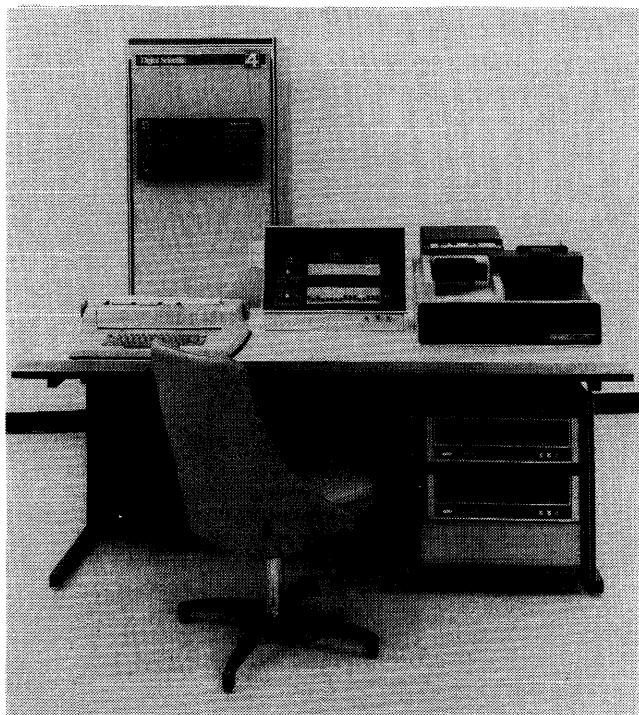# Digital Scientific Corporation
META 4/1130 and META 4/1800

The META 4/1130 system shown above includes a Model 4030 Basic Processor (background) with Microprogrammer's Panel, Programmer's Control Panel (center of desk, foreground), and Operator's I/O Typewriter/Printer (recessed into desk, left); plus an optional Model 3463-1 Card Reader (600 cpm, right end of desk) and an optional pair of Model 1448-1 Disc Storage Drives (512K words each, in desk pedestal). With 32K words of storage, this system sells for $86,320 or rents for $2,618 per month on a 1-year lease. Separately priced monthly maintenance costs $604.

MANAGEMENT SUMMARY

Digital Scientific Corporation, founded in 1967, began deliveries of microprogrammed META 4 minicomputers to emulate and replace IBM 1130 computers in 1970. The closely-held firm has delivered 100 META 4/1130's to date. DSC also produces the META 4/1800, an emulator for the IBM 1800 Data Acquisition and Control System, and has delivered 25 of them to date. The basic META 4 components are also available to customers as separate parts for "basic processor" or "special" systems, and 18 of these systems have been delivered. The majority of the META 4/1130's have been delivered as single systems, although some companies use several, while the 1800's and particularly the "specials" tend to be delivered in multiple quantities to end users.

Digital Scientific is a hardware company; users must rely either upon IBM, a proprietary software firm, or their own inventiveness for software and systems support.

The IBM 1130 is a versatile and enigmatic computer that was intended by IBM to be used as a scientific and problem-solving processor, basically as a batch-mode FORTRAN machine. During its development lifetime, ▷

Digital Scientific has been delivering META 4/1130 emulators for the IBM 1130 since 1970, and this highly cost-effective replacement for the "software-mature" IBM system is steadily gaining in popularity. DSC's META 4/1800 emulates the basically similar IBM 1800.

▶ CHARACTERISTICS

MANUFACTURER: Digital Scientific Corporation, 11455 Sorrento Valley Road, San Diego, California 92121. Telephone (714) 453-6050.

VENDOR: Marketing, sales, and service in the United States and Canada are handled by the manufacturer. Leasing is also handled by Digital Scientific, which maintains sales offices in Chicago, Dallas, Detroit, Los Angeles, New York, and Washington, DC. Additionally, 47 service offices are located nationally.

In Europe, contact Digital Scientific Corporation, Brett House, Park Parade, London, NW-10, England.

Sales and service in Japan are handled through a distributor agreement with Mitsui and Company, 2-9 Nishi Shimbashi, Ithchome, Minato-Ku, Tokyo, Japan.

MODELS: META 4/1130 (Model 4030) and META 4/1800 (Model 4040).

DATA FORMATS

BASIC UNIT: 16-bit word.

FIXED-POINT OPERANDS: One or two 16-bit words, with sign in leftmost bit position. Negative numbers are expressed in two's-complement form. Formats are identical to those used in IBM 1130 and 1800 systems for complete compatibility.

FLOATING-POINT OPERANDS: Users can employ IBM floating-point subroutines or DSC floating-point arithmetic firmware. Standard-precision operands are two words, consisting of a 23-bit fraction plus sign and an 8-bit characteristic formed by adding +128 to the exponent. Extended-precision operands are three words, consisting of a 31-bit fraction plus sign and an 8-bit characteristic formed as above. These formats are identical with those used in the IBM 1130 and 1800 systems.

The floating-point firmware not only adds floating-point arithmetic facilities, it also adds emulation in firmware of 37 floating-point arithmetic algorithms and subscript calculation in firmware for FORTRAN programs. The only modification to IBM 1130 or 1800 user programs required by the feature is rebuilding of the coreloads to include the new version of arithmetic, and the vendor provides aids for this and also to undo the modification. The routines that replace the IBM subroutines are completely re-entrant, requiring three memory words per entry point.

