Making use of audio indicators

The circuits described in this article have two things in common — all are based on the use of solid state audio indicator modules, and all are quite practical. There are seven circuits altogether, including a rain detector circuit, a car headlight warning unit, a turning indicator alarm, and a capacitance activated buzzer.

☆ **Rain detector** ☆ **Car Headlight Warning** ☆ **Turning Indicator** ☆ **Low-cost sensor** ☆

Many electronic circuits make use of some sort of audible output device, particularly when the circuit is used in an alarm situation. In the past, buzzers or a loudspeaker driven by an audio amplifier were the most common forms of audio output device; but in recent years a range of self-contained solid state audio transducers has become available. These have the advantage of low cost and compact size.

Four different audio indicators are used in the circuits described here: AI124, AI125, X50W12A and X70W06. All are imported by Instrument Technics (Victoria), from Projects Unlimited of Dayton, Ohio.

Basically, the audio indicators used fall into two broad types. The AI124 is an electronic/mechanical transducer, while the other three units are all piezo-electric transducers. A third type of audio transducer, based on a small speaker, is also listed in the Projects Unlimited catalog, but this type is not used in the projects described here.

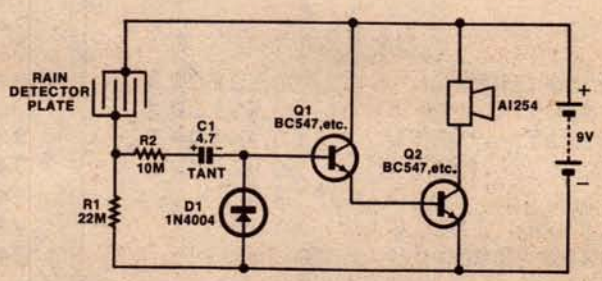
An electronic/mechanical transducer consists of a tuned reed driven by an electronic oscillator. These audio indicators emit a buzzing sound high in harmonic content, around 375Hz in the case of the AI124.

Piezo-electric transducers differ in that they are made of a thin ceramic element bonded to a brass disc. The element is electrically attached to an audio oscillator circuit which causes the element and brass disc to flex, thus generating sound waves. Claimed advantages of piezo-electric transducers include lower power consumption and higher sound level output than electronic/mechanical types.

Readers will note that, as used in the following circuits, the piezo-electric transducers all feature two-wire termination, these being the power leads. The AI124, on the other hand, has a third lead connected it. This lead is a "control" line,and a minimum of 0.5V must be present on this line for the buzzer to be activated. The sound output increases to a maximum as the control voltage is increased to 1V.

The transducers used in the following circuits by no means represent the complete range imported by Instrument Technics. Those readers requiring further information regarding availability and price should contact the company at PO Box 224, Doncaster, Victoria 3108. Telephone (03) 842 5661.

Rain Detector



RAIN DETECTOR

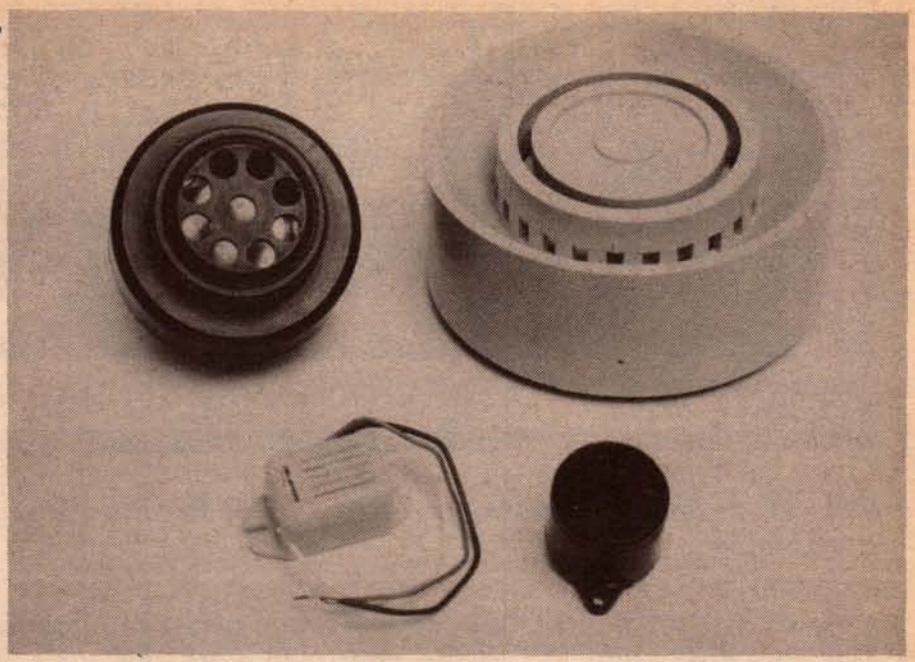
This simple circuit will not stop the rain, but at least it will help the lady of the house to get the washing dry — by sounding a warning buzz when the rain starts. Of course, there are many other uses for a simple moisture alarm. The device could, for example, be used as a pool splash alarm, a bed-wetting alarm, or as an indicator that the bath water has reached the desired level.

