Sensor krav og motivasjon

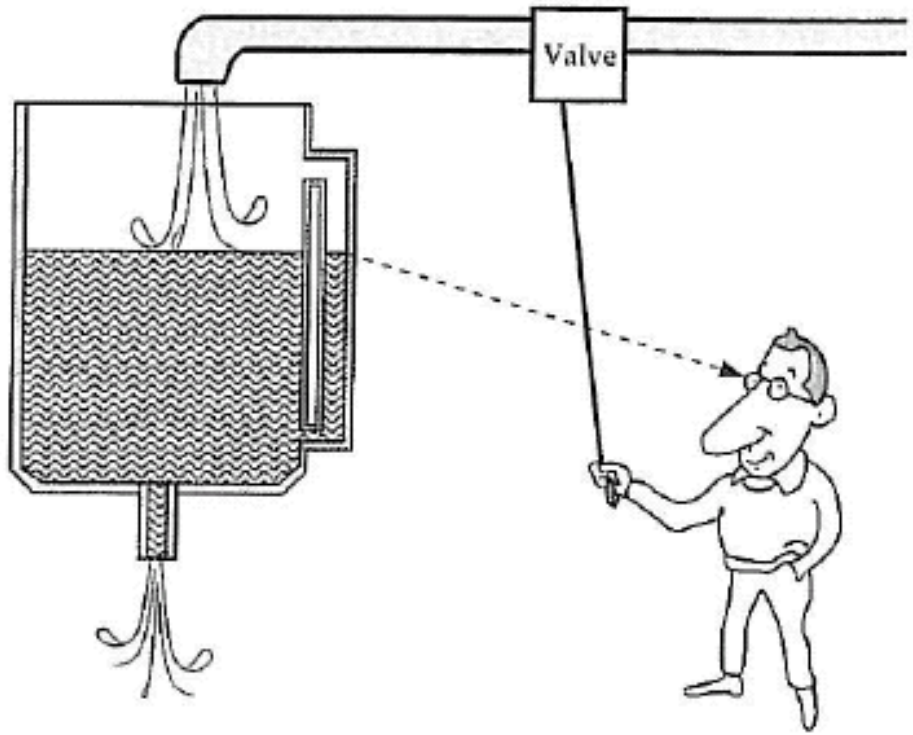
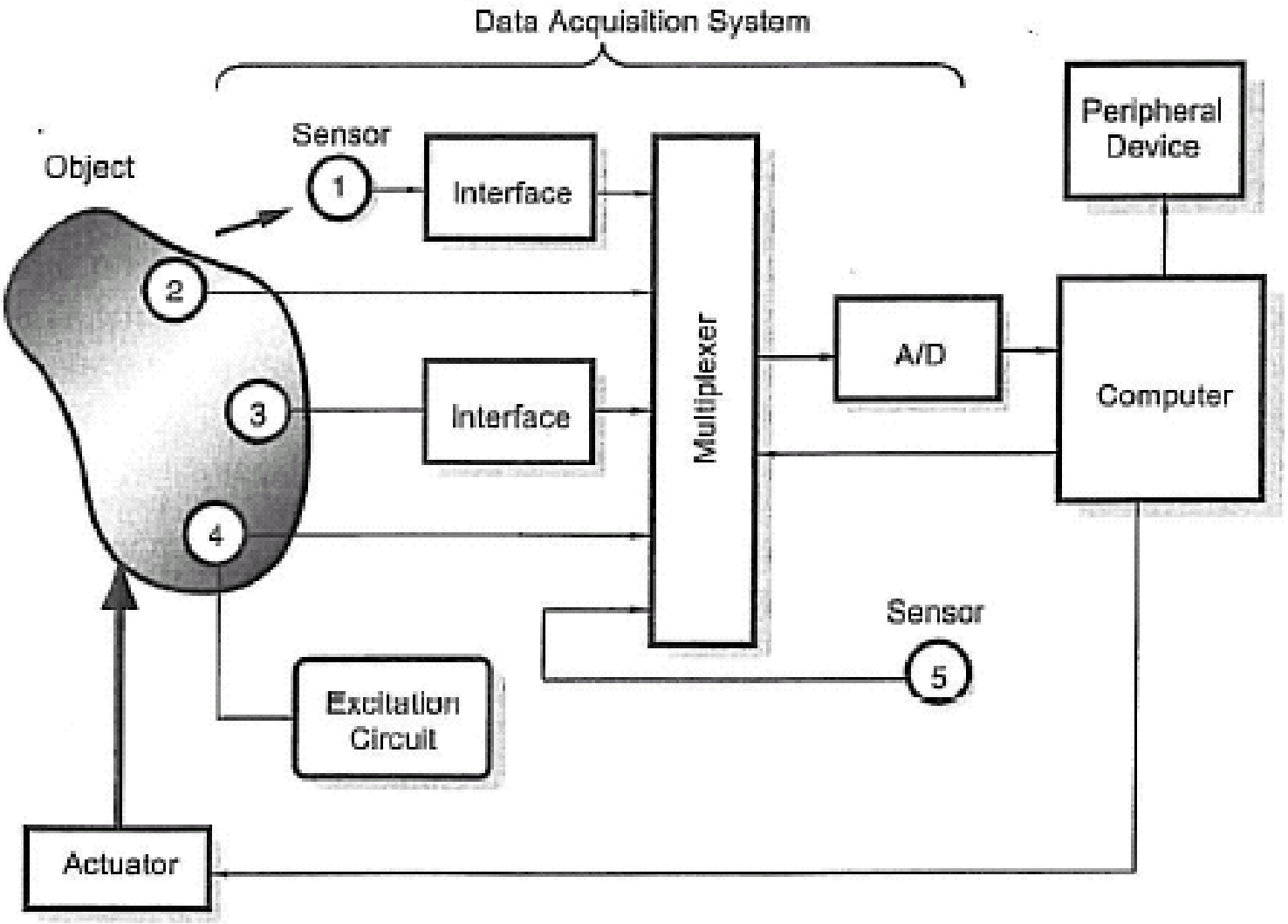
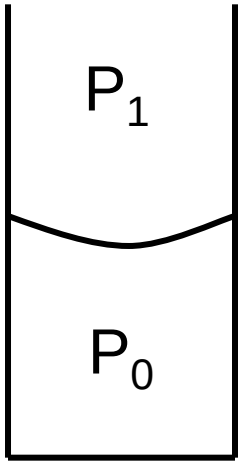


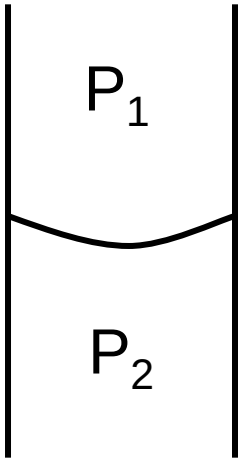
Fig. 1.1. Level-control system. A sight tube and operator's eye form a sensor (a device which converts information into electrical signal).

Målesystem (Fraden)

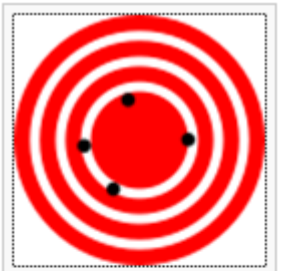


Absolutt eller relativ sensor



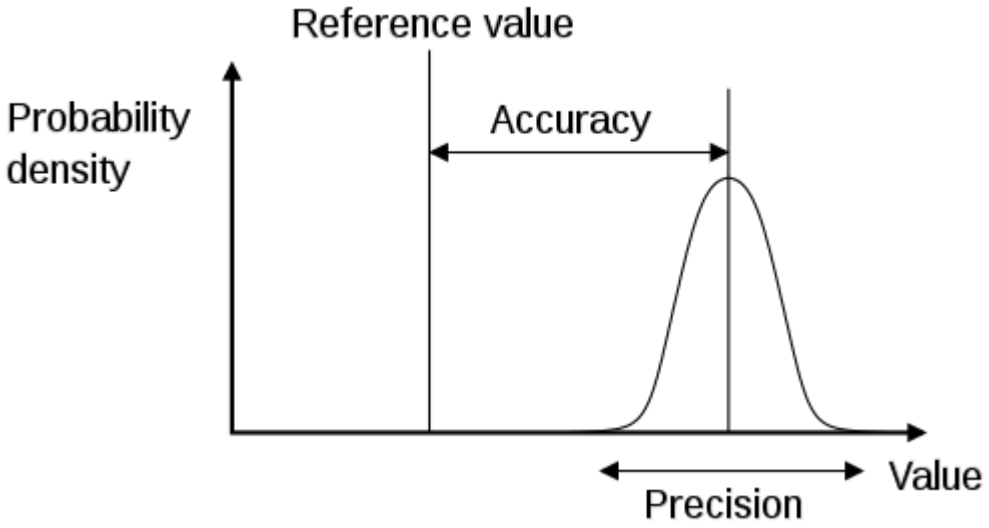


Nøyaktighet og presisjon



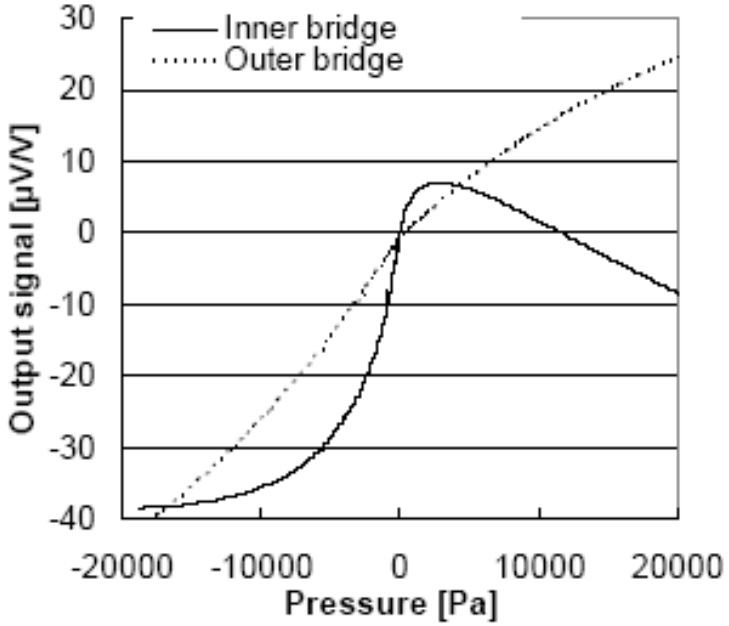
High **accuracy**, but low **precision**

