



AXIOM

HAND HELD HDTV SERIAL DIGITAL GENERATOR OPERATOR'S HANDBOOK

ISSUE B

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LABEL AT THE REAR OF THE UNIT

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GENERAL INFORMATION

WARRANTY

This product is manufactured by Hamlet Video International Ltd and is warranted to be free from defects in components and factory workmanship under normal use and service for a period of one year from the date of purchase.

FREE EXTENDED WARRANTY

The warranty period can be extended to two years by registering the instrument on the Hamlet web site

<http://www.hamlet.co.uk/serv.html>

TERMS AND CONDITIONS

During the warranty period, Hamlet Video International Ltd will undertake to repair or at its option, replace this product at no charge to its owner when failing to perform as specified, provided the unit is returned shipping prepaid, to the factory or authorised service facility.

No other warranty is expressed or implied. Warranty shall not be applicable and be void when this product is subjected to:

1. Repair work or alteration by persons other than those authorised by Hamlet Video International Ltd in such a manner as to injure the performance, stability, reliability or safety of this product.
2. Misuse, negligence, accident, act of God, war or civil insurrection.
3. Connection, installation, adjustment or use otherwise than in accordance with the instructions in this manual.

Hamlet Video International Ltd reserves the right to alter specifications without notice. This warranty does not affect the statutory rights of the UK customer.

GENERAL INFORMATION

SAFETY COMPLIANCE

This product is manufactured and tested to comply with **BS EN 61010-1 : 1993**
Safety requirements for electrical equipment for measurement, control and laboratory use.



EMC COMPLIANCE

We, Hamlet Video International Limited, Maple House, 11 Corinium Business Centre, Raans Road, Amersham, Bucks, HP6 6FB, England, declare under our sole responsibility that the product **HAMLET AXIOM** to which this declaration relates is in conformity with the following standards:

EN50081-1 Generic emissions standard for light industrial applications.

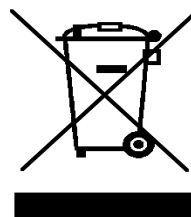
EN50082-1 Generic immunity standard for light industrial applications.

Following the provisions of EU EMC directives 89/336/EEC and 92/31/EEC.

NOTE. During the EMC certification of this product, shielded cables were used.
We recommend that they be used in operation.

