Microprocessor 8085:

from their inception to their widespread use today

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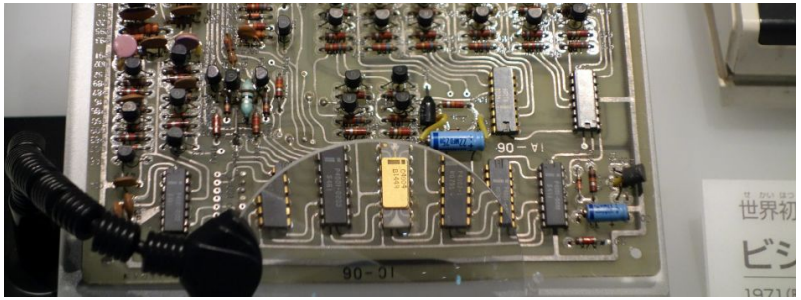
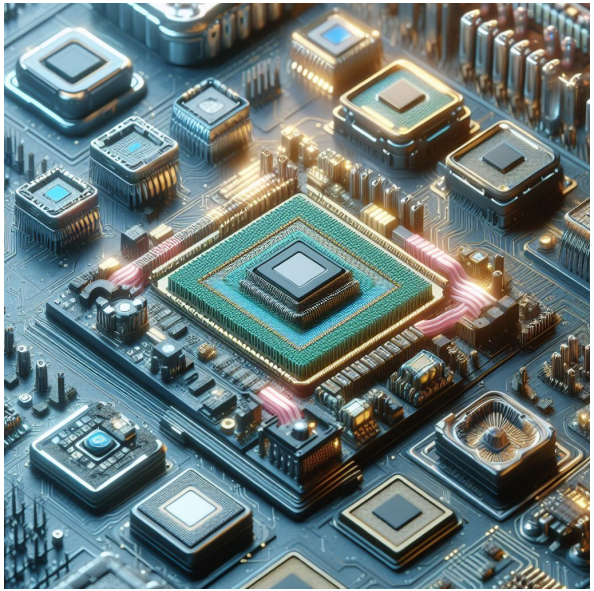
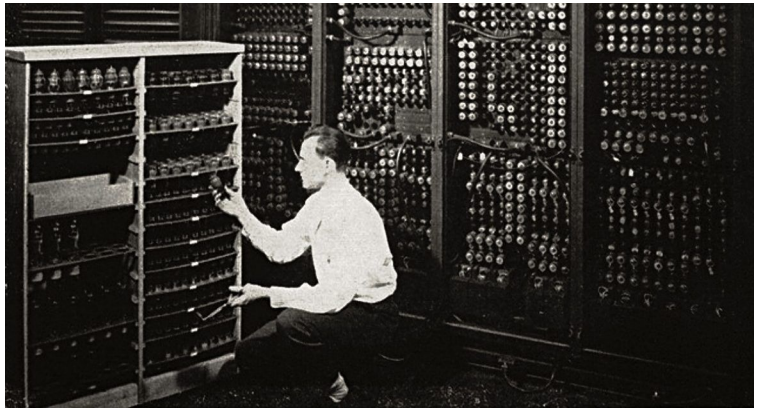
Birth of Microprocessors:

- Imagine a time when computers filled entire rooms, their power measured in rooms rather than gigabytes. That's when the idea of a microprocessor emerged.
- **In 1971, Intel released the *4004*, a chip with a staggering 2,300 transistors. It was the first commercially available microprocessor, and its birth heralded the dawn of a new era.**





- Microprocessors started small, literally. They were tiny compared to the **hulking machines** of the past, but they packed a punch.



Electronic Numerical Integrator and Computer,
was the result of a U.S. government-funded project
during World War II to build
an electronic computer that could be programmed.
The project was based out of the
University of Pennsylvania's Moore School of Engineering.

- With each generation, microprocessors grew more powerful. The Intel 8080 followed the 4004, then the 8085, each one more capable than the last.

In 1972–1973, a team led by Dr. Paul Friedl
at the IBM Los Gatos Scientific Center
developed a portable computer prototype
called SCAMP (Special Computer APL Machine Portable)
based on the IBM PALM processor with a
Philips compact cassette drive, small CRT
and full function keyboard.

