1. POWER – MEASUREMENT for balanced THREE-PHASE LOAD

Task: To measure the **input power** of asynchronous motor by no–load test – using **ONE – Wattmeter Method** – the artificial Neutral wire, with.
To compute with respect to the wattmeter consumption **P´.**

Diagram (lab 107):

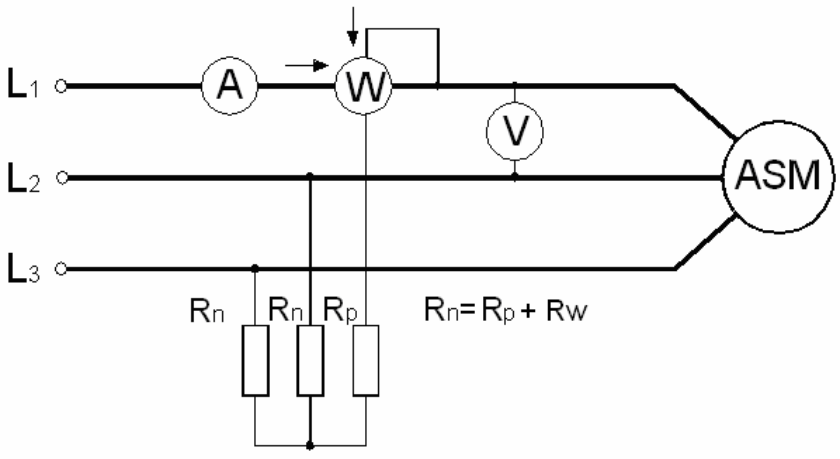
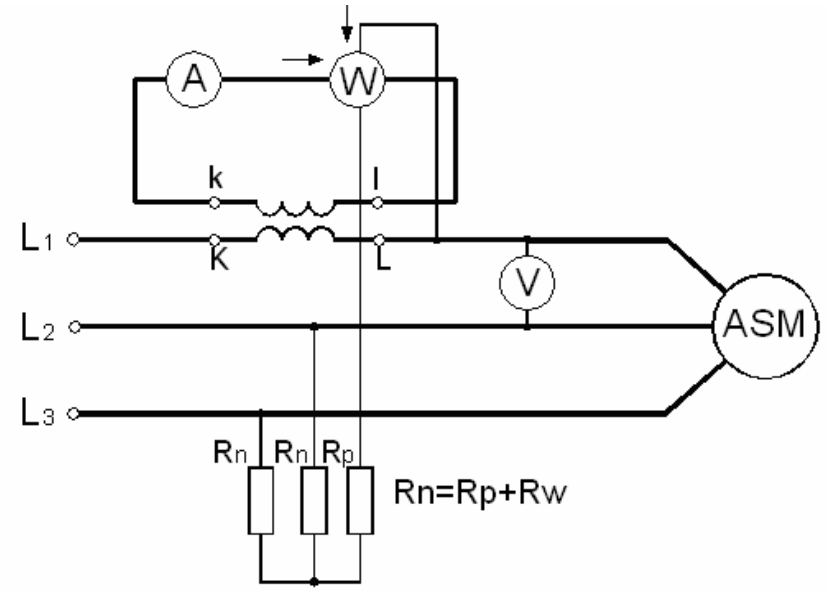


Diagram for lab 57:



Instruments:

V_{AC}…ferromagnetic voltmeter 250V — $R_{n\ldots}$ resistance multiplier for wattmeter
A_{AC}…ferromagnetic ammeter 5A — ASM … asynchronous motor
W… ferrodynamic wattmeter cos φ 0,2
The measuring Current transformer is used in lab 57 (the transformer secondary winding has to be shortened – during the as. motor start).

Measured and computed values:

V_{L1L2} [V]	I_{L1} [A]	α_W [d]	k_W [W/d]	R_W [Ω]	R_V [Ω]	P_1 [W]	P'_W [W]	P'_V [W]	P_3 [W]	cos φ [-]

Wattmeter reading: $P_1 = k_W \alpha_W$ $k_W = \frac{r_V . r_A}{d} \cos \varphi_w$

Wattmeter and voltmeter consumption: $P'_W = \frac{U^2_{L1}}{R_W}$ $P'_V = \frac{U^2_{L1L2}}{R_V}$ $U_{L1} = \frac{U_{L1L2}}{\sqrt{3}}$

