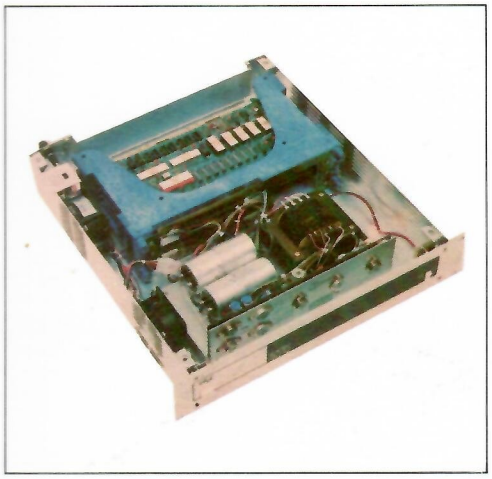
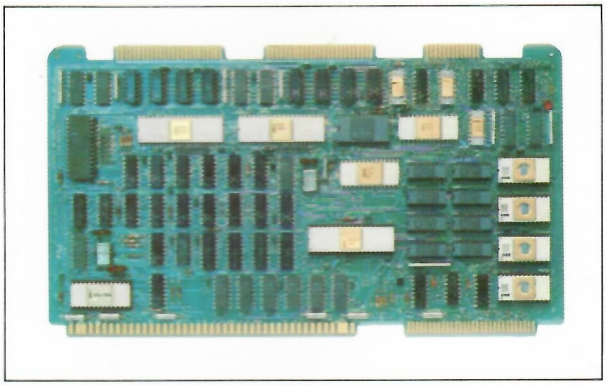
MICROCOMPUTER SYSTEMS DATA BOOK





$2.00
98-414B

INTELLEC® 888 SYSTEM
MICROCOMPUTER DEVELOPMENT CENTER

Complete Intellec Microcomputer Development Center with 64K Bytes of RAM Memory

Intel's Teleprinter-Compatible CRT Terminal with Detachable Keyboard, up to 9600 Baud Data Transfer Rate

Total Compatibility with Intellec® MDS 800 Peripherals, ICE™ Modules and the Universal PROM Programmer

PL/M 80 High Level Compiler Language

1M Byte (Expandable to 2M Bytes) of Diskette Storage with Intel's Dual Drive Double Density Diskette Operating System

ISIS-II Double Density Diskette Operating System Software including Relocating Macro Assembler, Linker, and Library Manager™

The Intellec 888 System provides the complete resources necessary to develop microcomputer system software in assembly language or Intel's high level Intellec resident programming language, PL/M-80. The package used with the optional ICE (In-Circuit Emulator) modules provides complete support to the design engineer from program development, through prototype debug, to production and field test.

HARDWARE

The Intellec® 888 System has been assembled to provide the total resources necessary to design and develop software for the Intel® family of microprocessors. Elements comprising the package are the Intellec Microcomputer Development System with 64K bytes of Intel RAM memory, the new Intellec Double Density Diskette Operating System, the Intellec System CRT Keyboard Display, and software supporting design and development of systems using the MCS-80 and MCS-85 family of microprocessors including Intel's Intellec resident high level compiler language, PL/M-80.

INTELLEC MICROCOMPUTER DEVELOPMENT SYSTEM

The Intellec Microcomputer Development System consists of CPU Module, 64K bytes of RAM memory, Front Panel Control and Monitor Modules, Diskette Drive Controller Modules, an interconnecting printed circuit motherboard, power supplies, fans, a chassis and a front panel.

The CPU module uses Intel's NMOS 8-bit 8080 microprocessor. The 8080's 2 μs cycle time, 78 instructions, unlimited subroutine nesting, vectored interrupt, and DMA capabilities are fully utilized by the Intellec MDS. Bus control logic resolves bus contention conflicts between the CPU module and other modules capable of acquiring control of the bus. The CPU module interfaces with a 16-line address bus and a bidirectional 8-line data bus. 8080 status signals are decoded and utilized for memory and I/O operations. An 8-level nested interrupt priority system, complete with an interrupt priority push-down stack, resolves contention for 8080 interrupt servicing.

