MAXIM CVR500

Digital Standards Converter

Operation & Service Manual

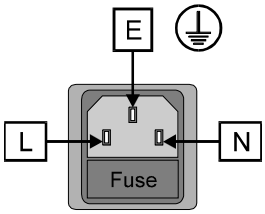
Snell & Wilcox Ltd, Durford Mill, Petersfield, Hampshire, GU31 5AZ, United Kingdom.
Tel: +44(0) 1730 821188. Fax: +44(0) 1730 821199.

Safety Warnings

Always ensure that the unit is properly earthed and power connections correctly made.

This equipment shall be supplied from a power system providing a **PROTECTIVE EARTH** ⏚ connection and having a neutral connection which can be reliably identified.

The power terminals of the IEC mains input connector on the rear panel are identified as shown below:



E = Protective Earth Conductor

N = Neutral Conductor

L = Live Conductor

Power cable supplied for countries other than the USA

The equipment is normally shipped with a power cable with a standard IEC moulded free socket on one end and a standard IEC moulded plug on the other. If you are required to remove the moulded mains supply plug, dispose of the plug immediately in a safe manner. The colour code for the lead is as follows:

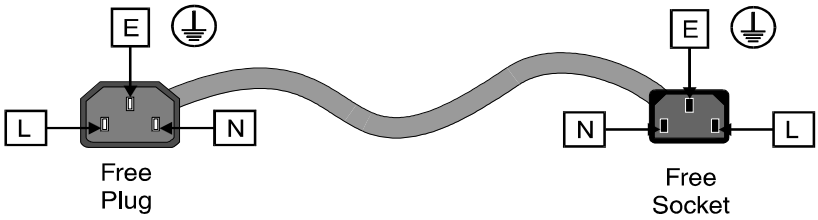
GREEN/YELLOW lead connected to E (Protective Earth Conductor)
BLUE lead connected to N (Neutral Conductor)
BROWN lead connected to L (Live Conductor)

Power cable supplied for the USA

The equipment is shipped with a power cord with a standard IEC moulded free socket on one end and a standard 3-pin plug on the other. If you are required to remove the moulded mains supply plug, dispose of the plug immediately in a safe manner. The colour code for the lead is as follows:

GREEN lead connected to E (Protective Earth Conductor)
WHITE lead connected to N (Neutral Conductor)
BLACK lead connected to L (Live Conductor)

The terminals of the IEC mains supply lead are identified as shown opposite:



Note that for equipment that is not fitted with a mains power switch, to comply with BS60950 Clauses 1.7.2 and 2.6.9, the power outlet supplying power to the unit should be close to the unit and easily accessible.

⚠ Warnings ⚠

Voltages within this unit can be lethal under certain circumstances. Where power is required to be connected to the unit during servicing great care must be taken to avoid contact with these voltages.

Maintenance should only be carried out by suitably qualified personnel.

EMC Standards

This unit conforms to the following standards:

Electromagnetic Compatibility-Generic Immunity Standard BS EN 50082-1:1992

The European Standard EN 50082-1:1992 has the status of a British Standard and is related to European Council Directive 89/336/EEC dated 3rd May 1989.

Electromagnetic Compatibility-Generic Emission Standard BS EN 50081-1:1992

The European Standard EN 50081-1:1992 has the status of a British Standard and is related to European Council Directive 89/336/EEC dated 3rd May 1989.

Safety Standards

This unit conforms to EN60065:1992 as amended by amendment A1(May 1993) and amendment A2(March 1994). Specification for safety of technology equipment, including electrical business equipment.

EMC Performance of Cables and Connectors

Snell & Wilcox products are designed to meet or exceed the requirements of the appropriate European EMC standards. In order to achieve this performance in real installations it is essential to use cables and connectors with good EMC characteristics.

All signal connections (including remote control connections) shall be made with screened cables terminated in connectors having a metal shell. The cable screen shall have a large-area contact with the metal shell.

COAXIAL CABLES

Coaxial cables connections (particularly serial digital video connections) shall be made with high-quality double-screened coaxial cables such as Belden 8281 or BBC type PSF1/2M.

D-TYPE CONNECTORS

D-type connectors shall have metal shells making good RF contact with the cable screen. Connectors having "dimples" which improve the contact between the plug and socket shells, are recommended.

Packing List

The unit is supplied in a dedicated packing carton provided by the manufacturer and should not be accepted if delivered in inferior or unauthorised materials. Carefully unpack the carton and check for any shipping damage or shortages.

Any shortages or damage should be reported to the supplier immediately.

Enclosures:

- MAXIM CVR500 Digital Standards Converter
- Power cable
- Operating and Service Manual

Manufacturers Notice

INFORMATION TO THE USER

NOTE
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

CAUTION
Any changes or modifications to this equipment that are not specifically authorized in writing by Snell & Wilcox could void your authority to use the equipment.

This device complies with Part 15 of the FCC rules.
Operation is subject to the following two conditions:
1, this device may not cause harmful interference, and
2, this device must accept any interference received, including interference that may cause undesired operation.

Information in this manual and software are subject to change without notice and does not represent a commitment on the part of Snell & Wilcox Ltd.

Software Version Amendments

Notes about Version Fitted

This machine is shipped with version A10 of the firmware.

Specific limitations of this version are as follows:

Table of Contents

Manual Revision Record

Date	Version No.	Issue No.	Change	Comments
15/4/98	1	1		Provisional Manual Issued
150698	1	2	Audio added	First Issue
150998	1	3	FCC data added to section 0	New section 0 issued
290998	1	4	3.4 switch data corrected, 4.3 Frm Sync item added	New section 0, 3 and 4 issued
230899	1	5	Audio and Aspect Ratio Modes sections added. Maxim added to name	Complete new manual issued
140100	1	6	Audio setup section changed 4.3	New sections 0 and 4 issued

SNELL & WILCOX

MAXIM CVR500

Digital Standards Converter

Operation & Service Manual

Snell & Wilcox

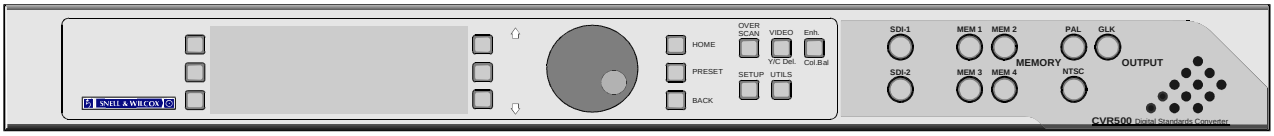
MAXIM CVR500

Digital Standards Converter

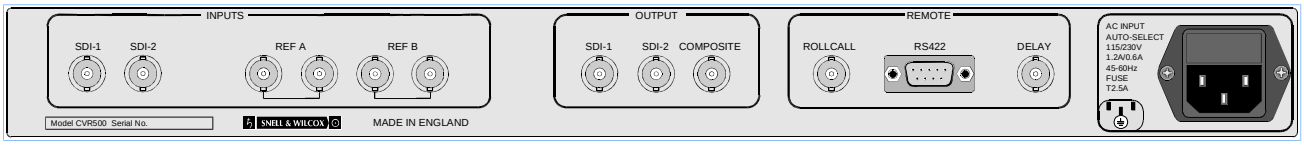
Operation & Service Manual

Introduction

Digital Standards Converter Maxim CVR 500



The Maxim CVR500 is a compact, broadcast quality digital standards converter with serial digital inputs and outputs. It converts between 525-line standard and 625 line standard component inputs, in either direction. The unit has extensive video processing facilities, including gain, overscan and aperture correction and also handles embedded audio. The converter can also be remotely controlled either via an RS-422 port, or via the Snell & Wilcox RollCall network. Maxim CVR500 is designed to fit in continuity suites, studios, outside broadcast vans, etc and facilitates the production of master tapes for broadcast using PAL+, D2MAC and digital transmissions. Maxim CVR500 is a compact 1RU unit for location on the desktop or in a 19in. rack



Specification

Inputs

Format

Two serial digital at 270Mbits/sec., CCIR-656, BNC.

Two analogue references, 0.3V to 2V, BNC loop-through.

Outputs

Two serial digital at 270Mbits/sec., CCIR-656, BNC.

One delay output, BNC. A TTL pulse which is high for a period equal to the delay through the unit.

Remote Control

One serial RS-422, 9-way D.

One RollCall network connection, BNC.

User Controls

Selection is via pushbuttons and a continuously variable control with a 3-line alpha-numeric display.

OVERSCAN: Allows position, and size of the output to be manually set.

VIDEO: Gives control of Video and chroma gain.

Enh: Allows adjustment of horizontal and vertical enhancement.

SETUP: Allows selection of Aspect ratios, Audio Setup, Clipping, Freeze, Gamut Limiting, Input Standard (625, 525), Reference (genlock), Panel Brightness and whether a status log is sent to RollCall.

UTILS. Allows selection of Fade, Freeze, activity on input loss, monochrome, and test pattern.

Y/C Delay. Controls horizontal Y/C delay.

Col. Bal. Allows colour balance to be set.

INPUT. Select which serial digital input is to be used.

MEMORY. Store and select a particular set of control setting (up to 4).

OUTPUT. Select PAL (625) or NTSC (525). Select Genlock.

Power Requirement

90V to 260V a.c., automatic selection. Frequency 45 to 90Hz. Total consumption approximately 75W.

Physical

Dimensions: Width 483mm, depth 530mm and height 47mm (1U).

Weight: Approximately 18kg.

Options

Remote Control Panel using RS422 protocol.

Extender Card.

Embedded Audio synchronisation.

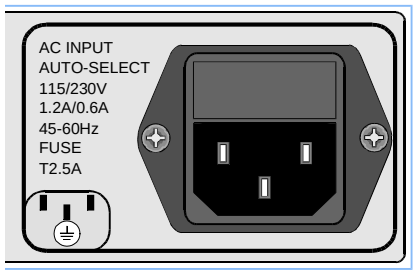
Installation

POWER CONNECTIONS

Power Supply

Mains power is supplied to the unit via a filtered IEC connector with integral fuse holder. The fuse rating is 2.5 A (T).

The unit automatically senses the supply voltage in the ranges 90V-132V and 176V-264V and sets itself up accordingly. No voltage adjustment procedure is required.



ENVIRONMENT

The unit is ruggedly constructed to meet the normal environmental requirements. It is important that there is a free flow of air at both sides of the unit to dissipate the heat produced during operation. Installations should be designed to allow for this.

