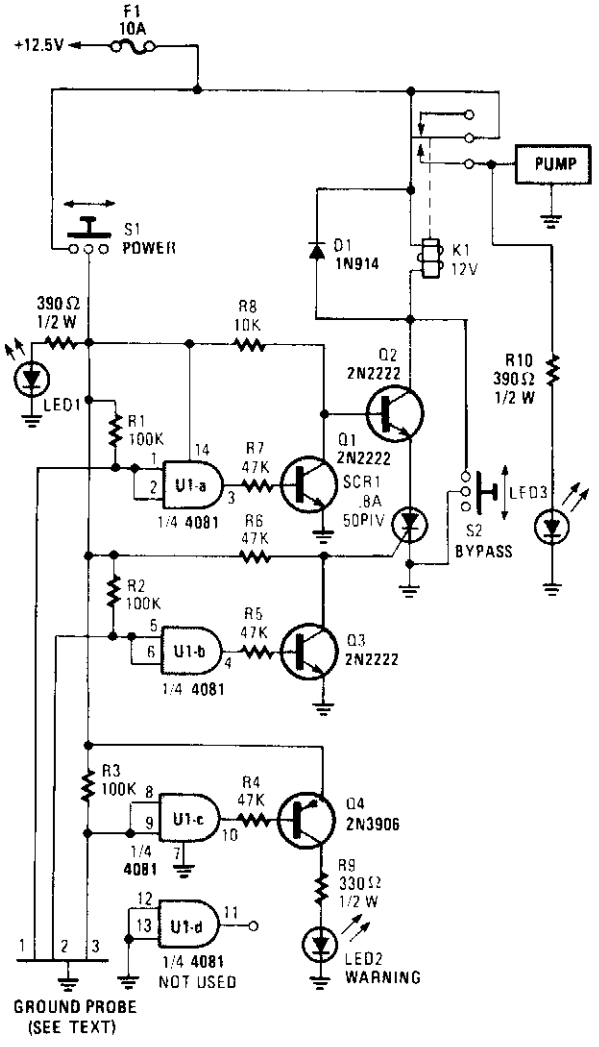
32

Fluid and Moisture Detectors

The sources of the following circuits are contained in the Sources section, which begins on page 666. The figure number in the box of each circuit correlates to the entry in the Sources section.

Water-Level Control
3-V Water-Level Detector
Liquid-Level Sensor
Full Bathtub Indicator
Moisture Detector
Flood Alarm
Rain Alarm
Full-Cup Detector for the Blind
Latching Water Sensor
Water-Leak Alarm
Water-Level Measurement Circuit

WATER-LEVEL CONTROL



POPULAR ELECTRONICS

Fig. 32-1

This circuit will power up a water pump when the water reaches a predetermined level. Then it turns itself off when the water recedes to another predetermined point.

Gates U1A through U1C each have their two inputs tied together, and serve as probes. The probes are then placed at various levels to trigger a particular function at a predetermined time. The ground side of the circuit is placed below the minimum water level. The inputs to each gate are tied high through a 100-kΩ resistor connected to the +12.5-V bus.

