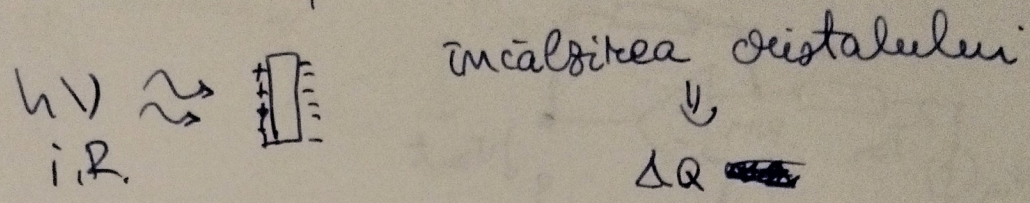
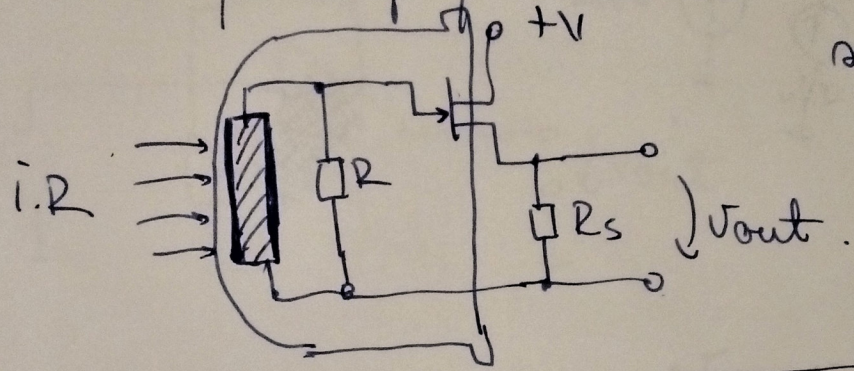


- cristale polarizate natural

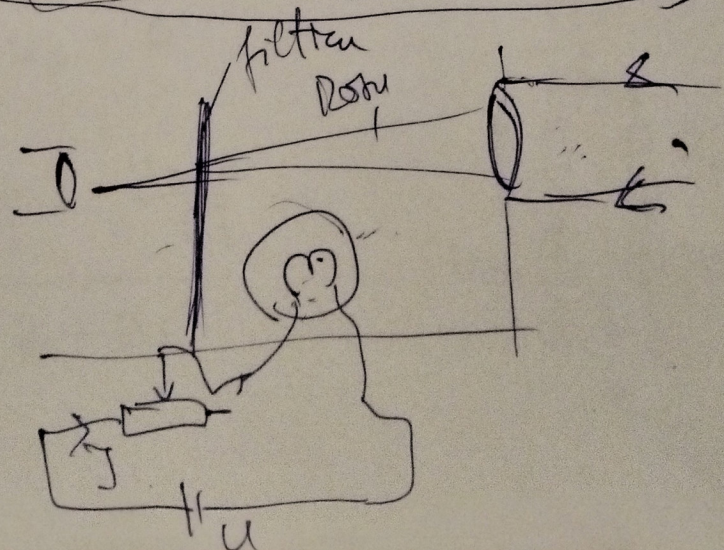
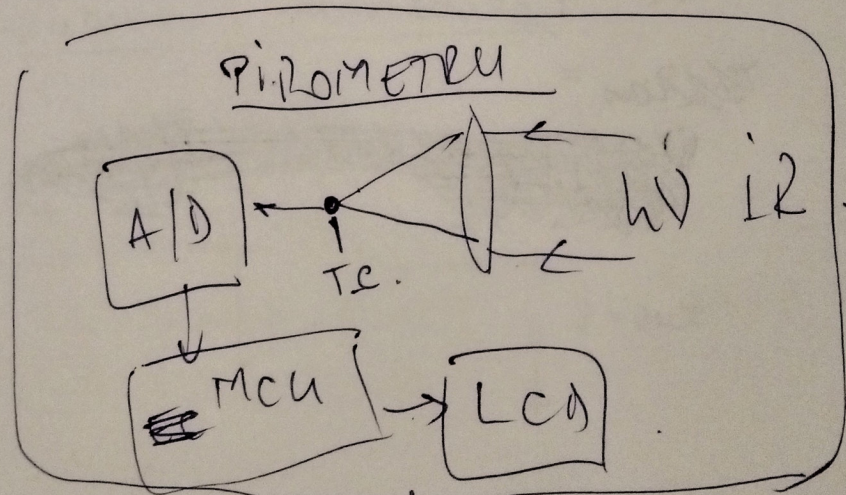


