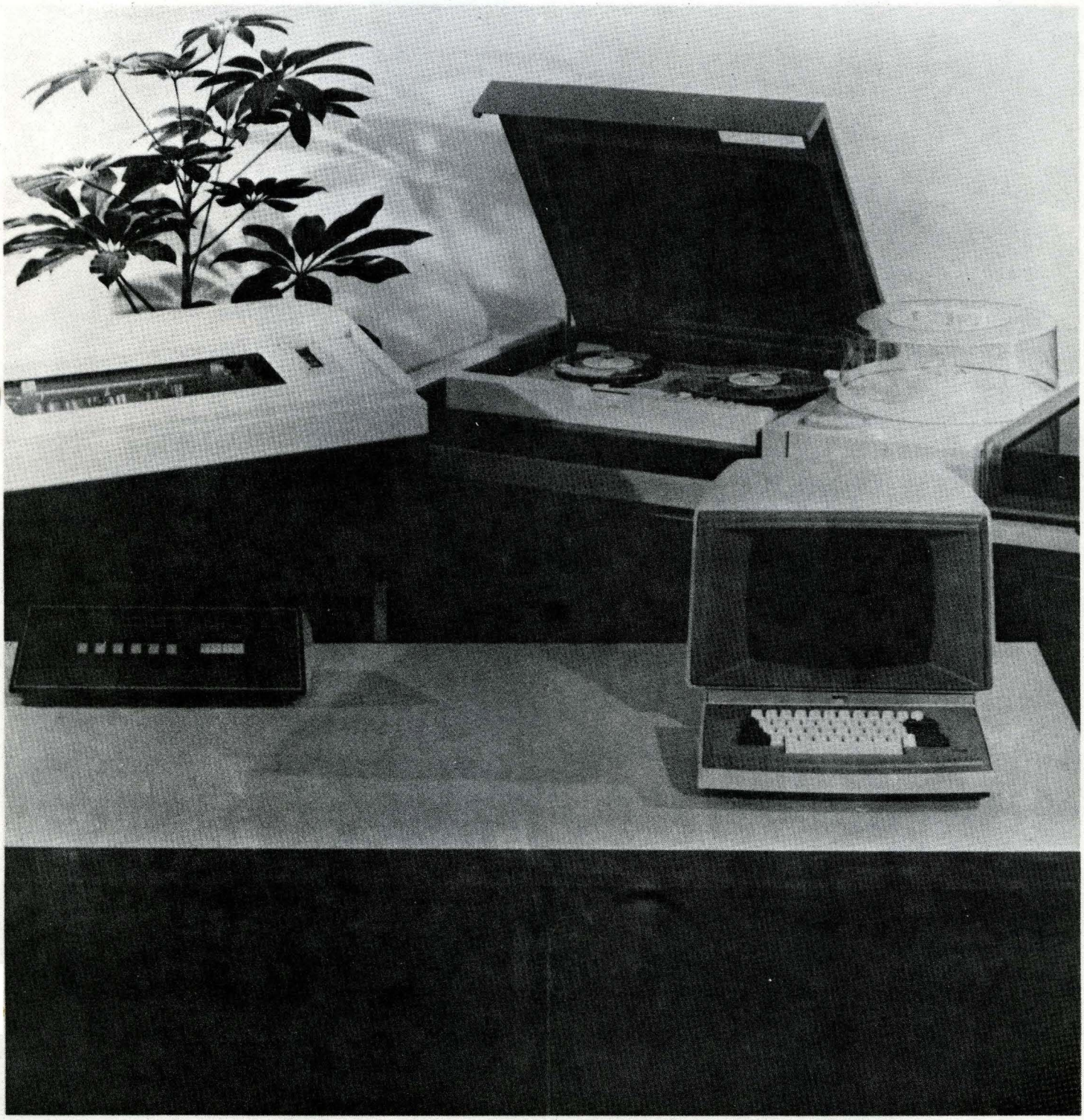
PERTEC
COMPUTER
CORPORATION

PCC 1800 MOD II
Application Processing System

General Information



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June 1979

680337-00

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I. INTRODUCTION

The PCC 1800 MOD II Multifunction Application Processing System is an advanced, minicomputer-based, multiterminal system that performs a mix of data retrieval, data entry and data management functions in addition to application processing. This system brings to medium-to-large installations, and to individual user departments in large organizations, powerful data processing and multifunction application processing capabilities that significantly reduce the cost and turnaround time to produce error-free, computer-ready data. The PCC 1800 MOD II System enables user departments to prepare accurate data with source department personnel, to access and update local data bases for better information control and to generate needed reports and documents on demand.

The PCC 1800 MOD II combines its processor architecture with a sophisticated multitasking Data Management Operating System (DMOS) to provide a system capable of concurrent data retrieval, applications processing, batch data entry, source data capture, data communications and file inquiry. The 1800 MOD II brings multifunction flexibility, large-volume production data entry, processing and efficient use of resources to the user at the lowest possible cost. Three user programming capabilities are provided: a simple-to-use checkbox specification format; an easy-to-program interactive terminal language (KOBOL™, PCC's Keystation On-Line Business-Oriented Language) for editing, data validation and file inquiry; and an RPG II compiler for report generation and special user-generated application programs.

Data Communications, via PCC's TeleBatch™, enables remote sites to communicate with other PCC Systems or with mainframes and terminals using industry-compatible binary synchronous protocols over leased or switched telephone lines. Data Communications functions concurrently with all other system activities.

The primary design objectives of the PCC 1800 MOD II System are to offer immediate distributed processing cost savings today while providing a modular, economical growth path into more sophisticated data processing applications as user needs change. Features required to meet current and future applications are provided in the basic system software or may be customer-designed using the system's programming capabilities. Through memory and peripheral expansion, the user easily grows into more sophisticated application areas, employs more system capabilities and performs a variety of processing tasks that no longer require a mainframe computer to accomplish.

