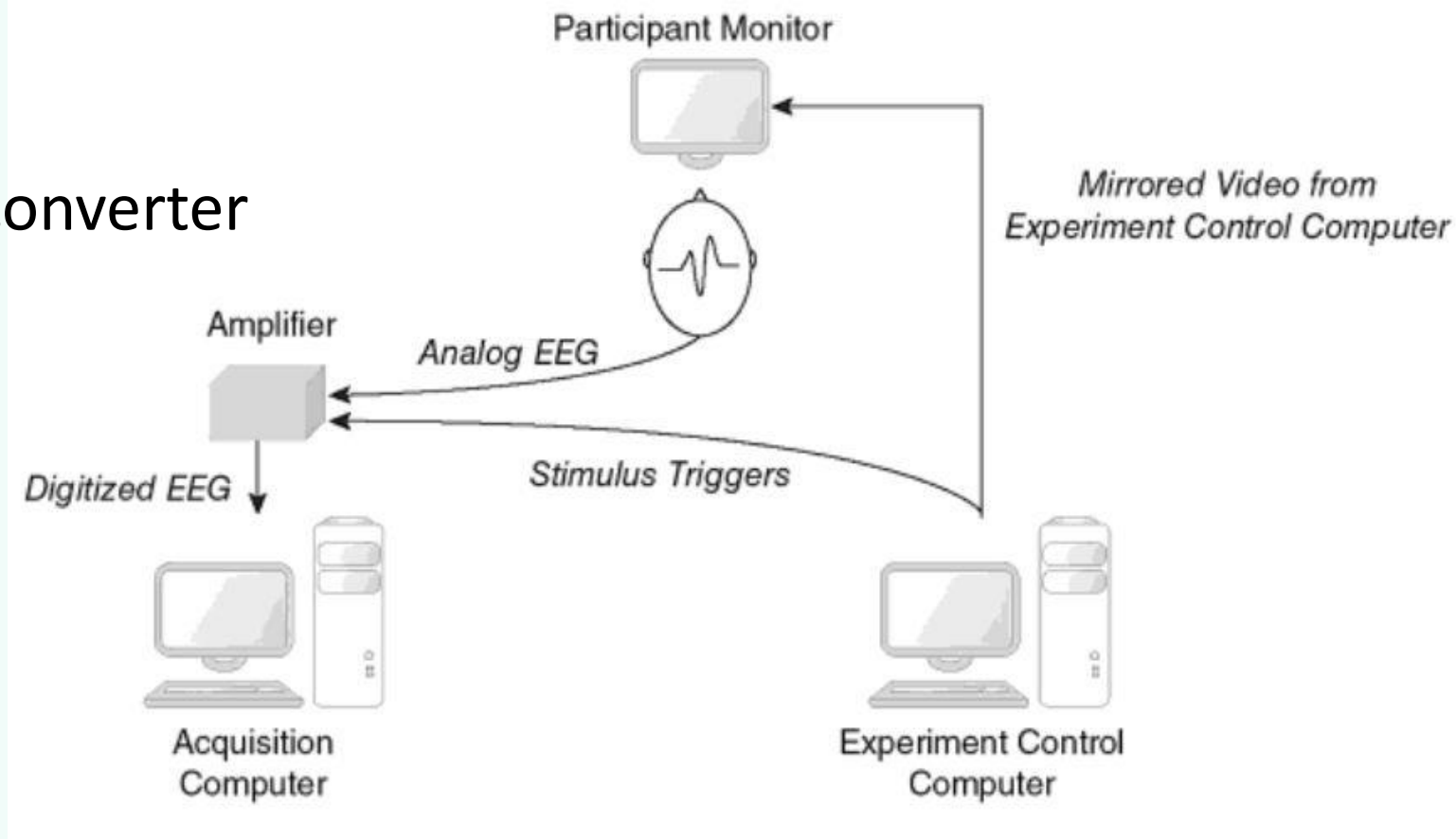
From the scalp into the computer

Jure Mur

Essential components

- Electrodes
- Amplifier
- Analogue-to-digital converter
- Recording device

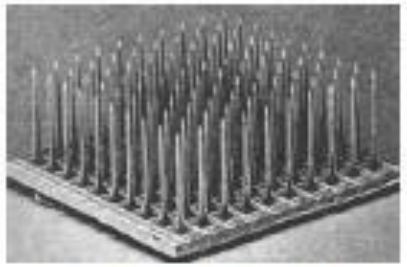


Dickter & Kieffaber (2014)