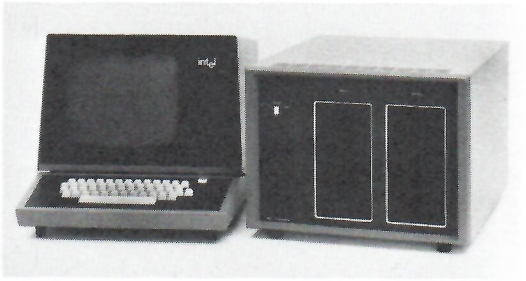
The RAM memory modules total 64K bytes of Intel dynamic RAM which operates at full processor speed. All necessary address decoding and refresh logic is contained on the module.

The Front Panel Control module provides system initialization, priority arbitration, and real-time clock functions. System initialization routines reside in a 256-byte PROM-resident bootstrap loader. An 8-level priority arbitration network resolves bus contention requests among potential bus masters. A 1 ms interrupt request generator, which can be disabled under program control, provides real-time clock functions. A 10 ms automatic time-out feature is also provided to force an interrupt request if nonexistent memory or I/O is addressed.

The Intellec universal bus structure enables several CPU and DMA devices to share the bus by operating at different priority levels. Resolution of bus exchanges is synchronized by a bus clock signal which is derived independently from processor clocks. Read/Write transfers may take place at rates up to 5 MHz. The bus structure contains provisions for up to 16-bit address and data transfers and is not limited to any one Intel microcomputer family.

The Intellec front panel is intended to augment the primary user interaction medium, the system console. The simplicity of the front panel coupled with the power of the system monitor provides an efficient user/Intellec interface. The front panel contains eight interrupt request switches with corresponding indicators, CPU RUN and HALT status indicators, a bootstrap loader switch, RESET switch, and a POWER ON switch and indicator.

The Monitor module contains the Intellec System Monitor and all Intellec peripheral interface hardware. The system monitor resides in a 2K byte Intel ROM. The module contains all necessary control and data transfer circuitry to interface with the Double Density Diskette Operating System and System CRT, as well as all standard Intellec peripherals including the optional Intellec Line Printer and Universal PROM Programmer.



DISKETTE OPERATING SYSTEM HARDWARE

The Intellec diskette system provides direct access bulk storage, intelligent controller, and two diskette drives. Each drive provides 1/2 million bytes of storage with a data transfer rate of 500,000 bits/second. The controller is implemented with Intel's powerful Series 3000 Bipolar Microcomputer Set. The controller provides an interface to the Intellec system bus, as well as supporting up to four diskette drives. The diskette system records all data in soft sector format.

The diskette controller consists of two boards, the Channel Board and the Interface Board. These two PC boards reside in the Intellec System chassis and constitute the diskette controller.

The *Channel Board* receives, decodes and responds to channel commands from the 8080 CPU in the Intellec system. The *Interface Board* provides the diskette controller with a means of communication with the diskette drives and with the Intellec system bus. The Interface Board validates data during reads using a cyclic redundancy check (CRC) polynomial and generates CRC data during write operations.

When the diskette controller requires access to Intellec system memory, the Interface Board requests and maintains DMA master control of the system bus, and generates the appropriate memory command. The Interface Board also acknowledges I/O commands as required by the Intellec bus.

The Diskette System is capable of performing seven different operations: recalibrate, seek, format track, write data, write deleted data, read data, and verify CRC.

In addition to supporting a second set of Double Density Drives, the Diskette Controller may co-reside with the Intel Single Density Controller to allow conversion of Single Density to Double Density format.

SYSTEM CRT

The Intellec System CRT Keyboard Display Unit provides total user communication with the entire range of Intellec Diskette System software packages and system peripherals. The RS232C-compatible CRT provides asynchronous data transfer rates switch-selectable up to 9600 baud.

