

C8002
Computer
System



ONVX

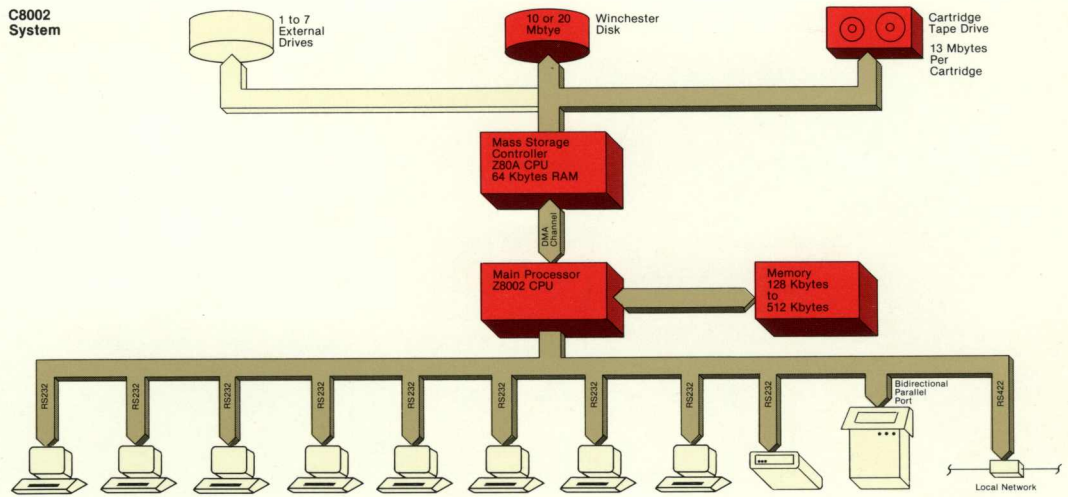
The logo features the letters 'ONVX' in a bold, black, sans-serif font. The 'O' is partially enclosed by a purple circle. The background is a complex geometric composition of red, black, purple, and white shapes, including a large red circle on the left and various angular blocks and lines.

The ONYX C8002 is a microcomputer-based system specifically designed to meet today's information processing requirements. It is a multi-user system with large storage capacity and micro-computer performance in a compact low cost package. MINI

A single C8002 fills the information processing needs of most organizations because it can simultaneously execute work processing, financial and engineering programs. WORD

The C8002 is quickly expandable without loss of software compatibility. Additional user stations and storage capacity can be added in minutes. And in larger applications, C8002s can be connected together in a network. As a result, the C8002 is a cost-effective building block for small business applications and large on-line systems.

Architecture



The C8002's advanced system architecture, integrated mass storage peripherals and unique packaging result in exceptional cost effectiveness. The entire system consists of six basic modules:

- Main Processor**
- Memory**
- Mass Storage Controller**
- Disk Drive**
- Cartridge Magnetic Tape Drive**
- Power Supply**

The ONYX C8002 represents a new standard for cost effectiveness in small business computers. The system combines a Winchester fixed disk drive, cartridge tape drive, 16 bit processor and up to 512K bytes of memory all in a single low-profile enclosure.

The C8002 supports 8 users and an assortment of printers and communications devices. Almost any standard terminal, printer or modem can be directly connected to the C8002 making it extremely easy to configure a wide variety of business systems.

An 8 inch Winchester disk provides fast, reliable and compact mass storage. High density 3M cartridge tape can back up the entire disk on single tape cartridge. The Z8002* 16 bit microprocessor, equivalent to a PDP-11/45* in throughput, is the major element in the C8002's sophisticated multiprocessor architecture. A light and efficient switching power supply drives the entire system.

The UNIX* timesharing operating system has been adapted for use on the C8002. UNIX is a highly respected, proven system that enables users to share files, subject to security constraints, and compile or execute programs written in BASIC, COBOL, FORTRAN, Pascal and C concurrently and independently. Memory is allocated and managed in 2K pages using techniques previously unavailable on microcomputers.

