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# Perspective

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# Microprocessors in Control Systems: Components and Types

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# Description

A microprocessor is a type of computer processor in which the data processing logic and control are stored on a single integrated circuit or a small number of integrated circuits. The microprocessor includes the arithmetic, logic, adding, subtracting, transferring numbers from one area to another, comparing two numbers and control circuitry required to perform the tasks of a computer's central processing unit.

The microprocessor, commonly known as the Central Processing Unit (CPU), is the brain of all computers as well as a wide range of household and electronic gadgets.

## **Components of Microprocessor**

Today's processors are quite compact in comparison to the earliest EPIC. microprocessors, but they still have these basic components from the initial model.

- CPU
- Bus
- Memory

# CPU

The CPU is built as a Very Large Scale Integrated Circuit (VLSI) and contains these components.

Instruction register: It stores the instruction to be executed.

Decoder: It decodes (converts to machine language) the instruction and transmits it to the ALU

ALU (Arithmetic Logic Unit): It contains the circuits to perform logical, arithmetic, memory, register, and program sequencing operations.

Register: It stores intermediate results obtained during program execution. Because accessing registers is nearly ten times faster than accessing RAM

#### Bus

Buses are simply a collection of wires that transport data from one device to another. There are three types: Address buses, data buses, and control buses. And the combination of these three lines is known as a system bus.

Address bus: This identifies the memory location that the processor will read data from or write data to

Data bus: The data bus contains the contents that have been read from the memory location or are to be written into the memory location.

Control bus: This manages the information flow between components, indicating whether the operation is a read or a write and ensuring that it occurs at the appropriate time.

#### Memory

The microprocessor programme is stored in memory. There are two types of memory: ROM (Read Only Memory), which is mostly used to store programs as read-only data, and RAM (Random Access Memory), which can read and write data. RAM and ROM are classified according to their primary use.

RAM: This memory stores the programs and data that the CPU demands during program execution and also called the main memory or the primary memory. It is a volatile memory because when the power is switched off, the data is lost.

ROM: It stores essential information required to run the system, such as the application required to boot the computer. It is not volatile and always keeps its data. It is used when there is no need to modify the programming, such as in embedded systems.

## **Types of Microprocessor**

Microprocessors are classified into three types: CISC, RISC, and

# **CISC (Complex Instruction Set Computer)**

It is made up of a complex series of instructions. Instructions that require two memory addresses can take up to five bytes to comprise the entire instruction code. As a result, CISC has variable-length instruction encoding, and instruction execution may take a variable number of clock cycles. A compiler's job is to generate a set of machine instructions for each high-level language statement. If there are machine instructions that directly implement the statements, the work is made easier. The primary purpose of a CISC design is to provide only one machine instruction for each statement that is executed.

## **RISC (Reduced Instruction Set Computer)**

RISC provides great performance per watt for battery-powered systems where energy efficiency is essential. A RISC processor performs only one action per instruction. The operation execution time is reduced by completing it in just one cycle. It also supports more registers and spends less time on loading and writing values to memory due to the absence of complicated instruction decoding logic.

# **EPIC (Explicitly Parallel Instruction Computing)**

It enables parallel computation of instructions through the use of compilers. Moreover, the complicated instructions operate at lower clock frequencies. It also encodes the instructions in 128-bit bundles. Where each bundle comprises three 41-bit instructions and a 5-bit



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template. This 5-bit template specifies the type of instructions and which instructions can be executed repeatedly.

# Conclusion

In conclusion, microprocessors are essential components in modern technology, performing complex tasks such as data processing and

control. They are integrated on a single chip, making them compact and efficient. Microprocessors have revolutionized the computing industry and have enabled the development of many new technologies such as embedded systems and the Internet of Things. However, microprocessors also have their limitations, including issues with security and reliability, which must be addressed to fully realize their potential.