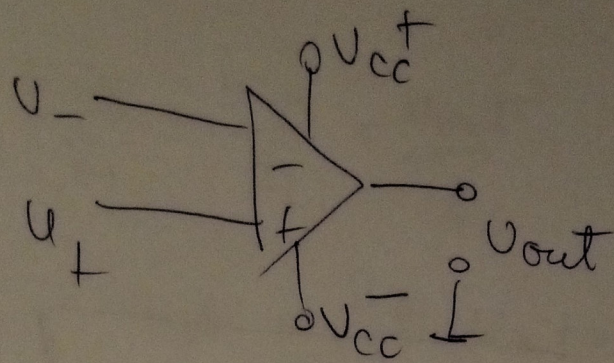
$i = A \cdot p \cdot \frac{dT}{dt}$ → putem măsura variația temp.

A - aria detectorului
 p - coef. piroelectric



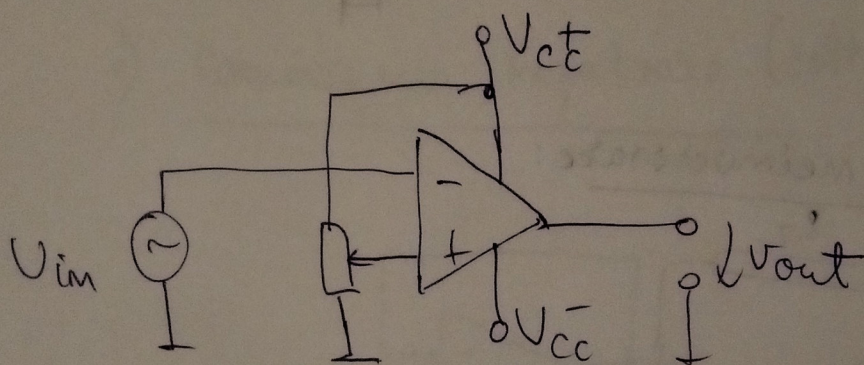
senzori de prezență



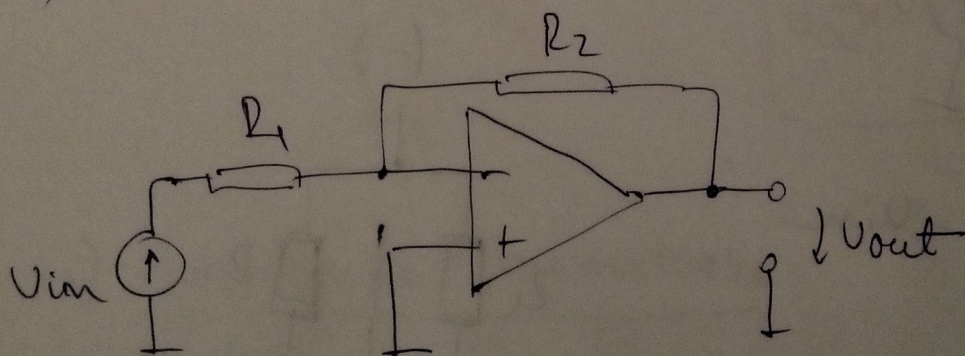


$$U_{out} = A_v (u_+ - u_-)$$

$$A_v \sim 10^5 - 10^6$$

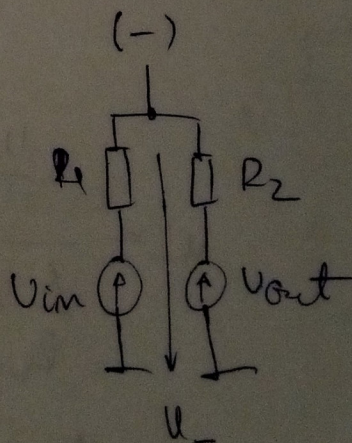


1) Comexiunea inversoare:



