Design of Synchronization Panel For Alternator

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Abstract- *In this study, the design of an automatic as well as manual operating synchronization unit has been explained for the parallel connection of synchronous alternator. Two synchronous alternator are connected in parallel manual and automatically with the developed control unit. The voltages, frequencies, phase sequences and synchronism time data have been transferred to the microcontroller. These data are monitored and evaluated by the control algorithm coded into the microcontroller in automatic method. Parallel operation of alternator are realized automatically when all parallel connection conditions are satisfied. The system doesn't require additional measuring tools for monitoring and control processes. The developed automatic synchronization unit is fast, cost effective, reliable and precise to be used for monitoring, measurement and parallel operation of the synchronous alternator as compare to manual operating synchronization panel.*

Keywords- Alternator, microcontroller, prime mover, parallel connection and Synchronization.

I. INTRODUCTION

If an AC electric power system, synchronization is the process of matching the speed and frequency of generator or other source to a running network. An AC generator cannot deliver power to an electrical grid unless it is running at the same frequency as the network. If two segments of grid are disconnected, they cannot exchange AC power again until they are brought back into exact synchronization. Electrical power system consist of the interconnection of large number of synchronous generator operating in parallel, interconnected of transmission lines, and supplying large number of widely distributed loads.If an AC electric power system, synchronization is the process of matching the speed and frequency of generator or other source to a running network. An AC generator cannot deliver power to an electrical grid unless it is running at the same frequency as the network. If two segments of grid are disconnected, they cannot exchange AC power again until they are brought back into exact synchronization. Electrical power system consist of the interconnection of large number of synchronous generator operating in parallel, interconnected of transmission lines, and supplying large number of widely distributed loads.When one machine is taken out of service for its scheduled maintains and inspection, the remaining machine maintains the continuity of supply. If there is breakdown of the alternator, there is no interruption of power supply. In order to meet the increasing future demand of load more machine can be added without disturbing the original installation. Synchronizing by means of manually operated switching is not suitable for the system having large capacity. Hence there is a need of automatic synchronization process, the adjustment of magnitude of voltage, frequency and phase sequence of the incoming alternator is done by automatically. When all the parameters of synchronization are satisfied then the two or more alternator is synchronized with each other. The manual method of synchronization demand a skilled operator and the suitable for no load operation or normal frequency condition. Under the emergency condition such as lowering of frequency or synchronizing of large machines a very fast action is needed, which may not be possible for human operator. The paper introduced here is for the complete automation of synchronize i.e. the adjustment of the magnitude of voltage and frequency of incoming alternator is done automatically. When all the requirement of synchronization are satisfied then by closing of the main switch of the incoming machine is done by the automatic synchronizer.

II. NECESSARY CONDITION FOR THE PARALLEL OPERATION OF ALTERNATOR

Most of the synchronous machines will operate in parallel with other synchronous machines. The process of connecting one machine in parallel with another machine or with an Infinite Bus-bar system is known as **Synchronizing.**

The following condition should be satisfied for parallel of alternator are as follows-

[1] The voltage of the reference alternator should be same as that of incoming alternator.
[2] The frequency of the reference alternator should be same as that of the frequency of the incoming alternator.
[3] The phase sequence of the reference alternator should be same as that of the incoming alternator.

In addition, the auto synchronizer has been designed so that the alternator is started with in minimum voltage and minimum frequency conditions.In earlier system the phase sequence is measured with the help of phase sequence meter, the voltage is measured with voltmeter and frequency is measured with the use of synchroscope. But due to certain limitations like the system become more bulky and costly, it is not preferable hence automatic synchronization comes in existence.

III. AUTOMATIC SYNCHRONIZATION UNIT FOR ALTERNATOR

First, the device monitors the voltage difference between the two i.e. generator and supply system bus-bar regulates the voltage amplitudes to reduce the voltage difference when it is not in the allowed scope.

Second, the device monitors the slip frequency between the two generators and regulates the frequencies to reduce the slip frequency when the slip frequency is not allowed.

Third, the device monitors the phase-angle difference between the two generators and regulates the phase s to reduce the slip frequency when the slip frequency is not allowed.

Fourth, when the frequency, voltage, and phase-angle match the parallel requirements, the closing order is issued. This thesis introduces the principles and the structure of a new automatic synchronizer. It also introduces the corresponding algorithm and some other key implementing techniques based on thyristor switching which is the aim of the thesis, to achieve the previous operations with minimizing the wiring harassment.

The voltage output of both the alternator is given to PIC using Potential transformer (P.T.) A Zero Cross Detector (ZCD) is connected to count the number of Positive pulse for frequency calculation. Power Supply block is provided to supply 5V dc to the PIC a LCD is connected to see the output. The LCD will display the output result of the PIC. A Prime Mover (DC SHUNT MOTOR) is connected to provide mechanical input to the incoming alternator.

The voltage of three phases of both the units are monitored using pic, the difference in the voltage is then displayed on the LCD. The excitation voltage is provided to the field of alternator and prime mover by dc supply block. The excitation of field winding of alternator and speed of prime mover is controlled.

IV. EXPERIMENTAL SETUP AND DESIGN

A) For manual based opeartion:-

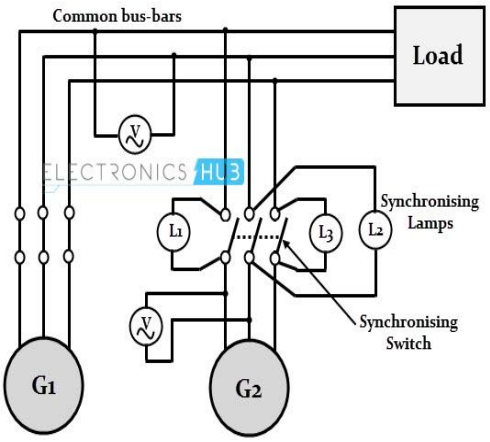

Fig.1 Connection diagram

Fig.2 Design of panel

B) For automatic based operation:-

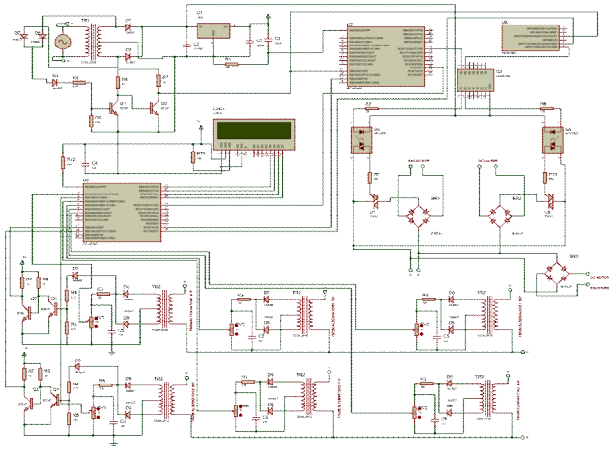

Fig.3 Connection diagram

V. ADVANTAGES

- Load supply can be increased.
- High efficiency.
- The system is precise to use for monitoring, control & measurement.
- The system is cost effective.
- No need of skilled operators in automatic syn.

VI. DISADVANTAGES

- If there is some malfunction in the main PIC, the system may misbehave.
- Individual protection circuit is required for each alternator.

VII. CONCLUSION

The automatic synchronization of alternator is having several advantages over the manual conventional methods by synchronizing the alternators the capacity of the grid can be increased to meet huge load demand. And also we can improve the whole power scenario. In our project we achieved the design of PIC microcontroller and PCB layout with the panel.

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