

Rank Xerox 530 Computer



Introduction

The Rank Xerox 530 is a low-cost, microprogrammed, 16-bit computer for both scientific and commercial applications.

Software for the Rank Xerox 530 is compatible with that used on the highly successful Rank Xerox Sigma 3 computer. Operating under the Real-Time Batch Monitor (RBM), the 530 handles multiple real-time jobs in the foreground while concurrently running general-purpose batch programmes in the background. This complete set of proven, available software includes such versatile compilers as ANS FORTRAN IV and RPG (Report Programme Generator) in addition to an array of service routines and utilities.

Rank Xerox 530 features allow the user to get the job done in the most efficient and productive way. Standard features include memory protection, sixteen input/output channels on a separate I/O processor, six general registers, extended arithmetic, comprehensive instructions, automatic fault detection, remote assistance interface, and much more. Floating point and field addressing instructions are optional.

Multi-use capability, proven software, big-machine features and high availability at a low cost...that's the 530.



Introduction

The Rank Xerox 530 is ideal for the small-computer user who needs the functional capabilities and features of a big-computer system. Operating under the field-proven Real-Time Batch Monitor (RBM), the Rank Xerox 530 keeps a combination of real-time and general-purpose batch jobs running at the same time. Enhanced reliability and maintainability features provide a level of system availability which is unique even in the higher priced systems. When it comes to price/performance, the Rank Xerox 530 is in a class by itself—here are some of the big reasons why:

Field-proven software

Extensive user support services. RBM has extensive user support services such as memory conservation, file management, re-entrant service routines, operator controls, job accounting and system integrity.

Multi-use capability. RBM provides concurrent batch-processing and real-time capabilities on a minimal hardware configuration – maximises CPU utilisation and optimises price/performance.

Powerful processors and utilities. Under RBM, a wide range of industry accepted processors and utilities are offered including Extended Symbol, ANS FORTRAN IV, RPG, Scientific Sub-routines, DEBUG, and SORT.

Advanced hardware

Multi-bus system. Multiple access paths to the memory system with independent asynchronous I/O processors combine to provide a true multi-bus system.

Multi-level interrupts. Sixteen standard interrupts are provided with the system and are expandable in two groups of 12 for a total of 40.

Real-time clocks. Two real-time clocks are standard with selectable frequencies including a user supplied frequency source.

Memory protection. Protects real-time programmes against destruction or alteration by an unchecked background programme.

Six general registers. Any of the six general registers can be operated on by load, store, add, subtract, logical and, or compare instructions.

Power fail-safe. Provides safe shutdown in event of power failure and resumption of processing when power returns.

Comprehensive instruction set. A comprehensive repertoire of instructions to provide effective and efficient use of the 530 hardware.

Floating point arithmetic (optional). Provides increased computational speed for scientific problems.

Field addressing (optional). Allows the addressing of a field of up to 16 consecutive bits without regard to either the location of the field within a memory word or to memory word boundaries.



Reliability and maintainability

Large circuit boards. Eliminates a large number of cables, wires, and connectors which can typically cause system failures.

Rank Xerox assist programme. Provides at no cost to the user remote assistance through a communications link to the operator's console.

Error detection hardware. Automatically alerts the operating system so that appropriate recovery and/or logging can be initiated.

Error logging and analysis. Operating system logs all detectable hardware and software errors and saves the data for further analysis.

Dump analysis programme. Contents of memory can be dumped into a RAD/disc in order to show the environment of the system at the time of failure.

Micro-diagnostics. Implemented through the use of micro-programmed control memory, these diagnostics are implemented in three parts: load, basic processor and Input/Output processor tests.

Load and go diagnostic system. A set of comprehensive unit diagnostics which are designed to reduce the time required to initialize and interpret failure information used for preventive and corrective maintenance.

Load and go system exerciser. A stand-alone programme which provides a tool for total system verification.

Hardware

Introduction

The hardware design for the Rank Xerox 530, implemented using LSI, MSI, and micro-programming techniques, is aimed at two major objectives:

1. provide a highly reliable, multi-use system at the lowest possible cost;
 2. provide a maximum of flexibility and expandability.
- Throughout, the Rank Xerox 530 design emphasis has been placed on features that provide efficient, concurrent real-time and batch capabilities. These features include high-speed memory, multi-access paths to memory, complete system protection, flexible addressing, comprehensive instructions, and a powerful interrupt system.

The Rank Xerox 530 is modular and can be easily expanded in the field by adding memory, input/output channels, peripheral equipment and central processor options.