- The 1980s saw a revolution as microprocessors found their way into homes. Personal computers became a reality, and the Intel 8088 powered the IBM PC, changing the way we live and work.
- With the introduction of graphical interfaces and operating systems like Windows, microprocessors became the beating heart of every computer, enabling user-friendly experiences.
- As technology advanced, microprocessors shrank in size but expanded in power. The birth of mobile computing brought us laptops, smartphones, and tablets.
- Processors like the Intel Pentium and ARM architecture chips became household names, powering devices that fit in our pockets but had the computing power to rival older desktop computers.
- Today, microprocessors are everywhere, not just in computers but in everyday objects. From smart TVs to refrigerators, from cars to wearable devices, they permeate our lives.
- The Internet of Things (IoT) has transformed ordinary objects into smart, connected devices, all thanks to the tiny but mighty microprocessor.

Introduction to Microprocessor Architecture

Brain of Modern Computing Devices:

- Microprocessors serve as the brains of modern computing devices, powering everything from smartphones to supercomputers.
- They are like tiny electronic brains that process instructions, perform calculations, and manage data.

Basic Components and Functions:

- Control Unit (CU):
  - Acts as the manager of the microprocessor, fetching instructions from memory and executing them.
  - Coordinates the flow of data within the microprocessor and controls its operations.
- Arithmetic Logic Unit (ALU):
  - Responsible for performing arithmetic (mathematical) and logic (comparison) operations.
  - It can add, subtract, multiply, divide numbers, and perform logical operations like AND, OR, and NOT.
- Registers:
  - Small, high-speed memory units within the microprocessor used to store temporary data and instructions.
  - Accumulator: Holds the results of arithmetic and logic operations.
  - Instruction Register: Stores the current instruction being executed.
  - Program Counter: Keeps track of the memory address of the next instruction to be fetched.
- Memory Unit:
  - Stores data and instructions that the microprocessor needs to process.
  - It includes various types of memory like RAM (Random Access Memory) and ROM (Read-Only Memory).
- Bus Interface Unit (BIU):
  - Manages communication between the microprocessor and external devices like memory and peripherals.
  - It controls the flow of data along the data bus, address bus, and control bus.

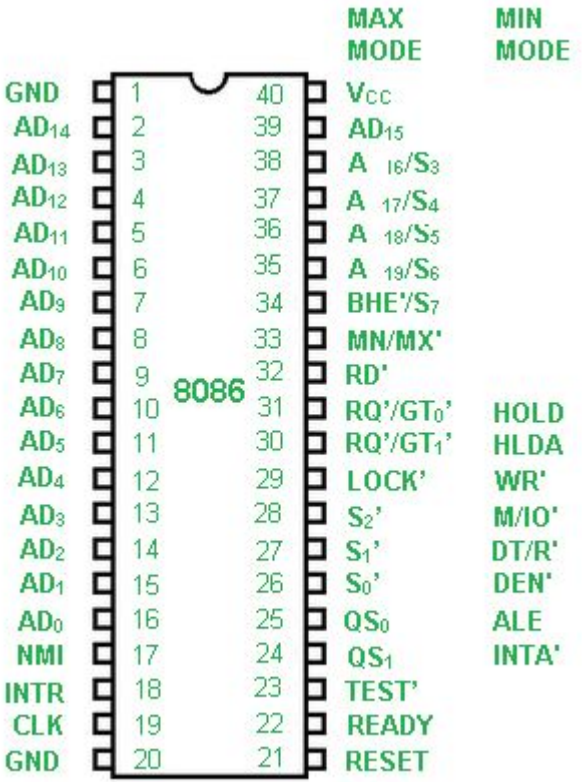
Interconnection:

- These components are interconnected through buses, which are like highways for data and instructions within the microprocessor.
- The control bus carries signals that control the operations of the microprocessor.
- The address bus specifies the memory location for read or write operations.
- The data bus transfers data between the microprocessor and memory or peripherals.

Basic Introduction to 8085 Microprocessor

- The Intel 8085 microprocessor is an 8-bit microprocessor introduced by Intel in 1976.
- It is one of the earliest and most popular microprocessors in the 8000 series.
- The 8085 microprocessor played a significant role in the development of early microcomputers and electronic devices.
- With a clock speed of 3 MHz, it can execute up to 200,000 instructions per second.
- The 8085 microprocessor features 74 instructions, allowing it to perform a variety of arithmetic, logic, and data transfer operations.
- It has a 16-bit address bus, enabling it to access up to 64 KB of memory.
- The architecture of the 8085 includes various registers such as the accumulator, general-purpose registers, and special-purpose registers like the program counter and stack pointer.
- Interfacing with external devices is facilitated through data, address, and control buses.
- Despite its age, the 8085 microprocessor remains relevant in educational settings and embedded systems due to its simplicity and versatility.

