REFGEN

SDI/analogue reference generator

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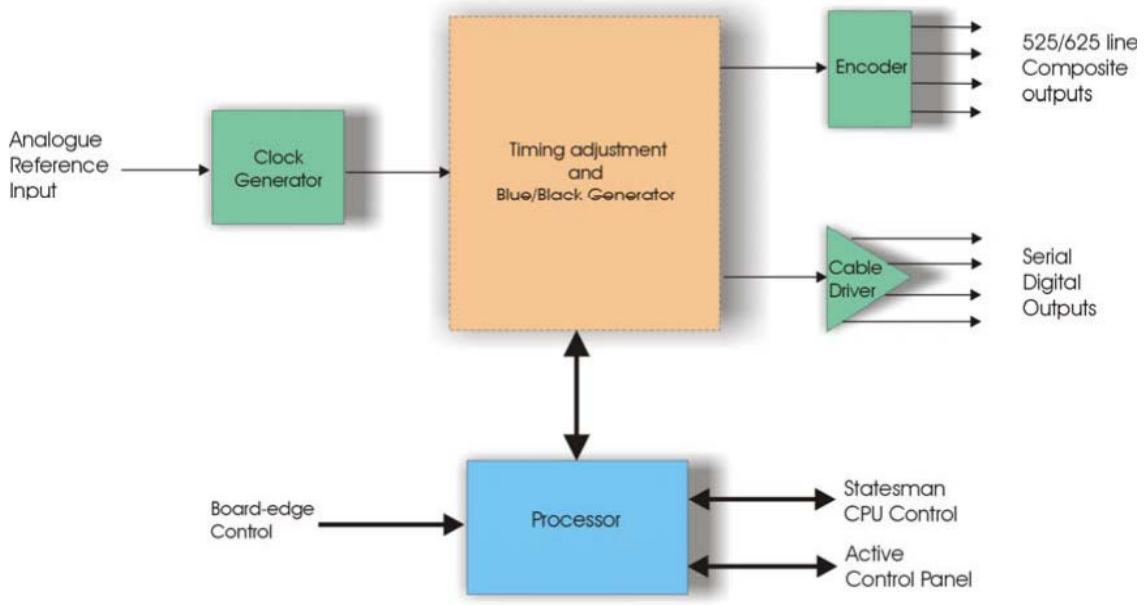
1 Introduction

The REFGEN is an analogue and digital black generator that will output both an analogue and serial digital reference. The REFGEN may be operated in a stand-alone free-running mode or when given an analogue input, an output that is locked to the input but with up to a two field delay. A choice of a blue or black output may also be selected.



REFGEN block diagram

The serial digital output has virtually no output jitter both when used with a stable analogue reference and when used without a reference. The minimum delay between the input reference and output is only 2µs.

The main features are as follows:

- Free running or timed to analogue input
- Selectable black or blue output
- Up to four simultaneous Serial Digital and four Composite outputs
- Output timing up to two field's adjustment from analogue reference input.
- 50 ppm free running accuracy
- Flexible control

REFGEN is a 100mm x 266mm module that will fit in all the standard frames and can be integrated with any boards from the company's full product range.

Free running and synchroniser/delay modes

The REFGEN has two modes of operation, free running and synchroniser/delay.

In synchroniser mode the unit takes its timing from the analogue external reference and will automatically lock its output to this. It is then possible to add a delay of between 0 and 2 fields in lines and pixels to the output reference with respect to the external reference.

In free running mode the output reference is timed to an accurate on-board clock generator.

Switching between free running and synchroniser mode is automatic when the external reference is added or removed.

2 Hardware installation

The REFGEN analogue and digital black generator will fit into all Crystal Vision rack frames. All modules can be plugged in and removed while the frame is powered without damage.

Note: Connection information differs from the original REFGEN.

Rear modules and signal I/O

The 4U Indigo 4 frame takes up to 24 single height Crystal Vision modules, 12 single height modules fit in the 2U frame, six single height modules fit in the 1U frame and two single height modules fit in the 1U desk-top box.

