V6411
V6411VP
V6411AP

ADVANCED FRAME SYNCHRONISER

INSTALLATION and OPERATION

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1. <u>DESCRIPTION</u>

The V6411 is a versatile SDI Video Frame Synchroniser with integrated Audio processing which forms part of the Vistek V1600 range of interface products. It is a 3U high card which is fitted into either a V1601 or V1606 rack (or even the earlier generation V1603) from which it obtains its power and control. A passive rear module is required for all signal interconnections. A range of these are available for both the V1601 and V1606/V1603 chassis. The V6411 is very similar to the V1641, but has a different style of Audio channel selection and mixing.

The fundamental frame synchroniser operates in both 625/50 and 525/60 formats and the SDI input will automatically detect which format, if any, is present. An external analogue video reference, usually Black and Burst, is normally applied and this may also be either format (PAL or NTSC). The timing of the SDI output may be varied relative to the reference both horizontally over a whole line and vertically over ±127 lines.

Although there is a standard rear panel for the V6411 for each of the Rack options (1U and 3U) two of the BNC connections are configurable. One of the SDI ports can set to be either a second SDI input, a buffered loop-through of the main input or an extra synchronised output. On the reference BNC ports a second BNC can be configured as either a passive loop-through or a TTL signal representing the delay in the video path.

Two options are available – the **VP** includes a Video Processor and the **AP** includes an Audio Processor. The Video Processor allows adjustment of the Video Gain, Chroma Gain, Black Level and Hue of the SDI video. It has a limiter that ensures the output always remains legal within the D1 domain. The Audio Processor handles two stereo audio channels each of which has two audio signals usually Left and Right. Thus in total four audio signals can be processed. The processing consists of re-synchronising, gain adjustments, channel swapping and delay compensation. The audio delay consists of a fixed amount, up to 1250ms set by the operator, plus a variable tracking delay which changes according to the video delay through the Frame Synchroniser. The fixed delay can be made negative, up to 40ms, in which case it is subtracted, if possible, from th etracking delay.

For the audio there is a range of sub-modules which may be fitted to an **AP** version. These provide the four options of Analogue or Digital inputs and outputs. The digital input signals are passed through a sample rate converter on the unit so there is no need for them to be synchronous and in fact they can have any sample rate in the range 32kHz to 48kHz. There is also the option of demultiplexing the audio from the incoming SDI video. The audio also feeds through to a multiplexer on the output which can put the audio onto any of the four groups. The incoming ancillary data may be blanked so it is possible to extract the audio from one group and, after processing and re-timing, put it back into the same group. Since the audio processing also re-synchronises the audio to the reference the digital input audio does not need to be synchronous with the video reference.

As from software version 1.2 onwards it is also possible to replace a group of audio. This is done by marking the existing group data as non-audio and appending the new data for the group. Using this method other groups of data, audio or non-audio, can be passed through unaffected.

In case the audio processing on the board is not sufficient it is possible to feed the audio out to an external processor and then feed it back into the unit to be multiplexed into the audio. There may be restrictions to this re-entrant audio which are discussed later in this manual.

The V6411 is fully dual standard for both 625/50 and 525/60 D1 signals and automatically detects the presence and format of the input signal and operates accordingly. It also monitors the video reference, and if this is of the opposite format to the input then the unit will ignore the reference. The input signal is carefully monitored and if it starts to fail, then the unit will freeze the picture until full field data is available again. It can be set to feed black to the output either immediately on input fail or after a suitable time, as set by the operator.

The unit contains a simple test pattern generator which provides a selection of full D1 specification test signals.

There is a versatile front panel with an alphanumeric display which lets the operator set up a large number of parameters and read the internal status of the unit. Also it is fully compatible with the DART remote control system which means it can be controlled by the V1601 1U Control Panel, Viewfind PC based control software or any other 3rd party software written for the DART system.

There are three GPI inputs which the user can configure for a variety of functions, such as Test Patterns, Freeze, Tone, Mute etc.

On later versions (V1.3 and later) the Delay output can also be used as a General Purpose Output. In this case instead of Delay it can indicate Input Fail, Input 2 Selected, Power Good or Reference Fail.

2. <u>INSTALLATION</u>

Due to the large amount of I/O available on the V6411 it is expected that a variety of rear panels will be available. Presently there are four; two for the 3U chassis, V1606, and another two for the 1U chassis, V1601. The L type rears provide most of the possible facilities, except for the last two SDI outputs, but the audio connections are on a less convenient multi-pole connector. This means that if separate audio connections are needed then a 'break-out' box will be required. The P type rears provide direct unbalanced AES audio connection on BNC connectors, but not all signals are available.

This manual has generally been written assuming that one of the L type rear panels is being used with access to all signals.

2.1 3 U REAR PANELS

For the 3U Chassis two types of rear panel are available. The 16VR3L provides connections for all possible I/O using a high density D-type connector for the audio and other ancillary signals, such as GPI and AES reference. For those applications where unbalanced audio is used and not all connections are needed, then a nine BNC panel is available, the 16VR3P. This has the advantage of simpler cable connections, but at the expense of losing some signals.

Connection details are given in section 2.3.
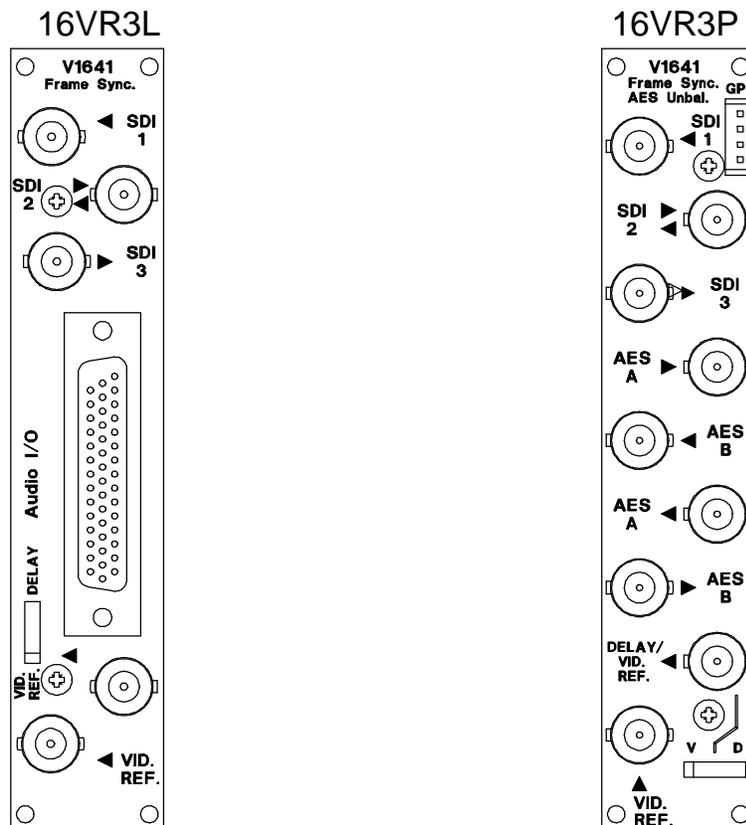
2.2 1 U REAR PANELS

For the 1U Chassis two types of rear panel are also available. The 16VR1L provides connections for all possible I/O using a high density D-type connector for the audio and other ancillary signals, such as GPI and AES reference. For those applications where unbalanced audio is used and not all connections are needed, then a nine BNC panel is available, the 16VR1P. This has the advantage of simpler cable connections, but at the expense of losing some signals.

Connection details are given in section 2.3.
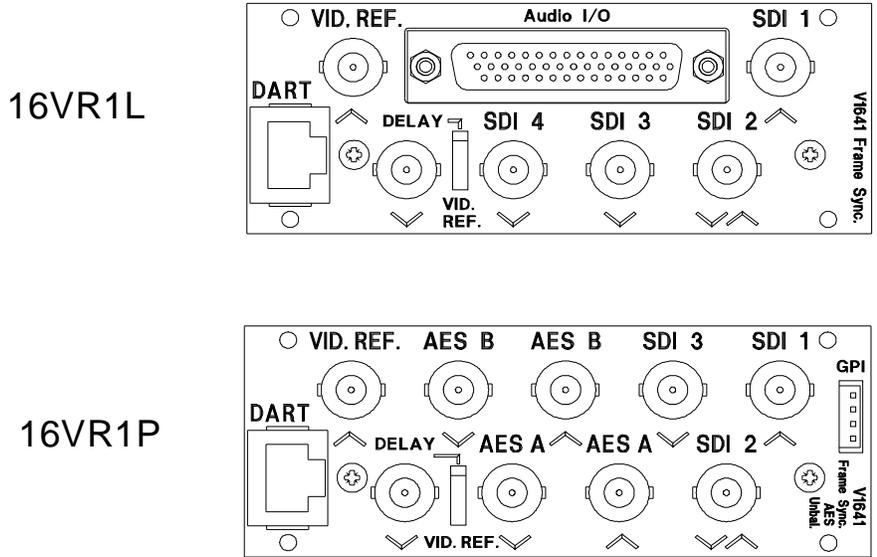
16VR1L

16VR1P

2.3 CONNECTIONS

2.3.1 SDI BNCs

On all the rear panel types the upper three BNCs are for SDI video as follows:

Rear Type	SDI 1	SDI 2	SDI 3	SDI 4
16VR3L	Input 1	I/P 2 or O/P 2 or SDI Buffer	Output 1	n/a
16VR3P	Input 1	I/P 2 or O/P 2 or SDI Buffer	Output 1	n/a
16VR1L	Input 1	I/P 2 or O/P 2 or SDI Buffer	Output 1	Output 3
16VR1P	Input 1	I/P 2 or O/P 2 or SDI Buffer	Output 1	n/a

Note: The three options for SDI 2 are by a pair of links on the main PCB (LKs 2 and 3). It is important that both links are set up the same way.

2.3.2 REF BNCs

The last two BNCs on each rear panel are used as follows:

BNC	Description
Vid. Ref.	Video Reference
Delay Vid. ref.	Dual purpose connector as set by the switch on the rear panel. Either a direct Loop output of the Video reference or a TTL signal representing the video delay on the unit

2.3.3 AES BNCs

These are only available on the 16VR3P and 16VR1P rear panels. They provide for unbalanced AES inputs and outputs for channels A and B. With these rear panels it is not possible to have the second AES outputs or re-entrant audio.

2.3.4 Audio I/O

On the 16VR1L and 16VR3L rear panels there is a 44 way connector in the same footprint size as a standard 25 way D type connector. It is used for all the audio connections, both digital and analogue, although many of them share pins, and other signals. Of course whether the audio signals are analogue or digital (or present at all) depends on the type of module fitted to the unit.

If the HDD socket is to be used for audio and connected with multi-way cable it is essential that the audio pairs, both analogue and digital, are individually screened.

The signals to and from the pins on this connector are as shown in this table:

Pin	Signal		Pin	Signal		Pin	Signal	
	Analogue	**Digital**		**Analogue**	**Digital**		**Analogue**	**Digital**
15	GND	GND	30	GPI_3	GPI_3			
14	ALinP	AESAinP	29	GND	GND	44	ALinN	AESAinN
13	ARinP	AESAin75	28	GND	GND	43	ARinN	AESAin0
12	BLinP	AESBinP	27	DELAY_75	DELAY_75	42	BLinN	AESBinN
11	BRinP	AESBin75	26	GND	GND	41	BRinN	AESBin0
10	GND	GND	25	GPI_2	GPI_2	40	GND	GND
9	ALoutP	AESA1outP	24	GND	GND	39	ALoutN	AESA1outN
8	ARoutP	AESA1out75	23	AESREFinP	AESREFinP	38	ARoutN	AESA1out0
7	BLoutP	AESB1outP	22	AESREFinN	AESREFinN	37	BLoutN	AESB1outN
6	BRoutP	AESB1out75	21	GND	GND	36	BRoutN	AESB1out0
5	GND	GND	20	GPI_1	GPI_1	35	GND	GND
4	AESCinP	AESA2outP	19	GND	GND	34	AESCinN	AESA2outN
3	AESCin75	AESA2out75	18	AESREFin75	AESREFin75	33	AESCin0	AESA2out0
2	AESDinP	AESB2outP	17	AESREFin0	AESREFin0	32	AESDinN	AESB2outN
1	AESDin75	AESB2out75	16	GND	GND	31	AESDin0	AESB2out0

Note:
1. Pin 1 is at the bottom
2. For unbalanced digital connections the active signal should be connected to the '75' pin and the return signal (ground) should be connected to both the N pin and the '0' pin..

2.3.5 GPI

The 16VR1P and 16VR3P panels have a separate Molex connector for external GPI connection. (On the other panels the Audio I/O connector is used.) The connections are:

Pin	Signal
1	GND
2	GPI 1
3	GPI 2
4	GPI 3

2.3.6 Breakout Cable Specification

In many cases it may be desirable to make up a breakout cable from the HDD socket. It is important that this cable cable is made with separately screened sections to get the best audio performance; this is particularly true when using analogue audio but does also apply to digital audio. This table shows how the cable should be sectioned with the various I/O options, Analogue, Balanced Digital and Unbalanced Digital, and how each individual wire should be labelled.

Sub-Cable	Pin	Label	Analogue	Digital Balanced	Digital 75R
Audio 1	14	IP A L P	Input A Left Pos	Input A Pos	
	44	IP A L N	Input A Left Neg	Input A Neg	
	15	IP A L GND	Input A Left Gnd	Input A Gnd	
Audio 2	13	IP A R P	Input A Right Pos		Input A
	43	IP A R N	Input A Right Neg		Input A Return
	28	IP A R GND	Input A Right Gnd		
Audio 3	12	IP B L P	Input B Left Pos	Input B Pos	
	42	IP B L N	Input B Left Neg	Input B Neg	
	26	IP B L GND	Input B Left Gnd	Input B Gnd	
Audio 4	11	IP B R P	Input B Right Pos		Input B
	41	IP B R N	Input B Right Neg		Input B Return
	40	IP B R GND	Input B Right Gnd		
Audio 5	9	OP A L P	Output A Left Pos	Output A Pos	
	39	OP A L N	Output A Left Neg	Output A Neg	
	10	OP A L GND	Output A Left Gnd	Output A Gnd	
Audio 6	8	OP A R P	Output A Right Pos		Output A
	38	OP A R N	Output A Right Neg		Output A Return
	24	OP A R GND	Output A Right Gnd		
Audio 7	7	OP B L P	Output B Left Pos	Output B Pos	
	37	OP B L N	Output B Left Neg	Output B Neg	
	21	OP B L GND	Output B Left Gnd	Output B Gnd	
Audio 8	6	OP B R P	Output B Right Pos		Output B
	36	OP B R N	Output B Right Neg		Output B Return
	5	OP B R GND	Output B Right Gnd		
Aux 1	4	AES C P		AES C Pos	
	34	AES C N		AES C Neg	
	19	AES C GND		AES C GND	
Aux 2	3	AES C 75			AES C
	33	AES C 0R			AES C Return
	19	AES C GND			
Aux 3	2	AES D P		AES D Pos	
	32	AES D N		AES D Neg	
	16	AES D GND		AES D GND	
Aux 4	1	AES D 75			AES D
	31	AES D 0R			AES D Return
	16	AES D GND			
AES Ref 1	23	AES REF P		AES REF Pos	
	22	AES REF N		AES REF Neg	
	21/24	AES REF GND		AES REF GND	
AES Ref 2	18	AES REF 75			AES REF
	17	AES REF 0R			AES REF Return
	16/19	AES REF GND			
Misc	20	GPI 1			
	25	GPI 2			
	30	GPI 3			
	27	DELAY			

2.3.7 Unbalanced AES

For unbalanced digital signals it is essential to connect the Return and 'Neg' pins to GND. For example for Channel A I/P you should connect **Input A Return**, **Input A Neg** to **Input A Right Gnd** – pins 43, 44 and 28.

The same principles apply to the AES output signals.

2.3.8 Breakout Cables and Panels

Vistek can supply a variety of solutions for the connection of audio to the V6411. This tables show what is available.

CODE	DESCRIPTION
V6901/BAL	1U Breakout Panel for balanced AES or analogue audio. Can be used with up to 4 V6411s. The interconnection cable(s) are not included.
V6901/UNBAL	1U Breakout Panel for unbalanced AES signals. Can be used with up to 4 V6411s. The interconnection cable(s) are not included.
V6902/ANALOG	Interconnection cable with HDD plugs on both ends for use with analogue audio, but can also be used with digital audio.
V6902/DIGITAL	Interconnection cable with HDD plugs on both ends for use with digital audio. It can be used for analogue audio but performance, particularly crosstalk may not be acceptable.
V6903/SINGLE/X	HDD to XLR audio break out cable for single channel input and output. (A channel is considered either an AES or analogue left and right.)
V6903/DUAL/X	HDD to XLR audio break out cable for dual channel input and output. (A channel is considered either an AES or analogue left and right.)

