

UNDER PEER REVIEW

29 African nations also suffer the same problem. This has popped lots of thoughts to the minds African
30 Electrical Engineers.

31 Following the intermittent electric power failure, the need for stable power supply to equipment such
32 as computer, TV sets, theatre equipment in the hospitals and a host of others led to the development
33 of the inverter systems with different design based on the technology employed. Inverter is a means
34 through which an Alternating Current (AC) is produced from a Direct Current (DC) power of a desirable
35 output voltage, current and frequency (Fink and Beatty, 1998).

36 Thus an inverter compensates for the possibility of power failure. Frequent public power outages have
37 led to massive use of generators with its negative consequences which include; noise, fire outbreak
38 and environmental pollution (Amachire, 2008).

39 Inverters overcome these draw backs as it does not require fuelling, cheaper and environmentally
40 friendly. The output frequency for this design is 50Hz and a peak voltage of 240V is in agreement with
41 national standard. Its driving circuit incorporates Bipolar Junction Transistor (BJT) as the main
42 switching component. In this case, BJTs were chosen as the high power output device due to their
43 excellent power handling capability, fast switching action, high voltage and high current rating with low
44 heat dissipation.

45 *It is on this paper is over sized? you need to add paragraph
next to explain this*

46 2. LITERATURE REVIEW

47 2.1 Introduction

48 In the world today, there are currently two forms of electrical transmission, Direct Current (DC) and
49 Alternating Current (AC), each with its own advantages and disadvantages. DC power is simply the
50 application of a steady constant voltage across a circuit resulting in a constant current. A battery is the
51 most common source of DC transmission as current flows from one end of a circuit to the other.
52 Alternating current, unlike DC, oscillates between two voltage values at a specified frequency, and its
53 ever changing current and voltage makes it easy to step up or down the voltage. For high voltage and
54 long distance transmission situations, all that is needed to step up or down the voltage is a
55 transformer. AC current is more viable but less available. Conversion of DC current to AC is done by a
56 device called INVERTER.

57 A lot of engineers had earlier conceptualized what they felt inverter system should look like. The
58 incessant power outage in Nigeria has prompted the engineers to improve the inverter power system
59 and this project is not an exception. Power system is a very paramount constituent of technological
60 growth. Constant supply of power improves productivity of factories and companies. Computer rooms
61 as well as domestic homes require constant supply of electricity. All this has prompted the urgency to
62 improve on the properties of the inverter power system in quality, durability, maintainability and
63 capacity.

64 2.2 Review of Past Projects

65 The inverter system usually has different parts, with some parts compulsory and others necessary.
66 Amongst these parts are the transistors for switching, the transformer and 555 Timer IC as an
67 oscillator has been the basic constituent of power inverter system. The oscillator is the device that will

68 accept direct input and give oscillating output. In this case, it takes direct current to give an oscillating
69 current. This oscillating current is not a perfect sine wave current, so there is need for current
70 modification and filtering to achieve the sine wave as required for an oscillating current. Transistors
71 are basically used for the current modification and in combination with resistors for filtering to achieve
72 the sine wave. This output is stepped up by a transformer of certain power rating, the power rating of
73 this transformer gives is the power rating of the inverter system. The inverter system requires a
74 battery to function. The direct current (DC) is obtained from a DC battery supply. The current rating of
75 this DC battery must be of a rating so as to carry the power required by the inverter. The battery
76 supply is 12V DC. Combination of any DC battery to achieve the 12V cannot be used because of
77 *Warning* current rating. Usually, a Lead Acid Accumulator battery or a dry cell battery of required current rating
78 is used for the battery. When this battery is low, there will be need for the battery to be charged. The
79 charger is a rectifier and a step-down transformer. Rectifier converts the AC current to a DC current.
80 The bank of transistors is used for current modification for the step up transformer input. The step up
81 transformer has the secondary winding that is a couple of the primary winding in number of turns,
82 depending on the output voltage required and the current rating for which it is meant for. The core
83 Area of the transformer is calculated based on the power rating to be achieved as well. The wire for
84 the primary winding is made very thick so as to carry the power and bear the heat coming from the
85 transistors. The wire to be used for the secondary winding is dependent on the type of load for which
86 it is meant. For house hold appliances, a 2.5mm laminated cable is used for the secondary winding.
87 The inverter is commonly known as *interrupted power supply system (UPS)*. Usually, heat sink is
88 used to cool down the transistors. The heat sink is not sufficient to cool the transistors. *So what the solution?*

2.3 Review Modification

89 The inverter works as enumerated above, but radiates lots of heat. In this project, IRF 150 MOSFET
90 has been incorporated in place of the transistor which radiates less heat. Furthermore, the IRF 150
91 MOSFETs gives room for expansion.
92 Battery level indicator is also incorporated to show when the battery is low and when the batter is full.
93 In the circuit for battery full and battery low is the comparator. A comparator is a device that takes two
94 inputs and gives output after comparing the two inputs. The output is in form of the input of the either
95 the inverting or the non-inverting, depending on what it is meant for. *are you sure?* If the inverting input is higher
96 than the non-inverting input, the output will be zero after comparing the two. But if the inverting is less
97 than the non-inverting, the output will be the reference value of the non-inverting. In this case, the
98 reference value is the voltage supply, when the voltage at the inverting is less than the non-inverting,
99 the output will be the input voltage. This is used to indicate battery low and battery full with the aid of a
100 voltage fixing diode (zener diode). The room for future expansion is good for any electrical project. To
101 supply 1kVA, a combination of six MOSFETs in cascade can serve the purpose, but for this project,
102 there is allowance in the number of MOSFETs used. Fourteen MOSFETs are incorporated in the
103 design, these can supply five (5) times of 1kVA, that is, it can supply up to 5kVA with an increase in
104 the number of battery to be used. It can go as far as supplying five (5) times the power that is used for
105 in this project.

