VISTEK V6421 COLOUR CORRECTOR USER GUIDE

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Contents

1. DESCRIPTION

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

This manual covers the following module:

V6421 HD Colour Corrector

1.1 General

The **V6421 HD Colour Corrector** is an SDI Colour Corrector, with controls for Lift and Gain in the RGB domain, although it works fully in the YCbCr component domain. Internal limiting is included to ensure that the output signal is generally within the legal RGB gamut. The unit is not a full specification legaliser and it is not possible to guarantee that there are no excursions, particularly with high frequency signals. It operates with both HD and SD SDI signals, and automatically detects which one to use. All ancillary data, both HANC and VANC will be passed unchanged.

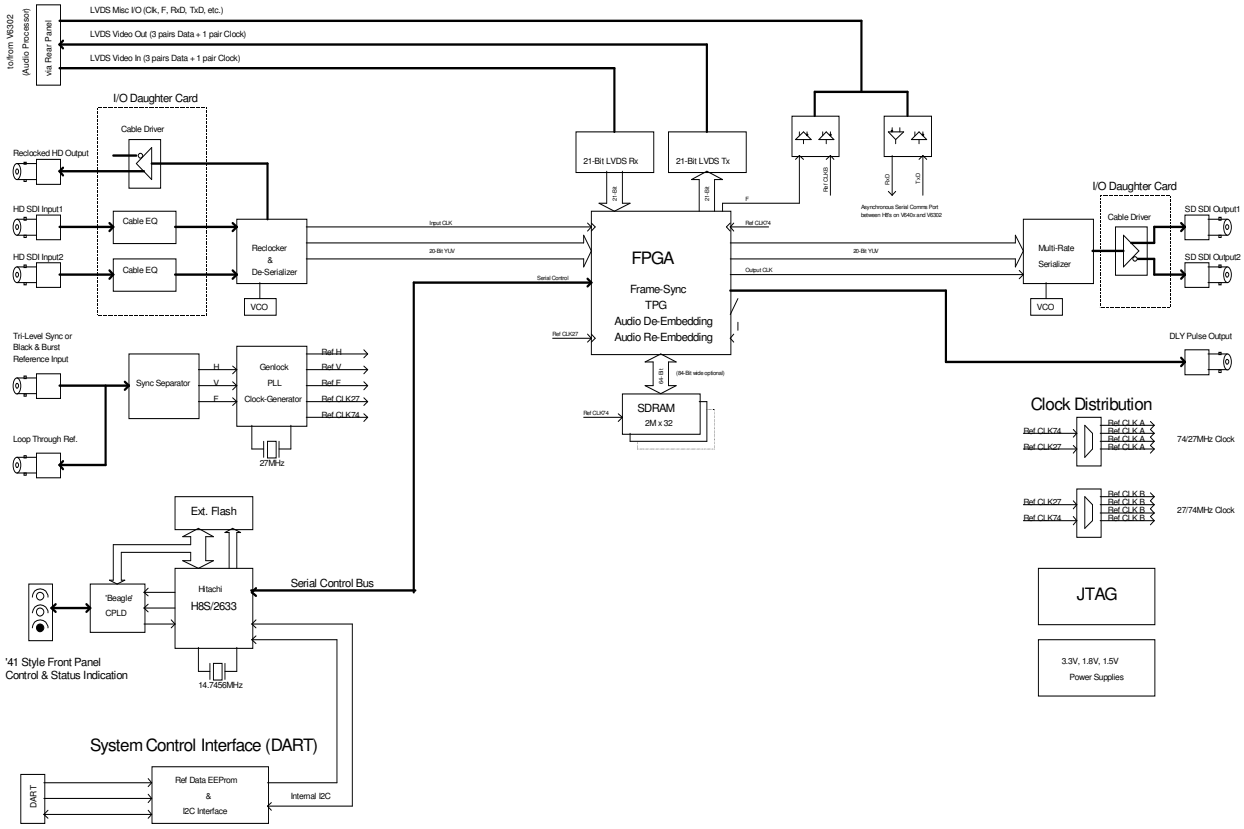
The unit has two independent inputs, which can be selected either on the front panel or remotely via Vistek's control interface 'DART'. They also have a fully re-clocked and buffered output, which is after the input signal selection. Generally it is recommended to terminate unused input BNC's in order to improve the unit's noise susceptibility.