Greater floating-point precision is optional under software control. Programs that use this feature would no longer be IBM 1130- or 1800-compatible, however. ▶

Digital Scientific Corporation
META 4/1130 and META 4/1800

This expanded Digital Scientific META 4/1800 system (Model 4040) can accommodate a large complement of specialized data acquisition, process control, or analog/digital hardware in its auxiliary cabinets. The system also includes an optional Model 3482 Line Printer (background). The Model 4133 Operator's I/O Typewriter is standard. On the processor, the standard Model 4158 Programmer's Control Panel is the lower panel. Above it is the Model 4150 Microprogrammer's Panel.
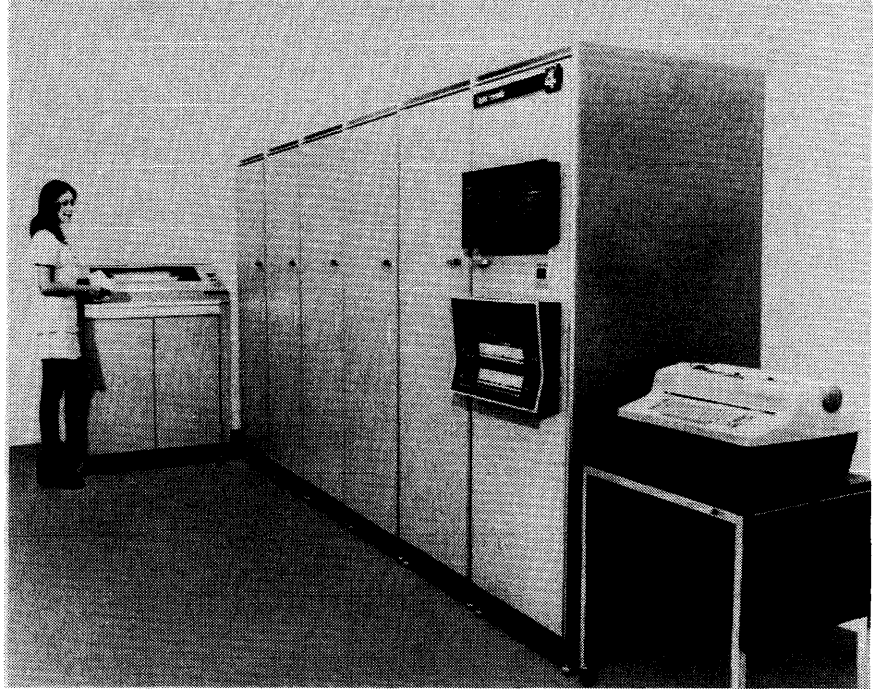
▷ IBM endowed it with RPG and, in 1971, with a COBOL program product. A macro assembler has also been available since initial delivery in 1965. About 5,500 or more 1130's were delivered by IBM, and current estimates indicate that more than 4,000 users are still loyal to the 1130. It seems to have found a following among business users and even among service bureaus. The 1130 simply won't go away.

IBM 1130 systems are currently available from third-party lessors. An enormous library of applications programs is shared by many users' groups. Plug-compatible peripherals are available from a multiplicity of sources. So is plug-compatible core memory. Enhanced operating systems are available, notably from DNA Systems, Inc., which also produces an 1130 FORTRAN and 1130 SORT, as well as other enhancement software. Donovan Data Systems is also noteworthy as a vendor of utility programs for the 1130.

Imitation is the sincerest form of flattery. Flatterers usually have an ulterior motive. Compatibility is the computer industry's analog for imitation. And the big IBM 1130 customer base is a clear motive, especially in times when the prices of hardware (modern technology versus discrete circuits, that is) have declined dramatically. It adds up to this: The IBM 1130 is imitated today by three compatible systems. They are the Digital Scientific META 4/1130, the Computer Hardware Incorporated (CHI) 2130, and the General Automtion DM-200 (formerly the 18/30).

All of the 1130 replacements can give the user more for less. More speed and processing power for less money. That's cost-effectiveness, and it's the name of the game. ▷ Especially in 1975's economy.

▶ INSTRUCTIONS: The META 4/1130 and META 4/1800, through emulation, implement the instruction sets of the IBM 1130 and 1800, respectively. Each also implements eight short-format instructions: six register-to-register and two register-immediate (an immediate operand is one contained in an instruction) not found in the IBM machines. An additional 16 floating-point instructions are optional.

Instructions are one or two words in length. In addition to the register-to-register and register-immediate, the standard META 4 instruction sets include five classes of instructions: Load/Store, Arithmetic (fixed-point), Shift, Branch, and Input/Output. Besides these, firmware-implemented instruction classes exist for: Floating-Point Arithmetic, Fast Fourier Transforms (FFT), FORTRAN Subscript Calculations, and user-specified instructions (via programmable ROM).

Short instructions consist of a 5-bit operation code, 1-bit format designator (always "zero"), 2-bit index register tag, 1-bit indirect addressing indicator, and 7-bit displacement value. In the long format, the initial 6 bits have the same assignments (but now the format bit is always "one"). They are followed by two tag bits (as in short-format instructions), and then by an indirect address indicator bit, a branch or skip indicator condition bit, six modifier bits (masks for status indicators tested by two instructions), and finally by a 16-bit address field (sufficient to directly address 65K words of memory).

An understanding of META 4 (or IBM 1130 or 1800) addressing methods is necessary in order to fully comprehend the entries under "Indexing" and "Indirect Addressing" below. Short (1-word) instructions *never* contain an explicit address. Rather, they imply the "effective address" (EA) of the operand in main storage. The EA is generated by combining the 16 bits contained in the Instruction Address Register (program counter) or in one of the three "Index" registers (in this case, they're really general registers) with the 7-bit *signed* displacement value. The four possible states of the two register tag bits select either the IAR or "index" register 1, 2, or 3. To the 16-bit address therein, then, the displacement value is ▶