2.4 SIGNAL SPECIFICATIONS

SIGNAL	TYPE	COMMENTS
Power (No Module)	9.8W	Supplied from rack
Power (A-A Module)	12.5W	Supplied from rack
Power (A-D Module)	12.5W	Supplied from rack
Power (D-A Module)	11.7W	Supplied from rack
Power (D-D Module)	10.6W	Supplied from rack
Power (H-H Module)	12.0W	Supplied from rack
SDI Inputs and Outputs	BNC	SDI Video to SMPTE 259M Max cable length >200m
Video Reference	B+B	Any 1V Composite video may be used, but Black & Burst is recommended.
Audio, Analogue	Balanced	$Zin = 20k\Omega \qquad Zout = <50\Omega$
Audio, Digital (AES)	Balanced	$Zin = 110\Omega \qquad Zout = 110\Omega$ Input Sample rate 32–48kHz Output Sample rate 48kHz
Audio, Digital (AES)	Unbalanced	$Zin = 75\Omega \qquad Zout = 75\Omega$ Input Sample rate 32–48kHz Output Sample rate 48kHz
AES Reference	Balanced	$Zin = 110\Omega$ or HI Z Sample rate 48kHz
AES Reference	Unbalanced	$Zin = 75\Omega$ or HI Z Sample rate 48kHz
DELAY 75	TTL, 75R	Positive pulse represents the video insertion delay. Repeat period is 2 frames (80ms for 625/50 and 67ms for 525/60).
GPI	5V pull-up via 4K7	Connect to GND to activate.

2.5 GPI CONNECTIONS

There are three GPI inputs to the V1647. Depending on the type of rear panel being used they are either connected through the high density D-type connector or through the 4 pin Molex connector as shown in sections 2.3.4 and 2.3.5.

They have an internal pull-up resistor of 4K7 to +5V and should be made active by grounding the relevant pin.

The status of the GPI pins can be monitored on:

```
STATUS     GPI Sta    1‾ 2‾ 3‾
```

The arrows indicate the status of each GPI input by pointing up if the GPI is active (in practice this means that they point down for +5V and up for 0V).

The use of the GPIs is described in Section 4.6.1.

2.6 VIDEO INSERTION DELAY

The V6411 is primarily a synchroniser so the insertion delay is inherently variable over the range of a frame (40ms for 625/50 and 33.6ms for 525/60). In order to be able to handle time varying input signal without dropping in and out of a frame of delay there is some hysteresis at the shortest and longest delays. This means that the shortest delay has two values, one for when the input is faster than the reference and one for when it is slower.

There is also a control to set the unit into Minimum Delay (section 4.3.11).

```
FRM Sync    Vid Del    Del Var
                       Del Min
```

The unit normally goes into minimum delay mode when the reference is missing, or is of the opposite format to the SDI input. However if the reference is missing the unit can be put into a variable delay mode using menu.

```
FRM Sync    RFL Mode   Min Del
                       Var Del
```

This table shows the various delays and where they are measured. Note that the delays are common for both operating standards and do not change whether the Video Processing is enabled or not.

	Delay Pulse mS	Parallel Processing mS	Clocks	SDI to SDI mS
Minimum Minimum	2.75	4.55	122	4.94
Maximum Minimum	12.9	14.75	394	15.12
Set Minimum	3.66	5.5	147	5.88

Thus the delay hysteresis is 10.15μs, equivalent to approximately 270 clock pulses.

2.7 AUDIO INSERTION DELAY

Provided the AP Option is enabled the V6411 also acts as an audio synchroniser. To do this the audio data is resampled so that it is synchronous with the output video sampling. This resampling has a minimum processing time. It is also possible to include a fixed amount of delay, and enable an additional tracking delay, so that the total audio delay varies at the same rate as the video through the synchroniser. A particular feature of the V6411 is that when the video synchroniser 'rolls over', so changing its delay by a frame period, the audio delay adjusts slowly so there is no perceptible disturbance to the audio quality.

The total audio insertion delay is made up of three components – the core delay from the processing hardware, the Fixed delay as set by the user and the tracking delay to match the video processing.

The core delay depends on the source and destination of the audio and is a combination of the input section, the SRC (Sample Rate converter) and the output section. As a general rule the core delay can be assumed to be about 4ms but for a more detailed analysis this table can be used:

I/P		SRC		O/P	
DMUX I/P	0.54	+1.75	MUX O/P	0.875
Digital I/P	0	+1.75	Digital O/P	0
Analogue I/P (AA module)	0.5	0	Analogue O/P (AA module)	0.54
Analogue I/P (AD module)	0.81	0	Analogue O/P (DA module)	0.9

The fixed delay can be set by the user and the tracking delay varies according to the synchroniser timing settings and the standard. Assuming a core delay of 4ms this table shows the full audio insertion delay range. A more detailed discussion of audio delay, including negative delay, is given in sections 4.5.11 and 4.5.12.

	Track Delay	Fixed Delay	Total delay
625 Mode	$0 \wedge 40$	$-40 \wedge 1250$	core $\wedge$ 1294
525 Mode	$0 \wedge 33$	$-40 \wedge 1250$	core $\wedge$ 1287

2.8 ADJUSTMENT RANGES

2.8.1 Video Adjustments

This table shows the full ranges of the video adjustments:

VARIABLE	RANGE	RESOLUTION
H Timing 625	0 to 63.96µs in 37ns (625)	37ns
H Timing 525	0 to 63.52µs in 37ns (625)	37ns
V Timing	$-128 \rightarrow +127$ lines	field lines
Video Gain	$-6.02 \rightarrow +6.01$ dB	1024 steps.
Chroma Gain	$-6.02 \rightarrow +6.01$ dB	1024 steps.
Black Level	$-128 \rightarrow +127$	D1 levels
Hue Shift	$-45° \rightarrow + 44.65°$	0.35°

2.8.2 Audio Adjustments

This table shows the full ranges of the audio adjustments:

VARIABLE	RANGE	RESOLUTION
Audio Gain[1]	$-16dB \rightarrow +15.75dB$	0.25dB
Audio Phase	Normal, Invert	
Audio Fixed Delay	$0 \rightarrow 1250ms$	1ms
Analogue MIL	$+12dB \rightarrow +24dB$	1dB
Analogue MOL	$+12dB \rightarrow +24dB$	1dB

[1] Earlier units had an Audio Gain range of –16 to +15dB in 1dB steps.

2.9 HARDWARE

2.9.1 The PCB

The figure below shows diagrammatically the printed circuit board along with certain other components of interest. In particular it shows the position and orientation of the links and switches which set up the operation modes and the location of the audio sub-module if fitted.

The EPROM location is shown, as it is the component that would need to be changed as a result of any software upgrade in the field. This is a PLCC type and the proper tool should be used to remove a device and care must be taken to ensure that a replacement is inserted the right way round and pushed fully 'home'.
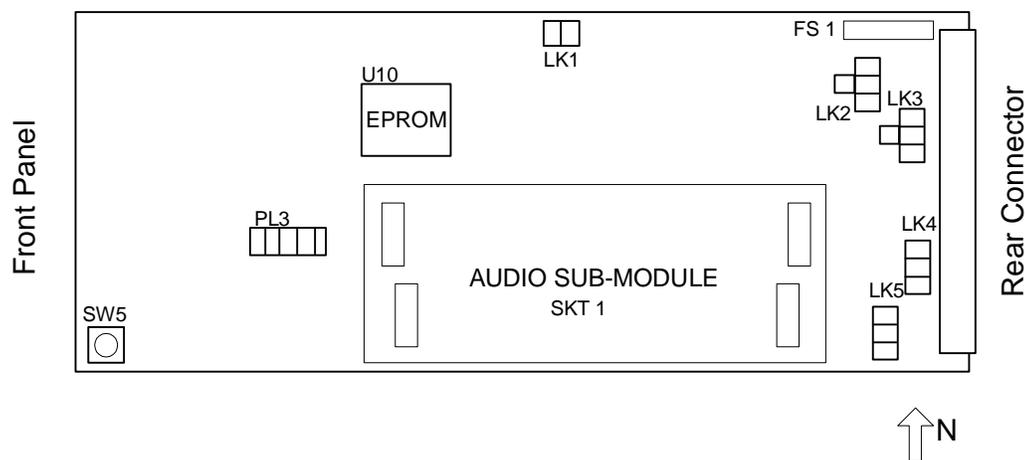
2.9.2 Links and Switches

The purposes of the links and switches is shown in the following table. Details of their operation are described in later sections.

ITEM	Title	Section	Comments
FS 1	Fuse		In series with the +15V input to the module.
SW 5	RESET		Used to reset the internal microcontroller and DSP.
SKT 1	Audio Sub-module		Various sub-modules are available for the different audio options. See section 2.12
PL 3	JTAG Connector		For development and test use only. (May not be fitted)
LK 1	JTAG enable		Never used in operation. (May not be fitted)
LK 2, 3	Define BNC 2		North – Buffered Output (**NOT** synchronised) West – SDI Input 2 South – SDI Output 2
LK 4	AES REF Term		North – High Z South – Terminated
LK 5	Video REF Term		North – High Z South – Terminated

2.9.3 Fuse

There is only one fuse on the V6411 which is in series with the main DC input:

FS 1	Fuse 2 Amp Wire ended		In series with the +15V input to the module.

2.10 FRONT PANEL
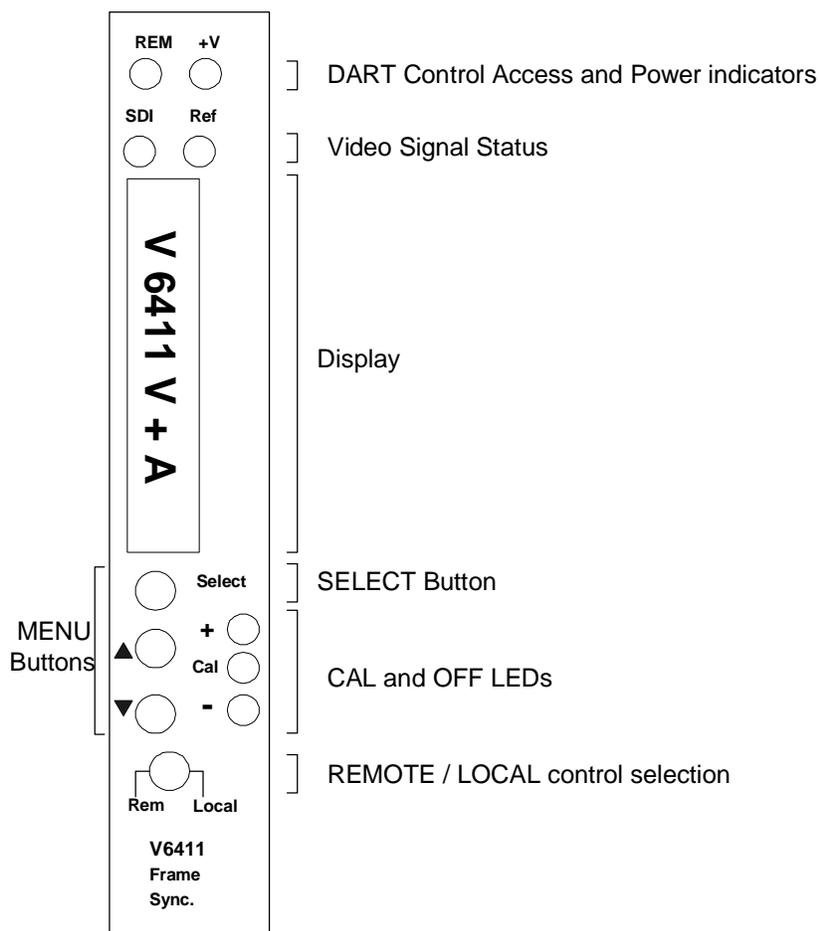
The front panel on the V6411 is a considerable advance on what is usually available on single module interface equipment. It provides the user with total control and monitoring of the unit without the need to consult manuals and read unlabelled indications. While this kind of control is generally available with a remote control system, as it is over DART, it is unusual to have this level of access locally.

At first use the menu system may seem cumbersome but with only a small amount of practice it will become very easy to use.

2.10.1 Direct Indications

The four LEDs at the top of the panel provide these direct indications of the unit:

REM   Short blinks to indicate access by the DART controller, if fitted. It does **not** directly indicate that the unit is in remote control mode. If the rack frame does not have a Rack Controller fitted then this LED will not blink.

+V   Indicates that the main +5V is present on the board. This is derived from the +15V distributed through the rack. The V6411 does have many power rails, but only the main +5V is indicated here. It will, of course, be off if the fuse, FS1, were to have been blown.

SDI   Indicates that a D1 signal is being received.

REF   Indicates that a video reference signal is being received.

2.10.2 Display and Switches

The main display is an eight character LED matrix display. It has been set so that when fitted into a 3U rack (V1606) it can be read from the left, and when fitted to a 1U rack (V1601) it is horizontal and the 'proper' way up.

The three buttons are labelled **Select**, s and t. The **Select** button is used to move down and up the menus. A short press will move down one level, while pressing and holding for about half a second will move up one level. If you continue to hold it will progressively move up a level every half second until it reaches the top level (**SLEEP**), or you let go, in which case it will stay where it is. When at any level the s and t buttons will move through the list of options, or if in an actual variable (such as Video Gain) they will change the values.

The menu system is described in more detail later in section 4.1.2.

If the unit is in Local control then the display and switches are used to set up and show the operation the module. If in remote mode then they are still active for showing the status but cannot be used to actually change anything.

Beside the s and t buttons are three LEDs marked **+**, **CAL** and **–**. In general the **CAL** LED is used to show that a variable is set to its normalised value and if not then the others show which direction to which it has been changed or that it is no longer on its CAL value.

2.10.3 Remote/Local Control

The lowest switch selects between Local control and Remote control over DART:

Local	Control is from the front panel itself.
Rem	Control is from the DART system. This requires the use of an external controller running a suitable programme, which communicates with multiple racks using the Dartnet protocol.

2.11 CONFIGURATION

The V6411 can be configured with either one or two extra processing options – Video Processing (VP) and/or Audio Processing (AP). When the unit powers up it goes through an internal initialisation process and then starts with the front panel menu at the top level (excluding Sleep). This shows which of the extra options, if any, are available. If the unit is not as required it must be returned to the factory for upgrading (or possibly downgrading). The menu will display one of these messages:

V6411	Standard V6411
V6411 VP	V6411+ Video Processing
V6411 AP	V6411+ Audio Processing
V6411 V+A	V6411+ Video Processing + Audio Processing

There is no direct indication of whether any audio sub-modules are fitted; however this is easily visible on the module itself and can be found from the front panel by going to

STATUS   Sub-Mod

2.12 AUDIO I/O SUB MODULES

Various audio sub-modules are available for the V6411 depending on the audio requirements. The audio sub-modules are only relevant if the Audio Processing option has been ordered. No harm will be done to the board if they are fitted without the Audio Processing.

To change the module remove the V6411 from the chassis and carefully remove the existing one, if fitted, by lifting evenly at both ends. To fit a new one check the orientation by aligning the offset connectors and place the module carefully. Push it home evenly at both ends. It may be stiff but do not force it aggressively since if the connectors are not mating correctly then one or more of the pins may get bent.

The details of the analogue and digital audio signals are given in Section 2.4.

These are the available modules:

Type	Part No.	Description
AA	130-2920	Analogue Audio In and Out – Both channels
DD	130-2930	Digital Audio In and Out – Both channels
AD	130-2940	Analogue Audio In and Digital Audio Out – Both channels
DA	130-2950	Digital Audio In and Analogue Audio Out – Both channels
HH	130-3090	Hybrid: Channel A – Analogue Audio In and Out Channel B – Digital Audio In and Out

3. <u>BLOCK DIAGRAMS</u>

3.1 VIDEO PROCESSING
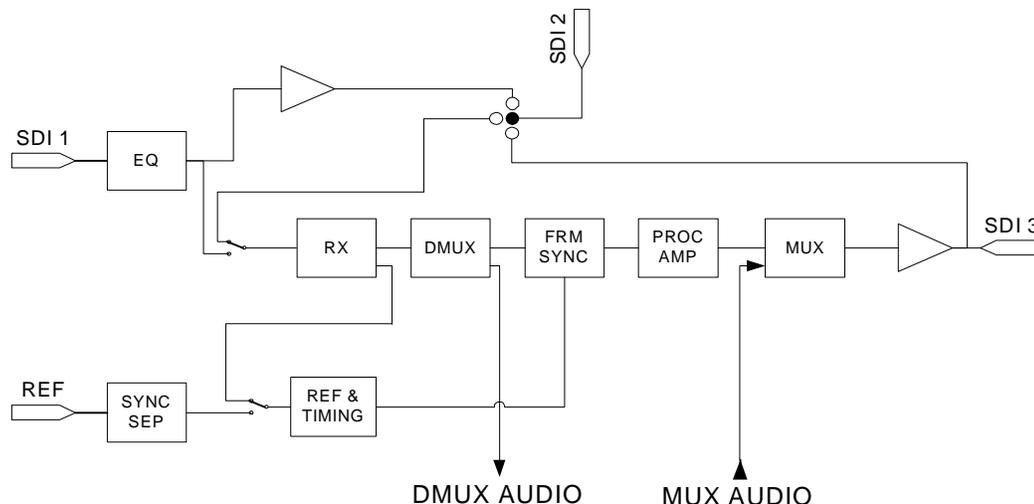
This diagram shows how the video flows through the V6411. In particular the selection for SDI 2 between a second input, a buffered output and a main output can be seen. This drawing is diagrammatic and should not be read literally; for example it may seem that there is no equaliser (EQ) for SDI 2 when it is being used as an input but this is not the case since in fact the EQ is inside the Receiver block (RX) along with the selection switch.