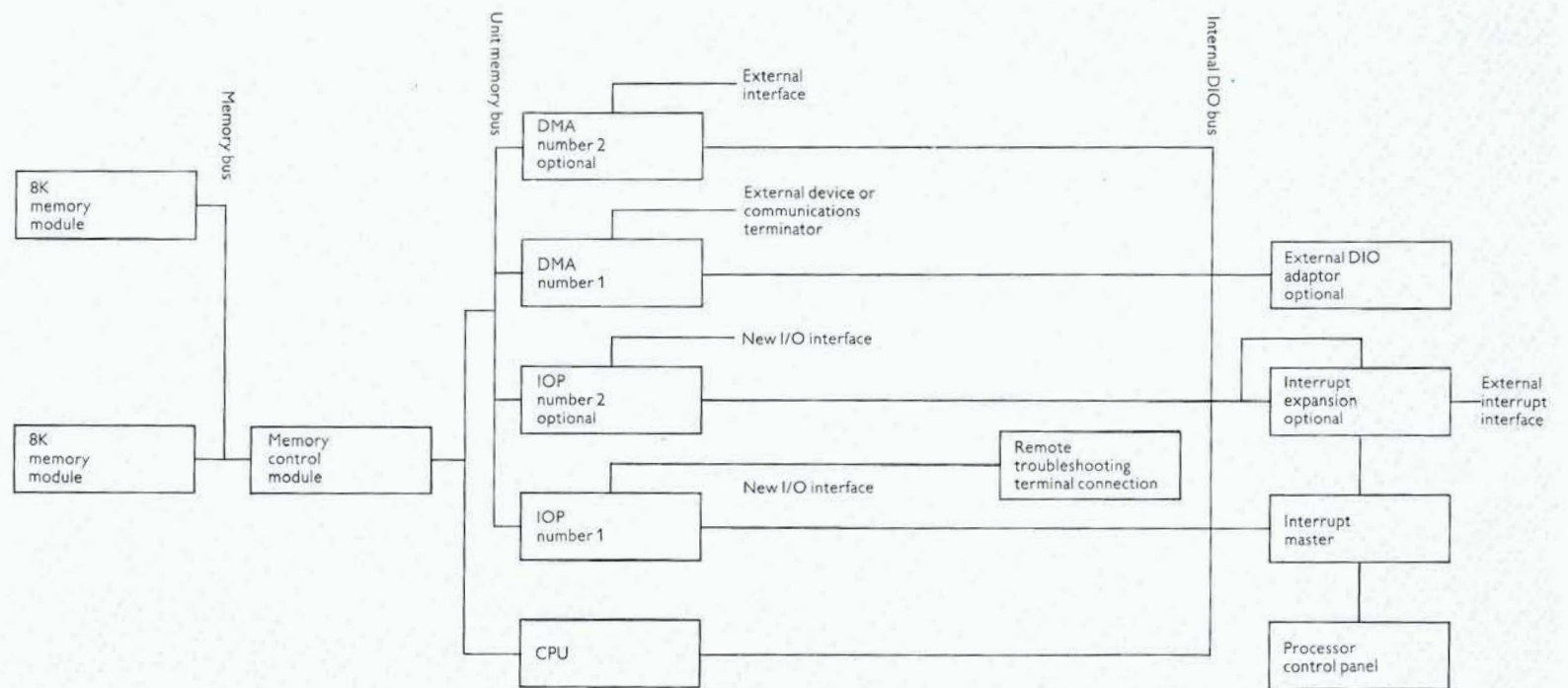
Memory

The Rank Xerox 530 memory is word oriented with each word consisting of 16 bits plus 2 parity bits. Memory cycle time for a 16-bit word is 800 nanoseconds. Memory access time is only 480 nanoseconds. Available in 8K word increments, memory can be field expandable from 8K to 64K words in a single bank. Multiple access paths to memory are provided through independent asynchronous I/O processors.

Memory access paths

As shown in the diagram, there are three main busses in the system: the Memory Bus, the Unit Memory Bus, and the Internal DIO Bus. The memory bus connects the memory control to all memory modules. The unit memory bus is used for memory addresses and data by all units that require direct access to memory with the exception of the CPU. The internal DIO bus provides control intercommunication between the CPU, interrupt system, External Interface Feature, IOPs, and Direct Memory Adapters (DMA).

Rank Xerox 530 memory access paths



Input output processors

Input/output processors are capable of high volume data I/O operations where simultaneous computing is required.

The IOP is composed of channels that operate asynchronously with one another and the processing unit in providing data transfer/communication between various types of I/O devices and memory provided the peak transfer rate does not exceed the capacity of the IOP. Each channel, instructed by its own I/O control double-word, can govern a data transfer operation between storage and a selected I/O device. The IOP interface provides lines through which peripherals are connected and provides lines for data exchange between peripherals and the IOP.

IOP 1 is capable of handling 16 channels. IOP 2 (optional) handles an additional 12 channels.

Direct memory adapter (DMA)

A DMA is a 16-bit synchronous direct memory interface. It provides direct data interchange between the user's external devices and the 530 main memory at a high data transfer rate (2660K bytes/sec) for specialised applications. It consists of data lines, parity, address lines, control lines, and status lines.

The Rank Xerox 530 system architecture uses a Unit Memory Bus to memory which consists of four memory access paths in addition to the CPU memory access path. In this way memory is addressed identically through the memory access paths and only one memory access may take place during any instant of time. Each DMA (maximum of two) uses one of the memory access paths on the unit memory bus.

Extended arithmetic capability

The extended arithmetic feature available with the 530 contains the multiply and divide, double word arithmetic and compare, multiple register move and general register instructions.

To use any double word, multiple word, or general register commands, a Read Direct instruction is executed. This sets the next instruction to the multiple mode. After one instruction, the CPU automatically goes back to normal mode.

Double word integer arithmetic and compare operations are possible with the multiple precision feature. Add, subtract, and compare instructions operate with double words when set to the multiple mode. Multiple register load and store, handling up to six sequential registers, is possible when set to the multiple mode. Foreground overhead is shortened by allowing register saves and restores to be completed in four instructions.

The general register instructions have the capability of using all six general registers to execute single precision Load, Store, Add, Subtract, And, and Compare.

Real-time clocks

Two real-time clocks permit programmes tied to interrupts to be initiated and timed on different bases. Time critical operations can be monitored on an elapse time basis, since the programme is signaled by priority interrupt.

The first clock is hardwired to 500 Hz; the other can be set to one of four frequencies via switches. Standard selectable frequencies are 2000 Hz, 8000 Hz, equal to the site's power frequency (50 or 60 Hz, or a special user supplied external frequency.

Memory protect

The standard memory protection feature allows the monitor to prevent an untested background programme from accidentally destroying the foreground. A background attempt to write or execute instructions in the foreground, or execute privileged instructions, triggers the protect interrupt.

