Model 8/16 Processor

PRODUCT DESCRIPTION

The Model 8/16 Processor extends Interdata's 16-bit line to provide you with large machine performance at minicomputer prices. The Model 8/16 features 16 general purpose registers, direct addressing, dual I/O busses, directly vectored interrupts and an IBM-like instruction set. Extended arithmetic capabilities provide performance capabilities unchallenged by any competitor in its class. Memory is available in 32 or 64KB core sizes with cycle times of 750 nanoseconds. Parity is optionally available.

Interdata's 16-bit hardware, software, and peripherals are upward compatible with Interdata's 32-bit products. This allows easy expansion without affecting application software. The multiplexor and selector channel interfaces for peripheral controllers are also compatible. No expensive interface redesign is necessary.

The Model 8/16 combines hardware versatility with complete software compatibility to offer the OEM and end user a flexible, expandable, and most economical minicomputer system.

FEATURES

- Advanced Architecture
  IBM-like Instruction Set
  Dual I/O Bus Structure

16 General Purpose Registers
15 Index Registers
Directly Addressable Memory to 65, 535 Bytes
Memory Access Time of 275 nanoseconds
Memory Cycle Time of 750 nanoseconds
List Processing Instructions

- Extended Arithmetical Capabilities (optional)
  Signed and Unsigned Hardware Fixed Point Multiply/
    Divide
  Single Precision Floating Point Hardware includes
    8 Hardware Single Precision Floating Point Registers
  Double Precision Floating Point Hardware includes
    8 Hardware Double Precision Floating Point Registers

- Built-In Reliability
  Printed Circuit Back Panel for All Interlaced Connections
  Thermal-Shock Testing of All Integrated Circuits
  Vibration Testing to 1.25 G's
  Temperature Testing—Burn In at 50°C for 52 hours

- Field-Proven Software
  OS/16MT2 — A real-time, multi-tasking operating system
  Utilities — OS Edit, OS Aids, OS Copy
  Languages — FORTRAN IV, FORTRAN V, Basic,
    MACROCAL

- Upward compatible with Interdata's 32-bit products,
  application software, peripherals

INSTRUCTION REPERTOIRE

The basic 108 instructions provide large-machine capability that results in more time for applications programming and less worry about routine functions. While the 8/16 instruction formats are similar to those of the IBM 360/370, Interdata has added several classes of instructions to increase memory utilization efficiency. The instruction set provides both 16-bit and 32-bit formats and permits operation between any two general registers (RR), a general register and any memory location (RX), a general register and a 16-bit data constant carried in the primary instruction word (RI), or a general register and 4-bit data constant (SF).

INSTRUCTION FORMAT

REGISTER TO REGISTER (RR)

0		7	11	15

OP-CODE	R1	R2

SHORT FORMAT (SF)

0		7	11	15

OP-CODE	R1	DATA
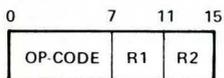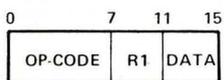
REGISTER TO INDEXED MEMORY (RX)

0	7	11	15	31

OP-CODE	R1	X2	16 BIT ABSOLUTE ADDRESS

REGISTER IMMEDIATE (RI)

0	7	11	15	31

OP-CODE	R1	X2	16 BIT DATA
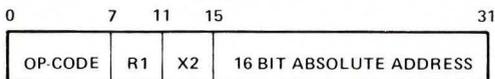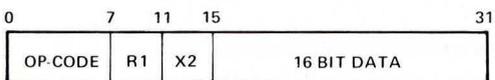
OP-CODE = HEXADECIMAL REPRESENTATION OF FUNCTION TO BE PERFORMED (ADD, MULTI.)

R1 = ANY ONE OF 16 G.P. REGISTERS AS A FIRST OPERAND.

R2 = ANY ONE OF 16 G.P. REGISTERS AS A SECOND OPERAND.

X2 = ANY ONE OF 15 INDEX REGISTERS AS AN INDEX VALUE (ADD TO APPARENT ADDRESS OR DATA FIELD TO OBTAIN TRUE VALUE OF ADDRESS OR DATA).

