Computer Automation Naked Mini 4

MANAGEMENT SUMMARY

Computer Automation, Inc., founded in 1967, has become one of the high-volume suppliers of minicomputers. The latest figures released by the company state that there are more than 30,000 CA minicomputer systems now in operation around the world and that the company is currently shipping more than 150 systems per week.

Since its introduction of the Naked Mini 16 in April 1971, CA has addressed itself to the OEM and volume end user marketplace. Prior to this time, nearly all computer systems had been sold directly to their ultimate owners. The Naked Mini 16 was a general-purpose, three-board TTL processor that was offered in skeleton form so as to enable the OEM and volume end user to more easily design his specialized products and systems. The first Naked Mini 16 used 1600-nanosecond core memory and cost $2,500 with 4K words, in single quantities. Both 16-bit and 8-bit Naked Mini versions were offered. With a chassis and power supply, the Naked Mini became the Alpha 16 or Alpha 8.

Over the next two years, approximately 3000 Naked Mini's were delivered—almost exclusively 16-bit machines.

In May 1973, CA took the next step forward and reduced the three boards to one, including up to 8K words of core ▷

The Naked Mini 4 family currently being offered by Computer Automation features five 16-bit models: the SCOUT 4/04, the NM 4/10, the NM 4/30, the NM 4/90, and the NM 4/95. All can have up to 128K bytes of directly addressable memory, and all are architecturally identical. The NM 4/95 with Memory Management Unit is capable of addressing up to eight mega-bytes. Like CA's previous LSI line, the NM4's are aimed directly at the OEM and large-volume end user markets.

MAIN MEMORY: 4K bytes to eight mega-bytes.
DISK CAPACITY: Up to 300 megabytes per disk controller
WORKSTATIONS: Resource dependent; maximum of 64
PRINTERS: 120 cps to 600 lpm
OTHER I/O: Magnetic tape, paper tape, punched card reader, floppy disks

CHARACTERISTICS

MANUFACTURER: Computer Automation, Inc., 18651 Von Karman, Irvine, California 92713. Telephone (714) 833-8830. ▶

The NM 4/95 is the top performer in Computer Automation's Naked Mini 4 family. This configuration is an NM 4/95 with programmer's console, floppy disk drive (top), medium-capacity disk drive (below), and CA's CRT terminal (left).

Computer Automation Naked Mini 4

▷ memory, and called it the Naked Mini/LSI. The price, including 4K words of memory, was an impressively low $990 in quantities of 200 or more—about half the price of its nearest competitors at the time. At the same time, CA quietly decided to discontinue the marketing of 8-bit machines, concentrating instead on the 16-bit machines and their vastly larger market.

The Naked Mini/LSI, or LSI-1 as it was later named, was also offered in an Alpha version which included the new one-board processor and memory, power supply, chassis, and operator console. The Alpha LSI originally sold for $1,990 in single quantities and could use up to 256K words of core or MOS memory.

The LSI-1 processor did not replace the existing Naked Mini 16 or Alpha 16, since it was a lower-performance version of the older minicomputers. That distinction was reserved for Computer Automation's line of LSI-2 mini-computers and the LSI-3/05 microcomputer, known as the Naked Milli. The LSI-2 family included the LSI-2/10, 2/20, and 2/60 MegaByter minicomputers. Still OEM-oriented, the LSI-2 minis were intended for use as components of large systems, and the "naked" versions were available only in quantities of five or more.

The Naked Milli (LSI-3/05) was unveiled in January 1975 and represented the low end of CA's line. Applications for the Naked Milli included industrial automation and machine control, distributed processing systems, lab monitoring, pollution control monitoring, and data entry/output control. Like its predecessors, the Naked Milli was offered as a single half-board or as a package with memories, power supplies, cabinets, and I/O controllers. The basic board was priced at $295 (minimum order of 5) and, when combined with the different memories available, ranged in price from $695 with 1K bytes of RAM to $1,990 with 16K bytes of core memory.

The LSI 4 series, introduced in May 1977, was the next entry in Computer Automation's line of minicomputers. Like its predecessors, the LSI-2 and LSI-3 series, the LSI 4 minicomputers addressed themselves to the OEM market-place or large-volume end users and were offered in unpackaged (Naked Mini 4) configurations, consisting of a basic processor and memory, and in packaged versions (Alpha LSI 4) that included chassis, power supply, operator's or programmer's console, and I/O ports in addition to the CPU and memory.

The current line of Naked Mini 4 computers consists of a family of five compatible 16-bit minicomputers ranging from the NM 4/04 SCOUT with ISOLITE automatic fault isolation at the low end to the NM 4/95 with memory management capability up to eight megabytes at the high end. All have 128K bytes of direct memory addressability. In addition, a "slave" computer, the NM 4/10S, is available.

Throughout the NM4 line, there is compatibility of software, documentation, input/output, power supplies, and chassis. Every processor can be purchased ▷

▶ Computer Automation entered the market with the Naked Mini OEM minicomputer in 1971 and remained a strictly OEM manufacturer until the end of 1975. The company is currently organized into three distinct divisions: the Naked Mini Division, the Industrial Products Division, and the Commercial Systems Division. The Naked Mini Division is responsible for the development and marketing of Computer Automation's mainstay minicomputer products, the LSI-2 series, the LSI-3 series, and the latest offering, the Naked Mini 4 series, as well as specialty systems based on these computers. The Industrial Products Division markets the CAPABLE line of circuit testers to other manufacturers in the electronics industry. The Commercial Systems Division produces and markets the SyFA small business computer system (Report M11-168-301).

Computer Automation has manufacturing facilities in California, Texas, Ireland, and India and sales offices and distributors in Europe, Asia, North and South America, Australia, and Japan.

MODELS: NM 4/04 SCOUT, NM 4/10, NM 4/30, NM 4/90, NM 4/95, and 4/10S Slave Computer.

DATA FORMATS

BASIC UNIT: 16-bit word or 8-bit byte.

FIXED-POINT OPERANDS: 16-bit words consisting of 15-bit integer and one sign bit. Negative numbers are in the two's-complement form. Larger fixed-point operands can be implemented through the use of optional variable-length byte string instructions.

FLOATING-POINT OPERANDS: Hardware option on all processors except NM 4/95, on which it is standard.

INSTRUCTIONS: The Naked Mini 4 family instruction set is divided into functional groups, or classes, as follows:

Memory reference instructions—single- and multiple-word type; use the contents of memory in performing their operations.

Immediate instructions—operate on a selected register using a byte operand contained in the instruction.

Register-to-register instructions—refeence two processor registers, a source and a destination register.

Shift instructions—perform shift and rotate operations on single registers and register pairs.

Conditional jump instructions—alter the sequence of program execution based on the result of a test.

Input/Output instructions-used to transfer data to/from peripheral devices.

Control instructions—used to regulate the operation of the processor and to enable and disable interrupts.

Stack instructions—enter data into, and retrieve data from, user-defined stacks in memory.

Trap instructions—used to emulate trap conditions.

Console service instructions—cause a data word to be transferred between the console and the processor or between the console and memory, with the processor halting when the transfer has been made.

Character/numeric instructions—operate on characters and decimal numbers contained in strings within memory. ▶

Computer Automation Naked Mini 4

PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION	MANUFACTURER
MAGNETIC TAPE INPUT		
18631-01	Industry-compatible, 25 ips, 9-track, 800 bpi, read/write, max. of 4 transports per controller (1 slot), 20KB/sec	—
LINE PRINTERS		
22108-01	132 columns, 64 characters, 120 cps, bidirectional (½ slot)	Centronics
22108-02	132 columns, 64 characters, 180 cps, bidirectional (½ slot)	Centronics
45028-00	132 columns, 64 characters, 300 lpm	Dataproducts
45029-00	132 columns, 64 characters, 600 lpm	Dataproducts
CARD UNIT		
22077-20	Reader, 80-column, 285 cpm (½ slot)	Documation
PAPER TAPE UNITS		
22223-11	Reader, 300 cps (½ slot)	Remex
22223-60	Reader/Punch, 300/75 cps (1 slot)	Remex
TERMINALS		
22205-00	Hard-copy terminal with paper tape read/punch	Teletype ASR-33
22851-80	CRT keyboard/display terminal, 24 lines by 80 characters, 128-character set, selectable data rate	Computer Automation

▷ individually (with volume discounts) in combination with memories, chassis, power supplies, high-level software, PicoProcessors, and peripherals; in packaged (Alpha) systems; or in development system configurations.