Power monitor

Power monitor is another standard feature which monitors transient conditions in the commercial power network which may cause unreliable operations. The power monitor feature detects these conditions and causes either a power-off or power-on interrupt to initiate save or restore. Note, however, that data may be lost from an active I/O operation. With this feature, general registers and interrupt status can be saved through the operating system which provides the software to save and restore the system thus minimising lost data and system down time.

Multilevel priority interrupt

The Rank Xerox 530 provides 16 interrupt levels as standard with the central processing unit. Ten are reserved for system use (clock interrupts, power on/off, etc.) and 6 external levels are available for user applications. When an interrupt occurs, its source is identified and its priority in relation to other currently active interrupts is determined rapidly and automatically by the hardware. Because these functions need not be programmed, interrupt routines occupy minimum space and require shorter execution times.

Three levels of control are provided by the interrupt system permitting dynamic reassignment of priorities with complete flexibility. Each interrupt level can be individually armed/disarmed, enabled/disabled or inhibited under programme control.

The Rank Xerox 530 can trigger any interrupt level with a single instruction. This feature is especially useful when it is necessary to write programmes to interact with special equipment that uses interrupts, before that equipment is actually available, since it allows small routines to stimulate the special equipment for programme debugging.

Interrupt triggering is also useful in establishing a hierarchy of interrupt responses. A high-priority routine can complete the urgent part of its processing and subsequently trigger a lower-priority interrupt to defer the less urgent part. This technique permits faster servicing of intermediate-priority interrupts.

Keyboard printer control

The keyboard printer control provides a means of connecting the local operator keyboard printer to the Central Processor. Additionally, it provides a means of connecting a remote terminal via telephone lines to the CPU for remote assistance.

The keyboard printer control provides all the interface and control to operate the local operator keyboard printer. Additionally, it provides a communication interface which is independent of the presence or absence of any other communications equipment in the system. The communications interface is used to implement the remote assistance capability of the 530 system.

Introduction

Rank Xerox 530 programming systems are completely compatible with that of the Rank Xerox Sigma 3 computer. This field proven software reduces the user's operating costs by greatly simplifying his programming and operating procedures. The user can focus his attention on the problem to be solved because the Rank Xerox-supplied programming system automatically perform many routine programme-writing functions and free him from concern with hardware details. With the 530, the user has the ability to expand his system in terms of memory, peripherals and optional features in order to meet his growth requirements. For example, a minimum Batch Control Monitor (BCM) system with 8K memory can be easily upgraded to a larger Real-Time Batch Monitor (RBM) system. Following this, the minimum RBM system can be easily expanded to the maximum RBM configuration. And processors like ANS FORTRAN IV and RPG provide for an easy transition to larger Rank Xerox computers.

