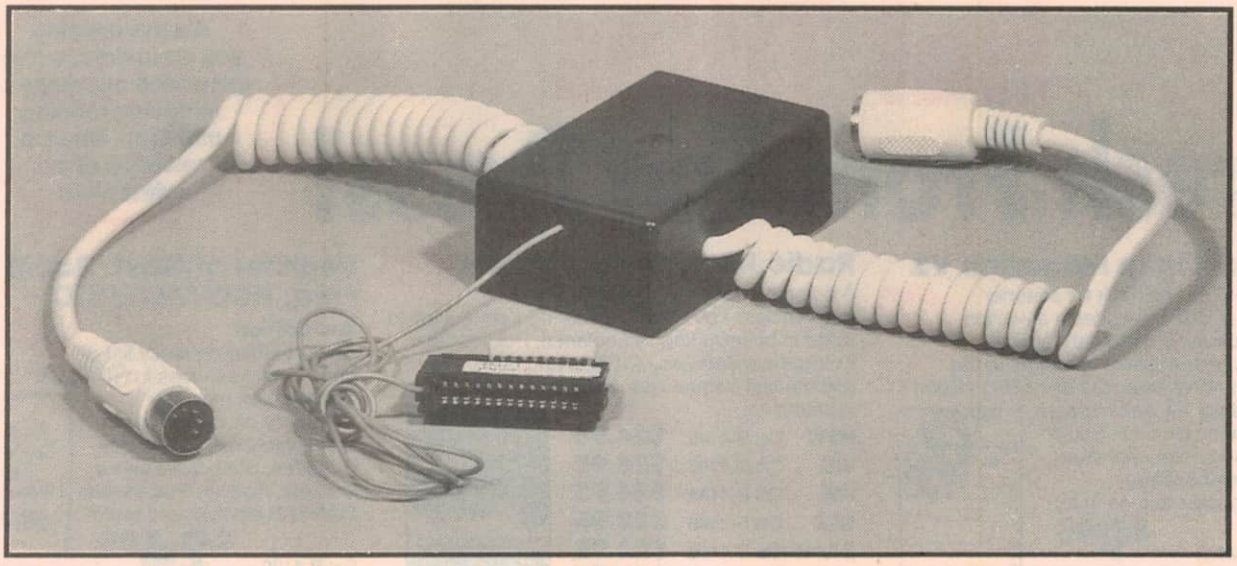
Construction Project:



A HARDWARE SCREEN SAVER

If your PC is fitted with an expensive video monitor, you shouldn't leave it displaying a bright static image on the screen. A 'screen saver' program is the popular remedy, but these can cause conflicts with some applications packages. Here's a simple low cost project which does the job quite 'transparently', using hardware rather than software. It works with many 'IBM clone' PCs and popular VGA cards...

by DAVID JONES

It's a well known fact that leaving the same picture on a monitor for extended periods of time can 'burn' the image into the phosphor coating on the inside of the picture tube screen. This leads to washed-out or faded areas on the screen, and necessitates the need to turn the brightness and contrast up — which in turn causes more damage and shortens the life of the tube. A rather grim tale, and the last thing you want to happen to your brand new, whiz-bang multiscan colour monitor that cost you a second mortgage on the house.

Fortunately there is an easy solution: a 'screen saver' program which turns off the picture on the monitor when the keyboard has not been touched for a preset time period. This allows you to walk away from the machine, safe in the knowledge that the screen won't be left on at full brightness for hours on end.

Screen saver programs are the latest craze at the moment. They come in all different shapes and sizes, from simple ones that just turn the screen blank, to full colour graphics of tropical fish, paddling ducks, flying toasters, scenes from popular movies or just about anything else you can think of.

The problem is that these programs must be either built into the application that is running (there's not too many of these), or in the form of a TSR program that takes up memory and can cause possible conflicts with some software applications.

Wouldn't it be great if you had a screen saver built into the hardware, so that it would work totally transparently to all programs, and wouldn't use one bit (pun intended!) of memory?

Well here it is — a hardware device that connects to almost any clone PC with a keyboard and a VGA card with one of the so-called 'feature connectors'.

