



SNS COLLEGE OF ENGINEERING

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Sub: Microcontroller Programming And Interfacing

Subcode:23ECB202

Unit-I

PIC Microcontrollers: History, Features, & Architecture

Topic: PC and PIC ROM Memory Space



Introduction

Program Counter (PC)

- The **Program Counter (PC)** is a register inside the microcontroller that keeps track of the address of the next instruction to be executed. It ensures the microcontroller executes instructions in the correct sequence.
- **How it works:** The PC holds the memory address of the next instruction that needs to be fetched from the Program ROM (Read-Only Memory). After fetching an instruction, the PC is updated (usually incremented) to point to the next instruction in memory.
- **Size of the Program Counter:** The PC size in a PIC microcontroller depends on the address space provided by the ROM. The **Program Counter** is a 13-bit register in the PIC16F877A, meaning it can address up to 8,192 locations (8 KB) in the Program ROM (Flash memory).



- The PC automatically increments after each instruction fetch unless the execution flow is altered by control instructions such as branches or jumps.
- In the event of an **interrupt**, the PC value is pushed onto the stack, and the address of the interrupt vector is loaded into the PC, allowing the PIC to execute the interrupt service routine (ISR).



Program ROM Space

The **Program ROM Space** refers to the memory area in a PIC microcontroller where the firmware (program code) is stored. The Program ROM is non-volatile, meaning it retains its contents even when the power is off, unlike RAM (Random Access Memory).

- **ROM Types:** In older PIC microcontrollers, the Program ROM was often implemented using **EPROM** (Erasable Programmable Read-Only Memory), or **Flash memory** in modern PICs.
- **Size of the Program ROM:** The size of the Program ROM varies depending on the model of the PIC microcontroller. Some older PIC models might have as little as 512 bytes, while modern versions might have several kilobytes or even megabytes of memory available for storing program code.
- **Addressing the ROM:** The Program ROM space is divided into addresses that the Program Counter can access. The microcontroller's instruction set is designed to reference specific addresses in this ROM space. The ROM's size determines how much program code can be stored and executed. The address space is mapped directly into the program counter.



Program ROM Space in the PIC16F877A



- The **PIC16F877A** has **14-bit wide instructions**, and the **Program ROM** is **14 bits** wide as well.
- The **Program ROM** (Flash memory) is **14 KB** (or **8192 words**). Since each instruction is 14 bits wide, each memory location holds one instruction.
- The ROM is non-volatile, meaning it retains the program even when the power is off.
- The Program ROM is divided into the following:
 - **0x0000 to 0x1FFF**: Normal program memory, where the user code is stored.
 - **0x2000 to 0x3FFF**: This space is reserved for EEPROM data memory, not for code storage.
 - **Interrupt Vector**: The PIC16F877A has special locations for interrupt vectors. At reset, the PC points to **0x0000**, and interrupt vectors are mapped to specific addresses (e.g., 0x004, 0x008, etc.).