# Crystal Vision

ARC-20MC

10 bit bi-directional aspect ratio converter

ARC-20MC is an affordable high performance aspect ratio converter for those that care about the quality of their output picture, with its 10 bit processing and motion adaptive video de-interlacing.

It's quick to use, with presets for the six most commonly used conversions – but you can also customise the output picture too, with picture size, position and crop adjustments.

It also includes all the features you could want, including full AFD functionality with live update of the aspect ratio, four group audio handling, a variable video delay, signal checking, relay bypass protection and even integrated fibre I/O connectivity. Add to this the five SDI outputs which could save you a distribution amplifier in your system.

ARC-20MC is an aspect ratio converter you know you can use in *any* application.
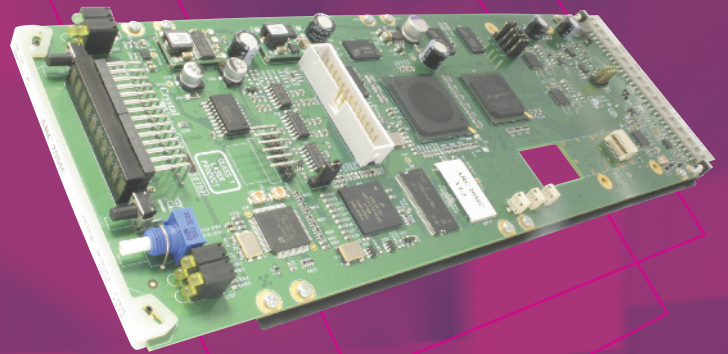
- 10 bit bi-directional digital aspect ratio converter suitable for all applications
- Exceptional performance thanks to 10 bit processing, motion adaptive video de-interlacing, noise reduction and detail enhancement processing
- Maintain your picture's colour fidelity: use the RGB and YUV lift and gain controls
- Save time with presets for the six most commonly used aspect ratio conversions
- Three presets allow 16:9 sources to be shown on a 4:3 monitor: 16:9 to 4:3 Letterbox, 16:9 to 14:9 Letterbox and 16:9 to 4:3 Full Screen
- Three presets allow 4:3 sources to be shown on a 16:9 monitor: 4:3 to 16:9 Pillarbox, 4:3 to 14:9 Pillarbox and 4:3 to 16:9 Full Screen
- Customise your output picture with flexible size, position and crop adjustments
- Change your aspect ratios live on air: will reconfigure cleanly within a single frame blanking period
- Let it automatically select the aspect ratio for you: use the SMPTE 2016 AFD, Video index or WSS data embedded in the input – with live update
- Help downstream equipment to select the correct aspect ratio: insert SMPTE 2016 AFD, Video index or WSS data into the output
- Compensate for video delays generated by other equipment, with the variable video delay of up to one frame
- Passes all embedded audio with same delay as picture
- Flag up faulty video and audio signals and provide warnings of any problems using Statesman alarms or SNMP traps
- Save a DA in your system: gives up to five converted SDI outputs
- Easy to distribute the original SDI signal: get six reclocked input loop-throughs by fitting a DA6 top board
- Get an extra layer of security with relay bypass protection
- Optional integrated fibre input/output connectivity means you won't be limited by cable lengths
- Space-saving: 100mm x 266mm module allows 12 ARC-20MC in 2U (six in 1U and two in desk top box), or six ARC-20MC in 2U if a DA6 is fitted (three in 1U and one in desk top box)
- Flexible control, including board edge, front and remote panels, GPIs, SNMP, PC software and your web browser

GET EXCEPTIONAL PERFORMANCE

ARC-20MC's exceptional quality conversion comes from a combination of 10 bit processing and motion adaptive video de-interlacing, which maximises the picture's vertical resolution and ensures that it will choose the best processing method based on the video content. Changing the aspect ratio can result in an apparently softer picture, therefore the adjustable detail enhancement feature allows the image to be sharpened – with the options of using either the Fine Detail Enhancement to apply sharpening to the entire image, or the Edge Enhancement to apply sharpening only to object edges. Also available is noise reduction, with ARC-20MC able to detect and remove mosquito noise, while colour fidelity can be maintained by using the RGB and YUV lift and gain controls.