The power source switching has been made automatic by 555 timer IC, which controls the switching from AC main and battery supply. The 555 timer IC is an integrated circuit that can function in either monostable or astable mode. In the astable mode, the 555 timer can be used as a timer, it engages and disengages at certain time controlled by its clock. This timing is to delay the supply by some microseconds before the power comes up. The delay is to prevent transient current from the circuit. Transient current are the surge current which are higher than the normal current. Surge current can damage electrical appliances. This surge current is imminent when the power is just supplied. With the combination of the timer and the capacitor, the surge will not have influence on the appliances. The capacitor absorbs the surge and the delay does the function of delaying the time and allows every surge to be absorbed before the circuit is engaged with power. This will make the inverter safe to use.

In the inverter is also the charging circuit. When the battery goes down in voltage, the inverter will definitely go off. Then there will be need to charge the battery and this has been incorporated in the inverter. The inverter battery charging circuit contains basically the step-down transformer and the rectifier. The rectifier is a device that converts an alternating current AC to a direct current DC. The step-down transformer steps down the voltage from the mains to the required voltage needed to charge the battery. In this case it will step down from 220V/AC to 15V/AC before the voltage is rectified. In the charging circuit, the voltage regulator maintains the amount of voltage coming out of the charging circuit to the required voltage. To show the voltage output of the inverter, a meter indicator is used, this increases the viability of the inverter as it tells the user when the battery is going low even before the indicator indicates that the battery is low.

3.0 METHODOLOGY

3.1 Transformer Design

1kVA step-up Transformer

Starting with the 1kVA step-up transformer

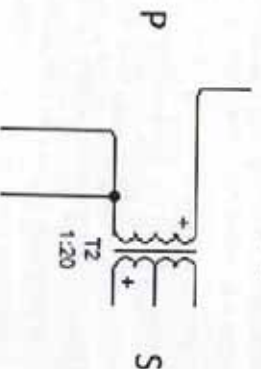


Fig. 1: 1kVA step-up Transformer

139 P = transformer primary

Side

(3.11)

140 S = transformer secondary

side

(3.12)

141 The transformer primary voltage = 12 volts

24V

Here the ratio is 1/2

142 The transformer secondary voltage = 220 volts

143 The transformer primary current = $\frac{1000 \text{ watts (power)}}{12 \text{ (volts)}}$

144 = 83.3333Ampere

145 The transformer secondary current = $\frac{1000 \text{ watts (power)}}{220 \text{ volts (secondary voltage)}}$

(3.14)

146 The operating frequency = 50 Hz

147 3.1.2 Design of Amplifying and Current Distribution Circuit

148 IRF 150 (cascaded MOSFETs)

149 The IRF 150 is a metal oxide semiconductor with voltage divider combination of resistor at the gate.

150 From the data sheet, it has on-state resistance of 0.05X and a drain current of 38A.

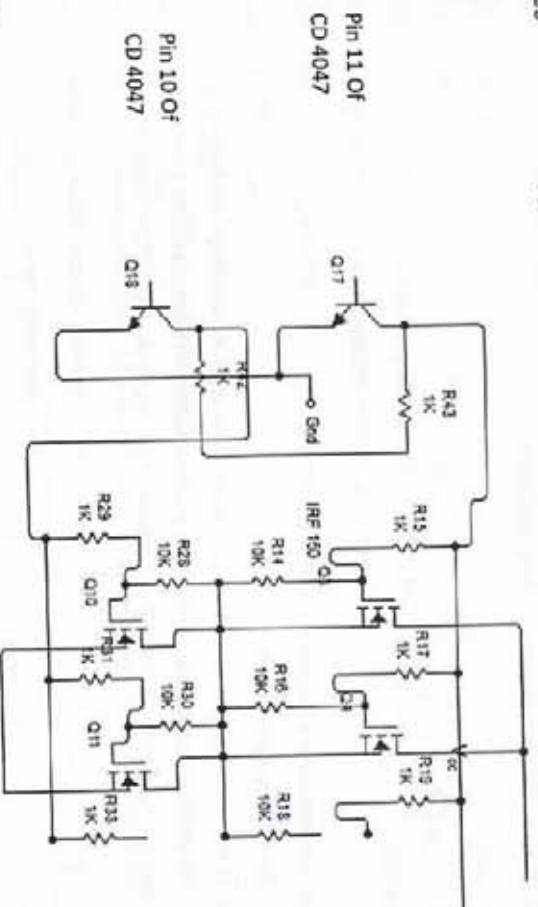
151 Power = $(38)^2 \times 0.055 \text{ watts}$

(38)^2

(3.15)

152 = 1444 x 0.055 watts

153 = 79.42 watts



154 Fig. 2: Switching and a section of the current modification circuit

155 Now, using IRF 150 MOSFET (cascaded) for the power transmission and current modification,

156 $\frac{1000 \text{ watts}}{79.42 \text{ watts}} = \text{number of IRF 150 MOSFETs required for the cascade}$ (3.16)

157 = 12.5912

158 14 MOSFETs will be used for even power distribution.

