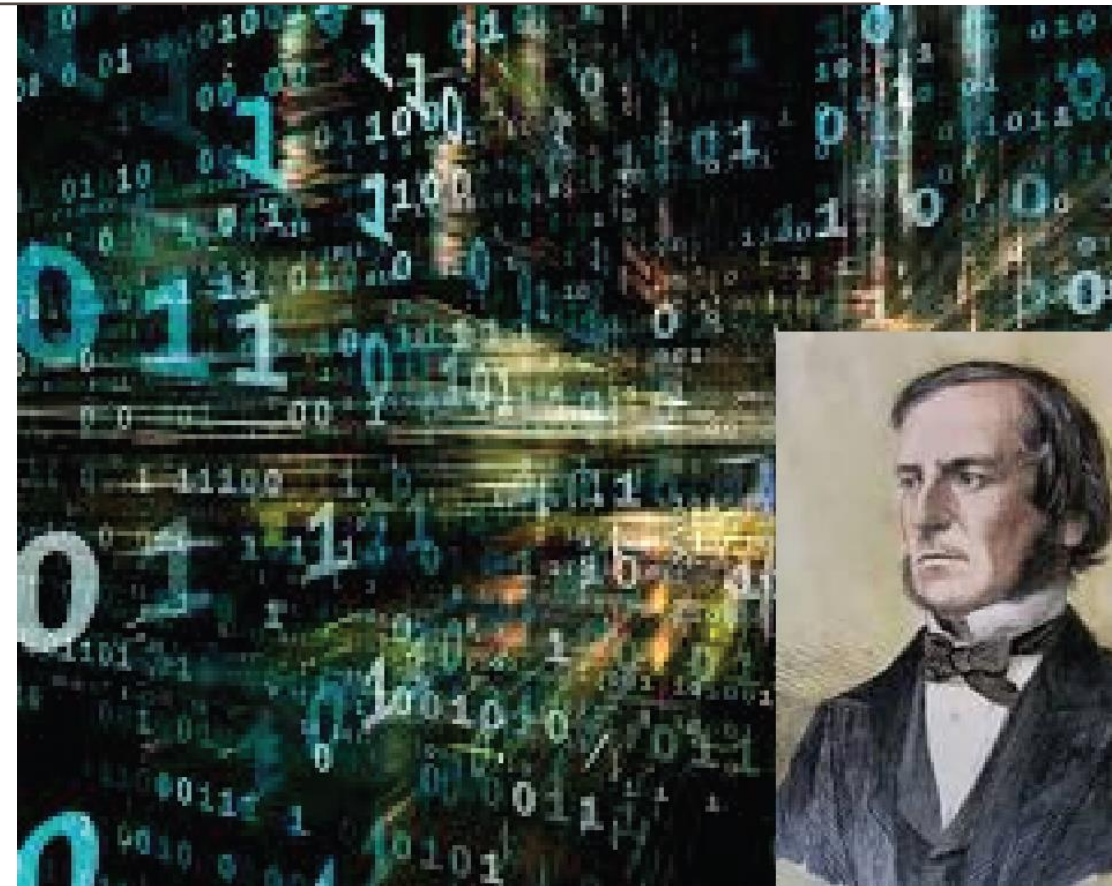




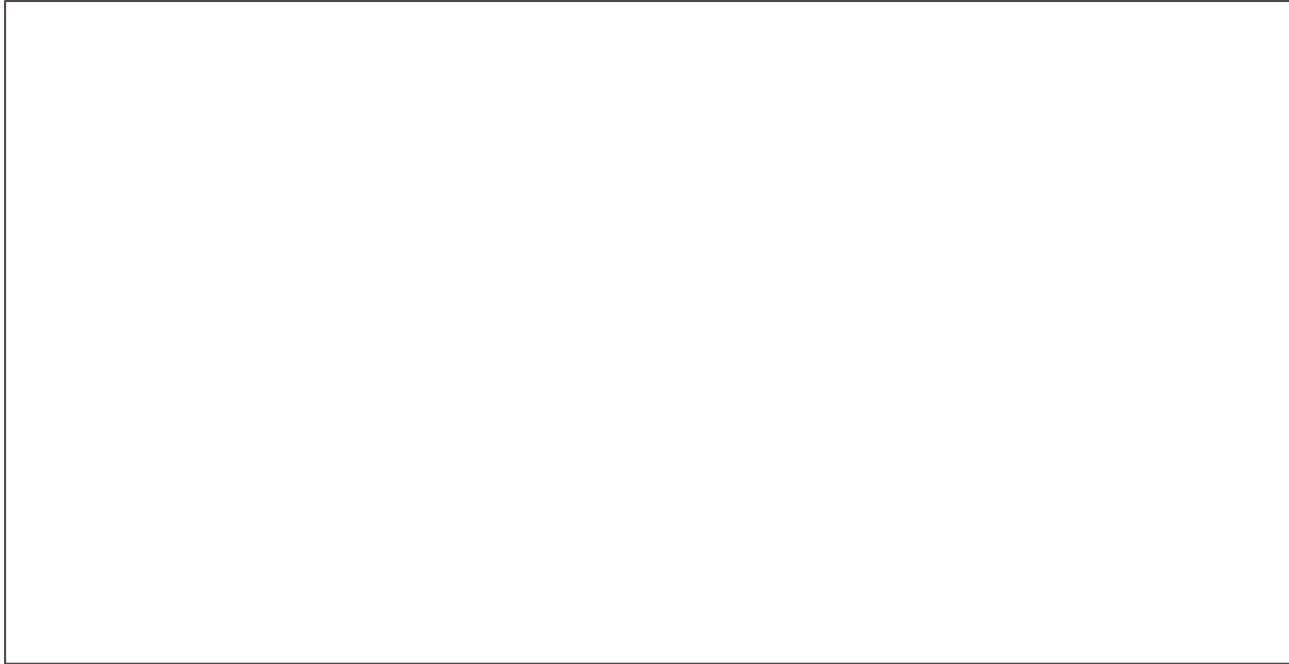
DIGITAL CIRCUITS

Week-1, Lecture-2 Introduction

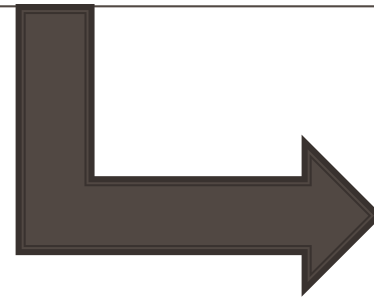