Electrodes

(a) Ag-AgCl electrodes

(b) Active electrodes

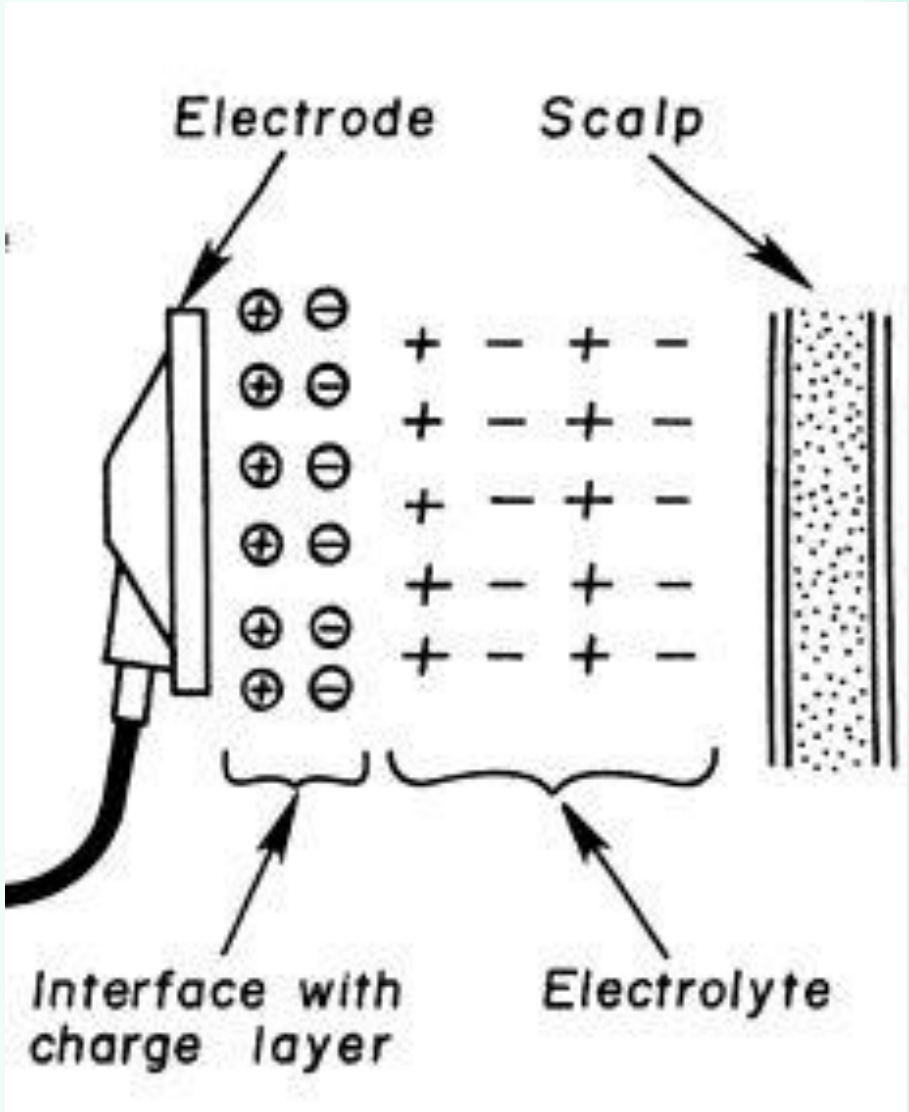


(c) Intra-cortical electrode array

(d) EEG caps (left to right: Standard: 256-ch., (me) (Neuroscan) [7], (Neuroscan) [7], (EGI) [8], Active; (Biosemi) [9], Hydrocel (EGI)) [8]

Usakli (2009)

- Usually require **electrolyte gel**
- Current flow based on **redox** reactions
- When rates of oxidisation/reduction are equal, the electrode is **non-polarisable**
- **Half-cell potential** exists between electrode and electrolyte
- Exhibit a certain **impedance** to flow of eletricity
- Best **materials**: gold, platinum, silver/silver-chloride



