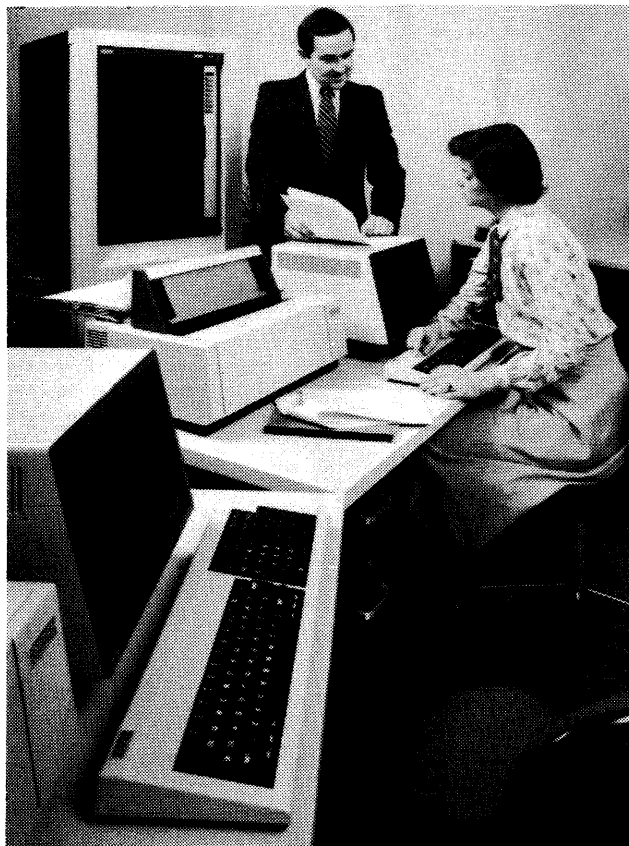


Nixdorf System 8870/1 and 8870/3



This Nixdorf 8870 configuration includes the processing unit with up to 512K bytes of main memory, two 40-megabyte cartridge disk drives, two display/printer workstations, and one 9-track magnetic tape drive.

MANAGEMENT SUMMARY

Nixdorf Computer Corporation is the largest of the many affiliated companies of Nixdorf Computer AG, West Germany. It provides the North American end-user market with a family of data entry, distributed data processing, and general business computer systems. Nixdorf pioneered the minicomputer multi-task workstation concept and currently claims an installed base in excess of 4000 customers, many with multiple-system installations. Worldwide, the Nixdorf group is operating in more than 28 countries.

In May 1977, Nixdorf acquired Entrex, Inc., a Massachusetts-based manufacturer of key-to-disk data entry equipment and distributed data processing systems. Nixdorf had marketed Entrex products in Western Europe since 1973, and at year-end 1974 began manufacturing key-to-disk systems in West Germany under a license agreement with Entrex. The Entrex acquisition has had a positive effect on both the development and marketing directions taken by Nixdorf Computer Corporation. ➤

Nixdorf's 8870/1 and 8870/3 Computer Systems provide a flexible, modular approach to satisfy the data processing needs of many small- to medium-sized businesses. The equipment is coupled with a broad selection of application programs tailored for the small business user.

MAIN MEMORY: 96K bytes to 512K bytes
DISK CAPACITY: 6 megabytes to 265 megabytes of on-line storage
WORKSTATIONS: 1 to 32
PRINTERS: 100-cps matrix printer to 300-lpm line printer
OTHER I/O: Magnetic tape

CHARACTERISTICS

MANUFACTURER: Nixdorf Computer Corporation, 168 Middlesex Turnpike, Burlington, Massachusetts 01803. Telephone (617) 273-0480 or (800) 225-1484.

MODELS: 8870/1 and 8870/3.

DATE ANNOUNCED: 8870/1, October 1978; 8870/3, November 1980.

DATE OF FIRST DELIVERY: 8870/1, December 1978; 8870/3, January 1981.

NUMBER INSTALLED TO DATE: Over 1500 worldwide.

DATA FORMATS

The Nixdorf 8870/1 and 8870/3 are based on a 16-bit minicomputer processor. The user does not normally work with the system at the machine level, but at the application program level. In some cases, users may develop or modify programs using the Business BASIC programming language used by Nixdorf to write application software. At the application level, constraints are placed on the data formats typically available with BASIC through data checking and editing procedures adapted to particular needs. Assembly language programming is used for the operating software, but its use by users is not encouraged. The information presented in the following paragraphs reflects the facilities of Business BASIC as available to 8870/1 and 8870/3 users.

BASIC UNITS: Decimal digits and alphanumeric characters. Representations include simple arithmetic variables, one- or two-dimension numeric arrays, and character strings.

