISION DIGITS:	2	4	6	8	10	12	14
<b>ADD</b>							
best	1	1	1	1	1	1	1
typical	8	8	9	9	10	10	11
worst	10	10	10	11	11	12	12
<b>SUBTRACT</b>							
best	4	4	4	4	4	4	4
typical	8	8	9	9	10	10	11
worst	15	16	17	18	19	20	21
<b>MULTIPLY</b>							
best	5	5	5	5	5	5	5
typical	18	34	55	80	111	146	186
worst	51	125	228	382	527	720	933
<b>DIVIDE</b>							
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=(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

# CRT Terminal From North Star

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.

## **Power Requirements**

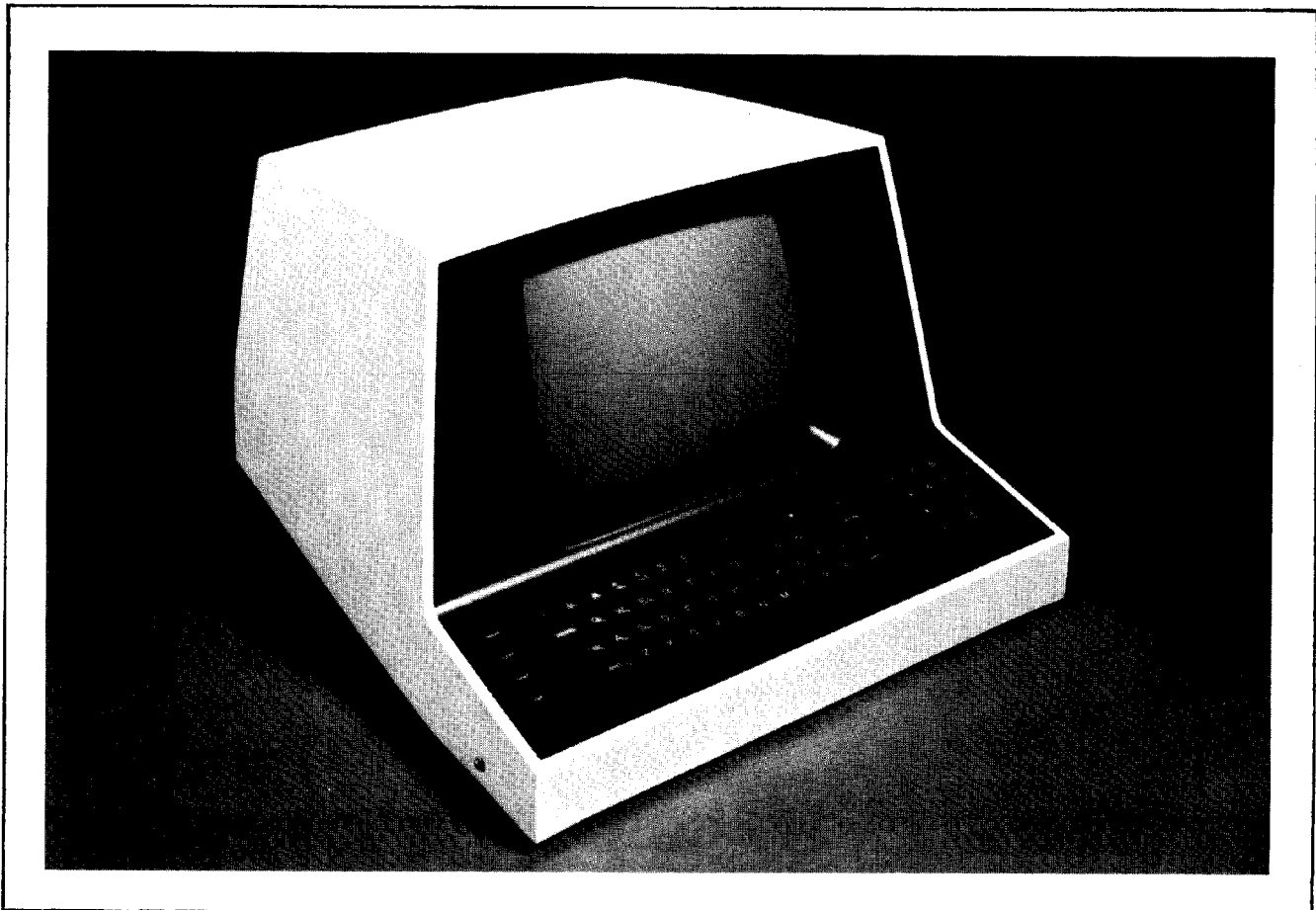
115V AC, 60 Hz, 130 watts  
50 Hz and/or 230V AC available

## **Dimensions**

18" x 12½" x 21"

## **SOROC CRT Terminals**

SOROC  
SOROC-F: (non U.S. Standard Service)  
CABLE-232: (Terminal-Computer Cable)



# Letter Quality Character Printer From North Star

NORTH STAR computers offers a letter-quality printer for all your printing needs. The NEC Model 5530-2 SPINWRITER is a micro-processor controlled, impact printer designed for printing applications where typewriter quality printing is required. The SPINWRITER will print up to 55 characters per second while receiving data at rates to 120 characters per second (1200 baud).

The SPINWRITER uses the most advanced technology for added durability. Reinforced plastic in the SPINWRITER's unique "thimble" print element provides normal element life of more than 30 million impressions. Faster than the "golf-ball" with better quality than the "daisy-wheel," the SPINWRITER offers the combined advantage of the thimble plus a rich and continuously increasing variety of print thimbles to enhance its ability to meet diverse user applications. The unique thimble enables the SPINWRITER to store and print in two different font styles without the need to replace one print element with another.

Name the application, and the SPINWRITER character printer has a range of standard features for it. In word processing, the SPINWRITER does a top-quality, letter-perfect job that includes selectable 10- or 12-pitch characters with line widths up to 163 characters. Optional proportional spacing can be performed under software control. For graphing and plotting the standard features of the SPINWRITER's 1/120-inch horizontal resolution and 1/48 inch vertical resolution plus incremental platen movement ensure more precise paper control during sub- or superscripting. Other features include bi-directional printing; OCR-quality registration; self-testing diagnostics; and horizontal and vertical tabbing. The SPINWRITER comes equipped with a standard 8-bit parallel interface, a standard thimble, a carbon ribbon and a forms tractor.

The SPINWRITER is supported by Release 5.1 of the DOS through the parallel output port and a parallel interface cable (CABLE-PAR).

The NEC 90-day customer warranty is honored at the NEC factory in Woburn, Mass. or by contact with any NEC field office.

#### **Power**

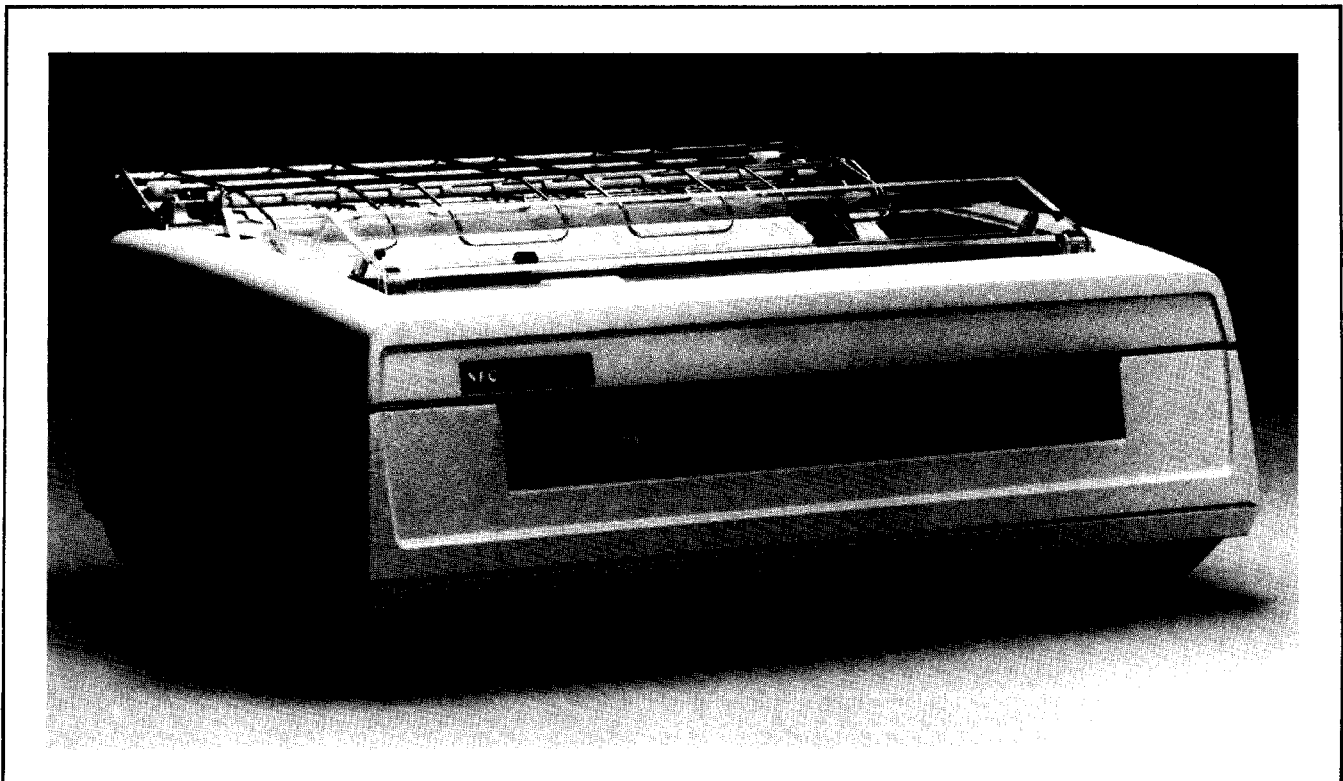
115 volts, 50/60 Hz, 350 watts

#### **Dimensions**

23" x 16½" x 8"

#### **NEC Printer**

NEC 5530-2 with forms tractor  
CABLE-PAR (Parallel interface cable)



# Cost Effective Business Printer From North Star

NORTH STAR is now offering the Anadex Model DP-8000 Alpha-numeric Line Printer: a cost effective impact printer for use with the HORIZON. The DP-8000 has features of printers costing much more without sacrificing quality or reliability. With a printing speed of 112 characters per second, the DP-8000 is capable of 84 lines per minute while printing in a bi-directional mode. The printer has an RS-232 interface, a parallel interface and a current loop interface. These features allow the printer to be connected using the HORIZON's parallel output port or one of the serial I/O ports.

