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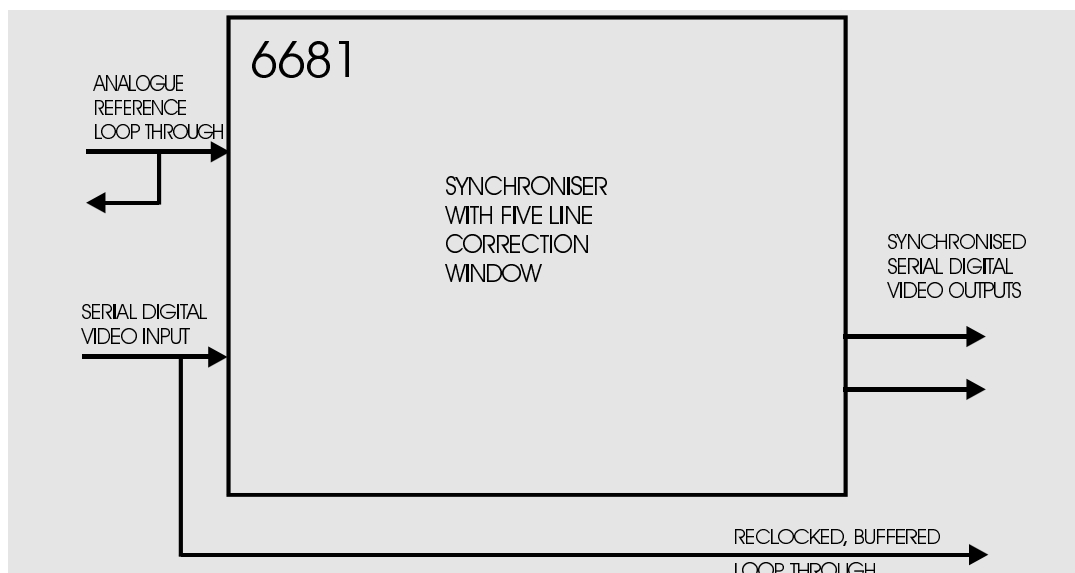
1 Introduction

The 6681 is a serial component digital video synchroniser with a movable five line correction window. It can be used singly or in cascade with similar units. The product consists of a 6682 base board and the 6681 line-synchroniser sub board.

The 6681 has the following features:

- Movable five line correction window (adaptive delay)
- Removal of timing discontinuities caused by switching
- Clean switching of SMPTE 272M embedded audio.
- Automatic input equaliser
- Buffered and re-clocked serial digital video input loop through
- Two main serial digital video outputs
- Two main serial digital video outputs
- Analogue reference loop through

The main applications of the 6681 are the removal of timing discontinuities caused by upstream switching and the insertion of video delay to satisfy system timing requirements. The timing of the analogue reference input may lie anywhere within the five line timing correction window. Sufficient adjustment is provided to set the digital output timing anywhere within the window. Any serial digital video input between approximately zero and five lines earlier than the pre-set output time will be output at that pre-set time.



6681 five line synchroniser

2 Installation and configuration

The line synchroniser consist of a submodule mounted on a base card. The card -set is shipped ready assembled and takes a single card position in either a 1U 6265 or a 3U 6063 Pro-Bel modular rackframe . It uses the 1681 rear connector.

The following ports, switches or jumpers are either not used or are for factory use and should be set as follows:

6682 SW1, position 3,(GAP) and position 4 are both not used

6682 SW1, position 1,(270/360) not used with 6681

6681 SW3, position 4 is not used

6681 SW4, factory use, leave in 'normal' position

6682 JP3, leave in 6672 position

The ports PL2 and PL3 on the 6681 sub board are for factory use only.