Rear module connections with the RM01

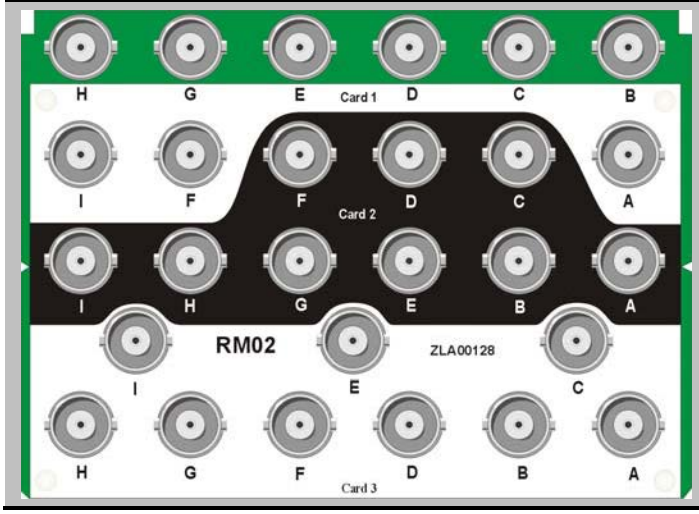
The RM01 single height rear module allows maximum packing density but has limited connections.

RM01 fits in all current frames	Description
	**RM01** 24 modules per 4U frame • 12 modules per 2U frame • 6 modules per 1U frame • 2 modules 1U desk top box • All frame slots can be used

BNC	Signal
A	Analogue reference output 1
B	Analogue reference output 2
C	Analogue reference output 3
D	SD reference output 1
E	SD reference output 2
F	External reference input

Rear module connections with the RM02

The RM02 give a greater number of outputs with the addition of an on-board loop- through for the external reference but with a small reduction in packing density.

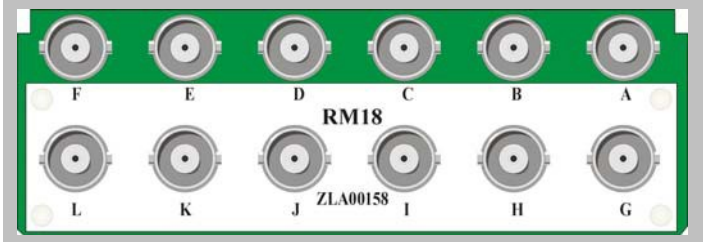
RM02 fits in a 2U frame	Description
	**RM02** • 18 modules per 4U frame • 9 modules per 2U frame • 3 modules per rear connector • 9 connections available • Card 1 fits in slots 1, 5 and 9 • Card 2 fits in slots 2, 6 and 10 • Card 3 fits in slots 4, 8 and 12 • No card fits in 3, 7 or 11 This module will not fit the 1U frames

BNC	Signal
A	Analogue reference output 1
B	Analogue reference output 2
C	SD reference output 1
D	SD reference output 2
E	SD reference output 3
F	Analogue reference output 3
G	SD reference output 4
H	External reference loop through output (on board loop)
I	External reference input

Note: The external reference loop-through will be disconnected if the board is removed from the frame.

Rear module connections with the RM18

The RM18 gives the maximum number of both analogue and digital outputs, with the addition of an on board-loop though for the external reference. This increase in available outputs again reduces packing density.

RM18 fits in all current frames	Description
	**RM18** • 12 modules per 4U frame • 6 modules per 2U frame • 3 per 1U frame • 1 per 1U desk top box • 1 module per rear connector • 10 connections available • Card fits in upper slot • No card fits in lower slot

BNC – ZLA00158	Signal
A	No connection
B	Analogue reference output 2
C	Analogue reference output 3
D	SD reference output 1
E	External reference input
F	External reference loop through output (on board loop)
G	No connection
H	SD reference output 2
I	SD reference output 3
J	SD reference output 4
K	Analogue reference output 1
L	Analogue reference output 4

Note: The external reference loop-through will be disconnected if the board is removed from the frame.

