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Video Signal Recognition, ATV Squelch

The presence of a video signal can be recognised using a synchronisation signal detector.

If a video signal is present, this circuit extracts the synchronisation signals and uses them to detect the frame change signal. An adjustable time delay prevents problems caused by interfering signals. An automatic change over to a second video source completes the circuit, which is described below.

1. Introduction

Details of circuits which recognise a video signal have already been published on several occasions [1, 2]. Usually a filter allows only the horizontal frequency to pass through (15625Hz for PAL) and subsequently to be detected.

In the circuit described here, another method is proposed. A sync-separator IC screens out the synchronisation signals from the video signal, then the frame change signal triggers a monostable. A signal is thus obtained which changes from low to high level when a video signal is recogised. An adjustable time delay is then created using a simple RC network and a comparator.

A micro-controller could also be used instead of the monostable, RC network and comparator. This is certainly more flexible, due to its programming options, but it would make the circuit unnecessarily expensive without any real advantages. It would also be necessary to consider possible software crashes in long-term operation and to take suitable measures (Watchdog).

In this version, it is also possible to switch automatically to the signal from a second input (e.g. test pattern, information program) by means of an integrated relay. An adjustable response time suppresses the reaction to interfering signals (e.g. radar signals) or to short interruptions to reception. The circuit thus becomes a complete ATV squelch.

ATV relays or amateur radio TV stations are typical applications for this ATV squelch, together with other video applications.

2. Circuit Description

The ATV squelch circuit diagram is shown in Fig. 2. The video signal to be evaluated arrives at the sync separator U1 via a low-pass filter comprising of R2 and C1. The filter attenuates the high

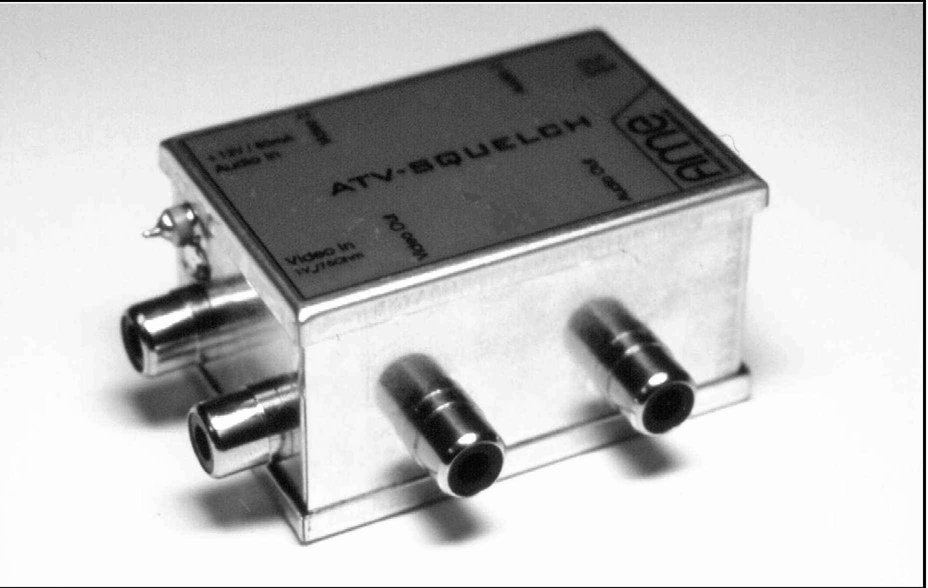

Fig. 1: The assembled ATV squelch ready for operation in the tinplate housing.

frequencies, which are unnecessary for evaluation (image contents, noise) and thus makes very good video signal recognition possible, even for poor reception signals.

The sync separator input is relatively high-impedance at > 10k Ohms, and imposes practically no load on the video signal. If the video signal does not have a termination (a sink of 75 Ohms), the input circuit can be terminated at 75 Ohms with the plug-in bridge, J1.

For a video signal which is satisfactorily received, the amplitude of the input signal should be 1V p-p into 75 Ohms. During the period of time in which a video signal is applied to the input, but when the circuit has not yet switched it to the output due to the delay selected, there is no termination (unless J1 is plugged in), therefore a double voltage (2V p-p) is applied at the input of U1. The IC can handle this without any problems. In contrast to this it also processes very noisy video signals that can arise when reception is poor.