FIXED-POINT OPERANDS: Integer arithmetic is restricted to values between -7999 and +7999; each value is stored in one 16-bit memory location (one word).

FLOATING-POINT OPERANDS: An explicit dimensioning statement permits the user to identify a numeric value with a precision of 6, 10, or 14 decimal digits; these values refer to the fraction part of a floating-point representation. Exponent values for all three representations are limited to ± 63 . The three types occupy two, three, or four words of memory, respectively. In practice, users will normally use conventional decimal representation and will be unaware of the floating- ➤

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8870/1 and 8870/3 Model Characteristics

	8870/1		8870/3	
	8013	8015	8033	8035
Minimum memory, bytes	96K	96K	128K	128K
Maximum memory, bytes	192K	256K	224K	512K
Chassis slots	14	28	14	28
System printer	165 cps—300 lpm	165 cps—300 lpm	165 cps—300 lpm	165 cps—300 lpm
Number of displays	1	16	1	32
Disk capacity	6MB-66MB	6MB-66MB	26MB-264MB	26MB-264MB

➤ The Nixdorf Systems 8870/1 and 8870/3 are each available in two basic configurations. Previous Nixdorf systems were oriented toward processing transactions entered by a single operator, with business documents prepared at the same time. The 8870/1 can handle transactions from as many as 16 users simultaneously, while processing a batch task in the background. The 8870/3 increases these capabilities to handle up to 32 users simultaneously.

The System 8870/1, announced in the United States in October 1978, is based on a central processor that is manufactured by Nixdorf in Germany and has been used in Nixdorf systems sold in Europe since mid-1978. The 8870/1 replaces the earlier System 8870, which was announced in August 1975 and based on a Digital Computer Controls processor. The 8870/3 provides an increase in processor speed, disk capacity, and memory sizes. The 8870/3 was announced in January 1980.

While there are some new avenues explored in the 8870/1 and 8870/3, two typical Nixdorf touches remain. Processing is still transaction (but not document) oriented, combining data entry and data processing in the same step. And Nixdorf's "turnkey" approach to application software is being continued.

Nixdorf has always advocated application programming by its own staff, and has developed considerable expertise in billing, invoicing, accounts receivable, and other accounting functions. The company estimates that it has provided the applications programming for 80 to 90 percent of the existing Nixdorf installations in the U.S., including those with the earlier Series 800 small accounting computers. While most of the applications are within the realm of accounting, they span a wide range of style and complexity. The 8870/1 and 8870/3 are not directly program-compatible with the previous Nixdorf 8870 and 800 Series systems, but conversion procedures enable Nixdorf to convert customers' 8870 software to the newer systems. The application knowledge can be carried across; thus, a U.S. customer base of somewhere around 3000 Series 800 and 400 Series 8870 systems provides a solid base for marketing the 8870/1 and 8870/3.

Software for these systems includes the NIROS operating system. NIROS provides multiple partitions to enable multiple users to access the system simultaneously for independent tasks. Application software is written entirely ➤

➤ point "nature" of variables; however, explicit exponent values can be entered.

INSTRUCTIONS: The BASIC statements are of the normal format with a 1- to 4-digit statement (line) number followed by an English word or abbreviation and an expression of parameter list. Generally, the maximum statement size is limited to one display line or 80 characters for readability, but they can be longer. The statements are stored in the system in an intermediate form with spaces deleted and some decoding. The system's BASIC interpreter accesses, decodes, and executes these statements directly in statement-number order modified by any branching or looping directives in the program itself.

INTERNAL CODE: 7-bit ASCII; the eighth bit is fixed as "one."

MAIN STORAGE

TYPE: Metal Oxide Semiconductor (MOS).

CYCLE TIME: 8870/1, 380 nanoseconds; 8870/3, 350 nanoseconds.

CAPACITY: 8870/1, 96K bytes to 256K bytes; 8870/3, 128K bytes to 512K bytes.

CHECKING: 8870/1, detection only; 8870/3, detection and correction with 1 bit parity.

STORAGE PROTECTION: None in hardware. A password technique with different security levels prevents unauthorized access to system programs, files, and records. Battery backup is provided for protection against power failures for 30 minutes.

RESERVED STORAGE: Eighteen words are reserved by the hardware in low-order memory for interrupt servicing and memory registers. In addition, resident portions of the operating system, including the BASIC interpreter, will detract from the amount of memory available to the user for programs.

