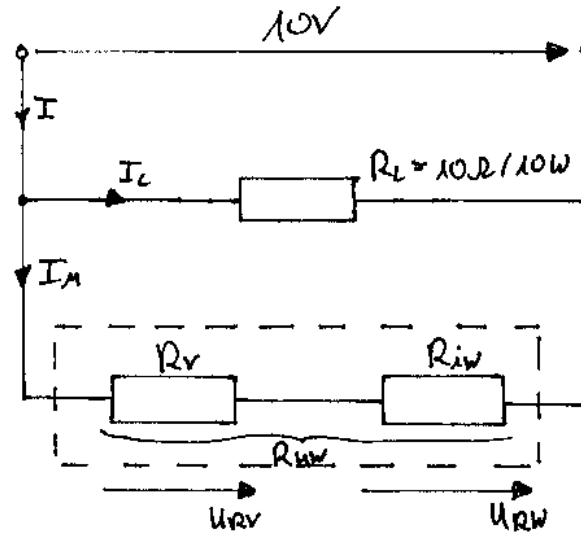


Spannungsmessung:



$$U_{Rk} = R_k \cdot I_{MW} = 20\Omega \cdot 5mA = 100mV$$

$$R_{iW} = R_{iK} + \Delta R = 2000\Omega + 1,2\Omega = \underline{\underline{2001,2\Omega}}$$

$$R_{gesw} = \frac{R_{iW} \cdot R_L}{R_{iW} + R_L} = \frac{2001,2\Omega \cdot 10\Omega}{2001,2\Omega + 10\Omega} = \underline{\underline{9,95\Omega}}$$

$$I = \frac{U}{R_{gesw}} = \frac{10V}{9,95\Omega} = \underline{\underline{1,004997A}}$$

$$I_L = \frac{U}{R_L} = \frac{10V}{10\Omega} = \underline{\underline{1A}}$$

$$I_M = I - I_L = 1,004997A - 1A = \underline{\underline{4,997mA}}$$

$$U_{RW} = I_M \cdot R_{iW} = 4,997mA \cdot 21,2\Omega = \underline{\underline{105,9mV}}$$

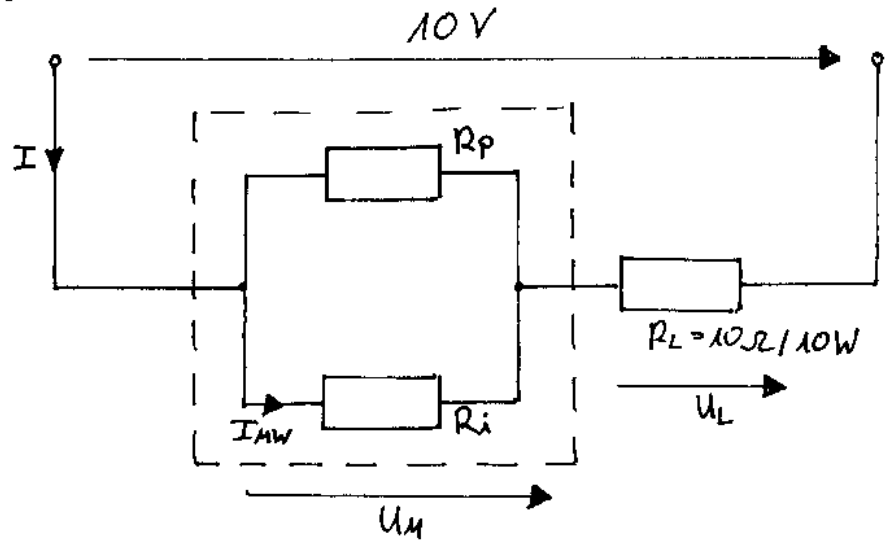
$$U_{RV} = U - U_{RW} = 10V - 0,1059V = \underline{\underline{9,894V}}$$

$$f_U = \frac{105,9mV - 100mV}{100mV} \cdot 100\% = \underline{\underline{0,06\%}}$$