Main features of the circuit are as follows:

- Zero standby current, as no power switch is required;
- Unit switches off automatically after about 3 minutes. It will automatically retrigger if the sensor plate dries and becomes wet again;
- Maximum current drain is 5mA, giving a long battery life; and
- Low cost and low component count.

In addition to the AI254 audio indicator, the circuit uses two low cost NPN transistors (BC547) or similar and a handful of other components. The detector plate, or sensor, can be made out of a small piece of Veroboard with alternate copper strips connected in

The four audio indicators used in the seven projects. Clockwise from top left: X70W06; X50W12A; AI254; and AI124.



Seven useful circuits from Derek Williams, Instrument Technics

Capacitance activated buzzer ☆ Light beam alarm ☆ Reversing buzzer

parallel. Power for the unit can be supplied from a small 9V battery.

Circuit operation is as follows: When the sensor plate is dry, the base of Q1 is held at ground potential and Q1 and Q2 are turned off. However, when the detector plate gets wet, its resistance drops to a finite value, and current flows in the base of Q1. Q1 thus turns on, turning Q2 and the audio indicator on in turn.

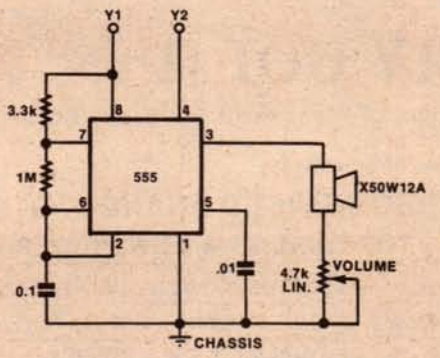
As C1 charges, the current through the base of Q1 gradually decreases. After about 3 minutes, Q1 turns off, turning off Q2 and the audio indicator. When the sensor plate dries, C1 discharges through D1, R1 and R2, and the unit is ready for retriggering.

Reversing Buzzer for Cars

As part of the design rules for Australian cars, all new cars must be fitted with reversing lights. These can be either separate white lights, or the amber indicator lights. In either case, they must come on when reverse gear is selected and the ignition is on.

However, situations do exist where some form of additional indication is warranted, particularly when reversing out of concealed driveways. An effective audible reversing indicator can be made using just one 555 timer IC, an X50W12A audio indicator and a few low-cost components, as shown in the accompanying circuit. A volume control is fitted in series with the audio indicator, and can be adjusted as required.

The sound output from the audio indicator is a 2.7kHz tone, pulsed on and off at a rate of 7Hz by the 555 timer IC. The reset pin, pin 4, is used to make the timer also function as an AND gate, so that the unit can be used with vehicles that use the amber indicator lights as reversing indicators. In this



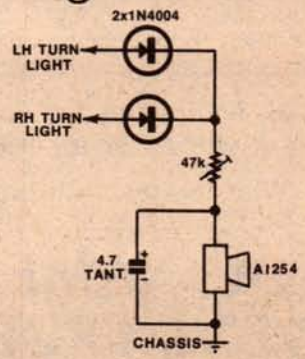
REVERSING BUZZER FOR CARS

case, Y1 and Y2 are run to the +12V sides of the left and right hand turn indicator bulbs respectively.

For cars fitted with separate reversing indicators; Y1 and Y2 are connected together, and a single wire run to the +12V side of the lights.

One further point: substituting the AI254 for the X50W12A will give a substantial cost saving at the expense of available audio output.

Audible turning indicator



TURNING INDICATOR

In many cars, the mechanical click of the turning indicators is barely audible and the indicator may be inadvertently left on. This is most undesirable. Failure to cancel turning indicators is not only a traffic offence — it could also be the cause of a serious accident.

The circuit featured here is designed to overcome this problem. It costs just a few dollars, can easily be installed behind the dash panel, and will deliver a 4kHz tone whenever the turning light flashes. The volume of the tone is easily adjusted for personal preference.

The two diodes act as an OR gate, delivering current to an AI254 audio indicator from either one of the turning indicator circuits. Volume is adjusted by means of the 47k preset pot. The 4.7uF tantalum capacitor is required to ensure stable operation of the audio indicator.

