Modcomp Classic Systems

MANAGEMENT SUMMARY

Modular Computer Systems, Inc. (Modcomp), introduced the Classic 7860 in February, 1978, heralding it as "the first member of a complete new family of computer systems designed specifically for measurement and control, communication, scientific and information processing applications." In July, 1978, Modcomp added the Classic 7870, the current high end model in the family with a maximum main memory capacity of two million bytes, and a new version of the 7860 that offered up to one million bytes of main memory, twice that available on the earlier version. Extensions are available to increase the capacity of the 7860 and 7870 to up to four million bytes. The Classic 7810, the entry level member of the Classic family with a maximum main memory capacity of 128K bytes, was added to the line in September, 1978. The newest members of the line, the mid-range 7830 and 7835, were introduced in June, 1979, and offer from 128K to 512K bytes of main memory.

The Classic 7810 is a 16-bit parallel processor that is fully compatible with the Modcomp II as well as the other members of the Classic family. It uses the MAX II and MAX III operating systems as well as their MAXNET extensions for distributed network systems. The 7810 is available either as a computer-on-a-board or as a fully integrated system. It has a full Modcomp II instruction set as well as its 15 general purpose registers and its systems protect features. It is available in three versions with 64K, 96K, or 128K bytes of solid state memory that has an effective cycle time of 600 nanoseconds. All memory is directly addressable in any of seven addressing modes. The 7810 has an optional control panel for data entry and display, program fill, master clear, console keylock, and console interrupt functions. A battery backup option is

Modcomp's Classic Family, heir-apparent to the Modcomp System II and IV line, currently consists of five models. The Classic 7810 is essentially a more powerful version of the Modcomp II, while the Classic 7830, 7835, 7860, and 7870 are enhanced versions of Modcomp IV models. Designed for measurement and control, communication, and scientific/engineering applications, basic system prices range from $7,500 for the 7810 with 64K bytes of memory to $64,000 for a 7870 CPU with 512K bytes of memory and a dual bus I/O processor.

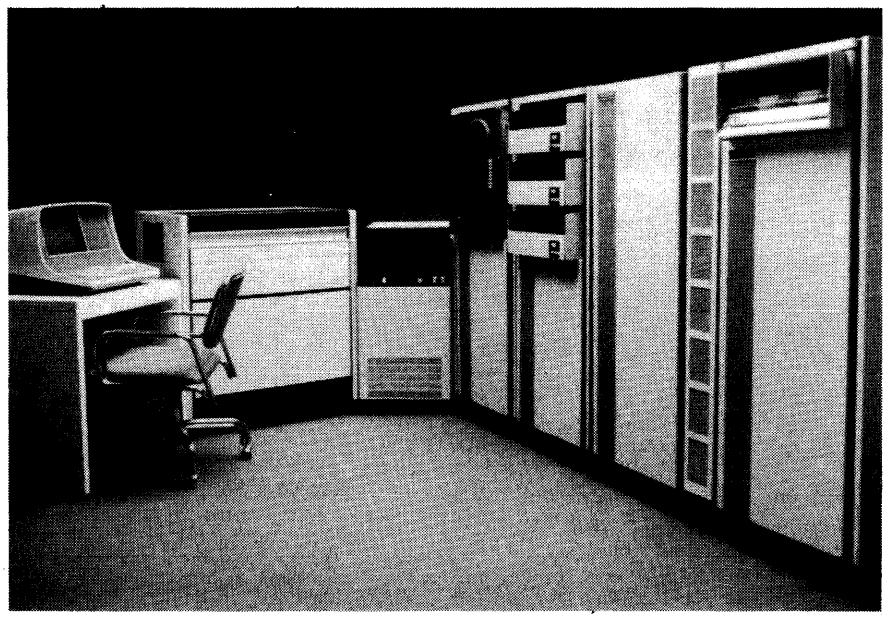
CHARACTERISTICS

MANUFACTURER: Modular Computer Systems, 1650 West McNab Road, Fort Lauderdale, Florida 33309. Telephone (305) 974-1380.

Modcomp is a manufacturer of real-time computer systems ranging from small, single-processor configurations to large-scale multiprocessor systems used primarily in measurement and control applications, power generation, petrochemical and metals processing, nuclear control, traffic control, building control systems, and communications networks. Modcomp provides service from 45 U.S. locations plus offices in England, France, Belgium, Germany, Japan, Norway, El Salvador, Korea, Spain, Sweden, Switzerland, and the British Virgin Islands.

DATE ANNOUNCED: Classic 7810, September 1978; Classic 7830 and 7835, June 1979; Classic 7860, February 1978; Classic 7870, July 1978.

DATE OF FIRST DELIVERY: 7860, April 1978; 7870, November 1978; 7810, May 1979; 7830 and 7835, August 1979.



Modcomp's Classic 7870 features memory capacity of up to two million bytes. A Shared Multiport Memory system (SMM) extends this capacity to four million bytes as well as allowing users to configure shared memory systems. Both the 7860 and 7870 models include an integral high-speed floating-point processor that performs operation in 32-, 48- or 64-bit operands in parallel. As a standard feature, the 7860 and 7870 systems have five concurrent memory access paths.

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CHARACTERISTICS OF THE CLASSIC PROCESSORS

	7810	7830	7835	7860	7870
PROCESSOR WORD SIZE (BITS)	16	16	16	16	16
STANDARD MEMORY TYPE	MOS	MOS	MOS	MOS, CORE	MOS
MEMORY CYCLE TIME (WORD)	.6	.125	.125	.125	.125
MEMORY ACCESS TIME	.6	.125	.125	.125	.125
MEMORY PORTS	1	4	4	4	4
MEMORY INTERLEAVING	—	2 or 4	2 or 4	2 or 4	2 or 4
SHARED MEMORY	—	OPT	OPT	OPT	OPT
MEMORY SIZE (BYTES)	64K-128K	128K-512K	128K-512K	128K-1M	512K-2M
MEMORY ADDRESSING (DIRECT)	128K	512K	512K	4M	4M
MEMORY PROTECTION	OPT	STD	STD	STD	STD
INSTRUCTION SET SIZE	169	369	369	367	367
INTERNAL INTERRUPTS	16	16	16	16	16
EXTERNAL INTERRUPTS	5	5	5	5	5
INTERRUPT SUB-LEVELS	63	128	128	128	128
DMP CHANNELS	8	8	8	16	16
MODULAR BUS CONTROL	—	STD	STD	STD	STD
EXTENDED DMP CHANNELS	—	OPT	OPT	OPT	OPT
MAXIMUM I/O RATE (BYTES/SEC)	275K	1M	1M	4M	4M
HARDWARE MULTIPLY/DIVIDE	STD	STD	STD	STD	STD
HARDWARE FLOATING POINT	—	OPT	STD	STD	STD
HARDWARE COMMUNICATION MACROS	—	OPT	—	OPT	OPT
BATTERY BACKUP	OPT	OPT	OPT	OPT	OPT
HARDWARE BYTE MANIPULATION	STD	STD	STD	STD	STD
ADD TIME (MICRO SEC)	2.7	.3	.3	.2	.2
REAL TIME CLOCK	STD	STD	STD	STD	STD
WRITABLE CONTROL STORAGE	—	—	—	—	—
CACHE MEMORY	—	—	—	—	—
NO. OF ACCUMULATORS	15	240	240	240	240
NO. OF INDEX REGISTERS	7	112	112	112	112
HARDWARE STACK REGISTER	—	STD	STD	STD	STD

available to keep the MOS memory refreshed in event of a power loss. The 7810 uses all standard Modcomp peripheral equipment.

The classic 7830 and 7835 models are designed for use as medium performance standalone systems, as network hosts, or as powerful network satellites. The 7835 is the same as the 7830 but its Modular Bus Control (MBC) option slot includes the Classic arithmetic accelerator to provide high speed floating point and shift operations. With the exception of the Extended Instruction Mode, both the 7830 and 7835 execute the entire Classic instruction set, and the MAX III and MAX IV operating systems.

The 7830 and 7835 CPU's execute most register to register instructions in as little as 300 nanoseconds. The memory management capability provides addressability of up to 512K bytes. A two word deep instruction/operand stack utilizes the CPU pipeline to memory. Sixteen sets of 15 general purpose registers are provided to maintain compatibility with the MAX IV operating system. The integral I/O processor provides 16 direct memory processor (DMP) channels and operates at up to one megabyte of I/O throughput in the dual word mode. Sixteen priority interrupt levels and 128 sublevels are provided. Remote multiprocessor interrupts are standard as is a remote fill capability.

The first version of the Classic 7860 system accommodated a maximum of 512K bytes of main memory, either core, error correcting MOS, or a mixture of both. A later version, announced at the same time the company intro-

NUMBER INSTALLED TO DATE: Not available.

MODELS: Classic 7810, 7830, 7835, 7860, 7870.

DATA FORMATS

BASIC UNIT: 16-bit word in all models.

FIXED-POINT OPERANDS: 16-bit words, single bits, or 8-bit bytes for all systems; also limited use of 32-bit double words for the 7810. The 7830, 7835, 7860 and 7870 systems have an expanded capability for 32-bit double words and the facility to handle 48-bit triple words and 64-bit quad words. Files up to eight words in length can be accessed in memory by a single instruction. Negative numbers are represented in two's complement format.

FLOATING-POINT OPERANDS: For the 7810, floating-point instructions are executed via software simulation. For the 7830, 7835, 7860, and 7870 systems, a single-, double-, or triple-precision format consisting of a 9-bit exponent and signed 22-bit, 38-bit, or 54-bit fraction, respectively, can be employed.

INSTRUCTIONS: One-or two-word instruction formats with an eight-bit operation code and eight bits for operand register, index register, bit address within a word, displacement address (up to 16 locations) with respect to a base address, shift count, interrupt level or peripheral drive address, and (for two-word direct, indirect, and indexed address instructions format) one bit to specify indirect addressing. Two word immediate instructions are like the one-word types plus a 16-bit immediate operand: and two-word direct, indirect, and indexed address instructions are like the one-word types plus a 16-bit memory address. All register-to-register, shift, input/output, and control instructions use the single-word format. Many memory reference instructions also use this format and obtain a 16-bit operand address through short displaced, short indexed, or immediate addressing techniques.

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PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION AND SPEED	MANUFACTURER
MAGNETIC TAPE EQUIPMENT		
4148/4151	Industry-compatible, 45 ips, 9-track, 10.5-inch reels, 800 bpi, NRZI, 150 ips rewind speed; 4151 is add-on drive; 36 KBS	Wangco Mod 10
4155/4156	Industry-compatible, 45 ips, 9-track, 10.5-inch reels, 1600 bpi, PE, 150 ips rewind speed; 4156 is add-on drive, 72 KBS	Wangco Mod 10
4157/4158	Industry-compatible, 45 ips, 9-track, 10.5-inch reels, 800/1600 bpi, NRZI/PE, 150 ips rewind speed; 4158 is add-on drive; 72 KBS	Wangco Mod 10
4164/4165	Industry-compatible, 75 ips, 9-track, 10.5-inch reels, 800 bpi, NRZI, 200 ips rewind speed; 4165 is add-on drive; 60 KBS	Wangco Mod 11
4168/4169	Industry-compatible, 75 ips, 9-track, 10.5-inch reels, 1600 bpi, PE, 200 ips rewind speed; 4169 is add-on drive; 120 KBS	Wangco Mod 11
4170/4171	Industry-compatible, 75 ips, 9-track, 10.5-inch reels, 800/1600 bpi, NRZI/PE, 200 ips rewind speed, 4171 is add-on drive; 120 KBS	Wangco Mod 11
5550	Magnetic Tape Subsystem, 75 ips, GRC recording; 6,250 bpi, PE	—
PRINTERS		
4211-2	Chain/train; 132 positions, 64 ASCII character set, 10 characters per inch, 3.5 to 19.5-inch paper, 6 lines per inch, vertical format control, one-line buffer; 600 lpm	Data Printer
4214-2	Same as 4211-2 but 300 lpm	Data Printer
4213	Table-top line printer; 132 positions, 64 ASCII character set, 50-150 lpm	—
4216-1	Electrostatic; 7 x 9 dot matrix; 132 positions, 64 character set, 12.5 characters per inch, 11-inch paper, 6.6 lines per inch, programmable VFU, 1000 lpm	Versatec 1100 Series
4217-1	Same as 4216 but with plotting capability at 0.010 inch	Versatec
4226	Serial matrix; table-top, 132 positions, 64 ASCII character set, bidirectional, 256-character buffer, 64-440 lpm	—
4228	Same as 4226 with RS-232C interface	—
4227	Line Printer; 132 positions, 63 ASCII character set, solid character impact printing, 280 lpm	—
PUNCHED CARD EQUIPMENT		
4411-2	Reader; 80-column, table-top mounting, 1000-card input hopper and output stacker; 300 cpm	Documation M300L
4412-2	Reader; 80-column, table-top mounting, 1000-card input hopper and output stacker; 1000 cpm	Documation M1000L
PUNCHED TAPE EQUIPMENT		
4513	Reader; 5- to 8-level code, any standard tape; 625 cps	Chalco 5101
4512	Reader/punch; 5- to 8-level code; any standard tape; 625/110 cps	Chalco 5101/Teletype
4515	Punch; 5- to 8-level code, any standard tape; 110 cps	Teletype
TERMINALS		
4205	KSR communication printer; belt, 80 positions, 64-character set, 10 characters per inch, 3 to 12.8-inch paper, 6 lines per inch, 2-channel tape VFU, RS-232C interface; 30 cps	GE Terminet 300
4206	Same as 4205 but 120 cps and 120 positions	GE Terminet 1200
4233	ASR-33 teletypewriter, cabled console; 6020-ma current loop interface; 10 cps	Teletype
4611	CRT conversational terminal; for console or remote use; 24 lines by 80 characters, 1920 characters, 95 ASCII character set, switch-selectable RS-232C or current loop interface; 100 to 19.2K bps, switch-selectable	Hazeltine
4612	Same as 4611 but with line or page mode transmission for editing applications and block data transfers	Hazeltine

