

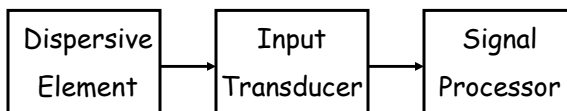
January 21, 2005

- Thanks for the emails - still waiting for some . . .
- **NOTE:** 1st problem set/reading assignments are posted!
- **Office Hours:** will be posted by Monday

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Signal Processor

- *Buffers* input and output transducers (*impedance matching*)



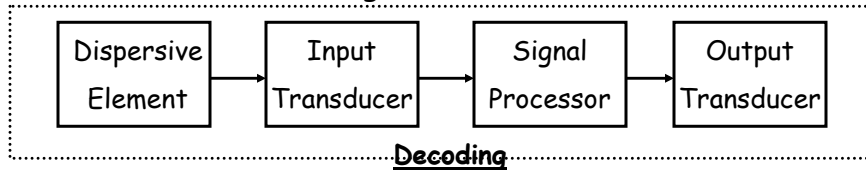
Examples:

- Amplification
- Modulation/waveshaping
- Current-to-voltage conversion
- ADC and/or DAC
- AC-to-DC conversion
- Math (log, FT, integration)

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Output Transducer

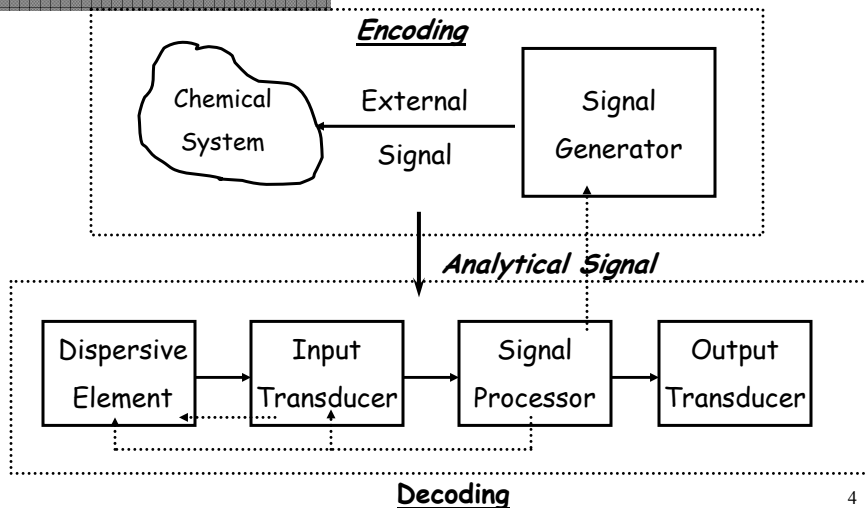
- Converts electrical signal into a "human-understandable" signal



- Most often, a computer
- Also does much of the signal processing

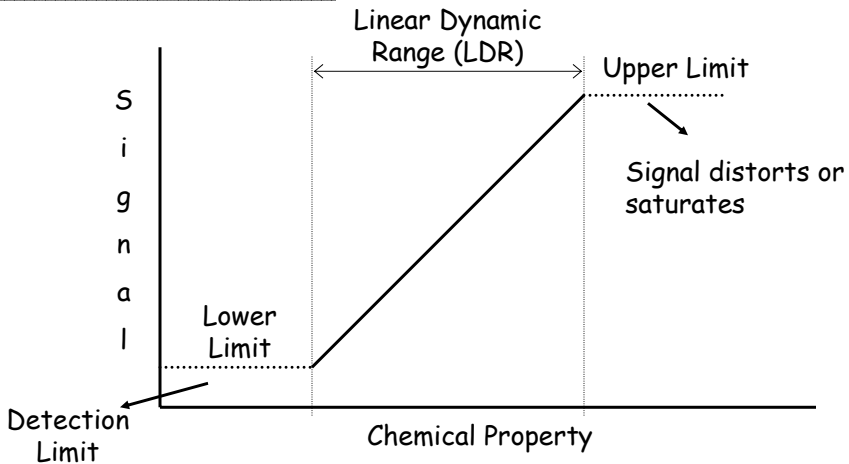
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The General Instrument



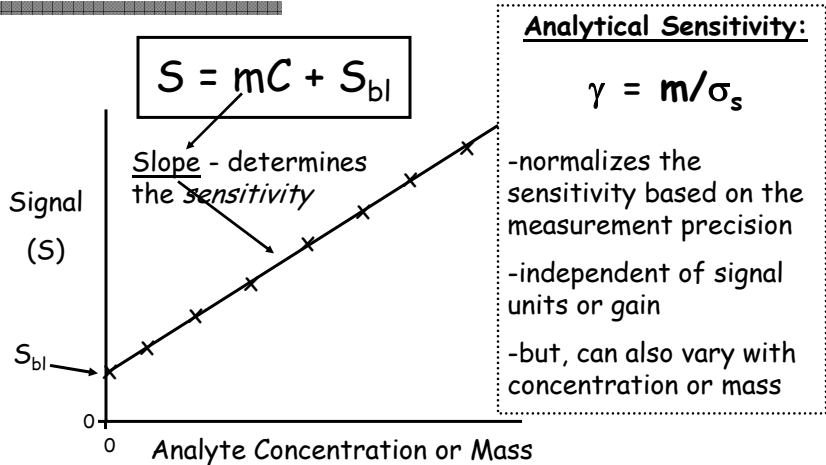
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Quantitative Properties of Analytical Instrumentation



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The Analytical Curve



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Detectability

- Bottom Line Question:

Is the Analytical Signal distinguishable from the Blank?

- Example: Pb analysis

| <u>Concentration</u> | <u>Signal</u> | <u>NET Signal</u> |
|----------------------|---------------|-------------------|
| 0 ppm (blank) | 0.136 | 0.000 |
| 10. ppm | 0.721 | 0.585 |
| 1.0 ppm | 0.195 | 0.059 |
| 0.10 ppm | 0.142 | 0.006 |
| 0.010 ppm | 0.137 | 0.001 |

We need to know the uncertainty of the measurements.

Std Deviation (σ)
(NOISE)

Which of these are detectable?

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Defining the Detection Limit

- We use the *Signal-to-Noise Ratio (S/N)* as the defining figure of merit.

- Most commonly accepted definition:

The detection limit is the concentration of analyte needed to produce a **S/N = 3**

- Where: S = signal due to analyte
N = σ_{blank}

Signal different from blank at about 89% confidence level

So, Det. Limit occurs when **S = 3 σ_{blank}**

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