Rear module connections with the RM23

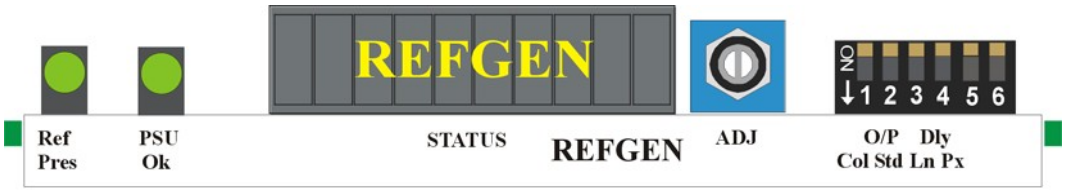
The RM23 single height rear module is useful in situations where only a digital reference is required. A benefit of the RM23 is that it has an external reference loop-through output that is not reliant on the REFGEN PCB so it will still be present should the REFGEN be removed.

RM23 modular rear connector	Description
	**RM23** • 24 modules per 4U frame • 12 modules per 2U frame • 6 modules per 1U frame • 2 modules 1U desk top box • All frame slots can be used

BNC	Function
A	External reference loop through output (RM loop)
B	Analogue reference output 1
C	Analogue reference output 2
D	SD reference output 1
E	SD reference output 2
F	External reference input

3 Card edge operation

The hinged front panel of the case reveals user controls of the card, LED indication of card status and the monitoring headphone socket.



The REFGEN front edge view

Card edge switch settings

The 4-way piano switch allows the operating modes and status options to be selected.

Lever	Function	Up	Down
1	Output Colour	No function	Adjust Black/Blue
2	Output Standard	No function	Adjust 625/525 lines
3	Delay in Lines	No function	Adjust 0-624 lines PAL. 0-524 lines NTSC
4	Delay in Pixels	No function	Adjust 0-1727 pixels PAL. 0-1715 pixels NTSC
5	No function		
6	No function		

6-Way DIP switch functions

Notes: DIP2 has no selection when an external reference is present DIP3 and DIP4 have no effect in free run mode

Card edge rotary controls

Control	Function
ADJUST	Used in conjunction with DIP 1 to DIP 4 switches. When the any single DIP switch is DOWN the ADJUST control when rotated will change the current selection or setting.

Rotary control functions

Notes: Rotary controls can access menus and parameter values by clockwise or anti-clockwise rotation.

Reading card edge LEDs

Card edge LEDs may be used in conjunction with status information from any connected remote status panel display or from Statesman if available.

Refer also to the trouble-shooting chapter for more help with solving problems and monitoring status information.

The following table summarises the card edge LED functions and colours:

Name	LED Colour	Function when ON
REF	Green	External reference analogue sync input present. (bottom left LED)
PSU	Green	Good power supply (PSU) rails. (bottom right LED)

Card edge configuration

All DIP switches must remain in the up position apart from for the required selection.

Selecting the reference output colour

Set DIP Switch 1 to Down. This allows the selection of the reference output colour. The choices are black (default) or blue field.

[OP = 'xxxxx']		Rotate ADJUST for reference output colour
Option:	**'Black'**	The analogue output will be black and burst. The serial digital outputs will be digital black.
	'Blue'	The analogue output will be blue field. The serial digital outputs will be digital blue.
Confirmation:		The new selection is active the moment it is displayed

Note: This function will work in both free running mode and with an external reference present.

Selecting the reference output standard

Set DIP Switch 2 to Down. This allows the selection of the reference output standard. The choices are 625-line PAL and 525-line NTSC.

[OP = 'xxxxx']		Rotate ADJUST for reference output standard
Option:	**'625L'**	The reference outputs will be 625-line.
	'525L'	The reference outputs will be 525-line.
	'no ctrl'	An external reference is present.
Confirmation:		The new selection is active the moment it is displayed

Note: This function will only work in free running mode i.e. no external reference present.

Setting the course video delay

Set DIP Switch 3 to Down. This sets the number of lines to delay the reference outputs by with respect to the reference input.

[L Del 'nnn']	Rotate ADJUST control for course reference delay value
Option: 'nnn'	Video delay in lines: where 'nnn' is 0~624 for 625 line systems, or 0~524 for 525 line systems
Confirmation:	The new value is active the moment it is displayed

Note: This function will only work with an external reference present.

Setting the course video delay

Set DIP Switch 4 to Down. This sets the number of pixels to delay the reference outputs by with respect to the reference input.

[S Del 'nnnn']	Rotate ADJUST control for fine reference delay value
Option: 'nnnn'	Video delay in lines: where 'nnn' is 0~1727 for 625 line systems, or 0~1715 for 525 line systems
Confirmation:	The new value is active the moment it is displayed

Note: This function will only work with an external reference present.

