# What is a Register?

•A register is a very small amount of very fast memory that is built into the CPU (central processing unit).

- Contents can be accessed at extremely high speeds.
- Registers are used to store data temporarily during the

•execution of a program.

- Different processors have different register sizes.
- Registers are normally measured by the number of bits they can hold, for example, an 8-bit register means it can store 8 bits of data or a 32-bit register means it can store 32 bit of data.

| Register symbol | name | Number of bits | description |
|---|---|---|---|
| AC | Accumulator | 16 | Processor register |
| DR | Data register | 16 | Hold memory data |
| TR | Temporary register | 16 | Holds temporary data |
| IR | Instruction register | 16 | Holds instruction code |
| AR | Address register | 12 | Holds memory address |
| PC | Program counter | 12 | Holds address of next instruction |
| INTR/OUTR | Input/output register | 8/8 | Holds input/output data |

**ACCUMULATOR (AC):**

The processor register AC consists of 16-bits. It is used to hold the results or partial results of arithmetic and logical operations. An accumulator is a register in which intermediate arithmetic and logic results are stored. The 16-bit inputs to the Adder / logic circuit come from the outputs of AC. They are used to implement register micro operation such as complement and shift the contents of AC.

**DATA REGISTER (DR):**

The register DR consists of 16-bits and it is used to hold memory operands (data). This register contains the data to be written into memory or receives the data read from memory.

**TEMPORARY REGISTER (TR):**

Temporary register have 16-bits and it provides temporary storage of variables or results.

**INSTRUCTION REGISTER (IR):**

The instruction register consists of 16-bits. The purpose of the instruction register is to hold a copy of the instruction which the processor is to execute. In our basic computer, instruction register (IR) holds instruction code which is read from memory.

**ADDRESS REGISTER (AR):**

This register specifies the address in memory for next read or writes operations. The address register consists of 12-bits.

**PROGRAM COUNTER (PC):**

Program counter has 12-bits and it holds the address of the next instruction to be read from memory after the current execution is executed. The instructions are read sequentially because the program counter automatically increments after fetching the current instruction.