Other features include:

- Sprocket Feed
- 9 x 7 Character Font
- 1000 characters of FIFO Storage
- Programmable Form Length
- Double Width Printing
- Print Head Life in excess of 100 million characters

The Anadex DP-8000 has provisions for paper feeding using either ASCII Line-Feed, Form Feed, Vertical Tab or the FEED pushbutton located on the printer front panel. The out-of-paper detector holds the printer off-line, advances the remaining paper and maintains the paper feeding mechanism so that the paper supply may be replenished.

The ANADEX printer is supported by Release 5.1 of the DOS through the parallel output port and a parallel interface cable (CABLE-PAR).

The Anadex 90-day limited warranty is honored at the Anadex factory in Southern California and at regional repair centers around the world.

#### Power

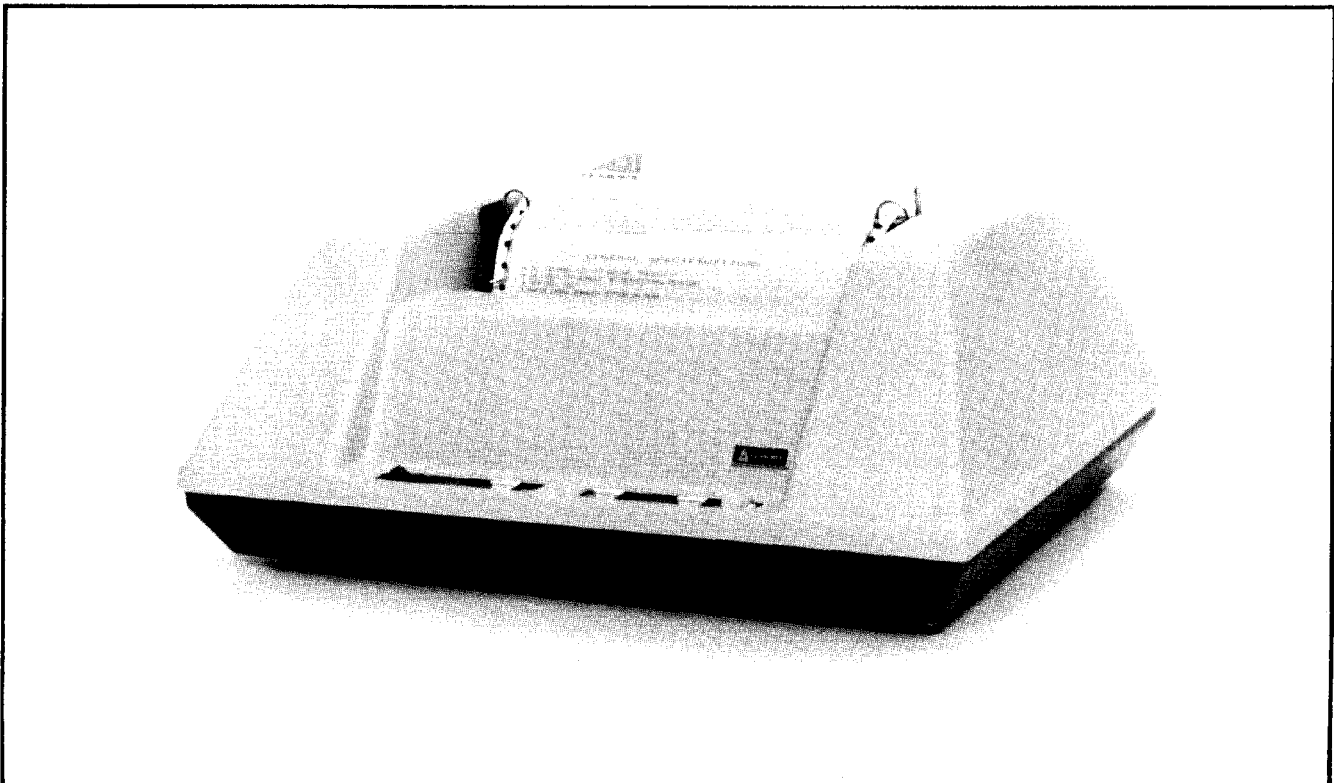
115V AC, 60 Hz, 120 watts  
230V AC, 50 Hz, 120 watts (ANADEX-F)

#### Dimensions

18.5" x 15" x 7"

#### Anadex Matrix Printer

ANADEX  
ANADEX-F (230V 50 Hz)  
CABLE-PAR (Parallel interface cable)



# Short Form Catalog and Price List

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

<b>Horizon Computer Configurations</b>		<b>Assembled</b>	<b>Kit</b>
HRZ-1-32K-D	The HRZ-1-32K-D includes chassis, motherboard with twelve S-100 connectors, two serial and one parallel input/output interfaces, cooling fan, power supply, Z80A processor board (ZPB-A), complete single drive double density MICRO-DISK SYSTEM (MDS), 32K RAM board with parity (RAM-32-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 additional RAM and/or FPB boards.	\$2315	\$1999
HRZ-1-48K-D	Same as HRZ-1-32K-D except that one 16K RAM board is added.	2775	**
HRZ-1-64K-D	Same as HRZ-1-32K-D except that one 32K RAM board is added.*	2975	**
HRZ-2-32K-D	Same as HRZ-1-32K-D except that one drive is added.	2765	2399
HRZ-2-48K-D	Same as HRZ-1-32K-D except that one 16K RAM board and one drive are added.	3225	**
HRZ-2-64K-D	Same as HRZ-1-32K-D except that one 32K RAM board and one drive are added.*	3425	**
HRZ-1-32K-Q	Same as HRZ-1-32K-D except that a quad capacity drive is supplied in place of a double density drive.	2565	2199
HRZ-1-48K-Q	Same as HRZ-1-32K-Q except that one 16K RAM board is added.	3025	**
HRZ-1-64K-Q	Same as HRZ-1-32K-Q except that one 32K RAM board is added.*	3225	**
HRZ-2-32K-Q	Same as HRZ-2-32K-D except that quad capacity drives are supplied in place of double density drives.	3215	2799
HRZ-2-48K-Q	Same as HRZ-2-32K-Q except that one 16K RAM board is added.	3675	**
HRZ-2-64K-Q	Same as HRZ-2-32K-Q except that one 32K RAM board is added.*	3875	**
*Note that in 64K HORIZON configurations 8K of address space is reserved for the bootstrap PROM and memory-mapped I/O.			
**Note that kit versions of HORIZONS with greater than 32K of RAM and/or one drive may be configured by ordering a standard HORIZON kit and additional drive and/or RAM boards as required.			

<b>Horizon Options</b>		<b>Assembled</b>	<b>Kit</b>
HRZ-DRV-D	The additional drive plus necessary parts to add a double density disk drive to a single drive HORIZON. Includes double density drive, cabling and connector.	***	\$400
HRZ-DRV-Q	The additional drive plus necessary parts to add a quad capacity disk drive to a single drive HORIZON. Includes quad capacity drive, cabling and connector.	***	600
HRZ-UPS	Universal power supply option. For use of HORIZON computer with 230 volts and/or 50 cycles as well as with American standard service.	59	39
***Assembled additional drives are specified at time of original order by specifying one of the HRZ-2 products and/or ADC products.			

<b>Options for Horizon and Other S-100 Computers</b>		<b>Assembled</b>	<b>Kit</b>
RAM-32-A	32K byte dynamic RAM board. Includes printed circuit board, all parts and documentation. Also includes parity checking and bank switching.	\$659	\$599
RAM-16-A	16K byte dynamic RAM board. Includes printed circuit board, all parts and documentation. Also includes parity checking and bank switching.	459	399
ZPB-A	Z80A processor board. Includes printed circuit board, all parts and documentation.	259	199
ZPB-PROM	1K byte erasable PROM option which mounts on ZPB-A board. Includes one 2708 EPROM plus additional support parts. May be ordered assembled only in conjunction with an assembled ZPB-A or assembled Horizon order.	69	49
FPB-A	Hardware floating point board. Includes printed circuit board, all parts and documentation.	359	259
MDS-A-D	MICRO-DISK SYSTEM. Includes double-density controller board, one double density mini disk drive, power regulation, cables, DOS, Monitor and extended BASIC software on diskette, and documentation. If ordered assembled, be sure to specify if ADC or MDS-CAP-PS options are desired.	799	699
MDS-A-Q	MICRO-DISK SYSTEM. Includes double-density controller board, one quad capacity mini disk drive, power regulation, cables, DOS, Monitor and extended BASIC software on diskette, and documentation. If ordered assembled, be sure to specify if ADC or MDS-CAP-PS options are desired.	999	899
MDS-DRV-D	Double density second, third or fourth drive for MDS-A system. Compatible with double density MDS systems as well as earlier single density systems. Includes power regulation, and connector for adding to existing cable.	450	400



MDS-DRV-Q	Quad capacity second, third or fourth drive for MDS-A systems. Compatible with double density MDS systems. Includes power regulation and connector for adding to existing cable.	650	600
MDS-CAB-PS	Cabinet for a single disk drive for MDS-A or MDS-DRV. Includes power supply, blue metal cover and base.	89	79
ADC-0	Additional drive cabinet to house one or two mini disk drives. Includes a cable and power supply capable of driving both drives in this cabinet. Specify choice of wood or blue metal cover.	N/A	129
ADC-1-D	Same as ADC-0 with one double density disk drive included.	579	****
ADC-2-D	Same as ADC-0 with two double density disk drives included.	999	****
ADC-1-Q	Same as ADC-0 with one quad capacity disk drive included.	779	****
ADC-2-Q	Same as ADC-0 with two quad capacity disk drives included.	1429	****
DISKETTE-20-D	Package of 20 blank diskettes compatible with single and double density HORIZON and MICRO-DISK SYSTEM. Includes diskettes and protective envelopes.	90	N/A
DISKETTE-20-Q	Package of 20 double-sided blank diskettes for use on quad capacity drives. Includes diskettes and protective envelopes.	135	N/A

\*\*\*\* For kit ADC systems, order ADC-0-KIT and the appropriate MDS-DRV and/or MDS-A kits.

