Make Yourself A COMPLETE IC POWER SUPPLY

S.K. Biswas

No test bench is complete without a power supply that will cater for the requirements of various integrated circuits. These requirements are usually of +5V, +15V or ±15V. But often special IC's require other supply levels, even such voltages as +14 and -7V! Thus, the power supply unit must be designed to meet this wide range of supply conditions, while keeping the circuit simple and economical.

This circuit uses commonly available components and provides a wide range of output voltages. It simultaneously can provide a fixed positive as well as a fixed split supply, which may or may not be balanced (as desired). The output is short circuit protected, with the current internally limited to one ampere at each output terminal. It also provides excellent regulation and ripple rejection, being a truly versatile piece of equipment.

Performance

Three output terminals are available which provide three independent voltages with respect to the ground terminal. These voltage levels can again be independently adjusted, although they are marked as +5V, +15V and -15V. The voltage adjustment is done through the corresponding potentiometer, with the voltmeter switched to that output terminal.

The outputs obtainable are:

+5V terminal: Variable from +3V to +6V
+15V terminal: Variable from +5V to +18V
-15 V terminal: Variable from -5V to -18V

The maximum load current at any voltage is internally limited to one ampere, which will be sufficient for most requirements. This protects the circuit over an indefinite duration of short circuit at the output.

The voltage drop from no-load to full-load is about 100 mV, while the output ripple magnitude is about 0.33% at full load.

Circuit

The circuit consists of three small regulated supply modules, which are fed from the same transformer via separate rectifiers and filters. Each supply module is an adjustable voltage regulator built using BEL 723 ICs and external pass transistors. Construction is thus simplified, but the modules must be connected together observing proper polarities.

A simple neon power-on indicator is provided at the input circuit which also is protected by a fuse.

The main transformer has a primary rated at 230V with three separate secondaries rated at 24V, 24V and 12V respectively. The secondary current rating is 1A.

Each of the transformer's secondaries is connected to separate bridge rectifiers D1, D2 and D3 as shown. The rectified outputs are filtered by electrolytic capacitors C1, C2 and C3 respectively. Thus, three isolated DC supplies are obtained, each of which is fed to a regulator. The outputs of these regulators are interconnected, as shown, to obtain the complete power supply.

Each regular module consists of a 723 voltage regulator

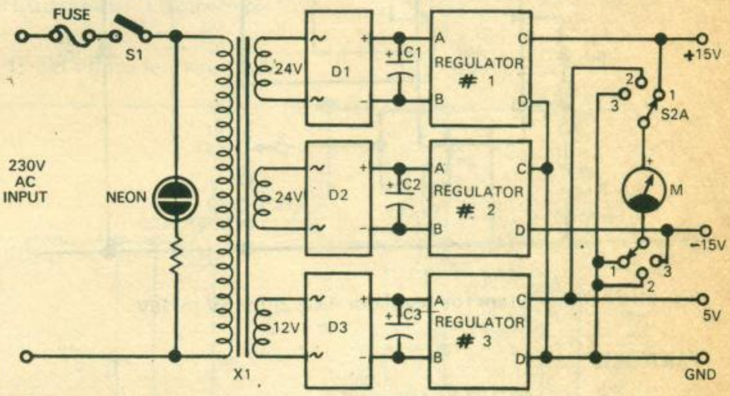


Fig. 1: Block schematic diagram of the IC power supply

IC. Pin 5 of each is connected to the negative terminal of input. The internally generated reference from pin 4 is connected to the non-inverting input (pin 3) of the error amplifier via a potential divider. For regulators 1 and 2, the voltage at pin 3 is fixed, but for regulator 3, this voltage can be varied by the potentiometer R12.

The unregulated supply voltage is fed to pins 7 and 8 of the IC while the regulated output from pin 6 drives the bases of the SL100 transistors (T1, T2, T3). The 2N3055 power transistors (T3, T4, T6) are connected in Darlington configuration so that they can handle the main current flow to circuit load. Thus, the 2N3055 power transistors must be provided with suitable heatsinks. The output current is taken from the power transistor emitter via a short circuit protection resistor Rsc(R5, R6, R14). The emitter side of Rsc is connected to pin 10 of the IC while the load side is connected to pin 1. The voltage drop across the resistor is sensed and when this increases by about 0.65V, the output drive to pin 6 is diverted away internally. Rsc is chosen so that current limit takes place at slightly over one ampere.

To obtain the proper output voltage, a feedback is provided to the inverting input of the error amplifier (pin 2) by sensing the output voltage. In first and second regulators, a fraction of the actual output voltage is fed back from the potential divider, and this fraction can be varied by the potentiometer R7 or R8. In third regulator, the entire output voltage is fed back through resistor R15.

For frequency compensation of the error amplifier, a 2nF capacitor (C4, C5, C8) is connected between pin 9 and pin 2.

Finally, an output capacitor (C6, C7, C9) and a reverse biased diode (D4, D5, D6) are connected at the output of each regulator to prevent oscillatory feedback from the load into the regulator.

The modules are connected as indicated by the terminal identifications. The output voltage adjustment of regulator 1 and 2 (i.e. the voltage adjustment of terminals +15V and -15V respectively) is done by potentiometers R7 and R8 respectively. The adjustment of third regulator (i.e. that of the +5V terminal) is done by potentiometer R12.

A two-pole, three way rotary switch S2 connects a DC voltmeter between each output terminal and ground by rotation. This facilitates easy setting of the output voltages. Positions 1, 2 and 3 correspond to the +15V, +5V and -15V outputs respectively.

Assembly

The bridge rectifiers and filter capacitors may be assembled on an ebonite board. Thick wires should be used for connection. The regulator circuits can be assembled on three separate printed circuit boards, whose common layout is shown (Fig. 4). Since the regulator circuits are nearly the same, only minor adjustments are required while soldering components. For regulators 1 and 2, join together points a, b and c on the PCB. Connect point d to the wiper of R7 (or R8) and point e to one end of it. The other end of R7 (or R8) is connected to R9 (or R10) through point f. For regula-

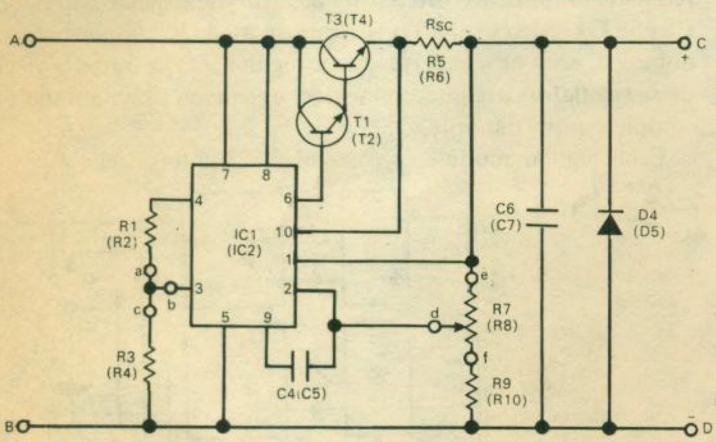


Fig. 2: Circuit diagram for regulator 1 (& 2) for 5V to 18V

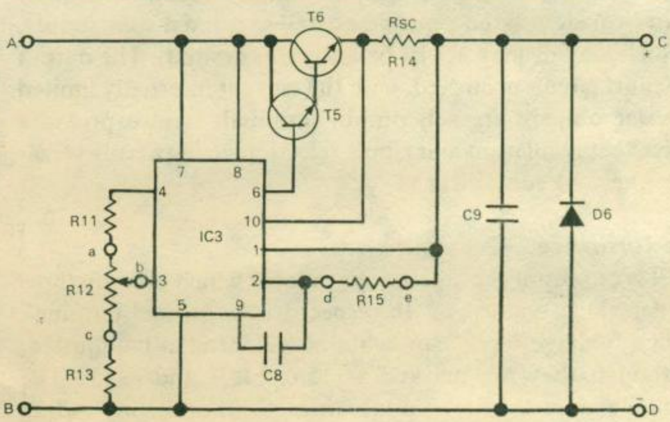


Fig. 3: Circuit diagram for regulator 3 for 3V to 6V

PARTS LIST

D1, D2, D3	—EC1B2 bridge rectifiers
D4, D5, D6	—BY125 or 1N4007 diodes
T1, T2, T5	—SL100 transistors
T3, T4, T6	—2N3055 transistors
IC1, IC2, IC3	—BEL 723 Voltage regulator (metal can package)
S1	—On/off switch
S2	—Two-pole, 3-way rotary switch
Fuse	—500mA fuse
M	—0 to 30V DC voltmeter