SOFTWARE

INTEL SYSTEMS IMPLEMENTATION SUPERVISOR (ISIS-II)

The ISIS-II operating system resides on the system diskette and supports a broad range of user-oriented design aid software. Total file management and input editing features greatly reduce software development time. The ISIS-II Relocating Macro Assembler, Linker, Object Locator and Library Manager can be loaded from the diskette in seconds. All passes of the assembler can be executed without the need for user intervention. Object code and listings may be directed to any output device, or stored as diskette files.

Power system console commands are provided in an easy-to-use English context. Monitor mode can be entered by a special prefix to any system command or program call.

A file is a user-defined collection of information of variable length. ISIS-II also treats each of the standard Intellec system peripherals as files through preassignment of unique file names to each device. In this manner, data can be copied from one device to another using the same command required to copy one diskette data file to another. ISIS-II provides automatic implementation of random access disk files. Each file is identified by a user-chosen name unique on its diskette. Up to 200 files may be stored on each one-half-million-byte diskette.

ISIS-II 8080/8085 MACRO ASSEMBLER

The ISIS-II 8080/8085 Macro Assembler translates symbolic 8080 or 8085 assembly language instructions into relocatable and/or absolute object code modules. In addition to eliminating the errors of hand translation, the ability to refer to program addresses with symbolic names makes it easy to modify programs by adding or deleting instructions. Full macro capability eliminates the need to rewrite similar sections of code repeatedly and simplifies program documentation. Conditional assembly permits the assembler to include or delete sections of code which may vary from system to system, such as the code required to handle optional external devices.

In addition, the user is allowed complete freedom in assigning the location of code, data and stack segments.

The ISIS-II Assembler accepts diskette file input and produces a relocatable object file with corresponding symbol table and assembly listing file, including any error messages. The list file may then be examined from the system console or copied to a specified list device.

The relocatable object file generated by the assembler may be combined with other object programs residing on the diskette to form a single relocatable object module or it can be converted to an absolute form for subsequent loading and execution.

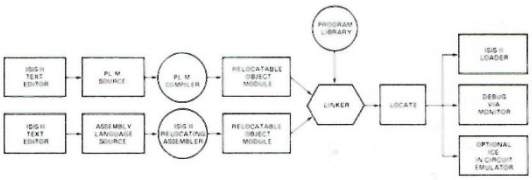
ISIS-II LINKER

The ISIS-II Linker provides the capability to combine the outputs of several independently compiled or assembled object modules (files) into a single relocatable object module. The Linker automatically resolves all external program and data reference during the linking process.

Object modules produced from previous link operations may be easily linked to a new module. ISIS-II also provides facilities to ease the generation of overlays.

An optional link map showing the contents and lengths of each segment in the output module can be requested. All unsatisfied external references are also linked.

If requested by the user, the ISIS-II Linker can search a specified set of program libraries for routines to be included in the output module.



PROGRAM DEVELOPMENT FLOW USING ISIS-II DISK OPERATING SYSTEM

PL/M-80 HIGH LEVEL PROGRAMMING LANGUAGE

PL/M-80 is an advanced, high level programming language for Intel 8080 Microprocessors, SBC 80 OEM Computer Systems, and Intellec Microcomputer Development Systems. PL/M has been substantially enhanced since its introduction in 1973 and has become one of the most effective and powerful microprocessor software systems implementation tools available. It is easy to learn, facilitates rapid program development and debugging, and significantly reduces maintenance costs.

PL/M-80 is a high-level algorithmic language in which program statements can naturally express the algorithm to be programmed. This frees programmers to concentrate on their system development without having to deal with assembly language details (such as register allocation, meanings of assembler mnemonics, etc.).

The PL/M-80 compiler efficiently converts free-form PL/M programs into equivalent 8080 instructions. Substantially fewer PL/M statements are necessary for a given application than if it were programmed at the assembly language or machine code level.

Since PL/M programs are problem oriented and more compact, programming in PL/M results in a high degree of productivity during development efforts. This translates into significant reductions in software development and maintenance costs for the user.