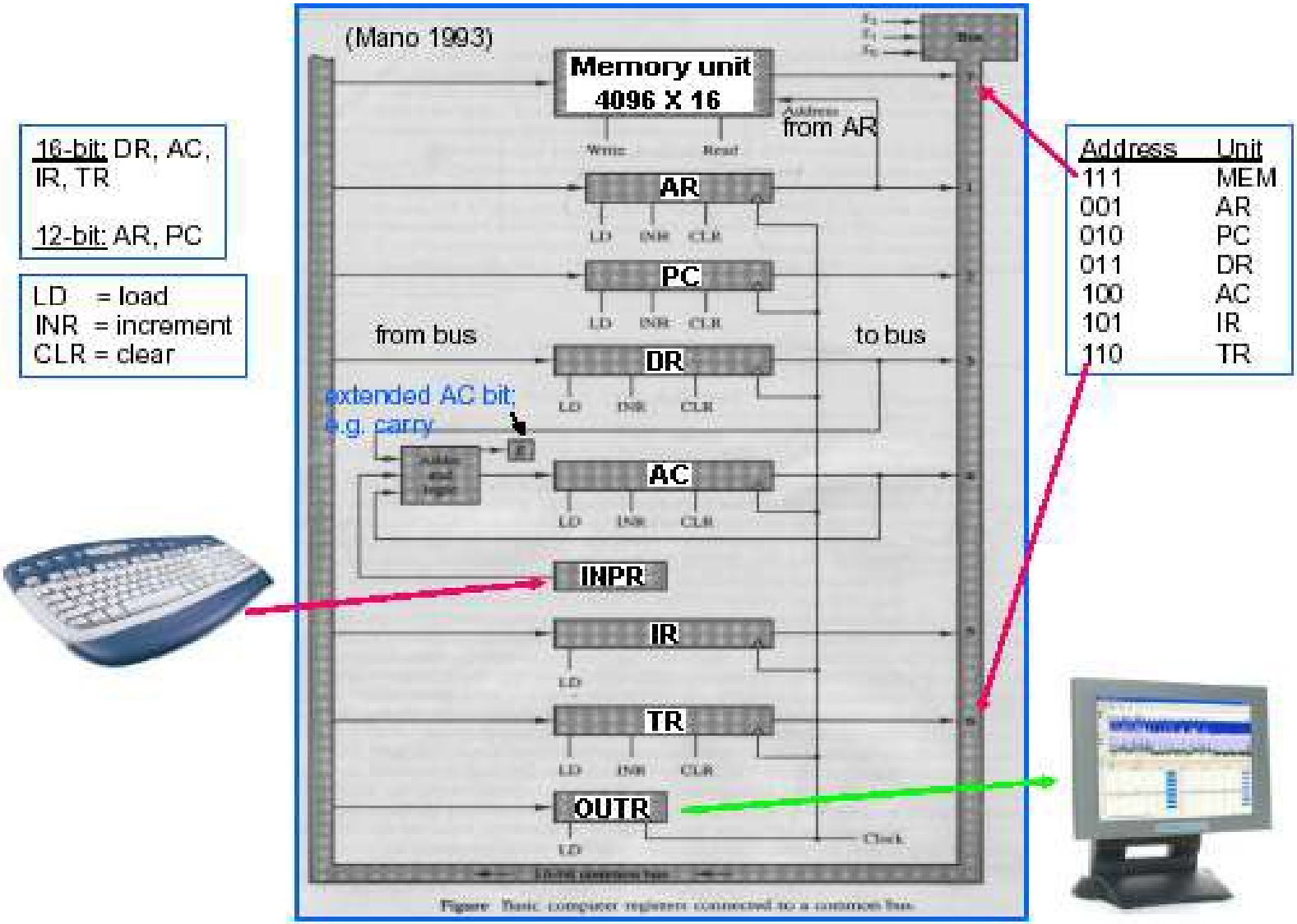
**INPUT REGISTER (INPR):**

Input register has 8-bits. INPR register receives a character from an input device and delivers it to the AC.

**OUTPUT REGISTER (OUTR):**

Output register has 8-bits. The output register receives information from AC and transfer it to the output device.

# Common bus system



**BUS:**

A wire or a collection of wires that carry some multi-bit information is known as bus. Main purpose of bus is to transfer information form one system to another.

**DESCRIPTION:**

The basic computer has eight registers (AC, PC, DR, AC, IR, TR, INPR, OUTR), a memory unit and a control unit. Path must be provided to transfer information from one register to another and between memory and registers. The number of wires will be excessive if connections are made between the output of each register and input of other registers. A more efficient scheme is to use a common bus. Thus common bus provides a path between memory unit and registers.

**Five registers have three control inputs: L(load), INR (increment) and CLR (clear). Two registers have only a LD input**

**Load (LD):**

The lines from the common bus are connected to the inputs of each register and the data inputs of the memory. The particular register whose LD input is enabled receives the data from the bus.

**Increment (INR)) and Clear (CLR):**

The contents of the particular register are incremented when its INR signal is enabled and cleared when its CLR signal is enabled.

# CIRCUIT OPERATION DESCRIPTION

**Memory Unit:**

The memory receives the 16-bit information from the bus when its write input is enabled and the memory places its 16-bit information onto the bus when its read input is activated and S2S1S0 = 111.

## Address Register (AR):

This register specifies the address in memory for next read or writes operations. The address register consists of 12 bits. When selection inputs S2S1S0 =001 is applied to the bus, the address register AR receives or transfers address from or to the bus when its LD input is enable. The address is incremented or clear by the inputs INR or CLR.

**Program Counter (PC):**

Program counter has 12 bits and it holds the address of the next instruction to be read from memory after the current execution is executed. When selection inputs S2S1S0 = 010 is applied to the bus, the program counter (PC) receives or transfer address from or to the bus when its LD input is enable. The address is incremented or clear by the inputs INR or CLR.

**Data Register (DR):**

The register DR consists of 16-bits and memory operands (data). This register contains the data to be written into memory or receives the data read from memory. When selection inputs S2S1S0 = 011 is applied to the bus, the data register DR receives or transfers data from or to the bus when its LD input is enable. The data is incremented or clear by the inputs INR or CLR.

**Accumulator (AC):**

The processor register AC consists of 16 bits. The 16-bit inputs to the Adder / logic circuit come from the outputs of AC. They are used to implement register micro operation such as complement and shift the contents of AC.

The results of these micro operations are again transferred to AC. So an accumulator is a register in which intermediate arithmetic and logic results are stored.

When selection inputs S2S1S0 = 100 is applied to the bus, the processor register AC receives or transfers its data to the bus by enabling the LD input of DR, it transfers the contents of DR through the adder / logic circuit into AC when its LD input is enable. The data of AC is incremented or clear by the inputs INR or CLR.

**Instruction Register (IR):**

The instruction register consists of 16-bits. The purpose of the instruction register is to hold a copy of the instruction which the processor is to execute.

The instruction read from memory is placed in the IR.

When selection inputs S2S1S0 = 101 is applied to the bus, the instruction register IR receives or transfers instruction code from or to the bus when its LD input is enable.

**Temporary Register (TR):**

Temporary registers have 16 bits. It provides temporary storage of variables or results. When selection inputs S2S1S0 = 111 is applied to the bus, the temporary register TR receives or transfers temporary data from or to the bus when its LD input is enable. The data is incremented or clear by the inputs INR or CLR.

**Input Register (INPR):**

The Input Register INPR consists of 8-bits and hold alphanumeric input information. The serial information from the input device is shifted into input of 8-bit register INPR. When LD input of AC is enable, the 8-bit information of INPR is transferred to the AC via Adder/logic circuit.

**Output Register (OUTR):**

The output OUTR receives information from AC and transfers it to the output device.