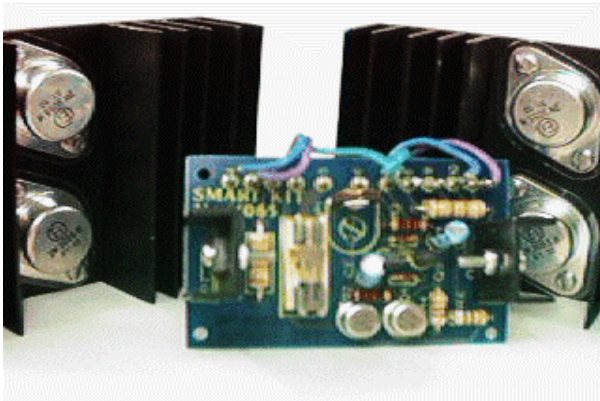


## QUASAR ELECTRONICS KIT No. 1065

### INVERTER 12 VDC TO 220 VAC



---

#### General Description

Often, it is necessary to have 220 VAC to operate a small domestic appliance or tool but the nearest mains outlet may be at a distance of several kilometres! This is a common situation in camping sites, caravans and boats. The circuit we are presenting you with here will solve this problem, provided there is a car battery available, as it will convert 12 VDC to 220 VAC @ 150 Watts maximum power.

---

#### Technical Specifications - Characteristics

Input voltage: 12V DC  
Input Current: 20A  
Output voltage: 220 V AC  
Output current: 500 mA  
Frequency: 50 Hz  
Power: 100 Watt max

---

#### How it Works

The circuit consists first of all of an oscillator built around Q3,5 which works at 50 Hz. The output of the oscillator is used to drive the two driver transistors Q2 and Q4 that in turn drive Q1 and Q6 respectively which then driver the output stage which consists of two parallel pairs the Q7,8 and Q9,10. The out put transistors are loaded with the secondary winding of a 2x10 V/20 A mains transformer from the input of which is taken the AC voltage of 220 V.

The frequency of the oscillator is adjustable by means of the trimmer P1 and can be set at exactly 50 Hz if this is necessary for the operation of the appliance that is going to be powered from the circuit.

---

#### Construction

First of all let us consider a few basics in building electronic circuits on a printed circuit board. The board is made of a thin insulating material clad with a thin layer of conductive copper that is shaped in such a way as to form the necessary conductors between the various components of the circuit. The use of a properly designed printed circuit board is very desirable as it speeds construction up considerably and reduces the possibility of making errors. QUASAR ELECTRONICS Kit boards also come pre-drilled and with the outline of the components and their identification printed on the component side to make construction easier. To protect the board during storage from oxidation and assure it gets to you in perfect condition the copper is tinned during manufacturing and covered with a special varnish that protects it from getting oxidised and also makes soldering easier. Soldering the components to the board is the only way to build your circuit and from the way you do it depends greatly your success or failure. This work is not very difficult and if you stick to a few rules you should have no problems. The soldering iron that you use must be light and its power should not exceed the 25 Watts. The tip should be fine and must be kept clean at all times. For this purpose come very handy specially made sponges that are kept wet and from time to time you can wipe the hot tip on them to remove all the residues that tend to accumulate on it.

DO NOT file or sandpaper a dirty or worn out tip. If the tip cannot be cleaned, replace it. There are many different types of solder in the market and you should choose a good quality one that contains the necessary flux in its core, to assure a perfect joint every time. DO NOT use soldering flux apart from that which is already included in your solder. Too much flux can cause many problems and is one of the main causes of circuit malfunction. If nevertheless you have to use extra flux, as it is the case when you have to tin copper wires, clean it very thoroughly after you finish your work.

In order to solder a component correctly you should do the following:

- Clean the component leads with a small piece of emery paper.
- Bend them at the correct distance from the component's body and insert the component in its place on the board.
- You may find sometimes a component with heavier gauge leads than usual, that are too thick to enter in the holes of the p.c. board. In this case use a mini drill to enlarge the holes slightly. Do not make the holes too large as this is going to make soldering difficult afterwards.
- Take the hot iron and place its tip on the component lead while holding the end of the solder wire at the point where the lead emerges from the board. The iron tip must touch the lead slightly above the p.c. board.
- When the solder starts to melt and flow, wait till it covers evenly the area around the hole and the flux boils and gets out from underneath the solder. The whole operation should not take more than 5 seconds. Remove the iron and leave the solder to cool naturally without blowing on it or moving the component. If everything was done properly the surface of the joint must have a bright metallic finish and its edges should be smoothly ended on the component lead and the board track. If the solder looks dull, cracked, or has the shape of a blob then you have made a dry joint and you should remove the solder (with a pump, or a solder wick) and redo it.
- Take care not to overheat the tracks as it is very easy to lift them from the board and break them.
- When you are soldering a sensitive component it is good practice to hold the lead from the component side of the board with a pair of long-nose pliers to divert any heat that could possibly damage the component.
- Make sure that you do not use more solder than it is necessary as you are running the risk of short-circuiting adjacent tracks on the board, especially if they are very close together.
- When you finish your work cut off the excess of the component leads and clean the

board thoroughly with a suitable solvent to remove all flux residues that may still remain on it.