Car Headlight Warning

Ever left your car's headlights on and returned later to find a flat battery? At best this situation is inconvenient; at worst it's dangerous and expensive. A warning circuit to indicate when the car's lights have been left on can save you time and money.

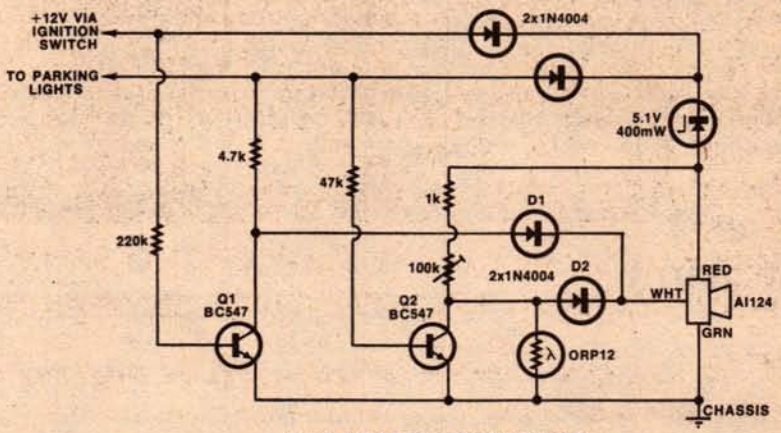
The circuit described here has two functions. First of all, it monitors the ambient light level and, when this falls below a preset level, sounds an alarm to indicate that the headlights should be turned on. Secondly, it will sound the alarm if the engine is stopped with the headlights (or parking lights) left on.

Refer to the circuit. It's really very simple and uses two transistors, five diodes, an ORP12 LDR (light dependent resistor), and an AI124 audio indicator. No alteration to the car's existing wiring is required.

When both the headlights and the engine are on, transistor Q1 conducts, effectively shorting the audio indicator input to earth via D1. Turning the engine off turns Q1 off, forcing its collector high and turning on the audio indicator. The indicator can then only be turned off by turning off the headlights.

Automatic light level sensing is provided by the LDR. In daylight, its resistance will be low and the AI124 audio indicator will be held off. The resistance of the LDR increases as the light level decreases until, at a critical point, the audio indicator is turned on. Turning the headlights on will now turn transistor Q2 on, and the audio indicator off.

The trimpot in series with the LDR is adjusted so that the alarm will sound at the desired light level.



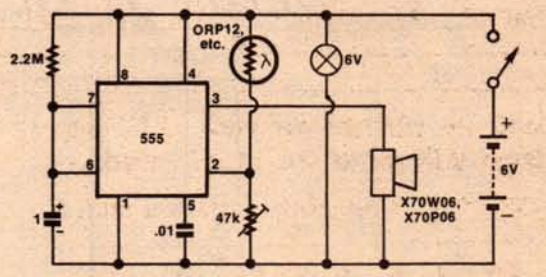
CAR HEADLIGHT WARNING

Light beam door-entrance alarm

Need a light beam door entrance alarm? Our circuit uses a 555 timer IC, wired as a monostable in a manner similar to the capacitance activated buzzer described below. A 6V torch globe, an LDR, an X70W06 audio indicator, and a handful of other components complete the circuit.

In use, the unit is usually set up with the light source on one side of the doorway, and the LDR on the other side. When the light path between the two is interrupted, the resistance of the LDR suddenly increases, triggering the timer via pin 2 and forcing its output (pin 3) high to drive the audio indicator. This arrangement ensures that the audio indicator will stay on for around 2.4 seconds, no matter how brief the interruption time was.

For most applications, it will be necessary to provide a light source with a suitable reflector, in order to achieve the necessary path length to the LDR. A low cost torch would be ideal for the job. The 47k trimpot should be adjusted for reliable triggering.



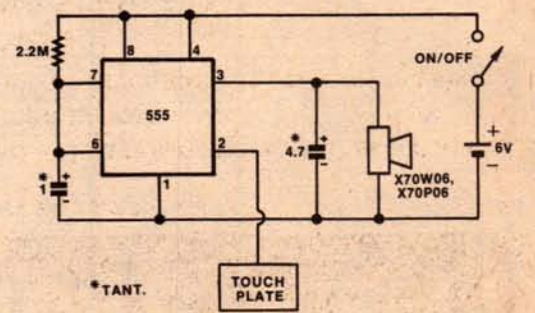
LIGHT BEAM ALARM

Capacitance activated buzzer

A proximity switch or a capacitance activated door buzzer — call it what you will. You can use this circuit as a door buzzer for the home, as a shop counter buzzer, or as an inter-office buzzer.