2.1 Module installation

Installation is as follows:

- slide the 6682 base card along the guide rail of the required slot, gently pushing it fully home until it marries up with the connector on the motherboard
- attach the 1681 back panel ensuring that the pins and socket mate on a one-to-one basis and that there is no offset either vertically or horizontally
- secure the back panel to the metalwork using the M2.5 crosshead screws supplied. If the screw holes do not align then the panel is fitted wrongly



WARNING: The screws form an essential chassis connection for EMC compliance and must not be omitted

2.2 Module removal

To remove the cards proceed as follows:

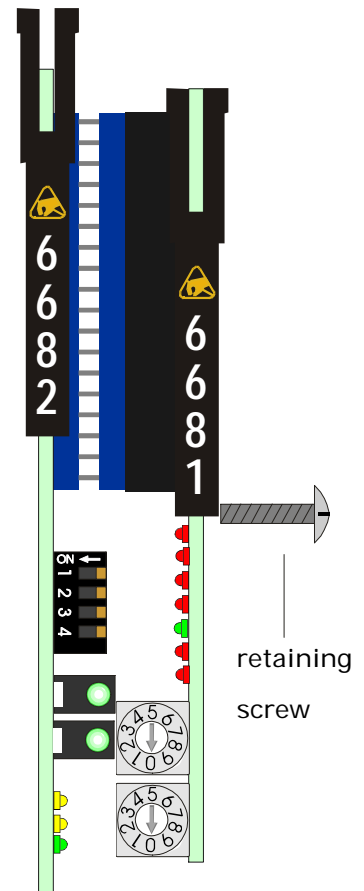
- lift up the card ejector on the 6682 base card and gently pull the combined cards out

2.3 Removing the sub-board

- Remove the central retaining screw
- Carefully lift the sub-board from the base card by applying equal pressure to both ends of the board to prevent damage to connectors or plugs

2.4 Refitting the sub-board

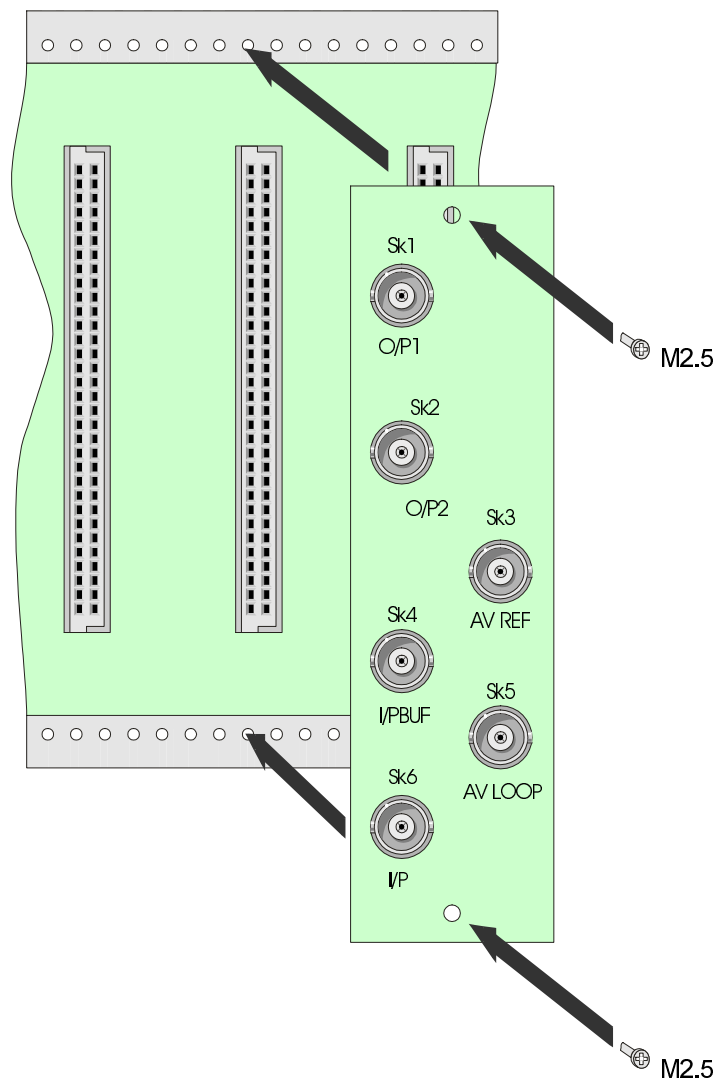
- The sub-board should be carefully push-fitted to its base-board using the three connectors provide (SK2, SK3, Sk4)
- Refit the central screw to secure the sub-board to the base-board



WARNING: Please observe normal static handling precautions when handling electronic equipment or sub assemblies

2.5 Rear panel connections

There are four BNC connections for signal I/O; one serial digital video input, a buffered and re-clocked loop through output and two main outputs. In addition there are two BNC connections for the analogue reference loop through.