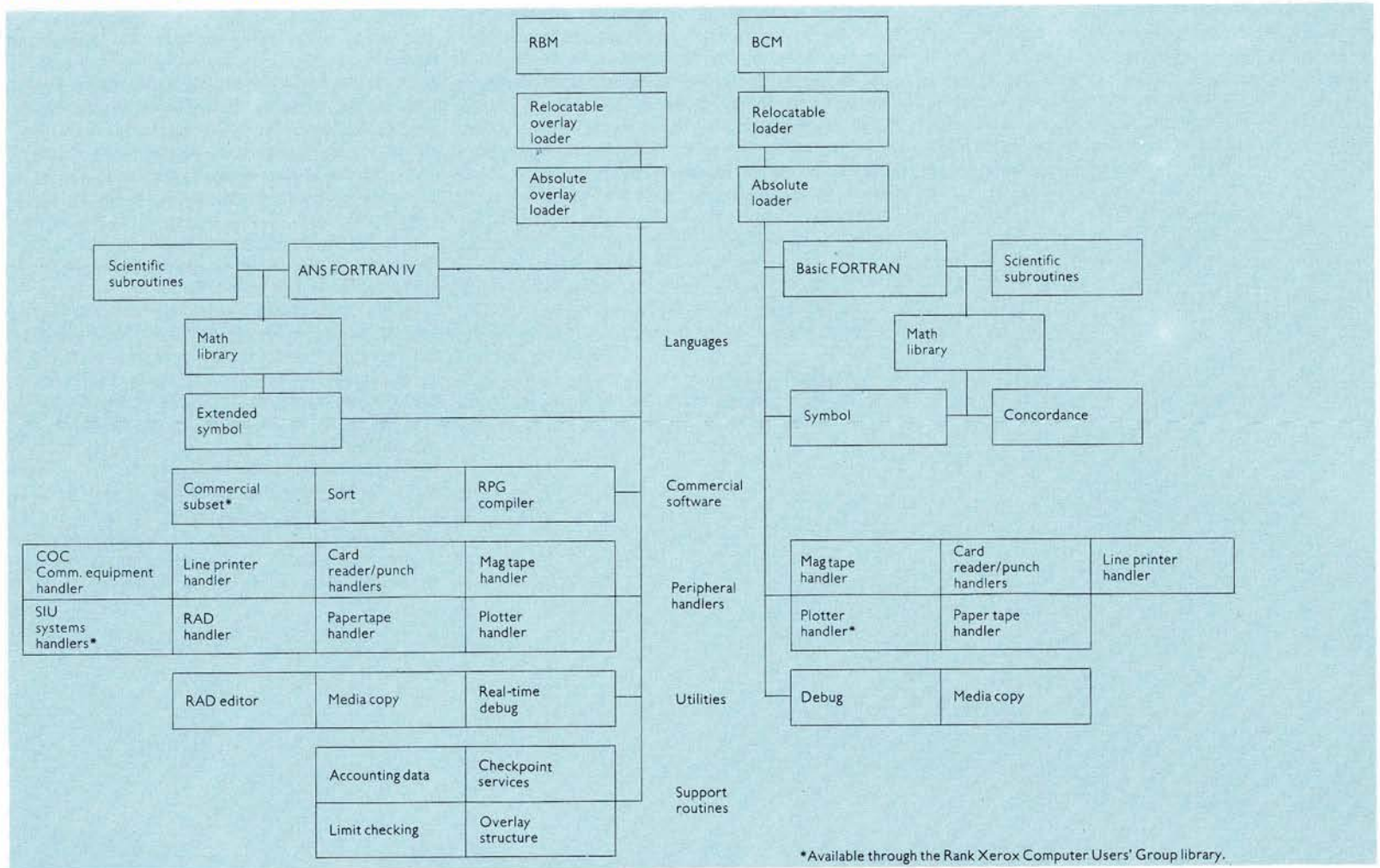
Operating systems

Real-time batch monitor (RBM). RBM is a unique monitor for a 16-bit machine. It offers services and languages that are generally available only on larger computers. It takes maximum advantage of its mass storage design to offer such features as concurrent operations, non-resident real-time programmes, foreground/background overlays, and the ability to utilise background memory when needed for real-time programmes (checkpoint). The RBM software co-ordinates foreground and background workloads for maximum

concurrency of operations and maximum throughput. As shown in the accompanying Rank Xerox 530 programming systems diagram, the monitor provides a large complement of language sub-systems, handlers, utilities, and support routines. RBM requires only 4K to 6K words of memory, although it includes approximately 25,000 instructions. It achieves this compactness by an elaborate overlay technique. The speed of RAD/disc storage where RBM resides allows this monitor overlay technique to operate efficiently and effectively.

Rank Xerox 530 software operating under RBM

Rank Xerox 530 software operating under BCM



Typical RBM services

Mnemonic	Name of Command	Services performed
M:SEGLO	Segment load	Calls in overlays in both background and foreground.
M:READ/M:WRITE	Read/write	Read locates and reads a record on a specified logical device (in the case of the RAD, a dictionary is accessed). Write writes records on a specified logical device (in the case of the RAD, a dictionary is accessed).
M:CTRL	Control	Positions sequential files (e.g., RAD and magnetic tape).
M:CKREST	Checkpoint/ restart	Checkpoint allows all background I/O, to be completed, at which point it saves machine context and transfers entire background to the RAD. Restart reads the previous background back into memory, and restores machine context. Background processing is restarted at point of checkpoint.
M:COG	Communications handler	Handles communications I/O, accumulating data in unique buffer areas for each input line and directing output to proper output line. Recognizes and responds to communications control codes.
M:LOAD	Load	Calls in a foreground programme from the RAD for execution. Programmes are loaded and executed in the order in which they are requested. Via this command, one foreground programme can initiate another.
M:RSVP	Reserve peripherals	Dedicates a specified peripheral for use by real-time programmes only.
M:ASSIGN	Assign a peripheral	Relates a logical I/O unit to an actual (physical) peripheral, or to a particular RAD file.

Typical commands for RBM operator communication

RBM provides a number of commands that allow the operator to control the background process and selected portions of the foreground process. Following are typical examples of these operator-communication commands.

Command	Foreground or background process	Functions performed
C:Connect	Foreground	Allows operator to trigger a real-time process.
Q:Programme name Q:Queue a programme	Foreground	Allows operator to call in a foreground programme for execution.
DE:Debug	Background	Allows operator to initiate operation of the Real-Time Debug programme.
UL:Unload	Foreground	Allows operator to force termination of a nonresident foreground programme.
FG:Foreground	Foreground	Allows a background programme that has been assembled and debugged to be transferred to the foreground.
SY:System	Background	Allows a background programme to modify a system RAD file. System files cannot be modified except through use of this command.
KP:Keyboard/printer	Background	Tells the Monitor to begin reading control commands from the keyboard/printer.
W:Wait	Background	Temporarily suspends the current background programme.
S:Start	Background	Causes background programme to resume execution.
X:Abort	Background	Aborts the current background programme.
DM:Dump memory	Background	Causes a specified portion of memory to be written out to a selected diagnostic peripheral.
DS:Device substitution	Foreground or background	Changes the device address from its SYSGEN assignment.
RA:Remote arm	Background	Permits dial-up connections for remote field-engineering trouble shooting.

For both real-time and background users

Certain basic characteristics of RBM contribute equally to both real-time and background (batch) operations. For example:

Extensive RAD and disc management capabilities, including an Editor, are provided. All files are addressed by file name, not by absolute location. Files can be written in several modes: compressed or expanded, sequential or random. Various levels of Write protection can be specified for any named file.

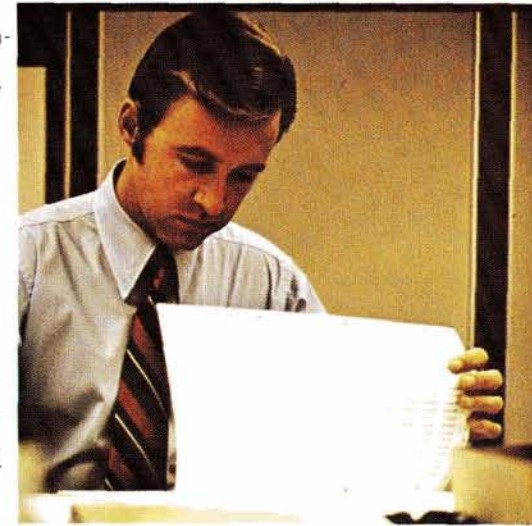
Full overlay services are provided. All types of programmes—real-time, system, and batch—can be segmented into an overlaid tree structure; segments are then called into core and dismissed as needed. Absolute and relocatable loaders provide for specification of these overlay structures. RAD/disc speed allows this technique to be used with little loss in efficiency. A System Generation (SYSGEN) facility allows the user to generate an operating system tailored to his own installation.

