# SYN102

## SDI Synchroniser

# USER MANUAL

Crystal Vision

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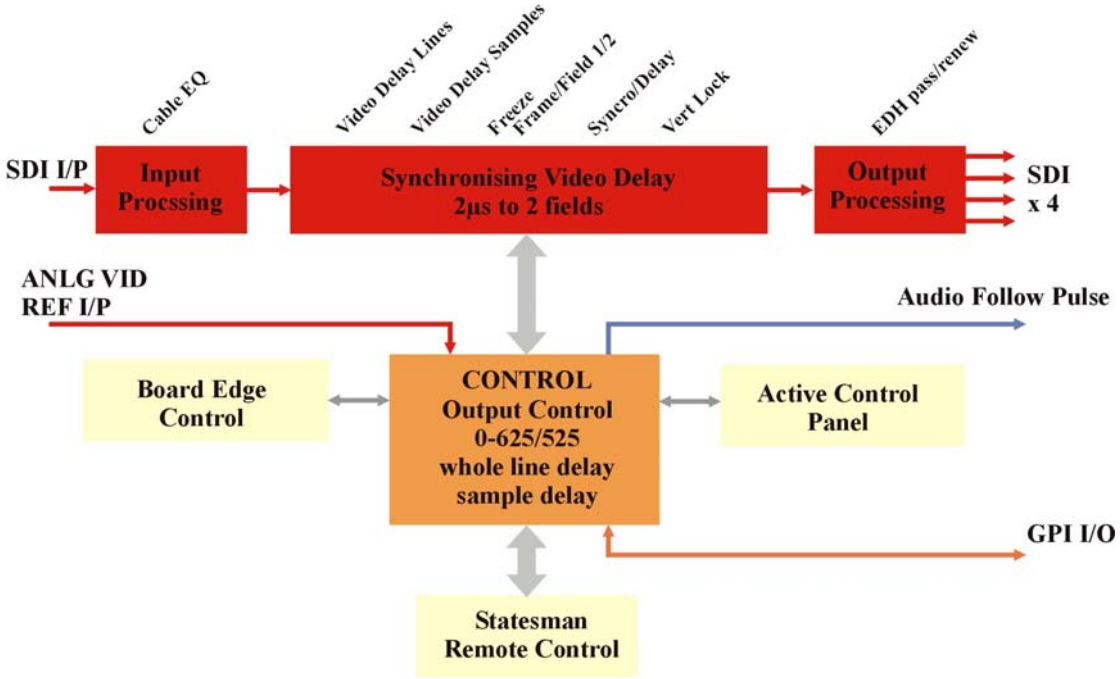
Revision8. Termination link information amended. Page 27. 15-05-09

# 1 Introduction

The SYN102 is a serial digital synchroniser / delay module with up to four SDI outputs, an audio follow output, and an input for an external analogue reference. It has two fields of output timing adjustment and a short minimum delay of 2µs.

There are two operational modes: synchroniser and delay line. In synchroniser mode it will automatically correct the incoming frame rate and any delay by taking its timing from the analogue reference. Where input and output frame rates are locked together it can synchronise sources containing embedded audio.

Delay line mode is ideal when the frame rate is correct but the source has been delayed by processing.




*SYN102 video synchroniser*

The serial digital output has virtually no output jitter (less than 500ps at 1KHz), both when used as a synchroniser (with a stable analogue reference) and when used as a delay line without a reference. Only in delay mode can jitter on the SDI input affect the output, but even then all high frequency jitter is removed by an internal phase-locked-loop.

When using 625-line video, picture disturbances on untimed input cuts are avoided by waiting until line 23 to re-lock. The module regenerates all the video sync information in its output data stream and will always produce legal video. It will pass ancillary data sync word sequences, but not isolated sync word values.

There is a choice of black, or field/frame freeze on input failure.

The main features are as follows:

- Frame or line synchroniser or use as a fixed delay line
- Full vertical and horizontal adjustment from 0 to 2 fields in any mode
- Fast lock after up-stream switch
- Selectable black or freeze on input failure
- EDH generation and error detection
- Digital green suppression
- Audio follow control output
- Passes embedded audio (when output locked to input)
- Removes SDI jitter
- Flexible control

SYN102 is a 100mm x 266mm module, which fits in the three standard frames and can be integrated with any boards from the company's full product range. 12 modules fit in 2U, 6 in 1U or 2 in desktop box. It uses the RM01, RM02 and RM18 rear connectors.

**Note:** The Audio Follow Video pulse output, the duration of which reflects the current video delay, is designed to be used with an external audio delay processor.

## Synchroniser mode

In Syncro (synchroniser) mode the unit takes its timing from the analogue external reference and will automatically synchronise sources with or without embedded audio between 0 and 2 fields. Synchroniser mode is ideal for external sources that are not timed to station references such as satellite or remote contribution feeds.

The timing can be adjusted through an entire frame using horizontal (fine) and vertical (line increments) settings. When both settings are zero the serial output will be timed to the analogue reference as per ITU-R BT.601. Increasing the vertical setting will delay the output relative to the reference in increments of one video line. Increasing the horizontal setting will increase this delay in samples or increments of 37ns. When the horizontal setting reaches the end of a video line it wraps round and the vertical setting is changed to provide continuous adjustment. In synchroniser mode the delay through the board depends on this adjustment and the relative timing of the serial input and the analogue reference.

## Delay mode

In Delay mode, timing is derived only from the SDI input. Typical applications are where a source passes through a processor such as a DVE, chroma keyer or standards converter where the delay can be a few microseconds, multiple lines or up to two fields.

The timing can be adjusted through an entire frame using the vertical and horizontal settings. When both settings are at their lowest the board will be set for the minimum delay (input to output) of approximately 1.9 µs. Increasing the vertical setting will increase this delay in increments of one video line. Increasing the horizontal setting will increase the delay in increments of 37ns. When the horizontal setting reaches the end of a video line it wraps round and the vertical setting is changed to provide continuous adjustment. The maximum setting of both controls will provide a delay of one frame plus approximately 1.9 µs.

In either mode the video delay remains fully adjustable over two complete fields. This allows the output of the SYN102 to be timed into any edit suite irrespective of the timing of the black and burst reference used in synchroniser mode.

## Analogue timing reference

The SYN102 provides a synchronisation function that allows the digital output to be timed to an analogue reference. Video or composite syncs can be used although composite black and burst plus 300mV syncs into 75 Ohm as per EBU N14-1988 is preferred. The analogue sync input can be looped through the board or terminated depending on a jumper link setting.

## Audio follow pulse

To allow an audio delay to track the delay through the SYN102, a TTL level pulse is provided. This pulse is output every frame. The length of the pulse (the time between the rising and falling edges) is the same as the delay through the store on the SYN102.

## Freezing the picture

The type of picture freeze used when the freeze command is given may be selected from frame, field 1 and field 2. If there is movement between both fields a frame freeze may show movement judder. A field freeze works by repeating the same field to produce a synthetic frame of video, without movement judder. However a field freeze is more likely to show jagged edges on near horizontal lines.

