# EXPERIMENT

**MOTOR CONTROL SYSTEM**

**OBJECTIVE**

Tuliskan tujuan dari praktikum ini untuk apa, misal ingin mengatur kecepatan dengan metode apa

**REFERENCE**

**EXPERIMENT EQUIPMENT**

Tulis semua alat baik detail dari komponen motor dan komponen lainnya

**PRE-EXPERIMENT TASK**

Saranku kasih pertanyaan tentang motor dan metode controlnya

**INTRODUCTION**

Mengenai motor terco → apa saja yang bisa dilakukan di motor → metode apa yang bisa digunakan untuk mengontrol motor → sedikit penjelasan mengenai metode kontrol tsb → sekilas contoh penerapan motor terco dan metode kontrolnya

**The Components of the Motor Control System**

The Lab Exercises are completed with different types of motor for AC and DC. These can be loaded gradually with a magnetic powder brake. During the lab exercises studies are made of different control equipment that is used to run and control the motors. A few examples of control equipment are contactors, frequency converters, current rectifiers and PLC. These units are either assembled as a separate unit or as a module card that is fitted to the Base Unit 2000.

**Base Unit 2000**

The Base Unit is the centre for connecting different equipment. It is supplied by 230V AC and feeds the connected modules. These modules are inserted between two slides to a 64-pole socket.



Figure 1 Base Unit 2000

**Vs Motor**

The Vs motor is a 250W synchronous motor. It is connected to 3phase 400V supply voltage and can be connected in Y or D. (Star or delta). The supply to the Vs motors power circuit is via a 3-phase terminal that is connected to the 3-phase network. It can also be supplied from a frequency converter.



Figure 2 Vs Motor

**Ls Motor**

The Ls motor has a power of 250W and has a separately magnetised field winding. A current rectifier must be used when connecting to 230V AC, single phase.

A picture containing tool

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Figure 3 Ls Motor

**Revolution Counter (rpm)**

To measure the rotation speed of the motor, a tachometer is attached to the motors axle.A picture containing device

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Figure 4 Revolution Counter (rpm)

**3-Phase Terminal**

The connection of the Vs motor to 3-phase is via a 3-Phase Terminal having a 5 pole 16A plug according to standards CEE17. On the terminal there is a control panel for three phases and a neutral. The three phases are fused and fed via an isolating transformer. The terminal is prepared for current and voltage measurement on all phases. It has also a phase rotation indicator with LEDs showing the rotation. Connection to the 3-phase terminal is via lab leads, either direct or via the Contactor Module. Only touch protected 4mm lab sockets are used.

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Figure 5 3 Phase Terminal

**Frequency Converter**

To be able to give a soft start and to regulate the speed, a frequency converter is used. This unit can be used for many other functions but in this exercise it is for soft start and stop, speed regulation and study of the overload protection.

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Figure 6 Frequency Converter

**Current Rectifier Module**

The current rectifier is used to drive the DC motor. Different parameters are set such as speed, current limits, acceleration ramp etc.

A close-up of a computer

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Figure 7 Current Rectifier Module

**EXPERIMENT**

**Experiment 1. Motors Nameplate**

1. **Operational Procedure**

Place the Vs motor on the workbench so that the nameplate is visible.

1. **Experimental Data**

Table 1 Experiment of Motors Nameplate

|  |  |
| --- | --- |
| **Type of Vs motor** |  |
| **Frequency of Vs motor** |  |
| **Voltage when motor is connected Delta (D)** |  |
| **Voltage when motor is connected Star (Y)** |  |
| **Rated current in delta** |  |
| **Rated current in star** |  |
| **Rating speed motor** |  |
| **Power factor** |  |
| **Slip (S)** |  |
| **IP rating** |  |

1. **Analysis and Experimental Task**
2. What is the stated axle power?
3. What is the asynchronous speed of the motor?
4. How many poles has this motor?
5. The relative slip s can be calculated by comparing **ns** with **na** = asynchronous speed. What is the percentage slip?
6. The power factor is given on the nameplate. What is the power factor of this motor?

**Experiment 2. Motors Direction of Rotation**

1. **Objective**

An electric motor can be started and stopped in many different ways. It will be necessary to run the motor in different direction of rotation. These problems will be studied in this chapter.

1. **Operational Procedure**

**B.1 Connecting the Motor**

1. Place the Vs motor on the workbench so that the nameplate is visible.
2. Connect the motor in star.

Connect to the 3-phase terminal as shown in figure 2.1 below. i.e. L1-U1, L2-V2, L3-W3.

1. Start the motor using the switch on the 3-phase terminal.

Diagram, schematic

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Gambar xx 3-Phase terminal with star connected motor.

1. Switch off at the 3-phase terminal and study the direction of rotation when the
2. speed is slow enough to see how the axle is turning.
3. State the direction of rotation seen from the axle end of the motor

The direction of rotation is always from the axle end.

1. Switch off the supply and let the motor stop completely. Change over any two phases, start up the motor and check the direction of rotation.
2. Sketch the motors direction of rotation seen from the other end.
3. By changing over any two phases on an asynchronous motor the direction of rotation will be reversed. The direction of rotation is dependent on the order in which the phases L1, L2 and L3 are connected to the motor windings. The  
   phases have an angle difference of 120 degrees. This means that the motor windings are supplied in rotation. See figure 2.2.

As the phases come in the order L1, L2 and L3, then according to 2.2 the motor will turn clockwise. If two of the phases are changed then the supply order is changed and the direction of rotation will change to anti-clockwise.

**B.2 Phase Rotation Meter**

A phase rotation meter can be used when the motor is at full speed and it is  
difficult to see which direction it is turning. This meter gives an optical indication  
of direction.

A motor that is connected L1-U1, L2-V2 and L3-W3  
will rotate clockwise.

1. Switch off the supply to the 3-phase terminal.
2. Connect the Vs motor and phase rotation meter as shown in figure 2.3.

Text

Description automatically generatedDiagram, schematic

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Gambar xx 3-Phase terminal with phase rotation meter and Vs motor.

1. Switch on the 3-phase terminal and check the phase rotation on the phase  
   rotation meter. Was it correct?
2. Check the motor rotation with different phase changes. Leave the phase rotation meter connected and change over the phases as shown in the table  
   below. Mark with rotation arrows the motors direction of rotation.
3. **Experimental Data**

|  |  |
| --- | --- |
| Motor connection | Direction of rotation |
| L1-U1L2-V1L3-W1 |  |
| L1-U1L2-W1L3-V1 |  |
| L1-W1L2-U1L3-V1 |  |
| L1-V1L2-U1L3-W1 |  |
| L1-V1L2-W1L3-U1 |  |
| L1-W1L2-V2L3-U3 |  |

1. **Analysis and Experimental Task**
2. Why we connect L1-U1, L2-V2 and L3-W3? Determine type of connection!
3. By changing any two phases to an asynchronous motor, the motor will change  
   direction of rotation. If the motor is connected….

**E3. Motor Control with Frequency Converter**

**E4. Motor Control with Current Rectifier**