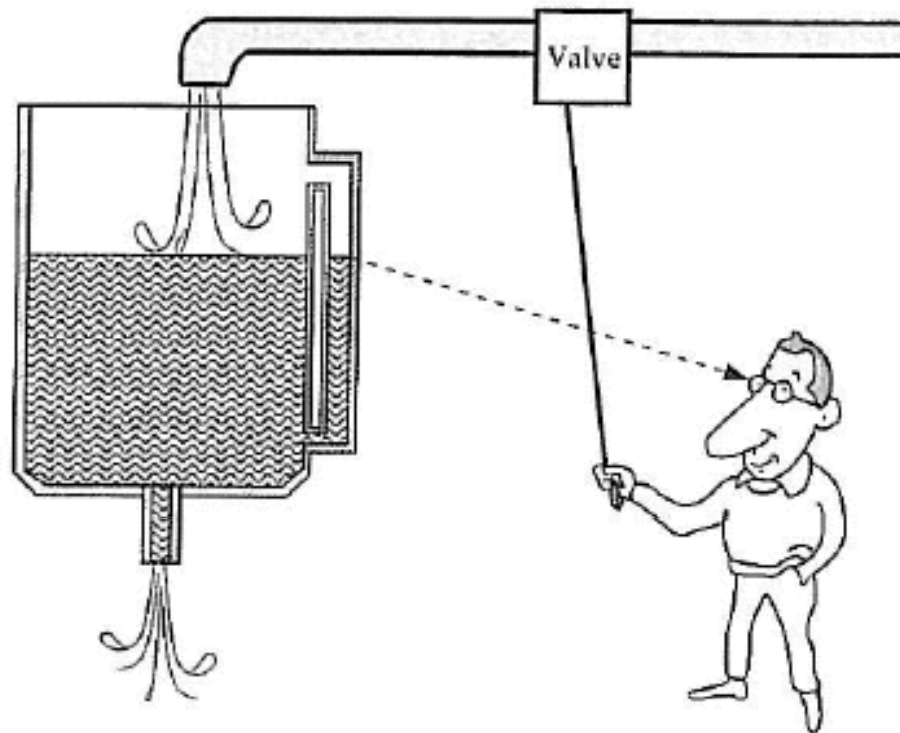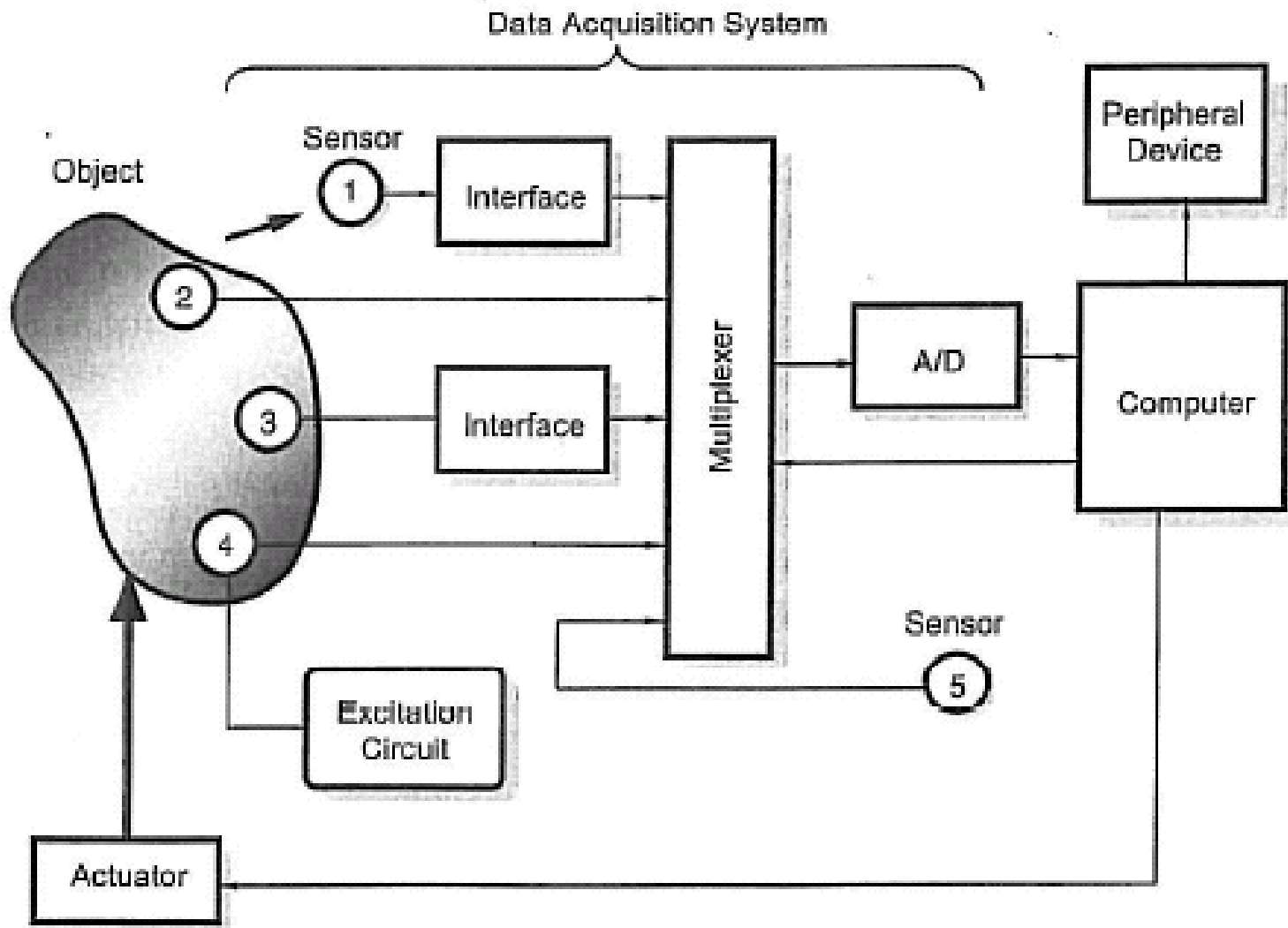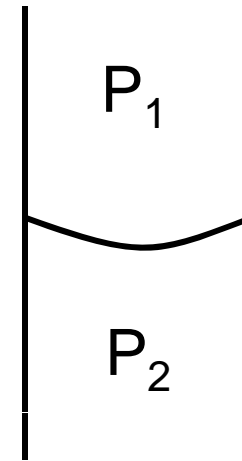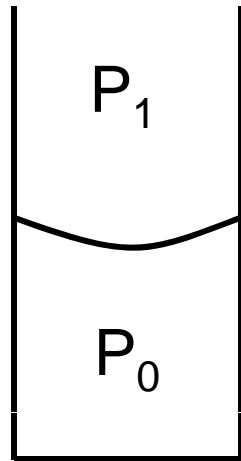# Sensor krav og motivasjon

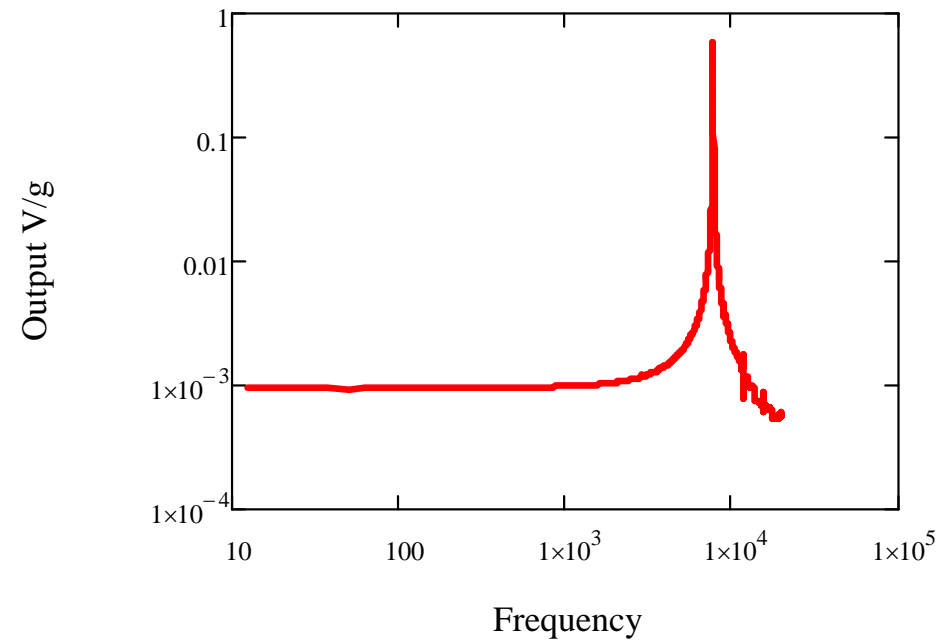**Fig. 1.1.** Level-control system. A sight tube and operator's eye form a sensor (a device which converts information into electrical signal).