duced the 7870 uses the same 512K-byte memory modules used on the 7870, thus enabling the system to accommodate up to 1.25 million bytes of MOS memory. Both versions are currently marketed by Modcomp.

Both the 7860 and 7870 models include an integral high-speed floating-point processor that performs operations on 32-, 48-, or 64-bit operands in parallel. Special hardware instructions are included that are specifically oriented toward fast FORTRAN execution for users writing real-time tasks in the FORTRAN language. As a standard feature, the Classic 7860 and 7870 systems have five concurrent memory access paths. These paths provide concurrent CPU and I/O access capability. Therefore, in the 7860 and 7870, high throughput I/O operations only affect CPU operations when both attempt to access the same memory module at the same time. Two paths are

INTERNAL CODE: ASCII.

MAIN STORAGE

TYPE: Core or semiconductor; see "Characteristics" table.

CYCLE TIME: Classic 7810, 600 nanoseconds; Classic 7830, 7835, 7860, 7870, 125 nanoseconds, MOS, 125 nanoseconds core. With the appropriate options, all systems but the 7810 can have four-way interleaving that provides an effective MOS memory cycle time of 125 nanoseconds and core memory cycle time of 225 nanoseconds per 16-bit word.

CAPACITY: See the "Characteristics" table.

SHARED MULTIPORT MEMORY: A Shared Multiport Memory (SMM) system is optionally available for use on Classic 7860 or 7870 systems. This device enables the user to extend and connect two or more 7860 or 7870 memory buses. By simply housing the second memory bus in the SMM

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used by the CPU; one for the instruction pipeline, the other for the operand pipeline. Each of these pipelines may be loaded with up to four 16-bit memory words, a quad-word operand and up to four precalled instruction words. This substantially reduces memory access overhead by calling the next several instructions while the previous one is still executing. The remaining paths are used by the I/O processors, the optional Communications Processor, or by external users. Each access path has switch selectable priority so that the system can be optimized in certain applications.

A wide range of communication interfaces are offered, ranging from the dual channel controllers to serial or parallel CPU to CPU links. Included in this range are 16 channel asynchronous controllers for both switched and non-switched lines as well as an asynchronous subsystem which will multiplex up to 128 full duplex channels. Also included are the high performance subsystems which allow up to 256 full duplex channels in any mix of asynchronous, byte synchronous, and bit synchronous. These high performance subsystems provide a DMI channel to memory through the communications processor and will dynamically search for protocol character strings and perform code conversions. A complete line of software emulators is available including IBM 2780, 3780, 3271, Univac 1004, CDC UT200, and HASP workstation. In addition, direct channel attachments are provided for CDC 3000 and 6000, and IBM selector or multiplexer channels.

Modcomp offers numerous process input/output interface options for the measurement and control market. The newest of these is MODACS III and was first introduced in 1978. It functions as a front end subsystem on the I/O bus of any Classic CPU. MODACS III also accepts a CPU board from the 7810 computer and will function as a node in a distributed processing network with full Maxnet support. This combination will also support Modcomp's complete peripheral line to function as a stand alone system. The interface modules which plug into the chassis include digital and analog input options, and special function counter and interrupt options. The complete file including CPS and process I/O options can be backed up for five minutes with internal batteries to ride through brief power outages.

A Shared Multiport Memory (SMM) system, announced in June 1979, extends the 7860 and 7870 series processors memory capacity to four million bytes as well as allowing users to configure shared memory systems. An SMM system may consist of a memory expansion cabinet, a memory port interface, and the MAX IV operating system and associated software. The SMM hardware provides the ability to connect two or more Classic 7860 or 7870 memory buses. When the second memory bus is housed in the memory expansion cabinet the resultant effect is main memory expansion. When two or more computers extend and connect their memory buses to the memory port interface in the expansion cabinet, the configuration allows both computers to access the memory in the cabinet, the resulting effect is main memory expansion. When two or more computers extend and connect their memory buses to the same SMM cabinet, all of the computers can access the memory and share the data stored there. A maximum of four CPU's can connect to one SMM cabinet.

The SMM cabinet is an enclosure that comes complete with an eight-slot card file, an interface connector panel, and switching power supplies for the logic and memory devices. The card file can be configured with up to four remote memory port interfaces and up to three Classic memory options cards. A memory expansion chassis can be added for the 7860 and 7870 to provide the maximum capacity of four remote memory port interfaces and four memory options.

The memory port interface provides everything necessary to connect two standard memory buses, including two interface PC boards and cabling. A local memory port interface (LMPI) resides in the same card file with the computer that is seeking to share the external memory and the remote memory port interface (RMPI) card resides in the same card file as the remote or shared memory. The shared memory can be either part of the main memory of another 7860/7870 computer or the memory contained in the memory expansion cabinet. A maximum of two LMPI cards can be configured in each 7860/7870 system.

CHECKING: One parity bit per byte is standard. Parity is generated during writing and checked during reading.

STORAGE PROTECTION: On the 7810, a standard system protect feature includes memory protect and privileged instruction trap capabilities. The protect feature is enabled and disabled by operation of a keyswitch on the control panel. This standard switch also disables the other panel switches, except the data switches and Console Interrupt. An optional memory protect feature enables all of memory, except the user program currently being executed and a common area in upper memory, to be protected against modification or program entry. The program protect status can be modified under program control by changing the contents of two registers—the upper and lower protect registers. A third register is used to define the lower common boundary. Common extends to the upper memory boundary.

On the 7830, 7835, 7860, and 7870 models, two forms of memory protect are provided—virtual and non-virtual protect. The virtual memory protect system is implemented in the Memory Management System and consists of a four-level protect code which is assignable to each 512 byte page. Four levels of protection (read-only, read-execute, read-write-execute, and no access) are provided. The non-virtual protect supports a three-boundary protect mechanism that can be used to isolate non-privileged tasks from other areas of memory. The three boundaries divide common memory into task areas and a global common area. Program protect status can be modified under program control by changing the upper and lower protect register.

RESERVED STORAGE: For the 7810, the first 256 words in memory are reserved for the bootstrap loader and interrupt vector storage. For the 7830, 7835, 7860 and 7870, locations 32 through 767 are reserved for interrupt vectors, an operating system map image, and memory allocation blocks. If memory allocation and memory management are not used, only locations 32 through 511 need be reserved.

CENTRAL PROCESSOR

All Modcomp processors provide parallel operation for arithmetic, logical, compare, and shift functions. Each of the Modcomp processors is upward compatible with the larger, more powerful models, and has a modular bus control interface, general register file, and a priority interrupt system. Other features include a 200 Hz real-time clock, multiple

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memory expansion cabinet and to share the data stored there.

Allocation of multiple shared common areas is allowed by the MAX IV sysgen capability. MAX IV system software such as the FORTRAN compiler, the assembler, and the Task Overlay Cataloger facilitate user access to shared storage areas through some specific service instructions.

The user must design and implement the shared strategies that are unique to their application, i.e., Global Common Areas. Similarly, real-time redundancy and load sharing strategies can only be properly specified by the user for each situation. MAX IV provides the user interface, but does not make special provision for interprocessor communication.

All models in the Classic series have a multi-word architecture so that all instructions can be sized in whatever 16-bit word multiple is appropriate for the work being done—16, 32, 48, or 64 bits in length. This allows memory and register space to be optimized around the user application.

Software for the Classic Series includes operating systems MAX III, MAX IV, and MAXCOM; support software includes assembler, FORTRAN, COBOL, CORAL 66, Source Editor, Math Library, Debug, and Editor; distributed processing system software, MAXNET III and MAXNET IV; applications emulators, sort/merge, and XY Plotter Package; data base management, TOTAL and INFINITY; time sharing/transaction processing, DSX; diagnostics, local and remote.

Features of the MAX III and MAX IV operating systems include an execution control routine called Taskmaster that multiplexes CPU time between independent tasks at up to 256 different software levels; execution of tasks in either a privileged or unprivileged mode; context switching of the Taskmaster by completion of a delayed service or I/O operation, directly connected interrupt or another task; scheduling, starting, suspension, resumption or termination of tasks by operator directives, timers, directly connected interrupts, I/O handlers or other tasks; use of optional spooling tasks and special purpose symbionts to buffer slow devices to or from disk files or to simulate special device characteristics; provision of special task timers such as delay timers, task scheduling timers, watchdog timers, or CPU utilization counters.

MAXCOM is an executive software system that handles a wide range of communications systems applications, including message switching, data concentration, front-end processing, remote job entry, packet switching, and network transmission handling.

MAXNET is an operating system extension that enables the connection of any number of Classic, Modcomp II, or Modcomp IV computers in a network. Resources can be shared and the computing load can be distributed among the network members, with specific functions assigned to

controllers, programmer's control panel, operator console, hardware multiply/divide, power fail/restart, memory parity, stall alarm, and memory management system. Further available features include hardware fill, extended arithmetic unit (hardware floating-point), storage protection, more interrupts, a remote console, a direct memory processor, and a secondary I/O processor. The availability of these features on the various processor models can be found in the "characteristics" table.

REGISTERS: All classic models have fifteen 16-bit general-purpose registers plus one control panel switch which is program-accessible. Seven of the 15 registers can be used as index registers. On all Classic models except the 7810 there is a block of 240 16-bit context switching registers (16 sets of 15 registers). The Program Status double-word (PSD) defines which set of 15 of these registers is to "track", the general purpose register File. Each time new information is stored in a General Purpose Register, it is simultaneously stored in the corresponding Context File Register. When program switching occurs, by exchanging the PSD, the content of newly designated register file is automatically copied from the Context File to the General Purpose Register File. Therefore, 16 sets of General Purpose Registers are available to the programs currently residing in memory.

Additional registers are provided for storage protection and memory management, and a number of special-purpose transfer registers are multiplexed on to and out of the bus structure to provide the required buffer storage and holding registers needed to implement the CPU, I/O, and memory operations.

Last-in, first-out (LIFO) memory stacks are implemented in the Modcomp 7830, 7835, 7860 and 7870. They are useful to order list-structured precedence operators and operands, and to control reentrant and/or recursive task execution. For each separate stack, a user task establishes a stack pointer table in memory to define and maintain pointers to the low, current, and high stack address, plus a stack underflow/overflow error return address. Separate hardware PUSH and PULL instructions are provided to allocate/deallocate memory stack space and to move specified stack contents from/to the general-purpose registers. These stack processing instructions address the appropriate stack pointer table and supply the number of words to allocate or deallocate the beginning register number, and the number of registers to transfer to/from the beginning of the allocated/deallocated stack space. Register wrap-around through R0 occurs when R15 is accessed and the number of registers remaining to transfer is not zero.