CENTRAL PROCESSOR

The 8870/1 and 8870/3 central processors include the processor and main memory. The processor is a general-purpose, 16-bit processor with a 380-nanosecond memory cycle for the 8870/1 and 350 nanoseconds for the 8870/3. Additional major operating characteristics include memory access to two bytes (16 bits or one word) per cycle; one-word instruction length; overlapping of instruction call-up and execution phases; and an instruction set of 31 8870/1 basic instructions and 58 8870/3 commands. Each instruction set provides 300 functions. Four accumulators, two of which can be used as index registers; 12 additional registers for interrupt processing and instruction counter; direct, indirect, relative, and indexed main memory addressing; peripheral ➤

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PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION	MANUFACTURER
PRINTERS		
831	Serial printer, controller, 64-character set, 165 cps	Centronics
833	Line printer and controller, 64-character set, 300 lpm	Dataproducts
833A	Line printer and controller, 96-character set, 240 lpm	Dataproducts
835	Workstation printer, 100 cps, needle printer	Nixdorf
837	Hard-copy terminal, 30 cps, with keyboard, local connection	Diablo
837R	Hard-copy terminal, 30 cps, with keyboard, remote connection	Diablo
MAGNETIC TAPE UNITS		
8401	Reel-to-reel tape drive and controller, 1600 bpi, 9-track, 25 ips	Pertec
8402	Reel-to-reel tape drive and controller, 800 bpi, 9-track, 45 ips	Pertec
VIDEO DISPLAY TERMINALS		
811	2000-character display (local attachment), character-mode	Nixdorf
811R	2000-character display (remote attachment), character-mode	Nixdorf
812M	2000-character display (local attachment), block-mode	Nixdorf
812RM	2000-character display (remote attachment), block-mode	Nixdorf
812S	2000-character display (attachment to 812M or 812RM), block-mode	Nixdorf

➤ in Business BASIC. To most users, however, the interface with the system is through the application programs. The style of these programs is to offer multiple levels of menus for operator selection of activities. System services are intermixed in the same style and are indistinguishable from application tasks to the average operator. A password technique incorporating separate three-level access codes for programs and files allows control of data security.

Nixdorf offers a flexible parameter-driven applications system designed specifically for the 8870/1 and 8870/3. It consists of a series of software packages including order processing and invoicing, inventory control, financial accounting, and financial modeling. The entire system or individual modules are available for a single-payment license or on a monthly license plan. Due to its flexibility, the Nixdorf software is said to offer both the low cost of standard software packages and the capability of easily and quickly "customizing" a package to best suit the user's needs. This flexibility is found in all areas of the system, including input, processing, and output. Both real-time and batch processing are offered, and a combination of both may be used.

The Nixdorf applications programs operate under the NIROS and TAMOS operating systems, both of which are mandatory for the 8870/1 and 8870/3. Two types of data access are provided. One is by record number within file, with implicit sequential access or directed access. The second is by alphanumeric keys associated with each record. Multiple levels of directories in the second technique provide flexible access to a single data base.

USER REACTION

Datapro was able to contact and interview four Nixdorf users: two with 8870/1 systems and two with the earlier 8870 models. We were unable to obtain additional user names from Nixdorf. The average system life reported was ➤

➤ channels; programmable real-time clock; automatic program loader and remote switch-on; and automatic restart from power fail condition are also standard features.

INSTRUCTION TIMINGS: Information on BASIC statement execution times is unavailable. However, on one of the systems used by Nixdorf for program development and demonstration, tasks such as simultaneous file creation by five users did not degrade system performance below the two-second response time the company considers adequate.

PHYSICAL SPECIFICATIONS

The 8807/1 and 8807/3 are each available in two models. The one-cabinet configuration of each is designated either the 8013 or 8033. The larger two-cabinet models are the 8015 or 8035. The 8013/8033 cabinet is 28.5 inches high, 23.5 inches wide, 35.25 inches deep, and weighs 278 pounds. The 8015/8035 double cabinet is the same height and depth, but is 47 inches wide and weighs 566 pounds.

The environmental constraints are consistent regardless of the model. The operating temperature must be between 60° F and 80° F, with a relative humidity of 30 to 80 percent (non-condensing). The heat dissipation is rated at 5120 BTUs per hour.

The electrical requirements for the 8870/1 and 8870/3 are as follows: 117 VAC \pm 10 percent, 20 amperes circuit breaker, 60 Hertz \pm 1 percent, 13 amperes current, and 1500 watts consumption.

INPUT/OUTPUT CONTROL

Programmed I/O and direct memory access (DMA) are both included in the basic processor. Slower-speed units utilize the programmed technique to transfer data one character at a time to and from memory registers; each data transfer must be separately initiated.

The disk unit utilizes the DMA facility to transfer data two bytes at a time; data transfers are initiated by block.

SIMULTANEOUS OPERATIONS: All peripheral devices can be active simultaneously, subject to memory cycling rate and I/O routine execution speeds.