$$u_+ = 0$$

$$u_- = \frac{\frac{u_{in}}{R_1} + \frac{u_{out}}{R_2}}{R_1 + R_2}$$



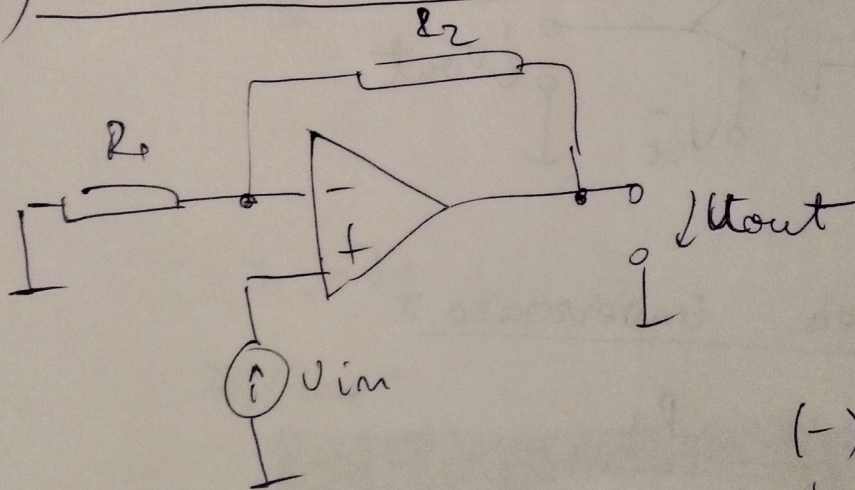
$$u_+ = u_-$$

$$\frac{u_{in}}{R_1} + \frac{u_{out}}{R_2} = 0$$

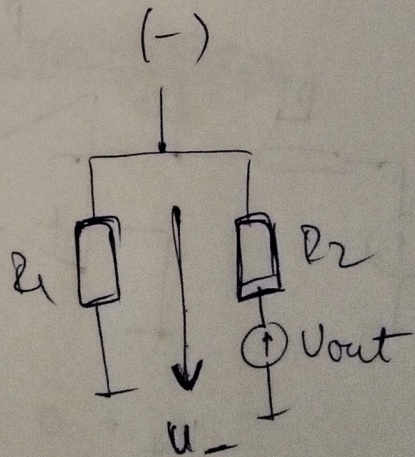
$$\frac{u_{in}}{R_1} = -\frac{u_{out}}{R_2} \Rightarrow \boxed{u_{out} = -\frac{R_2}{R_1} \cdot u_{in}}$$

$$A = -\frac{R_2}{R_1}$$

1) Conectarea neinversoare:



$$u_+ = u_{in}$$



$$u_- = \frac{\frac{u_{out}}{R_2}}{\frac{1}{R_1} + \frac{1}{R_2}} = u_{in}$$

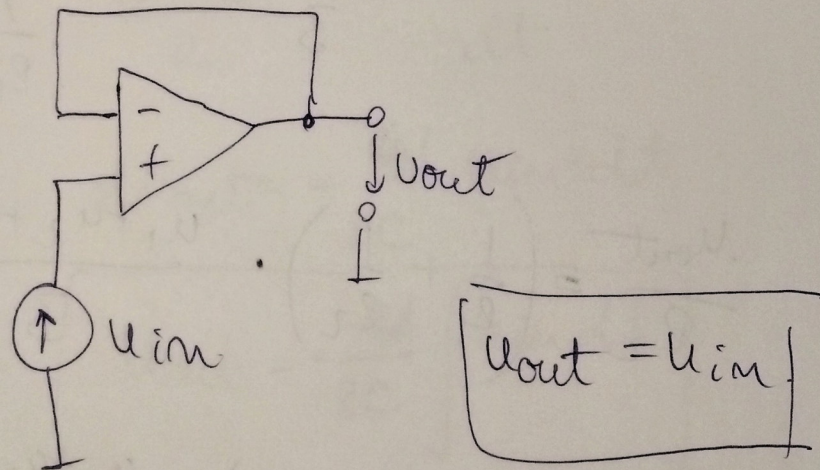
$$u_{in} \left(\frac{1}{R_1} + \frac{1}{R_2} \right) = \frac{u_{out}}{R_2}$$