4 Using the active front panel

This operational guide assumes that the panel has been setup according to the panel set-up procedure described in the Crystal Vision Control Panel manual.

Note: It is **ESSENTIAL** that the panel set-up procedure is followed and any old or unknown passwords cleared prior to using the panel for the first time.

At power up, the two lines, 20-character screen will display 'Crystal Vision' followed by the firmware version number for the control panel. All eight control panel keys LEDs will illuminate.

The Crystal Vision control panel start up display

'Control Panel' then briefly replaces the version number display.

If the control panel firmware has been updated for Statesman control (version 1.5.0 or higher), Statesman Mode will be entered and the message, 'Press CAL to Exit' will be displayed and the CAL LED will light.

Statesman mode is entered by default

To continue with control panel operation or configuration, press the CAL key once. A second press of the CAL key will return to Statesman control.

The control panel will display the name of the card that first responds to the polling request together with its location number.

The location number consists of the frame number plus the card position in the frame.

Navigating the display

The functions assigned to control panel keys are:

- DEVICE – enters Device menu to select a card or show cards available / enters panel set-up when held down during power up / shows frame status when pressed from Statesman mode
- CAL – enters or leaves Statesman mode / enters panel diagnostics mode when held down during power up / updates the display
- Asterisk – enters board rename menu from the Device menu
- F1 to F4 – soft keys, function assigned within each menu
- HOME – moves the display to the home menu
- ENTER – accept current selection
- Upward arrow – used to move up the menu structure / enter lock panel menu from the Device menu
- Rotary control – shaft encoder used to select options or variable data

Note: Please refer to the Crystal Vision Control Panel manual for details of the Panel Setup, Lock Panel and Diagnostic menus.

Selecting REFGEN

To select a particular card in a frame, press the DEVICE key to go to the Device menu. The top line of the display will show 'Available Cards X', where X is the number of cards that have responded so far to the polling request.

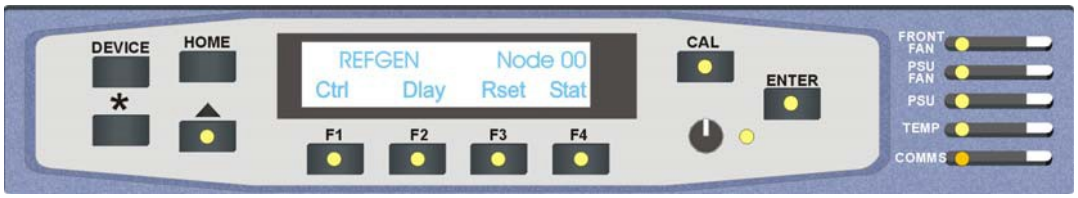
The available cards menu

Rotate the shaft encoder and the bottom row will display the successfully polled cards by name and location or slot number.

In the example above, the card displayed is located in the first frame in slot number 3.

When the desired card is selected press the ENTER key to access that card's HOME menu.

The message shows that a REFGEN has been selected.



The REFGEN home menu

4.1 Updating the display

The values displayed on an active front panel are only updated when an adjustment is made and when changing menu level. If changes occur through the use of card edge controls or other remote control, the text displayed on the active front panel will not be updated immediately. If necessary, use the upward arrow to leave and then re-enter a menu to update the display.

4.2 The REFGEN active panel menu structure

At any time the main top-level menu (Home) is obtained by pressing the HOME key. From the home menu further selections can be made. Active function keys are indicated by illuminated, integrated LEDs.

The main top-level menus for the REFGEN module are obtained by pressing the F1- F4 keys from the HOME menu. Menu keys are illuminated when active and when further menus are available. The top-level menus are:

- Ctrl (Output colour and line standard) – press F1
- Delay (Lines and samples delay) – press F2
- Rset (Board reset) – press F3
- Stat (Status) – press F4

When a sub menu has been selected, further options may be obtained by using the shaft control to scroll through them. Once the desired option has been located, a selection or value change can be made by either toggling the appropriate function key or by selecting and using the shaft control to alter a numerical value. A configuration change or value will be activated as the shaft control is rotated or function button is toggled. The variable being adjusted will appear in brackets. Pressing Enter will fix the new value.

