ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Voltage Source Inverter with Three Phase Preventer and Selector for Industrial Application

Vilas Bhandare
Department Electronics and Telecommunication, Sharadchandra Pawar College of Engineering, Dumbarwadi (Otur)

Dr. G. U. Kharat
Department Electronics and Telecommunication, Sharadchandra Pawar College of Engineering, Dumbarwadi (Otur)

Abstract

In this competing world industries uses 3 phase supply that even a single phase failure of supply not allow where efficient and effective production takes place, aim is to design a system with the help of existing phase supply that can support one of the phase. The development of this system will be completed by using microcontroller which can be programmed using embedded. . Microcontroller is then connected to inverter using driver circuitry. If we go to have a three- phase inverter, which is available in market the cost of it is more. So, here is an aim to have single phase to three phase inverter with appliance protection and live phase selection, which saves money up to great extent.

Index Terms- ***automatic phase selector circuit; DIP switch; Gate drive; Indicator;MOSFET based inverter; Opt isolator;***

Introduction

Now a day's electrical supply has at most important become one of the basic needs but due to some climatic and environmental conditions and practical limitation the generation of electricity is less to fulfill the electricity requirement of common mankind in these fast changing world, electronics has made a great improvement in each and every field. Just press of button complex jobs performs easily. So load shading is done, but it is not satisfying the need of people. A.C. supply from battery is required for Inverter is used to have supply. Due to their advantages over single-phase power supply industry use three phase appliances are frequently used. The cost of inverter is very high. Due to its simple and rugged construction induction motor is the most widely used motor in the industry. As compare to the other electrical motorist requires less maintenance an important role in its long life service the induction motor used. Mainly the variation of the input supply affects the induction motor needs protection from variable supply for small motors which is in common use not only in big industry but also in small scale industries to increase their capital cost the small scale industries are not able to provide costly protection to the drives. In India there are so many industries in different fields. For example steel sector, oil sector, irrigation etc. All industries have many drives and equipment's like conveyor belts, pumps, Mill etc. All drives of industries use electrical motors.

Most of the electrical motors are designed for 50 Hz three phase supply. Due to single-phasing three phase Induction Motors get damaged, when they are subjected to low supply. The motor will operate within its rating when the voltages balanced. When the voltages become unbalanced, excessive heating will occur, and the motor will have to be dreaded. To operate when a disturbance on the system causes the terminal voltages a three-phase induction motor operating in the steady-state will continue to become single phased. This condition is referred to as "single phasing" and will result in an operating condition that produces excess heating in the motor [7].

A.Concept of Inverter

An inverter is a circuit which converts a D.C. power into an A.C. The A.C. output voltage could be fixed at a fixed or variable frequency. This conversion can be

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

achieved either by controlled turn-on and turn off devices (e.g.BJT's, MOSFET's, IGBT's, and MCT's). The output voltage of ideal inverter should be sinusoidal. But it is non-sinusoidal and contains certain distortion. The D.C. power to inverter may be battery, fuel cell, solar cells or other D.C. source.

But in most industrial application, it is fed by a rectifier. The filtering of distortion is not flexible when the output frequency varies over a large range, and the generation of A.C. Waveforms with low. Harmonic content is important. When inverter A.C. output is given to a transformer or A.C. motor, this output voltage must be varied in conjunction with frequency to maintain the proper magnetic conditions. Therefore the output frequency of an inverter is determined by the rate at which the semiconductor devices are switched on and off by the inverter control. Voltage control is an essential feature of an adjustable frequencysystem.

B. Inverters Classification

Inverters based up on input power source, inverters are classified as i) Voltage source inverter (VSI) ii) Current source inverter (CSI). In case of VSI, a ripple free dc voltage source is provided by inverter but in CSI, the voltage source is converted into a current source and then used to supply the power to the inverter. Inverters can classify depending up on the nature of output voltage waveforms as: i) Square-Wave inverter ii) Quasi-Square Wave inverter iii) Pulse Width Modulation inverter. A square wave inverter produces a Square-Wave ac voltage of constant magnitude. Square wave ac voltage is adequate to less and medium power applications. To achieve voltage control within the inverter and to reduce the distortion content in output voltage, PWM inverters, width of the output pulses are modulated to achieve the voltage control.

SYSTEM DEVELOPMENT

Phase absence is a very common & severe problem in industry [7]. Many times one or two phase may not be live in three phase supply. Due to this some electrical appliances will be "ON" in one block and "OFF" in another block. This create big disturbance. For load schedule management a scheme that is presented here single phase to three phase converter by using embedded system. The government of Maharashtra has started single phasing and we can't run three phase appliances on single phase supply so we can use such a system to drive the applications. Microcontroller 89c51 is heart of system which is design to generate PWM pulses. These pulses are not sufficient to drive the gate of MOSFET so signal amplifier is design to boost the current. Opt isolator is design for isolation between power circuitry and control circuitry. In single phasing condition load is directly disconnect from mains by using four poles two way switches. These system consist of different block such as

- Power Supply
- Gate Driver Circuit
- Microcontroller Circuit
- Six In One Power Supply
- MOSFET Based Inverter
- Power Supply for Inverter
- Three Phase Appliance Protector
- Automatic Phase Selector Circuit
- Induction Motor

Four Pole two ways Switch a single phase to three phase converter scheme that address on building up system as a mention above is presented for load schedule management using embedded. When phase are present simultaneously 4 pole 4 way relay will activate and 3 phase will connect directly to load or motor. If there is failure of phase then suddenly motor will disconnect from 3 phase.