$$\frac{u_{im}}{R_1} + \frac{u_{im}}{R_2} = \frac{u_{out}}{R_2}$$

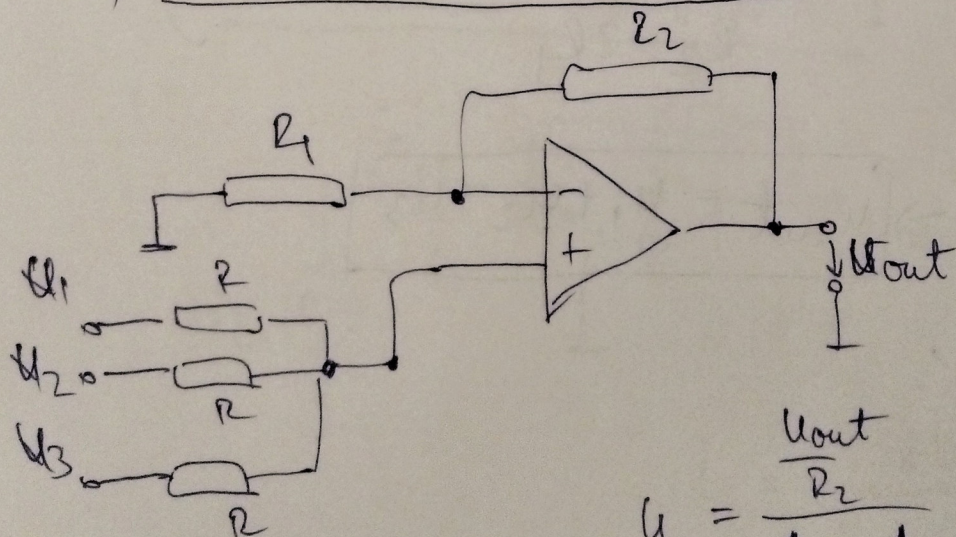
$$u_{out} = \frac{R_2}{R_1} \cdot u_{im} + u_{im}$$

$$u_{out} = u_{im} \left(1 + \frac{R_2}{R_1} \right)$$

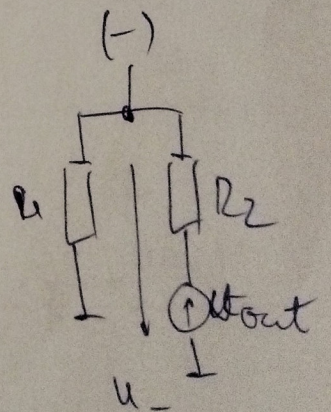
1) Conexiunea repetitoare (voltage follower) "buffer".

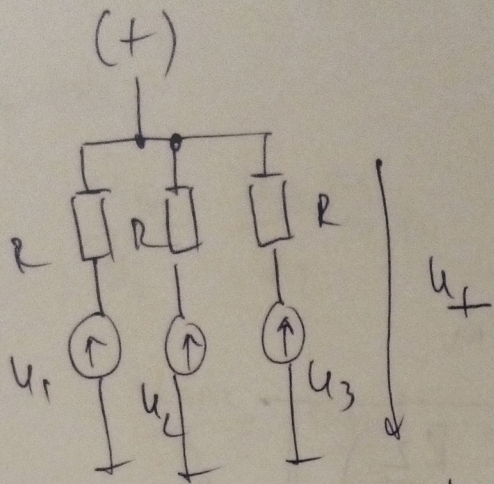


2) Conexiunea sumatoare



$$u_- = \frac{u_{out}}{R_2} = \frac{1}{R_1} + \frac{1}{R_2}$$





$$u_+ = \frac{\frac{u_1}{R} + \frac{u_2}{R} + \frac{u_3}{R}}{\frac{1}{R} + \frac{1}{R} + \frac{1}{R}} = \frac{u_1 + u_2 + u_3}{\frac{3}{R}}$$

$$= \frac{u_1 + u_2 + u_3}{3} = \frac{u_{out}}{R_2} = \frac{1}{R_1} + \frac{1}{R_2}$$