## SDI loss behaviour

Automatic freeze is available when input fails through loss of signal. The user can specify to show the last good field repeated before picture failure, the whole frame in which failure happened (useful for diagnostic purposes) or a black screen.

## Vertical lock mode

With 525 line sources the re-lock is timed from the field flag to accommodate different lengths of vertical blanking. Normally when operating with 625 line sources SYN102 re-locks on the input at the start of active video. This means that if switch occurs between untimed sources there will be no disturbance in the active video if both the sources are in vertical blanking when the switch occurs. To allow operation with 625 line sources that have non-compliant vertical blanking lengths, it is possible to select a re-lock timed from the field flag.

## Changing EDH options

Normally the EDH is passed through unchanged to the output. With card-edge lever 3 in the DOWN position, EDH data on input can be overwritten with fresh EDH data. The exact way new EDH data is generated and the behaviour of the card-edge EDH LEDs is set by jumpers J3 and J4. Please refer to the Card edge operation and Installation chapters for further information.

# 2 Statesman

The Crystal Vision Statesman PC control software is designed to control a range of Crystal Vision modules via serial control from a PC.

The main Statesman application communicates with each module in a frame through an active control panel with or without a LCD display. Statesman will not be able to detect modules used in a frame with only a passive front panel.

## 2.1 Installing Statesman

### Minimum pre-requisites:

- A PC running either Windows 2000 or Windows XP is recommended
- A parallel port dongle for Statesman PCs with attached Crystal Vision frames
- An RS422 serial connection from the host PC to the Control/422 RJ45 or Remote/RMT 2 connector on Crystal Vision frames
- An active or Statesman enabled control panel MUST be fitted to the frame with version 1.63 or above firmware – if it is an Indigo frame the firmware must be V1.04 or above
- An optional RS422 to RS232 converter if the PC has no RS422 ports

### Installing Statesman

- Refer to the readme and/or help file on the CD before proceeding
- To view all application windows, set graphics resolution to at least 1024 x 768
- Remove any previous version of the Statesman software using the Add/Remove Programs application in the Windows Control Panel
- Ensure that the Statesman dongle is fitted to the parallel port of the host PC
- Insert the Statesman CD and the installation should start immediately – if it does not, run the setup.exe file on the CD
- Obey any installation program prompts and restart the PC when prompted

### 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 will require licence information and an administrator name and password. It will also need to know which computer port is being used to connect to a Crystal Vision frame(s).

**Note:** For further details of Statesman configuration please refer to the Statesman manual.

## 2.2 Statesman operation

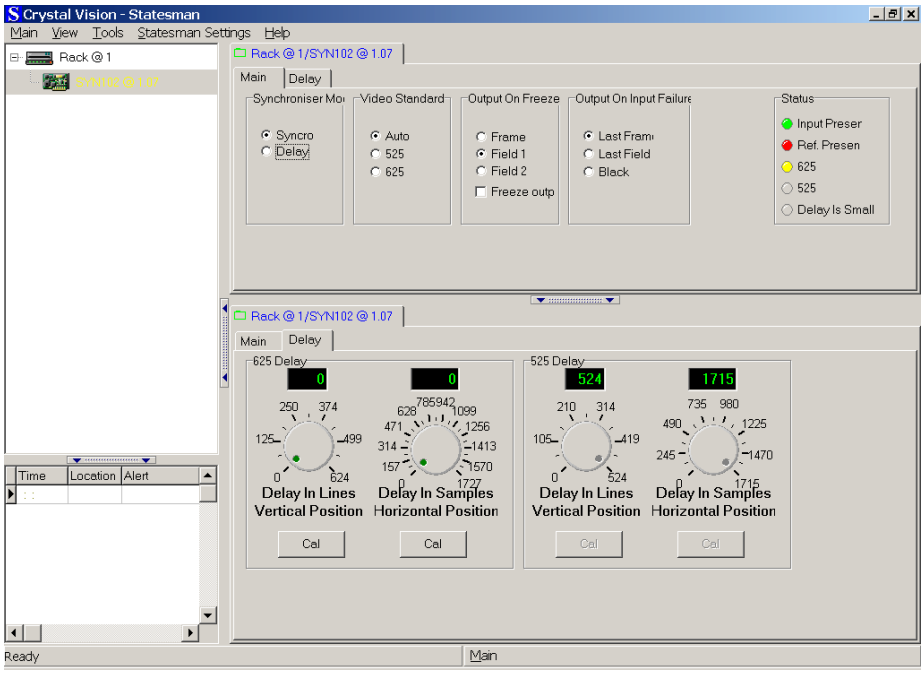
Once Statesman is configured it should automatically detect any statesman compatible modules in the connected frame or frames and display them in the main application left hand explorer-style window.

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 and choosing rename.

To aid user recognition of module and frame status quickly, the following colour and size coding is used:

- A module is shown present by full colour and absent by greyed colour
- A module is shown open by large icon size and closed by small icon
- A module is the source of an active alarm if red and not alarmed if green

Double-clicking on a module will enable the display of the main application menus.




*Statesman main application window*

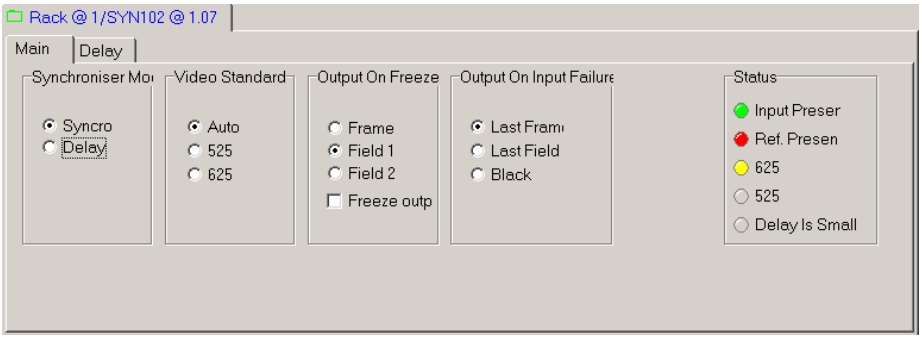
The two large control panes shown in the upper and lower halves of the window may display different menus for the same card, or controls for different cards. Click on the horizontal button-bar between the two panes to close the lower plane or drag the button to vary the size of the panes.

**Note:** For further details of Statesman configuration and operation please refer to the Statesman manual.

## Selecting synchroniser or delay mode

The SYN102 may be used in either Syncro (synchroniser) or Delay mode.

To select the desired mode check either the Syncro for synchroniser or Delay for delay mode.




*SYN102 main properties*

In Synchroniser mode the unit takes its timing from the analogue external reference and will automatically synchronise sources between 0 and 2 fields.

In Delay mode, timing is derived only from the SDI input.