It will prevent motor or load. Live phase is selected by the automatic phase selector circuit. That single phase is then converted into the three phase with the help of inverter circuit.

1) DIP Switches-are used as input to the heart of the system that is microcontroller 89C52. The DIP switch consists of 8 parallel switches. Microcontroller has given the output of dip switch. Dip switch select the frequency between 10 Hz to 100 Hz.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

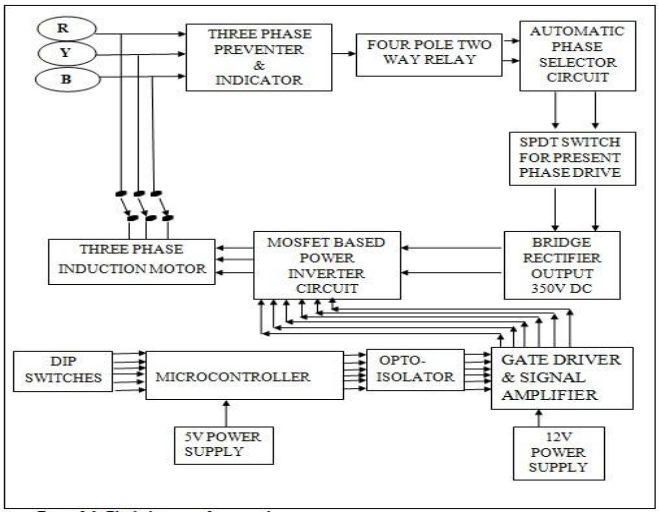

Figure. 1 Block diagram of proposed system

2) Opt isolator- It isolates the control circuitry from the power circuitry. Control circuitry operates on 5v and Power circuitry operates on 350v. So to isolate these voltage opt isolator is used [5].
3) Signal Amplifier- amplification of signal is required as output of opt coupler is not sufficient for driving the MOSFET so the signal amplifier is used.
4) RYB Indicator- Three phase appliance protector has provided the three led for indication.
5) Inverter circuitry- The inverter circuitry consisting of MOSFET as power device as they are connected in the bridge configuration. MOSFET have many advantages over the other power device like MOSFET, FET and SCR.

Three are two modes of inverter 120 degree and 180 degree. A quasi square waveform the 120deg mode phase voltage while line voltage is of six step waveform. In 180deg mode the phase voltage is of six step waveform while line voltage waveform is quasi square waveform [10].

RELEVANCE OF PROJECT

This system can be used in agricultural area, in chemical plant, etc. The application circuit can be changed to control various home appliances or industries. The applications can be increased by adding some advanced circuit.

RESULT & DISCUSSIONS

Microcontroller 89c51 is used for PWM pulse generation. The output is given to opt coupler PC-817. This opt coupler is used for isolation of voltage between the control circuit and power circuit. Gate driver voltage is 3.2v across the output of signal amplifier. Signal amplifier TIP-122 is used darling tone pair transistor for current boosting. Total time period is equals to the ON time plus OFF time which is 20msec Frequency is 50Hz.

Line Voltage: Voltage across any two lines is called as line voltage VRY = VYB= VBR = Line voltage = VL. Practically calculated Line voltage VRY= 247v, VYB= 252 v, VBR= 250v