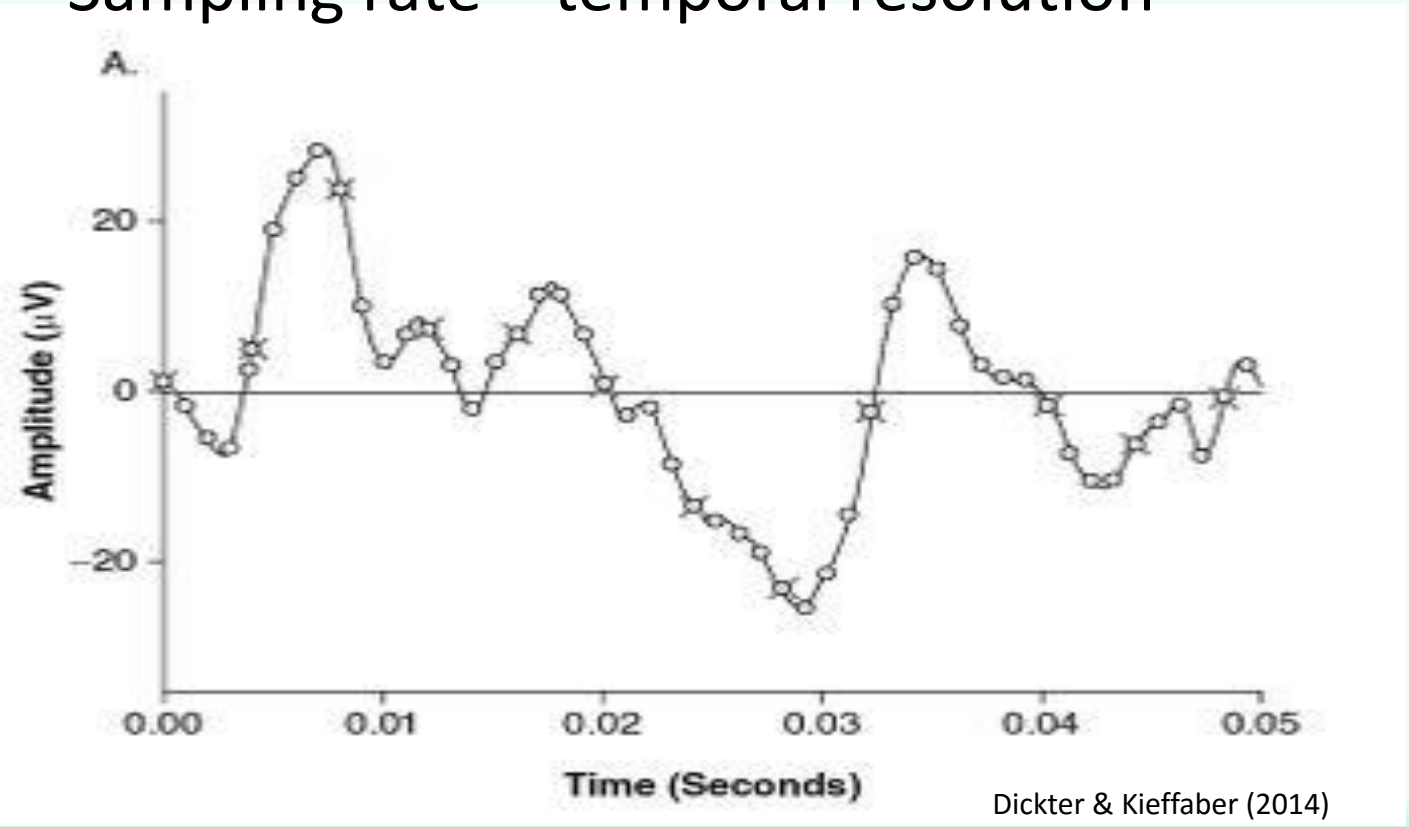
Tyner, Knott & Mayer (1983)

- Active electrodes amplify signal **before** entering electrode lead
- Active electrodes perform better at all impedances except very low ones
- Active electrodes are less able to accurately follow the EEG