The resistor, R3, was calculated for the PAL colour television standard which is used in Germany [3]. The sync-separator IC makes several outputs available: the vertical signal, a combined vertical/horizontal signal, a signal for recognising the colour burst, and a frame change signal.

In order to produce a stable image for the eye, our television picture consists of 25 frames per second. These are divided into two halves, so that finally we see 50 half-frames per second. The frame change signal at pin 7 of U1 alters its level for each frame change so that normally a frequency of 25Hz can be measured. If there is no longer a video signal at the input, the output remains unaltered at the last level. There is a problem in that an interfering signal (e.g. radar) can also lead to a level change. But we can control this by means of the adjustable response and switching time.

The frame change signal arrives at the input of the re-triggerable monostable, U2A. This reacts only to the positive edge, and thus only to a frame change. If

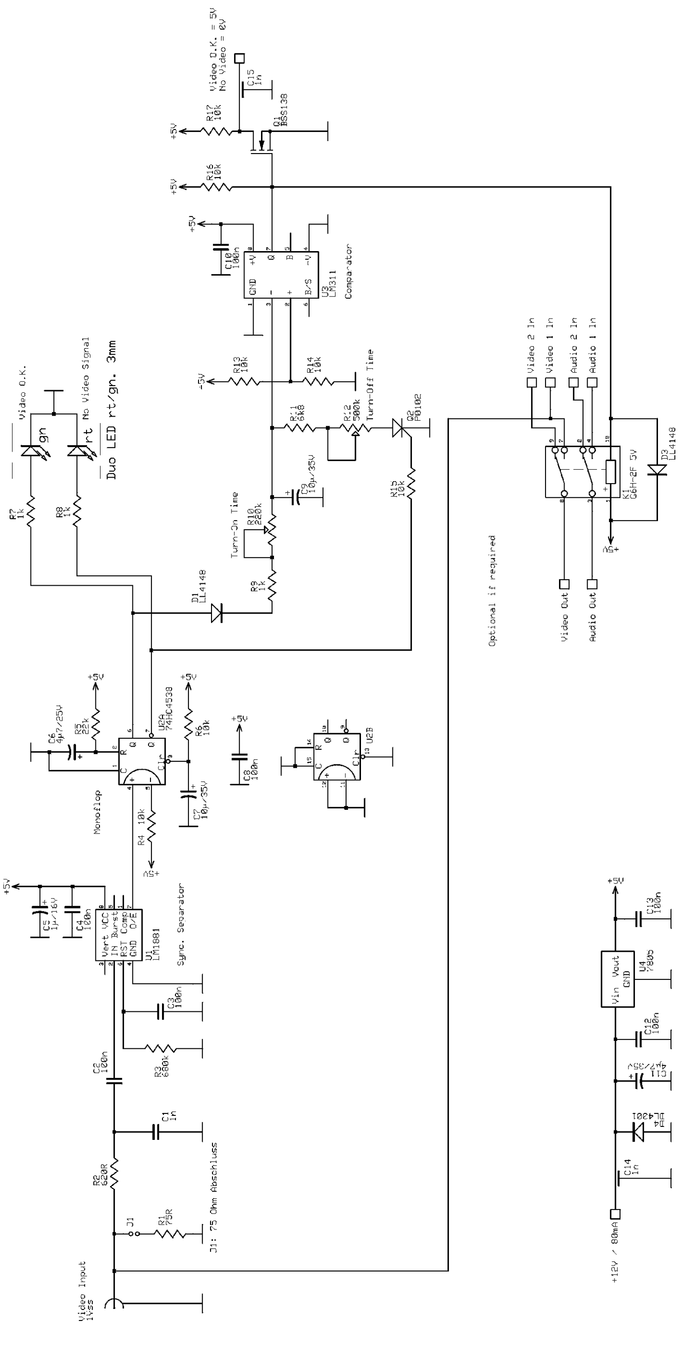

Fig 2 : Circuit diagram of ATV squelch by DG6RBP.

a video signal is present, the output pin 6 is at a high level (5V) and the LED is green, or otherwise it is red. This LED is connected before the response delay or slow switch, it directly indicates the condition of the input signal. A poor signal which is interrupted can be recognised by a flickering of the LED.

