

# Crystal Vision



## 3G/HD/SD Colour Corrector and Legaliser

CoCo 3G is a colour corrector and legaliser for 25 different video standards. Designed for whole picture colour correction or for ensuring that the broadcast colour gamut is always legal, it allows flexible adjustments in both the RGB and YUV colour spaces.

With control options to suit all preferences, CoCo 3G includes an impressive list of features, including numerous RGB and YUV adjustments, advanced correction for gamut errors, preview mode with illegal signal value highlighting, relay bypass protection and even optional integrated fibre input/output connectivity. As a 100mm x 266mm module, CoCo 3G will save you rack space too.



- ▲ Colour corrector and legaliser for whole picture adjustments in the RGB and YUV domains
- ▲ Use it with any source: works with 3Gb/s, HD and SD sources and 25 different video standards
- ▲ Wide range of RGB colour correction tools: with independent gain, lift and gamma
- ▲ Wide range of YUV video level tools: with independent and overall lift and gain, hue phase adjustment and Black clean up
- ▲ Legalise naturally and maintain the colour: changes YUV colours illegal in RGB to be valid in RGB by desaturating the colour without changing the hue
- ▲ Preview and perfect your adjustments: wipe horizontally or vertically between the processed and unprocessed signal for a 'before' and 'after' comparison
- ▲ Easily spot the problem areas: highlight any pixels containing illegal signal values
- ▲ Remove any unwanted picture material: with adjustable horizontal and vertical cropping
- ▲ Optional integrated fibre input/output activity means you won't be limited by cable lengths
- ▲ Use it with embedded audio sources: passes ancillary information, including embedded audio
- ▲ Save yourself time: use the 16 user memories to store regular adjustments
- ▲ Protect your programme output with relay bypass protection option
- ▲ Space-saving: 100mm x 266mm module allows 12 CoCo 3G in 2U (24 in 4U, six in 1U and two in desk top box)
- ▲ Choice of control with easy-to-use interface: select from board edge switches, front and remote panels, PC software, SNMP and dedicated 1U panel

## WHAT CAN YOU USE IT FOR?

CoCo 3G is ideal for manipulating the colours in any digital image whenever you need to correct for camera or lighting problems or standardise pictures shot at different times. Popular applications include adjusting the colours on in-shot plasma displays, being placed before an encoder to set the range of colours to be transmitted and the correction of computer-generated or post production outputs. Its small size also makes it ideal for multi-channel applications. CoCo 3G can be used with embedded audio sources, passing all ancillary data including embedded audio without modification.

## WHICH VIDEO STANDARDS WILL IT WORK WITH?

CoCo 3G supports 25 different video standards, including the 23.98, 24 and 25 frames per second progressive video standards for film to HD video transfers. The video formats supported are 625, 525, 720p23.98, 720p24, 720p25, 720p29.97, 720p30, 720p50, 720p59.94, 720p60, 1035i59.94, 1035i60, 1080PsF23.98, 1080PsF24, 1080i50, 1080i59.94, 1080i60, 1080p23.98, 1080p24, 1080p25, 1080p29.97, 1080p30, 1080p50, 1080p59.94 and 1080p60.

## WIDE RANGE OF RGB ADJUSTMENTS

There's an impressive range of colour correction tools available, with independent gain, lift and gamma in the RGB domain.

The gain and lift tools are used together to effortlessly increase or reduce the red, green or blue individually, allowing CoCo 3G to perform true colour correction. Overall gamma is used to lighten or darken the picture without crushing the blacks or the whites, while independent adjustment of red, green and blue gamma – rarely seen at this price level – allows extremely sophisticated colour manipulation.

## WIDE RANGE OF YUV ADJUSTMENTS

The YUV video level adjustment tools on offer include independent lift, independent gain, overall lift and gain and hue phase adjustment. With Black clean up, Y levels below a user-defined value are forced to black which can be useful for cleaning up noise. The range of adjustment for the Black clean up threshold is 0-10% of peak white.

The full list of RGB and YUV adjustments are available in the Specification section on the back page.