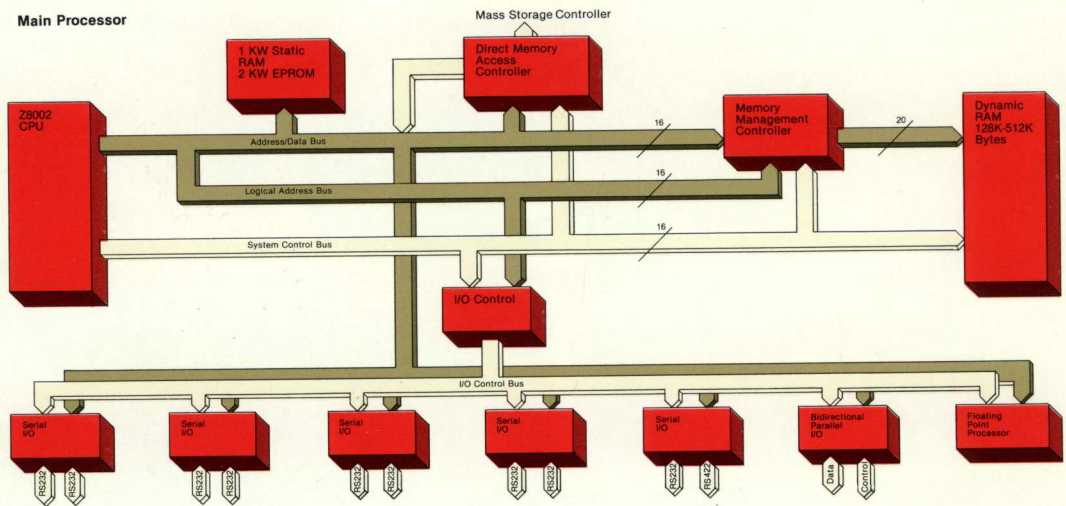
The C8002 is the newest and most powerful member of the C8000 family. At the low end is the 8 bit one or two user C8001. The C8001 can be quickly field upgraded to the C8002 when the need for more terminals or computing power arises. Disk storage capacity can be easily increased on any C8000 system by "daisy chaining" up to 7 additional disk drives to the internal controller.

When more than eight terminals are required, C8002s can be linked together in a high-speed local network. This advanced but inexpensive architecture permits the construction of very large distributed data bases accessible from many terminals.

The result is a system with an unprecedented degree of flexibility and performance at less than half the price of a comparable minicomputer system.

*Z8000 is a trademark of Zilog, Incorporated; PDP is a trademark of Digital Equipment Corporation; UNIX is a trademark of Bell Laboratories.





Main Processor

The main processor module contains the Z8000 16 bit microprocessor, direct memory access (DMA) channel, serial and parallel I/O ports, memory management controller, floating point processor and assorted support circuitry. The operating system and all user programs execute on the main processor.

Z8000 Processor: The Z8000 is Zilog's newest and most advanced microprocessor. It features 110 distinct instructions, 8 addressing modes and seven data types including BCD, string and long word (32 bits). Other features include 16 general purpose registers separate instruction and data spaces, privileged instructions and 3 interrupt modes. The Z8000 executes all but one instruction (MULTIPLY) considerably faster than a PDP-11/45.

DMA Channel: The DMA channel is primarily used to transfer data to the mass storage controller, but it can also be used for memory to memory and I/O transfers.

Serial & Parallel I/O Ports: The C8002 has 10 serial I/O ports. Eight of these ports are RS-232C (CCITT V.24) buffered and designated for CRT terminals or serial printers. Baud rates between 300 and 19.2K are software selectable for each port. The ninth serial port is a fully configured RS-232C port that supports standard synchronous modems using

bisync or SDLC protocols. The tenth port is a high speed RS-422 port capable of transmitting at 880K bits/sec. It is designed to be used as the interface to a local network. Also included is a bidirectional parallel port with 8 data lines and 8 control lines. This buffered and terminated TTL port can be programmed to interface to peripherals such as a line printer.