#### Terminals – Display & Printer

		Price
SOROC-120	24 line by 80 character CRT Display Terminal for use with HORIZON. Fully assembled.	\$ 995
SOROC-120F	Same as SOROC-120 except for non U.S. standard service. Specify 50 or 60 Hz operation and 115 V or 230V operation at time of order. Fully assembled.	1025
ANADEx	118 character per second dot matrix serial line printer, for use with HORIZON. Included are RS-232, parallel and current loop interface. Fully assembled. Requires CABLE-232 to connect to serial I/O port or CABLE-PAR to connect to parallel I/O port.	995
ANADEx-F	Same as Anadex except for non U.S. standard service (50 Hz 220V operation). Fully assembled.	1025
NEC-5530-2	55 character per second, 132 column, letter quality printer with form feed tractor, for use with HORIZON. Requires a CABLE-PAR to connect to the HORIZON. Includes NEC-THI-301 (Courier 72/Manifold) thimble and one NEC-CAR (Carbon Ribbon). Fully assembled.	2915
CABLE-232	Cable for connecting an RS-232 device to the HORIZON computer. Includes 5-foot ribbon cable terminated with two 25-pin male RS-232 connectors.	25
CABLE-PAR	Cable for connecting either the Anadex or the NEC-5530-2 printer to the parallel interface of the HORIZON computer. Includes 8-foot cable terminated by one 15-pin and one 36-pin connector.	\$49

#### Printer Support Products

		Price
NEC-FAB-12	Black fabric ribbons for use with the NEC-5530-2 Spinwriter. Package of 12.	65
NEC-CAR-12	Black carbon multi-strike ribbons for letterpress quality printing on the NEC-5530-2 Spinwriter. Package of 12.	65
NEC-THI-301	NEC Spinwriter thimble with Courier 72 and Manifold character sets.	15
ANA-P-RIB-12	Purple fabric ribbon with special inking for Anadex dot matrix printer. Package of 12.	30
ANA-B-RIB-12	Black fabric ribbon with special inking for Anadex dot matrix printer. Package of 12.	30

#### Documentation

		Price
SOFT-DOC	Complete software documentation for North Star BASIC, DOS and Monitor.	\$10
PAS-DOC	Complete Pascal software documentation.	20
HRZ-DOC	Complete HORIZON documentation pack, including all hardware and software manuals.	20
MDS-DOC	Complete double density MICRO-DISK SYSTEM documentation pack including hardware and software manuals.	15
RAM-16-DOC	Complete RAM-16-A documentation.	5
RAM-32-DOC	Complete RAM-32-A documentation.	5
ZPB-DOC	Complete ZPB-A documentation.	5
FPB-DOC	Complete FPB-A documentation.	5

<b>Software</b>		<b>Price</b>
PAS-PRI-DQ	North Star Pascal on diskette. Includes the complete software documentation manual (PAS-DOC). For double density or quad capacity. Licensed for use with HORIZON or MDS only.	\$49
PAS-AUX-DQ	An auxiliary package to the PAS-PRI. Includes an 8080/Z80 assembler and other utilities. Requires PAS-PRI for operation. For double density or quad capacity. Licensed for use with HORIZON or MDS only.	29
MDS-PERS-DQ	Standard versions of the DOS, Monitor and BASIC on diskette which have been I/O configured for commonly available S-100 microcomputer systems. Ask your dealer for a list of currently available versions. For double density or quad capacity. Licensed for use with HORIZON or MDS only.	10
SOFT-SPEC-DQ	Special orders may be made for specifying non-standard precision (8, 10, 12 & 14 digits) for versions of BASIC, and for specifying non-standard origins for the disk controller PROM, DOS and BASIC. All such orders must be made on a "Special Order Form" which may be requested from your dealer. Special orders placed any other way will not be accepted. For double density or quad capacity. Licensed for use with HORIZON and MDS only.	25
NSSE DISKS	Collection of programs in the public domain, submitted by North Star users to the North Star Software Exchange. For an up-to-date listing of available diskettes, refer to a recent North Star Newsletter.	10

# Pascal

(Continued from page 5)

## Turnkey Operation

The system may be configured to "boot up" into a specific applications program. Thus, entire turnkey systems for business and industry may be written in Pascal. The end user needs only to interact with the applications system.

## System Requirements

When used for program development, the North Star Pascal system requires at least 48K of RAM memory and at least one double-density or quad capacity drive. The processor may be a Z80, 8080, or 8085. In turnkey mode, the system can run with as little as 24K of memory, depending upon the size and data-storage requirements of the user's turnkey applications package. The user may configure the North Star Pascal system to expect system RAM beginning either at 0000H or 2000H.

## Configurations

Pascal system software is available in two packages. The primary package (PAS-PRI) includes the North Star Pascal operating system, text editor, compiler, linker, P-machine simulator, bootstrap loader, and a utility package which permits the user to configure the system for different console terminals. Documentation includes the standard North Star Pascal System Reference Manual, and an Addendum which details the steps necessary to interface the system to any I/O configuration.

The Pascal auxiliary package (PAS-AUX) includes both Z80 and 8080 assemblers, and numerous utility programs. The assemblers may be used to prepare machine-code procedures and functions which may be linked into compiled Pascal programs.

## Pascal

PAS-PRI-DQ Primary Pascal system — double-density or quad-capacity

PAS-AUX-DQ Auxiliary Pascal system — double-density or quad-capacity

# Product Support

North Star supports its products and customers in several ways.

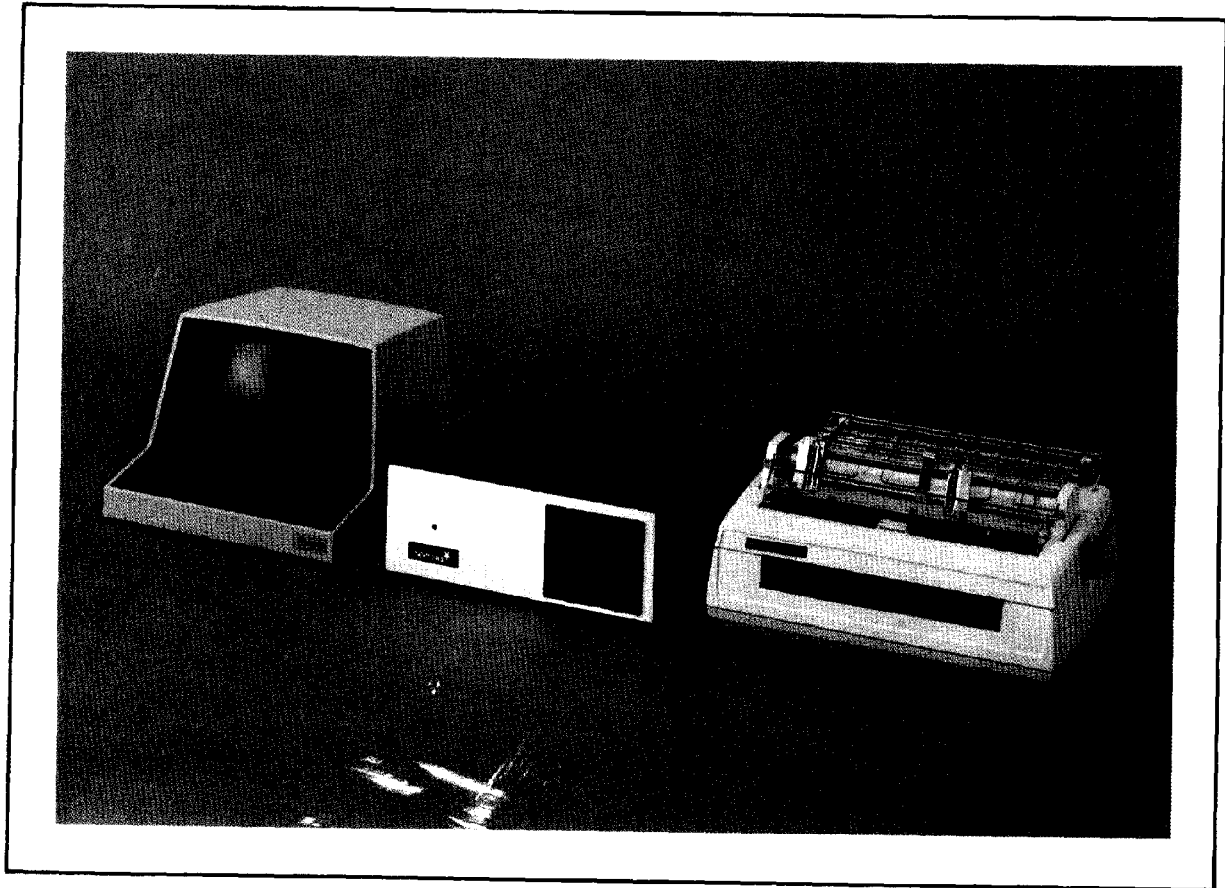
**(1) Warranty.** North Star offers a 90-day factory limited warranty on all products. The details of the warranty for each specific product is included in the documentation supplied with that product. For printer and terminal products, the warranty is honored at the original manufacturer's service facilities.

**(2) Technical Assistance.** Customer service engineers are available for consultation using our telephone "hot line" for problems which cannot be resolved by the local dealer. The hot line number for technical information is 415-549-0906 and is answered from 10 to 4 Pacific Standard Time. These lines are reserved for technical questions about North Star Hardware and Software.

**(3) Customer Newsletter.** North Star publishes a customer Newsletter and sends it to all customers who fill out the registration card included with each product. The Newsletter includes information on software available from independent vendors as well as North Star. Articles of technical interest about North Star products are included, as well as some general information articles.

**(4) Software Updates.** North Star is continually upgrading and improving its Software products. New releases of software (including single density) are made available to all customers who wish to take advantage of the improvement for a nominal charge. New Software releases are announced in the North Star Customer Newsletter and are available from your local dealer.