MARCH 1975

Digital Scientific Corporation
META 4/1130 and META 4/1800

PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION	SPEED	USED WITH	
			4/1130	4/1800
MAGNETIC TAPE				
3410	7-track, NRZI, 800 bpi, 37.5 ips	30 KCS	—	●
3412	9-track, NRZI, 800 bpi, 37.5 ips	30 KCS	●	●
3416	9-track, NRZI, 800 bpi, 75 ips	60 KCS	●	●
CARD I/O UNITS				
3463	Reader, 80-column	600 cpm	●	●
3465	Reader, 80-column	1000 cpm	●	●
1442	Read/Punch (IBM); 80-column, via DSC 3472:			
	Mdl. 5 (punch only)	120 cpm	●	●
	Mdl. 6 (read/punch)	300/60 cpm	●	●
	Mdl. 7 (read/punch)	400/120 cpm	●	●
1710	UNIVAC VIP Keypunch, via DSC 3474	Varies	●	●
PRINTERS				
3482	Line printer, 132-column, 64-character set	600 lpm	●	●
3484	Line printer, 132-column, 64-character set	300 lpm	●	●
PAPER TAPE UNITS				
3421	Punch, 5- to 8-level	50 cps	●	●
3431	Reader, 5- to 8-level, strip/fanfold feed	400 cps	●	●
3431	Reader with reeler, 5- to 8-level	400 cps	●	●
PLOTTERS	Digital Plotters, via DSC 3443:			
	DSC 3442; 11-in. x 145-ft. chart	300 increments/sec	●	●
	CalComp 500; 31 x 34-in. chart	300 increments/sec	●	●
	Houston Instrument DP-1; 11-in. x 145-ft. chart	450 increments/sec	●	●
	IBM 1627; 30-in. x 120-ft. chrt	200 increments/sec	●	●
COMMUNICATIONS				
4101	Binary Synchronous, single line	2000/9600 bps	●	●
4108	Multiple Terminal Communications Adapters	110/600 bps	●	—
PROCESS I/O EQUIP.				
4200 series	Digital Input (voltage, contact, TTL)	—	—	●
(see Price List)	Digital Output (ECO, TTL, register)	—	—	●
	Analog Input (solid-state, relay, low-level)	—	—	●
	Analog Output (2 to 16 channels)	—	—	●

▷ IBM itself produced several versions of the 1130, which varied in cost, speed, and configurability. It is toward the high-end 1130 configurations that DSC has aimed its marketing of the META 4/1130. These are the users who have enormous investments in IBM 1130 software and procedures and who are best served by a "stretched" 1130 or 1130-type system. And the 1130 itself can be stretched only so far, even with the best independent software.

Digital Scientific is entirely committed, at this time, to manufacturing machines that emulate, and improve upon, the 1130 and its near cousin, the 1800. One of its competitors in this market is primarily a plug-compatible peripheral vendor, and the other now considers the mainstream of its business to be its line of growth-compatible business systems based on its own mini-computer.

The traditional IBM 1130 system can be viewed as a low-performance unit with a huge applications software ▷

► added algebraically, yielding an EA that is the register's contents "displaced" by 127 words in either direction. If you really stop to think about it, short-format instructions can only be *postindexed* by the displacement increment.

Long format instructions, on the other hand, *never* use the IAR as an address base. (In other words, only short-format instructions can use program-relative addressing.) The final 16 bits of the instruction are either the direct EA, the EA after indexing (the tag bits specify no indexing or one of three Index Registers), or the indirect address pointer. Indirect addressing rules are the same as direct addressing rules, except that when the IA bit in the instruction is set to "one," the calculated address is that of the word in memory which contains the EA.

INTERNAL CODE: No fixed internal character code. The I/O devices use a number of different character codes, and frequent code conversions must be performed under program control.

MAIN STORAGE

TYPE: Magnetic core.

►

Digital Scientific Corporation
META 4/1130 and META 4/1800

base. (One DSC competitor views its 1130-compatible line in that same way.) But DSC's META 4/1130 not only copies the 1130's actions, it is also a high performer. The META 4 uses 90-nanosecond read-only memory (ROM) microprogramming to emulate every 1130 instruction. And its main memory is 900-nanosecond core, as compared to 2.2 microseconds in the fastest 1130. Additionally, the META 4/1130 has more advanced internal architecture, and that stands the user in good stead when floating-point processing, Fourier transforms, interrupt processing, and even indexing are considered. Details of the architecture appear in the Characteristics section of this report.

Here are some of the advantages the META 4/1130 can give a user, compared to some things that IBM can't—or won't—provide on the 1130: storage protection, magnetic tape support, support for over 32K words of memory, support for up to 165 logical disc cartridges on-line, four times as many logical discs per physical disc as IBM provides, additional instructions, firmware floating-point arithmetic, and even 16-user time-sharing. Some of these advances, made possible jointly by the META 4 and independent software, are not even available on competitive 1130-compatible systems.

The IBM 1800 market is different. It's a soft market, smaller in terms of the installed user base, and more restricted, due to the specialized nature of data acquisition and process control systems. Not nearly as many prepared programs are available for the 1800, nor is the ▷

CYCLE TIME: 900 nanoseconds per 18 bits.

CAPACITY: A META 4/1800 can have up to 65K words of core memory attached, in 8K modules (K=1024 words). A META 4/1130 can have 8K, 16K, or 32K words of memory. IBM software does not support more than 32K words of storage on the 1130, which the META 4/1130 emulates, but DSC can provide special operating system software (modified DM-2) if a user wishes to configure an enlarged-capacity (over 32K) META 4/1130.

CHECKING: One parity bit per word. The processor halts upon detection of a parity error. Parity is odd.

STORAGE PROTECTION: Standard in hardware, using one bit in each memory word. This suffices in a nonmulti-programming system. The protection bit is not accessible to user programs.

RESERVED STORAGE: Initial six word locations are reserved for interrupt vectors (addresses of servicing routines), and eight for the printer scan field. Three addresses are also "set aside," so that the system "looks like" an IBM 1130 or 1800, which implements its index registers in reserved storage.

CENTRAL PROCESSOR

GENERAL: The META 4/1130 (Model 4030) and META 4/1800 (Model 4040) processors are emulating machines, respectively, for the IBM 1130 Data Processing System (1131 CPU) and the IBM 1800 Data Acquisition and Control System (1801 or 1802 Processor-Controller). They achieve their functions through the technique of firmware emulation implemented in read-only memory (ROM), and, in the process, are also able to extend the functions and performance of the systems they emulate. Examples of ▶

