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Smart Single Phase to Three Phase Conversion

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Abstract *- This paper presents a single phase to three phase converter topology using power electronic devices. Different converter section is used for the conversion. This idea will reduce the switching current and harmonic distortion of input side converter. The input to the converter is a single phase supply and the output taken is a balanced three phase. With the help of MOSFT which is used for six leg inverter. The sinusoidal waveform is remain constant even though the load is increased. Simulation nd experimental results are provided to illustrate and compare the operation of the system. Three phase machines can be run on this by converting single phase to three phase AC supply wherever three phaseAC supply is absent. Three phase induction motor can be used as load for testing of the hardware. For example, electric vehicles. The experimental result showed that PWM pulses produced remained approximately constant and the hardware have satisfactorily converted the single phase power to three phase power supply.*

Key Words: *AC to DC converter, DC to AC converter, Transistor s, drive system, inverter, Boost converter, PWM*

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I. INTRODUCTION

1.1 Need for single Phase to Three Phase Inverter

Nowadays electric supply is one of the basic needs but because of surrounding environmental conditions and practical limitations the generation of electricity is insufficient hence to fulfill the electricity requirement load shedding is executed, but it is not satisfying the complete requirement so inverter is used to obtain ac supply from a battery. In industries three phase appliances are frequently used due to their advantages over single phase power supply. If we go to have a three phase inverter which is available in the market, cost factor comes in to the picture. So we have made an attempt made to have "Single Phase to Three Phase MOSFET Based Inverter", which can save money up to great extent .This paper makes an attempt to demonstrate a variable frequency control of three phase induction motor using PWM technique, to control the speed of a three phase induction motor.[1]

We aim to design and implement a variable frequency drive for three phase induction motor using PWM control technique for a three phase MOSFET based Inverter.

1.2 Principle of Operation

1) To vary motor speed, we vary stator supply
frequency 'f 'because
2) Synchronous Speed = Ns = 120f / P.
Where P = no. of poles of Induction Motor
To achieve maximum torque we need to keep air gap flux constant .This is done by keeping the voltage to frequency ratio constant i.e. Vs / f = constant

1.3 Frequency controlled induction motor drive This method involves changing synchronous speed by changing frequency of a.c. supply to induction motor to cause speed variation, as the true speed of the motor is very close to synchronous speed. Either voltage source inverters or current source inverters may be used.
The three-phase induction motors have some advantages in the machine efficiency, power factor, and torque ripples compared to their single-phase counterparts. Though the precise control of single phase induction motor is less complex in comparison to the three phase induction motor, but when the torque requirement isconsidered then three phase induction motor is the best choice.

II. BLOCK DIAGRAM

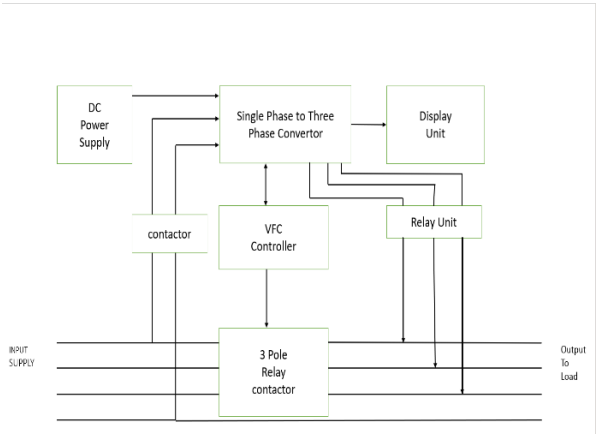


Fig. Block Diagram of Single-phase To Three-Phase Converter

III. BLOCK DIAGRAM DESCRIPTION

The basic block diagram of the Smart Single Phase To Three Phase convertor is shown in the figure 2.1. Mainly this block diagram consists of thefollowing essential blocks.

1. Power Supply.
2. 1 Ph to 3 Ph Convertor
3. Micro controller AT mega 328
4. Relay Module.
5. Ammeter.
6. Voltmeter
7. VFC.

1 phase to 3 phase convertors

This is one of the main parts of our project. The main intention of this block is to sense the Analog signal . A phase converter is a device that converts electric powerprovided as single phase to multiple phase or vice versa.

Relay Module

Relay module is a magnetically operated switch which closes the external circuit based on signal received from the Arduino UNO board. The relay seeks voltage from the source to induce a magnetic field which attracts a metal strip and closes the external circuit; at once it receives the positive signal from the Arduino UNO.

LCD – Display Board

Liquid Crystal Display board of dimension 16x2 where it can display of 32characters in two lines each of 16 characters.

Ammeter

A device or instrument that is used to measure the current is called the ammeter. The unit of the current is ampere. So this device measures the current flow in ampere is named as an ammeter or ampere meter.

