# HAMLET
## EXCELLENCE IN VISION

# VIDEOSCOPE 302 WVR

## VIDEO MONITORING SYSTEM

## OPERATOR'S HANDBOOK

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.



## 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 VIDEO SCOPE 302WVR**

to which this declaration relates is in conformity with the following standard,

EN50081-1
Generic emissions standard for light industrial applications.
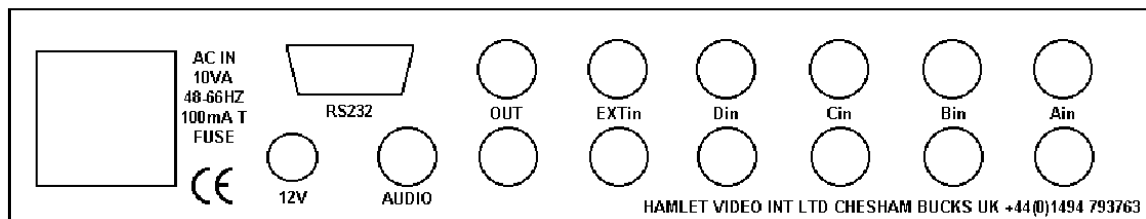
EN50082-1
Generic immunity standard for light industrial applications.

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 are used in operation.

# FRONT AND REAR PANELS

## HAMLET VIDEOSCOPE 302WVR PANEL DETAILS
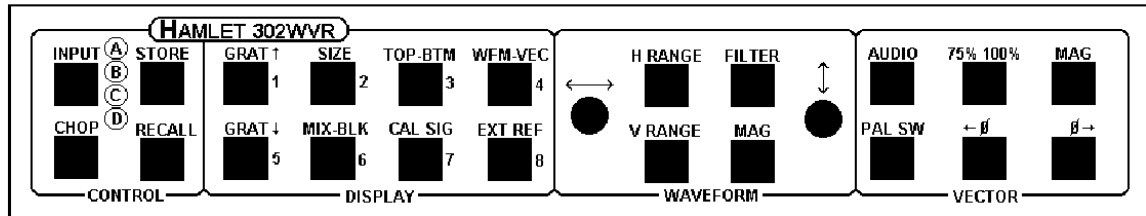
# INTRODUCTION

The 302WVR waveform monitor provides full broadcast standard measurements and displays conventional waveform and vector displays cut into the television picture. It is available for PAL, NTSC or PAL-M formats.

The unit provides accuracy better than 1%, 1 deg, and includes individual or combination full screen displays of both waveform and vectors, 1/2 and 1/4 size screen displays, plus mix display. Waveform functions include H, 2H, HMAG, 2V, V, VMAG, Chroma Pass, Low Pass and Flat filtering, vertical and horizontal shift and gain magnification.

Vector controls include 75% and 100% set positions for vectorscope, x3 magnification, phase rotation and pal switch defeat.

A calibrator is built-in to check waveform and vector calibration, and there is an internal broadcast quality mono P.G. to maintain a display with no input-can also be used to black component tapes!

There are three full function control memories, plus further memories for horizontal and vertical shifts and vector phase.

All functions can be remotely controlled via the RS232 connector. Software is provided to create a virtual control panel on a PC.

The condensed size and low power consumption of the Hamlet 302WVR lends itself to numerous operational applications, P.S.C. (Portable Single Camera shoots), flyaway editing packs, mobile satellite links, inject points, links packs etc.

# TECHNICAL SPECIFICATION

## DISPLAY AREA

The waveforms are in square boxes burnt into the video signal.

Small mode: Video and vector boxes, are each 128 lines high with a width of 8.5uSec in PAL and 10uSec in NTSC

Half mode: Video and vector boxes, are each 256 lines high with a width of 17uSec in PAL and 20uSec in NTSC

Expand mode: Video and/or vector boxes, are each 512 lines high with a width of 34uSec in PAL and 40uSec in NTSC

## SIGNAL CONNECTIONS

IN: BNC connectors for A, B, C and D with input impedances of 22K.
EXT: BNC connector with input impedance of 22K.
LOOPS BNC connectors for A, B, C, D and EXT.
OUT Two outputs to monitor, 1 Volt to 75 ohms.
AUDIO 6 pin mini din. Stereo balanced input. Impedance 22K.
RS232 9 pin D plug.
YC option has 4 pin mini-din connectors replacing some or all of the BNC connectors.

## WAVEFORM MONITOR

Response: FLAT is +/- 1% from 25Hz to 5.5MHz, -5% at 10MHz
LPASS is a low pass filter -1db at 1MHz, -40db at 3.58 / 4.4MHz
CPASS is a bandpass filter -3db at +/- 750KHz
Sensitivity: 1V video-in displays 100% (140 IRE) in CAL mode
Gain variable between 1.0 and 3.0
Error in CAL position is less than 1%.
D.C. Restorer: Attenuation of less than 30% to line hum signals
Display level change less than 2% for 1 volt change in signal level.
Timebase: 2V, V, VMAG, 2H, H, HMAG.
Accuracy limited only by display resolution due to crystal sweep.