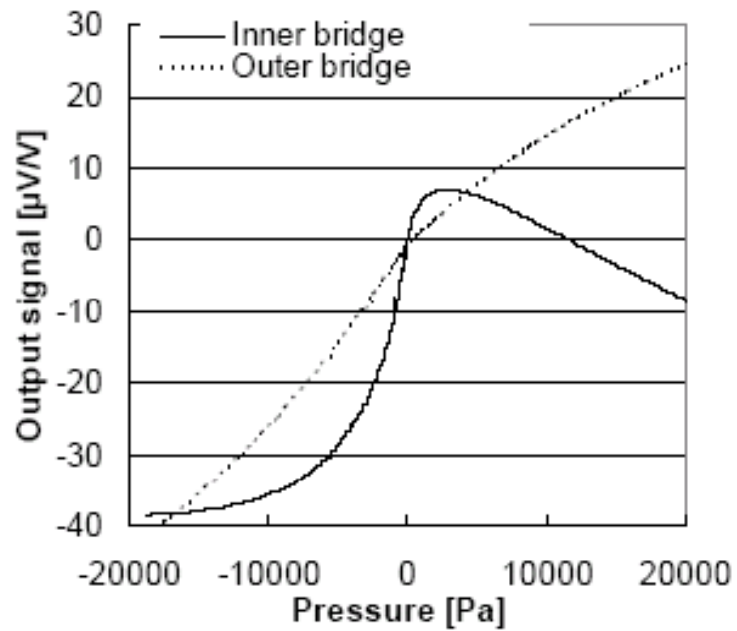# Målesystem (Fraden)

Absolutt eller relativ sensor

P_1

P_0

P_1

P_2

Statisk og dynamisk karakteristikk

Dynamikk - amplitude

Input signal source — Circuit A — Load

Input signal
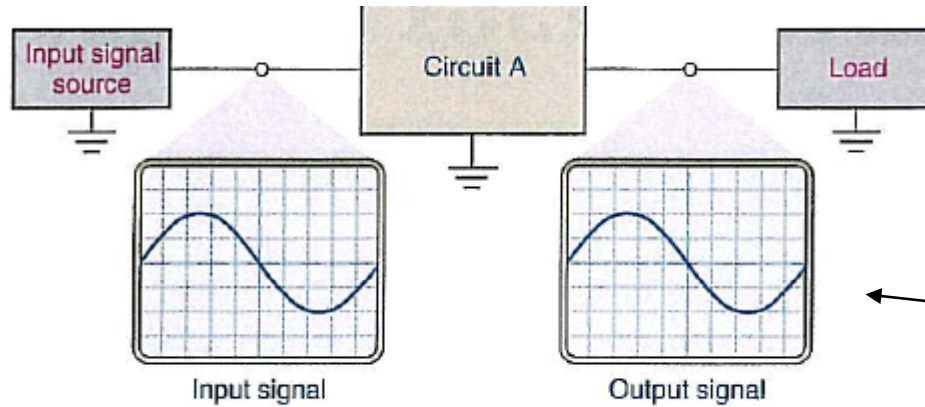
Output signal

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

Input signal source — Circuit A — Load

Input signal

Output signal

ximum

Zero

V_{out}

f_a f_b f (Hz)
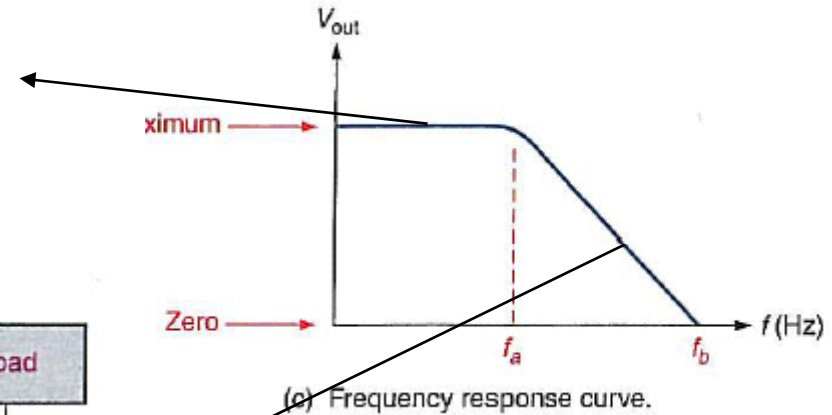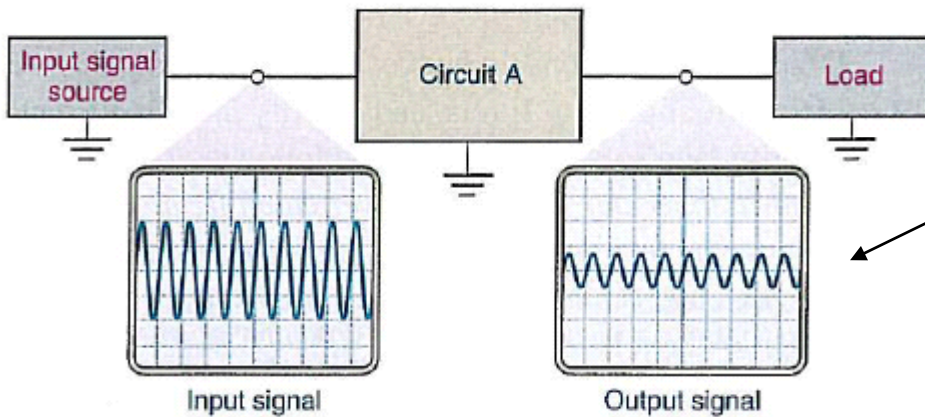
(c) Frequency response curve.

iation

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
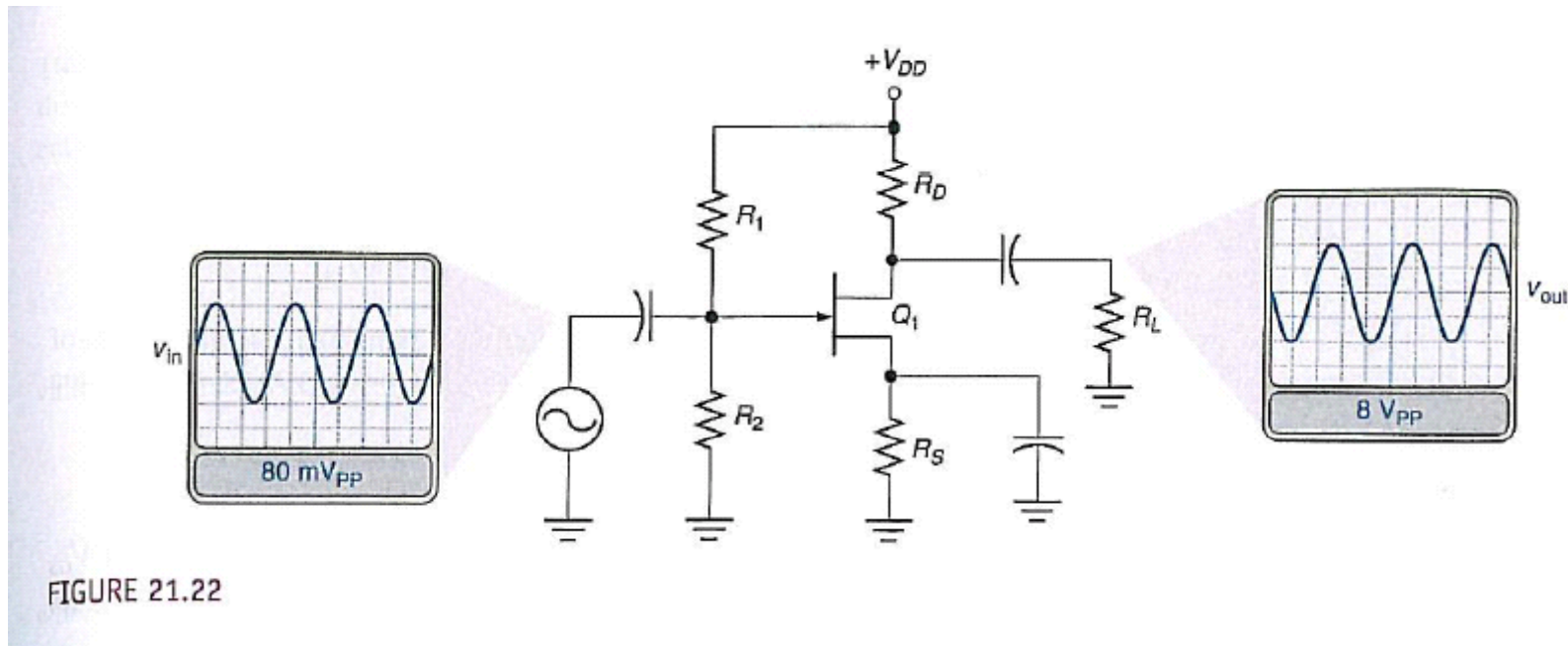
Eksponensiell respons - STM

