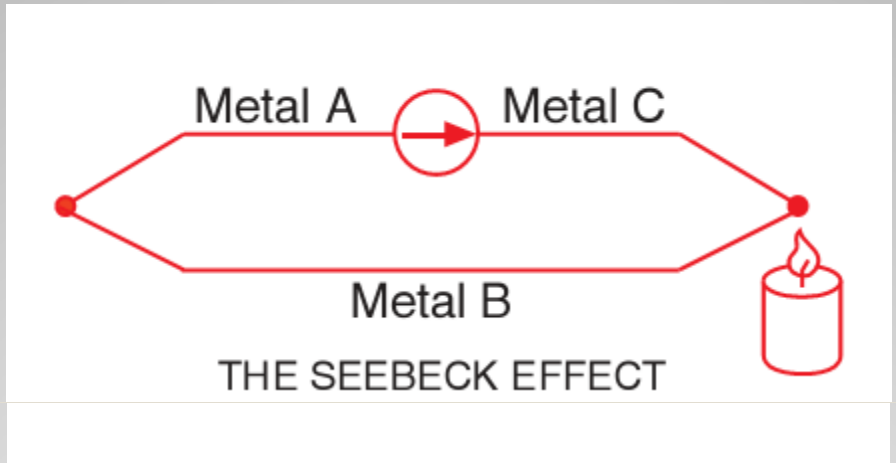
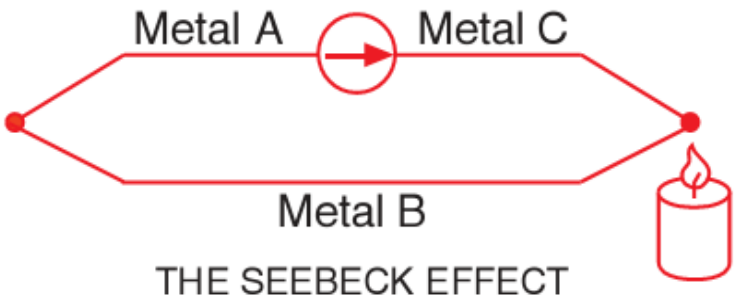
ALAT UKUR TEMPERATUR MENGGUNAKAN SENSOR TERMOKOPEL