Resistors: (All 1/4 W, ±5% unless otherwise stated)

R1, R2	—2.2K-ohm
R3, R4	—4.7K-ohm
R5, R6, R14	—0.56-ohm, 1W
R7, R8	—5K-ohm, 1W wirewound potentiometer
R9, R10	—1.8K-ohm
R11	—270 ohm, 1W
R12	1K-ohm, 1W wirewound potentiometer
R13	—1K-ohm
R15	—180-ohm

Capacitors:

C1, C2	—2200μF, 50V
C3	—2200μF, 25V
C6, C7, C9	—1μF, 30V, non-electrolytic
C4, C5, C8	—2nF

Transformer (X1):

Primary rated at 230V

Three secondaries rated at 24V, 24V and 12V respectively, with current rating of 1A each.

Winding details:

Primary:	920 turns of 26 SWG enamelled copper wire
Secondaries:	(a) 100 turns of 21 SWG enamelled copper wire
	(b) 100 turns of 21 SWG enamelled copper wire
	(c) 50 turns of 21 SWG enamelled copper wire
Core:	GKW size 33, CRGO
	Stack height: 1.4"

Miscellaneous:

Output terminal posts, knobs, power transistor heatsinks and neon indicator for 230V.

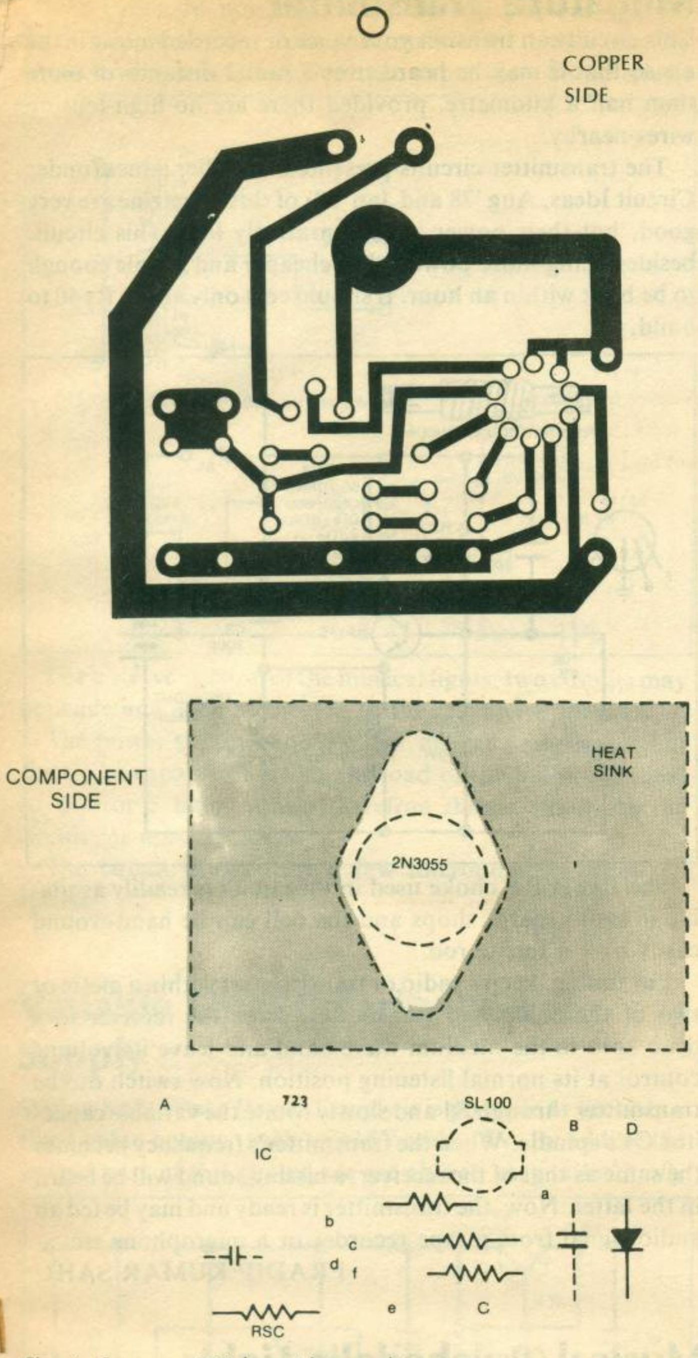


Fig. 4: Common PCB layout for regulators

tor 3, connect point a to one end of R12, point b to its wiper and point c to the other end. Also connect R15 between points d and e.

Place everything inside a suitable box with the fuse and power transistors (mounted on their heatsinks) at the rear exterior of the box. Place the output terminals on the front panel with the corresponding adjusting potentiometer shaft above the terminal post. Also place the voltmeter, its selection switch, power switch and power-on indicator on the front panel. Provide ventilation for the box.

circuit ideas

Electrocardiograph Using an Oscilloscope and a Camera

An electrocardiograph, though a very costly medical instrument, is of immense use nowadyas. The body potentials to be measured by this instrument being too feeble, are normally amplified for being recorded. To do so, voltage picked up by the electrodes from the subject is amplified by the amplifier shown in Fig. 1 and displayed on an oscilloscope. The set-up is shown in Fig. 2.

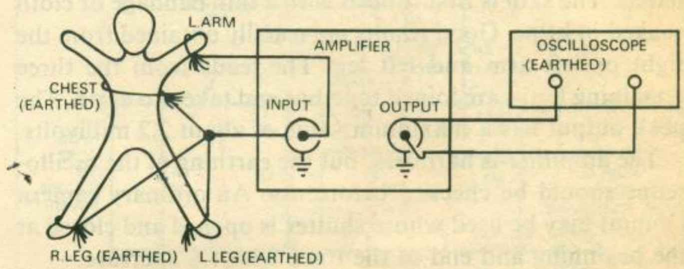


Fig. 1: Set up for left wrist study.

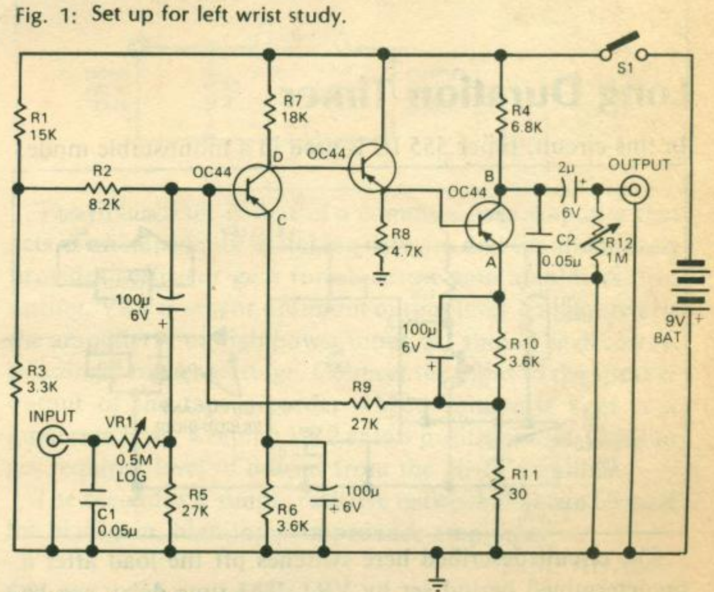


Fig. 2: ECG amplifier circuit.

The amplifier is constructed in a small box with coaxial sockets for input and output. The components are not very critical, but R1 and R4 are so adjusted as to give a potential difference of 3.5 to 4 volts between points A and B, and about 0.5 volt between points C and D.

