UNIT VI

Analog to digital converter

And

Digital to analog converter

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Part One

Analog to Digital converter

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Outline

- Definition
- Why we need ADC
- Types ADC and each basic operation
- Applications of analog to digital converter

Definition

- An electronic integrated circuit which transforms a signal from analog(continues) to digital(discrete) form
- Analog signals are directly measurable quantities
- Digital signals only have two states for digital computer we refer to binary states, 0 and 1

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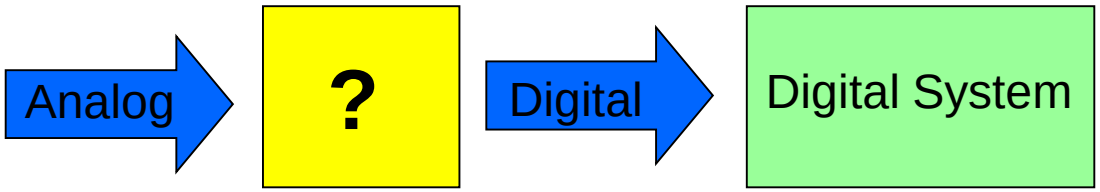
- The heart of computer-based data acquisition is usually the analog to digital converter
- Basically this device is digital volt meter
- Digital Systems require discrète digital data



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- Digital computers require signals to be in digital form whereas most instrumentation transducers have an output signal in analogue form.
- ADC conversion is therefore required at the interface between analogue transducers and the digital computer

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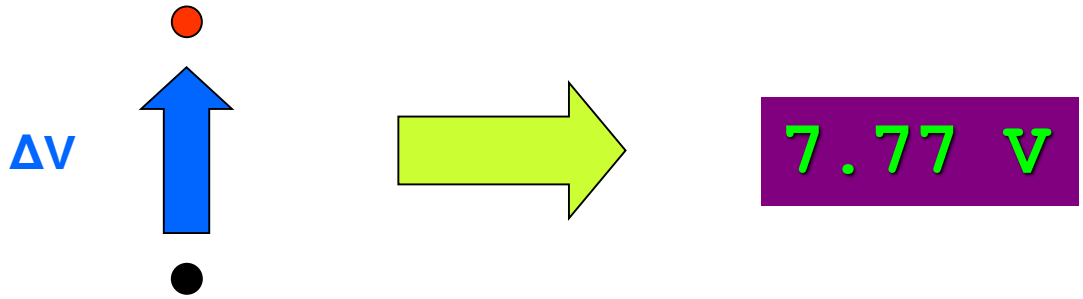
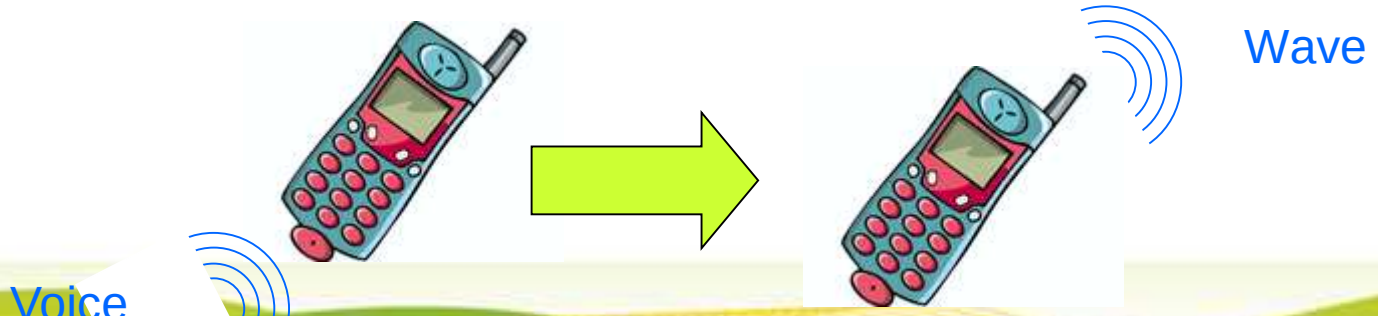
Examples of use

- **Voltmeter**



- **Cell phone (microphone)**



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Why we need ADC

- Microprocessors can only perform complex processing on digitized signals
- When signals are in digital form they are less susceptible to the deleterious effects of additive noise
- ADC Provides a link between the analog world of transducers and the digital world of signal processing and data handling.