The circuit is not critical and difficult to build, but the high currents involved, and the high voltage produced in the out put call for extra care in building and testing this project. Please follow all the steps outlined in the instructions as closely as possible to avoid mistakes which can be irritating, dangerous and ... expensive!

The four output transistors and their two drivers must be mounted on the heatsinks provided to protect them from overheating during operation. The four 2N3055's should be mounted on the two larger heatsinks that come with the kit, two in parallel on each heatsink. The two BD239's which are the drivers will be mounted on the smaller heatsinks one on each. Use the mica insulators and the special insulator washers in mounting the transistors to ensure that there is no electrical contact between the transistor and the heatsink. Failing to insulate the transistors from the heatsink will result in their instantaneous self-destruction at the moment of power up!. The mounting screws should be tightened as much as possible to ensure a good thermal contact between the transistors and their heatsinks. To improve the thermal transfer characteristics of the contact smear some heat transfer compound on the surfaces before bringing them together.

Solder the pins, the resistors and the capacitors on the board, taking care to insert the electrolytic properly, carefully to avoid overheating them solder the diodes and the four transistors that go on the p.c. board and then make the following connections:

- Point 1 with the bases of the power transistors Q7,8.
- Point 2 with the collectors of Q7,8.
- At points 3,4 and 8,9 you may optionally connect a 2 position 2 pole switch that can be used to turn the circuit on and off. Otherwise connect point 3 with 4 and point 8 with point 9.
- Point 5 must be connected with the positive pole of the 12 V battery.
- Point 6 with the central tap of the secondary winding of the transformer.
- Point 7 with the negative pole of the battery.
- Point 10 with the bases of Q9,10.
- Point 11 with the collectors of Q9,10.

The emitters of all the four power transistors Q7,8,9,10 are connected together and then taken to the common point 7 on the p.c. board.

The transformer which is not included in the kit must be of the very best quality to ensure that the circuit will operate as efficiently as possible.

The secondary winding of the transformer (2x10 V) should be connected with its central tap at point 6 of the p.c. board and the two ends of the winding with the collectors of the power transistors at points 2 and 11 of the board. The connections of the transformer, the power transistors and the battery should be made with heavy gauge cables as the currents that flow in this part of the circuit are very heavy. The fuse is rated at 20 A.

If everything was done properly and you turn the power on there should be 220 VAC across the primary winding of the transformer. To test it, connect (AFTER TURNING FIRST THE POWER OFF) a common filament bulb across the transformer and see if it lights.

If there is a frequency counter available you can adjust the frequency of the oscillator to exactly 50 Hz by turning the pointer of the trimmer P1, till you get the exact frequency. The counter should be connected at the base of either Q2 or Q4.

Please note that if the device you are going to use requires a perfectly sinusoidal supply voltage for its operation, as it is the case with many B&W TV sets which use the sine wave input from the power supply to time the screen sweep circuits, the circuit is not suitable.

It is however perfectly suited for supplying small domestic appliances like light bulbs, radios, record players, cassette recorders, STEREO hi-fi systems of low power, shavers, soldering irons etc.

When you had finished testing and adjusting the circuit use a suitable case for the circuit because the voltage across the primary winding of the transformer is DANGEROUS and should be considered as if it were the mains to avoid serious electric shocks that could even be lethal.

The case you choose for the circuit should be quite sturdy to take the weight of the transformer and should have good ventilation to help dissipate the heat from the power transistors.

---

## Adjustments

If there is a frequency counter available you can adjust the frequency of the oscillator to exactly 50 Hz by turning the pointer of the trimmer P1, till you get the exact frequency. This kit does not need any other adjustments, if you follow the building instructions.

---

## Warning

QUASAR ELECTRONICS kits are sold as stand alone training kits.

If they are used as part of a larger assembly and any damage is caused, our company bears no responsibility.

While using electrical parts, handle power supply and equipment with great care, following safety standards as described by international specs and regulations.

### CAUTION

The circuit converts low voltage (12 VDC) which is quite harmless to 220 VAC which is the same voltage as the mains.