There are two (identical) Output BNCs, capable of driving either SD or HD SDI, according to the input.

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 more complex units in the range.

1.2 Block Diagram

V6421 HD Colour Corrector



1.3 Supported Video Standards

This unit has been designed to operate using all the current Standard Definition and High Definition Standards based on field and frame rates of 23.98Hz, 24Hz, 25Hz, 29.97Hz, 30Hz, 50Hz, 59.94Hz and 60Hz. The Bit Serial Interface for all listed HD modes is in accordance with SMPTE specification 292M. For all SD modes, the Serial Digital Interface is in accordance with ANSI/SMPTE 259M.

Supported Video I/O Standards at the time of printing (FPGA Firmware Version V01.00)

Tektronix Definition	SMPTE	Colloquial
1920x1080/60/2:1	274M - 4	1080i60
1920x1080/59.94/2:1	274M - 5	1080i59
1920x1080/50/2:1	274M - 6	1080i50
1920x1080/30/1:1	274M - 7	1080p30
1920x1080/29.97/1:1	274M - 8	1080p29
1920x1080/25/1:1	274M - 9	1080p25
1920x1080/24/1:1	274M - 10	1080p24
1920x1080/23.98/1:1	274M - 11	1080p23
1920x1080/24/1:1SF	RP211 - 15	1080sf24
1920x1080/23.98/1:1SF	RP211 - 16	1080sf23
1280x720/60/1:1	296M	720p60
1280x720/59.94/1:1	296M	720p59
1280x720/50/1:1	296M	720p50
1280x720/30/1:1	296M	720p30
1280x720/29.97/1:1	296M	720p29
1280x720/25/1:1	296M	720p25
1280x720/24/1:1	296M	720p24
1280x720/23.98/1:1	296M	720p23
1920x1035/60/2:1	260M	1035i60
1920x1035/59.94/2:1	260M	1035i59
625/50/2:1	125/259M	625i50
525/59.94/2:1	125/259M	525i59

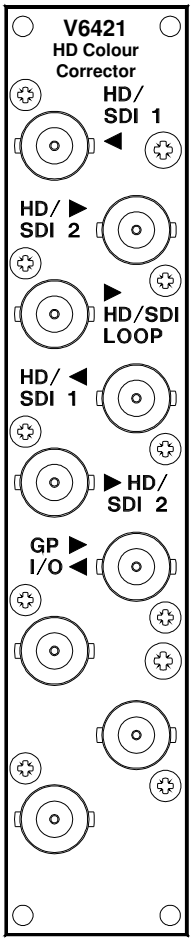
HD

SD

Note: The 'colloquial' label is how they are referred to in this manual.

2. INSTALLATION

2.1 Rear Panels



2.2 Connections

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

Connector	Type	Function
▶ HD/SDI 1	BNC	HD/SDI Video Input 1
▶ HD/SDI 2	BNC	HD/SDI Video Input 2
◀ HD/SDI LOOP	BNC	HD/SDI Reclocked and Buffered Loop-through Output
◀ HD/SDI 1	BNC	HD/SDI Main Output 1
◀ HD/SDI 2	BNC	HD/SDI Main Output 2
▶ GPIO ◀	BNC	General Purpose Input or Output (bi-directional)

2.3 Module and Environmental Specifications

Parameter	Environmental Specification
Module Size	Standard V1600 range form factor; fits in V1606 3U rack or V6011 '1-Box'
Rear Panel	V16HR3C Single width rear
Operating Voltage	+9..+18V
Power Consumption	+15V/0.35A (5.3W typ.)
Operating Temperature	0 to +60°C
Storage Temperature	-40°C to +85°C
Relative Humidity	95% non-condensing