SAVE TIME WITH PRESETS FOR THE SIX COMMON CONVERSIONS

ARC-20MC has been designed to change the aspect ratio of an SDI video signal while preserving the geometry, and provides presets for the six commonly used conversions between 4:3 and 16:9.

Three of these conversions allow 16:9 sources to be shown on a 4:3 monitor with the geometry preserved, while the other three allows similar easy conversion of 4:3 to 16:9. There's the choice of showing the whole picture with wide black edging (the 16:9 to 4:3 Letterbox and 4:3 to 16:9 Pillarbox conversions), less picture with narrow black edging (the 16:9 to 14:9 Letterbox and 4:3 to 14:9 Pillarbox conversions) or even less picture with no black edging (the 16:9 to 4:3 Full Screen and 4:3 to 16:9 Full Screen conversions).

To maintain the best picture quality ARC-20MC will automatically enter a bypass mode with matching delay when the input aspect ratio is the same as the selected output aspect ratio.

CUSTOMISE YOUR CONVERSIONS

The preset aspect ratios can each be independently customised, with flexible size, position and crop adjustments. Should you want to change the size, there's continuous compression or expansion in line and pixel increments of up to +/- 25% of nominal picture size. Vertical and horizontal offsets of +/- 50% allow the easy addition of subtitles. Vertical and horizontal cropping from 0-100% of picture size also make it possible to completely blank the image starting from any edge and so remove any unwanted material. Once the customised controls are set, they are automatically recalled whenever that particular aspect ratio is active.

AUTOMATING YOUR ASPECT RATIOS: WORKING WITH AFD

ARC-20MC can have full AFD functionality – with no restrictions. The board is well suited to following any AFD data present in the signal for automatic switching of the aspect ratio – with its ability to switch instantly and cleanly between two conversions in a single frame blanking period, which allows aspect ratios to be changed live on air. ARC-20MC can dynamically select the best conversion based on the SMPTE 2016 AFD, Video index or WSS data in the incoming video. SMPTE 2016 AFD, Video index and WSS can also be inserted into the output video for use by downstream equipment – either manually or by following the incoming AFD. (See the Specification for full information.)

HANDLE (AND DELAY) EMBEDDED AUDIO

ARC-20MC passes all embedded audio, ensuring the audio is delayed by the same amount as the video and therefore removing the need for a separate audio delay.

MATCH VIDEO DELAYS IN YOUR SYSTEM

ARC-20MC can also compensate for delays generated by other equipment in your system. On top of the minimum fixed delay of one frame minus 16 lines there is a fully flexible variable video delay of up to one frame plus 16 lines, adjustable in lines and pixels.

FLAG UP FAULTY SIGNALS

ARC-20MC includes signal probe functionality with 13 video and audio alarms available, which makes it useful for flagging up faulty signals. The status indications include input missing, video black, video frozen, input incompatible, audio missing and audio silence. Video black and video frozen and all the audio parameters can be delayed before an alarm is asserted to prevent false alarming during brief video pauses or quiet audio periods. Two GPI outputs are reserved for alarm indication, while warnings of any problems can be provided via Statesman alarms or SNMP traps.