CONFIGURATION RULES

Nixdorf has developed an extensive System Configurator plan to determine the main memory, disk storage, and ➤

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➤ 20 months with the respondents ranging in experience with their systems from four months to four years. Three users purchased their systems directly, while one preferred to lease his system from Nixdorf.

Two users reported accounting to be their principal application. Manufacturing, distributed processing, transaction processing, and software development were also noted. All four users noted "ready-made" programs from the manufacturer to be their source of application programs. Two users also utilized in-house personnel to meet to their programming needs. One user purchased proprietary software packages in addition to Nixdorf's offerings, one user went to contract programming, and one utilized Nixdorf's personnel to modify their software packages.

The four systems covered in the survey each include one CPU and from 2 to 12 workstations per system. All use BASIC as their programming language. For the coming year, one user is planning to purchase proprietary software from another supplier, and one is planning to add both additional data communications facilities. Three of the four respondents are not planning to replace their system in the near future; one user, however, is planning to go to a different manufacturer for his replacement system.

The respondents were generally impressed with their Nixdorf systems. The only problems reported were few. One user felt that the original system proposed by the vendor was too small and had to be expanded or replaced. One user reported that the vendor did not provide all the promised software or support. Finally, one respondent stated that the terminal and peripheral compatibility was not what the vendor promised. The good far outweighs the bad as far as these systems are concerned. Three users were impressed with the ease with which the system can be reconfigured or expanded. Two users noted they were happy with the system's response time. One user felt that the data base language was efficient and effective, and one reported that their equipment delivery/installation was ahead of schedule.

The complete user ratings are summarized in the table below.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	2	2	0	0	3.5
Reliability of mainframe	3	1	0	0	3.6
Reliability of peripherals	2	2	0	0	3.5
Maintenance service:					
Responsiveness	2	1	0	1	3.0
Effectiveness	1	2	1	0	3.0
Technical support:					
Trouble-shooting	2	0	2	0	3.0
Education	1	1	2	0	2.6
Documentation	2	0	1	1	2.6
Manufacturer's software:					
Operating system	1	2	1	0	3.0
Compilers and assemblers	0	1	0	0	3.0
Ease of programming	1	1	1	0	3.0
Ease of conversion	1	2	1	0	3.0
Overall satisfaction	1	3	1	0	3.0

*Weighted Average on a scale of 4.0 for Excellent.

➤ terminal requirements of each user. The requirements of each applications package are factored into the final system configuration.

The maximum configuration parameters for the Nixdorf 8870/1 and 8870/3 are as follows:

- Up to 512K bytes of main memory
- Up to 264 megabytes of on-line disk storage
- Up to 32 workstations, application dependent
- Up to two systems printers
- Up to 16 workstation printers

WORKSTATIONS: The 8870/1 and 8870/3 can support up to 32 remote or local workstations depending upon the application. Four units are interfaced to each Asynchronous Line Controller (ALC).

DISK STORAGE: Disk storage is available through either cartridge disk drives or storage module disks. The 8870/1 supports from 6 megabytes to 66 megabytes of on-line disk storage; the 8870/3 increases its disk capacity to support from 26 megabytes to 264 megabytes of storage.

MAGNETIC TAPE: The 8870/1 and 8870/3 support both 1600-bpi phase-encoded and 800-bpi NRZI tape units. One drive can be handled by each controller. The 8870/1 and 8870/3 each supports one tape drive.

PRINTERS: Two system printers, a 165 character-per-second serial printer and a 300/240 line-per-minute line printer are supported by the 8870 systems. Workstation printers and hard copy terminals extend the hardcopy and FORMS capability of these Nixdorf units.

MASS STORAGE

CARTRIDGE DISK: An 8870/1 system can support from one to four 821 Cartridge Disk Drives providing 10-, 20-, 30-, or 40-megabytes of formatted on-line storage. Each drive can provide five megabytes of fixed and five megabytes of removable storage. A six-megabyte single drive configuration (three megabytes fixed and three megabytes removable) is provided for users with small file storage requirements. The disks rotate at 2400 rpm, with an average data access time of 50.5 milliseconds and a data transfer rate of 312K bytes per second. Common spindles are combined with independent read and write heads for each disk.

STORAGE MODULE DISK: The 822 Series Module Disks can be configured with capacities of 26, 42, 66, 132, 198, and 240 megabytes of storage. The 822 family consists of two to four independent disk units mounted in pull-out drawers in up to four separate cabinets. The disks rotate at 3600 rpm, with an average data access time of 38.3 milliseconds and a data transfer rate of 1.2 megabytes per second. The removable storage module has multiple disk surfaces and individual read/write heads for each. These disk units can be configured on either an 8870/1 or 8870/3 system.