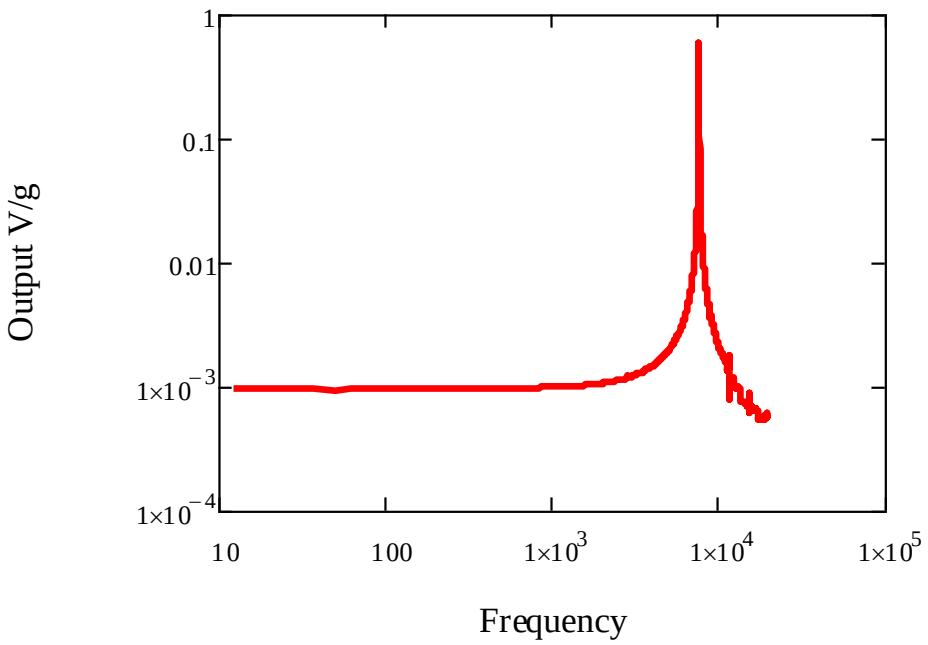
High **precision**, but low **accuracy**



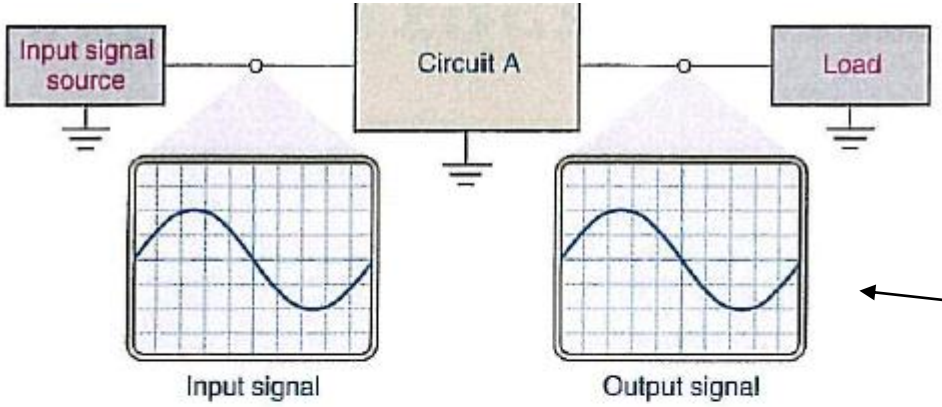
http://en.wikipedia.org/wiki/Accuracy_and_precision

Statisk og dynamisk karakteristikk

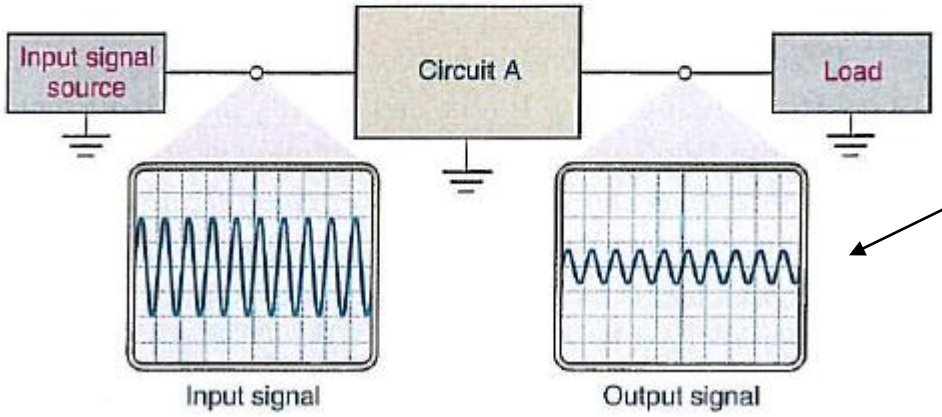


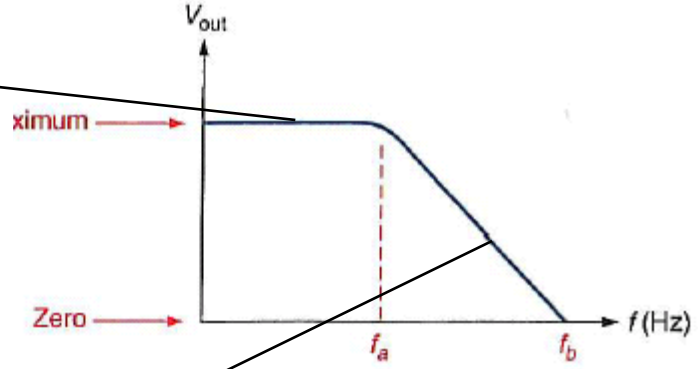


Dynamikk - amplitude



(a) Circuit A input and output signals at a given frequency (f).





(c) Frequency response curve.

lation

Paynter s 450

2. ordens system

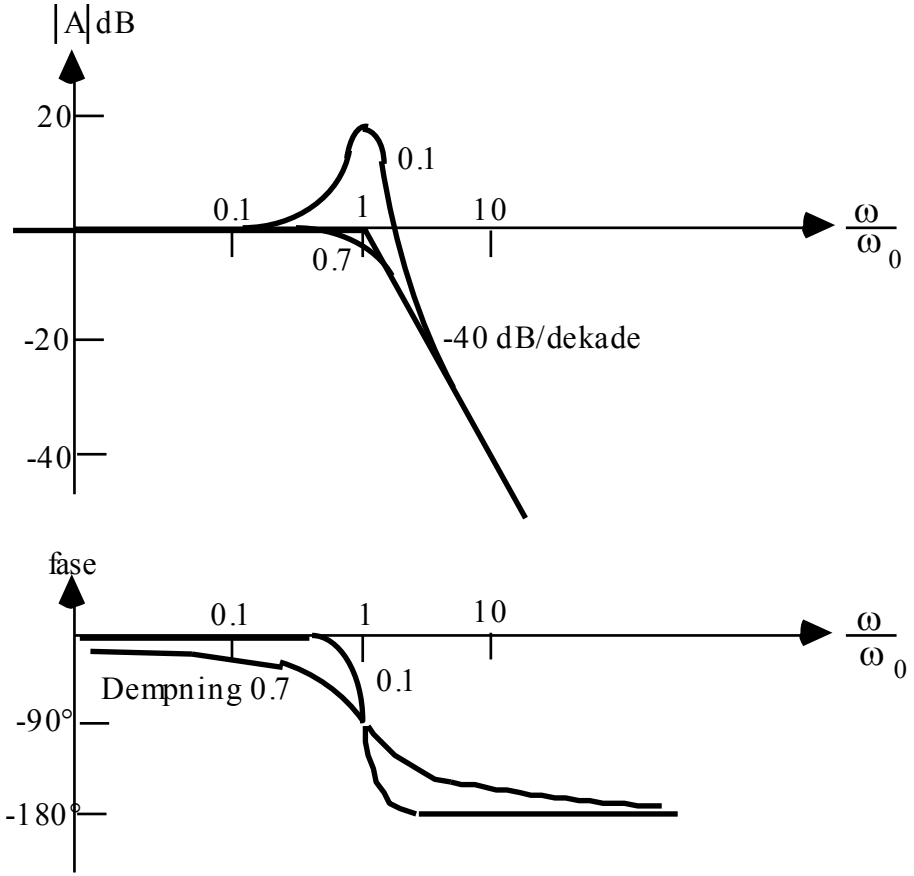


Fig. 5.7 Modul- og fase-forløp for dempning lik 0.1 og 0.7 .

Dynamikk - fase

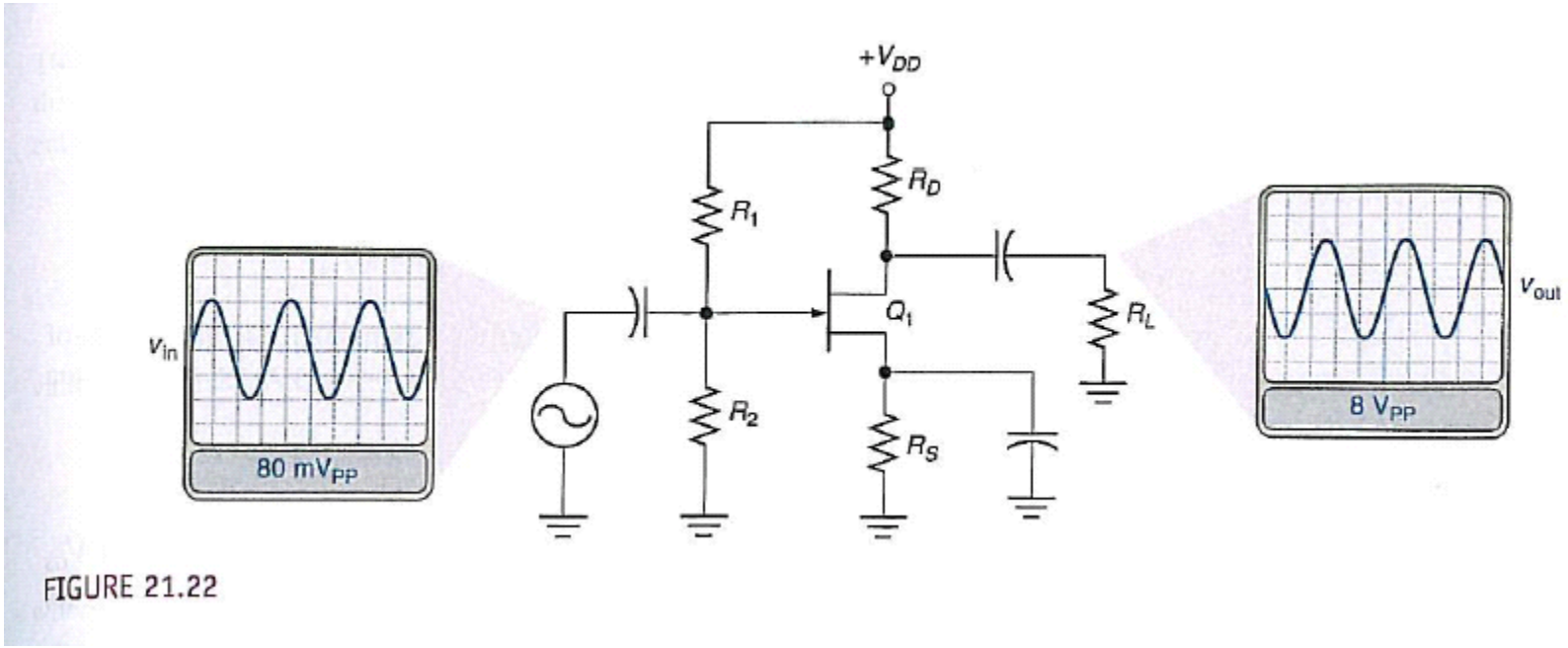


FIGURE 21.22

Paynter

Respons (statisk)