For minimum noise output, R1, R2, R3 and VR1 should be high-stability resistors. With VR1 set to zero, an input of 100 microvolts and 0.2 microamperes gives 1-volt output.

The frequency response is from 5 to over 50 KHz and the noise output is about 5 millivolts, equivalent to 0.5 microvolt at the input.

For better results, VR1 should consist of switched high-stability resistors of values 470, 47, 4.7K and zero to give voltage gains of 10, 100, 1000 and 10000; a 0.5-megohm logarithmic volume control may be more convenient, but this gives slightly more noise. The current consumption is less than 2 milliamps.

The time base of the oscilloscope is set to give a sweep of about 1.5 to 3 seconds. The timing capacitor's value can be increased, if necessary. Sometimes, a large output may be caused by the electrode leads picking up stray and spurious high frequencies. This can be removed, however, by adding C1 and C2, each of 0.05 μF, which reduce the frequency response to about 200 Hz on the lower end.

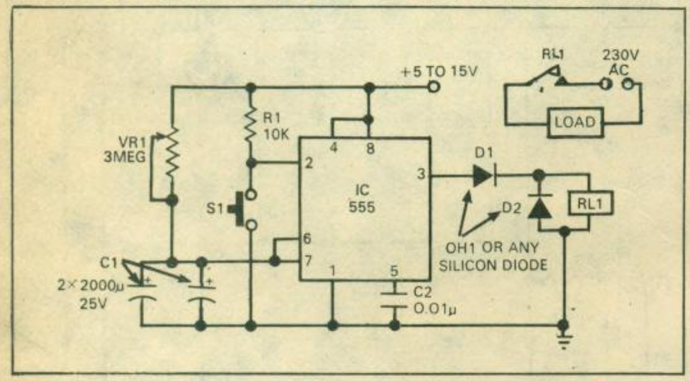
The electrodes may be strips of brass foil about 3.75cm wide held in place round the wrists and ankles by elastic bands. The skin is first rubbed with a thin bandage or cloth soaked in brine. Good results are usually obtained from the right or left arm and left leg. The leads from the three remaining limbs are joined together and taken to earth. The peak output has a maximum value of about 2.2 millivolts.

The amplifier is harmless, but the earthing of the oscilloscope should be checked before use. An ordinary camera (35mm) may be used whose shutter is opened and closed at the beginning and end of the trace with f 8 aperture.

Dr SAMIR KUMAR GHOSH

Long Duration Timer

In this circuit, timer 555 IC is used in a monostable mode.



The circuit described here switches off the load after a predetermined period set by VR1. The time delay can be varied from a few seconds to an hour. The relay is held closed for a time given by 1.1 times the product of VR1's in-circuit portion and C1, and then released.

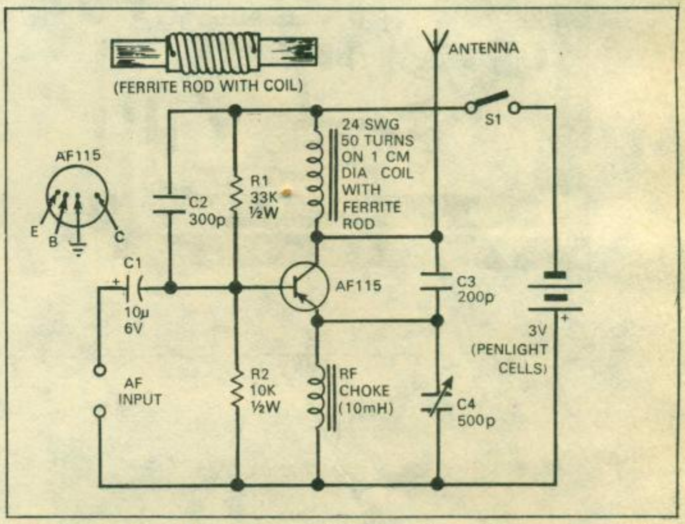
DC type of relay with working voltage ranging from +5V to +12V and operating current less than 200mA is used here. The time period is fairly independent of the supply voltage.

M. KATHIRESAN

Miniature Transmitter

This circuit can transmit your voice or recorded music in the air so that it may be heard over a radial distance of more than half a kilometre, provided there are no high-tension wires nearby.

The transmitter circuits presented in earlier issues (under Circuit Ideas, Aug '78 and Jan '79) of this magazine are very good, but their power is comparatively low. This circuit, besides being more powerful, is cheaper and simple enough to be built within an hour. It should cost only about Rs 40 to build.



The 10mH RF choke used in the circuit is readily available in radio spares shops and the coil can be hand-wound easily over a ferrite rod.

For tuning, keep a radio or transistor set within a metre or two of the completed transmitter. Tune the receiver to a dead spot in the medium-wave band and leave its volume control at its normal listening position. Now switch on the transmitter through S1 and slowly rotate the variable capacitor C4's spindle. When the transmitter's frequency becomes the same as that of the receiver, a hissing sound will be heard in the latter. Now, the transmitter is ready and may be fed an audio signal from a tape recorder or a microphone etc.

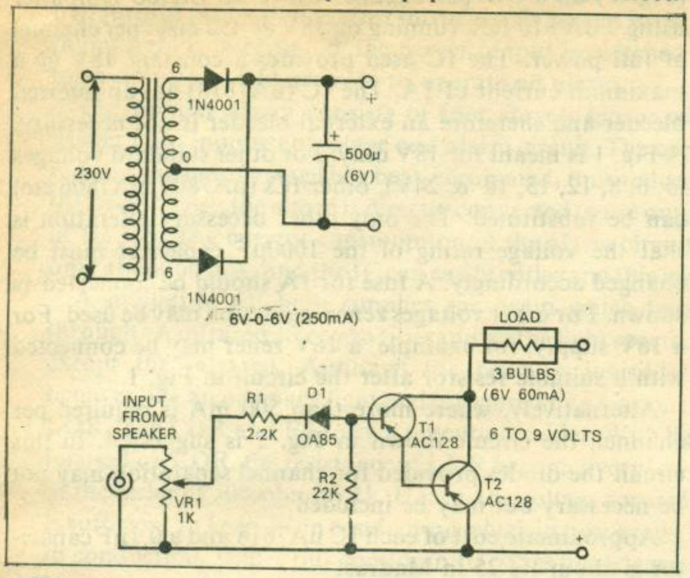
PRADIP KUMAR SAHU

Musical/Psychedelic Lights

This is a very simple and inexpensive circuit employing a darlington pair of transistors. The transistors are common type, and any pnp (AC128/2SB77/2N3020) transistors can be substituted.

The input to the circuit is taken directly from the speaker of the amplifier. The 1k preset (VR1) is set for the best flashing effect at desired volume. Up to three bulbs (6V/60mA) can be used with an AC128 mounted on a heatsink for T2. For more lights, a power transistor (PT6) may be substituted for T2.

The lights do not just switch on and off, but vary in brightness in unison with the music. The bulbs may be covered with coloured cellophane paper for a better effect.



For a stereo version of the musical lights, two circuits may be made and each connected to the respective speaker.

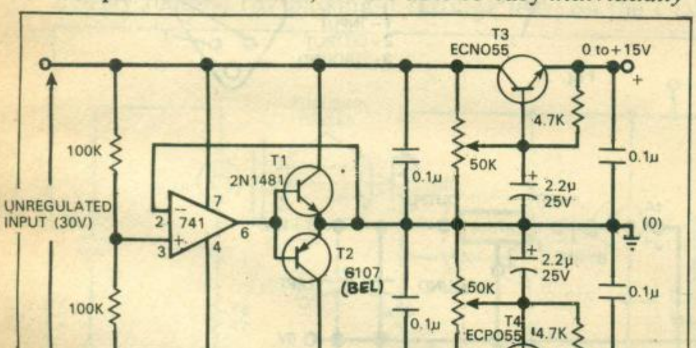
The power supply should either deliver 6 or 9 volts, but should be capable of taking the load of the bulbs. An ideal supply for 3 bulbs is also therefore shown alongwith the circuit for musical lights.