FIBRE CONNECTIVITY – ON THE BOARD

It's easy to give ARC-20MC integrated fibre connectivity – and still only use a single frame slot. Just order either the FIP fibre input option or FOP fibre output option. Designed for SMPTE 297-2006 short-haul applications the FIP and FOP use a Class 1 laser, with the FIP used to receive an optical input and the FOP to transmit an optical output. Having the fibre integral to the board reduces the need to use up additional rack space for separate fibre optic transmitters and receivers – as well as saving you money.
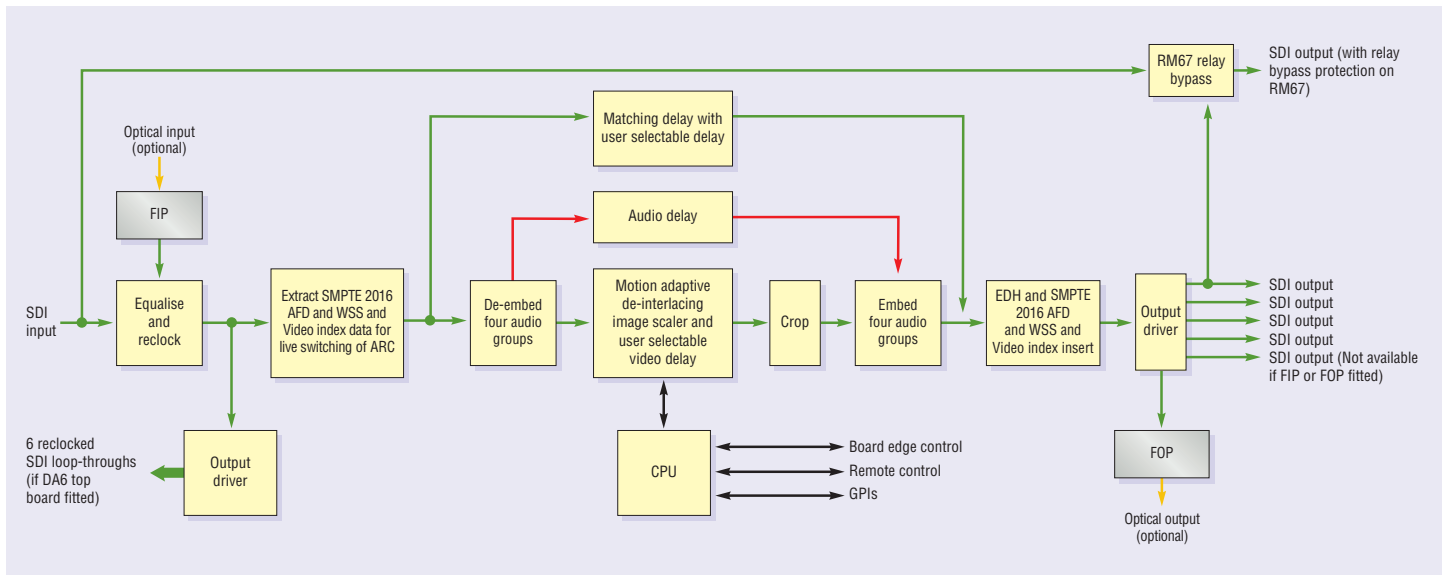
SO MANY OUTPUTS! (AND RELAY BYPASS PROTECTION)

As a 100mm x 266mm module ARC-20MC brings space-saving benefits, fitting in the Crystal Vision Indigo frames allowing easy integration with any product from the Indigo range. ARC-20MC provides an amazing five outputs of the converted signal, which could save you a DA in your system. There's the option to fit a DA6 top board to give six reclocked loop-throughs for distribution of the original SDI signal – useful if you have both 4:3 and 16:9 versions of a programme or you want to monitor the picture before and after the aspect ratio conversion. If a DA6 is fitted, ARC-20MC becomes a 'double decker' board and uses two frame slots.

ARC-20MC is used with the RM41 frame rear module for normal applications and the RM57 for fibre applications, with the RM67 selected by those who want relay bypass protection to help maintain programme output in the event of power failure or board removal.
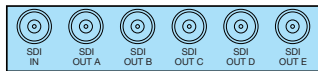
Control options include Crystal Vision's intuitive board edge interface, an integrated control panel on the AE frames, the VisionPanel remote control panel, SNMP, the Statesman Lite PC software and the VisionWeb web browser control. The current board settings can be saved in one of 16 locations to be recalled as required.
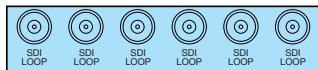
RM67 relay bypass

SDI output (with relay bypass protection on RM67)

Optical input (optional)