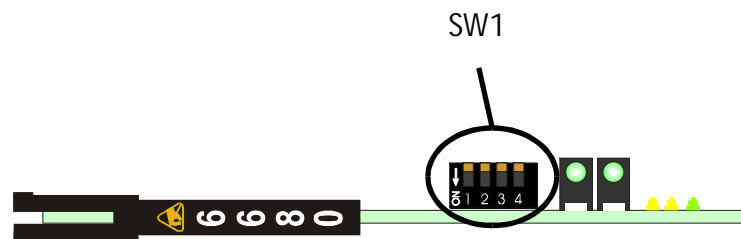


Fitting the rear connector panel

2.6 Selecting the frame rate

The DIL switch, SW1 on the base card is used to select 525/60 or 625/50 operation.

Video frame rate selection	
SW1 bit S2	Line / frame rate
Off	625 line 50 field
On	525 line 60 field



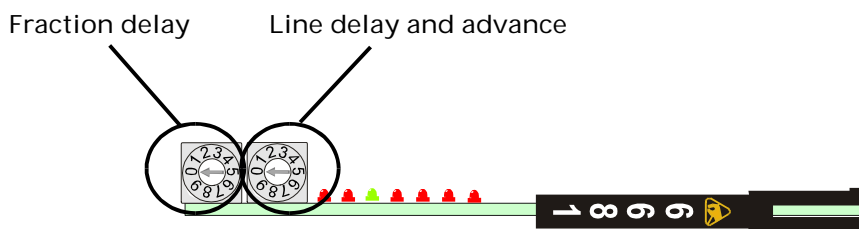
2.7 Centring the correction window

For the input video to be synchronised, it must lie inside the five line correction window. This is achieved by delaying or advancing the internal reference with respect to the external reference until the in-range LED is illuminated. There are two controls on the 6681 to accomplish this, line delay and fractional delay.

Line synchronisers cannot advance the timing of the input signal, but introduce a variable delay so that the output timing is constant. The output timing must therefore be set later than the latest input to be synchronised.

Whole line delay	
Output timing	Switch SW1 position
-5 lines early	5
-4 lines early	6
-3 lines early	7
-2 lines early	8
-1 line early	9
In sync	0
+1 line late	1
+2 lines late	2
+3 lines late	3

Fractional delay	
Output timing	Switch SW2 position
Exact line delay value	0
Line delay + 1/8	1
Line delay + 1/4	2
Line delay + 3/8	3
Line delay + 1/2	4
Line delay + 5/8	5
Line delay + 3/4	6
Line delay + 7/8	7
Line delay + 7/8	8

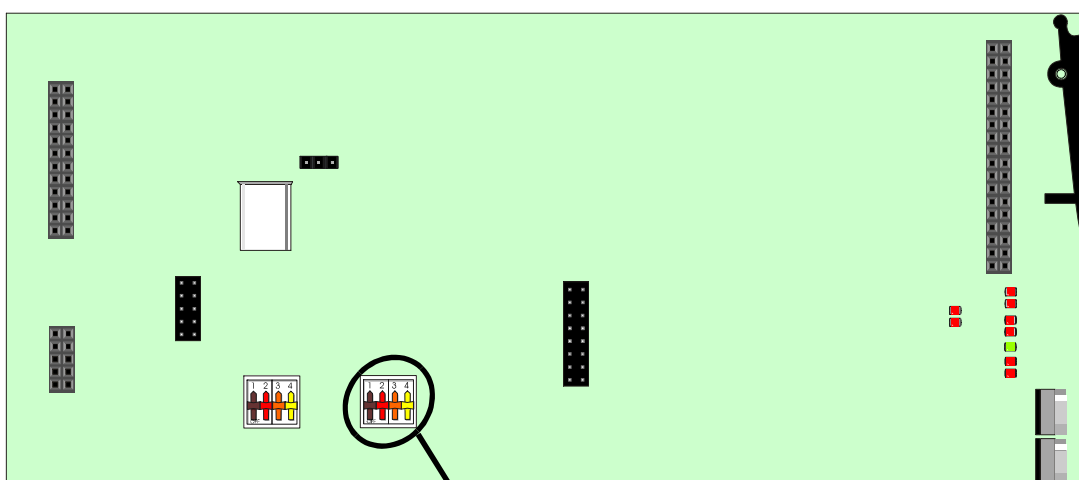


2.8 Setting the black line insertion mode

At least one TV line (the switching line according to SMPTE RP168) is replaced by internally generated digital black to mask switching disturbances.