159 The IRF 150 from the data sheet has:

160 Capacitance of 1.1pF, Charge(Q) of 125nC

161

This is a DC in DC but here we have an AC

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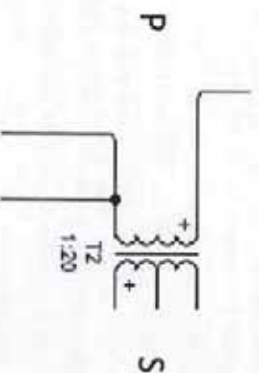


Fig. 1: 1kVA step-up Transformer

on the
output

To obtain the rise time of the pulse
Frequency = 50Hz

BDX53 Transistor(Q17 and Q15) has been selected for switching

The transistor Q1 and Q2 can be used as a switch by driving them to saturation.

$$I_C = I_{CE} \quad (3.17)$$

To obtain the suitable current for the cascaded MOSFET, I have chosen 220K resistor for R_3 and R_4 so that

$$\frac{V_{CC}}{R_3} = 13 \quad (3.18)$$

$$\frac{12}{220} = 0.06amp$$

To obtain the current rating for each MOSFET,

$$\text{the pulse period} = \frac{1}{\text{frequency}} = \frac{1}{50} = 0.02 \text{ seconds} \quad (3.19)$$

Pulse period = 20 msec

$$\text{the rise time} = \frac{20msec}{2} = 10msec$$

$$\text{the MOSFET gate current} = \frac{C \cdot V}{t} \quad (3.21)$$

C = capacitance (Farad), V = voltage (volts), t = time (seconds)

$$I_G = 1.1\mu F \times \frac{12}{10} msec$$

$$I_G = 1.32 \times 10^{-6} = 1.32 \mu A$$

For seven MOSFETS,

$$= 1.32 \mu A \times 7$$

= 0.0092mA (the required current to drive the entire MOSFETS).

3.1.3 Design of the Battery Low Circuit

From the circuit above, the diode D7 (1N4733A) is a zener diode used as a voltage regulator to fix a 5.1V voltage at the positive input of the operational amplifier(LM358N¹) (non-inverting input). 470Ω resistor will be used as R_4 . 49mA is maximum input current from the op-Amp (LM358N) data sheet.

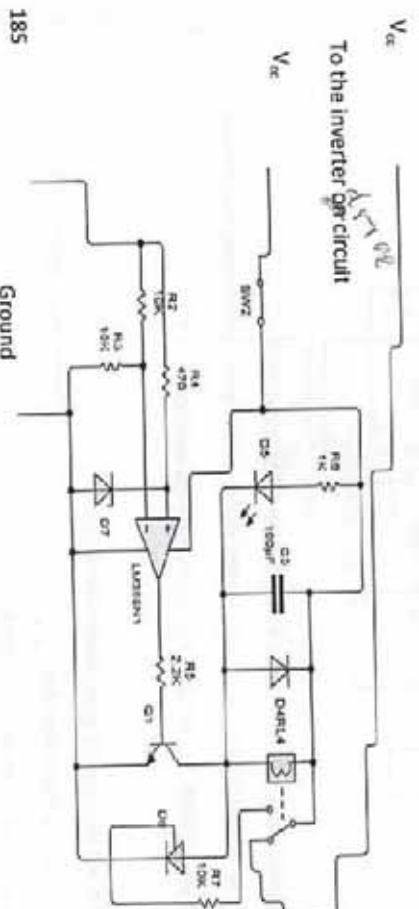


Fig. 3: The battery low circuit

$$\frac{12V}{470} = 0.025319Amp$$

$$= 25.5319mA$$

Any value other than 470Ω can be used but for the sake of allowance, we have chosen 470Ω

The voltage divider combination has been done to divide the supply voltage into fractions which will then be compared with the fixed voltage, which is the 5.1volts.

10kΩ has been chosen for R2 and R 3. They are just to divide voltage any equal combination of resistors could have divided the voltage.

So, Inverting input

$$The V^- = \left(\frac{10k\Omega}{(10k\Omega + 10k\Omega)} \right) V_{supply} \quad (3.22)$$

Vsupply is the voltage from the battery.

V+ = 5.1 volts (fixed by zener diode (1N4733A))

When the supply voltage (battery voltage) is 14 volts (fully charged)

$$V^- = \left(\frac{10k\Omega}{10k\Omega + 10k\Omega} \right) 14volts \quad (3.23)$$

$$= \left(\frac{1}{2} \right) 14 \text{ volts}$$

$$= 7 \text{ volts}$$

$$V+ = 5.1 \text{ volts}$$

V- > V+, the output voltage equals zero $\rightarrow$ NO alarm

When the supply voltage (battery voltage) is 11 volts,

$$V^- = \left(\frac{10k\Omega}{10k\Omega + 10k\Omega} \right) 11 \text{ volts}$$

$$= \left(\frac{1}{2} \right) 11 \text{ volts}$$

$$= 5.5 \text{ volts}$$

$$V+ = 5.5 \text{ volts.}$$

V- > V+, the output voltage of Op-amp is zero. no current flows to the external circuit.