The reference to the Frame Synchroniser can be either from the external reference input or from the input video itself. A third option, not shown here, is that the internal oscillator can free run, but this is only used when there is no input signal and no reference. In fact the selection of the reference between the external and the SDI input is automatic so that the external reference is always used if it is present and the SDI when there is no reference. Similarly if there is a discrepancy between the standard of the SDI and that of the reference then the reference will be ignored and the unit will behave exactly as if the reference were not present. Normally, when locked to the input, the variable timing is disabled and the unit will operate in minimum delay mode; but this can be changed in the **FRM SYNC** : **RFL Mode** (For Ref. Fail Mode).

> **FRM SYNC   RFL Mode   Min Del**   Minimum Delay mode (default)
> **Var Del**   Variable Delay Mode

The audio Demultiplexer is always in the signal flow (assuming the Audio Processing option is enabled) as is the Multiplexer.

3.2 AUDIO PROCESSING – ANALOGUE OUTPUTS
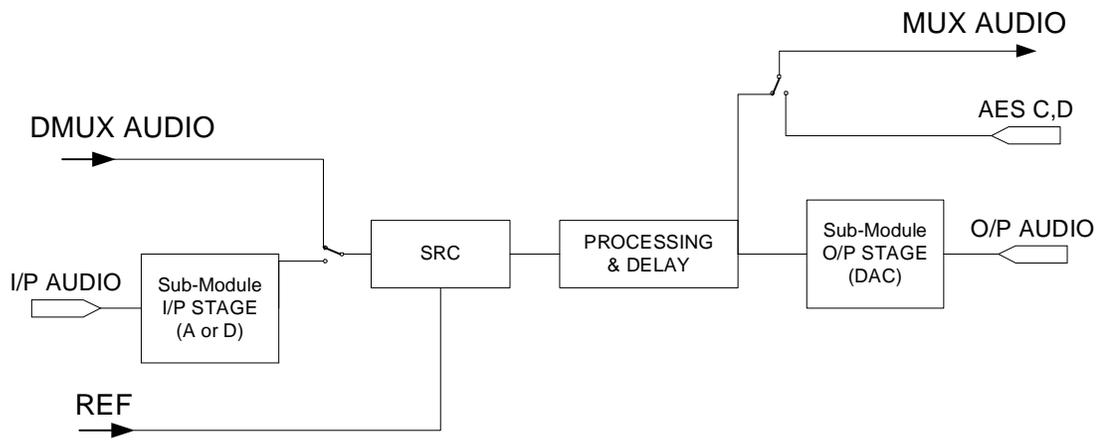
This diagram shows the audio signal flow when a sub-module with analogue outputs is being used. As far as the audio inputs are concerned in the signal flow they may be either analogue or digital. The actual audio inputs are always processed by the input part of the plug in module. The audio to be processed is selected from either the module or demultiplexed from the SDI video. As discussed elsewhere the unit can process two AES channels, referred to as AES A and AES B, and these can either come from the same source (GANGED) or separate sources (SPLIT).

In either case the audio is re-sampled in a Sample Rate Converter (SRC) so that it is synchronous to the system reference. It is the SRC which converts any input video not at a sample rate of 48kHz to that rate (for example from 32kHz or 44.1kHz from CD players) and it is from this point on that the audio has a sample rate of 48kHz.

If the sub-module has an analogue output then only one output set is available.

If only embedded audio is required, on both the input and output sides then there is no need to fit a sub-module. The internal control software ensures that the operator can only select signals that are available on a particular unit.

3.3 AUDIO PROCESSING – DIGITAL OUTPUTS

MUX AUDIO

AUX I/O

DMUX AUDIO

```
I/P AUDIO ──▶ ┌─────────────┐        ┌─────┐   ┌──────────────┐   ┌─────┐        ┌──────────────┐
              │ Sub-Module  │────o───▶│ SRC │──▶│ PROCESSING   │──▶│ SRC │───────▶│ Sub-Module   │──▶ O/P 1
              │ I/P STAGE   │         └─────┘   │ & DELAY      │   └─────┘        │ O/P STAGE    │
              │ (A or D)    │                   └──────────────┘                  │ (Digital)    │
              └─────────────┘                                                     └──────────────┘
```

REF

AES REF ──── ┌─────┐
             │ AES │
             │ RX │
             └─────┘
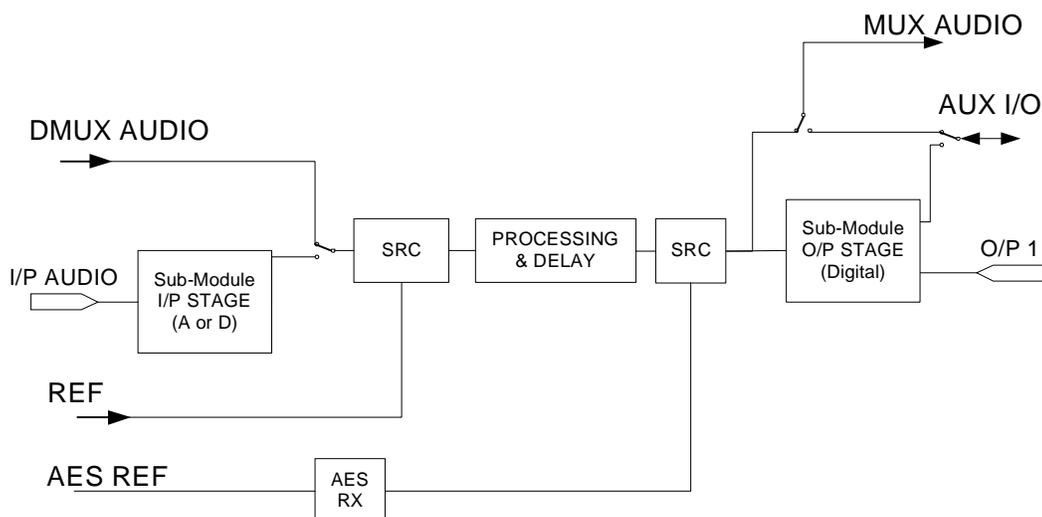
This diagram is similar to that in the previous section except to show the different output options when a digital output module is fitted. Since the digital AES outputs are more efficient in terms of pin count there can be a second output on the AUX I/O pins.

If a module with a digital output is fitted then the external AES reference is available. This can be used to lock the digital AES output to another AES. If no AES reference is connected then the SRC will be in bypass mode.

Since the audio to the multiplexer is after the SRC it is essential that that the AES reference is synchronous to the video reference if embedded audio is to be used. If the multiplexer is not being used then there are no restrictions on the AES reference.

Apart from the second output the AUX I/O can also be used as the input to the multiplexer. This feature makes it possible to process audio inside the V6411 for delay and gains etc, and then pass it out to an external processor for more sophisticated processing before returning it in to the multiplexer. Depending on the type of sub-module there may be some restrictions on the return audio. This is discussed later in section 4.5.14.

3.4 AUDIO SUB-MODULES

A range of audio sub-modules are available and these block diagrams show the different facilities on each of them.

3.4.1 Analogue to Analogue (AA)
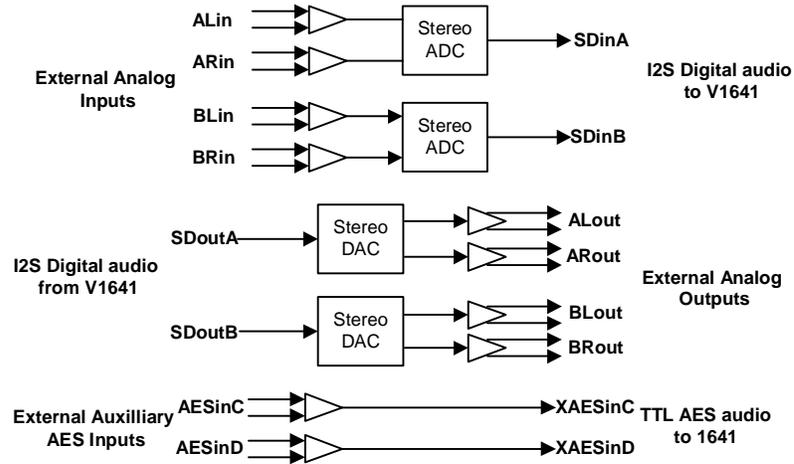
The AA module provides two stereo pairs (i.e. four signals in total) on the input and the output.

The auxiliary AES port is always an input to be selected by the multiplexer.

3.4.2 Digital to Digital (DD)
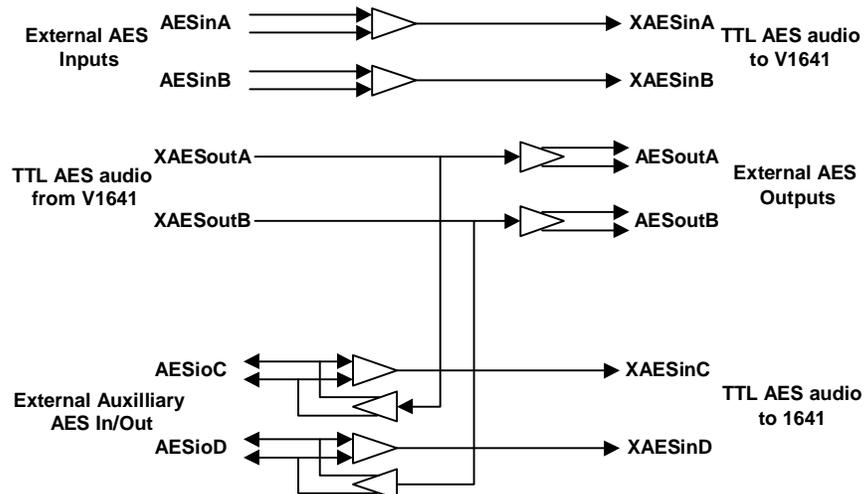
The DD module provides two AES signals, each containing a stereo pair, on the input and output.

The auxiliary AES port can be either a duplicate set of outputs or as an external input to the multiplexer. The selection is made from the front panel, or by remote control over DART.

3.4.3 Analogue to Digital (AD)
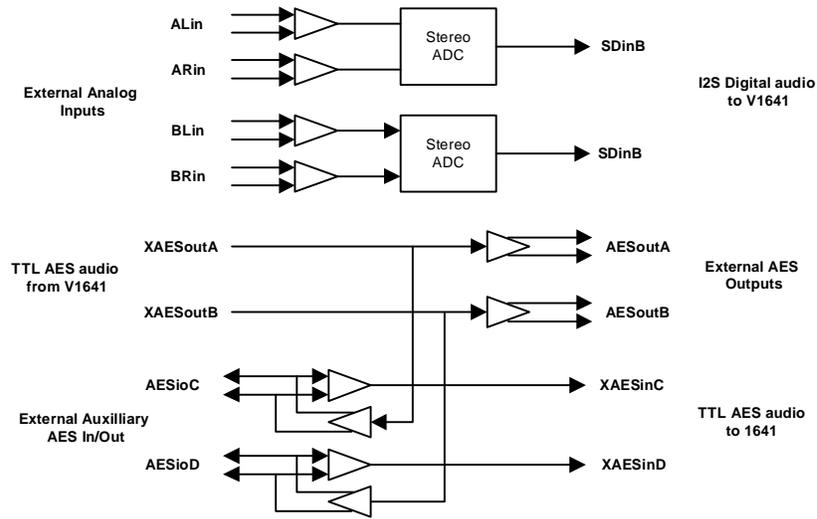
The AD module provides two stereo pairs (i.e. four signals in total) on the input and two AES signals, each containing a stereo pair, on the output.

The auxiliary AES port can be either a duplicate set of digital outputs or as an external input to the multiplexer. The selection is made from the front panel, or by remote control over DART.

3.4.4 Digital to Analogue (DA)
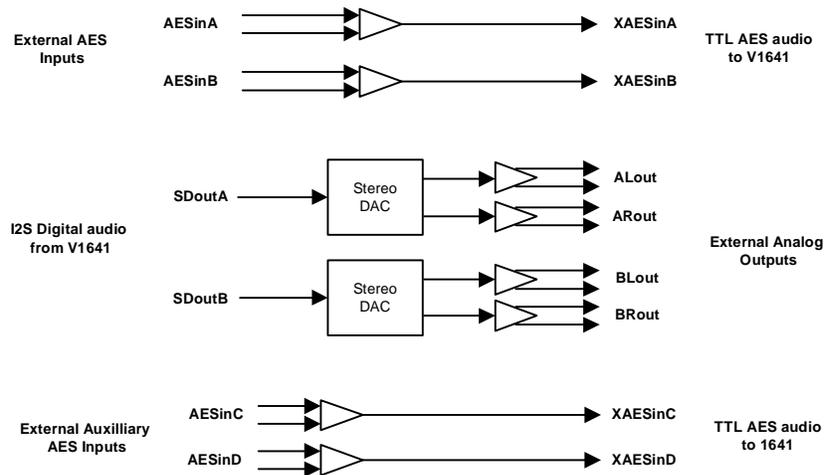
The DA module provides two AES signals, each containing a stereo pair, on the input and two stereo pairs (i.e. four signals in total) on the output.

The auxiliary AES port is always an input to be selected by the multiplexer.

3.4.5 Hybrid to Hybrid (AD-DA)
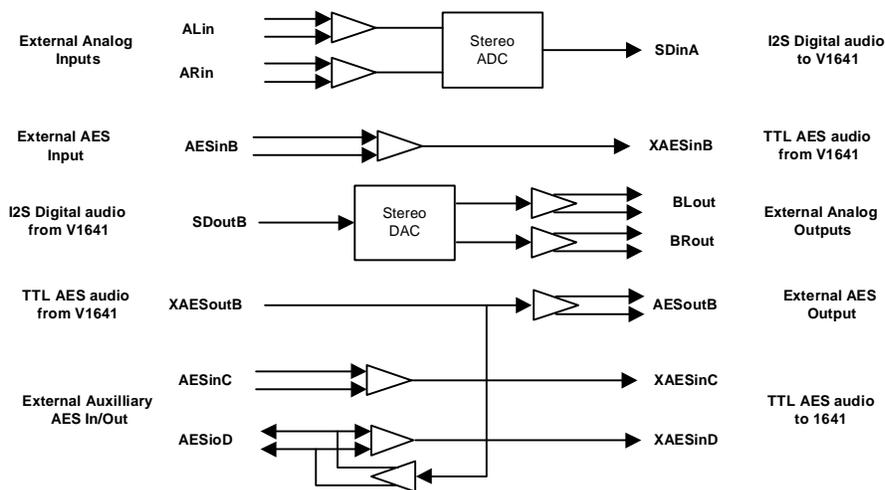
On the hybrid module there is a mixture of analogue and digital ports on the input and the output. The A channel has analogue inputs and outputs while the B Channel has digital inputs and outputs.

The auxiliary AES port can be either a duplicate set of digital outputs or as an external input to the B channel of the multiplexer. The selection is made from the front panel, or by remote control over DART.

4. <u>SYSTEM OPERATION</u>

4.1 LOCAL CONTROL

4.1.1 Start up

Local control and monitoring of the V6411 is done through the front panel with its eight character LED display and three control buttons **Select**, s and t. There are three LEDs which also contribute to the status indication; these are labelled **+**, **Cal** and **–**.