The amount of black line insertion that occurs can be extended with the transient insertion switch, SW3 on the 6681. The 6681 sub-board must be removed to make this adjustment-see paragraph 2.3.

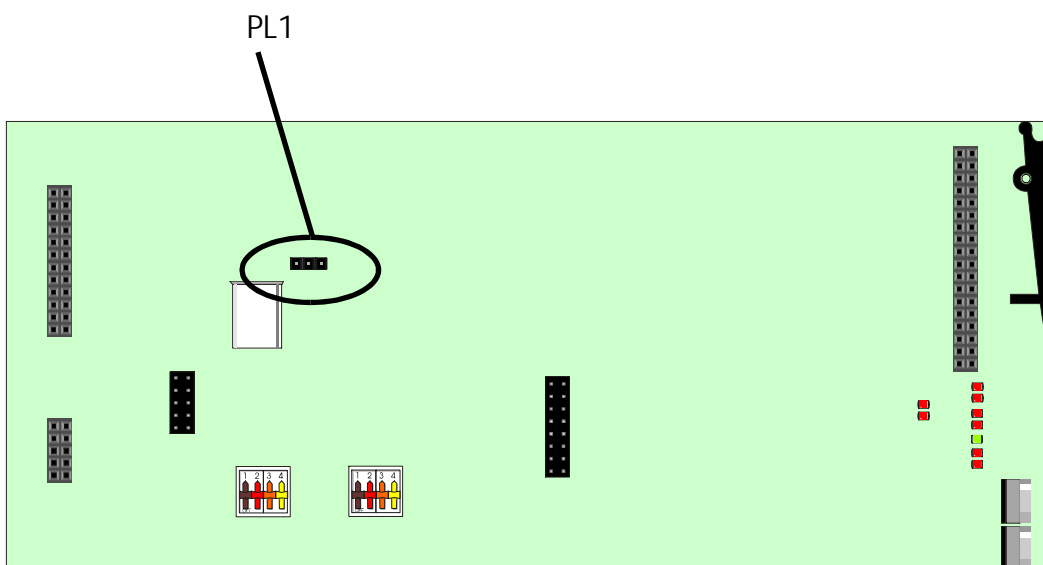
Transient insertion switch		
Mode	Delay	Lines of black insertion
Single line, SW3 = 1111	0 - 5 lines	6 and 319 for 625 10 and 273 for 525
Multiple line, SW3 ≠ 1111	0 - 1 line	5-11 and 318-324 for 625 9-15 and 272-278 for 525
Multiple line, SW3 ≠ 1111	1 - 2 lines	4-10 and 317-323 for 625 8-14 and 271-277 for 525
Multiple line, SW3 ≠ 1111	2 - 3 lines	3-9 and 316-322 for 625 7-13 and 270-276 for 525
Multiple line, SW3 ≠ 1111	3 - 4 lines	2-8 and 315-321 for 625 6-12 and 269-275 for 525
Multiple line, SW3 ≠ 1111	4 - 5 lines	1-7 and 314-320 for 625 5-11 and 268-274 for 525



6681 board switch SW3

2.9 Selecting reference absent options

Missing reference behaviour	
Jumper PL1 setting	Synchroniser output
PL1 on	Internally generated digital black
PL1 off	Uncorrected input video

