HAMLET
EXCELLENCE IN VISION

INDEX

HAND HELD SERIAL DIGITAL GENERATOR

OPERATOR'S HANDBOOK

ISSUE B

Hamlet Video International Limited
Maple House 11 Corinium Business Centre Raans Road Amersham Bucks HP6 6FB England
Main Line: +44 (0)1494 729 728 Fax Line: +44 (0)1494 723 237 Free phone (UK) 0500 625 525
E-mail: sales@hamlet.co.uk Web site: www.hamlet.co.uk

Hamlet Video International USA service center , Tecads Inc, 23 Del Padre St, Foothill Ranch, CA 92610, U.S.A. Tel: +1 (949) 597 1053, Fax: +1 (949) 597 1094. Toll Free Tel number: (866) 4 HAMLET
E-mail: service@hamlet.us.com Web site: www.hamlet.us.com

IN CORRESPONDENCE CONCERNING THIS INSTRUMENT
PLEASE QUOTE THE SERIAL NUMBER PRINTED ON THE
LABEL AT THE REAR OF THE UNIT

CONTENTS

LIST OF FIGURES

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.

CE

EMC COMPLIANCE

We: HAMLET VIDEO INTERNATIONAL LTD
MAPLE HOUSE, 11 CORINIUM BUSINESS CENTRE,
RAANS ROAD, AMERSHAM, BUCKS, HP6 6FB, ENGLAND.

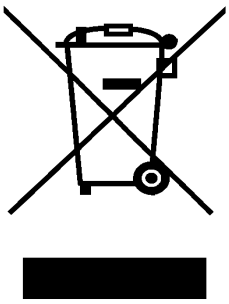
Declare under our sole responsibility that the product **HAMLET INDEX** to which this declaration relates are in conformity with the following standards:

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.

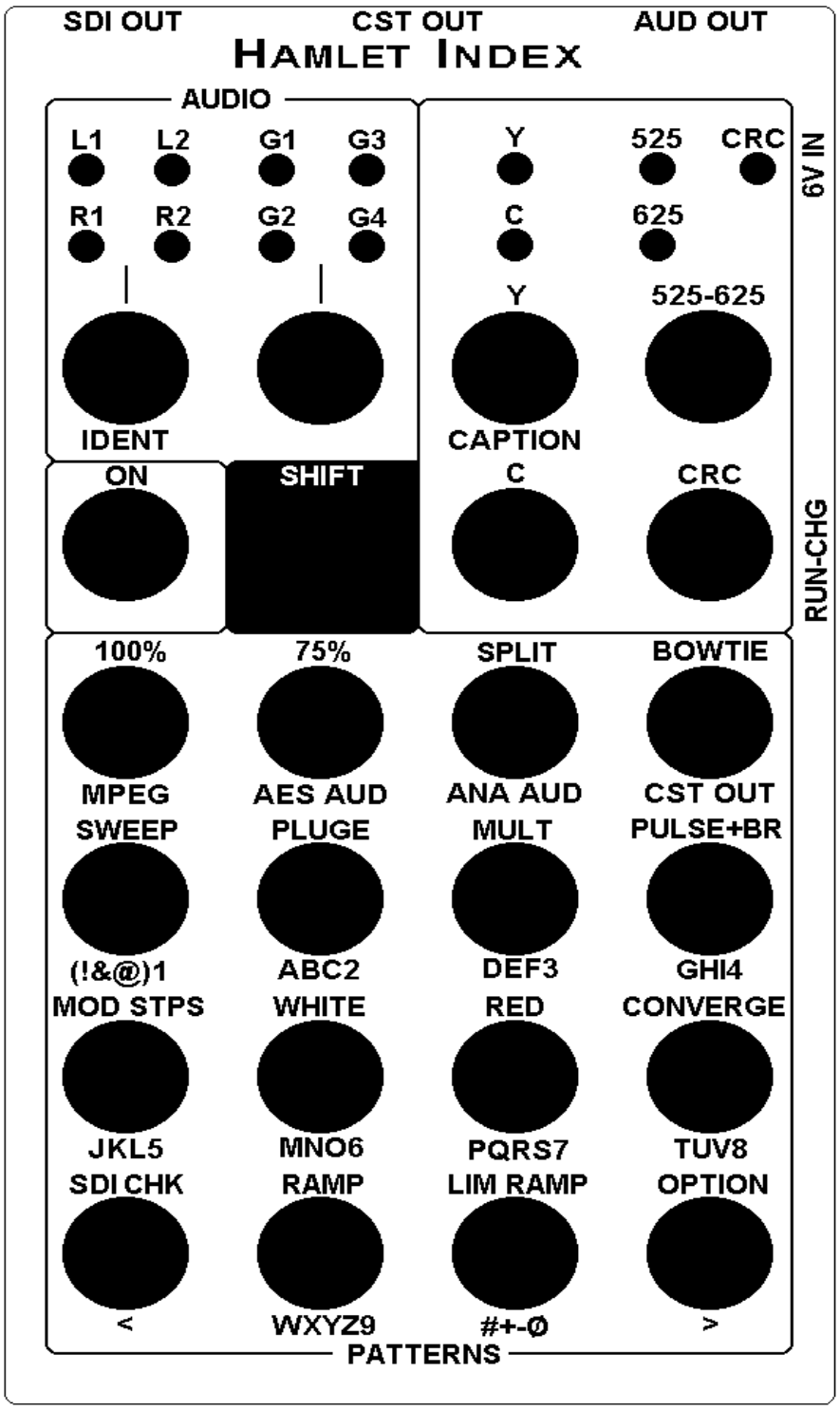
NOTE. During the EMC certification of this product, shielded cables were used. We recommend that they be used in operation.