The time constant (R5/C6) of the monostable has been calculated in such a way that, even if the signal is missing for scarcely more than one complete frame the time is nearly expired. It would be possible to have a slow time at this point, but it offers no advantages. On the contrary, we would no longer be able to recognise short interruptions to the input signal from the LED.

The capacitor, C7, prevents any possible false output signals from the monostable while the operating voltage is being applied.

As already mentioned, the circuit should not recognise the presence of the input signal until it has been applied to the input for longer than an adjustable period of time. Likewise the change-over relay (or the circuit output) should not open until an input signal has not been applied for a separately adjustable period of time. Relatively small interruptions to the video signal (or synchronous signal) are permitted during both these times.

The monostable output charges the capacitor, C9, through an adjustable resistor (R10, switching time). As soon as the voltage at the capacitor exceeds the comparison voltage of approximately 2.5V, pre-set by the voltage divider, R13/R14, the comparator, U3, discharges its output (open collector) to earth. The relay, K1, then switches the recognised video signal through to the output. A control signal is provided by the FET, Q1, which changes to + 5V. This is just a control signal (e.g. for further processing in the control computer of an ATV relay), and it is not suitable for directly operating an external relay. For this purpose, another transistor would have to be used as a driver.

If we require only the control output without a change-over relay, we do not need to fit this relay. The resistor, R16, ensures the functioning of the control signal even without a relay.

In order to be able to set the switching time and the opening time independently of one another, the output of the monostable may cannot discharge the capacitor, C9, the diode, D1, being used to prevent this happening. If the input signal disappears, C9 is discharged in a controlled manner through the adjustable resistor, R12 (opening time) using the thyristor, Q2.

The voltage supply is fed to the circuit through a 1nF feedthrough capacitor. The diode, D4, acts as a reverse battery protection. The supply voltage of 12V (± 10%) is stabilised at 5V using the voltage regulator, U4. When the relay switches, the current is just 80mA. A higher input voltage is not possible, due to the higher power loss and the associated increased heating dissipation of U4.

3.

Assembly

The ATV squelch circuit is assembled on a 54mm x 36mm double-sided epoxy printed circuit board, (Figs. 3a and 3b). The circuit board is through-hole plated and tin-plated. Through-platings are created only at the points necessary i.e. not on the normal soldering areas for conventional components.

First, the housing is drilled, or even better punched. The mid-points of the cinch jacks are about 10mm. away from the housings underside.

Since space is very limited, we should be careful to ensure that the jacks do not touch any components on the printed circuit board when it is fitted! We should also select cinch jacks with as short a

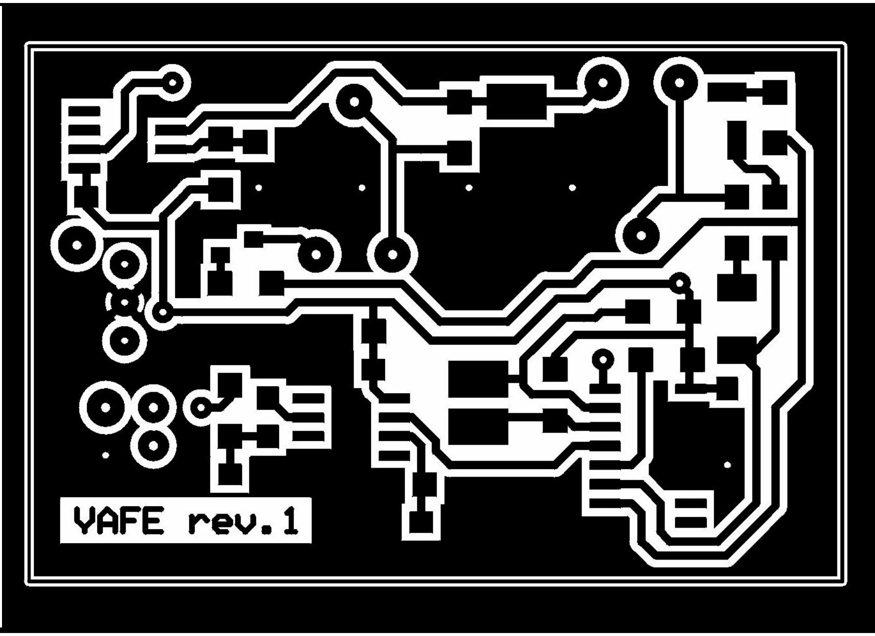

Fig. 3a: Layout of components side (not to scale!).