Three phase input power: $P_3 = 3\,(P_1 - P'_W - P'_V) = 3\,P_{L1}$

Power factor: $\cos\varphi = \frac{P_{L1}}{U_{L1}\,I_{L1}}$

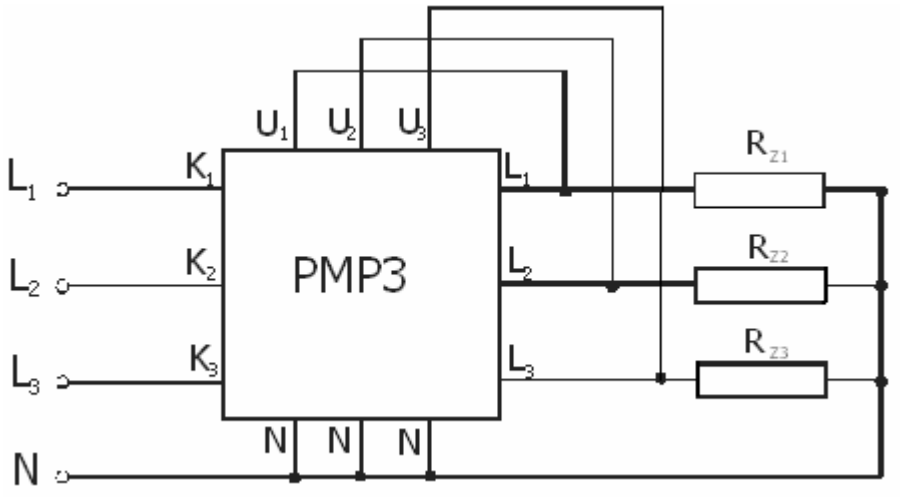
2. POWER MEASUREMENT for Unbalanced FOUR-WIRE, WYE-Connected Load (the neutral conductor, with).

Task:

Having been realized, the 3 – PHASE-WYE connected LOAD (the three various resistors); by the electronic wattmeter using, to measure:

- either the **average power** in **each phase**;
- and either the **total average power**, too.

Diagram:



Instruments:

PMP3 … the electronic programmable ELKO ŠŤOVÍČEK
R_{Z1} … load resistor 250 Ω (lab 57 … 400 Ω)
R_{Z2} … load resistor 450 Ω (lab 57 … 600 Ω)
R_{Z3} … load resistor 600 Ω (lab 57 … 1200 Ω)

Measured and computed values:

V_{L1} [V]	I_{L1} [A]	P_{L1} [W]	V_{L2} [V]	I_{L2} [A]	P_{L2} [W]	V_{L3} [V]	I_{L2} [A]	P_{L3} [W]	P_3 [W]	cos φ [-]

Note:

The electronic wattmeter has to be controlled in agreement the enclosed instructions, with.

3. TWO WATTMETER METHOD (Aron´s Method)
- **for the TOTAL POWER MEASUREMENT in a THREE-PHASE system (no-neutral conductor, with).**

Task:

Two Wattmeter Method - being applied to the THREE resistors DELTA -connected LOAD; to measure the **input power**.

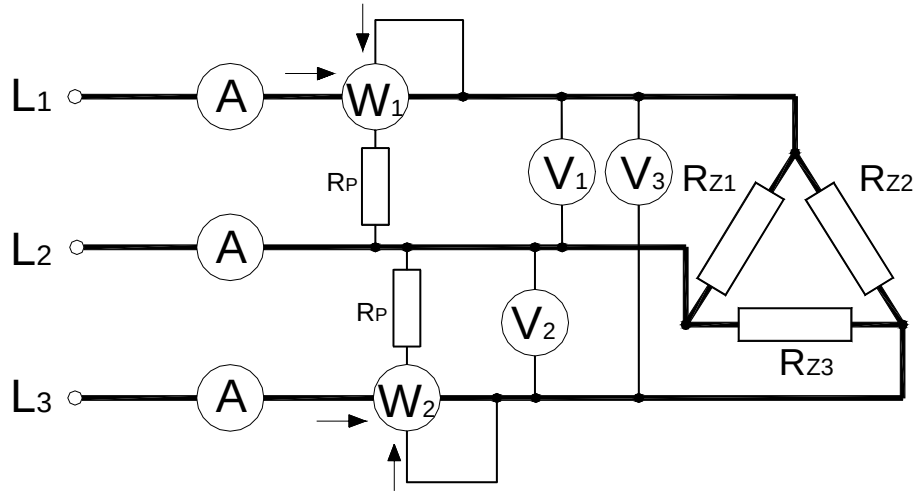
To compute – being respected – the instruments consumptions.