## THE BEST WAY TO CORRECT GAMUT ERRORS

CoCo 3G is an excellent legaliser. It has advanced correction for gamut errors, changing any YUV colours that are illegal in RGB to be valid in RGB in a brilliant and subtle way. CoCo 3G legalises by reducing the colour saturation without changing the hue, processing the RGB components on each pixel at the same time and achieving a legal and natural-looking picture. When there is no RGB processing, the signal is legalised in the YUV domain to make it RGB legal, avoiding the distortion inevitable when changing colour space. Thanks to some clever processing CoCo 3G will correctly pass transients caused by the

different bandwidths in the RGB and YUV colour spaces. YUV adjustable soft clipping is also available and limits the gamut to a YUV range by providing a combination of adjustable threshold and slope controls.



## PREVIEW AND PERFECT YOUR ADJUSTMENTS – AND SPOT ILLEGAL VALUES

It's easy to preview and perfect any adjustments. Using Preview Mode, the auxiliary outputs can be connected to a monitor and will allow the operator to wipe horizontally or vertically between the processed and unprocessed signal for a split-screen 'before' and 'after' comparison.

The auxiliary outputs can also be used to highlight any pixels containing illegal signal values using the Gamut Error Highlighter, making it easier to locate the problem and make any adjustments to equipment in the system.

You can even remove unwanted parts of the picture by using the adjustable horizontal and vertical cropping tools – from zero to full image width left and right, and zero to full image height top and bottom.

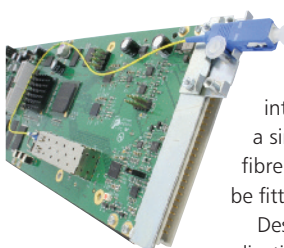


Preview and perfect your adjustments: wipe between the processed and unprocessed signal



View the illegal pixels on the auxiliary output

## FIBRE CONNECTIVITY – ON THE BOARD



Should you need to colour correct or legalise signals from beyond the local equipment bay, it's easy to give CoCo 3G

integrated fibre connectivity – and still only use a single frame slot. Simply request either the FIP fibre input option or FOP fibre output option to be fitted to the motherboard by Crystal Vision.

Designed for SMPTE 297-2006 short-haul applications the FIP and FOP use a Class I laser, with the FIP used to receive an optical input and the FOP used to transmit an optical output. If a FIP is fitted, you can select your video input source to be taken either from the input BNC or the optical input.

Having the fibre integral to the board reduces the need to use up additional rack space for separate fibre optic transmitters and receivers – and also saves you money.

