clinic

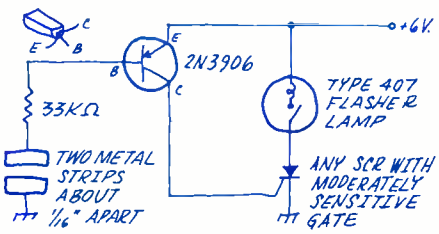
READERS WRITE FOR HELP WITH TECH PROBLEMS

BY JEFF SANDLER

Now you see it, now you don't

I need a battery powered light that can be mounted in the cabin of my boat. The light should turn on easily, stay on for just a few seconds, then turn off again. Since it will be battery powered, it should draw as little current as possible, yet provide enough light for me to see the control panel.

V.J., Brookfield, IL



One of the best circuits I've seen for this kind of service uses a type 407 flasher lamp; the kind used in the red warning light of large lanterns. The bulb has a tiny switch built into it that opens the filament circuit when the lamp heats up–a process that takes about five seconds in a cold bulb. The circuit is triggered when you place a finger across the gap between two strips of metal, about 1/16th inch apart. Enough current will flow through your finger to trigger the SCR after being amplified by the 2N3904. Once the SCR is fired, current will flow through the bulb until its internal switch turns it off. Once that happens, the SCR will return to its nonconducting state.

What's wrong with TTL?

In your projects and clinic circuits I see CMOS. I've been building digital circuits for years using TTL and I think it's great. Why not use some TTL in your projects?

E.W., Wynnewood, PA

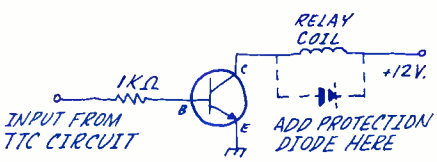
TTL is unbeatable for high-speed digital circuits, and it's readily available at low cost. But, TTL is not without its drawbacks. For one thing, it draws current, even in its low state. Put a few TTL ICs together and the current drain gets too high to power by battery. Another problem I have with TTL is its relatively low input impedance. Many of my projects require very high input impedances. CMOS, on the other hand, draws virtually no current in its standby mode, and has an input impedance of about one million, million ohms. This combination of low drain and high impedance makes possible battery-powered circuits that are actuated by touchplate. Battery life in these circuits is essentially the shelf life of the battery. CMOS can be powered from virtually any supply providing between three and 15 volts, another big advantage over TTL. And its output swings from rail to rail, with zero offset. This permits me to use CMOS gates and buffers in place of op-amps in some circuits. However, when the circuit requires it, you can be sure I will use TTL.

Needs protection

I just built a TTL logic controlled alarm. The alarm itself is powered by line voltage applied through a relay controlled by the logic through a transistor. I've checked the circuit a dozen times, and it seems to be wired correctly. But every time I use it, the transistor blows. How come?

F.Y., Palisades Park, NJ

Looking over the diagram you sent me leads me to believe the problem lies with something you left out–a protection diode around the relay coil. TTL logic is very fast–almost instantaneous. Once the transistor begins conducting current through the relay coil, a magnetic field is generated. This is what causes the relay contacts to close. When the TTL logic turns off the transistor, the field around the relay coil collapses in an instant. In doing so, it generates hundreds of volts,

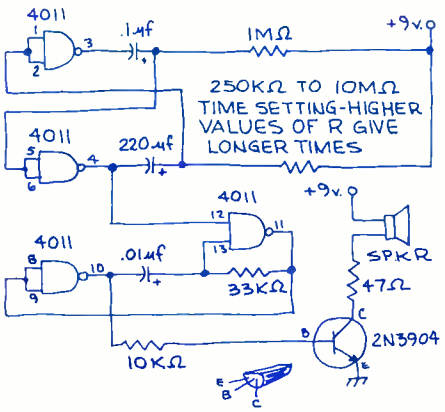


just the way an automobile's ignition coil does. It is that voltage that pops your transistors. Placing a diode across the coil as shown will short circuit the voltage, preventing any damage to the transistor.

It doesn't work!

I'm having trouble getting the Pink Ticket Beater circuit, on page 17 of the February issue, to work. I notice that +9 volts is shown at two different places in the diagram. Is this correct? The emitter of the 2N3904 is shown connected to the chassis. Is this the nine-volt return? You didn't specify what kind of speaker to use. I used a 2¼-inch speaker. Is this okay? I know all the parts are good. Is there something missing in the diagram?

M.M., Houston, TX



Try connecting +9 volts to pin 14, and the return to pin 7. It's very common to show voltage supply terminals at several points in a diagram. This is done to simplify the drawing by eliminating the need for a single supply line snaking around the circuit. In most circuits, you can assume the ground to be the power supply return. Unless a particular kind of component is specified, you can use anything you'd like with the required rating. Your choice of speaker is fine.

Help!

I thoroughly enjoyed Volume one, Number one of *Modern Electronics*—largely due to the grab bag of gadgets to build. Although I majored in physics, I've been away from electronics for some time and I'm finding the going a little rough with all the new stuff. My problem is the Egg Timer on page 49 of the February issue—it doesn't work! I've double checked everything.

E.B., Tarkio, MO

Based on the additional information you gave me in your letter, I guess you didn't provide power to the 4011 IC itself. You should be able to get the timer going by applying the positive

supply voltage to pin 14 and the ground return to pin 7 of the 4011 IC. You can use any voltage up to 15 volts. A nine-volt transistor battery is the best bet.

Sorry, we goofed

I was intrigued by the power-failure alarm described in the February issue. However, your schematic had absolutely nothing to do with a power-failure alarm. What gives?

