

Experiment 22: SHORT CIRCUIT TEST FOR THE SINGLE PHASE TRANSFORMER, ANALYZING THE CUPPER LOSSES

Purpose: Finding the copper losses in the primary and secondary of the transformer, measuring the short circuit current of the transformer.

Equipments:

- Experiment board with energy unit Y-036/001
- A.C measurement unit Y-036/005
- Energy analyzer Y-036/004
- Single phase transformer Y-036/028
- Jagged cable , cable with IEC plug

Connection diagram for the experiment :

Y-036/001

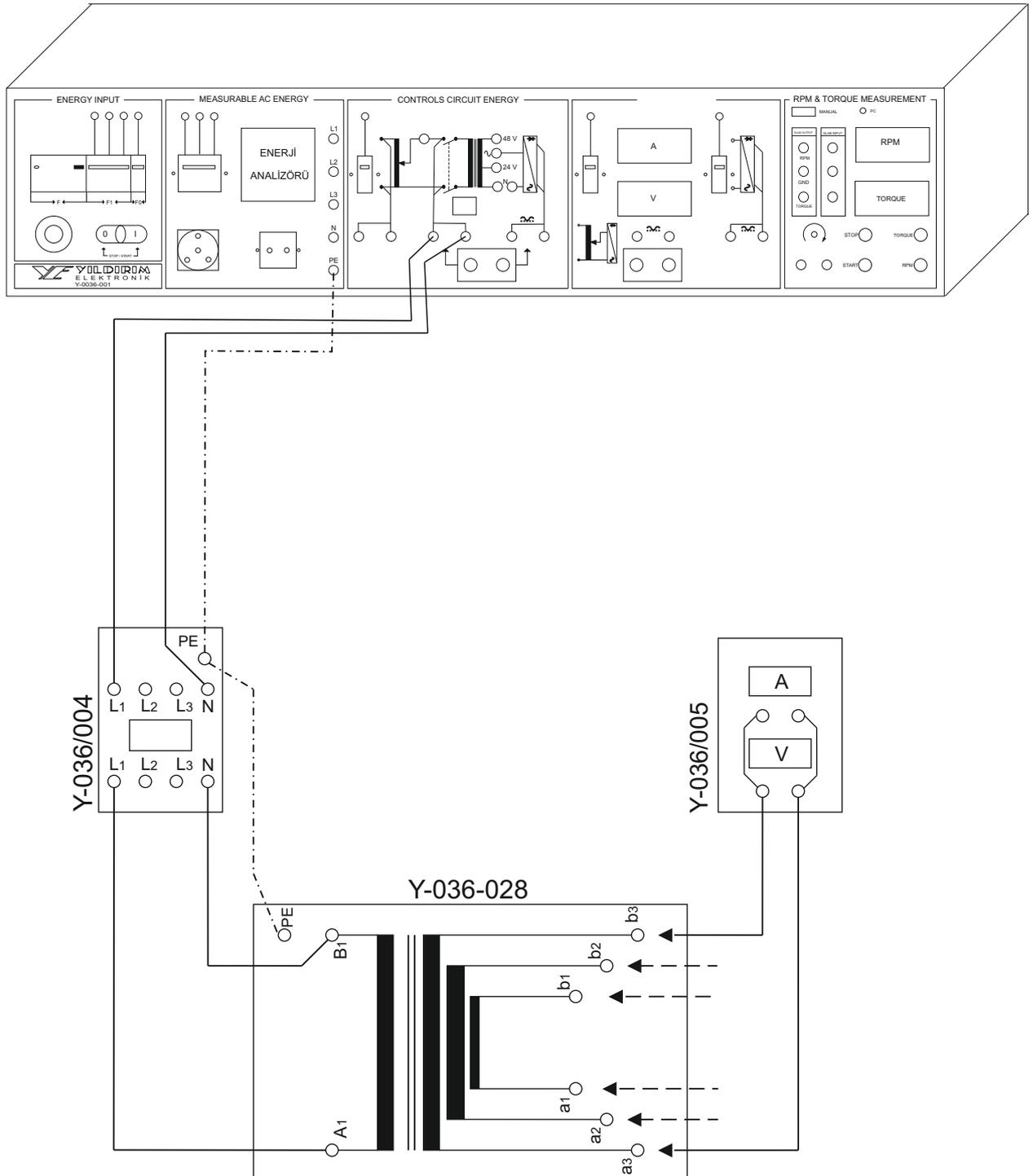


Figure 22.1 Connection diagram of short circuit test for the single phase transformer.