FIP

Matching delay with user selectable delay

Audio delay

SDI input

Equalise and reclock

Extract SMPTE 2016 AFD and WSS and Video index data for live switching of ARC

De-embed four audio groups

Motion adaptive de-interlacing image scaler and user selectable video delay

Crop

Embed four audio groups

EDH and SMPTE 2016 AFD and WSS and Video index insert

Output driver

SDI output
SDI output
SDI output
SDI output
SDI output (Not available if FIP or FOP fitted)

6 reclocked SDI loop-throughs (if DA6 top board fitted)

Output driver

CPU

Board edge control
Remote control
GPIs

FOP

Optical output (optional)

REAR MODULE CONNECTIONS

For standard applications

SDI IN | SDI OUT A | SDI OUT B | SDI OUT C | SDI OUT D | SDI OUT E

RM41

SDI LOOP | SDI LOOP | SDI LOOP | SDI LOOP | SDI LOOP | SDI LOOP

SDI IN | SDI OUT A | SDI OUT B | SDI OUT C | SDI OUT D | SDI OUT E

RM41 + RM34

For fibre applications

SDI IN | SDI OUT A | SDI OUT B | SDI OUT C | SDI OUT D | OPTICAL IN OR OUT

RM57

SDI LOOP | SDI LOOP | SDI LOOP | SDI LOOP | SDI LOOP | SDI LOOP

SDI IN | SDI OUT A | SDI OUT B | SDI OUT C | SDI OUT D | OPTICAL IN OR OUT
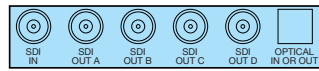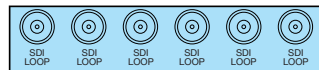
RM57 + RM34

For relay bypass applications

SDI IN | SDI OUT A | SDI OUT B | SDI OUT C | SDI OUT D (SWITCHED) | SDI OUT E

RM67

SDI LOOP | SDI LOOP | SDI LOOP | SDI LOOP | SDI LOOP | SDI LOOP

SDI IN | SDI OUT A | SDI OUT B | SDI OUT C | SDI OUT D (SWITCHED) | SDI OUT E

RM67 + RM34

SDI → **ARC-20MC RM41** Single height → SDI x 5

SDI → **ARC-20MC with DA6 top board fitted RM41 + RM34** Double height → SDI loop x 6, SDI x 5

SDI (BNC) → **ARC-20MC RM57** Fibre in or out Single height → SDI x 4
Optical in (SDI) → Optical out (SDI)

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

SDI (BNC) → **ARC-20MC with DA6 top board fitted RM57 + RM34** Fibre in or out Double height → SDI loop x 6, SDI x 4
Optical in (SDI) → Optical out (SDI)

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

SDI → **ARC-20MC RM67 (Relay bypass protection)** Single height → SDI x 5

SDI → **ARC-20MC with DA6 top board fitted RM67 + RM34 (Relay bypass protection)** Double height → SDI loop x 6, SDI x 5

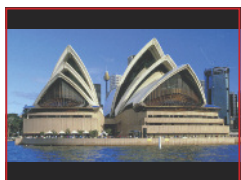## THE SIX STANDARD CONVERSIONS

16:9 to 4:3 Letterbox

- Full 16:9 source width mapped to 4:3 monitor width
- Full source height compressed to 75% of monitor height
- Horizontal black bands added to top and bottom
- No picture lost

16:9 to 14:9 Letterbox

- Central 87.5% of 16:9 source width stretched to 4:3 monitor width
- Full source height compressed to 87.5% of monitor height
- Horizontal black bands added to top and bottom
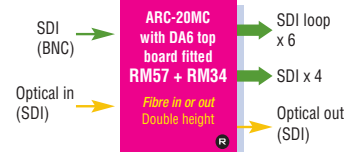- Minimal picture lost

16:9 to 4:3 Full Screen

- Central 75% of 16:9 source width stretched to 4:3 monitor width
- Full source height mapped to monitor height
- No horizontal black bands required
- Significant picture lost
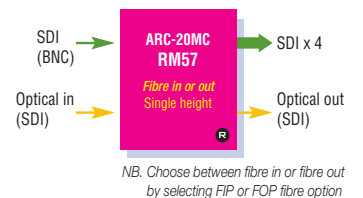
4:3 to 16:9 Pillarbox