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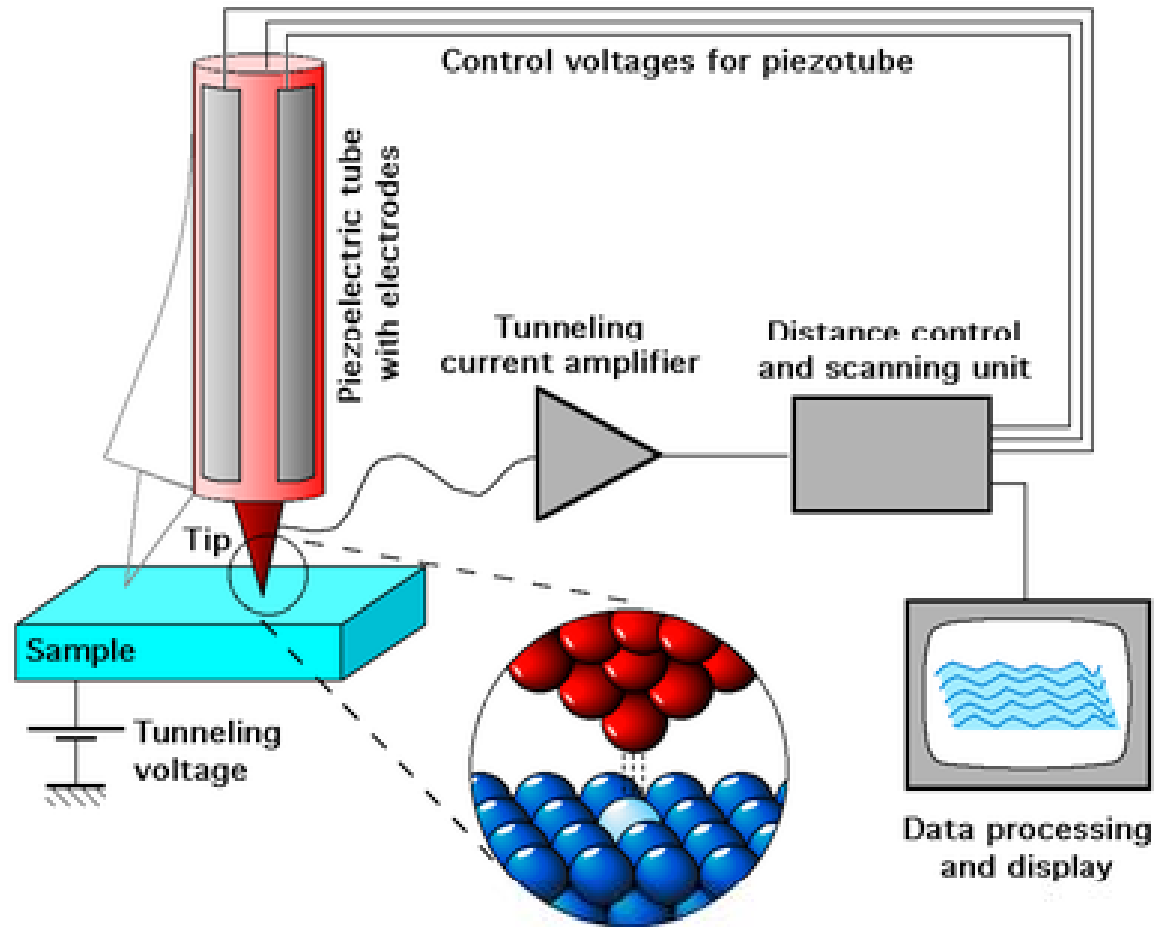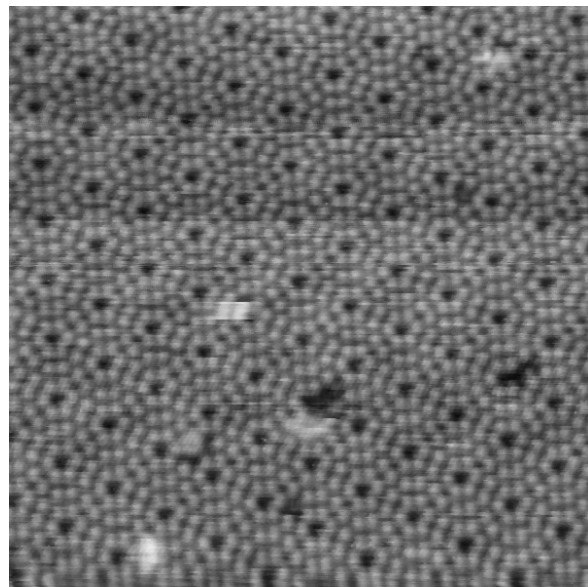
Wikipedia

Eksponent respons - pyrometer

Utstrålt effekt
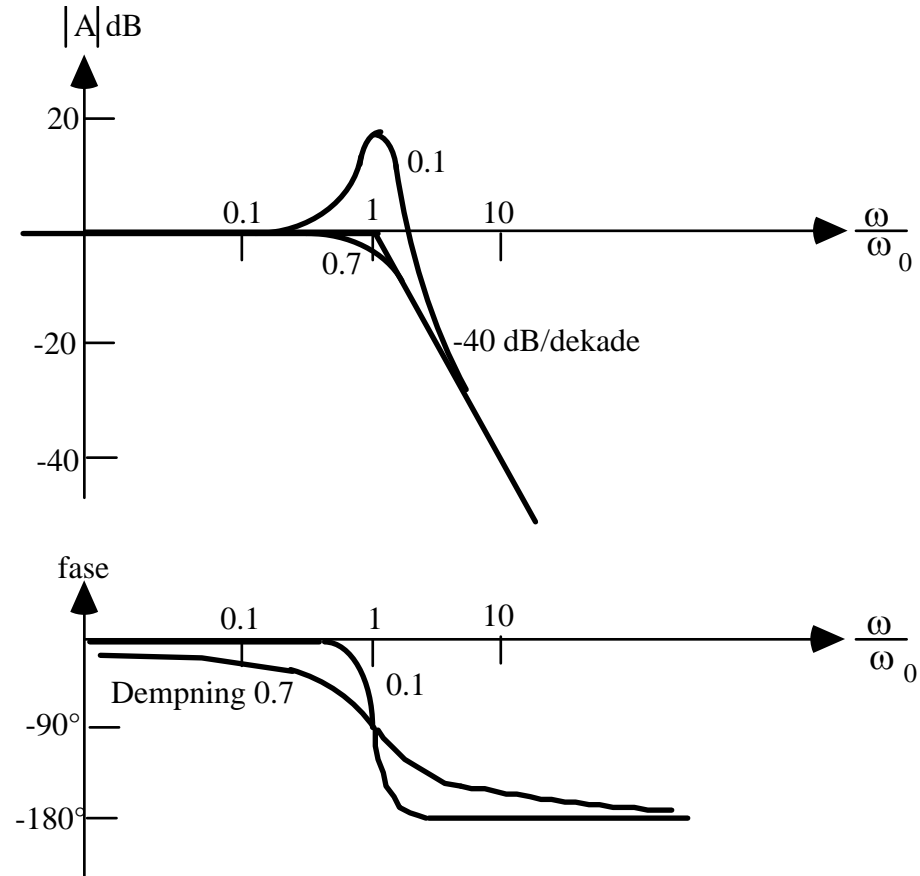
$$V = G(T_b{}^4 - T_s{}^4)$$

Følsomhet

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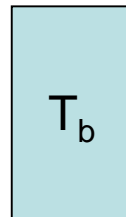
T_b

T_s

www.pyrometer.com

Følsomhet

Lineær respons

Spenning (V)

Full Scale Output : 1V

Signal (S)

1

Stimulus (s)   2   Trykk (bar)