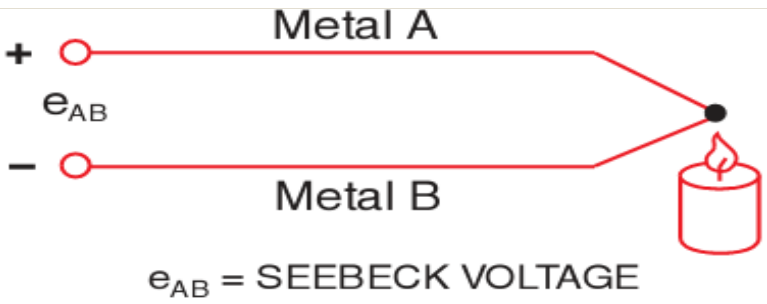
Oleh
IFAN WIRANTO



PRINSIP TERMOKOPEL



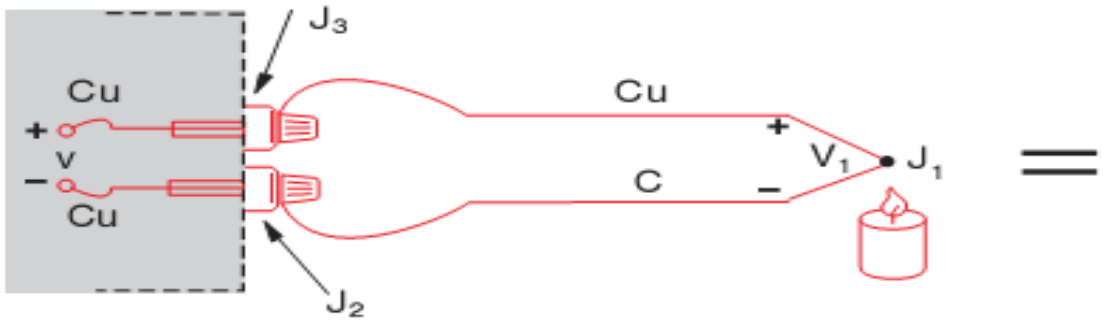
THE SEEBECK EFFECT



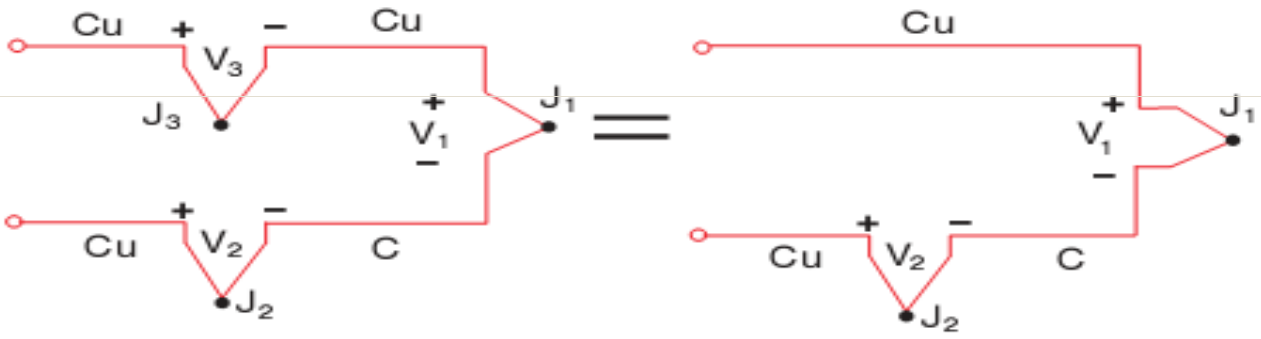
e_{AB} = SEEBECK VOLTAGE

$$\Delta e_{AB} = \alpha \Delta T$$

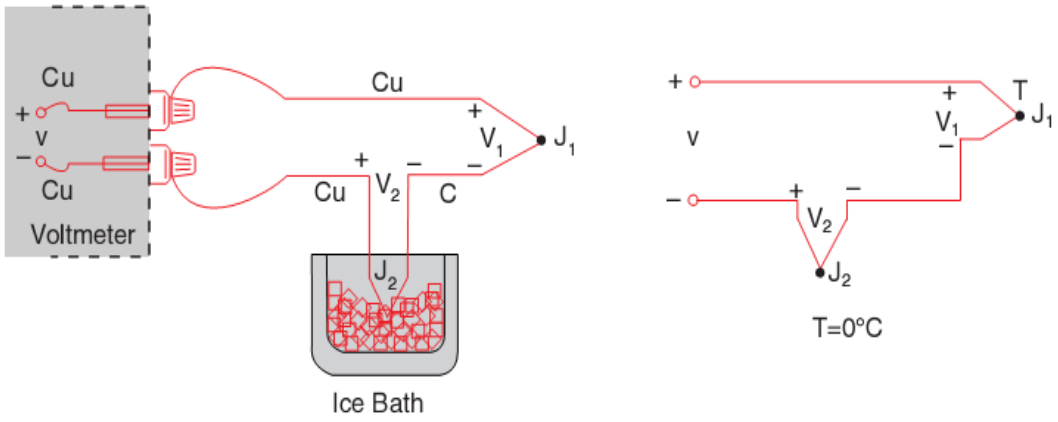
a=koefisien Seebeck



EQUIVALENT CIRCUITS



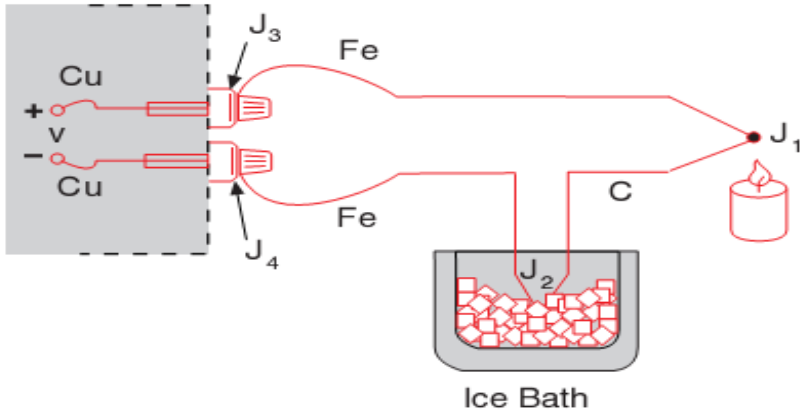