PRODUCT DISPOSAL INSTRUCTIONS

B2B COMPLIANCE REG NO.
WEE/GJ0146QT



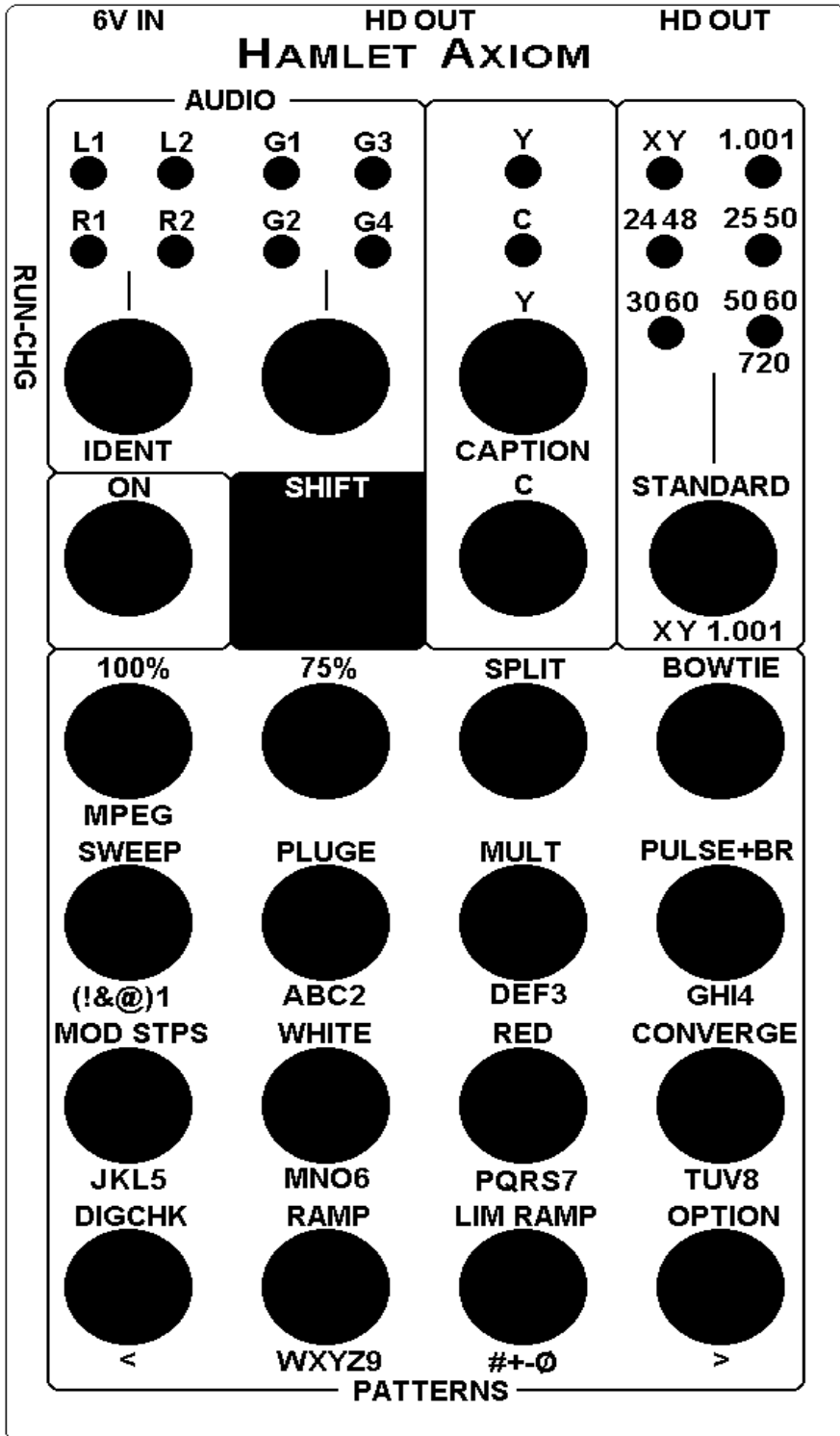
The symbol shown above and on the Hamlet Axiom means the product is classed as Electrical or Electronic Equipment and should not be disposed with other commercial waste at the end of its working life. The Producer Registration Number above, WEE/GJ0146QT proves that Hamlet are formally registered with a legally approved Compliance Scheme. The Scheme we are registered with is called "B2B Compliance". B2B Compliance takes on the legal responsibilities of the reporting on, and the collection and treatment of, all WEEE that Hamlet Video International Limited is obliged for - and ensures that the appropriate recycling targets are met on this WEEE

The Waste of Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC) has been put in place to recycle products using best available recovery and recycling techniques to minimise the impact on the environment, treat any hazardous substances and avoid the increasing landfill.

Product disposal instructions for business users.

Business users in the EU should contact their Hamlet Axiom supplier to arrange for its return to Hamlet head office in the UK, who will safely dispose of it and ensure that this Hamlet Axiom is not mixed with other commercial waste for disposal.

FRONT PANEL



OVERVIEW

The Hamlet Axiom is a hand held test signal generator designed to output HD serial digital (SMPTE 292) video together with embedded audio. All signals are digitally derived, for accuracy and stability.

STANDARDS SUPPORTED

SMPTE 274M

<u>STANDARD</u>	<u>FRAME RATE</u>	<u>CLOCK</u>
1920 x 1080	60 2:1 I	74.25MHz.
1920 x 1080	59.94 2:1 I	74.25MHz/1001
1920 x 1080	50 2:1 I	74.25MHz
1920 x 1080	30 1:1 P	74.25MHz
1920 x 1080	29.97 1:1 P	74.25MHz/1001
1920 x 1080	25 1:1 P	74.25MHz
1920 x 1080	24 1:1 P	74.25MHz
1920 x 1080	23.98 1:1 P	74.25MHz/1001
1920 x 1080	30 S.F.	74.25MHz
1920 x 1080	29.97 S.F.	74.25MHz/1001
1920 x 1080	25 S.F.	74.25MHz
1920 x 1080	24 S.F.	74.25MHz
1920 x 1080	23.98 S.F.	74.25MHz/1001

SMPTE 296M

<u>STANDARD</u>	<u>FRAME RATE</u>	<u>CLOCK</u>
1280 x 720	60 1:1 P	74.25MHz
1280 x 720	59.94 1:1 P	74.25MHz/1001
1280 x 720	50 1:1 P	74.25MHz

An ident word can be cut into the selected pattern, consisting of 16 alphanumeric characters selected by the front panel buttons.