Intel 8085 Microprocessor Chip

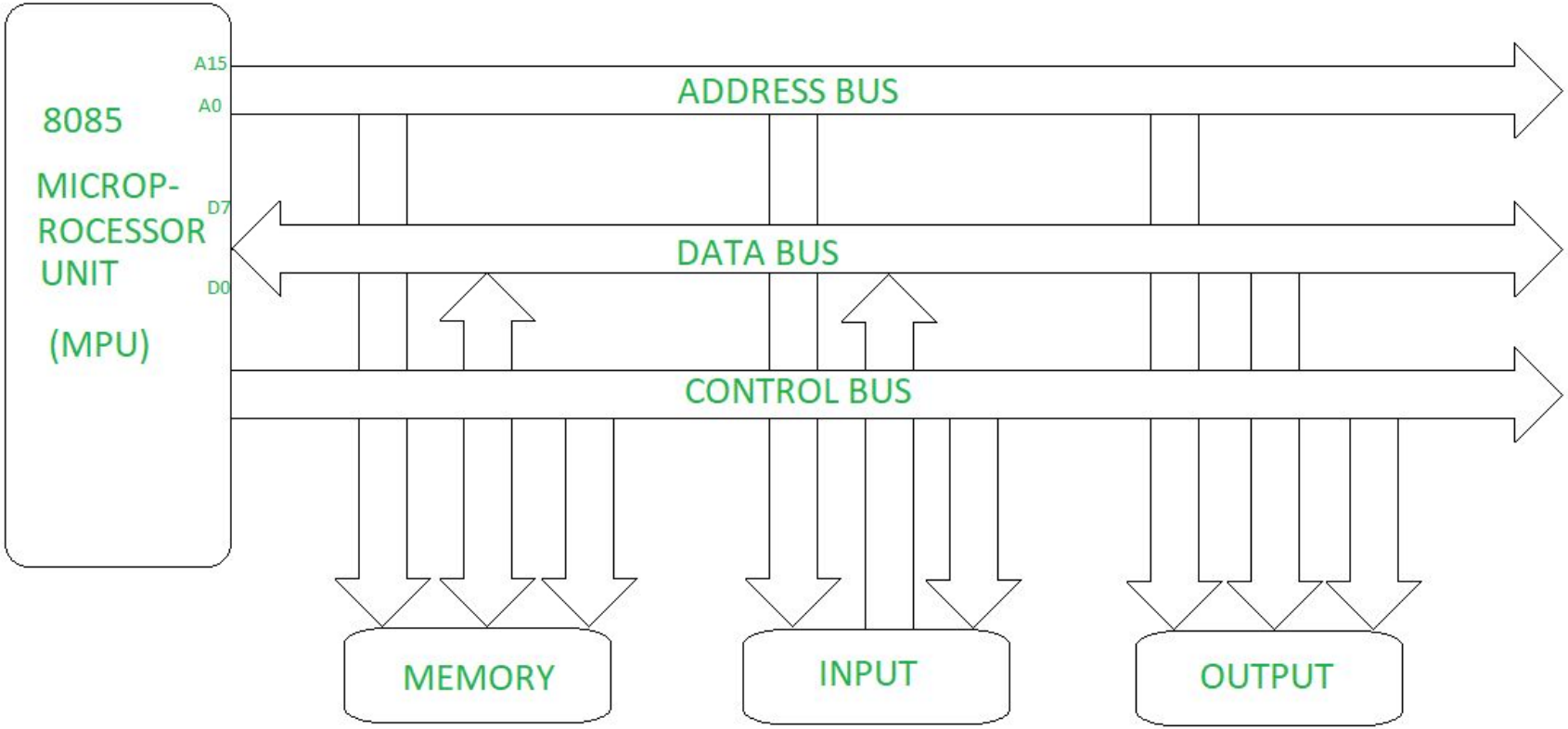


Pin Diagram of 8085-86 Microprocessor:

- The 8085-86 microprocessor has 40 pins.
- Key pins include:
  - VCC and GND for power.
  - Address bus (A15-A0) and data bus (D7-D0).
  - Control signals like RD, WR, and RESET.
  - Clock input and output pins.
- Other pins are for interfacing with memory, input/output devices, and peripherals.