Mengukur Teganan Persambungan Menggunakan Voltmeter



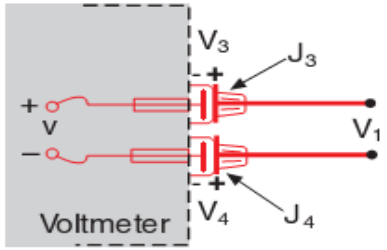
$$V = (V_1 - V_2) \cong \alpha(t_{J1} - t_{J2})$$

Jika t dalam derajat celcius, maka:

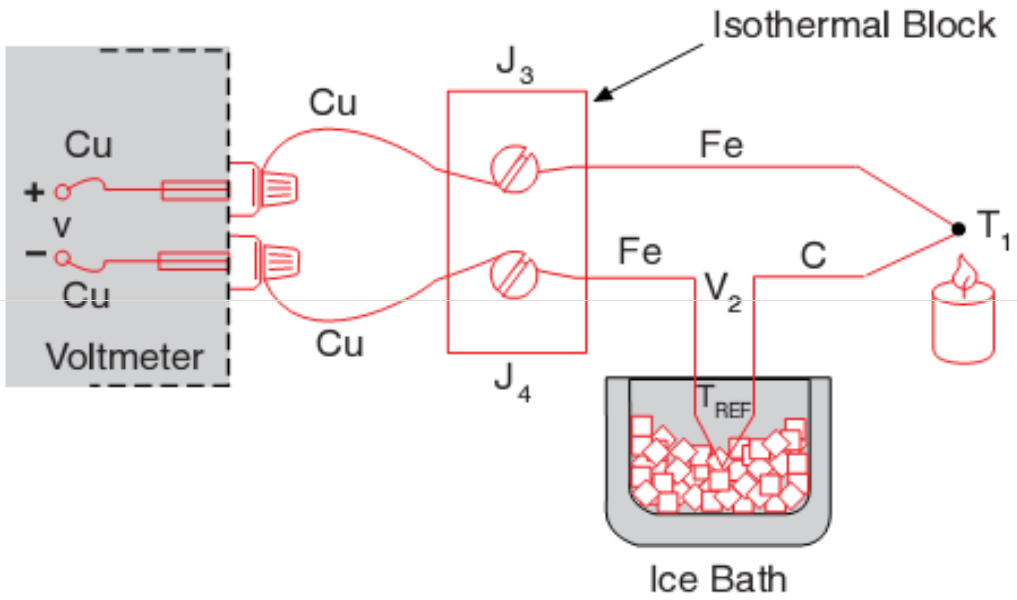
$V = V_1 - V_2 = \alpha[(T_{J1} + 273{,}15) - (T_{J2} + 273{,}15)]$
$= \alpha(T_{J1} - T_{J2}) = \alpha(T_{J1} - 0)$ $V = \alpha T_{J1}$



