THINK TANK

The Bitgrabber Revisited

By John J. Yacono

Back in the December 1990 issue of **Popular Electronics**, there was a project (which I designed) that generated a good deal of mail—luckily all of it was good. Many people came out with additions and modifications to the circuit, and since it is a very simple project, I though I'd present some of the mail here.

The project was called the *Bitgrabber*, and it was a very simple (read that "beginner's") computer project. In fact, even if you've never built a computer-oriented circuit, you needn't hesitate to try assembling the Bitgrabber; as long as you wire it correctly, it will work. (In fact, one of this month's contributors reduced the project to a one-IC circuit!)

What the Bitgrabber does is monitor the parallel-printer connector of an IBM compatible and waits to see a particular character coming out from there. The character it looks for is set by the user through some switches. When the user-set character matches the computer-generated character, the output of the Bitgrabber goes low.

The Bitgrabber is as useful as it is simple. It can be used to troubleshoot parallel-printer cables and interfaces, or even serial cables. By using optocouplers, you can even use it to turn appliances in your house on and off at the command of your home computer.

HOW IT WORKS

Inside a computer, characters are represented by 8-bit binary numbers. The number that represents each character can be taken off an ASCII or IBM character chart, which is contained in most computer books. When a computer sends a character to a parallel printer, it sends all of the character's eight bits at once (*i.e.*, in parallel). They exit the computer through pins 2–9 on a DB-25 connector.

The Bitgrabber circuit is shown in Fig. 1. The eight switches, S1-a–S1-h, are used to tell the Bitgrabber the pattern of the bits it is to look for. When the bit pattern from the computer matches the pattern of the switches, the Bitgrabber's output goes low. That's all there is to it. If you want a more in-depth explanation of the parallel-printer port or the operation of the Bitgrabber, see the December 1990 issue of **Popular Electronics.**

The Bitgrabber is really a springboard; a project that leaves it up to the builder to make it really useful. That's what many of you have done. Let's take a look at some of the ideas that you've sent in (all of them will of course be rewarded with a *Think Thank II* book), and permit me to throw in a few curves of my own.

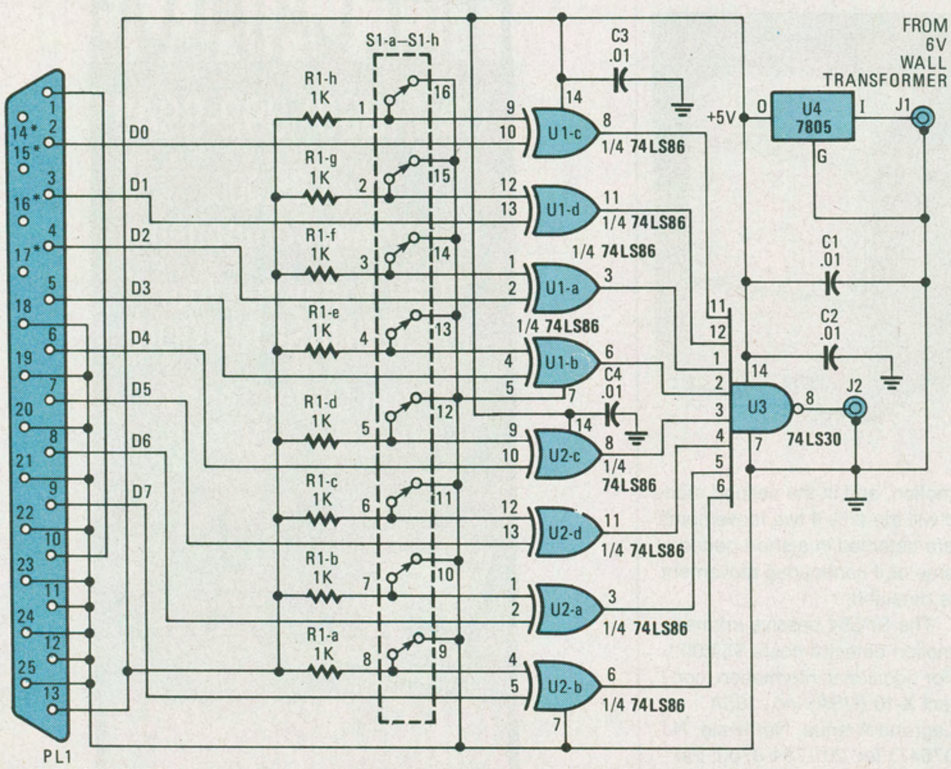

Fig. 1. The Bitgrabber in its earliest incarnation. It's a springboard that many ideas have sprung from.