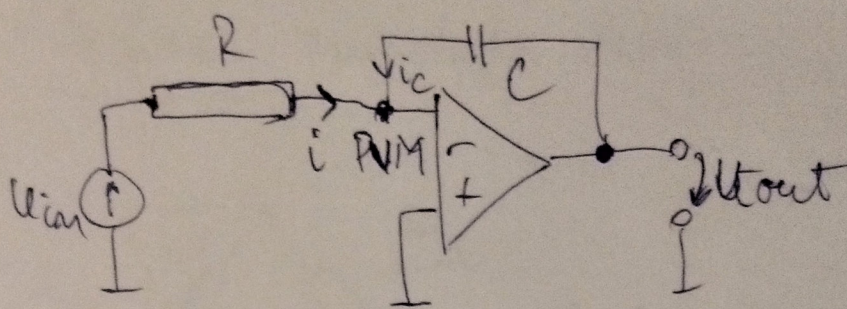
$$\frac{u_{out}}{R_2} = \left(\frac{1}{R_1} + \frac{1}{R_2} \right) \cdot \frac{u_1 + u_2 + u_3}{3}$$

$$u_{out} = \left(1 + \frac{R_2}{R_1} \right) \cdot \frac{u_1 + u_2 + u_3}{3} \quad \Rightarrow$$

$$R_2 = 2R_1$$

$$\Rightarrow u_{out} = u_1 + u_2 + u_3$$

1) Comexiunea integratoare



$$i_c = C \cdot \frac{dU_c}{dt} = C \cdot \frac{d(-U_{out})}{dt}$$

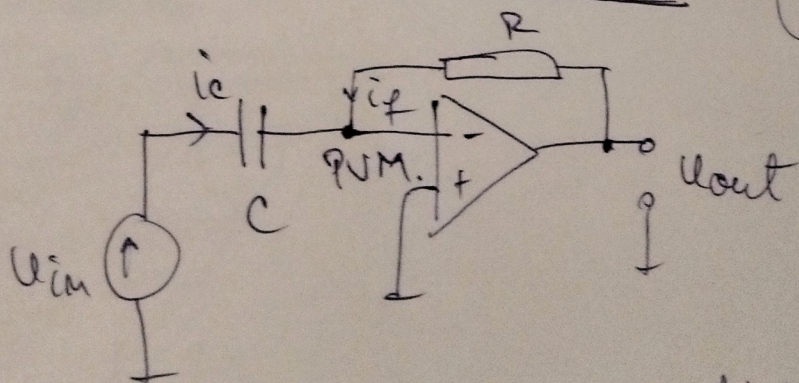
$$i = \frac{U_{in}}{R} = i_c$$

$$\frac{U_{in}}{R} = -C \cdot \frac{dU_{out}}{dt}$$

$$dU_{out} = -\frac{1}{RC} \cdot U_{in} \cdot dt$$

$$U_{out} = -\frac{1}{RC} \int U_{in} dt$$

2) Comexiunea derivatoare:



$$U_{out} = -RC \cdot \frac{dU_{in}}{dt}$$

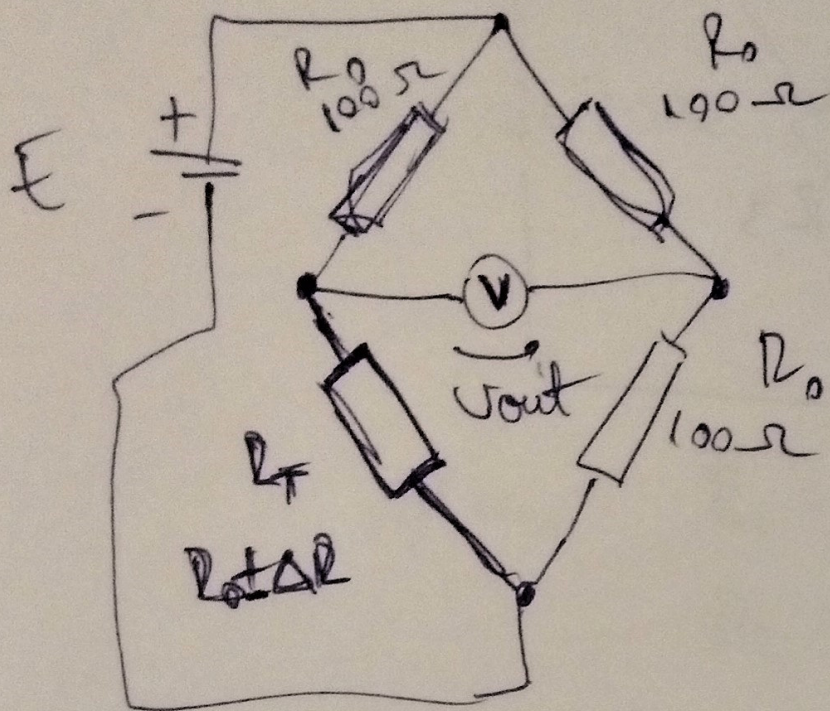
$$i = i_f$$

$$i_f = \frac{U_{out}}{R}$$

$$i_c = C \cdot \frac{dU_{in}}{dt} = -\frac{U_{out}}{R}$$

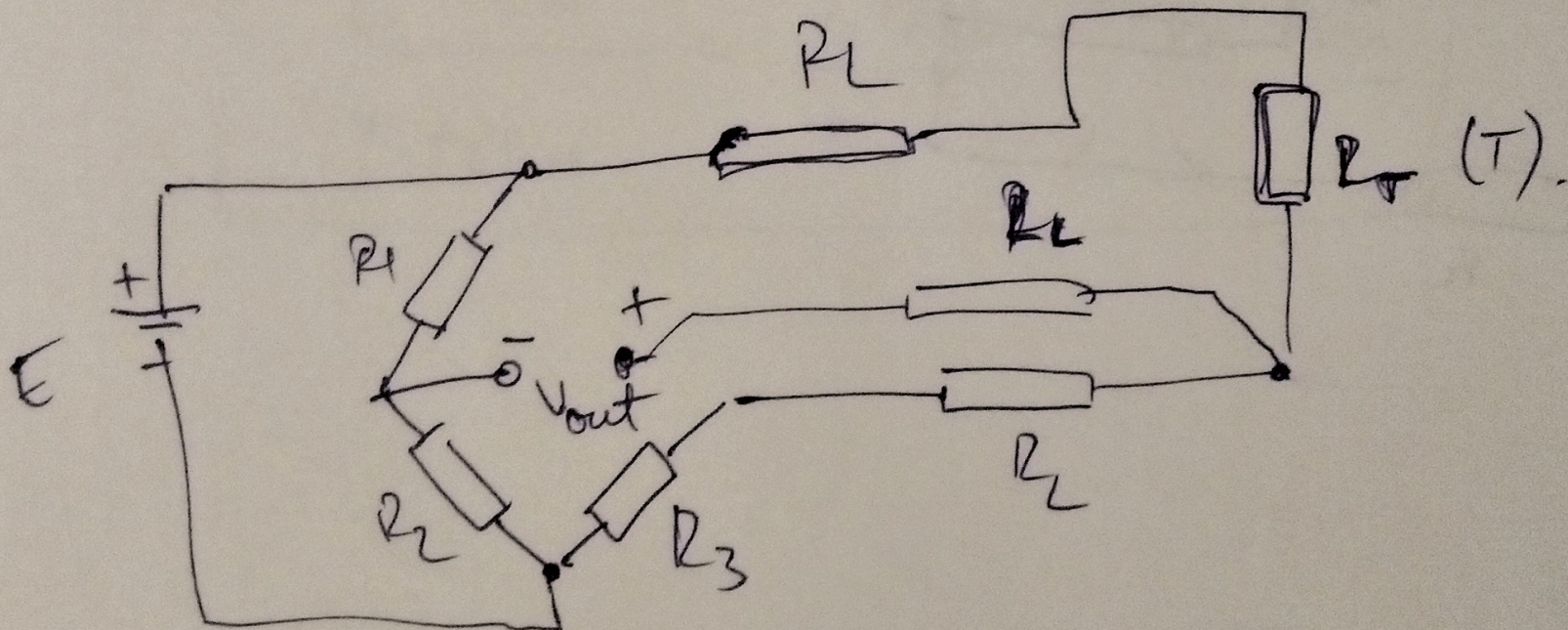
Pt 100 ;