PHYSICAL SPECIFICATIONS

UNIT	PHYSICAL SIZES (in.) & WEIGHT (lbs.)				60-HZ. POWER REQUIREMENTS			
	HEIGHT	WIDTH	DEPTH	WEIGHT	PHASES	WIRES	VOLTAGE	AMPS OR WATTS
META 4/1130 CPU	71.5	23.5	33	450	3	5	208	30A (approx.)
Operator's Console	29.25	72	37	200	—	—	—	—
Storage Access Chan.	7.25	rack space		—	—	—	—	—
BSCA Adapter	7.5	rack space		—	—	—	—	—
Multi-Term. Adapter	7.5	rack space		—	—	—	—	—
3463 Card Reader	16	23	18	75	1	3	115	400 watts
3465 Card Reader	16	23	18	75	1	3	115	400 watts
1448 Disc	6.5	rack space		40	1	3	115	250 watts
3484 Line Printer	41	34	18	450	1	3	115	690 watts
3474 Controller	mounts in I/O slot		—	—	1	3	115	500 watts
1455 Controller	72	22	30	450	3	4	208	40A
1455 Discs	39	30	24	395	powered thru controller			—
META 4/1800 CPU	71.5	47	33	550	3	5	208	50A (approx.)
I/O Typewriter	10	22	17	62	1	3	120	325 watts
I/O Typewriter Desk	27	26	20	NA	—	—	—	—
3432 Paper Tape Rdr.	7	rack space		30	1	3	115	1800 watts
3431 Paper Tape Rdr.	7	rack space		28	1	3	115	150 watts
3421 Paper Tape Punch	14	rack space		20	1	3	115	350 watts
37.5 ips Mag. Tape	24	rack space		95	1	3	115	400 watts
75 ips Mag. Tape	24	rack space		95	1	3	115	900 watts
3482 Line Printer	47	36	34	650	1	3	115	720 watts
3442 X-Y Plotter	10	20	14	55	1	3	115	200 watts
3472 Controller	12	rack space		3	1	3	115/208	—
I/O Chassis Extender	14.25	rack space		66	1	3	115	350 watts

Notes on Physical Specifications Table: Units common to both META 4's are listed only once. The META 4/1800 uses two standard 23.5-inch-wide cabinets. Detailed rack space requirements for process control, analog/digital, and data acquisition units are not included, due to their complexity of arrangement. The 3431 and 3432 Paper Tape Readers extend 5.5 inches out from the rack; the 3421 Paper Tape Punch extends out 4.5 inches. The 3442 Plotter and 3463 Card Reader mount on a table. Only one magnetic tape unit can be mounted in a single rack.

MARCH 1975

Digital Scientific Corporation
META 4/1130 and META 4/1800

▷ range of available plug-compatible peripherals as broad. Still, DSC is in the market with the META 4/1800. The 1800 and 1130 being so similar, it follows naturally. But DSC currently finds itself alone in this potentially less rewarding market. The 1800 is just an 1130 with an interrupt system that is slightly restructured to enable it to handle an array of real-time (process I/O) devices.

There have been various speculations about DSC's economic viability, but the privately held firm has been around since 1967 and did not appear about to go under when Datapro visited it in Feburary 1975. To the contrary, in fact, DSC was preparing to announce the META 4/1130 Timesharing formally, either as a feature of existing systems or as a new product. Not only that, the company is working on an intriguing emulator product, which Datapro saw and photographed. Moreover, we note that vendor credibility scored highly with META 4 users, as noted in the User Reaction section that follows.

Datapro can think of no reason for a large IBM 1130 user to avoid considering switching to a META 4/1130. The same can be said for 1800 users and the META 4/1800, provided a remote terminal network is not under consideration.

USER REACTION

Especially for this report, Datapro contacted 10 *META 4/1130* users at random. These 10 users owned or rented a total of 17 systems. Three out of the 10, or 30 percent, had purchased their systems, usually after some term of trial. The rentals were all through a third-party lessor, with "transparent" arrangements by Digital Scientific. Experience with the META 4/1130 of the users interviewed averaged 28 months, from a high of 38 months (two users) to a low of one year. The systems of nine of the users replaced IBM 1130's, one of which had been installed for six years; only one user had installed the META 4/1130 as his first computer. Six users wrote their own applications programs, while the other four used applications programs by IBM, DNA, or Donovan Data Systems. Average system up-time quoted was 93 percent; most of the reported up-times were in the high 90's, and the only significantly lower one (80 percent) was quoted by a user who has a complex system that he considers to be still in development.

Here are the tabulated ratings of the users we interviewed. Please note that the totals do not always equal 10; some users did not answer all the questions, and some use software from more than one source. Our usual question regarding technical support was dropped, since Digital Scientific does not provide system software support, but only equipment maintenance.

	Excel.	Good	Fair	Poor	WA*
Ease of operation	5	4	0	0	3.6
Reliability of mainframe	4	3	3	0	3.1
Reliability of peripherals	3	4	3	0	3.0
Responsiveness of maintenance service	2	5	3	0	2.9

▶ extended functions are fast Fourier transform (FFT) microcode, "overextended" floating-point arithmetic software, additional standard instructions in the processor's repertoire, and the built-in capability to accept customization through the addition of specially masked (coded) ROM. Examples of extended performance are the use of hardware registers where the emulates systems use memory locations for the same registers, improved processor cycle time, and faster memory cycle time.

CONTROL STORAGE: Model 1425 Read-Only Memory is used to control the META 4 processors. Each module of this ROM contains, 1,024 (1K) 16-bit words, and two modules (META 4/1130) or three modules (META 4/1800) of this ROM occupy positions in the four ROM slots provided in each processor. Thus, a META 4/1130 can be enhanced by two custom ROM modules, and a META 4/1800 by one. The ROM cycle time is 90 nanoseconds, 10 times the speed of the META 4 core memory.

For customers wanting to pattern their own ROM additions, a "do-it-yourself" ROM Pattern Board Set, Model 9000, is available.

META 4 processors include a Microprogrammer's Panel for firmware or hardware debugging as standard equipment. Through the panel, data can be entered, and all machine instructions can be executed, in step-by-step fashion. The panel is on the processor cabinet.

REGISTERS: The META 4/1130 uses 16 hardware registers, and the META 4/1800 uses 28. But either CPU can address 32 hardware registers, and the additional hardware is available in the form of double-bus accumulators, I/O registers, or scratchpad memory. Registers normally implemented in user storage in the emulated IBM systems are implemented in hardware in the META 4's. The impact of this technique is dramatic, as consideration of indexed addressing makes clear.