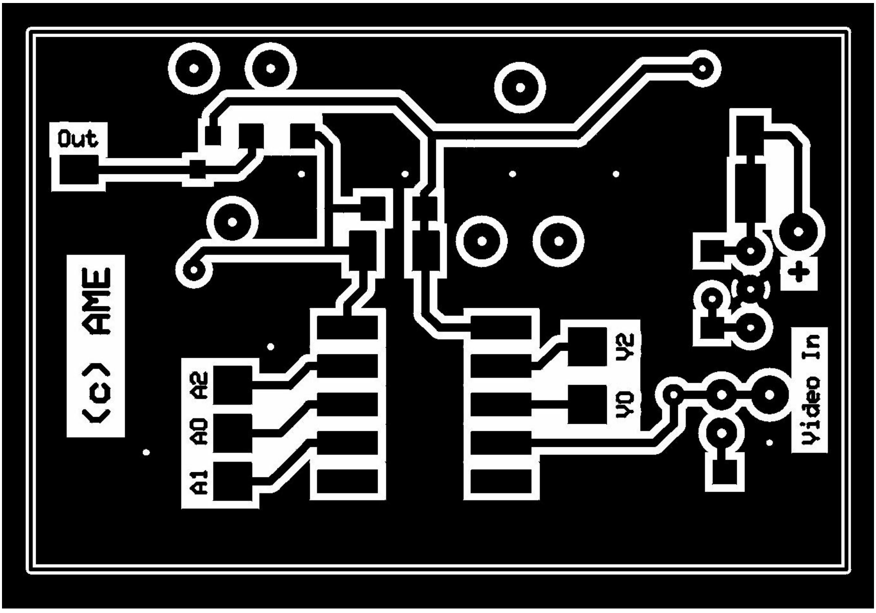

Fig. 3b: Layout of foil side (not to scale!)