ISIS-II OBJECT LOCATOR

The ISIS-II Locate program takes output from either the PL/M-80 resident compiler, the macro assembler or the Linker and transforms that output from a relocatable format to an absolute format which may then be loaded via the standard ISIS-II loader, or loaded into the appropriate In-Circuit Emulator (ICE module).

During the Locate process, code, data and stack segments can be separately relocated, allowing code to be put in areas to be subsequently specified as ROM, while data and the stack can be directed to RAM addresses.

A Locate map showing absolute addresses for each code and data segment and a symbol table dump listing symbols, attributes and absolute address can also be requested.

ISIS-II TEXT EDITOR

The ISIS-II Text Editor is a comprehensive tool for the entry and correction of assembly language and PL/M-80 programs for the Intel 8080 Microcomputer. Its command set allows manipulation of either entire lines of text or individual characters within a line.

Programs may be entered from the console keyboard or may be loaded directly. Text is stored internally in the editor's workspace, and may be edited with the following commands:

- String insertion or deletion
- String search
- String substitution

To facilitate the use of these editing commands, utility commands are used to change positions in the workspace. These include:

- Move pointer by line or by character
- Move pointer to start of workspace
- Move pointer to end of workspace

The contents of the workspace are stored on the diskette and can be immediately accessed by ISIS-II commands or other programs such as the ISIS-II 8080/8085 Macro Assembler.

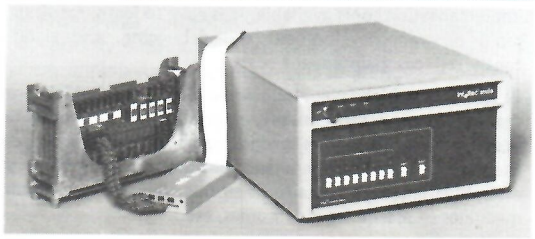
ISIS-II LIBRARY MANAGER™

The ISIS-II Library Manager program provides for the creation and maintenance of a program library containing Intel-provided and user-written programs and subroutines. These library routines can be linked to a program using the ISIS-II Linker. Several libraries, each containing its own set of routines, can be created.

OPTIONS

DESIGN AND DEBUG AIDS

The Intellec 888 System supports a complete line of design and debug aids for all MCS-80™, MCS-85™, MCS-48™, and 3000 Series microcomputing elements. With the appropriate In-Circuit Emulator (ICE) modules interfaced to the user's prototype system CPU, the designer can emulate that system's execution in real time or in single-step mode and substitute Package 888 resources such as Intellec memory and I/O for the eventual user system equivalents. Software development takes place concurrent with hardware design. Powerful Intellec debug functions are extended into the user system, allowing dynamic program development. In addition, program break conditions and memory modification may be done using symbolic references instead of absolute values. In-circuit emulators for new Intel microprocessors will continue to be supported on the Intellec bus and enhanced capabilities include logic state analysis, programmable displays and interrogation of up to 511 CPU memory cycles.