RBM input/output is device-independent. All I/O commands may be directed to a logical I/O unit; actual assignment of logical I/O units to physical devices (line printers, teletypewriters, card equipment, etc.) is under control of system generation (SYSGEN) as well as the operator. Therefore, no programme need be dependent on a particular configuration of peripheral units.

A Real-Time Debug package allows debugging of foreground or background programmes without compromising the security of the foreground area thus greatly reducing programme checkout time.

Core-resident public library facility allows any user or system library routine to be permanently imbedded in the resident operating system.

Memory-Protect feature assures system integrity. Real-time programmes, as well as the operating system itself, are completely protected from batch jobs. Privileged instructions can only be executed in protected memory.



For real-time users

In a typical foreground/background processing environment, foreground tasks are assigned individual priority levels and subsequent scheduling is done by hardware without the need for programme intervention. Real-time operations are facilitated by the following RBM features:

Real-time programmes can be either resident or non-resident; if non-resident, they are called in and released as required.

Real-time programmes can be initiated by external events, by the operator, by request from the batch job stack, or by a real-time clock.

Real-time programmes can initiate other real-time programmes or background jobs, and they can communicate via common areas.

Multiple real-time tasks can be processed concurrently. Re-entrant monitor services and public library are available to the real-time user.

Checkpoint capability makes background memory available to a foreground programme that requires more core than is normally allocated to the foreground area.

Peripherals can be dedicated to real-time tasks.

Character-Oriented Communications (COC) handler is provided for use with data communications devices utilizing both half- and full-duplex lines.

I/O queueing and task dismissal providing complete system utilisation.

For background users

The following RBM features are of special value to background (batch) users:

A job accounting facility provides a running log of system utilization and a permanent log of utilization by name and account.

Batch jobs will run continuously with little or no operator intervention.

Language subsystems including ANS FORTRAN IV, EXTENDED SYMBOL and RPG are provided, as well as peripheral handlers, utilities, and support routines.

Temporary scratch files in the RAD are available to the background programme.

Reliability and maintainability

Introduction

To provide a high level of availability, a comprehensive set of features is included in the Rank Xerox 530 for fault detection, recovery, logging, and diagnosis. Extensive fault detection circuits are provided throughout which include such features as parity checking on address and data information for main memory operations as well as for read-only memory used in the micro-instruction control logic; internal and external interface timeouts; checking of IOP data paths; and many others.

Fault register

A unique hardware fault register is also provided which automatically collects fault status and alerts the monitor (e.g., RBM) via the machine fault interrupt. Once the monitor has retrieved the contents of the fault register, appropriate subroutine can be called on to perform recovery and logging procedures. The fault register contains status which both isolates the faulty unit and identifies the specific nature of the fault. In addition, the contents of the fault register may be displayed on the processor control panel.

Error log

An error log file (such as under RBM) can save a history of all fault occurrences including those reported by the fault register, by input-output status, as well as various software checks. The error log is a powerful tool in the early identification and repair of intermittent problems before they lead to catastrophic results. The error log can be accessed in various ways both locally at the site, and by experts located remote from the system but connected to it by means of a communications interface.

Remote assistance

Every system will be provided with, at no cost to the user, a special remote troubleshooting communication interface independent of any other communications equipment. This enhances system availability by allowing diagnosis of the error log to proceed simultaneously with system operation, or by enabling a diagnostic session to be conveniently scheduled so as not to preempt user's time. These functions can be accomplished as a low-priority background job.

Remote assistance communications interface



Diagnostic programmes

In addition to the error log as a diagnostic tool, there are three basic levels of diagnostic programmes provided for the Rank Xerox 530.

The first level is a "micro-diagnostic", which tests the basic data and control paths. This diagnostic is permanently stored in read-only memory and is initiated automatically as a part of the load sequence. Faults detected during its execution are clearly displayed on the processor control panel.

The second level is a set of unit diagnostics which have as their objective fault isolation to the smallest set of replaceable elements. These are provided for the CPU, memory, IOPs, and each peripheral. Special test instructions and features are provided that assist in the isolation process.

The third level is a system exerciser.

System exerciser

A system exerciser is provided which activates units in the system in order to verify their proper operation or to rapidly converge on a unit which is exhibiting subtle or infrequent fault characteristics.

The error log, unit diagnostics, and the system exerciser make use of improved user interface protocols, and all may be accessed or controlled remotely as well as locally.

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Applications

Introduction

The Rank Xerox 530 performs best in situations that demand the most from a computer in a multi-use environment. It provides fast response to such real-time events as controlling machinery or processes and monitoring and guiding experimental procedures. At the same time it provides a powerful batch processing capability for a number of different business, scientific and specialised applications.

Most users take advantage of both the real-time and batch capabilities. Rank Xerox helps them do this by providing total hardware/software support, including the powerful Real-Time Batch Monitor and versatile compilers such as RPG and ANS FORTRAN IV.

Hundreds of Rank Xerox multi-use systems, at work in applications similar to those shown here, have established Rank Xerox as the world leader in the real-time computing field. The Rank Xerox 530 offers the low-cost computer user the power and versatility which such applications require.

General-purpose

Fortran Shop, Civil Engineering, Circuit Design and Analysis, Statistical Analysis, Forecasting, Inventory Control, Architectural and Consulting Engineering, Payroll, Accounts Receivable.

Biomedical

Physiological Monitoring, Hospital Accounting, Clinic and Research Laboratory Computerisation, Analysis Mathematical Models, Multiphasic Health Screening, ECG Analysis.



