International Journal of Research in Advent Technology (E-ISSN: 2321-9637) Special Issue
1st International Conference on Advent Trends in Engineering, Science and Technology
"ICATEST 2015", 08 March 2015

"CONVERSION OF SINGLE PHASE TO THREE PHASE SUPPLY"

Arvind K.Yadav, Nayan Wadgure, Pavan kamdi

Department of Electrical Engineering ,D.M.I.E.T.R (wardha)

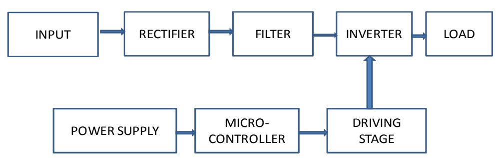
ABSTRACT:- This paper presents a simple converter topology for driving a load with a single-phase ac supply. Using only six active switch IGBT's. The converter supplies balanced output voltages at rated frequency, the proposed topology permits to reduce the rectifier switch currents, the harmonic distortion at the input converter side, and presents improvements on the fault and control approaches are supported by test results. The convertor takes single phase supply and converts it into three phase supply with the help of thyristors. The single phase supply is first converted into dc supply by using rectifier again dc supply of rectifier is given to inverter where IGBT's are used and converts the dc supply again into three phase ac supply. The experimental result showed that sinusoidal waveform produced remained approximately constant with increase in load and the developed hardware has satisfactory converted the single phase power to three phase power supply.

Keywords:- AC to DC to AC converter, IGBTs, drive system, inverter.

INTRODUCTION:- In the past, single-phase to three-phase conversion systems were made possible by the connection of passive elements capacitors and reactors with autotransformer converters. Such kind of system presents well know disadvantages and limitations. so to overcome from this disadvantages the newly adopted thyristors and power electronics devices were used mainly thyristors like SCRs, MOSFETs, GTOs etc. The project is about 'single phase to three phase conversion system using **IGBTs.**

Since the beginning of the solid state power electronics, the semiconductor devices were the major technology used to drive the power processors. Looking at the semiconductor devices used in the former controlled rectifiers and comparing them with the new technologies it makes possible to figure out the astonishing development. Beyond the improvement related to power switches, it was also identified a great activity in terms of the circuit topology innovations in the field of three-phase to three-phase, single-phase to single phase and three-phase to single-phase conversion systems. The single-phase induction motor drives by the three-phase induction motor drives in some low-power industrial applications and. However, in some rural areas where only a single-phase utility is available, we should convert a single-phase to a three-phase supply. This paper proposes an alternative solution for phase conversion with very low overall cost, moderate motor performance during start up and high steady-state performance at line frequency. This system fits the requirements in rural areas where only a single-phase supply is available.

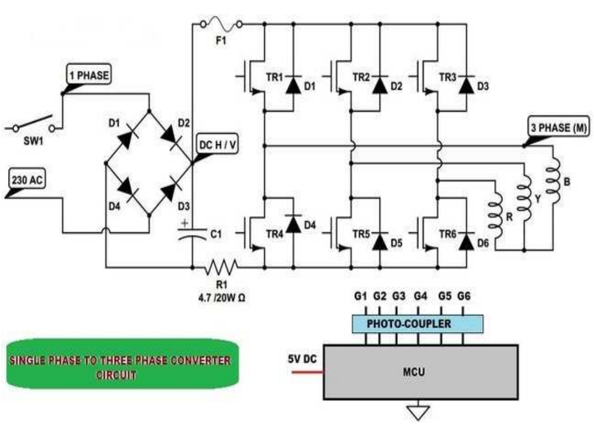
BLOCK DIAGRAM:-



As we all know any invention of latest technology cannot be activated without the source of power.All the electronice or electrical components need power supply of AC supply .So,we are converting power from single phase into three phase AC supply.Using these three phase power supply ,we can drive any motor.Block diagram of converting single phase to three phase power supply consist of input,rectifier,filiter,inverter,load,drivingstage,micr ocontrolled and power supply. As we seen from the block diagram the first stage is input , input is given in two circuits, first one is given to rectifier and further towards the other and the second input is given to controller stage Since the input is first works in rectifier which converts the ac supply into pulsating dc but after rectification also having some ac contain. So to remove that filters are used consisting of inductors and capacitors which helps to eliminate the ac contain and gives nearly pure dc. Futher the supply is given to invertor where IGBT's are connected. In addition with main power supply again a energising stage is there which use to energise IGBT's i.e DRIVING STAGE comprises of micro controller where programs are made accordingly supply is given to invertor stage as per the programmer's and circuit requirment.