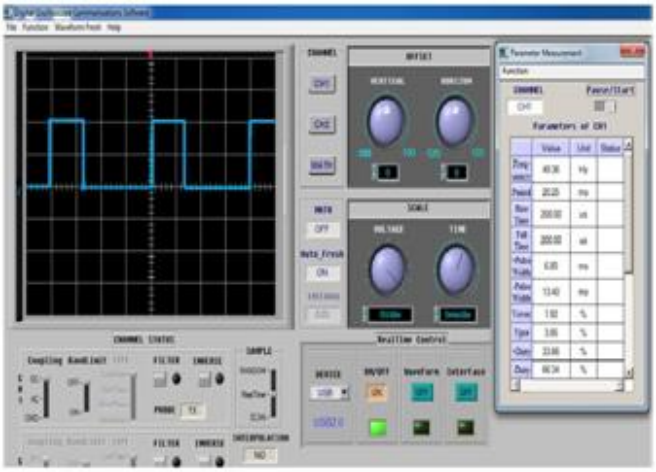
Figure.2 Gate drive waveform

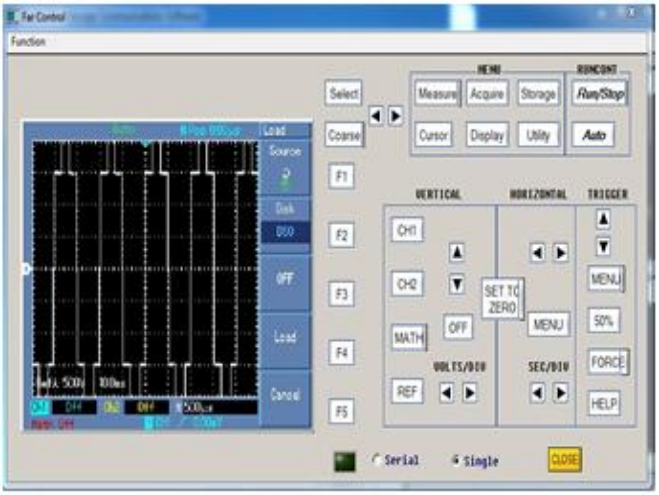
Figure.3 Line Voltage waveform

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Phase Voltage: Voltage across the line with respect to the Neutral is known as phase voltage. VRN = VYN = VBN = Phase voltage = VPH Practically calculated phase voltage VRN = 113v, VYN = 109v, VBN = 121v

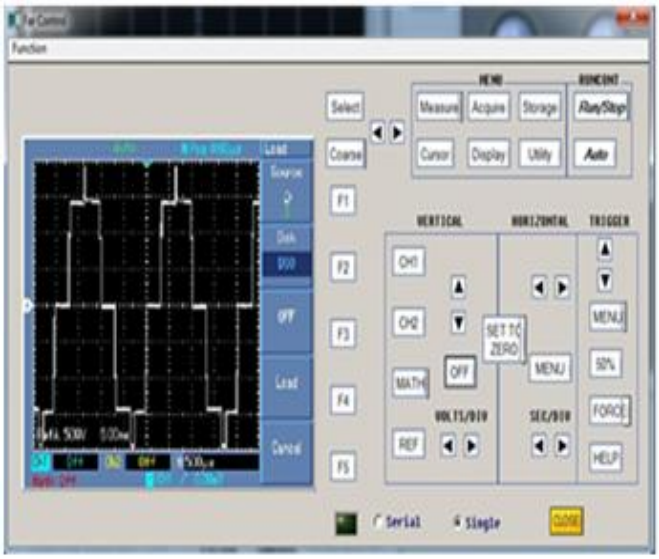

Figure.4 Phase Voltage Waveform

The MOSFET have two conduction mode 120 degree & 180 degree. In 120 degree conduction mode the line voltage is six step waveform and phase voltage is quasi square wave form. In180 degree conduction mode line voltage is quasi square wave form and phase voltage is six step waveform.

CONCLUSION

This system gives the continuous power supply. System converts single phase to three phases by using microcontroller89c51. Automatic phase selection is heart of system which selects the present phase. The three phase load is connected across the inverter.

ACKNOLEDGMENT

Completion of this system is a task which would have not accomplished without co-operation of my guide Prof. Dr. G. U. Kharat. I also thanks to Prof. M. G.ChincholeHead, Electronics and telecommunication Department for his encouragement and guidance all the time. At last I also thank my parents. I am also thankful to my friends who have helped me in completion of this system.

REFERENCES

[1] P. Hammond, "A new approach to enhance power quality for medium voltage AC drives", IEEE Trans. Ind. Applicant., vol. 33, pp.202–208 Jan. /Feb. 1997.

[2] L. M. Malesani, L. Rossetto, P. Tenti, and P. Tomasin, "AC/DC/AC PWM converter with reduced energy storage in the DC link", IEEE Trans. Ind. Applicant. vol. 31, pp. 287 292 ar./Apr.1995.

[3] Richa bhargava, amit shrivastava, "cascaded h-bridge multilevel inverter using micro controller for single phase induction motor", International Journal on Emerging Technologies 3(2): 101-108 02 December, 2012.

[4] Venkata Anil Babu Polisetty, B.R.Narendra, "Enhanced performance of multilevel inverter fed induction motor drive", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 2, Issue 11November 2013.

[5] Mr. G. Pandian and Dr. S. Rama Reddy "Implementation of Multilevel Inverter-Fed Induction Motor Drive", journal of industrial Electronics, Vol 24(June 2008).

[6] Muhammad ajmal p, "automatic phase changer" July 2007.

[7] William H. Kersting, "Causes and Effects of Single-Phasing Induction Motors" IEEE transactions on industry applications, vol. 41, no. 6, November/December 2005.

[8] Bandana Bhutia & Dr. S. M. Ali "The Three Phase PWM Voltage Source Inverter for Photovoltaic Application". International journal of innovative research in electrical, electronics, instrumentation and control engineering vol. 2, issue4, April2014.

[9] Ali M. Almaktoof, A. K. Raji eatl. "Modeling and Simulation of Three-Phase Voltage Source Inverter

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Using a Model Predictive Current Control" International Journal of Innovation, Management and Technology, Vol. 5, No. 1, February 2014.

[10] K. P. Basu, "Experimental Investigation Into Operation Under Single-Phasing Condition of a Three-Phase Induction Motor Connected Across a Zigzag Transformer" IEEE transactions on education, vol. 47, no. 3, august 2004