ADDRESSING: All memory is directly addressable. There are seven addressing modes, including direct, immediate, indirect, indexed, indexed-direct (pre-indexing), short displaced, and short indexed modes. In addition to the seven addressing modes described, the classic systems can also address individual bytes through a variation of the short indexed addressing mode and can address individual bits in either memory or general-purpose registers through certain instructions, employing any addressing mode except immediate operand. Also, both doublewords and files up to eight words in length can be accessed or replaced in memory by individual instruction execution.

The Classic 7830, 7835, 7860, and 7870 systems use virtual memory addressing to address memory systems larger than 128K bytes. When enabled, an effective memory address is generated from any of the standard addressing modes to form a 16-bit virtual address. Address mapping hardware translates the virtual address into an actual page address. Mapping is accomplished using map files that contain 1024 registers. The map files may be configured in either of two ways. The first has four maps of 256 registers each, while the alternate configuration consists of seven maps, three with 256 registers and four with 64 registers.

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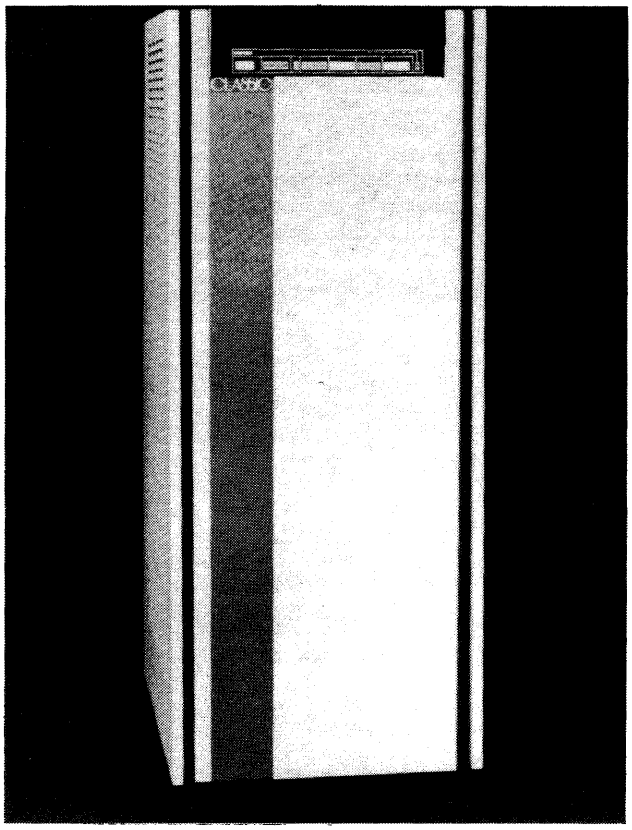

The Classic 7810 is designed for use in lower level measurement and control, scientific, and information processing applications. The 7810 is available either as a computer-on-a-board or as a fully integrated system. Features include a set of 169 instructions, 15 general purpose registers, and system protect. The 7810 is available in three versions with 64K, 96K, or 128K bytes of solid state memory that has an effective cycle time of 600 nanoseconds.

host processors and attended or unattended satellite processors.

Competition for the Classic systems comes from all of the major minicomputer vendors. The 7810 competes with the DEC PDP-11/04 and 11/34, the Data General micro-Nova and Nova 3, the Honeywell Series 60 Level 6, and other members of 16-bit minicomputer families, while the Classic 7860 and 7870 compete against DEC's PDP-11/70 and VAX-11/780, Data General's M/600, Prime's high-end systems, Hewlett-Packard's HP 3000 Series III, and the 32/XX series from Systems Engineering Laboratories. The mid-range 7830 and 7835 compete with a number of systems from these same manufacturers. Modcomp's targeted markets include users with process control applications in the chemical, petrochemical, and metals industries; manufacturing control systems for automotive components manufacturers and aircraft engine manufacturers; power utility systems for users with plant monitoring and control applications within the electric power utility industry; users with data acquisition and control or experiment monitoring applications, including certain segments of the Federal Government; and users with energy management applications. Pursuit of these markets is direct to the end user and through OEM and systems houses.

Switching between programs is acomplished by switching Program Status Doublewords (PSD). The PSD defines the map files, general purpose register file, and all other required program context. Programs of 256K-, 128K-, or 32K-bytes, for example, can be assigned to the map files. The 256K-byte program set is mapped through two 256 register maps—one for operands and one for instructions. The 128K-byte program is mapped through one 256 register map, and the 32K-byte program is mapped through one of the 64 register maps.

INSTRUCTION REPERTOIRE: For the classic 7810: 18 load, store, and transfer instructions; 33 arithmetic instructions; 32 logical instructions; 9 shift instructions; 36 bit manipulation instructions; 5 byte manipulation instructions; 7 unconditional branch instructions; 9 interrupt and call instructions; 4 control instructions; and 16 input/output instructions.

For the Classic 7830, 7835, 7860, 7870: 50 move instructions; 57 fixed point arithmetic instructions; 41 floating-point instructions; 60 logical instructions; 13 shift instructions—30 compare and test instructions; 49 branch and hop instructions; 37 control instructions; 13 interrupt and call instructions; and 17 input/output instructions.

INTERRUPTS: The Classic systems have 16 priority interrupt levels. Two of these levels, the I/O levels, can each be connected to up to 63 sublevels used by device controllers and external user signals. All levels and sublevels are automatically vectored. A Program Status Doubleword (PSD) is stored in a pair of dedicated memory locations for each level and sublevel. A second dedicated location pair per level is used to store the current PSD when an interrupt occurs. Program switching consists of storing the old PSD and obtaining the new PSD, both using the dedicated locations. The interrupt control instructions allow each level to be selectively enabled, disabled, requested, activated, and cleared.

PHYSICAL SPECIFICATIONS: The Classic 7810 processor is 21 inches high, 19 inches wide, 25 inches deep, and weighs 72 pounds. The 7810 is packaged in a four slot card file which occupies 21 inches of vertical rack space. The plug-in PC boards are 19 by 14 inches. Included with the four slot file are the power tray and I/O device connector panel.

The Classic 7830 and 7835 processors are 17.5 inches high, 19 inches wide, 24.6 inches deep, and the basic systems weigh 120 pounds. The card file, programmer's maintenance panel, and I/O connector panel occupies 35 inches of vertical rack space. The plug-in circuit cards are 19 by 14 inches.

The Classic 7860 and 7870 processors are 62.5 inches high, 24 inches wide, 29.5 inches deep, and the basic systems weigh 450 pounds. These systems use 19-inch printed circuit boards that plug into a multi-layer backplane. The basic model includes four modular units mounted in a cabinet. These units are the central processor chassis with 8 card slots and integral power supplies, the operator's panel, an AC distribution panel with convenience outlets, and a connector panel for I/O and peripheral device cables.

Power requirements for the Classic systems are 120 to 132 VAC, 48 to 62 Hz. The operating environment should be 32 to 131 degrees F. and between 0 and 90 percent relative humidity, noncondensing.

INPUT/OUTPUT CONTROL

The basic I/O structure in the classic computers consists of a party line bus capable of transferring words or characters between any of up to 63 peripheral devices and any of the 15 general registers. Transfers can be timed either by peripheral device interrupts or by program testing of device status. A word or character is transferred over the bus by execution of a

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USER REACTION

Datapro interviewed four users of Classic systems from a list of six supplied by Modcomp. Two of the six users contacted declined to comment, both citing as their reason insufficient experience with the system at the present time. All of the responding users had Classic 7860 models and each of the systems had a main memory capacity of 128K words. Three of the four users had one system installed, while one user had 11 7860's functioning as nodes in a network and dedicated to performance test applications. Seven of the 11 systems in the latter user's network had no peripherals on-line other than two CRT terminals per system. The following configuration information is based on the seven installed systems that include other type peripherals in addition to CRT terminals. Four systems had 10 megabytes of disk storage, two had 20 megabytes, and one had 130 megabytes; two systems had 1 magnetic tape on-line, one system had 2 magnetic tapes; and five systems had 1 remote CRT terminal while one system had 2 remote terminals on-line.

All of the systems were running under the MAX IV operating system and all were using MAXNET. FORTRAN was the primary language used by all of the users, with three of the four doing some assembly programming. Principal applications mentions included real-time control, data communications, and scientific/engineering computing. All application programs were being written by in-house personnel.

These systems had been installed for periods ranging from 7 months to 22 months, with an average installation life of 10 months. All of these users had purchased their systems outright.

The table below summarizes the ratings given by these Modcomp Classic users.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	2	2	0	0	3.5
Reliability of mainframe	2	2	0	0	3.5
Reliability of peripherals	1	2	1	0	3.0
Maintenance service:					
Responsiveness	1	1	2	0	2.8
Effectiveness	1	2	1	0	3.0
Technical support	0	2	2	0	2.5
Manufacturer's software:					
Operating system	2	2	0	0	3.5
Compilers and assemblers	0	4	0	0	3.0
Ease of programming	2	2	0	0	3.5
Ease of conversion	0	1	0	0	3.0
Overall satisfaction	2	2	0	0	3.5

*Weighted Average on a scale of 4.0 for Excellent.

On the plus side, all four of the users were impressed with the flexibility and reliability of the system. System features mentioned by these users as praiseworthy included the FORTRAN compiler, MAXNET, the price/performance ratio, the I/O file structure, and number of operating system services that are available to the user.

single instruction that contains the device number, general register address, direction of transfer, and type of information —data in or out, command out, or status in.

Immediately after execution of an I/O instruction, a new I/O instruction can be executed, specifying a different device and all other transfer parameters. Therefore, transfer routines for many different devices can be performed at the same time on an independent, interrupt-driven basis.

The Classic 7810 features a Direct Memory Processor (DMP) that consists of eight automatic, multiplexed transfer channels. It enables up to eight blocks of words to be transferred between memory and peripheral devices or measurement control, and communication subsystems. The capability for automatic data chaining is also provided. Transfers are made over the standard party line bus and have the highest interrupt priority in the 7810 CPU. The DMP automatically transfers control from the program whenever word transfers are requested by active peripheral devices connected to the DMP channels.

All eight of the DMP channels contain a pair of 16-bit memory locations that hold the memory address for the next transfer and the number of words remaining to be transferred in the current block. These channels can transfer words at combined rates up to 250K words per second. The classic 7830, 7835, 7860, and 7870 systems include an Input/Output Processor (IOP) that contains 16 multiplexed, block transfer channels connected directly to memory. An I/O access can be made to one memory module at the same time that a CPU access is being made to a different memory module. Different transfer rates can be achieved depending upon the length of the bus. A system with two dual-bus IOP's could have an aggregate I/O transfer rate of 8 million bytes per second on a Classic 7860 or 7870, and up to 4 million bytes per second on a Classic 7830 or 7835. Each of the 16 channels contain a pair of 16-bit registers which hold the virtual address for the next memory transfer and the number of words remaining to be transferred in the current block. When a block transfer is initiated, the physical page address corresponding to the first virtual page address is automatically obtained from the memory-stored map image assigned to the program. As each new virtual page is entered, by incrementing the virtual address after each word transfer, the next physical page address is automatically obtained from the map image in memory.

CONFIGURATION RULES

Modcomp Classic systems are rack mounted systems that use plug-in card files for controllers, CPU logic, and memory. Each plug-in card requires one slot. Some controllers are called port options and mount on a plug-in card to allow flexibility in the function of the plug-in card. The Classic 7800 computers can accommodate up to three I/O controller plug-in cards within the basic CPU chassis along with CPU logic and memory. Enclosures are also available for additional memory and controllers.

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4190 MEMORY+ SYSTEM: This product is a bulk core memory system designed to replace head-per-track swapping disks in high-performance systems. The bulk core subsystem operates as an I/O device and can accommodate up to 4 million bytes in 16 256K-byte increments. Addressing is organized into tracks and sectors, and Memory+ controller commands are the same as those issued to a head-per-track controller. One significant exception, however, is that Memory+ permits data transfers of as little as one word.