After power up the display will start at the top level and show the unit type and any options that are included. These options are not the same as the plug-on modules for the audio I/O. The display will be one of these:

`V6411`	Standard V6411
`V6411 VP`	V6411 with Video Processing
`V6411 AP`	V6411 with Audio Processing
`V6411V+A`	V6411 with both Video and Audio Processing

4.1.2 Menu Control

The **Select** and s and t buttons are used to manoeuvre around the menu system. The menu structure has five levels and the **Select** button is used to go up and down the structure. The s and t buttons are used to move between selections or to adjust a parameter depending on which sort of menu is displayed. The five levels are as follows:

Sleep	Display is blank (except for Banner warnings).
Top Level	As above, e.g. **V6411 V+A**
Main Menu	The Main menu items, such as `FRM SYNC`, `ENG'ING` etc. These items are all in Upper Case.
Sub Menu	Menu items under each main heading, such as `Video` or `Hor Tim` under the `FRM SYNC` main menu. These items are all in Sentence Case (generally lower case but with upper case first letters).
Parameter	The lowest level under the Sub Menu, and used to actually adjust a parameter. The display will depend on the actual parameter and may be a value such as `+0.00dB` for a gain or `ON` or `OFF` for a switch variable. There is usually a title to describe the variable and a small icon in the left hand character position, but 8 characters cannot provide for a detailed description.

Some Main Menus are only available if certain options have been included. These are:

|	
`PROC AMP`	Only present if Video Processing is enabled
`AUDIO`	Only present if Audio Processing is enabled
`DELAY`	Only present if Audio Processing is enabled

Many of the sub menus depend on which audio I/O sub modules are fitted. For example the Calibration functions of the analogue audio ADCs and DACs under `CALIB` do not appear unless a suitable sub-module is fitted.

To move down a level just press the **Select** button briefly; then press either the **Select** button again to go down another level or the s and t buttons to move around the options within a level.

To move up a level press and hold the **Select** button for about half a second which will move up one level. If you continue to hold the **Select** button then it will move up a level every half a second until it reaches the Sleep level (one above the Top Level).

A complete list of all the menus is given in Section 0.

4.1.3 Menu Examples

This section has examples of how to manoeuvre through the menu system. The first one starts with the unit in its 'sleep' mode where the display is blank, and then proceeds to set the output Multiplexer to use group 2. The sequence assumes that audio channels are ganged.

Action	Display	Comments
Select	`V6411 AP`	Top Level
Select	`FRM SYNC`	First Main Menu
▼	`PROC AMP`	
▼	`AUDIO`	The Main Menu we want
Select	`Aud I/P`	
▼	`Audio A`	
▼	`Audio B`	
▼	`Mux Grp`	The Sub Menu we want
Select	`None`	The default setting
▼	`Mux Gp 1`	
▼	`Mux Gp 2`	Set it to Group 2 that we want

Now we shall make sure that the ancillary data is being blanked in the unit so that there can be no audio group conflict. The following steps should be taken from the current position (Select+Hold means that you should press and hold the select button for about half a second):

Action	Display	Comments
Select+Hold	`Mux Grp`	UP to the Sub Menu level
Select+Hold	`AUDIO`	UP again to the Main Menu
▼	`DELAY`	
▼	`STATUS`	
▼	`ENG'ING`	Along to the Engineering Main Menu
Select	`Aud Ctrl`	
▼	`Anc Data`	To the Sub Menu we want
Select	`Anc Blnk`	Check that the ancillary data is set to Blank

4.1.4 Sleep

If the front panel is not used for a certain amount of time then the display will automatically go into a sleep mode when it will be blank. Pressing any of the buttons will cause it to 'wake up' back into the top level. The time delay before the unit slips into sleep mode can be set up using the `ENG'ING` : `Sleep` menu.

The brightness of the display can also be adjusted using the `ENG'ING` : `LEDLevel` menu.

4.1.5 Banner

There are some conditions which need to be directly indicated to the operator and although the display system is highly versatile for a lot of complex operations it is not really convenient for immediate indications. In the past LEDs on the front panel have been used for this purpose.

To help with this a banner message will pass across the screen from right to left to show any critical statuses when the display is in sleep mode. This saves the need to manoeuvre down the menus to find out, for example, that a Test Pattern has been selected. Remember it is not necessary to wait for the time-out period for the unit to go into sleep mode, it can be forced there by going up a level from the so-called Top Level. The following conditions will be displayed on the Banner:

Minimum Delay	(by command only, not by cross standards)
Video Frozen	(by command only, not i/p fail)
Test Pattern	
Free-run	
Audio A Set to Tone	
Audio B Set to Tone	
Audio A Muted	
Audio B Muted	
Mux Conflict	Indicates muxing over an existing group
System in Test Mode	(Not available to user)

4.1.6 High Level Signal Status

There are two LEDs on the top of the front panel to indicate that the SDI and video reference inputs are present, and consequently these also indicate that they are absent. However there is no direct indication as to the format of these signals, i.e. 625/50 or 525/60. Since many installations may use multiple formats and therefore need a quick indication there are parallel menus with the Top Level.

If you press the s and t buttons from the Top Level then you will see the SDI and Video Reference status directly. In each case this will show the signal presence and if it is there then what format it is. Again this is considerably faster than manoeuvring down the menu structure. For example:

```
            SDI 625
```

There are in fact four different stati available at this level. They are:

```
     IP 625 4    or     IP FAIL
     RF 625 4            NO REF
     DEL >1FD        DEL <1FD
     REF AES4        REF AES6
```

These indications are still at the Top Level, so a single press of the Select button will immediately move down the menu tree.

4.1.7 Variable Calibration

Most variables have a calibrated or normalised value. In some cases this is obvious, such as the Video Gain in the Proc Amp section should be normalised to 0dB, but in others it is less so. In the listing of all the variables in Section 8 the normalised value is shown.

Any variable can be individually set to its normalised value by pressing the s and t buttons at the same time.

Within each the Main Menu at the end of the list of Sub Menus is a pseudo Sub Menu called **Norm**. Selecting into this will let you normalise all the parameters within the Main Menu item to their normalised value.

The three LEDs beside the s and t buttons are used to show whether the variable is calibrated or not. After calibration the **CAL** LED will be ON.

4.2 REMOTE CONTROL

In addition to being controlled with the menu system on the front panel the V6411 can also be controlled over the DART remote control system. For this it should be fitted into a rack which also contains a Rack Controller. The Rack Controller provides an interface between all the units in the rack and the external DARTNET network. Various controlling devices are available for accessing units on the DARTNET; these include the V1605 1U hardware panel, the ViewFind PC program and the more sophisticated ViewNet Client Server interface. It is also possible to have third party software written to interact with DARTNET. The details and specification of the DART interface are described elsewhere.

There are separate settings for the unit when operating in Local and Remote control modes. This means that if the unit is changed between Local and Remote mode then the settings may change. The advantage of this is that if the unit has been set up locally and the operator inadvertently changes to Remote mode (which probably has different, or even default, settings) the local settings are not lost. There could be a disadvantage in that once the unit has been set up remotely it cannot not be switched to Local without causing a disturbance.

When in Remote Control the front panel menu system is still active but is only used to monitor the status of the unit. It cannot be used to change anything. There are in fact some exceptions to this since some parameters cannot be controlled remotely. For these, which are listed below, it is always possible to use the front panel to change them.

FRM SYNC	**XstdMode**	Set the Cross standard mode
DELAY	**Delay A1**	Disables the Delay in Channel A1
DELAY	**Delay A2**	Disables the Delay in Channel A2
DELAY	**Delay B1**	Disables the Delay in Channel B1
DELAY	**Delay B2**	Disables the Delay in Channel B2
ENG'ING	**Free-run**	Set the Oscillator into Free run
ENG'ING	**Aud Ctrl**	Select between Ganged and Split control of audio
ENG'ING	**AutoMono**	Select and set Auto Mono Mode (Off, -3dB, -6dB)
ENG'ING	**MuxGpDel**	Mark the existing MUX group for deletion
ENG'ING	**FailMode**	Set the Input Fail mode to Kill rather than digital Black
ENG'ING	**TPs**	Set the Test Patterns to Full Field
ENG'ING	**Sleep**	Set the display Sleep timeout
ENG'ING	**LEDLevel**	Set the Display brightness
ENG'ING	**525F1L21**	Blank/Pass Line 21, Field 1 (525 mode only)
ENG'ING	**525F1L22**	Blank/Pass Line 22, Field 1 (525 mode only)
ENG'ING	**525F2L21**	Blank/Pass Line 21, Field 2 (525 mode only)
ENG'ING	**525F2L22**	Blank/Pass Line 22, Field 2 (525 mode only)
CONFIG	**Banner**	Turn the top level display Banner On or Off
CONFIG	**GPI 1**	Set the application for GPI 1
CONFIG	**GPI 2**	Set the application for GPI 2
CONFIG	**GPI 3**	Set the application for GPI 3
CONFIG	**GPO**	Select GPO function of the DELAY Output

4.3 FRAME SYNCHRONISER

4.3.1 SDI Inputs

The SDI inputs must conform to SMPTE 259M or its equivalents. If only one input is required then it should be connected to SDI 1 and then SDI 2 may be set up to be either a buffer output or a synchronised output. For this the on board links must be set correctly:

Buffer Output	LK2, LK3 North
Synched Output	LK2, LK3 South

If two SDI inputs are needed then the links should be set as follows:

Input 2	LK2, LK3 West

In this case there is no access to the buffer output and only one synched output is available with the 3U rear panel and two with the 1U rear panel.

The control processor will know whether input 2 is available and if so it will appear on the selection menus. If it is not available then it will not appear on the menu. This applies to local control and any remote controller on DART should act in the same way. (All Vistek supplied control software will conform, but third party software is outside of our control.) From the front panel you can see if SDI 2 is available on the **STATUS** : **SDI I/P2** menu.

Apart from the Front Panel or remote control SDI 2 can be selected using one of the three available GPIs. See section 4.6.1.

Since Firmware version 1.4.6 it is possible to indicate on the dual purpose Delay/GPO output that SDI 2 has been selected, by whichever method. See section 4.6.2.

4.3.2 SDI Buffer Output

The SDI buffer output is simply an equalised version of Input 1. The SDI signal is equalised, but not re-clocked. It is only available on the SDI 2 BNC connector if the links are set correctly:

Buffer Output	LK2, LK3 North

4.3.3 SDI Main Output

The main synchronised SDI output is available on several BNCs depending on the type of rear and the link set up:

3U Rear	LK2, LK3 North or West	BNC 3
	LK2, LK3 South	BNCs 2 and 3
1U Rear	LK2, LK3 North or West	BNCs 3 and 4
	LK2, LK3 South	BNCs 2, 3 and 4

4.3.4 Video Reference

The external video reference should be a standard composite black and burst video signal. It is possible to use a real video signal but this is not recommended for high quality systems. The rear panel provides the option of looping the reference through another BNC which is shared with the Delay output. If the rear panel switch is set to REF LOOP then the Delay signal is not available on a BNC but is still present on the multi-pin connector as shown in section 2.3.4.

Whether the reference is looped or not there is the option of terminating it on the PCB as controlled by link LK 5.

High Impedance	LK 5 North
Terminated in 75Ω	LK 5 South

4.3.5 SDI Input Fail

If the selected input should fail then the V6411 will immediately stop writing into the frame store and will start to read data only from the other field. (This is the opposite field to that which was being written when the input failed.) Since only one field is being displayed there will be a loss of vertical resolution, but there should be no motion judder.

It is usual on Frame Synchronisers for the image to be frozen when the input fails. This is especially useful when there is likely to be occasional and intermittent breaks in the signal to give a minimum disturbance to the output. However this can be very confusing when installing a system with static test patterns since it is hard to trace the signal. On the V6411 there is the option of freezing the picture for a short period and then cutting to black. The default period is 3 seconds, but this can be varied from 0 to 14 seconds, and even set to an infinite freeze. The freeze delay is set on the **FRM SYNC** : **VFL Mode** menu.

When the output of the module goes to Black after the set delay it is also usual that this is a clean digitally generated black, so that any following equipment sees no disturbance. However there may be cases where this is not desirable, for instance if downstream equipment also needs to be aware that the signal has failed and therefore take some action. For this reason it is possible for the output can be corrupted on SDI Input Fail rather than go to a clean black. In this case the digital signal to the serialiser is disabled, and the serial output is grossly non-standard. This feature is set in the **ENG'ING** : **FailMode** menu which can be set to either Black or 0V. Note that it is not possible for the serial output to be completely disabled, but only set to a non-standard signal. This feature is only available from firmware version 1.3 onwards.

When the unit goes into freeze mode from the SDI Input Fail the vertical blanking interval data will always be blanked, as will the ancillary data. This prevents normally dynamic data being read out from a static store.   In particular it prevents Teletext and embedded audio being completely corrupted.

4.3.6 Video Reference Fail

If the video reference fails, or simply is not be present, then the synchroniser will normally lock to the SDI input and set itself into minimum delay. In this way the unit can still be used as a SDI Video Proc Amp (if enabled) and all the audio functions are still available (again only if they are enabled).

If the unit is wanted as a variable delay device then this setting back to minimum delay can be overwritten so that the unit goes into variable delay on the **FRM SYNC** : **RFL Mode** menu. If this is set to variable then the current offset settings will be used to adjust the output timing relative to the SDI input rather than the video reference.

4.3.7 Standard Detection

The V6411 automatically monitors the selected SDI input and the video reference to detect which standard they are – either 625/50 or 525/60. If they are the same standard then the unit will operate accordingly.

However, if they are of opposing standards then there is a choice as to how the system operates. Normally the input standard will be ignored and the unit will continue to lock to the applied external reference. This means the output will always be 'clean', in the sense of producing no errors on the SDI output signal, whatever happens to the input signal, but the signal of course will not be processed correctly. But there are instances when it is preferable to follow the standard of the input signal rather than the reference so it is possible to change the operation on the **ENG'ING** : **X Std** menu. This is normally set to REF, but can be changed to IP. In this case the unit will operate from the input just as if the reference were not present at all and will automatically go into its minimum delay mode so that any H or V offsets will be ignored.

This is summarised in the following table:

SDI I/P	Reference	Cross Standard = Ref		Cross Standard = IP	
		Operating Standard	Locking Source	Operating Standard	Locking Source
None	None	Last used	Free Run	Last used	Free Run
	625/50	625/50	Ref	625/50	Ref
	525/60	525/60	Ref	525/60	Ref
625/50	None	625/50	Input	625/50	Input
	625/50	625/50	Ref	625/50	Ref
	525/60	525/60	Ref	625/50	Input
525/60	None	525/60	Input	525/60	Input
	525/60	525/60	Ref	525/60	Ref
	625/50	625/50	Ref	525/60	Input

4.3.8 Manual Freeze

Apart from the automatic freeze of the video when the input fails it can also be frozen by the operator. This can be done in three ways:
1. Locally on the front panel
2. Remotely over DART
3. From the GPI connections on the rear.

In all cases the freeze is clean in that it occurs on a field boundary, so that either of the two fields may be shown.

Locally there is a choice of three freezes – Field 1, Field 2 or Frame. If the unit is put into any of these Freeze modes manually and the power is removed then this is not remembered, so it will not wake up again in Freeze mode.

Remotely or over the GPI there is only the option of freezing either Field or Frame. On a Freeze Field the next full field will be continually displayed. Thus if the command is received during Field 2 then although both fields are frozen only Field 1 will be displayed on both output fields. On a Freeze Frame writing will stop at the end of the current frame and it will then be repetitively read out.

Setting up of the GPIs is described in section 4.6.1.

When the unit is in freeze mode the vertical blanking interval data is blanked so as to prevent normally changing data, such as Teletext or time-code being frozen. This applies to an automatic freeze from an input SDI fail as well.

Also when in Freeze mode, either automatic or manual the all ancillary data is blanked independently of the main control for this (**ENG'ING** : **Anc Data** menu).

4.3.9 Vertical Interval

There is individual control of which active lines in the vertical blanking interval are passed through the Frame Synchroniser. The exact lines which can be selected depends on the operating standard and are shown here using the usual line numbering conventions for the particular standard:

Standard	Field 1	Field 2
625/50	Lines 7 – 22	Lines 320 – 335
525/60	Lines 10 – 20	Lines 10 – 19

If the unit is operating in 525/60 then the selection menu will only show the lines available in that standard.

The lines are selected in pairs across the two fields, so that if, for example, you wish to pass Line 12 on Field 1 then you will have to also pass Line 12 on Field 2.

This only selects whether the active picture part of the VBI is passed, that between the SAV and EAV, and not the ancillary data which is discussed in section 4.3.13.

Changing the VBI selections is a little different to the other menus. First go to the **ENG'ING** : **VBI** menu and select whether you want all lines to be Passed, or all to be Blanked or to Sel to make a selection. Only if you have selected Sel will there be the individual lines pairs on the **ENG'ING** menu below **VBI**. The easiest way to do this is to decide whether you want the majority of lines to be passed or blanked and set the unit accordingly, then change to Sel and change those lines you want to be different.