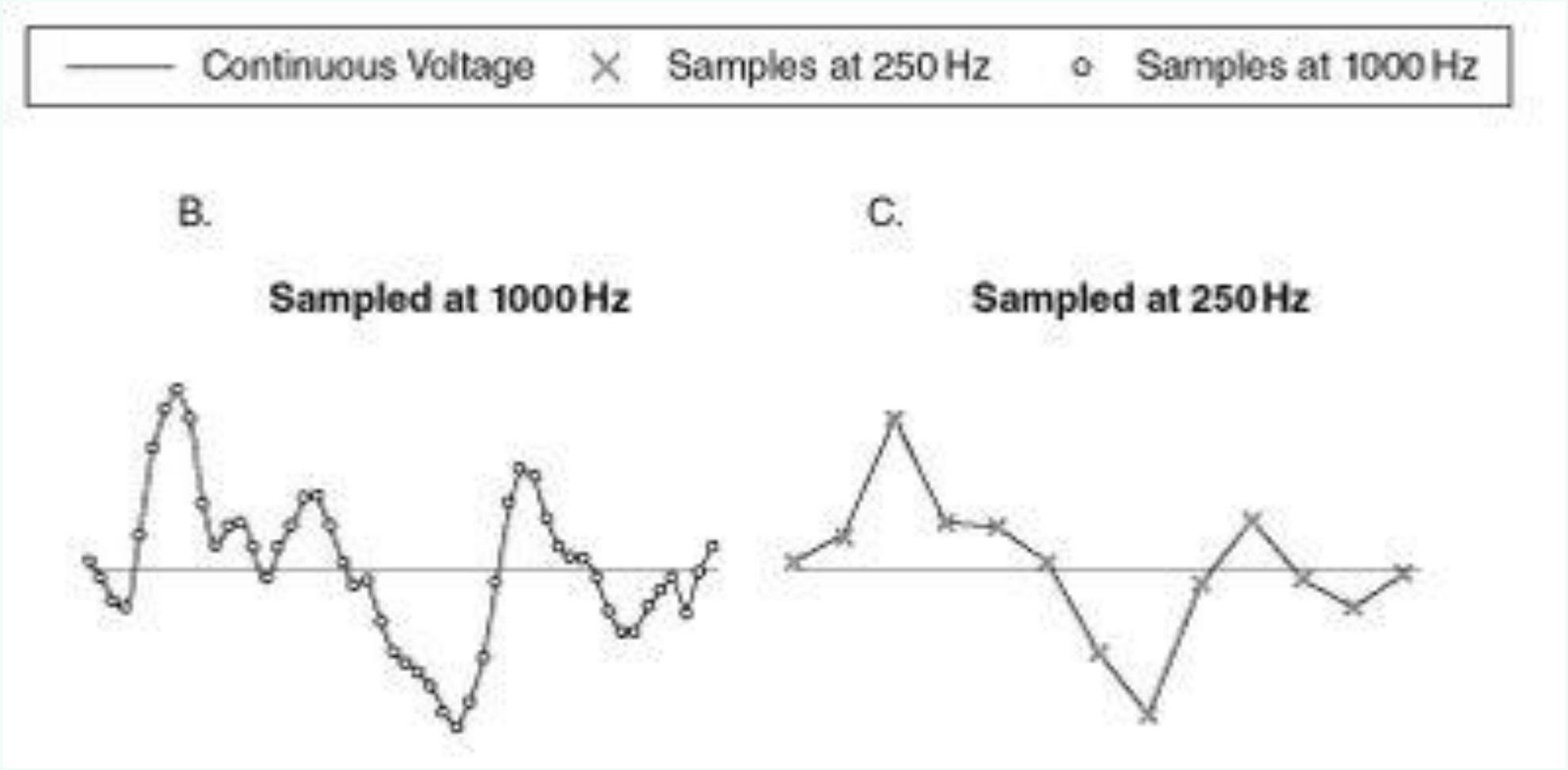
Laszlo, Ruiz-Blondet, Khalifan, Chu & Jin (2014)

