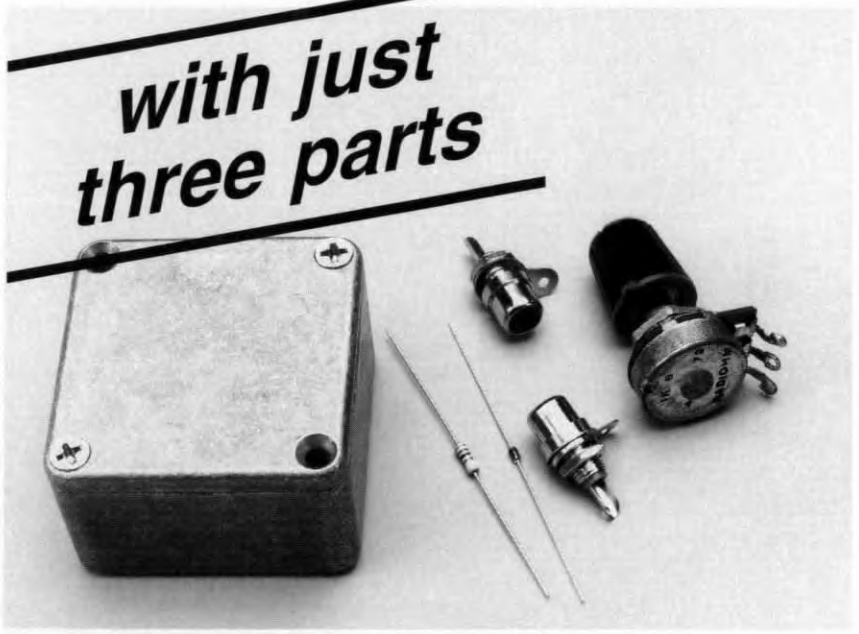
low-cost video fader

with just three parts



One of the first accessories almost any camcorder user will want to have is a simple fader which can help to soften the rather abrupt transitions between filmed shots. The circuit discussed here does just that without any power supply whatsoever. What's more, its component count being down to three, the fader is easily inserted into the video cable.

Design by K. Walraven

As long as audio signals are involved, a simple fader (level control) is no problem at all. A voltage divider in the form of an ordinary potentiometer will be just fine in many cases. Of course, the value of the potentiometer needs to be matched to the relevant input and output impedance, but that is rather easy. If quality is at stake, however, more components will be involved than just the one potentiometer. In professional mixing desks, the pot is usually surrounded by complex electronics, which serves to maintain steady terminating impedances at the input and output of each level control unit. The circuitry around the pot then also prevents the characteristic of the level control from being affected by the signal source. Be that as it may, a simple 'passive' volume control will be sufficient for many applications.

With a video signal, the situation is slightly more complex. Video signals are more complex than audio signals because they contain synchronisation pulses which can not be 'pinched off' just like that using an ordinary potentiometer.

VIDEO, BLANKING, SYNC.

The function of the basic components is discussed below, mind you, without going into details as regards the intricate structure of a video signal. **Figure 1** shows one line period.

The video signal is sometimes also referred to as 'composite video' or CVBS, which stands for colour, video, blanking, sync. For simplicity's sake, the colour component will not be discussed here. The drawing in Fig. 1 clearly shows that the larger part of the total swing of the signal (approx. 67%) is reserved for the V (video) component. This component determines the

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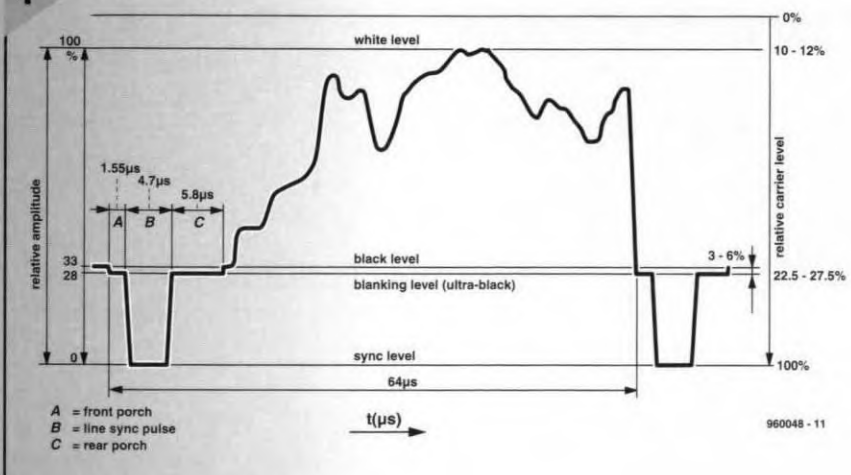

Figure 1. Composition of a video signal during one line period. For a video fader, it is essential that the sync pulses (B) arrive intact at the output.

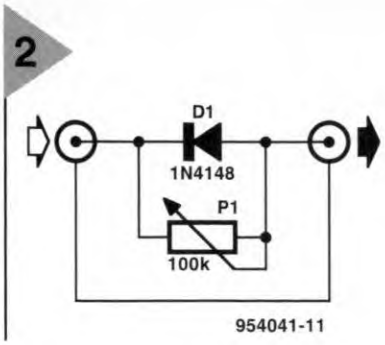

Figure 2. The trick with the diode: when the video level is reduced with P1, diode D1 provides a safe by-pass for the sync pulses.

brightness of the individual picture elements should have relative to a pre-defined black level. The 4.7-µs long synchronisation pulses (B) are between 0 and 28% of the total swing. Each pulse arrives with a 'front porch' (A) and a 'rear porch' (C). During the complete period A+B+C, the electron beam inside the picture tube is quenched ('blanked') to enable the horizontal and vertical retrace (flyback) to become invisible during the line and raster synchronisation.