Afterwards the dc supply which is fed to invertor is converted into ac supply in the form of three wire i.e three phase supply. After the coversion the three phase supply is given to load which is moto of this project means to convert single phase supply into three phase supply. In the sense of load the load may be a motor or any three phase load but in these project we use three phase lamps.

CIRCUIT DIAGRAM:-



The Single phase to Three phase converter using IGBT for driving three-phase induction motor by using switching frequency about 7 kHz. Varying above frequency this results is smooth increasing and decreasing the spindle speed of motor Tree phase motor. The sinusoidal waveform of three-phase which converted from the single-phase input of the 230 Ac rectified by bridge diodes.The gate drive circuit needs to provide an interface between the switching signals coming from the DSP waveform generator and the IGBT in the circuit. The Digital processing from MCU gives a 3.3V signal, while the waveform generators allow for a specified voltage level. The gate to source voltage needed for desired operation of the MOSFET is on a 110 DC level. In addition, the high side IGBT in this circuit do not have the source connected to ground, so the actual voltage needed to drive the gate depends on the varying voltage at the source. Switching Signal currently small motor drive systems are expensive and implement control schemes that use relatively high switching frequencies. One drawback to the high switching frequencies is the decrease in efficiency that occurs from switching loss.

The control scheme has been used widely and generates little acoustic noise since the switching frequency is on the upper end of the audible acoustic range (20 Hz – 4k – 20 kHz). These control schemes also provide good dynamic performances. However, this application does not need good dynamic performance since there are no dynamic load and speed requirements. The rating of power element such as gate driver, power IGBTs dc bus.

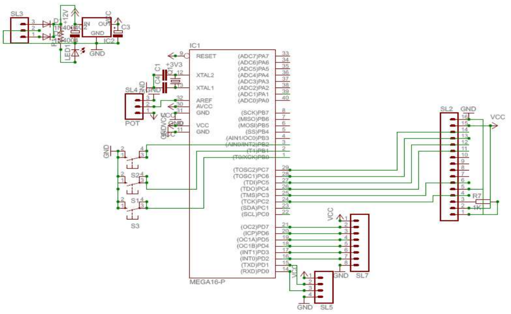
WORKING:-

As shown in above figure that the single phase 230v supply is given to the input and the rectifier circuit is connect after that to convert single phase AC to DC. The filter is connected to reduce the harmonics present in the ac and gives the pulsating DC, the fuse is connected to protect the circuit and the resistor is connected to limit the current and then the converter circuit is connected in which the six IGBT switching device is connected to convert DC to three phase AC.

Each gate of IGBT is connected to each terminal of microcontroller. In microcontroller the embedded c program is installed and which drives the IGBT.

We are giving 230v supply to rectifier, for positive pulse two diode are trigger and for negative another two diode are trigger and AC supply is converted to DC. In inverting stage we using six IGBT as inverter. upper side three IGBT are called as positive group IGBT and lower side three IGBT are called as negative group IGBT. IGBT work in 180 degree mode of operation in which one IGBT from upper group and anther two from lower group and after that one from lower group another from upper group. same procedure is fallow by whole inverter circuit. diode are connect across each IGBT to limiting the reverse current flowing through the inverter. in this way we getting the three phase from middle of two IGBT.

Pin diagram:-



VCC **:** Digital supply voltage.

GND **:** Ground.

Port A (PA7..PA0) : Port A serves as the analogy inputs to the A/D Converter. Port A also serves as an 8-bit bi-directional I/O port, if the A/D Converter is not used. Port pins can provide internal pull-up resistors (selected for each bit). The Port A output buffers have symmetrical drive characteristics with both high sink and source capability. When pins PA0 to PA7 are used as inputs and are externally pulled low, they will source current if the internal pull-up resistors are activated. The Port A pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port B (PB7..PB0) : Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port B also serves the functions of various special features

Port : Pin Alternate Functions

PB7 : SCK (SPI Bus Serial Clock)
PB6 : MISO (SPI Bus Master Input/Slave Output)
PB5 : MOSI (SPI Bus Master Output/Slave Input)
PB4 : SS (SPI Slave Select Input)
PB3 : AIN1 (Analogy Comparator Negative Input)
OC0 (Timer/Counter0 Output Compare Match Output)
PB2 : AIN0 (Analogy Comparator Positive Input)
INT2 (External Interrupt 2 Input)
PB1 : T1 (Timer/Counter1 External Counter Input)
PB0 : T0 (Timer/Counter0 External Counter Input)
XCK (USART External Clock Input/Output)

Port C (PC7..PC0) : Port C is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port C output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running. If the JTAG interface is enabled, the pull-up resistors on pins PC5(TDI), PC3(TMS) and PC2(TCK) will be activated even if a reset occurs.