When the supply voltage (Battery voltage) is 10 volts.

$$V^- = \left(\frac{10k\Omega}{10k\Omega + 10k\Omega} \right) 10 \text{ volts} = \frac{1}{2} (10) \text{ volts}$$

$$V^- = 5 \text{ volts}$$

$$V+ = 5.1 \text{ volts}$$

V+ > V-, the output voltage equals to the voltage supplied and current drives through the external circuit.

At the external circuit, a transistor BC547(Q1) has been selected for efficient switching.

When the output equals to the supply voltage, the transistor (Q 1) switches on.

The transistor has current gain (hfe) of 270 and collector current of 100mA (from the data sheet).

$$\text{The base current } I_b = \frac{I_c}{h_{fe}} \quad (3.24)$$

$$220 \quad I_b = 0.037 \text{ mA}$$

221 The base voltage is less than 12 volts

$$222 \quad R_s = \frac{\text{base voltage}}{\text{base current}} \quad (3.25)$$

$$223 \quad R_s = \frac{12\text{V}}{0.37} \times 10^{-3}$$

$$224 \quad R_s = 3.49 \text{ M}\Omega$$

225 2.2k Ω has been chosen as it's the minimum value of resistance that will not blow up the transistor.

226 When the transistor is switched on, the relay (RL4) charges and closes up its switch (Electromagnetic induction) there by disconnecting the inverter circuit and putting on the main supply if the main supply is available.

229 The diode D4 (1N4007) has been connected across the relay to prevent any form of backward flow of current to the transistor (Q1).

231 The capacitor of capacitance 1000 μF has been connected across LED (light emitting diode) to supply 2V and a resistor of 1k Ω has been connected to the LED to protect the LED from blowing up as the maximum current requirement for the LED is 10mA.

234 The LED is an indicator, showing battery is low.

235 The thyristor (D5) has been installed also across the transistor Q1 to protect the transistor from the sudden change from the relay.

$$237 \quad R_o = \frac{(V_s - V_o)}{I} \quad (3.26)$$

238 V_s is the source voltage = 12 V

239 Voltage required by LED = 2V

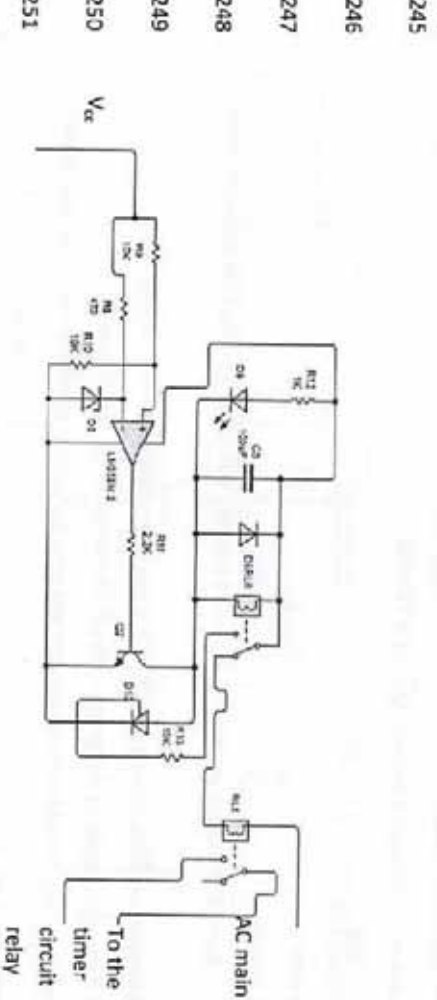
240 I is LED current rating = 10mA

$$241 \quad R_o = \frac{(12-2) \times 10^{-3}}{10 \times 10^{-3}} \text{ m}\Omega$$

$$242 \quad R_o = 1000 \Omega$$

$$243 \quad R_o = 1 \text{ k}\Omega$$

244 3.1.4 Design of the Battery Full Circuit



252 **Fig. 4: The battery full circuit**

253 From the circuit above, the diode D3 (1N4736A) is a zener diode to fix the voltage at the inverting
 254 input of 6.8 volts. R_9 and R_{10} are equal resistors, that is resistors of equal value to serve as a voltage
 255 divider, so that only half fraction is supplied to the non-inverting input

256 R_9 keeps the current at the non-inverting to a value less than 49 mA (The maximum current allowable
 257 at Op - amp input).

258 A value of 470Ω is chosen for R_9 so that

259 $\frac{12V}{470} = 0.0255319 \text{ Amp}$

260 $12V/470 = 0.0255319 \text{ Amp}$

261 = 25.5319mA (input current) which is smaller than the allowable current of the Op-Amp.