Messtechnik Aufgabe 1B

a) Strombereichserweiterung

geg.: $R_i = 20\Omega$
 $I_{MW} = 5mA$
 $I = 1A$



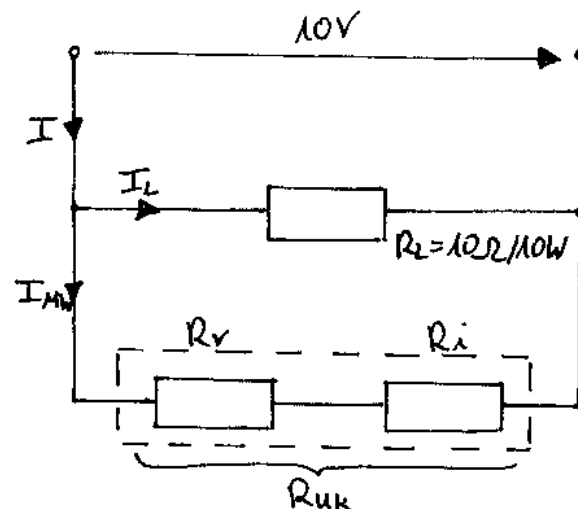
$$n = \frac{I}{I_{MW}} = \frac{1A}{0,005A} = \underline{\underline{200}}$$

$$R_p = \frac{R_i}{n-1} = \frac{20\Omega}{199} = \underline{\underline{100,5m\Omega}}$$

$$R_A = \frac{R_i * R_p}{R_i + R_p} = \frac{20\Omega * 0,1005\Omega}{20\Omega + 0,1005\Omega} = \underline{\underline{0,1\Omega}}$$

b) Spannungsbereichserweiterung

geg.: $U = 10V$
 $\Delta v = 15K$
 $\alpha_{cu} = 4 * 10^{-3} \frac{1}{K}$



$$R_{UK} = \frac{U}{I_{MW}} = \frac{10V}{0,005A} = \underline{\underline{2000\Omega}}$$

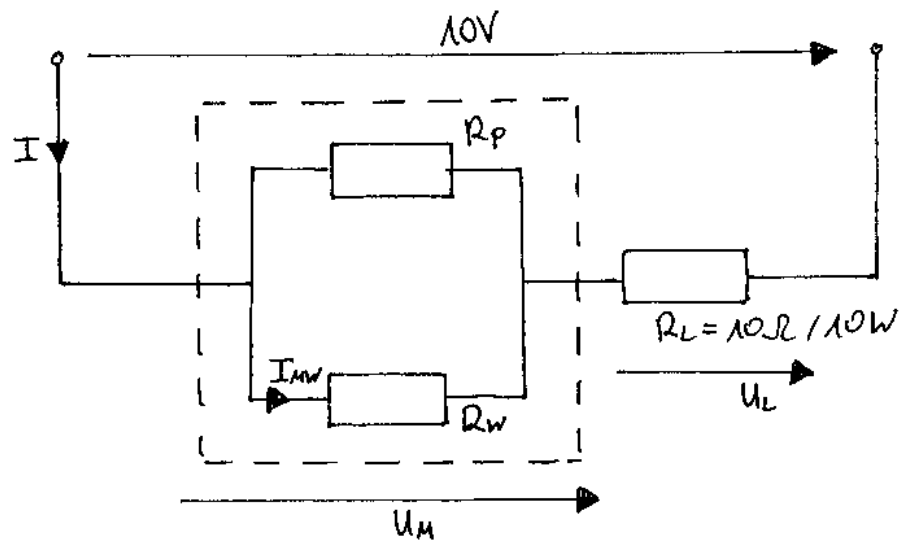
$$R_v = R_{UK} - R_i = 2000\Omega - 20\Omega = \underline{\underline{1980\Omega}}$$

c) Anzeigen und Fehler

$$R_w = R_i(1 + \alpha * \Delta v) = 20\Omega(1 + 4 * 10^{-3} \frac{1}{K} * 15K) = \underline{\underline{21,2\Omega}}$$

$$\Delta R = R_w - R_i = 21,2\Omega - 20\Omega = \underline{\underline{1,2\Omega}}$$

Strommessung:



$$R_{ges} = \frac{R_w * R_p}{R_w + R_p} + R_L = \frac{21,2\Omega * 0,1005\Omega}{21,2\Omega + 0,1005\Omega} + 10\Omega = \underline{\underline{10,1\Omega}}$$

$$I = \frac{U}{R_{ges}} = \frac{10V}{10,1\Omega} = \underline{\underline{0,99A}}$$

$$U_L = R_L * I = 10\Omega * 0,99A = \underline{\underline{9,9V}}$$

$$U_M = U - U_L = 10V - 9,9V = \underline{\underline{0,1V}}$$

$$I_{mw} = \frac{U_M}{R_w} = \frac{0,1V}{21,2\Omega} = \underline{\underline{4,72mA}}$$

$$I_{ANW} = 200 * I_{mw} = \underline{\underline{0,944A}}$$

$$f_t = \frac{4,717mA - 5mA}{5mA} * 100\% = \underline{\underline{-5,66\%}}$$