Memory Management Controller: The memory management controller (MMC) enables the C8002 to perform address translation, memory block protection and separation of instruction and data spaces. Sixteen independent map sets are implemented, with each map set consisting of an instruction map and data map. Within each map are 32 page registers. Each page register relocates and validates a 2K byte page. The MMC generates a 20 bit address allowing the C8002 to access up to one Mbyte of physical memory.

Floating Point Processor: The main processor board contains a hardware math processor capable of 64 bit floating or fixed point arithmetic. This processor has its own stack and can interrupt the Z8000 when its computations are complete.

Memory

The C8002 has maximum memory capacity of 512K bytes using two 256K byte modules. Each module contains 4 banks of 64K bytes using 16K dynamic RAMs. The memory is byte or word addressable and is controlled by the Z8000 bus coming from the main

processor. Each memory card contains its own refresh generator and circuitry to compute and check parity on all transfers. Also included are registers to store the address of any memory location which exhibits a parity error.

Mass Storage Controller

The mass storage controller on the C8002 greatly increases throughput by relieving the main processor of all disk and tape control functions. The controller consists of a Z80A processor, 64K bytes of parity memory, disk and tape control circuitry, and a DMA channel. One section of the controller's RAM contains all device specific formatting and error recovery routines necessary to control the tape and disk drives. The remaining memory is used as an aged (LRU) sector cache for the disk. This large cache memory decreases apparent disk access time because many commonly accessed

disk sectors reside in memory. This feature significantly increases speed especially in multiuser commercial systems where disk access time typically limits throughput.

Data blocks are rapidly moved between the main processor and mass storage controller by a special DMA transfer across an 8 bit bus.

The mass storage controller supports 7 disk drives in addition to the one contained within the C8002.

Disk Drive

The C8002 uses an integral rigid disk drive with a formatted capacity of either 10, 18 or 40 Mbytes. The drive uses "Winchester" type heads—characterized by low mass and light loading. The head is designed to take off and land on the disk surface—virtually eliminating head crashes. The 200 millimeter diameter disks, read/write heads and actuator all operate in a factory sealed contamination-free environment. Because the

drive is impervious to atmospheric contamination, its reliability is greatly enhanced.

Fast access time (35 ms average) and reliable data recovery are insured by the use of a track following servo system and linear voice coil actuator.

Cartridge Magnetic Tape Drive

Cartridge magnetic tape was chosen as the removable media for the C8000 family because it is the only device available that combines high capacity and speed in a compact unit. A single 3M data cartridge, measuring 4 x 6 x .75 inches, can store over 12 Mbytes. An entire 10 Mbyte disk can be copied to a single cartridge in less than 14 minutes.

Reliable data recovery is assured because the tape drive, in conjunction with the mass storage controller, computes CRC and performs read-after-write checks and write-with-extended-gap.

The drive can be used to backup an entire disk (binary mode) and store and retrieve named files (logical file mode). The latter mode is especially important in a multi-user environment because it enables a user to backup and restore files without affecting the other users.

Power Supply

All components of the C8002 are powered by a single 300 watt switching power supply. This supply is 80% efficient and regulates over an extremely large range of line voltage and frequency. This means the C8002 generates little heat, requires no special cooling, and performs reliably in both "brownout" and surge conditions.

The C8002 also contains a line filter and transient suppressor to minimize the effects of line noise and spikes. Orderly shutdown during a power failure is assured by a line monitor which interrupts the processor when the A.C. line voltage drops below specification.

Network

The C8002 has a provision for connection to a high speed local network. A network of C8002s can accomplish tasks too large for a single system because it allows users access to data stored on any machine in the network.