Bus Structure

- Data Bus:
  - The data bus in the 8085 microprocessor is an 8-bit bidirectional bus.
  - It is used for transferring data between the microprocessor and external devices such as memory and peripherals.
  - The 8085 microprocessor being an 8-bit processor can transfer data in 8-bit chunks over the data bus.
- Address Bus:
  - The address bus in the 8085 microprocessor is a 16-bit unidirectional bus.
  - It is used to specify the memory address for read or write operations.
  - With 16 address lines, the 8085 microprocessor can access up to 64 KB of memory.
- Control Bus:
  - The control bus in the 8085 microprocessor consists of various control signals that govern its operations.
  - Some of the important control signals include:
    - RD (Read): Indicates a read operation from memory or an I/O device.
    - WR (Write): Indicates a write operation to memory or an I/O device.
    - ALE (Address Latch Enable): Indicates the availability of a valid address on the address bus.
    - IO/M (Input/Output, Memory): Specifies whether the current operation is a memory operation or an I/O operation.



Bus organization system of 8085 Microprocessor

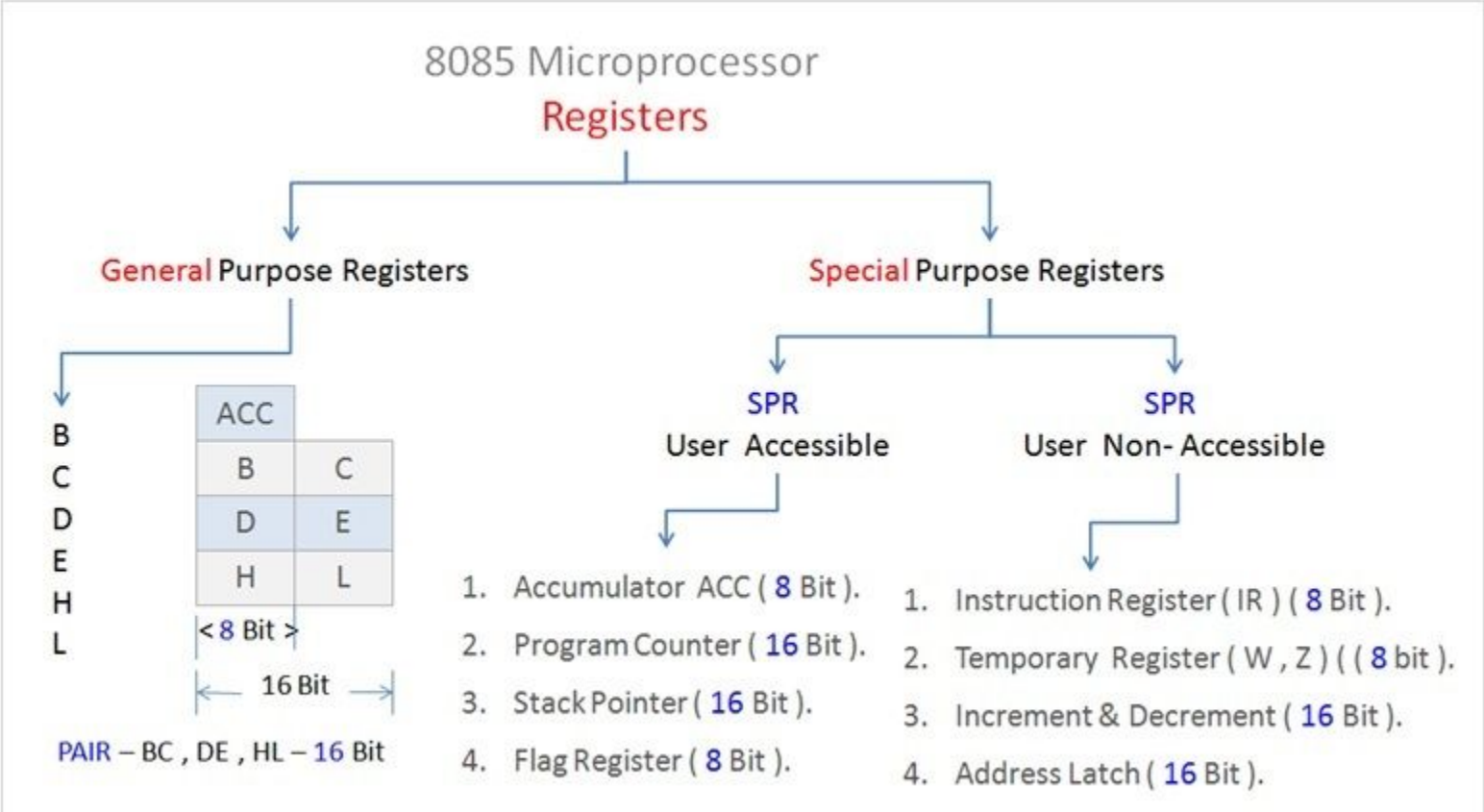
Interaction of Buses:

