



# V6221

## SD Video ADC with Audio Embedding

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**User Guide**

**Issue: 1.0**

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# Vistek V6221 SD Video ADC with Embedded Audio

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# Vistek V6221 SD Video ADC with Embedded Audio

## 1 Description

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The module described in this manual forms part of the Vistek 1600 range of interface products. Although it processes Standard Definition (SD) video signals and analogue and AES audio, it is fully compatible with all other products in the range in terms of its form factor, power supply requirements and control interface. The V6221 is a 3U high card that can be fitted into a V1606 rack, a V6011 '1-Box or a V6012 '2-Box', from which it obtains its power and control. A passive rear module is required for all signal interconnections.

The V6221 SD Video ADC with Embedded audio has the following option available.

AP: **Audio Processing**

### 1.1 General

The **V6221 SD Video ADC with Embedded Audio** takes analogue video input signals and converts it to a Standard Definition (SD) SDI output with up to 2 groups (8 channels) of embedded audio sourced from either analogue or AES digital inputs.

The input video can be of any of the following standards:

PAL NTSC PAL M PAL N SECAM NTSC (Japan) YPbPr YC  
or GBR (with internal sync on G or external sync)

The reference input is not used on this unit, but can be a passive loop of the Ext Sync. The Ext Sync can be either a conventional Black & Burst signal or Sync pulses up to 4 volts. A 75Ω reference termination can be selected using a switch on the I/O Daughter Board.

The V6221 offers four (identical) SDI Outputs on BNC's.

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. The front panel operates in the same way as many of the other units in the range.

### 1.2 Supported Video Standards

The Serial Digital Interface is in accordance with ANSI/SMPTE 259M.

| Input Standard | Output Standard |
|----------------|-----------------|
| 525i59         | 525i59          |
| 625i50         | 625i50          |

# Vistek V6221 SD Video ADC with Embedded Audio



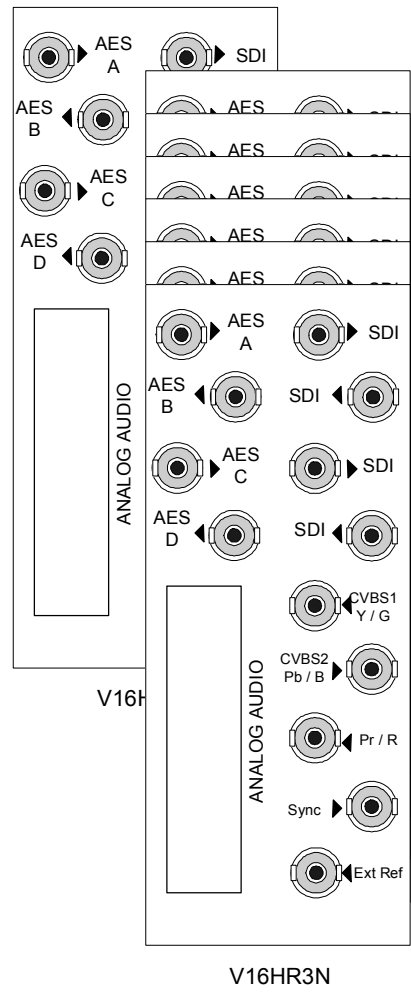
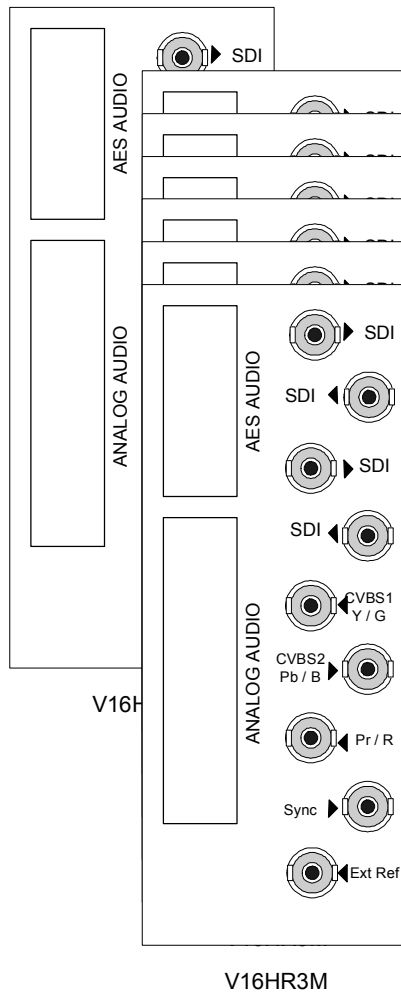
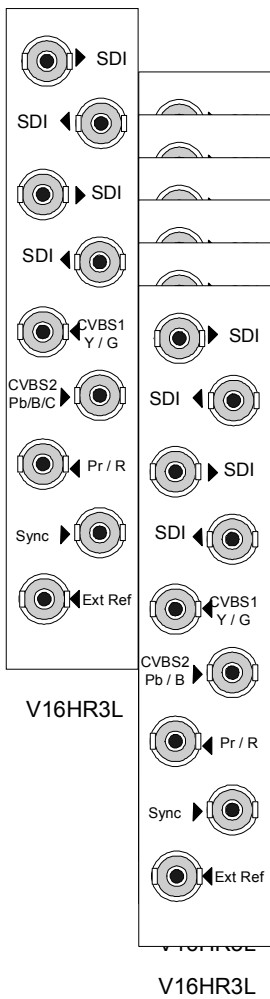
## 2 Installation

### 2.1 Rear Panels

No Audio

Balanced AES + Analogue Audio

Unbalanced AES + Analogue Audio





## Vistek V6221 SD Video ADC with Embedded Audio

The following table shows the function of the rear panel BNCs:

| Connector             | Type | Function   |
|-----------------------|------|--|
| ◀ SDI 1               | BNC  | SDI Main Output 1  |
| ◀ SDI 2               | BNC  | SDI Main Output 2  |
| ◀ SDI 3               | BNC  | SDI Main Output 3  |
| ◀ SDI 4               | BNC  | SDI Main Output 4  |
| ▶ CVBS 1 / Y / G      | BNC  | Analogue Video input                                     |
| ▶ CVBS 2 / Pb / C / B | BNC  | Analogue Video input                                     |
| ▶ Pr / R              | BNC  | Analogue Video input                                     |
| ▶ Sync                | BNC  | Ext Sync for GBR Mode                                    |
| ▶ REF.                | BNC  | Reference Input. Switch selectable termination on board. |