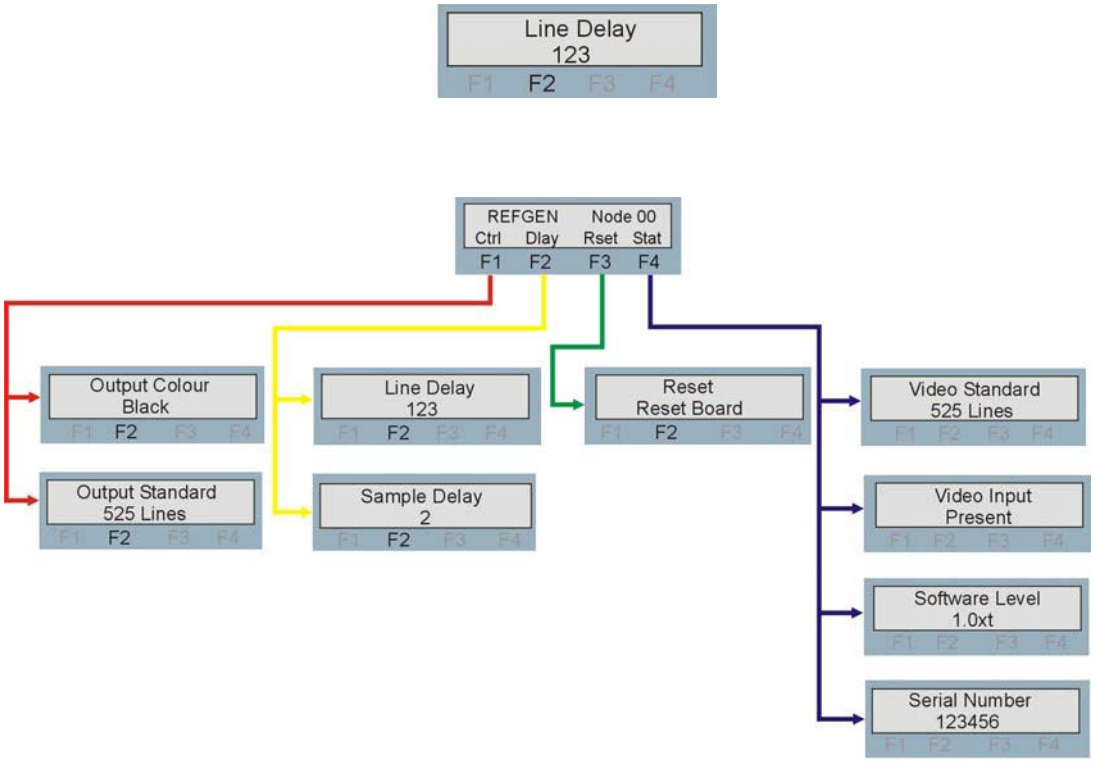
The following chart shows the available REFGEN menus. The actual menus available may vary slightly as software is updated.

Example: to adjust the samples delay setting.

From the Home menu select the Delay (Dlay) sub-menu by pressing F2. Rotate the shaft control to display the Samples Delay sub-menu. Press F2 and note that the second's value now appears in square brackets. Rotating the shaft control will now increment the sample value. Once the required value has

been reached it can be fixed by pressing the Enter button. Pressing Cal at any time will return the value to the default of two samples.

Note: If the value change is not fixed by pressing the Enter button the value will revert to its previous fixed value on exiting from the menu.

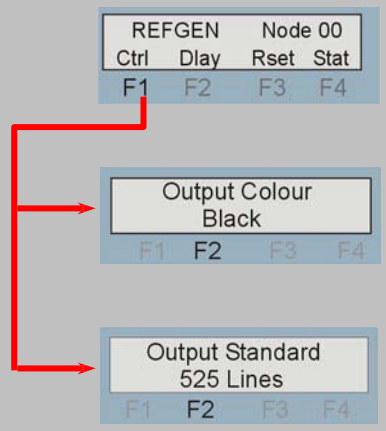


The REFGEN menu tree

Note: Function key LEDs are illuminated when active.