The unit can be programmed via jumper links, to time for any period from a few seconds to many hours of non-keyboard activity before the screen blanks out. Another jumper selects between a totally blank screen, or one that flashes on and off every couple of seconds. Pressing any key on the keyboard will cause the screen to switch back to the normal display, exactly where it left off.

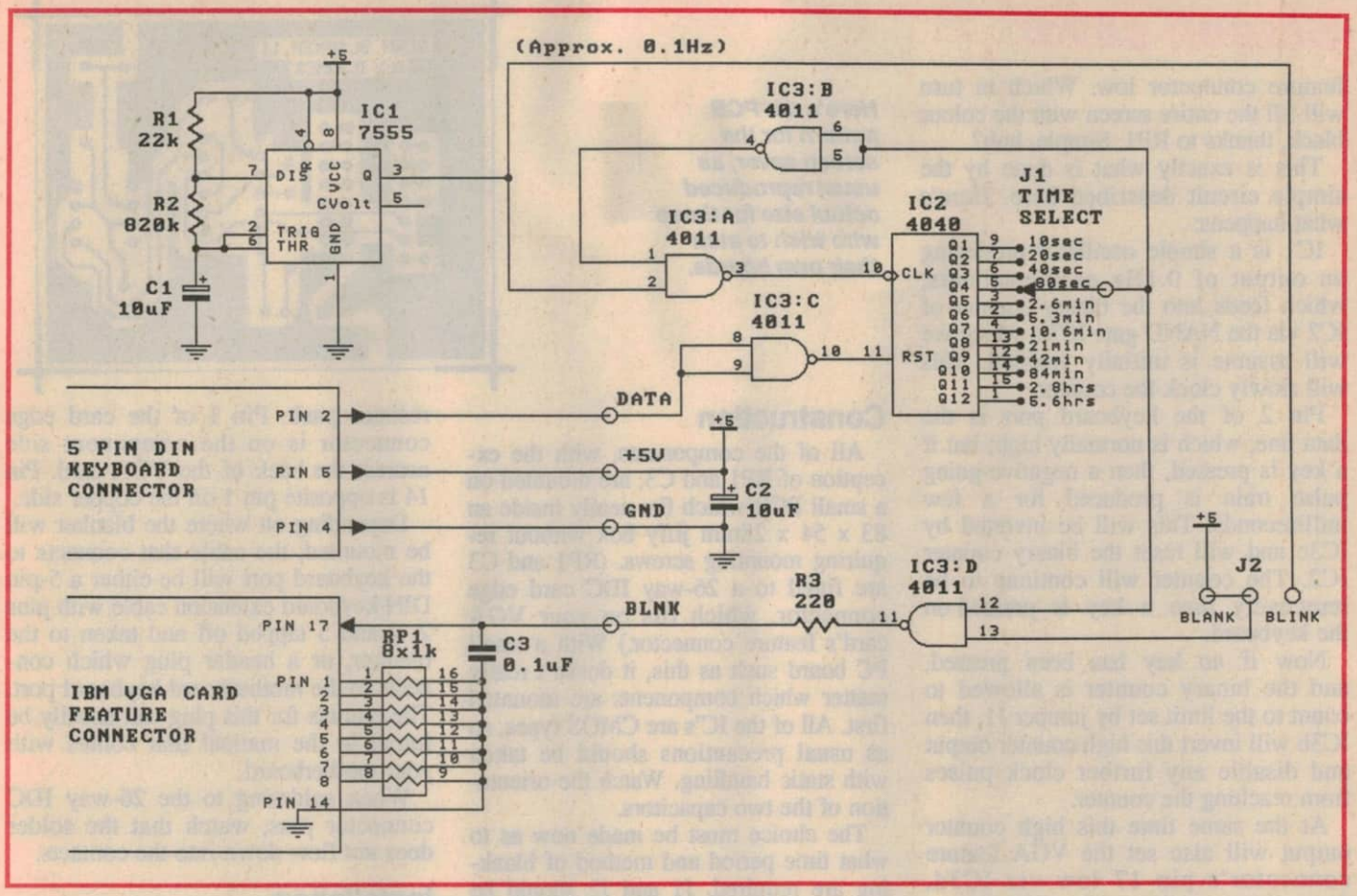
The device fits in one of the smallest jiffy boxes (UB5) and takes its power from the keyboard port, which is also used to sense keyboard activity. There is only a single other wire that goes to the VGA feature connector, which is a 26-way card edge connector located on the top edge of most VGA cards.