At the low end, the NM 4/04 SCOUT features ISOLITE, a self-test diagnostic function which automatically tests and identifies malfunctioning boards by lighting a red LED located on the board. SCOUT's small board format (6.25 by 8.3 inches) allows each function to be contained on its own board (a processor board, a memory board, etc.) and combines with ISOLITE to make the replacement of a faulty board a simple matter. SCOUT offers 87 standard instructions, including multiply/divide and 16- and 32-bit instructions, and an optional 38 instructions are available, including floating-point arithmetic functions. Memory options include up to 128K bytes of directly addressable RAM or RAM E/P/ROM combinations. Memory configurations include 32K, 64K, 96K, and 128K bytes of RAM and 4K or 8K bytes of RAM with up to 32K bytes of E/P/ROM. The system is software-compatible with the rest of the NM4 family. A 16-bit CPU with 32K-byte RAM, I/O, and card cage lists for well under $1,000 with volume discounts available.

The NM 4/10 is a full 16-bit minicomputer on a board that incorporates two TTL-compatible N-channel MOS chips, 32K-byte RAM memory, and four distributed I/O channels, all packaged on a half-size (7.5 by 15 inches) circuit board. The basic NM 4/10 is priced at $1,275 per unit, with discounts available to volume purchasers. A basic packaged Alpha NM 4/10 configuration is priced at $2,075. ▷

▶ **List instructions—operate on blocks of information in memory.**

Floating point instructions—perform arithmetic and conversion operations on floating-point numbers.

Instructions are 1 or 2 words long with 11 different formats. The first 64 words/bytes in memory are referred to as "scratchpad." These locations are the only ones accessible to instructions using direct addressing and therefore can be addressed from anywhere in memory. Addressing modes include direct (to scratchpad), relative (to current location), indexed, indexed through scratchpad, indirect relative to current location, and indirect post-indexed.

INTERNAL CODE: ASCII.

MAIN STORAGE

STORAGE TYPE: Core, MOS, or MOS ECC.

CYCLE TIME: 850 or 1200 nanoseconds (full card) and three microseconds (half-card) for core; 550 or 700 nanoseconds (full card with parity), 520 nanoseconds (full card with ECC), 550 nanoseconds (full card with ECC, NM 4/95), and one microsecond (fifth-card, NM 4/04 SCOUT) for MOS. Memory modules can be odd/even interleaved for faster effective cycle times.

CAPACITY: MOS memory—32K to 256K bytes in 32K-, 64K-, and 128K-byte cards. Core memory—8K to 32K bytes in 8K-, 16K-, and 32K-byte cards. Memories of different speeds, types, and sizes can be combined with the Naked Mini 4/10 through 4/95 processors.

CHECKING: MOS memories include invalid-data detect sensing logic which provides protection from accessing bad data resulting from power failures. Full-card MOS memories have an optional parity bit associated with each eight-bit byte. ▶

Computer Automation Naked Mini 4

▷ The NM 4/30 is architecturally identical to the NM 4/10, but CA claims the 4/30 is more than twice as fast as the 4/10. A basic 4/30 with 32K bytes of RAM memory is priced at $2,095. The basic packaged Alpha NM 4/30 version carries a $3,905 price tag.

The NM 4/90 is architecturally identical to the NM 4/10 and 4/30. CA claims it is typically twice as fast as the 4/30. A basic 4/90 with 32K bytes of RAM memory is $2,595, and a basic Alpha NM 4/90 costs $4,405.

The Naked Mini 4/95 is Computer Automation's top-of-the-line system. In addition to its 128K-byte direct memory addressability, the 4/95 has memory management capability for up to eight megabytes of error-correcting physical memory plus a 50-nanosecond 2K-byte cache memory. Up to one megabyte of memory can be installed in the 9-slot chassis and two megabytes in the 17-slot chassis. A basic 4/95 with 128K bytes of error-correcting RAM memory, Memory Management Unit, and cache memory lists at $10,000.

The 4/10S is a single-board (half-card) slave minicomputer with 32K bytes of RAM memory and four input/output channels, packaged on-board with a two-chip custom MOS processor and associated logic. It operates as a peripheral DMA device for off-loading CPU functions which run concurrently with and independently of the host processor. The 4/10S utilizes the basic 4/10 instruction set. Up to four 4/10S slave computers can operate under the control of a single host. The NM 4/10S cannot function as a stand-alone computer. It is priced at $1,990.

Computer Automation stresses that the NM4 series of minicomputers features a "plug-in commonality" of software packages. This means that each computer's instruction repertoire is a superset or subset of the other computers. The SCOUT NM 4/04 is supported by the synchronous SCOUT bus. The NM 4/10 through 4/95 are supported by the asynchronous MaxiBus. The SCOUT NM 4/04 memories and I/O controller will operate only on the SCOUT bus. Memories and I/O controller for the MaxiBus are usable with the NM 4/10, 4/30, 4/90, and 4/95. Peripherals are "plug-in capable" between SCOUT and MaxiBus I/O controllers.

All processors in the Naked Mini 4 family have the same 16-bit architecture, with six levels of priority vectored interrupts (including real-time clock, console, and four program-selectable I/O interrupt levels), multiple general-purpose registers, stack registers and instructions, 64K-word direct addressability, and both word and byte operations. Addressing modes include absolute, relative, and indirect, in several combinations with indexing. I/O modes are programmed, automatic, and DMA, all of which operate on word or byte data.

All Naked Mini 4 processors have a basic or "core" instruction set (subset) which is common to all processors, and the instruction set of each processor is a superset of the ▷

▶ **STORAGE PROTECTION:** None.

RESERVED STORAGE: About 20 of the first 256 words are normally reserved for device interrupt addresses.

CENTRAL PROCESSOR

GENERAL: There are currently five Naked Mini 4 models: the NM 4/04 SCOUT, NM 4/10, NM 4/30, NM 4/90, and NM 4/95. All offer the same 16-bit architecture with six levels of priority vectored interrupts (including real-time clock, console, and four program-selectable I/O interrupt levels), multiple general-purpose registers, stack registers and instructions, 128K-byte direct memory addressability, and both word and byte operations. Optional features include floating-point (standard on the 4/95) and scientific instructions and on-board battery backup for MOS memory. The NM 4/04 SCOUT is contained on a 6.25-inch by 8.3-inch fifth-board; the NM 4/10 is contained on a 7.5-inch by 16.9-inch half-card; and the NM 4/30, NM 4/90, and NM 4/95 are each contained on 15-inch by 16.9-inch full cards.

CONTROL STORAGE: None.

REGISTERS: All of the NM4 series processors contain eight 16-bit user-accessible registers, including two general-purpose accumulators, one index register/accumulator for post-index operations where indirect addressing is encountered, one index register/accumulator for pre-index operations, a stack pointer register, a stack limit register, a program counter, and a status word register.

INDIRECT ADDRESSING: Multilevel indirect addressing is possible.

INDEXING: Memory addresses can be indexed using the X and Y registers. Pre- and post-indexing is also possible during indirect addressing operations.

INSTRUCTION REPERTOIRE: The NM4 family has a standard set of 87 instructions which is common to all processors. It is made up of 13 single-word memory reference instructions, 9 immediate instructions, 3 multiple-word memory reference instructions, 13 register-to-register instructions, 6 single-register shifts, 4 bit manipulation instructions, 16 conditional jumps, 6 control instructions, 9 I/O instructions, 2 emulate traps, 2 stack instructions, and 4 status change instructions.

Optional instructions for the SCOUT 4/04 and the 4/10 include three single- and nine double-register shifts, eighteen multiple-word memory reference, and seven floating-point instructions.

The NM 4/30's standard instruction set includes, in addition to the 87 basic instructions, five more multiple-word memory reference instructions, three more single-register shifts, and nine double-register shifts. Optional instructions consist of thirteen double-word memory reference instructions, seven floating-point arithmetic instructions, and four list instructions.

The standard instruction set for the NM 4/90 includes, in addition to the 87 basic instructions, eighteen more multiple-word memory reference instructions, three more single-register shifts, and nine double-register shifts. The 4/90's twenty optional instructions consist of a business set of thirteen character/numeric string manipulation instructions or a scientific set of seven floating-point instructions. The business and scientific sets are mutually exclusive.