4.3 Control menu

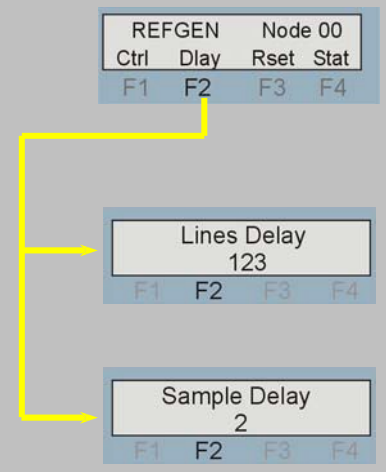
The control menu is where the output colour and line standard can be set.

REFGEN control menu	Description
	To select the control menu, press F1 to activate. Selection is made by rotation of the shaft control. Press Enter to make selection. To select the output colour, press F2 to activate. Selection is made by rotation of the shaft control. Press Enter to make selection. ***Black, Blue.*** To select the output line standard, press F2 to activate. Selection is made by rotation of the shaft control. Press Enter to make selection. ***525 Lines, 625 Lines, IP Pres no control.***

Note: Output line standard is only available in free-running mode.

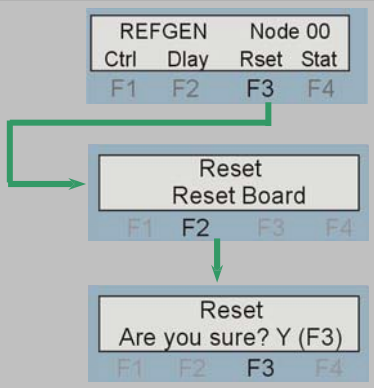
4.4 Adjusting delay time

Pressing F2 from the home menu will bring up the delay menu. The delay menu provides access to the delay settings available when an external reference is present. Rotate the shaft encoder to select each sub-menu and also change parameters.

REFGEN delay menu	Description
	From the Home menu, press F2 to select the delay menu, which is then traversed by rotating the shaft control. Note: Delay settings are only valid if an external reference is present. Rotate shaft encoder to select the Lines delay. Press F2 to select to change the value. Rotate shaft encoder to set the new value. Press enter to accept the new value. NTSC ***0-524,*** PAL ***0-624.*** Rotate shaft encoder to select the Samples delay. Press F2 to select to change the value. Rotate shaft encoder to set the new value. Press enter to accept the new value. NTSC ***0-1715,*** PAL ***0-1725.***

Delay times are variable in single lines and single samples (pixels) to a maximum of two fields. Pressing Cal at any time will return the delay to the default value of zero lines and two samples. If enter is not pressed to accept the changed value, the value will revert to the value last saved.

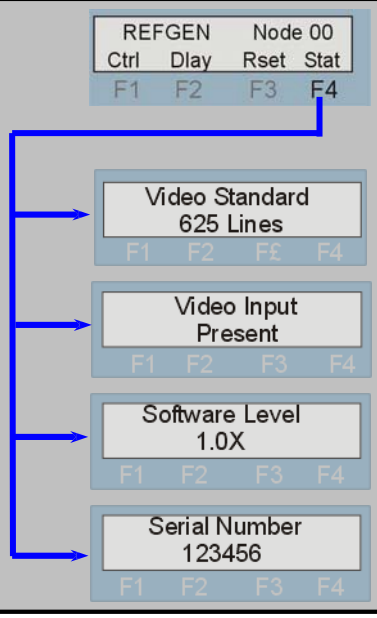
4.5 Board Reset

REFGEN Reset menu	Description
	From the Home menu, press F3 to select the Reset menu. Press F2 to select Reset. Press F3 to Reset.

Parameter	Default value
Lines delay	0-lines
Sample delay	2-samples
Output colour	Black
Output Standard	525 Lines (no external reference present)

4.6 Status

The status menu contains various information about the board and the video input such as standard, presence, serial number and software level.

REFGEN status menu	Description
	From the Home menu, press F4 to select the status menu, which is then traversed by rotating the shaft control. Rotate the shaft control to view the video standard. ***525 Lines, 625 Lines, No Valid Input.*** Rotate the shaft control to view the video-input status. ***Present,*** ***Missing.*** Rotate the shaft control to view the software version. Rotate the shaft control to view the serial number.

5 Statesman

The Crystal Vision Statesman PC control software is designed to control a range of Crystal Vision modules via serial control from a PC. Statesman provides a user friendly means of configuring and operating Crystal Vision modules with the benefit of “see-at-a- glance” status monitoring.