4.3.10 Special Vertical Blanking (525 Mode only)

Some active picture lines are used for carrying data even though they are nominally in the active picture region. A particular example of this is the carrying of Closed Caption data on Line 21 of Field 1. Sometimes this line needs to be blanked quite separately from other lines and the other field.

To do this there are special menu entries in **ENG'ING** for the individual control of 4 lines: 21 and 22 on each field.

Only the blanking of Line 21, on each field, can be controlled over the remote control system, but the local control is always active. This means that Line 21 access can still be controlled even if theunit is set to Remote Control.

4.3.11 Minimum Delay

The Frame Synchroniser can be set into a minimum delay mode which can also be considered as a synchroniser bypass. This is done on the **FRM SYNC** : **Vid Del** menu.

Note that when set into the Minimum Delay the unit will not be synchronising to the reference, so it may appear not to be working. For this reason the high level Banner message (section 4.1.5 will carry a warning.

The minimum delay for both standards is 3.66μs.

4.3.12 Delay Signal

The Frame Synchroniser produces a signal that represents the delay being inserted into the video path. Normally this is used internally by the audio processor to provide a tracking delay to the audio. However the signal is also available externally so it can be used by other audio tracking devices.

From version 1.3 onwards the Delay output may be used as a General Purpose Output (GPO) instead of delay. This is set in the **CONFIG** : **GPO** menu and is described in more detail in section 4.6.2.

The Delay signal has repetition rate of two frames (80ms for 625/50 and 66.7ms for 525/60) and the positive pulse width represents the delay. This is shown in this diagram.
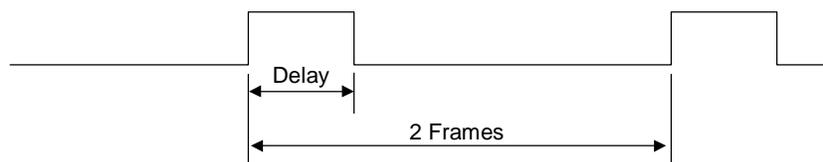
If the unit is not synchronising, such as loss of i/p or Freeze then the delay output is blanked. It is expected under these conditions that the audio processing will hold its current delay from the last valid measurement until a pulse re-appears. This is what the internal audio delay does.

The external Delay Pulse output is available on the rear panel in two places – a BNC shared with the Reference loop output, and on the high density D type connector. For the BNC output the switch on the rear panel must be set to the correct position. For the D-type it is on pin 27 and is always available.

The external pulse itself is nominally TTL level (0 to 5V) and is driven from a TTL line driver.

4.3.13 Ancillary Data

Ancillary data is all the information embedded in the D1 data between the EAV and SAV TRSs. In most installations this is digital audio and EDH data but can include any other data that is embedded using the appropriate standard. It must be remembered that the V6411 is a Frame Synchroniser and periodically there could be a time when the output timing rolls through the input timing such that there is either a frame repeat or a frame drop-out. There is no protection of the ancillary data when this occurs.

Usually the audio data is processed separately and this is precisely what the V6411 has been designed to do. When handling embedded audio on the input it is demultiplexed and processed in parallel with the video processing and then re-multiplexed onto the output. In this way it avoids the frame disturbance at the roll-over time. Non-audio data cannot be handled this way and will be passed through the frame synchroniser.

The V6411 provides the ability to blank all of the ancillary data with the video processing. This provides a 'clean sheet' for the re-multiplexing process. It is done on this menu:

    ENG'ING Anc Data

It is not normally possible to re-multiplex audio onto a group that is already present on the video. It is possible to append a different group number so that for example if the input audio is on Group 1 the processed audio can be re-multiplexed onto Group 2 quite successfully (but see note below). But if you want to replace the audio in Group 1 with its processed equivalent then you must remove the original Group 1. It is not possible to selectively remove a single group so normally you must remove all the ancillary data.

However since Version 1.2 the V6411 is able to disable a single group. This is known as 'marking for deletion' and in principle looks for any existing data associated with the chose Mux Group and changes its identity. This means that any following demux equipment will not see the re-marked data as audio and ignore it. Thus the new data can be successfully embedded. This method does **not** release any data space, so care must be taken to ensure that the worstcase audio data does not overflow the ancillary data space. What this method does allow is, say, extracting Group 2 data for modification and re-insertion while leaving Group 1 data alone. The control for this menu:

    ENG'ING MuxGpDel

This selective deletion happens after the full Ancillary Blanking, so if the unit is set to Blank the Ancillary Data then the selective deletion will have no effect.

Incidentally total blanking will also remove the EDH signal from the input, but this is usually replaced on the output anyway. However there can be a problem if the output EDH is disabled and the original EDH is passed through (Ancillary Data pass) since the original EDH does not relate to the processed data. This will result in EDH errors on downstream detection equipment.

> **Note** To append one group of audio onto existing ancillary data one it is essential that the original SDI signal conforms to the standard for embedded data and leaves no gaps between the EAV and the data. Some test equipment, notably the Tektronix TSG422 signal generator, does not conform and it is not possible to successfully append data onto its output.

4.3.14 TRS Signals

The TRS signals are the digital equivalent of the analogue synchronising pulses. The V6411 always regenerates the TRS signals on its output, so that any errors on the input signal will not be propagated through.

4.3.15 Test Patterns

The V6411 contains a useful test pattern generator which can be used to provide suitable signals for system testing and even for testing other pieces of equipment. They are selected as if they were an alternative signals source on the **FRM SYNC** : **Video** menu. From the remote control system they can be called up directly.

The patterns available are:

Black	Digitally generated Black
Bars	For 625/50 operation these are 75% (EBU) Bars For 525/60 operation these are SMPTE Bars
100% Bars	Always 100% Colour Bars
Timing	A reference timing signal which marks the first and last luminance and chrominance pixels in the digital active line, and the first and last active lines in each field. It also marks the centre pixels and centre lines for each format.
Ramps	A progressive luminance and chrominance ramp on all lines which goes from the legal minimum (004H) to the legal maximum (3FB) precisely over a digital line.
Stress	The standard two part pathological stress signal which fully exercises the equaliser and clock recovery PLL on subsequent equipment.

Even though the test patterns are selected as if they were alternative inputs to the unit they are actually generated on the output. This means that selecting them will not destroy any data already in the frame store which may, of course, be frozen. It also means that it is possible to cut cleanly between them and the real input video. It also mean that they cannot be used as an internal confidence signal for proving the correct operation of the V6411 itself.

Normally the actual test patterns are only produced during the active lines of each field but they can be set to also work during the vertical blanking interval. This is discussed in section 4.6.5.

The vertical interval is considered to be a part of the Test Pattern so it is always synthesised as either Black or the pattern itself. This means that the vertical blanking interval is always blanked when Test Patterns have been selected.

Conversely the Ancillary Data in the horizontal blanking interval is still passed through, assuming that option has been selected on the Engineering menu, even when Test Patterns have been selected. This is because the horizontal interval is usually audio, rather than the video in the vertical interval, and this should be handled separately.

4.3.16 EDH

EDH is a method of embedding data within the ancillary data space which carries a measurement of the video and other data. By regenerating the equivalent measurement at the receiving end it is possible to check that the data has been received correctly.

The V6411 does not process the EDH data on the incoming SDI video, but it does regenerate new EDH data on the output. EDH is always put in the same place, so the new data will overwrite the old.

The generation of the new data can be disabled on the **ENG'ING** : **O/P EDH** menu. Care must be taken if the new EDH generation is disabled and the old EDH is being passed through because it will probably not correctly represent the data. In this case the Ancillary Data really ought to be blanked on **ENG'ING** : **Anc Data**.

This control is not available over DART, so it is always active on the front panel even if the unit is in Remote Control.

4.4 VIDEO PROCESSING AMPLIFIER

4.4.1 Video Gain

`PROC AMP  V Gain`

The adjustment range is ±6dB and it applies equally to the luminance and both of the chrominance channels (Cb and Cr). The gain is applied after the black level offset. The Video gain is applied simultaneously with the Chrominance gain so they can cancel one another out. For example +3dB of Video gain along with –3dB of Chroma gain will result in the luminance being increased by +3dB and the Cb and Cr channels being unchanged.

The output is limited to ensure that there us no numerical overflow as the output fits into the 10 bit D1 domain. There is no gamut legalisation function.

4.4.2 Chroma Gain

`PROC AMP  C Gain`

The adjustment range is ±6dB and it applies equally both the chrominance channels. The gain is applied along with the video gain and after the black level offset. The Chrominance gain is applied simultaneously with the Video gain so they can cancel one another out. For example +3dB of Video gain along with –3dB of Chroma gain will result in the luminance being increased by +3dB and the Cb and Cr channels being unchanged.

The output is limited to ensure that there us no numerical overflow as the output fits into the 10 bit D1 domain. There is no gamut legalisation function.

4.4.3 Black Level

`PROC AMP  Blk Lvl`

The adjustment range is –127 and +128 D1 levels (equivalent to -101/+102mV). The black level adjustment is applied before the gain stages. This is considered the best arrangement since the unit is usually used to correct incoming errors.

4.4.4 Hue Shift

`PROC AMP  Hue`

The adjustment range of the hue shift is ±45° in 0.35° steps.

4.4.5 Dynamic Rounding

`PROC AMP  Dyn Rnd`

Since some quantising effects may be visible on the output of this unit when variable gains are applied, Dynamic Rounding has been applied. This Dynamic Rounding is only used to reduce the effects of the fractional bits of lower significance than the normal 10 bits; it does **not** reduce the resolution to 8 bits.

This can be disabled on the `PROC AMP` : `Dyn Rnd` menu.

This control is not available over DART, so it is always active on the front panel even if the unit is in Remote Control.

4.4.6 Limiting

`PROC AMP  Hrd Clip`

Since gain can be applied to the D1 signal it is possible to generate levels outside the normal 10 bit gamut of D1 and so limiting is required. The V6411 Proc Amp normally applies a soft form of limiting that progressively reduces the gain of a signal as it approaches the limits, either overshoot or undershoot. If this is not required then it can be disabled on the `PROC AMP` : `Hrd Clip` menu.

The limiting that is applied is 'simple' in that it does not ensure that the output is correctly within the colour gamut, but only that each of the three components remains within the legal 10 bit range.

Certain test patterns, most notable the amplitude ramps, contain data that is within the overshoot and undershoot areas. If they are passed through the Proc Amp with its default soft clipping then they will be modified. This means that the EDH value on the output will be different to that on the input. If this is not wanted then the Hard Clipping can be turned ON, but this is not recommended for normal Proc Amp operation.

This control is not available over DART, so it is always active on the front panel even if the unit is in Remote Control.

4.5 AUDIO PROCESSING

4.5.1 Signal Flow

These block diagrams show the audio signal flow through the Audio Processing section. (The AP option must be enabled for there to be any audio processing). There are two channels of audio processing which are always referred to here as the A and B channels, but there are also two separate inputs which are also referred to as the A and B inputs. (These inputs may come from the sub-module or the de-multiplexer, but the exact source is not relevant at this stage.) Normally these two channels are routed together but it is possible to mix them in such a way that each of the four outputs may be a sum of any of the inputs. The way this switching over relates to the gain controls and delays is shown in this first block diagram.
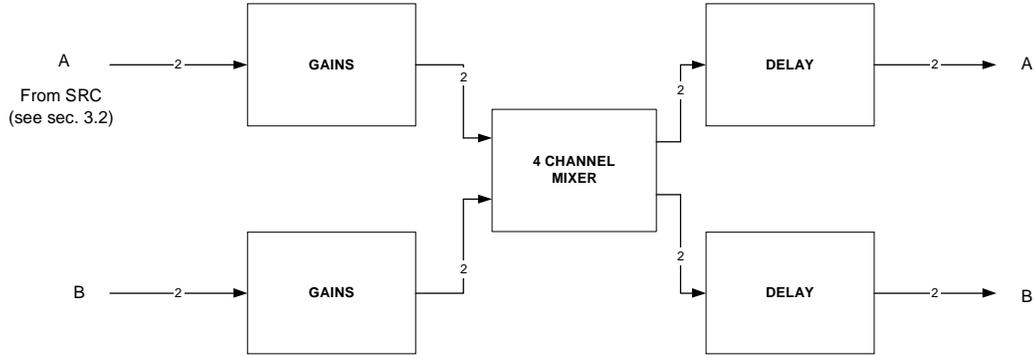
This second diagram shows in more detail the processing of only the A L channel but the AR, BL and BR channels are identical. By showing the order of operations it should explain how the different functions interact.
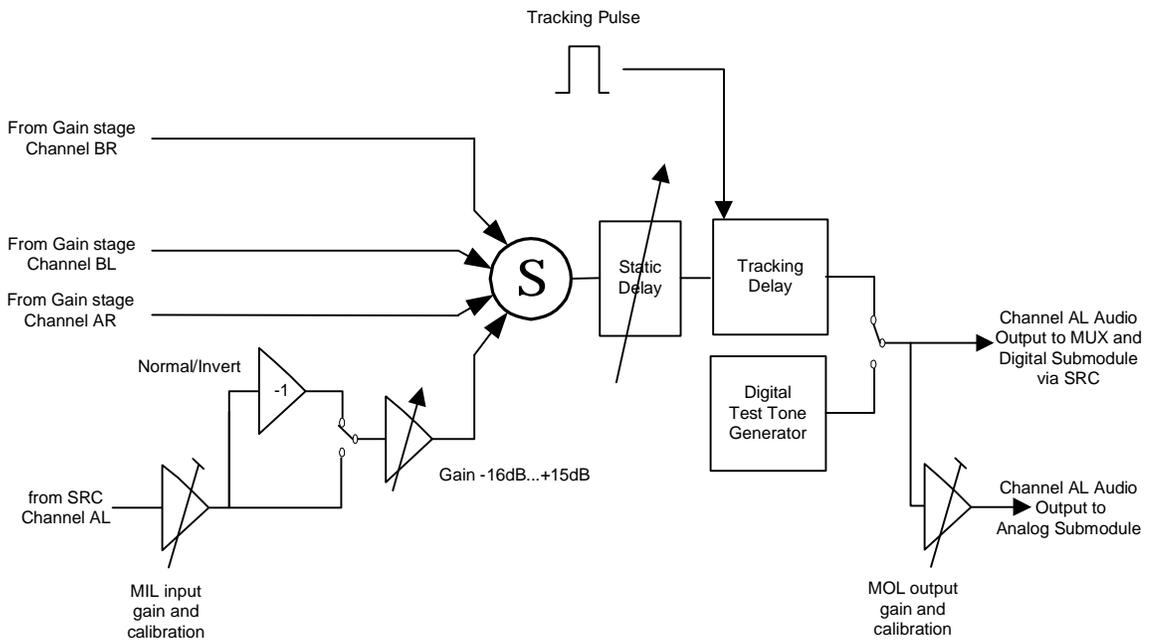
4.5.2 Gang and Split

The V6411 processes a total of four separate audio signals. These are grouped into two channel pairs (or stereo pairs) called A and B.   Most control settings are made on a 'per channel pair' basis and it is further possible to gang the controls for A and B channel pairs. The selection for selecting between ganged or individual (split) channel pair controls is under the engineering menu:

```
ENG'ING    Aud Ctrl    Split
                       Ganged
```

Throughout the following sections, for simplicity, it will be generally assumed that the audio controls are ganged. For split control there are often duplicate menus for the A and B channels.

4.5.3 Audio Input Selection

The source of audio for each channel can be from either the SDI Demultiplexer or externally from the sub-module. If the demultiplexer is chosen then there is a further choice of one of the four possible groups. The menu will show wording appropriate to the type of sub-module fitted.

```
AUDIO        Aud I/P     DMX Gp 1
                         DMX Gp 2
                         DMX Gp 3
                         DMX Gp 4
                         Analog      - If sub-module has analogue Inputs
                         AES         - If sub-module has digital Inputs
```

You can find out which groups are occupied on the incoming SDI on the Status menu which follows showing for example that groups 1 and 3 are occupied. Only those groups that are occupied will appear on the selection menu.

```
STATUS     I/P Grps   1 – 3 -
```

There is only one demultiplexer so if you are operating in Split mode then it is still only possible to select audio from one group but you can still have one channel from the demultiplexer and the other from the sub-module. You should select the sub-module input first and then the group.