The NM 4/95's standard 171-instruction set consists of 13 single-word memory reference instructions, 12 register-to-register instructions, 9 immediate instructions, 4 register bit ▶

Computer Automation Naked Mini 4

▷ next more powerful machine's instruction set. All modules for the NM 4/10 through 4/95 interface to a common MaxiBus, which provides full I/O compatibility and "plug-in" interchangeability throughout the product line.

A unique feature of all of CA's NM4 4/10 through 4/95 series systems is the Distributed I/O System. Connecting to the MaxiBus, it consists of an I/O Distributor and "intelligent cables," each containing a PicoProcessor, a small microprocessor (3 by 8 inches and about 1 inch thick) with a 250-nanosecond cycle time. The I/O Distributor is a 7½-by-15-inch half-card that acts as a standard interface between the processor and up to eight I/O channels. Each I/O channel consists of an appropriately programmed PicoProcessor and an I/O device. The I/O Distributor buffers and steers data between the computer bus and the PicoProcessors. It also provides interrupt priority control and interrupt vectoring for two interrupts per Pico-Processor. This I/O system provides direct memory access (DMA) or Automatic I/O (Auto I/O) control to a wide range of devices, which can be 8- or 16-bit, serial or parallel mode. Automatic byte packing and unpacking are also standard.

Auto I/O is a data transfer method that operates like a DMA-type controller (in which the controller transfers data directly to and from memory, keeping track of word/byte counts and buffer addresses in self-contained registers). Under Auto I/O, the operation is similar, except that the count and address registers are not integral with the controller but instead are in the processor, forming a small data control block. Updating these locations is done in the processor through execution of interrupt-driven Auto I/O instructions. Input and output operations, word or byte, can occur concurrently in any mix on all channels. Once started, data transfers continue until either the specified number have occurred or an error condition has been detected, at which time a separate vectored terminate interrupt is issued to the main processor.

A special feature, for serial channels only, is available to provide clocks and a special ASCII control mode. All common data rates from 75 through 19,200 bits per second are available for up to eight PicoProcessor interfaces for each distributor. Each channel can operate at any data rate, selectable by straps on the I/O Distributor.

The ASCII control mode is enabled or disabled for each device under program control. In this mode, each input character is examined. If the character is a carriage return, input is terminated and the appropriate vectored interrupt is generated. This means that an input operation can be concluded either by transferring the correct number of characters or by detection of a carriage return. In addition, under ASCII control mode, the eighth (parity) bit of each input character can be unconditionally set to one to speed up formatting.

The PicoProcessor contains interface drivers and receivers. It translates peripheral interface signals into standardized three-state bus signals and passes them on to ▷

manipulation instructions, 7 floating-point instructions, 4 stack instructions, 16 conditional jumps, 8 I/O instructions, 9 control instructions, 4 status change instructions, 2 mapping instructions, 2 emulate traps, 9 single-register shifts, 9 double-register shifts, 22 multiple-word memory reference instructions, 2 procedure instructions, 3 bit field instructions, 5 queue instructions, one data block instruction, 22 stack relative memory reference instructions, 2 semaphore instructions, 3 double-precision instructions, and 3 error correction instructions.

INSTRUCTION TIMINGS: All times shown are in microseconds for full-word, fixed-point operands and direct addressing mode. The execution times shown are for a SCOUT, a 4/10 with 850-nanosecond on-board MOS memory, a 4/30 with 700-nanosecond MOS memory, a 4/90 with 550-nanosecond MOS memory, and a 4/95 with ECC RAM memory.

	SCOUT	4/10	4/30	4/90	4/95
Copy	3.8	3.6	1.8	1.3	0.85
Add/Subtract	3.2	3.0	1.8	1.5	0.85
Multiply	54.25	66.6	12.7	12.3	6.4
Divide	63.45	71.9	12.2	11.9	7.8
Compare and Skip	5.3	5.6	2.2	1.8	0.85

INTERRUPTS: Three types of interrupts are recognized by the system: I/O, Console, and the Real-Time Clock (RTC) interrupt. These interrupts are differentiated by vector addresses supplied externally in the case of the I/O interrupts or internally for the Console and RTC interrupts.

The NM4 series interrupt/trap system permits the CPU to execute one or more instructions outside the presently executing program flow to respond to conditions external or internal to the CPU. Both the interrupt and trap suspend the executing program and vector to a location in memory specific to the interrupt or trap being processed, where a single instruction is executed. Instructions executed at these specific locations are called "interrupt instructions." Valid interrupt instructions include automatic input word, automatic input byte, automatic output word, automatic output byte, increment and skip, jump and stack, jump and store, no operation, and halt.

The RTC interrupt is the highest-priority interrupt. The vector for the RTC interrupt is generated internally by the processor. The console interrupt, initiated by the console interrupt switch on the console, has a higher priority than I/O interrupts but lower than the RTC interrupt. The interrupt vector for the console interrupt is also generated internally by the processor. I/O interrupts are initiated by the I/O controllers connected to the MaxiBus. I/O interrupts are lower in priority than either RTC or console interrupts. Within a priority level, precedence is given to the module closest to the processor. The I/O controller supplies the intrrupt vector during the interrupt address request cycle of the processor. All interrupt conditions can be enabled or disabled by the Status Inhibit (SIN) instruction and/or by bits in the Status Register.

PHYSICAL SPECIFICATIONS: The NM4 minicomputers are available in various processor/memory and packaged configurations. In the PC board versions, the systems are referred to as Naked Mini 4's, while the packaged versions are known as Alpha systems. The SCOUT 1/5-card is 6.25 inches wide by 8.3 inches long, the 4/10 half-card PC board is 7.5 inches wide by 16.9 inches deep, while the 4/30, 4/90, and 4/95 full-card boards are 15 inches wide by 16.9 inches deep. Power requirements for the SCOUT 4/04 are 4.0A at +5 volts; for the 4/10, 5.4A at +5 volts; for the 4/30, 8.3A at +5 volts; for the 4/90, 13.5A at +5 volts; and for the 4/95, 18A at +5 volts. Operating environment for all systems is 32 to 122 degrees Fahrenheit with humidity not exceeding 95 percent (non-condensing). ▶

Computer Automation Naked Mini 4

▷ the I/O Distributor. It responds to computer commands, manages all data transfers, including strobe and command line sequences, and monitors all peripheral status lines. No program intervention is required. Because PicoProcessors are microprogrammed, a wide range of both standard and special, serial and parallel interfaces is available.

The serial PicoProcessor is available with EIA or current loop interface. The current loop unit controls a standard ASR teletypewriter, including automatic tape reader and motor on/off control. The EIA version controls CRT terminals or modems using five- through eight-bit characters and odd, even, or no parity.

The parallel PicoProcessor can be microcoded to control 8-bit, 16-bit, and 32-bit input and output devices. To date, standard programs have been developed for paper tape readers and punches, line printers, card readers, magnetic tape, and some general-purpose interface disciplines. Each PicoProcessor mounts in a small plastic box and can be attached to the peripheral it controls by adhesive-backed hook-and-loop fastening strips or by screws.

Computer Automation wisely prefers to keep the posture of an OEM-oriented vendor, selling its products to other manufacturers who add value by incorporating them into large systems. CA's service facilities consist of five repair sites: the factory in Irvine, California, and facilities in Ramsey, New Jersey (near New York); Elk Grove, Illinois (a suburb of Chicago); Dallas, Texas; and Watford, Hertfordshire, England (a suburb of London). CA's policy towards peripherals has always been simple and eloquent—buy directly from the manufacturer and save money. However, if a customer requests it, CA will include specified peripherals on a package basis and is now offering its own CRT display terminal, introduced at the same time the LSI 4 Series was announced. This unit can be used with all NM4 series computers.□

▶ INPUT/OUTPUT CONTROL

I/O CHANNELS: The MaxiBus supports 5 data transfer modes with 64 parallel lines. The modes are direct programmed I/O, interrupt programmed I/O, automatic word I/O under interrupts, automatic byte I/O under interrupts, and DMA.

Direct programmed I/O transfers the data directly to and from the operating registers of the processor. Programmed I/O instructions can be combined with Sense and Skip instructions to allow testing of controller or peripheral status prior to making a transfer.

In the interrupt programmed I/O mode, the processor can initiate an I/O operation with interrupts, in which case it will be interrupted when the operation is complete and will vector to an interrupt service routine.