## Freezing the video

The video signal may be frozen as a full fame (two fields) or single field. The field used may be field 1 or field 2. Make the selection by checking the Frame, Field 1 or Field 2 box, then check the Freeze On box to freeze the input. The selection can be made before or after the store is frozen.

## Loss of input behaviour

The video display options when the video input is lost may be selected from the following:

| **Loss of video option** | Video behaviour |
|---|---|
| **Black** | Output goes immediately to black |
| **Last field** | Last good field is repeated to produce a frame output |
| **Last frame** | Last frame including video at point of failure |

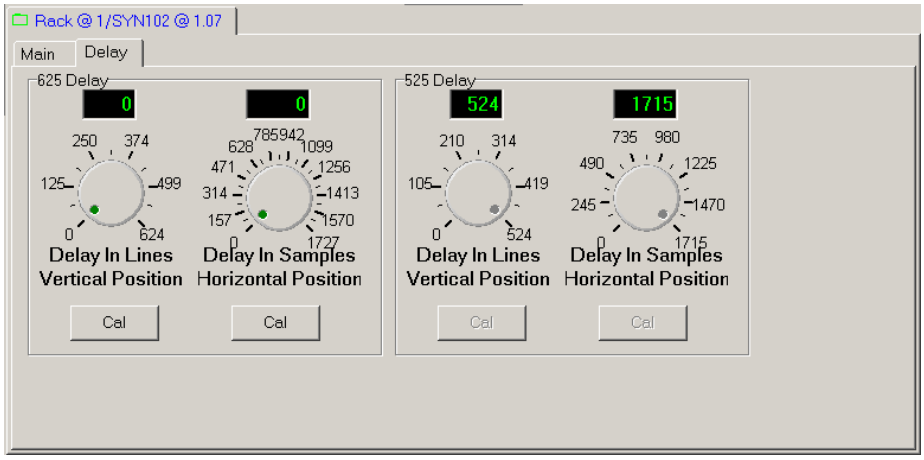
The selection can be made before or after the input is lost.

## Vertical lock mode

Please refer to the Card edge operation and Installation chapters for further details.

## Adjusting the video delay

The video delay may be adjusted from 0 to 2 fields for both 525 and 625 inputs in either Syncro or Delay mode.




*SYN102 main properties*

Use the Delay in Lines and Delay in Samples controls to set the delay.

| Delay control | 625 range | 525 range | Description |
|---|---|---|---|
| **Delay in Lines** | 0 to 624 | 0 to 524 | Number of lines of delay in Delay Mode or vertical timing offset with respect to reference in Syncro mode |
| **Delay in Samples** | 0 to 1727 | 0 to 1715 | Fine delay or horizontal offset in pixels in Delay Mode or fine vertical timing offset with respect to reference in Syncro mode |

**Note:** The settings for 525 and 625 are retained when input standards change.
In delay mode, the minimum delay setting is 2 samples.

# 3 Using the active control panel

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

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

At power up, the two line 20-character screen will display ‘Crystal Vision’ followed by the firmware version number for the control panel. All eight control panel key 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, 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*

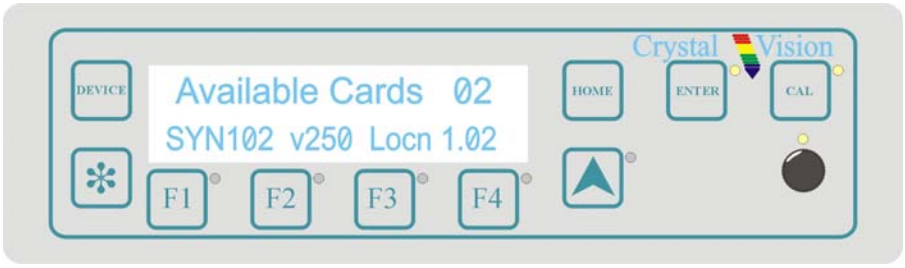
To continue with control panel operation or configuration, press the ‘CAL’ key once. A second press of the ‘CAL’ key will return to Statesman control.

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.

## Selecting the SYN102

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.

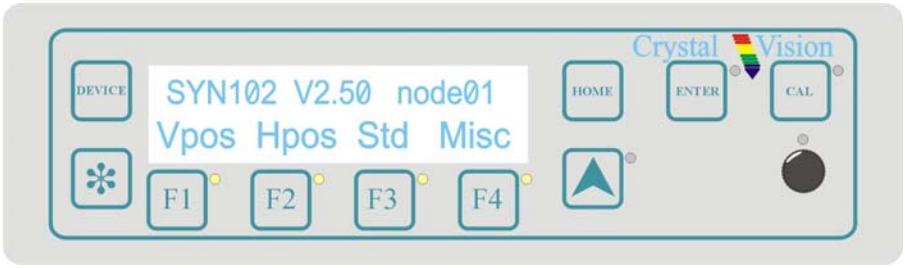



*Control panel showing available cards*

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 2.

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




*SYN102 home menu*

**Note:** In all current Crystal Vision frames the node address is coded into the backplane giving a unique node address for each slot. The node address is typically one less than the location number. Refer to the Frame manual for further information on using node addresses.

## 3.1 Navigating the display

The functions assigned to control panel keys are dependent on the card selected for control, and the panel mode. The following list illustrates the functions when controlling the SYN102:

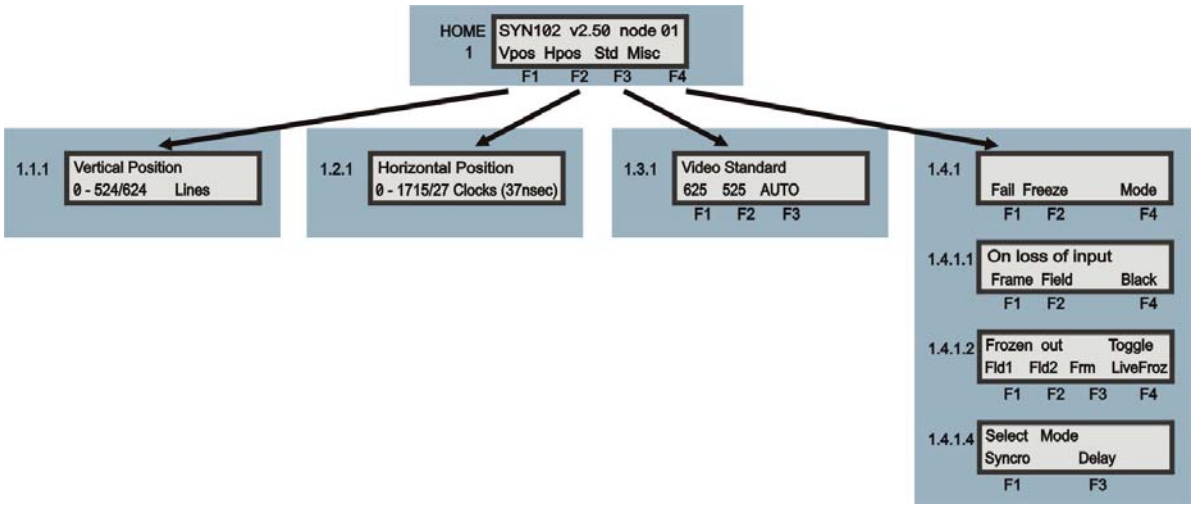
- DEVICE – enters Device menu to select a card or card to control / enter Panel setup when held down during power up / shows frame status when pressed from Statesman mode
- CAL – Enter or leave Statesman mode / enter Panel Diagnostics mode when held down during power up
- Asterisk – enters Board Rename menu from the Device menu
- F1 to F4 – soft keys, function assigned within each menu
- HOME – moves the display to the Home menu
- ENTER – press to enable or disable data entry mode or accept device 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 change assigned data values

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

# 3.2 The SYN102 active panel menu structure

The main top-level menus for the SYN102 module are obtained by pressing the F1 to F4 keys from the HOME menu. Menu keys are illuminated when active and when further menus are available.