How it works

First up, it may be best to describe in basic terms how the VGA feature connector works. Basically it is an external port which provides access to all of the sync and digital colour bits.

The lines that we are interested in are the 8-bit data bus (pins 1 - 8) and the data bus direction line (pin 17).

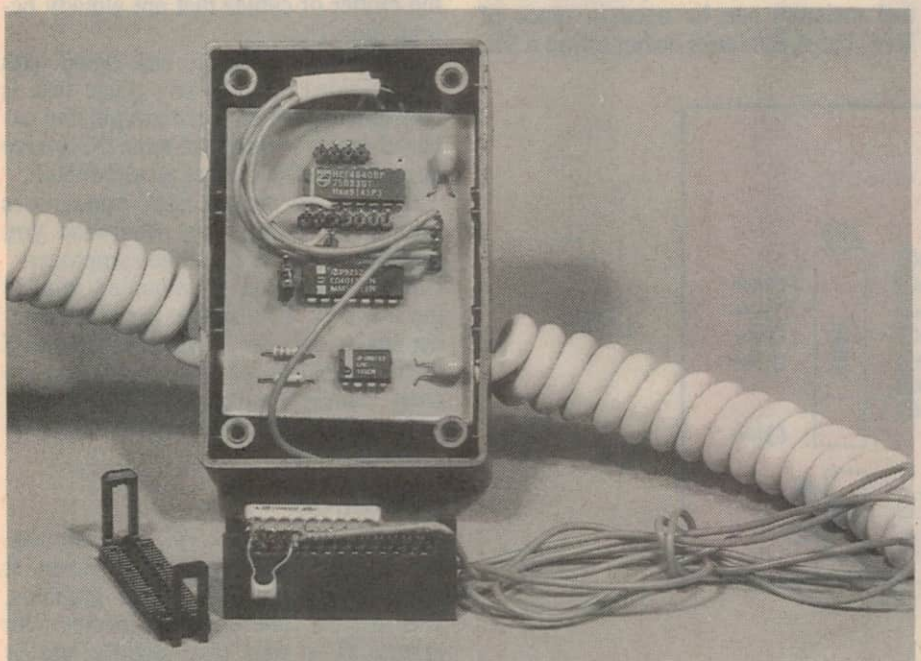
Pin 17 is tied high on the VGA card, and this sets the data bus to an output



There's very little hardware in the screen saver, as you can see. Low frequency oscillator IC1 drives counter IC2, which produces blanking of the screen by controlling pin 17 of the 'feature connector' on your VGA graphics card. If there has been no keyboard activity to reset the counter via IC3c, the screen is blanked

which contains all the colour information generated by the DAC chip on the VGA card.

However if pin 17 is pulled low, then this selects the data bus as an input. Therefore in this mode 8-bit colour data information can be fed in externally via this port, and displayed on the monitor instead of the data from the DAC.



This view shows inside the author's prototype unit, which was fitted in the centre of a keyboard extension cable. Also visible at the bottom is the 26-way connector used for the VGA card interface, showing the added components.

Regardless of the state of pin 17, the sync signals will still be generated internally and all we are doing is selecting either the colour information from the computer or an external one — which in this case is the colour black, because we tie all the data bits low via resistor pack RP1 (see schematic).

You may have guessed that it would be possible to 'blank' the screen with any colour we choose, simply by applying the correct colour bit pattern to the bus. But that really defeats the entire purpose of a screen saver!

The feature connector also contains external sync lines, which could have been used to blank the screen also. All you have to do is select external sync and then not apply any! But this can cause some multi-sync monitors to switch to their lowest scan frequency — which is usually 15.625kHz. As a lot of people can hear this frequency, it can become quite discomforting!