- Data Transfer:
  - During a data transfer operation, the microprocessor places the data on the data bus.
  - The address for the data transfer is specified on the address bus.
  - Control signals like RD (Read) or WR (Write) determine the direction of data transfer.
- Addressing:
  - When accessing memory or I/O devices, the microprocessor places the address on the address bus.
  - ALE (Address Latch Enable) signal indicates that a valid address is present on the address bus.
  - Depending on the IO/M signal, the microprocessor distinguishes between memory and I/O operations.
- Control:
  - Control signals on the control bus coordinate various activities of the microprocessor.
  - These signals synchronize the timing of operations, ensure proper data transfer, and manage memory and I/O operations.

Importance of bus structure :

- Understanding the bus structure of the 8085 microprocessor is crucial for understanding how data and instructions are transferred between the microprocessor and external devices.
- It enables programmers and hardware designers to interface the microprocessor with memory, input/output devices, and other peripherals effectively.
- Mastery of the bus structure allows for efficient utilization of the microprocessor's capabilities and the design of optimized systems.

In-depth Analysis of 8085: Register Organization



Accumulator (A):

- The Accumulator is the primary register in the 8085 microprocessor.
- It stores one of the operands for arithmetic and logical operations.
- The result of these operations is often stored back in the Accumulator.

General Purpose Registers (B, C, D, E, H, L):

- These are six additional registers that can be used for various purposes.
- Each register can hold 8 bits of data.
- They can be paired to form register pairs for certain operations.

Flag Register (F):

- The Flag Register contains various flags that indicate the result of arithmetic and logical operations.
- These flags include the Sign (S), Zero (Z), Auxiliary Carry (AC), Parity (P), Carry (CY), and two unused/reserved bits.
- These flags are set or cleared based on the result of arithmetic and logical operations.

Program Counter (PC):

- The Program Counter is a 16-bit register that stores the memory address of the next instruction to be fetched and executed.
- It automatically increments after fetching each instruction.

Stack Pointer (SP):

- The Stack Pointer is also a 16-bit register.
- It points to the memory location in the stack where the next value will be stored.
- It is primarily used for managing the stack in subroutine calls and returns.

Instruction Register (IR):

