

## What is CPU Register? Explain Types of Register.

Registers are used to quickly accept, store, and transfer data and instructions that are being used immediately by the CPU. These registers are the top of the memory hierarchy, and are the fastest way for the system to manipulate data. In a very simple *microprocessor*, it consists of a single memory location, usually called an *accumulator*. Registers are built from fast multi-ported memory cells. There are various types of registers; those are used for various purposes. Some of the most commonly used registers are the Accumulator (AC), Data Register (DR), Address Register (AR), Program Counter (PC), Memory Data Register (MDR), Index Register (IR), and *Memory Buffer Register (MBR)*.

Registers are used for performing various operations. While we are working on the system, these registers are used by the CPU for performing operations. When we give some input to the system, the input will be stored in the registers, and when the system gives us the results after processing, the result will also be from the registers. So they are used by the CPU for processing the data which is given by the user. Registers perform:-



1) **Fetch:** The Fetch Operation is used for taking the instructions that are given by the user, and the instructions that are stored in the Main Memory will be fetched by using registers.

2) **Decode:** The Decode Operation is used for interpreting the instructions. This means the instructions are decoded, meaning the CPU will find out which operation is to be performed on the instructions.

3) **Execute:** The Execute Operation is performed by the CPU. The results that are produced by the CPU are then stored in the memory, and after that they are displayed on the user screen.

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**Registers are the most important components of CPU. Each register performs a specific function. A brief description of most important CPU registers and their functions are given below:**

1. Memory Address Register (MAR): This register holds the address of memory where the CPU wants to read or write data. When the CPU wants to store some data in the memory or reads the data from the memory, it places the address of the required memory location in the MAR.

2. Memory Buffer Register (MBR): This register holds the contents of data or instructions read from, or written in memory. The contents of instructions placed in this register are transferred to the Instruction Register, while the contents of data are transferred to the accumulator or I/O register. In other words, you can say that this register is used to store data/instructions coming from the memory or going to the memory.

3. I/O Address Register (I/O AR): I/O Address register is used to specify the address of a particular I/O device.

4. I/O Buffer Register (I/O BR): I/O Buffer Register is used for exchanging data between the I/O module and the processor.

5. Program Counter (PC): Program Counter register is also known as Instruction Pointer Register. This register is used to store the address of the next instruction to be fetched for execution. When the instruction is fetched, the value of IP is incremented. Thus this register always points or holds the address of next instruction to be fetched.
6. Instruction Register (IR): Once an instruction is fetched from main memory, it is stored in the Instruction Register. The control unit takes instruction from this register, decodes and executes it by sending signals to the appropriate component of computer to carry out the task.
7. Accumulator Register(AC): The accumulator register is located inside the ALU, It is used during arithmetic & logical operations of ALU. The control unit stores data values fetched from main memory in the accumulator for arithmetic or logical operation. This register holds the initial data to be operated upon, the intermediate results, and the final result of operation. The final result is transferred to main memory through MBR.
8. Stack Control Register(SCR): A stack represents a set of memory blocks; the data is stored in and retrieved from these blocks in an order, i.e. First In and Last Out (FILO). The Stack Control Register is used to manage the stacks in memory. The size of this register is 2 or 4 bytes.
9. Flag Register(FR): The Flag register is used to indicate occurrence of a certain condition during an operation of the CPU. It is a special purpose register with size one byte or two bytes. Each bit of the flag register constitutes a flag (or alarm), such that the bit value indicates if a specified condition was encountered while executing an instruction. For example, if zero value is put into an arithmetic register (accumulator) as a result of an arithmetic operation or a comparison, then the zero flag will be raised by the CPU. Thus, the subsequent instruction can check this flag and when a zero flag is "ON" it can take, an appropriate route in the algorithm.
10. Data Register(DR): A register used in microcomputers to temporarily store data being transmitted to or from a peripheral device.