The video Y and C components can be individually disabled from both outputs and the embedded audio packets can be disabled from the SDI output.

Embedded audio tone can be on any of the four groups. It can be on Ch1, Ch2 or both and on Left, Right or both.

All settings are stored when the unit is switched off.

Internal NiMh batteries provide one hour of continuous operation.

OPERATING INSTRUCTIONS

6V IN SOCKET

Plugging in the power connector disables the batteries allowing external power operation.

CHG-RUN SWITCH

CHG Charges the internal batteries from the external supply. Independent of ON switch.

--- Disconnects the batteries. Use during shipping or prolonged storage.

RUN For battery operation. Power supply connector must be unplugged.

ON

Toggles power on and off. This does not affect the battery charger.

SHIFT

Press this key followed by a blue text key for IDENT, CAPTION, MPEG or INTERLACE/ 1.001 select.

IDENT

Embedded audio channel can be idented on and off every second by pressing SHIFT then IDENT. This also recalls the stored 'ident text caption' from memory and cuts it into the video display. To disable the function press SHIFT the IDENT again.

AUDIO Left key

Toggles the embedded audio between the following options:

NO AUDIO PACKETS

EMBEDDED SILENCE

CH1 ONLY (L1 & R1)

CH2 ONLY (L2 & R2)

or BOTH CH1 & CH2 on together.

AUDIO Right key

Toggles the embedded audio group number from the following options:

Group1

Group2

Group3

Group4

Y key

Toggles on & off the Y (Luma) component of the serial data stream.

C key

Toggles on & off the Cr & Cb (Chroma) components of the serial data stream.

OPERATING INSTRUCTIONS

Standard key

24/48 light on.	24Hz Progressive or 48Hz Interlaced.
25/50 light on	25Hz Progressive or 50Hz Interlaced.
30/60 light on.	30Hz Progressive or 60Hz Interlaced.
50/60 light on.	720Progressive at 50Hz or 60Hz.

SHIFT - STANDARD

Toggles standard modes between green and red texts.
Also toggles normal or NTSC compatible 1/1.001 frequency.

PATTERN keys

Pressing a pattern key selects that pattern, the OPTION key is for future or custom patterns, currently set to SMPTE bars.

MPEG key

Press SHIFT then MPEG. A moving horizontal bar is provided to identify frame interpolation errors in MPEG systems or stuck frames in field stores.
To deselect press SHIFT the MPEG again.

CAPTION key

Up to 64 characters of text can be stored, but only 16 characters can be superimposed on the selected pattern at one time To enter new characters or edit an existing ident caption press SHIFT then CAPTION.

The current text caption appears cut into the screen and a cursor appears below the left hand character.

Select the required letter or number by pressing the appropriate key, 'Cell phone text message style'

e.g. to select the character 'A' press the 'ABC2' key once.

To select the character 'F' press the 'DEF3' key 3 times.

After each character is selected move the cursor along by pressing Right Cursor Key, (bottom right). Thus entering or editing a caption can be done by moving the cursor right or left then changing the character above the cursor with a letter key.

Note that the 'space' character is provided by pressing the 100% key.

When the caption is finished press SHIFT then CAPTION again to store it in memory.

PATTERNS

100% BARS

100% full colour bars.

Digital levels are Yblack =64, Ywhite = 940, Cr and Cb are 512 +/- 448 max.

75% BARS

White as 100% bars. Colours reduced to 75% level.

SPLIT

Top half of screen is 100% colour bars, bottom half is full red.