Sneh Saurabh
3rd August, 2018



Digital Circuits: Announcements/Revision



Digital Circuits



Introduction

Signal

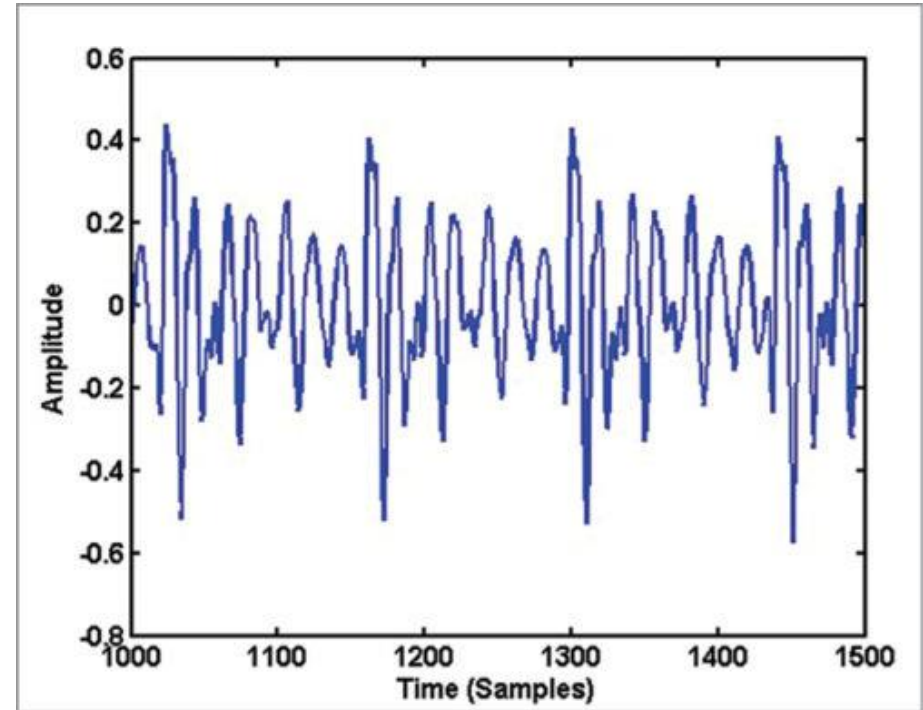
What is **Signal**?