**(5) Hardware Updates.** North Star has a general policy of supporting its existing customers. When a new product obsoletes an earlier product, we try to make upgrading convenient. For a complete list of currently available upgrade products, contact your local dealer.



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Bulk Rate  
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★ NORTH STAR COMPUTERS, INC.



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February, 1977

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 distributed with the product. Our current price schedule is as follows:

MICRO-DISK SYSTEM (MDS-A-KIT)	\$699
MICRO-DISK SYSTEM (MDS-A-ASM)	\$799
ADDITIONAL DRIVE (MDS-DRIVE-KIT)	\$425
ADDITIONAL DRIVE (MDS-DRIVE-ASM)	\$450
SINGLE-DRIVE CABINET (MDS-CAB)	\$ 39
SINGLE-DRIVE POWER SUPPLY (MDS-PS)	\$ 39
ADDITIONAL DISKETTE (MDS-DISKETTE)	\$4.50
MDS SPECIAL VERSION* (MDS-SPEC)	\$ 25
MDS DOCUMENTATION PACK (MDS-A-DOC)	\$ 10
MODEL A FLOATING POINT BOARD (FPB-A-KIT)	\$359
MODEL A FLOATING POINT BOARD (FPB-A-ASM)	\$499
MODEL A FPB DOCUMENTATION PACK (FPB-A-DOC)	\$ 10
MODEL B FLOATING POINT BOARD (FPB-B-KIT)	\$359
MODEL B FLOATING POINT BOARD (FPB-B-ASM)	\$499
MODEL B FPB DOCUMENTATION PACK (FPB-B-DOC)	\$ 10

North Star products include a limited warranty of 90 days for kits and 180 days for assembled units. U.S. Shipping (within contiguous 48 states) is included with fully prepaid orders. To place orders, please send check or money order for full amount. Uncertified checks require up to 6 weeks processing. BankAmericard and Master Charge orders are also accepted. California residents please add sales tax. Prices are subject to change without notice.

Delivery is stock to 60 days.

\*To place an order for a non-standard version of the MICRO-DISK SYSTEM, first request the "MDS SPECIAL ORDER BLANK."

### 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 may not involve BASIC. North Star Extended BASIC will operate on both 8080 and Z-80 computer systems. Three versions of BASIC are currently available in conjunction with the hardware floating point board and/or MICRO-DISK SYSTEM: Version 5-FPB, Version 6, and Version 6-FPB. North Star Extended BASIC is not available as a separate product, but is only sold with North Star hardware products. Object code only is supplied.

Version 5-FPB is an extended version of BASIC which includes the following extended features:

- Strings (no limit on string length)
- String operators (concatenation, relationals, and substrings)
- Multiple dimensioned arrays
- Multiple-lined function definitions with multiple arguments
- Formatted output facility
- Machine language CALL and memory read and write
- Logical operators (AND, OR and NOT)
- IF-THEN-ELSE and ON-GOTO statements
- Program RENUMBER capability

BASIC commands:

RUN	LIST	SCR	REN
CONT	LINE	NULL	CLEAR

BASIC statements:

LET	GOTO	PRINT	DEF
FOR	NEXT	INPUT	EXIT
STOP	REM	READ	DATA
RESTORE	GOSUB	RETURN	FILL
DEFFN	ENDFN	OUT	END
IF	ON		

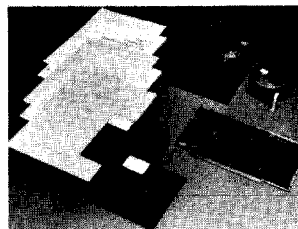
Built-in functions:

ABS	SGN	SIN	COS
RND	SQRT	LOG	EXP
FREE	INT	LEN	VAL
STR\$	ASC	CALL	EXAM
IN	CHR\$		

Version 5-FPB is supplied on paper tape with the hardware floating point board. It can be executed from an 8K read-only-memory. The origin is set at 2000 hex, and the precision is set at 8 digits.

Version 6 includes all the features of Version 5. Additionally, it includes commands to save and load programs using the North Star MICRO-DISK SYSTEM. Version 6 also includes the ability for BASIC programs to perform both sequential and random-access disk file processing. Both strings and numeric values may be stored in BASIC data files. A convenient line editor for modifying BASIC programs is also included. Version 6-FPB is the same as Version 6 except that it requires the FPB to operate. Version 6-FPB will execute up to 10 times faster than Version 6, depending on the amount of floating point computation in a program. Version 6 and Version 6-FPB require less than 10K of RAM to execute. If an FPB is ordered for use with a MICRO-DISK SYSTEM, then specify that Version 6-FPB on diskette is desired rather than Version 5-FPB on paper tape. Version 6 and Version 6-FPB have their origin at 2A00 and do arithmetic with 8-digit precision in the standard versions. Non-standard origins and precisions (up to 14 digits) may be ordered as added options (MDS-SPEC).

### NORTH STAR MICRO-DISK SYSTEM



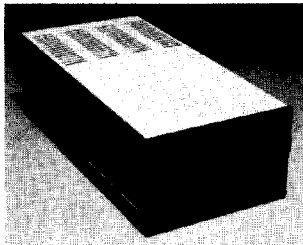
The North Star MICRO-DISK SYSTEM is a complete floppy disk system for 8080 and Z-80 computer systems which follow the S-100 (ALTAIR, IMSAI, etc.) buss conventions. For a complete, disk-oriented computer system which can execute BASIC, all

that is needed is the computer, 16K bytes of memory (RAM), an I/O terminal and the North Star MICRO-DISK SYSTEM. Just turn on the power and begin executing our Version 6 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 has been established as the leader in floppy disk drive manufacturing by delivering over 60,000 floppies. The minifloppy is a compact, economical version of their standard drive. Hard sectored for 256 byte records, each 5" diameter 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 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 interfaces the disk drive to the computer system. The control-

ler is a single PC board that plugs directly into the S-100 buss. Commands and data are transferred from software 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 data block read from disk. The controller automatically turns the drives on and off to minimize head and diskette wear. The controller is made from Schottky and low-power Schottky small and medium scale integrated circuits and includes its own crystal controlled clock. Sockets are supplied for all integrated circuits.



**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 Disk Operating System (DOS) from drive #1 into memory and then branches to the loaded DOS. Much of the low-level

software for the DOS is 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 versions with different origins are available as an extra cost option (MDS-SPEC).

**Disk Operating System:** The North Star Disk Operating System (DOS) is supplied on diskette. The DOS provides access to disk files either through *COMMANDS* typed from the computer terminal, or through *SUBROUTINES* called by software. The operations provided implement a named file system (i.e., all files on the disk(s) can be referenced by 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
CF	copy file to file	GO	load and execute
IN	initial 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		

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 a permanent part of the DOS. The North Star DOS resides in 2.5K of memory, and has its origin at 2000 hex in the standard version. Non-standard origins of the DOS may be ordered as an extra cost option (MDS-SPEC).

**Extended Disk BASIC:** North Star Extended Disk BASIC is an integral part of the MICRO-DISK SYSTEM, and is supplied on diskette. See the description above for Version 6 BASIC. Commands exist to load and save BASIC programs from disk, and BASIC programs can process disk files in either sequential or random order.

**Power:** The power requirement for the controller board is .7 amps at 5V. The power requirements of a single drive are as follows:

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. 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, and POLY88. Alternatively, the North Star MICRO-DISK Power Supply (MDS-PS) is available as an added option. The MDS-PS uses standard 115VAC power. One MDS-PS will provide power for 1 drive.

**Mounting:** For the controller, a single slot on the computer backplane is required. The drive itself measures 5.75" by 3.25" by 8" and may be mounted inside the computer system, if sufficient room exists. 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.

**Included in the MICRO-DISK SYSTEM (MDS-A-KIT and MDS-A-ASM):**

- The North Star Controller
- The SA-400 drive (assembled and tested)
- Power regulation PC card with components
- Cabling and connectors
- Two diskettes (one pre-loaded with DOS and BASIC software)
- Complete hardware and software documentation

**Included in the ADDITIONAL DRIVE (MDS-DRIVE-KIT and MDS-DRIVE-ASM):**

- The SA-400 drive (assembled and tested)
- Power regulation PC card with components
- Additional cable connector

#### HARDWARE FLOATING POINT BOARD



The North Star FPB floating point unit is a single PC board which performs decimal floating point add, subtract, multiply and divide with up to 14 digits of precision. The Model-A FPB plugs into the S-100 (ALTAIR, IMSAI, etc.)

buss, and the Model-B FPB plugs into the Intel SBC and MDS busses. 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.

The FPB floating point unit is implemented using Schottky and low-power Schottky small and medium scale TTL integrated circuits. Sockets are provided for all integrated circuits. The FPB implements a high speed microprocessor specially designed to perform fast floating point operations. The FPB microprocessor waits for a command from the 8080 or Z-80 program to start a floating point calculation. The command indicates the operation desired, and the precision. Then the FPB microprocessor 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 computer and the FPB permits values to be passed at the rate of 6 microseconds per byte using an 8080A, and proportionately faster if a higher speed computer is used.

The FPB is delivered with a version of North Star BASIC. See above for details.

The power requirements for the FPB are as follows:

Model-A: 8V (unregulated) at 1.7A  
Model B: 5V (regulated) at 1.7A

### 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.

## ★ NORTH STAR COMPUTERS, INC.

2465 FOURTH STREET, BERKELEY, CA 94710

TEL: 415-549-0858

### PRICE REDUCTIONS!!

	<u>OLD</u>	<u>NEW</u>
MDS-DRV-KIT	\$425	\$400
FPB-A-KIT	359	259
FPB-B-KIT	359	299
FPB-A-ASM	499	359
FPB-B-ASM	499	399





NORTH STAR ★ COMPUTERS  
**PRODUCT CATALOG**

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**NORTH STAR ★ COMPUTERS**

2547 Ninth Street • Berkeley, California 94710 • (415) 549-0858

# INTRODUCTION

North Star Computers is located in Berkeley, California and was incorporated in June, 1976. The company offers the HORIZON<sup>™</sup> 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.