BOWTIE

Y channel is 500KHz. Cr,Cb channels are 502KHz phase adjusted so equal to Y in mid line. Suitable monitoring equipment, e.g. the Hamlet LCDScope 292WVA, produce (Y-Cr) and (Y-Cb) displays to accurately check system gains and timings, with the traditional bowtie displays.

Y Waveform is 438 bits (350mV) p/p centred on 502 bits (350mV).

C Waveform is 448 bits (350mV) p/p centred on 512 bits (350mV).

Timing markers at +/-5nSec and at every 20nSec.

SWEEP

Sweeps from 1MHz to 30MHz over the line period, with markers at 5,10,15,20,25 MHz.

Waveform is 600bits (480mV) p/p centred on 502 bits (350mV).

PLUGE

Grey scale block for colour monitor gain tracking adjustment and grey/superblack stripes for brightness setting.

Block is 940 bits (700mV), 502 bits (350mV), 239 bits (140mV).

Stripes are at 64 +/- 18bits (+/- 14mV).

MULTI

White bar at 765 bits (560mV) followed by five frequency bursts at 5MHz, 10MHz, 15MHz, 20MHz and 25MHz at 526 bits (370mV) p/p centred on 502 bits (350mV).

PULSE+BR

2T luma pulse at 940 bits (700mV), 10T chroma pulse at 502 bits (350mV), 20 uSec bar at 940 bits (700mV).

PATTERNS

MOD STPS

5-step ascending staircase, equal steps of 175 bits (140mV) each.
Added chroma of Cr at 638 bits and Cb at 652 bits.

WHITE

Plain full white screen.

Y waveform 940 bits (700mV), Cr is 512 bits, Cb is 512 bits.

RED

Plain full red screen.

Y waveform is 250 bits (149mV), Cr is 960 bits, Cb is 409 bits.

CONVERGE

Crosshatch pattern for colour monitor convergence adjustment.

DIG CHK

Top half of the screen is the equaliser test and contains several examples of 19 "0"s followed by 2 "1"s per frame.

Bottom half of the screen is the phase locked loop test and contains several examples of 20 "0"s followed by one "1" per frame.

RAMP

Y waveform is an ascending ramp, running from 64 bits (0mV) to 940 bits (700mV).

Cr and Cb waveforms are ascending ramps, running from 64 (-350mV) to 960 (+350mV)

LIM RAMP

Y waveform is an ascending ramp, running from 1 bit (50 mV below black) to 1022 bits (66 mV above peak white).

OPTION

Future or optional patterns, e.g. SMPTE colour bars.

TECHNICAL SPECIFICATION

OUTPUTS

Serial digital 2 x BNC connectors. Output impedance 75 ohms.
SMPTE 292, serial component. 800mV pp
Full 10 bit pattern generation.
Embedded audio tone is a 1KHz asynchronous sine wave
at a level of -18dBFS.

POWER

External 6Vdc +/-0.5V regulated @ 0.9A.
Current draw is 1A if charging as well. 100mA if charging only.
Charging time 16 hours max.
2.1mm power connector, centre negative.
Mains supply adapter 220/110VAC +/-20% 50/60Hz 10VA max.

Internal 600mA hour NiMh batteries with integral charger.

ENVIRONMENT

Indoor use, 5 to 45 deg.C. ambient to 2,000m.
Max humidity 80% to 31 deg.C decreasing to 50% at 40 deg.C.
Overvoltage category 2. Pollution degree 1.
Weight 400g.