The main Statesman application communicates with each module in a frame through an active control panel. An active panel must be fitted to allow for Statesman control.

Running Statesman for the first time

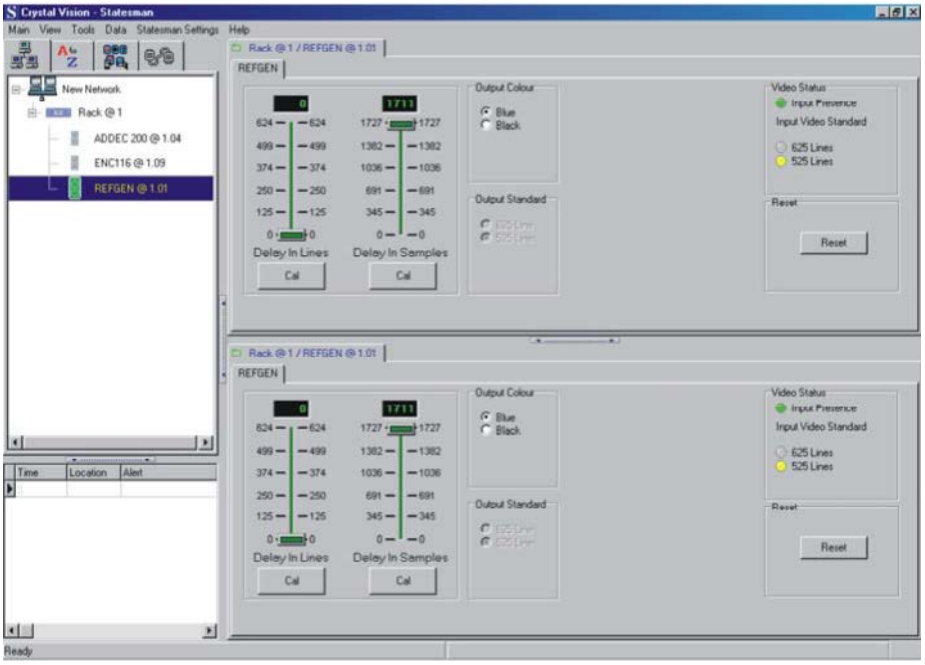
The Statesman PC Control System may be run from the Crystal Vision programs folder via the Start menu or by double clicking on the Crystal Vision.exe file in the installed program directory.

When the program runs it should automatically detect any Statesman compatible modules in the connected frame or frames and display them in the main application left hand explorer-style window.

Open any frame by clicking on the ‘+’ sign or by double clicking on a frame. Installed modules should be shown with module icons. Frame and module icons can be named as desired by right-clicking or using the edit menu.

5.1 Statesman operation

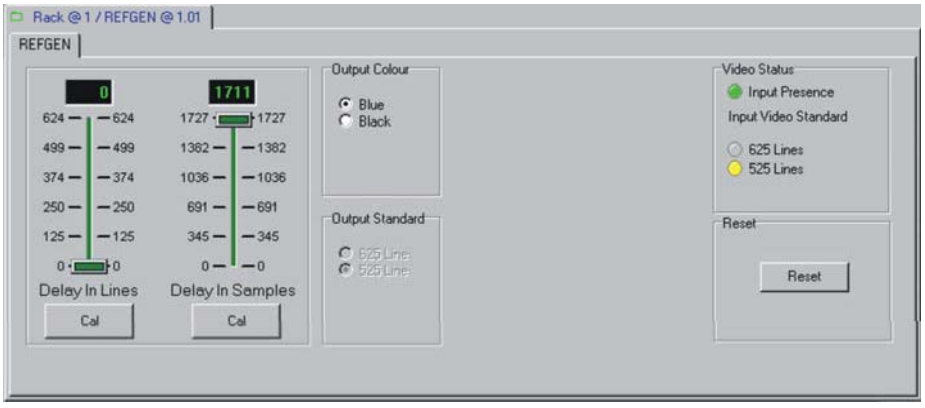
The initial window will show an Explorer style view of the connected frames and modules. Double clicking on a module will enable the display of the main application menus.