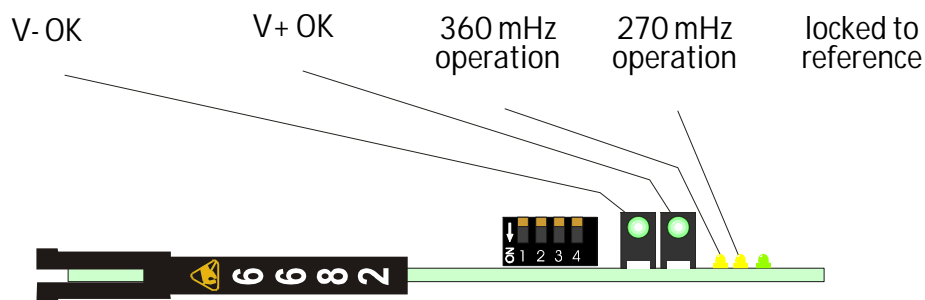


PL1 is used to change the card's behaviour when the reference is absent

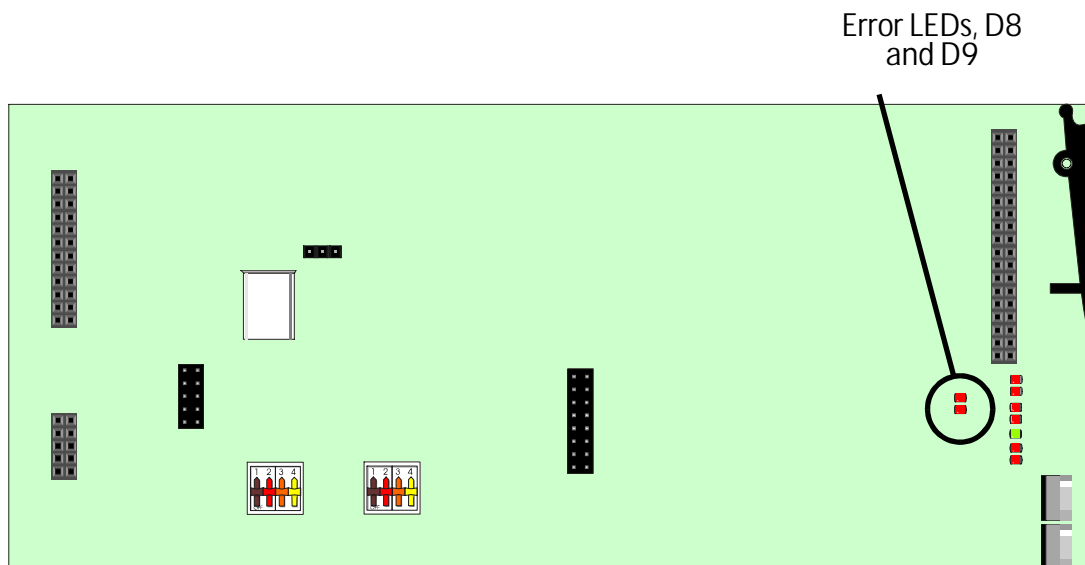
Note: The black output when the reference is absent is locked to the input and the line and fraction delay switches work as normal.

3 Problem solving

3.1 Ensuring basic operation

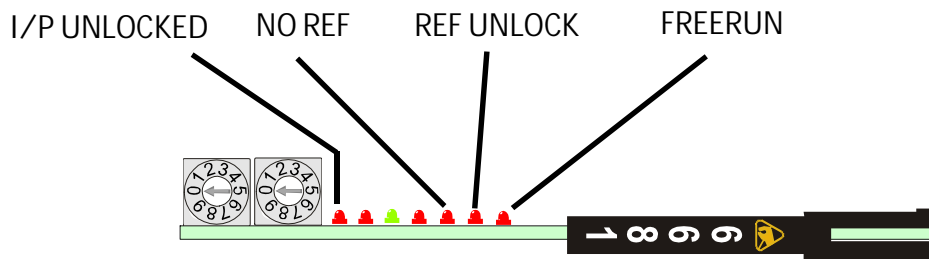


The green LEDs on the 6682 base card marked V- and V+ indicate the presence of -5 volts and +5 volts respectively. The yellow LEDs marked 270M and 360M indicate which data rate the card has been selected to operate in. Please note that the 6681 only works in 270Mbit/s and will ignore the 360Mbit/s setting. The lock LED should always be illuminated with an output signal locked to a valid reference.



Two red error LEDs, D8 and D9, on the 6681 board will light if there is any fault with the control circuit or its programming.

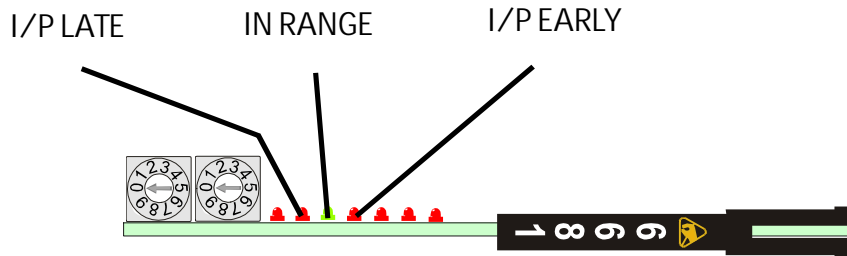
3.2 Validating the video reference



The following table shows what indications are to be expected under varying conditions of the reference signal and input signals.