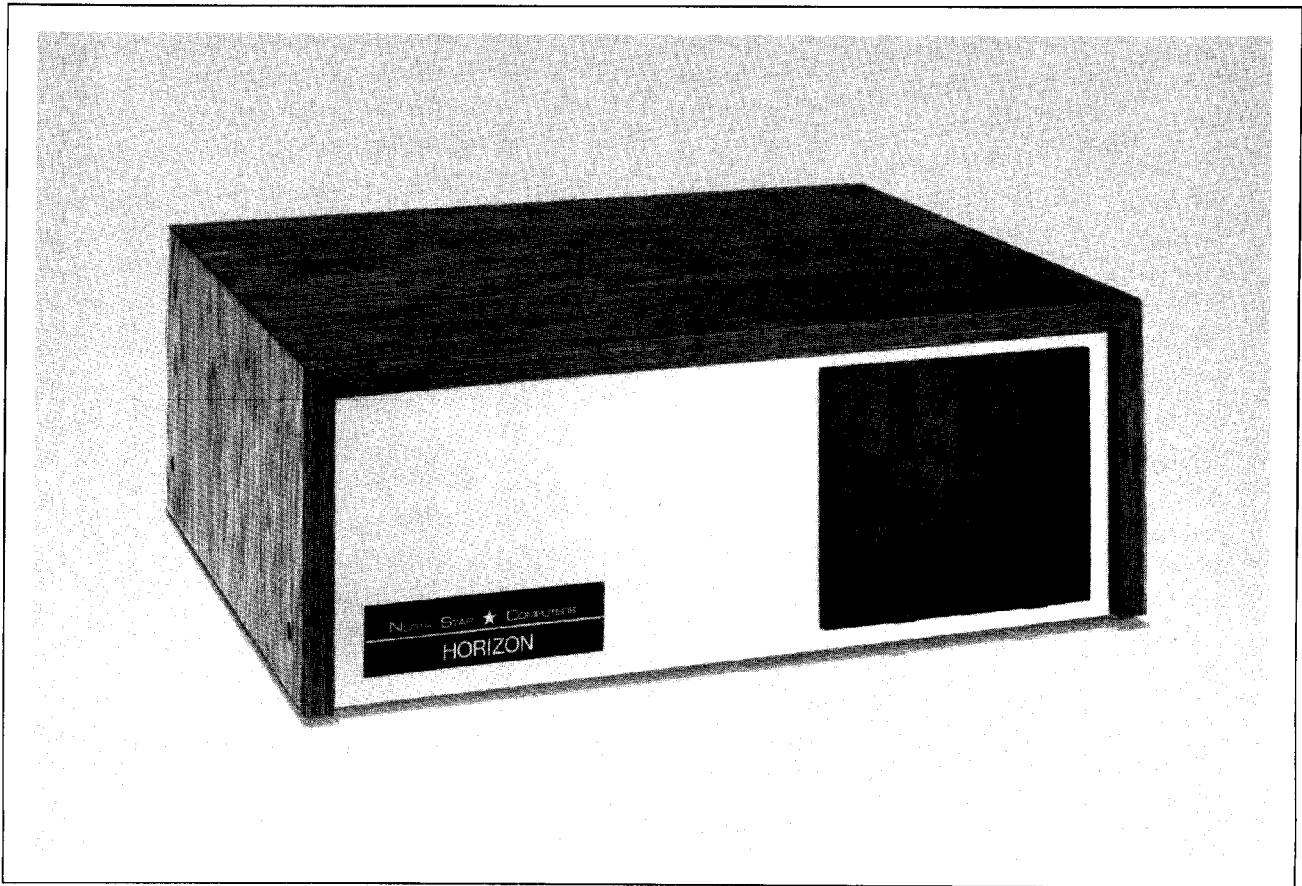
North Star intends to maintain its reputation for delivering top quality microcomputer products by continuing to use only the best components available. Only factory-prime integrated circuits and sockets are used. Printed circuit boards are made from the finest materials and have solder mask on both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

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\*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  $\pm 16$  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-dimensional 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

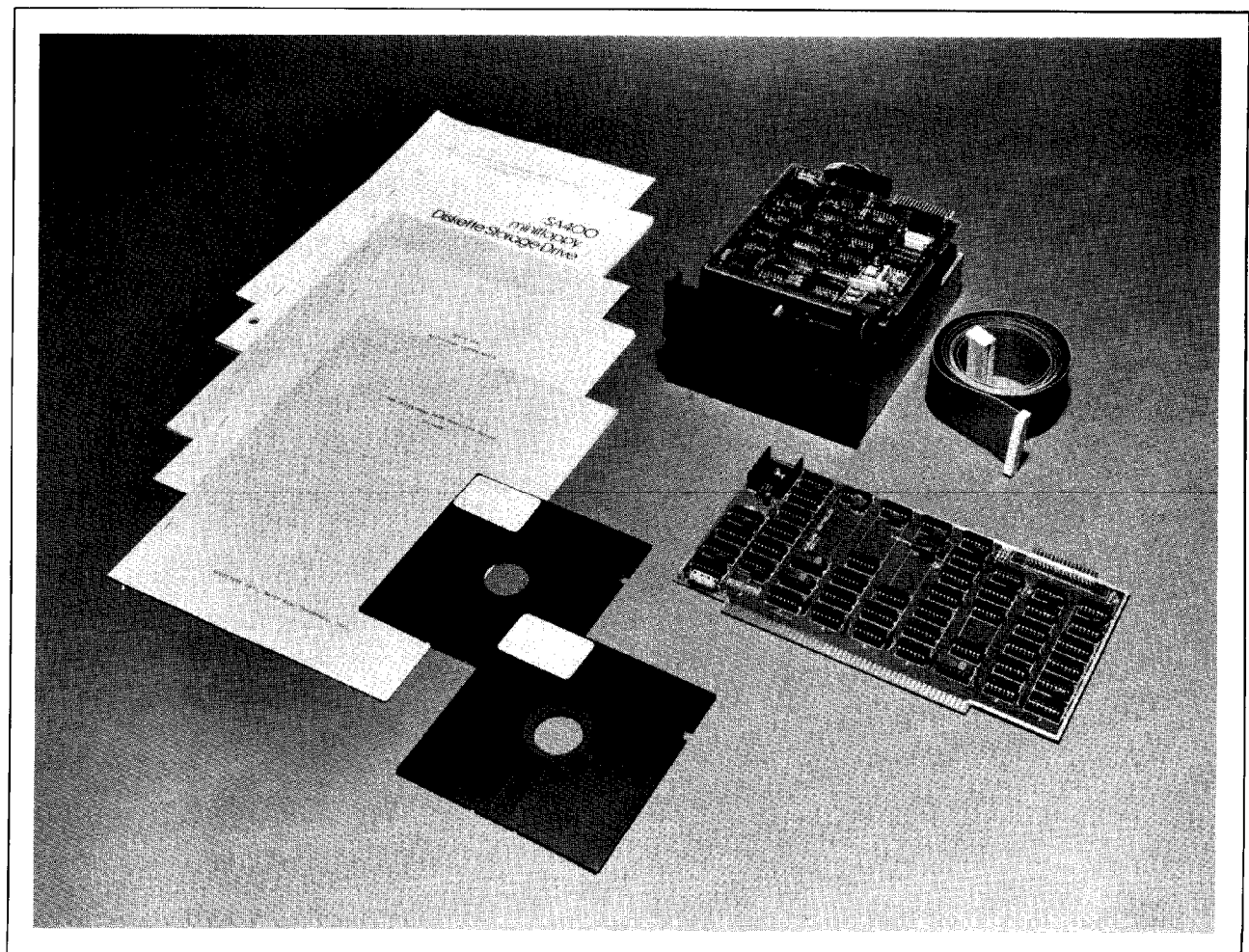
All printed output from the Monitor is formatted to fit into sixty-four character lines. The Monitor occupies 2.5K of RAM. Three copies of the Monitor are supplied, assembled at locations 0, 2A00 hex, and F400 hex.

# 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-





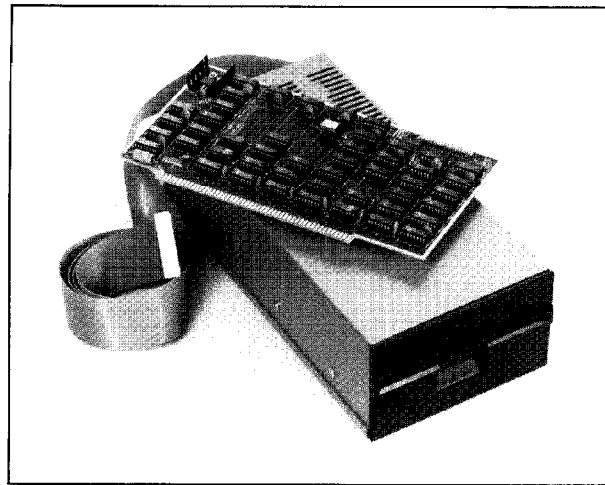
TEM. Just turn on the power and begin executing our extended disk BASIC within a few seconds.