The Statesman main application window

The menu display is repeated for convenience to allow dual-control display of modules with duplicate signal paths or to allow two functions to be viewed at the same time.

REFGEN has just a single Statesman menu tab that allows configuration of delay, output standard and output colour. Video status is also presented here.



REFGEN Statesman menu

The REFGEN tab is divided into five group boxes, Delays, Output Colour, Output Standard, Video status and Reset

Delays

The two sliders labelled Lines Delay and Samples Delay may be adjusted to obtain a delay between 2 samples and 2 lines in steps of samples and lines.

Tip. Zero delay can be obtained by setting the sliders for one full frame of delay minus 2 samples

The variable assigned is always shown in the top line of the slider display. It is not possible to assign a delay beyond the range indicated by the slider. If a value less than the minimum or greater than the maximum is assigned, the slider will automatically jump to the minimum or maximum value i.e. the maximum NTSC delay is 524 lines and 1715 samples (pixels)

The delay controls may be a set in several different ways. The slide can be clicked and dragged, the numerical display may be edited or by clicking on the selected position on the scale, the slider will jump to the value corresponding to that position.

The sliders may be reset to their default values at any time by clicking on the Cal button below each slider.

Output Colour

The output colour can be set to either Black or Blue by checking the appropriate radio button.

Output Standard

In free-running mode i.e. no external reference present, the output standard may be selected by checking the appropriate radio button.

Video status

The Input Present indicator will illuminate green when an external reference is present or red if missing.

The video standard of the external reference is automatically detected and is shown by a yellow indicator. The reference output will automatically follow the reference input irrespective of the output standard selection.

Further status information is provided by the Statesman logging and alarms feature, which is described in more detail in the Statesman manual.

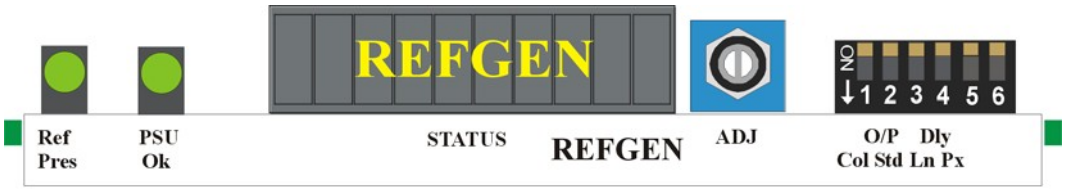
Reset

Selecting reset will return variables to their default values. The output standard will depend on the presence of an input.

6 Trouble shooting

Card edge monitoring

The card edge may be used to perform simple trouble shooting. The Statesman PC control system can be used for more comprehensive trouble shooting.



The card edge LEDs will indicate a fault in the on-board power supplies, missing external reference or a misplaced switch.

Basic fault finding guide

The Power LEDs are not illuminated

Check that the frame PSU is functioning – refer to the appropriate frame manual for detailed information

There is no video output

Check that any cabling is intact

The video output exhibits jitter

Check that the input signal stability is within normal limits and that the maximum cable length has not been exceeded

The card no longer responds to card edge or remote controller

Check that the card is seated correctly and that the Power OK

LED is lit Check any active control panel cabling

Check if the control panel can control another card in the same rack

If necessary re-set the card by simply removing it from the rack whilst powered and re-inserting it after a few seconds. It is safe to re-insert the card whilst the rack is powered

Check that the remote/local lever is correctly set for the mode of operation.

7 Specification

General	Dimensions:	100mm x 266 mm module with DIN 41612 connector
	Weight:	170g
	Power consumption:	3.5 W
Reference input	Video:	Analogue Black and Burst, mixed syncs or video Amplitude of syncs 100mV to 4V
		PCB link selects 75 ohm termination or high impedance with loop-through
Outputs	SDI:	Maximum of 4 reclocked SDI outputs to EBU Tech 3267-E and SMPTE-259M
		Will drive >200m Belden 8281 or equivalent
	Composite:	Maximum of 4 PAL/NTSC analogue outputs
Processing	Delay:	Output reference delayed to external reference input from 2 µs to 2 fields
Control	Local/remote control panel:	Multi-drop 19200 Baud, 8 bits, no parity – control from local frame active front panel / remote panel
	Statesman:	RS422 control via 9-way Remote 2 connector on 4U, 2U and 1U frames