HDTV SERIAL DIGITAL BASICS

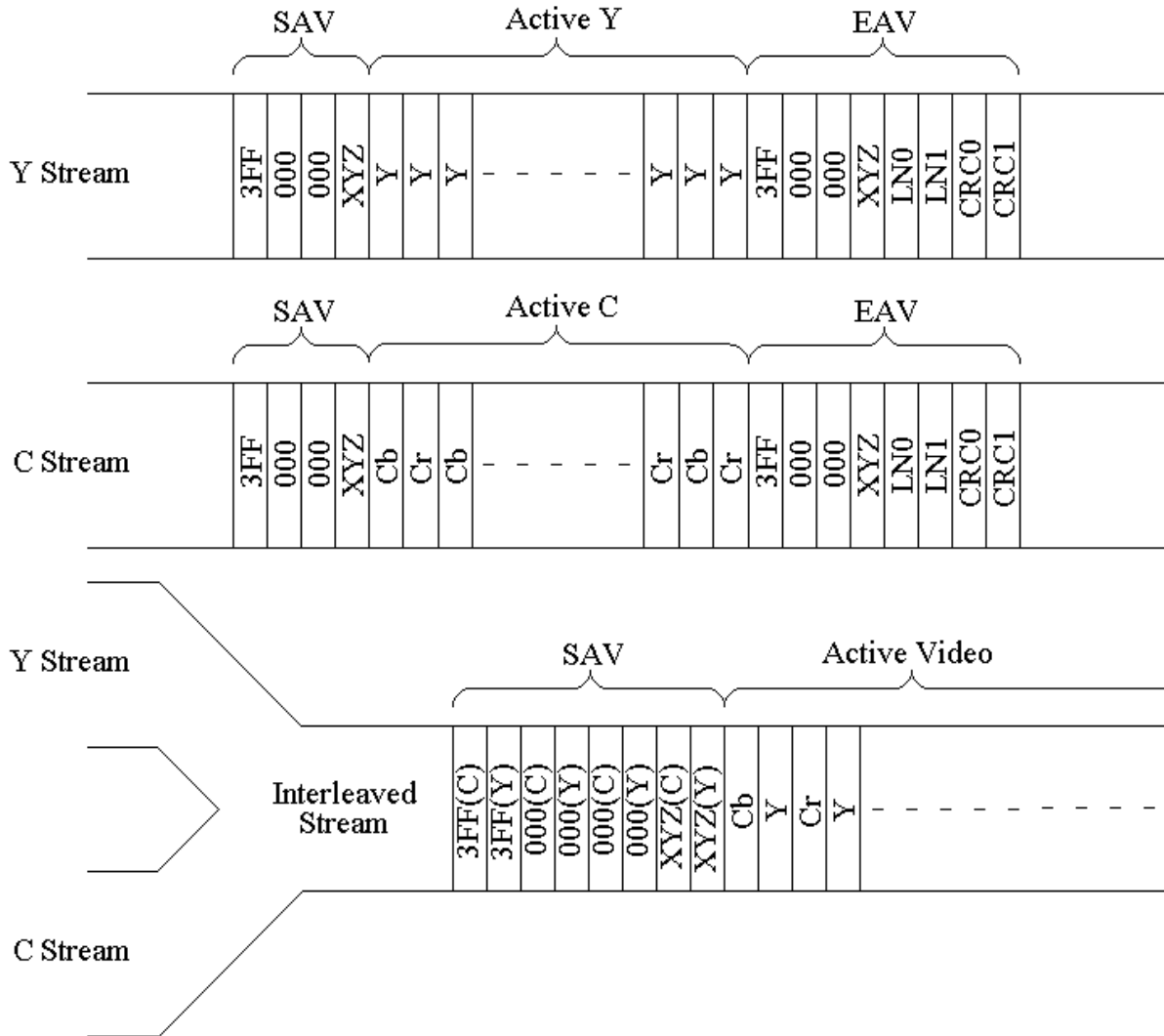


Fig 2

HDTV SERIAL DIGITAL BASICS

BIT SERIAL DIGITAL INTERFACE DEFINED BY SMPTE 292M.

HDTV digital component video is produced by applying a 4:2:2 sampling structure to the analog signal. The luminance component (Y) is sampled at 74.25 MHz, the colour difference components U & V) are both sampled at 37.125 MHz.

The Y stream is quantised to 10 bits resolution and Timing Reference Signals (TRS) are added at the beginning and end of the horizontal video blanking period.

The U & V streams are also quantised to 10 bits and then interleaved to give a C stream at 74.25 MHz. TRS are added at the beginning and end of the horizontal video blanking period.

The 74.25MHz Y and C streams are then interleaved to produce a single stream at 148.5MHz.

This data is then scrambled and serialised using a None Return to Zero (NRZ) code to produce a 1.485 GHz signal.