CARTRIDGE MODULE DISK: The units are available for use on the 8870/3 in capacities of 26, 39, and 52 megabytes, with a removable, top-loading cartridge of 13 megabytes; the balance of the capacity is composed of fixed disk storage. These 823 Series disks have a transfer rate of 1.2 megabytes per second, with an average data access time of 38 milliseconds. File copy times (for backup) are four minutes per 13 megabytes of disk storage, consisting of two and a half minutes for the copy and one and a half minutes for disk pack handling.

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➤ Considering our limited user sample, the Nixdorf system fared extremely well. The ratings concerning the actual use and reliability of the system scored extremely high. The traditional weak areas, education and documentation, were the lowest ranked areas for Nixdorf also. Again, our sample was limited, but three out of four respondents said that they would recommend their system to another user in their situation. This speaks well of Nixdorf in the sales, service, and support areas. Their hardware seems capable and reliable. Nixdorf deserves more than a second glance for small businesses looking for their first system. □

➤ INPUT/OUTPUT UNITS

See the Peripherals/Terminals table.

COMMUNICATIONS CONTROL

The 8870/1 and 8870/3 provide remote terminal capabilities with full-duplex asynchronous transmission via an RS-232-C interface at speeds from 1200 to 9600 bits per second over dial-up or leased lines. Each terminal requires its own port and a separate modem. A programmable line controller (PLC) with 2780/3740/3780 binary synchronous communications protocol operates over half-duplex leased or dial-up lines at 1200 to 9600 bits per second, with auto-dial and auto-answer features.

SOFTWARE

Software support for the Nixdorf 8870/1 and 8870/3 combines applications software with multiple industry-oriented packages. Custom modifications can be separately arranged with Nixdorf or outside software houses. The applications programs are normally programmed in Business BASIC and run under the NIROS operating system. The user can also program in BASIC if desired. Assembly language programming by users is not supported.

OPERATING SYSTEM: *NIROS* is a multi-user, time-sharing operating system. Its basic function is to provide a "clean" interface between the system and the users (i.e., to minimize machine-oriented functions). To the user (the person sitting at a terminal running an application program) the interface consists of simple commands typed in response to system-displayed requests. This interactive style of processing reduces the amount of training and data processing knowledge required by the operator. Program development can also be carried out interactively as a separate task. In general, work flow consists of developing a program in Business BASIC through a program operating under NIROS. The output, the application program, is a compressed version of the BASIC statements entered. The application program can be permanently or temporarily stored on disk. Execution of the application program is performed by a separate run-time BASIC interpreter that runs under NIROS.

The principal functions provided by NIROS include management of system resources (such as processor time and disk space), management of disk access methods and file structures, and maintenance of information concerning usage of the system by each operator.

NIROS provides from one to seven partitions to enable multiple users to access the system simultaneously for independent tasks. When more than seven partitions are required, NIROS swaps operating system tasks between disk and main memory. A partition area of from 11,000 bytes (two disk tracks) to 14,000 bytes is established for the outgoing and

the incoming system programs. The time required to swap programs is not available for user processing. The impact of the swap times on system performance is governed by the rate at which swaps are required. This, in turn, depends on the number of active users and the tasks being performed.

Processor time is not required while the operator is keying in data or system commands; data is temporarily stored in the display buffer. Ending the entry operation, usually by depressing the carriage return key, is a signal to the operating system that some processing action is required by that user. Accordingly, that user's task is swapped into main memory, and execution of the program is begun at the point where it was stopped the previous time it was in main memory. If a disk access or other peripheral operation is begun, control is shifted back to the operating system, which initiates a swap to the highest-priority task outstanding. Similarly, completion of a disk access or other peripheral operation causes a change to the associated program. A system time-out prevents a program with heavy processing requirements but light I/O demands from monopolizing the processor. To the user, delays are encountered only when an output or request is completed, not during the keying itself.

This technique of allocating processor time is constant with manual operations of data entry by the operator. Auxiliary input devices that could allow a sizeable amount of data to be accumulated prior to entry are not available to the operator. The primary way the operator can get information into the system is through the keyboard. Thus, the system is suited for transaction-oriented data processing. Characteristic of this type of operation is the combining of data entry with immediate processing of that data, with modification of master files being accomplished at the same time.

For tasks not requiring operator interaction to input new data, such as the preparation of a report from data extracted from a master file, one background task is supported. Nixdorf refers to this facility as the "phantom port" to make the nomenclature synonymous with the normal designation of each operator workstation interface with the processor as a port.