PRODUCT DISPOSAL INSTRUCTIONS



The symbol shown above and on the Hamlet Index 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 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 should contact their Hamlet Index supplier to arrange for its return to Hamlet, who will safely dispose of it and ensure that this Hamlet Index is not mixed with other commercial waste for disposal.

FRONT PANEL


SDI OUT
CST OUT
AUD OUT
HAMLET INDEX
AUDIO
L1
L2
G1
G3
R1
R2
G2
G4
Y
525
CRC
C
625
6V IN
Y
525-625
IDENT
CAPTION
ON
SHIFT
C
CRC
RUN-CHG
100%
75%
SPLIT
BOWTIE
MPEG
AES AUD
ANA AUD
CST OUT
SWEEP
PLUGE
MULT
PULSE+BR
(!&@)1
ABC2
DEF3
GHI4
MOD STPS
WHITE
RED
CONVERGE
JKL5
MNO6
PQRS7
TUV8
SDI CHK
RAMP
LIM RAMP
OPTION
<
WXYZ9
#+-Ø
>
PATTERNS

OVERVIEW

The Hamlet Index is a hand held test signal generator designed to output serial digital (SMPTE 259) video together with embedded audio and CRC checksums. There are additional outputs of analogue composite video, AES/EBU digital audio and analogue audio. All signals are digitally derived for accuracy and stability.

16 different patterns can be selected for both formats and standards, including colour bars, frequency sweeps and the sdi test matrix pattern. The serial digital output is generated in full ten bit specification and the composite output is from a 9 bit digital to analogue converter.

Both output formats can be switched to 625 (PAL) or 525 (NTSC) standards. PAL-M is available on request.

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

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

4:3 or 16:9 circles and 16 text characters can be superimposed on the pattern

All settings are stored on power down

Internal NiMh batteries provide one hour of continuous operation.

OPERATING INSTRUCTIONS

6V IN SOCKET
Plugging in the power supply connector disables the internal 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 another key for additional functions. See page 8.

AUDIO (L)
Toggles the embedded audio between:
NO AUDIO PACKETS, EMBEDDED SILENCE, CH1 ONLY, CH2 ONLY, CH1 & CH2.

AUDIO (R)
Selects the embedded audio group:
GP 1, GP 2, GP 3, GP 4.

Y
Toggles the video Y component on and off.

C
Toggles the video C component on and off.

525-625
Switches the television standard between 525 (NTSC) and 625 (PAL).

CRC
Enables the CRC embedded checksum packet.

PATTERN KEYS
Pressing any of the pattern keys selects that pattern. The OPTION key is for future or custom test patterns. e.g. SMPTE colour bars

ADDITIONAL FUNCTIONS

IDENT TEXT DISPLAY

Up to 64 characters of text can be stored, but only 16 characters can be superimposed on the selected pattern at one time.

To display the text:

Press SHIFT then IDENT to display (or cancel) the first 16 of the 64 text characters, then press the < or > keys to scroll round the 64 stored characters.

To edit the text:

Press SHIFT then CAPTION (Y) to enable the cursor, which is fixed at the right side.
Use the < and > keys to scroll the text past the fixed cursor.
Press the appropriate button until the correct character is displayed at the cursor, similar to mobile telephone text messaging. Press 100% for a blank space.
Press SHIFT then CAPTION (Y) when finished to store the new message.

CIRCLE

A circle can be superimposed on to the selected pattern.
Pressing SHIFT then CRC toggles between 4:3 circle, 16:9 circle and off.

SMPTE COLOUR BARS

This pattern is available by pressing the OPTION button in 525 mode.

STEREO AUDIO IDENT

The left audio channel can be idented by pressing SHIFT and then the left AUDIO button. This toggles the left channel on and off every second. Pressing SHIFT and then the left AUDIO button again cancels the ident. The ident text will also appear with the audio ident.

MPEG PATTERN

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

AUDIO OUTPUT FORMAT

The audio output can be in either AES/EBU digital or in analog format. To select, press SHIFT and then AES AUD or ANA AUD.

BATTERY SAVING MODE

The composite output can be disabled, doubling battery life.
Press SHIFT then CST OUT to toggle enable/disable.

PATTERNS

100% BARS
100% full colour bars. Composite video 1V p/p.
Digital levels are Yblack =64, Ywhite = 940, Cr and Cb are 512 +/- 448 max.
NTSC option set has SMPTE bars in this position.

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.
NTSC option set has 75% colours in this position.

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 DigiScope 601, 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 500KHz to 5MHz over the line period, with markers at 1,2,3,4,5 MHz.
Waveform is 600bits (480mV) p/p centred on 502 bits (350mV).
When using the composite output, disable the C component to avoid Y/C beating.