Over 100 systems can be connected at any point along a 1 Km length of inexpensive coaxial cable. Systems are connected to the cable using intelligent

taps. Data is transferred between the C8002 and the tap over a RS-422 link at 880K bits/sec. The tap buffers the data and broadcasts it over the cable at 3 Mbits/sec using a contention arbitration protocol. This protocol uses no host or master system and insures reliable performance because the failure of any system has no effect on network operation.

Reliability and Maintainability

Numerous hardware and software features on the C8002 insure reliable operation and allow quick repair. These features include:

- Extensive use of LSI components
- Comprehensive component and system burn-in
- Built-in fault isolation
- Low heat generation
- Error logging

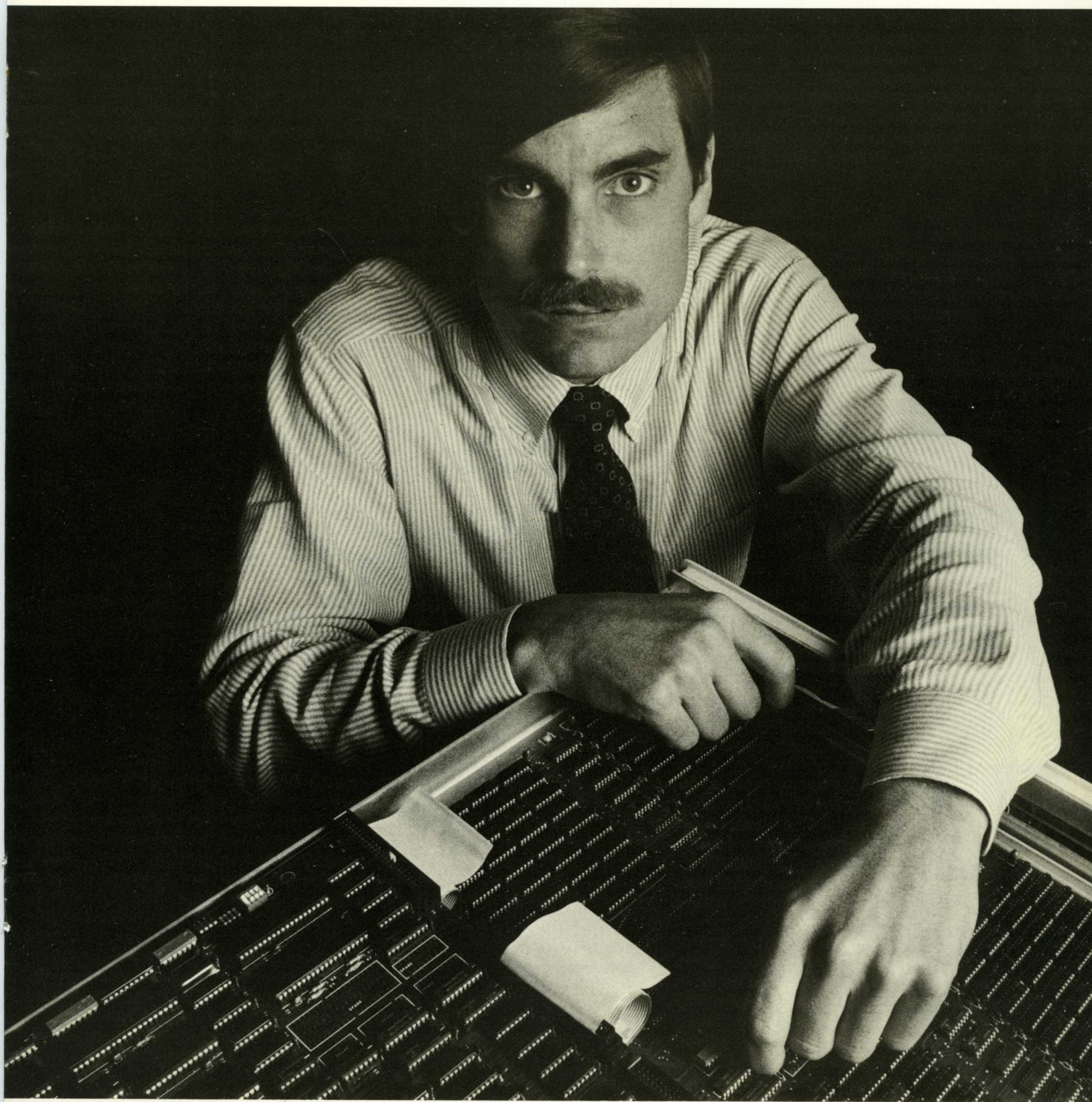
The C8002's extensive use of large scale integrated circuits means fewer components, fewer pieces that can fail and consequently higher inherent reliability. The C8002 contains an order of magnitude fewer components than previous systems with its capability.

