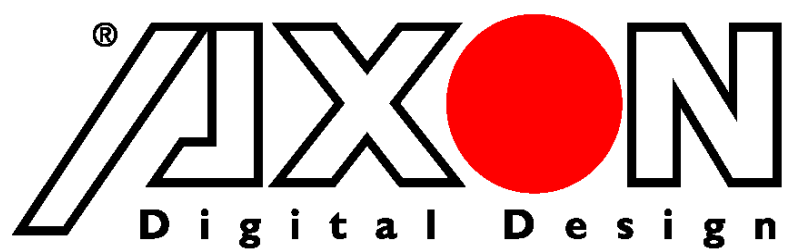


**TECHNICAL MANUAL**

ARC-200

ASPECT RATIO CONVERTER



**THE MARK OF DIGITAL ACHIEVEMENT**

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## Introduction

The ARC200 is a two-way aspect ratio converter, specially designed for optimum conversion between 16:9 and 4:3 aspect ratio formats. The user can select conversion formats like letterbox, panscan and any other format. The vertical-filtering has two modes of operation: Film-mode, used only with film sources, and Video-mode which is used with normal 50Hz video sources. Panning of the picture is possible in both horizontal and vertical directions. The ARC-200 card fits in the Axon FR-9, FR-2009, FR-2, FR-2AV, FR-2002 and FR-2002AV racks.

The ARC200 features digital serial component input and outputs, both 8 bit. The internal calculations however are more precise. The ARC200 boards can communicate via a serial bus, based on the RS422 / RS485 specifications. With a host computer a custom aspect ratio can be set and stored in an EEPROM. A software version for a PC is available. Contact Axon for more information.

Features of the ARC200 are:

- Automatic cable equalization ( up to 300 meters of high grade coax)
- A digital serial input, a reclocked output and two converted digital serial outputs
- Format : 8 bit, 625 lines/50 Hz or 525 lines/60Hz (software defined!)
- Optimum conversion between 16:9 and 4:3
- Film and video mode
- Panning of picture in horizontal / vertical directions
- Vertical transparent blanking (8 bits)
- Total delay between input and converted outputs is one frame (40 ms)
- A serial bus (RS422/485)
- EEPROM for data storage of software setting
- A software version is available

## Contents

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## Warranty

Axon warrants their products according to the warranty policy as described in the general terms. That means that Axon Digital Design BV can only warrant the products as long as the serialnumbers are not removed.

## TECHNICAL SPECIFICATIONS

### ❑ Digital serial input

|                      |   |
|----------------------|---|
| Input format         | : 270 Mb/s, scrambled NRZI                  |
| Input level          | : 800 mV p/p $\pm 10\%$ , 75 Ohm terminated |
| Maximum cable length | : 300 meters typical (high grade coax)      |

### ❑ Digital serial outputs

|                     |  |
|---------------------|--|
| Serial data rate    | : 270 Mb/s                             |
| Output levels       | : 800 mV p/p, 75Ohm terminated         |
| Transfer distance   | : 250 meters typical (high grade coax) |
| DC offset           | : $< \pm 500$ mV                       |
| Rise and fall times | : 0.75 nsec to 1.5 nsec (20%-80%)      |
| Jitter              | : 450 psec pp                          |

### ❑ Miscellaneous

|                     |  |
|---------------------|--|
| Input-output format | : 8 bit                                    |
| Line format         | : 625 lines                                |
| Total delay         | : 40ms                                     |
| Power consumption   | : +6.5 Volt / 600 mA<br>-6.5 Volt / 600 mA |
| Ambient temperature | : +10°C / +45°C                            |
| Dimensions          | : 220 x 100 x 15 mm                        |

## ADJUSTMENTS

Note: Lacquer sealed trim units should only be adjusted after consulting with Axon. In case of unauthorized adjustment the warranty expires.