Måler:

Bruker:

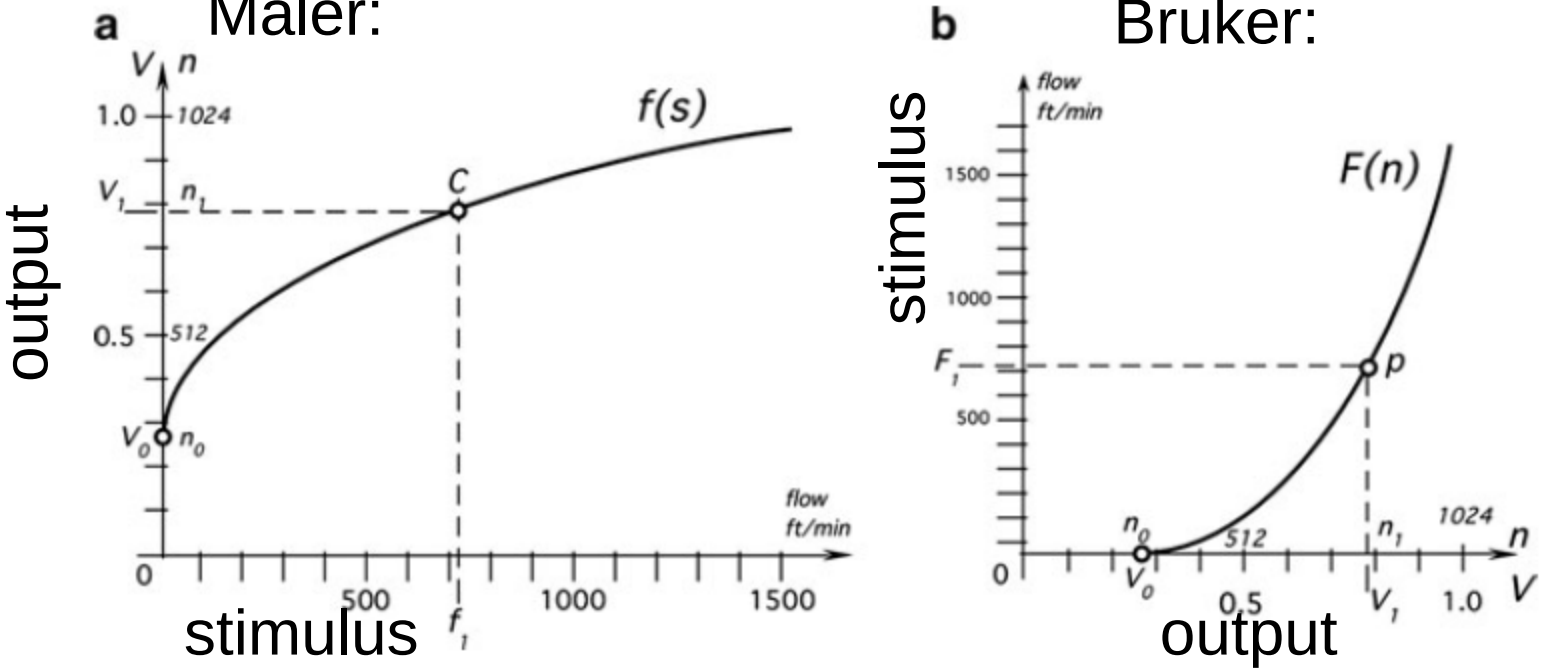
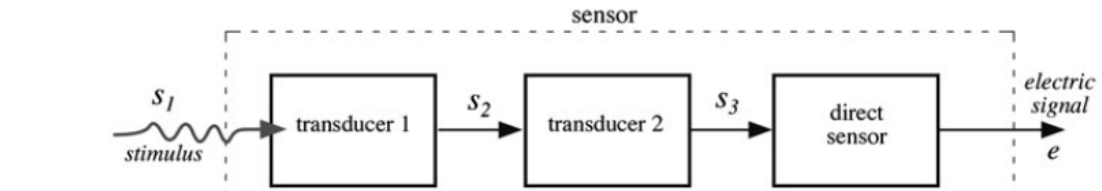


Fig. 2.1 Transfer function (**a**) and inverse transfer function (**b**) of a thermo-anemometer



