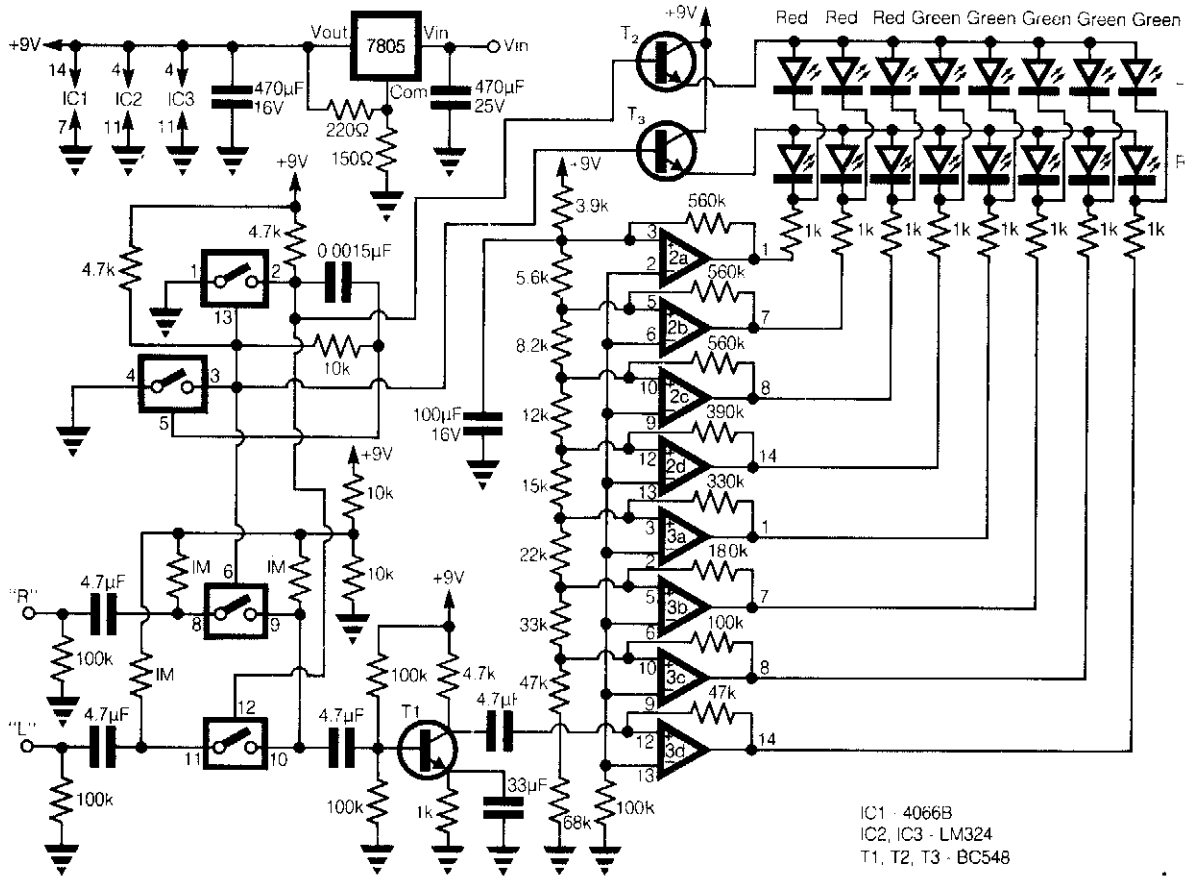
37

Indicators

The sources of the following circuits are contained in the Sources section, which begins on page 667. The figure number in the box of each circuit correlates to the entry in the Sources section.