The circuit uses a 555 timer IC wired as a monostable, with a metal touch plate connected to the trigger input (pin 2). Normally the 1uF tantalum capacitor is held discharged by a transistor inside the timer. When a hand touches the metal plate, the increase in capacitance between pin 2 and earth sets an internal flip-flop, releasing the short circuit across the capacitor and driving the output (pin 3) high.

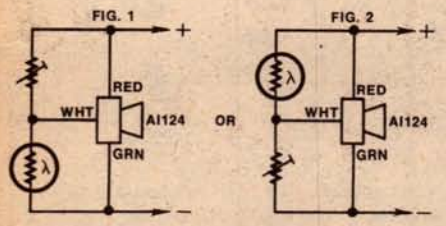
The capacitor now charges via the 2.2M resistor. When the voltage across it reaches 2/3 the supply voltage, a comparator (inside the 555) resets the flip-flop which in turn rapidly discharges the capacitor and drives the output low. Touching the touch plate will now cause the cycle to start all over again.



CAPACITANCE ACTIVATED BUZZER

The length of time that the output is forced high (and hence the length of time that the buzzer sounds) is around 2.4 seconds. This depends on the time constant of the 2.2M resistor and the 1uF tantalum capacitor. Increasing the value of either component will increase the length of time that the buzzer sounds.

Low-cost sensor with alarm



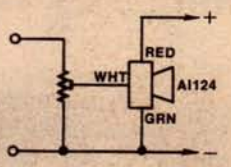
LOW-COST SENSOR

Here are two very simple circuits that can be used to indicate a variety of alarm situations, merely by changing the sensor R1. For example, R1 could be an LDR, a thermistor (to sense temperature), or a liquid probe. R1 and the preset pot are simply used as a voltage divider, which turns the AI124 audio indicator on and off.

You will notice that there are two circuits, each for a different situation. The circuit in Fig.1 will sound the alarm only when the resistance of R1 increases to a preset level; the circuit in Fig.2, on the other hand, sounds the alarm when the resistance of R1 decreases to a preset level. The preset pot sets the circuit sensitivity, and its value chosen to suit R1.

Typical circuit applications include a temperature alarm, a liquid level alarm, and a low-cost light beam door entrance alarm. By using a thermistor for R1, for example, the circuit in Fig.1 could indicate the failure of a heating element, while Fig.2 could indicate overheating equipment. By replacing the thermistor with a liquid probe, Fig.1 could indicate liquid drop in a tank while Fig. 2 could indicate when the tank was full.

Preset voltage sensor



Essentially a variation on the two circuits shown above, this circuit is used for detecting preset voltage levels. It can be used as an under- or over-voltage detector on power supplies, or can be connected to fuel, oil and temperature gauges in a car to give a warning at a preset level. When used in the latter application, a 5 volt zener diode (C5V1) should be inserted in the positive supply line so that the voltage rating of the AI124 (7V max) is not exceeded.

Where to buy audio indicators

Buy your audio indicator from Instrument Technics, PO Box 224, Doncaster, Victoria 3108. Prices (including 15½% sales tax), are as follows: AI124, $2.29; AI254, $4.31; X70W06, $9.76; X50W12A, $19.99. Add 60c each for postage and packing. Also available from the following distributors: Delsound (Brisbane); Protronics (Adelaide); Radio Parts (Melbourne); Magrath (Melbourne).

AUDIO INDICATOR SPECIFICATION TABLE

PARAMETER	COND	AI124			AI254			X50W12A			X70W06			
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
SUPPLY VOLTAGE (Vcc)		3	5	7	3	12	16	6	12	20	3	6	12	VDC
SUPPLY CURRENT (Average)	Vcc = 3V		16	21										mA
	Vcc = 6V								10	13		8	12	mA
	Vcc = 7V		34	45										mA
	Vcc = 12V					4	6							mA
	Vcc = 20V								47	55				mA
SUPPLY CURRENT (Peak)	Vcc = 3V		43	50										mA
	Vcc = 6V								43	53		60	100	mA
	Vcc = 7V		95	110										mA
	Vcc = 12V					40	70							mA
	Vcc = 20V								130	150				mA
FUNDAMENTAL FREQUENCY	Vcc = 5V	270	375	550										Hz
	Vcc = 6V										2.8	3.2	3.6	kHz
	Vcc = 12V				3	4	5	2.3	2.7	3.1				kHz
SOUND PRESSURE LEVEL	Vcc = 3V	67	80											dBa
	Vcc = 6V							100	110					dBa
	Vcc = 7V	72	83											dBa
	Vcc = 12V				75	89								dBa
	Vcc = 20V							105	116					dBa
CONTROL CURRENT (Average)	Vcc = 3V	0.58	0.67	0.80										mA
	Vcc = 7V	1.5	1.8	2.0										mA