The programmer can cause a record to be "locked" when a program accesses it to prevent updating errors if two or more users are working out of the same file.

There are two basic file structures that can be maintained on disk: random and contiguous. In the random structure, data records are recorded in any order in any location on disk within the basic data grouping of a block or disk sector of 512 bytes; a list of physical disk sector addresses is maintained in the file header in logical record number order. In the contiguous structure, records are maintained on disk in strict logical sequence, with only the record size carried in the file header. The random structure permits a file to be expanded at will with no space penalty. The contiguous structure requires a fixed size to be determined, with a file copy/rebuild operation required to expand or contract the file size.

The file header of the random file provides space for 128 addresses. For a file larger than 128 sectors, the file header area can be used to refer to auxiliary headers, each of which can contain 256 sector addresses. There is no practical limit on the size of a contiguous file.

In general, data transfers are made by sector (512 bytes). Random file accessing requires two or three disk transfers to get the required data block into main memory. The header for contiguous files is maintained in memory, so that a direct disk transfer can be made based on the calculated disk sector address. Record fetches are normally made on the basis of record number by the programmer. Implied sequential access can be used for either file structure. ➤

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► Specialized versions of these two structures provide additional flexibility for programmers.

A random file can be made into a formatted file by including in the file header the size and data type for each data item (field) in the record; these are common to each record. Programs can reference data directly by item for both read and write operations, with the operating system performing a data type check.

Another use of the random structure is a text file. The text file is in reality a single ASCII string with no logical divisions. Access is by starting location and the number of characters desired.

A special form of the contiguous file, indexed random, has been implemented. An indexed file provides for access to data by key value. The key is set by program and is not necessarily a part of the data record, although this is normally a good idea. A three-level directory is maintained to provide access to data. Each level occupies the amount of space needed. In each level, a sector address is associated with the highest key value in the corresponding lower-level directory. The third level contains the real sector addresses of the records corresponding to the key values. Up to 15 directories can be maintained for a single data file. Single-argument search by key value is supported in BASIC. The key value argument need not be as long as the key value in the directories, which permits group searches. Convenient continuance to return multiple-record matches is provided.

Two principal applications of the indexed file structure and access are searches for records when only partial information is known and simplification of access to data in a particular, frequently used order. To support the first application, separate directories can be maintained, each based on an element of record identification. Parallel searches based on two or more elements greatly reduce the number of records that have to be retrieved and viewed to obtain the desired record. The second application presupposes the need to produce a printed report or separate data file in several different sequences from data contained in one file; in this application, the indexing capability eliminates the need for a sort operation. Approximately four disk transfers are required to get the required record (or the first of the required series) into memory. But because the currently accessed sectors for each of the three directory levels and data are maintained in memory, references to nearby keys will quite often not require an additional access.

The accounting function of NIROS causes a file to be maintained that includes records for each operator using the system. Information recorded includes connect time, processor time, and number of disk file accesses.

A password technique is used to control access to particular programs and data files. Three levels of access can be specified. Each level includes the levels below it. Separate access levels can be specified for a program and for a file.

PROGRAMMING LANGUAGE: *Business BASIC* for the Nixdorf 8870/1 and 8870/3 is an upward-compatible superset of Dartmouth BASIC if allowance is made for the differences between a compiler and an interpreter (i.e., all statements must be included in the logic flow). For example, directives that are not executable, such as DIM statements, have no effect to an interpreter if they are not included in the statements reached through the logical flow of the program. The language processor is in two parts: a program-time module compacts and partially decodes the BASIC statements; and a run-time module interprets the inter-

mediate-level source statements. A program listing can be obtained in conventional form directly from the intermediate form, so two levels of source code are not retained in the system.

Business BASIC provides two principal extensions to conventional BASIC: extended-precision arithmetic and editing of print lines. Floating-point variables can be specified as 6, 10, or 14 decimal digits in precision. While the values are carried in floating-point form internally, the programmer can use conventional decimal notation freely. The edit capability is implemented through a PRINT USING command that includes provision for suppression of leading zeroes, decimal point insertion, asterisk fill, and exponent notation of numeric values. It also permits complete flexibility in positioning data fields in the output, rather than being limited to the five 15-character columns usually available.

APPLICATIONS SOFTWARE: Nixdorf's principal application software is designed to be flexible enough to be adapted to most business environments in a few days and be made fully operational within weeks. The complete system includes fully integrated modules for inventory control, order processing and invoicing, financial accounting, and financial modeling. System security provides for password-controlled access to programs, files, and records; system backup; and three types of audit trails. A complete listing of the available software is including in the Equipment Pricing section of this report.

PRICING

POLICY: Nixdorf provides the 8870/1 and 8870/3 on a purchase basis.