II. SYSTEM OVERVIEW

The PCC 1800 MOD II combines state-of-the-art proven hardware and software technology into a multifunction applications processor capable of supporting multiple terminals operating in a distributed data entry, processing and multitasking environment.

The basic system hardware components include a supervisory console, one to six magnetic tape units, up to 121.6 megabytes of unformatted disk storage and a supervisory command console. The system supports from one to 64 terminals, a card reader, dual printers, binary synchronous communications interface and memory expandable to 256K bytes.

Flexible programming allows the 1800 MOD II to fill data processing requirements ranging from large, special-purpose, data entry applications to multipurpose processing functions. The sophisticated MOD II Data Management Operating System (DMOS) adds file inquiry, complete applications processing and communications capabilities to PCC's industry-standard-setting production data entry capability. The multitasking capabilities of DMOS permit up to 70 concurrent tasks, of which 64 applications may be interactive at terminals while six are CPU-oriented batch processing tasks.

The general flow of data through the system is from the keyboard through memory to the disk drive where it is collected into a data file. When a file is completed, it is transferred from the disk to a magnetic tape unit where a tape is produced that can be transported to a large-scale computing system to be read as input for mainframe processing. As an alternative, data files can be communicated over telephone lines to a mainframe computer or another PCC System. Data files may also be entered into the system from magnetic tape or Data Communications.

This section provides details on 1800 MOD II hardware, software and system operation. A summary of capabilities and features precedes the detailed descriptions.

CAPABILITIES/FEATURES SUMMARY

MAJOR CAPABILITIES

Multifunction Processing —

- Central Control. All supervisory functions, such as allocation of system resources, are initiated at the supervisory console.

- Data Entry. Production data entry at local CRT terminals; source data entry at remote terminals connected to the central PCC 1800 MOD II via telephone lines; or a combination of both.

- File Inquiry. Provides rapid multiple access to large data files; fast, flexible, very large table lookup; and full-screen file inquiry/update applications. These features add up to complete information update and retrieval via file inquiry procedures based on a multiple-key Indexed Sequential Access Method (ISAM).

  ISAM files can be randomly accessed by all concurrent activities. An unlimited number of master files can be created and maintained and may be accessed by primary key or up to 16 alternate keys. Anticipated file expansion can be input at file load time, permitting dynamic file expansion when reserve limits have been exceeded, eliminating chaining requirements. ISAM files may also be built as temporary work files and deleted as required to free disk space.

- Data Communications. Communications is provided in both batch and interactive mode. Up to 16 remote terminals may communicate over telephone lines to the 1800 MOD II interactively. System communications is binary synchronous up to 19.2K bits per second, emulating 2780, 3780, 3741/3747, expanded 3741 or 360/20 HASP protocols using the 1800 TeleBatch feature. Communications operates concurrently with other system activities.

- Procedure Control Language (PCL). Establishes a continuous dialog with the system, queueing concurrent activities and providing interactive communications with the command console. It allows the system to dynamically execute queued tasks when memory and/or files are available.

- Supervisory Procedures. Permits complete control of system resources, system operations, and file management functions, and permits the supervisor to create, list, delete and recall all sequential batch data files and ISAM files and obtain performance measurement reports and status and audit trail reports on demand.

Multitasking Data Management Operating System (DMOS) —

- Concurrent terminal and applications processing for up to 70 tasks: 64 interactive terminal applications and six CPU-oriented batch processing tasks.

- Dual Printer Capability. Provides user with two independent print functions concurrently.

- Dynamic Memory Allocation. Permits memory to be assigned to each task as needed and deallocated as tasks are terminated.

- Dynamic Disk Allocation. Permits entered data to be stored sequentially by track, while ISAM resident master files are assigned by cylinder addresses. All assignments and overflow conditions are dynamically handled by the system.

- Disk Optimizer. Provides an improved method of sequentially ordering disk seeks which maximizes the effectiveness of disk accesses.

User Programmability —

- Comprehensive System Software. Includes KOBOL, an interactive terminal language whose procedures provide powerful application programs for data entry, validation and retrieval of ISAM master files. Extensive data editing and validation is available at all levels — character, field, record and batch. Ensures clean, accurate data for processing and makes correction easy and efficient.

- RPG II. An IBM DOS-compatible programming language which permits extensive editing, conditional testing, computing, restructuring of batch data, creation of output tapes or disk files and processing of data management reports as well as creating, accessing and updating of ISAM files. Tape labeling. Programmable statistics reports.

- Checkbox Programming. Enables user personnel to interface with KOBOL, writing basic formats for editing, balancing, table lookup and arithmetic functions on a source input form provided with the system.

User Convenience —

- Operator-oriented. Easy-to-understand programmable prompts and automatically generated status messages guide and assist the operator.

- System dynamically updates user statistics for all data entry activities when batch is closed. Standard statistics utility programs are available or users may design their own with RPG II.

- Resource allocation permits user to allocate/deallocate memory and disk space to fit needs.

- File security and data protection of batch and ISAM files.

- Input data accuracy is highly improved in two ways:
  - Source data entry from user departments, ensuring specialized personnel expertise.
  - Automatic insertion, duplication and real-time edit and validity checks.

DATA ENTRY FEATURES

- Extensive format programs, tables, check digits, KOBOL modules and tape label command batches and tape codes storable on disk.
- Up to 32 levels per entry format program.
- Mid-record format level selection.
- 256- and 2000-character CRT displays.
- Full-screen prompting on 2000-character screen.
- Intensified display of data fields on 2000-character screen.
- Unlimited job names.
- Unlimited entry formats.
- 255 KOBOL program modules.
- 96 fields per level on 256-character screen, 255 fields per level on 2000-character screen.
- Up to 1920 data characters per record.
- Up to 240 data characters per field.
- 32 aux dups per format on 256-character screen.
- Rewrite mode for file updates.
- Field duplication from previous record.
- Autodup propagation procedure permits correction of all duplicated data in a dup chain (256-character screen).
- Field tabbing, skipping, bypassing.
- Boundary, range, sequence, table and value checks, as well as arithmetic and balancing functions.
- Multiple search modes.
- Unlimited libraries.