The circuit draws only a few microamperes from the speaker.

VIVEK MEHRA

Variable Dual Polarity Power Supply

With a Split Phase Power Supply it is possible to get only a fixed-value output, such as +15V and −15V. By adding the second part of this circuit, we are able to vary *individually*



both the positive as well as negative voltages. For simultaneous variation of the negative and positive voltages, the two 50k potentiometers may be ganged.

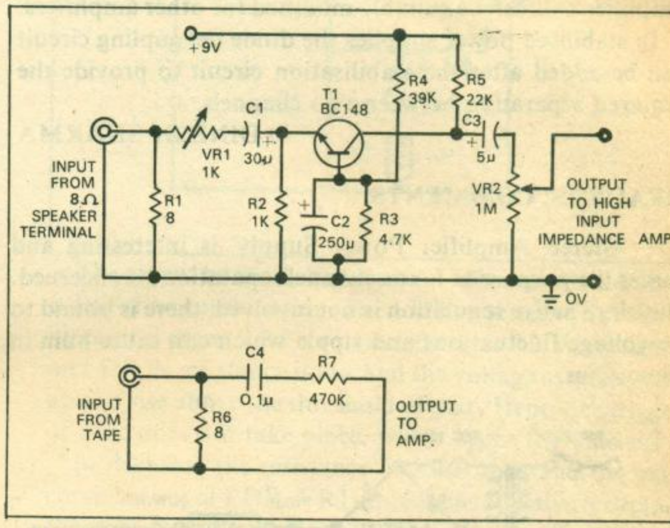
Transistors T3 and T4 act as emitter followers and ensure a low impedance of the power supply.

This power supply should prove useful for some op-amp circuits (such as '710') that require voltages like +12V and −6V.

R. RAGHUNATHAN

Matching 8-ohm Speaker Output to a High (Input) Impedance Amp

As output of an ordinary mono cassette tape recorder is usually meant for an 8-ohm speaker, its recording cannot be heard easily through a Hi-Fi amplifier that usually has a very high input impedance of the order of hundreds of kilo-ohms. So, for coupling them together, a matching network is necessary. Two circuits are given here for this purpose.



The first circuit is that of a common-base amplifier that acts as an impedance matching network and simultaneously provides sufficient gain for moderate gain amplifiers. For setting, VR1 is set for optimum output level, as required by the amplifier. For high power input, R1 should be of correspondingly higher wattage. Connect the input to the speaker output of the tape recorder whose volume is kept at a moderate level. Keeping VR2 at low position, adjust VR1 to get required level of output from the Hi-Fi amplifier.

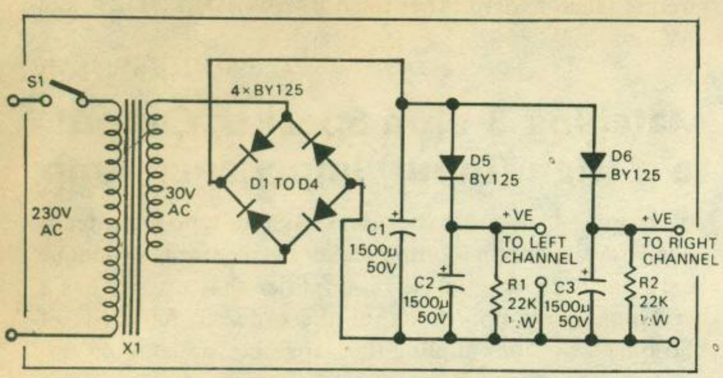
The second is a simple resistive network that can be used for high-gain, high input impedance amplifiers.

K.M. ANAND

Stereo Amplifier Power Supply

Generally power supplies in stereo amplifiers consist of a single transformer, bridge rectifier, filter and stabiliser circuits etc. Both the channels of the amplifier are provided power from a single point of the power supply. In the suggested circuit a method is given by which some separation can be arranged instead of the usual common point power supply for two channels of the stereo.

Diode decoupling is used in the power supply for this purpose. It provides about 80 dB of separation between the two stereo amplifier channels.



The power supply given is designed for a 10 watts power amplifier and can be suitably modified for other amplifiers.

In stabilised power supplies the diode decoupling circuit can be added after the stabilisation circuit to provide the required separation between two channels.

DINESH SHARMA

READERS' COMMENTS:

'Stereo Amplifier Power Supply' is interesting and serves the purpose as far as channel separation is concerned. But since active regulation is not involved, there is bound to be voltage fluctuations and ripple which can cause hum in the output.

I have included an IC and a capacitor to provide precise, stable and ripple-free output. The IC is also provided with thermal and shortcircuit protection. I have tried this circuit (Fig. 1) on a 6W per channel Universal Stereo Amplifier using TBA 810 ICs, running on 18V @ 450 mA per channel at full power. The IC used provides a constant 18V @ a maximum current of 1A. The IC (µA7818) has an internal bleeder and therefore an external bleeder is not necessary.

Fig. 1 is meant for 18V only. For other standard voltages (5, 6, 8, 12, 15, 18 & 24V), other ICs (µA7805, µA7806 etc) can be substituted. The only other necessary alteration is that the voltage rating of the 1000µF capacitor must be changed accordingly. A fuse for 1A should be connected as shown. For other voltages zener regulation may be used. For a 16V supply, for example, a 16V zener may be connected with a suitable resistor after the circuit in Fig. 1.

Alternatively, where more than 500 mA is required per channel, the circuit shown in Fig. 2 is suggested. In this circuit the diodes provided for channel separation may not be necessary but may be included.

Approximate cost of each IC µA7818 and a 0.1µF capacitor is about Rs 25 in Madras.

Equivalents µA7805, µA7806 etc are directly interchangeable with LM340-05, LM340-06 etc. (It must however be noted that the LM340 series costs about Rs 40 each in Madras for the same performance.)

The ICs must be mounted on suitable heatsinks equivalent to about 100 sq. cm of aluminium. Alternatively, they can be mounted directly on the metal chassis.

VIJAY ANAND ISMAVEL
Madras

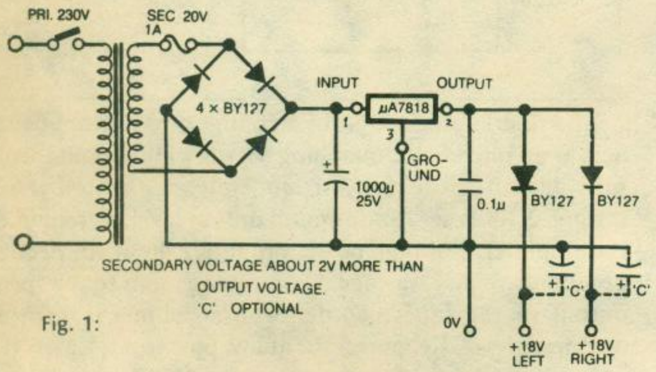


Fig. 1:

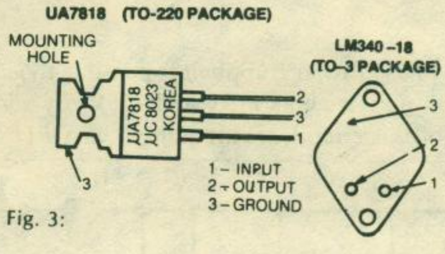


Fig. 3:

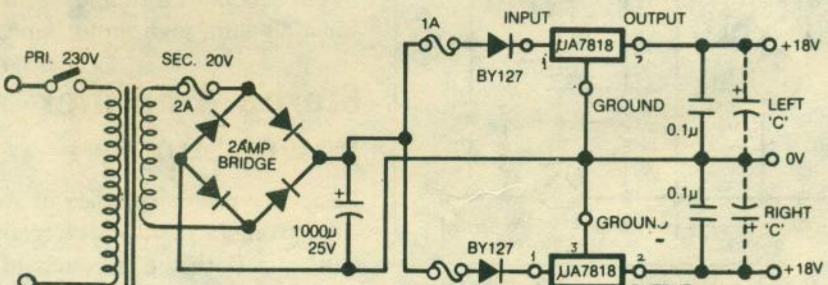


Fig. 2:

Infra-red Burglar Alarm

This burglar alarm design provides an inexpensive yet effective formof protection against intruders. When an invisible ray of light is interrupted, the power output is switched on for a duration of 55 seconds to operate an alarm.