It will be clear that a CVBS signal can not be sent through a resistive attenuator just like that because the sync pulses are then also weakened. Assuming that a pot fader is used, a relatively short range will be available during which the video signal is actually reduced, but then the monitor or TV will suddenly lose sync, and the picture can not be viewed altogether. In other words, the single potentiometer, great as it may be for audio, is not suitable as a level control for composite video.

BY-ROAD: FOR SYNCS ONLY

If you want to build a video fader which provides an acceptable fading range without sync loss, then care should be taken to attenuate the video component only, i.e., leave the sync pulses intact. If simplicity is not an issue, that may be achieved by using a so-called sync separator which extracts sync pulses from a CVBS signal, allowing these to be added again to the (attenuated) video component at the output of the fader. A perfect solution, true, but without doubt tied up to a rather complex circuit, which is not what we want here.

That brings us to the crucial question: is there a circuit which works, yet is wonderfully simple? Well, there is, if we apply a trick. The circuit of the 'Video Fader II' originally published in the December 1995 issue of *Elektor Electronics* is repeated in **Figure 2** for reference. The potentiometer is the least conspicuous part, of course. In combination with the input impedance of the video input on the monitor, it forms an adjustable voltage divider for the video signal. The trick is the shunt diode which creates a kind of by-pass for the sync pulses. The input and output electrolytic capacitors in the camcorder and the video recorder cause the video signal level to be 'clamped' at a certain average value. Relative to that level, the sync signal forms a train of negative-going pulses which are allowed to travel (almost) freely through the diode. This little circuit appears to fit the bill perfectly: the pot allows you to turn the brightness down without the monitor losing sync suddenly.

PERFECTING THE DESIGN

In practice, the circuit of Fig. 2 does have a few drawbacks, as some readers informed us. The operation of the fader is quite acceptable at high-impedance loads. However, when a terminating impedance of 75 Ω is used (which is customary with video equipment), the fade characteristic is far from ideal. Also, problems with sync degradation were sometimes reported. These problems are probably caused by the threshold voltage of the diode. All in all, sufficient reason to see if the circuit might be improved a little, provided, of course, it retains its charming simplicity.

Improving the 'flow' of the sync pulses was not difficult: all we had to do was replace the ubiquitous 1N4148 diode by a Schottky type BAT82. The lower threshold voltage of the Schottky diode ensures that the sync level remains intact at all times.

Improving the fade characteristic was far more difficult, as it turned out. It was clear that a parallel-connected potentiometer would be a better level control by definition, while also causing less of a mismatch. A practical problem arises, however: when the 'lower' terminal of the pot is simply connected to ground, and the wiper acts as the output, the inherent disadvantage is that the sync pulse is increasingly short-circuited to ground, together with the video components, as the brightness is reduced (fade-out). The diode, unfortunately, can not do anything about this situation.

One extra part, however, does the trick, see **Figure 3**. It may be too simple for words, but the crux of the revised video fader is the way R1 is connected into the circuit. When the wiper of P1 is at the top position, R1 is just a harmless series resistor, and the video signal is passed with virtually no attenuation. When the wiper of P1 is turned to ground (fade-out), R1 prevents the signal from being short-circuited to ground behind the diode. Functionally, R1 changes from a series into a parallel resistor as the pot is turned. At the end of the travel, it is just a harmless terminating resistance.

It will be clear that no passive control will ever form a perfect match between a 75-Ω input and output. Fortunately, the mismatch of the circuit shown here is so small that annoying effects will not occur. On the contrary, this video fader gives a quite acceptable fading characteristic while still offering the advantage of a nearly unrivalled simplicity.

MATCHBOX SIZE

There is hardly a point in discussing the construction of the circuit. Obviously, there is no printed circuit board, while none of the regular construction problems will occur in practice. The only thing to keep in mind is that the wiring between the three components must be kept as short as possible.

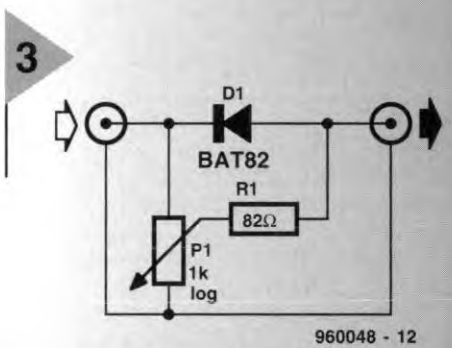

Figure 3. The operation of the circuit in Fig. 2 may be perfected by adding a single resistor.

Diode D1 and resistor R1 are, therefore, soldered directly to the terminals of potentiometer P1. Add two pieces of coax cable, and Bob's your uncle.

An ultra-small enclosure, say, the size of a matchbox, and preferably made of metal, is sufficient to house the circuit. If small size is not your foremost concern, then a small diecast case like the Hammond type 1590LB is worth going for. Also consider using a slide potentiometer for P1, in which case a type 1590A enclosure (also from Hammond) will offer the necessary space.

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