2.4 Signal Specifications

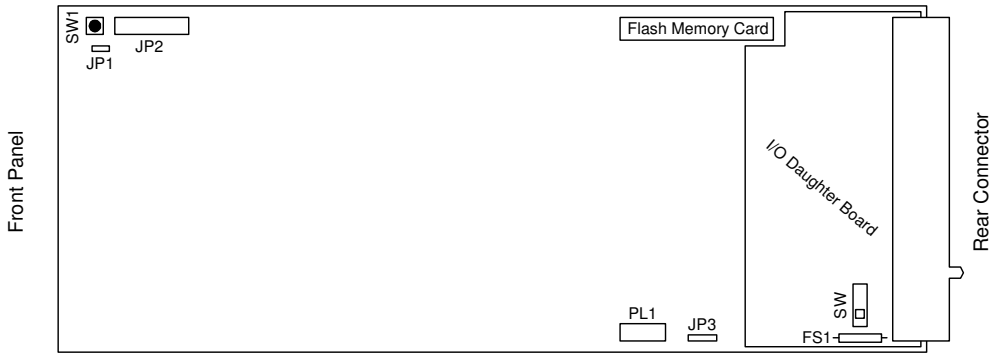
Signal	Type	Comments
Video Inputs	75Ω BNC	Input Format: SMPTE259M or SMPTE292M Input Impedance: 75 Ohm Return Loss: > 15dB, 5MHz – 1.5GHz Equal. Cable Length: 0-250m @ 270Mbps 0-100m @ 1.5Gbps
Video Outputs	75Ω BNC	Output Format: SMPTE259M or SMPTE292M Output Impedance: 75 Ohm Return Loss: > 15dB, 5MHz – 1.5GHz Jitter Performance: < 0.2UI p-p (Timing @ 270Mbps) < 0.2UI p-p (Alignment @ 270Mbps) < 1UI p-p (Timing @ 1.485Gbps) < 0.2UI p-p (Alignment @ 1.485Gbps) Amplitude: 800mV p-p (terminated) Drive Capability: > 250m @ 270Mbps (Belden 8281) > 100m @ 1.5Gbps (Belden 1694A)
GP Input	0V to 5.5V with Schmitt-Trigger characteristic	Positive-going input threshold voltage: 1.75V typ. Negative-going input threshold voltage: 1.0V typ. Hysteresis Voltage: 0.77V typ.
GP Output	LVTTL with +/- 24mA drive capability	Short-circuit protected.

2.5 Hardware

2.5.1 The PCB

This figure 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 two 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.



2.5.2 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)
JP3	JTAG Enable	For Test. Fit in 2-3 position.

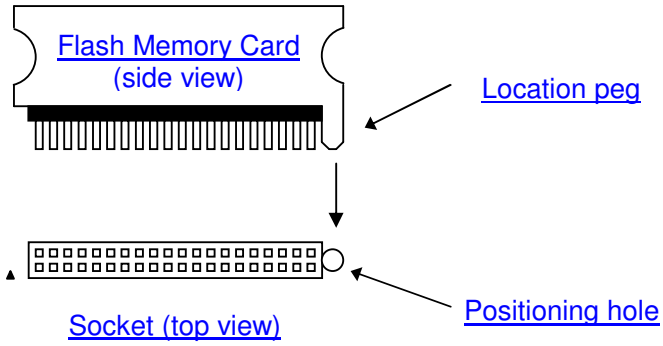
2.5.3 Fuse

There is only one fuse on these modules, which is in series with the main DC input.

FS1	Fuse 2 Amp Wire ended	In series with the +15V input to the module on the I/O daughter board.