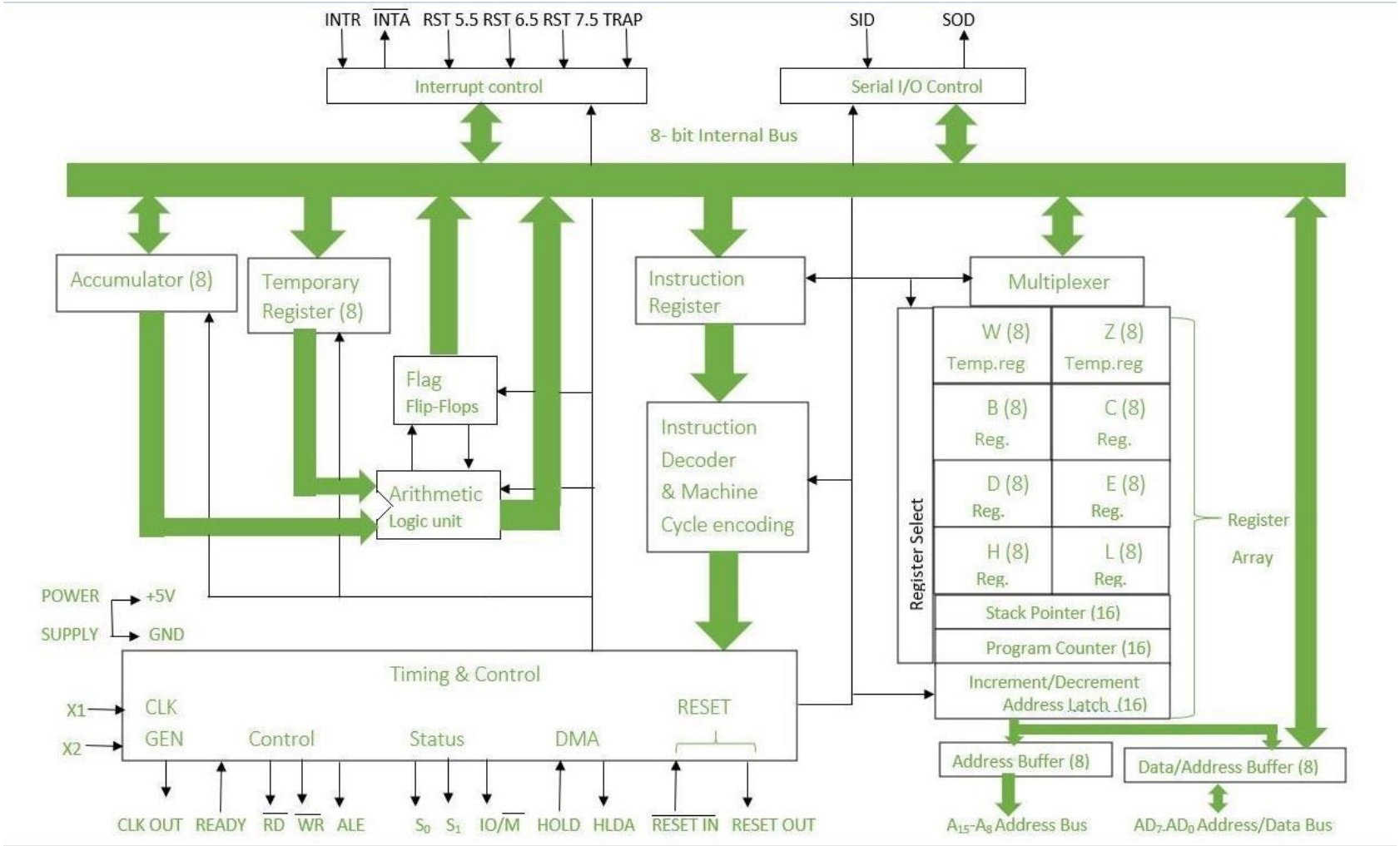
- The Instruction Register holds the current instruction being executed by the microprocessor.
- It fetches the opcode from memory during the fetch cycle of the instruction execution.

Memory Address Register (MAR) and Memory Buffer Register (MBR):

- These registers are used to interface with memory.
- The MAR holds the address of the memory location being accessed.
- The MBR holds the data read from or written to memory.

Temporary Register (TR):

- The Temporary Register is used for temporary storage during data transfer operations.
- It is often used in conjunction with the accumulator or other registers.


INTR
INTA
RST 5.5
RST 6.5
RST 7.5
TRAP
Interrupt control
SID
SOD
Serial I/O Control
8- bit Internal Bus
Accumulator (8)
Temporary Register (8)
Flag Flip-Flops
Arithmetic Logic unit
Instruction Register
Instruction Decoder & Machine Cycle encoding
Multiplexer
W (8) Temp.reg
Z (8) Temp.reg
B (8) Reg.
C (8) Reg.
D (8) Reg.
E (8) Reg.
H (8) Reg.
L (8) Reg.
Register Select
Register Array
Stack Pointer (16)
Program Counter (16)
Increment/Decrement Address Latch (16)
POWER
SUPPLY
+5V
GND
Timing & Control
X1
X2
CLK GEN
Control
Status
DMA
RESET
Address Buffer (8)
Data/Address Buffer (8)
CLK OUT
READY
RD
WR
ALE
S0
S1
IO/M
HOLD
HLDA
RESET IN
RESET OUT
A15-A8 Address Bus
AD7-AD0 Address/Data Bus

Thank You

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