The following chart shows the available menus.




*The SYN102 control panel menu tree*

## Menu numbering scheme

This manual uses a simple menu numbering convention based on the sequence of keys required to reach each menu from the top level Home menu. For example, menu 1.4.1.2 is reached from the Home menu by pressing F4, then pressing F2.

## Sub-menus and data entry:

In general, press the 'up' key to return to a sub-menu and press the 'home' key to return to the 'home' menu. The shaft encoder is used to change data values. There is no need to press the ENTER key. An asterisk is used to indicate the active parameter.

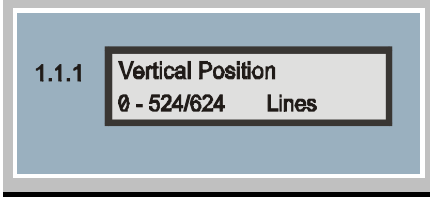
**Notes:** Function keys and shaft encoder LEDs are illuminated when active.

# 3.3 Using the timing menus

## Vertical position timing

Press F1 from the Home menu to display the Vpos (vertical position) menu.

The Vertical Position menu sets the number of whole lines the video is to be delayed in Delay Mode, or the vertical timing offset with respect to the reference input in Syncro Mode.

| Vpos | Adjust video timing in whole lines |
|---|---|
|  | The adjustment is made using the front panel shaft encoder. The adjustment range is one video frame. When the maximum adjustment is reached the value wraps round to zero.<br><br>Press the 'up' or 'home' key to return to the 'home' menu. |

**Note:** There are separate vertical timing adjustments for 625 and 525 line operation. Each is retained during operation in the other video standard.
In Delay mode the minimum total delay is 2 samples. If the horizontal delay setting is 0 or 1 sample, it will not be possible to set the vertical delay to 0 lines.

## Horizontal position timing

Press F2 from the Home menu to display the Hpos (horizontal position) menu.

The Horizontal Position menu sets the number of pixels the video is to be delayed in Delay mode, or the vertical timing offset with respect to the reference input in Syncro mode.

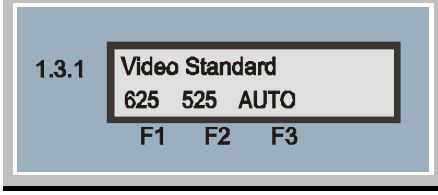
| Hpos | Adjust video timing in pixels |
|---|---|
| | The adjustment, in increments of 37ns, is made using the front panel shaft encoder.<br>When the maximum adjustment of one video line is reached the value wraps round to zero and the Vpos adjustment is modified.<br><br>Press the 'up' or 'home' key to return to the 'home' menu. |

**Note:** There are separate horizontal timing adjustments for 625 and 525 line operation. Each is retained during operation in the other video standard.
In Delay mode the minimum total delay is 2 samples. If the vertical delay setting is 0 lines, it will not be possible to set the horizontal delay to 0 or 1 samples.

## Selecting the video standard

Press F3 from the home menu to display the Std (video standard) menu.

The available selections are ‘625’, ‘525’, and ‘Auto’. Selecting ‘625’ or ‘525’ will force the unit to operate in the 625 or 525 line video standard respectively. Selecting ‘Auto’ allows the unit to auto-select the standard on the basis of the timing reference signal. An asterisk indicates the selected option.

| Std | Select video standard |
|---|---|
|  | Press F1 for 625, F2 for 525 and F3 for AUTO.<br><br>Press the ‘up’ or ‘home’ key to return to the ‘home’ menu. |

**Note:** There are separate timing adjustments for 625 and 525 line operation. Each is retained during operation in the other video standard.

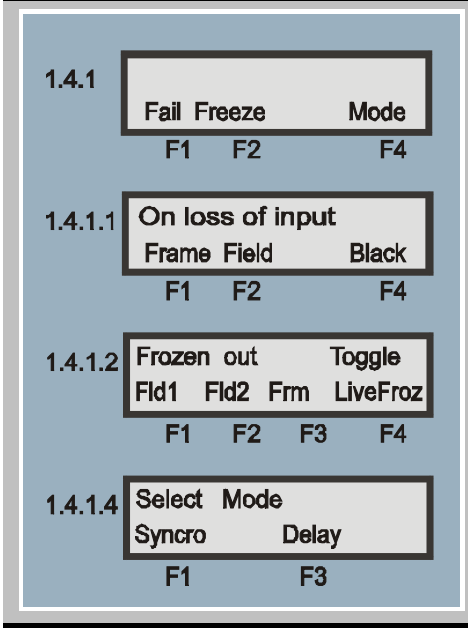
## Selecting system options

Selecting the ‘Misc’ menu to choose three further sub-menus:

Fail - choose frozen field, frame or black in the event of input signal failure

Freeze – choose freeze type

Mode - Delay or Synchro

| SYN102 Miscellaneous menu | Description |
|---|---|
|  | Select F1 for the Fail menu, F2 for the Freeze menu and F4 for the Mode menu.<br>Press the ‘home’ key to return to the ‘home’ menu.<br><br>Select F1, ‘Frame’ to output a frozen frame<br>Select F2, ‘Field’ to output the last good field received<br>Select F4, ‘Black’ to output digital black<br>Press the ‘up’ key to return to the ‘misc’ menu<br><br>Select F1, ‘Fld1’ to repeat field 1<br>Select F2, ‘Fld2’ to repeat field 2<br>Select F3, ‘Frm’to repeat last good frame<br>Select F4, ‘Live/Froz’ to toggle live/frozen status<br>Press the ‘up’ key to return to the ‘misc’ menu<br><br>Select F1 for Syncro mode<br>Select F3 for Delay mode<br>Press the ‘up’ key to return to the ‘misc’ menu<br>Press the ‘home’ key to return to the ‘home’ menu. |

## Selecting SDI loss behaviour

The SYN102 behaviour when the SDI input is lost may be selected to cut to black, freeze or hold a freeze for a about a second before outputting a black screen.