## A FLEXIBLE CHOICE OF CONTROL

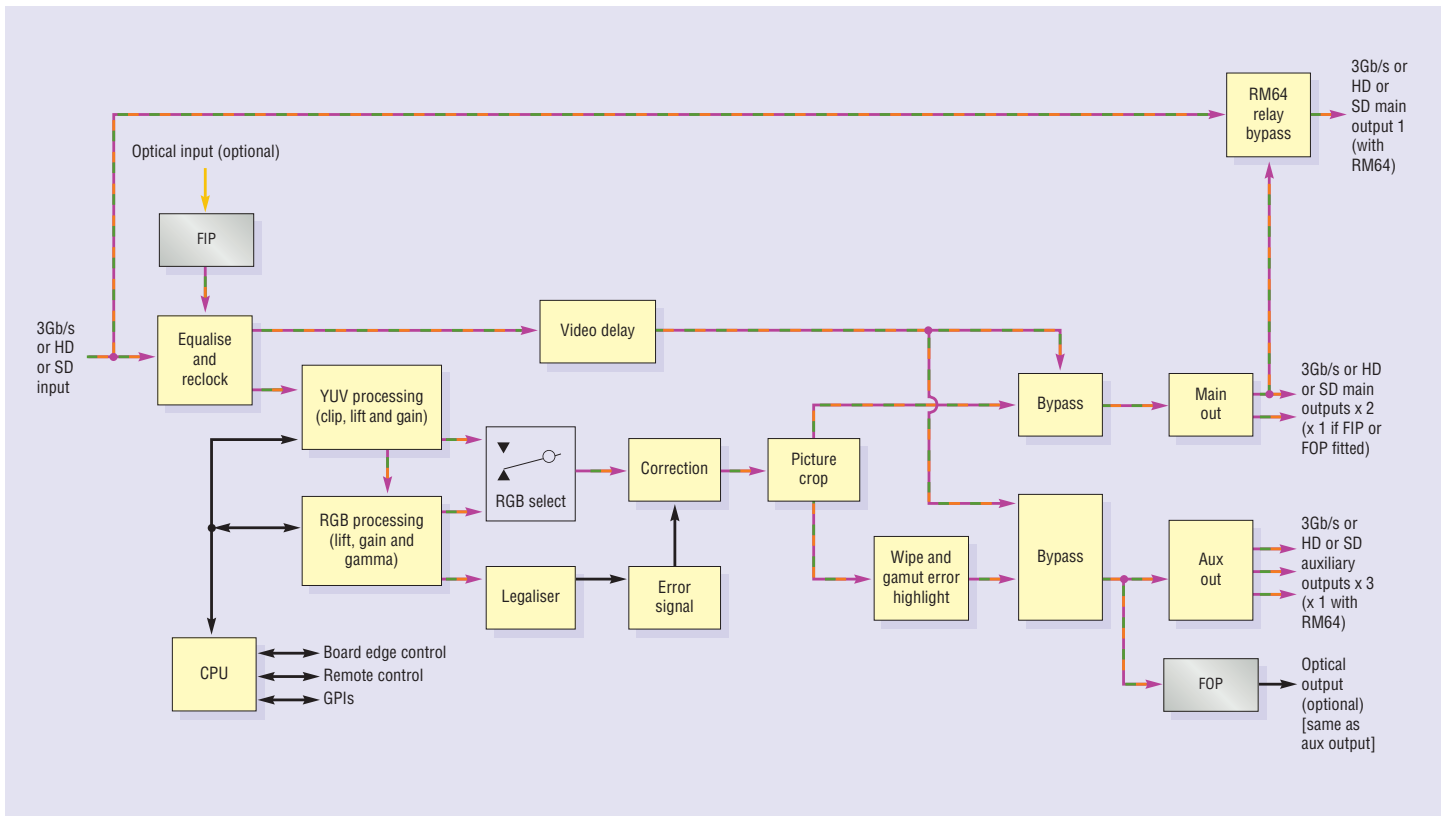


Hands-on control with the CoCo 3G Controller

The instinctive user interface makes CoCo 3G extremely simple to operate – with a choice of control methods to suit all preferences.

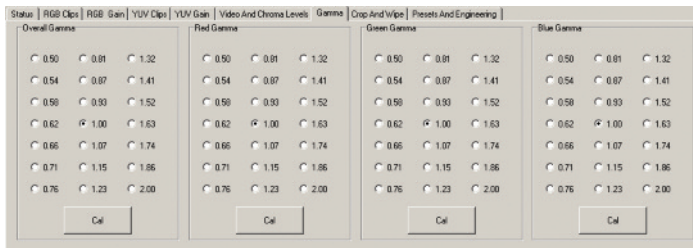
Ideal for live use, the CoCo 3G Controller is a dedicated 1U control panel for up to 12 colour correctors. Fitting easily into any control desk, it has seven dedicated shaft encoders for the most commonly used adjustments (video gain, chroma gain, black level, red gain, green gain, blue gain and gamma) with the values shown in a display, as well as quick set-up buttons to implement the common combinations.

Statesman is available for those who prefer PC control with adjustments available using nine different control tabs. Useful Statesman alarms can be set for out of range inputs, loss of input or loss of board. For a permanent set up, such as for legalising, a frame active front panel or Crystal Vision's



general remote control panel are ideal, while there's also full board edge control. SNMP monitoring and control is also available.

You can use the 16 presets to save yourself time: being able to store the precise adjustments for future use is ideal, for example, if you need to continually correct a feed from the same camera.