Video reference status				
	NO REF	REF UNLOCK	FREE RUN	I/P UNLOCKED
No reference signal present	on	on	off	off
No reference signal present, internal reference being used	on	on	on	off
Reference signal running at a different frequency to the input signal	off	off	off	flash

3.3 Ensuring correct timing



When the only green LED, called 'in range', is on then a valid input signal is within the correction range of the synchroniser. In this case the output will be synchronised to the incoming video reference. Any other combination of LEDs indicate that something is wrong.

The I/P early and I/P late indicators show that the input signal is outside the correctable window in the direction indicated.

4 Theory of operation

The 6681 is a 4:2:2 component digital video (525/625) line synchroniser with a five line range. The 6681 plugs in to the 6682 (similar to the earlier 6680) digital video, serial to parallel converter module.

The 6682 supplies the 6681 with 10 bit descrambled digital video plus the sample clock recovered from the input bitstream. No field ID info is recovered by the 6682. The adjustments, RV1 and RV2 for centring the receiver chip phase locked loops is set at the factory and should not require re-adjustment.

After processing the parallel digital video signal, the 6681 passes a parallel digital video signal back to the 6682 where it is converted back to ITU R-601 format and output from the card. A genlock circuit is included on the 6681, which is normally locked to an external reference to generate required reference timing signals including a movable internal reference.

The external reference may be either analogue black and burst, mixed sync or any composite video signal. The action taken when the reference is missing can be determined with jumper PL1 on the 6681. The choice is between sending the uncorrected input video to the 6682 main outputs or an internally generated black signal.

The movable internal reference allows the five line correction window of the synchroniser to be moved relative to house syncs. The adjustment range is 5 lines early or 4 and 7/8ths of a line late.

The 6681 internal reference which can be moved relative to the house reference by adjusting the the line and fraction (l+f) delay switches on the front of the 6681.

If the input video cannot be positioned into the five line correction window by the (l+f) adjustment, it cannot be synchronised.

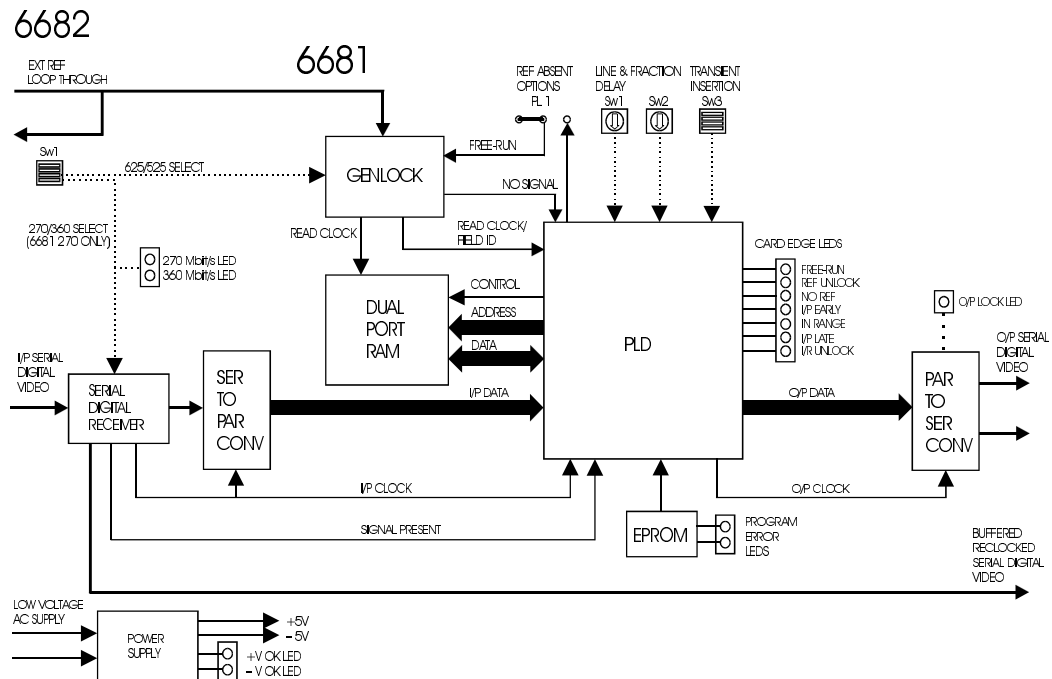
The input of the 6681 (say from a router) can be switched with the output synchronised, providing the inputs are all within the movable five line window.