1) 2 fire: acuratețe slabă

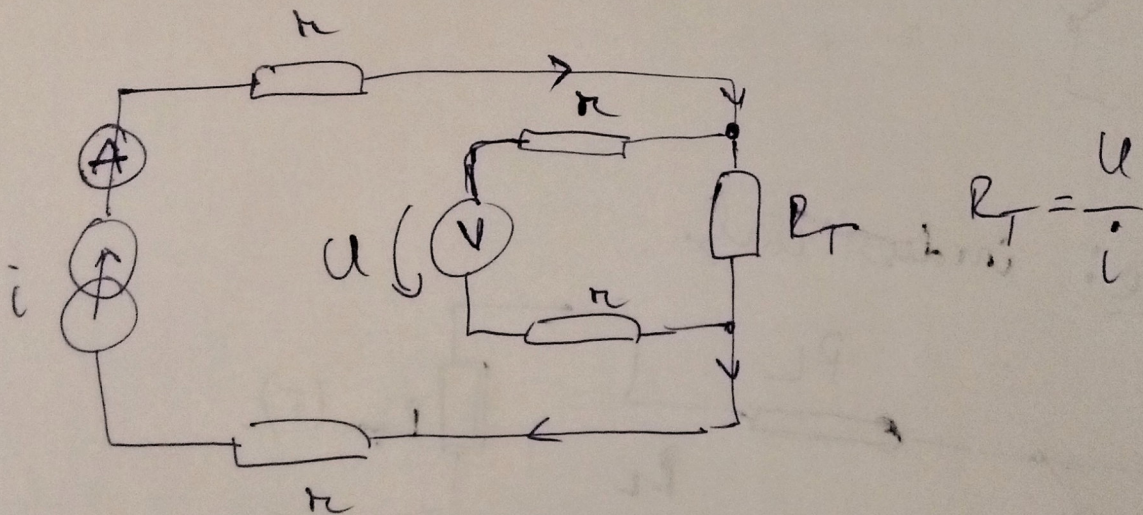
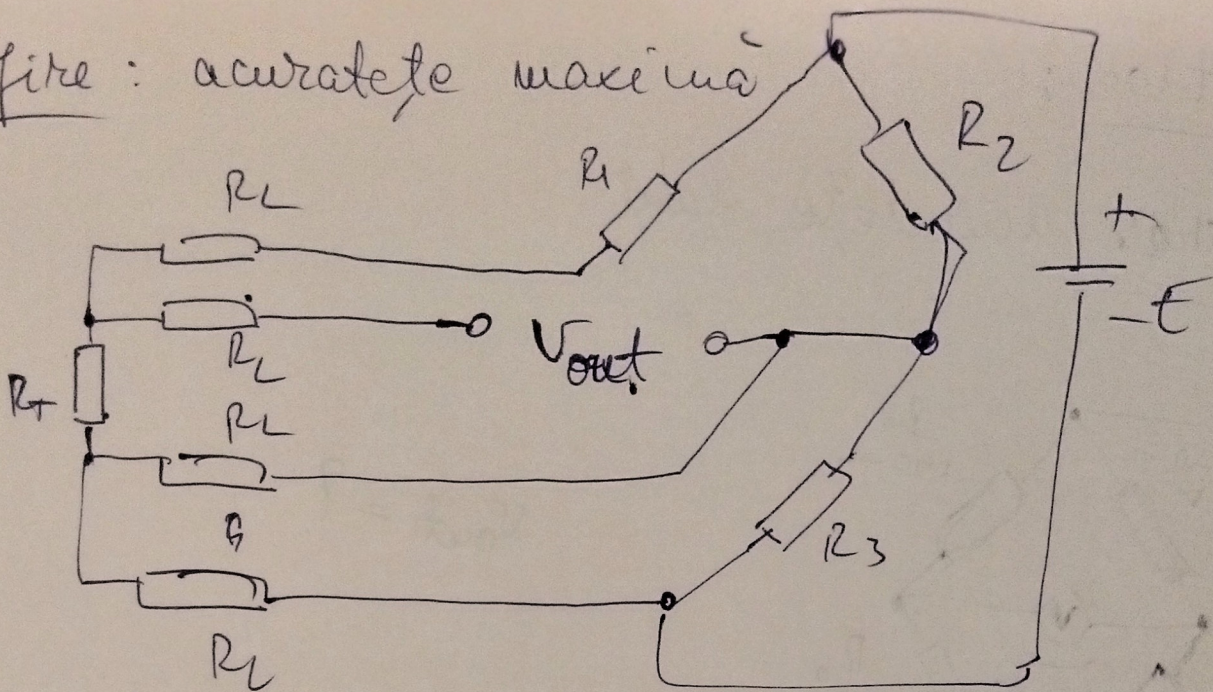