Full Scale Input : 2 bar
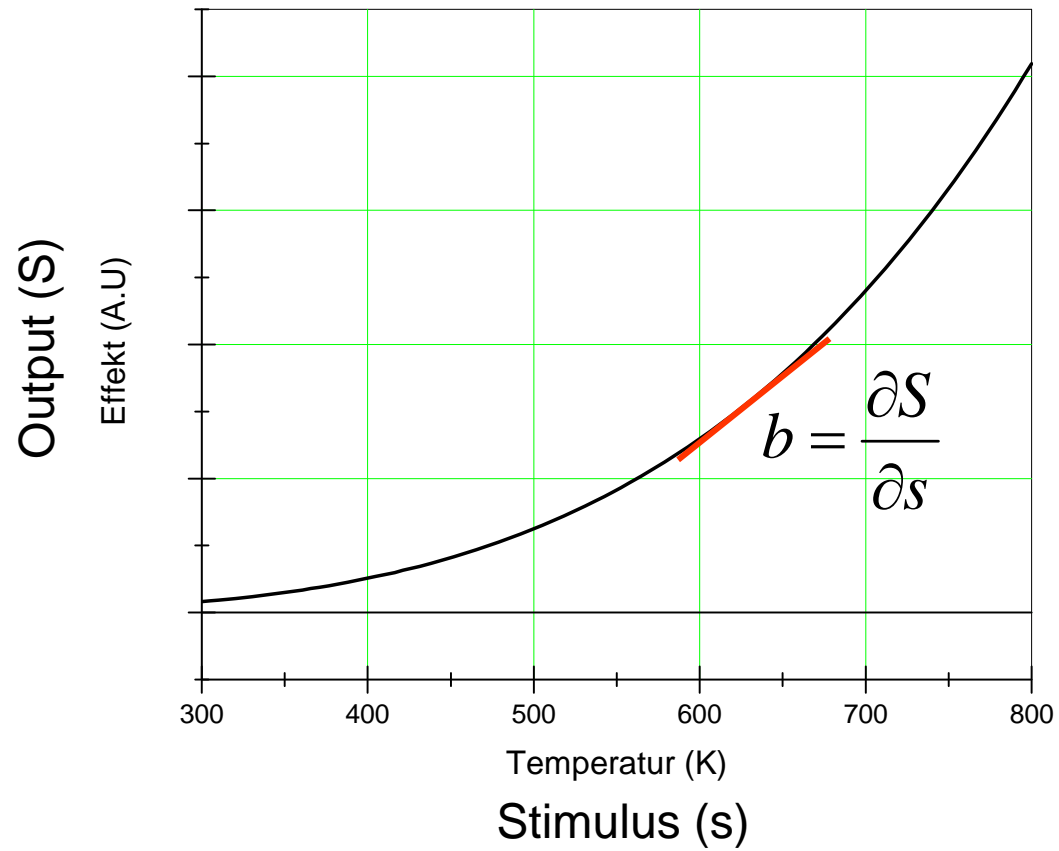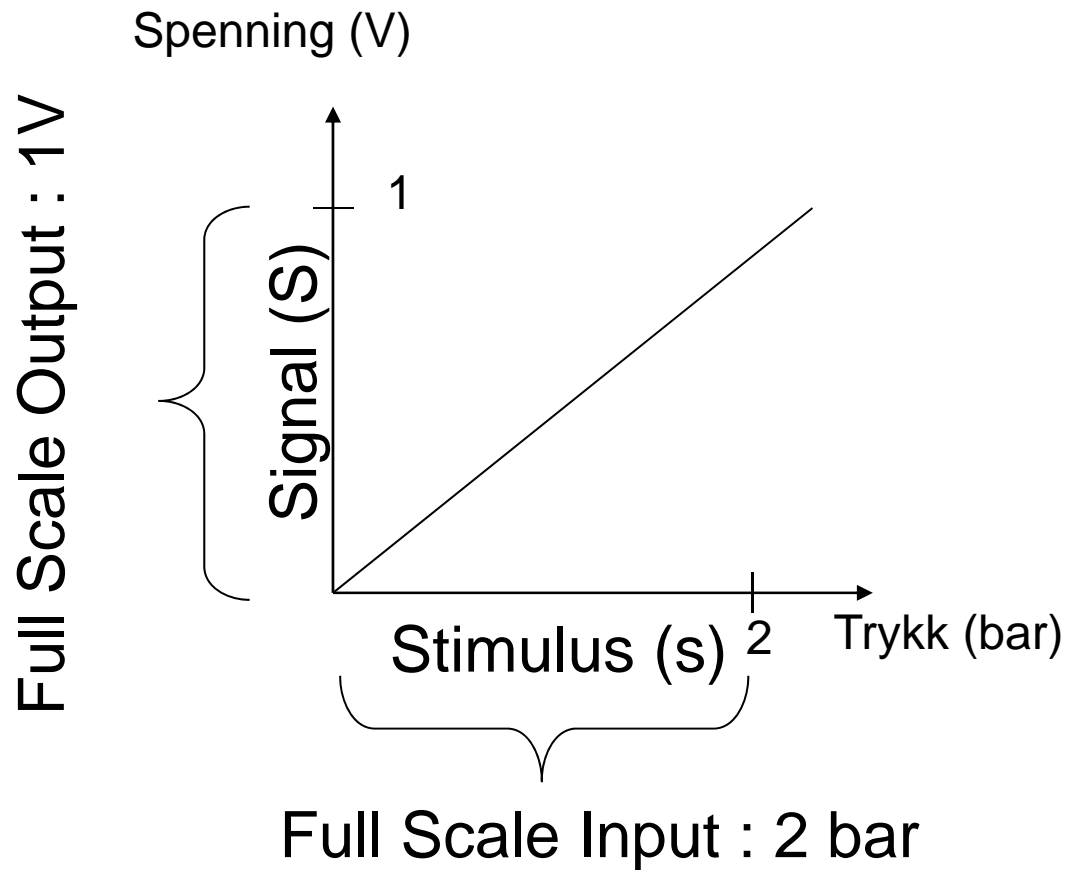
$S = b \cdot s$

b=0.5 V/bar

Span og range

Spenning (V)

1

-2   2 Trykk (bar)

-1

Output range ±1V
Output span 2V
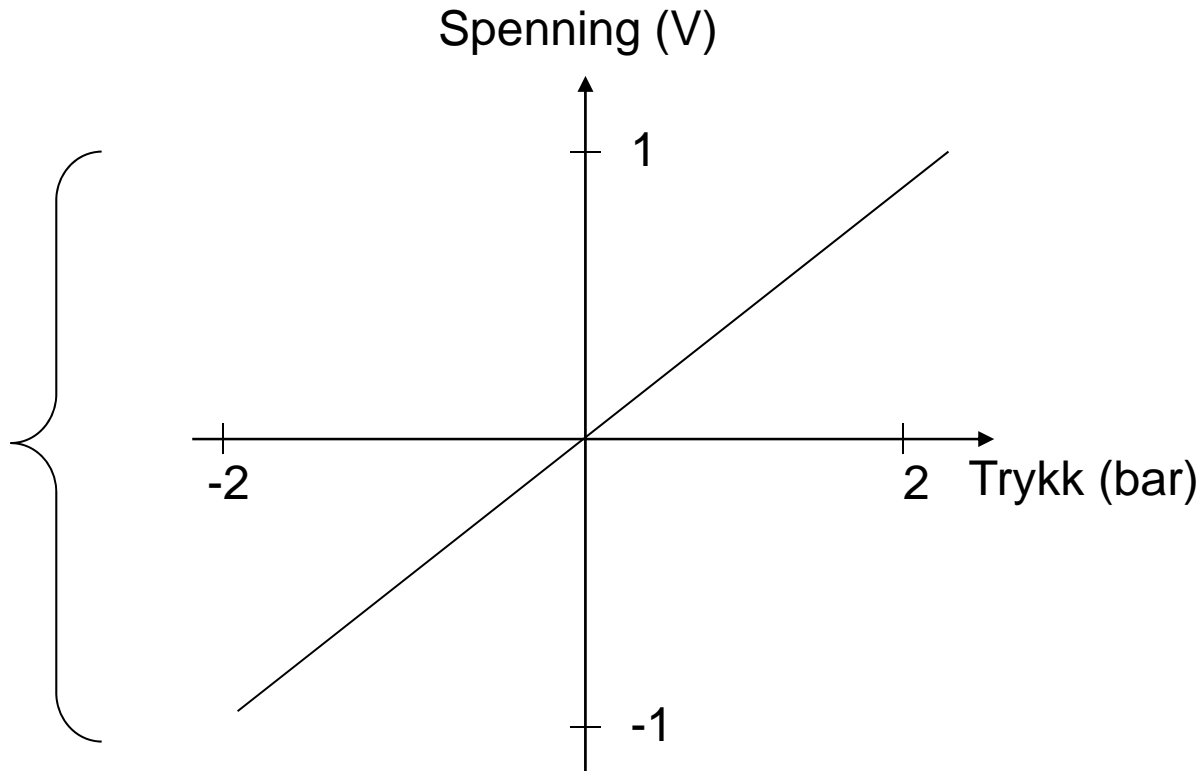
Input range: ±2 bar
Input span: 4 bar