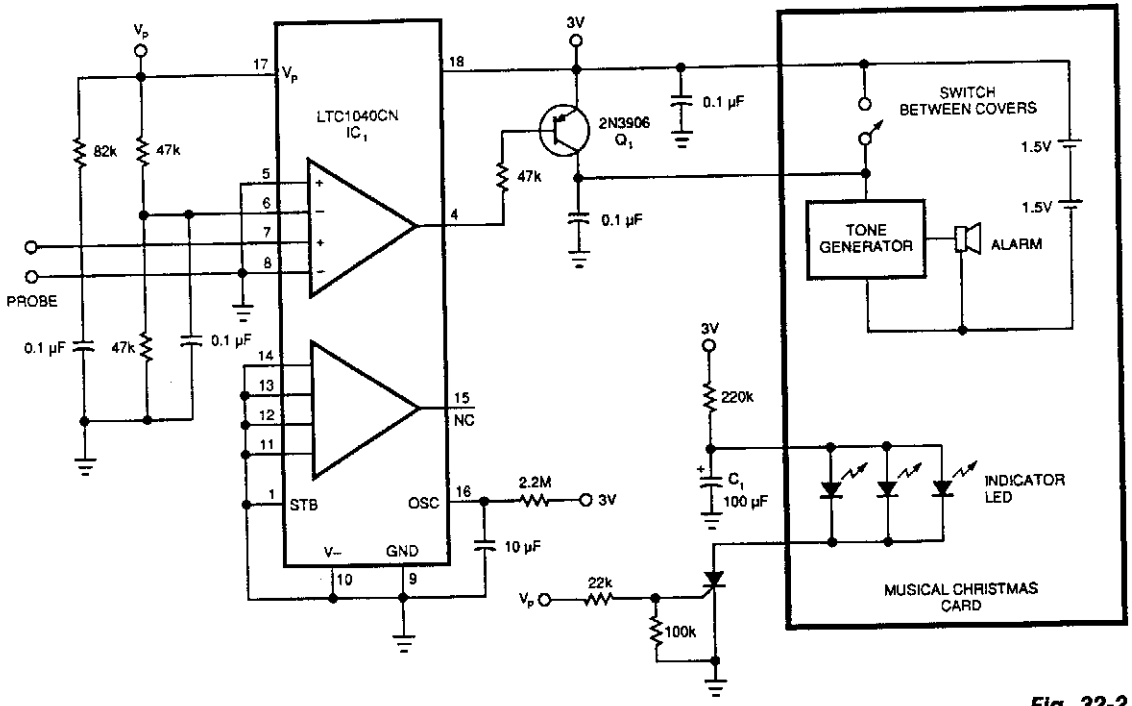
As the water level slowly rises to probe 1, the input to U1A is pulled low by the conduction of current through the water to the ground probe. That turns Q1 off and Q2 on. With Q2 turned on, the circuit is placed in the standby mode, ready to activate the pump when conditions are right.

Probe 2 is placed at the maximum water level. If the water level reaches probe 2, the input of U1B is brought low, turning Q3 on, which, in turn, causes current to be applied to the gate of SCR1, turning it on. The circuit through K1, Q2, and SCR1 is now complete to ground, and the water pump is now turned on, which causes the water level to recede. When the water level falls below probe 2, U1B goes back to logic high.

However, because of the latching nature of SCR1, the pump continues to run until the water level falls below probe 1. At that point, the ground circuit opens and de-energizes K1, which turns the pump off. The pump will not turn on again until the water level again rises above probe 2.

Probe 3 was added as a warning. If the water level reaches probe 3, LED2 indicates that the pump is not working. Switch S2 is a manual override and S1 powers the sensing circuit. LED3 indicates that power has been applied to the pump. LED1 indicates that power has been applied to the sensor.

3-V WATER-LEVEL DETECTOR

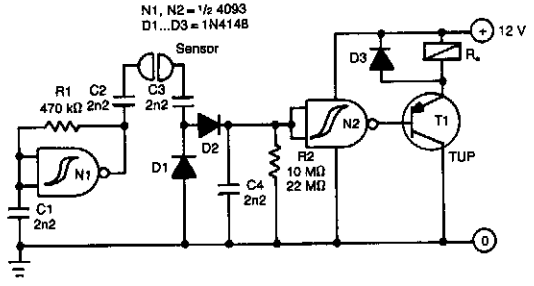


EDN

Fig. 32-2

Originally, this circuit was used to sense a low-water level in a Christmas tree stand, but the circuit can be used as a water-level detector for pump controls, water sensors (for garden and lawn applications), etc. A comparator and probe setup with a Linear Technology LTC1040CN comparator drives a 2N3906, which switches a tone generator. Sampling occurs every 20 seconds, which minimizes current drain. A pair of dry cells will power the circuit for several months.