FILE INQUIRY FEATURES

- 121.6 megabytes of unformatted disk storage.
- Allocatable ISAM file inquiry storage.
- Variable key position in ISAM resident master file.
- Multiple terminal work areas in KOBOL.
- ISAM and sequential access with RPG II.
- Full-screen document display.
- Multiple operators can concurrently share files.
- Files may be accessed by primary and up to 16 alternate keys without having multiple copies of the resident master file.
- File creation can be accomplished by four methods: supervisor creation from ordinary batches, input from magnetic tape, operator real-time creation from keyed data, or RPG II.
- File expansion is accomplished without overflow chaining.

DATA MANAGEMENT FEATURES

- 70 concurrent tasks, including 6 concurrent batch processing activities.
- Mixed ISAM and sequential file processing.
- Procedure Control Language stream.
- Dynamic relocatable memory and disk storage.
- RPG II.
- RPG tape labeling and manipulation.
- SORT/MERGE concurrent with other tasks.
- Bisynchronous communications up to 19.2K bits per second.
- Reentrant code allows user program sharing.
- Data and file security provided by KOBOL password routine.

- Transfer utilities from disk to tape/printer, tape to disk/printer and card to disk/tape.

- System reports, including system status (disk, memory, CRT terminals, peripherals), event log, job analysis, job status, job performance, terminal status, operator analysis and user-defined reports.

III. HARDWARE

SUPERVISORY CONSOLE

The supervisory console is a single-pedestal, desk-type unit which houses the central processor with up to 256K bytes of memory, peripheral controllers, all system electronics and a power supply.

The supervisor uses the control panel on the supervisory console in initiate system operations, perform recovery procedures and monitor conditions that require supervisory attention.

The control panel includes both indicators and control buttons, as well as the power On/Off switch. Indicators include: POWER, RUN, STOP, KEYSTN PARTITION, BKGRND PARTITION, PARTITION 3, EVENT STACK, SYSTEM ERROR, RESERVE and ALERT. Control buttons include: STOP, PROGRAM 1/2/3/4, TAPE LOAD, UNIT SELECT 1/2/3/4 and TONE.

Central Processor

The central processor is a 16-bit, programmable, high-speed processor with a cycle time of 1.2 microseconds, providing high throughput rates and fast system response. The processor is designed around a universal address and data bus system which provides highly flexible handling of both memory and peripheral processors. Using the bidirectional and asynchronous communications on the unviersal bus, peripheral devices can send, receive and exchange data independently without processor intervention.

The processor controls the time allocations for peripherals, provides the arithmetic and data manipulative capabilities in system operations, and interprets and executes the system operating programs. It contains multiple, high-speed, general-purpose registers which can be used as accumulators, address pointers, index registers and other specialized functions. The processor can perform data transfers directly between input/output devices and memory without disturbing the processor registers.

System Memory

The main memory within the central processor is a random-access storage facility capable of storing the system operating programs, currently active user programs and the current format and record for each terminal. This memory also acts as a high-speed buffer between the disk drives, tape units, and all other system input/output devices, including the CRT terminals. Minimum configuration is 96K bytes; maximum is 256K bytes.

Main memory is divided into two sections. One section is reserved for fixed operating system requirements; the balance is allocated or reallocated dynamically as required by the resident programs within certain maximums.

Command Console

The command console serves as the principal communications link between the supervisor and the system. The supervisor enters instructions at the command console for the control of the physical operations of the system and the control and creation of files and directories and other data management activities. In addition, the supervisor can interrogate the system and receive immediate reports on batch file and system status and summaries of operator statistics. All supervisory functions except stand-alone utilities can be operating concurrently with data entry tasks.

The command console may be either a 1920-character CRT terminal with typewriter-style keyboard or a 10-character-per-second KSR 33 teleprinter.

On either console, data keys are used to enter information to the system, and control keys (CTRL, ESC, SHIFT, RETURN and LINE FEED on the teleprinter; CTRL, ATTN, SHIFT and RETURN on the CRT console) are used to initiate system functions. The CRT console includes video controls to adjust the image on the display screen.

MAGNETIC DISK DRIVES

The magnetic disk controller will support up to four magnetic disk drives housed in freestanding cabinets. The first disk drive contains approximately 8.2 megabytes of user data storage, expandable in 3.8 megabyte increments to a disk capacity of 30.4 megabytes of unformatted data storage. Each subsequent disk drive has a 30.4 megabyte unformatted capacity up to a system maximum of 121.6 megabytes. Average access time is 35 milliseconds; with sequentially ordered disk seeks, the MOD II performs up to 32 disk accesses per second. Average latency time is 12.5 milliseconds. Track density is 100 tracks per inch.

The initial disk drive utilizes 3.1 megabytes for storage of system software. This area is not available to the user for storing data batches. The remaining space on the initial disk and all other disks is used for direct, sequential and ISAM files, with the space allocated by the user among the three. Disk space is allocated by the supervisor utilizing the Resource Allocator procedure.

MAGNETIC TAPE DRIVES

The magnetic tape controller will support up to six magnetic tape drives of which the mix may be up to four of one type: either 556/800- or 1600-bpi drives. Tape drives are dual-gap head, read-after-write units housed in freestanding cabinets which contain their own power supply. The magnetic tape is half-inch, industry-compatible,

2400-foot capacity on 10.5-inch reels. Seven- or nine-track NRZI (556/800 or 800 bits per inch, respectively) or nine-track, phase-encoded (1600 bits per inch) drives are available. Tape transport speed is 37.5 inches per second for the 556/800-bpi tapes; 25 inches per second for the 1600-bpi tape. Industry-standard error checks are features, including read-after-write checking.