Offset (nullpunktsavvik)

Spenning (V)

1

-2

2 Trykk (bar)

-1

←1.2 mV

$$S = a + b \cdot s$$
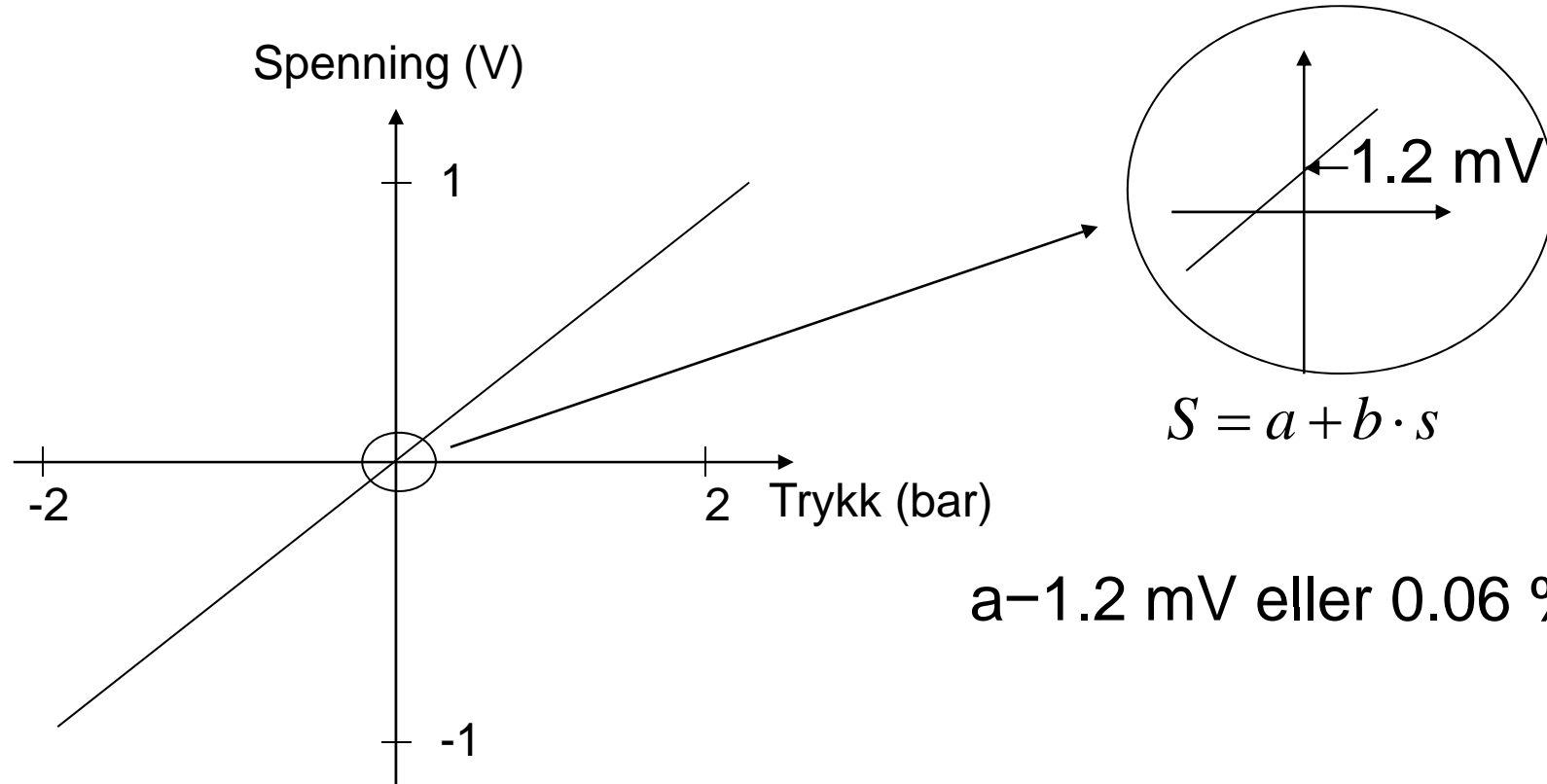
a−1.2 mV eller 0.06 % FS

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

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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		0.5 ... 10	
	mA		4...20 (16)	
Zero signal, adjustment tolerance (factory)	V		< ± 0.010	± 0,020
	mA		< ± 0.016	± 0.032
Sensitivity tolerance	V		< ± 0.010	± 0.020
	mA		< ± 0.016	± 0.032
Maximum signal	V		10,5	
	mA		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	kHz		4.5	
-1 dB	kHz		2	
Burden, min. / max.	Ω		10000 / 500	