LIQUID-LEVEL SENSOR

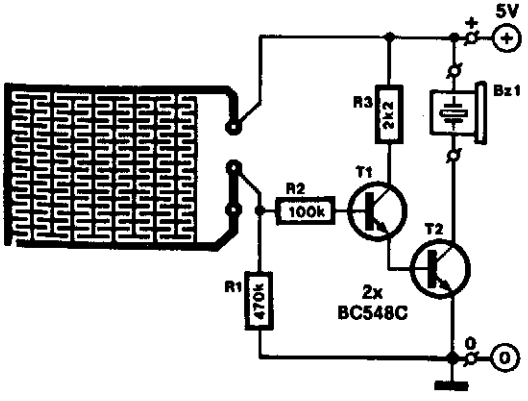


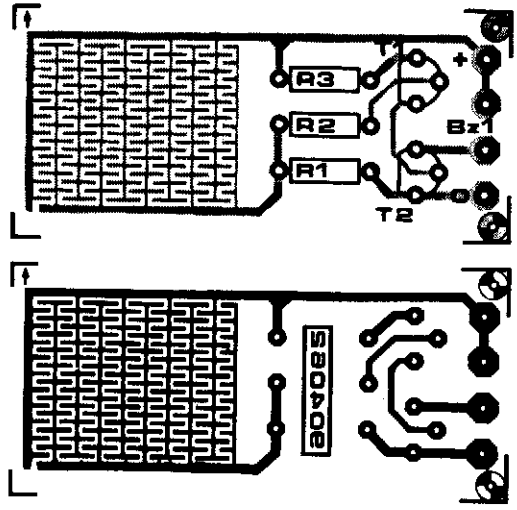
This circuit uses an ac-sensing signal to eliminate electrolytic corrosion. The ac signal is rectified and used to drive a transistor that controls a relay.

ELEKTOR ELECTRONICS

Fig. 32-3

FULL BATHTUB INDICATOR





ELEKTOR ELECTRONICS

Fig. 32-4

Running a bath can end in a minor domestic disaster if you forget to turn off the taps in time. This indicator activates an active buzzer to provide an audible warning when a given water level is reached.

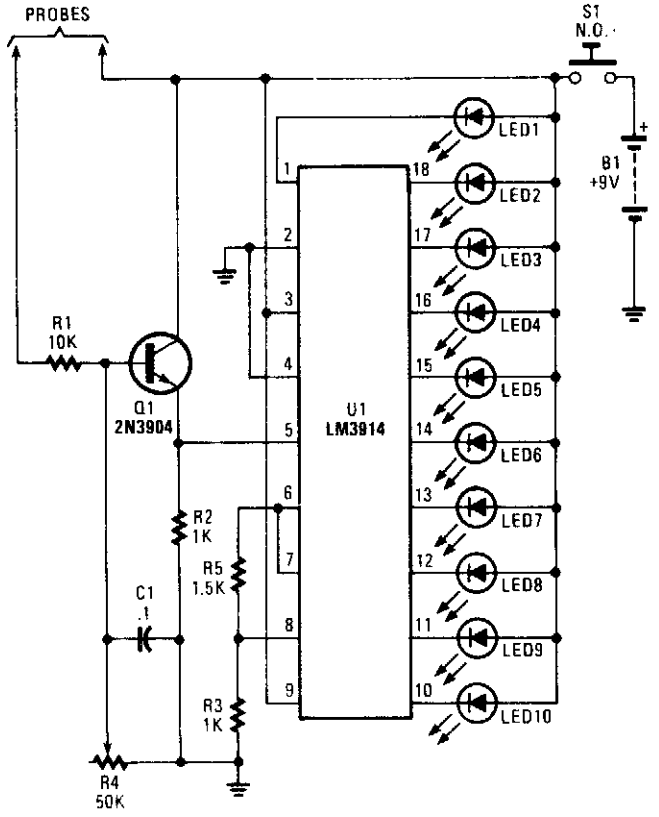
Because the water sensor and the driver circuit for the buzzer are contained on one PC board, the indicator, together with the 9-V battery and the buzzer, can be built into a compact case. Obviously, the sensor, which is etched on the PC-board, must not be fitted in case-iron or steel bath, the indicator is secured to it with the aid of a magnet glued onto the case. To prevent scratching the bath, the magnet can be covered in plastic or rubber. If you have a polypropylene bath, the indicator can be stuck to it with blue tack or double-sided adhesive tape.