The 8/16 also has four list processing instructions. These commands manipulate any number of circular lists each having up to 255 halfword slots. Elements can be added or deleted from the top or from the bottom of the list. These instructions are useful for stacking and queueing functions. Changes in the state of the list are effected in the Condition Code.

LIST PROCESSING
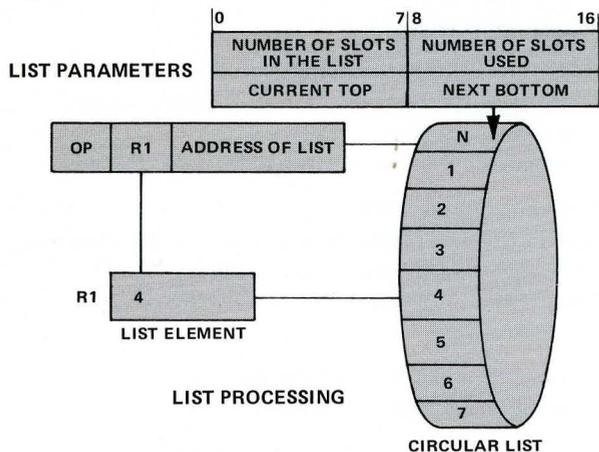
Arithmetic extensions including fixed and floating point instructions are available. Addition of the signed multiply/divide hardware increases the number of instructions to 114. Floating-point instructions provide a means of rapid manipulation of scientific data expressed as floating point numbers. Single precision as well as double precision instructions are implemented in hardware as well as two stacks of eight registers each dedicated to floating point operands. The comprehensive set of floating point instruction include load, store, add, substract, multiply, divide compare, fix, and float. 142 instructions are available to the programmer in an 8/16 equiped with these options.

OPTIONS

Model 8/16 options provide extensive flexibility so that the hardware configuration can be tailored to the application and easily field expanded.

- Memory Parity — Complete Data and Instruction Protection
- Power Fail/Auto Restart — Early power fail interrupt and power-up interrupt
- Binary Display Panel — Complete user control of the system. Includes long life Light Emitting Diode (LED) binary readout and hexadecimal input keyboard.
- Hexadecimal Display Panel — Complete user control of the system. Includes Hexadecimal LED readout and Hexadecimal input keyboard.
- Turnkey Console — Switch control for power, initialize, and execution.
- Display Interface — Interfaces for Binary Display or Hexadecimal display.
- Automatic Loader — Simple, single switch bootstrap load capability. Can be preprogrammed with OS/16MT2 loader or can be used with a custom designed program.
- Signed Multiply/Divide — Hardware execution of 16-bit fixed point Multiply/Divide operations.
- Single Precision Floating Point — Hardware execution of 32-bit floating point instructions.
- Double Precision Floating Point — Hardware execution of 64-bit floating point instructions.
- Selector Channel — For high-speed I/O requirements provides completely autonomous block transfers on a cycle stealing basis for high speed I/O.
- Stretch 32-Field updates a Model 8/16 processor to a software and I/O compatible 7/32 processor. The expanded system is capable of directly addressing one megabyte of memory and executing a full complement of 32-bit fullword instructions.

BUILT-IN RELIABILITY

The Model 8/16 uses the latest techniques in logic design, solid state technology, mechanical packaging, and manufacturing testing to ensure maximum hardware reliability and to minimize downtime. A printed circuit back panel provides all interboard connections. Individual logic boards are connected to the back panel with inline connectors.

PACKAGING

Model 8/16 packaging is consistent with Interdata standards of ruggedness, durability, and reliability. Interboard connections are military-type pin and receptacle connectors for sure, positive connection. Separately mounted power supplies, readily accessible test points and fuses, and plug-in modules mean fewer failures and less time for repairs. Interdata's testing includes thermal shock testing of all integrated circuits. The Model 8/16 is vibration tested at 1.25 G's while running diagnostic programs. Finally, all processors are run for 52 hours at 50°C — the quality is burned in.

