







Fig. 4. Equipment composition in the experiment.

## V. EXPERIMENTAL RESULTS

The speed measurement on the rotary machine in the experimental setup to compare the accuracy between the proposed unit and two types of Tachometer with speed from the calculation. The speed of the motor when varying the supply voltage can be summarized as shown in Table 1, and the average error of compare to calculation speed can be summarized, as shown in Table 2.

TABLE I. THE MOTOR SPEED MEASUREMENT USING DIFFERENT TYPE OF TACHOMETER

Voltage (V)	Speed of Motor			
	Calculation	Laser Tachometer	Contact Tachometer	Proposed Unit
24	3000	3656	3543	3432
20	2500	2577	2561	2544
16	2000	2074	2023	2040
12	1500	1421	1572	1594
8	1000	1097	1089	1074
6	750	784	786	774
3	375	386.8	372.2	360

TABLE II. THE AVERAGE ERROR OF DIFFERENT TYPES OF TACHOMETER

Average Error (%)		
Laser Tachometer	Contact Tachometer	Proposed Unit
±8%	±7%	±6%

The result from the table shown that the proposed Tachometer can achieve a better accuracy compared to other types of Tachometer with an average error of around 6%

## VI. CONCLUSION

This paper proposes the development of contact motor tachometer by receiving input signals from rotary encoders connecting to various types of motors. MCU controlled all devices and processed by displaying the numbers in RPM (Revolutions Per Minute) units by LCD. The maximum speed is 4,000 rpm with  $\pm 6\%$  error compared to products in the commercial sector. It can be concluded that the proposed speedometer has accuracy and reasonable price, an error is caused by the contact axis between the motor and the speedometer, resulting in a loss of approximately 3-6% of the contact axis, including faulty processing and loss within the circuit as well. It appears that it can be used and applied in industrial applications such as motor revolutions or mechanical speed control in industrial applications.

The problems found in the experiment are that when measuring the motor speed, the contact of the motor and the Tachometer may be tilted or slippery, and the contact axis is impacted, causing the damaged surface of the contact, resulting in the distorted measured value. The guidelines for the further development of contact tachometers is increasing the capacity of the circuit to be able to measure the high speed of the circuit to be more sensitive and accurate and to improve the device to be more compact, to be easy to carry and accessible to users.

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