When the water reaches the sensor, the base of T1 is connected to the positive supply line. As a result, T1 and T2 are switched on so that the buzzer BZ1, a self-oscillating type, is activated. The current drawn by the circuit in that condition is about 25 mA.

In case the circuit is actuated by steam, its sensitivity can be reduced by increasing the value of R2. It is best to tin the PC board tracks to prevent corrosion.

T1, T2 = BC548C
BZ1 = active piezo-ceramic resonator

MOISTURE DETECTOR

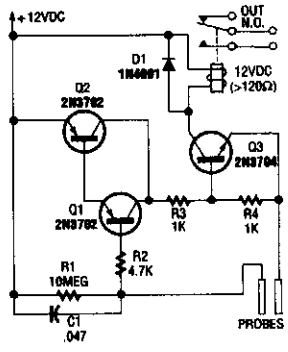


POPULAR ELECTRONICS

Fig. 32-5

A bar-graph LED driver is used to drive 10 LEDs to give a relative indication of moisture. The moisture probes are connected so that electrical conductivity due to moisture tends to forward bias Q1, providing a dc voltage at pin 5 of U1 that is proportional to leakage current. Ideally, the probes should be made of stainless steel.

FLOOD ALARM

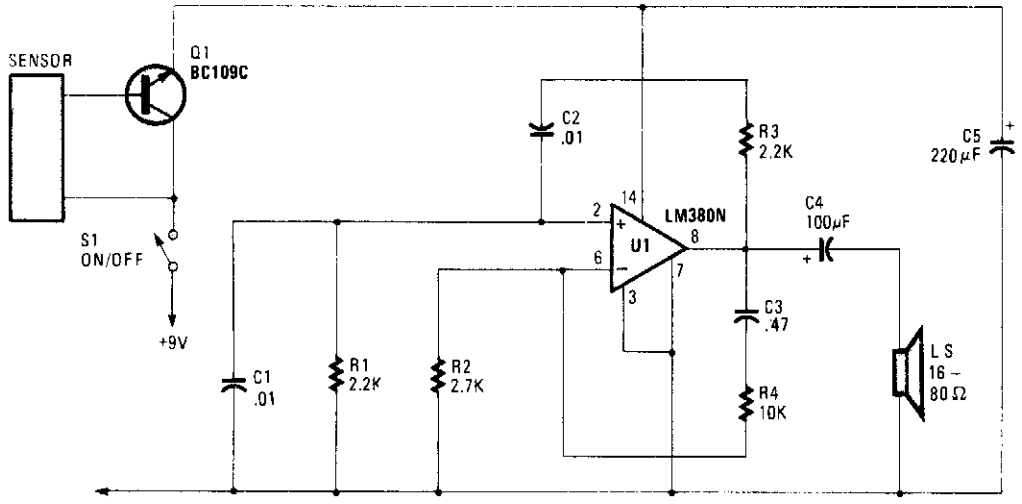


RADIO-ELECTRONICS

Fig. 32-6

Using a few bipolar transistors, this circuit acts as a flood alarm. When liquid touches the probes, leakage current biases Q1, Q2, and Q3 (a dc-coupled amplifier) into conduction, which activates the relay. The contacts can be hooked into the alarm system.