4.5.4 Audio Mixer

Following the source selection the four individual channels A1, A2, B1, B2 are input to a mixer. The mixer has 4 inputs and 4 outputs. Each of the outputs can be made up as a mix of none, any or all of the inputs. There is no gain adjustment in the mixer; the constituent channels of the mix are simply added together, and the user shoould adjust the Input gains to ensure that clipping does not occur.   The mixer controls are on the Audio menu as follows:

```
AUDIO        Audio A1
                       - - - A₁
                       - - A₂ -
                       - B₁ - -
                       B₂ - - -
                        - - A₂ A₁    AutoMono option available
                       - B₁ - A₁
                       B₂ - - A₁
                       - B₁ A₂ A₁
                       B₂ - A₂ A₁
                       B₂ B₁ A₂ A₁
                       B₂ B₁ - A₁
                       - B₁ A₂ -
                       B₂ - A₂ -
                       B₂ B₁ A₂ -
                       B₂ B₁ - -    AutoMono option available
                       - - - -
             Audio A2                Same mixer options as above
             Audio B1                Same mixer options as above
             Audio B2                Same mixer options as above
```

4.5.5 AutoMono

On any of the Audio Mixer options wherein the two channels of a pair normally assigned Left and Right are summed in isolation, ie A1+A2 or B1+B2, the AutoMono function is available.   This function assumes the two inputs are Left and Right of a stereo pair and provides gain scaling on the mix components prior to the summation. Options are Off   (0dB), On (-3dB) and On (-6dB) The AutoMono function is accessed from the **ENG-ING** menu.

```
ENG'ING    AutoMono   Off
                      On(-3dB)   for same power as a single mono signal
                      On(-6dB)   for same voltage as L and R of a stereo
                                 signal
```

The AutoMono option select is not available from the remote control menu. The setting of AutoMono on the module's front panel applies to both local and remote control modes.

4.5.6 Audio Gains

All four audio signals can have their gain individually adjusted over the range −16dB to +15.75dB in 0.25dB steps. The gain is applied to the channels at the input of the audio processing chain, before the mixer, so that if , for example, input Channel A2 has gain applied and is selected for output Channel B1 then the B1 output will have the increased gain.

```
AUDIO      Gain A1
           Gain A2
           Gain B1
           Gain B2
```

These input gains are applied in the digital domain and care must be taken to avoid clipping the signal.

4.5.7 Audio Phase

All four audio signals can have a phase inversion applied. This is useful to compensate for incorrectly wired links in a system. The phase adjustment is applied at the input of the audio processing chain, before the routing selection, so that if Channel A has an inversion applied and is selected for Channel B then the B output will be inverted.

```
AUDIO  Phase A1   Normal
                  Invert
       Phase A2      "
       Phase B1      "
       Phase B2      "
```

4.5.8 Analogue Audio MAL

Maximum Input Level (MIL) is the level of the analogue input signal at the input of the Analogue to Digital Converter (ADC) which corresponds to the full scale digital range. Any analogue signal level greater than this will cause clipping and hence severe distortion in the digital domain. It is usually quoted as a signal level relative to 0dBu. Thus a setting of +18dBu means that standard level audio at 0dBu will have a headroom of 18dB before clipping.
It should be noted that only increasing the MIL effectively **reduces** the signal amplitude, so as to give more headroom. This means that it does not operate in the same way as a gain control.

The Maximum Output Level (MOL) is the level of the analogue output signal on the output of the Digital to Analogue Converter (DAC) from full scale digital range. An analogue signal greater than this cannot be generated from the digital domain (excluding dynamic overshoots and undershoots from filtering). It is usually quoted as a signal level relative to 0dB. Thus a setting of +18dBu means that standard level audio at 0dBu will have a headroom of 18dB.

It should be noted that only increasing the MOL effectively **increases** the signal amplitude. This means that it does operate in the same way as a gain control.

The V6411 ADC sub-modules offer adjustment of MIL and MOL ganged together under a single control called **M**aximum **A**nalog **L**evel, MAL. The V6411 submodules with analog inputs and or analog outputs offer the MAL in the range +12dBu to +24dBu. The factory setting will be +18dBu. It should be noted that changing MAL, which increases MIL and MOL together, will have no apparent effect on the perceived loudness of a throughput analog in to analog out signal on the V6411, as only the headroom will be affected. However, on mixed mode throughput, ie analog in to digital out, or digital in to analog out, the MAL adjustment will have the effect of adjusting MIL or MOL respectively as described above.

MAL is adjusted on the following menu, and it should be noted that the MAL option will not be available if an all-digital submodule is fitted.

```
AUDIO   MAL A&B
```

4.5.9 Audio Test Tone

There is facility to override the audio output with a digitally generated audio test tone. Activation of this is done on the `ENG'ING` menu as shown below. Specification of the internally generated tone is given in section 4.6.9.

```
ENG'ING    TTone A    TTA Off    Output A1, A2 normal
                      TTA On     Test Tone on output A1, A2
           TTone B    TTB Off    Output B1, B2 normal
                      TTB On     Test Tone on output B1, B2
```

It should be noted that the Test Tone controls are only available in `LOCAL` mode from the front panel; Test Tone cannot be invoked through the remote control interface.

4.5.10 MUX Group Selection

The SDI multiplexing process supports up to 4 'Groups' of audio data on a single SDI digital video data stream.   These are called Groups 1 to 4 and each group may contain up to 2 channels of AES audio data, i.e. 4 individual channels. When a group has audio data embedded on it it is termed *occupied*, and when it does not have embedded audio data on it it is called *free*. The V6411 can embed data on any one of the four groups using the menu option:

```
AUDIO       Mux Grp    None
                       Mux Gp 1
                       Mux Gp 2
                       Mux Gp 3
                       Mux Gp 4
```

There are several guidelines that must be followed when selecting a group on which to embed audio data:

- If the SDI coming in to the V6411 has a group or groups already occupied, then these will be passed through the video processing unaltered unless the Ancillary Data (ANC) is being blanked.

- Usually it is not possible to 'selectively erase' a particular group or groups; the only mechanism that exists for removing embedded audio data is the *ANC blanking* which will delete all ancillary data including all audio groups. This is controlled on the following menu:

```
ENG'ING     ANC Data   ANC Blnk
                       ANC Pass
```

- However on the V6411 (from version 1.2) it is possible to 'Mark for Deletion' the selected Mux Group. This makes it possible to embed on the selected group even if that group is already present and the Anc Blank is set to Pass.   Use this menu:

```
ENG'ING     MuxGpDel   Gp Pass
                        Gp Del
```

- It is not possible to overwrite an occupied group with new embedded data unless the ancillary data has been blanked. If you do do this there will be a *conflict* which will corrupt the existing group. You can find out which groups are occupied on the input before the ancillary blanking on the **STATUS** menu where a number indicates that the groups is occupied and a dash indicates otherwise:

```
STATUS      I/P Grps  1 – 3 -     Indicates only Groups 1 and 3 are occupied
```

- To see whether there is a conflict by trying to overwrite onto an existing group again use the **STATUS** menu:

```
STATUS      Mux Grp    OK          No Problem
                       Over        Indicates there is a group clash
```

A conflict does not stop you actually selecting a group that should be used, but the setting needs to be resolved inone of four ways:

1.   Embed on a different Group
2.   Blank all the ancillary data
3.   Set the MuxGpDel to Gp Del
4.   Remove the offending group from the originating signal

4.5.11 Audio Delay Processing

The Delay Processing is only available if the Audio Processing option has been enabled.

There are two parts of the audio delay in the V6411 – an adjustable, but constant, delay component (known as the Fixed Delay or Static Delay) and a tracking delay which is equal to the amount of delay put into the video path by the Frame Synchroniser section. The delay is always applied equally to all four audio signals, but may be bypassed on each individual channel.

As the tracking delay changes there is no perceptible disturbance to the audio, even if it rolls over from the maximum, 40 or 33 ms, to zero. However any change to the fixed delay may cause result in a short click or pop.

The fixed delay can have a negative value up to 40ms. Of course the total delay cannot be less than zero, so if the sum of the fixed delay and the tracking delay is less then zero then the total delay will be limited to zero. Section 4.5.12 discusses negative delay in more detail.

The Fixed Delay is set by:

`DELAY`	`Fixed`	`xxxms`	xxx is in the range is –40ms to 1250ms

and may be bypassed for individual channels by:

`DELAY`	`Delay A1`	`A₁ Del On`	channel A1 Fixed Delay as set by user
		`A₁ Del Off`	channel A1 has Fixed Delay = 0
	`Delay A2`	`A₂ Del On`	channel A2 Fixed Delay as set by user
		`A₂ Del Off`	channel A2 has Fixed Delay = 0
	`Delay B1`	`B₁ Del On`	channel B1 Fixed Delay as set by user
		`B₁ Del Off`	channel B1 has Fixed Delay = 0
	`Delay B2`	`B₂ Del On`	channel B2 Fixed Delay as set by user
		`B₂ Del Off`	channel B2 has Fixed Delay = 0

The Tracking delay is not adjustable but it can be enabled/disabled and the value can be read.

`DELAY`	`Tracking`	`Trk On`
		`Trk Off`

The Tracking Delay is only enabled if the tracking pulse is present. It will not be present, for example, if the unit is in Freeze mode. The status can be read:

`DELAY`	`Pulse`	`Present`
		`Absent`

The amount of audio delay being put into the system can be read in two ways:

`DELAY`	`Trk Dely`	`xxxms`

or

`DELAY`	`Totl Del`	`yyyms`

4.5.12 Negative Audio Delay

Adding negative audio delay may seem to be impossible. However since the total audio delay to be added is the sum of the Fixed Delay and the Tracking delay it is only the total delay that must be positive. The tracking delay is not controllable by the user (other than turning it on or off) but is set by the frame synchroniser timing to be between 0 and 40ms (for 625/50, or 0 and 33ms for 525/60). It is quite reasonable therefore to subtract a fixed value from the tracking delay. Of course you cannot actually subtract more from the tracking delay than is actually there.

Thus the fixed delay can be varied from –40ms to 1250ms. This diagram shows the effective total delay for several arrangements. For explanation purposes the core processing delay is considered to be zero.

Fixed	Track		TOTAL
320	30		350
0	30		30
-20	30		10
-40	30		0
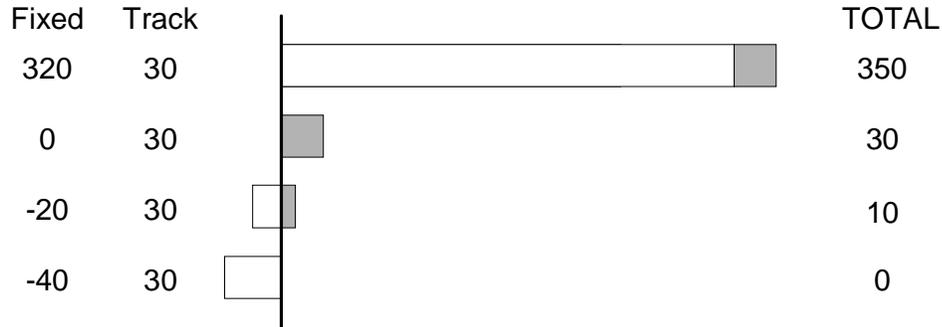
4.5.13 MUX Audio Selection

If a sub-module with digital outputs is fitted then the audio fed to the multiplexer can come from one of two sources – the internally processed audio or the auxiliary AES input. This is shown in the block diagram in section 2.3.4. If there is no sub-module or the sub-module has only analogue outputs then only the internally generated audio is available. The selection is made by:

AUDIO	**Mux Src**	**Int**	The internal audio
		Ext	The Auxiliary input

If a sub-module with Digital Outputs is fitted you should configure the system so that the auxiliary port is as required:

CONFIG	**Sub-Mod**	**xx+xx+DO**	As an output (default)
		xx+xx+DI	As an auxiliary input

When set as an output the AES C and AES D ports shown in the connections table in Section 2.3.4 are duplicate outputs of the main AES A and AES B outputs, but when set as inputs they become the auxiliary inputs to the multiplexer.

4.5.14 Re-entrant Audio

Re-entrant audio is available when the Auxiliary I/O has been set up as an input in the `CONFIG` menu. It means that external audio can be used as the source into the multiplexer. The requirement that the audio must be frequency synchronous with the video at the actual multiplexer still stands but some of the sub-modules have been designed so that this restriction is removed from the user. This is done by implementing an extra SRC on the sub-module itself.

This table shows the restrictions that apply for the various sub-modules:

SUB-MODULE	RESTRICTIONS
D-D 130-2930 Issue B and later	None. The AES C and D inputs can be independently from any source at any phase.
D-D 130-2930 Issue A	1. Both AES C and D channels must be present 2. Both must be frequency synchronous with the Video Ref. 3. The two AES channels must be synchronous to one another to within ±40ns. There is no restriction on the absolute timing.
A-A 130-2920	As with D-D 130-2930 Issue A
A-D 130-2940	As with D-D 130-2930 Issue A
D-A 130-2950	As with D-D 130-2930 Issue A
H-H 130-3090	As with D-D 130-2930 Issue A

4.5.15 AES Output Reference

The normal reference used by the entire audio subsystem of the V6411 is the video reference used by the Frame Synchroniser. As described elsewhere in this manual, the video reference defaults to the incoming SDI in the event of the video reference being absent. And if SDI fails or is absent, the reference free runs. From the point of view of the audio subsystem this is referred to as the *internal video reference*.

For Digital Output modules there is an option to use an external AES reference in the range 32...48kHz, as shown in the figure below.
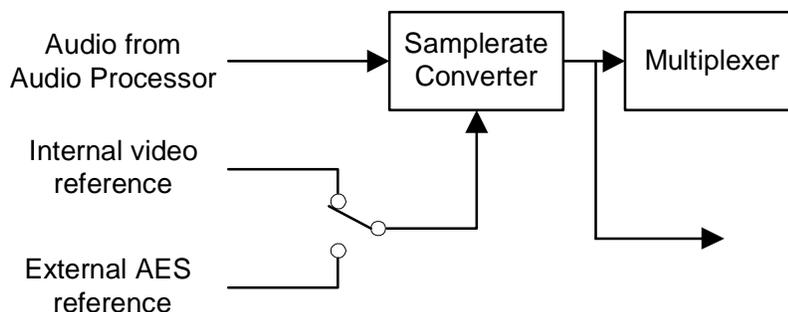
The benefit of this is that the AES signals fed to the multiplexer (internal feed only) and the Digital Output can be locked (frame, frequency and Channel Status Blocks) to the external reference. But since the multiplexer can only work with synchronous audio it is once again **essential** that the AES reference is itself locked to the video reference if the multiplexer is to be used. This restriction does not apply if only the Digital Output is to be used.

If the external AES reference is selected but there is no AES signal present then the outputs will use the video reference. This means that the unit can be fully set up in an installation before all signals are available. (The very early software versions did not permit this, since the menu item itself was not available if there was no AES reference present.)

The reference selection is made a follows:

```
        ENG'ING    AES Ref    Int Vid    Internal (Default)
                              Ext AES    External
```

4.6 SYSTEM

4.6.1 GPIs

The V6411 has three external GPIs so that external hardware can simply select certain parameters. The GPI inputs all have a 4k7 pull-up resistor to +5V, and expect external hardware should take the pin to Ground to activate the GPI.

The pin numbers on the high density D-type and Molex connectors are in this table:

Signal	HD Type	Molex
GPI 1	Pin 20	Pin 2
GPI 2	Pin 25	Pin 3
GPI 3	Pin 30	Pin 4

Various functions can be selected for each of the GPIs and there is no difference between them, other than that there is a priority ranging from GPI 1 (highest) to GPI 3 (lowest). Thus if GPI 1 is calling for Audio to be Tone and GPI 2 is calling for it to be Mute, then GPI 2 wins. The options for the GPIs are:

`CONFIG`	`GPIn`	`OFF`	GPI disabled
		`FZFD`	Freeze Field
		`FZFM`	Freeze Frame
		`BARS`	Select Colour Bars

4.6.2 GPO

The V6411 has a DELAY output (as described in section **Error! Reference source not found.**) which, from version 1.3 onwards, can be used as a General Purpose Output (GPO).

There is a choice of functions for this GPO which are set as follows:

`CONFIG`	`GPO`	`DELAY`	Standard DELAY Output - default
		`PWR GOOD`	Low for no power, or FPGA not programmed.
		`IP FAIL`	Indicates the selected input is not present
		`SDI 2`	SDI 2 is selected, either locally or remotely (GPI)
		`RF FAIL`	Reference is not present

4.6.3 VCO Centre Frequency

Normally, the output of the V6411 is locked to the video reference, if present and of the same standard as the video, or to the input video itself. If there is no signal or reference connected then the output will free run at the nominal centre frequency of the on board crystal. This centre frequency can be adjusted under the `CALIB` : `CntrFreq` menu, but this should not normally be necessary in the field.

It is possible to force the unit into its free-run mode using the `ENG'ING` : `Free-run` menu. This is an unusual requirement and so is a setting that appears on the top level banner when set.

4.6.4 Version Numbers

There are four separate items of software/firmware in the V6411 and they all have separate version numbers. These can be read on the following read only menus:

`STATUS`	`Softver`	`0.00.00`	The operating code
`STATUS`	`DSPver`	`0.00.00`	The Audio DSP code
`STATUS`	`Audiover`	`0.00.00`	The Audio FPGA data
`STATUS`	`Videover`	`0.00.00`	The Video FPGA data

4.6.5 Test Patterns

The use of the test patterns was discussed in section 4.3.15.