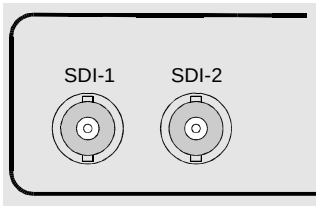
If the unit is to be rack mounted, first open the front panel by lifting up the two levers at right and left of the panel, hinge the panel down and pull it forward. The fixing “ears” behind the panel will be revealed and the unit can be mounted in the rack. Refit or close the front panel by pushing it back into position (the levers will click into place).

The rear of the base includes additional fixing holes on either side to allow a rear support to be added.

REAR PANEL CONNECTIONS

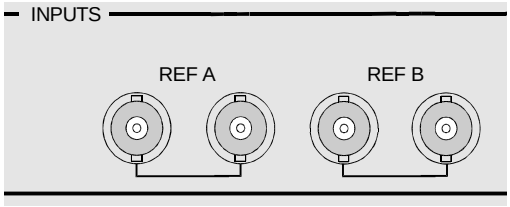
Digital Inputs (SDI-1 and SDI-2)

Two BNC connectors are provided for the serial digital inputs.



Reference Inputs (Genlock)

Two pairs of loop-through BNCs are provided for the two analogue references.

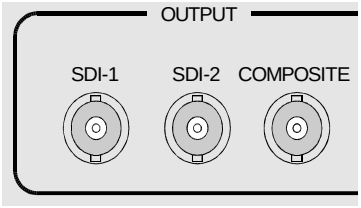


Digital Outputs (SDI-1 and SDI-2)

Two BNC connectors are provided for the serial digital outputs.

Composite Output

Not available.



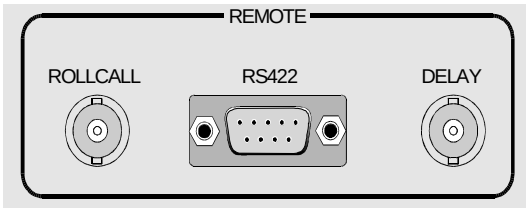
Delay Output

A BNC connector gives a TTL pulse which is high for a period equal to the delay through the unit.

Remote Control

The unit can be controlled from the special remote panel option via an RS-422-A D-type connector (see Table - *RS-422-A Remote Connections*)

If a remote panel is connected to the RS-422-A port, set the “Front Panel/Remote Comms/ Auxiliary switch on the A1UOPI2A card to “REM” (centre), see Fig. 3.1



RollCall System (Always Enabled)

The RollCall system should be connected using 75 Ohm “T” pieces in a similar manner to an “Ethernet” system. Both extremities of the system must be terminated in 75 Ohms.

A unique address for each unit on the RollCall system must be set by two hex switches on the OPI card. The address 00 is reserved and must not be used.

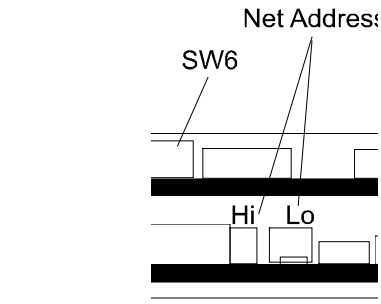
Hex switches (Behind Card Edge Controls)

Both of these switches are used to define the Unit Address code for the equipment. They are only read at power-up.

Position ‘0’ on the left-hand switch will disable the RollCall function on the unit; all other positions on these switches may be used to set the Unit Address code in Hex. (Left hand switch 1 to F, right-hand switch 0 to F).

Note that in a RollCall segment, all units must have different unit address codes.

Note: The coaxial link is bi-directional and therefore must not be passed through signal switching networks. Also, to allow hum and noise cancellation the screen of the coaxial connection must not be earthed.



RS-422-A Remote (Master) Connections

Pin	Function	Direction
1	Ground	
2	Transmit –	CVR 500➔ Remote
3	Receive +	CVR 500 ←Remote
4	Rec Sig Common	
5	Spare	
6	Trans Sig Common	
7	Transmit +	CVR 500➔ Remote
8	Receive –	CVR 500 ←Remote
9	Ground	

The Baud Rate is 38.4Kbs, half duplex. Format is 1 start bit, 7 data bits, 1 parity bit, 1 stop bit.

SWITCHING ON

Check that power is connected to the unit and is switched on. Open the front panel by pushing up the levers at the ends of the panel, and hinging the panel down and sliding partly out.

Set the switch on the Power Unit (see fig. 3.1) to on. Check that the indicator lamp illuminates and the alpha-numeric display is active.

Fig. 3.1 PCB Locations Maxim CVR 500

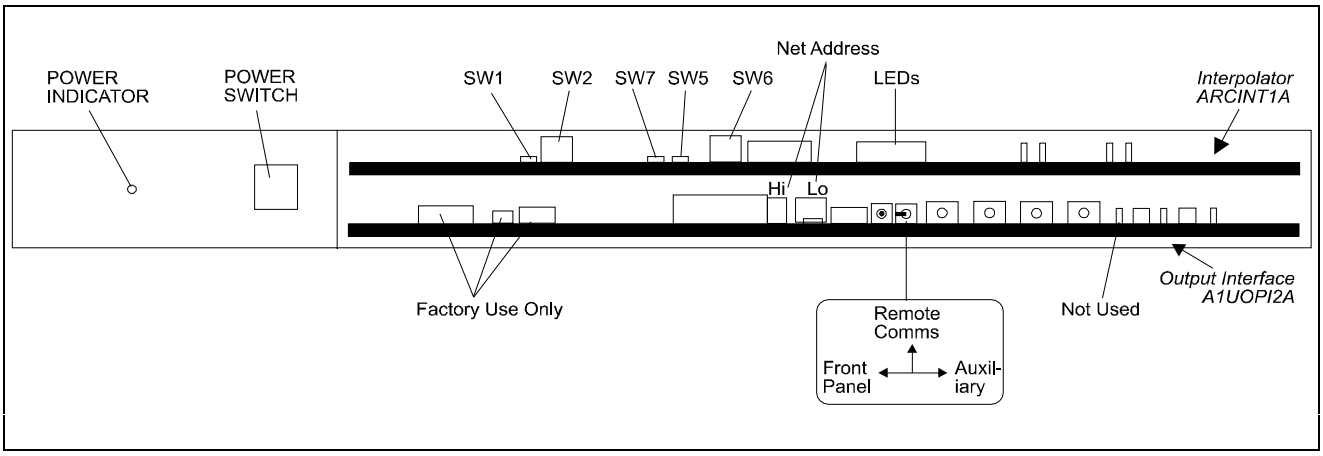
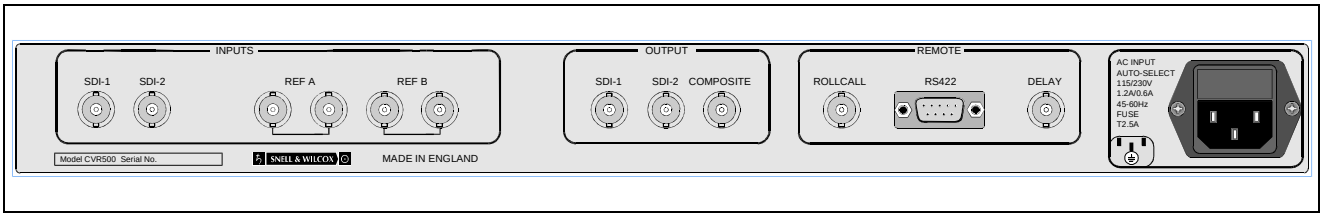


Fig. 3.2 Rear View of Maxim CVR 500



Operation

This section describes the action of each of the front panel controls and shows how to operate the Maxim CVR500.

The panel is grouped into areas to simplify operation and the controls in each area will be described in turn.

Pushbuttons

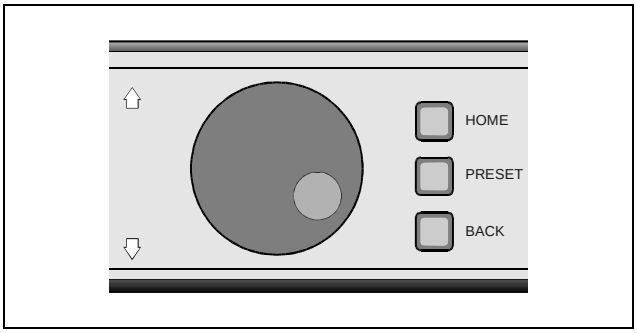
The buttons have indicator lamps in the centre. In general, when a button is pressed the indicator lamp illuminates. If controls are not in the “Preset” position or there is an abnormal condition the indicator lamp flashes. For more information see the appropriate control description.

Display and Display Controls

The display comprises three rows of 20 characters; the top row normally shows the current conversion, the bottom row shows the genlock status and the centre row shows other selected conditions. A typical top row display is shown, where the input is 625 lines, serial digital and the output is also 625 lines (PAL); the bottom line shows that genlock is off.

There is a selection pushbutton at both ends of each row. In some cases the row has information on one parameter, in which case the button at either end can be used for selection. In other cases, there are two parameters in the row, in which case the left-hand pushbutton selects the left-hand parameter and the right-hand button the right-hand parameter. An item with further options to select is indicated by ⇉ at the right-hand end of the display.

The rotary control allows you to scroll menus and to set parameters to a required value. The illuminated arrows indicate the direction options that you have.

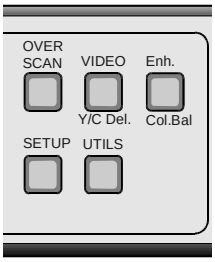


To return to the previous menu level, press the “BACK” pushbutton. It may be used to progress back up the menu tree. To return to the status display, press the button labelled “HOME”.

To return a value you have just changed to its preset value press “PRE”. To return all the values on the display which you have changed, press “HOME” and “PRE” simultaneously.

FUNCTION SELECT

These pushbuttons are used to preset operating conditions according to the system requirements.



OVERSCAN

Allows adjustment of the horizontal and vertical position of the display and allows the size to be changed from 95% to 105% of the input size.

```
Horiz Posn ⇨      0
Vert Posn  ⇨      0
Overscan   ⇨ 1.000%
```

VIDEO

When Video Gain or Chroma Gain is selected, the range of adjustment is ±6.00dB. Adjustment of the chroma gain does not affect the luminance.

When selected, the Video Black level offset can be set in the range ±88.0mV.

```
Video Gain ⇨  0.00dB
Video Black⇨   0.0mV
Chroma Gain⇨  0.00dB
```

Y/C Del

The Y/C delay setting is accessed by holding down the HOME button and then pressing the VIDEO button. The delay can be set in the range -450 to +600ns.

```
      Y/C Delay
Horizontal ⇨    0 ns
```

Enh

This function allows separate adjustment of vertical and horizontal enhancement. The enhancement is obtained by amplifying high frequency picture detail and adding it back in. Set the levels so that the machine response emulates that of a television camera; this is usually seen by crisper-looking edges.