RAIN ALARM

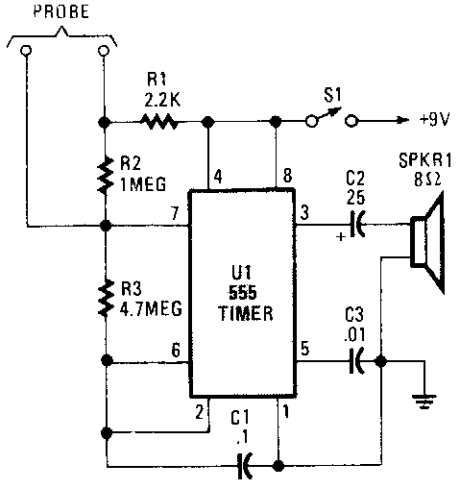


POPULAR ELECTRONICS

Fig. 32-7

This rain sensor causes Q1 to conduct when conductive liquid (rainwater, etc.) applies bias to its base. This bias triggers LM380N oscillator and causes LS to emit a tone.

FULL-CUP DETECTOR FOR THE BLIND



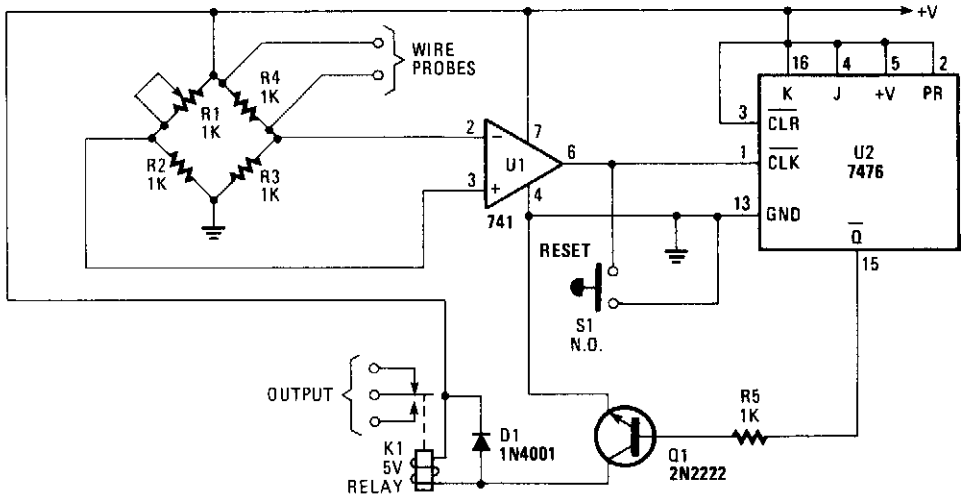
POPULAR ELECTRONICS

Fig. 32-8

At the heart of the Full-Cup Detector is a 555-oscillator/timer configured to produce a 15-Hz click, until its probe contacts are bridged, at which time its output frequency goes to about 500 Hz.

This circuit can be used by the visually handicapped to determine when a cup or bowl is full of liquid (coffee, soup, etc). U1, an NE555, produces ticks at 15 Hz. A set of probes (wire, etc.) is placed in the container at the desired level. When the liquid level contacts the probes, the frequency of clicks increases to several hundred hertz, depending on its conductivity.