Amplifier

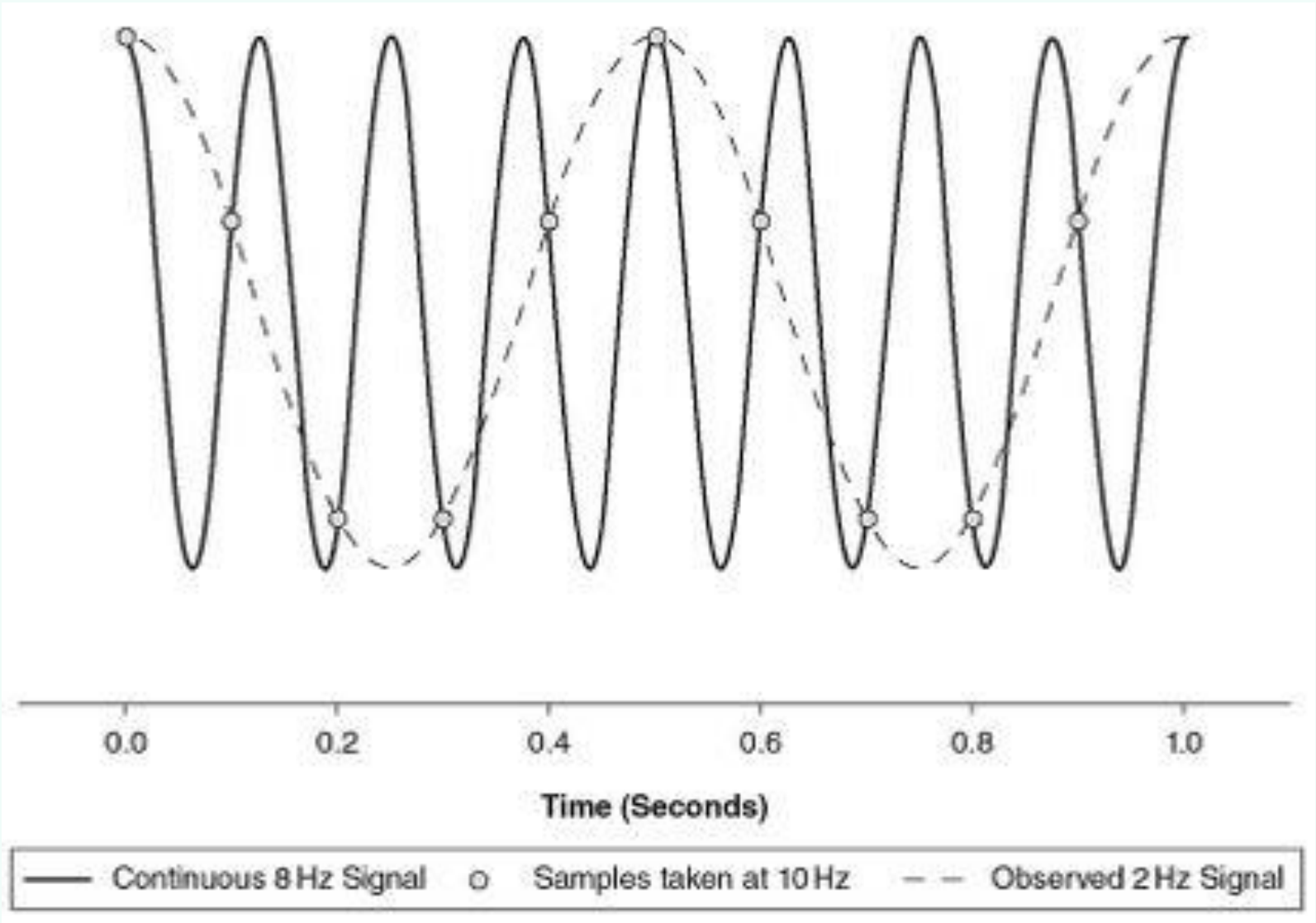
- Amplifies signal and reduces noise via **common mode rejection**
- Sampling rate = temporal resolution



Dickter & Kieffaber (2014)