Normally the test patterns only occupy the active video lines, but there are times when it may be useful to have them in the Vertical Blanking Interval as well. For example this could be used to test the blanking performance of equipment downstream. The test patterns can be set to be Full Field or active picture only on **ENG'ING** : **TPs**.

ENG'ING	**TPs**	**norm**	Active picture height
		FF	Full Field

4.6.6 Cross Standards

There are different requirements from users as to how the unit should operate when the SDI input and video reference are of opposite standards. Some operators would like the unit to ignore the reference in this case and switch into minimum delay mode locked to the SDI input. This is useful if the input may be of either standard, but the output will be used either directly or routed through a Standards Converter which, of course, also usually acts as a synchroniser in its own right. However many other users expect the output to always be locked to the reference, if present, and use it to always produce a clean output. 'Clean' in this instance means that the output fully meets the CCIR Rec. 601 specification. This would not be the case if the unit were to follow the input under cross-standard conditions.

The effect of this cross-standard operation was also discussed in section 4.3.7.

So the V6411 has a control for setting up the required conditions on the Engineering menu:

ENG'ING	**Xstd**	**IP**
		Ref

4.6.7 Illegal Codes

A function of the V6411 is to ensure that the SDI output always meets the CCIR Rec. 601 specification. In particular this means that the output is always legal in the sense of Line Length, Field Length and data values. In the main this works extremely well, but there are some circumstances where it fails:

1. If the output timing is being changed, there will be momentary errors.
2. If the input is noisy, such that erroneous data is received, then the ancillary data may get checksum errors. This obviously only applies if the Ancillary data is being passed. The video will be alright, since the EDH is regenerated on the output.
3. If the reference is unstable or changing standards then the output will not be stable.
4. If cross-standard operation is set to use the Input, then any momentary standard change on either the input or the reference will cause the locking loop to jump from one to the other which will cause errors.

4.6.8 525 V-BIT of TRS

There has been some inconsistency in the 525 D1 standard in regard of the number of line within the vertical blanking interval for which the V-bit is set in the TRS. Early versions of CCIR Rec. 656 (1986) called for it to be active only for 10 lines per field in 525/60 signals. However it became common practice for a longer V-bit so as to be active for all the non picture lines and much equipment has been produced like this. Recently the original specification has again come to the fore.

So the V6411 normally produces the proper CCIR Rec. 656 V-bit, but it is possible to produce the longer version using the **ENG'ING** : **525 VBit** menu:

ENG'ING	**525 VBit**	**Long**
		Short

This option is only available if the unit is operating in 525/60 mode.

4.6.9 Audio Tone

The internal audio tone generators, one for channel A and one for channel B, produce a digitally synthesised pure tone at 997Hz. This frequency is chosen so that it is sufficiently close to 1KHz so that it operates with all standard tone detectors and measurement equipment, but produces good excitation of all bits when the sampling rate is 48KHz, and is thus a better test of an audio channel.

The test tone amplitude is –18dBFS on digital outputs and the multiplexed output and 18dB below MOL on analogue outputs.

In particular, by avoiding an integer multiple of the sample frequency (48kHz) there will not be a precise frame repeat of the audio in 625/50 standard.

4.6.10 Display Sleep

Since, for the vast majority of its life, the V6411 will operate behind the front panel of a rack frame the display on the local front panel will not be visible so it will go to sleep after a certain time. This timeout delay can be changed on the **ENG'ING** : **Sleep** menu to be anything between 0 and 30 minutes; 0 minutes means that it will stay on indefinitely. The sleep timeout always counts from the last front panel button push. The default time is 5 minutes.

The panel can also be forced into its sleep mode by moving up a level from the Top Level menu which displays the module type, **V6411** etc.

To get the display to come on again simply press one of the buttons and the menus will start again at the Top Level.

4.6.11 Display Brightness

The brightness of the front panel display can be adjusted on the **ENG'ING** : **LEDLevel** menu.

<pre>
     ENG'ING   LEDLevel   z z z z
</pre>

4.6.12 Factory Initialisation

It is possible to reset the V6411 back to its initial configuration, as shipped from the factory. This may be useful if it is to re-deployed. This will set all parameters back to their normalised values, except for the Calibration menus.

The Factory Initialisation is done by pressing **CAL** and ▼ together while in LOCAL mode.

5. CALIBRATION

This section describes how to calibrate the unit as it is done in the factory. The V6411 and its modules do not contain any potentiometers, but like most equipment with analogue parts still needs to be calibrated. Normally this calibration is done in the factory and should not need to be repeated in the field but this section describes the procedure and is included for completeness.

High quality, calibrated test equipment should be used for this calibration. Note that it is not possible to return to the pre-calibration settings other than by making a note of the values and re-entering them.

5.1 SET-UP

There is a separate Main Level Menu for Calibration and this should be used throughout. The first sub-level menu is Cal Mode which can be used to turn calibration ON:

```
CALIB      Cal Mode   Cal Off
                      Cal On
```

The calibration mode must be turned ON before any parameter can be adjusted. The calibration mode will be turned OFF in one of four ways:

1. Manually on the **CALIB**   : **Cal Mode** menu.
3. By going up to the Top Level Menu
4. By re-powering the unit.
5. By letting the display timeout and go to sleep mode.

When the calibration mode is on then the unit will automatically set up the required conditions in the unit as you enter each sub-menu. For example if you go into the CntrFreq sub-menu the unit will automatically go into free run. Similarly if you go into a DAC calibration menu it will produce tone onto that channel.   For obvious reasons this should not be done on a unit that is being used On Air.

5.2 FREE-RUN FREQUENCY

The V6411 has a voltage controlled crystal oscillator which is usually locked to the external video reference or to the input video. However if there is no input or reference then it will free-run and this free running frequency should be set. The oscillator on the V6411 is not accurate enough to be used as a frequency reference but nevertheless should be set close to the ideal so that any succeeding SDI equipment will be able to lock to its output, and so that when in free run it will only drift slowly away from its starting reference.

To calibrate the frequency set the unit into Free Run by turning Cal Mode ON and selecting the CntrFreq sub-menu.

```
CALIB      Cal Mode   Cal On
```

Now monitor the clock frequency on TP 50 (Issue B and C PCB), or compare the output picture movement on a monitor with an accurate external reference and adjust the frequency on.

```
CALIB      CntrFreq                Range is –127 to +128
```

The setting is stored on the unit in non-volatile memory, and should not need regular adjustment.

5.3 ANALOGUE AUDIO SUB-MODULES

The audio sub-modules with analogue interfaces, both inputs and outputs, need to be calibrated. This operation is to 'trim out' the small errors in the components. It is not the same as the MIL and MOL settings discussed in sections 4.5.8.

The ADC and DAC sections are adjusted separately, but if an A-A module is fitted then the DAC adjustment should be done first.

The calibration values relate directly to the sub-module and not the main board, and they are stored on the sub-module itself. This means that there is no need to re-calibrate a sub-module if it is moved from one board to another.

5.3.1 DAC

By turning Calibrate Mode ON and selecting one of the DAC sub-menus the unit will automatically generate tone with an MOL of +18dBFS.

To calibrate the frequency set the unit to generate Tone by turning Cal Mode ON and selecting one of the DAC sub-menus.

```
CALIB      Cal Mode   Cal On
```

Connect the outputs in turn to a high quality analogue audio analyser and adjust each of the four channels for 0dBm on:

```
CALIB      DAC A(L)
CALIB      DAC A(R)
CALIB      DAC B(L)
CALIB      DAC B(R)
```

5.3.2 ADC

There is no need to change the internal settings to calibrate the ADCs, so it is not necessary to turn Calibrate Mode ON.

Connect the inputs from a high quality audio generator to the inputs at +16dBu and the outputs to an analyser. Set all MILs and MOLs to +18dBFS, and adjust the level +16dBu.

```
CALIB      ADC A(L)
CALIB      ADC A(R)
CALIB      ADC B(L)
CALIB      ADC B(R)
```

6. <u>TROUBLE SHOOTING GUIDE (FAQS)</u>

This section is to be a help in solving some common difficulties with the V6411. If there is no control from the front panel first check that the switch is set to Local.

6.1 VIDEO

Symptom	Possible explanation
The output is Black, even after powering down and up.	1. There is no input and the Video Fail Mode is set to Black, or Freeze then Black 2. Black test Pattern has been selected 3. SDI 2 is enabled and selected.
The output is badly corrupted, with no video data	The Video Fail mode is set to 0V rather than Black, and there is no input.
The Error light on the Tek 601M is ON.	The unit is set to pass ancillary data, but the O/P EDH is off, so the incoming EDH is being passed straight through despite the processing within the V6411. Either blank the ancillary data or enable the O/P EDH.
The O/P EDH is not the same as the I/P EDH	First check that the Proc Amp is normalised. Then check whether the incoming signal has over-white or sub-black levels. These may be changed by the Soft Clipping feature
EDH not stable on a test signal	Check whether the Proc Amp is normalised. If there is any gain added then the Dynamic Rounding will cause a varying EDH value.
The Proc Amp does not work	Is it set to Bypass?
There is no Vertical Interval data	1. The VBI blanking is not set correctly in the **ENG'ING** menu. 2. The unit is generating a Test Pattern.
Cannot change video timing	Probably because there is no reference and the Ref Fail Mode is set to Min Delay.

6.2 AUDIO

Symptom	Possible explanation
The Mux output is badly corrupted	Check that you are not trying to multiplex audio onto an existing group.
Mux output is corrupted with an external AES Ref	The AES Ref **must** be synchronous with the video output for correct multiplexing.
Cannot append onto audio group 1.	1. Make sure the Mux Group is not 1 2. Make sure the incoming signal meets the standards (i.e. not a TSG 422).
Ancillary data on the input is not on the output	1. Is the Ancillary data set to be blanked? 2. Is the unit in Freeze, either manually, via GPI or through the input being absent?
Why is there no Mux Src option?	For this option there must be a sub-module fitted with a Digital Output.
There is no audio from one of the channels, A1, A2, B1, B2.	Check whether the unit is in Split mode and the audio is selected in the mixer from a source that is silent.
There is audio from the modules but no muxed audio on theSDI	1. Make sure that you have selected a Mux Group. 2. Make sure that Mux Src (in **AUDIO**) is set to INTernal.
Tone on O/P	1. If tone is near 1kHz (998Hz) it is probably being generated internally; check the Test Tone settings in the **ENG'ING** menu. 2. If tone is exactly 1kHz it will not be from a Vistek test tone generator.
Output level 3dB or 6dB lower than expected	If Audio Mixer is set to A1+A2 or B1+B2 and AutoMono is On, then mix components will have scaling applied before summation.

6.3 OTHERS

Symptom	Possible explanation
Display never goes to sleep	Check whether the Sleep delay has been set to 0 Mins which means stay awake.
A GPI does not work	Check for GPI priority. GPI 1 overrules GPI 2 which overrules GPI 3. Each one can be checked on **STATUS** : **GPI STA**.
Front panel can change but there is no control	The unit is probably in Remote mode. The panel is still life for monitoring.
Lots of errors on the Alarm LED on a Tektronix WFM 601.	1. Changes are being made to the output timing, perhaps over the remote control system. 2. The input SDI is changing standards and the unit is set to follow the input standard when receiving cross-standard signals 3. A noisy SDI input is causing errors in the Ancillary data, which appear on the WFM 601 as ancillary checksum errors.

7. FRONT PANEL MENUS

The next three sections show the menus available on a V6411/AP/VP with no audio modules, a DD audio module and an AA module.   These have been selected since between them they show all the options.

If the VP option is not fitted then the **PROC AMP** main menu list will not be available.

If the AP option is not fitted then the **AUDIO** and **DELAY** main menu lists will not be available.

Some menu items may only appear with certain configurations. For example the Mux Src under Audio is only present if the sub-module has a digital output and it is configured for Input on its second port, rather than another output.

7.1 V6411 – NO AUDIO MODULES

```
                              ┌─────────┐
                              │ sleep   │
                              │   │     │
                              │ 6411V+A │
                              │   │     │
                              └─────────┘
```

FRM SYNC	PROC AMP	AUDIO	DELAY	STATUS	ENG'ING	CALIB	CONFIG
│	│	│	│	│	│	│	│
Video	V Gain	Aud I/P	Fixed	Options	Aud Ctrl	Cal Mode	Sub-Mod
Hor Tim	C Gain	Audio A1	Tracking	SDI I/P	Anc Data	CntrFreq	GPI 1[4]
Ver Tim	Blk Lvl	Audio A2	Pulse	REF I/P	MuxGpDel	norm	GPI 2[4]
Freeze	Hue	Audio B1	Trk Dely	AES Ref	Aud Bits		GPI 3[4]
VFL Mode	Bypass	Audio B2	Totl Del	SDI I/P2	Aud Dct		GPO
RFL Mode	Dyn Rnd[4]	Mux Grp	Delay A1[4]	I/P Grps	AutoMono		Banner[4]
XstdMode[4]	Hrd Clip[4]	Gain A1	Delay A2[4]	DMX Aud	AES Ref		Password
Vid Del	norm	Gain A2	Delay B1[4]	Mux Grp	FailMode		Options
Delay		Phase A1	Delay B2[4]	GPI STA	525 Vbit[1]		TestMode
norm		Phase A2	norm	Soft Ver	O/P EDH[4]		
		Gain B1		DSP Ver	Free-run[4]		
		Gain B2		AudioVer	TPs[4]		
		Phase B1		VideoVer	TTone A[4]		
		Phase B2			TTone B[4]		
		norm			Sleep[4]		
					LEDLevel[4]		
					VBI		
					VBI 7[2]		
					VBI 8[2]		
					VBI 9[2]		
					VBI 10[3]		
					VBI 11[3]		
					VBI 12[3]		
					VBI 13[3]		
					VBI 14[3]		
					VBI 15[3]		
					VBI 16[3]		
					VBI 17[3]		
					VBI 18[3]		
					VBI 19[3]		
					VBI 20[3]		
					VBI 21[2]		
					VBI 22[2]		
					525F1L21[1]		
					525F1L22[1]		
					525F2L21[1]		
					525F2L22[1]		
					norm		

```
        ↑              ↑              ↑
     VP Only        AP Only        AP Only
```

[1] Available with 525/60 video only.
[2] Available with 625/50 video and VBI in Select mode.

[3] Available when VBI in Select mode only.
[4] Also active when in Remote Control.

7.2 V6411 – DD AUDIO MODULE

```
                              ┌─────────┐
                              │ sleep   │
                              │   │     │
                              │ 6411V+A │
                              └────┬────┘
                                   │
```

FRM SYNC	PROC AMP	AUDIO	DELAY	STATUS	ENG'ING	CALIB	CONFIG
Video	V Gain	Aud I/P	Fixed	Options	Aud Ctrl	Cal Mode	Sub-Mod
Hor Tim	C Gain	Audio A1	Tracking	Sub-Mod	Anc Data	CntrFreq	GPI 1[4]
Ver Tim	Blk Lvl	Audio A2	Pulse	Mod I/Ps	MuxGpDel	norm	GPI 2[4]
Freeze	Hue	Audio B1	Trk Dely	Mod O/Ps	Aud Bits		GPI 3[4]
VFL Mode	Bypass	Audio B2	Totl Del	SDI I/P	Aud Dct		GPO[4]
RFL Mode	Dyn Rnd[4]	Mux Grp	Delay A1	REF I/P	AutoMono		Banner[4]
XstdMode[4]	Hrd Clip[4]	Gain A1	Delay A2	AES A	AES Ref		Password
Vid Del	norm	Gain A2	Delay B1	AES B	FailMode[1]		Options
Delay		Phase A1	Delay B2	AES Ref	525 Vbit[1]		TestMode
norm		Phase A2	norm	SDI I/P2	O/P EDH[4]		
		Gain B1		I/P Grps	Free-run[4]		
		Gain B2		DMX Aud	TPs[4]		
		Phase B1		Mux Grp	TTone A[4]		
		Phase B2		GPI STA	TTone B[4]		
		norm		Soft Ver	Sleep[4]		
				DSP Ver	LEDLevel[4]		
				AudioVer	VBI		
				VideoVer	VBI 7[2]		

```
           ↑          ↑          ↑
        VP Only    AP Only    AP Only
```

VBI 8[2]
VBI 9[2]
VBI 10[3]
VBI 11[3]
VBI 12[3]
VBI 13[3]
VBI 14[3]
VBI 15[3]
VBI 16[3]
VBI 17[3]
VBI 18[3]
VBI 19[3]
VBI 20[3]
VBI 21[2]
VBI 22[2]
525F1L21[1]
525F1L22[1]
525F2L21[1]
525F2L22[1]
norm

[1] Available with 525/60 video only.
[2] Available with 625/50 video and VBI in Select mode.
[3] Available when VBI in Select mode only.
[4] Also active when in Remote Control.