Port C also serves the functions of the JTAG interface and other special features

Port : Pin Alternate Function

PC7 : TOSC2 (Timer Oscillator Pin 2)
PC6 : TOSC1 (Timer Oscillator Pin 1)
PC5 : TDI (JTAG Test Data In)
PC4 : TDO (JTAG Test Data Out)
PC3 : TMS (JTAG Test Mode Select)
PC2 : TCK (JTAG Test Clock)
PC1 : SDA (Two-wire Serial Bus Data Input/output Line)
PC0 : SCL (Two-wire Serial Bus Clock Line)

Port D (PD7..PD0) : Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port D also serves the functions of various special features

Port : Pin Alternate Function

PD7 : OC2 (Timer/Counter2 Output Compare Match Output)

PD6 : ICP (Timer/Counter1 Input Capture Pin)
PD5 : OC1A (Timer/Counter1 Output Compare A Match Output)
PD4 : OC1B (Timer/Counter1 Output Compare B Match Output)
PD3 : INT1 (External Interrupt 1 Input)
PD2 : INT0 (External Interrupt 0 Input)
PD1 : TXD (USART Output Pin)
PD0 : RXD (USART Input Pin)

RESET **:** Reset Input. A low level on this pin for longer than the minimum pulse length will generate a reset, even if the clock is not running. Shorter pulses are not guaranteed to generate a reset.
Reset Sources **:** The ATmega16 has five sources of reset:
• Power-on Reset. The MCU is reset when the supply voltage is below the Power-on Reset threshold (VPOT).
• External Reset. The MCU is reset when a low level is present on the RESET pin for longer than the minimum pulse length.
• Watchdog Reset. The MCU is reset when the Watchdog Timer period expires and the Watchdog is enabled.
• Brown-out Reset. The MCU is reset when the supply voltage VCC is below the Brown-out Reset threshold (VBOT) and the Brown-out Detector is enabled.
• JTAG AVR Reset. The MCU is reset as long as there is a logic one in the Reset Register, one of the scan chains of the JTAG system.

XTAL1 **:** Input to the inverting Oscillator amplifier and input to the internal clock operating circuit.

XTAL2 **:** Output from the inverting Oscillator amplifier.

AVCC **:** AVCC is the supply voltage pin for Port A and the A/D Converter. It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter.

AREF **:** AREF is the analog reference pin for the A/D Converter.

REFERENCE PAPER USED:-

1. M. Khan, I. Husain, and Y. Sozer, "Integrated electric motor drive and power electronics for bidirectional power flow between the electric vehicle and dc or ac grid," *Power Electronics, IEEE Transactions on,*vol. 28, no. 12, pp. 5774–5783, Dec 2013.

2. Shivanagouda.B.Patil, M. S. Aspalli," Operating Three Phase Induction Motor Connected to Single Phase Supply ," International Journal of Emerging Technology and Advanced Engineering, ISSN 2250-2459, Volume 2, Issue 11, November 2012.

3. C. Jacobina, E. Cipriano dos Santos, N. Rocha, de Sa, B. Gouveia, and E. da Silva, "Reversible ac drive systems based on parallel ac-ac dc-link converters," *Industry Applications, IEEE Transactions on, vol. 46, no. 4,*pp. 1456 –1467, July-Aug. 2010.

4. C. B. Jacobina, E. C. dos Santos Jr., N. Rocha, and E. L. Lopes Fabricio,"Single-phase to three-phase drive system using two parallel single phase rectifiers," *Power Electronics, IEEE Transactions on, vol. 25,*no. 5, pp. 1285–1295, May 2010.

5. *Dong-Choon Lee, Member, IEEE, and Young-Sin Kim," Control of Single-Phase-to-Three-Phase AC/DC/AC PWM Converters for Induction Motor Drives," IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, VOL. 54, NO. 2, APRIL 2007.*