stimulus

output

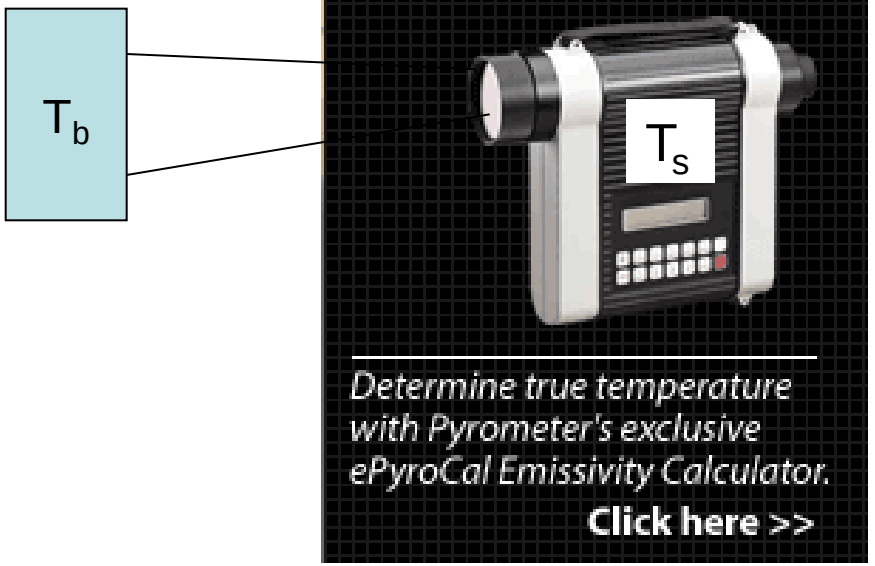
Eksponent respons - pyrometer

Utstrålt effekt

$$V = G(T_b^{\,4} - T_s^{\,4})$$

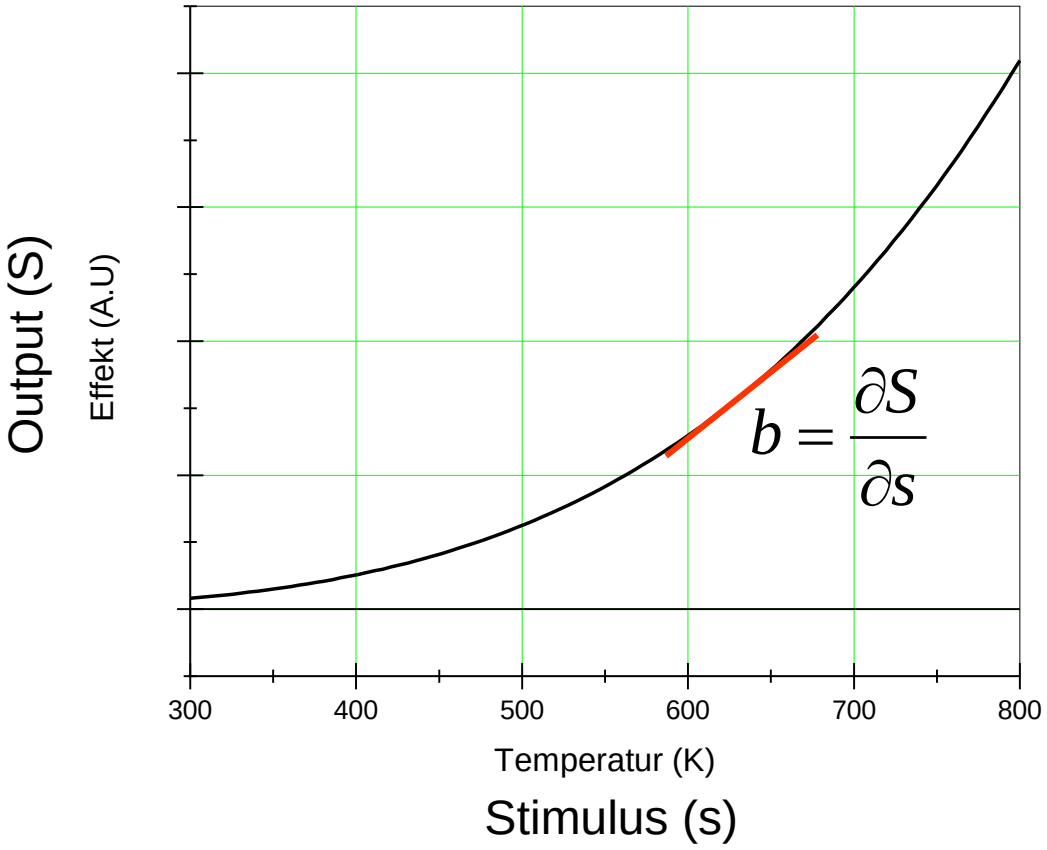
Følsomhet

$$b = \frac{\partial V}{\partial T_b} = 4GT_b^3$$



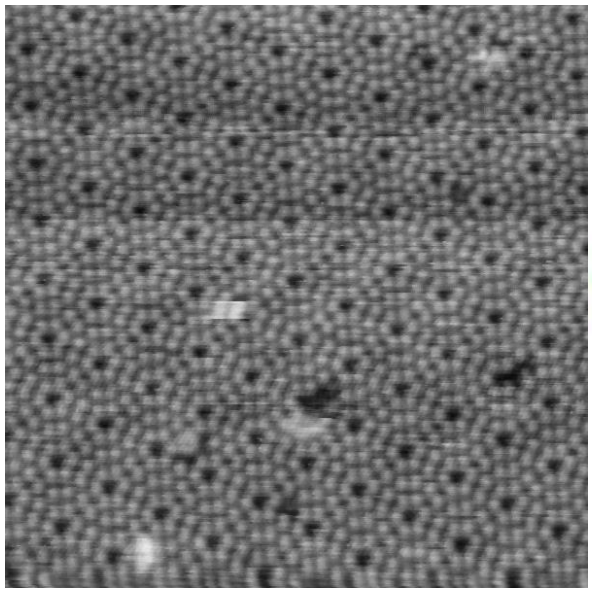
www.pyrometer.com

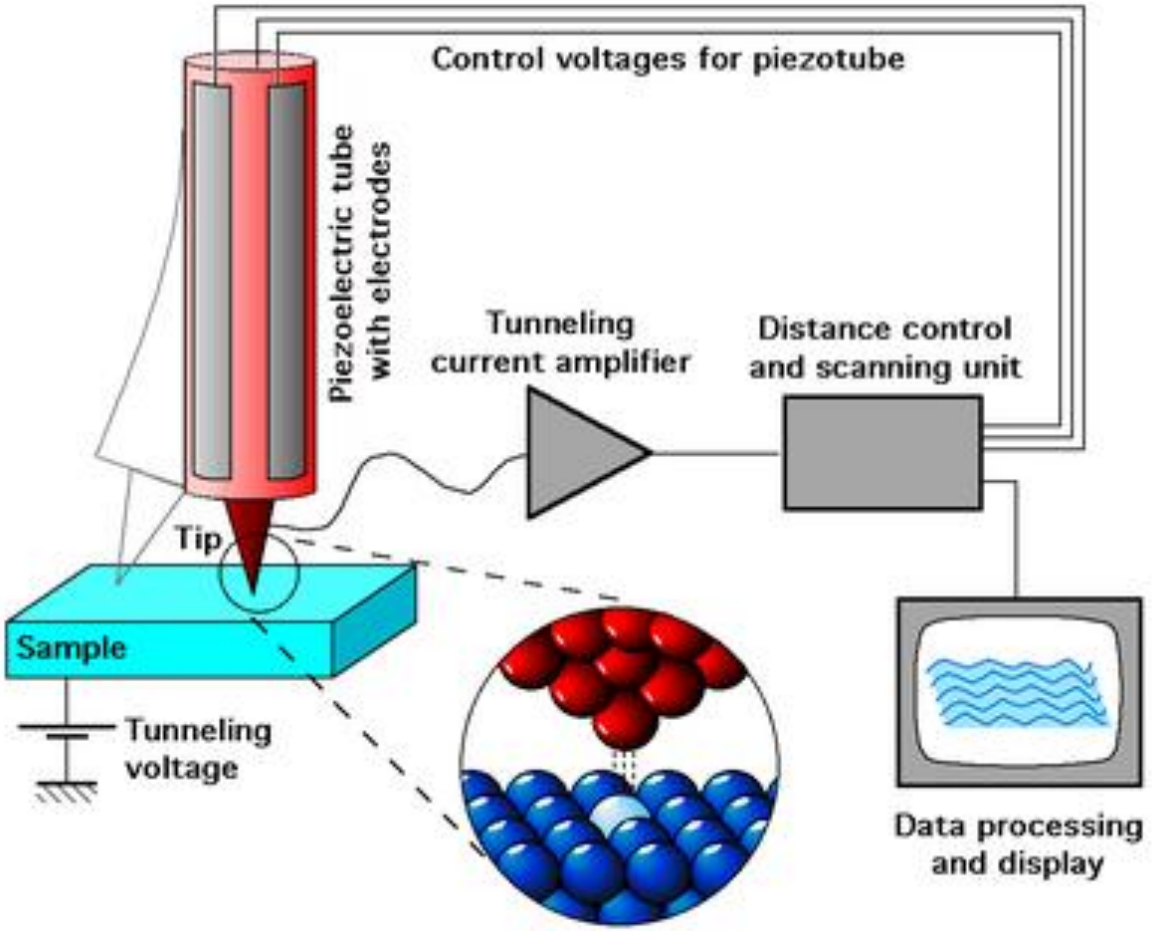
Følsomhet


Output (S)
Effekt (A.U)
$b = \frac{\partial S}{\partial s}$
300
400
500
600
700
800
Temperatur (K)
Stimulus (s)