There are 128 words (256 bytes) per sector, 32 sectors or 4096 words (8192 bytes) per track, 32 tracks or 131,072 (262,144 bytes) per module, 8 or 1,048,576 words (2,097,152

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On the minus side, two users were critical of Modcomp's documentation, one felt that their training program was not adequate for users who had no previous experience with Modcomp equipment, and one user said that maintenance response time was "not too quick." One user, who liked the system's I/O structure and flexibility, was not overly impressed with Modcomp's assembler or with the method used to access the object module file.

These users appeared to be quite satisfied with their Classic systems at this time. As one user expressed it, "Considering the system's flexibility and price/performance, if I had to do it over again, I'd still go Modcomp."□

bytes) per file, 2 files or 2,097,152 words (4,194,304 bytes) per 4190, and up to four 4190's per CPU. Each Memory+ bulk core module is a continuous 128K by 18-bit array that is folded around the four surfaces of two printed circuit boards. The two boards are hinged together for easy access to any core area.

Each file can have its own dual-access interface, which permits the addition of a second device controller, allowing overlapped file access within a single-CPU system or shared access from another CPU. A self-test capability is present in each file, allowing either file in the Memory+ system to be taken off-line for testing or repair.

The controller operation is comparable to that of Modcomp's peripheral fixed-head disk systems, but there are significant performance differences. Access to a Memory+ device can occur within 1 microsecond following service initiation, and data can be transferred at rates of 3 to 4 megabytes per second using currently available Modcomp IV models. Should a main memory port be unavailable, data will be transferred via the I/O bus at its normal rate. Data buffering is not required since there are no overflow implications in the core memory modules.

The controller utilizes standard virtual-mode addressing for management of data transfers between Modcomp IV main memory and Memory+. Standard Modcomp II and IV main memory protect features are also implemented.

With two controllers connected to a single file, dual access to that group of up to eight core modules is time-shared. When two controllers are connected to two files, however, one controller may access one file while the other controller accesses the other file. Either controller can lock out the other from accessing either file.

The 4190 has a data transfer rate of 1.32 to 4.58 megabytes per second, average. Up to four-way block address interleaving using more than one 256K-byte module yields a transfer rate of 3.7 million bytes per second. Cycle time for the bulk core memory is 1500 nanoseconds, with an access time of 600 nanoseconds.

410X SERIES FIXED-HEAD DISKS: Three models, the 4103-1, 4104-1, and 4106-1, respectively provide storage capacities of 524,288 bytes, 1,048,576 bytes, and 2,097,152 bytes. Each disk drive has its own controller and contains 64, 128, or 256 tracks, 32 sectors per track, and 128 16-bit words per sector. Average rotational delay is 8.7 milliseconds, and the data transfer rate is 512K bytes (256K words) per second. The 4100 Series disk drives are manufactured by Data Disc, Inc.

4120 SERIES CARTRIDGE DISKS: Models 4126/4127 provide removable-cartridge storage for up to 2,598,400 bytes, while Models 4128/4129 provide storage for up to 5,196,800 bytes. Model 4126 consists of a controller for one to four drives and one 4127 drive. Model 4127 is the add-on drive for the 4126 subsystem. Model 4128 includes a controller for up to two drives; each drive includes two disk cartridges (IBM 1315-type), one of which is removable. Model 4129 is a dual-cartridge add-on for Model 4128. Both units attach to the processor via the direct memory processor (DMP) channel, and the controller interface requires two slots in the peripheral controller interface. Write lockout is provided to insure track protection. Both models store data with 200 bytes per sector, 32 sectors per track, and 200 tracks plus 3 spares per surface. There are a total of 406 tracks on the 4126/4127 and 812 tracks on the 4128/4129. Data transfer rate is 195,600 bytes per second, and average access time is 90 milliseconds (including a 20-millisecond average rotational delay). Head positioning time is 15 milliseconds track-to-track and 135 milliseconds across all tracks. The drives rotate at 1500 rpm. The 4120 Series drives are manufactured by Diablo (Models 31 and 33).

4130 SERIES MOVING-HEAD DISK (IBM 2314-type): Models 4132/4133 and 4134/4135 provide per-spindle capacities of 24,944,640 bytes and 49,889,280 bytes, respectively. Each subsystem consists of a controller and up to four disk drives, providing total subsystem capacities of 100 and 200 million bytes for Models 4132 and 4134 subsystems, respectively. The 4133 is the add-on drive for the 4132 subsystem; the 4135 for the 4134 subsystem. The 4130 disks connect to the processor by means of a direct memory processor channel and occupy two slots on the peripheral controller interface. Cylinder protection is insured by a write lockout feature. Provision is also made for overlapping seeks and automatic sector and head switching.

Both models store data at 2200 bpi on IBM 2316-type disks with 20 tracks per cylinder, 24 sectors per track, and 364 bytes per sector. Models 4132/4133 have 203 cylinders per pack, and Models 4134/4135 have 406 cylinders per pack. Both models have a data transfer rate of 312K bytes per second and an average access time of 44.5 milliseconds (12.5 milliseconds rotational delay and 32 milliseconds head movement time). Track-to-track and across-all-tracks head movement are 8 milliseconds and 58 milliseconds, respectively. The 4130 Series units are supplied by Ampex (Model DM-323).

4136 SERIES MOVING-HEAD DISKS: The subsystem consists of a controller and up to four disk drives, providing a total of up to 40 megabytes of storage. The Model 4136 is the master drive and is provided with the controller. The Model 4137 is the add-on drive. The 4136 and 4137 each provide 10,027,008 bytes of formatted storage. The subsystem connects to the processor by means of a direct memory processor channel and occupies two slots on the peripheral controller interface. Data is stored at 2200 bpi on the disk packs, which have 4 tracks per cylinder, 24 sectors per track, and 256 bytes per sector. There are 408 cylinders per pack. The drives have an average rotational delay of 12.5 milliseconds. Track-to-track, average, and across-all-tracks head movement times are 10, 35, and 70 milliseconds, respectively. Data transfer rate is 312.5K bytes per second. The drives are rack-mountable and require 8¾ inches of vertical height. The 4136/4137 drives are manufactured by Wangco (Model T 2222).

4138 SERIES DISK DRIVES (IBM 3330-type): There are four models offered in this series. The 4138-1 includes one 83,962,368-byte disk drive and a controller for up to four drives. Model 4138-2 is the add-on disk drive. The 4138-5 is the double-density version of the 4138-1 and includes one 167,924,656-byte disk drive and a controller for up to four drives. The 4138-6 the double-density version of the 4138-2.

The 4138 disks have either 404 cylinders plus 7 spares, or, in the double-density version, 808 cylinders plus 7 spares; 19 tracks per cylinder; and 5,376 words (10,752 bytes) per track. Physical layout specifications for the 4138 include 128 words

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(256 bytes) per sector, 42 sectors per track, and 102,114 words (204,228 bytes) per cylinder. Also included in the 4138 subsystems are features such as error checking on an individual sector basis, overlapped seeks for two to four drives, and buffering of a full track of data. Average head positioning time is 28 milliseconds, and average rotational delay is 8.35 milliseconds. Track-to-track and across-all-tracks head movement times are 10 milliseconds and 55 milliseconds, respectively. The 4138 controller occupies four slots in the peripheral controller interface. The 4138 disk drives are supplied by Ampex (Models 9100 and 9200).

4173 MOVING HEAD DISK: Provides storage capacities of 21 or 67.4 megabytes. A fixed media unit with an average access time of 30 milliseconds, average latency time of 8.3. The data transfer rate is 1.2 million bytes per second. Requires 4143 controller.

4174 MOVING HEAD DISK: Provides storage capacities of 67.4 or 253.7 megabytes. A removable media unit with the same specifications as the 4173 unit. Also requires the 4143 controller.

4521/4522 FLOPPY DISK: Model 4521 includes a single floppy disk drive and a controller; Model 4522 includes dual floppy disk drives and controller. The controller can support up to two drives and connects to the direct memory processor through one slot in the peripheral controller interface. The drive automatically unloads the heads 600 milliseconds after each transaction to minimize disk surface wear. Storage capacity is 315,392 bytes per drive, with 256 bytes per sector, 16 sectors per track, and 77 tracks per drive. Average rotational delay is 83.3 milliseconds with a disk rotational speed of 360 rpm, and average seek time over 28 tracks is 290 milliseconds. Track-to-track head positioning time and head settling time after the last step are both 10 milliseconds. Head load time is 80 milliseconds. The 4521/4522 floppy disk drives have a data transfer rate of 315,392 bytes per second and are manufactured by Shugart.

INPUT/OUTPUT UNITS

See Peripherals/Terminals table. In addition to the traditional I/O peripherals, Modcomp offers an extensive and comprehensive line of analog/digital interfacing units and special generalized digital interfaces to enable users to implement nearly any process control or instrumentation application.

COMMUNICATIONS CONTROL

GENERAL: There are two aspects to communications control within the Modcomp processor line: the normal interface units, which connect data channels to the I/O bus, and an additional set of macro instructions supporting communications and implemented in control storage. The latter are also supported by direct memory interface (DMI) hardware, which provides a separate path for up to 256 full-duplex channels between the Universal Communications Subsystem Model 2 and memory. The special communications instruction set includes eight DMI instructions and six data manipulating instructions.

UNIVERSAL COMMUNICATIONS SUBSYSTEM: This subsystem contains two separate communications components and permits interfacing up to 256 full-duplex synchronous or asynchronous lines to any Classic Modcomp II or IV processor. The two elements employed in this subsystem are the 1907A-X/1907A/B-X Universal Communications Controller Model 2 Computer I/O Interface and the 1930-xx Communications Chassis. These units are described in separate paragraphs below.

1907A-X/1907A/B-X UNIVERSAL COMMUNICATIONS CONTROLLER MODEL 2 COMPUTER INTERFACE: The UCC controls up to 256 full-duplex lines in any mix of synchronous or asynchronous lines through storage of line parameters in a 64-bit by 256-word RAM. The status of each line is recorded in a 64-bit word which is alterable by the program. Line scanning is controlled by an internal processor, with the scanning algorithm implemented in programmable read-only memory. The scanning algorithm can be either standard factory-supplied or user-specified, enabling optimum servicing of any mix of low- and high-speed data lines. Line interfaces are provided through line interface adapters mounted in the 1930-xx Universal Communication Chassis. Up to eight chassis can be accommodated, with each chassis providing up to 32 full-duplex channels. The 1907A-X/1907A/B-X UCC plugs into a 4903 or 4905 Peripheral Controller Interface in a 4911 Peripheral Controller Enclosure.

1930-XX UNIVERSAL COMMUNICATION CHASSIS: This unit serves as a housing, power source, clock source, and general interface for up to 16 193x dual-line interfaces. All necessary power for the line interfaces is provided, as well as 15 standard clock frequencies. The asynchronous line interface module can select any of the 15 clock frequencies under program control. The universal communications chassis is available in a single-port (1930-1x) or dual-port (1930-2x) model. The x in the model indicates whether the chassis is equipped with terminators (1930-1A, 1930-2A) or not (1930-1B, 1930-2B). The dual-port models have connections for two different 1907A/B-X controllers connected to two different computer systems or to two 1907A/B-X's in the same system for redundant paths. The 1930-xx Chassis mounts individually and is connected to the 1907A/B-X Controller by cables.

193x DUAL-LINE INTERFACE MODULES: Nine models of dual-line interface modules are offered to connect various data communications lines to the 1930 Communication Chassis. All models accommodate two full-duplex lines and have full modem controls. Three of the five handle asynchronous lines at 15 standard data rates up to 19.2K bits per second, differing only in the line interface. The asynchronous channels also provide for a frame size of 5, 6, 7, or 8 bits; parity selection of odd, even, or none; 1, 1.5, or 2 stop bits; break detect and break transmit; busy out; rate select; secondary channel; echo; wrap-around; and split speed (different input and output rates on one full-duplex channel). Model 1931 is for RS-232C lines, while Models 1932 and 1933 offer 20/60-milliampere current loop interfaces, the former with 40 volts maximum isolated and the latter with a 17-volt battery. Transmit and receive rates need not be the same on full-duplex applications. Models 1934-1, -2, and -3 are for byte synchronous operation with RS-232-C, Bell 301/303, and CCITT V. 35 lines, respectively. The sync character may be different for each of the two lines and is software-selectable.