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 six frequency bursts at 500KHz, 1MHz, 2MHz, 3MHz, 4MHz, 5MHz at 526 bits (370mV) p/p centred on 502 bits (350mV).
When using the composite output, disable the C component to avoid Y/C beating.
NTSC option set is 500KHz, 1.25MHz, 2MHz, 3MHz, 3.58MHz, 4.2MHz.

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 at 512 bits, Cb at 512 bits.

RED
Plain full red screen.
Y waveform is 326 bits (209mV), Cr at 960 bits, Cb at 361 bits.

CONVERGE
Crosshatch pattern for colour monitor convergence adjustment.
23 Horizontal lines and 23 Vertical lines.

SDI 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
Normally gives SMPTE colour bars.
NTSC option set has 100% bars in this position.

CIRCLE
The 625 circle display is 512 pixels high x 469 pixels wide.
The 525 circle display is 426 pixels high x 469 pixels wide.

TECHNICAL SPECIFICATION

OUTPUTS

Serial digital	BNC connector. Output impedance 75 ohms. SMPTE 259M, ITU-R BT.601/656 serial component. 800mV pp Full 10 bit pattern generation. Addition of CRC checksum word. Addition of embedded tone at -18db.
Composite	BNC connectors. Output impedance 75 ohms. 1 volt p/p +/- 1% PAL, NTSC or PALM from 9 bit DAC. Differential gain and phase +/- 1% and +/- 1 deg. Sch phase 0 +/- 5 deg.
Audio	3 pin XLR plug. Analogue: 1KHz tone 0db to +8db balanced to 600 ohms Thd <0.5%. Digital: AES/EBU encoded 1KHz tone, balanced output to 110 ohms.
Frequency	The crystal master oscillator is accurate to better than +/- 15ppm.

POWER

External	6Vdc +/-0.5V regulated @ 500mA. Current draw is 600mA 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.

CALIBRATION

EQUIPMENT REQUIRED

Accurately calibrated waveform monitor and audio monitor, e.g. Hamlet DigiScope 601.
Frequency standard, e.g. off air signal from reputable tv broadcaster.

As all signals are digitally derived, the only adjustments are to the master clock frequency, the analogue composite output gain and response and the analogue audio output level.

To access the adjustments, remove the four screws in the case bottom and separate the case halves. Adjustments are made through the holes provided in the upper circuit board.

All adjustments should be carried out after 30 minutes warm up.

MASTER CLOCK FREQUENCY

If not used for more than one month, run the unit for 2 hours to re-age the crystal.
The oscillator is accurate to better than +/- 15ppm.

ANALOGUE COMPOSITE OUTPUT

Select PAL, 100% BARS pattern. Connect a 75 ohm terminated waveform monitor or oscilloscope to the composite output. Adjust R3 (CST) for 1V +/- 1% p/p video and L1 (RESP) for 885mV +/- 1% p/p chroma.

ANALOGUE AUDIO OUTPUT

With an oscilloscope, adjust R23 (AUDIO) for 0db output, 2.19V p/p +/- 1%. Or with an accurate ac voltmeter, adjust for 775mV RMS +/- 5mV.

COMPONENT COLOUR

The colour picture can be distributed in two forms, whether in 625 or 525 line standards:

RGB

This is the basic signal produced by a camera etc and fed to a colour c.r.t. It consists of three primary signals, **R**ed, **G**reen and **B**lue. By convention, black level is at 0mV and peak brightness is at + 700mV.

YCrCb

As the human eye can see less resolution with colours, the video can be modified to take advantage of this to reduce the amount of information needed. The picture is separated into monochrome and colour components. The monochrome Y signal is formed from:

Y = (0.3 x Red) + (0.59 x Green) + (0.11 x Blue) approximately.
This signal has black level at 0mV and maximum white level at + 700mV.

The colour components are two colour difference signals:

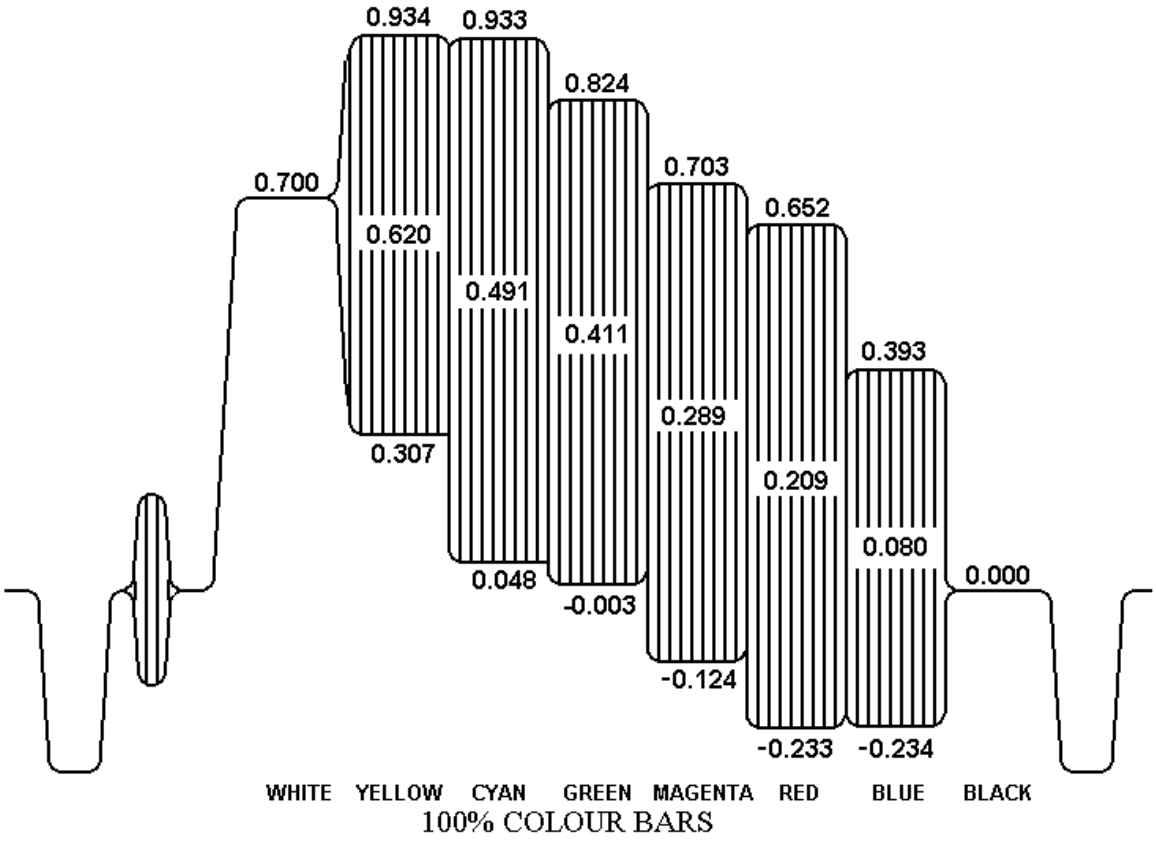
Cr = (R-Y) and Cb = (B-Y)
These are weighted to give maximum values of +/- 350mV and are bandwidth restricted to half that of the Y component.

PAL

Fig 2 shows an encoded 100% colour bar signal. The two colour components of Cr and Cb are used to amplitude modulate a 4.43361875Mhz carrier signal. The two carriers are arranged to be 90 degrees apart before they are combined with the Y luminance signal, so that they can be decoded separately. The PAL system is designed to minimise hue errors by phase reversing the Cr axis on alternate lines (**P**hase **A**lternate **L**ine). This reversal is copied by the decoder, so that the hue error will now alternate in phase. By combining the chrominance from two adjacent lines, the error is thus cancelled out.

NTSC

Fig 3 shows an encoded SMPTE (75%) colour bar signal. The two colour components of Cr and Cb are used to amplitude modulate a 3.579545Mhz carrier signal, but they are first modified into I and Q signals to reduce the overall maximum chrominance level when combined.



100% COLOUR BARS

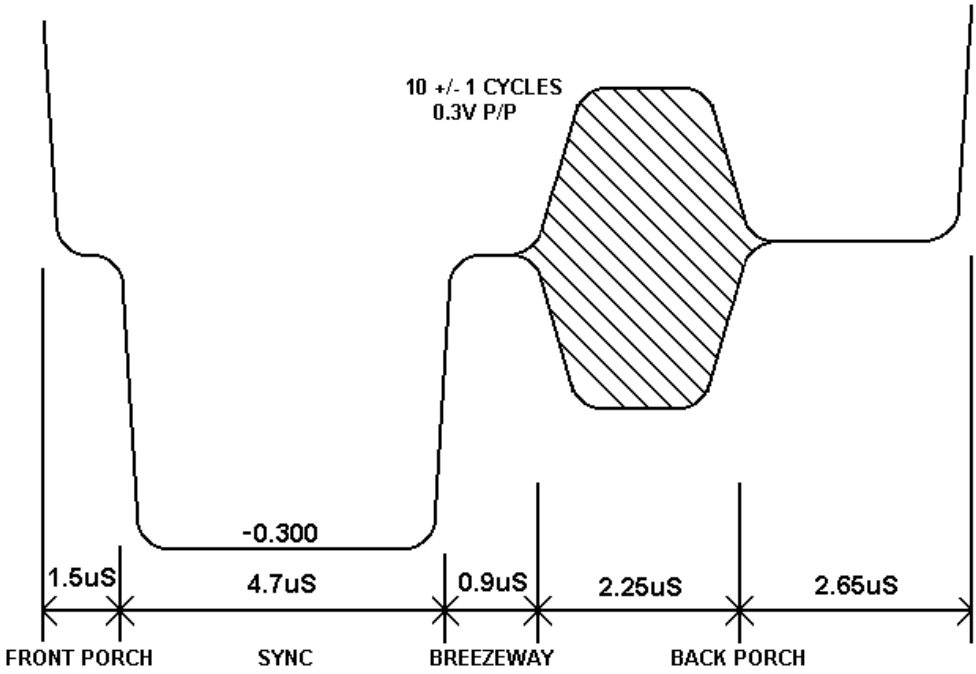
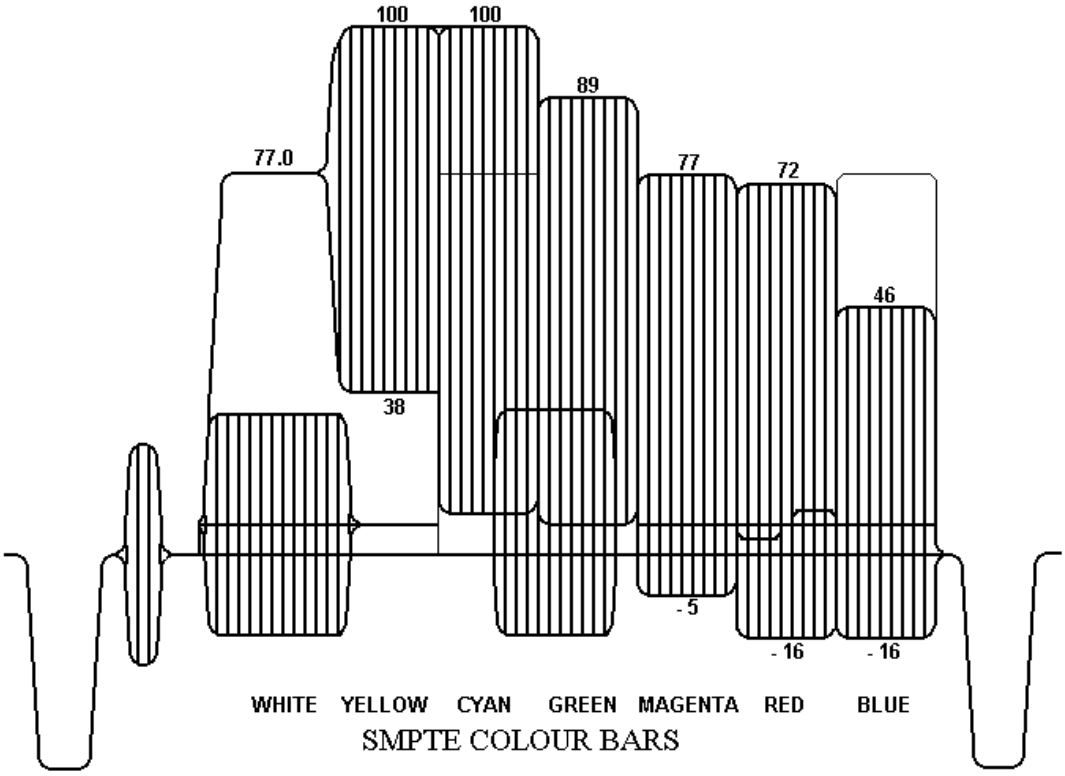