### 2.1.1 HDD26 Connector - Digital Audio

| Signal Group Label      | HDD26 Pin | Signal Function | Notes  |
|-------------------------|-----------|-----------------|--|
| Audio 1_2<br>AES A in ← | 9         | Input AES A Pos | These are balanced transformer coupled digital inputs to AES3.<br>Zin = 110Ω |
|                         | 18        | Input AES A Neg |  |
| Audio 2<br>AES B in ←   | 8         | Input AES B Pos |  |
|                         | 17        | Input AES B Neg |  |
| GND                     | 26        | GND             | Unbalanced AES inputs are not available on this rear panel                   |
| Audio 3_4<br>AES C in ← | 7         | Input AES C Pos |  |
|                         | 16        | Input AES C Neg |  |
| Audio 4<br>AES D in ←   | 6         | Input AES D Pos |  |
|                         | 15        | Input AES D Neg |  |
| GND                     | 25        | GND             |  |
|                         | 5         | Reserved        |  |
|                         | 14        | Reserved        |  |
|                         | 4         | Reserved        | Reserved   |
|                         | 13        | Reserved        |  |
| GND                     | 1         | GND             |  |
|                         | 3         | Reserved        |  |
|                         | 12        | Reserved        | Reserved   |
|                         | 2         | Reserved        |  |
|                         | 11        | Reserved        |  |
|                         | 20        | Reserved        |  |
|                         | 19        | Reserved        | Reserved   |
|                         | 24        | Reserved        |  |
|                         | 23        | Reserved        | Reserved   |
| GND                     | 10        | GND             |  |
|                         | 22        | Reserved        | Reserved   |
|                         | 21        | Reserved        |  |

Note: Pin 1 is at the bottom

# Vistek V6221 SD Video ADC with Embedded Audio



## 2.1.2 HDD44 Connector - Analogue Audio I/O

| Signal Group Label | HDD44 Pin | Signal Function     | Notes   |
|--------------------|-----------|---------------------|---|
| Audio 1<br>AL in ← | 14        | Input Analog AL Pos | <p>These are electronically balanced (transformerless) differential analog audio inputs with high Zin of 20kΩ.</p> <p>All inputs are a.c. coupled</p> <p>Maximum analog input level (MAL) is settable on the V6811 module in 1dB increments from +12dBu to +24dBu</p> <p>To apply a single-ended signal, connect the 'hot' from the source to the 'Pos' input, and the 'Neg' input to GND = source GND.</p> |
|                    | 44        | Input Analog AL Neg |   |
|                    | 15        | Input Analog AL Gnd |   |
| Audio 2<br>AR in ← | 13        | Input Analog AR Pos |   |
|                    | 43        | Input Analog AR Neg |   |
|                    | 28        | Input Analog AR Gnd |   |
| Audio 3<br>BL in ← | 12        | Input Analog BL Pos |   |
|                    | 42        | Input Analog BL Neg |   |
|                    | 26        | Input Analog BL Gnd |   |
| Audio 4<br>BR in ← | 11        | Input Analog BR Pos |   |
|                    | 41        | Input Analog BR Neg |   |
|                    | 40        | Input Analog BR Gnd |   |
| Audio 5<br>CL in ← | 9         | Input Analog CL Pos |   |
|                    | 39        | Input Analog CL Neg |   |
|                    | 10        | Input Analog CL Gnd |   |
| Audio 6<br>CR in ← | 8         | Input Analog CR Pos |   |
|                    | 38        | Input Analog CR Neg |   |
|                    | 24        | Input Analog CR Gnd |   |
| Audio 7<br>DL in ← | 7         | Input Analog DL Pos |   |
|                    | 37        | Input Analog DL Neg |   |
|                    | 21        | Input Analog DL Gnd |   |
| Audio 8<br>DR in ← | 6         | Input Analog DR Pos |   |
|                    | 36        | Input Analog DR Neg |   |
|                    | 5         | Input Analog DR Gnd |   |
|                    | 4         | Reserved            | Reserved  |
|                    | 34        | Reserved            |   |
|                    | 19        | Reserved            |   |
|                    | 3         | Reserved            |   |
|                    | 33        | Reserved            |   |
|                    | 19        | Reserved            |   |
|                    | 2         | Reserved            |   |
|                    | 32        | Reserved            |   |
|                    | 16        | Reserved            |   |
|                    | 1         | Reserved            |   |
|                    | 31        | Reserved            |   |
|                    | 16        | Reserved            |   |
|                    | 23        | Reserved            |   |
|                    | 22        | Reserved            |   |
|                    | 35        | Reserved            |   |
|                    | 18        | Reserved            |   |
|                    | 17        | Reserved            |   |
|                    | 35        | Reserved            |   |
|                    | 20        | Reserved            |   |
|                    | 25        | Reserved            |   |
|                    | 29        | Reserved            |   |
|                    | 30        | Reserved            |   |
|                    | 27        | Reserved            |   |
|                    | 29        | Reserved            |   |

Note: Pin 1 is at the bottom



# Vistek V6221 SD Video ADC with Embedded Audio

## 2.1.3 Breakout Cables and Panels

Pro-Bel can supply prefabricated Breakout Cables for use with the HDD44 and HDD26 connectors.

The following cables are available:

| Part No. | Description                          | Drawing Ref. | Notes                   |
|----------|--------------------------------------|--------------|-------------------------|
| V6905    | V6812/V6822 HDValid HDD26 to XLR     | 130-4681     | 4 x AES in, 4 x AES out |
| V6906/IN | V6812/V6822 HDValid HDD44 to XLR SKT | 130-4682     | 8 x Analog IN only      |

There is also a break out panel, V6907, which connects to the HDD connectors with ribbon cable and gives more conventional connectors on a 1U panel.