The automatic word I/O mode permits the transfer of 16-bit data to or from memory at high data rates with minimal interruption of the main program. The auto I/O instruction is executed once per interrupt, transferring the data, incrementing the memory pointer and data count in a single instruction, and immediately returning to the mainline program. When all data has been transferred, the interface issues

an End-of-Block interrupt. The automatic byte I/O mode operates exactly the same as the automatic word I/O mode but transfers 8-bit bytes, automatically packing or unpacking two bytes per word into memory. The maximum data transfer rate under the automatic I/O modes is 38K words/bytes per second for the SCOUT and the 4/10, 80K words/bytes per second for the 4/30, 115K words/bytes per second for the 4/90, and 115K words/bytes per second for the 4/95.

The Distributed I/O System, consisting of an I/O Distributor and "intelligent cables"—cable-mounted microprocessors (PicoProcessors) used as device controllers—is used for input/output control. A variety of intelligent cables can be connected to each I/O Distributor. The PicoProcessor controllers operate through the four automatic I/O instructions.

The following PicoProcessor controllers are available:

● Line printer controllers for any Centronics or Dataproducts line printer or equivalent.

● Card reader controller for any Documation card reader or equivalent.

● Paper tape reader controller for any Remex or Facit reader or equivalent.

● Paper tape punch controller for any Remex or Facit punch or equivalent.

● General-purpose byte-parallel controller for use with most 16-bit input or 8-bit output devices using positive- or negative-true logic and a "handshaking" I/O discipline.

● CRT controller for Computer Automation CRT.

● Teletypewriter controller for standard asynchronous TTY devices.

● Magnetic tape controller for 7- or 9-track NRZI or phase-encoded tape drives.

● IEEE controller for interfacing the bus system defined by the IEEE 488-1975 specification.

● 32-bit general-purpose controller for interfacing parallel, multi-byte-wide devices. Word size is selectable in 8-bit increments up to 32 bits, and data is transferred under automatic I/O programming using an I/O polling discipline.

● BiSync controller for interfacing the I/O Distributor to peripheral devices that use BiSync protocol.

● INTRACOMM Modem PicoProcessor.

CONFIGURATION RULES: Each of the basic Naked Mini 4 CPU's consists of one board and no chassis. Four- and nine-slot cages are provided for SCOUT one-fifth-card-based configurations. Fifty-watt and 100-watt power supplies are available for the four- and nine-slot cages, respectively. Two cages may be connected together by an expansion/extender card in each cage and interconnected via a flat ribbon cable. Two cages connected together provide a maximum capability of sixteen SCOUT cards. Three and five half-card cages are provided for half-card (4/10) based configurations, and five and nine full-card chassis are offered for full-card (4/30, 4/90) configurations. Half-card modules can be used in full-card chassis. Expansion chassis are offered to allow for expansion beyond five or nine full cards. Each expansion chassis includes a five- or nine-slot chassis, a blank front panel, an expansion buffer controller, interconnecting cables, and a power supply. Up to two expansion chassis may be used to provide maximum capabilities of 27 full cards or 54 half cards. ▶

Computer Automation Naked Mini 4

The 4/95 requires a "split" chassis with one or two external power supplies. The Memory Management Unit and memory cache are contained in a single full card, which is installed in the center slot. All DMA I/O controllers as well as all memories are positioned above the map. The 4/95 and non-DMA I/O controllers are positioned below the map. Up to one megabyte of memory can be installed in the 9-slot chassis and up to two megabytes in the 17-slot chassis.

Each core memory module requires one slot position. MOS, RAM, ROM, and PROM memories and general-purpose I/O options require half a slot each.

Memory and I/O controllers are available in half and full cards. The following chart shows the possible Naked Mini 4 memory configurations.

MEMORY CONFIGURATIONS

Type	Card Size	Speed (NSEC)	Capacity (Bytes)
Naked Mini 4/10 through 4/90			
Core	Full	850	16K
Core	Full	1200	32K
Core	Half	3000	8K, 16K
RAM	Half	580	32K, 64K, 128K
RAM, parity	Full	550	32K, 64K
RAM, parity	Full	700	32K, 64K
RAM, ECC	Full	520	32K, 64K, 128K
RAM plus sockets for 16Kb of E/P/ROM	Half	1400	512, 2K, 4K
Naked Mini 4/95			
RAM, ECC	Full	550	128K, 256K
Naked Mini 4/04 SCOUT			
RAM	Fifth	1051	32K, 64K, 96K, 128K
RAM plus sockets for up to 32K of E/P/ROM	Fifth	1051	0, 4K, 8K

WORKSTATIONS: A Remote Console Interface for the NM 4/04 SCOUT provides the necessary interface for the Remote Programmer's Console. The Remote Console Interface and the Remote Programmer's Console provide complete Programmer's Console capability. The interface board occupies one card slot position, and there can be only one interface per Alpha system.

The MaxiBus supports either an Operator's Console or a Programmer's Console, and only one or the other can be supported per Alpha system. The Operator's Console is a low-cost control panel that provides control and status display of essential functions.

The Remote Programmer's Console can also be connected to the Operator's Console to provide complete Programmer's Console capability.

The Programmer's Console provides full control and interaction with the computer via a comprehensive set of data entry, control, and function select switches; indicators; and an alphanumeric display.

Workstation support is a function of software capability. Up to 64 workstations may be connected to the 4/10 through 4/95.

MASS STORAGE: All disk controllers interface up to four drives. The floppy controller can interface either to the single-sided, single-density floppy disk with 243,000 bytes or to the dual-sided, dual-density disk with approximately one megabyte. The medium capacity disk controller can interface to cartridge disk drives with one fixed and one removable cartridge with a total capacity of ten or twenty megabytes. The high capacity disk controller accommodates storage modules with maximum capacities of four to 300 megabytes and a data transfer rate of 1.2 megabytes per second. Each disk controller and interface occupy two half-slot positions.

MAGNETIC TAPE UNITS: Computer Automation offers one model of magnetic tape drive: a 25-ips, 800-bpi, 20K-bytes-per-second unit. Up to four transports can be attached to one controller, and a controller occupies one slot.

PRINTERS: Computer Automation offers four printers: two bidirectional printers with print speeds of 120 or 180 characters per second and two printers with speeds of 300 or 600 lines per minute. Each printer occupies one-half slot. The printer interface is a line printer PicoProcessor which plugs into an I/O Distributor.

MASS STORAGE

45083-00 MINI FLEXIBLE DISK SUBSYSTEM: This unit consists of a desk-top mini-diskette (5¼-inch disks) drive mechanism with controller/formatter, power supply, and cables. The subsystem can support up to four drives. The recording format is sixteen sectors per track, thirty-five tracks, 71.6K bytes per diskette. Data transfer rate is 125K bits per second, and average access time is 566 milliseconds. Add-on drives (45083-01) are available for the desk-top model, and a rack-mountable dual-drive version is offered (45084-00). The interface and controller occupy two half-slot positions. The Mini Flexible Disk Subsystem plugs into the I/O Distributor card.

45003-00 DUAL FLOPPY DISK SUBSYSTEM: Includes two drives, power supply, cables, and controller/interface. It is compatible with the IBM 3740 system. Capacity is 243K bytes per drive. Average head positioning time is 176 milliseconds; average rotational delay is 83 milliseconds; and data transfer rate is nominally 15,625 words per second. The DMA-type controller can support two additional drives and requires 1/2 slot. Add-on dual drives are 22566-20, and a single-drive version is available (45007-00).

45118-02 DUAL DOUBLE-SIDED DOUBLE-DENSITY FLOPPY DISK SUBSYSTEM: Includes two double-sided, double-density floppy disk drives, half-card controller, rack-mountable chassis with power supply and cables. Recording format is IBM System 34. The controller automatically senses single- or double-density diskettes and operates accordingly when reading from diskettes. Data transfer rate is 62,500 bytes per second at double-density. Access time is quoted as a minimum of sixteen milliseconds and a maximum of 623 milliseconds. Recording format at double-density is 154 tracks, 26 sectors per track, and 256 bytes per sector. At single-density, the figures are 77 tracks, 26 sectors per track, and 128 bytes per sector. The controller occupies one half-slot position.

45011-00 MEDIUM-CAPACITY DISK SUBSYSTEM: This 10-megabyte cartridge disk system includes a drive unit with one fixed and one removable disk and an interface for up to three additional drives. Average head positioning time is 35 milliseconds, average rotational delay is 12.5 milliseconds, and data transfer rate is 156K words per second. The interface and controller occupy two half-slot positions.