Stereo LED VU Meter
Audio Amplifier Volume Indicator
Transistorized Bar-Graph Driver
Visual CW Offset Indicator
ac-Circuit LED Power Indicator
ac/dc Indicator
Balance Indicator
Mains Failure Indicator
On Indicator
Sound Sensor
Transmitter Output Indicator

STEREO LED VU METER



ELECTRONIC ENGINEERING

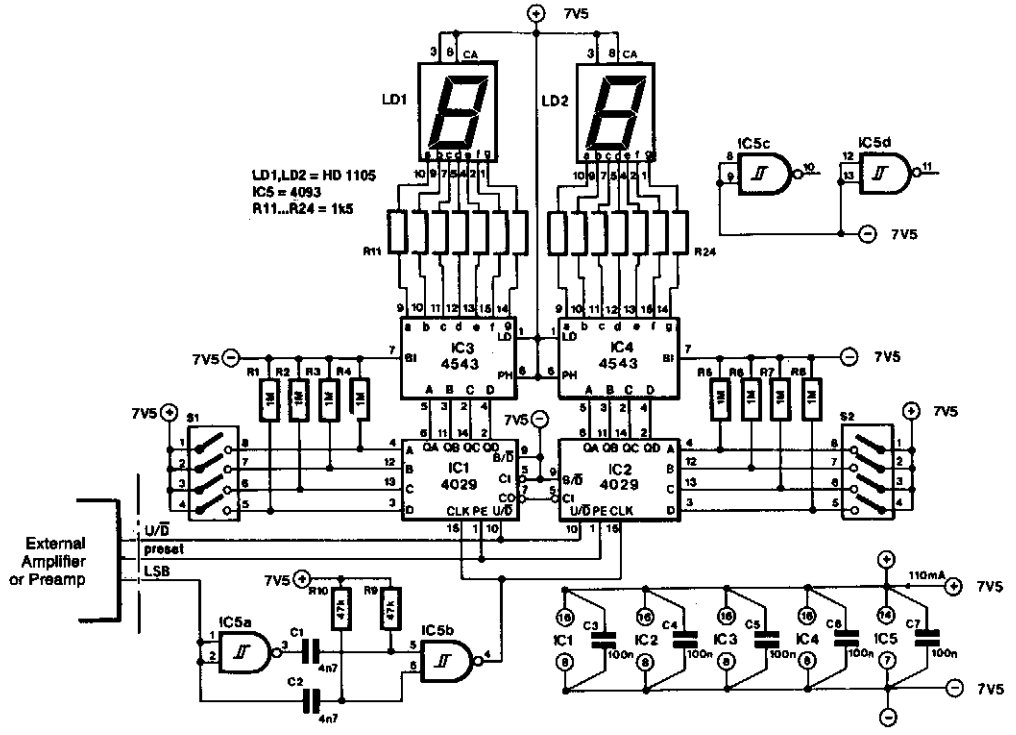
Fig. 37-1

This circuit provides a cheap alternative to the LM3915 series LED displays. The meter relies on a square-wave oscillator built around two CMOS analog switches, which alternatively selects the right and left channels for monitoring and display. The selected signal is amplified by the common-emitter stage T1, and the output is fed into the string comparators which control the display.

These eight comparators are from two LM324 quad op amps, each is connected to a resistor network, which has a 3dB step between each comparator. Each comparator has a positive feedback resistor to increase the hysteresis to provide a longer display, which is switched alternatively at about 10 kHz.

The two CMOS switches in line are biased at half the supply voltage by 1-MΩ resistors from a 100-kΩ divider, which allows them to handle analog signals up to 9 V peak to peak. As the voltage increases above the setpoint of each comparator, the output goes low and the corresponding LED lights, which produces a bar of light in response to the input voltage. For a linear response the resistor-network can be replaced by nine 10-kΩ resistors, giving an equal voltage gap before each LED comes on.