Eksponensiell respons - STM

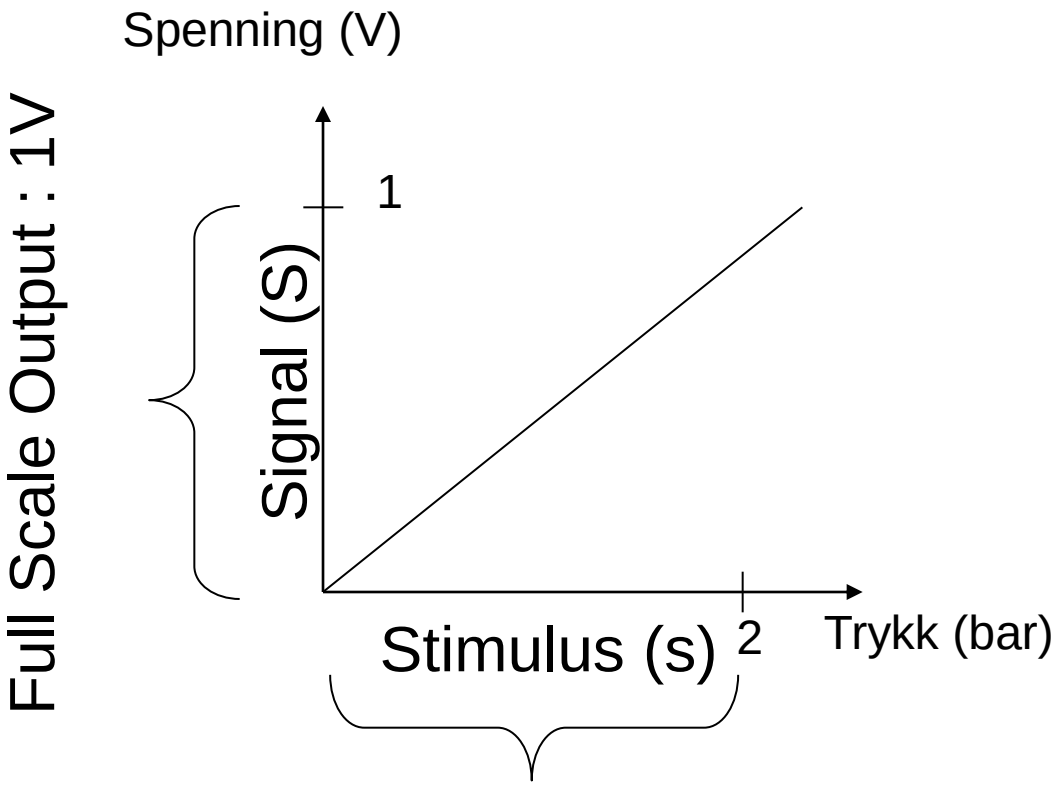
$$I \propto e^{\frac{-d}{d_0}}$$





Wikipedia

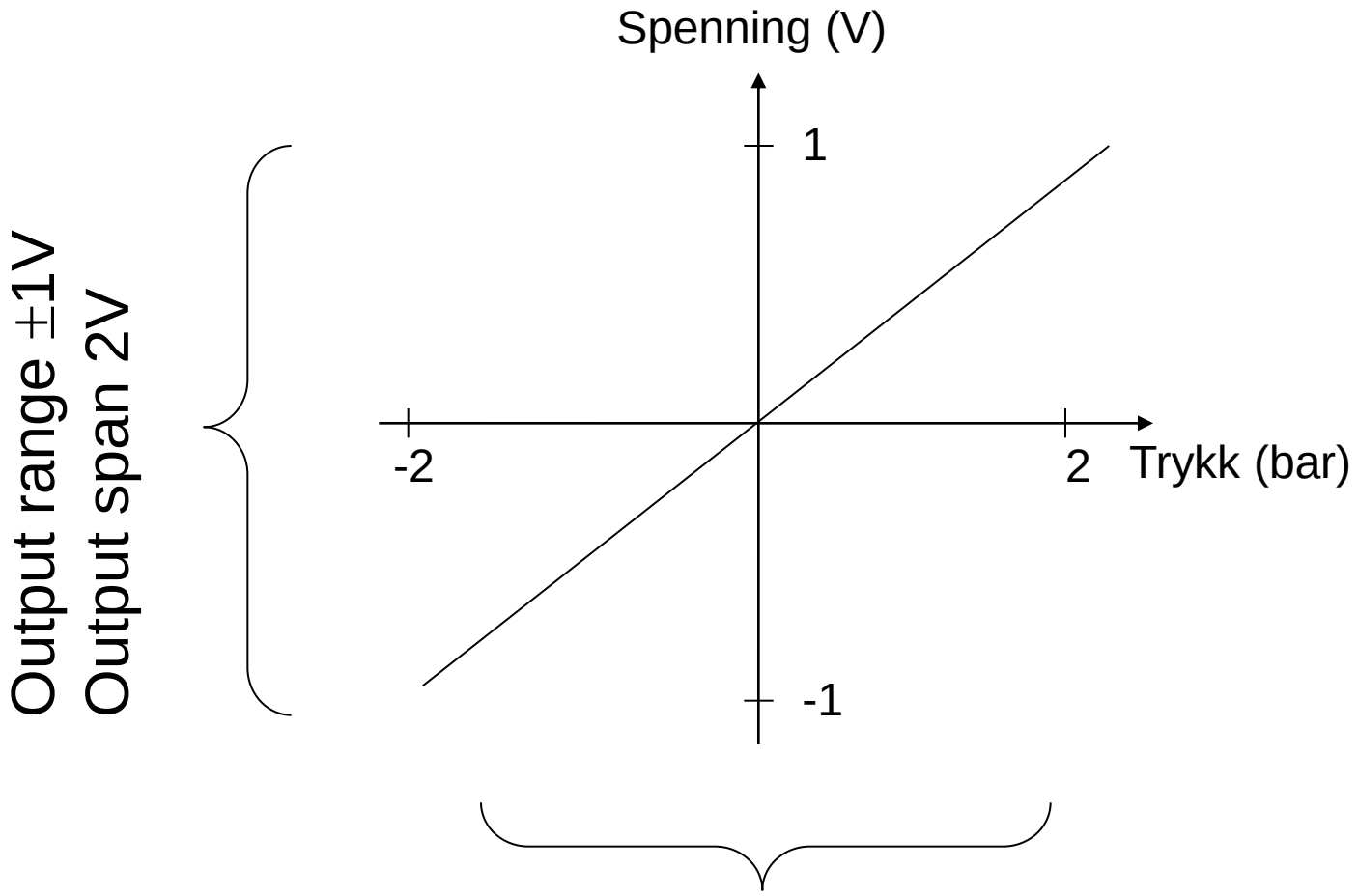
Lineær respons



$$S = b \cdot s$$

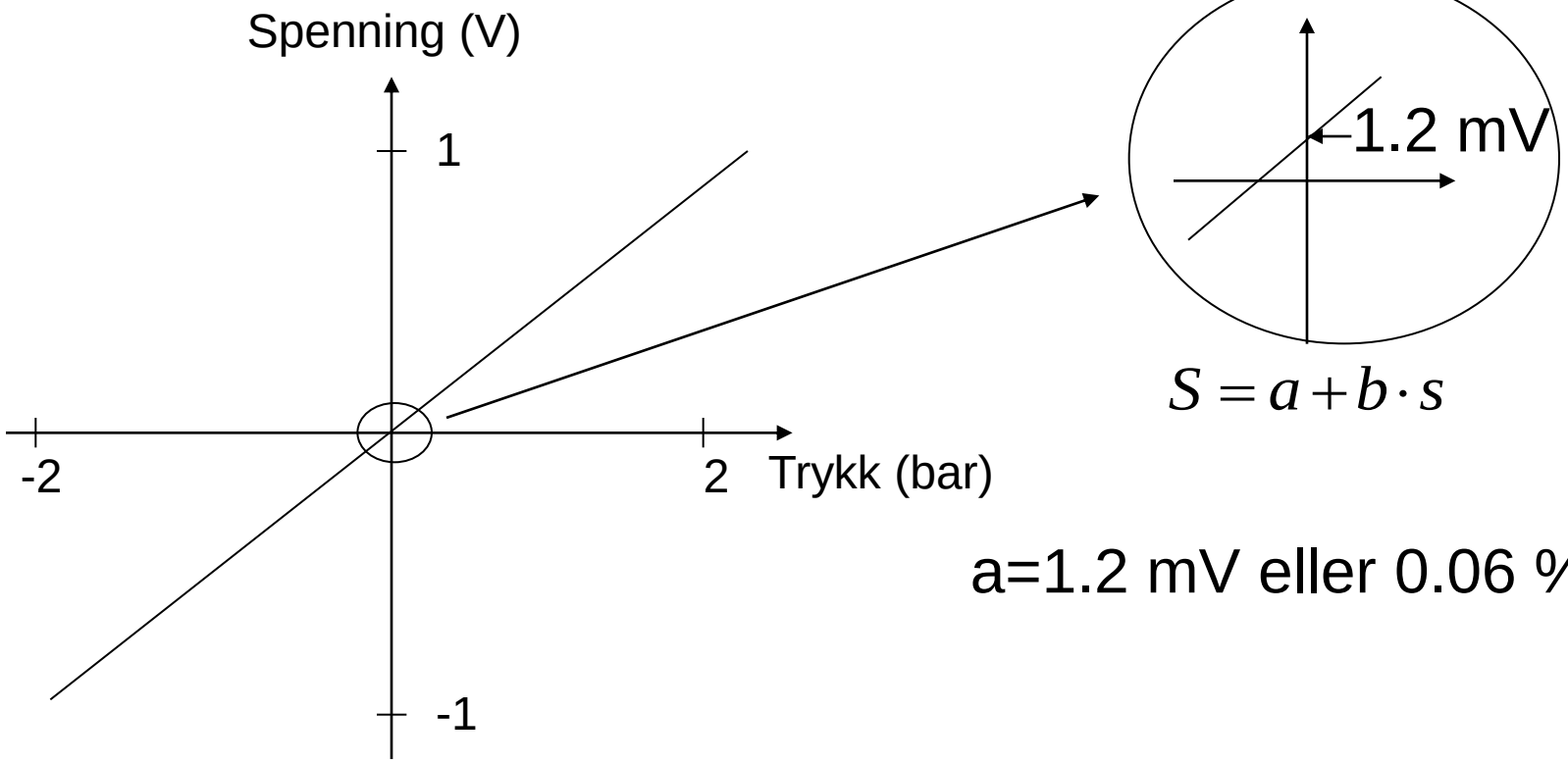
b=0.5 V/bar

Span og range



Input range: ±2 bar
Input span: 4 bar

Offset (nullpunktsavvik)



$$S = a + b \cdot s$$

a=1.2 mV eller 0.06 % FS

Sensor spesifikasjoner

Info	Type	Preview	Transducer for	Nominal meas. range in bar	Accuracy class [%]	Service range [%]	Nominal temperature [°C]	Max. medium temperature [°C]
i	P3MBP BlueLine		High-Pressure up to 15000 bar	5000, 10000, 15000	0.2, 0.4, 0.5	120	-10 ... +80	+100
i	P15		gage pressure	0...10 - 0...500	1	0...200	-20...+70	+105
i	P2V		absolute pressure	200, 500, 1000, 2000, 3000, 5000	0.2 (5000 bar: 0.4)	0...105	0...+70	
i	P3MB		absolute pressure	0...10 - 0...3000	0.1 / 0.15 / 0.2	0...100 / 0..150 / 0..200	-10...+80 / -20...+80	+100
i	P3MBP/2kb-PT100		absolute pressure	2000	0.2	150	+20 ... +70	100
i	P6A		absolute pressure	0...10 - 0...500	0.2	0...200 / 0...150	-10...+80	+100
i	P8AP		absolute pressure	0...10 - 0...500	0.3	0...150	-10...+70	+100 / +140
i	PE300		gage pressure	0...10 - 0...2000	0.15 / 0.2 / 0.3	-10...+110	-20...+70	+110

Input karakteristikk

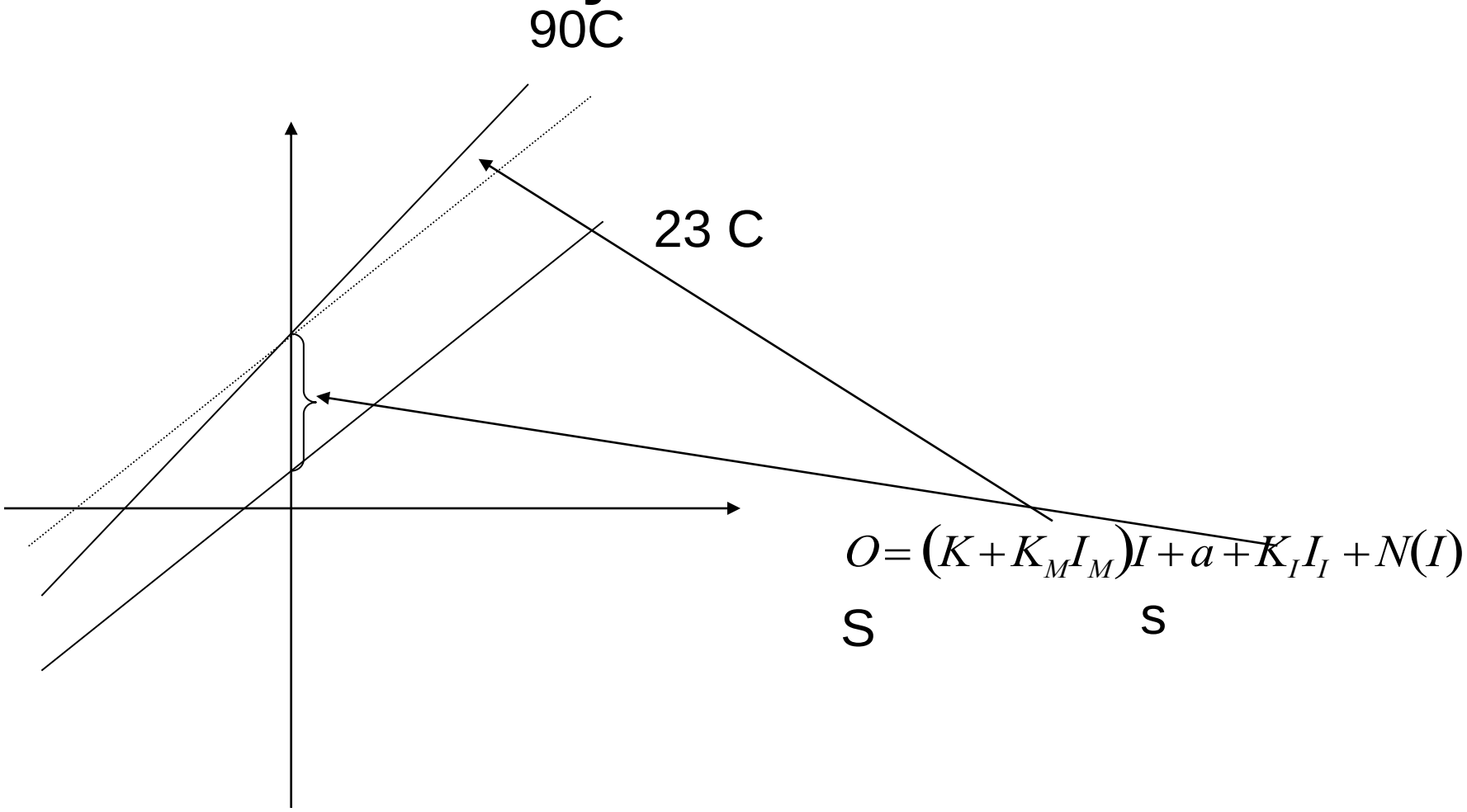
Specifications according to DIN 16086

Type		P2VA1 (output signal in V) [1)] *P2VA2 (output signal in mA)*	
Measuring ranges	bar	200, 500, 1000, 2000, 3000	5000
Input quantities			
Pressure type		Absolute pressure	
Accuracy class		0.2	0,3
Initial value	bar	0	
Operating range at reference temperature	%	0 to approx. 110 / *105*	
Overload limit at reference temperature	%	150	
Test pressure	%	200	150
During dynamic loading			
Permissible pressure	%	100	
Permissible vibration amplitude according to DIN 50 100	%	70	
Dead volume approx.	cm^3	0.8	
Control volume, approx.	mm^3	1.5	
Materials from which components in contact with the measure-ment media are made		1.4542 (measuring body) 1.4301 (seal)	
Auxiliary energy			
Reference voltage	V	24	
Nominal (rated) range	V	15 ... 30[2)]	
Effect of supply voltage on changing from 15 to 30 V	%	0.02	
Max. current consumption (for the P2VA2, excluding loop current)	mA	25	
Max. power consumption	W	<1 *<2*	