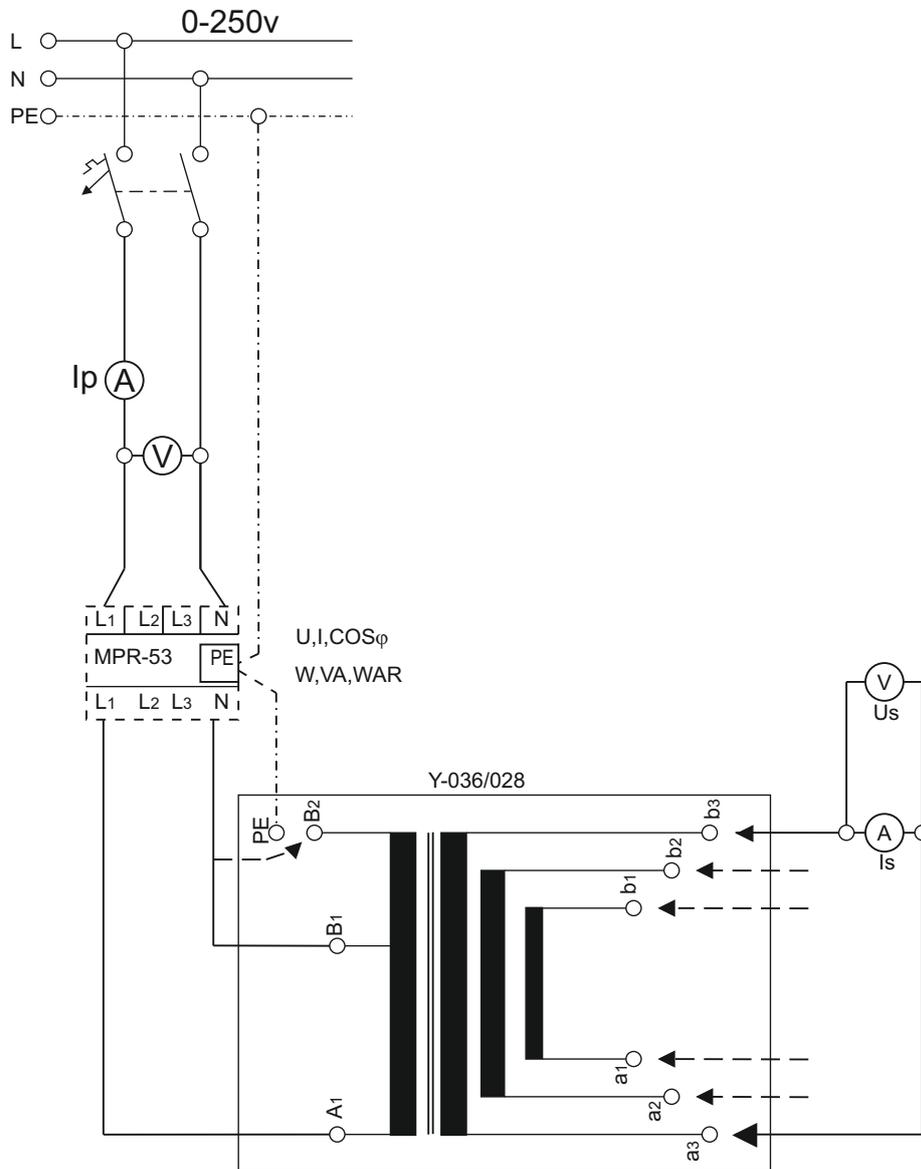


Figure 22.2 Connection diagram of short circuit test for the single phase transformer.

Procedure :

Note:* Be careful about the primary-secondary rated current values of the transformer used in the experiment.

- Connect the circuit shown in the figure 22.1 and 22.2.
- Set the voltage of the variable of the AC supply and connect it to the primary circuit of the transformer.
- Increase the voltage of the primary circuit until the current takes its rated value step by step. Take note of the values I_p , U_p , I_s , U_s and the parameters in the energy analyzer in each step.
- Increase the AC voltage of the primary circuit until the current takes 150 % of the rated value. Take note of the values I_p , U_p , I_s , U_s and the parameters in the energy analyzer for this case.
- Turn of the energy and finish the experiment.