For horizontal enhancement the range is 0.0dB to 9.0dB and for vertical enhancement it is 0.0dB to 6.0dB.

```
    Enhancement
Horizontal ⇨  0.0dB
Vertical   ⇨  0.0dB
```

Col. Bal

The colour balance settings are accessed by holding down the HOME button and then pressing the Enh button. The function allows the amount of red or blue in both the black and white areas of the picture to be adjusted; the green signal is considered to be constant. If necessary “Freeze” the picture while making this adjustment. The range is ±25% for each parameter.

```
        BLACK  WHITE
BLUE⇨    0.0%    0.0%
RED ⇨    0.0%    0.0%
```

SETUP

When pressed, the display becomes similar to that shown opposite:

```
Aspect Ratio
Audio Setup
Clipper  >On
Frm Sync >Off
Gamut Lim>On
Input St⇨Auto     E
```

⇧

```
Panel    ⇨Bright   E
Ref Input⇨Aut      E
RollCall Log >On
```

Aspect ratio modes
Ten available conversion modes are available in the Maxim CVR500. Selecting the Aspect Ratio item brings up a menu of possible aspect ratio conversions. Scroll through the menu and select the one required. Note that 4:3 to 4:3 is the default and causes no aspect ratio conversion.

A description of the affects to output image during aspect ratio conversion is given in appendix A.

```
4:3        =>    4:3
4:3        =>    14:9
4:3        =>    16:9 FH
4:3        =>    16:9 PB
16:9 FH    =>    4:3
```

⇧

```
16:9 FH    =>    14:9 LB
16:9 FH    =>    16:9 LB
16:9 LB    =>    4:3
16:9 LB    =>    14:9 LB
16:9 LB    =>    16:9 FH
```

Audio Setup
This allows the status of the audio channels to be set up. Note that the Audio Setup menu is only available if your unit has audio capability (optional).

Selecting Control allows the embedded output to be set to Off (no audio data), On (audio data from selected input group, Mute (silence) and Test Tone.
Use the delay item to set an additional delay to the output audio in the range of 0 to 750 ms.
Use the I/P Group item to select the input group to 1, 2, 3 or 4.
Use the O/P Group item to select the output group 1, 2, 3 or 4.

Note that only one input and one output group can be used at a time.

Maxim CVR500 also has an additional utility called RollTrack Audio Tracking. This enables Snell & Wilcox RollCall compatible audio delay products to track the video delay introduced by the Maxim CVR500. It should be noted that this delay is fixed and is not affected by the additional audio delay setup by the user, as described above.
An overview of RollTrack is given in Section 10.

Note: Roll track cannot be set up from the front panel of the Maxim CVR500 unit. It can only be set up from an external remote unit, i.e. "shoebox" or PC.
*During set up of RollTrack, the unit's audio will default to inactive. An "A" character must be added to the standard set up rolltrack network address to make the audio available. Hence, instead of the standard network address nnnn:xx:yy*z*d use the following to active the unit, nnnn:xx:yy*z*dA.*
See section 10 for details of setting up the network address from a remote unit.

Clipper
This allows you to turn the internal clipper on or off. The clipper limits the 10-bit data to 940 for white and 64 for black. Each time you select the function it toggles between On and Off.

Frm Sync (Frame Syncroniser)
This function allows the unit to operate in the synchronise mode (On) or Convert mode (Off)
Default is to OFF

Gamut Limiter
This turns on or off the colour gamut system each time it is selected. When On it ensures that the colour values are legal.

Input Standard
Allows you to set the Maxim CVR 500 to the incoming video standard.

When Auto is selected the standard is automatically detected. 525 forces the Maxim CVR 500 input to the 525/59.94 standard and 625 forces the Maxim CVR 500 to the 625/50 standard.

```
Input Std⇨Auto
          525
          625
```

Panel Brightness
When selected this allows you to select “Bright” or “Dim” for the Maxim CVR 500 display and indicators.

```
Panel    ⇨Bright
           Dim
```

Ref Input
Allows selection of either automatic detection of the most appropriate reference, or always use reference A, or always use reference B, or use the input as a reference. In the latter case, only the clocks are locked, the phase between input and output is not known.

```
Ref Input⇨Auto
          Ref A
          Ref B
          Input
```

RollCall Log
When this is set to On, and a computer running RollCall is attached, a log of CVR 500 activities can be created at the computer. Each time you select the function it toggles between On and Off.

Note : RollCall Log is only displayed in the front panel menu when the unit is linked to a RollCall network. Otherwise this option is not visible.

UTILS

When pressed, the display becomes similar to that shown opposite.

```
Fade      >On
Fade Time⇨1 Second E
Freeze    >Off
```

⇧

```
Inp  Loss⇨Freeze   E
Mono      >On
Pattern   >On
Patt Type⇨100% BarsE
```

Fade
Allows selection of the automatic fade facility. The rate at which the fade takes place is set by the "Fade Time". Each time you select the function it toggles between On and Off.

Fade Time
This allows the setting of the time to fade from full picture to black and vice versa.

```
Fade Time⇨Instant
          1 Second
          2 Seconds
          5 Seconds
          10 Seconds
```

Freeze
This allows you to turn the video freeze function on and off. Each time you select the function, it toggles between On and Off.

Inp Loss
This determines the action that will be taken when there is no input data.

```
Inp  Loss⇨Freeze
          Black
```

Mono
This allows you to turn off and on the chrominance part of the picture.

Pattern
This allows you to turn on and off the internal test pattern generator, the pattern being determined by the Pattern Type setting. Each time you select the function, it toggles between On and Off.

Pattern Type
This allows you to select the test pattern that will be produced when the internal pattern is switched on. The patterns are digitally generated to exact levels; to preserve their integrity there are no adjustments.

```
Patt Type⇨100% Bars
          75% Bars
          EBU Bars
          Y Ramp
          UV Ramp
          Y Sweep
          UV Sweep
          Bowtie
```

INPUT Selection

Press the pushbutton associated with the desired input connection. The indicator in the button will illuminate. If there is no input data present, the indicator will flash.

OUTPUT Selection

Press either the PAL (625 line standard) or NTSC (525 line standard) according to the output required. The indicator in the selected button will illuminate.

Genlock

When the GLK button is selected, the output is genlocked to the reference input which is most appropriate for the output standard selected. If the output cannot lock to the reference signal, the indicator flashes.

The messages on the bottom line of the display can be similar to the following:

`Genlock: 525/59.94/A`
(NTSC genlocked from reference A)
`Genlock: 625/50/B`
(PAL genlocked from reference B)
`No genlock reference`
`Genlock: Input`
(Genlocked from input signal)
`Attempting Genlock`
`Genlock Failed`
(Wrong standard)
`Genlock Off`

Genlock Timing

To adjust genlock timing, hold down the HOME button and press the GLK button. The display is shown opposite.

```
   Genlock Adjust
Horizontal ⇨   0 pix
Vertical   ⇨   0 lns
```

The timing horizontally with respect to the reference can be adjusted from 0 to 863 pixels (625 standard) or 0 to 857 pixels (525 standard) and vertically it can be adjusted from 0 to 624 lines (625 standard) or 524 lines (525 standard).

MEMORY

The current front panel settings can be saved to one of four memories. Hold down the HOME button and then press the desired memory button (MEM 1 to MEM 4); a beep will be heard and the indicator in the button will illuminate. It is suggested that you record the button number and the signal type for which the settings are appropriate.

To recall a memory setting, just press the appropriate memory button.

System Overview

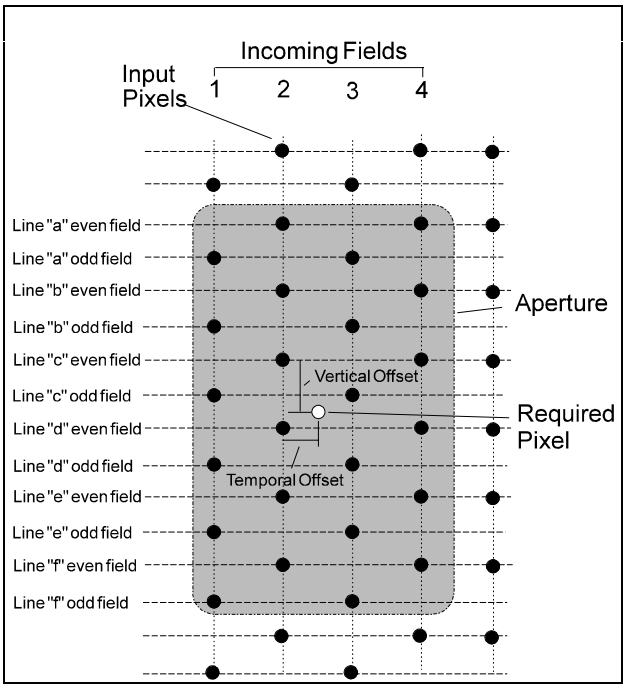
The Maxim CVR500 is a digital-in digital-out Standards Converter.

To change the line standard, lines and fields of the picture have to be interpolated from existing pixels.

The Maxim CVR500 vertical temporal interpolation operates on four fields and six lines of the incoming video and is effectively a 24-point filter (optimised individually for every pixel point of the picture). Filtering is carried out separately for luminance and chrominance. A large horizontal filter is applied after the vertical filter.

There are two factors influencing the performance of the interpolation, one is the number of points being used in the filter, and the other is the need to carry out vertical-temporal interpolation. To explain the latter factor, six lines on one field would only access half the information in the interlace system but when we use 12 lines from a full frame, the information in the second field is displaced in time from the first field; this must be taken into account when interpolating.

In the diagram you are looking at the lines of the video structure end-on as if you are looking into the side of the CRT face while the pixels of four fields are displayed. The field offset of the required pixel from field 2 is the temporal offset and the line offset from the nearest line in field 2 is the vertical offset. The area shaded is the aperture which is centred on the required pixel position. A proportion of every pixel in the aperture is used in creating the new pixel; the proportions diminish as the distance from the required pixel increases.



BLOCK DIAGRAM DESCRIPTION

Referring to the block diagram (drawing CVR500), the OPI card decodes the D1 serial digital video into separate luminance and chrominance data streams and feeds them to FIFO buffers, which allow for different input and output clock rates.

The data is then fed to the INT (Interpolator) card where all the required vertical/temporal and horizontal interpolation is carried out.

From the INT card the data is fed back to the OPI card where it is applied to a gamut limiting circuit. When gamut limiting is selected, any digital values that would provide illegal video values are brought within bounds.