Fig 2 .



SMPTE COLOUR BARS

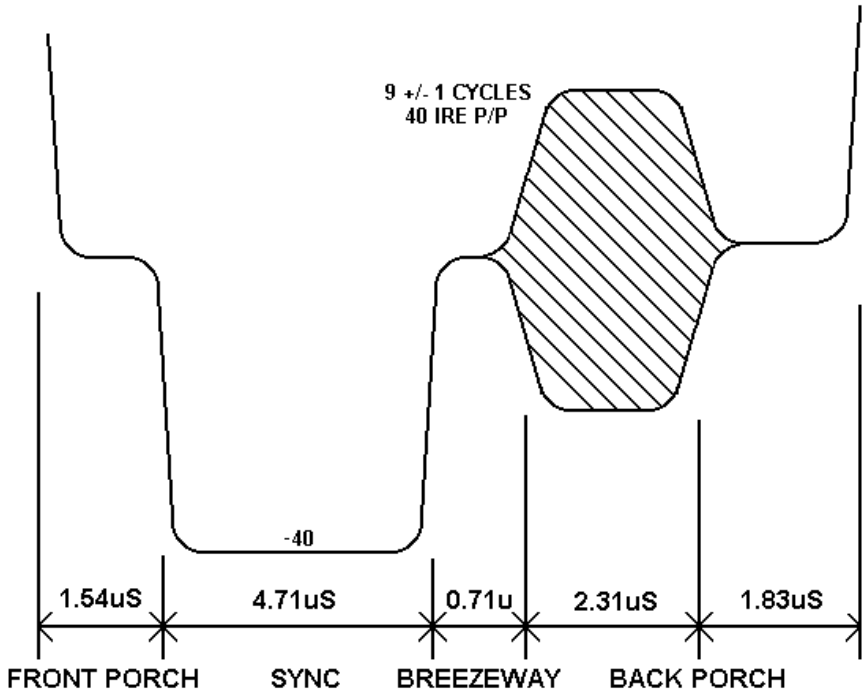


Fig 3.

SC-H RELATIONSHIP

PAL appears, at first sight, to be a four field system: field 1 being identical to field 5, and field 3 having the opposite pal switch phase. However, if a switch or edit is made between two video sources which are in the same pal sequence only, a small horizontal picture shift will often be noticed, this is due to the relationship between subcarrier and line frequencies. In order to avoid chroma patterning on monochrome receivers the PAL subcarrier frequency was chosen to have a 90 degree offset per television line, with 25Hz added on so that any remaining patterning would run through the picture:

F (pal) = (283.75 x 15.625KHz) + 25Hz = 4.43361875MHz

The drawback of this is that after one PAL frame of four fields the subcarrier will have executed exactly 354689.50 cycles, so it will be 180 degrees shifted from its original phase at the same sync point. Hence the subcarrier to horizontal sync (SC-H) phase will only repeat every EIGHT fields.
A similar problem also exists in NTSC, except that it is a four field system rather than eight field.