Additional user double-bus accumulators, which are four 16-bit registers that can be used as data sources on the processor's "A" or "B" bus and as destination data storage on the "D" bus, are optional. The feature, Model 4013, requires a change to the existing firmware, however. The four registers could be addressed and used as general registers.

Scratchpad memory, Model 4025, can be added to a META 4 processor to extend the limit of its register addressing capability by 64. The memory consists of 64 16-bit words of storage with 200-nanosecond speed. It occupies four register addresses, two of which are left unused. One of the two that is used holds an indirect pointer address for one of the 64 words, and the other holds data. The feature is not supported by vendor-supplied firmware in normal emulation.

INDIRECT ADDRESSING: Single-level indirect addressing in memory-referencing instructions can be specified for long-format instructions only. Indirect addressing and preindexing can be combined.

INDEXING: Three index registers can be used. Indexing of memory reference addresses is single-level in long-format instructions. Preindexing can be combined with indirect addressing in long-format instructions. An algebraic postindex of ± 128 words can take place in short-format instructions, but these can use the program counter's contents as a base address.

ADDRESS WRAPAROUND: Memory addressing follows the wraparound scheme for IBM's software, which does not ▷ support 24K. ▶

Digital Scientific Corporation
META 4/1130 and META 4/1800

► CONFIGURATION RULES: The Price List, Peripherals/ Terminals table, Physical Specifications table, and Mass Storage section combine to provide complete and detailed configuration guidelines.

MASS STORAGE

MODEL 1448 DISC SUBSYSTEMS: For the META 4/1130 and META 4/1800, this unit is functionally compatible with the IBM 2310 Disc Drive, and the IBM 2315 Disc Cartridge (or equivalent) is used. Disc cartridge capacity is 512,000 16-bit words, average positioning time is 70 milliseconds, average rotational delay is 20 milliseconds, and data is transferred at 36,000 words per second. Standard IBM DM-2 (Disc Monitor, Version 2) software for the 1130 supports up to five of these units per system. Up to two of the drives can be mounted conveniently in the META 4/1130 system console. The 1448-1 is for the META 4/1120, and the 1448-2 is for the META 4/1800.

MODEL 1455 DISC SUBSYSTEM: For the META 4/1130, this unit is functionally compatible with the IBM arrangement for attaching IBM 2311 Disc Drives to the 1130, except that the storage capacity per drive is quadrupled to 10.24 million 16-bit words per unit. Software support is provided through a DNA-written change to IBM's DM-2. Five 1448 Disc Drives can also remain attached to the system. In "bulk mode," twenty 2310 surfaces are simulated.

The disc storage is a logical arrangement of 20 simulated cartridges on a single disc pack, an IBM 2316 or equivalent. (IBM uses an arrangement of five simulated cartridges on a 1316 disc pack.) The average positioning time is 35 milliseconds, average rotational delay is 12.5 milliseconds, and the data transfer rate is 125,000 words per second. Modulo-4 data checking takes place on all data transfers, and hardware verifies disc addressing to guard against inadvertent writing upon the wrong logical cartridge. Up to 7 additional 1455's can be attached to the initial controller/drive, for a total capacity of 32 times IBM's arrangement. A total system capacity of 165 2310's is available. DSC will lend a cartridge disc unit for 30 days for use in converting to the 1455.

INPUT/OUTPUT UNITS

Please refer to the Peripherals/Terminals table on the third page of this report.

COMMUNICATIONS CONTROL

The META 4/1800 and the META 4/1130 can use a Binary Synchronous Communications Adapter (BSCA) to function as a point-to-point data transmission terminal on private or common-carrier switched or nonswitched lines. The interface used is the standard RS-232, supporting a single line at a data rate of 600, 1200, 2000, 2400, or 4800 bits per second in half- or full-duplex mode, in accordance with clocking provided by the modem.

The META 4/1130 alone can support up to 16 low-speed asynchronous terminals, eight each on up to two Multiple Terminal Communications Adapters (MTCA's). All lines on an MTCA must operate at the same rate. The bit rate can be 110, 134.5, 150, or 300 bits per second, using a Bell 103-equivalent modem and half- or full-duplex mode, or 600 bits per second in full-duplex using a Bell 202C-equivalent modem. The data code used is IBM 2741, ASCII-10, or ASCII-11 compatible. The MTCA's are supported by standard IBM software. DSC plans to supersede the foregoing support with character-oriented asynchronous support in about two months. The new support will also permit individually varying line rates up to 9600 bits per second.

Datapro's research enabled us to learn that one user saved about $30,000 by interfacing all of his remote terminals (e.g., Memorex, GTEIS, Teletype, and Betacom) via a Hetra minicomputer/controller (from Hetra Computer and Communications Industries, Inc., Box 970, 1151 South Eddie Allen Road, Melbourne, Florida 32901; telephone (305) 723-7731). This saving resulted from the MTCA's restriction of equal bit-per-second rates on all lines. The upcoming DSC Asynchronous Communications Adapter (ACA) should be price-competitive with the Hetra equipment.

SOFTWARE

Digital Scientific is primarily a hardware company, and software for the IBM 1130 and IBM 1800 emulator machines the company manufactures is left to IBM and also to DNA Systems, Incorporated, 1258 West Washington Street, PO Box 1424, Saginaw, Michigan 48605; telephone (517) 793-0815.

DNA is a leading vendor of independent software for the IBM 1130 and 1800 and machines that emulate them. Not only does DNA software "push" the IBM 1130 or 1800 to its limits, but it can use hardware features dound only on the META 4's to create an "1130" or "1800" system that is capable of more than would be possible with the IBM hardware under any circumstances. For example, DNA software can provide a META/4 1130 with storage protection, with support for over 32K words of storage, with magnetic tape unit and file support, with support for up to 165 logical disc cartridges on-line, and even with the ability to support up to 16 time-sharing users.

OPERATING SYSTEMS: For the *META 4/1130*, Digital Scientific provides customers with a copy of IBM's DM-2 (Disc Monitor 2) operating system. DM-2 is a disc-based operating system that supports 1130 Assembly-language assembly and execution, 1130 FORTRAN IV compilation and execution, and 1130 RPG (Report Program Generator) compilation and execution. Jobs, including assemblies and compilations, can be stacked.