Critical hardware components, like disk drives and memory chips, are tested at elevated temperature prior to system assembly. Assembled systems undergo a 50 hour burn-in at maximum rated temperature while constantly executing functional diagnostics and logging failures. This burn-in procedure isolates most potential hardware failures before

systems are shipped. Should a fault arise in the field, firmware diagnostics, a standard feature on all C8002s, allow rapid isolation to the module level. These diagnostics reside in ROM and are automatically invoked whenever the system is powered up or reset. Results of the diagnostics are displayed on the console and also on an array of LED's within the C8002. Once the faulty module is identified, it can be replaced in under 15 minutes using only a screwdriver.

Heat generation within the C8002 is held to a minimum by the extensive use of MOS components and a highly efficient switching power supply. This increases long term reliability and eliminates the need for an air conditioned environment.

To aid preventive maintenance, both the main and mass storage processors log recoverable hardware errors. This provides a long term chronology of system health which is especially useful for locating transient failures.



Software

ONYX provides a comprehensive set of system software packages that allow an applications implementor to take full advantage of the C8002's potential. The major packages offered are:

- Multiuser timesharing operating system
- Commercial programming languages
- Communications subsystems
- Text processing subsystems
- Data base management systems
- Commercial application software

Operating System

Version 7 of Bell Labs' UNIX operating system has been adapted for use on the C8002 and renamed ONIX. Except for a rewritten nucleus and several new compilers, ONIX is exactly the same system as Western Electric licenses for use on the DEC PDP 11 family.

ONIX is simple, flexible and extremely easy to use. It utilizes a number of sophisticated design concepts to create a "friendly" yet high performance development environment. Among its most significant features are:

- Automatic I/O redirection that permits the development of completely device independent programs. For example, all ONIX utilities may have their output directed to disk files, printers or terminals.
- Automatic hardware-enforced separation of code and data. Guarantees reentrant code generation, permits code sharing and minimizes swapping volume.
- Partitionless process management structure allows multiple programs (tasks) to operate concurrently on behalf of a single user (terminal). Processes can be run in "background" and can be "pipelined" so that the output of one is input to the next. Interprocess communication facilities permit arbitrarily complex collections of cooperating concurrent processes.

- Flexible and powerful command language treats any program as a command. Command files may be constructed and executed by combining system utilities, user programs and conditional commands like IF, THEN, ELSE and WHILE.
- Simple but sophisticated file system that employs a tree structured (hierarchical) directory and a flexible, efficient disk allocation strategy.

All of the Version 7 UNIX utilities as well as ONIX developed Z8000 utilities are supplied in binary form. These include:

- The shell, or command language interpreter
- C compiler and debugger
- Line oriented Text Editors
- Screen Editor
- NROFF/TROFF
- Z8000 Assembler
- Linking Loader
- Compiler Compiler (YACC)
- Sort/Merge

UNIX is installed in hundreds of sites world-wide. There is an active users group, USENIX, that hosts semiannual technical conferences and manages a library of contributed programs. In addition, there are a number of existing independent software firms specializing in UNIX support, UNIX-based packages and services for UNIX users.