F (ntsc) = (227.5 x 15.73426373KHz) = 3.579545MHz

After one NTSC frame of two fields, the subcarrier will have executed exactly 119437.50 cycles, so it will then be exactly 180 degrees shifted from its original phase at the same sync point hence the sc-h phase will only repeat every FOUR fields.

If a video edit or switch is made without regard to the above field sequence, there is a 50/50 chance of picking the wrong eight field match. This will cause an SC-H phase jump producing a picture shift of half a cycle of subcarrier. Whilst this may be acceptable if cutting to a different shot, in animation or tag-editing the shift would be very noticeable.
To produce reliable match frame edits it is therefore necessary to identify the correct field sequence. In addition, if due to misalignment, the SC-H phase was displaced from the ideal by 90 degrees, the field relationship would be uncertain.

Both these problems can be addressed by having an instrument which displays the subcarrier phase to horizontal sync phasing. Zero SC-H phase has been defined as a positive zero-crossing of subcarrier at the vertical sync point on field 1.

Systems can now be adjusted in the exactly correct SC-H phase to avoid uncertainty when near to the 90 degree point. A video signal in the exactly wrong eight-field sequence would show up as an 180 degree SC-H phase error.

SERIAL DIGITAL BASICS

625 and 525 digital component video is produced by applying a 4:2:2 sampling structure to the analog signal. This process is defined by a sub-set of international standards ITU-R BT.601 and BT.656. (these were formerly known as CCIR-601 and CCIR-656. The label 'CCIR601' is commonly applied to digital video coded in this manner.)

The luminance (Y) component is sampled at 13.5 MHz, and the colour difference components (U and V) are both sampled at 6.75 MHz. With 10 bit quantisation, this results in a data stream of 10 bit words at a clock frequency of 27 MHz. If the signal source uses 8 bit quantisation, 10 bit data is used with the two least significant bits of each sample code set to binary zero. This is to maintain the same data rate.

The quantizing levels employed in the analog to digital conversion are set to give 66.4mV headroom above peak white and 51.1mV below black. Coded U and V signals have 50mV above and below their normal maximum and minimum excursions.

The synchronisation pulses are discarded in the coding process, and are replaced by Timing Reference Signals (TRS) which are inserted into the data stream to serve the same purpose. Two TRS's are used to synchronise the data stream, EAV (End of Active Video) and SAV (Start of Active Video). These are placed at the beginning and end of the horizontal video blanking period. see fig 4.

Each TRS 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:

XYZ:
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'

SERIAL DIGITAL BASICS

The period between EAV and SAV is not used by normal video and is available for other purposes e.g.: error checking, timecodes or embedded audio.

Illegal Values: The values 0 and 3FF hex are used solely by TRS pulses (EAV and 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, 0mV, 040 hex.
Chroma is defined as being between max positive, 350mV, 3C0, hex and max negative, -350mV, 040 hex.
The values above and below these are termed "out of gamut".

The data is serialised using an NRZ (None Return to Zero) code to produce a 270 Mb/s signal. This coding method removes any low frequency component and is insensitive to polarity. The data has to be scrambled first to avoid the possible transmission of all '0's. This data is output at 800mV p-p to normal 75 ohm video coaxial cable.

Due to the high frequencies, the cable losses are quite high, typically 10dB per 100 metres at 270 MHz. To allow acceptable cable lengths, automatic cable equalises are used at the receiver which usually allow up to 300 metres of cable to be used. It is important that standard cable is used, otherwise the equaliser will not compensate correctly.

Suitable cable is: PSF 2/3 BELDEN 8281 F&G 1.0/6.6

DIGITAL ERROR DETECTION OVERVIEW

In order to check if the digital video signal has been received correctly a Cyclic Redundancy Check (CRC) can be made on each frame in the generating equipment, this four digit number is then placed in a 'packet' and put in the EAV-SAV space of one line of each field.

At the receiving equipment the incoming video field also has a Cyclic Redundancy Check number calculated, this value is then compared with the 4 digit number sent in the packet. If the two numbers are not identical an error has occurred between transmission and reception of the signal.

This type of error detection is known as Error Detection and Handling or EDH and is defined by SMPTE RP165. In practice two check sums are sent per frame, one for the active video period and one for the full frame. A typical packet consists of:

The Header:	(000, 3FF, 3FF) This always precedes an EDH packet.
Data ID:	(1F4)
Block Number:	(200)
Data Count:	This contains the number of words that follow.
Active picture CRC:	3 words
Full-field CRC:	3 words
Error flags:	3 words
Reserved:	7 words
Check Sum:	This is used to test for transmission errors.

Note, all values in Hex.