The following are available:

| Part No.    | Description                                   | Notes  |
|-------------|---|--|
| V6907/BAL   | HDD44 and HDD26 to Phoenix connectors         | 8 x Analogue In<br>8 x Analogue Out<br>4 x AES in<br>4 x AES out |
| V6907/UNBAL | HDD44 and HDD26 to Phoenix and BNC connectors | 8 x Analogue In<br>8 x Analogue Out<br>4 x AES in<br>4 x AES out |

## 2.2 Module and Environmental Specifications

| Parameter             | Environmental Specification  |
|-----------------------|--|
| Module Size           | Standard V1600 range form factor; fits in V1606 3U rack or V6011 '1-Box' or V6012 '2-Box'  |
| Rear Panels           | V16HR3L Single width rear (No Audio)<br>V16HR3M Double width rear (for Balanced AES audio)<br>V16HR3N Double width rear (for Unbalanced AES audio) |
| Operating Voltage     | +9..+18V   |
| Power Consumption     | @+15V / 1A (15W typical)   |
| Operating Temperature | 0 to +60°C   |
| Storage Temperature   | -40°C to +85°C   |
| Relative Humidity     | 95% non-condensing   |



# Vistek V6221 SD Video ADC with Embedded Audio



## 2.3 Signal Specifications

| Signal                | Type       | Comments  |  |
|-----------------------|------------|---|--|
| Video Inputs          | 75Ω<br>BNC | Input Format:<br>Input Impedance:<br>Return Loss:   | PAL / NTSC/ PAL M / PAL N / SECAM / NTSC (Japan) / YPbPr / YC / GBR + syncs<br>75 Ohm<br>< -35dB, 100Khz – 6.5 MHz   |
| Video Outputs         | 75Ω<br>BNC | Output Format:<br>Output Impedance:<br>Return Loss:<br>Jitter Performance:<br>Amplitude:<br>Drive Capability: | SMPTE259M<br>75 Ohm<br>< -15dB, 5MHz – 270MHz<br>< 0.2UI p-p (Timing @ 270Mbps)<br>< 0.2UI p-p (Alignment @ 270Mbps)<br>800mV p-p (terminated)<br>> 250m @ 270Mbps (Belden 8281) |
| Video Reference Input | 75Ω<br>BNC | 1V Composite video, but Black & Burst is recommended.   |  |

## 2.4 Timing Adjustment Ranges

### 2.4.1 Picture Position

The picture position may be adjusted within the active picture area of the digital signal in 148ns steps. The adjustment is available with any input format. The total range is

-2.37us to +2.22us.

### 2.4.2 YC Timing

The YC timing control is only available when the input format is YPbPr or YC. It adjusts the timing of the Y channel relative to the Chroma channels in 74ns steps. It has a range of

-0.59us to +0.52us.

## 2.5 Processing Delays

The processing delay through the module varies according to the input formats.

### Video Delays

|               |        |
|---------------|--------|
| Composite I/P | 177 us |
| YPrPb I/P     | 177 us |
| GBR I/P       | 49 us  |

### Audio Delays (with respect to output video)

|                       |             |
|-----------------------|-------------|
| Analogue I/P          | approx 2 ns |
| AES I/P (through SRC) | approx 1 ns |
| AES I/P (SRC Bypass)  | approx 0 ns |

\* SRC = Sample Rate Converter



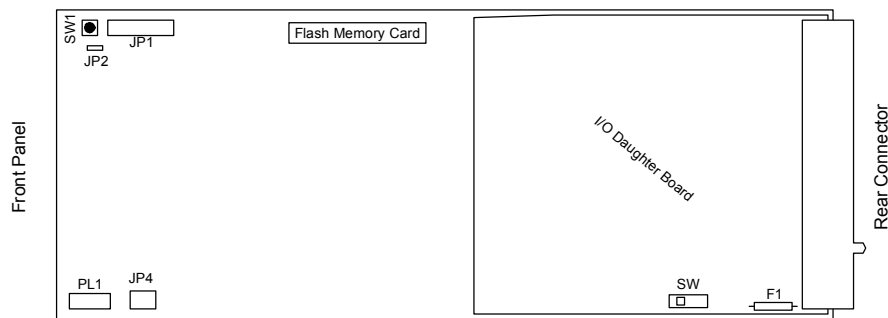
# Vistek V6221 SD Video ADC with Embedded Audio

## 2.6 Hardware

### 2.6.1 The PCB

The figure below shows the construction of the PCB, along with some components of interest. Note that the main I/O connector is in fact mounted on a daughter board, which is held down by screws.

The main connector is a 220-way 2mm press-fit connector. When new there may be a substantial insertion force when mating with a rear module; this is normal. However, it is important that the module is not plugged into one of Vistek's conventional units with significant force. If so then it is possible to break off one of the locating lugs.



### 2.6.2 Links and Switches

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

| ITEM | Title          | Comments   |
|------|----------------|--|
| SW1  | RESET          | Used to reset the internal microcontroller.                              |
| JP1  | Debug          | For development and test use only. (May not be fitted)                   |
| JP2  | H8 Program     | For development and test use only. (May not be fitted)                   |
| PL1  | JTAG Port      | Never used in operation. (May not be fitted)                             |
| JP4  | JTAG Enable    | Normal Operation. Fit in 1-2 position.                                   |
| SW   | Video REF Term | Slider left – Terminated with 75Ω<br>Slider right – Hi-Z (un-terminated) |

### 2.6.3 Fuse

There is only one fuse in series with the main DC supply input on this module.

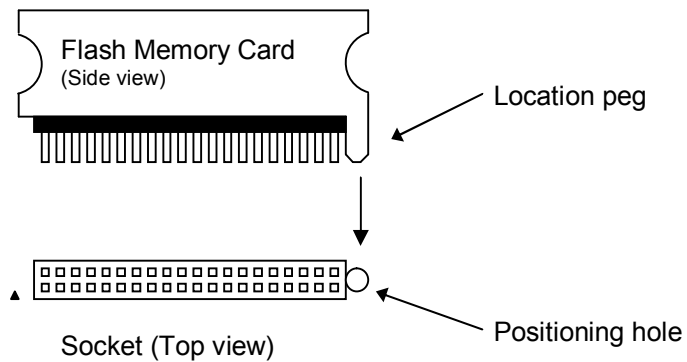
|    |                       |  |
|----|-----------------------|--|
| F1 | Fuse 2 Amp Wire ended | In series with the +15V input to the module on the I/O daughter board. |
|----|-----------------------|--|

# Vistek V6221 SD Video ADC with Embedded Audio



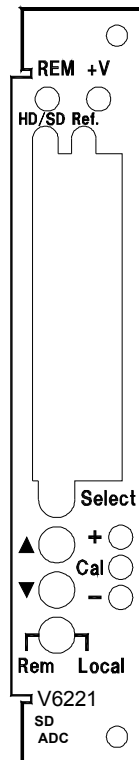
## 2.6.4 Flash Memory Card

The Flash Memory Card stores the firmware for the Microcontroller and the FPGA and is essential for the operation of the module. If this card is missing, the front panel display will come up with an error message (ERROR 10). The Flash Memory Card sits in a socket with a location peg to the right. In case of a firmware upgrade, one has to make sure that the replaced card sits firmly and straight in the socket with the location peg mating with the positioning hole on the baseboard.