LATCHING WATER SENSOR

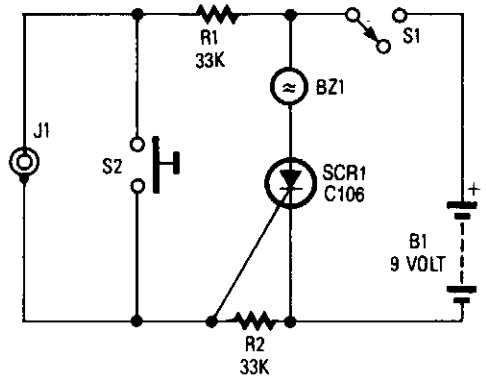


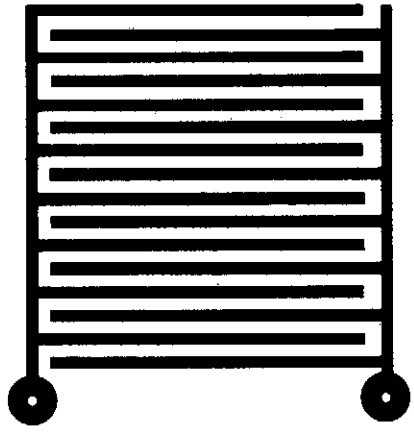
POPULAR ELECTRONICS

Fig. 32-9

A balanced Wheatstone bridge controls a JK flip-flop that uses an op amp as an interface. This in turn drives a relay circuit. R1 through R4 can be made larger for increased sensitivity.

WATER-LEAK ALARM





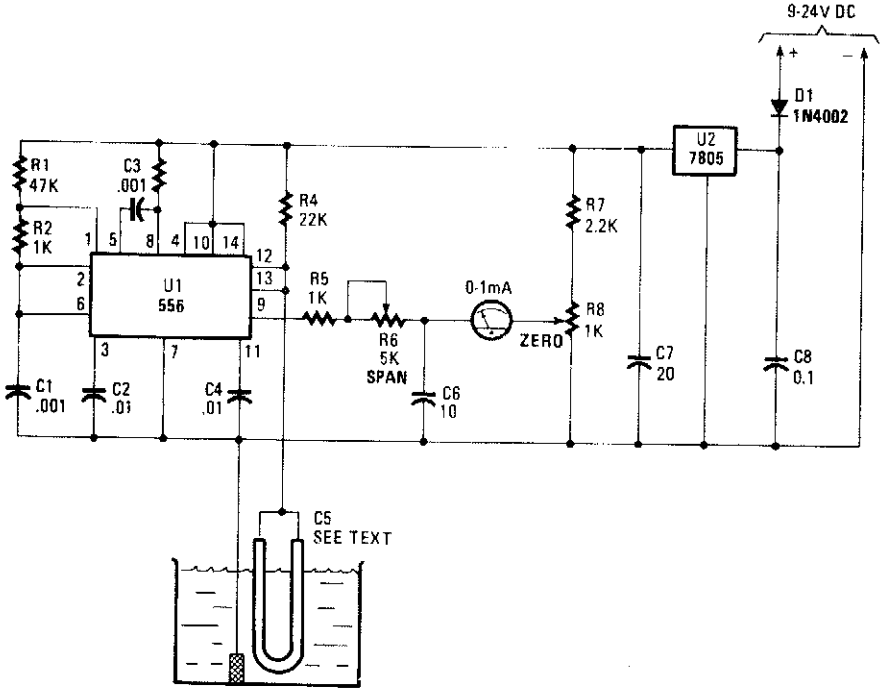
POPULAR ELECTRONICS

If you choose to make your own moisture sensor, this foil pattern should come in handy.

Fig. 32-10

A sensor connected to J1 causes SCR1 to conduct, which sounds buzzer BZ1. The sensor is a PC-board foil pattern grid. Several sensors can be wired in parallel for increased coverage or to monitor several places simultaneously.

WATER-LEVEL MEASUREMENT CIRCUIT



POPULAR ELECTRONICS

Fig. 32-11

Using a capacitor sensor to detect a water level is a simple method of sensing. This circuit uses C5, which is 10″ to 20″ of #22 enamelled wire as one electrode. This shifts the oscillator, an NE556 timer, in frequency. The frequency shift depends on the capacitance charge, which in turn varies with water level. A meter connected to pin 9 of the 556 is used as an indicator. C5 can be made larger or smaller to suit the intended application.