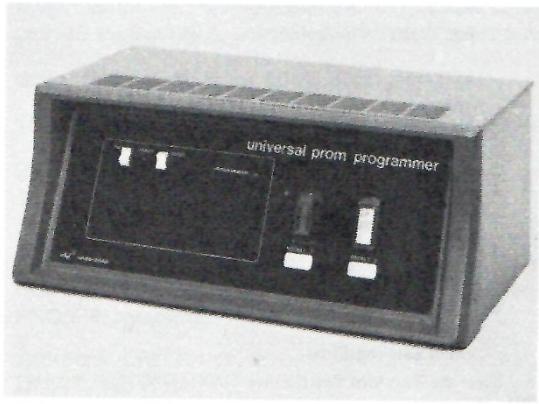


PRODUCT	DESCRIPTION
IN-CIRCUIT EMULATORS	
MDS-30-ICE	3001 Microprogram Control Unit (MCU) In-Circuit Emulator, cable assembly and interactive software included.
MDS-80-ICE	8080 CPU In-Circuit Emulator, cable assembly and interactive software included.
MDS-85-ICE	8085 CPU In-Circuit Emulator, cable assembly and interactive software included. Also includes 18 additional probes for logic state analysis and software display templates for selected Intel peripheral chips.
MDS-48-ICE	8048 CPU In-Circuit Emulator, cable assembly and interactive software included.
ROM SIMULATORS	
SIM-101	8K bit Bipolar ROM Simulator configurable as 512 X 16 or 1024 X 8, access time 130 ns max. A maximum of 4 units may be resident with the Intellec MDS. Includes cable kit and software to simulate the 3601 or 3301A ROMs.
SIM-102	Same as SIM-101, except includes cable kit and software to simulate 3602/3622/3302/3322 ROMs.
SIM-104	Same as SIM-101, except includes cable kit and software to simulate 3604/3624/3304A/3324A/8604 ROMs.

INTELLEC® 888 SYSTEM

UNIVERSAL PROM PROGRAMMER

The Universal PROM Programmer is an Intellec Package 888 peripheral capable of programming and verifying the following Intel® PROMs: 1702A, 2704, 2708, 3601, 8702A, 8704, 8708, 8748 and 8755. Programming and verification operations are initiated from the Package system console and are controlled by programs resident in the Intellec 888 and Universal PROM Programmer.



PROM PROGRAMMER

UPP-101	Universal PROM Programmer, includes cabinet, software, power supplies, cable, and one 16/24-pin zero insertion force PROM programming socket pair. At least one personality card must be specified, but price does not include selected personality card(s).
UPP-102	Same as UPP-101, except includes a 24/24-pin PROM programming socket pair in place of the 16/24-pin pair.

ADDITIONAL PROM PROGRAMMING SOCKETS

UPP-501	16-pin/24-pin PROM programming socket pair.
UPP-502	24-pin/24-pin PROM programming socket pair.

PERSONALITY CARDS

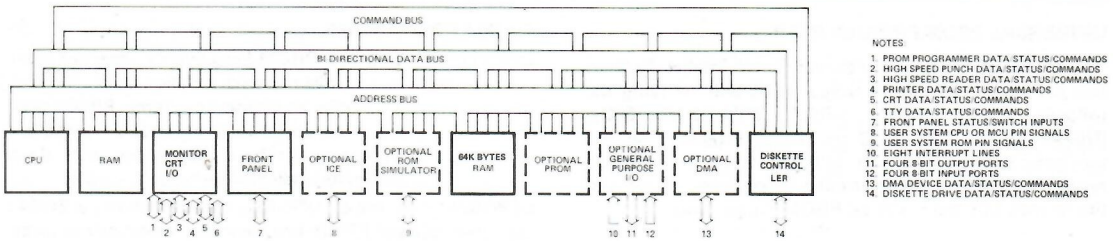
UPP-816	2716 Personality Card.
UPP-361	3601 Personality Card.
UPP-848	8748 Personality Card with adaptor socket.
UPP-855	8755 Personality Card with adaptor socket.
UPP-872	8702A/1702A Personality Card.
UPP-878	8708/8704/2708/2704 Personality Card.

OTHER INTELLEC 888 SYSTEM OPTIONS

The Intellec Package 888 is upward-compatible with the entire family of hardware and software options offered with the Intellec Microcomputer Development System 800. Pricing information and descriptions of additional options and peripherals are available in the "Memory Components & Microcomputer Systems OEM Price List" or from your Intel salesman.

PRODUCT	DESCRIPTION
PERIPHERALS	
MDS-PRN	5 X 7 matrix line buffered printer, maximum 165 characters per second. The line width is selectable by switch from 80 columns at 10 characters per inch to 132 columns at 16.3 characters per inch. Includes table-top cabinet, power supply, interface cable, operator lights, automatic on-off motor control for quiet operation, and 2-channel VFU control. Prints original plus 4 copies.
MDS-DDR	Add-on Diskette Drive unit attaches to the existing Intellec Package 888 Diskette Controller, providing data storage of a total of 2 million bytes on four drives.
INPUT/OUTPUT	
MDS-501	DMA Channel Controller – 2 MHz transfer rate, PC board edge connector includes. The cable assembly is optional.
MDS-504	General-Purpose I/O Module; 4 latched or unlatched input ports, 4 latched output ports, 8 system interrupt lines, all TTL compatible, PC board edge connector included. Cable assembly is optional.