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Types of analog to digital converter

- There are many different types of analog to digital converters
- Each offers something in the way of
  - ✓Speed
  - ✓Cost
  - ✓Power dissipation
  - ✓complexity

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Types of analog to digital converter

- Counter type
- Successive approximation
- There are many types such as flash type and sigma-delta but we will cover these two types

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Counter type

- One of the simplest types of analog to digital converter is counter type ADC
- The input signal of ADC is connected to the signal input of its internal comparator
- The ADC then systematically increases the voltage of the reference input of the comparator until the reference becomes larger than the signal

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- And the comparator output goes to 0
- Ex: consider an input signal is 4.78 volts. The initial comparator's input would be 2.5 volts
- The comparator compares the two value then the result this is less than 4.78 then the next higher voltage (5.00 volts) is applied
- The comparator compares the two value and says this is greater than 4.78 and switches 0

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- The digital output of the ADC is the number of times the ADC increase the voltage after starting at the initial 2.5 volts
- This scheme is relatively simple , but as the number of ADC increases the time it takes to scan through all possible values lower than input will grow quickly

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Components of counter type

- This type of converter uses some type of counter as part of its operation
- Counter type contains the following elements:
  - Digital to analog converter
  - Some type of counting mechanism
  - Comparator
  - clock

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Features of counter type

- Use a clock to index the counter
- Use DAC to generate analog signal to compare against input
- Comparator is used to compare V_{IN} and V_{DAC} where V_{IN} is the signal to be digitized
- The input to the DAC is from the counter

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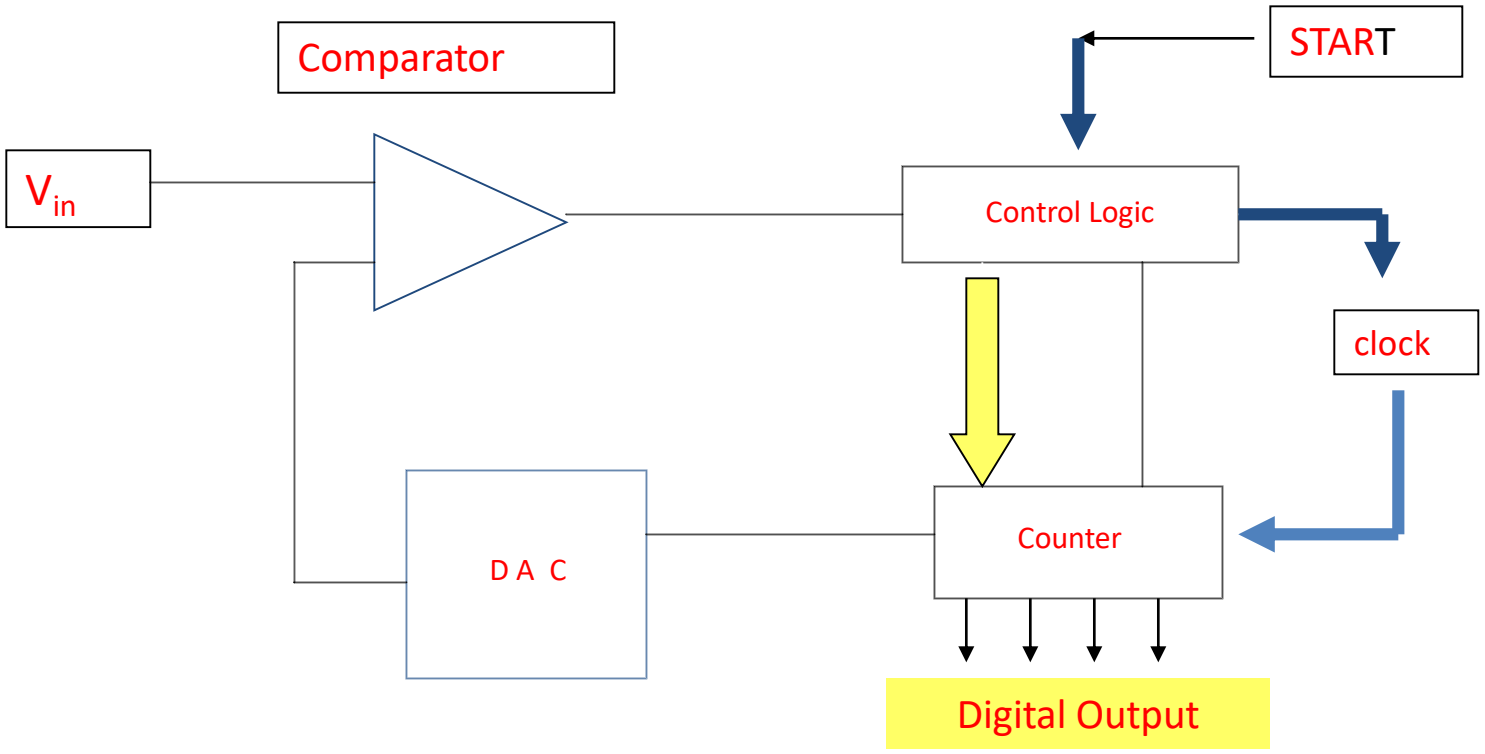
Operation of counter type