The burglar alarm consists of four stages: sensor unit, trigger unit, monostable stage and alarm circuit. The use of relay in the output stage has been eliminated, thus reducing the overall cost; the alarm is directly connected to the output of IC 555. The current consumption of the alarm circuit is only about 60 mA, and the IC can easily withstand this load.

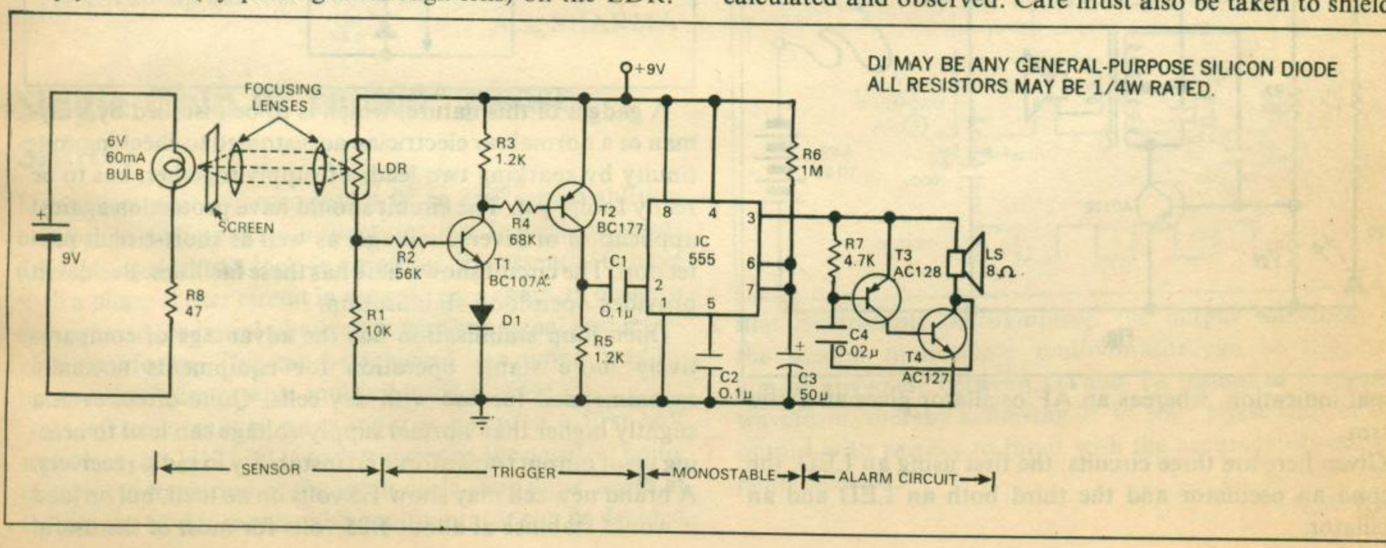
A miniature 6V bulb supplies the beam which passes through an infrared screen to filter out all the light spectrum except the infrared. Although the beam is invisible, it behaves like an ordinary light and is focused by a lens on the LDR. The LDR and R1 form a potential divider. With light focused on LDR, the resistance of LDR becomes very low—of the order of 500-ohm to 1k. Hence, the voltage across R1 is sufficient to keep T1 in conduction which in turn keeps T2 in conduction. Under this condition IC 555 is not triggered. The output of the monostable stage is low and alarm is unable to operate.

When the beam is interrupted momentarily, the resistance of LDR suddenly rises to 1-megohm. Now the voltage across R1 is insufficient to keep T1 in conduction, and hence T1 and T2 are cut off. Thus the collector of T2 is momentarily grounded, and the monostable stage gets triggered giving a high output at pin No. 3 which lets off the alarm giving a shrill whistle like sound.

The duration of the alarm can be varied by changing C3 to suit one's need. The alarm circuit is basically an oscillator with directly coupled transistors.

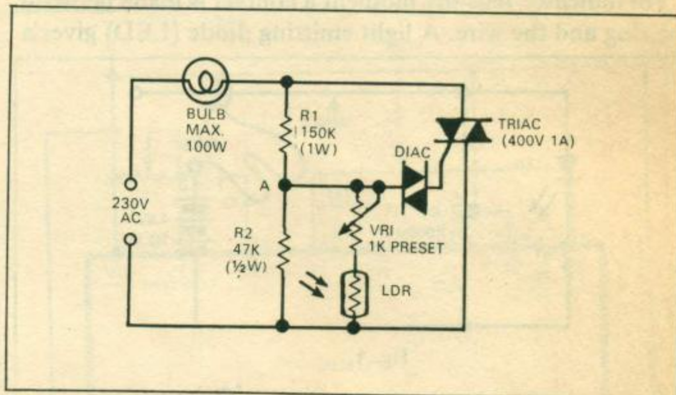
The infra-red burglar alarm is housed in two units, as shown. A bulb with a separate battery is one unit and the remaining circuit assembled on a PCB is another unit. The two units are so adjusted that the beam from the bulb is sharply focused (by passing it through lens) on the LDR. The infra-red source is obtained by passing the light through infra-red gelatine sheet which can be obtained from a photographic dealer. A dark coloured polystyrene sheet can also be used. Care must be taken that the surrounding light does not fall on the LDR.

ISRANI ASHOK



Low-cost Twilight Switch

Using a triac, a diac and a light dependent resistor a twilight switch can be made for about Rs 50 only. As this circuit does not require a relay or a transformer, it can be housed in a very small box.



The circuit basically consists of a potential divider feeding a diac-triac combination. The LDR in series with a sensitivity control preset VR1 is connected across R2. When light falls on LDR its resistance is low and the voltage at point A is not able to rise above the threshold of diac. Hence the triggering of triac does not take place, which keeps the bulb off.

In darkness the resistance of LDR rises and the parallel combination of LDR, VR1 and R2 has effective resistance of R2 only; the voltage at point A now increases sufficiently to trigger the triac.

Values for R1 and R2 are not very critical and depend on the sensitivity of LDR, but the ratings of resistors must be calculated and observed. Care must also be taken to shield the LDR from receiving the light of the bulb, otherwise positive feedback would cause flicker. No RF interference was detected with this circuit by a radio receiver, and hence the usual RFI filter was not found necessary.

NAVEEN MANDHANA

Steady-hand Testing Circuits

A hand steadiness tester provides hours of fun and is a good project for a beginner. To play the game one is required to pass a metallic ring over a wire without touching it. Bends on the wire put one's skill really to test.

An indicator tells the moment a contact is made between the ring and the wire. A light emitting diode (LED) gives a visual indication, whereas an AF oscillator gives an audio alarm.

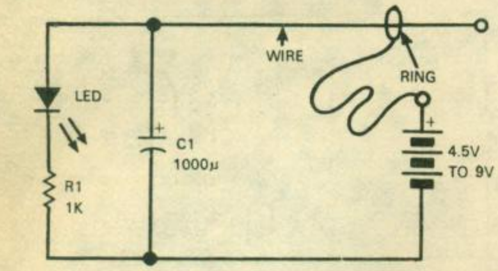


Fig. 1

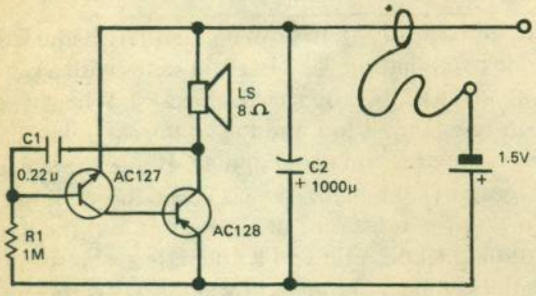


Fig. 2

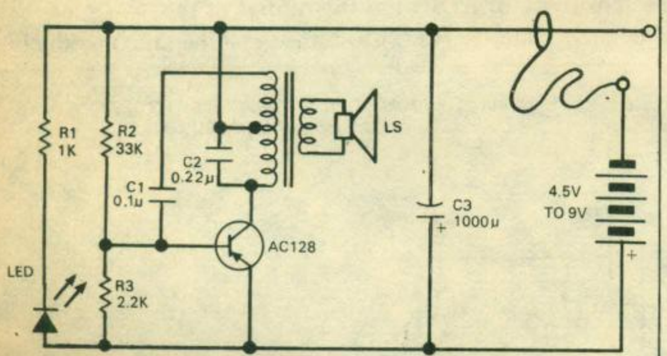


Fig. 3

Given here are three circuits: the first using an LED, the second an oscillator and the third both an LED and an oscillator.