262 When the voltage from the battery is 11 volts

263 $\left(\frac{R_9}{R_9 + R_9} \right) V_{\text{supply}} = V^+; R_9 = R_9$ (3.27)

= $\left(\frac{1}{2} \right)$ 11 volts = 5.5 volts

264 The inverting input is 6.8 volts (fixed by the zener diode);

265 The $V^- > V^+$, therefore the output voltage of the Op - Amp will be zero.

266 Again,

267 When the supply voltage is 12 volts

$\left(\frac{R_9}{R_9 + R_9} \right)$ 12 volts

268 $R_8 = R_9$

269 $\left(\frac{1}{2} \right)$ 12 Volts = V^+ (non inverting input)

270 $V^+ = 6\text{volts}$

271 V^- is still greater than V^+

272 Output still at zero.

273 When the supply voltage is at 13.5 volts,

$\left(\frac{1}{2} \right)$ 13.5 = 6.75 Volts

274 Output still at zero.

275 When supply is at 14 volts.

276 $(R_8/R_8 + R_9) V_{\text{supply}} = V^+$

$\left(\frac{1}{2} \right)$ 14 = V^+

277 $V^+ = 7V$

278 $V^+ > V^-$, the output voltage is 14 volts.

279 14 volts is the battery full voltage. This is used because of voltage drop across the circuit so that
 280 allowance of +2 volts will be there from the supply.

*you need to recognize
 this in more details
 as this is not acceptable
 for academic
 paper.*

*Just focus on
 the core of
 design*

281 Transistor (Q2) BC547 has been connected at the Op-amp output for efficient switching.

282 The transistor has collector current of 100mA and current gain (β_{dc}) of 270

283 The base current $I_b = \frac{I_c}{\beta_{dc}}$ (3.28)

$$= \frac{100\text{mA}}{270} = 0.037\text{mA}$$

284 The base resistance $R_b \approx \frac{V_p}{I_b}$

$$= \frac{14}{0.037} \text{mA}$$

286 $I_b = 378.37\text{k}\Omega$

287 $R_{11} = 3.78\text{M}\Omega$

288 $2.2\text{k}\Omega$ has been chosen as the minimum resistor value to drive the BC547 without blowing it up.

289 $R_{11} = 2.2\text{k}\Omega$

290 When the transistor is switched on, current flow through the relay (RL3) and the relay closes, the inverter turns on and the inverter is ready to power the load.

292 Light emitting diode (LED) has been used as an indicator to show when the battery is full.

293 The LED has maximum input current of 10mA so resistor R29 has been connected at the diode input to control the current to the value less than the maximum diode allowable current.

295 The capacitor C9 has been connected across the LED to keep the led on

296 Diode D6 (1N4007) has been connected to prevent any current from flowing back to the transistor from the relay (RL3).

298 The thyristor has been connected across the transistor Q16 to prevent any current from flowing back to the transistor when the RELAY closes.

300 Resistor of resistance $10\text{k}\Omega$ (R28) has been connected at the gate of the thyristor because the thyristor maximum gate current is 1.2 mA.

302 Relay (RL5) receives pulse from the timer circuit(RL1)

$$R_{12} = \frac{(V_1 - V_2)}{I} \quad (3.29)$$

304 R_{12} is the resistor connected to LED

$$R_{12} = \frac{12 - 2}{10} \text{mA} = 1000\Omega = 1\text{k}\Omega$$

305 $V_s = 12\text{volts}$, V_{out} consumed by LED is 2v

306 Max current needed by LED is 10mA

There are 2 LEDs

3.1.5 Design of the change-over circuit

The change-over circuit is a switching circuit that switches supply between MAINS or inverter

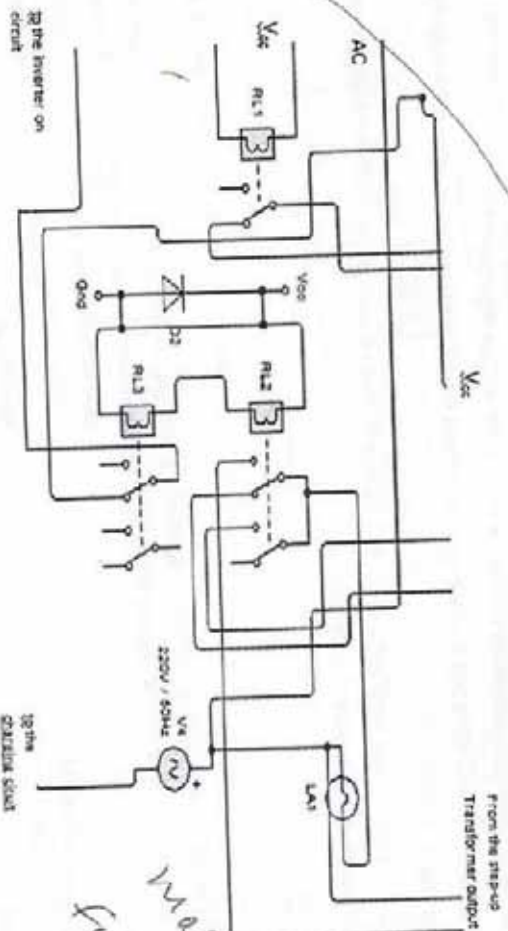


Fig. 5: change-over circuit

When the relay RL1 closes, the RL5 receives supply from the inverter battery full circuit and powers the load, inverter is on.

When its battery low, the inverter circuit is opened and charging and the load is connected to the MAINS if available. The inverter is OFF.

Diode D8 has been connected to prevent current from flowing to the ground from the 12 volts battery supply also isolates the MAINS and the battery.

