

4331

Processor



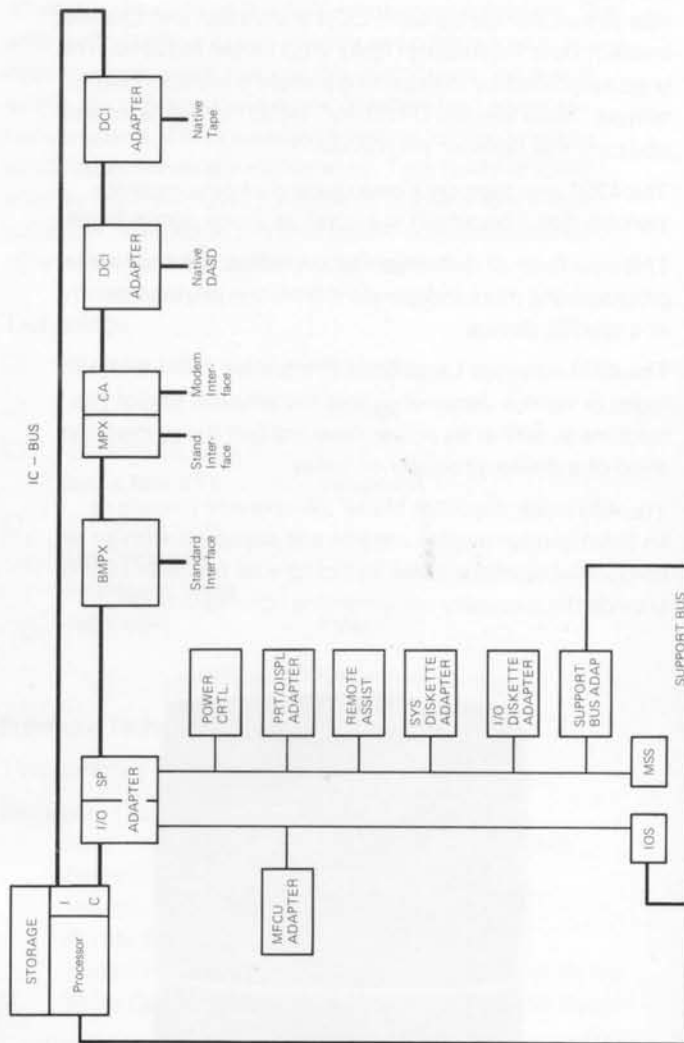


IBM 4331 PRODUCT DESCRIPTION

The IBM 4331 is a compact general purpose data processor designed to give new standards of performance and simplicity to small-to-medium sized applications.

Its concept includes:

- Ease of installation with minimum disturbance of existing I/O configurations
- Selectable System mode at IPL time between System /370 mode and Extended Control Program Support (ECPS) mode
- Integrated attachments for direct connection to tele-processing lines and basic I/O units
- Standard channels for System /370 I/O units
- Integrated channels for: System /370 I/O units, disk attachments for files with fixed block mode, supported by compatibility feature for count-key-data devices (2311 & 2314 & 2319)
- With equal workload a 3 to 6 (in average 4.6) times faster instruction execution speed was measured on the 4331 compared to the Processor of the System /360 Model 30
- Extended virtual storage concept with enhanced speed of address translation



General Characteristics

IBM 4331 is a small-to-medium size data processor with two different virtual storage capabilities. One of these is compatible with the System /370 virtual storage capability, the other is a new and simpler form of dynamic address translation which includes all channels and direct I/O attachments in the virtual storage concept. With this new virtual storage concept, CCW-translation and Channel Indirect Data Addressing (IDA) is no longer required. This is accomplished by maintaining a single translation table, termed "Main Storage Directory" (MSD) in hardware and updating this table via microcode.

The 4331 also features a new method of data organization on disk files which is known as Fixed Block Mode.

This new form of data organization makes the application programming more independent from the physical details of a specific device.

The 4331 employs Large Scale Integration (LSI) technologies in various densities so that the physical size of the machine as well as its power consumption is less than one third of a similar processor of today.

The 4331 uses the 3278 Model 2A operator console as an input/output display console and keyboard with an incorporated operator panel including vital function keys to provide the necessary man/machine communication.



For IBM internal use only

IBM 4331 OPERATING SCHEME

The 4331 is microcode controlled via fullword micro instructions. Instructions are executed in 100 nano second steps with the number of steps ranging from 3 to 16, depending on the complexity of the instruction. The general sequence of instructions is determined by the I-Phase in which the Op-code of the /370 instruction is fetched. The unique Op-codes are used directly as pointers to the microcode routines which execute the instructions. All events within the processor and in the channels lead to microcode trapping. There are eight hierarchical trap levels by which all activities are multiplexed. Trap levels of lower priority are intercepted by those of higher priority and control is returned to the intercepted program automatically when the other activity is completed.

Technology

- Bi-Polar LSI Processor
- FET-LSI Storage
- DUTCHES, GOLF
and a few VTL Adapters
- Ferro resonant
regulators and
intelligent linear
regulators Power

Processor Technical Summary

This summary lists the important technical data.