INTELLEC® 888 SYSTEM



INTELLEC® BLOCK DIAGRAM

SPECIFICATIONS

PHYSICAL CHARACTERISTICS

Intellec Chassis
- Dimensions: 8.5" X 19" X 17"
  21.6 cm X 48.3 cm X 43.2 cm
- Weight: 65 lb (29.5 kg)

CRT Monitor
- Dimensions: 14" X 16.5" X 15"
  35.6 cm X 41.9 cm X 38.1 cm
- Weight: 45 lb (20.4 kg)

CRT Keyboard
- Dimensions: 3.5" X 16.5" X 9.7"
  9.1 cm X 41.9 cm X 24.6 cm
- Weight: 7 lb (3.2 kg)

Diskette System
- Dimensions: 12.1" X 19" X 16.9"
  30.8 cm X 48.3 cm X 42.9 cm
- Weight: 64 lb (29 kg)

ELECTRICAL CHARACTERISTICS

Intellec Chassis DC Power Supply:

Volts Supplied	Amps Supplied	Basic System Requirements in Amps (Including Diskette Controller) Max	Typical
+5 ±5%	35.0	20.5	14.4
+12 ±5%	3.0	1.3	0.8
−10 ±5%	3.0	0.4	0.3
−12 ±5%	0.5	—	—

AC Requirements: 50—60 Hz, 115/230 VAC all components

ENVIRONMENTAL CHARACTERISTICS

Intellec Chassis Operating Temperature: 0° to 55°C

Diskette System Operating Temperature: 0° to 38°C

System CRT Operating Temperature: 5° to 40°C

PERFORMANCE SPECIFICATIONS

Host Processor (Intel 8080) Cycle Time: 2.0 μs

Maximum Bus Transfer Rate: 5 MHz

Intellec Memory Size: 64K bytes RAM, 2K bytes ROM, 256 bytes PROM (64K bytes maximum Program Addressability)

Diskette System Capacity (Basic Two Drives):

Unformatted
- Per Disk: 6.2 megabits
- Per Track: 82.0 kilobits

Formatted
- Per Disk: 4.1 megabits
- Per Track: 53.2 kilobits

Diskette Performance:
- Diskette System Transfer Rate: 500 kilobits/sec
- Diskette System Access Time
  - Track-to-Track: 10 ms
  - Head Settling Time: 10 ms
- Average Random Positioning Time: 260 ms
- Rotational Speed: 360 rpm
- Average Rotational Latency: 83 ms
- Recording Mode: M^2FM

EQUIPMENT SUPPLIED

Intellec Microcomputer Development System Chassis and Power Supply:
- CPU Module
- Monitor Module (System I/O)
- 64K RAM Memory
- Front Panel Control Module
- Double Density Diskette Controller Board
- Double Density Diskette Interface Board
- Floppy Disk Controller Cable
- ISIS-II System Diskette
- PL/M-80 Compiler Diskette
- ISIS-II System User's Guide
- PL/M-80 Programming Manual
- ISIS-II PL/M-80 Operator's Manual
- Intellec System and DDS Hardware Reference Manual

Dual Drive Double Density Diskette Operating System Cabinet and Power Supply:
- Two Double Density Floppy Diskette Drives
- Floppy Disk Peripheral Cable

System CRT Monitor and Detachable Keyboard

ORDER INFORMATION

Part Number	Description
MDS-888-KIT/110V /220V	Complete Microcomputer Development System with 64K RAM Memory, Double Density Diskette Operating System, System CRT and ISIS-II and Resident PL/M-80 Software Package.