Values recorded in the experiment :

Up	Ip	Energy analyzer parameters						Us	Is	Explanation
		U	I	cosφ	W	VA	VAR			

Evaluation :

Question 1: Why do we use short circuit test? Explain.

Question 2: What is the value of Up when Ip takes its rated value? What is the ratio of that value to rated value? What is that ratio called?

Question 3: What is the meaning of the short circuit current's being low or high?

Question 4: What are the parameters shown in energy analyzer when the Ip and Is take their rated values? Analyze.

Question 5: Sketch the $P_k=f(I_k)$ or $P=f(U_k)$ curve depending on the values recorded in the experiment.

Question 6: State your final observations about the experiment.

Experiment 19: THE NO-LOAD OPERATION OF THE SINGLE PHASE TRANSFORMER, FINDING ITS TURNS RATIO

Purpose: Analyzing no-load operation of the transformer, finding losses at no-load operation, finding turns ratio, getting experience about the subject.

Equipments:

- Experiment board with energy unit Y-036/001
- A.C measurement unit Y-036/005
- Energy analyzer Y-036/004
- Single phase transformer Y-036/027
- Jagged cable , cable with IEC plug

Connection diagram for the experiment :

Y-036/001

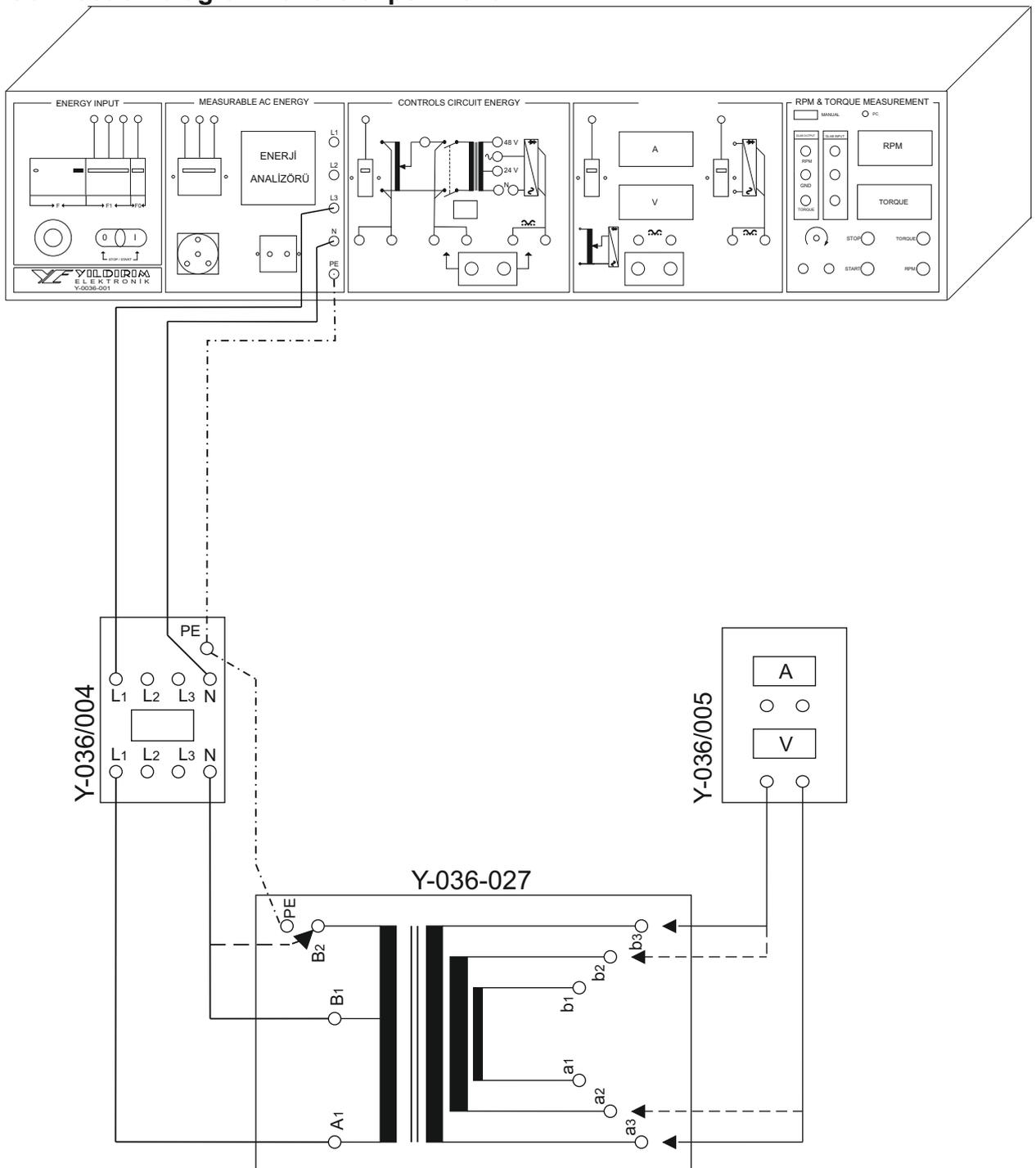


Figure 19.1 Connection diagram for no-load operation of the single phase transformer.

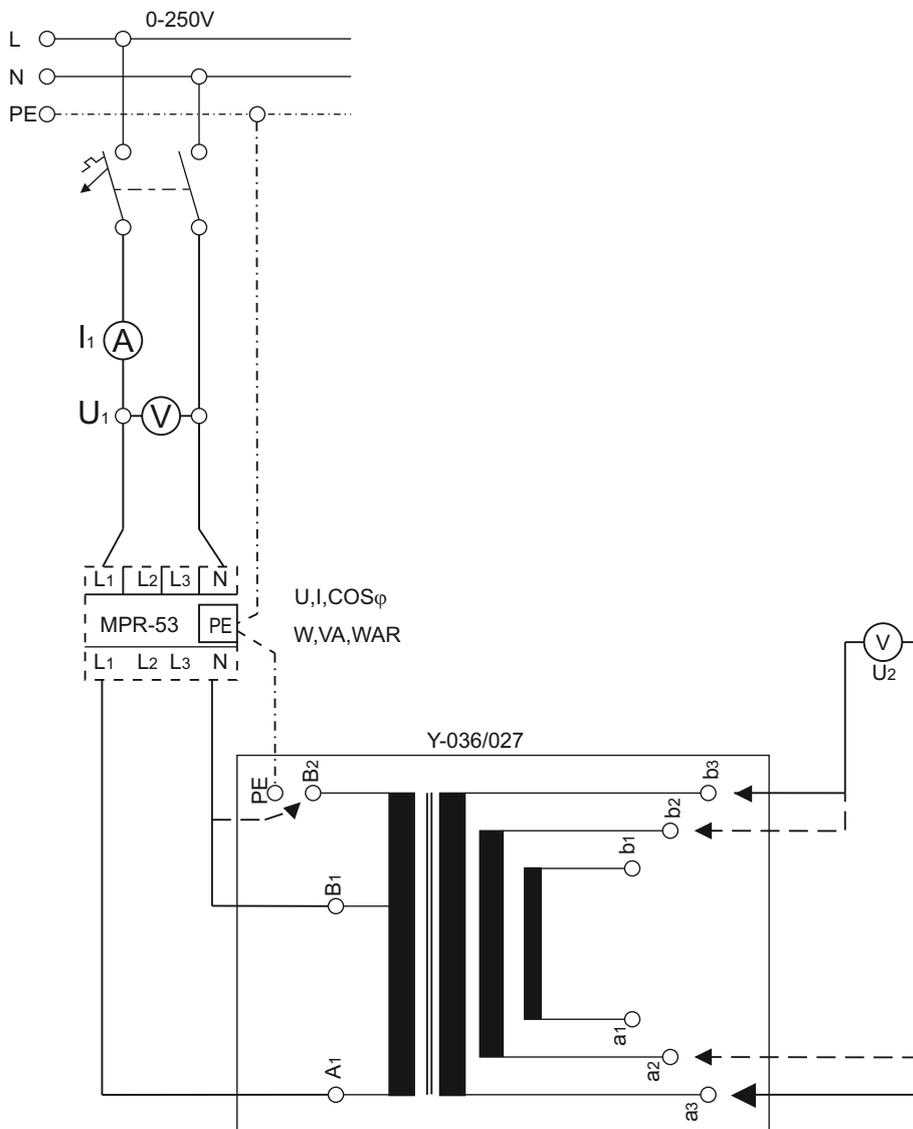


Figure 19.2 Connection diagram for no-load operation of the single phase transformer.