From the gamut system, the data is output blanked and converted back to serial digital (656) format before being fed out of the unit.

The syncs and timing are obtained either from a reference input (genlock) or from the video input, via a phase-locked-loop.

An internal pattern generator can be connected to the output in place of the interpolated signal.

The control circuit on the OPI card accepts inputs from the front panel, or a remote panel and provides the necessary control signals to the rest of the CVR 500. It also provides an output which is equal to the delay through the unit.

INTRODUCTION

This section gives a card-by-card description of the Maxim CVR500 unit. Circuit diagrams are in section 7

INTERPOLATOR CARD (ARCINT1A)

This card is a complete vertical, temporal and horizontal interpolator. The vertical/temporal aperture is six lines by four fields. It has support for VITS bypassing.

Top Level Drawing
This shows all the major circuit blocks of the card and their interconnections. Signals enter the board from the edge connectors at the left-hand side of the diagram and exit at the right-hand side.

Field Store Control (INT1A_01)
This shows the two programmable devices which provide all the control signals for the field store chips on the board. Input field store write control and output field store read control is performed by N115 (DISTRACT). N115 also contains a test signal generator. The input store read control and output store write control is performed by N138 (OVERACT). N138 also provides controls for the line store pipelines and the field store switching system.

Data Input (INT1Y_02)
Video data enters the board via N78 and N89 and is passed to the input field stores. Normally, data comes in as offset binary and is passed through N62 to become 2s complement in the field stores. If switch SW4 (drawing INT1A_27) is closed, the incoming data is replaced by a test pattern generated in N115 (drawing INT1A_01). The test pattern is selected using hex switch SW2 (drawing INT1A_27).

Data is written to each of the six field stores in turn as successive input fields reach the board. The output of the store is routed via the field store switch to the vertical temporal filter.

Field Store 1 to 6 (INT1A_03 to INT1A_08)
Each of these drawings contains three ICs that make up each of the input field stores. Data is written in at the input field rate and read out at the output field rate. On any given input field only one of the input stores is written. On each output field, all input stores are read.

Field Store Switching (INT1QA_09)
This takes in the data output from the six input stores and selects four of the six for use by the vertical temporal filter. The switching is controlled by the bus S[7:0] from N138 (drawing INT1A_01). The top 8 bits of video data are switched using D-type latches. The bottom two bits are routed via PALs N108 and N126.

Line Stores 1 to 5 (INT1A_10 to INT1A_14)
Each of these drawings shows six line stores with their inputs connected together. The line stores have individual write resets but common read resets. The outputs of each of the line stores are fed to different multiply/adders (2246 devices, drawing INT1A_16) for filtering. Note that the stores on diagram INT1A_14 contain the two least significant bits from all four of the field store switch outputs.

Coefficient Control (INT1A_15)
N112 (Actel Compact) reads the vertical temporal coefficients out of EPROMs N82 and N83. The EPROM outputs are latched in N130 (Actel Latchact) and then fed to the multiply/adders (2246 devices, drawing INT1A_16) which do the filtering. N112 also generates the control signals for the 2246 devices.

Interpolation Arithmetic (INT1A_16)
This drawing shows the six multiply/adders (2246 devices N33, N55, N71, N98, N117, N139) which do the vertical temporal filtering. Each 2246 receives data from the line store pipelines and the coefficient latch N130 (drawing INT1A_15) and multiplies and sums them. The 2246 device outputs are latched by D-types N34 and N49.

Output Field Stores 1 & 2 (INT1A_17, INT1A_18)
Each of these drawings shows a complete YUV field store. The stores are written with the output of the vertical temporal filter. The store output is sent to the clipping and blanking circuitry. Output field store 1 is written during output field two and read during output field one. Output field store 2 is written during output field one and read during output field two.

Output Clip (INT1A_19)
N45 (Actel Clipact) takes in the data from the output field stores, clips it to ten bits and applies horizontal blanking. The field store output data is sent to the circuit shown on drawing INT1A_20.

Horizontal Rate Converter (INT1A_20)
This is the top level drawing of the rate converter (RCV) circuits. Data enters via D-types N23 and N35 and is passed to circuits on one of the drawings INT1A_22, INT1A_ 23 or INT1A_ 24. From these circuits the output is taken to the backplane via D-types N43, N57 and N63. If the RCV is not active, these devices are tri-stated. Drawing INT1A_ 21 also shown here controls the RCV.

RCV Coefficient Control (INT1A_21)
This drawing shows the control system for the rate converter. Actel N13 generates all the control signals. Controls which have critical timing are passed through D-types N10, N14 and N18. This drawing also shows the EPROM N1 which holds the RCV interpolation coefficients. These are loaded into the filter at the start of each field. N1 also contains the control register values for the filter chips which are also loaded at field rate.

Notice that if the RCV is fitted, the three output field store controls OPR7 (ORLRS) OPR6 (OCCGR) and OPR3 (OYCGR) are also taken from N13. The corresponding outputs from N115 (drawing INT1A_01) are tri-stated in this case. Also, if the RCV is fitted, the blanking applied by N45 (drawing INT1A_19)) is controlled by the two control lines YBLACK and CBLACK from N13.

RCV Luma Interpolator (INT1A_22)
The luminance is passed through the FIR filter N15 into line stores N2 and N3. It then goes through the 2:1 decimating filter N11. It is clipped and has the ms bit inverted in the PAL N20 before being sent to the backplane via N43 and N57 (drawing INT1A_20). If the input and output clock frequencies to the RCV are different, the handover from one clock to the other is done in the line stores N2 and N3.

RCV Chroma Interpolator (INT1A_23)
The multiplexed chrominance data is passed through the FIR filter N16 and then into the line stores N4 and N5. It is separated into separate U and V streams before entering a pair of 2:1 decimating filters (N6 and N7). The data is re-multiplexed and passed through the clipper PAL N17 before being sent to the backplane via N63 and N57 (drawing INT1A_20). If the input and output clock frequencies to the RCV are different, the handover from one clock to the other is done in the line stores N4 and N5.

RCV Bypass Delay (INT1A_24)
VITS lines do not pass through the filters as it is not possible to provide a transparent path. Instead, three bypass line stores are provided (N30, N42 and N52). Their outputs are only enabled when reading VITS lines and are tri-stated otherwise. Because the VITS data does not pass through the Clipper PALs it is necessary to invert the ms bit of the VITS in N45 (drawing INT1A_19) during the VITS interval. There is a control line MSB_INVERT from N13 (drawing INT1A_21) to N45 which controls the ms bit inversion when the RCV is active. If the input and output clock frequencies to the RCV are different, the handover from one clock to the other is done in the line stores N30, N42 and N52.

F & H Inputs (INT1A_25)
This is where the incoming vertical (F_IN and F_OUT) and horizontal (H_IN and H_OUT) sync signals are clocked onto the board using D-types N96 and N97.

Clock Buffering (INT1A_26)
All clock buffering is performed by the circuits shown on this drawing. Incoming balanced ECL clocks are received from the backplane by N31 and converted to TTL by N56. These clocks are then fed to PAL N77 for routing to the clock distribution networks.

The selection of clocks and their frequencies is controlled by the control bus CKSEL[6:0] which comes from the CPU interface Actel N12 (drawing INT1A_27). There are three clock distribution networks, input clock, output clock and processing clock. These networks may operate at different clock frequencies if any sample rate changing is being done. The input to each of the networks is taken from N77 into the input of an integrated phase locked loop (PLL) IC (N69, N76, N88). The PLL generates one clock at the same frequency as the input and one at double the input frequency. The PLL outputs are buffered and delayed to provide the various clock waveforms that are required.

Microprocessor (INT1A_27)
This drawing shows the microprocessor which controls the whole board. N44 is the processor, which has a static RAM (N8) and a flash EPROM (N147) associated with it. The processor also provides, via N25, the 8 bit multiplexed CPU bus which is fed to all the FPGAs. This drawing also shows the Actel N12 which handles the message passing between the interpolator CPU and the master control CPU and passes some switch settings and the slot number to the interpolator CPU. A serial link is provided by N54 for downloading software and printing debug information.

Power In and Decoupling (INT1A_28)
This drawing shows the backplane power supply connections and the reset circuitry (SW1, N21 and N22).

+5V Decoupling (INT1A_29)
This drawing shows all the +5V power supply decoupling capacitors.

-5V Decoupling (INT1A_30)
This drawing shows all the -5V power supply decoupling capacitors.

PCB Mechanics (INT1A_31)
This drawing shows all the non-electrical parts that are included in the PCB construction.

OUTPUT INTERFACE CARD (A1UOPI2A)

In this application the card provides an input interface, a feed to the Interpolator card, and the output interface for the signals from the Interpolator card. It also contains the user controls microprocessor

Serial Input (A1UOPI2A Sheet 1)
The circuits Q15, N93 (equalising), N95 (PLL) and N96 (10-bit serial to parallel converter).

The parallel data is fed to two FIFOs (N141, N142), which are used to adjust timing, and it is also fed to the Actel N162 which carries out all the timing decoding. Status information is indicated by LEDs. The FIFO outputs are fed via the latch N67.

The Frame Store Option (shown in the middle at the bottom) is a plug in module which is not fitted in the MAXIM CVR500 system.

Input Stages (A1UOPI2A Sheet 2)
The parallel data stream from the Interpolator card via the backplane is de-multiplexed into separate 13.5MHz 10-bit luminance and chrominance streams by latch N40 with N80, N81, N130. This enables the data stream to be fed via the backplane to the Interpolator card.

The luminance and chrominance data returns from the Interpolator via a line delay (N143, N10, N144) to two 10-bit registers N70, N72. The registered output is applied to the filter IC N121. This allows the video gain and colour balance to be adjusted for blanking using coefficients loaded into the IC. N121 also re-multiplexes the Y and C data into a single 27MHz data stream conforming to the 601 specification.

N120 generates the high frequency video data which is used for enhancement.

N163 carries out the black level correction and it also generates all the control data for blanking. Its main output is YCB(9,0); the lower bus is similar but the luminance has been low-pass filtered ready for gamut correction.

Test patterns are generated by N109 and N110. N109 is switched into circuit in place of the video contains the eight msb's of the pattern information and the lower 2 bits are contained in N110.

Encode Pre-Process (ARCOPI12A Sheet 3)
The main data path from N163 (sheet 2) is fed to N22. The other input from N163 is fed to the Gamut Limit circuit. In this circuit the data is de-multiplexed - the luminance path is N170, N169, N173 and the chrominance path is N165-N167. The chrominance is further separated into Cb and Cr. This makes it possible to compute whether the equivalent GBR values would be legal. N42 and N43 compute the phase and magnitude of the chrominance signals respectively. The phase is compared with the luminance in N135. The result is compared in N44 with the actual value, which is the magnitude data fed via N168, N172. The result is a signal which, when the colour value is illegal, tells the system how much to reduce the chrominance by to correct it.