**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

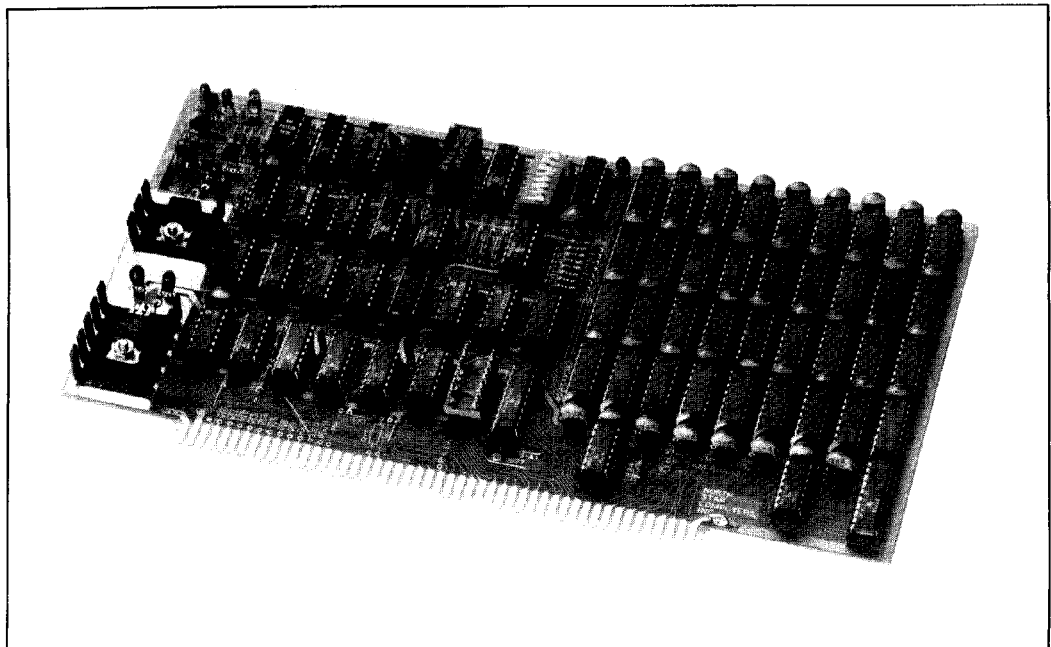
.4 amps @ +16 volts, unregulated

.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 microprocessor 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.

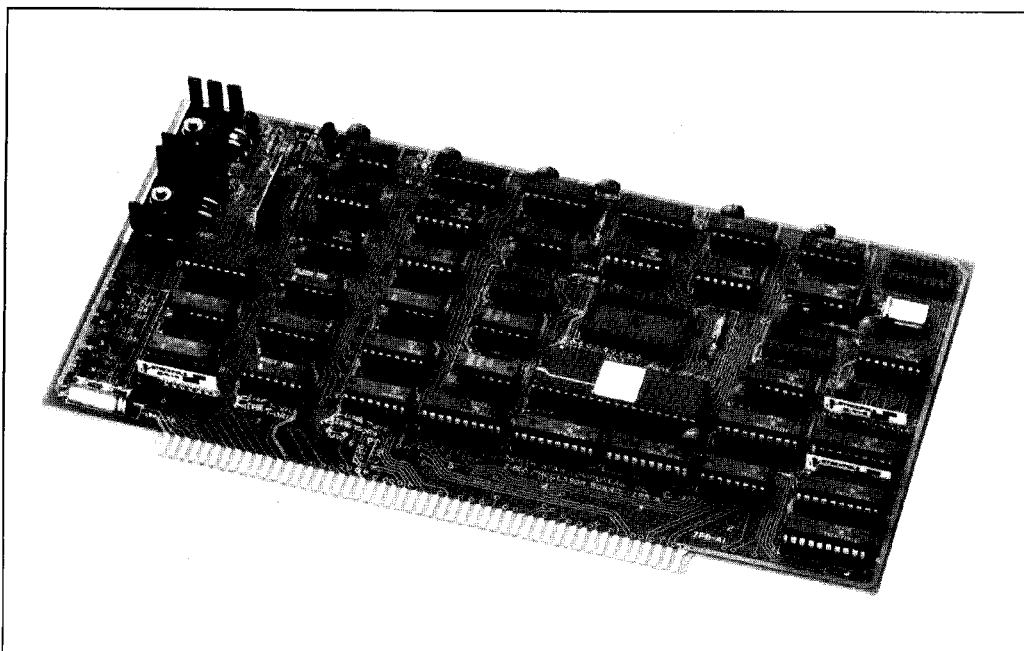
The ZPB also implements an 8-level vectored interrupt capability, and has a jumper option for adding a wait state to all memory used in the computer.

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

## **Z80A PROCESSOR BOARD**

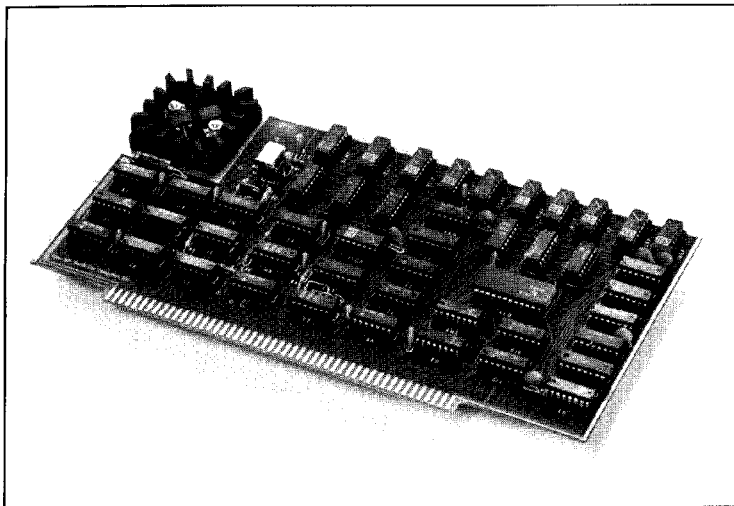
**KIT: \$199    ASSEMBLED: \$259**

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 <sup>1,2,3</sup>							
PRECISION DIGITS:	2	4	6	8	10	12	14
<b>ADD</b>							
best	1	1	1	1	1	1	1
typical	8	8	9	9	10	10	11
worst	10	10	10	11	11	12	12
<b>SUBTRACT</b>							
best	4	4	4	4	4	4	4
typical	8	8	9	9	10	10	11
worst	15	16	17	18	19	20	21
<b>MULTIPLY</b>							
best	5	5	5	5	5	5	5
typical	18	34	55	80	111	146	186
worst	51	125	228	382	527	720	933
<b>DIVIDE</b>							
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:**

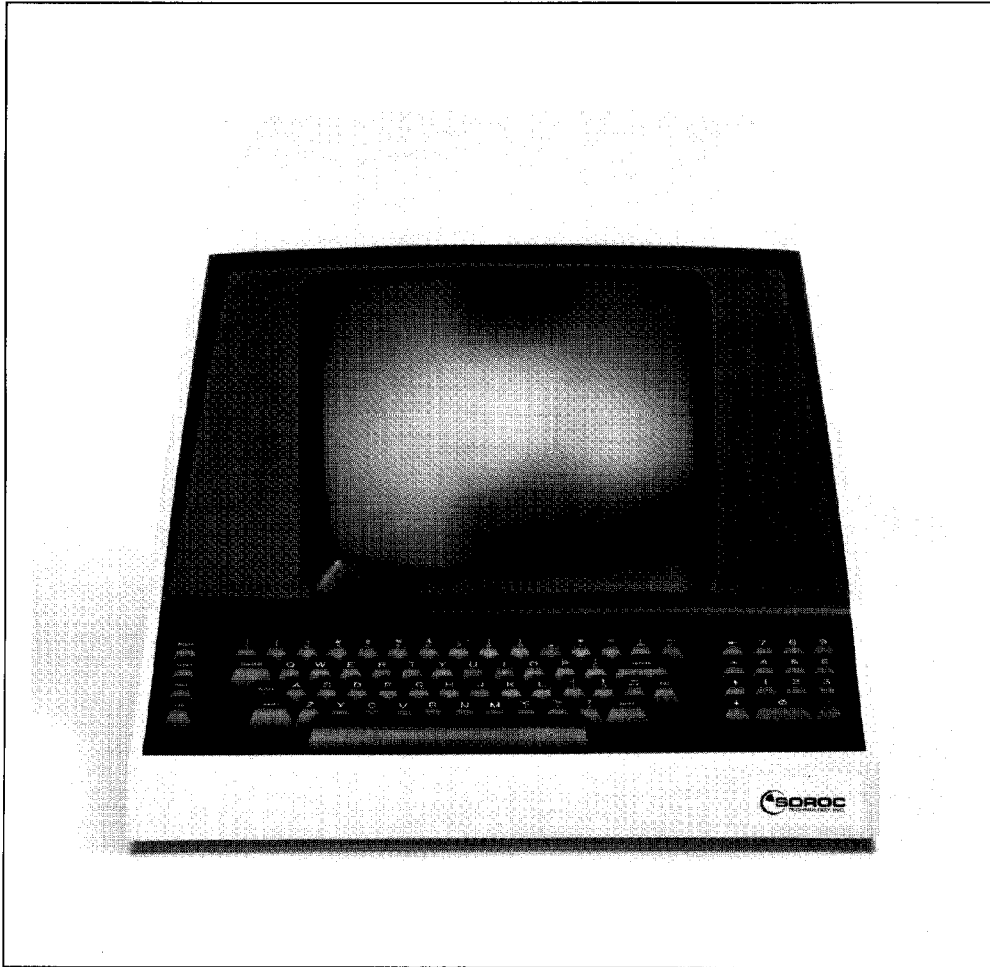
- Byte 1: bit 7 = sign (1 = negative number, 0 = positive number)  
bits 6-0 = exponent in excess 64 binary representation  
bits 7-0 = zero represents the zero value
  - Byte 2: bits 3-0 = least significant digit of value in BCD coding  
bits 7-4 = next least significant digit of value
  - Byte N: bits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