DNA's CYTOS conversational operating system for the META 4/1130 supports terminals, a text editor, and a disc source library. BASIC, APL, and PL/1 compilers are options under CYTOS. DNA's TSO supports time-sharing.

For the *META 4/1800*, the IBM 1800 Time-Sharing Executive (TSX) or IBM 1800 Multiprogramming Executive Operating System (MPX) can be used. TSX is disc-resident and supports IBM 1800 FORTRAN IV and Assembly language. It operates in an on-line mode under a skeleton executive to handle process control and data acquisition applications, and in an off-line mode under control of a temporarily assembled skeleton (TASK) for "nonprocess" jobs such as compilation, assembly, and testing and debugging. The TSX operating system runs "process" jobs in the foreground and "nonprocess" jobs in the background whenever the foreground is void of active tasks and can relinquish control of the CPU. The system skeleton is core-resident.

The MPX operating system goes beyond the TSX operating system, supporting larger process control/data acquisition systems and additional hardware devices. It uses partitioned memory and a programmed interrupt I/O handling technique. It has a core-resident executive and a disc-resident batch processing monitor. A system with up to 24 multiprogramming partitions, or a single TSX-type area, can be built by MPX.

LANGUAGES: *META 4/1130* Assembly Language (ASM) is IBM's most recently released DM-2 Assembler. It is a ►

one-pass assembler. *META 4/1800* Assembly Language is also IBM's. It provides automatic linkage to IBM sub-routines for data input/output, data conversion, and arithmetic functions.

The FORTRAN compiler for the META 4 systems generates machine-code object programs. It also supports automatic subroutine calls on the META 4/1800.

RPG runs only on the META 4/1130. It also compiles directly into machine code. RPG endows the META 4/1130 with business data processing capabilities. Coding forms are the same as for System/360 RPG, and the output-oriented functions of the language are similar. The IBM 1130, despite the market intentions IBM may have had for it, is a popular business data processing system. Its low cost probably had much to do with this. It is often found as a service bureau machine as well.

IBM's ANSI COBOL compiler for the 1130 will run on the META 4/1130.

UTILITIES: IBM-supplied utilities are available for both of the META 4 systems. These include loaders, dumps, debugging aids, data transcription routines, etc.

ALSO, DNA's popular and highly rated 1130/SORT can run on the META 4/1130. The package provides ISAM-like file support on the 1130.

According to users, DNA Systems as a company and the 1130/SORT as a package deserve high praise. The editors of *DATAPRO 70*, a companion publication, obtained six user ratings of the SORT (two from our user survey of proprietary software and four through telephone interviews), and the results were as follows:

	Excellent	Good	Fair	Poor	WA*
Overall satisfaction	6	0	0	0	4.0
Throughput/efficiency	6	0	0	0	4.0
Ease of installation	6	0	0	0	4.0
Documentation	3	3	0	0	3.5
Vendor technical support	6	0	0	0	4.0

*Weighted Average on a scale of 4.0 for Excellent.

The four users contacted by phone were using Digital Scientific's META 4, and these users also expressed a lot of satisfaciton with the equipment. The only area in which the 1130/SORT package failed to get a perfect rating was documentation. Specific criticism was expressed by one user: "The documentation could be improved in the area of samples given." And that's the worst criticism that was voiced.

It is truly unusual to find a group of users who stand so unanimously behind a software product and its vendor. But the comments of the 1130/SORT users speak well for both: "I can't recommend it highly enough. It's the best package we've ever bought." "Remember, it's only one of several packages supported by DNA. In my opinion, DNA is the best in the business. A little expensive maybe, but well worth it." "It's simple to use. One of the best in-place sorts I've ever seen for any machine."

Also available is DISKTAB, a utility package from Donovan Data Systems, 666 Fifth Avenue, New York, New York 10019; telephone (212) 586-0055.

APPLICATIONS SOFTWARE: The 1130 is a machine that is enhanced in value by a broad range of applications programs, from IBM Corporation as well as independent software vendors and from users. For the *META 4/1130*, for example, there are Construction Cost Control, Construction Estimating, Continuous System Modeling, Steady-State Distillation, Linear Programming, and Project Control — and these are just from IBM. Also from IBM, and also able to run on a System/360 or 370, are the EPIC group of educational institution applications programs and a mathematics subroutine library, SL-MATH. Most of these programs are FORTRAN-oriented, but EPIC is based upon COBOL.

META 4/1800 applications programs, because of the highly individualized nature of process control and data acquisition configurations, tend not to be as widespread. However, excellent adaptable programs can be obtained through users' groups.

PRICING

POLICY: In the U.S. and Canada, equipment sales and maintenance are handled directly by Digital Scientific Corporation. Leases are handled in the U.S. and Canada by a DSC affiliate, Digital Leasing Company. Sales and service personnel in these areas are DSC employees. Leases of one to five years can be arranged, with the long-term discounts from one-year lease rates ranging from 10 percent (two-year lease) to 25 percent (five-year lease). The purchase-to-lease ratios on one- to five-year leases, respectively, are 33:1, 36:1, 39:1, 41:1, and 43:1.

European and Japanese distributorships must be contacted directly regarding prices and terms.

META 4 computers are supplied with firmware which allows them to emulate IBM 1130 or 1800 systems. They operate under System Control Programming (SCP) available from IBM and can run IBM applications program products (PPA's) as well as other separately priced proprietary software packages.

EQUIPMENT: The following system configurations do not include system maintenance in the quoted equipment rental prices. Rentals are based on one-year leases.

SMALL META 4/1130 SYSTEM: Includes a META 4/1130 with 16K words of core storage, 600-cpm card reader, 300-lpm line printer, and 10 million bytes of disc storage. Purchase price: $82,795. Rental: $2,510. Maintenance: $595 per month.

EXPANDED META 4/1130 SYSTEM: Includes a META 4/1130 with 16K words of core storage, 1,000-cpm card reader, 600-lpm line printer, 10 million bytes of disc storage, plotter and controller, one 75-ips magnetic tape unit, and 8-line Multiple Terminal Communications Adapter. Purchase price: $119,365. Rental: $3,621. Maintenance: $855 per month.