The error gain signal is fed to the Actel N22 which carries out the appropriate adjustment of the chrominance signal gain.

The luminance notch circuit on the drawing is not used in the MAXIM CVR500. The output of the notch and gamut circuits are multiplexed onto a single bus by N122, N123.

N22 has two separate outputs. The luminance bus carries normal luminance and luminance with a notch (when implemented). The chrominance bus carries normal chrominance and gamut limited chrominance.

Pal N85 generates all the clocks for items on this circuit.

D1 Outputs (A1UOPI2A Sheet 4)
The Y and C busses from N22 (sheet 3) are applied to the output formatter N152. This can select luminance with or without notch and chrominance with or without gamut.

N146 is for embedded audio but is not implemented in the Maxim CVR500.

The output of N152 is a parallel data stream in 656 format which is fed to the serialiser N46. This produces two serial data outputs.

PAL N86 is only used to route the clock signal in this application.

Genlock Input (A1UOPI2A Sheet 5)
The reference input is fed via two hum-cancelling circuits comprising Q37, Q38, Q19 and N55, and Q40, Q39,Q1 and N4. The output is fed via a low-pass filter to N79 and N2, and to the sync separator IC N9. The sampling switch N6-11operates during the back porch period to clamp the sync signal to a known value. N79 is part of a second loop with N3 to provide a.g.c. The output of the sync circuit is applied to the analogue-to-digital converter N153.

D1 Genlock (A1UOPI2A Sheet 6)

Actel N48 is the Genlock sync pulse generator. The multiplier N21 and look-up table N158 circuits accept the input from the A-D converter (N153, sheet 5) and gate the data to produce a weighted average of the sync edge so that a measurement of the sync position can be made. The REFSYNC input (from N9, sheet 5) is also applied directly to N48.

The output of N48 is fed to the integrator N62 which is gated on by a reference input from N48 via Q20, Q21, Q22. The genlock error appears at TP5. The error is fed via N37 to the variable oscillator N88, which provides the main clock reference.

The clock distribution is from the PAL N39. Clocks are fed to the backplane via N129, directly to the sync pulse generator, and via a clock multiplier N77 so that 13.5MHz and 27MHz can be fed out via N102 and N103.

Register N132 takes the outputs from the sync pulse generator and feeds them on to the backplane.

Control Processor (A1UOPI2A Sheet 7)

The system is controlled by the microprocessor N14 in conjunction with flash memory N136 and static RAM N7 and N11. Non-volatile RAMs N115 and N175 provide memory during power-down.

The switches and indicators which are on the front edge of the card are shown in the centre of the sheet. SW3 and SW4 are used to set the RollCall network address.

The switches and indicators at the top-left of the sheet (SW2, SW7, SW8, D45, D11, D9, D8) are microprocessor specific, either directly or for diagnostics.

For factory diagnostics purposes, there is a socket on the front edge of the card which allows serial connection to the microprocessor via N12.

The CPU control ACTEL N26 communicates with N14 via bus CPUD(7:0), with the card edge menu system and with the backplane (System Control Bus) to control the Interpolator card.

A connector is provided for the front panel which communicates via N26 and the gates of N137.

Comms and Power (A1UOPI2A Sheet 8)

This sheet shows the communications to circuits external to the unit.

N19 is an ARCNET controller. N45 is a dual UART used for RS-422 functions. There is also a UART in the microprocessor. The PAL N18 allows any of these four to be routed to any communication channel.

There are two RS-422 interfaces (N23/N24 and N16/N17). Only the REM channel (N16, N17) is connected to the rear panel.

The third interface is for Rollcall, a network type of communications interface (Q2, Q3, Q5, Q6, Q7, Q9, N20 and associated components).

CONTROL PANEL (A1UF1U3X)

This provides the user interface and comprises two circuits.

Sheet 1

Communication with the main part of the Maxim CVR500 is via the interface Actel N1. The Actel drives the displays N4, N5, N10, N11, N13, N14; the 20 characters are constructed out of two 8 character displays and one 4 character display.

N3 provides the drive for the LED indicators in the pushbuttons.

RV1 is the front panel variable control used for selecting menu items.

Sheet 2

This sheet shows the front panel switches and indicators.

Circuit Diagrams

Block Diagram CVR500

Interpolator ARCINT1A

ARCINT1A	Top Level Drawing
INT1A_01	Field Store Control
INT1A_02	Field Stores
INT1A_03	Field Store 1
INT1A_04	Field Store 2
INT1A_05	Field Store 3
INT1A_06	Field Store 4
INT1A_07	Field Store 5
INT1A_08	Field Store 6
INT1A_09	Field Store Switching
INT1A_10	Line Stores (1)
INT1A_11	Line Stores (2)
INT1A_12	Line Stores (3)
INT1A_13	Line Stores (4)
INT1A_14	Line Stores (5)
INT1A_15	Coefficient Control
INT1A_16	Interpolation Arithmetic
INT1A_17	Output Field Store 1
INT1A_18	Output Field Store 2
INT1A_19	Output Clip
INT1A_20	Horizontal Rate Converter
INT1A_21	Horizontal Rate Converter Coefficient Control
INT1A_22	Horizontal Rate Converter Luma Interpolator
INT1A_23	Horizontal Rate Converter Chroma Interpolator
INT1A_24	Horizontal Rate Converter Bypass Delay
INT1A_25	F & H Pulse Inputs
INT1A_26	Clock Buffering
INT1A-27	Microprocessor & Memory
INT1A_28	Power In and Decoupling
INT1A_29	+5V Decoupling
INT1A_30	-5V Decoupling
INT1A_31	PCB Mechanics

Output Processor A1UOPI2A

Sheet 1	Serial Input
Sheet 2	Input Stages
Sheet 3	Encode Pre-process
Sheet 4	D1 Outputs
Sheet 5	Genlock Input
Sheet 6	D1 Genlock
Sheet 7	Control Processor
Sheet 8	Comms and Power

Backplane ARCB1U1Y

Sheet 1
Sheet 2
Sheet 3

Control Panel A1UF1U3X

Sheet 1
Sheet 2

Maintenance

DISASSEMBLY

Access to the sub-assemblies of the Maxim CVR500 is very easy and these minimal instructions are all that is required.

ENSURE THAT AC POWER IS REMOVED FROM THE UNIT BEFORE DISASSEMBLING IT.

MAINTENANCE SHOULD ONLY BE CARRIED OUT BY SUITABLY QUALIFIED PERSONNEL.

Removal of Card Assemblies

To gain access to the plug-in cards, lift up the levers at right and left of the front panel. hinge the panel down and then pull it out on its bottom slide panel. The location of the cards is shown in Section 3.

To remove a plug-in card, pull on the coloured PCB extractors at both sides. When refitting ensure that the card is pushed fully home.

Access to the Power Supply Assembly
To gain access, remove the top cover of the unit (14 screws). The power supply is retained in position by three screws on the underside of the unit.

ADJUSTMENTS

The Maxim CVR500 has no maintenance related user adjustable settings.

ASPECT RATIO CONVERSIONS

This section describes the available aspect ratio conversions on the Maxim CVR500.

The diagram pairs, for each conversion available, show the input image and format and the output image and format.

The format of the picture is shown in the middle of the relevant diagram. Below each output diagram is a description giving information about image aspect ratio correctness, loss of picture or added black bars for that particular conversion.

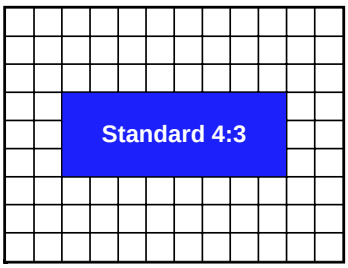
This provides an idea of what the output image will actually look like.

Note the following:

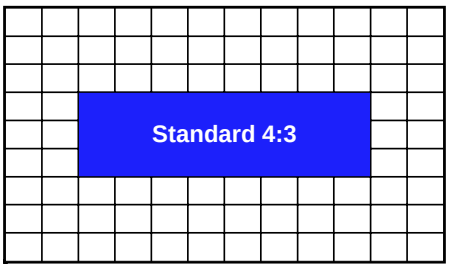
- PB = Piller box format
- LB = Letterbox format
- FH = Full height

Page Number	Input		Output
9.2	4:3	=>	4:3
	4:3	=>	16:9 FH
	4:3	=>	16:9 PB
	4:3	=>	14:9
9.3	16:9 FH	=>	16:9 FH
	16:9 FH	=>	4:3
	16:9 FH	=>	14:9 LB
	16:9 FH	=>	16:9LB
9.4	16:9LB	=>	16:9LB
	16:9LB	=>	4:3
	16:9LB	=>	14:9LB
	16:9LB	=>	16:9FH

4:3 Input image

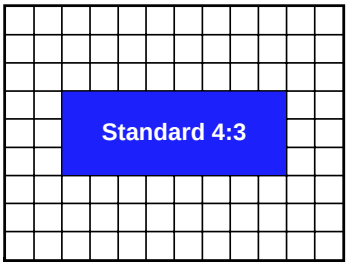


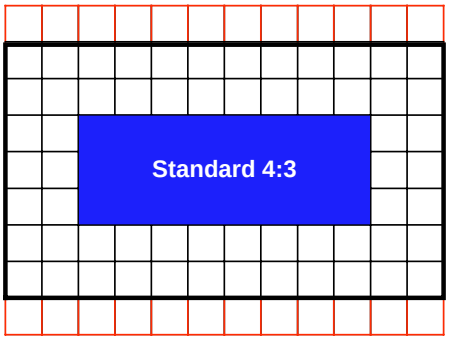
Standard 4:3 image displayed on 4:3 Monitor



Standard 4:3 image displayed on 16:9 Monitor. Aspect ratio compromised, picture stretched horizontally

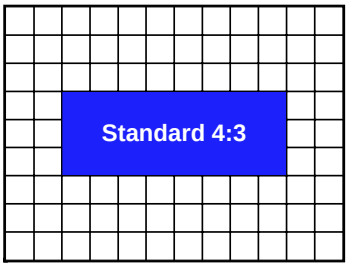
4:3 to 16:9FH conversion

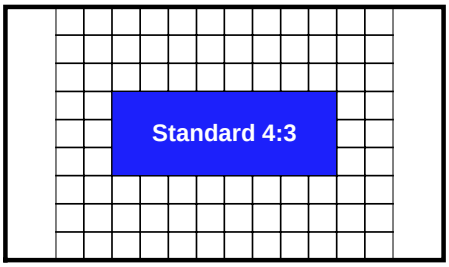




Standard 4:3 image converted to 16:9 Full Height image, displayed on 16:9 Monitor. Aspect ratio correct, loss of picture information at top and bottom of picture.