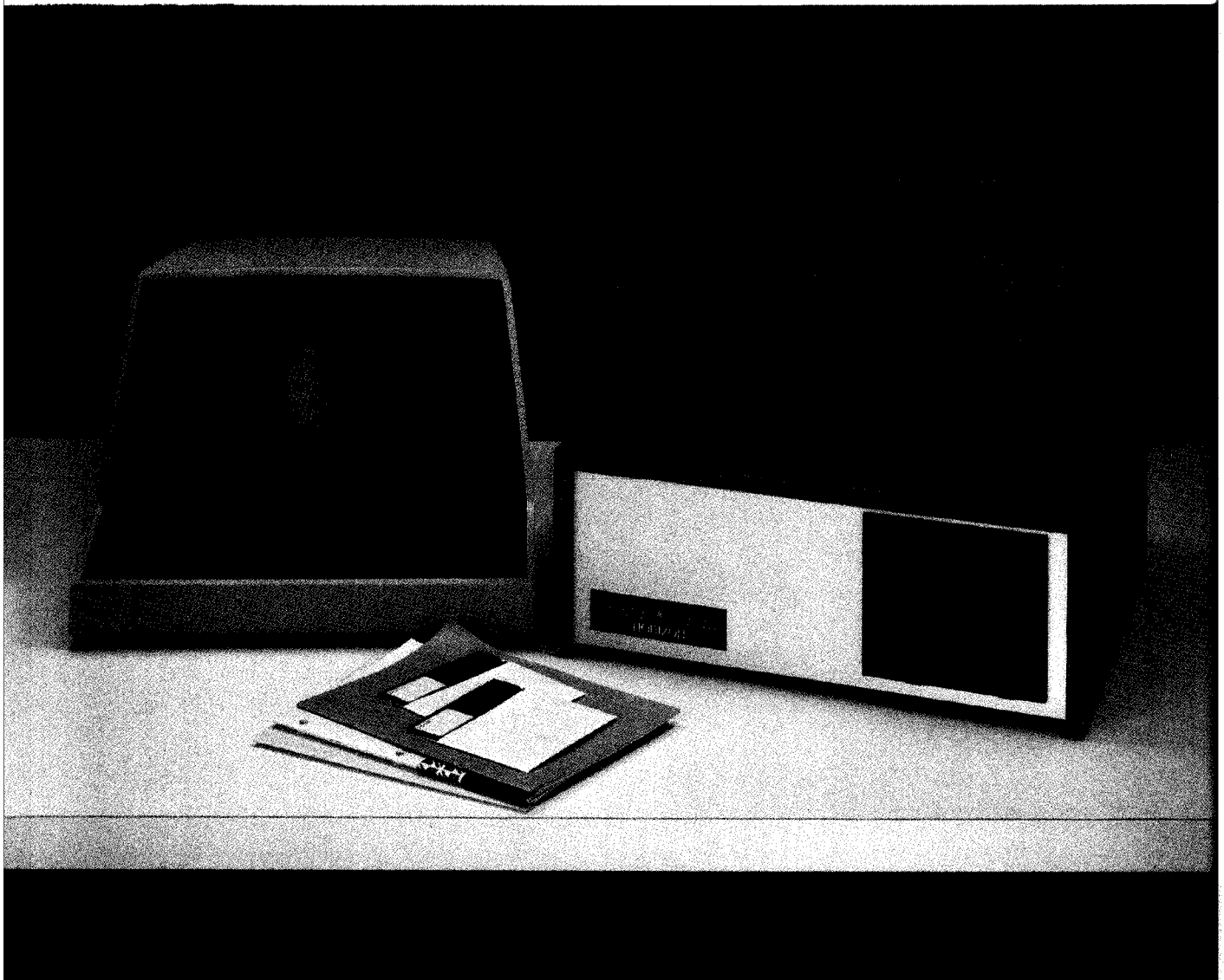
**FOR DIRECT MAIL ORDERS**, include check or money order for full amount or use VISA or Master Charge. Uncertified checks require 6 weeks processing. California residents add sales tax. Delivery is stock to 60 days.

<b>PRODUCTS FOR HORIZON OR OTHER S-100 COMPUTERS</b>		<b>KIT</b>	<b>ASSEMBLED</b>
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
<b>DOCUMENTATION</b>		<b>PRICE</b>	
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	
<b>SPECIAL SOFTWARE ORDERS</b>		<b>PRICE</b>	
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 VTI, 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.	—	

# NORTH STAR ★ COMPUTERS

2547 Ninth Street • Berkeley, California 94710

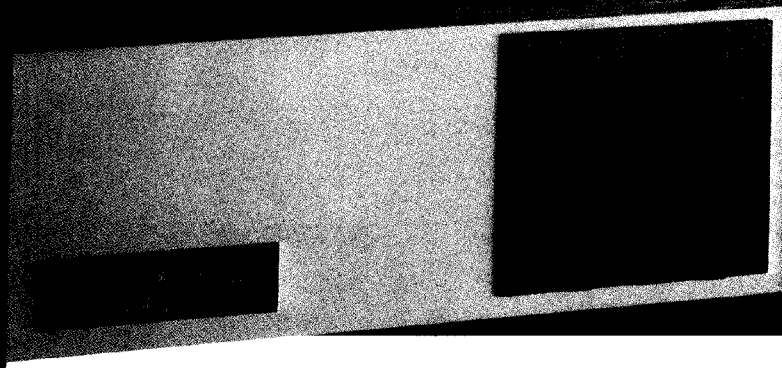
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# HORIZON

## THE COMPLETE COMPUTER



### Look To The North Star HORIZON Computer.

**HORIZON™**— a complete, high-performance microprocessor system with integrated floppy disk memory. HORIZON is attractive, professionally engineered, and ideal for business, educational and personal applications.

To begin programming in extended BASIC, merely add a CRT or hard-copy terminal. HORIZON-1 includes a Z80A processor, 16K RAM, minifloppy™ disk and 12-slot S-100 motherboard with serial terminal interface — all standard equipment.

#### WHAT ABOUT PERFORMANCE?

The Z80A processor operates at 4MHz — double the power of the 8080. And our 16K RAM board lets the Z80A *execute at full speed*. HORIZON can load or save a 10K byte disk program in less than 2 seconds. Each diskette can store 90K bytes.

#### AND SOFTWARE, TOO

HORIZON includes the North Star Disk Operating System and full extended BASIC on diskette ready at power-on. Our BASIC, now in widespread use, has everything desired in a BASIC, including sequential and random disk files, formatted output, a powerful line editor, strings, machine language CALL and more.

#### EXPAND YOUR HORIZON

Also available—Hardware floating point board (FPB); additional 16K memory boards with parity option. Add a second disk drive and you have HORIZON-2. Economical serial and parallel I/O ports may be installed on the motherboard. Many widely available S-100 bus peripheral boards can be added to HORIZON.

#### QUALITY AT THE RIGHT PRICE

HORIZON processor board, RAM, FPB and MICRO DISK SYSTEM can be bought separately for either Z80 or 8080 S-100 bus systems.

HORIZON-1 \$1599 kit; \$1899 assembled.  
HORIZON-2 \$1999 kit; \$2349 assembled.

16K RAM—\$399 kit; \$459 assembled; Parity option \$39 kit; \$59 assembled. FPB \$259 kit; \$359 assembled. Z80 board \$199 kit; \$259 assembled. Prices subject to change. HORIZON offered in choice of wood or blue metal cover at no extra charge.

Write for free color catalogue or visit your local computer store.

**NORTH STAR ★ COMPUTERS**

2465 Fourth Street • Berkeley, California 94710 • (415) 549-0858

### Z80A PROCESSOR BOARD

The North Star processor board offers the best price/performance ratio available for the S-100 bus. At the heart of this board is the powerful Z80A microcomputer chip. The Z80A is the fast 4MHZ version of the popular Z80. Using the Z80A programs execute more than twice as fast as on the 8080. Even greater speed advantages can be obtained by utilizing the extended Z80A instruction set.

**VECTORED INTERRUPTS.** For those applications which require it, the North Star Z80A board includes an 8-level vectored interrupt capability.

**FRONT PANEL OPERATION.** The processor board is fully compatible with ALTAIR and IMSAI type front panels. Operation without a front panel is also possible.

**AUTO-JUMP FEATURE.** A 16-bit address may be jumper selected for automatic program startup at power-on or reset of the computer. Possible uses are to start a floppy disk bootstrap or monitor program.

**ON BOARD PROM OPTION.** The processor board includes an option to add 1K bytes of PROM (2708 type), making it possible to permanently store programs on the board.

Kit: \$199. Assembled: \$259.

### NORTH STAR 16K RAM BOARD

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

**FAST.** The 16K RAM is designed using prime, high speed dynamic RAM chips. This means that the processor can compute at full speed (no wait states) at both 2MHZ and 4MHZ operation.

**Z80 AND 8080.** The North Star 16K RAM is designed for use with both 8080 and Z80 processors. The memory refresh is performed by on-board circuits which make refresh invisible to the processor.

**ERROR CHECKING.** Our unique parity error checking option allows the board to check itself on every operation. If an error is detected, an interrupt informs the processor immediately.

**BANK-SWITCHING.** The North Star RAM board can be turned on and off under program control. This permits expansion of the computer memory beyond 64K, and allows special applications such as time-sharing to be implemented more conveniently.

Kit: \$399. Assembled: \$459.

Parity option - Kit: \$39. Assembled: \$59.

### HARDWARE FLOATING POINT BOARD

If you do number crunching, this board is for you. The North Star FPB performs high-speed floating point add, subtract, multiply and divide. The precision is under program control and can be up to 14 digits. The FPB performs arithmetic up to 50 times faster than 8080 software. Use of the FPB can cause BASIC programs to execute up to 10 times faster. Do not confuse this product with slow calculator chip boards or integer multiply/divide boards. A version of North Star BASIC is included on paper tape or diskette (please specify).

Kit: \$259. Assembled: \$359.

### MICRO-DISK SYSTEM

There is not space here to adequately describe the North Star MICRO-DISK SYSTEM. In brief, it is a complete floppy disk system with all hardware and software needed to add floppy disk memory and a powerful disk BASIC to S-100 bus computers. Included is the S-100 bus interface board with on-board PROM for system start-up, a Shugart minifloppy disk drive, cabling and connectors, documentation, and two diskettes (one containing the powerful DOS and extended disk BASIC). Up to three drives can be controlled. Power can be taken from the computer power supply in most cases. The North Star MDS has been widely considered to be among the most complete and best designed S-100 bus computer products.

MICRO-DISK SYSTEM - Kit: \$699. Assembled: \$799.

Additional drive - Kit: \$400. Assembled: \$450.

Single-drive cabinet - \$39. Optional power supply - \$39.

### HORIZON OPTIONS

**8-BIT PARALLEL I/O INTERFACE.** This option is a chip set with connector and plug for mounting a parallel interface on the HORIZON motherboard.

Kit: \$39. Assembled: \$59.

**SECOND SERIAL I/O INTERFACE.** This option is a chip set with connector for mounting a second serial I/O interface on the HORIZON motherboard.

Kit: \$39. Assembled: \$59.