The Flash Memory Card is re-programmable. Customers are kindly asked not to throw it away after having upgraded a module with a newer firmware version. A service technician will collect it on his/her next visit or it can be put in an envelope and sent back to the postal address shown on the cover of this manual.

## 2.7 Front Panel



The front panel is similar to other complex V1600 types. It provides the user with total control and monitoring of the unit without the need to consult manuals and read unlabelled indicators.

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

### 2.7.1 Direct Indications

The four LED's 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 <b>not</b> 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 +5.0V is present on the board. This is derived from the +15V distributed through the rack. The modules do have many power rails, but only the main +5.0V is indicated here. It will, of course, be off if the fuse, FS1, were to have been blown. |
| HD/SD | Not used on this unit   |
| REF   | Indicates that a valid video Input signal is present. (which is also used for the reference)  |

# Vistek V6221 SD Video ADC with Embedded Audio



## 2.7.2 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 into a '1-Box' (V6011) or 2-Box (V6012) it is horizontal and the 'proper' way up. (It is not possible to fit the V6221 SD Video ADC with Embedded audio into the V1602 1U rack!)

The three action buttons are labeled **Select**, ▲ and ▼. 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 ▲ and ▼ buttons will move through the list of options, or if in an actual variable (such as Video Gain) they will change the values.

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

Beside the ▲ and ▼ buttons are three LED's 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 in which direction it has been changed or that it is no longer on its CAL value.

## 2.7.3 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 program, which communicates with multiple racks using the Dartnet protocol. |



## 3 System Operation

---

### 3.1 Local Control

#### 3.1.1 Start Up

Local control and monitoring of the module is done through the front panel with its eight character LED display and three control buttons **Select**, **▲** and **▼**. There are three LED's which also contribute to the status indication; these are labeled **+**, **Cal** and **-**.

After power up and having successfully passed the power-on-self test, the display will start at the top level and show the unit type and any options that are included. The display will be one of these:

| Unit type | Password protected Option(s) |
|-----------|------------------------------|
| V6221     | AP                           |

To see what options are fitted, use the **▼** button to navigate.

#### 3.1.2 Option Abbreviations

Options are indicated by abbreviations. The following list illustrates their meanings:

| Option | Meaning         |
|--------|-----------------|
| AP     | Audio Processor |

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## 3.1.3 Menu Control

The **Select**, ▲ and ▼ buttons are used to maneuver around the menu system. The menu structure has five levels and the **Select** button is used to go up and down the structure. The ▲ and ▼ 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. <b>V6221</b>  |
| Main Menu | The Main menu items, such as <b>VIDEO</b> , <b>STATUS</b> , <b>ENG'ING</b> etc. These items are all in Upper Case.   |
| Sub Menu  | Menu items under each main heading, such as <b>IP Fmt</b> or <b>Standard</b> under the <b>VIDEO</b> 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 <b>+0.00dB</b> for a gain or <b>ON</b> or <b>OFF</b> 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. |

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 ▲ and ▼ 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 5.

## 3.1.4 Menu Examples

This section has examples of how to maneuver through the menu system. The first one starts with the unit in its 'sleep' mode where the display is blank, and then proceeds to change the Video Gain.

| Action | Display         | Comments                       |
|--------|-----------------|--------------------------------|
| Select | <b>V6221</b>    | Top Level                      |
| Select | <b>VIDEO</b>    | The Main Menu we want          |
| Select | <b>IP Fmt</b>   | The first Sub Menu in the list |
| ▼      | <b>Standard</b> |                                |
| ▼      | <b>Pedestal</b> |                                |
| ▼      | <b>V Gain</b>   | The Sub Menu we want           |
| Select | <b>-0.00dB</b>  | The default setting            |
| ▲      | <b>+0.02dB</b>  | Set it as we want it           |



# Vistek V6221 SD Video ADC with Embedded Audio

Now we shall select the video black level offset. 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 | <b>V Gain</b> | UP to the Sub Menu level                         |
| ▼           | <b>C Gain</b> |  |
| ▼           | <b>Offset</b> | The Sub Menu we want                             |
| Select      | <b>+0</b>     | The default setting                              |
| ▲ + Hold    | <b>+1</b>     | Unit automatically counts up till it comes to... |
|             | <b>+127</b>   | or do you want it to go 'Black' after 14 sec?    |
| ▼           | <b>+126</b>   | Set it as we want it                             |

### 3.1.5 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 : LEDLevel1** menu.

## 3.2 Core Product Features

### 3.2.1 Video Inputs

The video inputs must conform to the standards, which were listed in section 1.1. If only one composite input is required then it should be connected to CVBS 1. Unused inputs can be left open, it is however recommended to terminate unused inputs with a 75Ω Terminator to improve noise immunity. Composite signals of different frame-rates, can be connected to the CVBS Inputs at the same time, however only one of the two inputs can be selected at a time. Note that switching between different standards is neither instant nor glitch-free. This has to do with the necessity of the decoder and other hardware to lock to the newly detected standard. Only one YPbPr or GBR video can be connected at any time as they share connections with each other and the composite inputs. If GBR is being used the sync's can be taken from the G signal (int) or a separate sync video (ext) can be provided.

As the video input standard can be automatically detected, a manual change may be required to the pedestal menu, for NTSC (Japan) or component 525 inputs without pedestal, as it is assumed this will be present.

The input selection is done on the **VIDEO : IP Fmt** menu.

The GBR sync source is set on the **TIMING : GBR Sync** menu.

The pedestal selection is done on the **VIDEO : Pedestal** menu.



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## 3.2.2 SDI Main Outputs

The SDI outputs are available on four BNC's.

## 3.2.3 Video Reference

The video reference used on this unit is selected in the **ENGINEERING : Ref Sel** menu. In Auto mode the reference is automatically selected according to the Input selection, except if GBR is selected, when the user has to set internal or external sync's as the reference source.

The GBR sync source is set on the **TIMING : GBR Sync** menu.

## 3.2.4 Standard Detection

The unit detects and reports back the detected video standard and frame-rate of the selected video input and that of the reference input. The detected standard can be seen in the **STATUS** menu under **I/P Std** and **Ref Std**. If the input and reference standards conflict or is different from a fixed output standard the output will default to the settings of reference fail mode.