- Full 4:3 source width compressed to central 75% of 16:9 monitor width
- Full source height mapped to monitor height
- Vertical black bands added to left and right
- No picture lost

4:3 to 14:9 Pillarbox

- Full 4:3 source width compressed to central 87.5% of 16:9 monitor width
- Central 87.5% of source height stretched to monitor height
- Vertical black bands added to left and right
- Minimal picture lost

4:3 to 16:9 Full Screen

- Full 4:3 source width mapped to 16:9 monitor width
- Central 75% of source height stretched to monitor height
- No vertical black bands required
- Significant picture lost
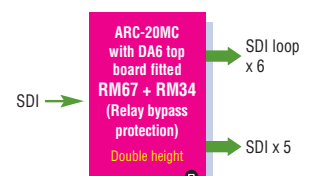
MECHANICAL
Standard Crystal Vision module 266mm x 100mm
With DA6 top board fitted: 'Double decker' module 266mm x 100mm (uses two frame slots)
Weight: 180g; 240g with DA6 fitted
Power consumption: 10 Watts; 3 Watts (DA6); 0.6 Watts (FIP and FOP)

VIDEO INPUT
One SDI input with reclocking
When using FIP fibre input option allows selection between one optical and one electrical input. The input loop-throughs will show whichever input has been selected
270Mb/s serial compliant to SMPTE 259
SD cable equalisation >250m with Belden 8281 or equivalent
Auto 625/525 line selection

VIDEO OUTPUTS
Using RM41 rear module: Five scaled SDI outputs
Using RM57 rear module with FIP fibre input option: Four scaled SDI outputs (select between one fibre and one electrical input)
Using RM57 rear module with FOP fibre output option: Four scaled SDI outputs, plus one copy of the output on fibre
Using RM67 rear module: Five scaled SDI outputs. The RM67 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
If a DA6 top board is fitted, ARC-20MC will also output six reclocked loop-throughs of the input. In this case ARC-20MC will use two frame slots and the RM41, RM57 or RM67 rear modules need to be used with an RM34 to create a 'double height' rear module

INTEGRATED FIBRE OPTIONS
ARC-20MC 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, ARC-20MC can be housed in a single 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 ARC-20MC is in even numbered slot positions. 3Gb/s and HD boards do not share this restriction. If a DA6 top board is also fitted, this positioning restriction does not apply
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
Fibre pigtail: Single-mode 9/125uM
Optical wavelength: 1290-1330nm (1310 typical)
Extinction ratio: 7.5dB
Laser safety classification: Class 1 FDA and IEC60825-1 Laser Safety compliant

PICTURE PROCESSING
Processing is 10 bit with 10 bit data path in horizontal and vertical blanking interval to allow embedded audio or data
Pixel based motion adaptive de-interlacing means that ARC-20MC will automatically choose the best processing method based on the video content. In video containing significant movement the output picture will look natural and smooth
Adjustable detail enhancement allows the user to sharpen the image. Fine Detail Enhancement applies sharpening to the entire image, while the Edge Enhancement applies sharpening only to object edges
Noise reduction is available with ARC-20MC able to detect and remove mosquito noise without blurring the edge of the text or graphics. This can be used to ensure that MPEG encoders do not waste unnecessary bandwidth on detail that is not really part of the picture
RGB and YUV lift and gain controls allow independent digital image adjustments in both the RGB and YUV domains, essential for maintaining colour fidelity

BYPASS MODE
To maintain the best picture quality ARC-20MC will automatically enter a bypass mode with matching delay when the input aspect ratio is the same as the selected output aspect ratio

ASPECT RATIO CONVERSION PRESETS
Presets are available for the six commonly used conversions to put a 16:9 source on a 4:3 monitor, or a 4:3 source on a 16:9 monitor
The available presets are: 16:9 to 4:3 Letterbox, 16:9 to 14:9 Letterbox, 16:9 to 4:3 Full Screen, 4:3 to 16:9 Pillarbox, 4:3 to 14:9 Pillarbox and 4:3 to 16:9 Full Screen

