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 back-ground programme.

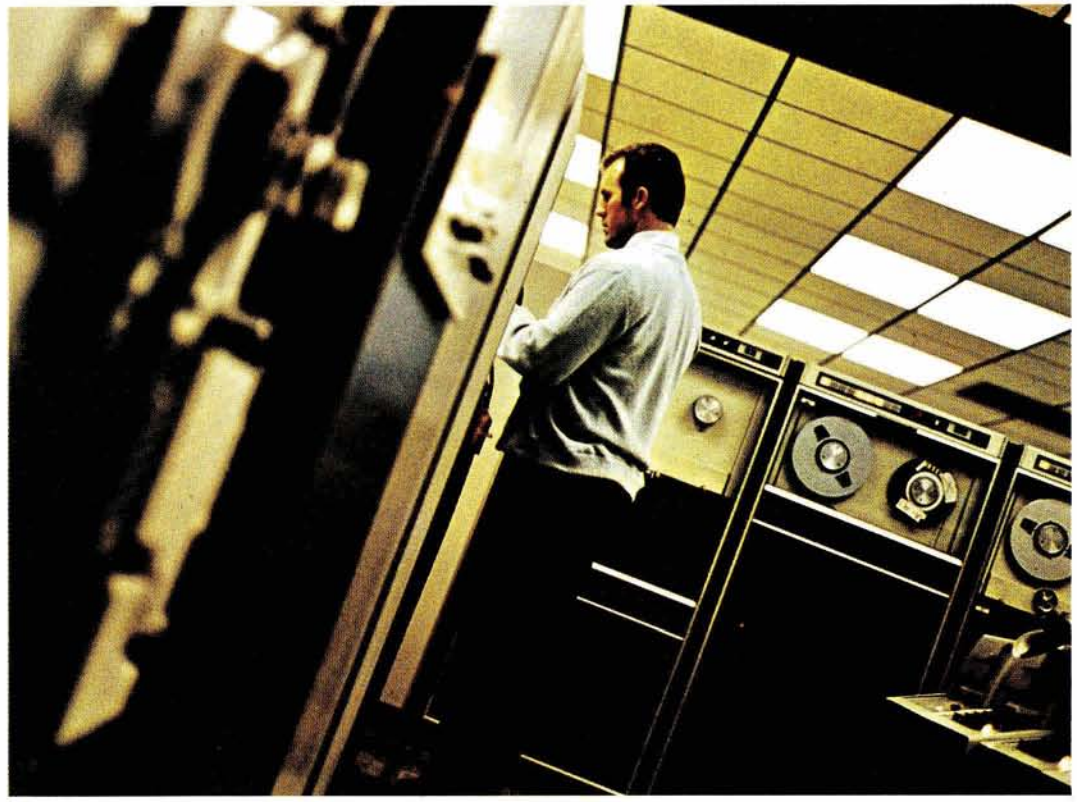
Six general registers. Any of the six general registers can be operated on by load, store, add, subtract, logical and, or compare instructions.

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.

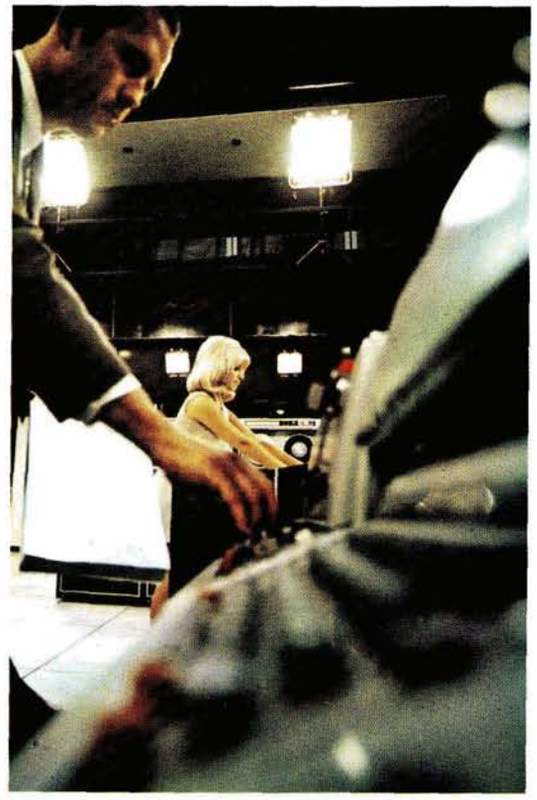
Introduction

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.