45014-00 HIGH-CAPACITY DISK SUBSYSTEM: This 80-megabyte removable-pack disk system includes a drive unit and controller for up to three additional drives. Average head positioning time is 30 milliseconds, average rotational delay is 8.3 milliseconds, and data transfer rate is 1.2 million bytes per second. The interface and controller occupy two half-slot positions.

Computer Automation Naked Mini 4

► **INPUT/OUTPUT UNITS**

Computer Automation will supply paper tape equipment, line printers, a card reader, disk units, and magnetic tape drives but recommends that the user purchase only the interface from Computer Automation and the I/O devices directly from their manufacturers.

See also Peripherals/Terminals table.

COMMUNICATIONS CONTROL

For data communications, Computer Automation offers intelligent cables for TTY's, asynchronous modems, and bisync (RS-232 and RS-422) communications, 2-channel and 4-channel automatic calling unit multiplexers, and 4-channel and 8-channel asynchronous multiplexers.

ANALOG I/O SYSTEM

This system provides analog-to-digital (A/D) and digital-to-analog (D/A) converters for laboratory and industrial applications. Two high-level A/D converters on a half-card and an A/D-D/A converter combination, also on a half-card, are available.

SOFTWARE

OPERATING SYSTEMS: Three operating systems are available for the NM 4 series, including a basic memory-resident system. All are separately priced. The memory-resident system can include the Omega conversational assembler/editor and utility package with loaders and debuggers.

A *Real-Time Executive (RTX4)* is offered as a modular system consisting of a multi-tasking executive, an I/O supervisor, a communications supervisor, and a real-time debugging program. RTX4 is designed to help the OEM user construct real-time application programs.

The *OS4 Operating System* is available to support disk, magnetic tape, and other standard peripheral devices. OS4 is a device-independent, batch-oriented system that supports program development and provides automatic control of job sequencing, I/O, interrupt handling, library support, file management, and on-line operator communication.

OMEGA4 is a general-purpose, memory-based software development system for Naked Mini 4 Family computers. The system includes all software required to create, assemble, edit, and debug assembly language user programs in small, memory-based environments. OMEGA4 operates in as little as 12K words of memory. Available modules may be configured in a variety of ways to best satisfy the specific requirements of the user.

OMEGA4 Plus is designed to provide a range of system capabilities utilizing Floppy Disk Resident utilities. OMEGA4 Plus includes all of the capabilities of OMEGA4 with the addition of a file management module and Floppy Disk I/O Drivers. OMEGA4 Plus supports execution of programs from the floppy disk, saving and retrieval of source files from the floppy disk, and the storing of binary programs on the floppy.

COMMUNICATIONS SOFTWARE: The *INTRACOMM* Real-time Communications Subsystem provides processor-to-processor communications capability for the NM4 series and allows the use of a wide range of user-developed applications such as message and data switching, process control, and distributed processing. Included in the package is the ability to download operating software from a NM 4/10, 4/30, 4/90, or 4/95 to a remote SCOUT. INTRACOMM application software can be developed under an OS4 operating system or the OMEGA4 Plus operating system. INTRACOMM software executes under the NM4 Real-time Executive (RTX4) on any SCOUT hardware system equipped with a Serial Peripheral I/O board and on any 4/10, 4/30, 4/90, or 4/95 hardware system equipped with an Asynchronous Multiplexer or INTRACOMM Modem PicoProcessor. INTRACOMM software operates in either a full or half duplex environment or asynchronous lines operated at speeds up to 9,600 bits per second. The software is also capable of driving lines using modems. The INTRA-COMM package functions as an RTX4-IOS4 device driver. The user interface to an INTRACOMM link is a standard IOS4 interface; functions of the line-control protocol are transparent to the user. No restrictions are imposed on the length of data blocks transferred, and data can be transmitted in any character set.

LANGUAGES: The *Naked Mini 4 Family Assembler* is a general-purpose development tool which provides the OEM user with a quick and easy means of developing user application programs. It includes a complete set of macro facilities which allow the programmer to define a sequence of operations and invoke them with a single name rather than repeating the entire sequence each time the set of operations is required in the program. The Assembler operates with all Computer Automation Operating Systems—OS4, OMEGA4, OMEGA4 Plus, and MULTED.

FORTRAN IV programs are compiled under the Operating System (OS4) and are executable on any Naked Mini 4 Family computer. Execution of the linked object program may be performed under either the Real-time Executive (RTX4) or the Operating System (OS4). Concurrent execution of FORTRAN tasks is supported under the Real-time Executive (RTX4). FORTRAN IV is compatible with ANSI X3.9-1966 standards and selected extensions from ANSI X3.9-1977. Additional features include simplified I/O programming, readable object-code listings, run-time trace/debug, and complete diagnostic messages.

Naked Mini 4 COBOL is a block-structured programming language that operates under the OS4 disk operating system. using the device-independent input/output facilities of the Real-time Executive (RTX4). Naked Mini 4 COBOL conforms in language element, representation, symbology, and coding format to ANSI specification X3.23-1974.

NM4 PASCAL is a high-level, block-structured programming language. The compiler operates under the OS4 disk-operating system on any Naked Mini 4 Family computer and generates directly executable code for the NM4 series of computers. The code produced runs under OS4 and RTX4. Computer Automation's NM4 PASCAL is a superset of the proposed ISO draft specification for PASCAL. This language is based on the PASCAL described in the Jensen-Wirth "User Manual and Report (Second Edition)" (Springer-Verlag, 1975). The ISO proposal is the basis for the proposed standards of both the ANSI X3J9 and IEEE PASCAL standards drafting groups.

The *NM4 BCPL* software package for the Naked Mini 4 enables source programs to be compiled under OS4. The compiled code may be run under OS4 or RTX4 (Real-time Executive) on any Naked Mini 4 Family computer. BCPL is a powerful systems programming language, primarily suited to non-numerical applications. An important feature of the language is that it provides great flexibility for the systems programmer but few safeguards for the undisciplined.

The *NM4 CORAL 66* software package enables users to replace assemblers and simplify the writing of Real-Time application programs. The use of CORAL as a programming language can dramatically reduce program development time and also produce compact, fast-running code. The benefits to ►

Computer Automation Naked Mini 4

► the programmer are ease of debugging and freedom from latent errors and for the software manager ease of maintenance and modification.

UTILITIES: The *Multi-Terminal Editor (MULTED)* allows up to four users to concurrently create or edit source files while allowing production programs to execute in a background partition. MULTED runs under the OS4 operating system on 128K-byte systems, with support for program development shared in the foreground 64K-byte partition and 64K bytes reserved for background production. Programs in assembler or higher-level languages can be developed under MULTED.

The system provides the terminal user with the ability to create a new file, edit an existing file, submit a checked-out file to the batch queue for processing, send a message to another edit terminal, and get a command summary display by typing "HELP." The source editor is a line-oriented text editor that provides insertion and deletion operations on source text. Character editing, including string search and string replacement functions, is also provided. With MULTED the user can create or edit text for use as source input to the Naked Mini 4 assembler or compilers. By using re-entrant code, only one copy of the editor resides in memory to service up to four users.

A number of basic utilities and program development aids are also available.

APPLICATIONS: In general, the user must develop his own applications programs. A user library is offered free to all CAUSE (Computer Automation User Software Exchange) members. CAUSE is a nonproprietary exchange service which CA makes available to users.

PRICING

POLICY: Computer Automation provides Naked Mini 4 minicomputers in multiple quantities under either an OEM Agreement or a Firm Purchase Agreement (FPA). Fully integrated Software Development Systems are also available and can be incorporated under the OEM Agreement or FPA.

Most software is separately priced; however, software required to support the fully integrated Software Development System is provided at no additional cost when the system is ordered.

SUPPORT: Technical support is provided through a series of Training Classes offered on a tuition basis in Irvine. Field Analyst support is also available through the direct sales organization with offices throughout the United States and Canada. All products, excluding CRT's and peripherals, are covered by a one-year warranty.

On-site maintenance is generally the responsibility of the user and can be performed rather easily through board replacement. Users, therefore, should keep a supply of spares on hand.

Training credits are granted to new customers ordering a Software Development System. Two weeks of credit is allowed for each Software Development System ordered. Credits are valid for eight months after date of issue and can be applied only to courses taught at the Irvine facility.

EQUIPMENT: A Naked Mini 4 system with a 4/10 processor, 32K bytes of 580-nanosecond RAM memory, MaxiBus interface, power-fail/auto-restart, real-time clock, and four I/O distributor channels is priced at $1,275.

