QUASAR ELECTRONICS KIT No 1167
TELEPHONE LINES PRIORITY SWITCH

General Description

The very fast growth of telecommunications has made the existence of two or more telephone lines in the companies, offices and houses quite common. There are a variety of devices connected to the telephone lines such as faxes, modems, automatic telephone devices etc.
Can you imagine what would happen if it was necessary to connect a separate line to each device? In that case, one would need two or more telephone devices or modems etc., in the same office for example.
Using the switching box one can avoid the above situation - saving much money - and can be sure that the transmitted information will be received by the telephone device or fax.
This solution could make your secretary happy since she can not listen the messages from two or three calls simultaneously.

Technical Specifications - Characteristics

Working voltage: 9 V DC
Current: 40 mA

How it Works

The circuit comprises three stages. Two of them are used to check if the telephone line is in use and the third one carries the contact terminals of the relay to the one or the other side.
Figure 1 displays the electric diagram of the circuit. In the left hand side of the figure there is a rectangular frame that is called LINE 1. The terminals of the telephone line are connected to the terminals 1 and 2 of the frame. Its voltage is rectified using a rectifying bridge and it is applied through the resistors R8 and R9 to the LED of the optocoupler ISO1. Notice, that the use of the rectifying bridge ensures the connection of the terminals of the telephone line regardless their polarity.
When LINE 1 is not in use, the LED within the optocoupler ISO1 turns on and lights the encapsulated photodiode driving the split - Darlington output stage in the switching on area. Simultaneously the voltage at the terminals of the resistor R6 becomes low preventing the capacitor C1 to be charged.
The result of this action is that the non- inverting input (+ / pin 3) of the comparator U1 becomes negative relative to the inverting input (- / pin 2) switching off the transistor Q1. Hence, the relay K1 / DPDT goes to the quiescent state where the terminals of LINE 2 are connected to the terminals 1 and 2 of the LINE OUT frame (see the right hand side of the figure 1).
In the case the LINE 1 receives a call, its voltage will start to change to lower values than that which correspond to the quiescent state of the line (50 or 60 Volts).
These changes drive the encapsulated transistor of the ISO1 out of the saturation region allowing the capacitor C1 to be charged. Hence, the non - inverting input (+ / pin 3) of the operational amplifier U1 is in positive dynamic with respect to the inverting input (- / pin 2). Then, the transistor Q1 conducts and the relay K1 / DPDT switches LINE OUT to LINE 1.

During the ringing time and between two successive rings, C1 helps the relay to hold its contacts connected to the terminals of LINE 1, allowing the device to answer the call.
If LINE 1 is in use, the output signal of the operational amplifier U1 is applied to the base of the encapsulated transistor of the optocoupler ISO2 driving it permanently in the safe operating area, independently of its own LED status. This connection is very important, since the circuit around the frame LINE 2 is similar to the circuit around LINE 1 and can ask for a connection with the frame LINE OUT.
Since the transistor is permanently turned on (its base is connected to the output of U1), it can not occupy the device that is in use by LINE 1. Hence, if you are calling LINE 2 you will receive no answer since the device is connected to LINE 1. The circuit comes back to the quiescent state after the occupation of LINE 1 has been finished connecting the terminals of LINE OUT to the terminals of LINE 2.
In the case the circuit is in the quiescent state and after this the LINE 2 is in use, then the contacts of the relay will not be removed, but will be permanently connected to the LINE 2.
In order to ensure the case where the LINE 2 will not be prevented by the LINE 1, the collector of the encapsulated transistor of the optocoupler ISO2 is connected through the resistor R5 to the inverting input of the operational amplifier U1.
So, if LINE 1 is in use and the device starts to answer to the inserted through the LINE 1 call, the transistor gives to the inverting input of U1 a voltage that is equal to the voltage of the source (VCC).
Since this voltage will always be higher than the dynamic in the non - inverting input the transistor Q1 will be turned on maintaining the relay in the excited state.
When the relay stops to be excited by the LINE 2 frame, the low dynamic of the collector of the transistor that is encapsulated in the optocoupler ISO2, will ensure to the inverted input a voltage that will be equal to the supply voltage (Vcc), making enable the circuit to be occupied by the LINE 1.
The diode D2 is used to suppress opposite polarity spikes which are caused by the current changes, while the diodes D3 and D4 are used to limit the voltage at the common connection points of the resistors R9 & R8, R11 & R12 respectively in a value not higher than 68V.

Construction

All the components will be placed on the pc board 1167. First place the jumper J1 and the sockets of the optocouplers. Then place the resistors and the capacitors checking the polarity of the capacitors. After this, place the diodes and the transistor.
The two rectifying bridges are round and the only symbols that are printed on the pc board are the symbols + and - that must be considered as reference points.
Finally place the relay and the integrated circuit on its socket.
Connection
There are four points to which must be connected two couples of cables. The two of them are used for the connections to the LINE 1 and the LINE 2. The other two are connected to the LINE OUT and to the supply voltage.
The supply voltage must be 12V. It is not necessary to check the polarity of the connections which are relative to the telecommunications network.

Adjustments

This kit does not need any 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.