CUSTOMISED ASPECT RATIO CONVERSIONS
The standard aspect ratios can be adjusted from their default values by using independent sets of size, position and crop controls:
Vertical and horizontal picture size adjustment: continuous adjustment of approximately +/- 25% of nominal image size
Vertical and horizontal picture position adjust +/- 50%
Vertical and horizontal picture crop adjust 0-100% of picture size
Once the controls are set they are automatically recalled whenever the particular aspect ratio is active

INSTANT SWITCHING
ARC-20MC can switch instantly and cleanly between two conversions in a single frame blanking period, allowing aspect ratios to be changed live on air

ACTIVE FORMAT DESCRIPTION, VIDEO INDEX AND WIDESCREEN SIGNALLING
ARC-20MC is well suited to following AFD data for automatic switching of

the aspect ratio and can dynamically select the best conversion based on the SMPTE 2016 AFD, Video index or WSS data in the incoming video
If more than one type of AFD data is present, the priority order is SMPTE 2016, then Video index, then WSS
SMPTE 2016 AFD data can be inserted into the output video for use by downstream equipment – either manually or by automatically following the incoming AFD data. One of 16 AFD codes is embedded in an ANC data packet, which is carried in the vertical blanking
Widescreen signalling information can be inserted into 625 line outputs for use by downstream equipment. WSS can be inserted manually or be set to automatically follow the incoming AFD data. If WSS data is present on the input video this can either be passed to the output unchanged or substituted for a user selectable code. WSS data can also be set to be blanked
Video index can be inserted into the output video for use by downstream equipment. The Video index AFD value can be selected manually, or automatically based on the incoming AFD value and the conversion used. Video index data can be set to be blanked or pass the input data to the output unchanged
Response to WSS and SMPTE 2016/Video index AFD codes:
The effect of AFD varies depending on the conversion being done, with three auto modes. In these modes the conversion applied (and output AFD data) will depend on the input coded frame and AFD code, which may be presented as WSS, Video index or SMPTE 2016.
Auto 16:9: The output coded frame is fixed at 16:9. If the input coded frame is 16:9, there will be an Anamorphic conversion and the output AFD will follow the input AFD. If the input coded frame is 4:3 then AFD codes for undefined/reserved, 14:9 and full frame inputs will produce a Pillarbox output. AFD codes for 16:9 Letterbox inputs will produce a conversion to a full frame output
Auto 4:3: The output coded frame is fixed at 4:3. If the input coded frame is 4:3, there will be an Anamorphic conversion and the output AFD will follow the input AFD. If the input coded frame is 16:9 then AFD codes for full frame and 14:9 inputs will produce a Letterbox output. AFD codes for a Pillarbox input will produce a conversion to a full screen output
Auto Adaptive: If the input coded frame is 16:9, a 4:3 Pillarbox AFD will produce a 4:3 full frame output, with appropriate Video index and/or WSS. All other AFD values will cause an Anamorphic conversion and the output AFD will follow the input value. If the input coded frame is 4:3, a 16:9 Letterbox AFD will produce a 16:9 full frame output, with appropriate Video index and/or WSS. All other AFD values will cause an Anamorphic conversion and the output AFD will follow the input value

DELAY THROUGH BOARD AND VARIABLE VIDEO DELAY
Minimum delay of one video frame less 16 lines
On top of the minimum delay, a variable video delay of up to one frame plus 16 lines, adjustable in lines and pixels, allows compensation for video delays generated by other equipment (giving maximum delay of two frames)

EMBEDDED AUDIO PASSING
De-embeds and re-embeds the first four numbered audio groups
Bypass: Audio bypassed in HANC space, with the same delay as the video