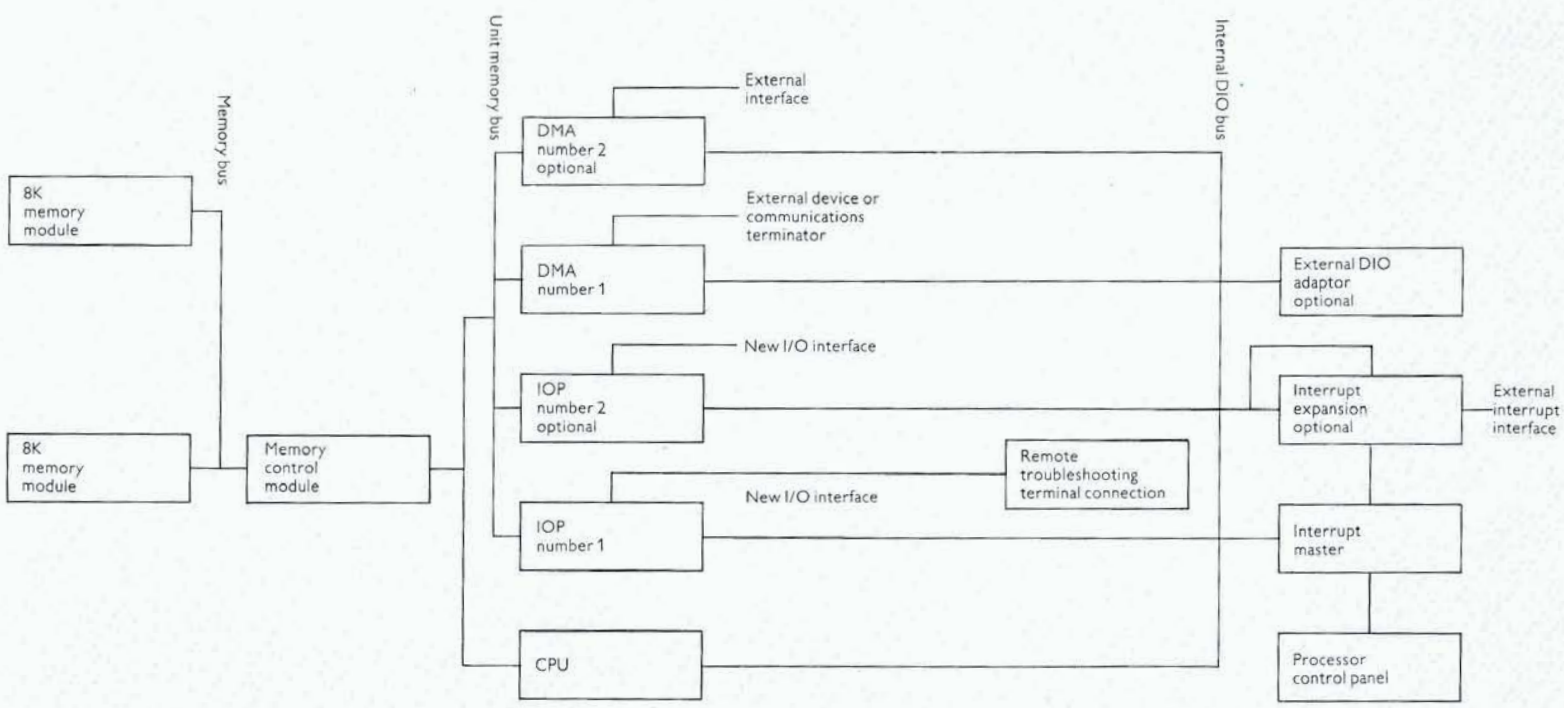
Memory

The Rank Xerox 530 memory is word oriented with each word consisting of 16 bits plus 2 parity bits. Memor 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 doubleword, 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.