A system-defined tape code table is stored on disk when the system tape is loaded. This table conforms to IBM requirements for nine-track EBCDIC (IBM9) tape. Additionally, an unlimited number of codes can be constructed and stored on the system concurrently with system codes.

Records are written on tape in blocks; each block consists of one or more logical records. The supervisor specifies the number of records per block when creating the tape files. Any blocking factor up to 255 can be used; however, the total number of characters in a block (record length *x* blocking factor) cannot exceed 9999.

The tape drive can be utilized for data transfer, communications, work files, print image files, loading of an ISAM master file and system backup. With a dual tape drive configuration, a master file update process is possible.

TERMINALS

The terminal is the primary means through which the operator communicates with the system. Each terminal consists of a CRT video display screen and a cable-connected alphanumeric keyboard, permitting operators to adjust the workstation for their own convenience and ease of use. The video displays are available with either a 256- or 2000-character screen, as well as standard keyboard configurations: keypunch, typewriter and on some typewriter models, a numeric pad.

The nine-inch CRT video unit displays 256 characters in eight lines of 32 characters each. The screen displays 240 data and prompt characters; the last 16 characters of the bottom line display mode and status information. Each character is displayed in a four *x* seven dot matrix. Small-screen terminals may be cable-connected up to 1000 feet from the system or connected to dial-up or leased telephone lines for remote operation.

The 12-inch CRT displays 2000 characters in 25 lines of 80 characters each, with each character displayed in a seven *x* nine matrix. The top line of the screen is reserved for current job or system status. The remaining 24 lines, or 1920 characters, can be intermixed with data, prompts or graphics. Large-screen terminals may be cable-connected up to 2000 feet from the system.

The data area on both displays may be programmed to display blanks for routine data entering, display the entire record or display preprogrammed prompting messages for fill-in-the-blanks-type entering. The 2000-character screen also provides a graphics capability.

A cursor indicates where the next character will appear on the screen. Tone volume, key click and CRT intensity controls are available for operator adjustment. Audible alarms and error messages bring input errors to the attention of the operator. The 2000-character screen displays prompts and graphics in low intensity and data in high intensity.

Keyboards contain both alphanumeric and control function keys for the keypunch or typewriter style configuration. If desired, different terminal configurations can be simultaneously used on the same system since separate translation tables in the processor memory can appropriately translate input from each keyboard.

The keypunch-style keyboard contains control keys, position keys, shift keys and data keys. The control keys are: ALPHA, ASD/DUP, AUX DUP, ← CHAR, CTRL, DISPLAY, LEFT ZERO, LEVEL, NUMERIC, REC ← FLD, REL, RESET, SKIP and SRCH/CORR. The positioning functions are: character backspace, character forward, field backspace, field forward, record backspace and record forward. The shift keys are: ALPHA and NUMERIC. The data keys include alphabetic, numeric, punctuation and special characters.

The typewriter-style keyboard contains the same basic character set as the keypunch-style keyboard except the numbers are treated as lower-shift characters. Several functions that have dedicated keys on a keypunch are located on the upper portion of data keys.

The PCC 1800 MOD II System will support small- and large-screen CRT's, separately or in combination, up to a total of 64 local 256-character terminals per processor, or a mix of up to 16 local 2000-character terminals and up to 32 local and remote 256-character terminals.

The central processor sequentially polls (addresses) all connected terminals to sense when information (data or control signals) is being entered through a terminal. As information is entered it is processed by the CPU and, when applicable, messages or data are formatted and sent back to the terminal for display on the video screen. CRT refresh memory is contained within each terminal except the local 256-character terminal, where refresh memory distinct from the processor's main memory is housed in the supervisory console.

CRT terminals are designed to be failsafe. If a station is turned off, removed from its multiplexor connection or disabled by a hardware failure, the remainder of the system is unaffected. A duplexor or triplexor controller permits cross-connection of local 256-character terminals between two or three co-located 1800 MOD II supervisory consoles, respectively. Terminal-to-console interchanges are accomplished using toggle switches on the panel of the freestanding duplexor or triplexor.

PRINTERS

The printer controller will support two printers operating concurrently, providing system capability to produce hard copy reports. Formatted reports containing

header and detail information are easily implemented through the use of RPG II procedures. The printer may also be employed as a logging device to provide audit trails of all supervisory activity. User program compile listings may also be output to the printer. An optional printer selection unit permits two co-located PCC 1800 MOD II Systems access to one line printer.

Line printers are available at speeds of 300 or 600 lines per minute. These printers may be installed up to 40 feet from the console. A 160-character-per-second bi-directional serial printer equipped with an electronic vertical forms unit is also available. This printer may be located up to 500 feet from the console. Printer line length is 132 positions, using a 64 character set. Horizontal spacing is 10 characters per inch; vertical is six or eight lines per inch. Paper widths from four inches to 15 inches may be used, printing an original plus up to five copies (four with the serial printer).

Only one TeleBatch function may be included in a dual printer activity.

CARD READER

An optional card reader is supported which permits cards to be input directly to disk via RPG II or input to a mainframe via communications. Standard 12-row, 80-column punched cards are read serially at speeds of 300 or 600 cards per minute.

DATA COMMUNICATIONS

The Data Communications function is provided by an optional TeleBatch Communications System. TeleBatch employs a bisynchronous communications (BSC) controller to allow PCC 1800 MOD II Systems to transmit to, or receive from, other PCC Systems (including PCC 3/5, XL40, XL20 and other PCC 1800 Systems), IBM 2780, 3741/3747, expanded 3741, 3780, 360/20 HASP Workstation, remote key-to-tape devices that offer a BSC compatibility option and IBM 360/370 systems (and other mainframes) using BSC line protocol.

