Quick designs

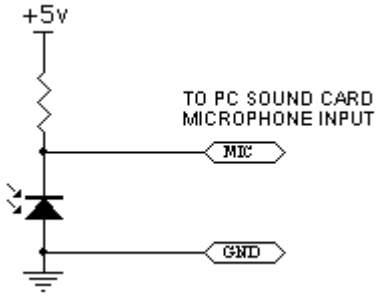
(aka "back of an envelope designs")

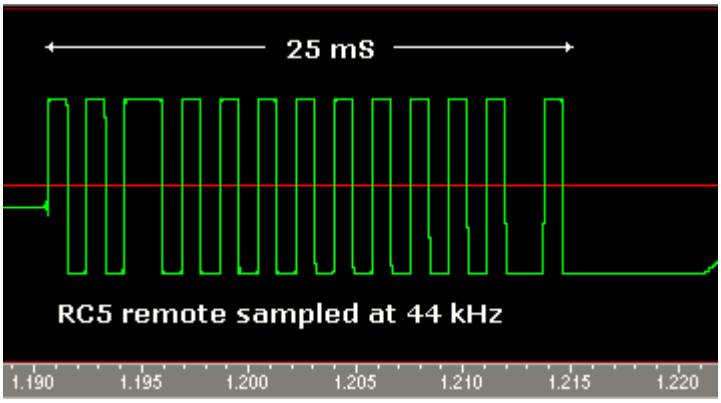
It surely happened to you, too. You are sitting with your friends, pleasantly drinking and talking, when someone asks "Anybody knows how to...". Immediate brainstorming, istantaneous urgence of a piece of paper to sketch something on. It usually ends up with a small, smart, useful circuit drawn on... the back of an envelope.

in this section:

Remote control tester / debugger

Experimentig with **infrared** remote controls is easier than you think. An infrared diode, powered by a 9V battery through a resistor, provides a 100 mV pseudo-audio signal: try to plot and listen it by connecting it to the **"mic" input of your sound card.**
Use the highest sampling frequency available.
The "data sound" is immediately recognizable for a dead-alive test. All remotes use higher frequencies than an audio card can handle, but many of them (e.g. popular RC5 codes) use a low frequency modulation that is easily detected.

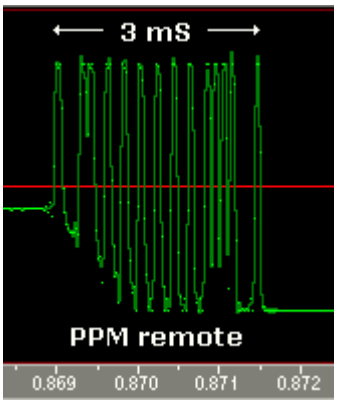




This is wat I've got from an RC5 remote placed at 15 cm from a BPW41 photodiode and a 100 kohm resistor. The original high frequency modulation is cut out by the sound card input filter, leaving a clean, intellegible waveform. Perfect!

click here to listen what RC5 remotes sound like

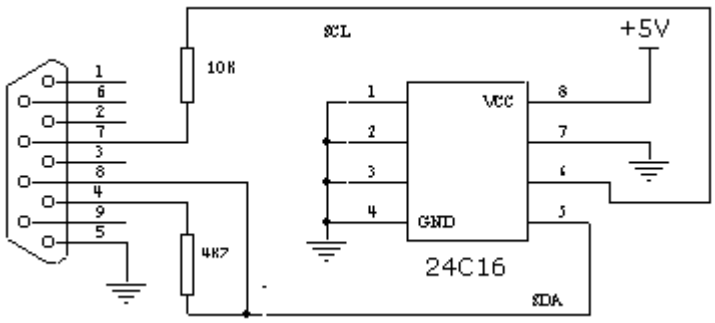
For PPM codes, that are based mainly on short, high frequency, unmodulated pulses,this technique is limited to simple detection. As the figure shows, most of the PPM pulses are distorted (aliased) due to the comparatively low sampling rate.
I made both plots with a Sound Blaster 16, sampling at 44 kHz, mono, 8 bits. I used the excellent Cool Edit audio software (shareware).



click here to listen what PPM remotes sound like

For more on infrared remote controls, check the Tomi Engdahl's pages at **http://fagersta.com/electronics/**
For free download of the Cool Edit program: **http://www.syntrillium.com**
For more on unusual sound card applications check the **mind provocations** page.

The simplest eeprom programmer...



program 24xx serial eeproms with only two resistors!

This design uses **only two resistors** to program any IIC serial eprom. It is connected to a PC serial port. I've succesfully built it for a 24C16 part, but it should work with both smaller and bigger chips (24C02 24C08 24C32 24C65 etc.). It is driven by the Claudio Lanconelli's PONY PROG free windows software. Set it to "SI-PROG serial interface" serial interface with API calls and no bit inversions.
Notice for dummies: the dashed triangle symbold is "power ground" (GND).