So now all we need is a circuit that times for a certain period of no keyboard activity and then sets pin 17 of the

feature connector low. Which in turn will fill the entire screen with the colour black, thanks to RP1. Simple, huh?

This is exactly what is done by the simple circuit described here. Here's what happens:

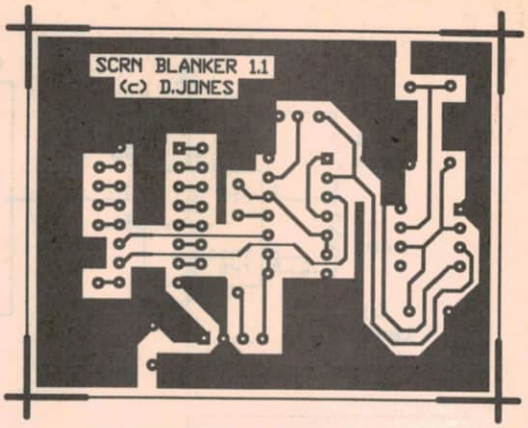
IC1 is a simple oscillator producing an output of 0.1Hz or thereabouts, which feeds into the binary counter of IC2 via the NAND gate IC3a, which we will assume is initially enabled. This will slowly clock the counter.

Pin 2 of the keyboard port is the data line, which is normally high; but if a key is pressed, then a negative-going pulse train is produced for a few milliseconds. This will be inverted by IC3c and will reset the binary counter IC2. The counter will continue to be reset every time a key is pressed on the keyboard.

Now if *no* key has been pressed, and the binary counter is allowed to count to the limit set by jumper J1, then IC3b will invert this high counter output and disable any further clock pulses from reaching the counter.

At the same time this high counter output will also set the VGA feature connector's pin 17 low via IC3d, depending on the setting of J2 — which will either toggle the screen off and on at the frequency of IC1, or blank it out completely.

VGA pin 17 will stay in this condition until a key on the keyboard is pressed. This will reset IC2, and the whole process starts over again. As you can see, it's quite straightforward.



Here's the PCB pattern for the screen saver, as usual reproduced actual size for those who wish to etch their own boards.

Construction

All of the components, with the exception of RP1 and C3, are mounted on a small PCB which fits neatly inside an 83 x 54 x 28mm jiffy box without requiring mounting screws. (RP1 and C3 are fitted to a 26-way IDC card edge connector, which fits on your VGA card's feature connector.) With a small PC board such as this, it doesn't really matter which components are mounted first. All of the IC's are CMOS types, so as usual precautions should be taken with static handling. Watch the orientation of the two capacitors.

The choice must be made now as to what time period and method of blanking are required. J1 and J2 should be linked accordingly. The schematic and overlay diagram show the information for these links.

C3 and RP1 should be mounted on the 26-way IDC card edge connector so they don't interfere with any adjoining cards, when it's fitted in position. Standard resistors can be used in place of RP1, but it just looks neater to use a SIL resistor pack. Pin 1 of the card edge connector is on the component side nearest the back of the VGA card. Pin 14 is opposite pin 1 on the copper side.

Depending on where the blanker will be mounted, the cable that connects to the keyboard port will be either a 5-pin DIN keyboard extension cable with pins 2, 4 and 5 tapped off and taken to the blanker, or a header plug which connects to the motherboard keyboard port. The pinouts for this plug can usually be found in the manual that comes with your motherboard.

When soldering to the 26-way IDC connector pins, watch that the solder does not flow down into the contacts.

Installation

If your PC motherboard has an internal keyboard connector (usually a four-pin header connector), then it would be best to mount the blanker inside the PC. In this case you can save the cost of the DIN connectors. This also won't add to the clutter of cables that are already behind most PCs.

It is best to stick the unit down with double-sided tape, in any place that is convenient. Just be sure to avoid any exposed mains wiring that some PC's have going to the front panel power switch.

Be sure to mount both connectors around the right way, otherwise you may get some very strange symptoms!

If the unit is to be mounted outside the PC, then it's a simple matter of connecting it into the keyboard cable and then running the IDC connector into the case, usually though an empty expansion card slot or 'D' connector cover on the back panel.