May 15 18:07 22.c Page 10

```
/* *****  
/* Determines the size of a data element in bytes  
/* *****  
size_t  
int t  
{  
    switch (tag) {  
        case BVAL: return( BSIZE);  
        case WVAL: return( WSIZE);  
        case LVAL: return( LSIZE);  
    }  
}  
/* *****  
/* Getword retrieves a word from  
/* returns it to the calling routine  
/* *****  
getword () {  
    unsigned val;  
    val = getc(ifilebuf) << 8;  
    val += getc(ifilebuf);  
    if (p2trace == TRUE)  
        printf("\nIFILE WORD = %d", val);  
    return(val);  
}  
/* *****  
/* Getbyte returns a single byte  
/* *****  
getbyte () {  
    int val;  
    val = getc(ifilebuf) & BYTEMASK;  
    if (p2trace == TRUE)  
        printf("\nIFILE BYTE = %2x", val);  
    return(val);  
}
```

Commercial Programming Languages

Available for ONIX are the most widely used commercial programming languages:

- COBOL (ANSI'74, LEVEL 2) featuring multikey ISAM, segmentation, interactive screen handling and interactive debugging
- CBASIC II*, Microsoft BASIC and an emulator for Basic Four Corporation's Business Basic III

- FORTRAN (ANSI 1977) featuring 64 bit floating point arithmetic
- UCSD Pascal compiler
- MUMPS

*CBASIC II is a trademark of Compiler Systems.

Communications Subsystems

Available with ONIX are the following industry Standard communication packages:

- 2780/3780 Emulator
- 3270 Emulator
- HASP

Standard asynchronous communications are supported directly by ONIX.

Text Processing Subsystems

ONIX supports transaction and text processing concurrently. Among the text handling subsystems currently offered are:

- Line-oriented and two dimensional text editors.
- Text formatters capable of output to printers and typesetters.
- Text preprocessors that produce multi-column output and facilitate typesetting mathematical equations.

- Utilities that search for typos, compare files, locate files containing specified text strings and sort text files.
- Electronic mail facilities.

Data Base Management System

A CODASYL model data base management system (MicroSEED) runs under ONIX. The system also has a query language and report generator.

Commercial Application Software

The C8002 supports several specialized and general purpose application packages, including General Ledger, Accounts Receivable, Accounts Payable, Inventory, Sales Order Entry and Job Costing.

A number of other languages, communication and utility packages are planned or under development. See the Software Scorecard for the latest information.





Specifications

| | | | |
|--------------------------------------|----------------------|---|--|
| Processors | | <i>Main</i> | <i>Mass Storage Controller</i> |
| | CPU | Z8002 | Z80A |
| | Word Size | 16 bits | 8 bits |
| | Cycle Time | 250 ns | 250 ns |
| | DMA | Yes | Yes |
| Memory | Size (bytes) | 128K to 512K | 64K |
| | Parity | Yes | Yes |
| Integral Mass Storage Devices | | <i>Disk</i> | <i>Tape</i> |
| | Technology | Fixed Winchester; closed loop track following servo system; 8 inch disks. | 4 track 3M DC300 type. 6400 bpi recording density. |
| | Capacity (formatted) | 10, 18 or 40 Mbytes | 12 Mbyte |
| | Speed | 3600 R.P.M. | 30 ips (90 ips search) |
| | Transfer Rate | 648K bytes/sec | 198K bits/sec |
| Access Time | 35 ms | 30 seconds | |
| Power | 115 VAC, 4 amps | | |
| | 220 VAC, 2 amps | | |
| Environment | Temperature | 10° - 40°C | |
| | Relative Humidity | 20% - 80% | |
| Physical | Height | 8.0 in/20.3 cm | |
| | Width | 17.0 in/43.2 cm | |
| | Depth | 22.0 in/55.9 cm | |
| | Weight | 60 lbs/27.0 kg | |



Onyx Systems
Incorporated

73 East Trimble Road
San Jose
California 95131
408 • 946 6330
TWX 910 • 338 • 2049