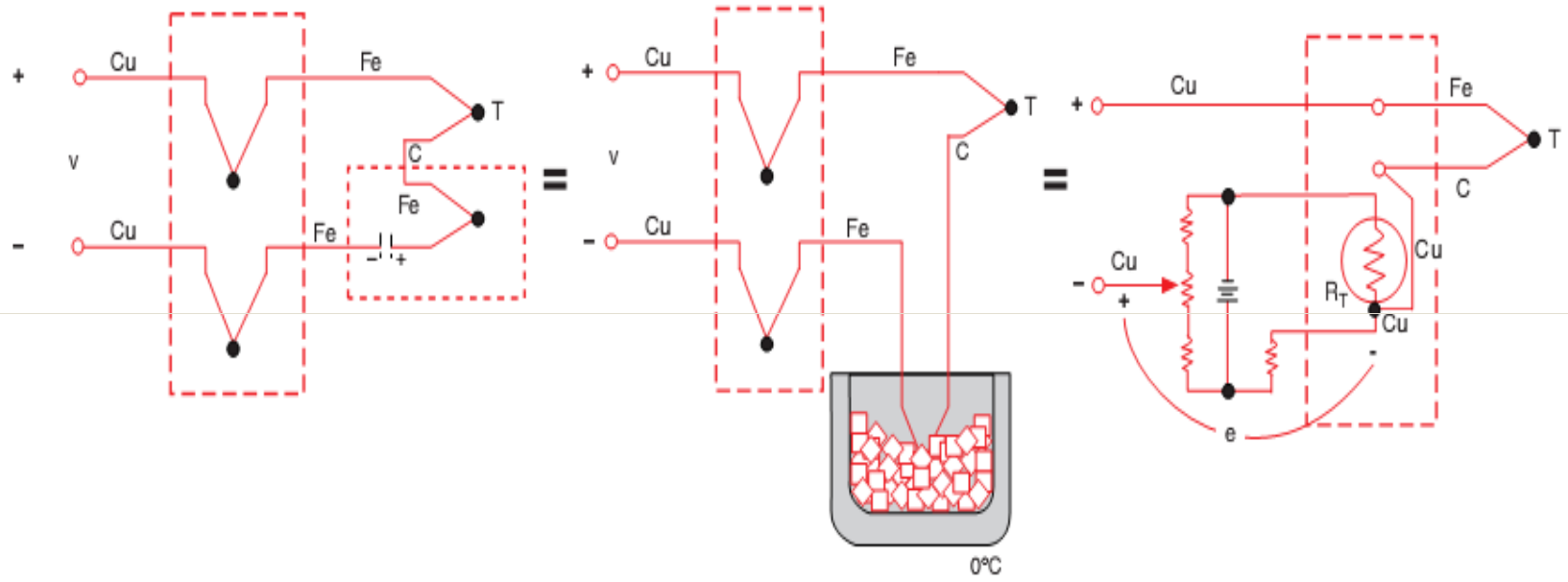
IRON-CONSTANTAN COUPLE

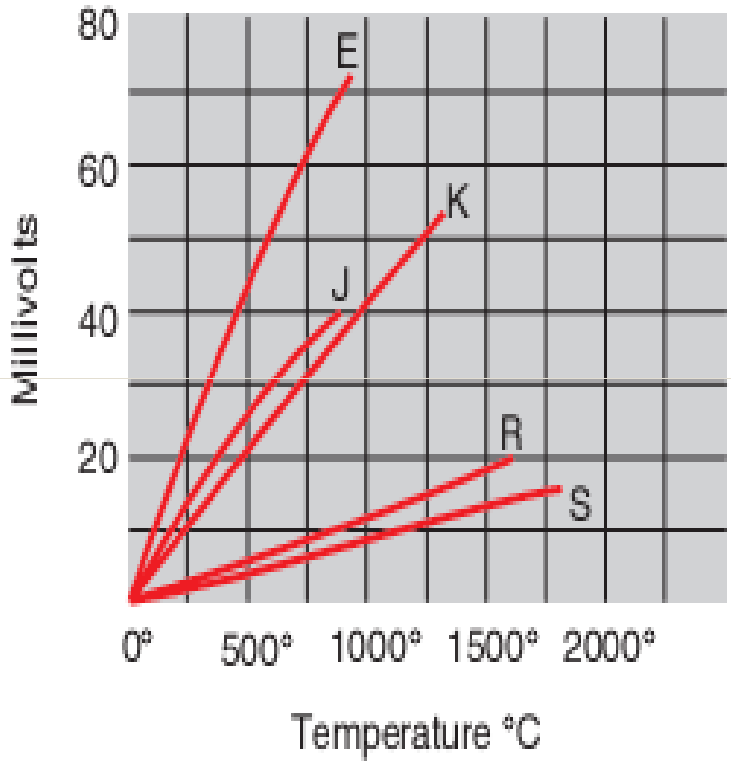


$V_1 = V$
if $V_3 = V_4$
i.e., if
$T_{J_3} = T_{J_4}$

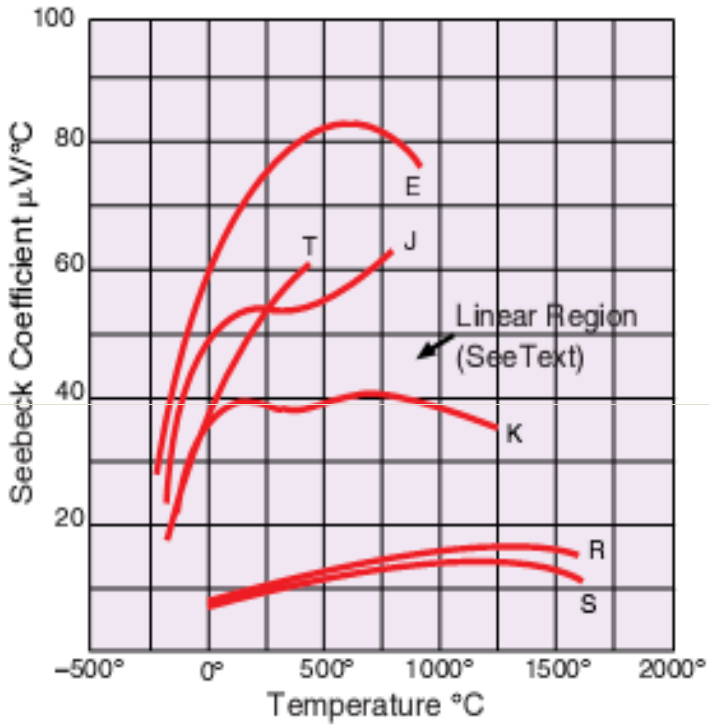


Menggeser sambungan dari terminal voltmeter


+
Cu
Fe
T
v
C
Fe
Cu
Fe
-
=
+
Cu
Fe
T
v
C
Cu
Fe
0°C
=
Cu
+
Fe
T
C
Cu
-
Cu
+
R_T
Cu
-
e



Type	Metals +	Metals −
E	Chromel vs. Constantan	
J	Iron vs. Constantan	
K	Chromel vs. Alumel	
R	Platinum vs. Platinum 13% Rhodium	
S	Platinum vs. Platinum 10% Rhodium	
T	Copper vs. Constantan	



SEEBECK COEFFICIENT vs. TEMPERATURE

THERMOCOUPLE TYPE	SEEBECK COEFFICIENT (μV/°C) @ 20°C	DVM SENSITIVITY FOR 0.1°C (μV)
E	62	6.2
J	51	5.1
K	40	4.0
R	7	0.7
S	7	0.7
T	40	4.0

REQUIRED DVM SENSITIVITY

Sensitivitas berbagai tipe Termokopel

Karakteristik Termokopel

$$\tau \frac{dT_{tc}}{dt} + T_{tc} = T_{in}$$

Dengan τ adalah konstanta waktu termokopel
T_{tc} adalah temperatur termokopel
T_{in} adalah temperatur yang diukur