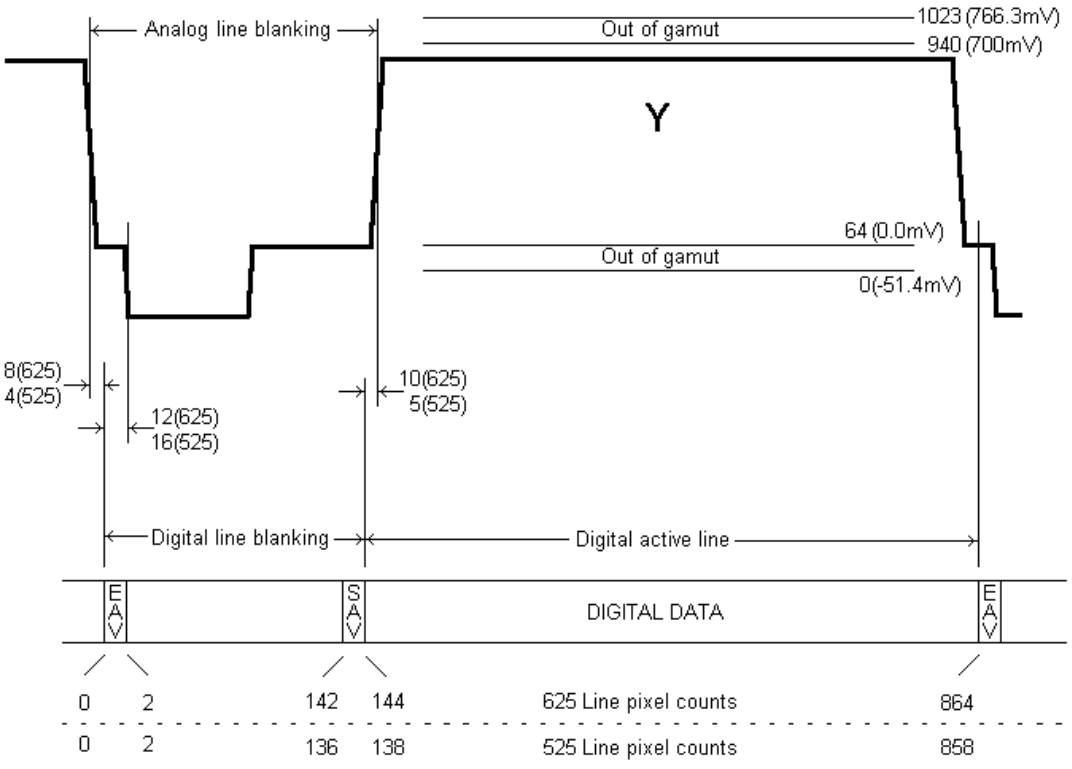
EMBEDDED AUDIO OVERVIEW

The period between the EAV and SAV markers can be used to send embedded digital audio signals. This is known as SMPTE 272M. 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 digitised in the sending equipment to 20 bits of resolution, usually at a 48 KHz sample rate. Often only 16 bits are used in practice. The digitised data is arranged in packets which are placed in the EAV-SAV space.
A typical packet consists of:

The Header:	(000, 3FF, 3FF) This always precedes an audio packet.
Data ID:	This contains the Audio Group number.
Block Number:	AES blocks have 192 'frames' of audio data
Data Count:	This contains the number of words that follow.
Audio Sample:	
Audio Sample:	
Audio Sample:	
Audio Sample:	
Check Sum:	This is used to test for transmission errors.

Each audio sample consists of a sample of all four audio signals,
eg: Channel 1 left, Channel 1 right, Channel 2 left, Channel 2 right.
Each signal requires 3 words to hold all 20 bits data, thus each audio sample has 12 words in it. Typically 3 or 4 audio samples are sent in each EAV-SAV period.
As with the video signal, words which consist of all '1's or all '0's are not allowed.

EAV and SAV



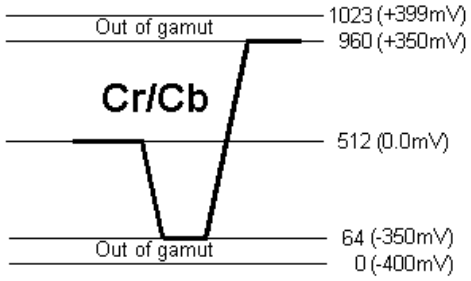


Fig 4 .