3.1.6 Design of the Battery Charging Circuit (Rectifying Circuit)

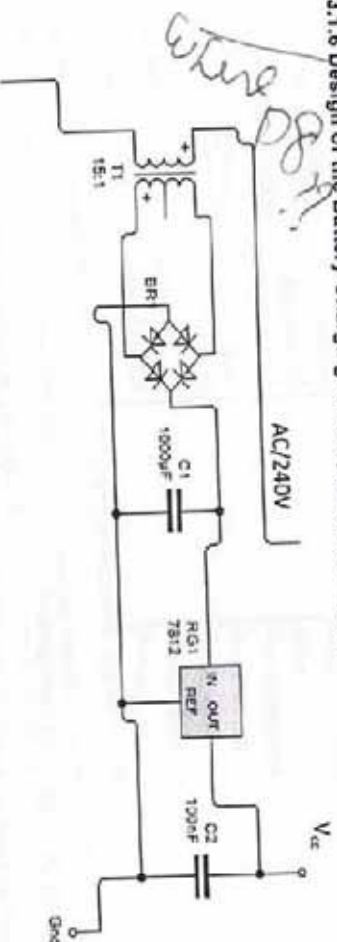


Fig. 6: The Rectifying circuit (Battery charger)

Transformer (T1) is a 15V/2000mA step-down transformer. It steps down the 220 Volts from MAINS to 15V output secondary. 15V is required at the output because of the voltage drop in the bridge circuit (AC - DC converter circuit) and voltage requirement of 7812 voltage regulator.

LM7812

336 The bridge rectifier selected is G25B80 bridge rectifier with four diodes. Each diode has a voltage
337 drop of 1 volt (from the data sheet).⁷

338 The total voltage drop is 2 volts at the output.

339 Capacitor C1 has been connected across the input of the voltage regulator 7812.

340 The voltage regulator 7812 has a minimum input voltage of 14.7 volts, but the voltage at the output of
341 the rectifier is 13 volts.

342 But 14.7 is the minimum input voltage for 7812 voltage to obtain a capacitor to produce stored voltage
343 of 2v to augment the current of capacitor,

$$344 I = C_1 \frac{dv}{dt} \quad (3.3)$$

$$345 Idt = C_1 dv$$

$$346 Idt = C_1 dv$$

$$347 It = C_1 V$$

$$348 C_1 = \frac{It}{V} \quad (3.31)$$

$$C_1 = \frac{10 \text{ msec} \times 2000 \text{ mA}}{2 \text{ volts}}$$

$$349 C_1 = 10 \text{mF}$$

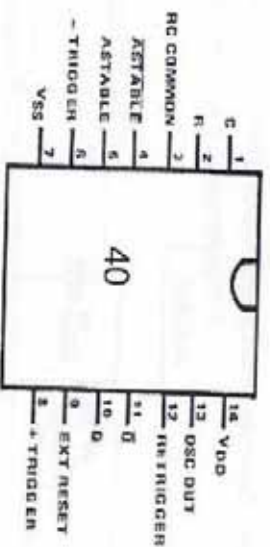
$$350 = 1000 \mu\text{F}$$

351 The 7812 voltage regulator produces an output voltage of 12 volts as indicated from the data sheet

352 The capacitor C2 (100nF) is a bypass capacitor, ensuring no AC component at the output.

353 3.1.7 Monostable/Astable Multivibrator (OSCILLATOR)

354 Integrated circuit (IC) 4047 has been selected to obtain the alternating pulse signal from the 12 volts
355 DC source from the battery.

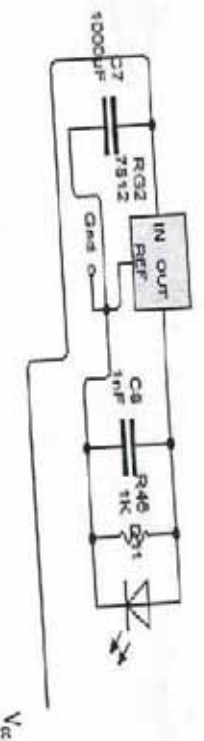


363 Fig. 7: 4047 Oscillator chip configuration

364 The astable operation is enabled by a high level on the ASTABLE (AST) input. The period of the
365 square wave at Q and Q is a function of the external component employed. Pulse on the
366 MONOSTABLE or ASTABLE input allows the circuit to be used as a gatable Multivibrator.
367 In the monostable mode, positive edge - triggering is accomplished by applying a leading edge pulse
368 to the +TRIGGER (+T) input. For -TRIGGER (-T) and a high level to the +TRIGGER.

369 From the 4047 data sheet, the wave form obtainable for astable mode is Astable Pulse from Pin 10
 370 and Pin 11.

371 3.1.8 The Inverter Output and Indicator



378 Fig. 8: The inverter on indicator circuit.

379 The capacitor C7 in the circuit above augment the voltage regulator input voltage to the required
 380 value. The voltage regulator has an input minimum (threshold) voltage of 14.7 volts, but the from the
 381 transformer input or battery output is 5 14 volts.