When ring touches the wire in first circuit, the LED is lit up. The LED keeps glowing for some time even after the ring has been removed from the wire, because of charge on C1. The time can be varied by changing the value of C1. The battery voltage may be anything from 4.5 to 9V.

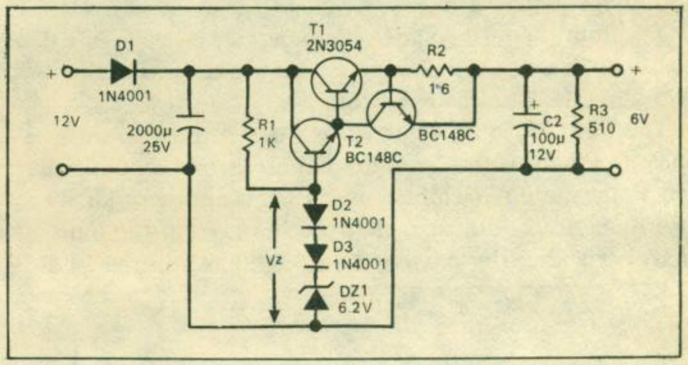
In the second circuit when the ring makes a contact with the wire the capacitor C2 charges up and a 'buzz' sound is heard from the loudspeaker. The relaxation oscillator's frequency can be varied by changing the value of C1 and R1. The time for which the alarm is heard after removing the ring from the wire depends on the value of C2. For C2 2000μF or 1000μF capacitors may be used. Their value can, however, be changed, if desired.

In the third circuit also, the 1000μF capacitor gets charged when the ring touches the wire, as in previous circuits. But, here, it discharges through the LED and oscillator. The value of C3 can be changed to vary the time for which indication is required after removing the contact between the ring and the wire. A miniature transformer like the one used in a pocket radio can be used.

SREEKUMAR J.

6-Volt Supply from Car Battery

During the last two years, quite a few circuits for obtaining 6 volts off a 12V car battery supply have appeared in EFY. Some of these recommended the use of voltage stabiliser ICs.



A gadget of this nature, which is to be installed by a layman or a normal car electrician accustomed to checking continuity by sparking two leads of supply together, has to be really foolproof. The circuit should have protection against application of reverse voltage, as well as short-circuit protection. The circuit shown here has these facilities. Besides, it provides open-loop stabilisation.

Open loop stabilisation has the advantage of comparatively more stable operation for equipments normally recommended for use with dry cells. Quite often, even a slightly higher than normal supply voltage can lead to heating up of output transistors and instability in radio receivers. A brand new cell may show 1.5 volts on no load, but on load it would stabilise at about 1.25 volts for most of the useful period of its life. The equipment is therefore designed for optimum operation at this lower level of supply.

The circuit uses 1N4001, a 1-amp., 50 PIV diode at the input. This diode prevents application of voltage to the circuit in case the supply terminals are reversed.

Reference voltage V_Z is obtained by using a zener with a couple of diodes, such as 1N4001, connected for forward conduction.

To obtain around 6 volts at the output, V_Z should be 1.2 volts above 6V, considering the base-emitter drops (0.6V each) in two-transistor darlington combination to provide for the drop in voltage. 6.2V zeners are readily available; additional 1.2 volts are provided by forward-biased power diodes in series with the zener. A 1k resistor in series with zener ensures adequate current through the zener.

The circuit has been designed to provide around 250mA at 6V. This can mean over 2 watts dissipation in the 2N3054 medium-power series transistor—ensuring reliable operation without the need of a large heatsink. (A 40mm piece of 25mm aluminium 'U' channel would suffice as heatsink.) Use of BC148 as driver ensures that only a small current need be drawn through the zener.

To limit the output current under short-circuit conditions, the current at the output is monitored by series resistor R2. Transistor T3 would go into conduction, thereby depriving T1 of drive current the moment drop across the resistor exceeds 0.6 volts—the forward bias required by silicon transistors between base and emitter for operation. Three low-wattage resistors (each 4.7-ohms) may be connected in parallel for 1.6-ohm value for R2.

A 2000µF, 25V electrolytic capacitor (C1) has been used at the input after the series diode. A 100µF, 12V capacitor (C2) along with a 510-ohm bleeder (R3) has been connected at the output. Along with the internal capacitor of the equipment to be used, these should provide adequate decoupling for the circuit.

The circuit should cost around Rs 30 only.

A.S. SHARMA

Single Chip 0° to 360° phase Shifter

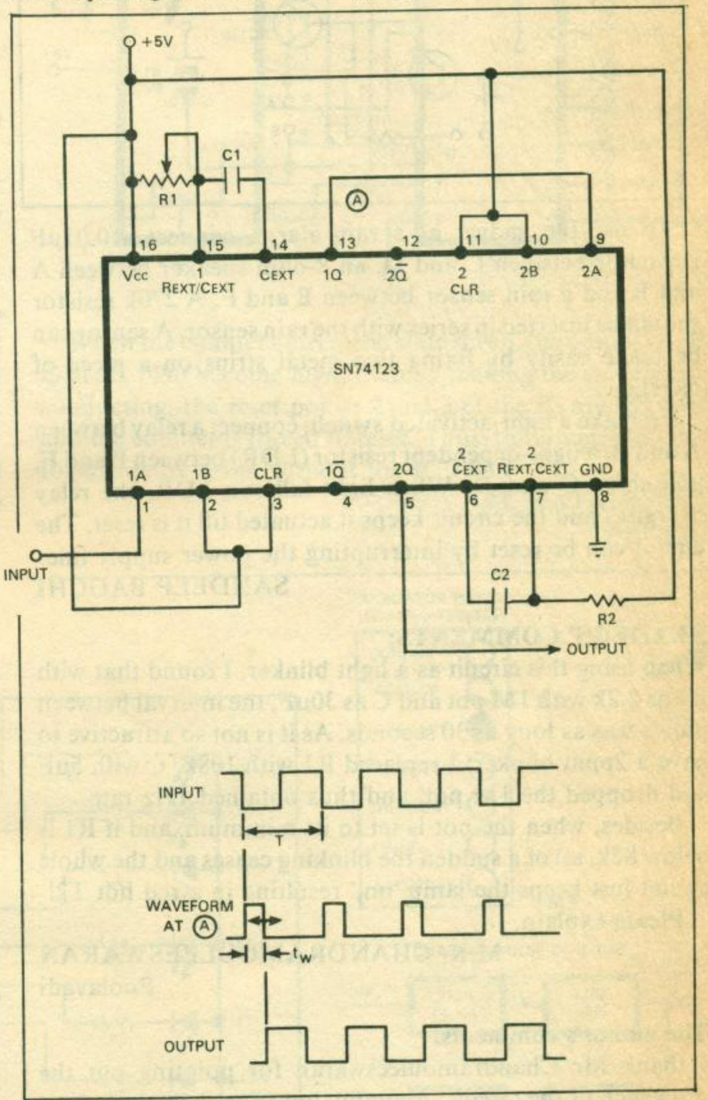
Many electronic systems need a 0° to 360° phase shifting network to achieve certain functions, e.g. in a synchronous detection system of a lock-in amplifier, it is essential to have such a phase shifter circuit in the reference chain, in order to compensate for initial phase shift between signal and reference waveforms. This can be achieved in a simple way by using a dual monostable multivibrator IC (74123).