Output karakteristikk

Output characteristics			
Transducer identification		TEDS	
Signal span (sensitivity)	V mA	0.5 ... 10 *4...20* (16)	
Zero signal, adjustment tolerance (factory)	V mA	< ± 0.010 *< ±0.016*	±0,020 *±0.032*
Sensitivity tolerance	V mA	< ± 0.010 *< ±0.016*	±0.020 *±0.032*
Maximum signal	V mA	10,5 *21.6*	
Temperature influence on zero signal in the nominal (rated) excitation voltage range per 10 K, by reference to the nominal (rated) sensitivity	% / 10K	0.2	
Effect of temperature on sensitivity in the nominal (rated) excitation voltage range per 10 K, by reference to the actual value	% / 10K	0.2	
Characteristic curve deviation (start setting)	%	0.3	
Repeatability according to DIN 1319	%	< ± 0.05	
Cut-off frequency -3 dB -1 dB	 kHz kHz	 4.5 2	
Burden, min. / max.	Ω	10000 / *500*	

Miljøeffekter



Linearitet

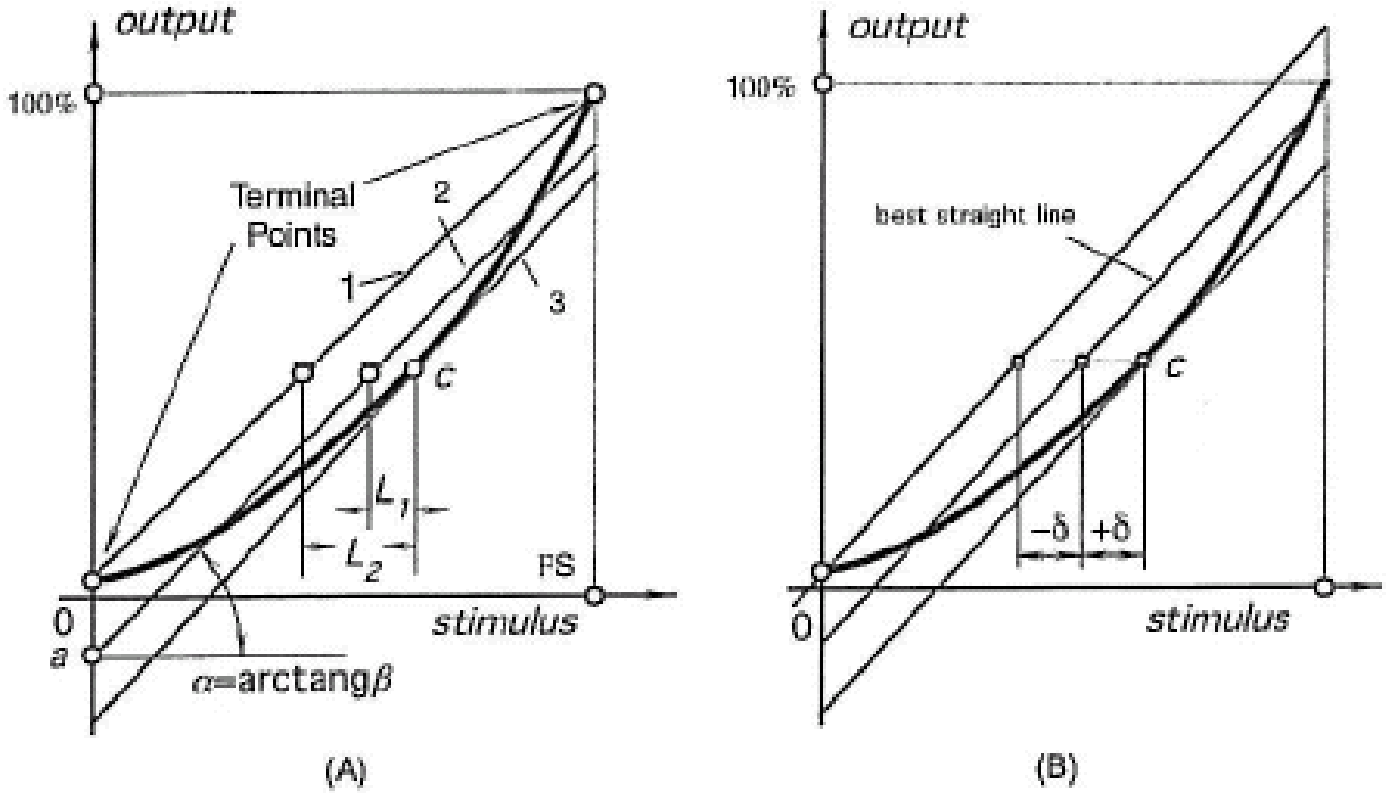


Fig. 2.5. Linear approximations of a nonlinear transfer function (A) and independent linearity (B).

Kalibreringsfeil

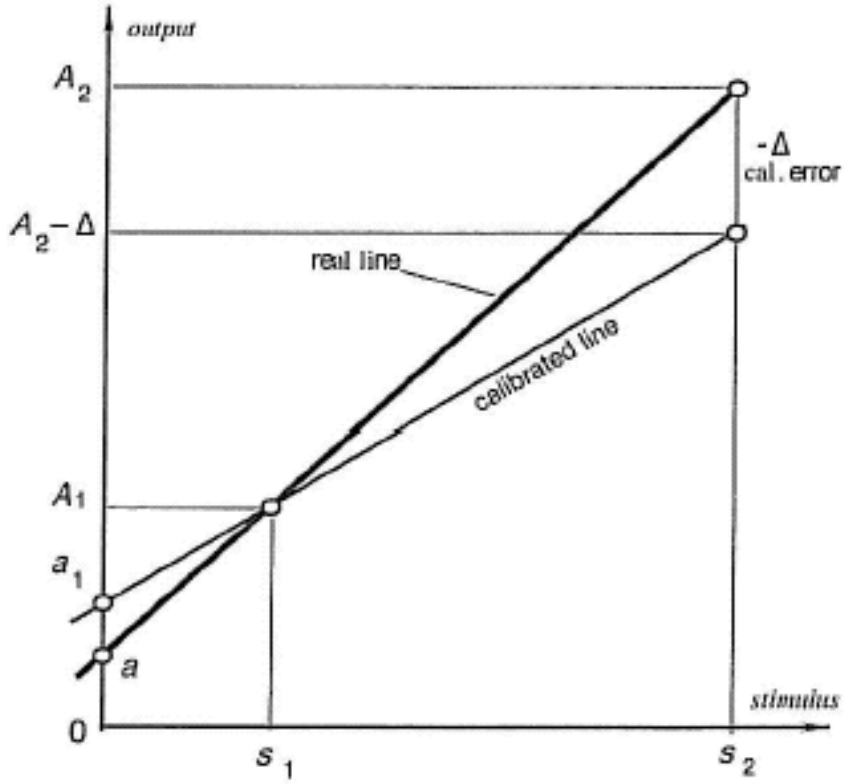
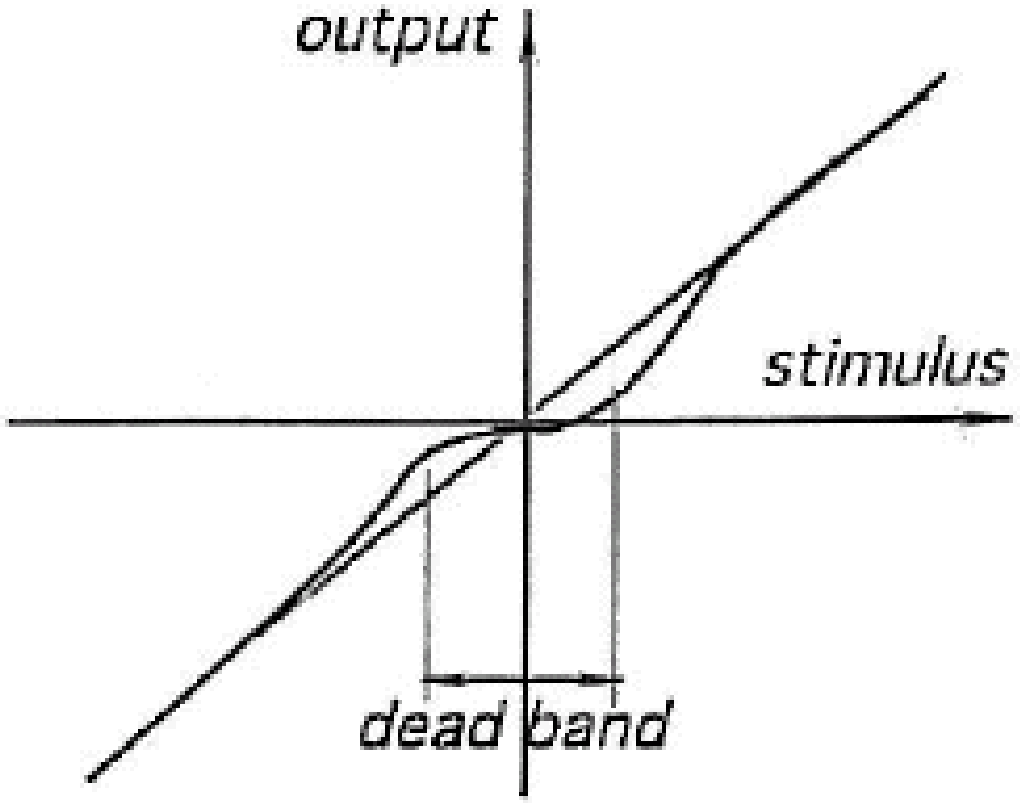


Fig. 2.3. Calibration error.