382 From the step-down transformer,

383 The current at secondary of (TR2) is 2000 mA

384 Capacitance = $\frac{I_s}{V_s}$ Farad

(3.32)

385 Time (t) = $\frac{1}{\text{frequency}} \text{ Sec}$

386
 387 $= \frac{1}{50} = \frac{20\text{msec}}{2} = 10\text{msec}(\text{for one half cycle})$

388 2 volts to be supplied by the capacitor to augment the input of the voltage regulator

$$C_7 = \frac{10\text{msec} \times 2000\text{mA}}{2}$$

389 $C_7 = 10\text{mF} = 10000\mu\text{F}$

390 For rise time of 1msec

$$C_7 = \frac{1\text{msec} \times 200\text{mA}}{2}$$

391 $C_7 = 1\text{mF}$

392 $C_7 = 1000\mu\text{F}$

393 C_8 is a bypass capacitor to prevent any form of ac component at regulator output

394 The LED (light emitting diode) has been connected to indicate inverter is powered only

395 A 1kΩ resistor prevents the current at the output from going directly to the LED as the LED maximum

396 current rating is 10mA

(3.33)

397 The LED resistor $R46 = \frac{V_s - V_L}{I}$ Ω

398 V_s = source voltage

399 V_L = Load voltage

$$R_{A6} = \frac{12-1}{10\text{mA}} \Omega$$

$$R_{A6} = \frac{10}{10\text{mA}} \Omega$$

$$R_{A6} = 1000 \Omega$$

3.1.9 The Delay and Timer Circuit:

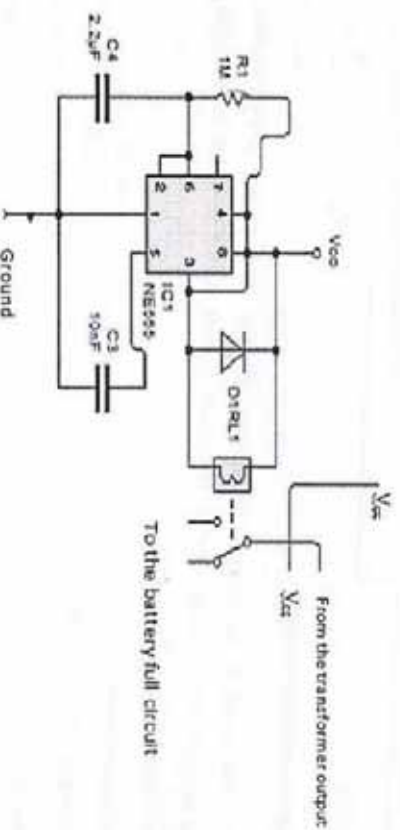


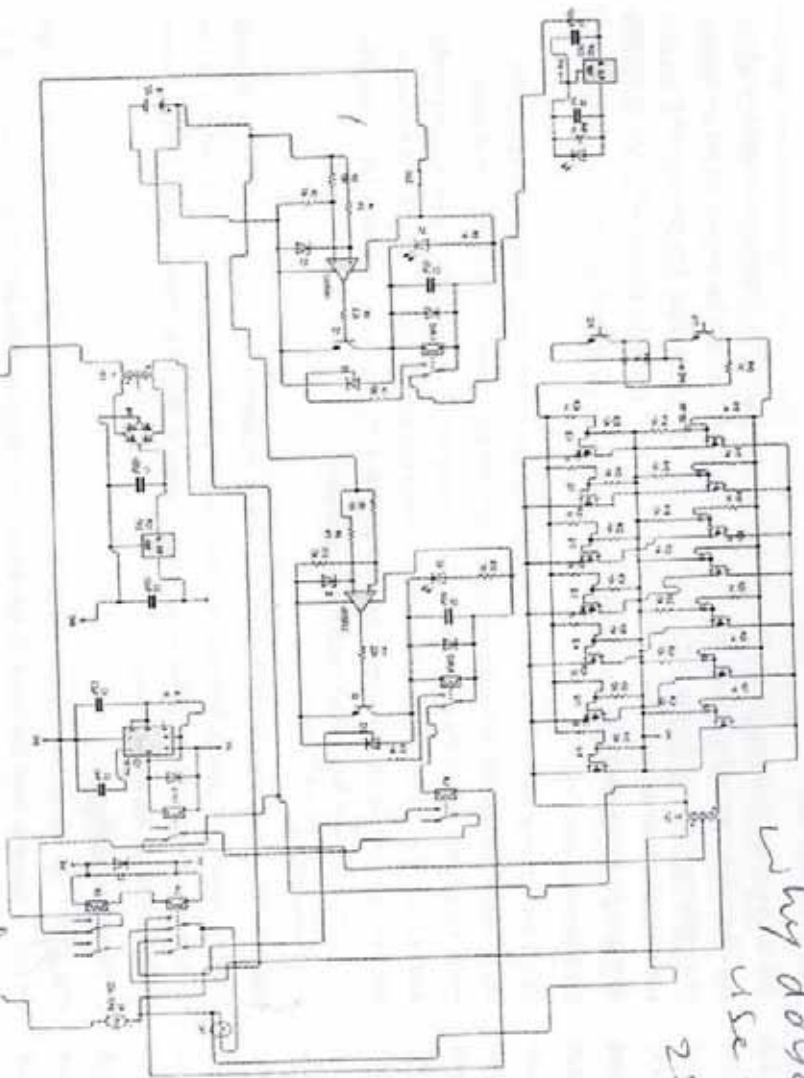
Fig.: 9 Delay circuit

In the monostable mode, the 555 functions as a "one-shot" pulse generator and application includes: timer, missing pulse detection, bounce free switches, touch switches, frequency divider, capacitance measurement and as pulse width modulation.