For correct calibration of the ARC200, a frequency counter and a digital serial test generator are needed. All adjustments should be performed after a 10 minutes warm-up period. The following testpoints can be used:

- Test point TP101 : Line rate output signal of deserializer (STV1602A).
- Test point TP103 : 27 MHz clock from deserializer (STV1602A).
- Test point TP501 : 27 MHz clock from serializer (STV1601A).
- Test point TP102 : Ground for probe.
- Test point TP601 : Ground for probe.

### Step 1 - Deserializer VCO adjustment

Short LK101 with a link. Do not connect an input signal. Adjust RV101 for a 27.000 MHz clock signal on TP103. ( $\pm 100$  kHz).

Remove the link on LK101 after adjustment.

### Step 2 - Serializer VCO adjustment

Short LK501 with a link. Do not connect an input signal. Adjust RV501 for a 27.000 MHz clock signal on TP501. ( $\pm 100$  kHz).

Remove the link on LK501 after adjustment.

## SWITCH SETTINGS

All switches are located at the front of the ARC200 board, so it can be accessed during operation.

### S301

Resets the microprocessor.

Can be used to center the picture precisely in the middle of the screen.

### S302

Pan switch which moves the picture up/down left/right depending on the type of conversion.

❑ **S303**

Dip-switch.  
Selects the type of conversion.

| CONVERSION        | MODE  | Ds1 | Ds2 | Ds3 | Ds4 |
|-------------------|-------|-----|-----|-----|-----|
| LETTERBOX         | VIDEO | 0   | 0   | 0   | 0   |
| PANSCAN           | VIDEO | 0   | 0   | 0   | 1   |
| INV. LETTERBOX    | VIDEO | 0   | 0   | 1   | 0   |
| INV. PANSCAN      | VIDEO | 0   | 0   | 1   | 1   |
| LETTERBOX         | FILM  | 0   | 1   | 0   | 0   |
| INV. PANSCAN      | FILM  | 0   | 1   | 0   | 1   |
| LETTERBOX         | FILM  | 0   | 1   | 1   | 0   |
| INV. PANSCAN      | FILM  | 0   | 1   | 1   | 1   |
| SOFTWARE SETTINGS | VIDEO | 1   | 0   | 0   | 0   |
| AXON FORMAT       | VIDEO | 1   | 0   | 0   | 1   |
| INPUT = OUTPUT    | VIDEO | 1   | 0   | 1   | 0   |
| INV. AXON FORMAT  | VIDEO | 1   | 0   | 1   | 1   |
| SOFTWARE SETTINGS | FILM  | 1   | 1   | 0   | 0   |

See appendix I for illustrations.

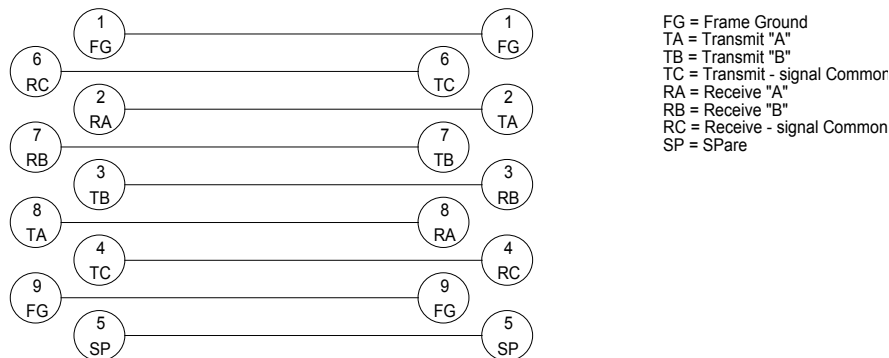
❑ **S304**

Rotary switch.  
Selects the address number of the board (hexadecimal).

**SERIAL RS422/485 CONNECTION**

The ARC200 is provided with a male D type connector (9 pins). Up to sixteen ARC200 boards can be connected to a host.

The figure below shows the connector pin connections from the host to the ARC200 board. (host on the left is DSUB9-female and the ARC200 on the right male).



The following transmission parameters are used:

- Baud-rate : 9600 Baud
- Data bits : 8
- Stop bit : 1
- Parity : none

The dip-switches must be set according to the desired configuration.