### *Fail menu*

If 'Frame' is selected the output will be a frozen frame up to and including the point of failure. If 'Field' is selected the output will be the last good field received, frozen and output twice to make up a full frozen frame. If 'Black' is selected the output will be a digital black. An asterisk indicates the selected option. In any event the output will continue to be a legal video signal. The freeze type can be selected before or after the input is lost.

### *Freeze menu*

Select the 'Freeze' sub-menu to choose the output when the synchroniser output is frozen. The available selections are 'Fld1', 'Fld2', and 'Frm'. If there is movement between two consecutive fields a frame freeze may show movement judder.

A field freeze works by repeating the same field to produce a synthetic frame of video, without movement judder. However a field freeze is more likely to show jagged edges on near horizontal lines.

If 'Fld1' is selected, field1 of the frozen frame will be output twice. If 'Fld2' is selected, field2 of the frozen frame will be output twice. If 'Frm' is selected the entire frozen frame is output. An asterisk indicates the selected option that can be changed after the freeze command.

An additional control is provided in this menu to switch the unit between live and frozen video. The F4 key can be used to switch between 'Live' and 'Froz', the board will output live and frozen video respectively. The unit will always power up in 'Live' mode.

The freeze type can be selected before or after the input is frozen.

**Note:** Freeze may be set to ON by manual control from edge of PCB, remote control panel, Statesman control, or by asserting a GPI "Assert Freeze" input low.

## Selecting the operating mode

The SYN102 has two modes of operation, synchroniser and delay line.

Selecting 'Syncro' configures the board as a synchroniser. The output video is timed relative to the analogue reference. If the input and reference are running through whole frames will be dropped or repeated as necessary. Selecting 'Delay' configures the board as a delay line. The output video is timed relative to the serial input. An asterisk indicates the selected option.

If the analogue reference is absent the board will automatically default to delay mode. If there is no analogue reference or serial input the board will freerun to a factory set clock.

## Selecting the vertical lock mode

This can only be accessed from the card edge. Please refer to the Card edge operation and Installation chapters for further details.

# 4 Card edge operation

The hinged front panel of the case reveals user control of the card, LED indication of card status and an alphanumeric display.

*The SYN102 front edge view*

## 4.1 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 |
|---|---|---|
| **+5V** | Green | Illuminates when the board 5V logic supply is present |
| **+3V** | Green | Illuminates when the board 3.3V logic supply is present |
| **Win** | Yellow | Illuminates when the delay through the store is less than approximately 1.5ms |
| **Frz** | Yellow | Illuminates when the board output has been set to frozen |
| **In** | Green | Illuminates when the serial digital input is present |
| **Ref** | Green | Illuminates when the board output is timed to the analogue reference input |
| **EDH0** | Red | EDH status flag 0. The meaning can be configured by jumper links |
| **EDH1** | Red | EDH status flag 1. The meaning can be configured by jumper links |

# 4.2 Card edge switch settings

The 4-way piano switch allows the V LOCK, EDH and manual freeze options to be selected.

| Lever | Up | Down |
|---|---|---|
| **1 V Lock (625 only)** | With a 625 line input the framestore relocks vertically based on the SDI V-blank flag. This allows switching on line 6 without disturbance to the active picture | With a 625 line input the framestore relocks vertically based on the SDI field flag. This allows operation with equipment that does not provide correct V-blank flag timing. |
| **2** | Not used, leave up. | |
| **3 (EDH)** | EDH data in input is passed through to output. | EDH data on input will be overwritten - output will contain fresh EDH data generated in the SYN102. EDH data is removed before the flags are extracted. |
| **4 Frz** | Output is live video. | Output is frozen at the end of the next frame. |

## Changing the vertical lock mode

*625 inputs*

Normally when operating with 625 line sources SYN102 re-locks on the input at the start of active video. This means that if switch occurs between untimed sources there will be no disturbance in the active video if both the sources are in vertical blanking when the switch occurs. To allow operation with 625 line sources that have non-compliant vertical blanking lengths, it is possible to select a re-lock timed from the field flag.

Set lever 1 in the UP position to relock vertically using the SDI V-blank flag.

Set lever 1 in the DOWN position to relock vertically using the SDI field flag.

*525 inputs*

With 525 line sources the re-lock is always timed from the field flag to accommodate different lengths of vertical blanking.

## Changing EDH options

Normally the EDH is passed through unchanged to the output. With lever 3 in the DOWN position, EDH data on input can be overwritten with fresh EDH data. The exact way new EDH data is generated and the behaviour of the card-edge EDH LEDs is set by jumpers J3 and J4. Please refer to the Installation chapter for further information.

## Using the manual freeze control

Card-edge switch lever 4 can be used to force a manual freeze. The type of freeze will be determined by the configuration currently active.

To freeze the output of the synchroniser place lever 4 in the DOWN position.

# 4.3 Card edge configuration

Menu order assumes clockwise rotation from the initial 'SYN102 v250' display.

To access the card edge menu system proceed as follows:

- Scroll through and select desired menu by rotating the SELECT control
- The current value assigned will be displayed
- To change the assigned value, rotate the ADJUST control

**Notes:** Rotary controls can change data values by clockwise or anti-clockwise rotation. The new value will be applied as soon as it is changed.

## Vertical position timing

Choose position 1 using the 'select' switch to display the Vpos (vertical position) menu.

| Select | Display Text | Description |
|---|---|---|
| **1** | Vpos 'n' | The Vertical Position menu sets the number of whole lines the video is to be delayed in Delay Mode, or the vertical timing offset with respect to the reference input in Syncro Mode. Use the 'adjust' control to set the value 'n' from 0 to 624/524.<br>The adjustment range is one video frame in increments of one video line. When the maximum adjustment is reached the value wraps round to zero.<br>There are separate Vpos adjustments for 625 and 525 line operation. Each is retained during operation in the other video standard. |

## Horizontal position timing

Choose position 2 using the 'select' switch to display the Hpos (horizontal position) menu.

| Select | Display Text | Description |
|---|---|---|
| **2** | Hpos 'n' | The Horizontal Position menu sets the number of pixels the video is to be delayed in Delay Mode, or the vertical timing offset with respect to the reference input in Syncro Mode. Use the 'adjust' control to set the value 'n' from 0 to 1715/1725.<br>The adjustment range is one video line in increments of 37ns. When the maximum adjustment is reached the value wraps round to zero and the Vpos adjustment is modified.<br>There are separate Hpos adjustments for 625 and 525 line operation. Each is retained during operation in the other video standard. |

*Delay mode timing interactions*

If the horizontal delay is less than two samples then the vertical delay cannot be set to zero. If the vertical delay is zero then the horizontal delay cannot be set to less than two samples.