## VECTOR MONITOR

Accuracy: Better than 1% in 75% or 100% positions
Variable up to 3 times gain
Display phase is continuously variable by +/- 45 degrees.

## POWER

DC 7V-15V at 0.5 amp
AC 110V or 220V +/-20%. 48-66Hz @ 10VA. 100ma slow T fuse.

## 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 1.75Kg.

# INSTALLATION

## UNPACKING

The Hamlet 302WVR unit is shipped from the factory in a specially constructed packing case. Exercise caution when unpacking the unit to prevent damage to the case finish. Examine the unit carefully for damage, which may have occurred during shipment

## MOUNTING INSTRUCTIONS

The Videoscope has been designed to operate as a desk top unit, or can fit into a standard 19 inch equipment rack, where it occupies 1U of height and half width. Rack mounting kits for one or two units are available from Hamlet. The unit itself generates little heat and does not need forced ventilation, but heat generated from adjacent units should not cause the case temperature to rise above 50 deg.C.

## POWER REQUIREMENTS

Mains supplies of 110V or 230V AC as supplied and 12V DC are suitable. When operating from mains supplies, the integrity of the supply earth should be checked to maintain electrical safety. The mains cable should be protected by a fast fuse of no greater than 6 amps in the supply feed.

## SIGNAL AND CONTROL CONNECTIONS

Input and output cable connections are all made to BNC sockets on the rear panel. To utilise all the Videoscope functions, the A B C and D inputs, both outputs, external reference (vid or syncs) and audio inputs should all be wired.
The inputs need not be composite video signals, as in EXT VID mode they are displayed keyed into the external video signal.

## CHECKOUT FOR INITIAL USE

After installation as above, switch on the Videoscope unit and operate each control in turn, verifying correct response as described in the operating instructions.

## PREVENTATIVE MAINTENANCE

The Hamlet 302WVR should be visually inspected, cleaned and the calibration checked every one year of operation.

CAUTION. The front panel is made from polycarbonate, which may soften if cleaned with some organic solvents. Do not allow water to get inside the equipment case.

# OPERATING INSTRUCTIONS

**INPUT**
Toggles between inputs A, B, C and D.

**CHOP**
Rapidly toggles between the 4 inputs for timing comparisons. Use in EXT REF mode.

**RECALL**
Recalls stored panel settings when followed by one of the 8 numbered buttons.

**STO**
Stores current panel settings. Press store, then the desired numbered button.

**GRAT**
Controls the brightness of the internal electronic graticules.

**SIZE**
Toggles between half and quarter size displays.

**TOP-BTM**
Displays the smaller displays at top or bottom of screen

**WFM VEC**
Displays full-screen waveform, vectors or both.

**MIX-BLK**
Toggles between ON, MIX, BLACK and OFF. Black displays waveforms on black. With no input, gives syncs out only. Mix provides a mix between picture and waveforms.

**CAL SIG**
Enables internal waveform and vector calibrators.

**EXT REF**
Switches to external sync reference. Hold down for one second for HFT mode.

**H RANGE, V RANGE**
Control the horiz sweep rate of the waveform monitor section giving two fields, one field, vertical magnified, two lines, one line and one line magnified.

**FILTER**
Switches the video filtering between flat, low pass and chroma pass modes.

**MAG**
Varies the gain of the waveform monitor, giving 1.0 x and variable.

**OPERATING INSTRUCTIONS**

**SHIFTS**
Provide horizontal and vertical shift for the waveform monitor section.
Press RECALL then H RANGE for preset horizontal position.
Press RECALL then FILTER for preset vertical position. To store a new vertical position, press both GRAT buttons together.

**AUDIO**
Turns the audio display and graticule on and off.

**75 100**
Varies the gain of the vectorscope section for 75% and 100% colour bars.

**MAG**
Gives variable vector gain (internal adj).

**PAL SW**
Disables the PAL switch action for a 6 vector display.

**PHASE**
Provides continuous rotation of the vector display to +/- 45 deg.
Press both buttons for preset position.

**JUMPER POSITIONS**

For CST operation fit J1 J6 J7 J8. Changeover J10 and J13.

For NTSC operation fit J5 and J9. Changeover J4.

For PPM/VU selection, changeover J2 and J3.

For External video in EXT SYNC mode, changeover J11 and J12.