Education

Teaching of Computer Sciences, On-Line, Real-Time Monitoring and Control of Laboratory Experiments, Business Data Processing, Student Use in Solving Homework Problems.

Radar

Precision Tracking, Target Identification, Impact Prediction, Coordinate Transformation.

Communications

Store-Forward Message Switching, Remote Information Retrieval and Update, Remote Data Display, Data Concentration, Order Entry, Data Collection.

Simulation

Aircraft and Missile Simulation, Pilot Training, Fire Control Officer Training, Direct Digital Control, Test Report Generation, System Analysis and Parameter Optimization, Hybrid Computation.

Nuclear physics

Reactor Monitoring, Film Scanning, Pulse Height Analysis, Spark Chamber Data Analysis, Instrument and Reactor Control.

Telemetry

Data Conversion, Data Editing, Data Compression, Data Quality, Data Display.

Analytical and scientific laboratories

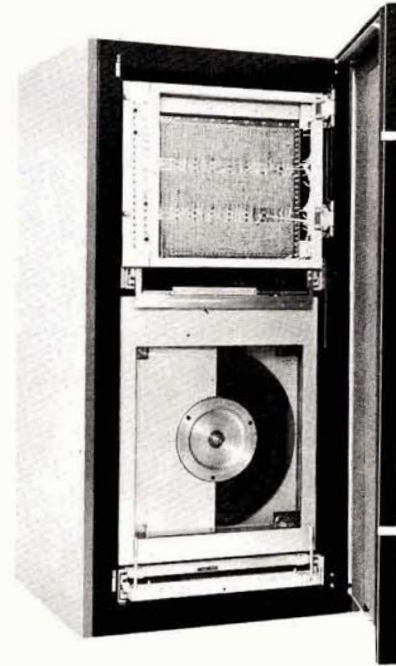
Gas and Liquid Chromatography, Mass Spectrometry, X-Ray Diffractometry, Nuclear Magnetic Resonance Spectroscopy.

Industrial

Process Control, Process Monitoring, Automatic Testing and Checkout, Environmental Control, Accounting, Inventory Control.

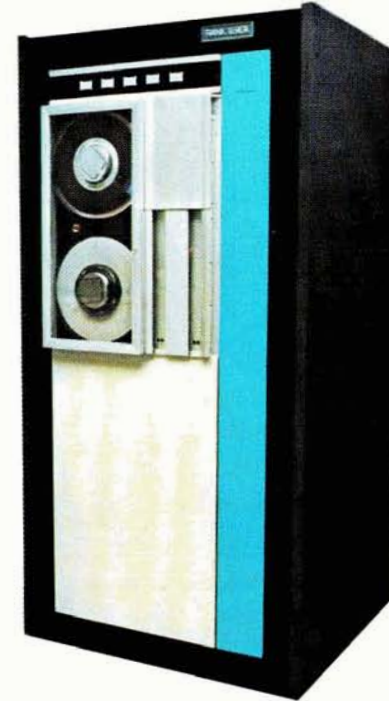


Rapid access data (RAD) files



Rapid access data (RAD) files. Capacities to 6.2 million bytes per unit; transfer rates of three million bytes per second; average access times from 17 milliseconds.

Magnetic tape units



Magnetic tape units. 7-track and 9-track systems, IBM compatible; 3-track units operating at 45 inches per second with transfer rates up to 36,000 bytes per second (above); and at 75 inches per second with transfer rates up to 60,000 bytes per second; and high-speed units operating at 150 inches per second with transfer rates up to 120,000 bytes per second.

Line printers, Data communications equipment



Line printers. Fully buffered with speeds from 135 up to 1,500 lines per minute; up to 132 print positions and up to 64 characters.

Data communications equipment. Complete line of character-oriented and message-oriented equipment to connect remote user terminals (including remote batch) to the computer system via common carrier lines and local terminals directly.

Introduction

A wide range of standard and special-purpose peripheral equipment is offered to meet the user's cost and performance requirements.

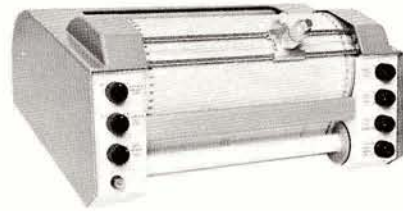
Keyboard/printer, Paper tape equipment



Keyboard printers. 10 characters per second; also available with paper tape reader (20 characters per second) and punch (10 characters per second).

Paper tape equipment (not shown). Readers with speeds up to 300 characters per second; punches with speeds up to 120 characters per second.

Graph plotters, Card equipment



Graph plotters (top). Digital incremental, providing drift-free plotting in two axes in up to 300 steps per second at speeds from 30 millimeters to 3 inches per second.

Card equipment (bottom). Reading speeds from 200 up to 1,500 cards per minute; intermixed binary and EBCDIC card codes.

Removable disc storage



Removable disc storage. Capacities from 24.5 million to 196 million bytes, transfer rate of 312,000 bytes per second, average access time of 87.5 milliseconds.

Cartridge disc system 4.6M bytes



Rank Xerox cartridge disc. Provides for 2.3 to 9.2 megabytes of secondary storage with a 70 millisecond average access time and a transfer rate of 195,000 bytes per second.

Systems capabilities

Introduction

The Rank Xerox Applied Technology Group provides complete system support, from concept through design, production documentation, installation, maintenance, and facilities management.

Successful real-time, on-line systems require more than a highly efficient systems-oriented computer; they need hardware and software capable of interfacing the computer with input/output devices, and capable of dealing with many kinds of information formats. In developing such systems, the degree of Rank Xerox Systems Organisation involvement is negotiable on any specific contract; however, there are definite advantages to the customer in allowing Rank Xerox to take total, single-source responsibility for the entire system. These advantages include assurance of highest performance standards, greater confidence in the implemented solution, lower operational and maintenance costs, maximum system availability, and prevention of premature obsolescence.

