

# PIC Interrupts & Interfacing – I

Processor Architecture (214451)

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# What is an Interrupt?

- An interrupt is a signal that temporarily halts the CPU's current task.
- Used to handle urgent events by executing an Interrupt Service Routine (ISR).
- Enables multitasking and efficient processor usage.
- Triggered by hardware or software sources.

# Interrupt vs Polling

- Polling: CPU repeatedly checks each device → Wastes cycles.
- Interrupt: Device alerts CPU only when attention is needed → Efficient.
- Polling is used in simple, less time-sensitive systems.
- Interrupts are ideal for real-time, time-sensitive applications.

# How Interrupts Work

- 1. Interrupt signal received.
- 2. CPU saves current program state.
- 3. Identifies ISR from Interrupt Vector Table (IVT).
- 4. Executes ISR to handle interrupt.
- 5. Restores saved state and resumes previous task.

# Types of Interrupts

- 1. Hardware Interrupts - From external devices.
  - a. Maskable - Can be ignored if needed.
  - b. Non-Maskable - Cannot be ignored.
- 2. Software Interrupts - From software events.
  - a. Normal - Intentional from program.
  - b. Exception - Unintentional errors (e.g., divide by zero).

# Interrupt Vector Table (IVT)

- IVT is a memory table storing addresses of ISRs.
- When an interrupt occurs, CPU finds ISR address via IVT.
- Allows fast and organized interrupt handling.

# Sources of Interrupts in PIC18

- 1. External devices (INT0, INT1, INT2 on RB0–RB2).
- 2. Timer overflows (Timer0, Timer1, etc.).
- 3. Port B pin changes (RB4–RB7).
- 4. Serial communication (USART).
- 5. ADC, CCP modules.
- 6. Reset conditions (Power-on, Brown-out, Watchdog).

# Important Interrupt Registers in PIC18

- RCON – Reset control.
- INTCON, INTCON2, INTCON3 – Main interrupt control.
- PIR1, PIR2 – Peripheral interrupt requests.
- PIE1, PIE2 – Enables for peripheral interrupts.
- IPR1, IPR2 – Sets interrupt priority.



# External Hardware Interrupts

- INT0, INT1, INT2 pins handle external interrupt sources.
- Typically triggered on negative edge (falling signal).
- Useful for detecting button presses, sensors, etc.

# LED, Buzzer, Relay Interfacing

- Output devices controlled by microcontroller pins.
- LEDs indicate status or patterns.
- Buzzers used for alerts.
- Relays used to switch higher power circuits.

# LCD Interfacing (16x2)

- Displays text (characters) for feedback or data.
- Key LCD pins: RS (data/command), RW (read/write), EN (enable).
- Initialization sequence needed before displaying data.
- Can be connected via Port B, D or E.

# Keypad Interfacing (Matrix Type)

- Matrix keypads use rows and columns to detect key presses.
- Initial state: Rows = 0, Columns = 1.
- Scan columns to detect press, then scan rows to identify key.
- Efficient for 4x4 or 4x3 keypad input systems.

# Assignment Questions

- 1. Explain PIR and IPR registers.
- 2. Explain function of LCD pins: RS, RW, EN.
- 3. Draw and explain interfacing of 4x4 matrix keypad with PIC18F.
- 4. Show LCD interfacing with Port D and Port E of PIC18F.
- 5. Justify use of INTCON register.
- 6. Explain external hardware interrupts in PIC18 with diagram.