The Ref fail mode is set on the **TIMING : RF Mode** menu.

## 3.2.5 TRS Signals

The TRS signals are the digital equivalent of the analogue synchronising pulses. The module described in this manual always regenerates the TRS signals for its output.

## 3.2.6 EDH

EDH is a method of embedding data within the ancillary data space that carries a measurement of the integrity of 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.

For SD signals it is optional. On the V6221 Video ADC with Embedded audio the EDH on the output can be disabled on the **ENG' ING : O/P EDH** menu.

## 3.2.7 Illegal Codes

A function of these modules is to ensure that the SDI output always meets the relevant 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:

- If the output timing is being changed, there will be momentary errors.
- If the reference is unstable or changing standards then the output will not be stable.



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### 3.2.8 Horizontal and Vertical Blanking Interval Data

Provided that the V6221 Video ADC unit is fitted with the Audio Processing (AP) option, relevant chunks of Ancillary data, of embedded Audio is inserted in the horizontal blanking area.

The Vertical Blanking period can be set to blank or pass the incoming video information, increasing the active number of lines equally on each field with one line resolution. It is also possible to increase the vertical blanking period to introduce widescreen blanking in either the 14:9 or 16:9 format. The widescreen blanking region of the active picture area may be set to a key level of sub-black for use in a separate keyer and the video is then limited to a minimum of black level.

The vertical interval blanking is set on the **ENGINEERING : Blnk625 or Blnk525** menu. The widescreen blanking is set on the **ENGINEERING : WS Blank** menu.

### 3.2.9 Video Input Fail (Reference Fail)

If the selected video input fails, then the output picture will be either set to Black, O/P Mute or Free-run. This is set in the reference fail menu as the input video feeds the reference circuits.

The reference fail mode is set on the **TIMING : REF Mode** menu.

### 3.2.10 Test Pattern Generator

The V6221 comes with a built-in Test Pattern Generator (TPG). The test patterns can be used to provide signals for system testing and even for testing other pieces of equipment. Clean switching between test patterns and the selected live video input is provided, but if no input is available the test pattern generator will free-run. If the card is free-running and a video is then connected a disturbance will occur on the output.

On a V6221, the test patterns are being generated on the 'Output' side. It also means that they cannot be used as an internal confidence signal for proving the correct operation of the V6221 itself.

The vertical interval is considered to be a part of the test pattern and is always synthesised as Black. This means that the vertical blanking interval is always blanked when Test Patterns have been selected. The same does not apply to Ancillary Data in the horizontal blanking interval, so audio will still be embedded.

The actual TPG selection menu can be found in the 'Engineering' Menu (**ENG'ING : Test Ptn**):

The default setting in the **Test Ptn** sub-menu is: *TPG Off*

In normal operation only the two colour bars and black are selectable, but in Eng Mode all of them are available.

A split screen mode is provided to aid the setup of the picture being processed, when selected

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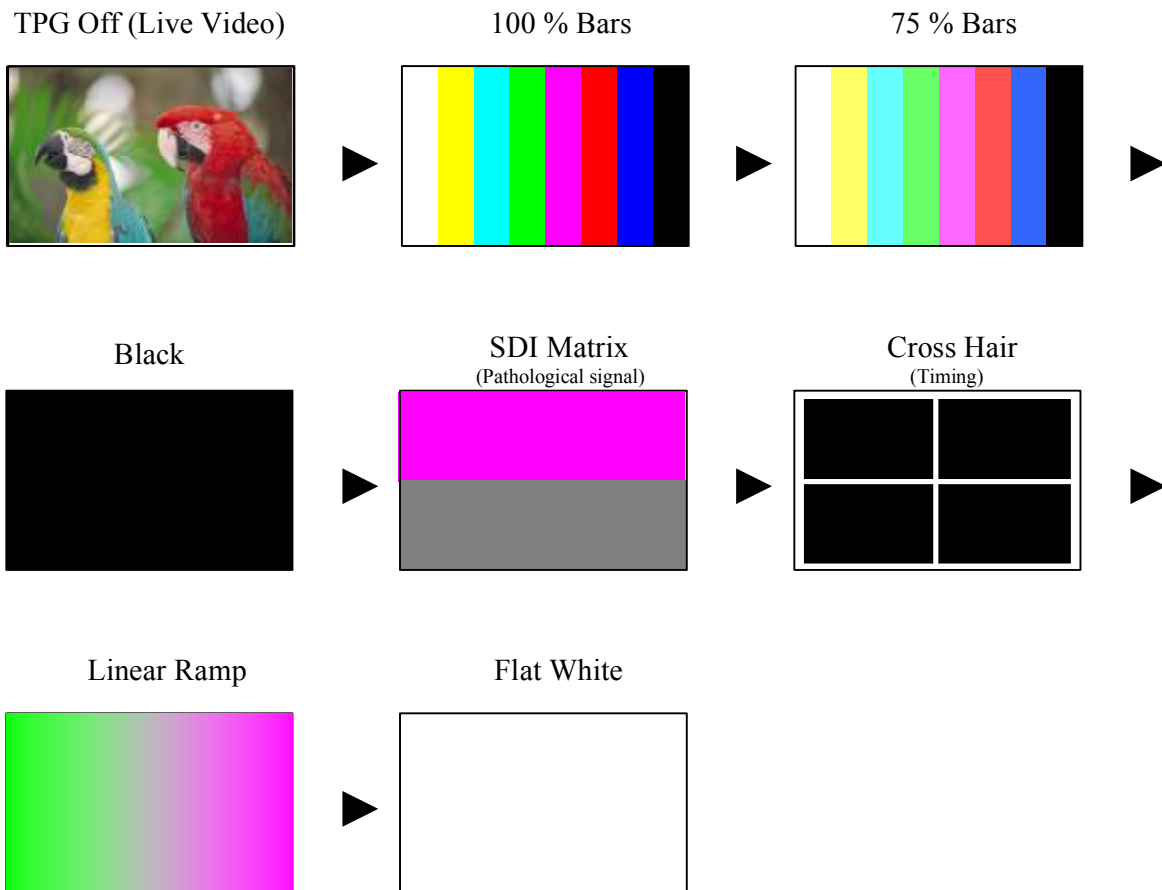
the incoming video will appear above the test pattern. All test patterns may be switched into the split screen mode.

The split screen selection menu can be found in the 'Engineering' Menu (ENG'ING : SplitPtn):

From the remote control system the test patterns and split screen can be called up directly.

Note that the 100% and 75% colour bars have limited transition rates between adjacent bars.