System interface units (SIUs)

In many cases, a system can be satisfactorily implemented using standard off-the-shelf components. Rank Xerox 530 customers preferring to take this approach will find their task greatly facilitated by the standardized System Interface Units available from Rank Xerox. A wide selection of these off-the-shelf, modular units is provided, meeting the requirements for many types of special-purpose systems without the need for special engineering. SIUs, which connect analogue and digital I/O devices to the system, are designed to take advantage of the advanced Rank Xerox 530 input/output structure.

Specific benefits derived from using SIUs include:

Lower cost. User costs to perform each function are lower because these are standard units which are in full production.

Ease of Design. Because flexible performance is available in a wide variety of operating modes, the user can design his own system faster and more simply.

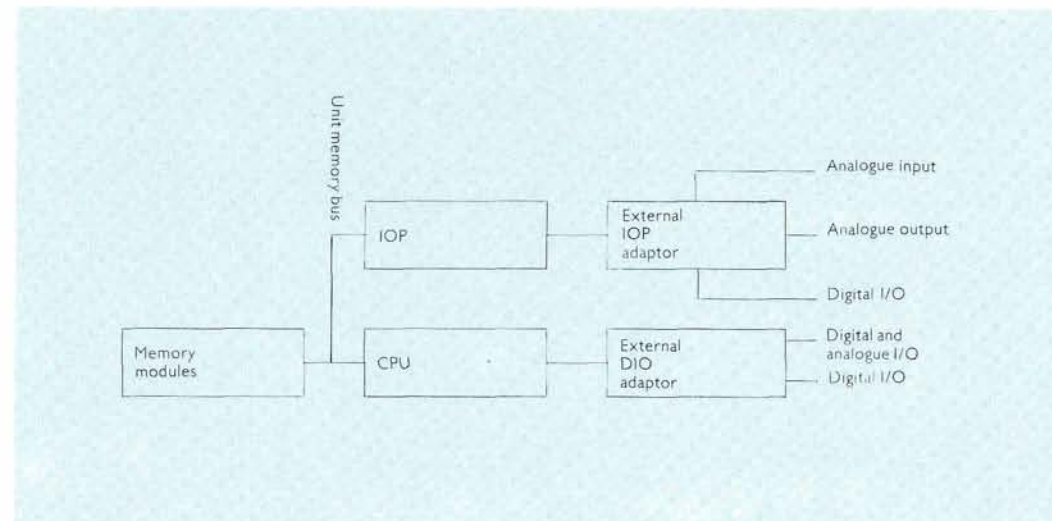
Ease of Maintenance. A full range of standard diagnostic and check-out programmes facilitate SIU maintenance.

Extensive Documentation. Thorough and accurate documentation is available to the user before hardware is installed.

Greater Flexibility. Rank Xerox engineers thoroughly research the design of these units, with special emphasis on their interaction with other system elements. Future expansion or change is simplified, with minimum cost to the user and minimum disturbance to the operating system.

SIU Software support

A complete selection of diagnostics and handlers are provided by Rank Xerox to support SIUs. Diagnostic software includes analog calibration and checkout programmes, as well as input/output handlers. These handlers, available through the Rank Xerox Computer User Group library, are written in re-entrant code and are FORTRAN callable.



Typical Rank Xerox 530 interface configuration

Instruction list

Memory reference

LDA	Load Register A
STA	Store Register A
LDX	Load Index
ADD	Add
SUB	Subtract
AND	Logical And
IM	Increment Memory
S	Shift (General)
SARS	Shift Arithmetic Right Single
SARD	Shift Arithmetic Right Double
SALS	Shift Arithmetic Left Single
SALD	Shift Arithmetic Left Double
SCRS	Shift Circular Right Single
SCRD	Shift Circular Right Double
SCLS	Shift Circular Left Single
SCLD	Shift Circular Left Double
CP	Compare
B	Branch

Conditional branch

BAN	Branch if Accumulator Negative
BAZ	Branch if Accumulator Zero
BEN	Branch if Extended Accumulator Negative
BNO	Branch if No Overflow
BNC	Branch if No Carry
BIX	Branch on Incrementing Index
BXNO	Branch on Incrementing Index and No Overflow
BXNC	Branch on Incrementing Index and No Carry

Copy

A one-word copy instruction specifies operations between any two general registers.

RCPY	Register Copy
RADD	Register Add
ROR	Register Or
REOR	Register Exclusive Or
RAND	Register And
RCPYI	Register Copy and Increment
RADDI	Register Add and Increment
RORI	Register Or and Increment
REORI	Register Exclusive Or and Increment
RANDI	Register And and Increment
RCPYC	Register Copy and Carry
RADDCC	Register Add and Carry
RORC	Register Or and Carry
REORC	Register Exclusive Or and Carry
RANDCC	Register And and Carry
RCLA	Register Clear and Add
RCLAI	Register Clear, Add, and Increment
RCLAC	Register Clear, Add, and Carry
MUL	Multiply
DIV	Divide

Read direct

The Read direct instruction generates a set of control or non-arithmetic instructions that may be comprised of 16 subsets of instructions (one subset of instructions for each mode or for each portion of the computer system).