AUDIO AMPLIFIER VOLUME INDICATOR



ELEKTOR ELECTRONICS

Fig. 37-2

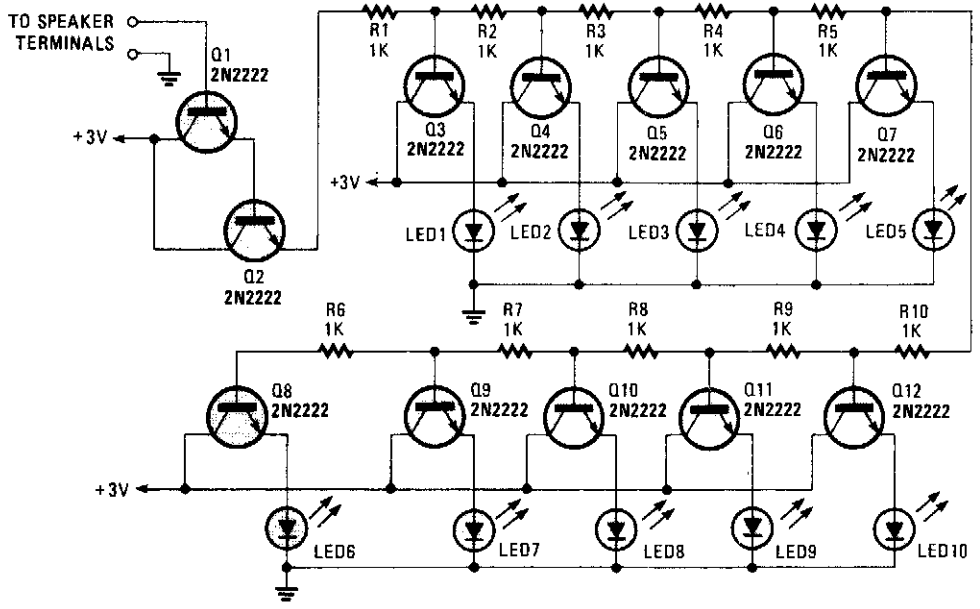
The indicator is intended for use with an audio amplifier or preamplifier, but it can also be used in other applications where a number of steps or changes must be counted rapidly. To prevent interference with the audio signal, the circuit is a static design. Thus, if the volume control is not adjusted, the circuit does nothing.

The circuit does not need an external clock signal, because this is derived from any changes in the least significant bit (LSB). This is done by two differentiating networks: R9/C1 and R10/C2, which double the frequency of an available LSB signal.

Moreover, to ensure that the counters of the indicator remain in step with the volume control, signals "up/down" and "preset" from the preamplifier are used. It might seem rather extravagant to couple the state of the counters in the preamplifier with that of the present counters, but it is a good way to keep the connections between the two units to a minimum. Furthermore, the present counters operate in 8-bit BCD, instead of 6-bit binary as used by those in the volume control (in the preamplifier). All that is required to display the state of the volume control are a couple of BCD-to-7-segment decoders and 7-segment displays.

The preset in the indicator must be set in BCD code. Leading zeros are not suppressed so numbers up to and including 9 are displayed, starting with a 0. The DIP switches and resistors R1 through R8 in the diagram can be omitted if only one fixed preset is likely to be used. The resistors should be replaced by jump leads.

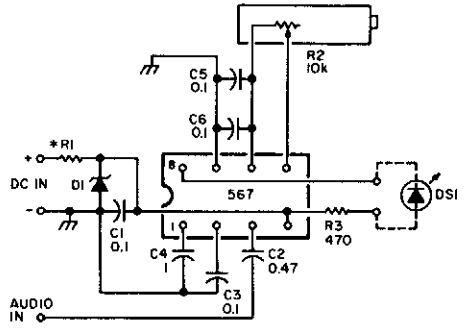
TRANSISTORIZED BAR-GRAPH DRIVER



POPULAR ELECTRONICS *Fig. 37-3*

A resistor network (R1 through R10) with emitter followers (Q1 and Q2) drives LED drivers (Q3 through Q7). This circuit was used as a "light organ" to provide visual volume indication. It can be hooked to a speaker, to another audio source, etc.