THE ONE-CHIP BITGRABBER

I have been an avid reader of **Popular Electronics** for a number of years and although I normally get a chance to read the magazine when it arrives, I just got around to reviewing the December 1990 issue.

The Bitgrabber article starting on page 33 is a

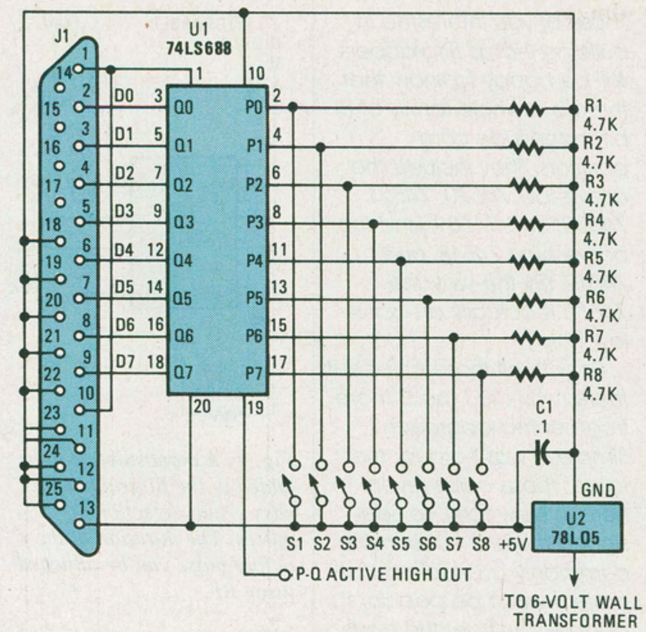

Fig. 2. One chip can replace all three of the chips in the old Bitgrabber. The trouble is getting the chip.

very interesting article and could be used as a basic building block for numerous computer projects. However, after a detailed inspection of the circuit I would like to suggest a simpler approach.

The IC used in my circuit (see Fig. 2) is a 74LS688 8-bit magnitude comparator. Amazingly enough, the functional blocks that make up the 74LS688 almost duplicates the circuit shown in your article. The chip is especially designed to accomplish exactly what the three chips in the Bitgrabber do. By placing the data from the computer on the Q inputs and the user-selected data from the switches (S1–S8) on the P inputs, you'll get an active-high output on pin 19, if and only if, the two sets of data match.

The greatest advantage to using this IC in the circuit is that it reduces the number of components. An added advantage, from my viewpoint, is that the output is an active high, which generally makes it easier to interface with other circuits. Also since the chip provides a chip-enable input (pin 1), it allows handshaking to be tested also.

The additional circuit (shown in Fig. 3) can easily be added to latch onto the circuit's output. It eliminates having to repeatedly output a match to activate a slow test instrument (such as a multimeter). It is a very simple circuit that can be found in about all reference books on SCR's. I hope both circuits will be useful to someone. Keep up the good work with the magazine.

—Bobby D. Smith, Lake Charles, LA

Very, very well done!

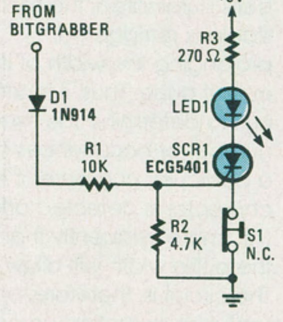

Fig. 3. A simple latching indicator can be made for the revised Bitgrabber (back in Fig. 2) with just a few components.

Those of you interested in building 1-chip Bitgrabbers will be happy to know that there is a whole family of 8-bit magnitude comparators. They include the active-low 74520, 74521, 74522, and 74689, and the active-high 74518, and 74519. (By the way, the 74688 is actually an active-low chip.)

So with all those chips out there, why did I use a more fragmented approach? Simple, it was hard for me to get those chips (even here in New York), so I designed the unit out of more commonly available stuff. A project won't be popular if people can't get the parts to build it.

By the way, I really prefer active-low outputs on TTL circuits. The reasons for that are pretty strong. First of all, active-low outputs can operate optocouplers. Optocouplers can operate DC loads, rectified AC, and full-wave AC loads. All you need is an optocoupler with the right output (transistor, SCR, or Triac driver, respectively).

Also by using an active-low output, you can interface the circuit with CMOS circuitry operating with a higher supply voltage. That's one reason why most outputs on TTL devices are active low.

By the way, the enable-input feature you mentioned is an excellent improvement. Some output ports actually hold one or two of the eight data lines high when idle. Your circuit removes the chance of falsely detecting that idle data.