Voltages above 50 V are DANGEROUS and could even be LETHAL.

In order to avoid accidents that could be fatal to you or members of your family please observe the following rules:

- DO NOT work if you are tired or in a hurry, double check everything before connecting your circuit to the mains and be ready to disconnect it if something looks wrong.
  - DO NOT touch any part of the circuit when it is under power.
  - DO NOT leave mains leads exposed. All mains leads should be well insulated.
  - DO NOT change the fuses with others of higher rating or replace them with wire or aluminium foil.
  - DO NOT work with wet hands.
  - If you are wearing a chain, necklace or anything that may be hanging and touch an exposed part of the circuit BE CAREFUL.
  - ALWAYS USE a proper mains lead with the correct plug and earth your circuit properly.
  - If the case of your project is made of metal make sure that it is properly earthen.
  - When you are testing a circuit that works off the mains, or at mains voltages wear shoes with rubber soles, stand on dry non conductive floor and keep one hand in your pocket or behind your back.
- If you take all the above precautions you are reducing the risks you are taking to a minimum and this way you are protecting yourself and those around you.

- A carefully built and well insulated device does not constitute any danger for its user.  
BEWARE: ELECTRICITY CAN KILL IF YOU ARE NOT CAREFUL.

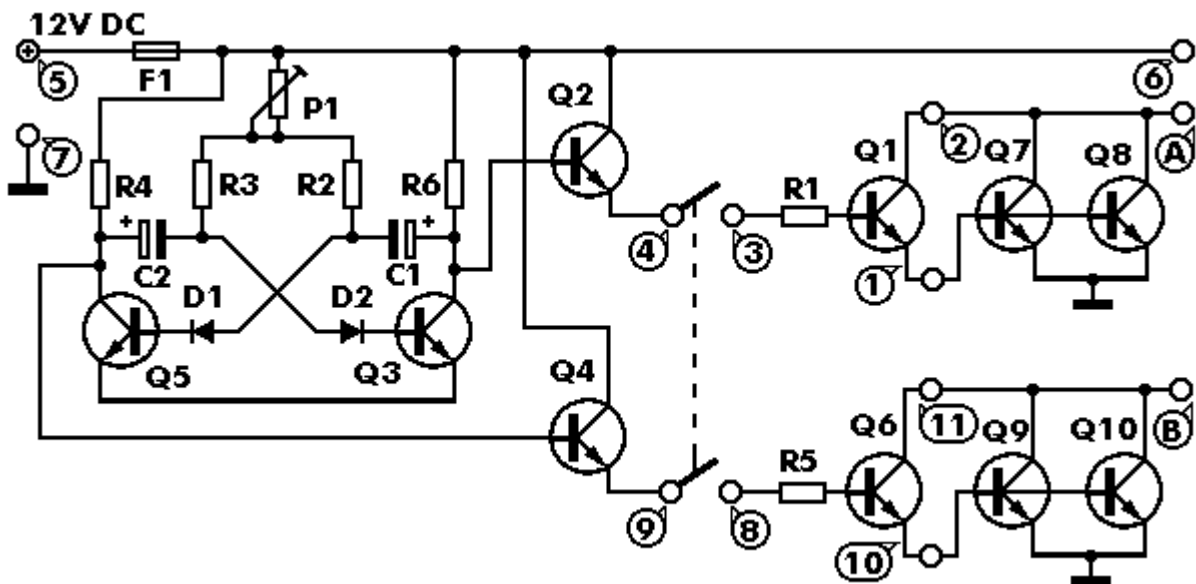
---

### If it does not work

- Check your work for possible dry joints, bridges across adjacent tracks or soldering flux residues that usually cause problems.
- Check again all the external connections to and from the circuit to see if there is a mistake there.
- See that there are no components missing or inserted in the wrong places.
- Make sure that all the polarised components have been soldered the right way round.
- Make sure that the supply has the correct voltage and is connected the right way round to your circuit.
- Check your project for faulty or damaged components.
- If everything checks out and your project still fails to work, please contact us for information on our Get-You-Going service.

---

### Schematic Diagram



---

### Parts List

All components including printed circuit board, assembly instructions including schematics and detailed parts list are supplied when you purchase the kit.

---

### Ordering

For pricing info and online ordering please visit:

<http://www.quasarelectronics.com/1065.htm>

For further info please contact us by e-mail:

[mailto: sales@QuasarElectronics.com](mailto:sales@QuasarElectronics.com)

---

**COPYRIGHT** © 2003 Quasar Electronics Limited. All rights reserved. Reproduction of this document in whole or in part in any form or medium without express written permission of Quasar Electronics Limited is prohibited.

E&OE