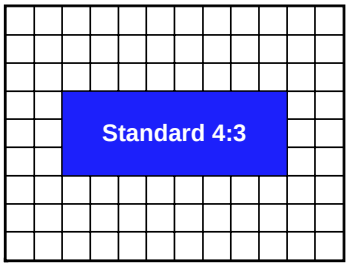
4:3 to 16:9PB conversion

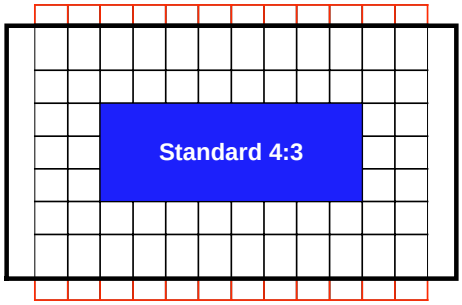




Standard 4:3 image converted to 16:9 PillarBox image, displayed on 16:9 Monitor. Aspect ratio correct, black bars left and right.

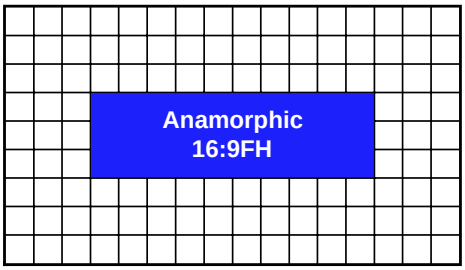
4:3 to 14:9 conversion



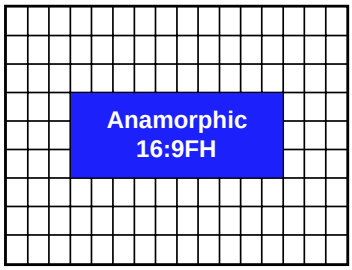


Standard 4:3 image converted to 14:9, displayed on 16:9 Monitor. Aspect ratio correct, loss of picture information at top and bottom of picture, black bars at side.

16:9FH Input image

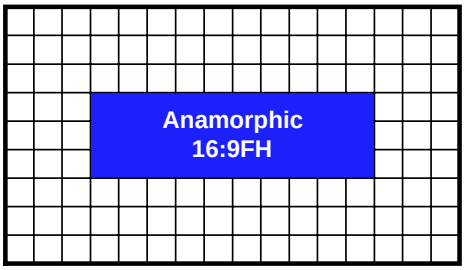


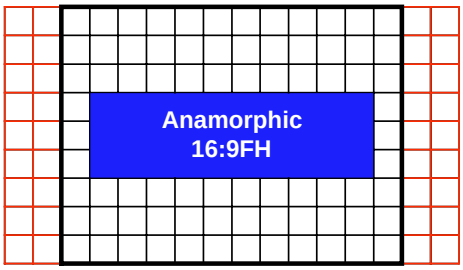
Anamorphic 16:9 Full Height image displayed on 16:9 Monitor.



Anamorphic 16:9 Full Height image displayed on 4:3 monitor. Aspect ratio compromised, picture shrunk horizontally.

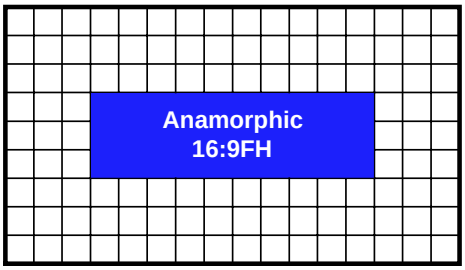
16:9FH to 4:3 conversion

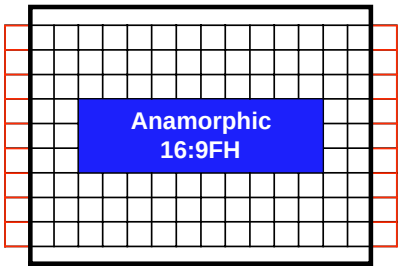




Anamorphic 16:9 Full Height image, converted to 4:3 image, displayed on 4:3 monitor. Aspect ratio correct, picture loss at sides of image.

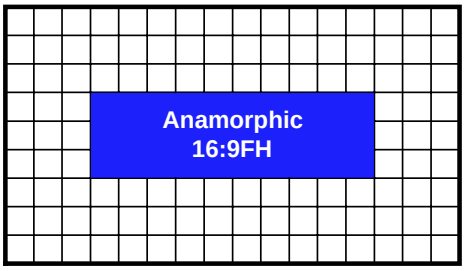
16:9FH to 14:9LB conversion

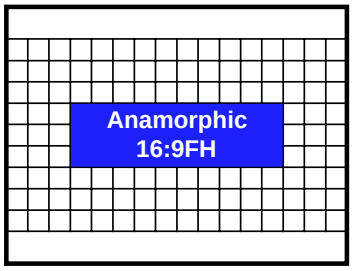




Anamorphic 16:9 Full Height image, converted to 14:9 Letterbox image, displayed on 4:3 monitor. Aspect ratio correct, picture loss at sides of image. Black bars at top and bottom of picture.

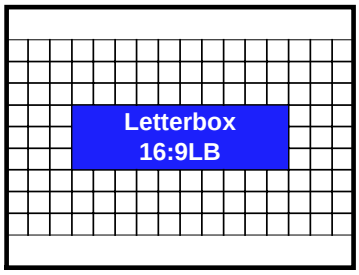
16:9FH to 16:9LB conversion



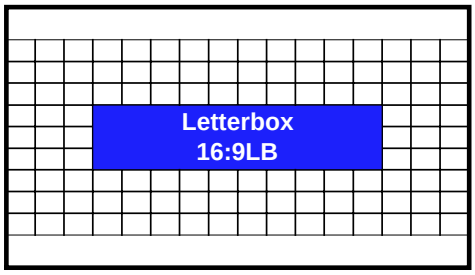


Anamorphic 16:9 Full Height image, converted to 16:9 Letterbox image, displayed on 4:3 monitor. Aspect ratio correct, no picture loss, black bars at top and bottom of picture.

16:9LB Input image

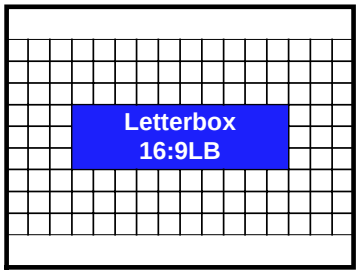


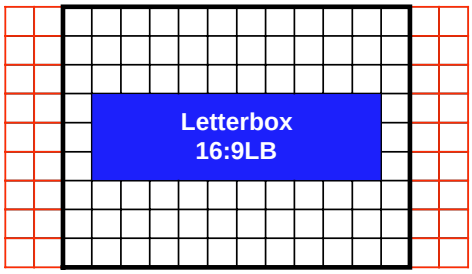
16:9 Letterbox image displayed on 4:3 monitor. Aspect ratio correct, black bars top and bottom.



16:9 Letterbox image displayed on 16:9 Monitor. Aspect ratio compromised, picture squeezed vertically, black bars top and bottom.

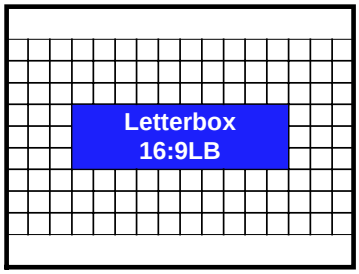
16:9LB to 4:3 conversion

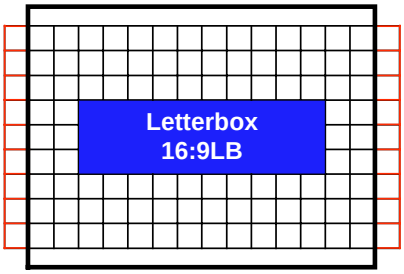




16:9 Letterbox image converted to 4:3 image, displayed on 4:3 Monitor. Aspect ratio correct, picture loss at side of image.

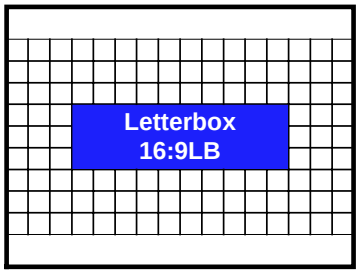
16:9LB to 14:9LB conversion

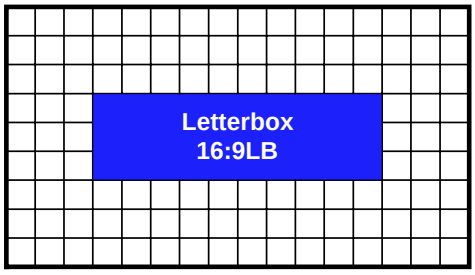




16:9 Letterbox image converted to 14:9 image, displayed on 4:3 Monitor. Aspect ratio correct, picture loss at side of image, black bars top and bottom.

16:9LB to 16:9FH conversion





16:9 Letterbox image converted to 16:9 full height image, displayed on 16:9 Monitor. Aspect ratio correct, no picture loss.

RollTrack Audio Delay Tracking

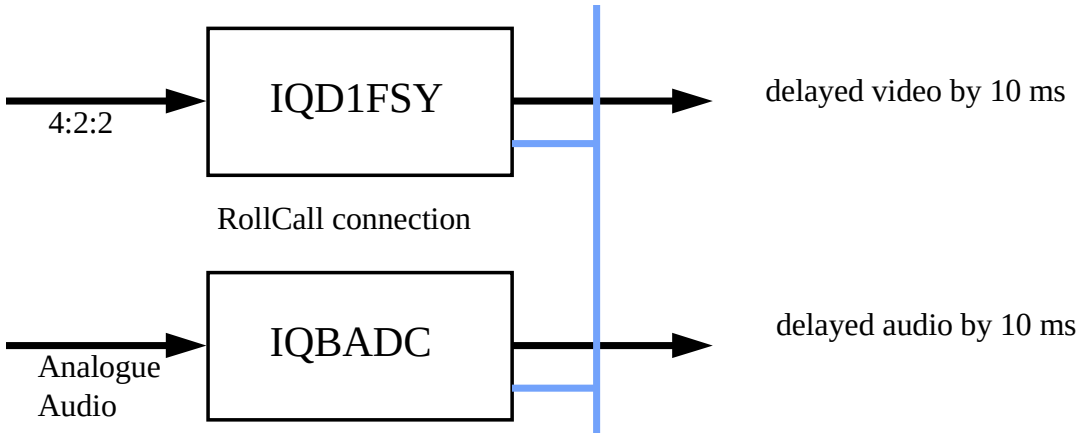
RollTrack is a feature of RollCall™ (Snell & Wilcox's proprietary remote control system), that allows devices to communicate across the RollCall network with no direct user intervention.