The line interface module will strip leading sync characters from input messages and insert six leading sync characters into output messages under program control. The secondary channel is supported by the interface as well as a programmable character size of 5, 6, 7, or 8 bits; parity selection of odd, even, or none; rate select; busy out; and wrap-around.

1908 INTEGRATED COMMUNICATIONS SUBSYSTEM: Includes controller, Asynchronous and Synchronous multiplexer and 8 full-duplex channels in one package. A second controller and related cable assembly can be attached to provide 16 full-duplex lines. Factory configured plug-in line interfaces are available for two full-duplex Asynchronous RS-232 interfaces, two full-duplex Asynchronous Current Loop interfaces, two full-duplex synchronous RS-232C interfaces, two full-duplex Synchronous W.E. 301/303 interfaces, or two full-duplex synchronous CCITT V.35 interfaces. The synchronous interface can be either byte or bit mode under software control.

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OPERATING SYSTEM REQUIREMENTS/SUPPORT

	MAX II				MAX III			MAX IV	
Residence	Core	Core	Disc	Disc	Core	Disc	Disc	Disc	Disc
Minimum memory capacity, bytes	32K	48K	32K	48K	32K	48K	64K	96K	192K
Multiply/divide	X	X	X	X	X	X	X		
Executive features**	X	X	X	X	X	X	X		
Direct memory processor			X	X		X	X	X	X
System protection						X	X		
Minimum disc capacity, bytes			256K	256K		512K	512K		
Binary I/O devices	X	X	X	X		X	X	X	X
Console	X	X	X	X	X	X	X	X	X
Assembly	X	X	X	X	*	X	X	*	X
Macro assembly, non-overlay	X	X		X	*		X	*	X
Macro assembly, overlay			X		*	X		*	
FORTRAN, non-overlay		X			*		X	*	X
FORTRAN, overlay			X		*	X		*	
System processors	X	X	X	X	*	X	X	*	X

*Dedicated application
**Executive features include a real-time clock, console interrupt, external level and task scheduler interrupts.

1905 ASYNCHRONOUS COMMUNICATIONS SUBSYSTEM: Provides economical interfacing for up to 128 full-duplex asynchronous lines at one of 11 rates from 75 to 9600 bps for low-speed line concentration, store-and-forward message switching, and interactive time-sharing. The 1910 subsystem consists of a 1905 Asynchronous Communications Multiplexer (ACM) Controller, up to four 1910 multiplexers, and a combination of up to 32 Model 1912 or 1914 full-duplex subchannels.

The ACM controller is responsible for scanning each of the subchannels and detecting/generating data and/or service interrupts as required by the subchannels. The 1910 multiplexer provides the power source, controller interface, clock generator, and card cage for up to 32 full-duplex channels. Each multiplexer may be configured with 5 of the 11 available rates.

The subsystem has provisions for 1 or 2 programmable stop bits; a programmable frame size of 5, 6, 7, or 8 bits; programmable character parity generation and checking, which may be either odd, even, or not present; and double-character buffering.

The 1912 and 1914 subchannels have the same functional characteristics, differing only in external signals and levels for interfacing. The 1912 is RS-232C-compatible and is limited to directly connected terminals or dedicated lines. The 1914 is designed for 20-ma current loop interfaces, and has an isolated solid-state interface.

4806 Asynchronous Terminal Controller: Provides control and multiplexing for 16 asynchronous full-duplex terminal lines, 110 to 19.2K bps. Channels can be configured for either RS-232-C or Current Loop interface. Requires one I/O slot in Classic series chassis.

4807 Asynchronous Terminal Controller: Same as 4806 but requires two controller positions.

4808 Asynchronous Modem Controller: Provides control and multiplexing for 16 asynchronous full-duplex switched modem lines, 50 to 19.2K bps. Channels can be configured for either RS-232-C or Current Loop interface. Requires one PCE controller position.

3108/3109 COMMUNICATIONS PROCESSOR: Consists of an optional logic board that can be added to Classic series processors. The addition of the communications processor extends the hardware instruction set and provides an external multiplexed data path between main memory and the communications subsystems. The extended instruction set is optimized for message-oriented data. Instruction capabilities include high-speed byte string move operations with the ability to perform character translations, editing functions, and computation of block check characters. The implementation of the instructions is in hardware.

The external multiplexed Direct Memory Interface (DMI) provides a data path directly to and from main memory for the communications subsystems. This data path is independent of the CPU and provides for message mode transfers concurrently on up to 256 full-duplex communications lines. Each communications line is controlled by its own discreet special character algorithms enabling detection to be performed in hardware. The individual algorithms are dynamically definable by software providing the flexibility to accommodate changing environments.

481X Dual Channel Controllers: Provides both asynchronous and synchronous channels for remote terminal/computer interfacing. Half- or full-duplex operation at up to 9600 bps is supported with double-character buffering, programmable hardware wrap-around, programmable character parity (odd, even, or none), asynchronous hardware echo, a programmable frame size of 5, 6, 7, or 8 bits, 1 or 2 programmable stop bits for asynchronous operation automatic sync character generation and deletion, and hardware CRC generation. Each of the channels occupies one slot position. The various channels offer asynchronous rates of 75 to 9600 bps (4810 and 4811) or synchronous rates of 110 to 9600 bps (4812, 4813, and 4815).

The 4810 and 4811 are dual asynchronous interfaces offering two full-duplex channels with a 20-ma current loop (4810) or RS-232C-compatible interface (4811).

Both the 4812 and 4813 are designed for asynchronous operation, offer one full-duplex channel, and are provided with remote fill capability. The 4812 is supplied with a current loop interface, while the 4813 has an RS-232C interface. the 4815 offers two full-duplex channels through a dual synchronous interface and is RS-232C-compatible.

4805-1 General Purpose 16-Bit Data Terminal: Computer interface includes I/O interrupts, DMP interface. A pair of 4805-1's provides a link for any Modcomp processor-to-processor link. The data transfer rate is 100K words per second.

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SPECIAL COMMUNICATIONS PRODUCTS: These are products which are offered for customized applications and are not available from standard product lines. Included in this category are the Modcomp 1941 CDC Satellite Coupler, which provides a bidirectional path for data transfers to and from Control Data 3000 or 6000 CPU's and a Modcomp processor; the 1950 Modcomp-IBM Channel Interface, which provides a bi-directional, parallel data path between an IBM 360/370 selector or multiplexer channel and a Modcomp processor; the 5950 IBM Selector Channel Emulator; and the 4819 Auto Call Unit Controller. For further information on these products, consult a Modcomp local sales representative.

REAL-TIME I/O

Modcomp has available a wide range of process interface devices for connecting their computer systems to plant and laboratory equipment.

Model 1200 High Level Analog Input Subsystem: Provides samples at rates up to 50,000 samples per second for 10 volt to 100 volt full range signals.

Model 1300 Wide Range Solid State Analog Input Subsystem: Offers 12 programmable gain ranges for full scale inputs from 5 millivolts to 10 millivolts and sample rates up to 20,000 samples per second. Zero suppression is optional.

Model 1400 Wide Range Relay Analog Input Subsystem: Provides the same capabilities as the Model 1300 but with sampling at lower rates to provide increased common mode rejection.

Model 1500 High Level Differential Analog Input Subsystem: Provides the same capabilities as the Model 1200 plus a sample and hold function.

Model 1800 Modular Data Acquisition and Control System: A full function process I/O interface system. It contains digital input and output, analog input and output, standard Direct Memory Processor (DMP) I/O functions, a Classic 7810 board computer with 64K to 128K bytes of MOS memory and a CPU-to-CPU communications link that supports hardware remote fill.

Model 1100 I/O Interface Subsystem: Can contain up to 16 channels to connect almost any combination of digital and contact inputs or outputs. Each channel can consist of 16 digital inputs or outputs, two analog outputs or a communications terminal interface. Also, channel multiplexers are available to multiplex up to 64 subchannels per channel, giving a capacity that should meet most needs.

Model 1600 Modular Data Acquisition Subsystem: Designed to handle small digital and analog data handling needs. Provides 16 or 32 analog inputs, 2, 4 or 8 analog outputs, or 32 digital inputs or outputs.

Model 1700 Remote Acquisition Subsystem: Allows any 1100, 1200, 1300, 1400, 1500, or 1600 subsystem to be remotely located as far away as one mile from the Classic computer. Transfer rates at speeds up to 32K bytes per second.

SOFTWARE

OPERATING SYSTEMS: The Modular Application Executive (MAX) system provides three levels of system capability: MAX II, MAX III, and MAX IV.

MAX II and MAX III are compatible operating systems; MAX III is a superset of MAX II. They share common executive services, peripheral handlers, and software.

MAX II is designed for batch processing with limited real-time requirements. It is a multiprogramming system that can execute multiple core-resident tasks concurrently with one batch job stream. MAX II is available in a core version and a batch version. The core version includes a taskmaster which allocates time slices to any number of core-resident tasks. It supports up to 256 unique execution priority levels. The batch version supports both moving-head and fixed-head disks and magnetic tape.

The MAX II core version includes re-entrant floating-point simulation and re-entrant FORTRAN IV run-time packages; re-entrant executive services for I/O operations; execution control, byte string syntax analysis, code conversions, and utilities; and a device-independent I/O system. The batch version adds nonresident background and batch processing services to the real-time services of the core version.

MAX III is a real-time multiprogramming system with foreground/middleground/background capabilities. It is task-oriented and can have any number of tasks active in up to 256 priority levels. MAX III is useful in medium-to-large Modcomp II multi-user configurations.

MAX III exists in three versions: a core version, a batch version, and an extended version. The core version executes resident foreground tasks contained entirely within fixed areas of memory. It also includes a clock-driven CPU control executive, re-entrant executive services, queued I/O services that can be performed concurrently with task execution or with the calling task, suspended, an off-line system generation program for configuring the resident elements and tasks of the system, and services for allocation of core not used by resident elements. Also included in the core version are a real-time clock for maintaining the time-of-day, timing task delays, and updating system watchdog timers; an option allowing the execution of more than one task at each priority level, and a feature allowing important or frequently used library subroutines to be declared resident at system generation time. Re-entrant library subroutines, memory tables, and variables may be made global. The system generation package permits generation of large core-resident systems in small core configurations.

The batch version of MAX III is a foreground/background system which adds the capabilities of a full-service loader for overlay programs catalogued on either sequential or direct-access devices. An optional background task may be added which uses a nonresident job control overlay to control batch processing operations. This version does not contain middleground or batch checkpointing capabilities.

The extended version of MAX III provides a full foreground/middleground/background system, which permits establishment of one or more core pools for foreground and middleground execution. Core is dynamically allocated to each task on a priority basis. The extended version also permits one or more background areas to support batch processing. These areas can be stored on a disc when higher-priority nonresident foreground programs require the memory space. The system allows background and middleground core area sizes to be changed by the operator, spooling of low-speed printing devices. Active tasks can request additional core blocks for use at run time. These blocks are automatically deallocated.

Foreground, middleground, and background tasks may be either privileged or unprivileged. The unprivileged mode is the user mode, where the task has absolute control within its own memory boundaries only. The privileged mode allows those programs that are fully debugged complete access to all system resources.

MAX IV is a disk-oriented, real-time, communications-oriented multiprogramming system specifically designed for

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medium-to-large Modcomp IV systems. The operating system utilizes the Modcomp IV hardware relocation capabilities, map protection, memory allocation/ deallocation instructions, multiple register sets, and multiported memories to reduce system overhead. In addition to most of the capabilities of MAX III, including a clock-driven CPU executive, MAX IV offers 256 task priority levels with the capability to execute multiple tasks at each level; re-entrant executive services for execution control, byte string syntax analysis, and code conversion; dynamic allocation of system resources; assigning privileged and unprivileged status to tasks; and the option of core residency or disk residency for tasks, if memory is to be conserved.

The basic executive services and functional capabilities of MAX II and III are included in MAX IV as a subset. Tasks and overlays developed under MAX II or III will operate normally under MAX IV provided that the interface to the operating system is via Modcomp macro calls, executive services, or standard FORTRAN call subroutines.