GENERAL META 4/1800 SYSTEM: Includes CPU, 48K words of core storage, selector channel, 600-lpm line printer, 1,000-cpm card reader, I/O typewriter & control, process interrupt, digital output, and analog/digital input. Does not include analog/digital interfaces. Purchase price: $145,605. Rental: $4,419. Maintenance: $998 per month.∎

Digital Scientific Corporation
META 4/1130 and META 4/1800

EQUIPMENT PRICES

	Purchase Price	Monthly Maint.	Rental (1-year lease)*
PROCESSORS AND MAIN STORAGE (META 4/1130)			
4030-1 Basic Processor, 8K	$33,850	$226	$1,026
4030-2 Basic Processor, 16K	41,400	276	1,255
4030-3 Basic Processor, 32K	57,325	383	1,738
4031 Processor without 1130 Emulation or core memory	21,950	147	666
Core Memory for META 4/1130:			
4068-1 Memory Subsystem, 8K	9,925	67	301
4068-2 Memory Subsystem, 16K	17,325	116	525
4068-3 Memory Subsystem, 24K	25,550	171	775
4068-4 Memory Subsystem, 32K	32,950	220	999
4068-5 Memory Subsystem, 40K	41,830	279	1,268
4068-6 Memory Subsystem, 48K	49,230	329	1,492
4068-7 Memory Subsystem, 56K	57,455	384	1,742
4068-8 Memory Subsystem, 65K	64,855	433	1,966

Note: FIC of $300 applies to all field upgrades past 32K. Also, 24K, 40K, 48K, 56K, and 65K sizes are not supported by standard IBM software.

	Purchase Price	Monthly Maint.	Rental (1-year lease)*
Processor Features for META 4/1130:			
1425 ROM, 1K	2,900	20	88
4130-1 Storage Access Channel I ($200 FIC)	1,320	10	40
4130-2 Storage Access Channel II ($200 FIC)	1,500	10	46
4185 Real-Time Clock	750	5	23
9078-1 Floating-Point Arithmetic (requires 1425)	1,500	0	46
MASS STORAGE (META 4/1130)			
1455-1 Disc Subsystem, 10M words (requires 4030; $200 FIC)	22,500	150	682
1455-2 Add'l. Drive for 1455-1, 10M words (max. 7; $100 FIC)	15,000	100	455
1448-1 Disc Storage, 512K words ($100 FIC)	11,500	77	349
MAGNETIC TAPE EQUIPMENT (META 4/1130)			
3412-1A Single drive, 9-track, 37.5 ips ($150 FIC)	12,150	81	369
3412-1B Dual drive, 9-track, 37.5 ips ($250 FIC)	18,700	125	567
3416-1A Single drive, 9-track, 75 ips ($150 FIC)	15,350	103	466
3416-1B Dual drive, 9-track, 75 ips ($250 FIC)	22,150	148	672
Note: All magnetic tapes require 0401 Cabinet; see below.			
80-COLUMN CARD EQUIPMENT (META 4/1130)			
3463-1 Card Reader, 600 cpm ($100-FIC)	5,995	67	182
3465-1 Card Reader, 1000 cpm ($100-FIC)	8,990	87	273
3472-1 Controller for IBM 1442 Model 5, 6, or 7 Card Read Punch ($100 FIC)	2,500	33	76
3474-1 Controller for UNIVAC VIP 1710 Punch ($100 FIC)	3,000	20	91
PAPER TAPE EQUIPMENT (META 4/1130)			
3421-1 Punch, 50 cps ($50 FIC)	3,640	25	111
3431-1 Reader, 400 cps ($50 FIC)	3,120	21	95
3432-1 Reader with reeler ($50 FIC)	4,365	30	133
Note: All paper tape equipment requires addition of an 0401 Cabinet.			
PRINTERS (META 4/1130)			
3282-1 Line Printer, 600 lpm ($300 FIC)	19,875	163	603
3484-1 Line Printer, 300 lpm ($300 FIC)	12,900	86	391
— 6/8 lines/inch feature for 3482-1 ($650 FIC)	1,000	7	31
DIGITAL PLOTTER EQUIPMENT (META 4/1130)			
3443-1 Controller for digital plotter: Digital Scientific 3442, IBM 1627, CalComp 500 or Houston Instrument DP-1	1,500	10	46
3442 X-Y Digital Plotter	4,975	34	151
COMMUNICATIONS EQUIPMENT (META 4/1130)			
4101 Binary Synchronous Communications Adapter ($200 FIC)	4,775	32	145
4108 Multiple Terminal Communications Adapter ($200 FIC)	4,775	32	145

*Rental prices do not include equipment maintenance.

FIC—Field Installation Charge.