- Quantity that carries data/information

Examples of **Signal**

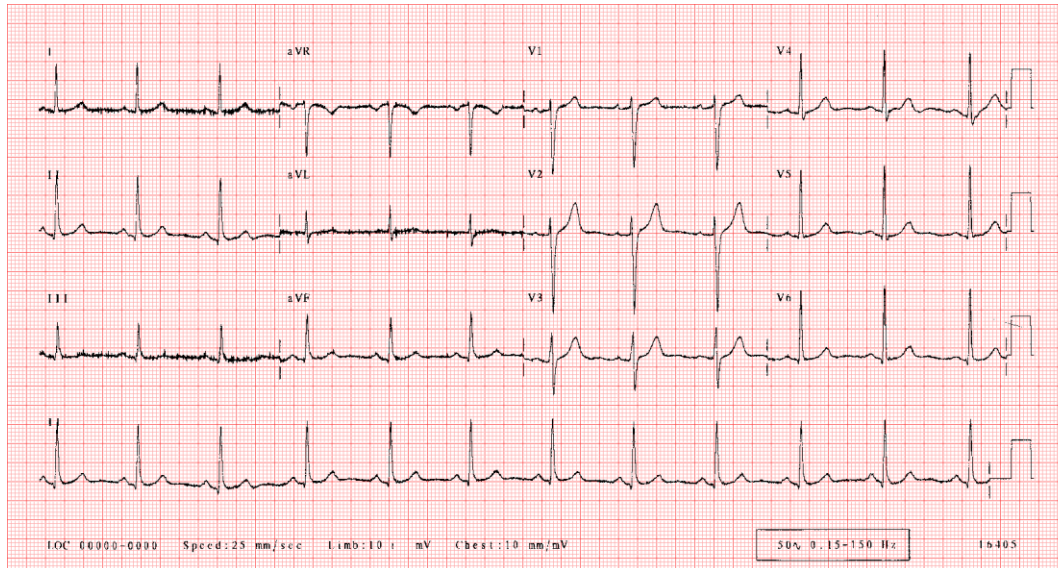
- Speech, Audio
- Image, Video
- Biomedical signals, Radar signals, Seismic signals, etc.

- Quantity that varies with time/space



An example of speech signal: vowel “aa”

Signal (Examples)



Electrocardiography (ECG): records electrical activity of the heart over a period of time



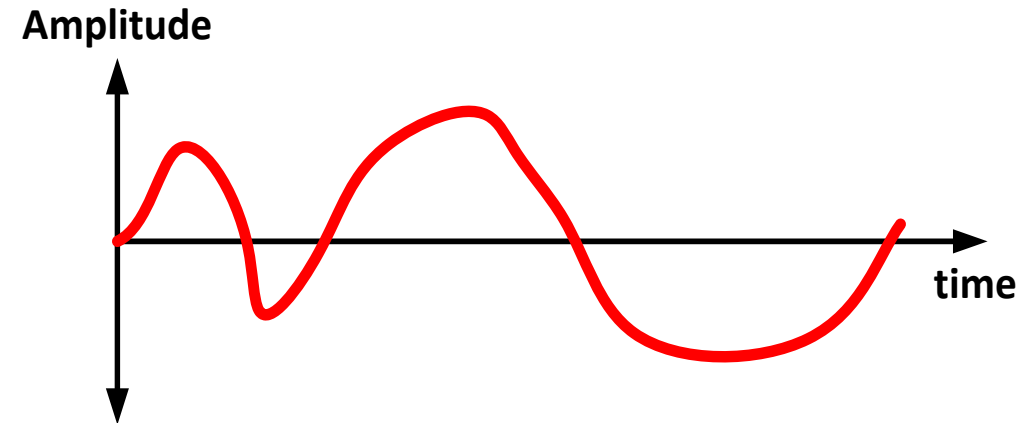
Stock price (of Apple) varying with time [Not a natural Signal]