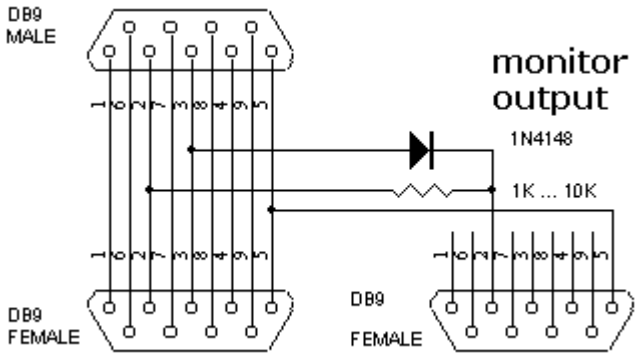
You need an external +5V power supply to feed the circuit. Be careful to apply the power before connecting the circuit to the serial port. If your PC case is permanently left open (just like mine), then you can easily steal the power from the PC supply. The photo on the right shows one of that spare PC floppy power connector. Usually GND is on both the black wires, +5V is on the red one.

UPDATE april 2000

Randy Roo found a 2432 EEPROM that refuses to work! Closer inspection reveals that newer part lack clamp diodes on the inputs, letting pin voltage exceed power rail. To fix it, place two 1N4148 diodes from pin 5 (anode) to +5V (cathode) and from pin 6 (anode) to +5V (cathode). Alternatively, put two 4,7 volts zener diode from pin 5 (cathode) to GND and from pin 6 (cathode) to GND.

...and the simplest RS232 monitor

This clever circuit has been posted on a newsgroup and Al Dickens kindly mailed it to me. At first glance, monitoring the communication between two RS232 devices (e.g. a PC and a peripheral) would require a separate PC with TWO free serial ports.
This amazing circuit does the job with only ONE serial port!!!
A large number of RS232 devices "talks" half duplex. Since only one device talks at any given time, a single port is more than sufficient to monitor the full datastream.
This circuit replaces the original cable between the RS232 devices.
Connect a PC to the monitor output
The circuit is a "mixer" of the RX and TX data streams. The combination of the diode+resistor



pulls the monitor output to the RS232 rest potential (negative) when no data is transmitted.

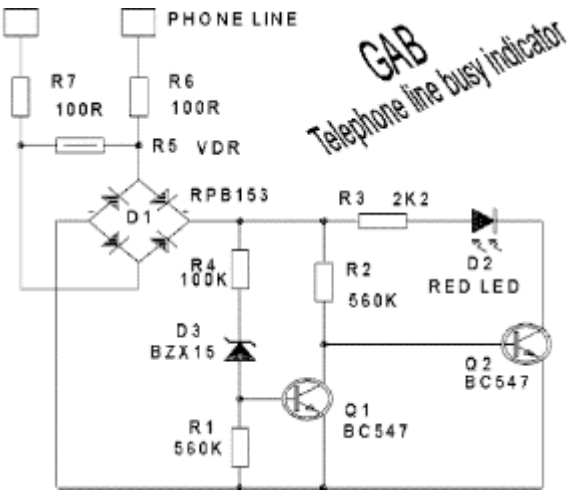
RS232 snake

Next time you stop to your favourite components store, don't forget to buy the following:

50 cm. 9 pole flat cable
two 9 pole male D snap-in connector
two 9 pole female D snap-in connector

Then snap all connectors on to the flat cable (a small vice will do the job). You get an instant male-male, male-female, female-female serial adaptor, plus a short extender cord. **A must-have tool if you're planning to play with serial ports**. You can even put an extra connector for monitoring the RS232 traffic.
This nice idea comes from Claudio Lanconelli.

Phone line status indicator



This circuit has been designed by Gabriele Bandini. His home is full of telephones, modems, and... kids. After a dozen of modem crashes, he decided to put an indicator LED on every phone plug to show to the family when the phone line is free.

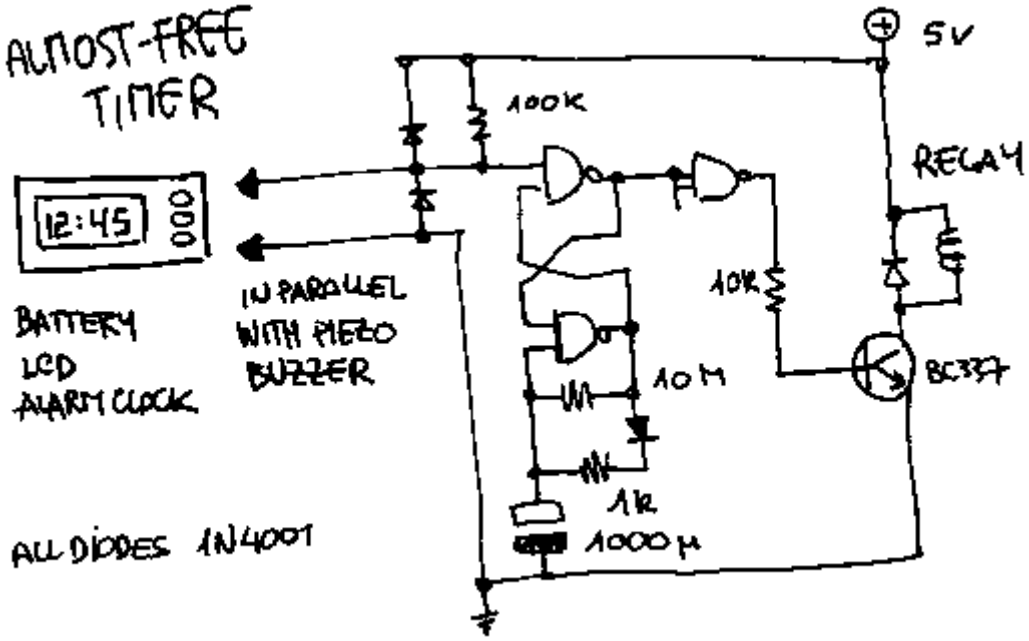
If you have a FAX and a phone on the same line, this circuit can show you when to make a phone call without disrupting an incoming fax. If you have an internal modem, this circuit will show you when it is on hook