Procedure:

Note: *Be careful about the rated values of the transformer. Two primary voltages are indicated for the transformer. The higher one is the secondary and the lower one is the primary. The secondary voltage changes when the primary voltage changes.

** For no-load operation experiment, the values I , $\cos\phi$ and power may not be observed in the measurement unit since the current values are very low. For that case a multimeter with mA measuring capability can be used.

- Connect the circuit shown in figure 19.1-19.2
- Close the switch of the primary circuit and set the voltage of the primary winding to its rated value step by step starting from 0V.
- Take note of the values U , I , I_2 and the values U , I , $\cos\phi$, W , VA , VAR in the energy analyzer in each step.
- * If the Y-036/001 unit is not sufficient for the primary voltage, the Y-036/002 unit can be used.
- Turn of the energy and finish the experiment.

Values recorded in the experiment :

U ₁	I ₁	U ₂	Energy Analyzer						Explanation
			U	I	cos ϕ	W	VA	VAR	

Evaluation :

Question 1: What is the power observed in the energy analyzer when the rated voltage(U₁) is applied to the primary of the transformer, and there is no load at the secondary?

Question 2: Find the transformation ratio of the transformer using the values U₁,U₂ recorded in the experiment.

Question 3: Sketch the no-load operation graph of the transformer using the values U₁, I₂ and the values read in the energy analyzer.

Question 4: How can we find the number of turns of transformer?

Question 5: Explain the operation principle of the transformer.

Question 6: State your final observations about the experiment.

Experiment 23: LOADED OPERATION OF THE SINGLE PHASE TRANSFORMER FINDING REGULATION AND EFFICIENCY OF IT

Purpose: Analyzing loaded operation of the transformer, analyzing the effects on regulation and efficiency

Equipments:

- | | | | |
|------------------------------------|-----------|-------------------------------------|-----------|
| -Experiment board with energy unit | Y-036/001 | -Switch with two poles | Y-036/052 |
| -A.C measurement unit | Y-036/005 | -Rheostat 50 Ω 1000w | Y-036/066 |
| -Single phase transformer | Y-036/028 | -Jagged cable , cable with IEC plug | |
| -Energy analyzer | Y-036/004 | | |

Connection diagram for the experiment :