Storage — Type:	Single Cell
Size:	0.5 MB or 1.0 MB
Refresh Repetition Rate:	11.2 Microsec.
Refresh Duration:	1.0 Microsec.
Access Width:	4 Bytes
Read Cycle:	0.9 Microsec. (4 Bytes)
Write Cycle:	1.4 Microsec. (4 Bytes)

Control Store — Type:	Single Cell
Size:	128 KB
Refresh Repetition Rate:	9 Millisec.
Refresh Duration:	400 ns
Buffer Access Time:	100 ns
Word Size:	4 Bytes

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PROCESSOR

The processor is a logical complex in which several different functions can be distinguished. These are:

- storage function
- arithmetic/logic function
- data mover function
- integrated channel bus
- individual channel adapters
- support processor function

Various circuit densities are employed, depending on the speed requirements. The processor storage has the highest density with 64,000 bits per chip.

Storage Function

Consists of single bit cell arrays which have a refresh cycle and special spare bits which can be assigned in case of damage. The access width is a full word.

Arithmetic/Logic Function

Consists of a fullword ALU with two fullword operand registers as entries and a fullword shift unit. A data local store with 512 fullword registers is available as work area.

Data Mover Function

Consists of six channel registers of 1-byte size which contain pointers to the unit control words in the data local store. With these channel registers and appropriate timing controls, data transfer can be multiplexed between six I/O channels or direct attachments. Depending on the configuration chosen, one byte multiplexer channel, one block multiplexer channel, and direct attachments are available through special channel adapters.

Integrated Channel Bus

Is a halfword wide uni-directional bus loop which connects up to six channel adapters with the arithmetic and storage functions. This bus loop is an internal interconnection of the processor elements implemented mainly in board wiring and crossovers. Data transfer over this bus occurs in cycle steal mode, two halfword shots in succession or in sense/control mode which is an individual halfword transfer. Up to 2.4 megabytes per second can be transferred.

Individual Channel Adapters

Consist of buffers with control logic and specialized interfaces, depending on the type of adapter and its purpose. The standard channel adapter has the standard System /370 I/O interface for external control units. The DCI adapter features the director/controller interface for disk drives and can also accommodate specific magnetic tape units.

The bus to bus adapter connects to a universal controller with its various device adapters. These device adapters allow for direct connection of line printers, keyboard display terminals, table top matrix printers, telecommunication lines, etc.

The variety of different channel adapters makes it possible to equip the processor with various channels and direct attachments.

Support Processor Function

The universal controller which controls the operator console and the microcode diskette also contains support functions for the system and for the Customer Engineer (CE). The system support consists mainly of initial microcode loading, checkout and manual operation execution, e.g. system reset, display/alter, etc.

The service support function consists mainly of internal logging and the generation of individual reference codes for each error case. These reference codes define the affected area and provide startpoint into the documentation. Support to specialists is given via manual operations and remote link.

Directory Look-Aside Buffer:	2 way, 32 entries
Instruction Buffer:	16 Bytes
Data Flow Width:	4 Bytes
IC-Bus-Speed:	2.4 MB/sec.
Width:	2 Bytes
Number of Adapters:	6 (max.)
BLCK-MPX (up to 32 unshared subchannels and 8 shared subchannels):	0.5 MB/sec.
MPX Byte/Burst (31 subchannels of which 8 sharable):	18/500 KB/sec.
Communication Adapter:	64 K Bits/sec.

Programming Support/Compatibility

The 4331 processor operates in either S/370 compatibility mode or in Extended Control Program Support: DOS/VS ECPS mode. These system modes are selectable at IPL — time and determine the basic operating characteristics of the machine.

- Two modes of operation, selectable at IPL time are possible. System /370 compatibility mode is identical to 370 EC mode with or without dynamic address translation and includes the BC mode to run 360 DOS Release 26. ECPS mode is a facility that reduces the processor time needed for certain frequently used functions when used with DOS/VSE
- Printer/Keyboard mode allows an Operating System, generated on a system with a 1052, 3210, 3215 as operator console to run on a 4331 processor
- 2311, 2314, 2319 compatibility allows 23XX data sets to be emulated on natively attached Fix Block Mode DASD
1401, 1440, 1460 compatibility feature in conjunction with the 1400 Emulator program allows execution of 14XX instruction
- System /3 Data import compatibility feature allows to import data (read only) which has been previously recorded on a System /3 by providing attachment capability of IBM 3340-A2 devices via the DASD adapter

Maintainability/Serviceability

A new maintenance concept complements Reliability, Availability, and Serviceability.

This new concept (enhanced through design and new technology) is based on automatic analysis of failure symptoms, performed by the processor.

The result of this "selfdiagnostic" is a processor generated eight-digit "Reference Code" which contains information to guide the CE to the failing unit.

This Reference Code is not only logged on the systems diskette from where it is retrievable at a later time, but also immediately displayed on the Operator Console to alert the operator.

A Remote Support Facility (RSF) allows remote diagnosis and inquiry of the RETAIN file via the Public Switched Telephone Network.

Maintenance and Service Highlights

- Resident Microdiagnostics (including recovery)
- Fault Location Microdiagnostics
- Maintenance Analysis Procedures (MAPs)
- Reference Code for MAP Entry
- Keyboard Alter/Display Functions
- Error Checking and Correction (ECC) for storage
- Logging of Reference Code
- New System Test (NST) to isolate system failure to the proper unit
- Remote Support Facility (RSF)
- RETAIN
- Machine- and channel check recording to SYSREC
- E-FRIEND
- ILT for native DASD, Tape and Communication Adapter

CE Career Path

This is a DP CE career path product.

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