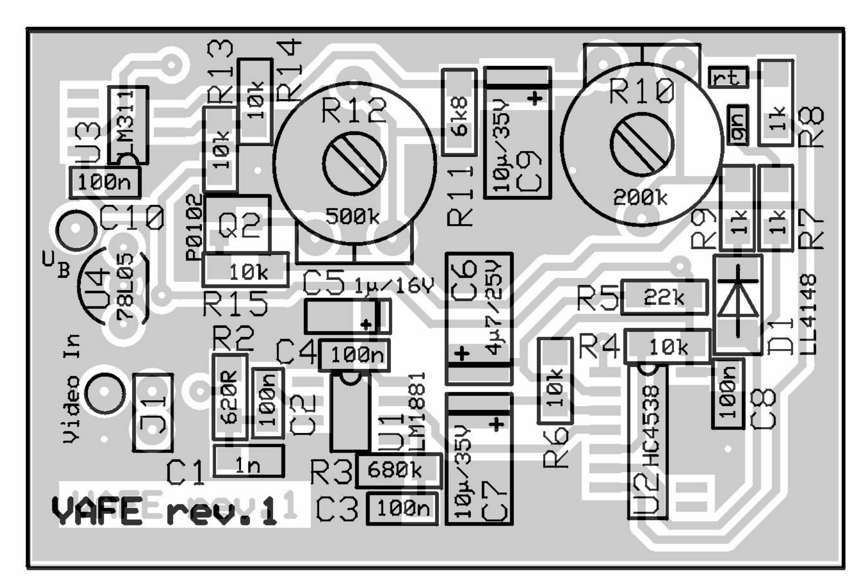

Fig. 4a: Component layout (mainly SMD) on topside

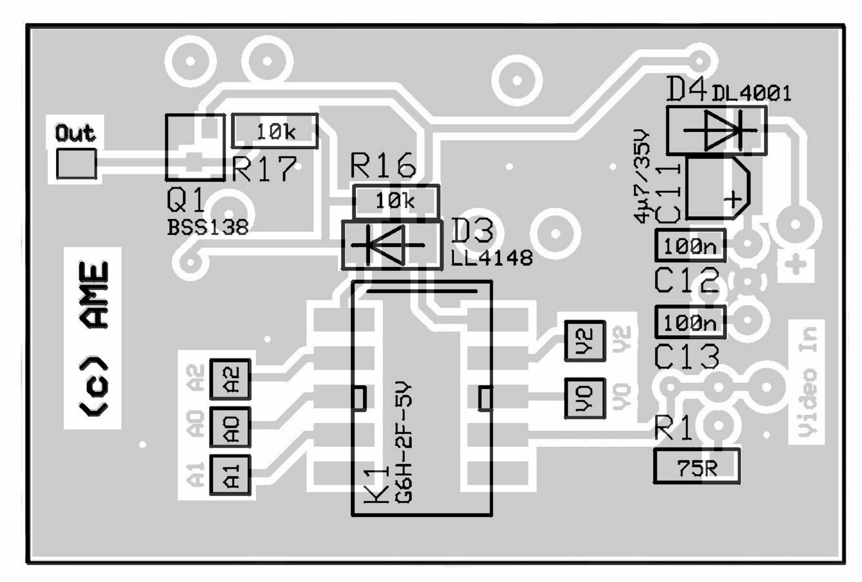

Fig. 4b: Component layout solder side with SMD components

thread length as possible.

The board is now inserted at a distance of about 10mm. from the top edge of the housing and soldered all round.

Next the components are mounted on the board first all the SMD components and then the other parts. Lastly, the two potentiometers, R10 and R12, together with the voltage regulator, U4, are soldered onto the two sides of the printed circuit board. Figs. 4a and 4b show the components drawings.

Finally, the cinch jacks, feedthrough capacitors and the LED are fitted. A thin cable is used for the connections to the corresponding soldering pads. After an initial functional test, the circuit is ready for operation.

4. Parts List

1 x	printed circuit board, DG6RBP-003
1 x	tinplate housing, 55 x 37 x 30mm
R1	75 Ohms, SMD 1206
R2	620 Ohms, SMD 1206
R7,R8,R9	1 kOhm, SMD 1206
R11	6.8 kOhms, SMD 1206
R4,R6,R13-17	10 kOhms, SMD 1206
R5	22 kOhms, SMD 1206
R3	680 kOhms, SMD 1206
R10	220 kOhms, PT 10
R12	500 kOhms, PT 10
C1	1 nF, SMD 0805
C14, C15	1 nF feedthrough capacitor
C2-4,C8,C10,C12,C13	100 nF, SMD 0805
C5	1µF/16 V, SMD tantalum
C6	4.7µF/25 V, SMD tantalum
C11	4.7µF/35 V, SMD electrolytic capacitor
C7,C9	10µF/35 V, SMD tantalum
D1,D3	LL 4148, SMD diode
D4	DL 4001, SMD diode
Q1	BSS 138
Q2	P0102 BL
U1	LM 1881 M (SMD)
U2	74 HC 4538 (SMD)
U3	LM 311 M (SMD)
U4	78L05 (TO-92)
K1	Omron G6H-2F (SMD)
J1	Jumper, RM 2.54
1	Duo LED, 3 mm., red/green,
1	Mounting for LED
6	Built-in cinch jacks

5. Putting Into Operation

The video input signal is connected to the video-in jack if no use is made of the integrated change-over relay and only the switching signal output is of interest.

If required the plug-in bridge J1, which terminates the input at 75Ohms, is inserted. The plug-in bridge is accessible once the housing cover has been removed.