Y-036/001

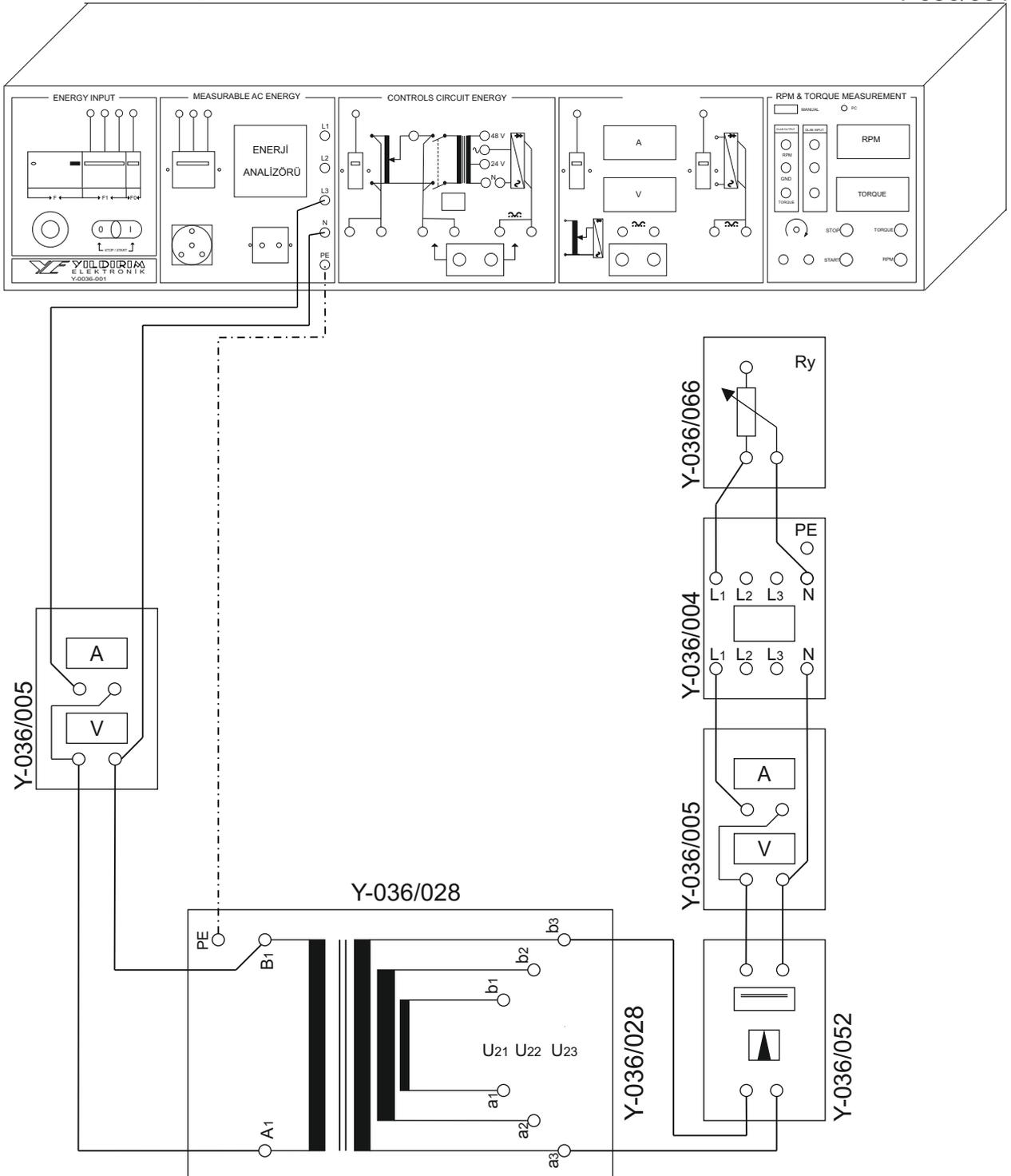


Figure 23.1 Connection diagram for the loaded operation of the single phase transformer.