OPERATING SYSTEMS AND DEVELOPMENT SOFTWARE

Interdata provides a comprehensive family of compatible operating systems and utility programs as off-the-shelf packages. All software is fully warranted and is supported by both field and home office staffs. Software includes:

- OS/16 MT2— Real-Time based multi-tasking multi-programming operating system.
- OS Assembler — Symbolic assembler
- FORTRAN compilers — Extended FORTRAN IV and FORTRAN V.
- OS AIDS — Interactive debug program.
- CAL — A common assembly language for all Interdata processors.
- BASIC Interpreter — Superset of Dartmouth standard.
- OS Edit — Text editor.

A complete line of utility programs is also available. And the Interdata users group, Interchange, has an extensive software library.

SYSTEM ARCHITECTURE

The Model 8/16's architecture, similar to the IBM 360/370 line, greatly simplifies system design, programming, and debugging. The large task-oriented instruction set allows the programmer to concentrate on system programming instead of having to program basic routines for functions like exclusive OR, multiple shifts, or byte processing.

Sixteen general registers reduce overhead, cut execution time and simplify program development. Temporary results can be stored for instant recall reducing overhead.

Directly addressable memory totally eliminates time consuming design problems caused by paging and indirect addressing. This direct addressability allows programmers to write straightforward, simple, in-line code for the Model 8/16.

INPUT/OUTPUT

The strength of the 8/16's input/output system is based on its dual bus architecture. High speed devices can operate at up to 2,666,000 bytes per second over the optional Selector Channel. Medium and low speed devices are connected to the standard Multiplexor Channel.

Operation over the Selector or Multiplexor channels may be in the 8-bit parallel or 16-bit parallel mode. Both channels operate on a request-response basis for simple, reliable device-controller design. Devices operating over the multiplexor channel are generally interrupt driven. Interrupts are automatically vectored for maximum machine efficiency and less software overhead.

Interdata offers broad line of inexpensive peripherals for the Model 8/16 that are both program and interface compatible with all members of the Interdata family. Interdata also offers standard low cost interface modules to aid the user in designing special-purpose interfaces.
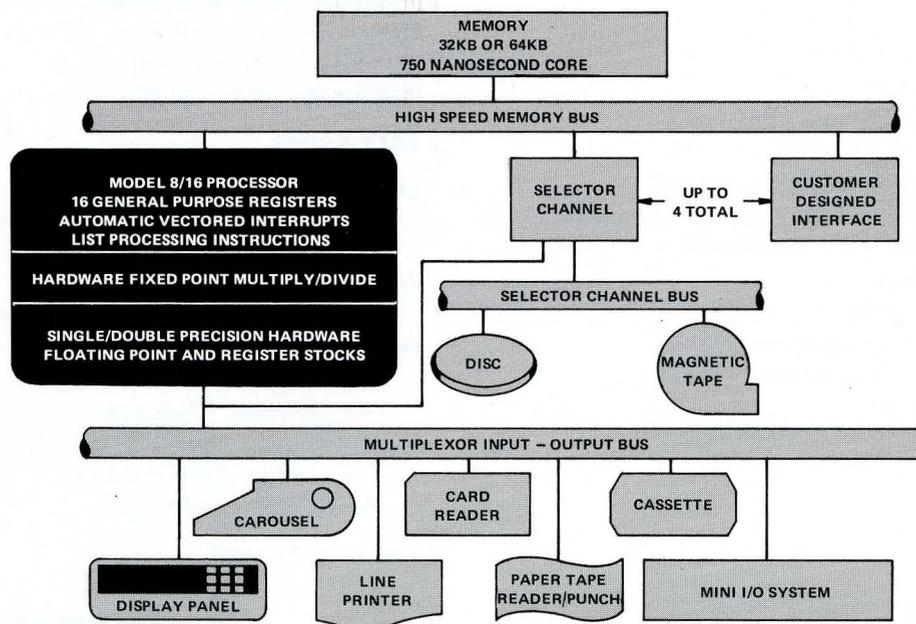
MODEL 8/16 SYSTEM DIAGRAM.