A file manager system is available as an extension to the MAX IV operating system which can be used by any task concurrently with MAX IV's basic I/O system. The file manager organizes, maintains, and services multi-level files in any size and number. Nesting of named data files and file directories to any level while maintaining file security at each level is permitted. Up to four levels of volume and file access protection are provided using locks and keys. Both volume and file disposition functions based on user expiration dates are available. Volume and file access are device-independent. The file manager provides both direct and sequential access methods, as well as the ability for the user to develop his own access method through the MAX IV basic I/O system. File names may be of variable length, controlled by the user. File space may be contiguous or noncontiguous and is automatically allocated and deallocated.

LANGUAGES: A 4K assembler and 16K macro assembler (6K resident requirement) are available for all Classic Systems, plus FORTRAN, COBOL, and CORAL 66.

The *Assembler* operates in two-pass fashion and requires a minimum batch processing area of 8K bytes, which can handle up to 200 symbol names. With additional available memory, the symbol table can be expanded at the rate of one symbol for every three words of memory.

Featured in the Assembler are both absolute and relocatable object format; free-field assembly format; a set of directives for aiding in expressing constants, allocating storage, interprogram communications, and listed output formatting; error diagnostics; an object listing including source and object code; symbolic addressing; the ability to define new instructions implemented in the ROM controller; and the capability to accept symbolic constants both as operands in an immediate instruction and in data statements.

The Macro Assembler is a free-format language processor that contains all of the assembler capabilities, plus additional features which include the generation of nested macros, recursive macro calls, assembly-time branches, and macro exits.

The Macro Assembler is a two-pass processor that generates relocatable and absolute object format and requires a minimum batch processing area of 24K bytes. This language processor contains directives which allow the definition of macro prototypes, conditional assembly, custom hardware macros, symbol definition, plus local and global label processing. The user can define COMMON blocks for communication between FORTRAN and assembly-language programs and subroutines.

The Modcomp *FORTRAN IV* compiler meets the specifications of the American National Standards Institute (X.39, 1966). Real-time extensions are provided which make FORTRAN a useful data acquisition and control language.

Modcomp FORTRAN IV is designed to produce efficient code through subscript optimization, block-level optimization, and the utilization of all Modcomp II or Modcomp IV machine capabilities, such as all general registers and the full instruction set.

Direct-access I/O to disk files is provided through DEFINE FILE statements. A file manager provides the utility functions for the creation and deletion of disk files to be used with the FORTRAN direct access I/O system. READ and WRITE may be free-format.

The programmer using the Modcomp FORTRAN IV compiler can write source code incorporating in-line assembly-language coding, including macro directives. The user can also call all the MAX executive services through in-line assembly-language coding for maximum run-time efficiency.

A set of CALL subroutines which are compatible with ISA Standard 61.1 has been added to the MAX IV System Library. They provide real-time capabilities for execution control of real-time tasks, status testing, and interrupt utilization. Array extensions provide the user with the freedom to use any arithmetic expression as an array subscript. Arithmetic capabilities include 16-bit and 32-bit (Modcomp IV) integers, plus 32-, 48-, and 64-bit (Modcomp IV) floating-point operations. The Modcomp floating-point hardware unit is fully supported by the compiler.

The FORTRAN I/O Run-Time Package is written in a reentrant format, allowing a single copy to be shared by all programs.

A comprehensive diagnostic capability provides assistance in the form of error printouts indicating the types and number of errors that exist in any line of coding.

Modcomp's FR5 FORTRAN IV compiler is a single pass compiler designed for use in a real time environment. The FR5 compiler provides many enhancements to the ANSI standard 3.9 1966 and takes advantage of the Classic family's FORTRAN oriented instructions to produce highly optimized and efficient code. FR5 features include extensive diagnostics during compile and run time, compile time options, sharable runtime code, extended memory support, trace and debugging facility, inline code, FORTRAN callable utility library, and a reentrant runtime package. FR5 operates under the MAX IV operating system. The compiler requires 44K bytes of main memory and requires a minimum of 6K bytes of additional memory for symbol table usage.

The Modcomp COBOL compiler is a low intermediate version, with enhancements, of the ANSI standard X3.23 1974. Compilation and execution can be performed under either the MAX III or MAX IV operating system. The minimum hardware requirement is a CPU with 256K bytes of memory, 5 megabytes of moving head disk storage, one magnetic tape, and a console device. The compiler requires a minimum of 30K bytes of memory.

CORAL 66 is a general-purpose high-level programming language particularly suited for real-time applications and system software development. MAX III and MAX IV versions are compatible with the official definition of the CORAL 66 language Type D with recursion. Extensions to the language include byte arrays, shift operators, hexadecimal constants, and multiple-named common and FORTRAN interfaces.

COMMUNICATIONS SOFTWARE: Modcomp has produced several specialized communications software packages, including MAXCOM and MAXNET.

Modcomp Classic Systems

MAXCOM is a demand-driven operating system for dedicated communications applications. It does not support background system processors. MAXCOM can support up to 256 tasks, each with a separate priority level. Drivers are included for TTY, IBM Bisync, and CDC 200 UT terminals as well as for CDC 6000 and IBM 360/370 host processors. The operating system provides queued I/O services with the option of immediate return to interrupted tasks, deferred return to interrupted tasks, or no return. System generation is accomplished through the Modcomp macro assembler or the CDC and IBM cross assemblers. Generally, MAXCOM offers all the features of MAX II plus the enhancements gained through the addition of the communication macros to any Modcomp II CPU. The minimum configuration needed to run MAXCOM is any Modcomp processor with 8K words of core. To generate MAXCOM, however, a minimum of 16K words is required.

MAXNET III is an extension of the MAX III operating system that permits linking multiple Modcomp II or IV or Classic processors to form a distributed network which operates as an integrated system. Each system in the network has all the capabilities of the extended version of MAX III plus the capabilities of the designated host system to exercise control over all satellite systems. The system permits such functions as establishment, activation, holding, and killing of remote tasks, default assignments if current tasks are non-executable, task resumption, and file assignment to both assembly language and FORTRAN users.

There are five specialized tasks to support network operations. These are the link task to interface the I/O system and allow device-independent I/O transfers through the network: a loader task for transferring other tasks from the host system disk to a satellite system; a linking loader that is specifically designed for network applications and will receive binary inputs from the host system, perform checksum validity checks, and request a predetermined number of retries under error conditions; and a software buffer management package which permits establishment of buffers in other systems' global or common areas.

The configuration needed for a MAXNET III host system is a Modcomp II, IV, or Classic with 128K bytes of memory and all peripherals required by MAX III, extended version. Satellite systems require 48K bytes of memory as a minimum and any Modcomp communications interface to the host system.

MAXNET IV is an extension of MAX IV with all of its real-time multiprogramming capabilities and provision for a mechanism to communicate with MAXNET III. The MAXNET IV host system requires a Modcomp IV processor with 256K bytes of memory and the peripherals required by MAX IV. A satellite MAXNET IV system requires 128K bytes of memory.

The *CDC 200 User Terminal Emulator* provides a means for a Classic to communicate with a remote Control Data 6000 or 7000 Series computer. The emulator operates under MAX II, III, or IV, performing its task concurrently with other real-time or background tasks. The features of the CDC 200 User Terminal provided by the emulator include interleaved I/O transmissions, switched or dedicated point-to-point operation at 2000 to 9600 bps, space and zero character compression, external BCD transmission code, ANSI or IBM 26 punched card input codes, and full double-buffering. Input may be from cards, disk, or magnetic tape; output may be to printer, disk, magnetic tape, or spooler.

The emulator requires a Modcomp processor with at least 7K words above the resident systems or tasks; one duplex channel of a 4815 Interface; an appropriate dial or dedicated communications line and Bell 201A, 201B, 208, or 209-type modem; and access to a CDC 6000 or 7000 Series computer operating under Export/Import, Cybernet, etc.

The *IBM 2780/3780 Terminal Emulator* enables a Modcomp Classic to communicate with a remote IBM System/360 or 370 computer. The emulator operates under MAX II or III as either a foreground or background task. Provided with the emulator are these features of the IBM 2780/3780: multiple record transmission, horizontal format control, EBCDIC transmission code, transparent text transmission, 3780 space compression, extended ENQ or error retry, variable-length records, and switched or dedicated point-to-point operation at 2000 to 9600 bps. Input may be from cards, disk, or magnetic tape; output may be to printer, disk, magnetic tape, punched cards, or spooler. The emulator may be non-resident and can perform its operations with other batch or foreground tasks.

Minimum requirements for operation of the emulator include a Modcomp processor with 5 to 8K words of memory above the resident tasks or systems; other requirements specified for the CDC 200 User Terminal Emulator above; and access to an IBM 360 or 370 computer under OS/VS, OS/HASP, DOS/VS, DOS/Power, etc.

The *IBM HASP Workstation Terminal Emulator* operates under MAX III or IV on a Modcomp Classic with 8K to 10K words of memory above the resident tasks or systems. Additional requirements include a duplex channel of a 4815 Interface; a dial or dedicated communications line, a Bell 201A, 201B, 208, or 209-type communications modem; and access to an IBM 360 or 370 computer under OS/VS, OS/HASP, or OS/ASP.

The HASP emulator includes these features of the workstation: multi-leaved I/O transmission, EBCDIC transmission code, transparent or nontransparent transmission, space, and duplicate character transmission, switched or dedicated point-to-point operation at 2000 to 9600 bps; file insertion; input from punched cards, disc, or magnetic tape; and output to punched cards, disk, magnetic tape or printer. The emulator may be non-resident and can operate with other batch or real-time tasks.

DATA BASE MANAGEMENT SYSTEMS: Infinity is a general purpose data base management system that runs under the MAX III and MAX IV operating systems with or without MAXNET extensions. Infinity supports multiprogram, multiprocessor access to data base files through the standard operating system's logical I/O structure. Infinity operates as a resident symbiont task processing queued user requests. Nonresident system data base processors are included for general-purpose data entry, retrieval, and file maintenance. Schema-driven files are created using a data description language (DDL) describing data record items, access structures, and other attributes. A set of callable routines provides a convenient data manipulation language (DML) interface with system I/O functions. Infinity is language-independent, supporting FORTRAN, COBOL, CORAL 66 and assembler interfaces, and is utilized in Modcomp's own MIS system.

TOTAL, a general-purpose data base management system, is made available as a Modcomp software product through an agreement with CINCOM Systems, Inc. TOTAL provides complete facilities for data base generation, manipulation, and accessing by any host language supporting a CALL statement. See Report M12-132-101 for full details on TOTAL.

TIME SHARING & TRANSACTION PROCESSING: TSX is a general-purpose Timesharing Executive & Transaction Processor for Modcomp computer systems. Versions of TSX are available on MAX III and MAX IV operating systems. TSX is transparent to standard Modcomp system processors and to most user-written, terminal-oriented programs. TSX dynamically schedules memory usage, allowing a large number of interactive users to perform concurrent processing.

Modcomp Classic Systems

Transaction processing applications are particularly easy to develop under TSX with the aid of the CRT Forms Processor. This capability facilitates the generation of complex CRT screens for fill-in-the-blanks operation.

UTILITIES: Modcomp provides a set of functions to maintain source, object, and load modules on disk storage; a file maintenance processor for files processes by the file manager; a direct-access maintenance processor for FORTRAN-defined direct-access data files; and a sort/merge routine with a standard control language.

PRICING

POLICY: The manufacturer offers Modcomp systems on a purchase-only basis, with separately priced maintenance and software.

Delivery will be made FOB Modcomp's plant. The warranty period is 90 days after delivery. Modcomp provides one-time, no-charge, on-site installation at the purchaser's location within the contiguous United States, Installation facilities including electrical power and connector requirements are the responsibility of the user and must be completed prior to installation. If a system is purchased with software, an additional $300 software service charge is billable. The software service charge includes delivery of the operating system (either Max II, III, or IV), support software (system languages) in object or load module form, and one set of software documentation. Additional copies of the software are available at prices specified in the equipment price list.

Software is supplied only with systems that have at least one disk drive or magnetic tape unit/disk drive combination. Software is always provided on the least costly medium that is compatible with the system configuration. Diagnostics and utilities are provided at no charge.