Miljøeffekter

90C

23 C
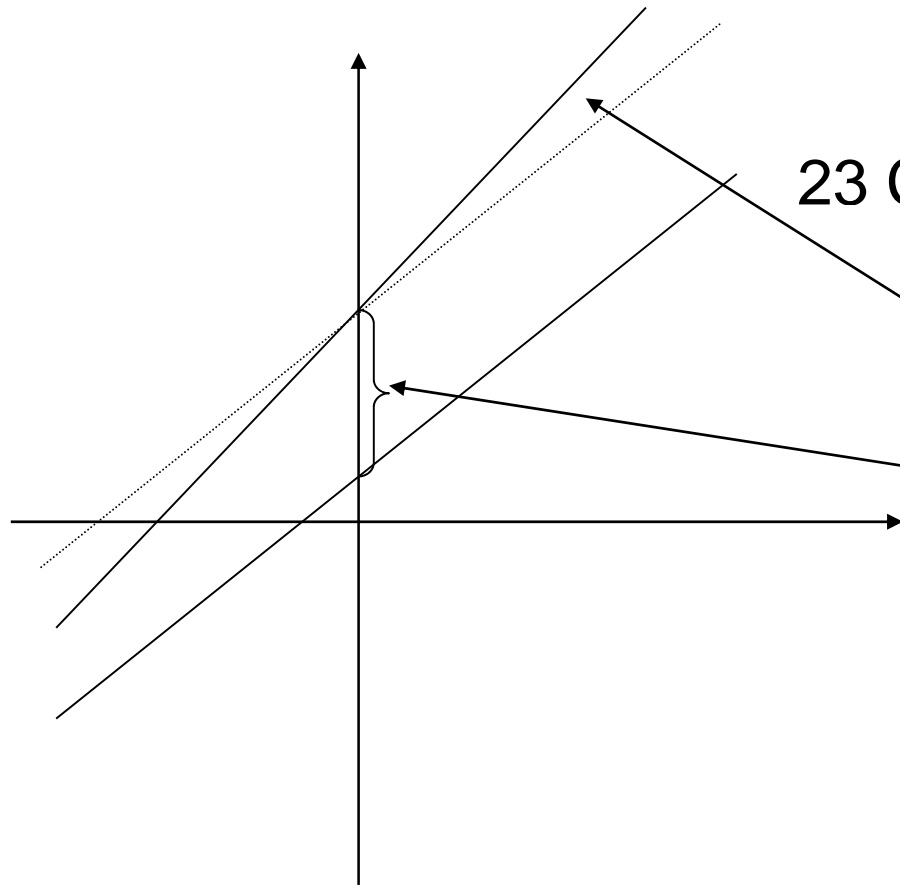
$$O = (K + K_M I_M)I + a + K_I I_I + N(I)$$

S   s

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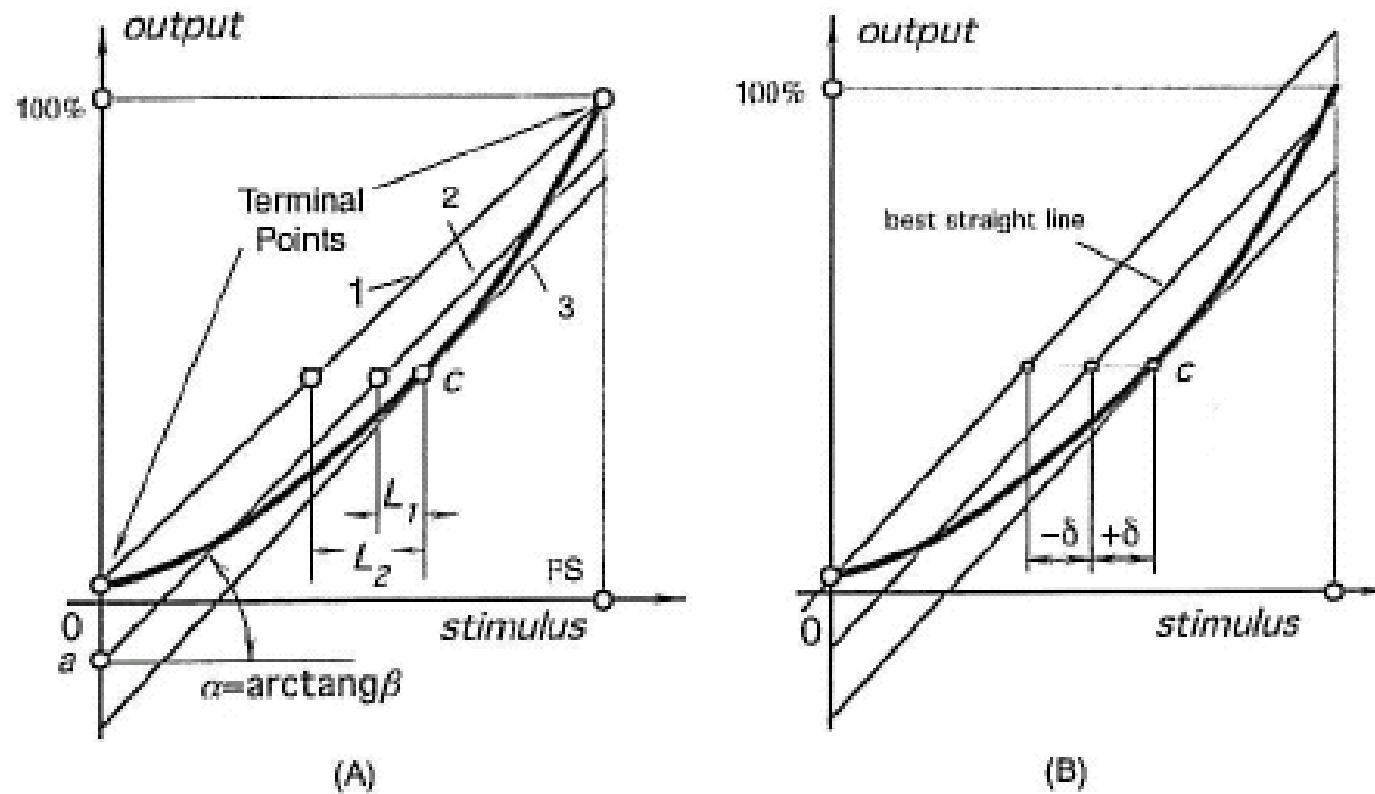
Fig. 2.5. Linear approximations of a nonlinear transfer function (A) and independent linearity (B).

Kalibreringsfeil

Fig. 2.3. Calibration error.

Vanligvis mye mer komplekst!!

Dødbånd

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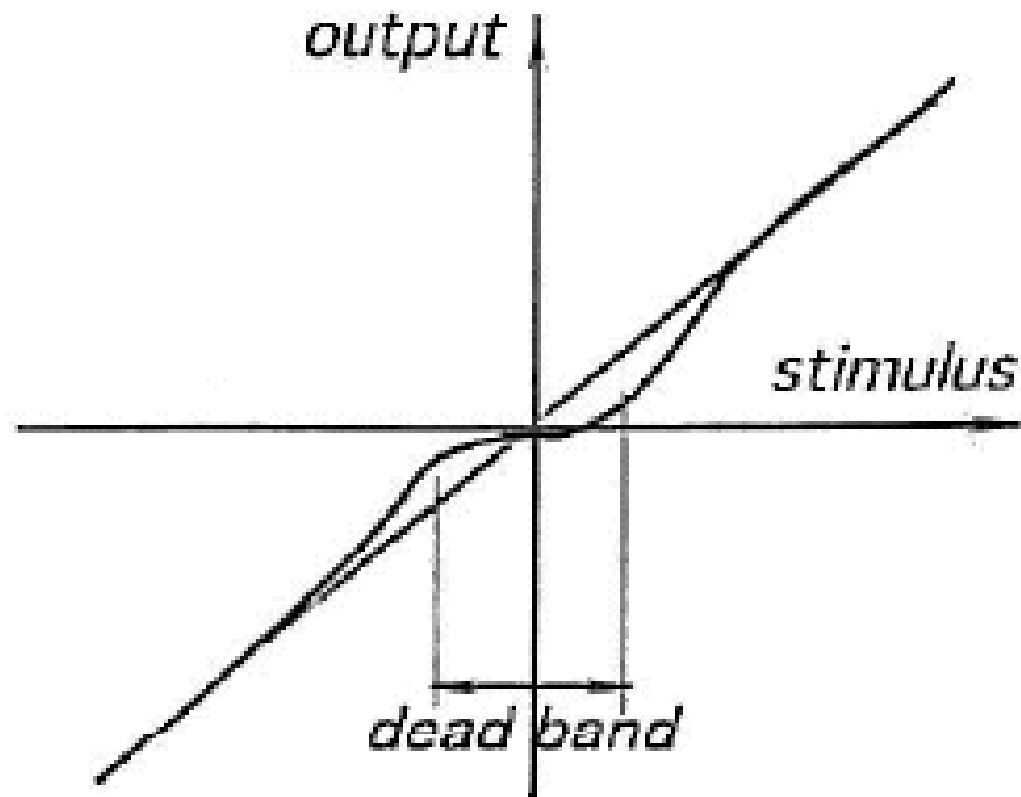
Repeterbarhet
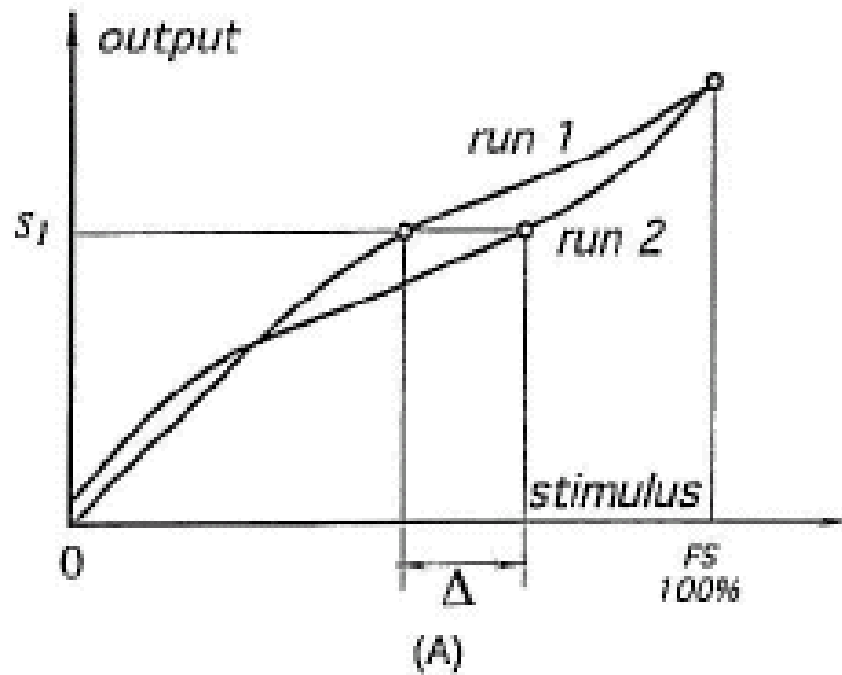
Fig. 2.7. (A) The repeatability error. The same o
input signals. (B) The dead-band zone in a transf

Hysterese
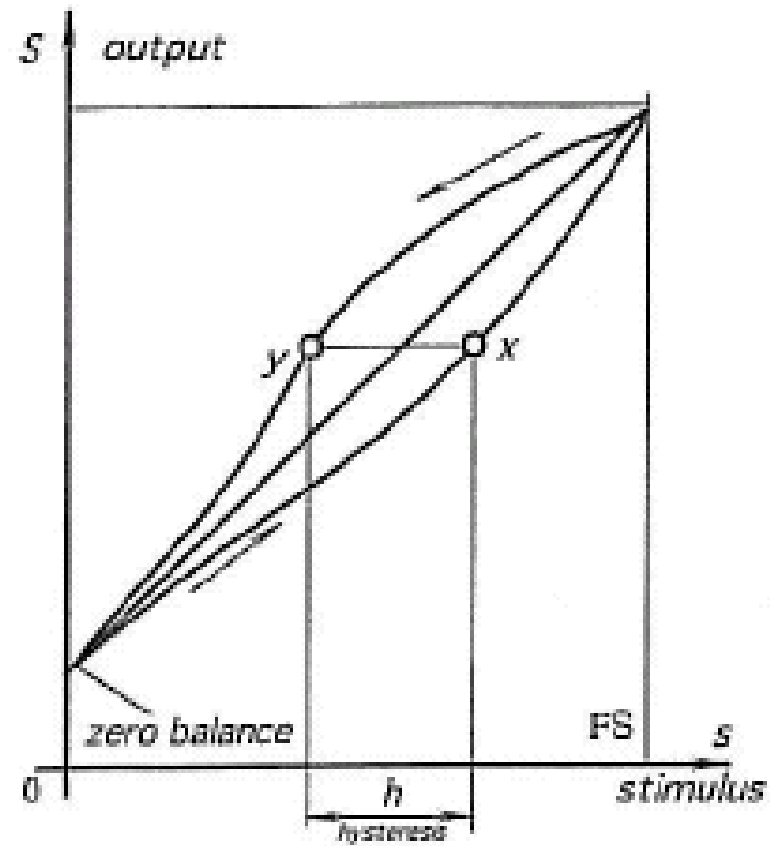
Fig. 2.4.