A Naked Mini 4 system with a 4/30 processor, 32K bytes of 700-nanosecond RAM memory, MaxiBus interface, power-fail/auto-restart, and real-time clock is priced at $2,425.

A Naked Mini 4 system with a 4/90 processor, 32K bytes of 550-nanosecond RAM memory, MaxiBus interface, power-fail/auto-restart, and real-time clock is priced at $3,415.

A Naked Mini 4 system with a 4/95 processor, 128K bytes of ECC RAM memory, Memory Management Unit, 2K-byte cache memory, MaxiBus interface, power-fail/auto-restart, and real-time clock is priced at $10,000.

See the Equipment Prices section which follows for the prices of the various packaged Alpha configurations.

EQUIPMENT PRICES

All Naked Mini 4 Family processors have identical architecture and a SCOUT bus or MaxiBus interface which provides compatibility. All processors include power-fail/auto-restart, auto load, and real-time clock as standard features.

SCOUT NM 4/04

CPU/memory combinations:

		Purchase Price
44003-16	CPU with 32K-byte RAM memory	$ 675
44003-32	CPU with 64K-byte RAM memory	975
44003-48	CPU with 96K-byte RAM memory	1,425
44003-64	CPU with 128K-byte RAM memory	1,875
44004-18	CPU with 4K-byte RAM memory and 32K-byte E/P/ROM memory	570
44004-20	CPU with 8K-byte RAM memory and 32K-byte E/P/ROM memory	610
44009-16	44003-16 with optional instruction set	825
44009-32	44003-32 with optional instruction set	1,125
44009-48	44003-48 with optional instruction set	1,575
44009-64	44003-64 with optional instruction set	2,025
44010-18	44004-18 with optional instruction set	720
44010-20	44004-20 with optional instruction set	760

Pre-configured systems:

Application programs for SCOUT systems typically will be developed on Naked Mini 4 systems. The following are the suggested minimum SCOUT configurations needed to interface to a Naked Mini 4 for development and debugging purposes.

44040-01 is configured to enable direct connection to a Naked Mini 4 equipped with an asynchronous multiplexer; 44040-02 is configured to enable direct connection to a Naked Mini 4 equipped with I/O Distributor.

►

Computer Automation Naked Mini 4

EQUIPMENT PRICES

▶ **SCOUT NM 4/04 (Continued)**		**Purchase Price**
44040-01	CPU with 64K-byte RAM memory and optional instruction set, CRT serial I/O controller, modem serial I/O controller, CRT/modem device cable, remote programmer's console and interface, 9-slot card cage, 20-amp power supply, NM4 async MUX to SCOUT modem serial I/O cable, RTX SCOUT	2,675
44040-02	Same as 44040-01 with CRT intelligent cable (14630-01) substituted for NM4 async MUX to SCOUT I/O cable	2,785

Add-on memories:

22109-16	32K-byte RAM memory expansion	625
22109-32	64K-byte RAM memory expansion	925
22109-48	96K-byte RAM memory expansion	1,375
54105-16	No RAM and 32K-byte E/P/ROM memory expansion	415
54105-18	4K-byte RAM and 32K-byte E/P/ROM memory expansion	455
54105-20	8K-byte RAM and 32K-byte E/P/ROM memory expansion	495

Input/output controllers:

22111-01	CRT serial I/O, RS-232C-compatible	230
22111-02	Modem serial I/O, RS-232C-compatible	230
22110-03	Paper tape reader controller	210
22110-04	Paper tape punch controller	210
22110-02	General-purpose parallel I/O	210

Cables:

45133-15	15-ft. CRT/modem device cable, for use with 22111-01 or 22111-02	50
44007-10	7-ft. paper tape reader device cable, for use with 22110-03	50
44008-10	7-ft. paper tape punch device cable, for use with 22110-04	50
45134-15	15-ft. NM4 async MUX to SCOUT modem serial I/O cable	50

Mass storage:

55404-02	8-inch dual-drive floppy disk subsystem; single-side, single-density; with controller and cable, 60 Hz	3,000
55405-02	Same, 50 Hz	3,000
55406-02	8-inch dual-drive floppy disk subsystem; double-side, double-density; with controller and cable, 60 Hz	3,950
55407-02	Same, 50 Hz	3,950
54124-01	Universal floppy disk controller	790

Consoles:

40980-00	Remote programmer's console with cable	375
54107-00	Remote programmer's console interface	100

Card cages, power supplies, and fans:

44005-04	4-slot card cage	100
44105-04	4-slot card cage, 10-amp power supply	345
44205-04	4-slot card cage, 10-amp power supply, one fan	400
44005-09	9-slot card cage	150
44105-09	9-slot card cage, 20-amp power supply	515
44205-09	9-slot card cage, 20-amp power supply, two fans, fan mounting plate	600
22007-01	10-amp power supply	245
22007-03	20-amp power supply	365

Sensor-based input/output modules:

54120-32	32-bit bidirectional, digital I/O	220
54122-04	4-channel digital to analog converter	650
54106-16	16/8-channel analog to digital converter	700
54108-08	8-channel isolated solid-state relay	450

Miscellaneous:

54404-00	Battery backup board/watchdog timer	230
54100-00	Prototyping board	90
54102-00	Extender/expansion card	95
44006-00	Expansion cable	25

Software:

44001-00	RTX SCOUT, on paper tape	500
44001-01	RTX SCOUT, on diskette	500
20029-00	OMEGA4, on paper tape	200
44002-00	INTRACOMM, on paper tape	200
44002-01	INTRACOMM, on diskette	200 ▶

Computer Automation Naked Mini 4

EQUIPMENT PRICES

► SCOUT NM 4/04 (Continued)

Documentation:

		Purchase Price
21304-00	SCOUT Handbook	20

All Alpha configurations contain the following: NM4 Family CPU with standard power-fail detect, real-time clock, auto-restart, and auto-load capability; RAM memory; eight distributed I/O channels for use with intelligent cables in 4/30 and 4/90 Alpha configurations; four distributed I/O channels for use with intelligent cables in 4/10 Alpha configurations; chassis; power supply; and operator's or programmer's console.

NM 4/10

41075-16	CPU with 32K-byte 580-nanosecond RAM memory, battery backup, half-card	1,275
41075-32	Same with 64K-byte RAM memory	1,650
41075-64	Same with 128K-byte RAM memory	2,595
41107-00	CPU with 32K-byte 700-nanosecond RAM memory, battery backup, parity	2,225
41109-00	Same with 64K-byte RAM memory	3,600
41023-00	CPU with 8K-byte 3000-nanosecond core memory, half-card	1,450
41024-00	Same with 16K-byte core memory	2,130
41017-00	CPU with 32K-byte 1200-nanosecond core memory	3,100
41006-00	CPU with 16K-byte 850-nanosecond core memory	2,245
45067-00	Alpha configuration with 32K-byte RAM memory, 5 half-card chassis, 17-amp power supply, operator's console	2,075
45095-00	Same with 64K-byte RAM memory, operator's console	2,450
45067-01	Same with 32K-byte RAM memory, programmer's console	2,275
45095-01	Same with 64K-byte RAM memory, programmer's console	2,650

NM 4/30

43075-16	CPU with 32K-byte 580-nanosecond RAM memory, battery backup, half-card	2,095
43075-32	Same with 64K-byte RAM memory	2,395
43075-64	Same with 128K-byte RAM memory	3,595
43107-00	CPU with 32K-byte 700-nanosecond RAM memory, battery backup, parity	2,425
43109-00	Same with 64K-byte RAM memory	3,800
43097-00	CPU with 32K-byte 550-nanosecond RAM memory, battery backup, parity	3,015
43099-00	Same with 64K-byte RAM memory	4,425
43017-00	CPU with 32K-byte 1200-nanosecond core memory	3,250
43006-00	CPU with 16K-byte 850-nanosecond core memory	2,645
45096-00	Alpha configuration with 32K-byte RAM memory, 5 full-card chassis, 36-amp power supply, operator's console	3,905
45097-00	Same with 64K-byte RAM memory, operator's console	4,205
45098-00	Same with 128K-byte RAM memory, operator's console	5,405
45096-01	Same with 32K-byte RAM memory, programmer's console	4,105
45097-01	Same with 64K-byte RAM memory, programmer's console	4,405
45098-01	Same with 128K-byte RAM memory, programmer's console	5,605