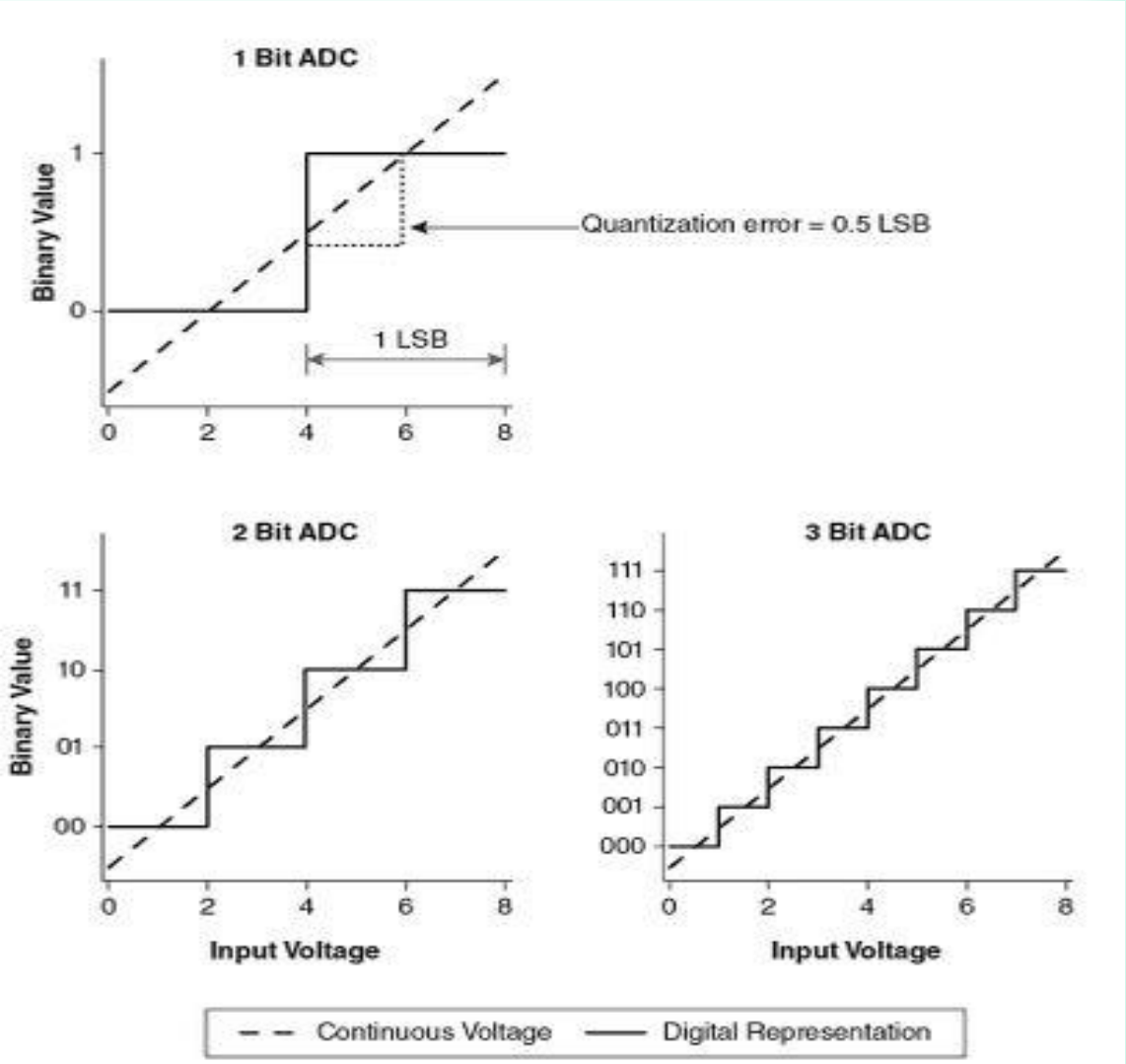
Dickter & Kieffaber (2014)



Dickter & Kieffaber (2014)

Analogue-to-digital converter

- Represents the analogue signals with **binary**
- Resolution expressed in **bits**
- Its resolution is a function of the **quantization resolution** and its **dynamic range**
- Small dynamic range –> „**clipping**“
- Theoretical resolution maximum is impossible to achieve



Dickter & Kieffaber (2014)

Thank you!

Retrieved from https://c1.staticflickr.com/9/8509/8499889901_f81fc65d25_z.jpg

Literature and further reading

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