RollTrack Audio Delay Tracking enables Snell & Wilcox RollCall™ compatible audio delay products to track delay introduced by RollCall™ compatible video processing products.

The current products that implement RollTrack Audio Delay Tracking are:

Audio Delay Modules	Video Modules	Other Products	
IQBAAD	IQD1FSY	ALCHEMIST	MDD3000
IQBADC	IQDMSDS	CPP100	MDD550
IQBDAC	IQDAFS	CPP200	MDD560
IQBDAD	IQDMSDS	NRS500	MDD570
IQBSYN	IQDMSDP	HD5050	MDD2000
IQBADCD		CVR500	

The simplest configuration is a single video unit and a single audio delay in a RollCall™ system. The audio delay will have the same delay as through the video path. If the delay changes the audio delay will track.



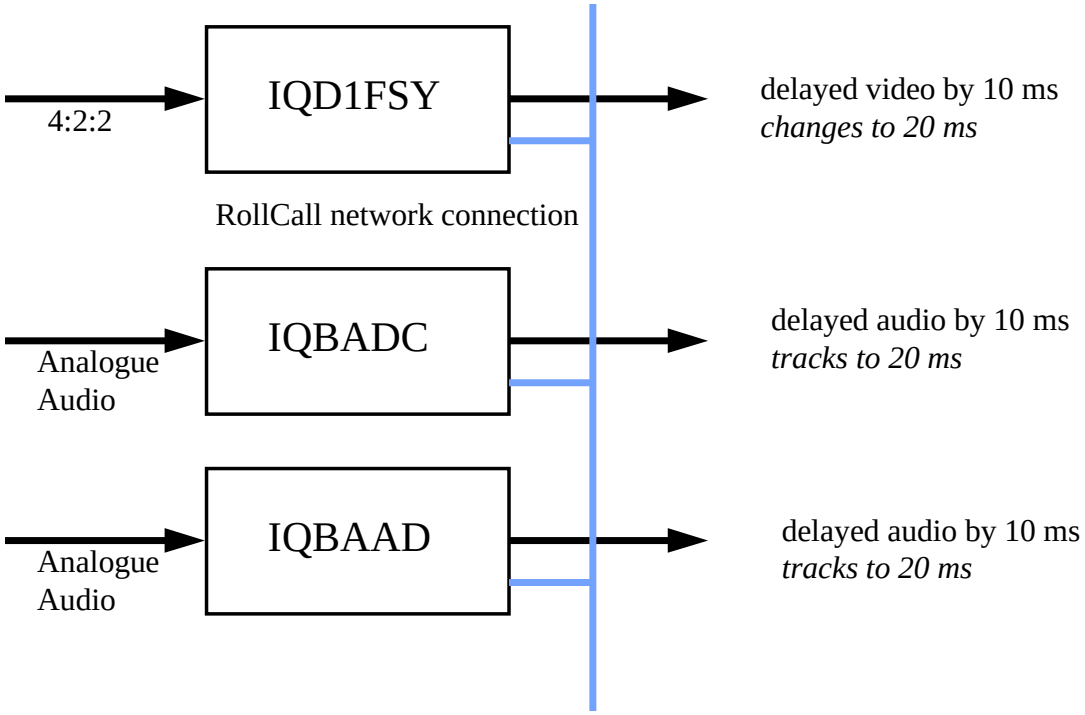
The next level of configuration is where there are multiple Frame Synchronizers (for example) each connected through RollCall™ to their own tracking Audio Delay. (It is worth stating that the synchronizers and audio delays do not have to be in the same enclosure; the addressing scheme, discussed later, allows for the units to be positioned anywhere in the RollCall™ domain.)

The maximum number of video units and audio delays in a RollCall™ system is set by the maximum limit of the number of modules in a RollCall™ network and is currently 3840 on a single network without bridges.

The unique identification of the destination unit (a decimal number) for various modules is as follows:

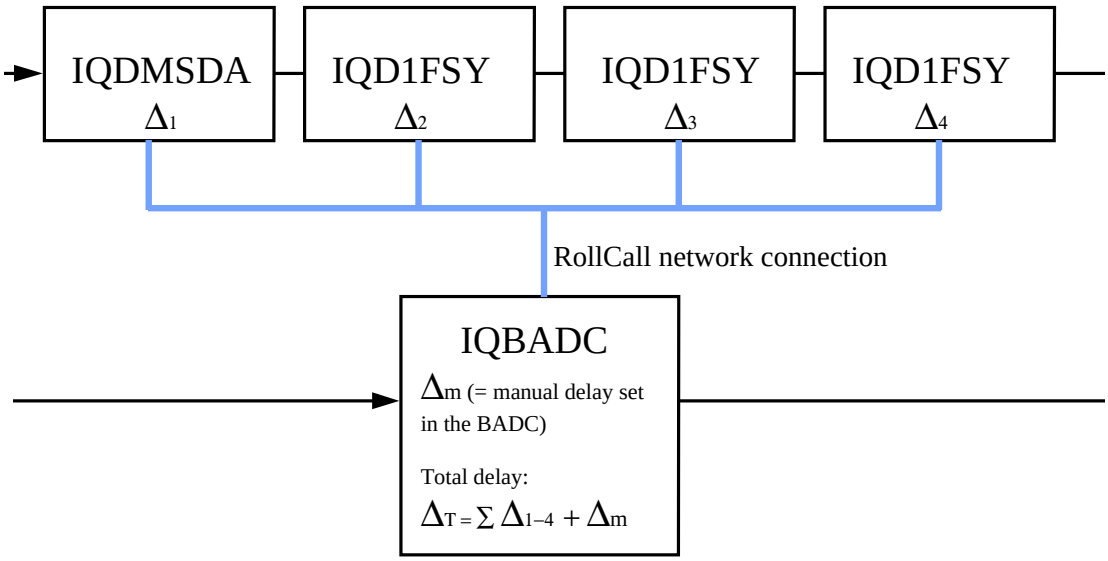
Module	ID
IQBADC	51
IQBDAC	52
IQBAAD	53
IQBDAD	54
IQBSYN	89
IQBADCD	107

The next level of complexity is *a vertical delay cluster* where a video unit can have up to eight audio delays tracking - of the same or different types.



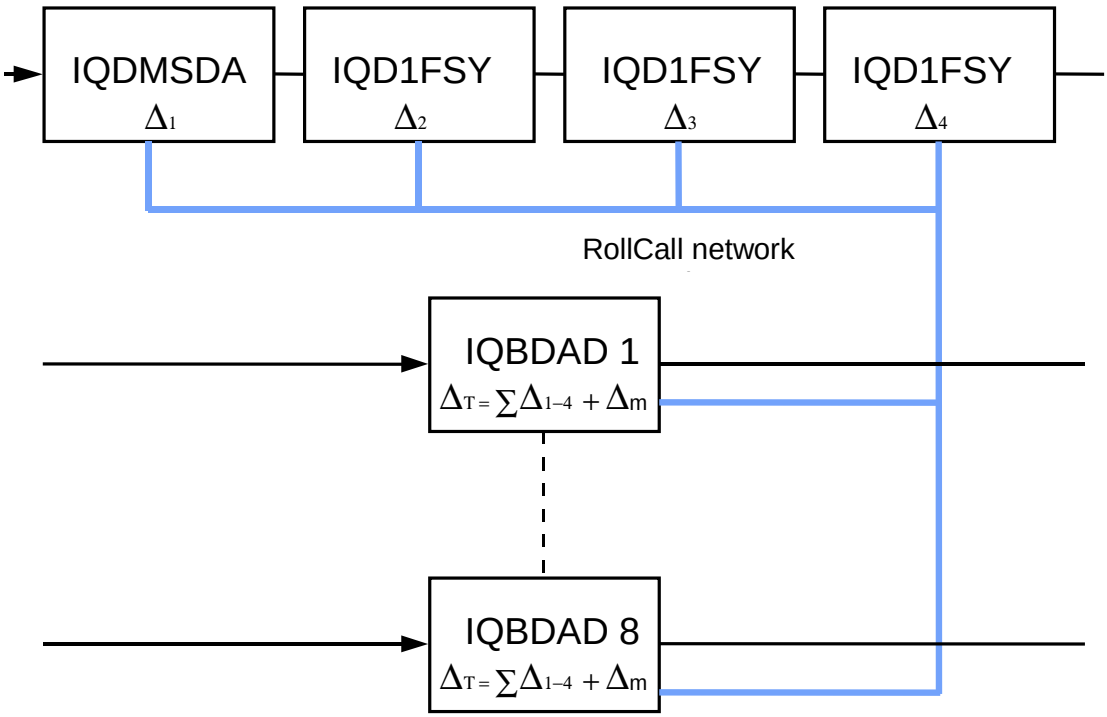
From one to eight audio delay products can be connected via RollCall™ to a single frame synchronizer, for example. If the synchronizer delay changes, then however many audio delays are connected will track the delay. The audio delays can also have a manual delay which will be added to the RollTrack delay.

The next level of complexity is *a horizontal delay cluster* where an audio delay can track up to four video units.



The total delay time through the audio delay is then the sum of the individual delays introduced by the video units plus the manual delay of the audio unit. The manual delay can be set to compensate for any fixed propagation delay in the video path or may be set to zero.

The next level of complexity is a *matrix delay cluster* where each audio delay (up to eight) can track up to four video units. This configuration is in effect a four by eight matrix of video units and audio delay units. The total delay time through the audio delay units is then the sum of the individual delays introduced by the video units plus the manual delay of the audio unit.