The controller interfaces with the communications line via the EIA standard RS-232-C, utilizing synchronous modems. Binary synchronous protocols are supported in half-duplex mode at speeds from 1200 bits per second up to 9600 bits per second over voice-grade lines and up to 19.2K bits per second over wide-band lines.

TeleBatch operates either concurrently with terminal activity or while terminals are not in use.

SYSTEM BLOCK DIAGRAM

The following diagram shows all major hardware elements of the PCC 1800 MOD II System.

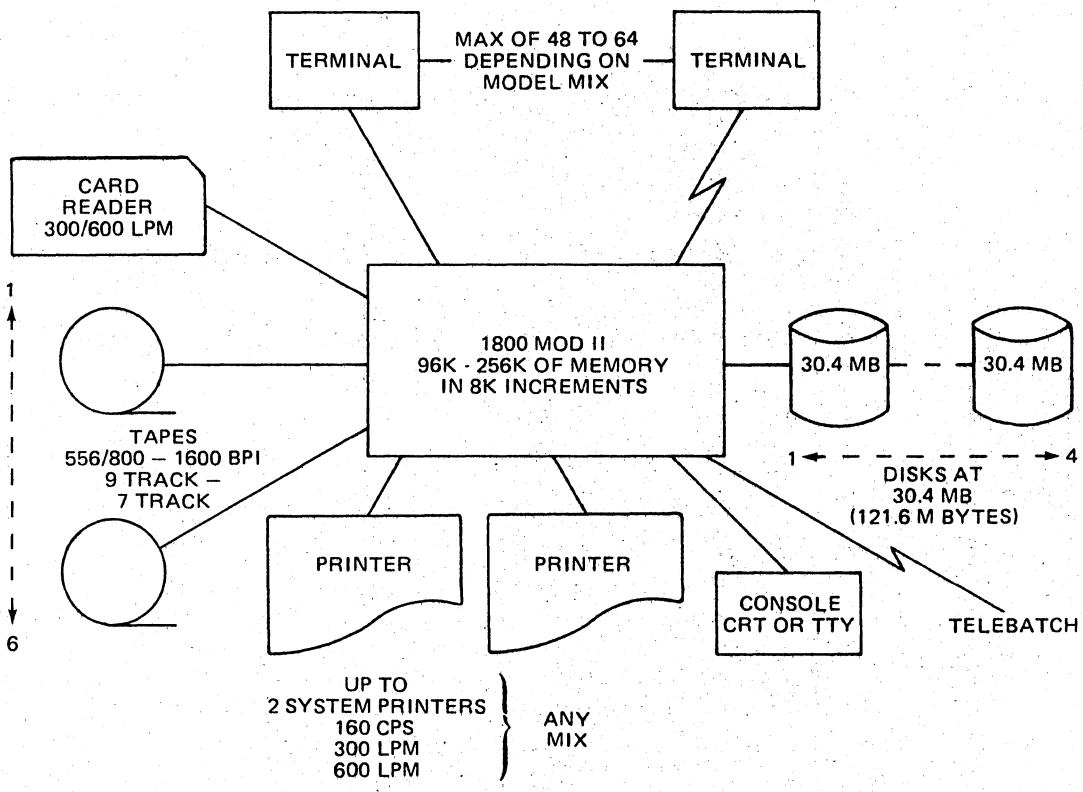

Figure 1. PCC 1800 MOD II System Block Diagram

IV. SOFTWARE

The system software includes the Data Management Operating System (DMOS) and its associated support software, user languages and system application programs.

OPERATING SYSTEM

The Data Management Operating System (DMOS) of the PCC 1800 MOD II is a general-purpose, interrupt-driven, multitasking system with software priority dispatching that monitors, schedules and controls data input, editing and computation; allocation of system resources; file loading, processing and output; program input and compilation; and input/output operations. It also allocates and maintains usage records of the hardware and software resources required by application programs.

DMOS is extremely versatile, permitting concurrent use of all system resources by up to 64 workstations. Not only can terminal operators access the 1800 MOD II System simultaneously via the CRT terminals (either local or remote), but up to six batch processing jobs can be run concurrently with terminal operations.

DMOS is designed to efficiently allocate, schedule and dispatch control of memory and disk resources among many related or unrelated programs being executed at one time. The controlled allocation of resources among several tasks for the data entry, file inquiry, storage, input/output and batch processing facilities of the system helps ensure that as much of the system as possible is always kept busy performing useful work. As a result, the 1800 MOD II sets an industry standard in throughput.

DMOS uses a reentrant code to conserve memory space and to reduce the time needed to access and move routines into memory. Reentrant code is a means of sharing program code common to various routines, allowing many activities to share this coding concurrently without the need to store it in memory more than once.

The system-dedicated portion of DMOS contains all of the elements necessary to provide the aforementioned system monitoring and control. These include routines for control of tasks (data entry, batch processing, supervisory procedures), input/output operations, programs and memory allocation. A series of diagnostic programs is provided for testing of the various input/output devices and the central system by field service engineers.

KOBOL

PCC's Keystation On-Line Business-Oriented Language (KOBOL), a COBOL-like high-level language, is designed specifically for interactive terminal applications, allowing PCC 1800 MOD II Systems to perform terminal transaction editing. By detecting and correcting errors during data entry, KOBOL user programs reduce or eliminate the requirement for editing usually performed by the mainframe computer system.

KOBOL parallels the industry-standard COBOL language convention by grouping English terms into sentence-type instructions, and is used basically to create program modules in the same way as other programming languages. Each statement begins with a verb, and describes some action to be taken. The verbs available for use in format programs are listed below.