## Selecting the freeze type

Choose position 3 using the 'select' switch to display the Freeze (horizontal position) menu.

| Select | Display Text | Description |
|---|---|---|
| **3** | Freeze F'n' | The 'adjust' shaft encoder can be used to select the output when the store is frozen. The selections are:<br>Frm The output is the frozen frame<br>Fd1 The output is field 1 of the frame output twice<br>Fd2 The output is field 2 of the frame output twice<br>The selection can be made before or after the store is frozen. |

## Selecting the input fail mode

Choose position 4 using the 'select' switch to display the 'No in' (No input) menu.

| Select | Display Text | Description |
|---|---|---|
| **4** | No in 'n' | The 'adjust' shaft encoder can be used to select the output if the SDI input is lost. The selections are:<br>Frm The output is the frame in which the input was lost<br>Fld The output is the last good field received before the input was lost, output twice<br>Blk The output is digital black.<br>The selection can be made before or after the input is lost. |

## Selecting the video standard

Choose position 5 using the 'select' switch to display the 'Std' (Standard) menu.

| Select | Display Text | Description |
|---|---|---|
| **5** | Std 525/625/Auto | The shaft encoder can be used to adjust the video standard mode.<br>The selections are:<br>Manual 525 - The board will operate in 525-line mode.<br>Manual 625 - The board will operate in 625-line mode.<br>Auto - The board will automatically switch to the video standard present on the timing reference. The standard being used is indicated on the text display. |

## Selecting the operating mode

Choose position 6 using the 'select' switch to display the 'S/D' (Syncro/Delay) menu.

| Select | Display Text | Description |
|---|---|---|
| **6** | S/D Syncro/Delay | The shaft encoder can be used to select the operating mode.<br>The selections are:<br>Delay - The board operates as a delay line and takes its timing reference from the serial digital input.<br>Syncro - The board operates as a synchroniser and takes its timing reference from the analogue sync input.<br>If the analogue sync reference is lost the board will automatically switch to delay mode. If there is no analogue reference or serial input the board will freerun to a factory set clock. |

## Recalling factory defaults

Choose position 7 using the 'select' switch to display the board name and software version and then power cycle the module.

| Select | Display Text | Description |
|---|---|---|
| **7** | DEFAULTS?<br>(Displayed after power cycle) | To recall factory defaults, set SELECT position 7 (display shows board name and firmware) and either power cycle the frame or pull the module, wait several seconds and then reinsert it. The display will read SYN102 0 then change to DEFAULTS? Toggle four-way switch level 1 DOWN and then UP to initiate the reset, or rotate the select switch away from position 7 to abort. |

The following table shows the default values for each parameter affected:

| Parameter | Default value |
|---|---|
| **Fail Mode** | Last good field |
| **Syncro Mode** | Syncro |
| **Freeze** | Live |
| **Freeze Mode** | Field 1 |
| **Video Standard** | AUTO |
| **Delay In Lines** | 0 |
| **Delay in Samples** | 2 - minimum through board |

**Warning:** On no account should the SELECT switch be left in position 7 during normal operation.

## Viewing the firmware issue no

Choose positions 0 or 7-F using the ‘select’ switch to display the board name and software version. DO NOT LEAVE THE SELECT SWITCH IN POSITION 7.

| Select | Display Text | Description |
|---|---|---|
| **0** | Syn102v250 | The display will show the board name and software version. |

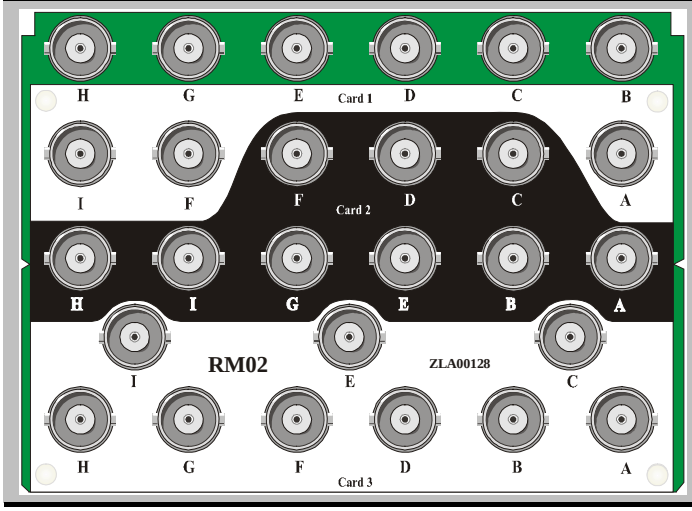
# 5 Installation

The SYN102 video frame/line synchroniser with tracking audio delay is a single height module, which fits into all Crystal Vision rack frames. All modules can be plugged in and removed while the frame is powered without damage.

## 5.1 Rear modules and signal I/O

The 2U frame takes up to 12 single height Crystal Vision modules, 6 single height modules fit in the 1U frame and 2 single height modules fit in the 1U desk-top box.

### RM02

| RM02 fits in a 2U frame | Description |
|---|---|
|  | **RM02 (ZLA00128 artwork)**<br>• 9 modules per 2U frame<br>• 3 modules per rear connector<br>• 9 connections available<br>• Card 1 fits in slots 1, 5 and 9<br>• Card 2 fits in slots 2, 6 and 10<br>• Card 3 fits in slots 4, 8 and 12<br>• No card fits in 3, 7 or 11 |

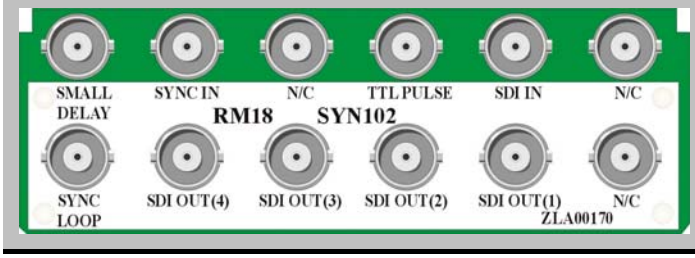
| BNC – ZLA00110 | BNC – ZLA00128 | Signal |
|---|---|---|
| **IN** | **A** | SDI In |
| **1** | **B** | Audio follow pulse output |
| **2** | **C** | SDI output 1 |
| **3** | **D** | SDI output 2 |
| **4** | **E** | SDI output 3 |
| **5** | **F** | Analogue reference sync loop through |
| **6** | **G** | Not used |
| **7** | **H** | Logic level signal, high when delay through the store is less than 1.5ms |
| **8/IN2** | **I** | Analogue reference sync input |

## RM01

| RM01 fits in all current frames | Description |
|---|---|
| | **RM01**<br>• 12 modules per 2U frame, 6 per 1U frame & 2 per 1U desk top box<br>• All frame slots can be used |

| BNC | Signal |
|---|---|
| **SYNC LOOP** | Analogue reference sync loop through |
| **SDI IN** | SDI In |
| **DLY PLSE OUT** | Delay pulse out |
| **SDI OUT 1** | SDI output 1 |
| **SDI OUT 2** | SDI output 2 |
| **SYNC IN** | Analogue reference sync input |