Modcomp provides software training for users with a basic knowledge of programming and maintenance training for those with at least two years of related technical training. Training courses are provided at the customer's site for a minimum of 10 students on a prearranged basis. Charges include $2000 (plus $300 for each additional student) for the first week and $1500 for week two or three, plus $70 per diem portal to portal and one round-trip economy air fare. Currently offered are 12 software courses varying in length from four days to two weeks and 21 maintenance courses varying in length from three days to twenty days. The software course list includes: basic programming, one week; assembly language programming, one week; MAX II/III operating systems, two weeks; MAX II/III technical course, one week; MAXNET III user's course, one week; MAXCOM operating system, one week; Modcomp IV programming concepts, one week; MAX IV operating system, two weeks; MAX IV technical course, one week; MAXNET II user's course, one week; MAX IV file manager user's course, three days; and MAX IV file manager technical course, two days.

Full-service maintenance is provided under one of four plans. VIP service guarantees a response time of eight hours or less during prime time. Prime Time is defined as 8 a.m. to 5 p.m. Monday through Friday excluding Modcomp holidays. The VIP service also includes 12 preventive maintenance calls per year on a monthly schedule, unlimited remedial maintenance calls, six months to one year duration of contract with a 30-day termination clause after the initial six-month period, and no travel expenses of the customer is within a 50-mile radius of the service center.

Real-time service is a variation of VIP service offering four-hour response time. This service is billed at 1.25 times the rate of VIP service.

IP service is another variation of VIP service that offers the same features but without a guarantee as to response time. Pricing is available on a special-quote basis.

Extended service offers coverages which can range from a guaranteed two-hour response time up to and including coverage 24 hours a day, 7 days a week. Rates for this service are on a special-quote basis. A customer may not mix types of service within a single system configuration.

EQUIPMENT: See EQUIPMENT PRICES for the packages Classic systems available from Modcomp.■

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.
PACKAGED SYSTEMS			
7862-AA	7860 CPU with 256K bytes of core memory, dual-bus I/O processor, 3765-XX 10MB disk drive and controller, console controller, MAX IV operating system	$ 68,200	$ 586
7862-AB	Same as 7862-AA but with 4138 168MB disk drive instead of 3765-XX	95,950	749
7862-BB	Same as 7862-AB but with 512K bytes of core memory	128,200	929
7863-CA	7860 CPU with 256K bytes of MOS memory, dual-bus I/O processor, 3765-XX 10MB disk drive and controller, console controller, MAX IV operating system	60,500	476
7863-CB	Same as 7863-CA but with 4138 168MB disk drive instead of 3765-XX	88,250	647
7863-DB	Same as 7863-CB but with 512K bytes of MOS memory	113,200	707
PROCESSORS AND OPTIONS			
7810-2	7810 CPU with 64K bytes of 600 nanosecond parity MOS memory, chassis with space for 3 additional controller boards, power supply and cooling package	7,500	75
7810-3	Same as 7810-2 with 96K bytes of memory	8,500	85
7810-4	Same as 7810-2 with 128K bytes of memory	9,500	95
7830	7830 CPU with 128K bytes of 600 nanosecond parity MOS memory, chassis, memory interface, and and integral I/O Processor	23,800	155
7835	Same as 7830 but with arithmetic accelerator	29,500	192
7860	7860 CPU with 128K bytes of core memory, chassis, single-bus I/O processor	43,300	292
7861	Same as 7860 but with 128K bytes of MOS memory	38,150	242
7862	Same as 7860 but with dual-bus I/O processor	45,850	352
7863	Same as 7862 but with 128K bytes of MOS memory	60,500	302
7870	7870 CPU with 512K bytes of MOS memory, dual-bus I/O processor	64,000	382
3108	Communications Processor	5,000	60
3109	Communications processor	5,150	60
3516	Arithmetic accelerator	6,000	48
3632	System protect feature	500	5
3770	Single-bus I/O processor	4,120	35
3771	Dual-bus I/O processor	7,025	60

Modcomp Classic Systems

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.
MEMORY			
3690	128K bytes of core memory with byte parity	14,950	90
3691	128K bytes of MOS memory with error correction; uses 2 slots in chassis	10,300	30
3692	512K bytes of MOS memory with error correction	36,000	110
3693	128K bytes of MOS memory with error correction; uses 1 slot in chassis	7,500	38
3320	Battery backup unit; provides 20 minute backup for one 3691, 3692, or 3693	980	8
3332	Battery backup unit; provides 15 minute backup for 128K bytes of MOS memory for Classic 7810	450	7
3648	Memory expansion assembly; provides mounting space for up to 256K bytes of core memory or 1024K bytes of MOS memory	6,400	60
3654	Shared memory expansion cabinet; 8-plane chassis, memory and logic power for up to two core memory modules or three MOS modules	15,000	90
3655	Shared memory port interface	6,000	66
MEMORY & BULK CORE STORAGE			
4190	256K-Byte Device File; includes controller, power supplies, 256K-byte core memory module, power fail-safe card, chassis, and all cables; space for up to 2 megabytes	20,600	250
4191	256K-Byte Expander File; for expansion to 4 megabytes; similar to 4190 device file above without controller; max. one per system	15,450	127
4192	256K-Byte Memory Module for 4190 or 4191 files above; max. seven per file	10,300	55
4193	Memory + Controller; includes power fail-safe card and all cables; can be made dual-access	5,150	38
MASS STORAGE			
4103-1	Fixed head disk, controller; 524,288 bytes	18,600	111
4104-1	Fixed head disk, controller; 1,048,576 bytes	20,600	133
4106-1	Fixed head disk, controller; 2,097,152 bytes	41,200	170
4126-1	Moving head disk, controller, 2,598,400 bytes	9,800	89
4127-1	Same as 4126-1 without controller	7,225	42
4128-1	Moving head disk, controller; 5,196,800 bytes	12,900	131
4129-1	Same as 4128-1 without controller	9,500	84
4136-1	Moving head disk, controller for three drives; 10,027,008 bytes	14,450	140
4137-1	Same as 4136-1 without controller	9,275	90
4138-A-1	Moving head disk, controller; 83,962,368 bytes	33,000	230
4138-A-2	Same as 4138-1 without controller	25,750	200
4138-A-5	Moving head disk, controller; 167,924,656 bytes	37,300	300
4138-A-6	Same as 4138-A-5 without controller	30,100	270
4173-1	Moving head disk, fixed media; 21 megabytes, formatted, one port	10,000	80
4173-2	Same as 4173-1 but with dual port	11,000	88
4173-3	Moving head disk, fixed media; 67.4 megabytes, formatted, single port	15,000	120
4173-4	Same as 4173-3 but with dual port	16,000	128
4174-1	Moving head disk, removable media; 67.4 megabytes, formatted, single port	17,000	153
4174-2	Same as 4174-1 but with dual port	18,500	167
4174-5	Moving head disk, removable media; 253.7 megabytes, formatted, single port	29,000	261
4174-6	Same as 4174-5 but with dual port	31,500	284
4521	Floppy Disk and controller; 315,392-byte capacity	4,020	40
4522	Dual Floppy Disk and controller; 630,784-byte capacity	6,180	60
MAGNETIC TAPE EQUIPMENT			
4148-1	Drive and controller; 9-track, 45 ips, 800 bpi, max. 4 drives per controller, requires 490X or 3708	10,550	104
4151	Expansion Drive for 4148-1; maximum 2 per 4148-1	8,250	88
4155-1	Drive and controller; 9-track, 45 ips, 1600 bpi, phase encoding; max. 4 drives per controller; requires 490X or 3708	17,750	144
4156	Expansion Drive for 4155-1; maximum 3 per 4155-1	10,300	130
4157-1	Drive and controller; 9-track, 45 ips, 800/1600 bpi, NRZI or phase encoding; max. 4 drives per controller; requires 490X or 3708	19,800	210
4158	Expansion Drive for 4157-1; maximum 3 per 4157-1	10,850	180
4164-1	Drive and controller; 9-track, 75 ips, 800 bpi; max. 4 drives per controller; requires 490X or 3708	13,700	135
4165	Expansion Drive for 4164-1; maximum 3 per 4164-1	11,350	120
4168-1	Drive and controller; 9-track, 75 ips, 1600 bpi, phase encoding; max. 4 drives per controller; requires 490X or 3708	22,150	210
4169	Expansion Drive for 4168-1; maximum 3 per 4168-1	12,800	180
4170-1	Drive and controller; 9-track, 75 ips, 800/1600 bpi, NRZI or phase encoding, max. 4 per controller; requires 490X or 3708	24,250	230
4171	Expansion Drive for 4170-1; maximum 3 per 4170-1	13,500	200
PRINTERS/PLOTTERS			
4211-2	Line Printer and controller; 132 positions, 600 lpm; requires 490X or 3708	17,000	125
4213	Line Printer and controller; 132 positions, 50 to 150 lpm; table-top mounted; requires 490X	9,500	96
4214-2	Line Printer and controller; 132 positions, 300 lpm; requires 490X or 3708	14,450	95
4216-1	Electrostatic Printer and controller; 132 positions, 1000 lpm; requires 490X or 3708	16,000	108
4217-1	Electrostatic Printer and controller; 132 positions, 1000 lpm, 0.010-inch matrix plotting; requires 490X or 3708	16,500	154
4226	Serial Matrix Printer, 132 positions, 64-440 lpm; includes controller	4,950	50
4228	Same as 4226 without controller	3,870	40
4227	Line Printer and controller; 132 positions, 280 lpm	8,150	72