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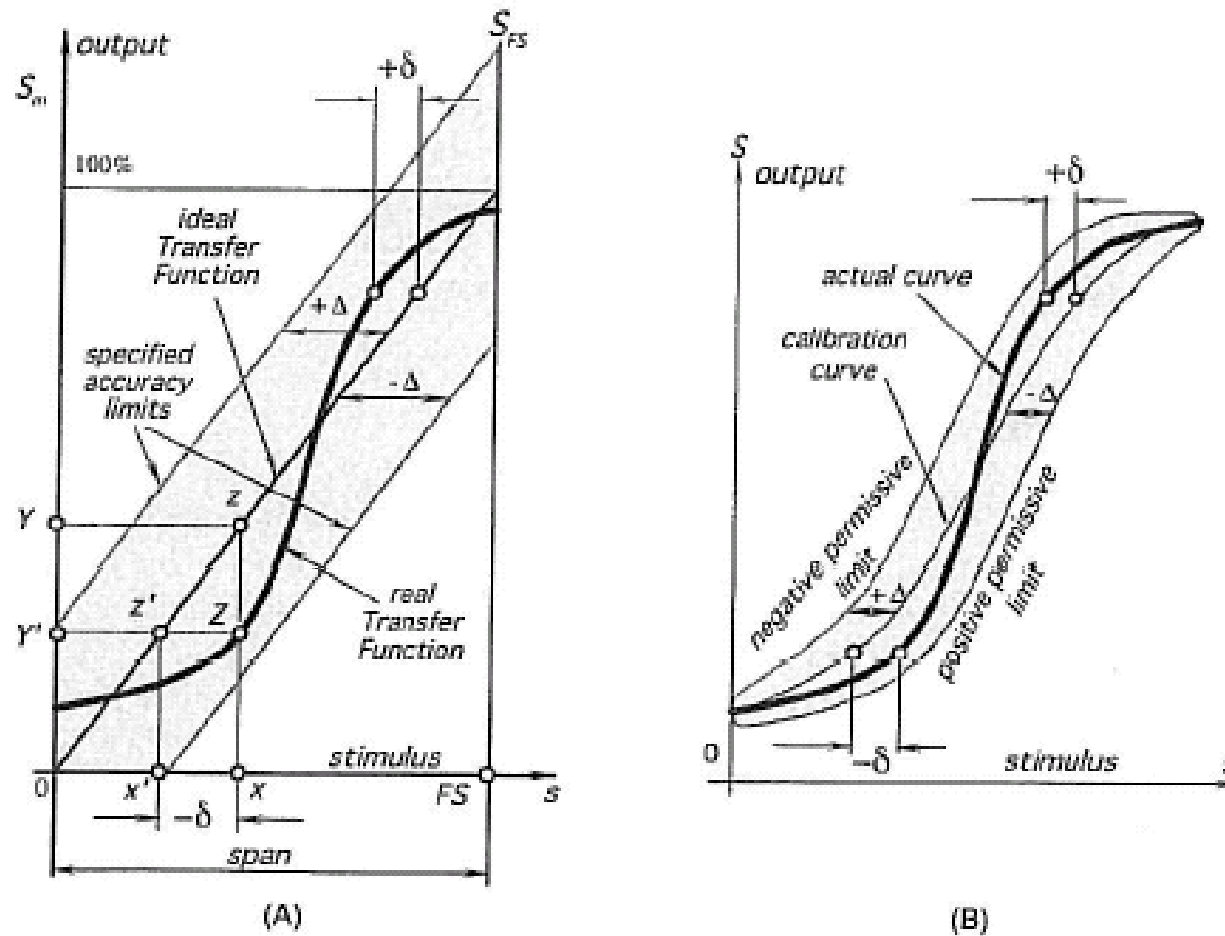
Fig. 2.2. Transfer function (A) and accuracy limits (B). Error is specified in terms of input value.

Oppløsning - fysisk

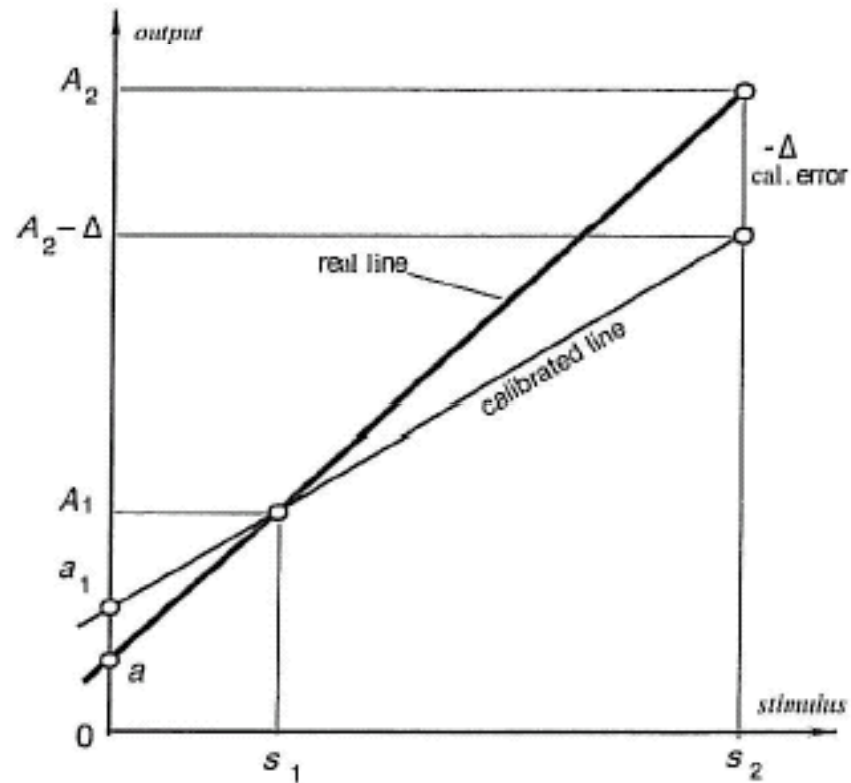256   7 Position, Displacement, and Level