Use the Statesman PC software to make any adjustments – including independent red, green and blue gamma

## SAVE RACK SPACE

CoCo 3G will also save you rack space. The 100mm x 266mm module fits in the Crystal Vision frames alongside any of the other products, allowing 24 boards in 4U, 12 in 2U, six in 1U or two in a desk top box.

CoCo 3G can be used with three different frame rear modules, depending on your requirements. The default rear module is the RM41 which gives access to one 3Gb/s, HD or SD input, two main outputs and three auxiliary outputs.

The RM57 rear module should be used for fibre applications and gives access to one 3Gb/s, HD or SD input (available on fibre if a FIP fibre option is fitted), one main output and three auxiliary outputs, plus one copy of the auxiliary output on fibre if a FOP fibre option is fitted.

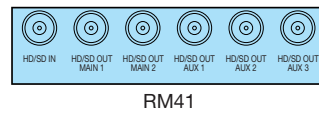
The RM64 rear module, meanwhile, is ideal for those using CoCo 3G with the CoCo 3G Controller control panel, as it allows one-to-one RS422 wiring from the CoCo 3G Controller straight to the board – allowing the same RJ45 cable to be used for any slot. It gives access to one 3Gb/s, HD or SD input, two main outputs and one auxiliary output.

## EXTRA PEACE OF MIND – WITH RELAY BYPASS PROTECTION

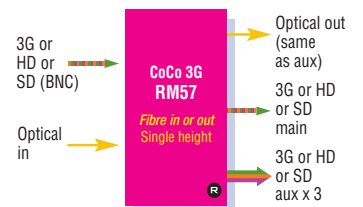
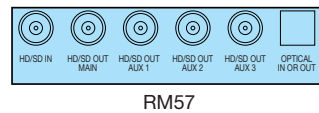
The RM64 rear module also gives CoCo 3G relay bypass protection – which helps maintain programme output in the event of power failure or board removal. It prevents signal loss by mechanically connecting CoCo 3G's input signal to main output 1 should the supply to the RM64 be interrupted.

## REAR MODULE CONNECTIONS

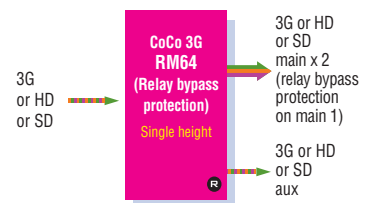
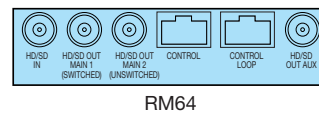
### For standard applications



### For fibre applications



### For relay bypass applications



NB. Choose between fibre in or fibre out by selecting FIP or FOP fibre option

## MECHANICAL

Standard Crystal Vision module 266mm x 100mm  
 Weight: 180g  
 Power consumption: 11 Watts; 0.6 Watts (FIP and FOP)

## VIDEO INPUT

One 3Gb/s or HD or SD input with reclocking  
 When using FIP fibre input option allows selection between one optical and one electrical input  
 270Mb/s or 1.5Gb/s or 3Gb/s serial compliant to EBU 3267-E, SMPTE 259M, SMPTE 292M and SMPTE 424M  
 The 25 video formats supported are 625, 525, 720p23.98, 720p24, 720p25, 720p29.97, 720p30, 720p50, 720p59.94, 720p60, 1035i59.94, 1035i60, 1080PsF23.98, 1080PsF24, 1080i50, 1080i59.94, 1080i60, 1080p23.98, 1080p24, 1080p25, 1080p29.97, 1080p30, 1080p50, 1080p59.94 and 1080p60  
 3Gb/s cable equalisation up to 80m using Belden 1694A.  
 HD/SD cable equalisation up to 140m with Belden 1694A or equivalent (approx. 100m with Belden 8281)  
 Input return loss: -15dB for 50MHz to 1.5GHz and -10dB for 1.5GHz to 3GHz  
 Auto data rate and video format selection