$V_{out} = ?$

2) 3 fire: industrial



4 fire: acuratețe maximă

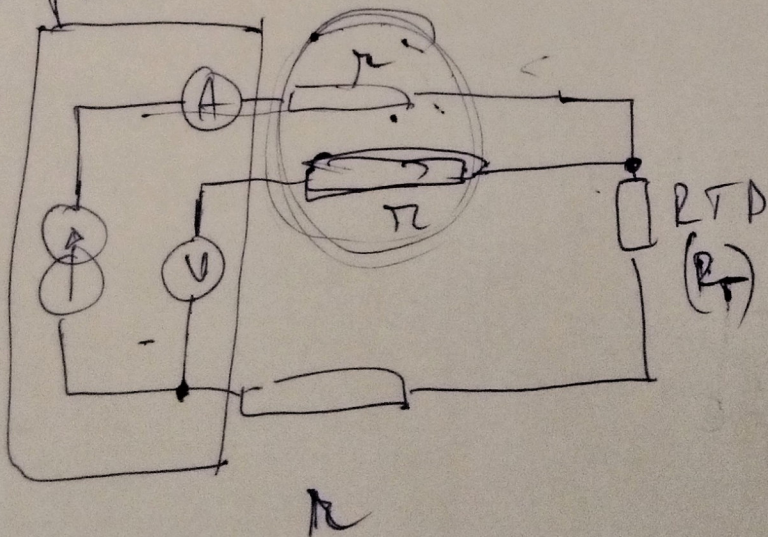


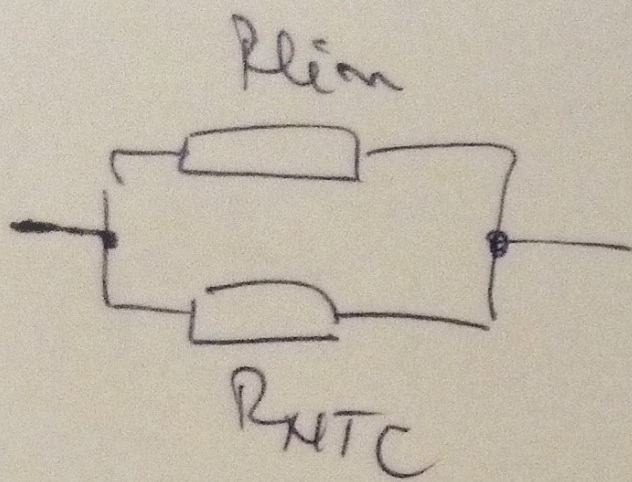
$$R_1 = 2r$$

$$r + R_T + r = R_2$$

$$R = R_2 - R_1 = R_T$$

3 fire





limiadezare între T_1 și T_2 .

$$T_3 = \frac{T_1 + T_2}{2}$$

știm

$$R_1 = R(T_1)$$

$$R_2 = R(T_2)$$

$$R_3 = R(T_3)$$

$$\frac{R_3 \cdot R_{lim}}{R_3 + R_{lim}} = \frac{\frac{R_1 R_{lim}}{R_1 + R_{lim}} + \frac{R_2 R_{lim}}{R_2 + R_{lim}}}{2}$$