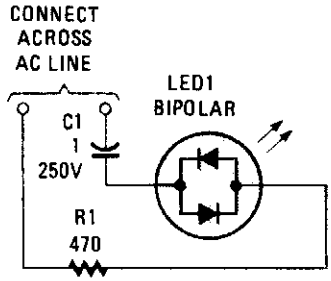
VISUAL CW OFFSET INDICATOR



73 AMATEUR RADIO *Fig. 37-4*

An NE567 tone decoder, tuned to the transceiver's CW offset frequency, ensures that the transceiver will be transmitting on the same frequency as the received CW signal. Simply tune the transceiver so that the LED lights. Eight to 13 Vdc is required; this can be taken from the transceiver supply or an extra battery. Audio is taken from the speaker or headphone output.

ac CIRCUIT LED POWER INDICATOR



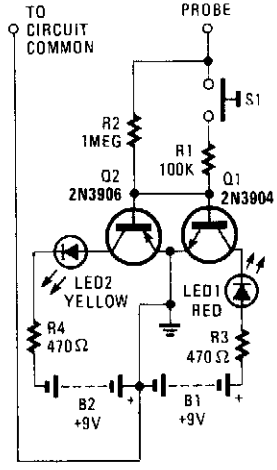
POPULAR ELECTRONICS

Fig. 37-5

Many electronic circuits need an indication that they are under power; for most ac circuits, a neon lamp is the device of choice. A bidirectional tricolor LED can be used if a capacitor is connected in series with the LED to limit the current through the LED. A 1-μF, 250-WVdc capacitor, which has a reactance of 2 650 ohms at 60 Hz, is used in series with an LED to limit the current through the unit to 43 mA. The impedance of the LED is low compared to the reactance of the capacitor, so nearly all the impedance will be caused by the capacitor with the added advantage of no energy loss caused by the capacitor.

The power of the LED is $1.175\ V \times 0.043\ A = 50$ mW compared to an NE-2H at 250 mW. For 230 V, use a $0.47-\mu$F, 400-WVdc capacitor.

ac/dc INDICATOR

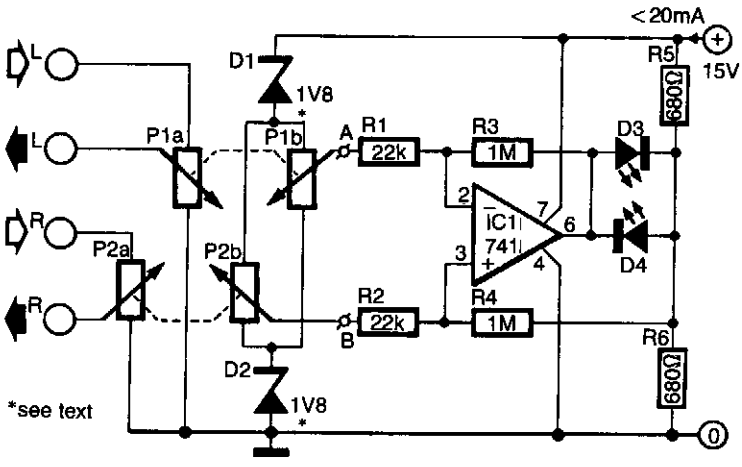


RADIO-ELECTRONICS

Fig. 37-6

By using two switching transistors and two LEDs, this circuit can distinguish low-level ac and dc signals. If the red LED illuminates, the signal is positive dc. If the yellow LED lights, the signal is negative dc. If the signal is ac, both LEDs will light.