If the integrated change-over switch is to be used, the video signal to be tested is connected to the video-in jack and the associated audio signal to audio-in. The alternative video and audio signals are connected to the video 2 and/or audio 2 inputs. The video-out output should be connected to equipment with a 75Ohms

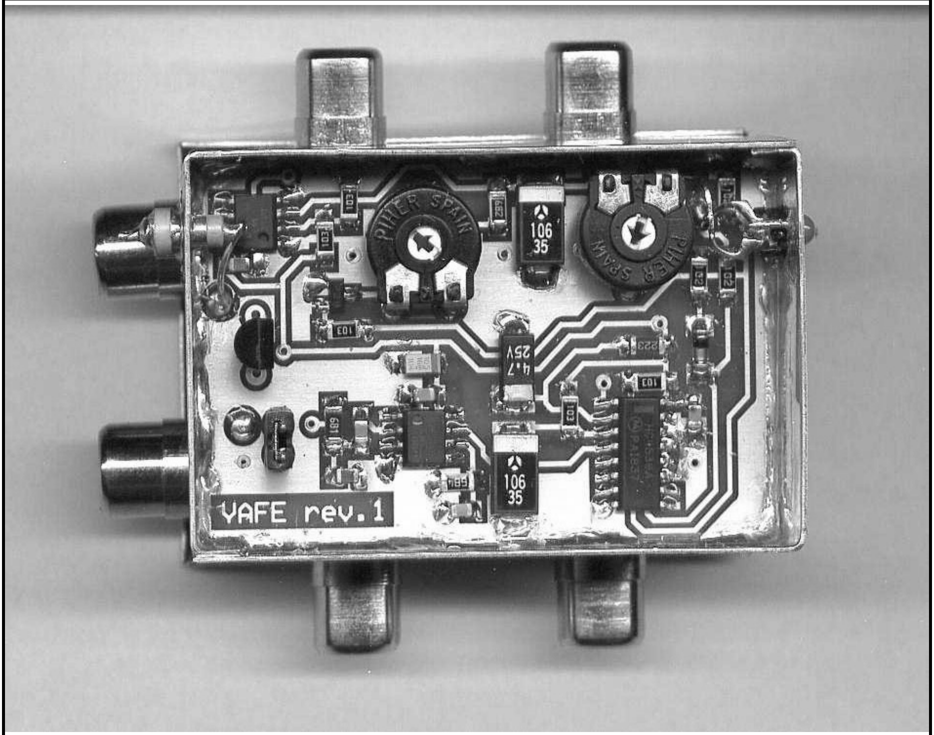

Fig. 5a: The completely assembled topside of the ATV squelch, already fitted into a tinplate housing with jacks.

terminating resistance. The audio output is likewise connected to the corresponding equipment (e.g. ATV transmitter).

Neat earth connections for the video signals are very important for satisfactory functioning of the squelch. It is the cinch plug-in connections where connection problems often occur, depending on the quality of the plugs and jacks. If there is no earth connection at all, a video signal is continuously faked by the sync separator, U1.

The switch signal output OUT 0/5V is a pure switch signal and may not be loaded. It can be used for further processing in a control computer or for triggering a relay with a corresponding driver. If the switch signal output is connected to other equipment (e.g. a control computer) bifilar cord should be used (for signal and earth).

When the supply voltage has been switched on, the module is ready for operation. The two-colour LED shows the condition at the video-in input. This reacts to the input signal independently of any specified switch delay or slow release. This gives a direct visual monitoring of the input signal.

If the LED is green, a video signal is being applied to the input. If the LED is red, there is no video signal. If the LED is flickering, this indicates a weak signal (poor reception) with interruptions to the synchronisation.

The potentiometer for setting the switching time, ton (R10) is set to the right-hand maximum (long delay), and the other potentiometer, toff (R12) to the left-hand maximum (short delay).