Modcomp Classic Systems

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.
PUNCHED CARD EQUIPMENT			
4411-2	Card Reader and controller, 300 cpm, table-top mounted; requires 490X or 3708	5,310	60
4412-2	Card Reader and controller; 1000 cpm, table-top mounted; requires 490X or 3708	8,100	70
4426	Key Punch/On-line Card Punch/Automatic Interpreter with controller; 35-60 cpm	22,600	CSQ
PUNCHED TAPE EQUIPMENT			
4513	Paper Tape Reader, 625 characters per second	1,860	16
4512	Paper Tape Reader/Punch and controller; 4513 reader plus 110-character-per-second punch; requires 490X interface	9,000	44
4515	Paper Tape Punch and controller; 110 characters per second; requires 490X interface	7,100	32
TERMINALS			
4205	Communication Printer; KSR, 30 cps, 80 positions, table-top mounted, RS-232C interface, pin-feed platen; requires 3753-2, 4811-XX, 1912-XX, or 1931	8,000	64
4206	Communication Printer; KSR, 120 cps, 120 positions, table-top mounted, RS-232C interface, external forms tractor, requires 3753-4, 4811-XX, 1912-XX, or 1931	8,050	89
3740	Programmable Power On/Off for 4205/4206; requires 3753-X	310	35
4222	Keyboard Printer Terminal; 96 character set, 132 columns; 30 cps	2,680	—
4233	ASR-33 Console Teletypewriter; requires 3751	2,480	91
3747	Programmable Power On/Off	465	42
4250	ASR-33TU; modified ASR-33 to 4233	310	—
4611	CRT conversational terminal; for console or remote terminal use; 95 ASCII character set; requires 1912-XX; 1931, 3752-X, or 4811-XX	2,010	26
4612	CRT line or page mode terminal; 95 ASCII character set; requires 1912-XX, 1931, 3752-X, or 4811-XX	2,840	26
I/O CONTROL			
3751	Controller for 4233 teletypewriter or for 4513 paper tape reader	880	2
3752-X	Asynchronous Controller for console device or paper tape reader; RS-232C interface, data rates from 110 to 9600 bits per second depending on model number (single rate per unit)	880	4
3753-X	Asynchronous Controller for 420X console devices and 4513 paper tape reader; 300 or 1200 bits per second (single rate per unit)	880	4
4903	Peripheral Controller Interface for all Modcomp models; for up to four controllers: includes power supplies and six controller locations	2,060	7
4905	Same as 4903 plus 375X device controller	2,580	11
4906	Peripheral Controller Switch: provides programmable switching capabilities for four controllers between any two Modcomp CPU's; includes power supplies and six controller locations and manual override switch	3,090	26
4701-X	Interval Timer; seven models depending on interval; 1, 2, 5, 10, 20, or 50-microsecond interval (single rate per unit or external source); can be interrogated by program; interrupt on completion of interval; requires 490X controller interface	1,030	6
4932	Frame casting with integral power supply regulators for 200 490X Peripheral Controller Interface Enclosure; mounting space for two standard controller locations	200	—
4100-1	Controller for the 410X-1 Fixed-Head Disc; without device power supply; requires 490X interface	4,120	—
4123	Controller for the 4136 and 4137 Moving-Head Disk; includes write/lockout control panel; requires 490X interface	5,675	—
4124-1	Controller for the 412X Moving-Head Disk; includes write/lockout control panel; without device power supply; requires 490X interface	3,920	—
4143-A-E3	Controller for series 4138-A, 417X moving head disk, includes distribution panel, write/lockout control panel, without terminator or device cable, requires 490X interface	9,275	—
4145-1	Controller for the 4148-1 or 4151 Magnetic Tape Unit; does not include cabinet, distribution panel or terminator	4,120	—
4146-1	Controller for the 4155-1, 4156, 4157-1, 4158, 4168-1, 4169, 4170-1, or 4171 Magnetic Tape Unit, does not include cabinet, formatter, or terminator, requires 490X or 3708 interface	6,200	—
4147-1	Controller for the 4164-1 or 4165 Magnetic Tape Unit; does not include cabinet or terminator; requires 490X or 3708 interface	4,120	—
4209	Controller for the 4228 Line Printer; requires 490X interface	2,060	—
4210-1	Controller for the 4211-2 or 4214-2 Line Printer; requires 490X or 3708 interface	3,090	—
4218	Controller for the 4216-2 or 4217 Electrostatic Printer/Plotters; requires 490X or 3708 interface	3,090	—
4220	Controller for the Calcomp 565 or compatible X-Y plotter; requires 490X or 3708 interface	2,500	—
4410-1	Controller for the 4411-2 or 4412-2 Card Reader, requires 490X or 3708 interface	2,060	—
4520	Controller for the 4521 or 4522-2 Floppy Disc Unit, requires 490X or 3708 interface	2,060	—
4801-1	General-Purpose Controller Module for specialized interfaces, requires 490X interface	1,550	—
4805-1	General-Purpose Data terminal Interface; provides DMP interface to specialized devices, requires 490X or 3708 Interface	2,060	17
MULTIFUNCTION CONTROLLER AND OPTIONS			
4850	Multifunction controller with up to four port options; each port controls one device and can be configured for byte-parallel or bit-serial data transfer	3,610	50
4851	Console device port option for asynchronous console device and paper tape reader	260	2
4858	Asynchronous channel port option, full-duplex, RS232 compatible or current loop interface, program selectable baud rates	670	7
4862	Port option for 300 cpm or 1000 cpm card reader	825	—
4864	Port option for 300 lpm or 600 lpm line printer	825	—
4866	Port option for 64-440 lpm matrix printer	825	—

Modcomp Classic Systems

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.
MULTIFUNCTION CONTROLLER AND OPTIONS (Continued)			
4870	Port option for 280 lpm line printer	825	—
4852	Punched Card Reader, including port option; 300 cpm	3,970	50
4853	Punched Card Reader, including port option; 1000 cpm	7,075	60
4854	Line Printer, including port option; 132 columns, 64 character set, 300 lpm	13,400	85
4855	Line Printer, including port option; 132 columns, 64 character set, 600 lpm	16,000	115
4856	Serial Matrix Printer, including port option; 132 columns, 64 character set, 64-440 lpm	4,120	50
4860	Line Printer, including port option; 132 columns, 64 character set, 280 lpm	7,075	62
COMMUNICATIONS CONTROL			
4806-X	Asynchronous Terminal Controller	4,020	—
4807-X	Asynchronous Terminal Controller	4,020	—
4808-X	Asynchronous Modem Controller	4,800	—
4810-XX	Asynchronous Communications Interface, 75 to 9600 bits per second; two full-duplex channels with independent data rates, 20-milliampere current loop interface; requires 490X interface	1,450	11
4811-XX	Same as 4810-XX with RS-232C interface	1,450	10
4812-X	Serial Asynchronous Interface; 110 to 9600 bits per second, remote hardware fill, one full-duplex channel; for the II/26, II/45, or II/2XX	1,650	14
4813-X	Same as 4812 with RS-232C interface	1,650	14
4815	Synchronous Communications Interface for two full-duplex channels; 110 to 9600 bits per second; RS-232C interface; requires 490X interface	1,450	11
4824-X	High-Speed Serial Coax Link Controller; includes I/O bus and DMP interface; requires 490X or 3708 interface	2,060	30
4826-1	Remote fill option; compatible with IV/35-B	260	—
4826-2	Compatible with II/26, II/45, and II/2XX; by special quote only for the II/12	415	—
1905	Asynchronous Multiplexer Controller for up to four multiplexers; occupies one controller location; requires 490X interface	1,240	11
1910-XXXXX	Asynchronous Multiplexer for 1905; 32 full-duplex channel capacity; includes power supplies and enclosure; any five of nine standard data rates between 75 and 9600 bits per second	2,580	14
1912-XX	Asynchronous Communications Channel for 1910; two full-duplex lines with any two of nine data rates between 75 and 9600 bits per second; RS-232C interface	515	6
1914-XX	With 20-ma current loop interface	515	6
1907-A-X	Universal Communications Controller, Model 2, provides buffering and control for 193X universal line interface modules, block data transfers, supported on CP2 processors; uses three controller positions	3,710	55
1907-B-2	32-Line Controller, requires 4911	3,710	55
1907-B-3	64-Line Controller, requires 4911	5,150	55
1907-B-4	128-Line Controller, requires 4911	8,240	55
1907-B-5	192-Line Controller, requires 4911	*	
1907-B-6	256-Line Controller, requires 4911	*	
1930-1X	Single-port Chassis for 193X line units; requires 1907-A-X	3,610	33
1930-2X	Dual-Port Chassis for 193X line units; requires 1907-A-X	4,440	33
1931	Asynchronous Line Unit for 1930; two full-duplex channels; RS-232C interface; 15 programmable data rates from 75 to 19.2K bits per second	515	9
1932	Same as 1931 with 20/60-milliampere current loop interface	515	910
1933	Same as 1932 with separate 12V battery supply	515	9
1934-1	Synchronous Line Unit for 1930; two full-duplex channels; RS-232C interface; data rate 2000 to 9600 bits per second; programmable sync character	570	8
1934-2	Synchronous Line Unit for 1930; interfaces WE 301/303 or equivalent wideband modem; data rates 19.2K to 230.4K bits per second; programmable sync character	670	8
1934-3	Synchronous Line Unit for 1930; two full-duplex CCITT V.35 interfaces; data rates 2000 to 9600 bits per second; programmable sync character	600	
1939-1	Synchronous Line Unit for 1930; two full-duplex RS-232C interfaces for SDLC, HDLC, or ADCCP formats; data rates 2000 to 9600 bits per second	825	
1939-2	Synchronous Line Unit for 1930; two full-duplex WE 301/303 interfaces for SDLC, HDLC, or ADCCP formats; data rates 19.2K to 230.4K bits per second	905	
1939-3	Synchronous Line Unit for 1930; two full-duplex CCITT V.35 interfaces for SDLC, HDLC, or ADCCP formats; data rates 2000 to 9600 bits per second	850	
1941	Modcomp-CDC Satellite Coupler for Modcomp II's or IV's; links Modcomp CPU to CDC 3000 or 6000 Series CPU through the data channel; DMP Interface; data rate 600K bits per second	8,000	96
1941-1	With remote fill option	9,000	96
1950	Modcomp-IBM 360/370 Interface for Modcomp II's or IV's; links Modcomp CPU to an IBM 360/370 CPU through either a selector or multiplexer channel; data rate 200K bits per second	8,000	84
1950-1	With remote fill option	9,000	90
1950-2	With the 5151 IBM Link Power Control option	8,800	113
1950-3	With both remote fill and 5151 IBM Link Power Control options	9,800	119
5950	IBM Selector Channel Emulator	7,000	84
4819	Auto Call Unit Controller	2,900	14
INTEGRATED COMMUNICATIONS SUBSYSTEM			
1908-1	Controller; asynchronous and synchronous multiplexer and 8 full-duplex channels	5,000	50
1908-2	Second controller and related cable assembly to provide 16 full-duplex channels	5,000	50
1909-X	Factory configured plug-in line interfaces for the following configurations:		
-1	Two full-duplex asynchronous RS-232-C interfaces	170	2
-2	Two full-duplex asynchronous Current Loop Interfaces	200	2
-3	Two full-duplex synchronous RS-232-C interfaces	260	2
-4	Two full duplex synchronous W.F. 301/303 interfaces	250	2
-5	Two full-duplex synchronous CCITT V.35 interfaces	300	2

*Price depends on the configuration of the system.

Modcomp Classic Systems

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.
CABINETS AND HARDWARE			
0001	Standard Cabinet, 62 inches high; includes AC power, side panels, and rear door	1,190	—
0005	Magnetic Tape Unit Cabinet; furnished with counter weights, brackets, special hardware, AC distribution panel, and short front door	1,450	—
PROCESS INTERFACES			
1199	16-channel I/O interface; supports analog outputs and digital I/O	2,480	15
1199-1	Same as 1199 but supports digital I/O only	1,860	13
1110	Channel multiplexer for up to 64 channels	310	3
1111	I/O interface expander; 16 channels, analog outputs and digital I/O	2,170	15
110X	Synchronizer card, & control bits input, 8 control bits output; provides external transfer control for 8 channels	1,700	13
1108-XX	Interval timer/pulse accumulator	365	4
1115/16	Asynchronous communications interface	515	6
112X	Digital input channel, 16-bit input; includes mating connector and signal conditioning circuit	165	2
113X	Digital output channel, 16-bit output	165	2
114X	Analog output channel, 12-bit binary	330	8
115X	External interrupt coupler, 8-bit input	250	3
116X	I/O interrupt coupler, 8-bit input for up to 8 data transfer interrupts or 8 service interrupt; 2 maximum per system	365	3
117X	Dual analog output channel, 12-bit binary	515	9
118X	Dual analog output channel with CRT option	515	9
119X	Digital input channel with common alarm feature, 16-bit input	310	3
1200	High level analog input subsystem	3,610	39
1300	Wide range analog input subsystem	6,300	55
1400	Wide range relay analog input subsystem	5,375	55
1500	High level differential analog input subsystem	3,610	39
1600	Modac subsystem	1,960	12
1605-X	Analog input module, 16 single ended input channels	1,400	13
1606-X	Same as 1605-X but with 32 channels	1,650	17
1607	Fixed gain amplifier and A/D converter per channel	2,890	16
161X	Analog output module, 8 channels	1,240	14
1805	MODACS 111 subsystem	2,850	15

SOFTWARE PRICES

STANDARD SOFTWARE	Purchase Price
Diagnostics	500-1,000*
Diagnostics Listings	100
Utility Software	200-700*
Utility Listings	100
MAX II, Core-resident version	600
MAX II/III Operating System	600-1,100*
MAX II/III Listings	1,200
MAX II/III Support Software	600-1,100*
MAX II/III Support Listings	2,000
MAX IV Operating System	700-1,200*
MAX IV Listings	2,400
MAX IV Support Software	700-1,200*
MAX IV Support Listings	2,000
MAXCOM Software	500-1,000*
MAXCOM Listings	1,200
SPECIAL-ORDER SOFTWARE	
X-Y Plotter Software	250-750*
X-Y Plotter Listings	100
IBM 2780 Emulator Software	250-750*
IBM 2780 Emulator Listings	100
CDC 200 Emulator Software	250-750*
CDC 200 Emulator Listings	100
MAXNET III Software	1,000-1,500*
MAXNET III Listings	1,200
MAXNET IV Software	1,100-1,600*
MAXNET IV Listings	1,200
Sort/Merge	250-750*
Sort/Merge Listings	100

*Price depends on recording medium.

LICENSED SOFTWARE	
COBOL	7,500
TOTAL-Single Task	10,000
TOTAL-Multi-task	10,000
Universal Versa Plot Package	1,500
Infinity	10,000
TSX	15,000