The whole circuit is placed inside the phone plug. The LED is visible drilling a hole on the back shell. Now I know why italian phone plugs are so large!!!

Note that this circuit is designed to work with italian telephones and that you need the written approval of your phone company prior to put something on the phone line.

Almost free daily timer

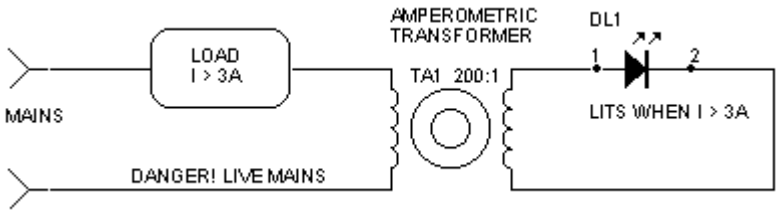
If you don't have noticed it yet, I like to reuse hardware objects. This design brings new life to an old lcd alarm clock (but I bet it would work with LED types too). It is useful for a variety of purposes, from watering your flowers to (precisely) switch on the heating, the garden lights or even your christmas tree!



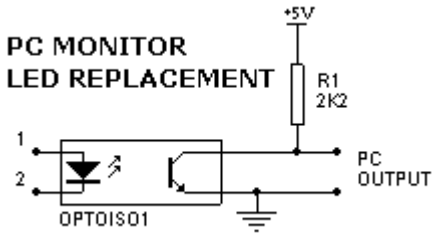
The circuit cannot be simpler: the activating signal is picked up in parallel from the original buzzer (that can even be removed). When the alarm "sounds", the set/reset flip flop is SET. The flip-flop output is also connected to the RESET input, through a 10Mohm x 1000uF delay network. This means that, after the delay time (about three hours on my prototype), the flip-flop resets itself. The daily timer is then ready for a new activation. You can set any delay you like, from seconds to hours, simply adjusting the resistor and/or capacitor values.

Appliance status monitor

This simple circuit lights an LED when the connected circuit draws more than 3 A ac. At 220 volts, this means something more than 600W.



Replace the LED with an optocoupler and connect it to the PC serial or parallel port to monitor when an appliance or an industrial equipement is working (a square wave is output)



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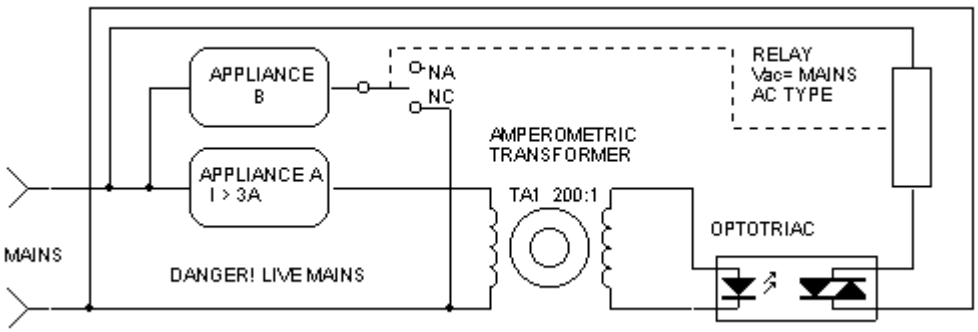
The amperometric transformer (TA) on my prototype is a 200:1, 5A max. toridal transformer, originally made for current measurement. The primary (black wire on the left) had 2 turns, but I have wound another one with 4 turns to increase sensitivity (white wire on top).

Appliance priority switch

Here in Italy, the amount of mains power for most households is limited to 3 kW. With an hairdryer taking as much power as 1900W, I must check not to exceed the maximum power rating every time I switch on an electric appliance. Failing to do it may result in an unplanned walk out of the home, to restore the mains circuit breaker switch.



I use this priority switch to automatically remove power from appliance B when A is powered on. That is, A takes precedence over B, and the maximum power consumption is never exeeceded.

One nice feature of this circuit is it does not require an external power supply, and it consumes nothing when not active.When current flows in the TA, the LED in the phototriac lits, and the triac turns on the relay disconnecting load B.