NM 4/90

49075-16	CPU with 32K-byte 580-nanosecond RAM memory, battery backup, half-card	2,595
49075-32	Same with 64K-byte RAM memory	2,895
49075-64	Same with 128K-byte RAM memory	4,095
49107-00	CPU with 32K-byte 700-nanosecond RAM memory, battery backup, parity	3,220
49109-00	Same with 64K-byte RAM memory	4,570
49097-00	CPU with 32K-byte 550-nanosecond RAM memory, battery backup, parity	3,415
49099-00	Same with 64K-byte RAM memory	4,825
49017-00	CPU with 32K-byte 1200-nanosecond core memory	3,650
49006-00	CPU with 16K-byte 850-nanosecond core memory	3,045
45099-00	Alpha configuration with 32K-byte RAM memory, 5 full-card chassis, 36-amp power supply, operator's console	4,405
45100-00	Same with 64K-byte RAM memory, operator's console	4,705
45099-01	Same with 32K-byte RAM memory, programmer's console	4,605
45100-01	Same with 64K-byte RAM memory, programmer's console	4,905
45101-00	Alpha configuration with 128K-byte RAM, 9 full-card chassis, 60-amp power supply, operator's console	6,435
45101-01	Same with programmer's console	6,635

NM 4/95

49501-01	CPU with 128K-byte ECC RAM memory, MMU/cache, 60-amp power supply, chassis for one power supply	10,000
49501-02	Same with 256K-byte ECC RAM memory	12,500
49501-03	Same with 512K-byte ECC RAM memory	18,000
49502-03	CPU with 512K-byte ECC RAM memory, MMU/cache, two 60-amp power supplies, chassis for two power supplies	19,000
49502-04	Same with 1-megabyte ECC RAM memory	30,000
49528-01	CPU with 128K-byte ECC RAM memory, MMU/cache	8,500
49528-02	CPU with 256K-byte ECC RAM memory, MMU/cache	11,500

4/10S SLAVE COMPUTER

53760-01	With 32K-byte RAM and four DIO channels on-board	1,990 ►

Computer Automation Naked Mini 4

EQUIPMENT PRICES

		Purchase Price
► ADD-ON MEMORIES		
RAM memories, 580-nanosecond, half-card, battery backup:		
53775-16	32K bytes	1,050
53775-32	64K bytes	1,350
53775-64	128K bytes	2,550
RAM memories, 700-nanosecond, full-card, battery backup, parity:		
11611-16	32K bytes	2,125
11611-32	64K bytes	3,475
RAM memories, 550-nanosecond, full-card, battery backup, parity:		
11711-16	32K bytes	2,320
11711-32	64K bytes	3,730
Core memories, 3000-nanosecond, half-card:		
11671-04	8K bytes	985
11703-08	16K bytes	1,895
Core memories, 1200-nanosecond, full-card:		
11673-16	32K bytes	3,050
Core memories, 850-nanosecond, full-card:		
11677-08	16K bytes	1,950
RAM/E/P/ROM memories, half-card:		
53678-00	No RAM, up to 8K E/P/ROM sockets	280
53678-39	512-byte RAM, up to 8K E/P/ROM sockets, battery backup	400
53678-59	Same with 2K-byte RAM	510
53678-69	Same with 4K-byte RAM	660
ECC RAM memories for NM 4/95:		
53828-01	128K bytes	3,500
53828-02	256K bytes	6,500
HOUSINGS		
3-half-card housings:		
10303-00	10-amp basic housing	440
40011-00	10-amp with operator's console	640
40012-00	10-amp with programmer's console	840
40020-00	17-amp basic housing	540
40021-00	17-amp with operator's console	740
40022-00	17-amp with programmer's console	940
5-half-card housings:		
10305-00	17-amp basic housing	600
40031-00	17-amp with operator's console	800
40032-00	17-amp with programmer's console	1,000
5-full-card housings:		
10506-00	25-amp basic housing	980
40051-00	25-amp with operator's console	1,180
40052-00	25-amp with programmer's console	1,380
12098-10	25-amp with first expansion housing	1,195
40060-00	36-amp basic housing	1,320
40061-00	36-amp with operator's console	1,520
40062-00	36-amp with programmer's console	1,720
40063-00	36-amp with first expansion housing	1,495
9-full-card housings:		
10508-00	36-amp basic housing	1,630
40071-00	36-amp with operator's console	1,830
40072-00	36-amp with programmer's console	2,030
12099-10	36-amp with first expansion housing	1,895
40080-00	60-amp basic housing	1,850
40081-00	60-amp with operator's console	2,050
40082-00	60-amp with programmer's console	2,250
40083-00	60-amp with first expansion housing	2,095 ►

Computer Automation Naked Mini 4

EQUIPMENT PRICES

		Purchase Price
►**CPU/MEMORY OPTIONS FOR NM 4/10, NM 4/30, AND NM 4/90**		
45035-00	Expanded instruction set for NM 4/10	175
53698-02	Expanded instruction set for NM 4/30	295
53772-02	Floating-point instruction set for NM 4/90	395
49682-39	AutoLoad ROM supporting paper tape reader and 5" floppy disk	50
49682-38	AutoLoad ROM supporting paper tape reader and 8" floppy disk	75
49682-37	AutoLoad ROM supporting magnetic tape, medium-capacity disk controller, high-capacity disk controller, 5" and 8" floppy disk	100

DISTRIBUTED I/O

I/O distributors:

53701-02	4-channel distributor	250
53701-01	8-channel distributor	290
14674-02	4-channel distributor, DMA	735

Type 1 intelligent cables:

14630-01	CRT, RS-232-compatible, for 22851-80 CRT	160
14632-01	TTY, current loop-20 ma	160
14630-02	Asynchronous modem, RS-232	160
14631-01	Line printer (Centronics)	250
14631-13	Line printer (Dataproducts)	250
14631-02	Card reader (Documation)	250
14631-03	Paper tape reader (Remex)	200
14631-53	Paper tape reader (Trend)	200
14631-04	Paper tape punch (Remex)	200
14631-54	Paper tape punch (Facit)	200
14631-11	General-purpose, negative-true, 16 bits in/8 out	160
14631-12	General-purpose, positive-true, 16 bits in/8 out	160

Type 2 intelligent cables:

14631-41	Magnetic tape	350
14676-01	IEEE-488 interface	350
14722-01	General-purpose, negative-true, 32-bit	250
45000-00	Bisync/async, RS-232	595
45001-00	Bisync/async, RS-422	595

MASS STORAGE

5-inch floppy disk subsystems:

45083-00	Mini-flexible disk drive subsystem, desk-top	1,100
45083-01	Add-on mini-flexible disk drive, desk-top	800
45084-00	Dual mini-flexible disk drive subsystem, rack-mountable	1,550

8-inch floppy disk single-density subsystems:

14696-01	Floppy disk controller	930
15566-01	Cable for floppy disk controller	75
45003-00	Dual-drive subsystem, 60 Hz	3,000
45005-00	Same, 50 Hz	3,000
22566-20	Add-on dual drive, 60 Hz	2,600
22566-22	Same, 50 Hz	2,600
45007-00	Single-drive subsystem, 60 Hz	2,200
45004-00	Same, 50 Hz	2,200
22566-21	Add-on single drive, 60 Hz	1,800
22566-23	Same, 50 Hz	1,800

Cables are included with above 8-inch subsystems and add-on drives.

8-inch floppy disk dual-sided/double-density subsystem:

45118-02	Dual drive subsystem (quad density), 60 Hz	3,950
45118-50	Same, 50 Hz	3,950

Medium-capacity disk subsystem:

14702-01	Medium-capacity disk controller, s/s	2,100
14702-03	Medium-capacity disk controller, vert.	2,100
15949-10	Daisy chain cable (PERTEC)	420
45011-00	10-megabyte disk subsystem, 60 Hz, s/s	9,600
45012-00	Same, 50 Hz, s/s	9,600
45008-00	10-megabyte add-on drive, 60 Hz	8,600
45008-50	Same, 50 Hz	8,600
45102-00	Diablo compatible device cable	420

Cables are included with above medium-capacity disk controllers, subsystems, and add-on drives.

►

Computer Automation Naked Mini 4

EQUIPMENT PRICES

		Purchase Price
►MASS STORAGE (Continued)		
High-capacity disk subsystem:		
14655-11	High-capacity disk controller, s/s	3,000
14655-10	High-capacity disk controller, vert.	3,000
15655-02	Cable set for HCDC, 10 ft.	300
15655-12	Same, 20 ft.	325
15655-22	Same, 30 ft.	350
45014-00	80-megabyte disk subsystem	14,800
45030-00	80-megabyte add-on drive	11,800

Cables are included with above high-capacity disk controllers and subsystems.