PERANCANGAN ALAT UKUR

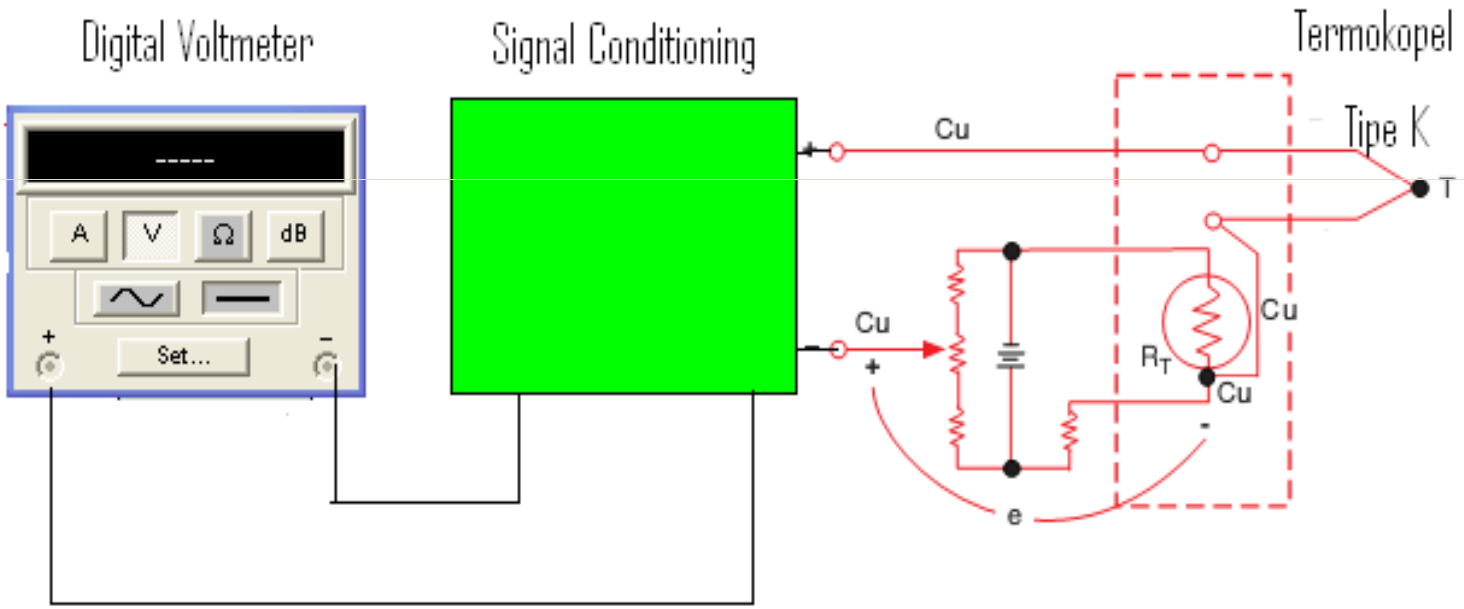
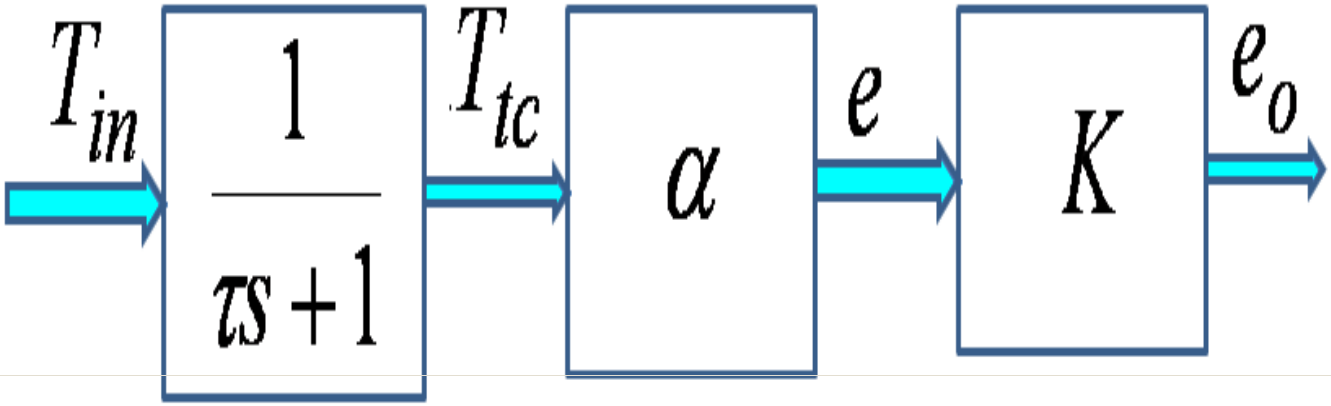
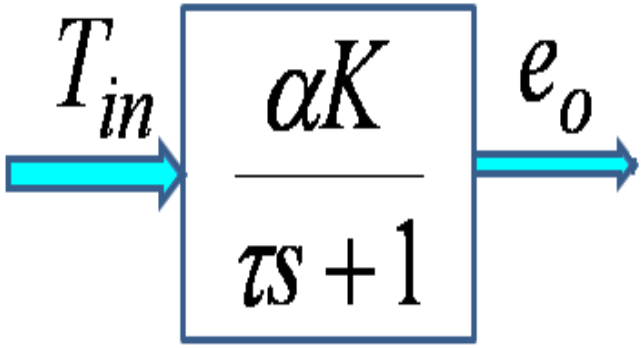
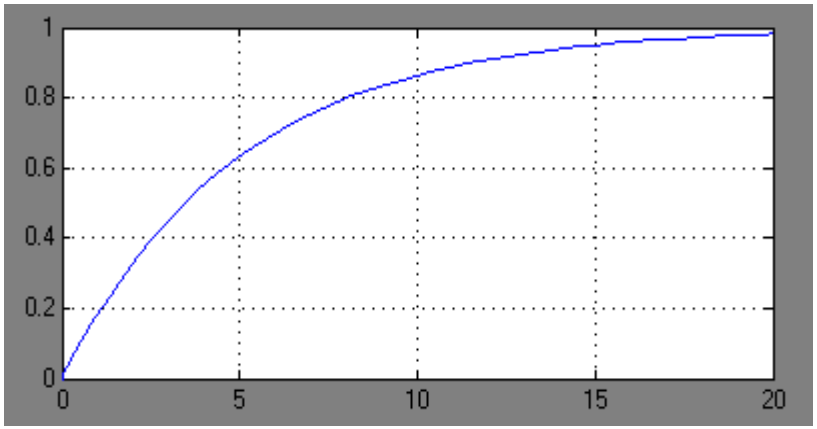