## VIDEO OUTPUTS

Using **RM41 rear module**: Five 3Gb/s or HD or SD outputs (two main, three auxiliary)  
 Using **RM57 rear module with FIP fibre input option**: Four 3Gb/s or HD or SD outputs (one main, three auxiliary). Select between one fibre and one electrical input  
 Using **RM57 rear module with FOP fibre output option**: Four 3Gb/s or HD or SD outputs (one main, three auxiliary), plus one copy of the auxiliary output on fibre  
 Using **RM64 rear module**: Three 3Gb/s or HD or SD outputs (two main, one auxiliary). Allows one-to-one RS422 wiring from the CoCo 3G Controller straight to the board meaning the same RJ45 cable can be used for any frame slot. The RM64 provides relay bypass protection to help maintain programme output. An electromechanical relay switch needs power to hold the switch in one state and will revert to the other state (board bypass) on loss of power. It prevents signal loss by mechanically connecting the input to main output 1 on complete frame power failure or board removal  
 Serial output: 270Mb/s or 1.5Gb/s or 3Gb/s serial compliant to EBU 3267-E, SMPTE 259M, SMPTE 292M and SMPTE 424M.  
 Output follows the input format

## INTEGRATED FIBRE OPTIONS

CoCo 3G can be given integrated fibre connectivity by fitting either the FIP fibre input option or FOP fibre output option. The chosen option should be fitted at the factory  
 To access the optical inputs or outputs an RM57 frame rear module must be used  
 When fitted with a FIP or FOP, CoCo 3G can be housed in any frame slot position but due to its extra height it is not possible to place Standard Definition or audio boards directly above it when the CoCo 3G is in even numbered slot positions. 3Gb/s and HD boards do not share this restriction  
 FIP and FOP meet the SMPTE 297-2006 short-haul specification, allowing operation with single-mode and multi-mode fibre  
 Connector type: SC/PC  
**FIP:**  
 Optical wavelength: 1260-1620nm  
 Input level maximum: -1dBm  
 Input level minimum: Typical -20dBm (-18dBm 3Gb/s pathological)  
**FOP:**  
 Optical power: Max -0.0dBm, min -5.0dBm (typical -2.0dBm or 630uW)  
 Fibre pigtail: Single-mode 8/125uM  
 Optical wavelength: 1290-1330nm (1310 typical)  
 Extinction ratio: 7.5dB  
 Laser safety classification: Class 1 (EN 60825), Class I (21CFR1040.10)

## DELAY THROUGH BOARD

<16us (SD)  
 <3us (HD)  
 <2us (3Gb/s)

## ANCILLARY DATA/EMBEDDED AUDIO

All data in the vertical and horizontal blanking interval is passed through unprocessed with full 20 bits. The unit will pass through embedded audio and any ancillary data with a delay that matches the default processing delay

## COLOUR CORRECTIONS

Increase/decrease overall lift and gain  
 Increase/decrease Y channel lift and gain  
 Increase/decrease U channel lift and gain  
 Increase/decrease V channel lift and gain  
 Hue shift U/V channels

Black clean up (Y levels below a user-defined value are forced to black)  
 Increase/decrease R channel lift and gain  
 Increase/decrease G channel lift and gain  
 Increase/decrease B channel lift and gain  
 Increase/decrease overall gamma  
 Increase/decrease R gamma  
 Increase/decrease G gamma  
 Increase/decrease B gamma

## LEGALISING

Set and soft limit Y channel positive and negative excursions independently  
 Set and soft limit U channel positive and negative excursions symmetrically  
 Set and soft limit V channel positive and negative excursions symmetrically  
 Set and limit R, G, B channel positive and negative excursions  
 Includes sophisticated processing to deal with transient errors  
 RGB gamut errors are corrected without changing the hue of the affected area  
 Set horizontal and vertical active picture area cropping region on final output (0 to full image width left and right and 0 to full image height top and bottom)

## PREVIEW MODE

The preview mode allows the unprocessed input and processed output to be seen side by side to facilitate adjustments using either a vertical or horizontal wipe. The split-screen preview is only available via the auxiliary outputs

## GAMUT ERROR HIGHLIGHTER

The auxiliary outputs can be used to highlight any pixels containing illegal signal values, making it easier to locate the problem and make any adjustments to equipment in the system