BALANCE INDICATOR



ELEKTOR ELECTRONICS

Fig. 37-7

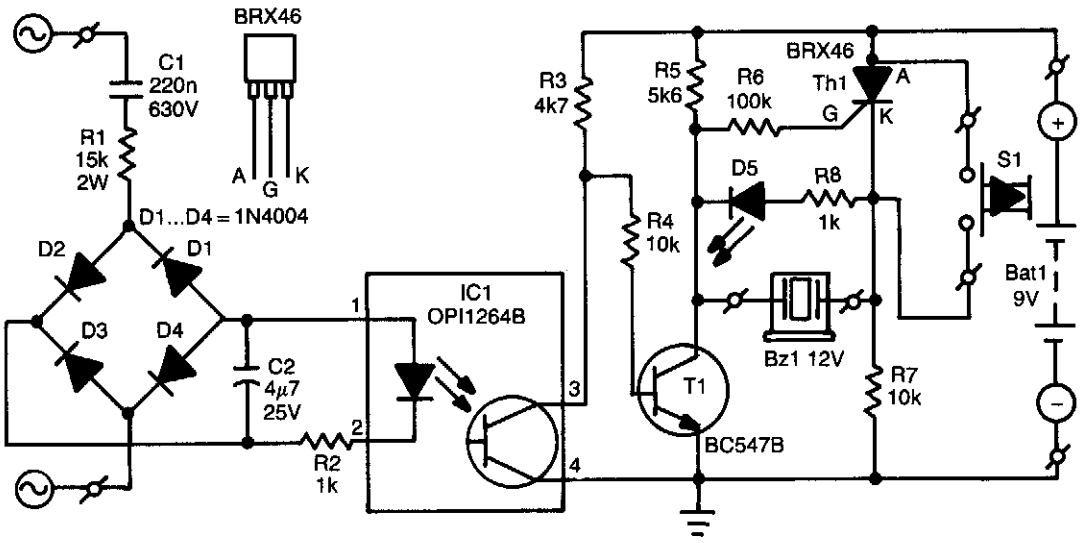
If your amplifier is fitted with two level controls, it actually offers you a balance control and a level control. A drawback of this is that it is quite difficult to set the balance properly. This can be obviated, however, by replacing the two monopotentiometers with stereo versions P1 and P2 in the diagram.

One half of the pair, P1A and P2A, assumes the tasks of the removed components. The other half is connected in a bridge circuit. The voltage between wipers of the potentiometers is then a measure of the balance between the two channels. The lower the potential, the better the balance. If you are interested in knowing the degree of unbalance, connect a center-zero moving coil meter with a bias resistor between A and B. With this arrangement, zener diodes D1 and D2 can be omitted: they are necessary only with the LED indicator shown in the diagram to prevent the input voltage of the op amp from getting too close to the level of the supply voltage.

The circuit around IC1 is a classical differential amplifier. Resistors R5 and R6 provide a virtual earth for the LEDs, which is necessary to ensure that, in spite of the asymmetrical supply voltage, a positive and a negative output is obtained.

Because the LEDs have been included in the feedback loop of the indicator, the circuit is pretty sensitive. At only 40 mV, that is, just $^1/_{400}$ of the supply voltage, one of the LEDs begins to light. The maximum current drawn by the LEDs is determined by the values of R5 and R6.

MAINS FAILURE INDICATOR



ELEKTOR ELECTRONICS

Fig. 37-8

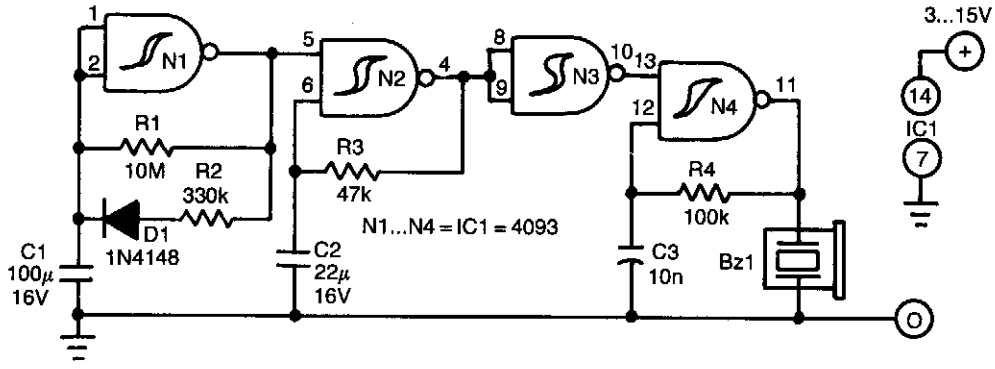
When the mains voltage is present at the input terminals, the transistor in the optocoupler is on, T1 is off, and silicon-controlled rectifier Th1 is in the conducting state. Because both terminals of the piezoelectric buzzer are then at the same potential, the buzzer is inactive. If the mains voltage drops out, transistor T1 conducts and causes one of the terminals of the buzzer to be connected to earth; the thyristor remains in the conducting state. In this situation, a large enough potential difference is across both the buzzer and D5 to cause these elements to indicate the mains failure—both audibly and visibly.