A reference square wave input is given to a first half section of the 74123 IC, which triggers on the negative going or '1' to '0' transition of the input cycle. The pulse width at the output of this monostable multivibrator can be decided by the formula

$$t_w = K\, R1\, C1\, \left(1 + \frac{0.7}{R1}\right)$$

where R1 is in kilohms, C1 is in pF, t_w is in ns and K = 0.28 for 74123.

With the help of a potentiometer in place of R1, t_w can be varied right from a few microseconds to almost the full period of the input cycle, T. The output of the first section of 74123 triggers the other section again on the trailing edge, whose output pulse width can be made equal to T/2 by choosing proper combination of R2 and C2 for a symmetrical output signal. Thus, by varying the pulse width t_w of the



first monostable multivibrator, the output waveform of the second monostable multivibrator can be triggered almost anywhere between O_{th} and T_{th} instant of the input waveform, thereby achieving 0° to 360° phase shift at the output with respect to input with the accuracy of components selected.

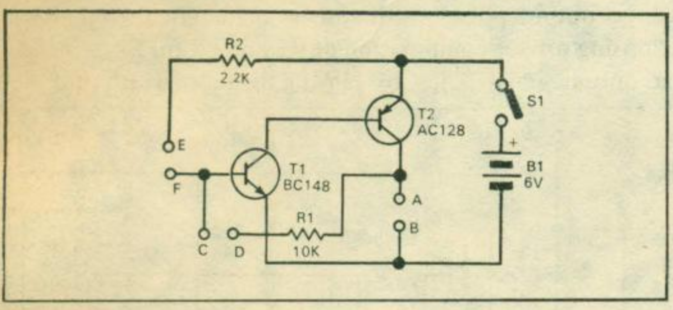
N.S. JOG

Multi Purpose Circuit

Here is a simple circuit that can be put to various uses, such as a light blinker, a rain alarm or a light-activated switch.

Transistors T1 and T2 form a complementary-pair direct coupled amplifier. Regeneration is provided through R1 and a capacitor connected between points C and D.

To use the circuit as a light blinker, connect a 30μF capacitor between C and D, a 6V, 300mA lamp between A and B and a 1-megohm potentiometer between E and F. The blinking rate can be varied by adjusting potentiometer.



To use the gadget as a rain alarm, connect a 0.01μF capacitor between C and D, an 8-ohm speaker between A and B and a rain sensor between E and F. A 270k resistor should be inserted in series with the rain sensor. A sensor can be made easily by fixing two metal strips on a piece of bakelite.

To make a light-activated switch, connect a relay between A and B, a light-dependent resistor (LDR) between E and F, and short C and D. When light falls on LDR, the relay energises and the circuit keeps it actuated till it is reset. The circuit can be reset by interrupting the power supply line.

SANDEEP BAGCHI

READERS' COMMENTS:

When using this circuit as a light blinker, I found that with R1 as 2.2k with 1M pot and C as 30μF, the interval between pulses was as long as 30 seconds. As it is not so attractive to have a 2ppm blinker, I replaced R1 with 108k, C with 5μF and dropped the 1M pot, and thus obtained 1Hz rate.

Besides, when the pot is set to its minimum, and if R1 is below 82k, all of a sudden the blinking ceases and the whole circuit just keeps the lamp 'on,' resulting in a red hot T2! Please explain.

M.K. CHANDRAMOULEESWARAN
Poolavadi

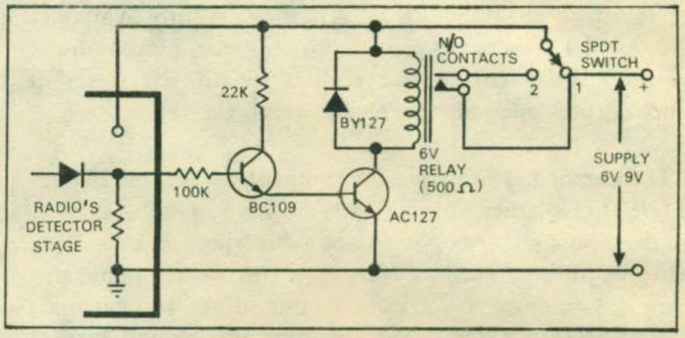
The author's comments:

I thank Mr Chandramouleeswaran for pointing out the drawback of the circuit. Actually, lowering the value of the resistance too much between E and F results in excessive biasing to T1 which in turn causes excessive drive to T2, resulting in heating of T2 and stopping of the blinking action. The 1-megohm potentiometer should be connected in series with a 150-kilohm resistor in order to prevent too much lowering of resistance in circuit.

Automatic Switch-off for Radio

For most stations in medium-wave and powerful stations in shortwave, a radio can automatically be switched off after the station goes off the air.

Put SPDT switch in position '1' so that the radio may get supply directly. After a station is tuned, the relay gets activated, making its N/O contacts to close. Then throw the SPDT switch to position '2' so that the supply is provided through contacts of the relay. When the station goes off the air, it deenergises the relay and breaks the supply.



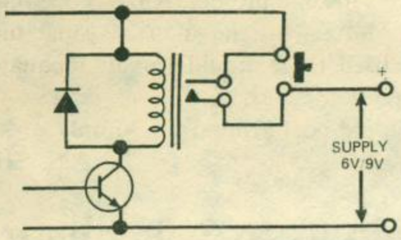
For positive-ground radios use all pnp transistor equivalents and reverse the diode connection across the relay. Relay-operating voltage should match the supply voltage.

U.C. PATNAIK

READERS' COMMENTS:

After a station is tuned, the relay gets activated, making 'N/O' contacts to close. When the SPDT switch is thrown to position '2,' its supply gets interrupted momentarily and causes the relay to release.

To overcome this defect, I suggest the following circuit:



A SPST non-locking switch (push-to-on) may be used, and it should be kept operated till the relay holds on its own contact.

M. VIJAYANAND
Guntur

The author's comments:

I had tried the circuit where the radio had a built-in 1000μF capacitor across the supply that in fact maintained the current to the set during that small interruption of supply while SPDT was undergoing a change and thereby was holding the relay. The effect was further supported by the type of relay I had used, which had a very high ratio of relay supply voltage to relay dropout voltage. However, in general, the problem pointed out is right and solution to that as suggested by Mr M. Vijayanand is perfectly correct.

Alternatively, however, a capacitor connected across the relay coil (in place of the diode) can also provide a short delay, the time period of which can be governed by the formula $T = 2.303\ R_rC \log_{10} E_S/E_D$, where T is time in seconds, R_r is relay resistance in megohm, C is capacitance in µF, E_S is supply voltage, and E_D is dropout voltage of the relay. And since the ratio of E_S/E_D for low-power relay is approximately three, the simplified formula becomes $T = R_rC$. A few seconds' delay can thus be obtained with a capacitance of 250µF to 500µF.

Day Indicator for Digital Clocks

Addition of a day-indicator enhances the appeal of a digital electronic clock enormously.

The circuit operates from an input of 1 pulse-per-day (ppd) applied at its input terminal A. This 1 ppd is divided by 7 with the help of IC1 (7490 connected in divide-by-seven mode). The BCD outputs from IC1 are in turn fed to IC2 (7442-BCD to decimal converter) where zero-level outputs (1 to 7) are used to indicate the day. Any LED connected between one of the seven outputs and the +5V rail will glow when that output becomes 'zero'. The eighth output (pin 9) is inverted by 1/4 IC7400 and then used to reset IC1.

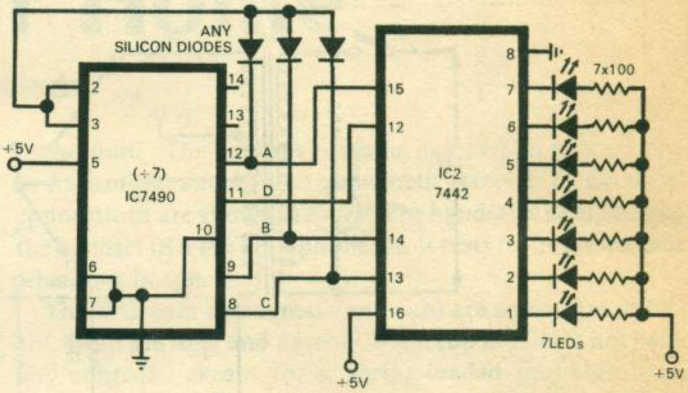
1 ppd may be obtained by either using the AM/PM output of the clock, or by using the 50Hz source or the crystal timebase with suitable chain of dividers.