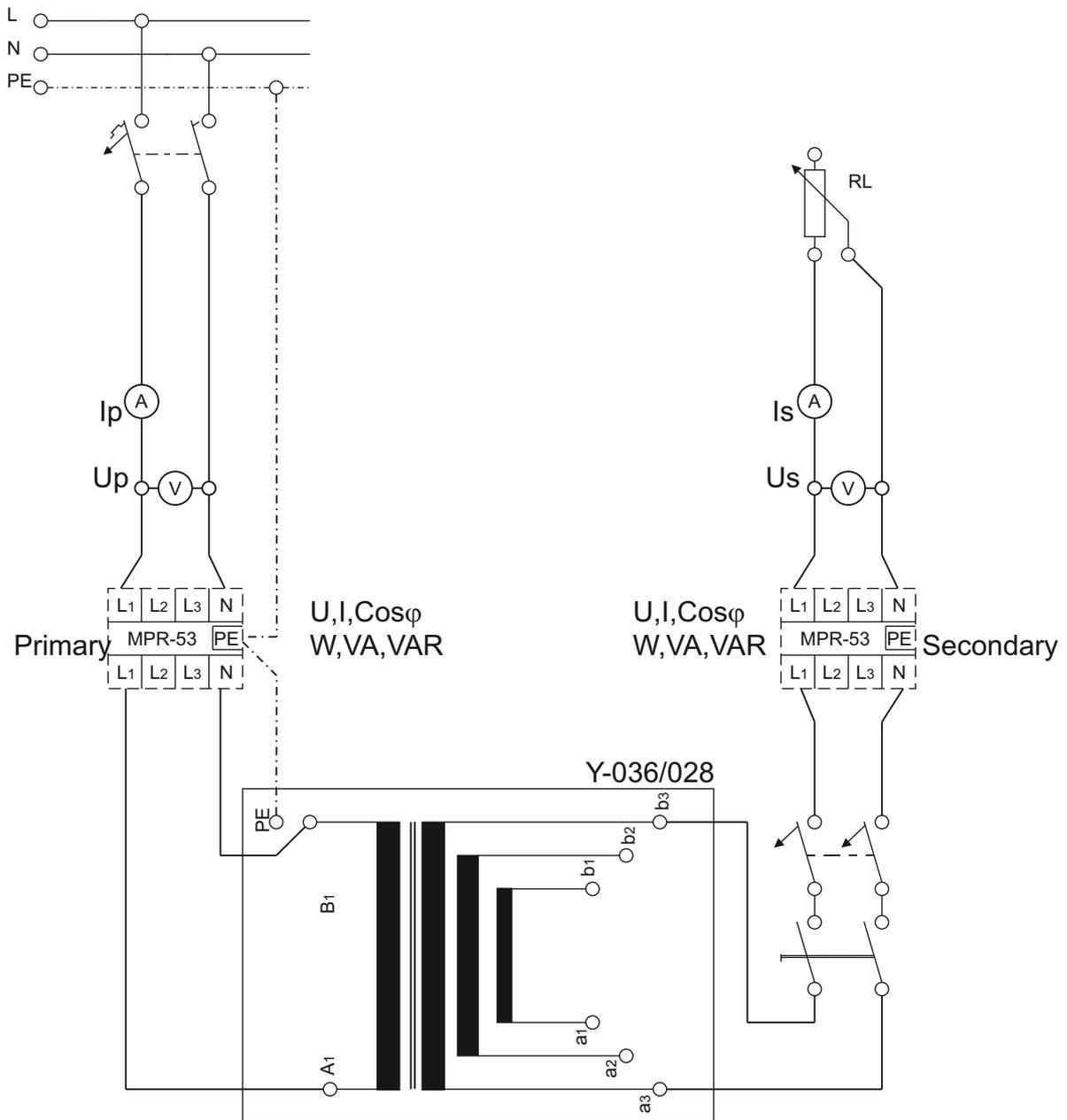


Figure 23.2 Connection diagram for the loaded operation of the single phase transformer.

Procedure :

Note: *It is possible to use L-N or L-L connection according to the rated value of the transformer.

*The measurements for the primary circuit can be performed by using the energy analyzer on the energy unit (Y-036/001).

*The experiment can be performed on a single or all outputs of the secondary.

*Use lamp group or second rheostat if the rheostat used is insufficient.

-Connect the circuit shown in figure 23.1 and 23.2.

*It is necessary to use measurement devices capable of measuring small values to measure the current and power values (I-W) at no-load operation of the transformer.

-Set the voltage of the primary circuit to its rated value while there is no load at the secondary of the transformer. Take note of the values I_p , U_p , U_s and the parameters in the energy analyzer.

-Load the transformer up to 1.25 times the rated power using the load rheostat (RL) step by step. Take note of the values I_p , U_p , U_s and the parameters in the energy analyzer in each step.

-When the secondary is at rated load $\left(\%R_g = \frac{\text{No-load } U_s - \text{Full load } U_s}{\text{Full load } U_s} \cdot 100 \right)$

Find the voltage regulation.

-Find the value of the efficiency $\left(\eta = \frac{P_2}{P_1} \cdot 100 \right)$ For each loading stage.

-Optional: Repeat the same procedure above for the secondary.

-Turn of the energy and finish the experiment.

Values recorded in the experiment :

PRIMARY CIRCUIT						SECONDARY CIRCUIT						Explanation
U	I	cosφ	W	VA	VAR	U	I	cosφ	W	VA	VAR	

Evaluation :

Question 1: Find the efficiency of the transformer at full-load and 20 % load. Analyze the effects on the efficiency.

Question 2: What does regulation mean in transformers? What is the meaning of the regulation's being small or great?

Question 3: What are the reasons of the voltage drop in the secondary of the transformer? Explain. What should be done to minimize it?

Question 4: Obtain the efficiency graph of the transformer using the values recorded in the experiment and analyze that graph.

Question 5: Sketch the transformer primary circuit power versus secondary voltage graph using the values recorded in the experiment and analyze that graph.

Question 6: State your final observations about the experiment.