If it does not work

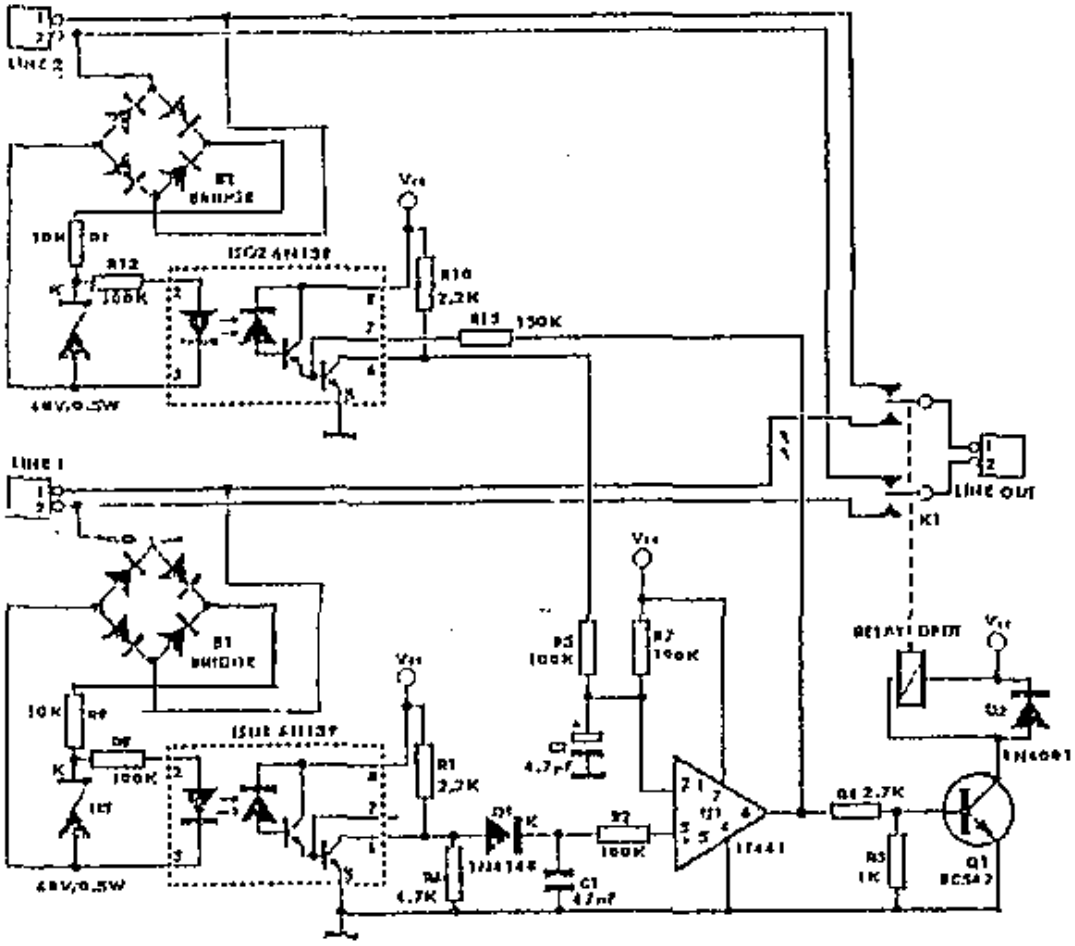
Having realised the construction and all the connections the possibilities to have made a mistake still exist. If there is a problem, you must follow the next steps:
Start checking if a component has been placed in the wrong place, with the wrong polarity or if it has been overheated.

The relay is not excited
Remove the integrated circuit U1 and using a small piece of cable, connect the pin 6 of its socket to the positive terminal of the supply voltage. The characteristic sound of the relay contacts will be heard. If this does not happen, check the transistor and the diode D2.
If the relay is excited, place the U1 and remove the optocouplers ISO1 and ISO2. You must hear the characteristic sound of the relay contacts. Use a small cable and connect the anode of the diode D1 to the earth. In that case, the relay will be not excited. If this does not happen check the diode D1 and the resistors R1, R6, R5, R7, R10 since it is possible to be placed in the wrong case. If you have soldered the IC U1 directly on the pc board, it is possible to have destroyed it.
If until now whatever you have done is right, but the contacts of the relay are not attracted when the LINE 1 is occupied, then the problem is the optocoupler ISO1. Place it on the pc board and measure the voltage between the pin 6 and the earth when it is in the quiescent state.
Its value must be between 200mV and 400mV. If you lift the headphone its value must be equal to the 2/3 of the Vcc.
If you do not receive the above values then check the U1, the diode D3 and the bridge B1.

LINE 1 is in use and it is interrupted by LINE 2.
Check the right position of R13 through which LINE 2 is blocked while LINE 1 is occupied. If it is placed on the right position check the ISO2.
LINE 2 is in use and it is interrupted by LINE 1. Check the right position of R5 through which LINE 1 is blocked while LINE 2 is occupied. If it is placed on the right position check the ISO2.
LINE 2 is called and in the time between two successive rings the relay starts to open and close very fast.
Check the right position and value of the capacitor C1. If they are right it may be necessary to slightly increase its value.

If everything checks out and your project still fails to work, please contact us for information on our Get-You-Going service.

Electronic 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/1167.htm

For further info please contact us by e-mail:

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