## BYPASS MODE

Bypass mode allows all the processing and legalising functions to be turned off so the input is passed unchanged. The signal is put through a matching delay so that the board can be

switched between bypass and processing while continuing to output valid video

## PRESETS

The current board settings can be saved in one of 16 locations to be recalled as required

## LED INDICATION OF:

Power supplies okay  
 Not cal (gains or levels not at their default values)  
 HD input  
 SD input  
 GPI 5 active  
 GPI 6 active

## GPI INPUT LEVELS

Active pull to ground, pulled up to +5V through 10 kohm

## GPI INPUTS

Four GPI inputs select one of 16 presets  
 Connections are also used for RS422 link to dedicated control panel

## GPI OUTPUT LEVELS

Electrically: Open collector transistors 30V, 270 ohm current limit resistors. Pulled up to +5V through 6800 ohm

## GPI OUTPUTS

Two GPI outputs  
 YUV clip status/RGB clip status

## LOCAL CONTROL

Full control using intuitive board edge interface with two select buttons, shaft encoder and ten character alphanumeric display

## REMOTE CONTROL

RS422/485  
 19200 baud, 8 bits, 1 stop no parity  
 CoCo 3G Controller 1U control panel operates up to 12 CoCo 3G modules  
 Control from frame active front panel and remote panel  
 Statesman allows control from any PC on a network  
 SNMP monitoring and control available as a frame option

## ORDERING INFORMATION

CoCo 3G	3G/HD/SD colour corrector and legaliser
FIP	Fibre input option for CoCo 3G motherboard providing integrated fibre input connectivity
FOP	Fibre output option for CoCo 3G motherboard providing integrated fibre output connectivity
Indigo 4	4U frame with passive front panel for up to 24 Crystal Vision modules
Indigo 4SE	4U frame with passive front panel fitted with Statesman CPU for up to 24 Crystal Vision modules
Indigo 2	2U frame with passive front panel for up to 12 Crystal Vision modules
Indigo 2AE	2U frame with active front panel for up to 12 Crystal Vision modules
Indigo 2SE	2U frame with passive front panel fitted with Statesman CPU for up to 12 Crystal Vision modules
Indigo 1	1U frame with passive front panel for up to six Crystal Vision modules. Power supply redundancy available with Indigo 1-DP
Indigo 1AE	1U frame with active front panel for up to six Crystal Vision modules. Power supply redundancy available with Indigo 1AE-DP
Indigo 1SE	1U frame with passive front panel fitted with Statesman CPU for up to six Crystal Vision modules. Power supply redundancy available with Indigo 1SE-DP
Indigo DT	Desk top box with passive front panel for up to two Crystal Vision modules
Indigo DTSE	Desk top box with passive front panel fitted with Statesman CPU for up to two Crystal Vision modules
RM41	Single slot frame rear module. Allows maximum number of boards in frame (24 in 4U, 12 in 2U, six in 1U, two in desk top box). Gives access to one 3Gb/s, HD or SD input and two main and three auxiliary outputs
RM57	Single slot frame rear module. Allows maximum number of boards in frame (24 in 4U, 12 in 2U, six in 1U, two in desk top box). Designed for applications using fibre inputs or outputs. <b>When using fibre input</b> , allows you to select between one fibre and one electrical 3Gb/s, HD or SD input, and gives access to one main and three auxiliary outputs. <b>When using fibre output</b> , gives access to one 3Gb/s, HD or SD input and one main and three auxiliary outputs, along with one copy of the auxiliary output on fibre
RM64	Single slot frame rear module. Allows maximum number of boards in frame (24 in 4U, 12 in 2U, six in 1U, two in desk top box). Provides relay bypass protection. Gives access to one 3Gb/s, HD or SD input and two main outputs, one auxiliary output and RS422 control connection
CoCo 3G Controller	Dedicated 1U remote control panel for up to 12 CoCo 3G
REMIND	19" remote control panel
REMIND-E	19" Ethernet remote control panel
Statesman	PC Control System
SNMP	SNMP monitoring and control

Performance and features are subject to change. Figures given are typical measured values. COCO3G0711