Stepping through the menu, the following Test Patterns will be generated:





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The V6221 can be used as a simple stand-alone TPG, without the need for an Input signal or Reference signal being present. If the module powers up without an Input signal present, its output will automatically switch to the Standard according to the selection made in the `CONFIG:Def Std` menu.

The Output Standard can be changed 'on-the-fly' by stepping through the `Def Std` menu. The Output Standard will instantly change to the selected mode without changing the selected test pattern.

If a test pattern is selected (`ENG'ING:Test Ptn:Bars 100` etc.) and the unit gets switched off, it will reboot next time with this last selected Test Pattern and the last selected Default Standard.

### 3.2.11 Video Gain

`PROC AMP V Gain`

The adjustment range is  $\pm 6\text{dB}$  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 is no numerical overflow as the output fits into the 10 bit D1 domain. There is no gamut legalisation function.

### 3.2.12 Chroma Gain

`PROC AMP C Gain`

The adjustment range is  $\pm 6\text{dB}$  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 is no numerical overflow as the output fits into the 10 bit D1 domain. There is no gamut legalisation function.

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## 3.2.13 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.

## 3.2.14 Hue Shift

PROC AMP Hue

The adjustment range of the hue shift is  $\pm 45^\circ$  in  $0.35^\circ$  steps.

## 3.2.15 AES Audio Input Processing

The 4 AES audio inputs feed Sample Rate Converters (SRC), which will retime them to the video clocks and convert the frequency to 48 KHz if necessary. The SRC's can accept audio at 32, 44.1, 48, 96 or 192 KHz.

A multiplex group however can be selected to bypass the SRC's for its AES audio selections to allow 48 KHz data to be embedded i.e. Dolby Encoded audio. This is done by setting the reference for the Multiplex group to asynchronous.

The SRC bypass menu can be found in the 'Audio' Menu (**AUDIO** : AB Ref)

## 3.2.16 Analogue Audio Input Processing

The eight channels of analogue audio are converted to 24 bit resolution digital signals at 48KHz locked to the video on the IO module and fed to the main module processor as a single multiplexed signal. All the calibration values for each channel of the ADC are held in a serial PROM on the IO module, so if there is a need to change the IO module the calibration goes with it.

The Maximum Audio Level (MAL) may be set for the module between +12 dBFs and +24 dBFs to allow for the standard setting of the installation.

The MAL menu can be found in the 'Audio' Menu (**AUDIO** : MAL)

Note : The procedure for calibrating the ADC is described later in this manual and should not be confused with the MAL setting.

## 3.2.17 Audio Matrix

The audio matrix is 24 input by 8 output and allows selection of any AES or Analogue input signal to be selected to the multiplexer inputs. AES inputs are either via the SRC's or bypass the SRC's according to the Reference selection for that group, this selection is done automatically, so the user only gets the choice of 8 AES and 8 Analogue audios to select from.

Care should be exercised when mixing AES inputs if the module is bypassing the SRC's (Asynchronous reference). If the AES audio is not locked to video prior to the module,



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disturbances can be experienced on the outputs, as the embedding processes is controlled by the clocks from the first audio channel in each group.

The matrix menu can be found in the 'Audio' Menu (**AUDIO** : MuxA.1, MuxA.2, MuxB.1, etc)

### 3.2.18 Audio Multiplexers

There are two independent audio multiplexers on the module and these can be selected to any of the 4 audio groups. Each group can have either 20 or 24 bit resolution and be either synchronous to the video or asynchronous to allow signals such as Dolby to be embedded. (The asynchronous control is shared with the bypassing of the SRC's on the AES inputs)

The Mux Group menu can be found in the 'Audio' Menu (**AUDIO** : AB MuxGr)

The resolution menu can be found in the 'Audio' Menu (**AUDIO** : AB Mux)

The Sync/Async mode menu can be found in the 'Audio' Menu (**AUDIO** : AB Ref)

### 3.2.19 Free-Run Frequency

There is 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 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 compare the output picture movement on a monitor with an accurate external reference and adjust the frequency accordingly.

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

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

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## 3.2.20 Analog Audio Inputs

The analog audio Inputs of the V6221 audio module requires calibration to 'trim out' the small errors in the components. It is not the same as the MAL setting. The module is calibrated at the factory and should not require recalibration under normal circumstances. However, should recalibration become necessary, it may be undertaken by the user provided the requisite equipment is available

The calibration values relate directly to the V6221's 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.

## 3.2.21 ADC

Turn Calibrate Mode ON and select one of the ADC sub-menus.

```
CALIB      Cal Mode  Cal On
```

Connect the Analog inputs from a high quality dual domain audio generator to the inputs at +16dBu and the AES outputs to an analyser. Set MAL to +18dBFS, and adjust the level on the AES outputs to -2dBFS.

```
CALIB      ADC A1
CALIB      ADC A2
CALIB      ADC B1
CALIB      ADC B2
CALIB      ADC C1
CALIB      ADC C2
CALIB      ADC D1
CALIB      ADC D2
```

## 3.2.22 Version Numbers

The V6221 module comprises various items of software/hardware and they all have separate version numbers. These can be read on the following read only menus:

```
STATUS     Soft Ver  XX.XX.XX  Microprocessor Code
STATUS     FPGA Ver   XX.XX     FPGA (Stratix) Code
STATUS     CPLD Ver   XX.XX     CPLD Code
STATUS     PCB Ver    XX.XX     The PCB revision, with Mod status
STATUS     Boot Ver   XX.XX.XX  Boot Loader
```

## 3.2.23 Display Sleep

Since, for the vast majority of its life, a module 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



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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.

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

### 3.2.24 Display Brightness

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

ENG'ING    LEDLevel    █ █ █ █





## 4 Controls

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 module configurations 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'.