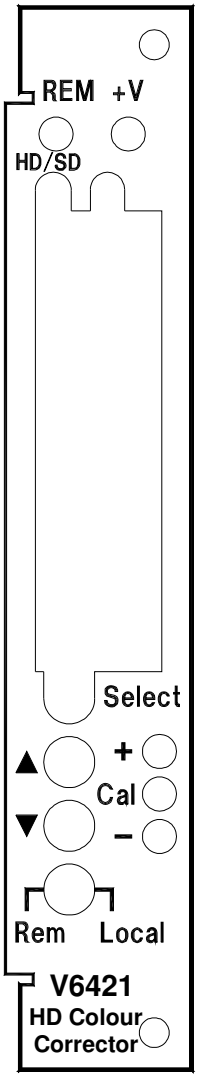
2.5.4 Flash Memory Card

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 Vistek 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.

2.6 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.

2.6.1 Direct Indications

The 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 +3.3V 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 +3.3V is indicated here. It will, of course, be off if the fuse, FS1, were to have been blown.
HD/SD	Indicates that a valid SDI signal (either HD or SD) is being received.

2.6.2 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) it is horizontal and the 'proper' way up. (At time of writing it is not possible to fit the V6421 card into the V1602 1U rack!)

The three action buttons are labelled **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 colour 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 then they are still active for showing the status but cannot be used to actually change anything.

Beside the ▲ and ▼ buttons there 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 in which direction it has been changed or that it is no longer on its CAL value.

2.6.3 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 modules is done through the front panel with its eight character LED display and three control buttons **Select**, ▲ and ▼. There are three LEDs which also contribute to the status indication; these are labelled **+**, **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. The display will be:

V6421

3.1.2 Menu Control

The **Select,** ▲ and ▼ 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 ▲ 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	**V6421**
Main Menu	The Main menu items, such as **VIDEO**, **COL-CORR**, **ENG'ING** etc. These items are all in Upper Case.
Sub Menu	Menu items under each main heading, such as **Source** under the **VIDEO** 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.

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.

3.1.3 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 enable the colour correction.

Action	Display	Comments
Select	`V6421`	Top Level
Select	`VIDEO`	The first Main Menu in the list
▼	`COL-CORR`	The Main Menu we want
Select	`CC Enab`	The Sub Menu we want
Select	`CC Off`	The default setting
▲	`CC  On`	Set it as we want it

Now we shall select input 2 as the unit input. 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	`CC Enab`	UP to the Sub Menu level
Select+Hold	`COL-CORR`	UP to the Main Menu level
▲	`VIDEO`	The Main Menu we want
Select	`Source`	The Sub Menu we want
Select	`I/P 1`	The default setting
▲	`I/P 2`	Set it as we want it

3.1.4 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.

3.2 Unit Features

3.2.1 SDI Inputs

The SDI inputs must conform to either the SMPTE292M or SMPTE259M standards, which describe the Bit Serial Digital Interface for HD and SD operation. If only one input is required then it should be connected to SDI 1. Unused inputs can be left open, it is however recommended to terminate unused inputs with a 75Ω Terminator to improve noise immunity. Signals of different frame-rates, resolutions or even a mixture of SD and HD standards can be connected to both 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 SDI de-serialiser hardware to lock to the newly detected standard. Furthermore, in case of an SD-to-HD switch over (or vice versa), the FPGA on the baseboard must be re-loaded. This process takes about 2 to 3 seconds.

The input selection is done on the **`VIDEO`** : **`Source`** menu.

3.2.2 SDI Reclocked & Buffered Output

This is always available, and is a reclocked version of either SDI 1 or SDI 2, depending on the source selection. It is an unprocessed signal, i.e. not colour corrected.

3.2.3 SDI Main Outputs

The main processed SDI output is available on two BNCs.

3.2.4 Standard Detection

The unit detects and reports back the detected video standard and frame-rate of the selected SDI input. The detected standard can be seen in the **STATUS** menu under **I/P Std**.