Analog Signals

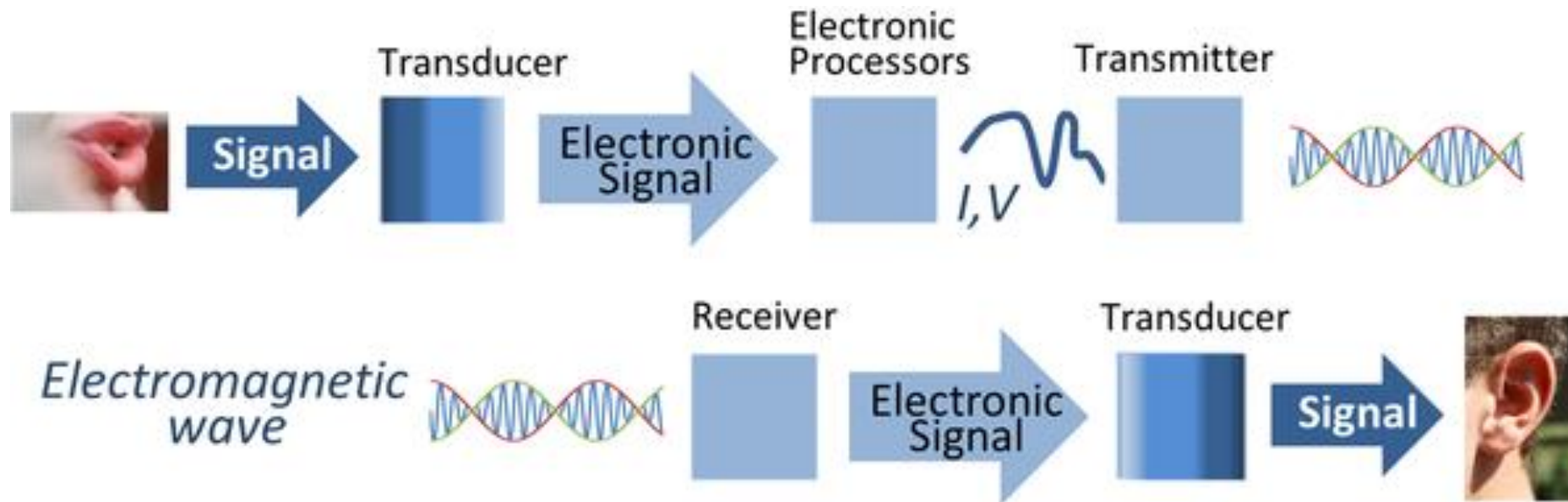
What is an **Analog Signal**?

- Analog signal is continuous in time and can take any value (between some minimum and maximum limits)
- Speech, audio, biomedical signals, radar signals, seismic signals, etc