To be used as a one-shot generator, the pulse begins when timer receives signal at trigger input falls below a third of voltage supply.

The width of the output is determined by the time constant R_1C_4 network which comprises resistor (R) and capacitor (C).

The output is obtained when the voltage of the capacitor equals to 2/3 of the supply voltage.



must clear?

why do you use 220V?

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Fig.: 10 Complete Circuit Diagram

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4.3 Testing

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The inverter system is a device to convert a DC voltage supply to an AC. In the course building the inverter, various tests are carried out amongst which are

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1. Device testing

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2. Continuity test

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3. Short circuit test

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4.3.1. Device Testing.

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To test the device, load of up to 800VA was connected to the device to test if the device can carry up to the power stipulated for it to bear.

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4.3.1.1 Test result

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The inverter was able to bear the load up to 870VA and after some time, the load began to malfunction as the battery voltage began to fall and later the battery low indicator came up before the inverter finally went off.

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Inverter finally went off.

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Inverter finally went off.

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Inverter finally went off.

437

Inverter finally went off.

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4.3.2 Continuity test

The continuity test is carried out to avoid any form of open circuit. The presence of an open circuit in any electrical system will create an open circuit fault in the system and the system will not function. The wires have to be continuous all the way from one terminal to another. The lead used in the soldering of the components must be well soldered and there should be no any form of partial contact as this might initiate open circuit in the system.

4.3.3 Short Circuit Test

Short circuit occurs when the live and the neutral wires touch each other. When this happens, the current goes infinitely high and can blow up the entire system. There should be no form of short circuit, be it on the legs of the integrated circuits or along the wires. Short circuit fault is a very costly fault as it can blow up the whole system and should be avoided as much as possible, so this test is very important prior to the powering of the inverter system. To determine the system failure rate, the part count analysis of the various components is required.

5.0 Conclusion

Based on this project work, it can be deduced that an inverter system can be used to change direct current to alternating current. This can be used to supply power to house hold appliances and can be made to have higher power rating which can be used in factories. This will help improve power stability and better the national economy.

5.1 Recommendation

This project has shown how inverter system can operate automatically; automatic in the sense that the supply changes from the mains to the battery and battery to main depending on when there is power supply from the Power Holding Company of Nigeria (PHCN). It is therefore recommended that both the engineers that construct and the user of inverter system should adopt this mode of inverter system configuration for its flexibility, reliability, availability and high resistance to stress. Since various parts are in different model, fault can easily be identified and repair can be carried out easily without affecting the other parts.

It is also recommended that the inverter should be suspended on a wood or a stand as placing it on the ground may allow it to come in contact with water and this can lead to rust or damage to some components in the inverter system.

REFERENCES

- Anthony, J. P. (1993). "Basic Electrical Power Transformers" 2nd Edition, Hayden basic company London. Pp 120
- Amachire, T.S. (2008). "Estimation of Carbonmonoxide Level of Selected Sites in Minna Metropolis". An Unpublished B. Tech. Thesis, Department of Physics, Federal University of Technology, Minna. Niger State. P14
- Charles, A. H. (1997). "Handbook of component for electronics". Mc Graw hill, New York. Pp 209.
- Fink, D and Beatty H. (1998). "Standard Hen book for Electrical Engineering". 11th edition, Mc Graw Hill Book Company, U.S.A. Pp50

you don't need to use this

*This paper is need result sections
major correction*

DESIGN AND CONSTRUCTION OF IKVA

POWER INVERTER SYSTEM

ABSTRACT

The inverter system is a device that converts the ^{D.C} direct current from a battery to an ^{A.C} alternating current ^{for} which can be used by appliances. It does not only convert the current, but also steps the voltage of the battery up to the required value. The inverter system does not require fuel to make it function, that makes it cheap.

The circuit has seven (7) embedded circuit in it; namely the oscillator circuit which comprises the 4047 Oscillator, ^{define it} it converts the DC current signal to AC signal at the same frequency.

The current modification circuit, this comprises the switching transistors and the cascaded MOSFETs, which modifies the current to the desired input to the step up transformer, which steps it up to the required voltage and current. The battery low circuit indicates when the inverter battery is low, while the battery full circuit indicates when the inverter battery is full. The source change circuit changes the ^{recap it} source from AC main to battery automatically. The rectifying circuit charges the battery and lastly the inverter on circuit: this indicates when the inverter is on.

The inverter system also has the battery full indicator, which helps to safe – guard the life of the battery, while charging and it automatically switches of charging mode once the battery is full. The inverter system has timer for delaying the incoming current surge to protect the inverter from the large surge current and increase the working life of the inverter.

Keywords: Inverter, Direct Current, Alternating Current, Step up Transformer, MOSFET, Oscillator

/C

1. INTRODUCTION

1.1 Background

Power stability has been the one of the major problems of Nigerian technological growth. The solution to power instability in Nigeria has been a major problem to Nigerian government. Other neighboring