3.2.5 EDH (SD Operation Only)

EDH is a method of embedding data within the ancillary data space which 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.

HD signals always have the EDH data in form of checksums embedded, but for SD signals it is optional. On the V6421 Colour Corrector, the EDH regeneration on the output can be disabled on the **ENG'ING** : **O/P EDH** menu. Care must be taken if the new EDH generation is disabled, as the old EDH is being passed through and it will probably not correctly represent the processed video data.

3.2.6 Horizontal and Vertical Blanking Interval Data (HANC and VANC)

Any data embedded in the horizontal and vertical blanking intervals will be retained through the Colour Corrector.

3.2.7 SDI Input Fail

If the selected SDI input fails, then there will not be a valid signal at the output.

3.2.8 VCO Centre Frequency

Normally, the output is locked to the input video itself, but 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. When in this mode, the output will free run at the nominal centre frequency of the on board clock generator. This centre frequency can be adjusted under the **CALIB** : **CntrFreq** menu, but this should not normally be necessary in the field.

3.2.9 Version Numbers

Each 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 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

3.2.10 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 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.

3.2.11 Display Brightness

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

ENG'ING LEDLevel ▮▮▮▮

3.3 Module Specific Functions

The main function of the V6421 is the Colour Corrector, which enables individual Red, Green and Blue gain and lift control, with a limitation function to help keeping the signal inside the legal RGB values.

3.3.1 Colour Correction Enable

COL-CORR CC Enab

It is possible to bypass all the colour correction adjustments, including the RGB limiting function, setting this control to off.

3.3.2 Colour Correction Gain

COL-CORR R Gain
G Gain
B Gain

The adjustment ranges from minus infinite (input R, G or B component multiplied by zero) to +12.037 dB, in 1536 identical linear steps, but with values displayed in dB. There is an individual gain control for the Red, Green and Blue components.

3.3.3 Colour Correction Lift

COL-CORR R Lift
G Lift
B Lift

The adjustment range if –876 to +876 in steps of 1 bit, with regard to a 10 bit video signal. There is an individual lift control for the Red, Green and Blue components.

3.3.4 Colour Limitation

ENG'ING Limit

This option control enables a limitation function in the RGB domain, limiting the Red, Green and Blue values to a 8%, 5%, 2% over/under the RGB legal values. It is also possible to switch off this control.

4. CALIBRATION

This section describes how to calibrate the unit as it is done in the factory. The units 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.

4.1 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:

Manually on the **CALIB** : **Cal Mode** menu.
By going up to the Top Level Menu.
By re-powering the unit.
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. For obvious reasons this should not be done on a unit that is being used On Air.

4.2 Free-Run Frequency

There is a voltage controlled crystal oscillator, which is usually locked to the input video. However if there is no input 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.

5. 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**'.

5.1 Video Processing – VIDEO

Main Menu	Sub Menu	Value		Comment
VIDEO	Source	I/P 1	n	Selects Input 1
		I/P 2		Selects Input 2
	Norm	******		Sets to normalized values in this Main Menu

5.2 Colour Corrector – COL-CORR

Main Menu	Sub Menu	Value		Comment
COL-CORR	CC ENAB	CC Off	n	Enable Colour Correction
		CC On		
	R Gain	---dB		Red Gain Control
		-54.2dB		
		↓		
		-0.00dB	n	
		↓		
		12.037dB		
	G Gain	---dB		Green Gain Control
		-54.2dB		
		↓		
		-0.00dB	n	
		↓		
		12.037dB		
	B Gain	---dB		Blue Gain Control
		-54.2dB		
		↓		
		-0.00dB	n	
		↓		
		12.037dB		
	R Lift	-876		Red Lift Control
		↓		
		+0	n	
		↓		
		+876		
	G Lift	-876		Green Lift Control
		↓		
		+0	n	
		↓		
		+876		
	B Lift	-876		Blue Lift Control
		↓		
		+0	n	
		↓		
		+876		
	Norm	******		Sets to normalized values in this Main Menu