SD SDI Field Blanking – 625

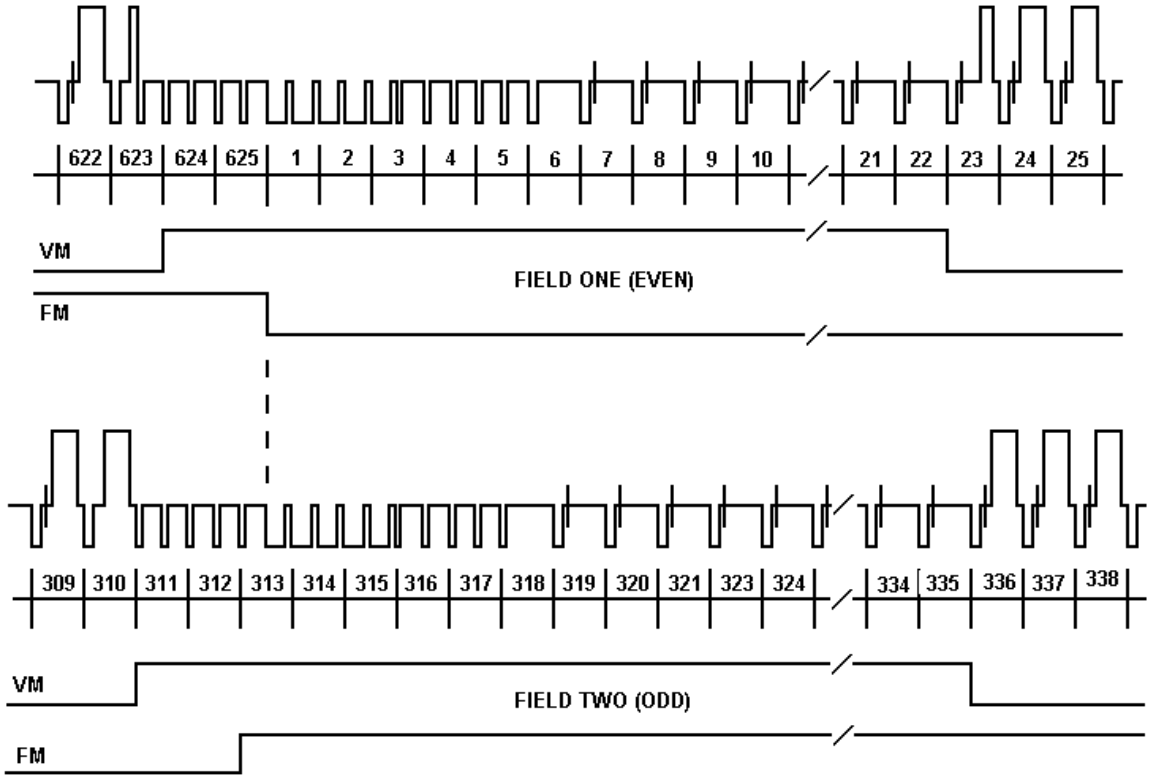


Fig 5 .

SD SDI Field Blanking – 525

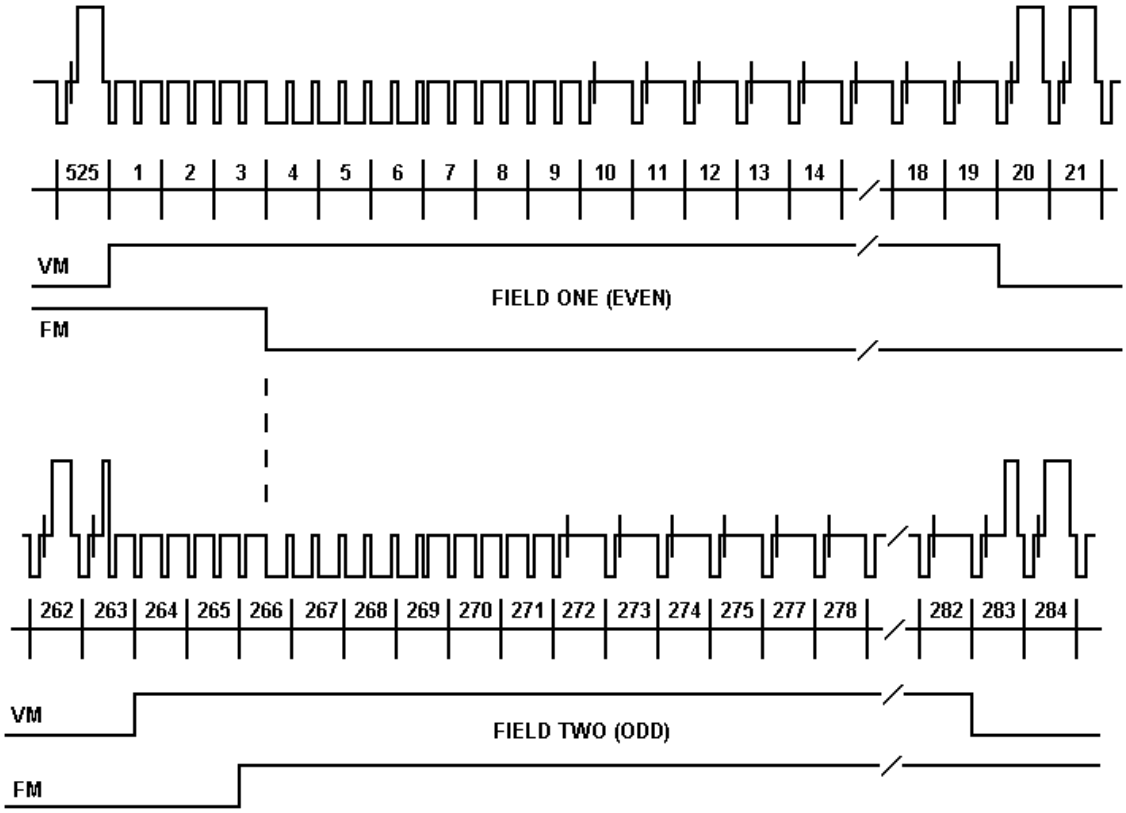


Fig 6.

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 Index, please contact:

Hamlet Video International Limited
Maple House 11 Corinium Business Centre Raans Road Amersham Bucks HP6 6FB England
Main Line: +44 (0)1494 729 728
Fax Line: +44 (0)1494 723 237
Free phone (UK) 0500 625 525
E-mail: sales@hamlet.co.uk Web site: www.hamlet.co.uk

Hamlet Video International USA service center , Tecads Inc, 23 Del Padre St, Foothill Ranch, CA 92610, U.S.A.
Tel: +1 (949) 597 1053,
Fax: +1 (949) 597 1094.
Toll Free Tel number: (866) 4 HAMLET
E-mail: service@hamlet.us.com Web site: www.hamlet.us.com

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