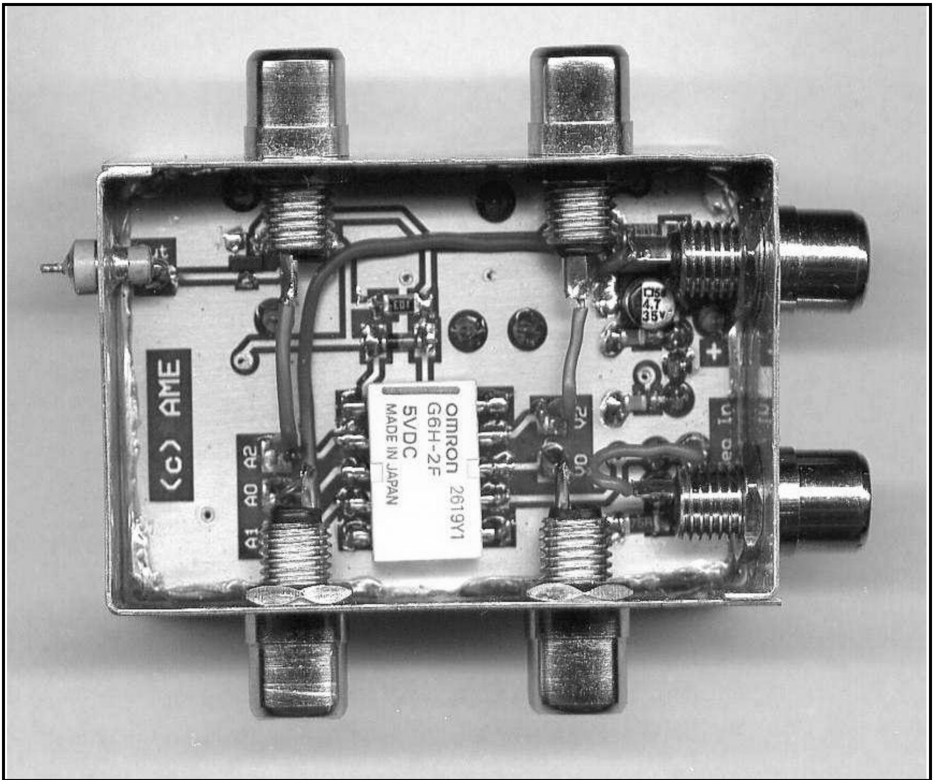

Fig. 5b:The underside of the ATV squelch with changeover relay (centre of picture) and cinch jacks.

If an input signal is applied for longer than ton, then the switch signal output switches to + 5V and the relay switches from video and tone channel 2 to the video-in and audio-in input. The switch signal output and the relay drop out again if the video signal at the video-in input is no longer available for longer than toff. Very short interruptions to the input signal are ignored, depending on the setting of ton and toff.

The switching delay, ton, is thus set (by turning to the left) in such a way that the reception of interference (e.g. radar in the 23cm. band) does not cause the switching relay to operate. The slow release, toff, is set (by turning to the right) in such a way that a poor reception signal with interruptions to the synchronous signal (recognisable by the flickering of the LED) does not lead to the relay dropping out. Neither delay should be set to be any longer than necessary.

The longer the delay time is, the more insensitive the squelch becomes for both interference and weak reception signals! A long slow release compensates for interruptions to synchronisation for poor reception signals, but, in combination with a badly selected delay times, can favour the reaction to interference! The squelch must therefore be optimally balanced to the facts at the reception location.

In general only screened cables should be used for the video and sound signals, and all connecting cables should be as short as possible!

6. Technical Data

Operating voltage:

+12V DC

Current consumption:

Max. 80mA (relay switched on)

Max. 50mA (relay off)

Video-in input signal:

(F)BAS, PAL, 1V p-p

(NTSC version on request)

Video-in input impedance:

10k Ohms or 75Ohms (plug-in bridge)

Type of detection:

Frame change pulse

Response time:

Adjustable, approximately 50ms to 1.5s

Slow release:

Adjustable, approximately 50ms to 4s

Switch signal output:

+5V (input signal recognised)

0V (no input signal recognised)

Display: two-colour LED:

Red: no sync signal at video input

Green: sync signal at video input

Changeover switch:

For an image and sound channel (mono)

Input voltage in each case max. 2V p-p

Operating temperature range:

+10 to +35°C.

Dimensions:

(L x B x H) 55mm. x 36mm. x 30mm. (without connecting jacks)

7. Literature References

[1] ATV squelch / synchronous evaluator: *TV-Amateur*, no. 123, fourth quarter 2001, Amateur Television Association (AGAF = Arbeitsgemeinschaft Amateurfunkfernsehen)

[2] Video interruption indicator; ELV Journal; No. 3/96, pp. 50-51; ELV, Leer

[3] Data sheet LM1881 National Semiconductors, April, 2001 www.national-.com

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