### 4.1 Front Panel Menu structure

| Main Menu | Sub Menu | Value  | Norm | Comment               |
|-----------|----------|--|------|-----------------------|
| VIDEO     | IP Fmt   | FmtCVBS1<br>FmtCVBS2<br>Fmt GBR<br>Fmt YUV<br>Fmt YC     | N    |                       |
|           | Standard | Auto<br>PAL<br>NTSC<br>PAL M<br>NTSC J<br>PAL N<br>SECAM | N    |                       |
|           | Pedestal | On<br>Off  | N    | For 525 video signals |
|           | V Gain   | -6.02dB<br>↓<br>0.00dB<br>↓<br>+6.01dB                   | N    |                       |
|           | C Gain   | -6.02dB<br>↓<br>0.00dB<br>↓<br>+6.01dB                   | N    |                       |
|           | Offset   | -128<br>↓<br>0<br>↓<br>127                               | N    |                       |
|           | Hue      | -45<br>↓   |      |                       |



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|       |           |  |   |  |
|-------|-----------|--|---|--|
|       |           | 0°<br>↓<br>+45   | N |  |
|       | Norm      | *****  |   |  |
| AUDIO | AB MuxGrp | Off<br>Group 1<br>Group 2<br>Group 3<br>Group 4  | N | Multiplex group select   |
|       | CD MuxGrp | Off<br>Group 1<br>Group 2<br>Group 3<br>Group 4  | N |  |
|       | AB Mux    | 20 bit<br>24 bit   | N | Audio Resolution   |
|       | CD Mux    | 20 bit<br>24 bit   | N |  |
|       | MuxA . 1  | None<br>AES A1<br>AES A2<br>AES B1<br>AES B2<br>AES C1<br>AES C2<br>AES D1<br>AES D2<br>None<br>Ana A1<br>Ana A2<br>Ana B1<br>Ana B2<br>Ana C1<br>Ana C2<br>Ana D1<br>Ana D2 | N | Selects Audio input for Multiplexing   |
|       | MuxA . 2  | MuxA . 2 A2  | N | None/A/B/C/D/E/F/G/H as above.<br>NOTE: Normalised settings for each control |
|       | MuxB . 1  | MuxB . 1 B1  | N |  |
|       | MuxB . 2  | MuxB . 2 B2  | N |  |
|       | MuxC . 1  | MuxC . 1 C1  | N |  |
|       | MuxC . 2  | MuxC . 2 C2  | N |  |

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|        |          |  |   |                       |
|--------|----------|--|---|-----------------------|
|        | MuxD.1   | MuxD.1 D1  | N |                       |
|        | MuxD.2   | MuxD.2 D2  | N |                       |
|        | AB Ref   | Video<br>Async   | N |                       |
|        | CD Ref   | Video<br>Async   | N |                       |
|        | MAL      | +24dB<br>↓<br>+18dB<br>↓<br>+12 dB   | N |                       |
|        | Norm     | *****  |   |                       |
| TIMING | YC Delay | -0.59μs<br>↓<br>+0.000μs<br>↓<br>+0.52μs   | N | YC and YUV modes only |
|        | Pic Posn | -2.37μs<br>↓<br>+0.00μs<br>↓<br>+2.22μs  | N |                       |
|        | RF Mode  | OP Black<br>OP Mute<br>Free Run  | N |                       |
|        | GBR Sync | Sync Ext<br>Sync Int   | N |                       |
|        | Norm     | *****  |   |                       |
| STATUS | Variant  | V6221  |   |                       |
|        | Vid I/P  | I/P x<br>I/P √   |   |                       |
|        | Ref I/P  | REF x<br>REF √   |   |                       |
|        | I/P Std  | NTSC<br>NTSC 443<br>PAL M<br>PAL 60<br>PAL<br>SECAM<br>PAL N<br>SECAM525<br>525<br>625<br>No Input |   |                       |



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|          |           |  |   |   |
|----------|-----------|--|---|---|
|          | O/P Std   | 525/60<br>625/50   |   |   |
|          | Ref Std   | 525/60<br>625/50   |   |   |
|          | AES ABCD  | AxBxCxDx   |   |   |
|          | IOModule  | CVBS Dcd   |   |   |
|          | Build     |  |   |   |
|          | Soft Ver  | xx.xx.xx   |   |   |
|          | FPGA Ver  | x.xx   |   |   |
|          | CPLD Ver  | x.xx   |   |   |
|          | PCB Ver   | x.xx   |   |   |
|          | Boot Ver  | xx.xx.xx   |   |   |
| ENG' ING | Eng Mode  | Eng OFF<br>Eng ON  | N | Normal operation<br>Allow extra controls and control states   |
|          | Test Ptn  | Off<br>100% Bars<br>75% Bars<br>Black<br>SDI<br>Matrix<br>X-Hairs<br>Ramp<br>Flat<br>White | N | Engineering mode only<br>Engineering mode only<br>Engineering mode only<br>Engineering mode only  |
|          | Split Ptn | Off<br>On  | N |   |
|          | O/P Mode  | Colour<br>Mono<br>U Only<br>V Only   | N | Engineering mode only<br>Engineering mode only  |
|          | Def Std   | LastUsed<br>Def 525<br>Def 625<br>525/60<br>625/50   | N | O/P follows I/P std - last used if no I/P<br>O/P follows I/P std - 525 if no I/P<br>O/P follows I/P std - 625 if no I/P<br>Always 525 O/P<br>Always 625 O/P |
|          | Vid AGC   | AGC Off<br>AGC On  | N |   |
|          | YUV Lev1  | SMPTE<br>BETACAM   | N | YUV mode only   |
|          | Pedastal  | On<br>Off  | N |   |
|          | WS Blank  | WS Off<br>WS 14:9<br>WS 16:9<br>14:9+Key<br>16:9+Key                                       | N |   |
|          | Blk 625   | Pass 0<br>↓  | N | 17 lines blank (6-22 & 318-335) - 625 only  |

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|       |            |   |   |   |
|-------|------------|---|---|---|
|       |            | Pass 17   |   | 0 lines blank                               |
|       | Blnk 525   | Pass 0<br>↓<br>Pass 10                          | N | 10 lines blank (10-19 & 273-282) - 525 only |
|       | O/P EDH    | EDH On<br>EDH Off                               | N | 0 lines blank                               |
|       | Free-run   | Free Off<br>Free On                             | N |   |
|       | Ref Select | Auto<br>CVBS 1<br>CVBS 2<br>Ext Sync<br>Ext Ref | N |   |
|       | Sleep      | 5 min   | N |   |
|       | LEDLevel   | ■ ■ ■ ■   |   |   |
|       | Norm       | *****   |   |   |
| CALIB | Cal Mode   | Cal Off<br>Cal On                               | N | Normal operation<br>Enter calibration mode. |
|       | CntrFreq   | Frq=-128<br>↓<br>Frq= +0<br>↓<br>Frq=+127       |   | May be changed only in calibration mode     |
|       | Audio1 Cal | Gain>1<br>↓<br>Gain=1.0<br>↓<br>Gain<1          |   | May be changed only in calibration mode     |
|       | Audio2 Cal | Gain>1<br>↓<br>Gain=1.0<br>↓<br>Gain<1          |   | May be changed only in calibration mode     |
|       | Audio3 Cal | Gain>1<br>↓<br>Gain=1.0<br>↓<br>Gain<1          |   | May be changed only in calibration mode     |
|       | Audio4 Cal | Gain>1<br>↓<br>Gain=1.0<br>↓<br>Gain<1          |   | May be changed only in calibration mode     |
|       | Audio5 Cal | Gain>1<br>↓<br>Gain=1.0<br>↓<br>Gain<1          |   | May be changed only in calibration mode     |
|       | Audio6 Cal | Gain>1<br>↓                                     |   | May be changed only in calibration mode     |