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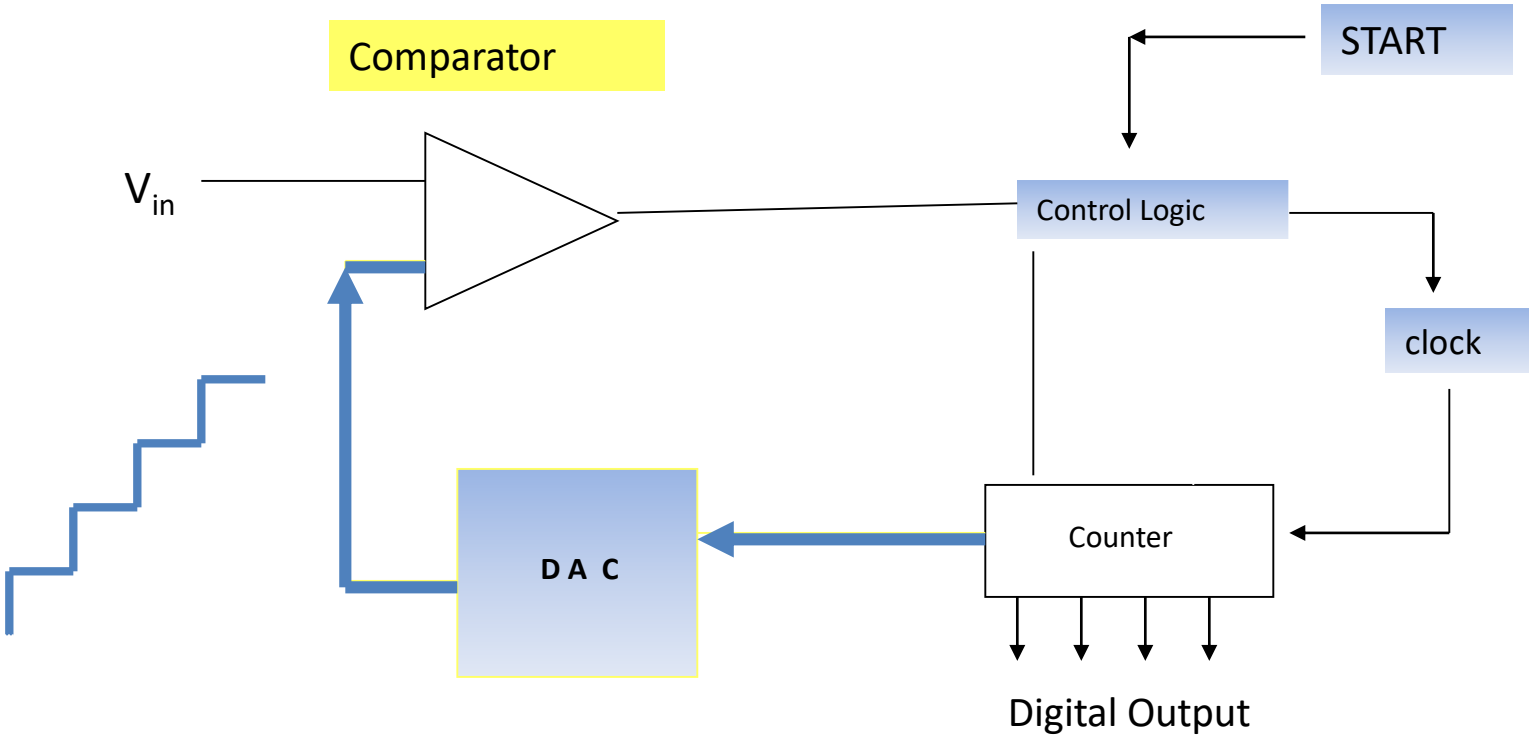
Operation of counter type



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Quick Quiz

- **Which of following is not a type of ADC?**

(a) Flash ADC

(b) Dual slope ADC

(c) Recessive approximation ADC

(d) sigma-delta ADC

Quick Quiz

- **A DAC is a**

(a) digital-to-analog computer

(b) digital analysis calculator

(c) data accumulation converter

(d) digital-to-analog converter