R.P., Duncansville, PA

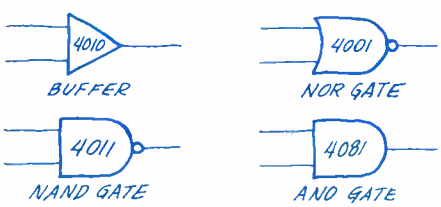
In the excitement of starting up a new magazine, the power-failure alarm and the temperature indicator schematic diagrams got mixed up. We did untangle the mess in the March issue on page 67. There you'll find both circuits with the right schematic attached to the proper text.

What does it all mean?

I'm just getting into electronics. I noticed some symbols in your diagrams on pages 49 and 50 of the February issue I've never seen before. Can you tell me what they mean? What are the numbers in the symbols?

G.P., Ste. Genevieve, Quebec

The symbols used represent digital logic elements. The triangular symbol is a buffer stage used to isolate the signal source from the following stage. The other symbols are digital gates. You'll find a good explanation of these gates on page 49 of the March issue of Modern Electronics. *The symbols represent one of the elements contained in a single integrated circuit (IC). Depending on the kind of element, there can be as many as eight individual circuits in each IC. The number printed inside the symbol is the type number*



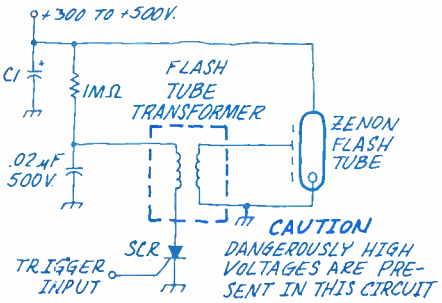
of the IC containing it. So, the 4011 you saw inside a gate symbol means it is one of the gates contained in a type 4011 IC. These type numbers are used the same as tube and transistor type numbers.

Pop goes the flash tube!

Rummaging around in my junk box I came across a couple of Zenon flash tubes. Do you have a circuit I can use to light them up?

P.J., Rochester, NY

Here's a circuit that should do the trick. The value of C1 and supply voltage depends on the bulb you're using. If you know which bulb



you have, check the manufacturer's spec sheet. If not, a good starting point might be a 0.5 mfd capacitor and 300 volts. You can use any flash tube transformer you have handy. Radio Shack used to carry flash tube transformers and you may be able to find one in your local store. The tube is flashed by the high voltage developed across the transformer secondary when the SCR is fired. Since the SCR circuit current is very small, you can use any SCR with the appropriate voltage rating. Remember, there are lethal voltages present in this circuit.

Where's the alarm?

On page 50 of the February issue there is a schematic for an electronic combination lock. The text says: "If an incorrect button is pushed, an alarm sounds and all pushbuttons stop working for two minutes." However, in the schematic I see nothing about alarms. Can you explain?

S.B., Manhattan Beach, CA

You'll notice that a relay is included at the bottom right of the diagram. An external alarm be connected through the relay contacts. The type of alarm used is up to you.

CMOS power hungry

I always thought CMOS drew very little current. I was really surprised when I built an audio oscillator using 4009 inverters. The circuit drew better than 20 ma. Why?

T.C., Willits, CA

The 4009 IC contains six inverters and your oscillator only uses two. What are you doing with the other four inverters? If you've left them floating, they've probably become unstable and begun to self-oscillate. Many experimenters bothered by what seems to be erratic operation in their CMOS circuitry are experiencing this oscillation. You can avoid the problem by tying all unused inputs to the supply rail.

Hunting wires

As an electrical contractor wiring new houses and occasionally troubleshooting in older houses and mobile homes, I could really use a device to locate wires buried in walls. Do you have a circuit I could use for this?

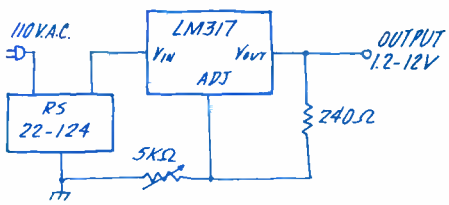
T.M., Lower Lake, CA

Here's a cheap and dirty wire-finding trick that's worked for me. All you need is a portable transistor am radio and line-powered drill, electric razor, hairdryer or other appliance that uses a brush-type ac-dc motor. If you have a choice, use the motor with the greatest amount of arcing at the brushes. This arcing generates the electrical interference you hear as static hash in your radio, and see as a series of white dots and dashes across your tv picture. Just plug in the appliance, lock it on, and listen on your radio for the hash. As you move the radio across the wall, the intensity of the hash will be greatest when the radio is nearest the ac line hidden in the wall. You may have to experiment with different radios and motors to optimize the effect, but it should work. Drop me a line and let me know how you make out.

Varying 22-124

I have a Radio Shack number 22-124 regulated 12-volt power supply. I would like to make it variable by adding a voltage control. How should I do this?

F.M., Des Moines, IA



Unfortunately, you can't just add a control to the wiring. However, you can convert your 12-volt supply to a regulated variable supply providing from 1.2 to 12 volts output. All you do is add an LM317 voltage regulator integrated circuit and two resistors. The addition can be built on a small perfboard mounted inside the 22-124 case. But make sure the LM317 is properly heat sunk.

More "How's a gqzlxbg work?"

In the March *Clinic* we mentioned that the best source for "how it works" information is a specialized book. There the author has hundreds of pages to explain the intricacies of a gqlxbg, or anything else for that matter. Well, if your interested in minicomputers and microprocessors, Wiley-Interscience, Box 92, Somerset, NJ 08873, has a great how-it-works-book called *Introduction to Microcomputers and Microprocessors* by Arpad Barna of Hewlett-Packard, and Dan Porat of Stanford University. Although I find it a bit scholarly, the book does contain just about everything you need to know about the subject.