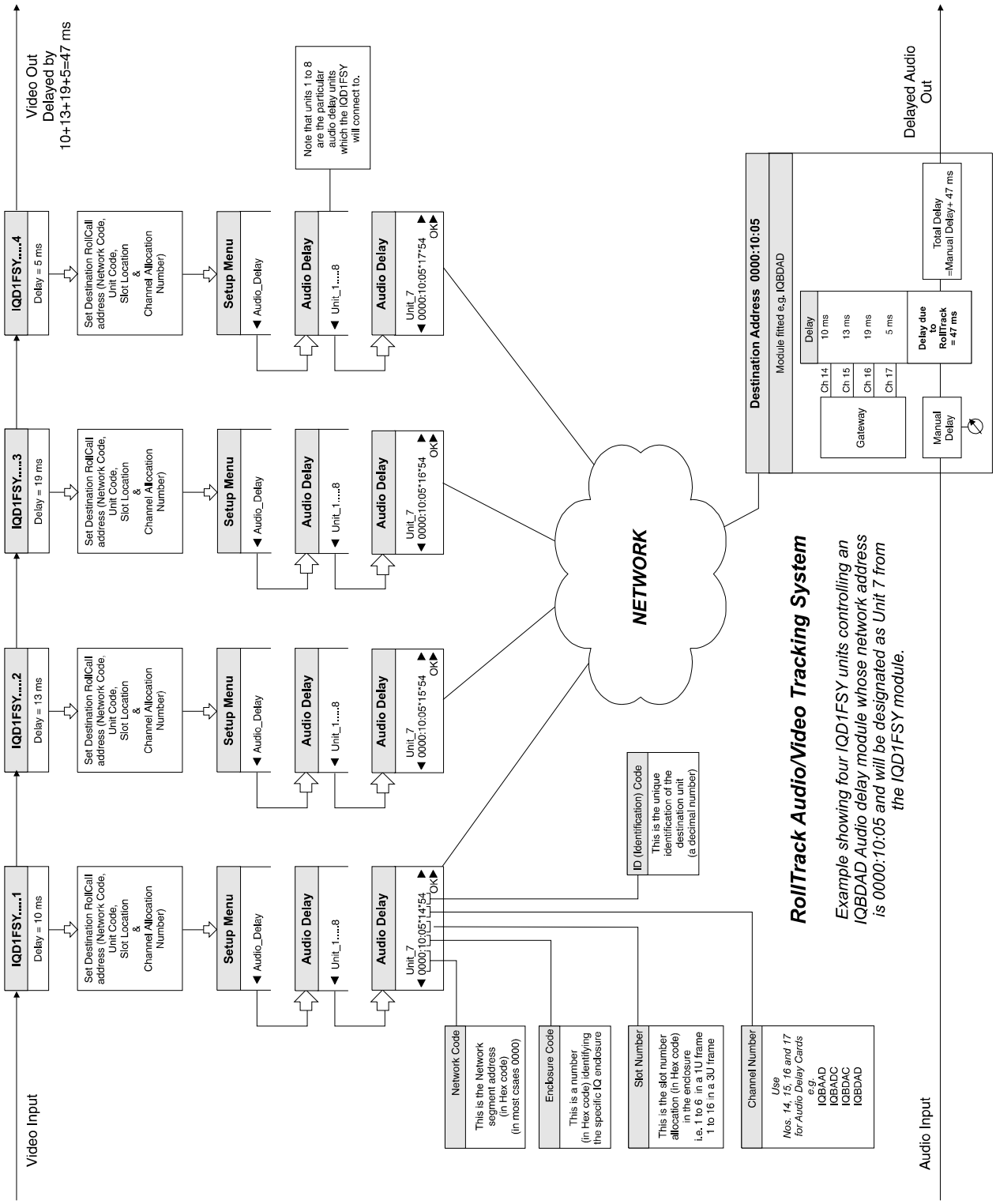
As any of the delay times change in the video path so will the audio delay time track this delay.
A virtual connection is made between from, say, an IQD1FSY to an IQBDAD by:

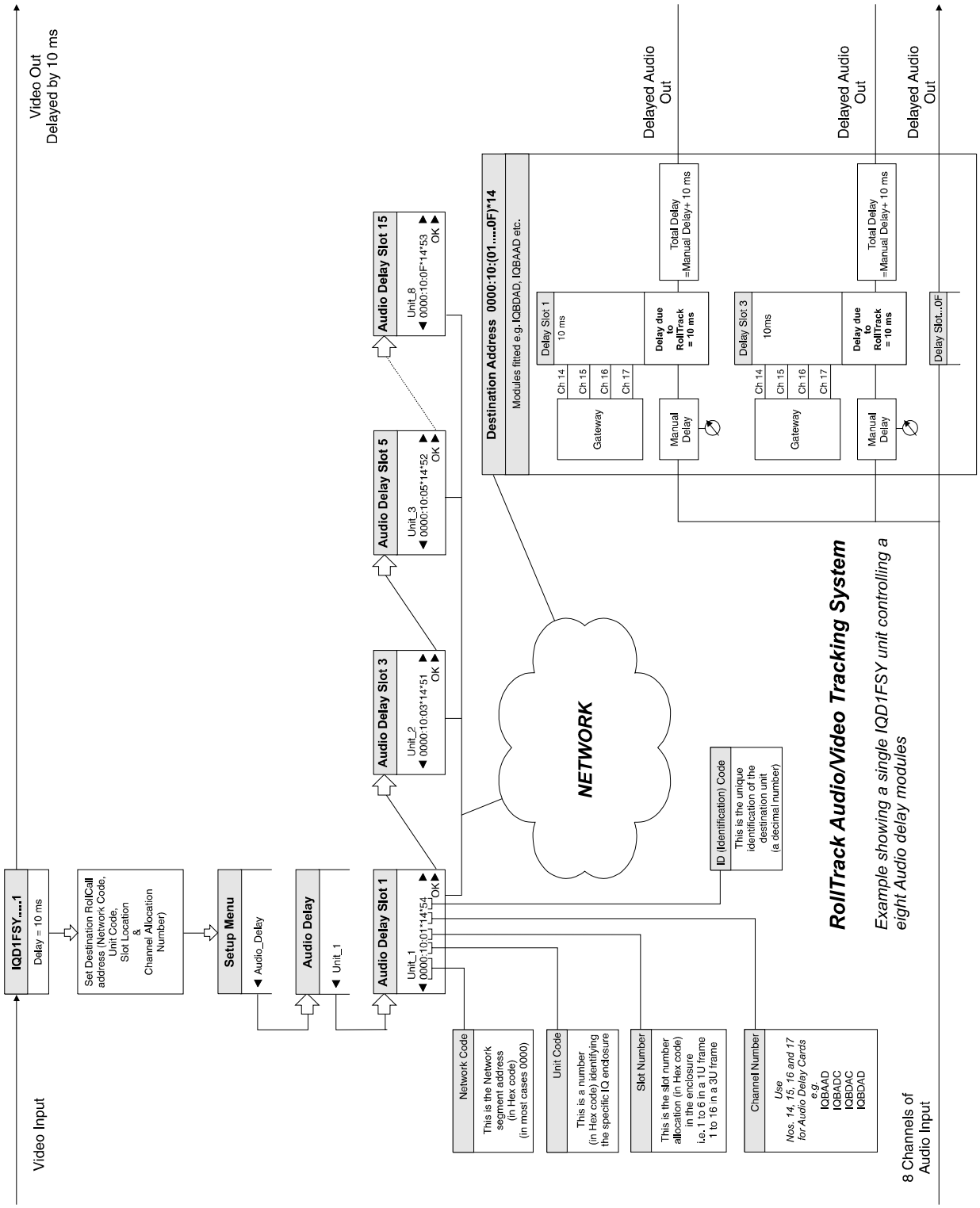
selecting the *Setup...* Menu of the IQD1FSY
then selecting the *Audio_Delay...* Menu
then choosing from *Unit_1* to *Unit_8*
then entering the unique network address of the IQBDAD in the form *nnnn:xx:yy*z*d*
where *nnnn* = network address and in most cases will be 0000(hex);
xx = IQ enclosure address (hex);
yy = slot address of the IQBDAD (hex)
z = the connection (or channel) number (decimal) - see table below.
d = the unique identification of the destination unit (decimal) The ID entered must match the receiving units own ID or else the command will be ignored. If the ID value is set to 00, the receiving unit does not perform an ID match and will always accept the incoming command
then selecting the *Delay...* Menu of the IQBDAD
then selecting *Auto*

Example of Network Addresses with Channel Numbers and ID Numbers

	D1FSY 1	**D1FSY 2**	**D1FSY 3**	**D1FSY 4**
Audio delay 1	0000:10:01*14*54	0000:10:01*15*54	0000:10:01*16*54	0000:10:01*17*54
Audio delay 2	0000:10:03*14*54	0000:10:03*15*54	0000:10:03*16*54	0000:10:03*17*54
Audio delay 3	0000:10:05*14*54	0000:10:05*15*54	0000:10:05*16*54	0000:10:05*17*54
Audio delay 4	0000:10:07*14*54	0000:10:07*15*54	0000:10:07*16*54	0000:10:07*17*54
Audio delay 5	0000:10:09*14*54	0000:10:09*15*54	0000:10:09*16*54	0000:10:09*17*54
Audio delay 6	0000:10:0B*14*54	0000:10:0B*15*54	0000:10:0B*16*54	0000:10:0B*17*54
Audio delay 7	0000:10:0D*14*54	0000:10:0D*15*54	0000:10:0D*16*54	0000:10:0D*17*54
Audio delay 8	0000:10:0F*14*54	0000:10:0F*15*54	0000:10:0F*16*54	0000:10:0F*17*54

The most complex system would be an array of matrix delay clusters




Video Out
Delayed by 10 ms
IQD1FSY....1
Delay = 10 ms
Set Destination RollCall address (Network Code, Unit Code, Slot Location & Channel Allocation Number)
Setup Menu
Audio_Delay
Audio Delay
Unit_1
Audio Delay Slot 1
Unit_1
0000:10:01*14*54
OK
Audio Delay Slot 3
Unit_2
0000:10:03*14*51
OK
Audio Delay Slot 5
Unit_3
0000:10:05*14*52
OK
Audio Delay Slot 15
Unit_8
0000:10:0F*14*53
OK
Video Input
Network Code
This is the Network segment address (in Hex code) (in most cases 0000)
Unit Code
This is a number (in Hex code) identifying the specific IQ enclosure
Slot Number
This is the slot number allocation (in Hex code) in the enclosure i.e. 1 to 6 in a 1U frame 1 to 16 in a 3U frame
Channel Number
Use Nos. 14, 15, 16 and 17 for Audio Delay Cards e.g. IQBAAD IQBADC IQBDAC IQBDAD
8 Channels of Audio Input
NETWORK
ID (Identification) Code
This is the unique identification of the destination unit (a decimal number)
Destination Address 0000:10:(01....0F)*14
Modules fitted e.g. IQBDAD, IQBAAD etc.
Delay Slot 1
10 ms
Ch 14
Ch 15
Ch 16
Ch 17
Gateway
Manual Delay
Delay due to RollTrack = 10 ms
Total Delay =Manual Delay+ 10 ms
Delay Slot 3
10ms
Delay Slot...0F
Delayed Audio Out
Delayed Audio Out
Delayed Audio Out
RollTrack Audio/Video Tracking System
Example showing a single IQD1FSY unit controlling a eight Audio delay modules