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

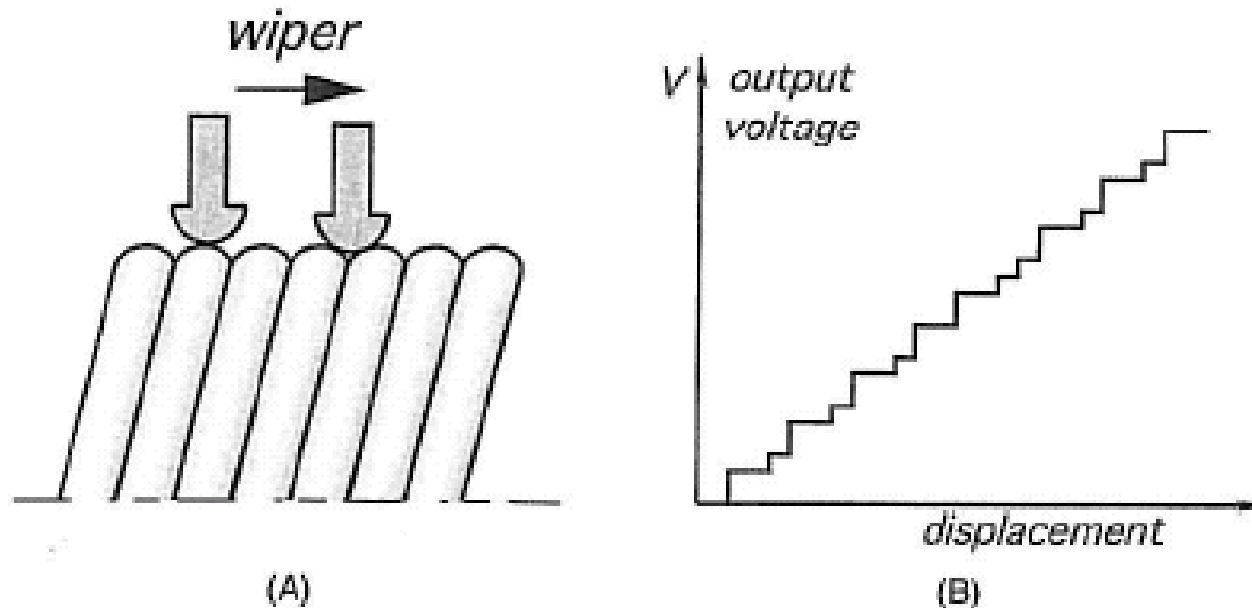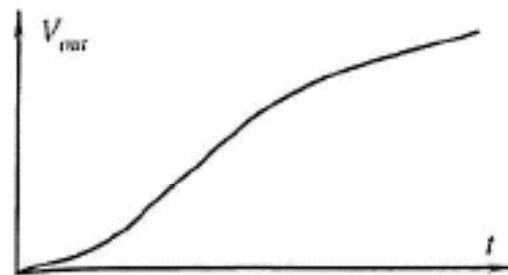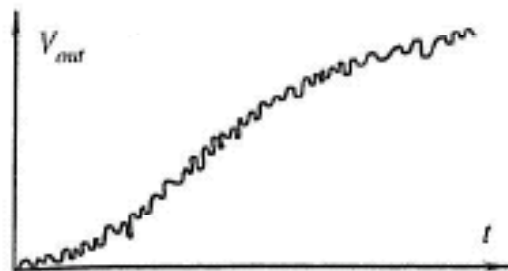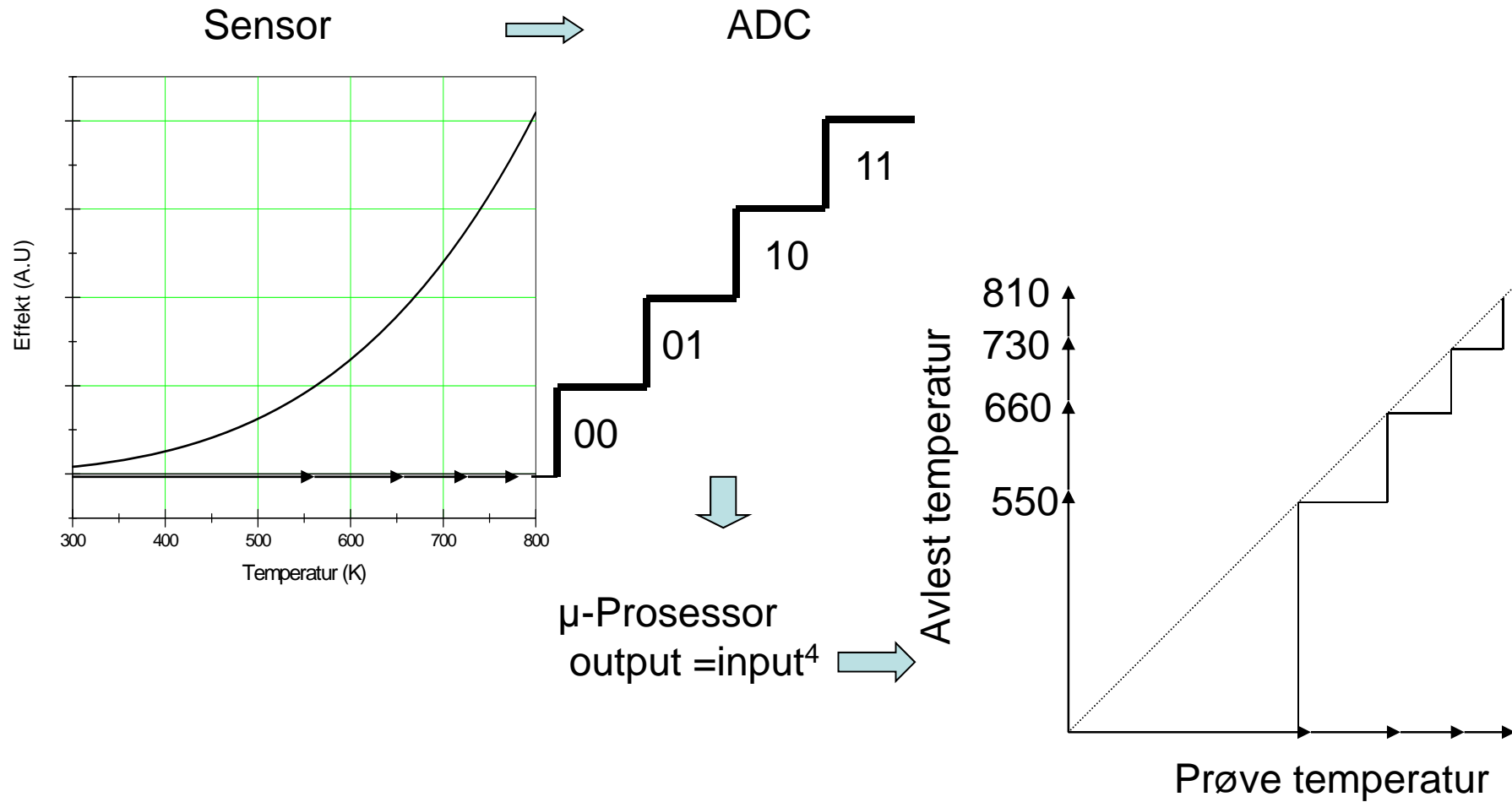| Bit	2^{-n}	$1/2^n$ Fraction	dB	$1/2^n$ Decimal	%	ppm
FS	2^0	1	0	1.0	100	1,000,000
MSB	2^{-1}	1/2	−6	0.5	50	500,000
2	2^{-2}	1/4	−12	0.25	25	250,000
3	2^{-3}	1/8	−18.1	0.125	12.5	125,000
4	2^{-4}	1/16	−24.1	0.0625	6.2	62,500
5	2^{-5}	1/32	−30.1	0.03125	3.1	31,250
6	2^{-6}	1/64	−36.1	0.015625	1.6	15,625
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

Effekt (A.U)

Temperatur (K)

300 400 500 600 700 800

00
01
10
11

μ-Prosessor
output =input^4

Avlest temperatur

810
730
660

550

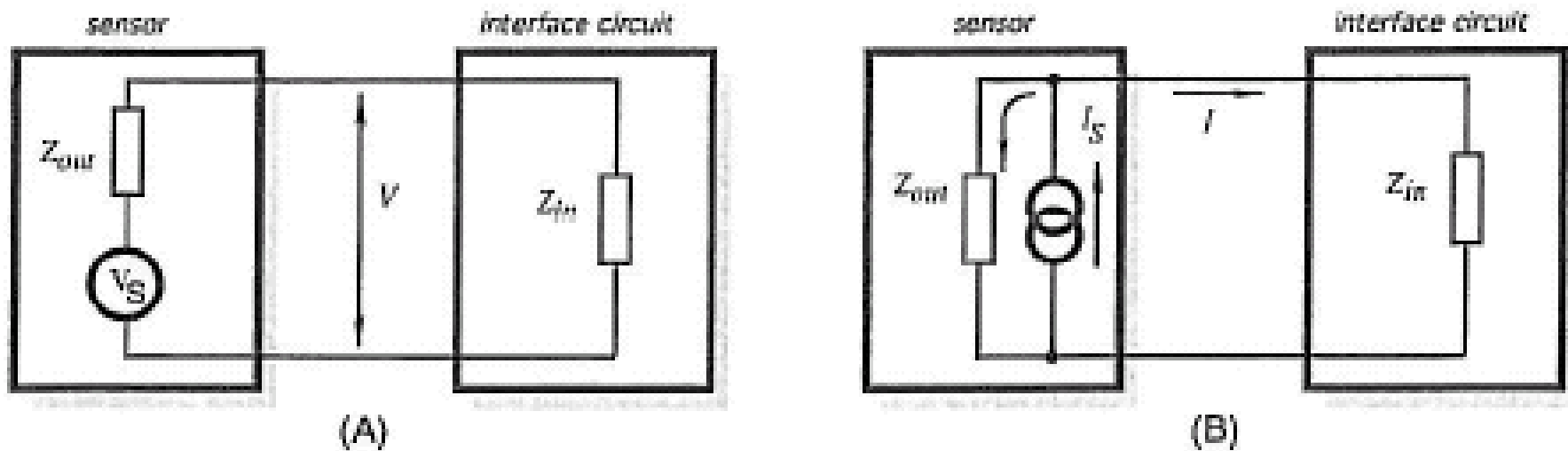Prøve temperatur

Utgangsimpedans

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