It is not mandatory that the upstream switched inputs are RP168 compliant. That is the switched inputs can be outside the 10ms co-timing recommended by SMPTE RP168 for switched inputs.

The 6681 can be used in two different modes, which affect the behaviour of the card during upstream switching. Single line correction mode is obtained when SW3=1111, and multiple line correction mode is obtained when SW3 ≠ 1111.

In single line mode and when all inputs are RP168 complaint, only line 6/319 (PAL) or line 10/273 (NTSC) are corrupted during the switch and black codes are inserted on these lines. Changing the l+f delay settings doesn't affect what lines black codes are inserted on, it is always as stated above.

In the multiple line mode however, the inserted seven black lines track the I+f delay switch settings across their whole range. This is to minimise user set-up effort and reduce the number of lines that might be overwritten with black codes.



6681 five line synchroniser: detailed schematic

Upstream switching with embedded audio

When the input is switched between sources where the timing difference is greater than half a line, the synchroniser maintains horizontal lock but a line is repeated or omitted at the switch point. The vertical position is restored at the end of the next field blanking. However, the lines inserted or removed by the synchroniser affect digital audio recovery and audible disturbances may result.

Only the single line mode is transparent to audio embedded according to SMPTE 272M, and only if the input switches between sources timed within half a line of each other and when the switch falls within the embedding gap. The two line embedding gap in vertical blanking is left to allow for EDH and the line blanking following the switching point..

When the timing difference is greater than half a line or if the multiple line mode is used, an audible disturbance may be heard as a result of upstream switching.

5 Specification

Video inputs

- Number One
- Type Serial EBU Tech 3267E, SMPTE 259M - C
- Impedance 75Ω
- Connector type BNC
- Data rate 270Mbits
- Regenerator Clock regeneration on input
- Return loss >15dB 10MHz to 300MHz; >13dB 300MHz to 400MHz
- Amplitude 800mV p-p nominal
- DC offset <50V
- Equaliser Adaptive automatic for up to 200m of cable (Belden 8281, PSF 1/2M or equivalent)

Video outputs

- Number Three
- Type Unbalanced NRZI coded serial data
- Specification Two outputs to SMPTE 272M - A. One output to Serial EBU Tech 3267E, SMPTE 259M -C
- Impedance 75Ω
- Connector type BNC
- Data rate 270Mbits
- Return loss >15dB 10MHz to 300MHz; >13dB 300MHz to 400MHz
- Amplitude 800mV p-p nominal
- Overshoot < 7%
- DC offset 0V ±0.5V

Power requirements

6682 plus 6681
frame

650mA @ +16V and 350mA @ -16V in a 6063

6 Warranty statement

Hardware Products

Hardware Products are warranted for a period of two years from the date of shipment. During this period Pro-Bel, at its discretion, will repair or exchange products proved to be defective providing that the products are returned to Pro-Bel, carriage pre-paid. The Company will use its best efforts to ensure that returned items are repaired and despatched within ten working days of receipt. Third party items, including PC hardware or any outsourced equipment is limited to the original manufacturers warranty, typically one year.

Software Products

Software Products are warranted for a period of ninety days from the date of shipment. During this period Pro-Bel undertakes to rectify products proved not to conform to the published specification provided with the product, when used in accordance with PC hardware and operating systems approved by Pro-Bel.

Loans

Within the warranty period, the Company will, at its discretion and subject to availability, provide loan units pending the repair of returned items. Loans are offered on a no charge basis providing that the loan units are returned to Pro-Bel within a period of twenty one days following the date of despatch of the repaired items. In the event that the loan units are not returned within this period, the loan units will be subject to a monthly overdue charge, details of which are available on request. Carriage charges apply to all loans.

NON WARRANTY PERIOD

Outside the stated warranty period, the Company will use it's best endeavours to rectify equipment failures through the provision of spare parts or in house repair services. Loan units may also be provided subject to availability. All services and carriage costs are subject to a scale of charges, details of which are available on request.