- $y = f(t)$: t is continuous
- y can taken any value within a range



Analog Systems



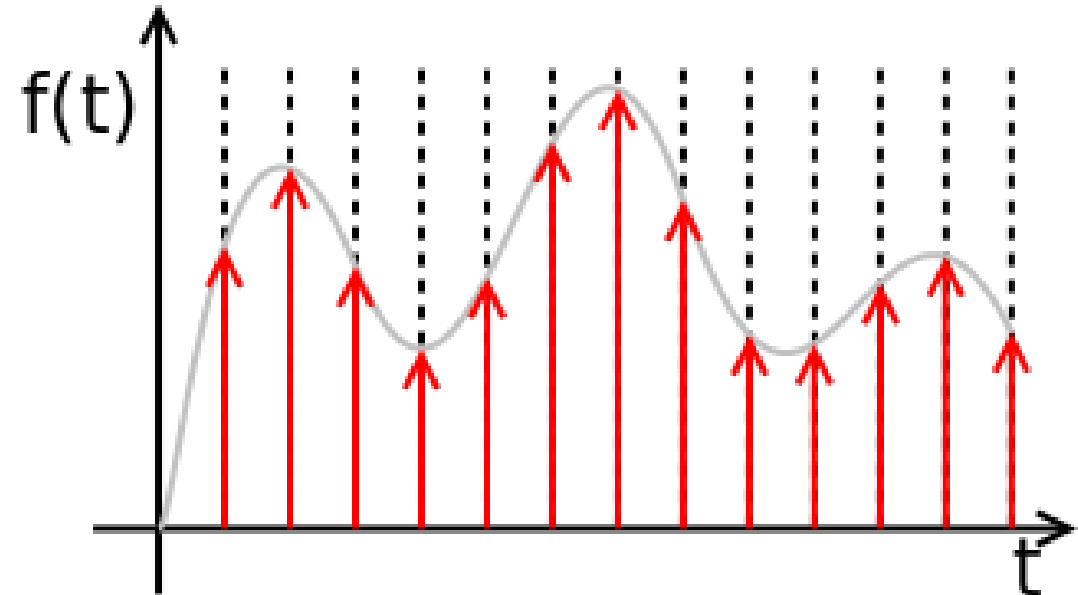
<https://en.wikipedia.org/wiki/Signal>

Discrete time signal

What is a **Discrete time signal**?

- Analog signal is observed at certain points of time
- The observation is made at constant or variable rate. This is known as **sampling**

- $y = f(t)$:
 - $t = nT$
 - n is an integer $\{0, 1, 2, 3, 4, \dots\}$
 - T is sampling period
- y can taken any value within a range



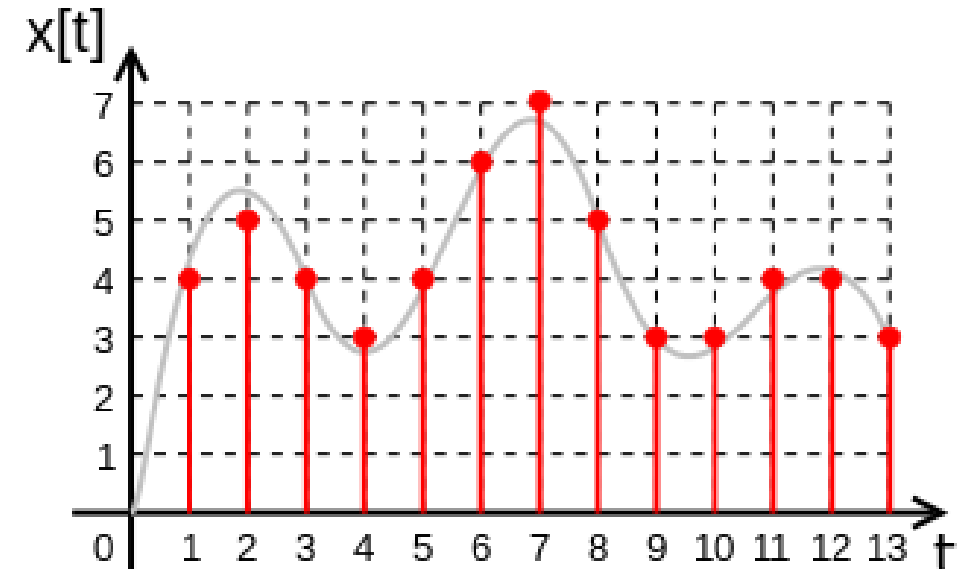
https://en.wikipedia.org/wiki/Discrete_time_and_continuous_time

Digital signal

What is a **Digital signal**?