ADD	ENTRY	MOVE	SELECT
CALL	EXIT	MULTIPLY	SET ERROR ON/OFF
CANCEL	GET	RANGE	SET FLDFLG ON/OFF
DISPLAY	GLOBAL	RELEASE	SET IND ON/OFF
DIVIDE	GO TO	RETURN	SUBTRACT
END	INITIALIZE	SEARCH	

Additional verbs available for ISAM file management are:

CLOSE	READ	START EQ, GE	UPDATE
DELETE	READ NEXT	START LO	WRITE
OPEN	REWRITE	UNLOCK	

Primary functions of KOBOL are to test the validity — range, discrete value, check digits — of data; to perform arithmetic calculations or extensions; to perform combinations of conditional testing and arithmetic functions, all based on some conditional requirements of the data; and to access resident ISAM master files by primary and up to 16 alternate keys in an inquiry, insert, delete or update activity.

KOBOL statements are entered into the system as data batches. These data batches serve as source programs which are then compiled into object code and stored on disk. Once stored, these programs can be called up from any terminal and remain resident in memory when entry formats specify (under user exits) the need to perform special edits.

Routines that are common to multiple formats being utilized on the system concurrently will be shared by all terminals permitting these routines to be resident in memory only once.

KOBOL exits at batch open time enhance file security at the batch open by permitting the user to program his own password scheme and, at batch close time, provide an indicator for the end-of-batch totals.

The 1800 MOD II provides up to 255 KOBOL modules per entry format, with up to 48K from the KOBOL user areas designated to handle the expanded capabilities.

RPG II

The Report Program Generator, RPG II, is a highly flexible, IBM DOS-compatible, problem-solving language that is easy to learn, use and code. It allows the user to specify many important operations with a minimum of effort by making simple entries on specially formatted coding sheets. RPG II is both relocatable and re-entrant, permitting it to run in a multitasking mode concurrently with terminals on line. RPG II also offers special edit routines and processing and report generation capabilities.

Based on the programmer's specifications, RPG II can generate reports with headings, totals accumulated for specific data groups and predefined spacing. In addition to RPG II's basic report-writing function, it can also handle various types of calculations, update files, perform table lookup operations and accept data from multiple input files. The RPG language also includes the ability to use dual input/output areas and to debug programs at the source language level.

The 1800 MOD II RPG II language also permits the user to create, read from, update or append information to ISAM files, providing an alternate method to the standard file maintenance procedure. In addition, RPG II creates programs using the RPG compiler and link editor, executes the resultant program and maintains the RPG program library. Memory is dynamically assigned as required to execute tasks.

Highlights of RPG II are:

- Reads input data from disk-resident jobs or batches, magnetic tape, punched cards, command console entry or ISAM files.
- Writes output data to tape, disk or printer.
- Updates disk-resident files and ISAM files.
- Creates disk batches, tables, files and printed reports, as well as ISAM files.
- Processes arithmetic operations, relational and conditional tests, data movement, table/array lookup and level control.
- Provides edit checking, balancing and data formatting.
- Provides tape labeling, data formatting and tape transfer; tape packing/unpacking.
- Inserts tape block and header records.

SOFTWARE BLOCK DIAGRAM

The following diagram (Figure 2) details the types of software used by the system:

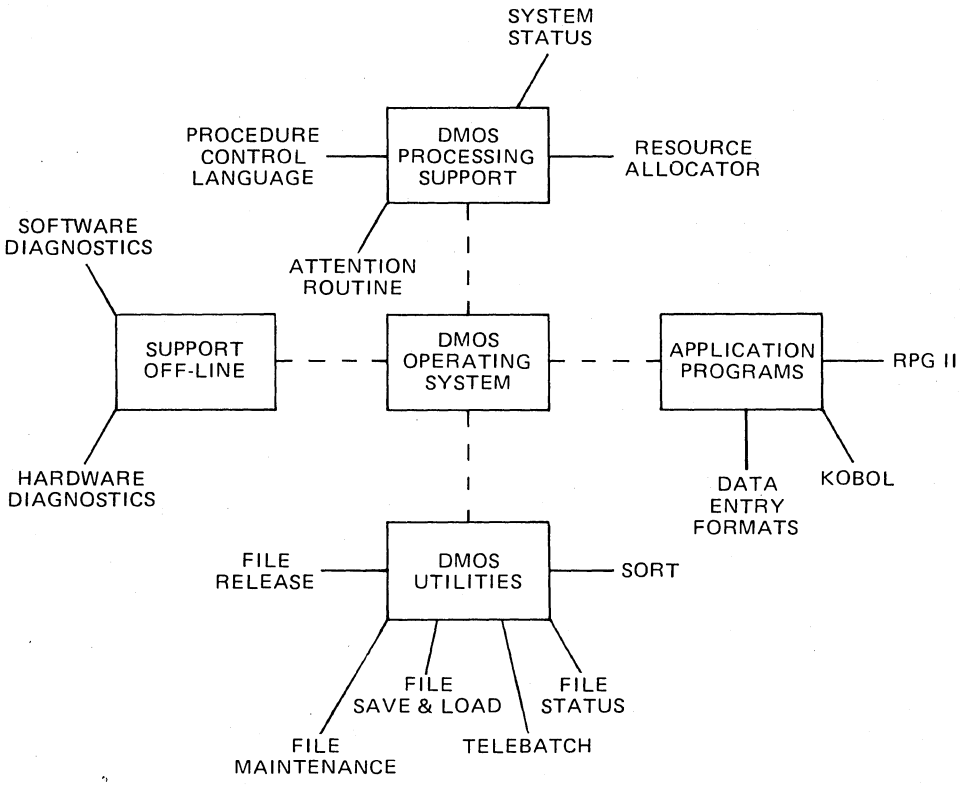

Figure 2. System Software

V. SYSTEM OPERATION

DATA ENTRY

The PCC 1800 MOD II operates as a data accumulator, verifier, retrieval/display system, media converter, data editor and processor in a multifunction mode.