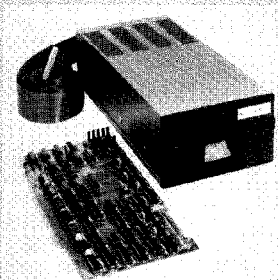
**UNIVERSAL POWER SUPPLY.** For using the HORIZON with 230 volts and/or 50 cycles in addition to American standard service, the HORIZON may be ordered with the Universal Power Supply Option.

Kit: \$39. Assembled: \$59.

## NORTH STAR COMPUTERS, INC.

2465 FOURTH STREET, BERKELEY, CA 94710

Bulk Rate  
U.S. Postage  
PAID  
Permit No. 251  
Berkeley, CA 94710



## New from North Star Double Density Performance at Single Density Prices

The new HORIZON computer and Micro Disk System now record in double density! That means each new Shugart SA-400 minifloppy disk drive accesses 180K bytes of on-line information. All double density HORIZON computers and Micro Disk Systems have a redesigned controller which allows the use of quadruple capacity disk drives as they become available in early 1979. A three-drive North Star System with quadruple capacity disk drives will access over a megabyte of on-line information. But, best of all there's no price increase for double density models.

North Star BASIC and DOS have been upgraded to accommodate the increased capacity and yet run existing programs with little or no change. The new disk system also supports single

density, so existing single density diskettes can still be used. Single density SA-400 drives previously purchased with North Star systems can also be used.

### Pricing

HORIZON with one double density SA-400 minifloppy (180K bytes), 16K RAM, Z80A processor and serial I/O port: \$1599 kit, \$1899 assembled.

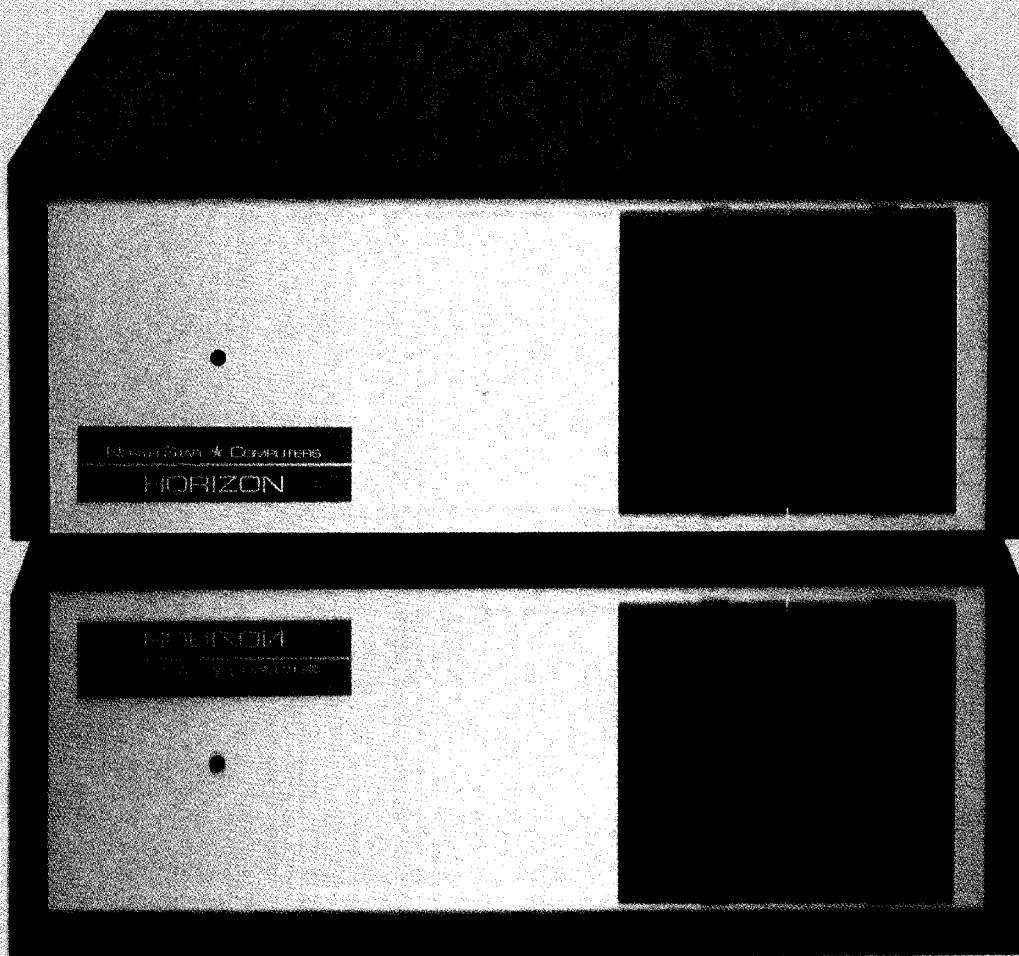
MICRO DISK SYSTEM with one double density SA-400 minifloppy, controller board and power regulation: \$699 kit, \$799 assembled. (Cabinet and power supply \$39 extra each.)

### Specifications:

S-100 compatible. MFM encoding, 35 tracks with ten 512-byte sectors per track. 179,200 bytes on double density SA-400 and North Star BASIC, DOS, and Monitor included.

For further information, write for full color catalog or contact your local computer store.

**NORTH STAR ★ COMPUTERS**  
2547 Ninth Street  
Berkeley, California 94710  
(415) 549-0858





# NorthStar

"Micro-Computer Products  
to Look Up to"

## Horizon Disk Capacity Keeps Growing

The Horizon is now capable of 720K bytes on-line! The Horizon can connect to four double density 5 1/4" single-sided disk drives. Each of those drives can access 180K bytes of information. A four drive system accesses 720K bytes!

That's capacity you don't usually find in a microcomputer, but there's even more to come! The North Star disk controller board is designed so that two-sided disk drives may be added as soon as they become available from North Star.

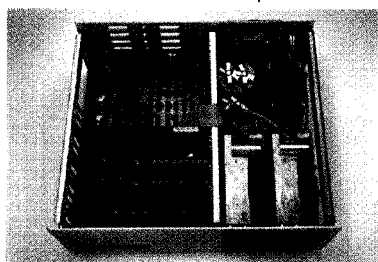
Existing Horizons will accommodate the new two-sided drives so North Star owners can simply add additional drives to up-grade their system. Each two-sided drive will access 360K bytes! That means the maximum on-line disk storage for the Horizon will increase to over 1.4 million bytes!

## New Cabinet for Disk Drives

North Star additional disk drives are now available with the same high quality wood cover as the Horizon computer! The Additional Drive Cabinet (ADC) is designed to accept either one or two drives for the Horizon or for mounting North Star Micro Disk System drives. Like the Horizon, the ADC is available with either wood or blue metal cover. Included is a new power supply capable of powering one or two drives. The ADC is \$129 in kit form. Assembled, with one drive the ADC is \$599, with two drives \$999.

## Pascal Now Available for Horizon

The much-heralded Pascal language is now being offered for use with the North Star Horizon computer. North



Inside view of Horizon with processor board, RAM board, disk controller, two drives, and power supply.

Star, with the co-operation of the University of California at San Diego, is now delivering a Pascal Program Development system. North Star Pascal is ideally suited for developing large programs because of features such as: long variable names, block-structured control statements, and compilation. North Star Pascal is available on 5 1/4" diskettes for use with the Horizon or Micro Disk System. North Star Pascal will operate with either the Z80 or 8080 microprocessor.

Pascal, including documentation, is available in either single or double density versions for \$49.

An auxiliary Pascal diskette, containing an 8080/Z80 assembler and some additional Pascal utilities, is available for \$29. Complete information is available at your local retail computer store.

## First Double Density, Now Double Memory

The new North Star 32K RAM board (RAM-32) has doubled the memory density of the popular Horizon computer. Available either with the Horizon or other S-100 bus computers, the RAM-32 runs at full speed — no wait states — with the 4 MHz Z80A microprocessor (as well as with slower Z80 and 8080 processors). Addressability of the RAM-32 is switch-selectable in four 8K regions.

North Star RAM features like bank-switching and parity checking are standard. The parity checking capability means that the RAM-32 is constantly diagnosing itself. That's a plus for your system. The fact that parity checking is a North Star RAM-32 standard is a plus for your pocketbook! There is no extra charge for this important capability.

A Horizon with 48K of RAM can be configured by using one North Star 16K RAM board and a RAM-32. Need more memory? 56K can be configured by using two RAM-32 boards with one 8K region switched off.

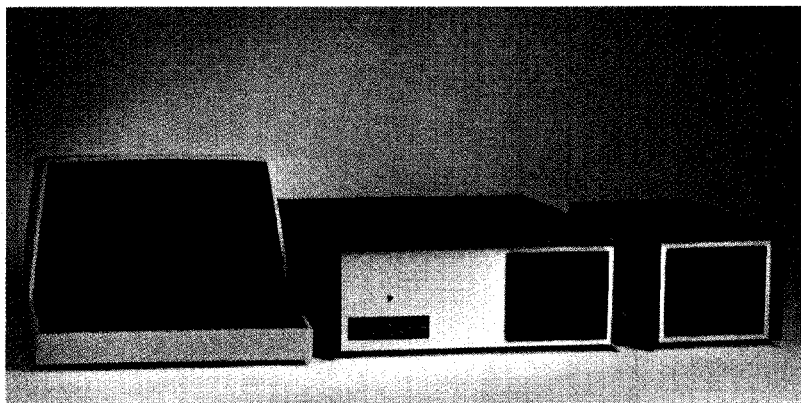
## NORTH STAR MDS, ZPB, FPB FOR OTHER S-100 COMPUTERS

Upgrade your system with these North Star products — available for any S-100 computer: Micro Disk System — a complete 5 1/4" floppy disk system, Z80 Processor Board, or the Hardware Floating Point Board.

### Horizon and RAM board prices are:

	Kit	Assembled
Horizon - 1-16K	\$1599	\$1899
Horizon - 1-32K	1849	2099
Horizon - 2-32K	2249	2549
RAM-32	599	659
RAM-16	399	459

◀ A typical Horizon configuration: CRT, Horizon computer, Additional Drive Cabinet (ADC).



**NorthStar**  
Computers

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Berkeley, California 94710  
(415) 549-0858