VIDEO AND AUDIO SIGNAL CHECKS
Checks can be performed on 13 video and audio parameters, with warnings of any problems provided via Statesman alarms and SNMP traps
The video parameters are: input missing, video black, video frozen and input incompatible
The video black and video frozen parameters can be delayed before an alarm is asserted to prevent false alarming during brief video pauses
The audio parameters are: input audio missing, silence group 1 channels 1 and 2, silence group 1 channels 3 and 4, silence group 2 channels 1 and 2, silence group 2 channels 3 and 4, silence group 3 channels 1 and 2, silence group 3 channels 3 and 4, silence group 4 channels 1 and 2 and silence group 4 channels 3 and 4
All audio parameters can be delayed before an alarm is asserted to prevent false alarming during quiet audio periods

LED INDICATION OF:
Power supplies on board, Input present, ARC selected, GPI output 5 active and GPI output 6 active

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

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

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

GPI INPUTS
Four GPI inputs can recall one of 16 presets

GPI OUTPUTS
Two GPI outputs. Selectable from loss of input, video black and frozen, audio missing, audio channel silence and input incompatible

LOCAL CONTROL
Intuitive board edge interface with two select buttons, shaft encoder and ten character alphanumeric display

REMOTE CONTROL
Control from integrated control panel on AE frames and remote panel
Statesman Lite allows control from any PC on a network
VisionWeb Control is available via the web server on the frame and allows operation using a standard web browser on a PC or tablet
SNMP monitoring and control available as a frame option
Control using ASCII and JSON protocols

ORDERING INFORMATION

ARC-20MC	10 bit bi-directional digital aspect ratio converter with motion adaptive video de-interlacing and full AFD functionality
FIP	Fibre input option for ARC-20MC motherboard providing integrated fibre input connectivity
FOP	Fibre output option for ARC-20MC motherboard providing integrated fibre output connectivity
Indigo 2AE	2U frame with active front panel featuring smart CPU and integrated control panel for up to 12 Crystal Vision modules
Indigo 2SE	2U frame with active front panel featuring smart CPU for up to 12 Crystal Vision modules
Indigo 1AE	U frame with active front panel featuring smart CPU and integrated control panel for up to six Crystal Vision modules. Power supply redundancy available with Indigo 1AE-DP
Indigo 1SE	1U frame with active front panel featuring smart 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 active front panel featuring smart CPU for up to two Crystal Vision modules
RM41	Single slot frame rear module. Allows maximum number of ARC-20MC in frame (12 in 2U, six in 1U, two in desk top box). Gives access to one SDI input and five SDI outputs
RM41 + RM34	Two single slot frame rear modules used together for when DA6 top board is fitted. Allows six boards in 2U, three in 1U and one in desk top box. Gives access to one SDI input, six reclocked input loop-throughs and five SDI outputs
RM57	Single slot frame rear module. Allows maximum number of ARC-20MC in frame (12 in 2U, six in 1U, two in desk top box). Designed for applications using fibre inputs or outputs. When using fibre input, allows you to select between one fibre and one electrical SDI input, and gives access to four SDI outputs. When using fibre output, gives access to one SDI input and four SDI outputs, along with one copy of the output on fibre
RM57 + RM34	Two single slot frame rear modules used together for when DA6 top board is fitted. Allows six boards in 2U, three in 1U and one in desk top box. Designed for applications using fibre inputs or outputs. When using fibre input, allows you to select between one fibre and one electrical SDI input, and gives access to six reclocked input loop-throughs and four SDI outputs.When using fibre output, gives access to one SDI input, six reclocked input loop-throughs and four SDI outputs, along with one copy of the output on fibre
RM67	Single slot frame rear module. Allows maximum number of ARC-20MC in frame (12 in 2U, six in 1U, two in desk top box). Provides relay bypass protection. Gives access to one SDI input and five SDI outputs
RM67 + RM34	Two single slot frame rear modules used together for when DA6 top board is fitted. Allows six boards in 2U, three in 1U and one in desk top box. Provides relay bypass protection. Gives access to one SDI input, six reclocked input loop-throughs and five SDI outputs
VisionPanel	3U Ethernet remote control panel with touch screen
VisionWeb Control	VisionWeb web browser control included within frame software
Statesman Lite	PC Control System
SNMP	SNMP monitoring and control

Performance and features are subject to change. Figures given are typical measured values. ARC-20MC1017