When the mains is restored, the circuit returns to its original state. A touch on the reset button then interrupts the current through the SCR so that the thyristor goes into the blocking state, and the other terminal of the buzzer is connected to ground.

The unit is powered by a 9-V battery and draws a quiescent current of 1.7-2.5 mA. It is important for the enclosure to be well-insulated.

If by accident the circuit to the optocoupler and R2 is broken, electrolytic capacitor C2 might be damaged because it will be charged well above its 25-V rating. Secondly, where a plug is used for the mains connection, it is advisable to solder a 1-MΩ resistor across C1 so that this capacitor does not retain its charge after the plug is removed from the mains socket.

ON INDICATOR



ELEKTOR ELECTRONICS

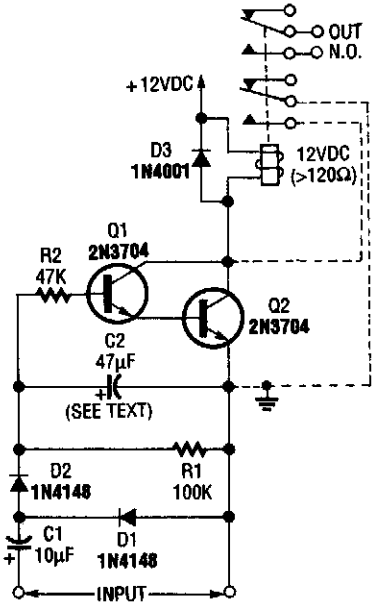
Fig. 37-9

Battery-operated equipment can work on one set of batteries for a long time nowadays. However, if it is left on inadvertently, that "long time" is over very quickly. Moreover, flat (dead) batteries are always found at the wrong moment. The circuit proposed here is a sort of *aide-memoire*. Every two minutes, it emits 5 to 10 pips to indicate that the equipment is still switched on.

Basically, the circuit consists of three rectangle-wave generators and an inverter. The first of the generators is formed by N1 and provides a signal with a period of about two minutes and a pulse duration of around 10 seconds. During those 10 seconds, the second generator starts operating in a one-second rhythm. Thus, N2 outputs 10 pulses every 2 minutes. That output is inverted so that N4, like N2, can only be enabled during the 10-second pulse train from N1. The difference is that during those 10 seconds, N4 is enabled and inhibited 10 times; this is what causes the pips.

Do not take the times and number of pulses too literally, because wide variances are between ICs from different manufacturers. On the other hand, component values are not critical, so it is fairly easy to adapt the circuit to personal taste or requirements. The buzzer can be a standard Toko type or equivalent. The current drawn by the circuit is negligible.

SOUND SENSOR



RADIO-ELECTRONICS

Fig. 37-10(a)

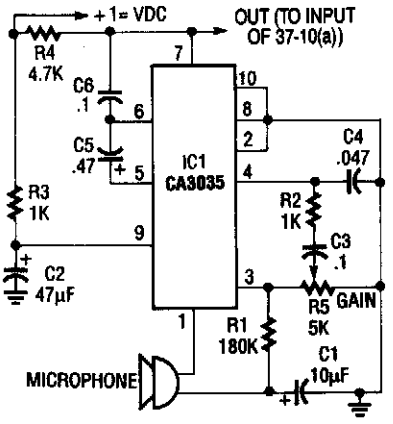
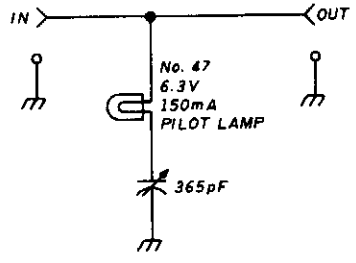


Fig. 37-10(b)

By using a microphone, high-gain amplifier (Fig. 37-10(b)), and detector-relay driver (Fig. 37-10(a)) a sound-detecting alarm system can be constructed. If you want a latching setup, make the dotted connections to the relay shown in Fig. 37-10(a).

TRANSMITTER OUTPUT INDICATOR



HAM RADIO

Fig. 37-11

Relative power can be indicated with this simple circuit. Adjust the 365-pF variable capacitor for desired lamp brightness.