7.3 V6411 – AA, AD, DA AUDIO MODULE

```
                              sleep
                                |
                              6411V+A
                                |
```

FRM SYNC	PROC AMP	AUDIO	DELAY	STATUS	ENG'ING	CALIB	CONFIG
Video	V Gain	Aud I/P	Fixed	Options	Aud Ctrl	Cal Mode	Sub-Mod
Hor Tim	C Gain	Audio A1	Tracking	Sub-Mod	Anc Data	DAC A(L)[4]	GPI 1[4]
Ver Tim	Blk Lvl	Audio A2	Pulse	Mod I/Ps	MuxGpDel	DAC A(R)[4]	GPI 2[4]
Freeze	Hue	Audio B1	Trk Dely	Mod O/Ps	Aud Bits	DAC B(L)[4]	GPI 3[4]
VFL Mode	Bypass	Audio B2	Totl Del	SDI I/P	Aud Dct	DAC B(R)[4]	GPO
RFL Mode	Dyn Rnd[6]	Mux Grp	Delay A1	REF I/P	AutoMono	ADC A(L)[4]	Banner[4]
XstdMode[6]	Hrd Clip[6]	Gain A1	Delay A2	AES A	AES Ref	ADC A(R)[4]	Password
Vid Del	norm	Gain A2	Delay B1	AES B	FailMode	ADC B(L)[4]	Options
Delay		Phase A1	Delay B2	AES Ref	525 Vbit[1]	ADC B(R)[4]	TestMode
norm		Phase A2	norm	SDI I/P2	O/P EDH[6]	CntrFreq	
		Gain B1		I/P Grps	Free-run[6]	norm	
		Gain B2		DMX Aud	TPs[6]		
		Phase B1		Mux Grp	TTone A[6]		
		Phase B2		GPI STA	TTone B[6]		
		MAL A&B[4,6]		Soft Ver	Sleep[6]		
		norm		DSP Ver	LEDLevel[6]		
				AudioVer	VBI		
				VideoVer	VBI 7[2]		
					VBI 8[2]		
					VBI 9[2]		
					VBI 10[3]		
					VBI 11[3]		
					VBI 12[3]		
					VBI 13[3]		
					VBI 14[3]		
					VBI 15[3]		
					VBI 16[3]		
					VBI 17[3]		
					VBI 18[3]		
					VBI 19[3]		
					VBI 20[3]		
					VBI 21[2]		
					VBI 22[2]		
					525F1L21[1]		
					525F1L22[1]		
					525F2L21[1]		
					525F2L22[1]		
					norm		

```
            ↑            ↑            ↑
          VP Only     AP Only      AP Only
```

[1] Available with 525/60 video only.
[2] Available with 625/50 video and VBI in Select mode.
[3] Available when VBI in Select mode only.
[4] Available with Analogue Inputs or Outputs and the AP option.
[6] Also active when in Remote Control.

8. <u>CONTROLS</u>

These tables show a complete list of all the parameters that can be controlled locally for the various configurations. Unless otherwise shown they can also be controlled over the DART remote control system. Not all menus are available at any one time, since they depend on which module type may be fitted, and sometimes on the operating conditions.

The tables also show the full range of the controls and their ranges and normalised value, if appropriate. The normalised value or setting is shown by the '**n**'.

8.1 FRAME SYNCHRONISER - `FRM SYNC`

FRM SYNC	Video	IP SDI1	n	
		IP SDI2		If enabled
		BLK		
		BARS		
		100%BARS		
		TIMING		
		RAMPS		
		STRESS		
	Hor Tim	+0.00us	n	
		ß		
		+63.96ms		for 625/50
		+63.52ms		for 525/50
	Ver Tim	-128		
		ß		
		+0	n	
		ß		
		+127		
	Freeze	Run	n	
		Frz Fld1		
		Frz Fld2		
		Frz Frm		
	VFL Mode	Black	n	
		1 sec		
		ß		
		14 sec		
		Freeze		
	RFL Mode	Min Del	n	
		Var Del		
	XStdMode	Xstd Ref	n	
		Xstd I/P		
	Vid Del	Vdel Var	n	
		Vdel Min		
	Delay	DEL <1FD		Status display only
		DEL >1FD		

8.2 PROCESSING AMPLIFIER – PROC AMP

This menu is only available if the Video Processing option is fitted.

PROC AMP	V Gain	-6.02dB		
		ß		
		0.00dB	n	
		ß		
		+6.01dB		
	C Gain	-6.02dB		
		ß		
		0.00dB	n	
		ß		
		+6.01dB		
	Blk Lvl	-128		
		ß		
		+0	n	Scale is D1 levels.
		ß		
		+127		
	Hue	-45.00°		
		ß		
		+0.00°	n	
		ß		
		+45.00°		
	Bypass	Byp Off	n	
		Byp On		
	Dyn Rnd	DR On	n	
		DR Off		
	Hrd Clip	HClp Off	n	
		HClp On		

8.3 AUDIO – AUDIO

This menu is only available if the Audio Processing option is fitted.

AUDIO				
AUDIO	AudI/P A	AES		Only if module with Digital inputs is fitted
		Analog		Only if module with Analogue inputs is fitted
		DMX Gp 1		
		DMX Gp 2		Split Mode Only
		DMX Gp 3		
		DMX Gp 4		
	AudI/P B	AES		Only if module with Digital inputs is fitted
		Analog		Only if module with Analogue inputs is fitted
		DMX Gp 1		
		DMX Gp 2		Split Mode Only
		DMX Gp 3		
		DMX Gp 4		
	Aud I/P	AES		Only if module with Digital inputs is fitted
		Analog		Only if module with Analogue inputs is fitted
		DMX Gp 1		
		DMX Gp 2		Ganged Mode Only
		DMX Gp 3		
		DMX Gp 4		
	Audio A1	$- - - A_1$	n	
		$- - A_2 -$		
		$- B_1 - -$		
		$B_2 - - -$		
		$- - A_2 A_1$		
		$- B_1 - A_1$		
		$B_2 - - A_1$		
		$- B_1 A_2 A_1$		
		$B_2 - A_2 A_1$		
		$B_2 B_1 A_2 A_1$		
		$B_2 B_1 - A_1$		
		$- B_1 A_2 -$		
		$B_2 - A_2 -$		
		$B_2 B_1 A_2 -$		
		$B_2 B_1 - -$		
		$- - - -$		
	Audio A2	$- - - A_1$		
		$- - A_2 -$	n	
		$- B_1 - -$		
		$B_2 - - -$		
		$- - A_2 A_1$		
		$- B_1 - A_1$		
		$B_2 - - A_1$		
		$- B_1 A_2 A_1$		
		$B_2 - A_2 A_1$		
		$B_2 B_1 A_2 A_1$		
		$B_2 B_1 - A_1$		
		$- B_1 A_2 -$		
		$B_2 - A_2 -$		
		$B_2 B_1 A_2 -$		
		$B_2 B_1 - -$		
		$- - - -$		
	Audio B1	$- - - A_1$		
		$- - A_2 -$		
		$- B_1 - -$	n	
		$B_2 - - -$		
		$- - A_2 A_1$		
		$- B_1 - A_1$		
		$B_2 - - A_1$		

		$-\ B_1\ A_2\ A_1$	
		$B_2\ -\ A_2\ A_1$	
		$B_2\ B_1\ A_2\ A_1$	
		$B_2\ B_1\ -\ A_1$	
		$-\ B_1\ A_2\ -$	
		$B_2\ -\ A_2\ -$	
		$B_2\ B_1\ A_2\ -$	
		$B_2\ B_1\ -\ -$	
		$-\ -\ -\ -$	
Audio B2	$-\ -\ -\ A_1$		
	$-\ -\ A_2\ -$		
	$-\ B_1\ -\ -$		
	$B_2\ -\ -\ -$	n	
	$-\ -\ A_2\ A_1$		
	$-\ B_1\ -\ A_1$		
	$B_2\ -\ -\ A_1$		
	$-\ B_1\ A_2\ A_1$		
	$B_2\ -\ A_2\ A_1$		
	$B_2\ B_1\ A_2\ A_1$		
	$B_2\ B_1\ -\ A_1$		
	$-\ B_1\ A_2\ -$		
	$B_2\ -\ A_2\ -$		
	$B_2\ B_1\ A_2\ -$		
	$B_2\ B_1\ -\ -$		
	$-\ -\ -\ -$		
Mux Grp	None		
	Mux Gp 1		
	Mux Gp 2		
	Mux Gp 3		
	Mux Gp 4		
Mux Src	Int	n	
	Ext		
Gain A1	-16dB		
	+0dB	n	Adjustable in 0.25dB steps
	+15.75dB		
Gain A2	-16dB		
	+0dB	n	Adjustable in 0.25dB steps
	+15.75dB		
Phase A1	Normal	n	
	Invert		
Phase A2	Normal	n	
	Invert		
Gain B1	-16dB		
	+0dB	n	Adjustable in 0.25dB steps
	+15.75dB		
Gain B2	-16dB		
	+0dB	n	Adjustable in 0.25dB steps
	+15.75dB		
Phase B1	Normal	n	
	Invert		
Phase B2	Normal	n	
	Invert		
MAL A&B	+12dBu		Analogue audio inputs/outputs only
	+18dBu	n	Adjustable in 1dB steps
	+24dBu		

8.4 DELAY CONTROL – DELAY

This menu is only available if the Audio Processing option is fitted.

DELAY	Fixed	-40ms		
		0ms	n	Adjustable in 1ms steps
		1250ms		
	Tracking	Trk On	n	
		Trk Off		
	Pulse	Present		Status only
		Absent		
	Trk Dely	xxxms		Status only
	Totl Del	yyyms		Status only
	Delay A1	A$_1$ Del On	n	
		A$_1$ Del Off		
	Delay A2	A$_2$ Del On	n	
		A$_2$ Del Off		
	Delay B1	B$_1$ Del On	n	
		B$_1$ Del Off		
	Delay B2	B$_2$ Del On	n	
		B$_2$ Del Off		

8.5 OPERATING CONDITIONS – STATUS

STATUS	Options	V6411		Basic Unit
		V6411 AP		Basic Unit with Audio Processing
		V6411 VP		Basic Unit with Video Processing
		V6411V+A		Basic Unit with Video and Audio Processing
	Sub-Mod	DI/O+DO		For example: Digital Input & Output
	Mod I/Ps	AB∏--CD		For example: CD as re-entrant inputs
	Mod O/Ps	--∏ABAB		For example: duplicate A and B outputs
	SDI I/P	IP 625 3		
		IP 525 3		
		IP FAIL		
	REF I/P	RF 625 3		
		RF 525 3		
		NO REF		
	AES A	AES A OK		
		No AES A		
	AES B	AES B OK		
		No AES B		
	AES Ref	RF AES 3		
		RF AES x		
	SDI I/P2	SDI 2 NA		
		SDI 2 OK		
	I/P Grps	None		No groups occupied.
		1 - - -		SDI input has Group 1 only is occupied
		- 2 - -		SDI input has Group 2 only is occupied
		- - 3 -		SDI input has Group 3 only is occupied
		- - - 4		SDI input has Group 4 only is occupied
		- 2 - 4		Group 2 and 4, for example, occupied
	DMX Aud	No DMX		
		DMX 20bt		
		DMX 24bt		
	Mux Grp	MUX OK		
		MUX over		
	GPI STA	1⁻ 2⁻ 3⁻		⁻ Þ Inactive. - Þ Active.
	Soft Ver	01.00.05		The operating code
	DSP Ver	02.00.00		The Audio DSP code
	AudioVer	01.02		The Audio FPGA data
	VideoVer	01.03		The Video FPGA data

8.6 ENGINEERING – ENG'ING

ENG'ING	Aud Ctrl	Ganged	n	
		Split		
	Anc Data	Anc Blnk	n	
		Anc Pass		
	MuxGpDel	Grp Pass	n	
		Grp Del		Mark selected Mux Group for Deletion
	Aud Bits	OP 20bit	n	
		OP 24bit		
	Aud Dct	Normal	n	
		Direct		
	AutoMono	Off	n	
		On(-3dB)		
		On(-6dB)		
	AES Ref	IntVideo	n	
		Ext AES		
	FailMode	FM Blk	n	Fail Mode to Black
		FM 0V		Fail Mode to 0V
	525 Vbit	Long	n	
		Short		
	O/P EDH	EDH On	n	
		EDH Off		
	Free-run	Free Off	n	
		Free On		
	TPs	TPs Norm	n	Test Patterns in active picture only
		TPs FF		Full Field Test Patterns to include the VBI
	TTone A	TTA Off	n	Test Tone A only available in local mode
		TTA On		
	TTone B	TTB Off	n	Test Tone B only available in local mode
		TTB On		
	Sleep	5 min	n	Variable 0 to 30 minutes.
	LEDLevel	▓ ▓ ▓		
	VBI	VBI All		
		VBI Sel		
		VBI None		
	VBI 7	L7 Pass	n	Individual lines only available if VBI is set to **VBI Sel**.
		L7 Blank		
	VBI 8			
	VBI 9			
	VBI 10			**VBI 8** to **VBI 22** are as **VBI 7**
	VBI 11			
	VBI 12			**VBI 7, 8, 9, 21, 22** are only available in 625/50
	VBI 13			
	VBI 14			
	VBI 15			
	VBI 16			
	VBI 17			
	VBI 18			
	VBI 19			
	VBI 20			
	VBI 21			
	VBI 22			
	525F1L21	F1L21On	n	
		F1L21Off		525 Mode Only.
	525F1L22	F1L22On	n	
		F1L22Off		Individual Control of Closed Caption Lines.
	525F2L21	F2L21On	n	
		F2L21Off		
	525F2L22	F2L22On	n	

		F2L22Off	

8.7 CALIBRATION – CALIB

CALIB	Cal Mode	Cal Off	n	
		Cal On		Must be set ON to enable correct conditions during calibration
	DAC A(L)	-128		
		+0	n	
		+127		
	DAC A(R)	-128		
		+0	n	
		+127		
	DAC B(L)	-128		
		+0	n	
		+127		
	DAC B(R)	-128		
		+0	n	
		+127		
	ADC A(L)	-128		
		+0	n	
		+127		
	ADC A(R)	-128		
		+0	n	
		+127		
	ADC B(L)	-128		
		+0	n	
		+127		
	ADC B(R)	-128		
		+0	n	
		+127		
	CntrFreq	Frq=-128		
		Frq=+20		Free-run Frequency
		Frq=+127		

8.8 CONFIGURATION – CONFIG

CONFIG	Sub-Mod	DI/O+DO	n	For DD module
		DI/O+DI		
	Sub-Mod	AI+DO+DO	n	For AD module
		AI+DI/O		
	Sub-Mod	AI/O+DI		For AA module
	Sub-Mod	DI+AO+DI		For DA module
	GPI 1	OFF	n	
		FZFD		
		FZFM		
		BARS		
	GPI 2	OFF	n	
		FZFD		
		FZFM		
		BARS		
	GPI 3	OFF	n	
		FZFD		
		FZFM		
		BARS		
	GPO	DELAY	n	
		PWR GOOD		
		IP FAIL		
		SDI 2		
		RF FAIL		
	VB Mode	VB F1&F2	n	Configure Fields for Vertical Blanking.
		VB F1		
		VB F2		
	Banner	On	n	
		Off		
	Password	0		
	Options	V6411		
		V6411AP		
		V6411VP		
		V6411V+A		
	TestMode	Off	n	
		On		Password required

8.9 TEST MODE – TEST

This section is not required for users, but is shown here for completeness.

TEST	AUD ERRA	0000	n	
		1F01		
	DMX STA	00000000	n	Demux Status
	AUD ERRB	0000	n	
		1F01		
	DSP OPFL	0000	n	
	DSP OP2FLG	8421	n	
	SRC VERS	14141414		Sample Rate Converter version numbers
	DMX REV	GS9023A		Gennum Demux Chip revision
	MUX REV	GS9023A		Gennum Mux Chip revision
	Module			

9. <u>FIRMWARE VERSIONS</u>

This table gives a brief summary of the various versions of software that have been issued with the corrections and improvements for each. This has been included in this manual so that users with earlier versions can understand when some facilities, or menu options may not appear.

VERSION	FRS	DATE	REMARKS
1.3	1	22-03-06	GPOs on Delay Output I/P Fail to 0V option
1.2	1	21-09-05	Single Group Delete Mark.
1.1.0	1	02-08-05	AutoMono function added to `ENG'ING` menu
1.0.0	1	22-07-05	Initial version modified from V1641 FRS 3 V1.3.4