S303 : type of conversion  
       DS1..4 = "1000" in video mode or  
       DS1..4 = "1100" in film mode  
 S304 : address select

## FIRMWARE VERSION

This protocol is ASCII based. Communication between the host computer and the ARC-200 boards, is based on the RS422 / RS485 (full duplex) standard.

The following transmission parameters are used:

- Baud-rate : 9600 Baud
- Data bits : 8
- Stop bit : 1
- Parity : none

Settings are transmitted in the following format:

<stx> <address> <mode> [<data>]

Stx : "X" Indicates start of message  
 Address : Address byte (00 to 0F) Hex  
 Mode : "N" for normal operation  
       "U" to update settings to EEPROM.  
 Data : Consist of 3 x 8 bytes.

|                   |                    |                        |
|-------------------|--------------------|------------------------|
| - Input window :  | Horizontal start,  | Low- / Highbyte (Hex.) |
|                   | Horizontal end,    | Low- / Highbyte (Hex.) |
|                   | Vertical start,    | Low- / Highbyte (Hex.) |
|                   | Vertical end,      | Low- / Highbyte (Hex.) |
| - Output window : | Horizontal start,  | Low- / Highbyte (Hex.) |
|                   | Horizontal end,    | Low- / Highbyte (Hex.) |
|                   | Vertical start,    | Low- / Highbyte (Hex.) |
|                   | Vertical end,      | Low- / Highbyte (Hex.) |
| - Aspect-ratio :  | No. input lines,   | Low- / Highbyte (Hex.) |
|                   | No. input pixels,  | Low- / Highbyte (Hex.) |
|                   | No. output lines,  | Low- / Highbyte (Hex.) |
|                   | No. output pixels, | Low- / Highbyte (Hex.) |

The ARC-200 will respond by sending an acknowledge.

ACK: "X"

### Examples:

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Copyright © 1995 Axon Digital Design  
 date created: 15-05-1995  
 date last revised: 10-02-1998

The numbers between () must be converted to ASCII. (41) = "A"

Send (Letterbox in video-mode):

X(00)N(8B)(00)(5B)(03)(15)(00)(35)(01)(8C)(00)(5C)(03)(15)(00)(35)(01)(20)(01)  
(D0)(02)(D8)(00)(D0)(02)

Receive:

X

Explanation:

|          |   |                         |   |          |
|----------|---|-------------------------|---|----------|
| X        | : | Start of message.       |   |          |
| (00)     | : | Address 0               |   |          |
| N        | : | Normal data             |   |          |
| (8B)(00) | : | Input Horizontal start  | = | 139 dec. |
| (5B)(03) | : | Input Horizontal end    | = | 859 dec. |
| (15)(00) | : | Input Vertical start    | = | 21 dec.  |
| (35)(01) | : | Input Vertical end      | = | 309 dec. |
| (8C)(00) | : | Output Horizontal start | = | 140 dec. |
| (5C)(03) | : | Output Horizontal end   | = | 860 dec. |
| (39)(00) | : | Output Vertical start   | = | 57 dec.  |
| (11)(01) | : | Output Vertical end     | = | 273 dec. |
| (20)(01) | : | No. input lines         | = | 288 dec. |
| (D0)(02) | : | No input pixels         | = | 720 dec. |
| (D8)(00) | : | No. output lines        | = | 216 dec. |
| (D0)(02) | : | No. output pixels       | = | 720 dec. |

Send:

X(00)U

Receive:

X

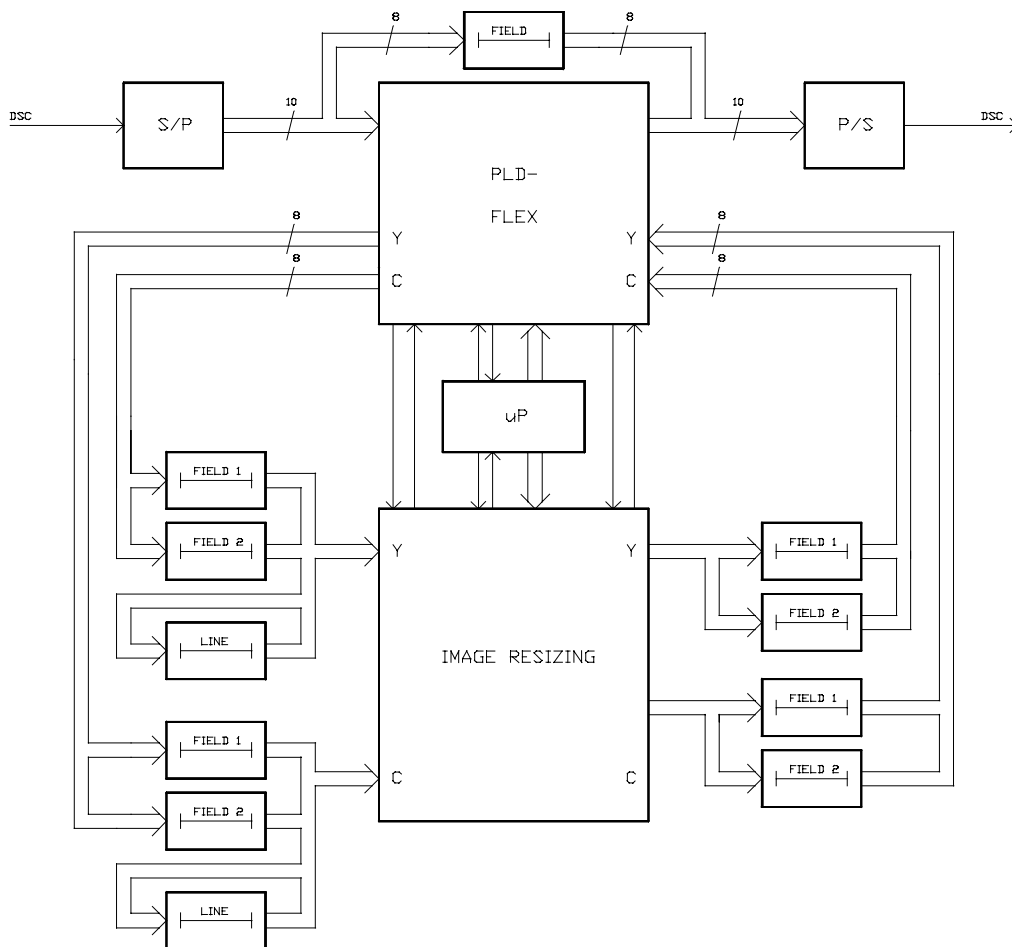
Explanation:

|      |   |                       |
|------|---|-----------------------|
| X    | : | Start of message.     |
| (00) | : | Address 0             |
| U    | : | Update data to EEPROM |

Restrictions:

1. Horizontal values must always be increased/decreased by two. The input window values must be odd and the output window values even.
2. Horizontal and vertical magnification at the same time is not possible.
3. Due to hardware limitations, in film-mode (letterbox and inv. Panscan) the picture can only be moved/scaled vertically by 20 lines. Exceeding this number or changing horizontal values will cause the ARC200 to filter between frames !  
On the ARC200 board itself panning in film-mode is automatically limited and for proper operation panning and/or changing the aspect-ratio externally is in film-mode not recommended.

## BLOCK DIAGRAM



## TECHNICAL DESCRIPTION

The serial digital video input signal is deserialized by U102 (STV1602A). A reclocked serial digital signal is buffered by cable driver U101 (CLC007), which provides one serial digital output. The parallel deserialized signal (27 MHz data rate) is converted from ECL levels to TTL levels by U104, U105 and U106. All 10 bits are input to U201. U103 is used to detect the presence of a serial digital input signal. U201 performs the following functions:

- Timing extraction of the TRS words
- Error detection and correction of the TRS XY data
- The demultiplexing of the parallel digital video words
- Selects with a window the part of the picture to be expanded

The demultiplexed data from U201 is stored in a framestore (U401,402,403,404) and, depending on the video- and film-mode, the data will be read interlaced or non-interlaced. After the image resizer (U407) the data is stored in the second framestore (U408,U409,U410,U411) and is also depending on the selected mode, interlaced or non-interlaced.