5.3 Operating Conditions – STATUS

Main Menu	Sub Menu	Value		Comment
STATUS	I/P 1	I/P 1 √		Present
		I/P 1 x		Absent
	I/P 2	I/P 2 √		Present
		I/P 2 x		Absent
	I/P Std	720p59		Auto detected Input Standard
		↓		
		525i59		
		625i50		
		Unknown		
		No Input		
	Soft Ver	01.00.00		
	FPGA Ver	01.00		
	CPLD Ver	00.01		
	IOModule	STD [3]		Standard I/O Daughter Board
		None		
	PCB Rev	00.00		
	Boot Ver	01.00.01		

5.4 Engineering – ENG'ING

Main Menu	Sub Menu	Value		Comment
ENG'ING	Limit	8%	n	Percentage allowed over/under the RGB legal values before limiting, when the Colour Corrector is enabled.
		5%		
		2%		
		Off		No RGB limitation applied.
	O/P EDH	EDH On	n	Only when O/P standard is SD
		EDH Off		
	Free-run	Free Off	n	
		Free On		
	Sleep	0 min		LED Display never falls asleep
		↓		
		5 min	n	Sleep after 5 minutes (default)
		↓		
		30 min		Sleep after 30 minutes
	LEDLevel	▓ ▓ ▓ ▓	n	LED Display Intensity
	Norm	******		Sets to normalized values in this Main Menu

5.5 Calibration – CALIB

Main Menu	Sub Menu	Value		Comment
CALIB	Cal Mode	Cal Off	n	
		Cal On		Must be set 'On' to enable calibration (CntrFreq setting)
	CntrFreq	Frq=-128		Free-run Frequency
		Frq= +0	n	
		Frq=+127		
	Norm	******		Sets to normalized values in this Main Menu

5.6 Configuration – CONFIG

Main Menu	Sub Menu	Value		Comment
CONFIG	Banner	On	n	This enables the Warning Msg. Banner.
	Password	0	n	
	Inp Mode	Auto		Auto-sensing of I/P standard
		HD		I/P forced to HD operation
		SD		I/P forced to SD operation
	PCB Rev	0		Password protected
		↓		
		15		
	H/W Rev	0		Password protected
		↓		
		15		
	TestMode	Off	n	Password protected
		On		
	Factory	Mode Off	n	Password protected
		Mode On		
	Norm	******		Sets to normalized values in this Main Menu

6. APPENDIX A

6.1 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*.

Q: My V6421 powers-up with no output, although a valid SDI video signal is connected to one of its inputs.

A: 1. Check whether the Front Panel HD/SD LED is lit. This indicates that a signal is being received.

2. Check whether the Input selection is set correctly. **VIDEO** : **Source** : **I/P 1 (or I/P 2)**

3. Make sure that the mode of operation (SD/HD) matches with your Input Standard. Set to 'Auto' sensing if in doubt. **CONFIG** : **Inp Mode** : **Auto**

Q: The Colour Corrector does not work.

A: Check whether it is enabled. **COL-CORR** : **CC Enab** : **CC On**

Q: Even all the Colour Corrector controls are set to zero, the output EDH code is not correct, or is different from the input.

A: Even there is not colour correction applied, the RGB limitation function may be still on:

1. Disable all the Colour Correction and RGB Limitation. **COL-CORR** : **CC Enab** : **CC Off**, or

2. Disable the RGB Limitation function only. **ENG'ING** : **Limit** : **Off**, or

3. With SD signals, enable the output EDH insertion. **ENG'ING** : **O/P EDH** : **EDH On**

Q: The display never goes to sleep.

A: Check whether the Sleep delay has been set to 0 Mins which means stay awake.
ENG'ING : **Sleep** : **5 min**

6.2 Initialization, Power On-Selftest & Error Messages

Every time the 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 the 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

6.3 Menu Structure

This page summarizes the menu structure on the module.