For initial setting up, a 1 pps input can be applied to input terminal B through a push-to-on switch. This could be obtained either from the 'blinking colons" output of the clock or from the circuit of Fig. 3. Please note that all the ICs are TTL type and operate on 5 volts.

SUBHAS SARKAR

READERS' COMMENTS

You can save IC 7400 by wiring IC 7490 as divide-by-seven counter.



When the counter detects the state seven, the outputs A, B, C of IC 7490 become high, thereby making the diodes non-conducting; the reset points 2 and 3 of the IC are left open and the counter is forced to reset. Thus, the counter is wired for divide-by-seven without the IC 7400.

M. KATHIRESAN
Tirunagar

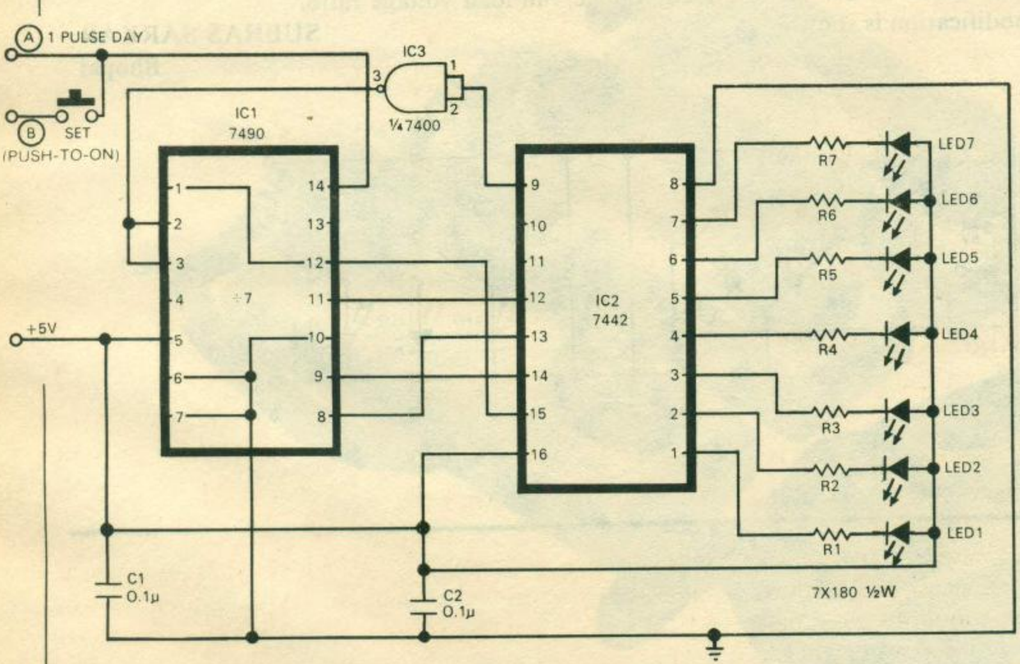


Fig. 1

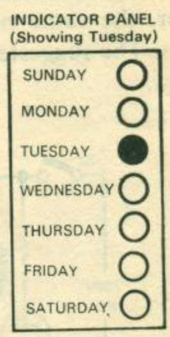


Fig. 2

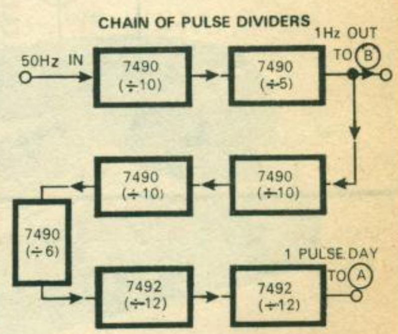


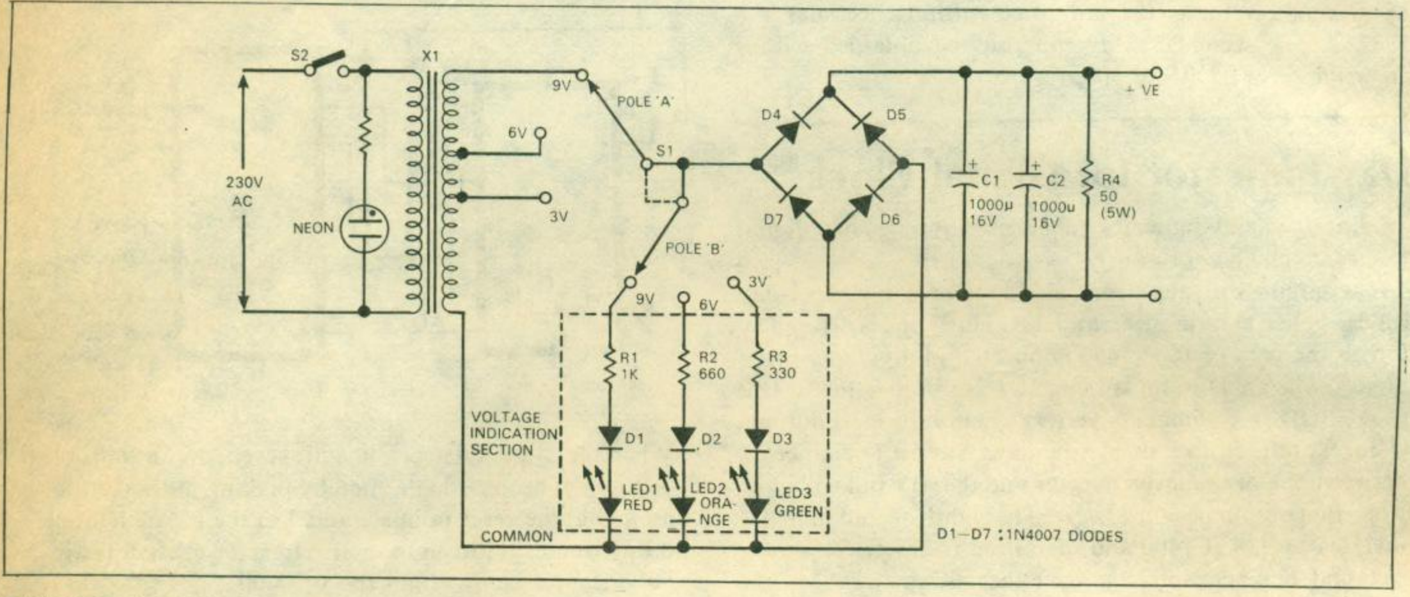
Fig. 3

Battery Eliminator With LED Indicators

The working principle of this circuit is the same as that of an ordinary battery eliminator, except for the addition of the voltage indication circuit which comprises LEDs, ordinary diodes and a few resistors.

The mains voltage is first stepped-down by transformer X1 that has three different voltage (3, 6 & 9V) tappings and a common terminal on the secondary side. When pole 'A' of the switch S1 is brought in contact with the 9V transformer tapping, its ganged pole 'B' automatically gets connected with the 9V LED voltage indicator. So the current flows through that particular LED and the LED starts glowing. Most of the current is, however, diverted to the load after proper rectification and filteration. Similarly, for 3V and 6V outputs, the corresponding LEDs glow.

SANJAY GHOSH



READERS' COMMENTS:

For indication, each LED is fed through one diode, i.e. there are totally three diodes (D1, D2 and D3) which feed DC to the LEDs. However, the same purpose could be served without these diodes. The suggested modification is shown in the diagram below:

Also, the value of the bleeder resistance R4 appears to me quite low. A value between 200- to 500-ohm would lead to less bleeding current, at the same time providing a good no-load voltage/full-load voltage ratio.

SUBHAS SARKAR
Bhopal