MARCH 1975

Digital Scientific Corporation
META 4/1130 and META 4/1800

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
ANCILLARY EQUIPMENT (META 4/1130)				
0401	Cabinet	825	6	25
4100-1	I/O Chassis Extender ($100 FIC)	2,750	19	84
PROCESSOR AND MAIN STORAGE (META 4/1800)				
4040	Basic Processor	39,360	263	1,193
Core memory for META 4/1800:				
4068-1	Memory Subsystem, 8K	9,925	67	301
4068-2	Memory Subsystem, 16K	17,325	116	525
4068-3	Memory Subsystem, 24K	25,550	171	775
4068-4	Memory Subsystem, 32K	32,950	220	999
4068-5	Memory Subsystem, 40K	41,830	279	1,268
4068-6	Memory Subsystem, 48K	49,230	329	1,492
4068-7	Memory Subsystem, 56K	57,455	384	1,742
4068-8	Memory Subsystem, 65K	64,855	433	1,966
	Note: Field Installation Charge (FIC) of $300 applies to all field upgrades past 32K.			
Processor features for META 4/1800:				
4069	Auxiliary Core Memory Feature	8,000	54	243
4118	OEM Channels (set of 5; $200 FIC)	5,000	34	152
4125	Selector Channel ($200 FIC)	9,250	62	281
1425	Read-Only Memory (ROM), 1K	2,900	20	88
9078-2	Floating Point Arithmetic (requires 1425)	1,500	0	46
4133-0	I/O Typewriter & Control	3,500	24	107
4133-2	1816 Printer/Keyboard Cable Adapter	350 (one-time charge)		—
4133-1	Remote 1816 Cables; max. 2000 ft.	$250/ft. (one-time charge)		—
MASS STORAGE (META 4/1800)				
1448-2	Disc Storage, 512K words	11,500	77	349
MAGNETIC TAPE EQUIPMENT (META 4/1800)				
3410-2A	Single drive, 7-track, 37.5 ips ($150 FIC)	12,150	81	369
3410-2B	Dual drive, 7-track, 37.5 ips ($250 FIC)	18,700	125	567
3412-2A	Single drive, 9-track, 37.5 ips ($150 FIC)	12,150	81	369
3412-2B	Dual drive, 9-track, 37.5 ips ($250 FIC)	18,700	125	567
3416-2A	Single drive, 9-track, 75 ips ($150 FIC)	15,350	103	466
3416-2B	Dual Drive, 9-track, 75 ips ($250 FIC)	22,150	148	672
80-COLUMN CARD EQUIPMENT (META 4/1800)				
3472-2	Controller for IBM 1442 Card Read Punch, Models 5, 6, or 7 ($100 FIC)	5,000	34	152
3463-2	Card Reader, 600 cpm ($100 FIC)	5,995	67	182
3465-2	Card Reader, 1000 cpm ($100 FIC)	8,990	87	273
PAPER TAPE EQUIPMENT (META 4/1800)				
3421-2	Punch, 50 cps ($50 FIC)	3,640	25	111
3431-2	Reader, 400 cps ($50 FIC)	3,120	21	95
3432-2	Reader with reeler, 400 cps ($50 FIC)	4,365	30	133
LINE PRINTERS (META 4/1800)				
3482-2	Line Printer, 600 lpm ($300 FIC)	24,500	164	743
3484-2	Line Printer, 300 lpm ($300 FIC)	12,900	86	391
—	6/8 lines/inch feature for 3482-2 ($650 FIC)	1,000	7	31
DIGITAL PLOTTER EQUIPMENT (META 4/1800)				
3443-2	Controller for digital plotter: Digital Scientific 3442, IBM 1627, CalComp 500, or Houston Instrument DP-1	1,500	10	46
3442	X-Y Digital Plotter	4,975	34	151

*Rental prices do not include equipment maintenance.

FIC—Field Installation Charge.

Digital Scientific Corporation
META 4/1130 and META 4/1800

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
PROCESS CONTROL & ANALOG/DIGITAL EQUIPMENT (META 4/1800)				
Digital Input:				
4200	Digital I/O Controller	4,275	27	130
4202	Digital I/O Adaptor (requires 4200; $500 FIC)	2,325	15	71
4203	Direct Memory Access (DMA) for Digital I/O (requires 4200; $300 FIC)	2,400	15	73
4213-0	Basic 2-Word Digital Input (requires 4202)	375	3	12
4213-1	Contact Sense Input, 1-Word (requires 4213; $200 FIC)	150	2	5
4213-2	Voltage Input, 1-Word (requires 4213; $200 FIC)	275	2	9
4213-3	TTL (transistor-transistor logic) Input, 1-Word (requires 4213; $200 FIC)	25	0	1
4213-4	High-Speed Voltage Input, 1-Word (requires 4213; $200 FIC)	275	2	9
4213-5	Special Input, 1-Word (requires 4213; $200 FIC)	300	2	10
Process Control Interrupt Input:				
4214-0	Basic 32-bit Process Interrupt Input (requires 4202)	775	5	24
4214-1	Contact Sense, 1-Word (requires 4214; $200 FIC)	425	3	13
4214-2	Voltage Input, 1-Word (requires 4214; $200 FIC)	575	4	18
4214-3	TTL Input, 1-Word (requires 4214; $200 FIC)	25	0	1
Digital Output:				
4232-0	Basic 2-Word Digital Output (requires 4202)	600	4	19
4232-1	ECO (emitter-coupled logic) Output, 1-Word, (requires 4232; $200 FIC)	400	3	13
4232-2	Register Output, 1-Word (requires 4232; $200 FIC)	500	3	16
4232-3	TTL Output, 1-Word (requires 4232; $200 FIC)	25	0	1
Analog Input (11 bits plus sign, single-ended):				
4231	DMA for Analog Input	2,425	15	74
4258-0	Basic Analog/Digital Converter (requires 4231; $500 FIC)	8,525	57	259
4258-1	16-Channel Input Module (requires 4258; max. 256 channels; $100 FIC)	800	6	25
Low-Level Analog Input (Controller for IBM Low-Level Analog Input):				
4225-0	Basic Multiplexer Controller ($400 FIC)	14,850	99	450
4225-1	Relay Adapter (requires 4225)	1,600	11	49
4225-2	Additional Relay Multiplexer Adapter (requires 4225)	800	6	25
4225-3	Solid-State Adapter (requires 4225)	1,600	11	49
Analog Output (13 bits plus sign, single-ended):				
4230	Analog Output Buffer (requires 4202; $400 FIC)	600	4	19
4234-2	Two Channels (requies 4230)	6,750	45	205
4234-4	Four Channels (requires 4230)	9,250	62	281
4234-6	Six Channels (requires 4230)	11,750	79	357
4234-8	Eight Channels (requires 4230)	14,250	95	432
4234-10	Ten Channels (requires 4230)	16,750	112	508
4234-12	Twelve Channels (requires 4230)	19,250	129	584
4234-14	Fourteen Channels (requires 4230)	21,750	145	660
4234-16	Sixteen Channels (requires 4230)	24,250	162	735
ANCILLARY EQUIPMENT (META 4/1800)				
0401	Additional Cabinet	825	6	25
4100	I/O Chassis Extender ($100 FIC)	2,750	19	84

*Rental prices do not include equipment maintenance.

FIC—Field Installation Charge.