From the keyboard, the operator controls the position within a field, record, level or batch. The operator can backspace or move forward one character, one field or one record. Each terminal can be operated in any of several primary modes, including Write, Verify and Read, or a sub-mode: Append, Display, Correction, Insert and Search.

Data is grouped in fields, records and sequential (data) batches. Data batches are made up of a variable number of data records, up to 1920 characters in length. Records consist of multiple fields. The maximum single field length is 240 characters. The MOD II allows up to 32 levels with 96 fields per level on the 256-character terminal; 255 fields on the 2000-character terminal.

Write Mode

The Write mode is used to create records in a data batch under control of a format. It is the primary means of defining and creating a data batch or adding records to an existing batch. Upon mode initiation, the character index (cursor) is positioned at the first field to be entered. As the operator enters data, the format ensures that all entered data meets the specified validity requirements. Any invalid characters or fields will be reported to the operator; further entry is inhibited until the character or field keyed suits the format. If an error cannot be corrected because the source document is incorrect, the operator can leave the character, field, record or batch in error and proceed to the subsequent data. When this occurs, the operator or system flags the error condition for ease of location in the Verify mode.

Real-time terminal edit checks are performed on the data as it is keyed. Since verification is specified on a field basis, the supervisor can indicate on the entry format sheet that certain fields are to be skipped during verification. The source document data is checked in real time.

As the source document data is entered, terminal edit checks are performed in the following order: field and verify type check; boundary check; auto balance or sequence check; KOBOL; value, range or table check; arithmetic edit check.

Autodup propagation is handled by a Supervisor procedure that restores broken automatic dup chains to their correct state in a batch in which records have been corrected, deleted or inserted.

Read Mode

Read mode permits the terminal operator to read any previously entered data in a batch without changing the data. The Read operator can read backward or forward into the batch.

Verify Mode

During the Verify mode, the data to be verified is displayed as it is keyed. Any terminal can be used as a verifier as well as an entry device. Verification is accomplished under control of the format for the particular job, batch and record. If records are omitted or duplicated, the operator may insert or delete the required records. When the batch being verified contains balance accumulators, all fields which contribute to an in- or out-of-balance condition may be formatted for key or sight verification. Concurrent entry and verification permits high-speed completion of priority jobs.

FILE MANAGEMENT

The PCC 1800 MOD II Data Management Operating System (DMOS) incorporates the Indexed Sequential Access Method (ISAM) of file management to enhance the creation, manipulation and retrieval of files of data records, job names, formats, address assignments, job control blocks, various statistics and system-related file applications.

ISAM is a file management capability which permits the 1800 MOD II user to create and maintain master disk files which may be accessed by the value of index fields within the data records in the master file. Each record contains one primary key and up to 16 alternate keys. Alternate keys are dynamically stored in a single, disk-based index file.

Records in an ISAM file are accessible randomly or sequentially, by primary or alternate key values. ISAM can support individual record updates, inserts and deletions within the file without affecting other records within the file. The ISAM package permits multiple local and remote terminal operators to access a file in either Write or Verify mode. File retrieval is based on ISAM procedures which cut typical search times to an average of 100 milliseconds. KOBOL is used to implement the file retrieval procedures, providing data handling aids and programmed edits designed by the user. RPG II can also be used to access and update ISAM files via the primary key. A file recover/integrity capability allows the system to temporarily store a duplicate of a block or directory entry while updating the original. Upon completion of a successful update procedure, the duplicate original is deleted from disk.

ISAM master files are created by a standard File Maintenance routine initiated by the system supervisor or by a user-created RPG II program, both of which construct indexed sequential disk files from sequential information on tape or in

a data batch. Data records are stored in the file in an ascending sequence according to key values. Alternate key indexes are created via the key extraction task of the File Maintenance procedure and may be output to tape or disk. Alternate key files must be sorted into proper sequence. Header records indicate the records in a particular file are extraction records and identify the primary file associated with the alternate keys.

Initial file load on the system can accept a percent value for projected ISAM file expansion and build master file data on disk in such a manner as to allow for that percent of expansion for each grouping. When a particular group of data is expanded beyond the reserve limits for that group, new disk space is automatically acquired. During ISAM seeks in a concurrent activity, no chaining is required to seek overflow items added to the files. Items deleted from the master file are flagged as nonaccessible.

An unlimited number of files may be constructed within the system's limits. The 1800 MOD II has a capacity of over 700,000 80-character records. Maximum record size ranges from 256 characters up to 7200 characters, depending on the type of record.

A File Release routine is provided to delete primary and alternate key ISAM files.

DATA COMMUNICATIONS

Data Communications tasks are initiated by the system supervisor through the use of the TeleBatch procedure. Binary synchronous protocols are supported in half-duplex mode up to 9600 bits per second for voice-grade lines and up to 19.2K bits per second for wide-band lines. IBM 2780, 3741/3747, 3780, 360/20 HASP Workstation and expanded 3741 protocols are provided. Transmission may be between two 1800 MOD II Systems, an 1800 MOD II System and another PCC System or mainframes and terminals using BSC protocols. Data Communications functions concurrently with all other system activities.

Features supported within the protocols are: standard EBCDIC code transmission, alternate eight-bit transparency transmission for remote job entry and standard IBM 2780-compatible 400-byte transmission buffers, expandable up to 957 bytes.

A high-performance feature is available which provides extended communications features, including data compression of strings of any character, 957-byte dual data buffers and fragmentation.

Tasks to be performed by TeleBatch are contained in a special data batch, the Communications Control Batch (CCB), stored on disk. Multiple CCB's may be run concurrently when the multileaving communications type (HASP) is specified. If more than one file is open, one CCB is required for each open file.