PERIPHERALS

18631-01	Magnetic tape subsystem; 25 ips, 800 bpi, with formatter and intelligent cable	10,000
22205-00	ASR 33 teleprinter (Teletype), integral paper tape punch/reader, prints 10 ASCII char. per second	1,695
22215-00	ASR 33 teleprinter mod kit	90
22851-80	CRT terminal, RS-232C compatible, 128 ASCII character set, 24 x 80 screen, selectable speed (75 to 9,600 bps)	1,900
22077-20	Card reader, 285 cpm, 550-card hopper and stacker (Documation)	7,690
22223-11	Paper tape reader, 300 cps (Remex)	1,945
22223-60	Paper tape reader/punch, 300/75 cps (Remex)	5,625
22108-01	Line printer, 132 col., 120 cps, bidirectional (Centronics)	3,500
22108-02	Same, 180 cps	4,000
22108-03	Printer stand, form basket (Centronics)	250
45028-00	Line printer, 300 lpm (Dataproducts)	11,800
45029-00	Line printer, 600 lpm (Dataproducts)	16,000

COMMUNICATIONS

45015-04	4-channel automatic calling unit MUX	500
45060-04	4-channel asynchronous multiplexer and connector panel (RS-232)	995
45060-08	8-channel asynchronous multiplexer and connector panel (RS-232)	1,495
45081-15	15-ft. modem device cable (RS-232)	50
45080-25	25-ft. CRT device cable (RS-232)	50

DIGITAL I/O

53813-01	64-bit output module	400
53841-01	64-bit input module	400

ACCESSORIES

12095-03	3 half-card cage	90
12095-05	5 half-card cage	150
12034-00	5 full-card chassis	420
20500-01	9 full-card chassis	650
12046-03	10-amp power supply	350
20928-00	17-amp power supply	450
12044-00	25-amp power supply	560
20929-00	36-amp power supply	900
20441-00	36-amp power supply, external mount	980
20930-00	60-amp power supply, external mount	1,200
40970-00	Programmer's console	400
40977-00	Operator's console	200
40980-00	Remote programmer's console with cable	375
53757-01	Wire-wrap breadboard, card 1H slot	500
53757-00	Blank breadboard, card 1H slot	75
20206-00	Blank front panel, 8¾" high	25
20660-00	Stiffener kit	10
53718-01	Bus monitor	800
42098-00	First expansion buffer	370
42098-01	Second expansion buffer	370
13265-00	Extender full-card	190
13265-03	Extender half-card	100
13638-01	Filler half-card, adjacent to 4/10	80
13638-02	Filler half-card	80
13265-02	Filler half-card, blank card	50
40091-00	Desk cabinet, 60 Hz	1,400
40091-20	Desk cabinet, 50 Hz	1,500
45124-00	Cabinet, 40 inches high, 60 Hz	1,850
45124-20	Cabinet, 40 inches high, 50 Hz	1,850

ANALOG SUBSYSTEMS

Analog I/O for NM4 computers is offered by Data Translation, Inc., 4 Strathmore Road, Natick, Massachusetts 01760 (617) 655-5300.

►

Computer Automation Naked Mini 4

EQUIPMENT PRICES

► **SOFTWARE DEVELOPMENT SYSTEMS**

All development systems are complete hardware and software packages including appropriate diagnostics and documentation. Installation assistance and two weeks of formal training at company's Irvine facilities are provided with purchase.

		Purchase Price
45090-06	DS-410-A; 4/10 processor with AutoLoad ROM, programmer's console, 128K-byte RAM memory with battery backup, 4 DIO channels, desk-style cabinet, 25-amp, 5 full-card chassis, Teletype 33 terminal, dual floppy disk subsystem, bus monitor; OS4, RTX4, FORTRAN IV; 60 Hz	11,500
45090-05	Same, 50 Hz	11,500
45091-06	DS-430-A; 4/30 processor with AutoLoad ROM, programmer's console, 128K-byte RAM memory with battery backup, 8 DIO channels, vertical cabinet, 36-amp, 5 full-card chassis, Teletype 33 terminal, dual floppy disk subsystem, bus monitor; OS4, RTX4, FORTRAN IV; 60 Hz	13,000
45091-05	Same, 50 Hz	13,000
45091-11	DS-430-B; same as DS-430-A with CRT terminal instead of Teletype 33, plus 180-cps Centronics line printer with printer stand and form basket, 60 Hz	16,800
45091-10	Same, 50 Hz	16,800
45092-06	DS-490-A; 4/90 processor with AutoLoad ROM, programmer's console, 128K-byte RAM memory with battery backup, 8 DIO channels, vertical cabinet, 60-amp, 9 full-card chassis, CRT terminal, 180-cps Centronics line printer with printer stand and form basket, dual floppy disk subsystem, bus monitor; OS4, RTX4, FORTRAN IV; 60 Hz	17,800
45092-05	Same, 50 Hz	17,800
45092-11	DS-490-B; same as DS-490-A plus a 10-megabyte disk subsystem, 60 Hz	26,800
45092-10	Same, 50 Hz	26,800

SOFTWARE PRICES

SYSTEMS SOFTWARE

		Purchase Price
20029-00	OMEGA4 (including RTX4), on paper tape	200
20029-01	Same, on diskette	200
45087-00	OMEGA4 Plus (including RTX4), on diskette	500
93460-01	OS4 (including RTX4), on diskette	2,000
45113-00	COBOL, on diskette	2,000
45066-00	NM4 FORTRAN IV, on diskette	1,500
45069-00	MULTITERMINAL EDITOR, on diskette	500
45104-00	4/10S SOFTWARE DEVELOPMENT PACKAGE, on diskette	200
44002-00	INTRACOMM, on paper tape	1,000
44002-01	Same, on diskette	1,000
45065-00	ROMGEN, on paper tape	100
45065-01	Same, on diskette	100

DIAGNOSTICS

45018-10	4/10 processor acceptance test, on paper tape	90
45018-11	Same, on diskette	80
45018-20	Same, with expanded instruction set, on paper tape	120
45018-21	Same, on diskette	100
45018-30	4/30 processor acceptance test, on paper tape	90
45018-31	Same, on diskette	80
45018-40	Same, with expanded instruction set, on paper tape	120
45018-41	Same, on diskette	100
45018-50	4/90 processor acceptance test, on paper tape	90
45018-51	Same, on diskette	80
45018-60	Same, with scientific instruction set, on paper tape	120
45018-61	Same, on diskette	100
93874-01	NM 4/95 system diagnostic, on diskette	100
45111-00	NM 4/10S diagnostic, on paper tape	120
45111-01	Same, on diskette	100
45038-00	RAM memory diagnostic, on paper tape	120
45038-01	Same, on diskette	100
45021-00	Distributed I/O diagnostic, on paper tape	120
45021-01	Same, on diskette	100
45022-00	IEEE-488 intelligent cable diagnostic, on paper tape	90
45022-01	Same, on diskette	80
45024-00	Magntic tape intelligent cable diagnostic, on paper tape	90
45024-01	Same, on diskette	80
45026-00	Floppy disk diagnostic with formatter, single density, on paper tape	120
45026-01	Same, on diskette	100
45025-00	Medium- and high-capacity disk diagnostic, on paper tape	120
45025-01	Same, on diskette	100
45027-00	Analog subsystem diagnostic, on paper tape	90
45027-01	Same, on diskette	80 ►

Computer Automation Naked Mini 4

SOFTWARE PRICES

DIAGNOSTICS (Continued)		Purchase Price
45082-00	Async MUX diagnostic and test cables, RS-232, on diskette	150
45013-00	Bisync pico diagnostic, on paper tape	120
45013-01	Same, on diskette	100
45086-00	Mini-flexible disk diagnostic, on paper tape	120
45086-01	Same, on diskette	100
45120-00	Floppy disk diagnostic, double density, on paper tape	120
45123-01	Same, on diskette	100
45136-00	NM4 64-bit input/output test program, on paper tape	90
45136-01	Same, on diskette	80
45227-00	Bus monitor diagnostic, on paper tape	90
45227-01	Same, on diskette	80
45115-01	System level acceptance test (SLAT) program, on diskette	500