General register

LW	Load Word
STW	Store Word
AW	Add Word
SW	Subtract Word
AND	Logical And
CW	Compare Word

Multiple register

LDM	Load Multiple
LDD	Load Double
STM	Store Multiple
STD	Store Double
DAD	Double Add
DSB	Double Subtract
CPD	Compare Double

Floating point (optional)

FLD	Floating Load
FST	Floating Store
FAD	Floating Add
FSB	Floating Subtract
FMP	Floating Multiply
FDV	Floating Divide
FCP	Floating Compare

Field addressing (optional)

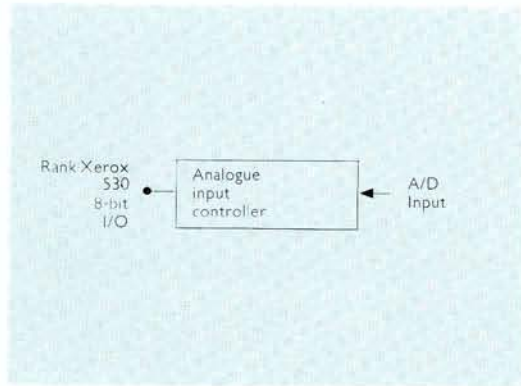
LLF	Load Logical Field
LAF	Load Arithmetic Field
STF	Store Field
SZF	Store Zero Field
SOF	Store Ones Field
CLF	Compare Logical Field
CAF	Compare Arithmetic Field
SLF	Sense Left Bit of Field

RANK XEROX

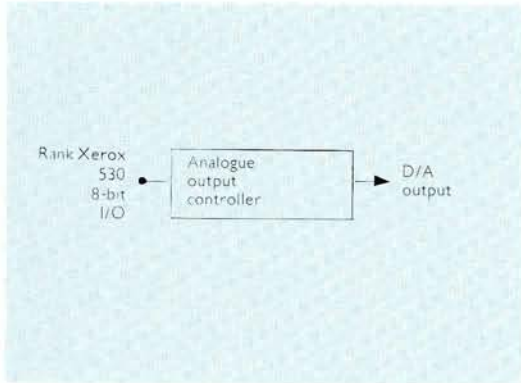
United Kingdom
Rank Xerox Data Systems
York House, Empire Way
Wembley, Middlesex
HA9 0QF
England
Tel. 01-903 4521
Telex 27992

Standard system interface units available for the Rank Xerox 530 systems include:

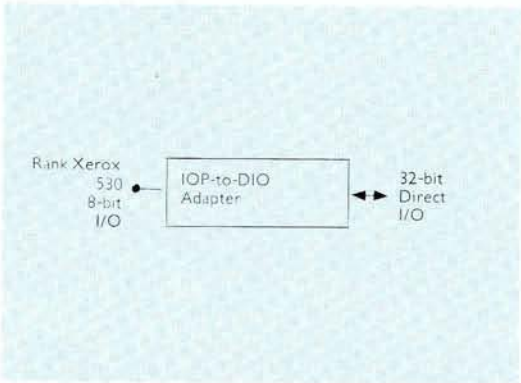
Analyse Input Controller, which provides the interface and control necessary to operate an analogue-to-digital converter and a high-speed multiplexer through an 8-bit I/O channel. It permits random or sequential sampling of analogue inputs, under programme control, at pre-specified intervals.



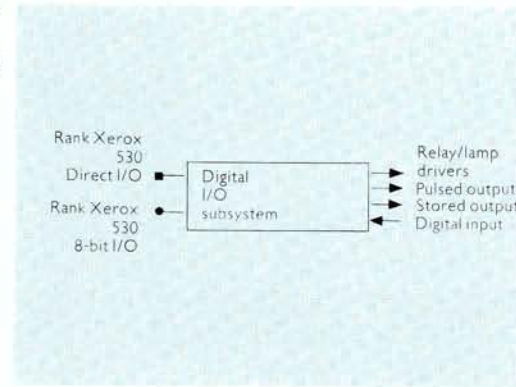
Analyse Output Controller, which provides the interface and control necessary to operate from one to 16 digital-to-analogue channel controllers through an 8-bit I/O channel. Each channel controller can operate five to 16 digital-to-analogue converters. The analogue output controller allows analogue outputs to be controlled randomly, sequentially, or simultaneously.



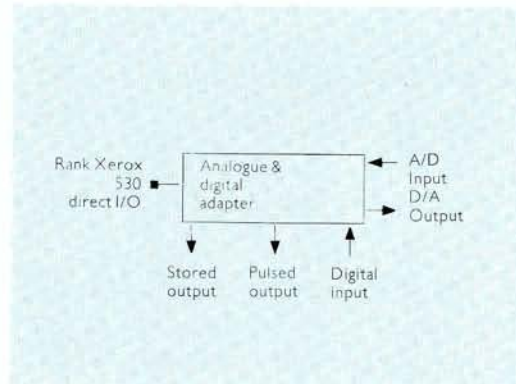
IOP-to-DIO Adapter, which transforms any Rank Xerox 530 8-bit I/O channel into an interface identical to the Rank Xerox 530 Direct I/O interface. This unit enables users to perform a programme-specified number of 32-bit direct input or output operations, in any combinations, through an 8-bit I/O channel.



Digital I/O Subsystem, which generates pulsed digital outputs, transfers data in memory to output registers, stores input signals in memory, drives relays or lamps, and provides latched relay drive signals. Each fully expanded subsystem accommodates 480 to 960 lines (intermixed input/output).



Analyse and Digital Adapter, which provides the interface and control circuitry to operate one analogue-to-digital converter, one analogue multiplexer, and one to 16 digital-to-analogue channel controllers on Direct I/O. It generates pulsed digital outputs, transfers data in memory to output registers, and stores the states of input lines in memory.



Frequency Control Subsystem, which provides frequency control of analogue input, analogue output, and digital transfer control units, causing external devices to perform operations at pre-specified intervals. Each fully expanded unit furnishes four frequency sources. The frequency of each source can be specified manually or, optionally, under programme control.