MEMORY

The Model 8/16 can accommodate up to a total of 64KB. of memory. Memory modules are contained on 15-inch printed circuit boards and are available in 32KB or 65KB sizes. Memory cycle time is 750 nanoseconds. Parity is optionally available.

PHYSICAL CONFIGURATIONS

The Model 8/16 consists of one processor board, one or two memory modules, and space for arithmetic and/or I/O device controllers. Chassis are available with either 8 or 16-slots and 25 or 50 amp power supplies. 8 slot chassis have space to house 5 subassembly slots while the 16 slot chassis can handle 13. A single subassembly slot can accommodate one 15-inch board or two 7-inch boards.

A large array of reliable peripherals and interfaces reduces risk and development costs. The Interdata peripheral family includes a complete range of magnetic tapes, discs, card and paper tape equipment, CRT displays, printers, analog and digital converters, data acquisition equipment, and communications hardware.

COMPATIBILITY

The Model 8/16 is hardware and software compatible with the entire Interdata 16-bit line, as well as being upward compatible through the 32-bit series. Interdata's emphasis on design compatibility results specifically in investment protection and broader applications capability at less cost to the OEM and end user. OS/16 MT2, for example, is upward compatible with the 32-bit operating system, OS/32 MT.

SPECIFICATIONS

Technology
    Processor T^2 L-MSI
    ROM Bipolar (60ns access time)
Data Word Length — 8, 16, 32, 64 bits
Instruction Word Length — 16, 32 bits
Number of Basic Instructions — 108
    With Fixed Point Multiply/Divide — 114
    With Single Precision Floating Point — 131
    With Single/Double Precision Floating Point — 148
Fixed Point Arithmetic — 2's Complement
Hardware Accumulators
    16 Fixed Point — 16 Bit
    8 Single Precision Floating Point — 32 Bit
    8 Double Precision Floating Point — 64 Bit
Hardware Index Registers — 15
Address Modes — Direct, Indexed, and relative

MEMORY

Memory Access Time — 275 nanoseconds
Memory Cycle Time — 750 nanoseconds
Memory Type — Core
Memory Capacity — 65, 536 Bytes

TYPICAL INSTRUCTION EXECUTION TIMING

Register to Register — 0.75 useconds
Memory Reference — 2.25 useconds
Immediate — 1.50 useconds
Fixed Point Arithmetic
    Multiply — 9.25 μ seconds
    Divide — 12.50 μ seconds
Single Precision Floating Point*
    Add/Subtract — 5.0/10.3 μ seconds
    Multiply — 13.4/19.6 μ seconds
    Divide — 10.25/14.0 μ seconds
Double Precision Floating Point*
    Add/Subtract — 5.75/13.0 μ seconds
    Multiply — 16.13/21.9 μ seconds
    Divide — 16.75/22.5 μ seconds

INPUT/OUTPUT

DMA Capabilities
    Four High Speed DMA Channels Standard
    Maximum Selector Channel Transfer rate — 2.66
        Megabytes/seconds
    Input/Output Word Lengths — 8 or 16 bits
Multiplexed Input/Output
    255 priority interrupt levels
    Programmed I/O Loop Rate — 66K Bytes/sec
    Interrupt Response Time — 8.25 μ seconds
        (includes Storage of Current Program Status Word
        and generation of New Program Status Word)

ENVIRONMENTAL

Operating Temperature Range — 0°C to 50°C
Storage Temperature Range — 55°C to 85°C
Vibration — 0 to 55 CPS at 1.25 G
Relative Humidity — to 90% without condensation

PACKAGING

Chassis Dimensions —
    7 inches by 19 inches by 19 inches RETMA
    14 inches by 19 inches by 19 inches RETMA
Power Supply Dimensions —
    7 inches by 19 inches by 9 inches RETMA
Weight with Power Supply —
    7 inch chassis, 50 pounds
    14 inch chassis, 70 pounds
Primary Power — 115 or 230 VAC ± 10%, 47 to 63HZ
    7 inch chassis, 3.6 or 6.0 amps
    14 inch chassis, 6.0 amps

*RR Times/RX Times