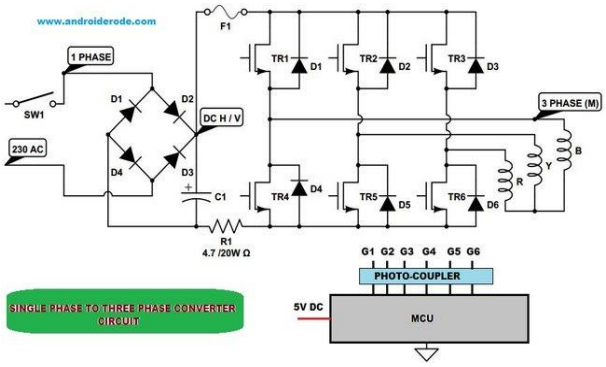
Voltmeter

The instrument which measures the voltage or potential difference in volts is knownas the voltmeter.

VFC

A voltage-to-frequency converter is an oscillator whose frequency is linearly proportional to a control voltage. The VFC/counter ADC is monotonic and free of missing codes, integrates noise, and can consume very little power.

IV. CIRCUIT DIAGRAM



Working :-

Normally operating condition that time three phase supply 440 volt providing in relay contactor three pole then providing output in motor. This will be fault condition occur in circuit (3 ph), that time two phase are closed one phase will have to operated in circuit. Single phase supply connected in single phase to three phase converter then rectifier circuit four MOSFT used in thus single phase ac supply converted in to dc supply then this supply to get a inverter circuit AC power from the utility is converted to DC, then back to AC. The power-switching devices used in this process are Thyristor.

In this type of digital phase converter the input rectifier consists of Thyristor in series with inductors.
The Thyristor are controlled by the DSP to draw current from the single-phase line in a sinusoidal fashion. A voltage created by power-switching devices like Thyristor is not sinusoidal. It is a pulse-width modulated (PWM) waveform very high in harmonic distortion.
The converters operate at 95%–98% efficiency. When the converter is energized with no load, it consumes very little power.

V. SYSTEM IMPLEMENTATION AND TESTING

TESTIG

Testing is a vital process in the development and realization of any design, be it hardware based, software based or both. The various components and their circuitry have to be tested to ensure that all the components on board are certified okay and in good working condition. The components that did not give the required output specification where isolated and troubleshoot to determine the nature and cause of the component failure through careful analysis, that is examination of the working principles of the component(s).

Display testing

When a program to shown " 1 ph to 3 ph " is burnt into Arduino the display shows the sentence. The following fig. shows the display test.

PWM kit testing

This section we test the generates variable width pulses to represent the amplitude of analog input signal .

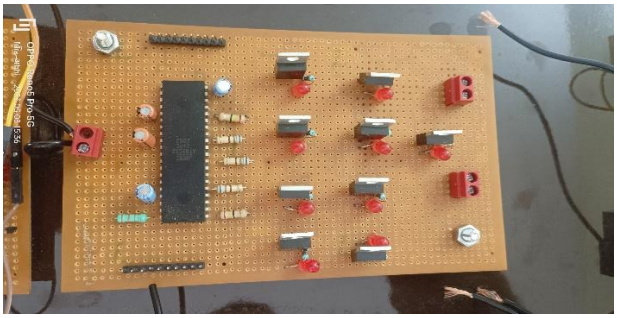


Fig.5.2 PWM Implementation And Testing

VI. HARDWARE

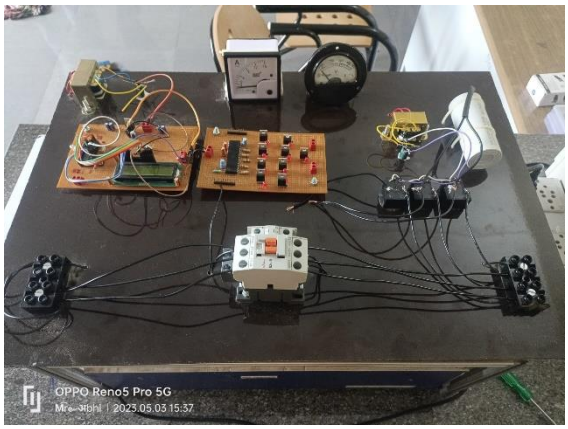


Fig.6.1 Hardware of 1 ph to 3 ph

This is experimental hardware or set up is converting single phase to three phase power supply consist of input, rectifier, filter, inverter, load,driving stage, and microcontroller power supply as shown in figure 6.1. All the electronics or electrical components need power supply of AC supply. So, we are converting power from single phase into three phase AC supply. Using thesethree phase power supply, we can drive any motor. A boost converter is used improve the DC voltage level in order to get the output AC voltage of appropriate value. After boost converter circuit the power factor will be reduced since converters are used, so power factor has to be improved, which can be done using the power factor correction circuit. This system fits the requirements in rural areas where only a single- phase supply is available.

VII.CONCLUSION

Three phase asynchronous induction motors are widely used in industrial applications due to their features of low cost, high reliability and less maintenance.

Due to the need for three-phase electricity in today's remote areas for agriculture work where three phase power is notavailable easily, in those areas these single phase to three phase converters are use full. Operating a three phase induction motor using single phase supply has been presented.

Applications of single phase to three phase converter are:

- Electric Vehicle.
- In Irrigation Pumps for Agriculture purpose.
- Rural Area Water Supply.

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