Maintenance is provided separately; extended period maintenance can be negotiated, but availability will vary depending on locality. Operator training and a copy of pertinent user manuals are included in the basic price.

Equipment installation charges are equivalent to one month's maintenance charges for new systems and two months' maintenance charges for add-ons and upgrades. The 8870/1 and 8870/3 hardware is covered by a 90-day warranty.

SOFTWARE: Nixdorf software is available to the user through a number of different licensing arrangements. The one-time license fee allows use of a software product on a single system for an unlimited period of time. N/A indicates that this product may only be licensed on a monthly use basis. The monthly license fee may be converted to a fully paid one-time license fee at any time with the following percentages of the monthly license fees paid to date applied towards the fully-paid license fee:

Number of Monthly License Fees Paid to Date of Conversion	Percentage of Total Fee Paid Applied Toward One-Time Fee
1-12	75%
13-24	50%
25-36	25%
37-up	10%

EQUIPMENT: The components and prices of Nixdorf's packaged configurations are listed in the following Equipment Prices section.■

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.
PROCESSORS			
800A	8870/1 CPU, 64KB memory, 13-slot chassis, 6MB disk with controller, 1st 4-line asynchronous line module, emergency power supply, 1 cabinet	\$18,800	\$192
800B	8870/1 CPU, 64KB memory, 13-slot chassis, 10MB disk with controller, 1st 4-line asynchronous line module, emergency power supply, 1 cabinet	20,900	192
800C	8870/1 CPU, 64KB memory, 13-slot chassis, 20MB disk with controller, 1st 4-line asynchronous line module, emergency power supply, 2 cabinets	28,500	289
801A	8870/1 CPU, 64KB memory, 28-slot chassis, 1st 4-line asynchronous line module, emergency power supply, 1 cabinet	13,500	118
801C	8870/1 CPU, 64KB memory, 28-slot chassis, 20MB disk with controller, 1st 4-line asynchronous line module, emergency power supply, 3 cabinets	32,450	312
8013	8870/1 Model 30 CPU, 96KB memory, 14-slot modular chassis, 1st 4-line asynchronous line module, emergency power supply, 1 cabinet	11,500	104
8015	8870/1 Model 50 CPU, 96KB memory, 28-slot modular chassis, 1st 4-line asynchronous line module, emergency power supply, 2 cabinets	15,500	135
8033	8870/3 Model 30 CPU, 128KB memory, 14-slot modular chassis, 1st 4-line asynchronous line module, emergency power supply, 1 cabinet	19,400	119
8035	8870/3 Model 50 CPU, 128KB memory, 28-slot modular chassis, 1st 4-line asynchronous line module, emergency power supply, 2 cabinets	23,400	150
PROCESSOR OPTIONS			
8081	14-slot expansion chassis with cabinet, requires 8013 or 8033	4,000	—
8082	Disk expansion cabinet, requires 8013 or 8033	3,500	—
MEMORY			
805A	32KB memory expansion, 64KB to 96KB	1,950	29
805B	32KB memory expansion, 96KB to 256KB, requires 805A	2,500	29
809	Emergency power supply supplement, for CPUs with memory greater than 224KB	650	6
8091	32KB memory expansion, requires 8013, 8015, 8033, or 8035	2,500	29
MASS STORAGE			
821	10MB add-on cartridge disk drive, 1 cabinet, 1 disk pack, requires 821A, 800B, 800C, or 801C	9,950	94
821A	10MB disk cartridge disk drive, controller, 1 cabinet, 1 disk pack, requires 801A	11,350	104
8210	6MB cartridge disk drive, controller, 1 disk pack, requires 8013	9,500	100
8211	10MB add-on cartridge disk drive, 1 cabinet, 1 disk pack, requires 800B, 800C, 801C, 821A, 8213, or 8013 + 8212	9,950	94
8212	10MB cartridge disk drive, controller, 1 disk pack, requires 8013	11,350	104
8213	10MB add-on cartridge disk drive, 1 disk pack, 2nd drive for 28-slot system only, requires 8013 + 8081 + 8212	9,950	94
822	66MB storage module disk, controller, (2x33MB), 1 cabinet, 2 disk packs	32,900	205
822A	42MB storage module disk, controller, (2x21MB), 1 cabinet, 2 disk packs	29,900	200
822B	26MB storage module disk, controller, (2x13MB), 1 cabinet, 2 disk packs	27,900	195
822C	132MB storage module disk, controller, (2x66MB), 1 cabinet, 2 disk packs	40,900	210
8221	26MB storage module disk, controller, (2x13MB), 2 disk packs	27,900	195
8222	42MB storage module disk, controller, (2x21MB), 2 disk packs	29,900	200
8223	66MB storage module disk, controller, (2x33MB), 2 disk packs	32,900	205
8224	132MB storage module disk, controller, (2x66MB), 2 disk packs	40,900	210
8225	Third 66MB storage module disk, controller, 1 cabinet, 1 disk pack	18,500	100
8226	Fourth 66MB storage module disk, 1 cabinet, 1 disk pack	17,500	100
8232	26MB cartridge module disk, controller, 13MB fixed and 13MB removable, 1 removable disk pack	18,900	133
8233	39MB cartridge module disk, controller, 2x13MB fixed and 13MB removable, 1 removable disk pack	21,900	145
8234	52MB cartridge module disk, controller, 3x13MB fixed and 13MB removable, 1 removable disk pack	24,900	155
MAGNETIC TAPE EQUIPMENT			
8401	Magnetic tape drive, 1600 bpi, 9 track, 25 ips, controller, 1 cabinet	14,780	125
8402	Magnetic tape drive, 800 bpi, 9 track, 45 ips, controller, 1 cabinet	14,240	100
PRINTERS			
831	165-cps serial printer, 64-character set, controller, 30-foot cable	7,750	73
833	300-lpm line printer, 64-character set, controller, 16-foot cable	12,900	150
833A	240-lpm line printer, 96-character set, controller, 16-foot cable	14,300	150
835	100-cps workstation needle printer, 16-foot cable	4,950	67
837	Hardcopy terminal, local connection, 30-cps, with keyboard, one V.24 interface board, 36-foot cable	5,000	47
837R	Hardcopy terminal, remote connection, 30-cps, with keyboard, one V.24 interface board, 16-foot cable	5,250	54
TERMINALS			
811	Character-mode display terminal, local connection, 2 IHSS interface boards, cable	2,950	38
811R	Character-mode display terminal, remote connection, 2 V.24 interface boards, cable	2,950	45