The TRS at the end of the horizontal blanking period is called Start of Active Video (SAV) it consists of 4 words:

- 1) 3FF hex i.e. all '1's
- 2) 000 hex i.e. all '0's
- 3) 000 hex i.e. all '0's
- 4) XYZ, which determines the type of TRS pulse, consisting of:

Bit 9: Always '1'

Bit 8: 0=frame 1, 1=frame 2

Bit 7: 0=normal 1=field blanking

Bit 6: 0=SAV 1=EAV

Bit 5: Bits used for Hamming correction.

Bit 4: Bits used for Hamming correction.

Bit 3: Bits used for Hamming correction.

Bit 2: Bits used for Hamming correction.

Bit 1: Always 0

Bit 0: Always 0

The TRS at the beginning of the horizontal blanking period is called End of Active Video (EAV) it consists of 8 words: The first 4 are the same as for SAV, followed by 2 words containing the current line number and 2 words containing a Cyclic Redundancy Check (CRC) for all the preceding words in the line. The period between EAV and SAV is not used by normal video and may be used for embedded audio or timecode data.

ILLEGAL VALUES

The values 000 and 3FF hex are used solely by TRS pulses (EAV & SAV) they must not appear anywhere in the active video area.

OUT OF GAMUT

Values apart from the illegal values which should not be used.

Luminance is defined as being between peak white, 700mV (3AC hex) and black 0 mV (040 hex) Chroma is defined as being between max positive 350mV (3C0 hex) and max negative -350mV (040 hex). Values above or below these values are termed 'Out of Gamut'.

PARALLEL DIGITAL INTERFACES

Several parallel video Standards can be used with the above serial interface. These are defined in SMPTE 274M for 1920 x 1080 scanning and SMPTE 296M for 1280 x 720 scanning.

SMPTE 274M

Several sub-standards for this are defined:

1920 x 1080/60/2:1

1920 samples/active line 1080 active line/frame 30PsF segmented format.
74.25 MHz Sample frequency 2200 total samples/line 1125 total lines/frame

1920 x 1080/59.94/2:1

1920 samples/active line 1080 active line/frame 29.97PsF segmented format.
74.176 MHz Sample frequency 2200 total samples/line 1125 total lines/frame
This standard gives an exact frame rate compatibility with NTSC.

1920 x 1080/50/2:1

1920 samples/active line 1080 active line/frame 25PsF segmented format.
74.25 MHz Sample frequency 2640 total samples/line 1125 total lines/frame

1920 x 1080/30/1:1

1920 samples/active line 1080 active line/frame 30 Hz Progressive scan.
74.25 MHz Sample frequency 2200 total samples/line 1125 total lines/frame

1920 x 1080/29.97/1:1

1920 samples/active line 1080 active line/frame 29.97 Hz Progressive scan.
74.176 MHz Sample frequency 2200 total samples/line 1125 total lines/frame
This standard gives an exact frame rate compatibility with NTSC.

1920 x 1080/25/1:1

1920 samples/active line 1080 active line/frame 25 Hz Progressive scan.
74.25 MHz Sample frequency 2640 total samples/line 1125 total lines/frame

1920 x 1080/24/1:1

1920 samples/active line 1080 active line/frame 24 Hz Progressive scan.
74.25 MHz Sample frequency 2750 total samples/line 1125 total lines/frame

1920 x 1080/24sf

1920 samples/active line 1080 active lines/frame 24 Hz segmented frame
74.25 MHz sample frequency 2750 total samples/line 1125 total lines/frame

HDTV SERIAL DIGITAL BASICS

1920 x 1080/23.98/1:1

1920 samples/active line 1080 active line/frame 23.98 Hz Progressive scan.
74.176 MHz Sample frequency 2750 total samples/line 1125 total lines/frame

SMPTE 296M

Several substandards for this are defined:

1280 x 720/60/1:1

1280 samples/active line 720 active line/frame 60 Hz Progressive scan.
74.25 MHz Sample frequency 1650 total samples/line 750 total lines/frame