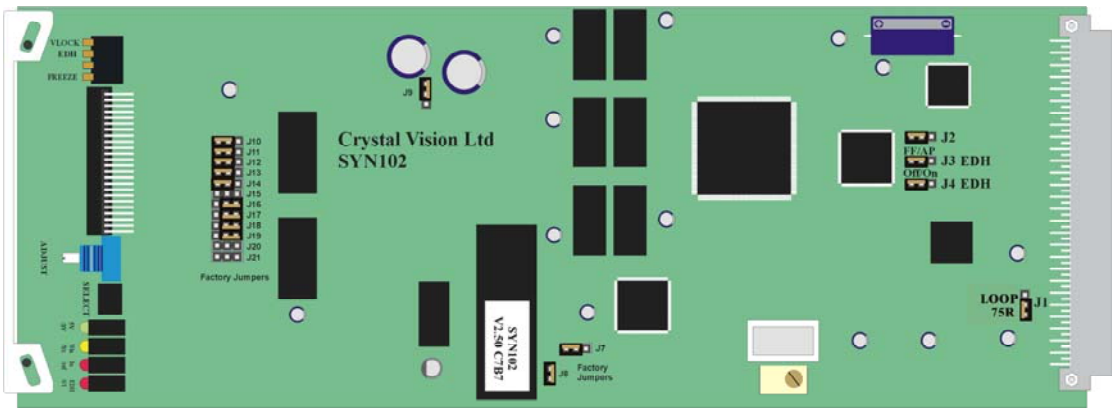
## RM18

| RM18 fits in all current frames | Description |
|---|---|
|  | **RM18 (ZLA00170 artwork)**<br>• 6 modules per 2U frame, 3 per 1U frame, 1 per 1U desk top box<br>• 1 module per rear connector<br>• 10 connections available<br>• Card fits in upper slot<br>• No card fits in lower slot |

| BNC – ZLA00170 | Signal |
|---|---|
| **N/C** | Not used |
| **SDI** | Serial Digital input |
| **TTL PULSE** | Audio follow pulse output |
| **N/C** | Not used |
| **SYNC IN** | Analogue reference sync input |
| **SMALL DELAY** | Logic level signal, high when delay through the store < 1.5ms |
| **SYNC LOOP** | Analogue reference sync loop through |
| **SDI OUT (4)** | Serial Digital output |
| **SDI OUT (3)** | Serial Digital output |
| **SDI OUT (2)** | Serial Digital output |
| **SDI OUT (1)** | Serial Digital output |
| **N/C** | Not used |

# 5.2 SYN102 configuration

Only jumpers J1, J3 and J4 are user adjustments, all other controls and jumpers on the board are set correctly when the unit is tested before despatch and should be left as set at the factory.




*SYN102 showing user adjustments (factory adjustments are greyed out)*

## Selecting the reference input termination

| J1 | Location | Function |
|---|---|---|
| **LOOP**<br>**75R** | Near edge connector | Upper position, reference unterminated and loop though output available<br>Lower position, reference input terminated with 75 Ω. No loop through |

## Selecting EDH options

| J4 | Location | Function |
|---|---|---|
| **EDH Checking: Off/On** | Towards the rear of the board, roughly in the middle | Controls EDH data insertion.<br>If J4 is fitted to the front, incoming EDH data will be ignored and overwritten. The right hand LED's will be permanently OFF.<br>If J4 is fitted to the rear, the incoming EDH data will be used to check for discrepancies in the framestore output data. EDH data in the outgoing data stream will be modified accordingly. The right hand LED's will indicate EDH status as set by J3.<br>The operation of this link is overridden by piano switch 3. |

| J3 | Location | Function |
|---|---|---|
| **EDH Checking: Full field**<br>**/Active Picture** | Towards the rear of the board, roughly in the middle | Selects the meaning of the right hand LED's when EDH data analysis is enabled. J3 only has meaning when J4 is fitted in the rear position.<br>If J3 is fitted to the front, the upper LED indicates an error in the link to the synchroniser (Error Detected Here, full field). The lower LED indicates an error upstream of the synchroniser (Error Detected Already, full field).<br>If J3 is fitted to the rear, the upper LED indicates an error in the link to the synchroniser (Error Detected Here, active picture). The lower LED indicates that no EDH data is present in the incoming data stream (Unknown Error Status). |

# 5.3 GPI connections

Each slot has an associated set of GPI connections for remote control and external status outputs on the frame rear-panel remote connectors. For convenience, GPI lines are associated with reference codes ‘a’ to ‘f’ in the connector pin-out tables for each frame.

| GPI | OPEN (+5V) | Ground | Notes |
|---|---|---|---|
| **‘a’** | Not used | Not used | |
| **‘b’** | Not used | Not used | |
| **‘c’** | Not used | Not used | |
| **‘d’** | Not used | Not used | |
| **‘e’** | Not used | Not used | |
| **‘f’** | Live video | Freeze | GPI Input |

The only GPI control available is a remote freeze input, which is logically in parallel with piano switch 4. The connection, which has a high resistance to +5V, should be left open for live video and connected to frame ground to freeze the synchroniser output.

The GPI connections are made through high-density D-type connectors on the rear of the frame. The connections for each slot are given below for the various types of frame available.

## 2U Indigo and FR2AV GPI Connections

GPI lines 1 to 6 of each module are brought to one of the four remote connectors at the rear of the frame as follows:

| Slot | GPI 'a' | | GPI 'b' | | GPI 'c' | | GPI 'd' | | GPI 'e' | | GPI 'f' | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **no.** | pin | rem | pin | rem | pin | rem | pin | rem | pin | rem | pin | rem |
| **1** | 8 | 1 | 9 | 1 | 18 | 1 | 26 | 1 | 19 | 2 | 20 | 2 |
| **2** | 7 | 1 | 16 | 1 | 17 | 1 | 25 | 1 | 10 | 2 | 11 | 2 |
| **3** | 8 | 3 | 9 | 3 | 18 | 3 | 26 | 3 | 19 | 4 | 20 | 4 |
| **4** | 7 | 3 | 16 | 3 | 17 | 3 | 25 | 3 | 10 | 4 | 11 | 4 |
| **5** | 5 | 1 | 6 | 1 | 15 | 1 | 24 | 1 | 1 | 2 | 2 | 2 |
| **6** | 4 | 1 | 14 | 1 | 13 | 1 | 23 | 1 | 3 | 2 | 4 | 2 |
| **7** | 5 | 3 | 6 | 3 | 15 | 3 | 24 | 3 | 1 | 4 | 2 | 4 |
| **8** | 4 | 3 | 14 | 3 | 13 | 3 | 23 | 3 | 3 | 4 | 4 | 4 |
| **9** | 3 | 1 | 12 | 1 | 22 | 1 | 21 | 1 | 12 | 2 | 13 | 2 |
| **10** | 10 | 1 | 11 | 1 | 19 | 1 | 20 | 1 | 21 | 2 | 22 | 2 |
| **11** | 3 | 3 | 12 | 3 | 22 | 3 | 21 | 3 | 12 | 4 | 13 | 4 |
| **12** | 10 | 3 | 11 | 3 | 19 | 3 | 20 | 3 | 21 | 4 | 22 | 4 |

**Note:** Remote (rem) 1 and Remote (rem) 3 are 26 way high density ‘D’ type female sockets and frame ground is pin 2 in each case. Remote (rem) 2 and Remote (rem) 4 are 26 way high density ‘D’ type male plugs and frame ground is pin 6 in each case.