- Discrete in time as well as **amplitude**
- Amplitude can take values from a discrete set of values

- $y = f(t)$:
 - $t = nT$
 - n is an integer $\{0, 1, 2, 3, 4, \dots\}$
 - T is sampling period
- y can taken values from a discrete set of values. For example: $\{0, 1, 2, 3, 4, 5, 6, 7\}$



[https://en.wikipedia.org/wiki/Digital_signal_\(signal_processing\)](https://en.wikipedia.org/wiki/Digital_signal_(signal_processing))

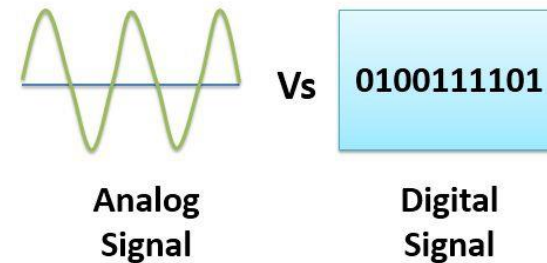
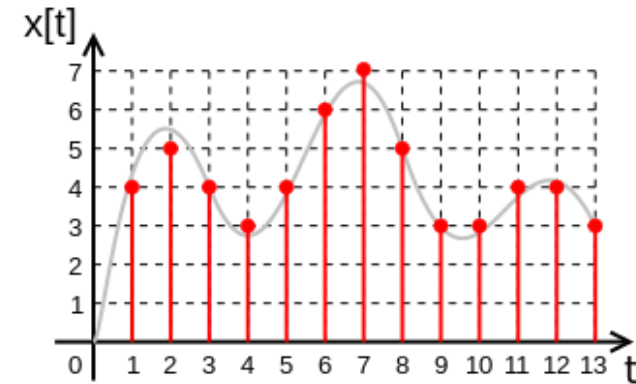
Analog to Digital signal

Two Steps:

1. **Sampling:** discrete time of measurement
2. **Quantization:** replaces exact value with a value from a discrete set

Accuracy:

1. Sampling rate
2. Discrete levels of amplitude



Analog System vs. Digital System (1)



Instruments

Sphygmomanometer

Analog System vs. Digital System (2)

CONVERT THESE:



TO THESE:



Storage

Analog System vs. Digital System (3)



Transmission

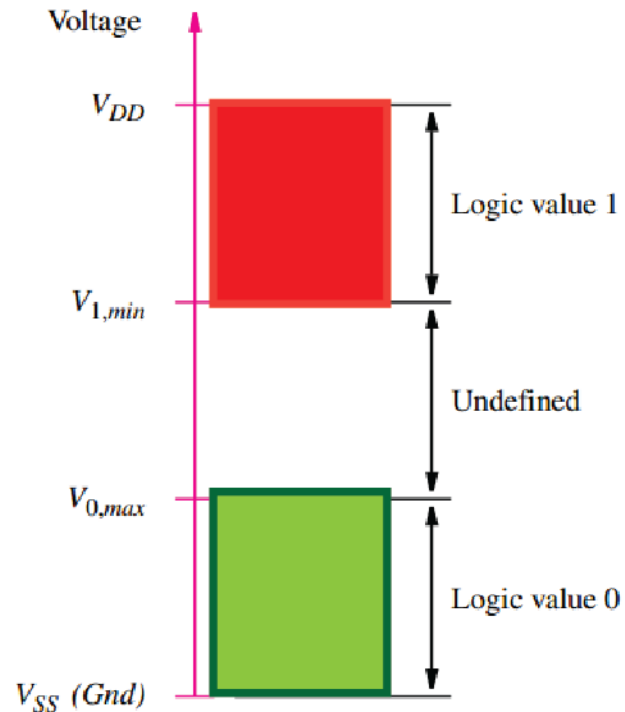


<https://keralaitnews.com/6385/ddk-trivandrum-ends-analogue-terrestrial-tv-transmission-goes-digital#prettyPhoto>

Analog System vs. Digital System (4)

- Quality of service
- Maintenance, Flexibility
- Delay (?)

Logic Circuits and Binary Levels



- V_{DD} to $V_{1,min}$ taken as logic "1"
- $V_{0,max}$ to V_{SS} taken as logic "0"

- Example:
 - $V_{DD}=1.2V, : V_{1,min}=0.8V$
 - $V_{SS}=0V, : V_{0,max}=0.4V$
 - What will be logic value for 0.9 V, 0.3 V?

- There is a margin for error
- Noise immunity