Vanligvis mye mer komplekst!!

Dødbånd



(B)

Repeterbarhet

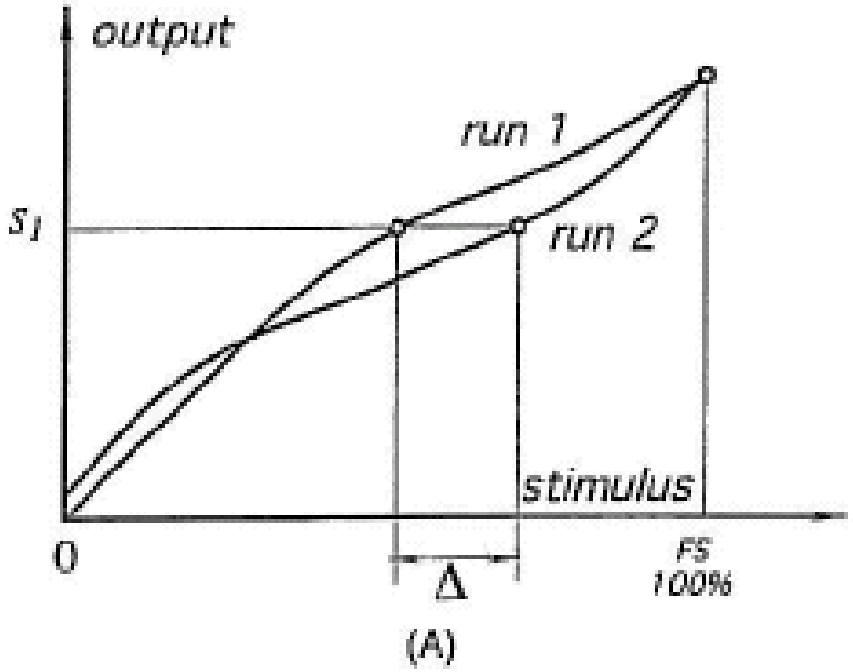


Fig. 2.7. (A) The repeatability error. The same o
input signals. (B) The dead-band zone in a transfe

Hysterese

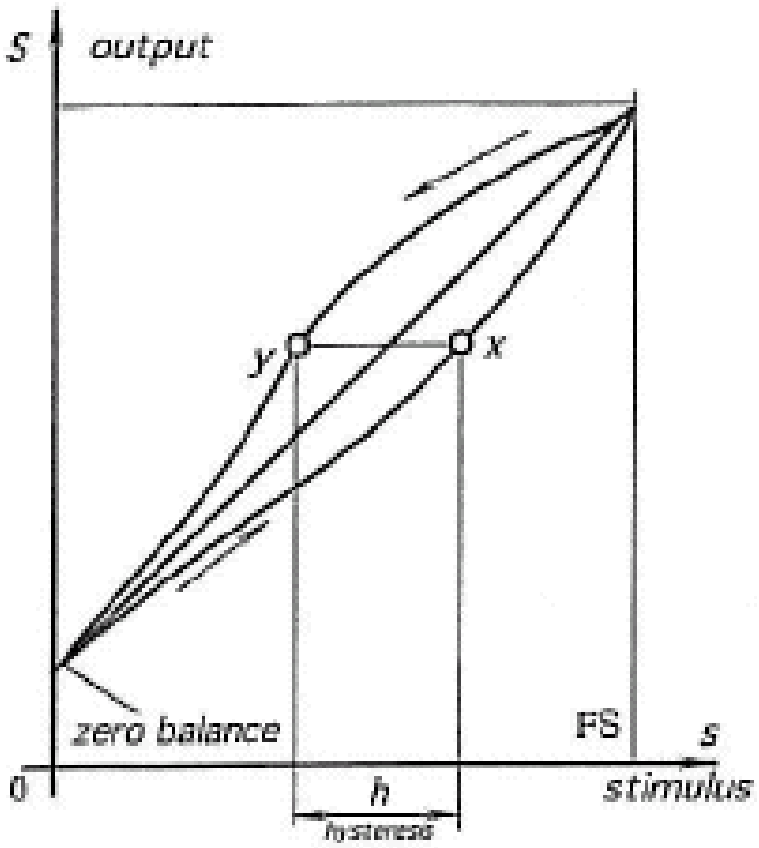


Fig. 2.4.

Ulineær kalibrering

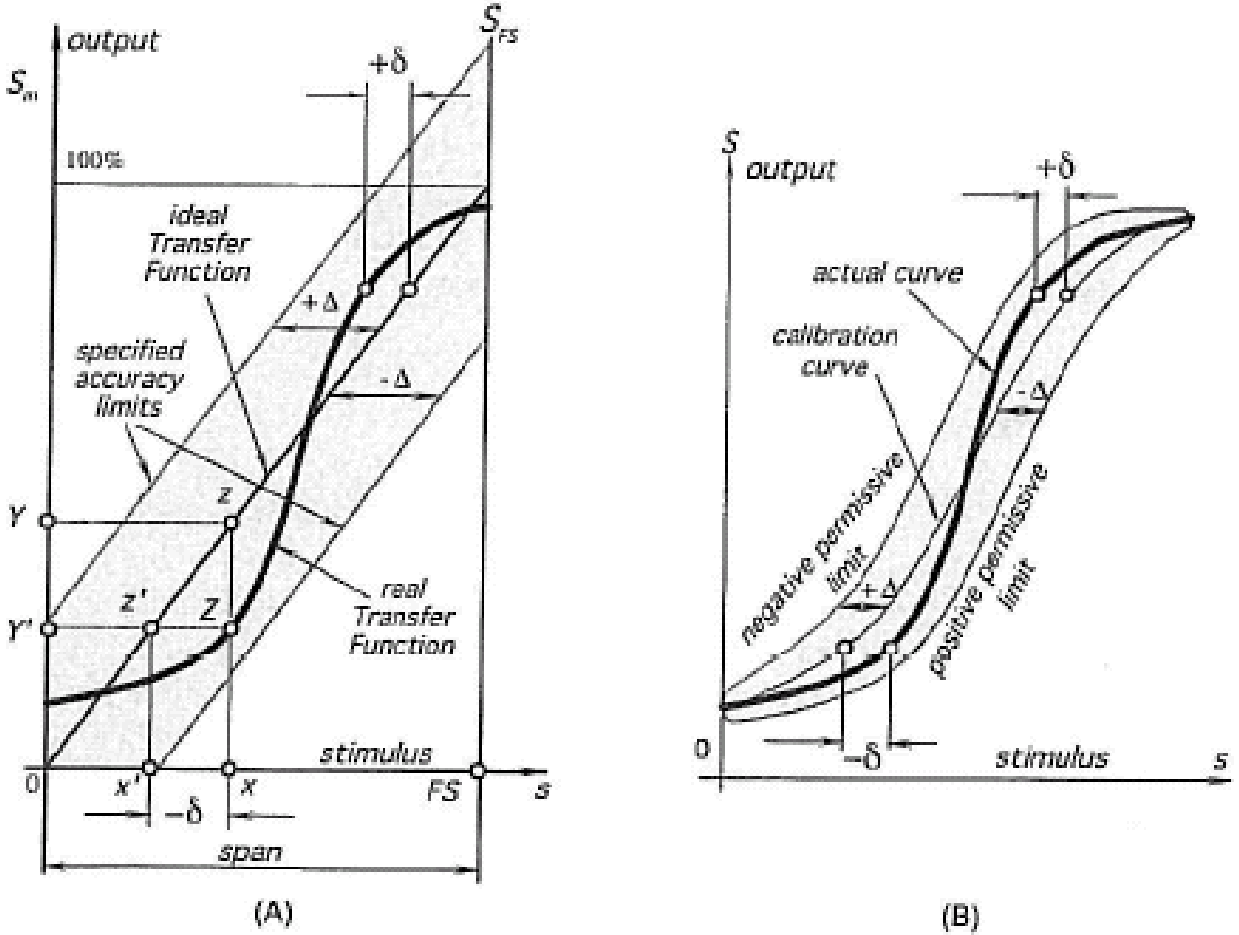


Fig. 2.2. Transfer function (A) and accuracy limits (B). Error is specified in terms of input value.

Oppløsning - fysisk

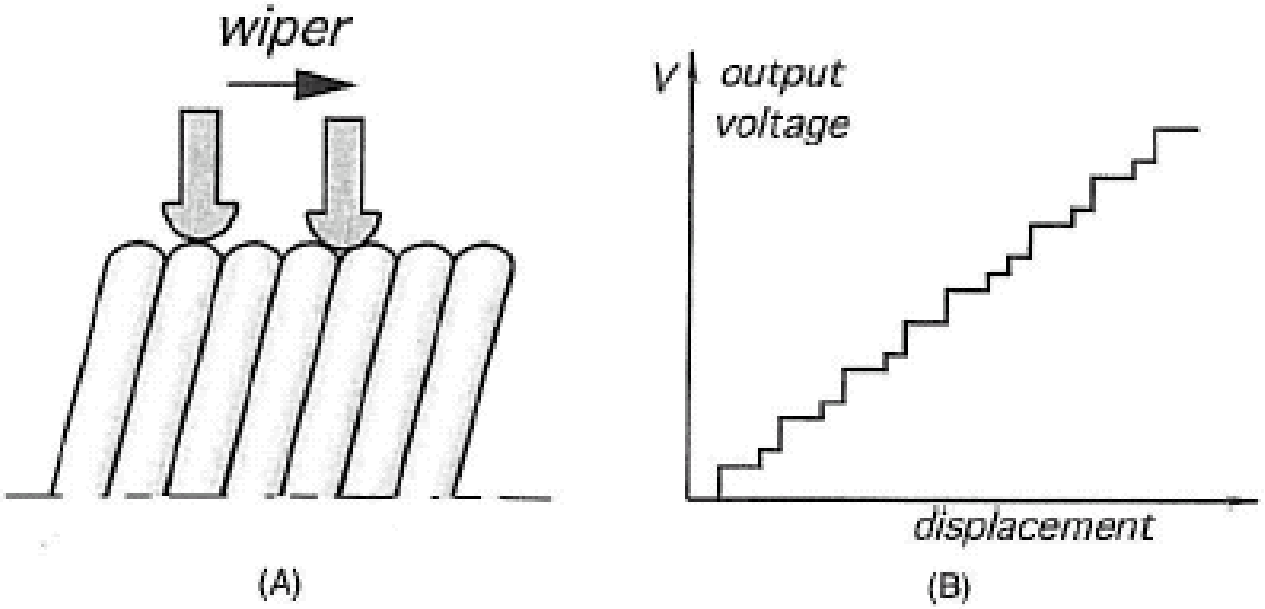


Fig. 7.2. Uncertainty caused by a wire-wound potentiometer: (A) a wiper may contact one or two wires at a time; (B) uneven voltage steps.