Data read from the second framestore is multiplexed by U204 and serialized with U501 (STV1601). The 270Mb output data of U501 is buffered with U502, which drives two outputs. U501 performs the following functions:

- Multiplexing of the parallel digital video words
- Insertion of the TRS XY data
- Selects with a window the part of the picture not to be blanked (shrink)

The vertical transparent blanking is realized by a FIFO (U203) which is placed between the deserializer and serializer.

The total delay between input and output is one frame (40 ms).

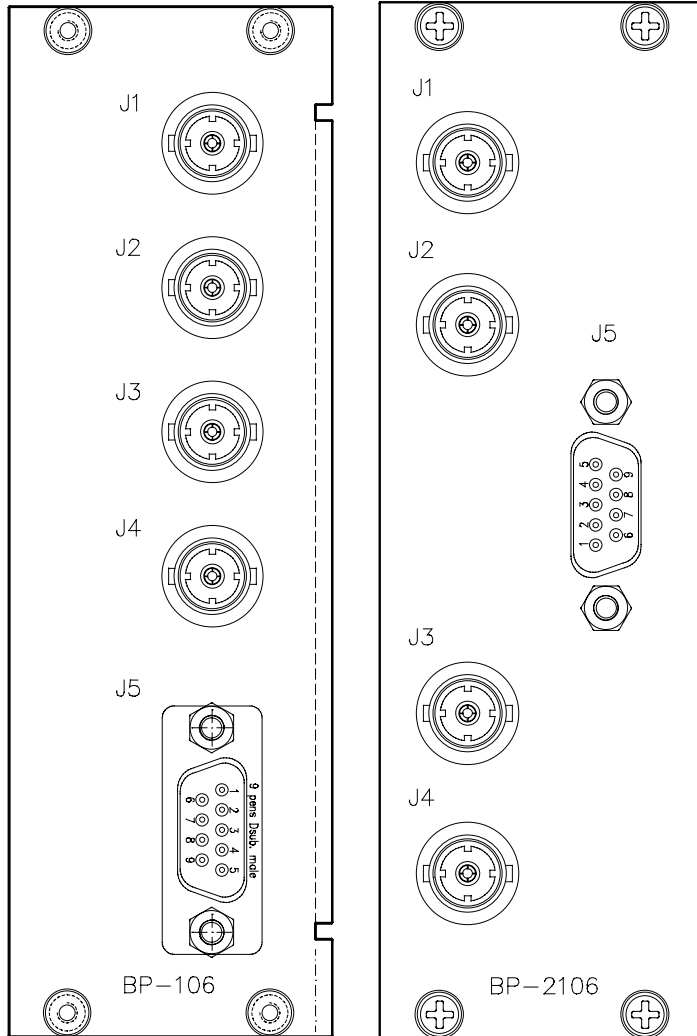
*Note:*

*Due to hardware limitations, in film-mode (letterbox and inv. Panscan) the picture can only be moved/scaled vertically by 20 lines. Exceeding this number or changing horizontal values will cause the ARC200 to filter between frames !*

*On the ARC200 board itself panning in film-mode is automatically limited and for proper operation panning and/or changing the aspect-ratio externally is in film-mode not recommended.*

## BACKPLANE CONNECTIONS

Connection through a BP-106 and BP-2106 is outlined below:



|    |                   |
|----|-------------------|
| J1 | DSC IN            |
| J2 | DSC RECLOCKED OUT |
| J3 | DSC CONVERTED OUT |
| J4 | DSC CONVERTED OUT |
| J5 | CONTROL IN/OUT    |

*Note: DSC = SDI 270 Mb/s*

APPENDIX I