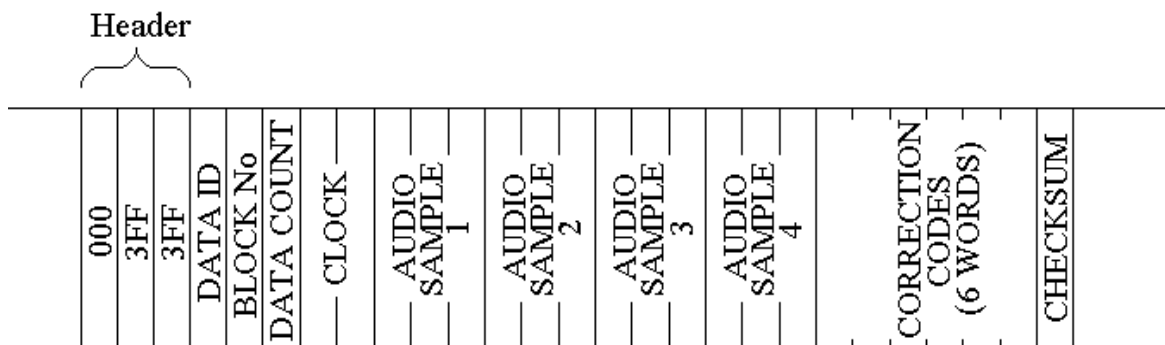
1280 x 720/59.94/1:1

1280 samples/active line 720 active line/frame 59.94 Hz Progressive scan.
74.176 MHz Sample frequency 1650 total samples/line 750 total lines/frame

EMBEDDED AUDIO

The period between EAV and SAV can be used to send embedded digital audio signals. This is defined in SMPTE 299M. Up to 16 separate audio signals may be sent in a single video channel. These are organised as four GROUPS of four signals, the four signals are often two stereo pairs. Typically only one group will be used, giving two stereo pairs of audio. The audio data is quantised in the sending equipment to 24 bits of resolution, usually at 48 KHz sample rate in AES/EBU format. The digitised data is arranged in packets which are placed in the EAV-SAV space.

A packet consists of:



HDTV SERIAL DIGITAL BASICS

The Header: (000, 3FF, 3FF)

Data ID: This contains the Audio group number.

Data block number: AES frames have 192 samples of audio data

Data Count: This contains the number of words that follow, always 218 hex

Clock: 2 words containing the number of video clocks that have elapsed between the first word of EAV and the time the audio sample was made, it is used by the receiving equipment to reconstruct the audio signal with the correct phase delay.

Audio Sample 1: Consists of four words

Audio Sample 2: Consists of four words

Audio Sample 3: Consists of four words

Audio Sample 4: Consists of four words

Error Correction Codes

Consist of six words used by the receiving equipment to detect or correct errors in the 24 words from the header to the last word of audio sample 4 inclusive.

Check Sum This is the sum of all previous words in the packet except the header words.

Each audio packet contains a sample of all four audio signals

e.g.: Channel 1 left, Channel 1 right, Channel 2 left and Channel 2 right.

Each audio signal requires 3 words to hold all 24 bits, thus each audio packet has 12 words of audio data.

Typically one or two packets are sent in each EAV-SAV period.

These audio data packets are placed in the Chroma data stream only.

Audio Control Packets.

The audio control packet structure is similar to the audio data packet.

Data in the packet includes the audio sample rate e.g. 48 KHz,
the number of active channels out of the possible 4,

the delay information between Channel 1 audio and Channel 2
and delay information between Channel 3 audio and Channel 4.

Audio control packets are placed in the Luminance Stream, this is sent once per frame in the second line after the switching point.

As with the video signal words consisting of all '1's or all '0's are not allowed.

USEFUL WEBSITES

HAMLET	www.hamlet.co.uk	
HAMLET (USA)	www.hamlet.us.com	
SMPTE	www.smpte.org	Society of Motion Picture Television Engineers
DIN	www.din.de	German Standards Institute
EBU	www.ebu.ch	European Broadcasting Union
AES	www.aes.org	Audio Engineering Society
ITU	www.itu.int	International Telecommunication Union

CONTACT DETAILS AND CUSTOMER SUPPORT

For any form of assistance in maintaining your Hamlet Axiom, please contact:

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In correspondence concerning this instrument, please quote the serial number, which you will find printed on the label at the back of the unit.