DIAGRAM BLOK ALAT UKUR

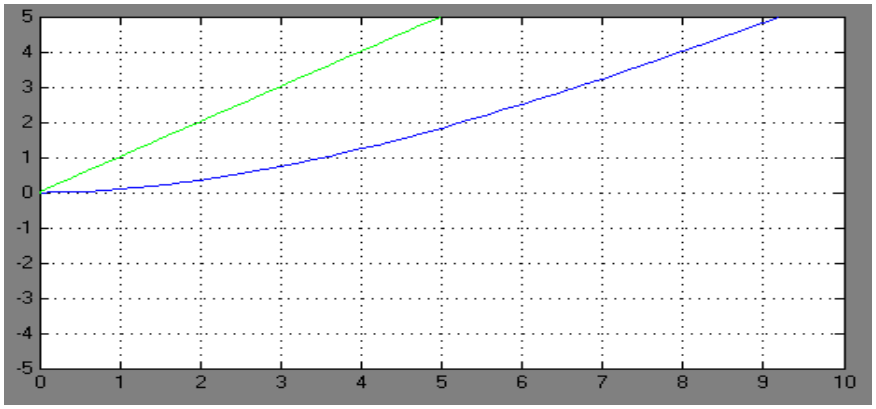




Tanggapan masukan step



Tanggapan masukan ramp



Tanggapan frekuensi