Oppløsning - Støybegrensning

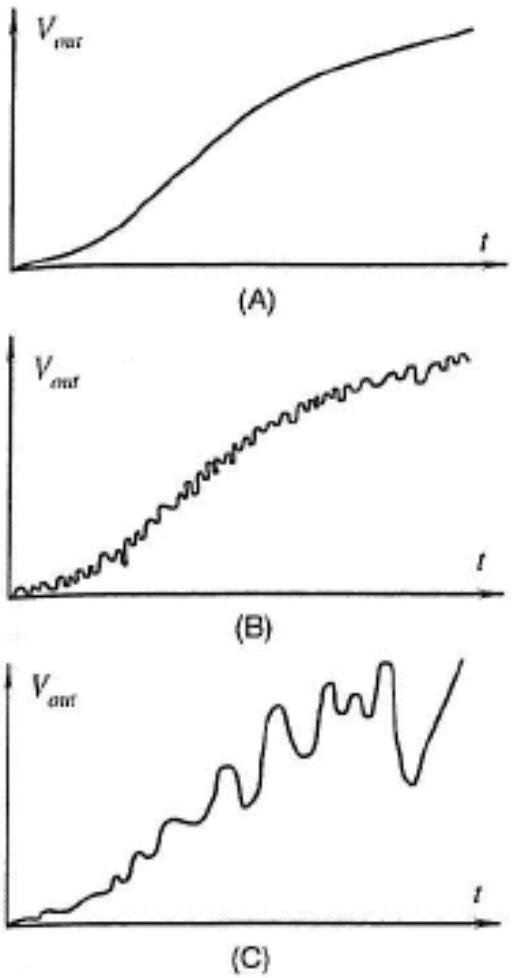


Fig. 5.46. Types of noise: (A) noise-free signal; (B) additive noise; (C) multiplicative noise.

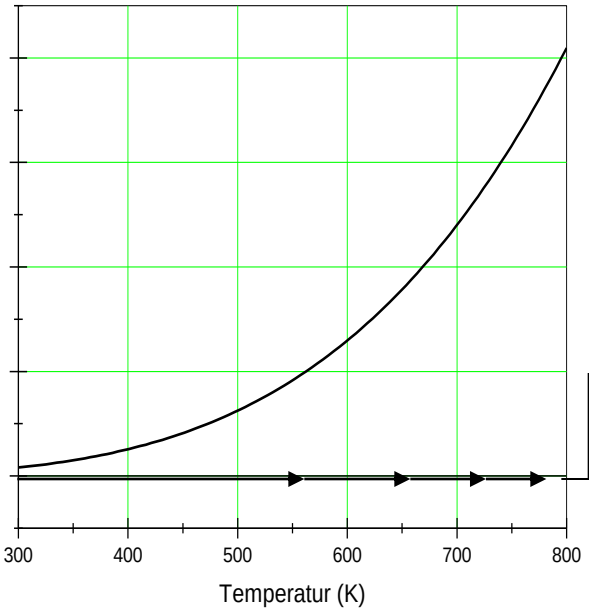
Digital oppløsning

Table 5.2. Binary Bit Weights and Resolutions

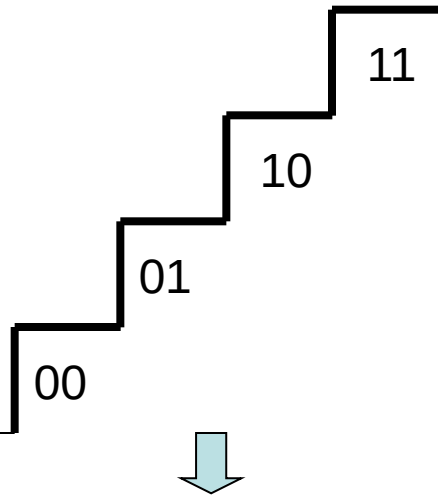
Bit	2^{-n}	$1/2^n$ Fraction	dB	$1/2^n$ Decimal	%	ppm
FS	2^0	1	0	1.0	100	1,000,000
MSB	2^{-1}	1/2	−6	0.5	50	500,000
2	2^{-2}	1/4	−12	0.25	25	250,000
3	2^{-3}	1/8	−18.1	0.125	12.5	125,000
4	2^{-4}	1/16	−24.1	0.0625	6.2	62,500
5	2^{-5}	1/32	−30.1	0.03125	3.1	31,250
6	2^{-6}	1/64	−36.1	0.015625	1.6	15,625
7	2^{-7}	1/128	−42.1	0.007812	0.8	7,812
8	2^{-8}	1/256	−48.2	0.003906	0.4	3,906
9	2^{-9}	1/512	−54.2	0.001953	0.2	1,953
10	2^{-10}	1/1,024	−60.2	0.0009766	0.1	977
11	2^{-11}	1/2,048	−66.2	0.00048828	0.05	488
12	2^{-12}	1/4,096	−72.2	0.00024414	0.024	244
13	2^{-13}	1/8,192	−78.3	0.00012207	0.012	122
14	2^{-14}	1/16,384	−84.3	0.000061035	0.006	61
15	2^{-15}	1/32,768	−90.3	0.0000305176	0.003	31
16	2^{-16}	1/65,536	−96.3	0.0000152588	0.0015	15
17	2^{-17}	1/131,072	−102.3	0.00000762939	0.0008	7.6
18	2^{-18}	1/262,144	−108.4	0.000003814697	0.0004	3.8
19	2^{-19}	1/524,288	−114.4	0.000001907349	0.0002	1.9
20	2^{-20}	1/1,048,576	−120.4	0.0000009536743	0.0001	0.95

Linearisering

Sensor

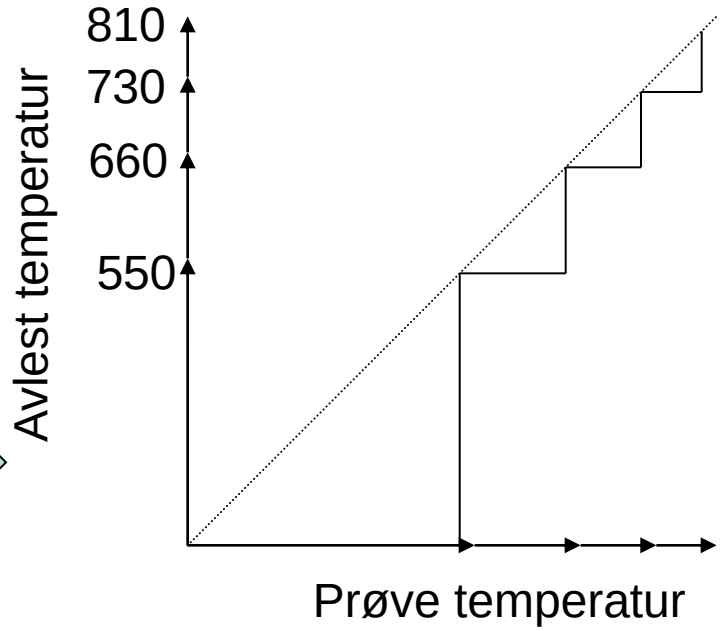


ADC



µ-Prosessor

output =input^4



Utgangsimpedans

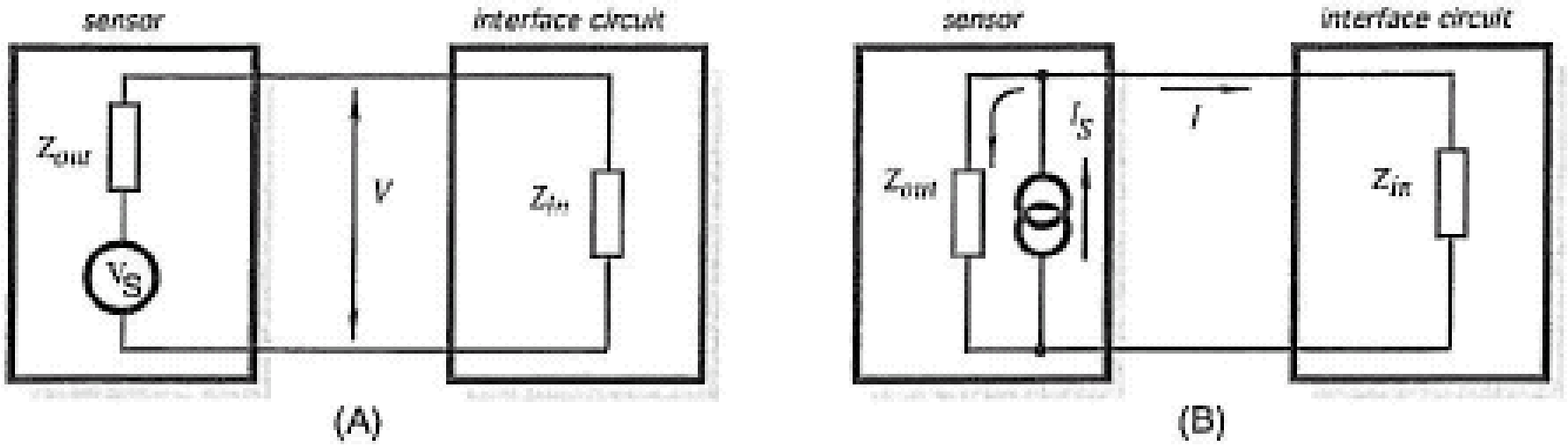


Fig. 2.8. Sensor connection to an interface circuit: (A) sensor has voltage output; (B) sensor has current output.

Utgangsimpedansen er den motstanden vi ser fra sensorens utgang med kortsluttede spenningskilder og åpne strømkilder