## 1U Indigo and FR1AV GPI connections

GPI lines ‘a’ to ‘f’ of each module connect to one of two rear remote connectors as follows:

| Slot no. | ‘a’ pin | ‘b’ pin | ‘c’ pin | ‘d’ pin | ‘e’ pin | ‘f’ pin |
|---|---|---|---|---|---|---|
| **1** | 8 (1) | 9 (1) | 18 (1) | 26 (1) | 19 (2) | 20 (2) |
| **2** | 7 (1) | 16 (1) | 17 (1) | 25 (1) | 10 (2) | 11 (2) |
| **3** | 5 (1) | 6 (1) | 15 (1) | 24 (1) | 1 (2) | 2 (2) |
| **4** | 4 (1) | 14 (1) | 13 (1) | 23 (1) | 3 (2) | 4 (2) |
| **5** | 3 (1) | 12 (1) | 22 (1) | 21 (1) | 12 (2) | 13 (2) |
| **6** | 10 (1) | 11 (1) | 19 (1) | 20 (1) | 21 (2) | 22 (2) |

*Table shows Pin number (Remote number)*

**Note:** Remote 1: 26 way high density D-type socket. Frame ground is pin 2 and +5V @500mA is pin 1.
Remote 2: 26 way high density D-type plug. Frame ground is pin 6 and +5V @500mA is pin 15.

## Desktop box GPI connections

GPI lines ‘a’ to ‘f’ of each module connect to the rear remote connector as follows:

| Slot no. | ‘a’ pin | ‘b’ pin | ‘c’ pin | ‘d’ pin | ‘e’ pin | ‘f’ pin |
|---|---|---|---|---|---|---|
| **1** | 1 | 2 | 3 | 4 | 5 | 6 |
| **2** | 9 | 10 | 11 | 12 | 13 | 14 |

**Note:** Remote connector is 15 way normal density D-type socket. Frame ground is pin 15.

# 6 Problem solving

Trouble shooting may be performed by using the card edge, Statesman or the remote status panel display.

*The SYN102 front edge view*

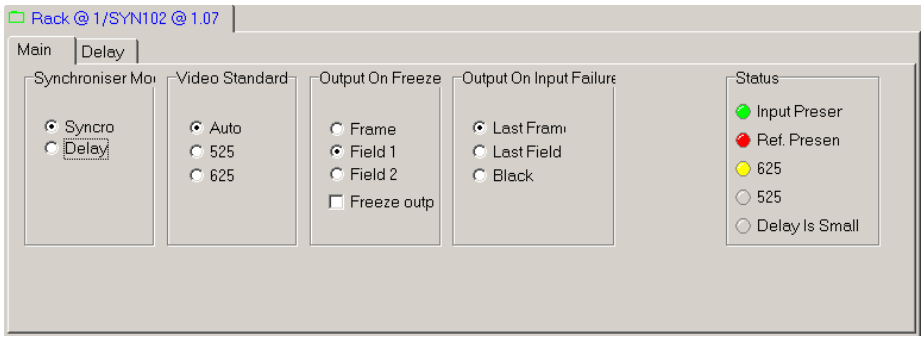
## Card edge LEDs

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

| Name | Led Colour | Function when ON |
|---|---|---|
| **+5V** | Green | Illuminates when the board 5V logic supply is present |
| **+3V** | Green | Illuminates when the board 3.3V logic supply is present |
| **Win** | Yellow | Illuminates when the delay through the store is less than approximately 1.5ms |
| **Frz** | Yellow | Illuminates when the board output has been set to frozen |
| **In** | Green | Illuminates when the serial digital input is present |
| **Ref** | Green | Illuminates when the board output is timed to the analogue reference input |
| **EDH0** | Red | EDH status flag 0. The meaning can be configured by jumper links |
| **EDH1** | Red | EDH status flag 1. The meaning can be configured by jumper links |

## The Statesman status display

The Statesman status ‘LEDs’ are on the main tab.




*The main tabt*

## Basic fault finding guide

**The Power OK LED is 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 a valid SDI is present and that any cabling is intact

**The video output exhibits jitter**

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

**The video output is not synchronous with other station sources**

If the input SDI stream is not synchronous with station sources ensure that SYN102 is in Syncro mode and that an appropriate analogue composite video signal such as station black and burst is used as a reference.

Check the video offset timing (delay) is correct for your application

**The card no longer responds to Statesman or front panel control**

Check that the card is seated correctly and that the Power OK LEDs are lit

Check any active control panel cabling

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

Check that the SELECT switch has not been left in position 7

If necessary re-set the card by simply removing the rack power and re-applying power after a few seconds or by removing the card from the rack and then re-inserting the card

It is safe to re-insert the card whilst the rack is powered

### Re-setting the card

The card may be reset by simply removing the rack power and re-applying power after a few seconds or by removing the card from the rack re-inserting the card. It is usually safe to reinsert the card whilst the rack is powered.

If necessary the factory defaults may be recalled as explained the Card edge operation chapter using SELECT position 7.

# 7 Specification

## General

| | |
|---|---|
| Dimensions | 100mm x 266 mm module with DIN 41612 connector |
| Weight | 200g |
| Power consumption | 6 W |

## Reference input

| | |
|---|---|
| Video | Analogue Black and Burst, mixed syncs or video |
| | Amplitude of syncs 150mV to 4V |
| | Link on PCB selects 75ohm termination or high impedance with loop-through (via PCB) |

## SDI input

| | |
|---|---|
| Video | SDI 270Mbit to EBU 3267-E and SMPTE 259M |
| | Cable equalisation >200m Belden 8281 or equivalent |
| | Auto 525/625 line selection |
| | May contain embedded audio when input and output frequencies are locked |

## Outputs

| | |
|---|---|
| SDI | Maximum of four outputs (two outputs with frame rear module RM01, three with RM02 and four with RM18) |
| | SDI 270Mbit to EBU 3267-E and SMPTE 259M with EDH |
| | <500ps 1KHz jitter and <800ps broadband jitter from stable 300mV Black and Burst reference |
| | <500ps 1KHz jitter in delay mode (low frequency jitter follows SDI input in delay mode only) |
| Audio follow output | TTL output<br>Pulse length shows delay through store<br>Can provide control signal for audio delay systems |

## 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 2U and 1U frames |

## GPI Inputs

| | |
|---|---|
| Type | Freeze |
| Details | Active: connect to ground |
| | Inactive: high impedance, or 3 to 48 volts |
| | Input current <50uA |

## GPI Outputs

| | |
|---|---|
| Type | Large delay in synchroniser (>25 lines) |
| Details | Active: connect to ground |
| | Inactive: high impedance, or 3 to 48 volts |
| | Input current <50uA |