Nixdorf System 8870/1 and 8870/3

EQUIPMENT PRICES

		<u>Purchase Price</u>	<u>Monthly Maint.</u>
TERMINALS (Continued)			
812M	Block-mode display terminal, local connection, 2 IHSS interface boards, cable	2,950	38
812RM	Block-mode display terminal, remote connection, 2 V.24 interface boards, cable	2,950	45
812S	Block-mode display terminal, slave connection, cable, requires 812M or 812RM	2,400	38
819A	Local interface board (IHSS)	250	—
819B	Remote interface board, CCITT V.24	75	—
819C	Remote interface board, RS-232-C	300	—
COMMUNICATIONS			
8501	Asynchronous line module (ALM), includes 4 line distributors	1,450	17
851A	Programmable line controller (PLC)	3,000	41
851B	Programmable line controller (PLC) with auto dial/answer	4,000	41

SOFTWARE PRICES

		<u>One-time License</u>	<u>Monthly License</u>
SOFTWARE			
S801	NIROS/TAMOS/BASIC for 8870/1	N/A	50
S803	NIROS/TAMOS/BASIC for 8870/3	N/A	100
S811	Batch communication utility package	N/A	50
Nationally Supported Application Software			
S831A	Mortgage closing system		
	-1 Initial license	4,800	144
	-2 Subsequent license	2,400	72
S831B	Escrow system		
	-1 Initial license	4,800	144
	-2 Subsequent license	2,400	72
S832	NIDAS—Nixdorf integrated distribution accounting system		
	-1 Initial license	2,500	75
	-2 Subsequent license	1,500	45
S836A	Insurance agency management system base software package		
	-1 Initial license	4,000	120
	-2 Subsequent license	2,000	60
Field Supported Application Software			
S862	NIDAS—Nixdorf integrated distribution accounting system		
	-1 Initial license	2,500	75
	-2 Subsequent license	1,500	45
S863	Accounts payable/general ledger		
	-1 Initial license	500	25
	-2 Subsequent license	300	25
S864	Payroll system		
	-1 Initial license	500	25
	-2 Subsequent license	300	25
S865	Hospital supply distribution system		
	-1 Initial license	10,000	300
	-2 Subsequent license	20,000	300
S867	Contractors management system		
	-1 Initial license	4,000	120
	-2 Subsequent license	2,000	60
S868	Client accounting system		
	-1 Initial license	2,000	60
	-2 Subsequent license	1,500	45
S869	Nixdorf modelling system		
	-1 Initial license	2,000	60
	-2 Subsequent license	1,000	30
S870	Medical clinic management system		
	-1 Initial license	5,000	150
	-2 Subsequent license	4,000	120
S5871	Letter writing system		
	-1 Initial license	200	25
	-2 Subsequent license	100	25