BITGRABBER ADDITION

Here's a simple addition to the Bitgrabber circuit from your December 1990 issue (see Fig. 4). In order to increase the usability of the circuit, an LED-driving circuit is added to the output. The

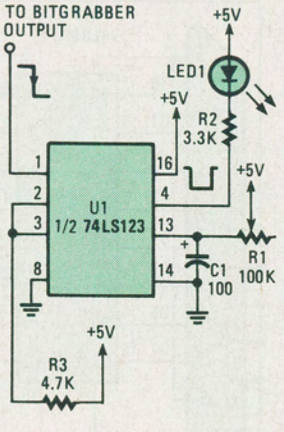

Fig. 4. A monostable can be added to the Bitgrabber for easy visual detection of pulses. The duration of the output pulse can be adjusted using R1.

circuit eliminates the need for hooking up a scope to the Bitgrabber's output and thus allows quick, portable use of the device.

In the circuit, the Bitgrabber's output drives half of a 74LS123 monostable multivibrator, which produces an output pulse with a duration long enough to illuminate LED1. The circuit is triggered by the falling edge of the Bitgrabber's output. The pulse width can be adjusted by varying R1. The values shown for R1 and C1 allow a maximum pulse duration of up to 4.5 seconds. When the desired character is detected, the LED will light for the duration of the pulse from the 74LS123.

If that character is detected again while the LED is still illuminated, the monostable is retriggered, prolonging the width of its output pulse. Thus, it is difficult to determine the exact number of occurrences of a particular character if the character is detected often (i.e., more frequently than the pulse width will allow). The circuit is, therefore, only useful for detecting an occurrence of a specific character.

—Brian Delsey, Hamilton, Ontario

You deserve a book for such a nice pulse stretcher.

RELAY DRIVER

I enjoy experimenting with transistors and other devices that allow you to control a high voltage with a low one. I built this circuit (see Fig. 5) awhile ago and forgot about it. I found it today and connected it to the Bitgrabber. The relay remains pulled in as long as the base of Q1 is held high. Diode D1 protects the circuit from the inductive kick-back produced by the coil of K1. Resistor R1 reduces the current flow out of the Bitgrabber and into the base of Q1. Hope this gets me a *Think Tank* book.

—*Jon Caywood, Lynnwood, WA*

Short and sweet. The reader should note that the printer port will have to output the selected character a couple of times to allow the relay (a pretty slow device) to deactivate.

Your interest in power control is well deserved; most of electronics is dedicated to that subject in one form or another.

MY OWN CURVE

At this point I'd like to throw in a twist of my own. By using SPDT center-off switches in place of the plain SPST units originally specified, you can set the switches to a "don't-care" state, as well as to high and low. That will allow the unit to ignore the value of one or more of a character's bits if that bit is inconsequential.

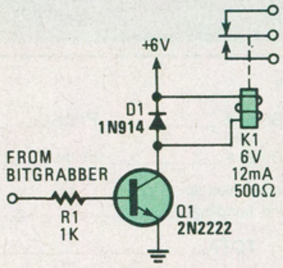

Fig. 5. A simple interface circuit can be made so that the Bitgrabber can operate powerful devices. Power control is one of the most important topics in electronics and its study accounts for most of the components we have today.

Take a look at Fig. 6 to see how that is accomplished. In the figure, we only show the operation of one switch since they all function identically. As shown, the switch can be set in one of three positions: the "low" position, which ties an input of the XOR gate to ground; the "high" position, which allows the gate input to float high via a pull-up resistor; or the "don't care" position, which ties the gate input to it's corresponding printer-port input, ensuring a match regardless of the port line's value. There is only one hitch to the modification: don't expect a Bitgrabber modified in this way to fit into a small case.

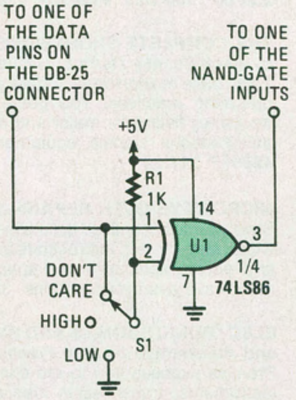

Fig. 6. The capability of the Bitgrabber can be greatly enhanced by using SPDT center-off switches. They allow the user to specify a "don't care" state for times when the value of a bit or two is unimportant.

In the future, if you improve upon a project that you've seen in this magazine, let me know. If I get enough letters on a particular project, we can explore the possibilities together. Write to *Think Tank*, **Popular Electronics**, 500-B Bi-County Blvd., Farmingdale, NY 11735. ■