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|        |            |  |   |   |
|--------|------------|--|---|---|
|        |            | Gain=1.0<br>↓<br>Gain<1                |   |   |
|        | Audio7 Cal | Gain>1<br>↓<br>Gain=1.0<br>↓<br>Gain<1 |   | May be changed only in calibration mode |
|        | Audio8 Cal | Gain>1<br>↓<br>Gain=1.0<br>↓<br>Gain<1 |   | May be changed only in calibration mode |
|        |            |  |   |   |
| CONFIG | Banner     | On<br>Off                              | N |   |
|        | Password   |  |   | Factory use only                        |
|        | Variant    |  |   |   |
|        | Options    |  |   |   |
|        | V SetPCB   |  |   |   |
|        | V SetH/W   |  |   |   |
|        | TestMode   | Off<br>On                              | N | Enables TEST menu                       |
|        | Factory    | Mode Off<br>Mode On                    | N | Enables Factory Mode on debug port      |
|        | Norm       | *****                                  |   |   |



## 5 Appendix

---

### 5.1 Trouble Shooting Guide (Frequently Asked Questions)

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

|            |  |
|------------|--|
| <b>Q:</b>  | My V6221 powers-up with a static test pattern or black output, although a valid video signal is connected to one of its inputs.                                |
| <b>A1:</b> | Check whether the Front Panel Ref LED is lit. This indicates that a signal is being received.  |
| <b>A2:</b> | Check whether the Input selection is set correctly.<br><code>VIDEO : I/P Fmt : CVBS 1 (or CVBS 2, etc)</code>  |
| <b>A3:</b> | Check that the Test Pattern Generator is turned off.<br><code>ENG'ING : Test Ptn : TPG Off</code>  |
| <b>A4:</b> | Make sure that the mode of operation matches with your Input Standard.<br>Set to 'Auto' sensing if in doubt.<br><code>Engineering : Def Std : Last Used</code> |

|            |  |
|------------|--|
| <b>Q:</b>  | There is no Embedded audio on the output video or it is corrupted  |
| <b>A1:</b> | Make sure that audio is selected to the group. (note..Some receivers require all audio channels to be occupied within a group.)<br><code>(AUDIO : MUXA.1 : AES A1, AES A2, etc)</code> |
| <b>A2:</b> | Make sure that Multiplex is selected to the group.<br><code>(AUDIO : AB MuxGrp : Group 1, Group 2, etc)</code>   |
| <b>A3:</b> | Some receivers will only work with synchronously embedded audio.<br><code>(AUDIO : AB Ref : Video)</code>  |

|            |   |
|------------|---|
| <b>Q:</b>  | The Dolby audio is corrupted.   |
| <b>A1:</b> | Make sure that the selected reference for the Audio Mux group is set to Asynchronous. <code>(AUDIO : AB Ref : Async)</code> |

|            |  |
|------------|--|
| <b>Q:</b>  | The output generated by my V6221 looks corrupted.  |
| <b>A1:</b> | Make sure that the selected Output Standard has the same frame-rate as the Input signal. |

|            |  |
|------------|--|
| <b>Q:</b>  | I want to use my V6221 as a stand-alone Test Pattern Generator, but I cannot see anything on the Monitor.  |
| <b>A1:</b> | Make sure that the selected 'Default Standard' is compatible with your Monitor specification <code>(ENG'ING : Def Std)</code> .                                  |
| <b>A2:</b> | Check whether the TPG is turned on and that you have not deliberately selected a 'Black' test pattern <code>(ENG'ING : TestPtn : Bars 100, Bars 75, etc.)</code> |



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|            |   |
|------------|---|
| <b>Q:</b>  | The display never goes to sleep.  |
| <b>A1:</b> | Check whether the Sleep delay has been set to 0 Mins, which means stay awake. |

## 5.2 Initialization, Power On-Self test & Error Messages

### 5.2.1 Board Initialization Sequence

Every time a board goes through a power-on cycle, either by re-seating the board in the rack or by triggering the manual reset, a sequence of initialisation and self-test events is being carried out by the on-board microcontroller.

If anything goes wrong, an error message is shown on the front panel display and program execution halts. The following table shows the error messages and their meaning:

|                 |          |  |
|-----------------|----------|--|
| Flash upgrading | ERROR 01 | Flash erasing failed   |
|                 | ERROR 02 | Flash programming failed   |
|                 | ERROR 03 | Main program checksum error after programming                              |
|                 | ERROR 04 | Bootloader checksum error after programming                                |
|                 | ERROR 05 | No program loaded and no valid upgrade in Flash Stick                      |
|                 | ERROR 06 | Bootloader upgrade required but no valid bootloader upgrade in Flash Stick |
| FPGA Load       | ERROR 07 | STATUS stayed low after CONFIG pulsed low                                  |
|                 | ERROR 08 | DONE stayed high after CONFIG pulsed low                                   |
|                 | ERROR 09 | STATUS went low during configuration                                       |
|                 | ERROR 10 | DONE stayed low after configuration  |
| Local EEPROM    | ERROR 11 | Error writing to local EEPROM  |
|                 | ERROR 12 | Error reading from EEPROM  |
|                 | ERROR 13 | Initialising EEPROM to default data  |
|                 | ERROR 14 | Initialising parameters to default data                                    |
| Debug Port      | ERROR 15 | Receive buffer overflow  |
|                 | ERROR 16 | Receive overrun  |
|                 | ERROR 17 | Receive framing error  |
|                 | ERROR 18 | Receive parity error   |





# Vistek V6221 SD Video ADC with Embedded Audio

## 5.3 Menu Structure Summary

Please note that the presence of some sub-menus depend on the factory configuration of your module. In other words, if an option is not fitted, the entire sub-menu belonging to it will not appear in the menu structure.