Operation

Apply power to the PC as usual and get any sort of image on the screen. It doesn't matter if it's text or graphics. Wait for the time you have preset with jumper J1. It may take slightly less or slightly more time before the screen blanks out, but this is just due to

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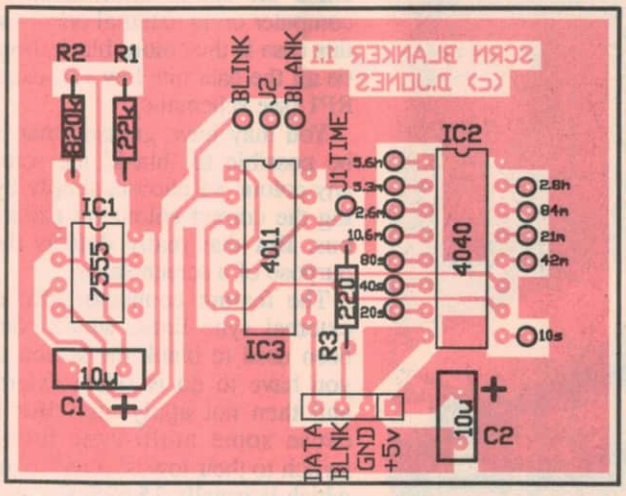

Use this overlay diagram as a guide when you are wiring up the saver PC board. Note that the spacing of the connection pins used for both the J1 timing link and the J2 blink/blank selection are spaced to allow use of SIL pinheader strip.

Screen saver

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the tolerance of the timer circuit components. Depending on the setting of J2, you will either get a permanently blank screen or one that flashes off and on.

Pressing any key on the keyboard should bring the screen back to normal, but the unit does not trap this key press. So whatever application you are in will accept this keystroke and act upon it. This can sometimes lead to an unwanted operation, such as a delete!

The best key to press to bring the screen back is either the <Shift> or <Ctrl> keys, because most programs don't accept a single press of these keys.

You can now have confidence that you can leave your PC on for any length of time, running any application you like, without worrying about wearing out your expensive monitor.

If it doesn't work

The first thing to do when anything doesn't work is to blame Murphy's Law. Cursing, swearing and throwing the thing across the room might also make you feel better, but it doesn't usually fix the trouble. If the keyboard does not work, then it is possible that the fuse has blown in the PC. This is usually a little Pico fuse, rated for a few hundred milliamps, which is soldered to the board — it looks similar to a resistor. Its job is to protect the motherboard from people like us who like to hook gadgets up to the keyboard port. If the fuse *has* blown, then your screen saver device could be hooked up backwards or something dumb like that.

PARTS LIST

Resistors

R1	22k 1/4W
R2	820k 1/4W
R3	220 ohms 1/4W
RP1	8 x 1k SIL resistor array

Capacitors

C1,2	10uF 16VW TAG tantalum
C3	0.1uF MKT or metallised polyester

Semiconductors

IC1	7555 timer
IC2	4040 binary counter
IC3	4011 quad NAND gate

Miscellaneous

PCB, 74 x 48mm; plastic jiffy box, UB5 (83 x 54 x 28mm); 16 x PCB terminal pins; 1 x 4-way length of SIL pin header strip; 1 x 26-way IDC card edge connector; connector for keyboard port interfacing; hookup wire, etc.

If there is no picture on the display when you connect the IDC connector, then there could be a short somewhere on the IDC connector, or the blanking line could be permanently tied low for some reason.

If the PC operates normally, but the screen doesn't blank out, then first check pin 2 of IC3 for the 0.1Hz clock signal. Next check that pin 11 of IC2 gets some positive pulses when a key is pressed.

If pin 11 of IC3d is going low after the time period you've set, then the project is working — try shorting out R3. If the screen blanks with a colour other than black, or random garbage appears, then the value of RP1 may be too high.

If all these suggestions don't fix the problem, then take the unit out of the computer and get it working on the bench before you try again.

If it still doesn't work, you may have a VGA card that works differently for some reason. In which case you'll need to check the manual for the card, which should contain information on its feature connector.

Good luck! ❖