The supervisor begins a Data Communications session by depressing the ATTN key and calling the TeleBatch routine, specifying the device protocol options to be used. Once communications parameters are set, the supervisor establishes a communications link with the remote device, then enters the appropriate dialogue for the run of one or more queued CCB's. Both the transmitting and receiving stations must be observing the identical protocol and options.

In the event of an unrecoverable line error (line noise, loss of connection, etc.), an appropriate error message is displayed at the command console. After an acceptable reconnection with the receiving station has been made, the supervisor again initiates the run. Normally the reconnection with the receiving station is a voice communication, permitting the supervisor to determine at what point transmission was interrupted and to begin the run at a point ensuring full communication of all data in the CCB.

SUPERVISORY FUNCTIONS

The main functions of the system supervisor are system management and data and file management. Many tools are provided which permit the system supervisor to establish system operating parameters, check on system status, monitor system operation and perform other supervisory tasks. Capabilities are also provided to catalog procedures and assign programmable procedures that relieve the supervisor of many repetitive and housekeeping responsibilities involved in monitoring and controlling data input, creating of files, compilation of programs and other data management functions.

System Management

The system management procedures are used to monitor system activities and to control the physical operation of the system. A number of such procedures and a Procedure Control Language are available to the system supervisor to facilitate ease of system operation and control of data, files and statistics. These procedures are initiated at the command console via system control buttons or keys.

RESOURCE ALLOCATOR	Controls allocation of memory and disk resources and system options.
DISK LOAD	Permits supervisor to load the system from disk for off-line or on-line operation (with terminals).
SYSTEM STOP	Provides for the orderly shutdown of the system.
ATTENTION ROUTINE	Permits supervisor to initiate, terminate or modify a supervisory procedure.
HELP	Lists supervisory procedures and reports with their associated call letters.
MLOG	Maintenance Log provides detailed error statistics on the tape, disk and system errors.

MR	Maintenance Report summarizes (counts) system activity on input/output and data communications devices; lists system configuration, options, feature selects, disk configuration.
REC	System Recover aids resumption of normal system operations following power failure or system malfunction.

Procedure Control Language

The Procedure Control Language (PCL) is an easy-to-use, specially designed language for conversational interface with the system. PCL was developed specifically for the PCC 1800 MOD II to enable the system supervisor to invoke procedures and to specify certain parameters for those procedures. As the means of communicating with the system, PCL can be used to display queries, accept and validate responses and to return status information.

This language may be used in three ways: in an automatic interactive dialogue mode where the system queries the supervisory; in a shorthand mode where the supervisor enters a string of responses to anticipated queries; and in a preset mode where responses are stored in a library on disk and invoked as needed. PCL permits the supervisor to specify serial execution of several procedures in a single command.

Attention Routine

The Attention Routine provides the input/output interface between the supervisor and the system and provides the facilities for the supervisor to initiate or modify the operational characteristics of supervisory procedures. Specifically, the Attention Routine permits the supervisor to initiate, terminate, cancel or restart a procedure. It also allows the assignment of procedure priorities so that the system will automatically process queued activities according to the needed priority without supervisor intervention, and the assignment of display devices. In addition, the supervisor may use this routine to close a batch open at a terminal from the command console.

Resource Allocation

The Resource Allocation procedure allows the system supervisor to configure system memory and disk resources in a manner that is most efficient for the user's operating environment. The procedure may be invoked daily at system startup time, permitting the supervisor to allocate or deallocate memory resources to supervisory procedures, terminals, KOBOL user space, format area manager or free memory for processing of data entry input, searches and batch and ISAM files. Disk space may be realigned between portions of disk allocated to direct, sequential (data) files and ISAM files. The versatility of this procedure also permits the supervisor to perform resource reallocation at intervals during the day if the data mix and flow demands it. Terminals may not be active, however. Once the procedures is completed, the memory map module and the disk volume table of contents will reflect the new configuration.

Data and File Management

The data and file management procedures allow the supervisor to control all data within the system. These procedures are initiated at the command console via call letter codes.

ADP	Autodup Propagation restores broken autodup chains flagged by the processor.
CTM	Code Table Maintenance permits supervisor to compile, list or delete code tables.
DI	Disk Initialize enables supervisor to purge and initialize the data area of disk if excessive errors occur.
EFM	Entry Format Maintenance permits the supervisor to compile, store, list or delete formats from the format library.
FCM	Forms Control Maintenance maintains carriage control information for the printers equipped with electronic vertical forms unit.
FLU	File Lock/Unlock permits supervisor to lock/unlock sequential (batch) and ISAM files.
FM	File Maintenance permits supervisor to create ISAM files and indexes as well as alternate key files.
FR	File Release permits the supervisor to delete selected direct, sequential or ISAM files from the disk.
FS	File Status lists current status statistics of specified batches and ISAM files.
FSR	File Save/Reload enables supervisor to save, list, reload all or selected batch or ISAM files from tape to disk or disk to tape. Also system libraries.
JCBM	Job Control Block Maintenance procedure permits the supervisor to create, modify, list or delete a Job Control Block (JCB) from the JCB library.
OH	Octal/Hexadecimal tape dump reads encoded information, printing or displaying tape contents in octal or hexadecimal format.
PSM	PRESET Maintenance permits the supervisor to create, modify, list or delete strings of preset instructions for system or supervisory activity from the PRESET Library.
SFM	Statistics File Maintenance preprocesses job and operator activity statistics for use in reports run by RPG II.
SORT	Sort/Merge sorts from one to seven batches into a single output batch in ascending or descending order; EBCDIC or ASCII sequence.
SR	System Reload reads contents of a system save tape onto the disk.
SS	System Save writes contents (batch data, libraries, system software) of disk onto magnetic tape.

SYS	System Status lists current status statistics of each active CRT terminal, disk, or peripheral, or of memory.
TCV	Tape Copy/Verify permits tape-to-tape copy operation or verification against a master tape.

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Printed in U.S.A.