Instruments:

V_{AC}…ferromagnetic voltmeter 500V
A_{AC}…ferromagnetic ammeter 2A
W… ferrodynamic wattmeter 360V/2A

R_{Z1} … load resistor 410 Ω
R_{Z2} … load resistor 600 Ω
R_{Z3} … load resistor 1200 Ω

Diagram:



Measured and computed values:

V_{L1L2} [V]	I_{L1} [A]	α_{W1} [d]	k_{W1} [W/d]	V_{L2L3} [V]	I_{L3} [A]	α_{W2} [d]	k_{W2} [W/d]	I_2 [A]	V_{L1L3} [V]	R_W [Ω]	R_V [Ω]	P' [W]	P_3 [W]

Calculation:

wattmeter consumption; and voltmeter consumption:

$$P'_{W1} = \frac{U^2_{L1L2}}{(R_{W1} + R_P)} \qquad P'_{W2} = \frac{U^2_{L2L3}}{(R_{W2} + R_P)} \qquad P'_{V1} = \frac{U^2_{L1L2}}{R_{V1}} \qquad P'_{V2} = \frac{U^2_{L2L3}}{R_{V2}}$$

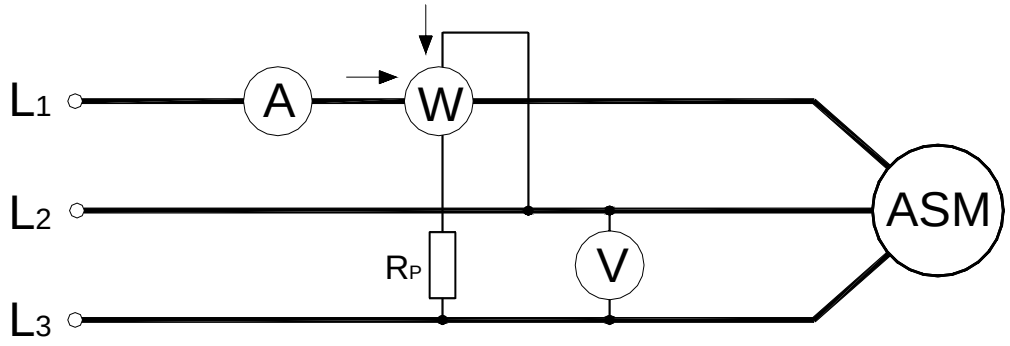
3 – phase input power:

$$P_3 = \left| k_{W1}\,\alpha_{W1} + k_{W2}\,\alpha_{W2} \right| - P' \qquad P' = P'_{W1} + P'_{W2} + P'_{V1} + P'_{V2}$$

4. REACTIVE POWER MEASUREMENT in a THREE-PHASE system

Task: To measure the **reactive input power** Q of asynchronous motor by no–load test – using **ONE – Wattmeter Method**.
To sketch the phasor diagram – the measured voltages, for.

Diagram:



Note:
To be measured the reactive power (by the average power wattmeter using) – the voltage coil has to be connected the voltage **lags 90˚,** on – with respect to the corresponding voltage.
These one voltage is the line – to line voltage:

- (between line L2 and L3), if it's measured in line L1;
- (between L3 and L1), if measured in L2;
- (between L1 and L2), if measured in L3;

Instruments:
V_{AC}…ferromagnetic voltmeter 500V W… ferrodynamic wattmeter 360V/2A
A_{AC}…ferromagnetic ammeter 2A

Measured and computed values:

α_{W1} [d]	k_{W1} [VAr/d]	α_{W2} [d]	k_{W2} [VAr/d]	α_{W3} [d]	k_{W3} [VAr/d]	Q [VAr]

Calculation:

$$Q = \frac{1}{\sqrt{3}}(k_{W1}\,\alpha_{W1} + k_{W2}\,\alpha_{W2} + k_{W3}\,\alpha_{W3})$$

Simplification – for the **one – phase** measurement, only:.

$$Q = 3\frac{1}{\sqrt{3}}(k_{W1}\,\alpha_{W1})$$