This allows waveforms to be displayed cut into external video, particularly useful when YUV and non-video signals need to be analysed. (Vectorscope shows EXT VID)

# GRATICULES

## PAL WAVEFORM GRATICULE

The waveform graticule divides the vertical axis into twelve amplitude steps of 100mV each, with markings on levels 0 to 1.0. At the 1 volt level, there are additional
K factor marks for +/- 2«% and +/- 5%.
The horizontal axis graticule marks are placed on the black level line.
Horizontal calibration is: 1 uS per division in HMAG
                     5 uS per division in H
                     10uS per division in 2H
In small mode, a more simple graticule is used, with amplitude lines drawn at 0V, black level and 1V.

## PAL VECTOR GRATICULE

The vector graticule shows the vector amplitude and phase positions for standard input 75% or 100% colour bars together with the U and V axis. The boxes represent limits of +/-5% amplitude and +/-3 deg phase and are labelled with the appropriate colour letter. Burst marks are provided for 75% and 100% gain settings.
Differential phase marks are provided every 90 degrees on the vector circle and are spaced 2 degrees apart.
Differential gain marks are on the left hand axis and are 2.5% apart.
The audio graticule can be specified for PPM, NORDIC or VU.
In small mode, a more simple graticule is used, without the lettering or diff phase marks.

## NTSC WAVEFORM GRATICULE

The waveform graticule divides the vertical axis into 140 IRE units, with markings at levels -40 to +100 and % marks at 0, 12.5, 75 and 100.
At the one volt level there are additional marks for K factor levels of +/-2«% and +/-5%.
The horizontal axis graticule marks are on the zero IRE line
Horizontal calibration is: 1 uS per division in H MAG
                     5 uS per division in H
                     10uS per division in 2H
In small mode, a more simple graticule is used, with amplitude lines drawn at 0V, black level and 1V.

## NTSC VECTOR GRATICULE

The vector graticule shows the vector amplitude and phase positions for standard colour bars, together with the U,V,I & Q axis. Boxes represent limits of +/- 3.5% of amplitude and +/- 2.5deg of phase and are labelled with the appropriate colour letter. A burst cal mark is provided on the left U axis
Differential phase measurement marks are provided at each 90 deg point on the vector circle and are spaced 2 degrees apart
Differential gain measurement marks are provided on the left hand U axis at 2.5% intervals
In small mode, a more simple graticule is used, without the lettering or diff phase marks.

# ADJUSTMENTS AND CALIBRATION

## AMPLITUDE CALIBRATION

Preset controls are provided for fine adjustment of waveform and vector gain in relation to the electronic graticule.
Adjust RV6 (WFM CAL) for waveform and RV10 (VEC CAL) for vector calibration.
Adjust RV8 (WFM MAG) and RV7 (VEC MAG) for required magnification.

## FILTERS

Adjust L2 (LPASS) for minimum chroma in low pass mode.
Adjust L1 (CPASS) for maximum chroma in chroma pass mode.

## CALIBRATOR

Only adjust if an accurate comparison source is available!
Adjust RV12 (WFM CAL SIG) for 1 volt luminance display.
Adjust RV9 (VEC CAL SIG) for 1 volt chroma display.
Adjust RV15 (OFFSET) for central vector cal circle w.r.t. vectors.

## MIX LEVEL

Adjust RV13 (MIX) for desired background level in mix mode.

## DIGITAL VCOS

Using a meter with input resistance greater than 1M ohm:
Adjust CV2, with a plastic tool, for 2.5 volts at U33 pin 9
Adjust CV3, with a plastic tool, for 2.5 volts at R79

## TIMEBASE CALIBRATION

As the horizontal sweep and graticule are both derived from a crystal reference, there is no need, nor is there provision for any adjustments.

## VECTORSCOPE LINEUP

With colour bars applied to the input, select VEC mode
Adjust RV2 (VEC H SHIFT) and RV1 (VEC DIAG) for centring
Adjust L8 (90 deg) and RV11 (UGAIN) for balanced display
Adjust L3 (VEC FILT) for straight lines between the vector dots
Adjust L9 (PHASE) for centred phase control action.

## AUDIO

Adjust RV5 (VPOS) so bottom of bars touch bottom of graticule
Adjust RV3 (L) for left channel gain calibration.
Adjust RV4 (R) for right channel gain calibration.

# REMOTE CONTROL

FOR MORE DETAILED INFORMATION, PLEASE READ THE DISC HELP FILE.

The software package is for remote control of the Hamlet 302WVR from a personal computer via an RS 232 serial link. It is recommended that the disk be copied to your hard disk drive and then kept safely as a backup. Please note this version is for a Microsoft Windows Environment. A DOS version is available from the factory if required. Before installation of the application please ensure that your system is able to run it correctly.

HARDWARE REQUIRED

IBM PC or 100% compatible personal computer.
At least 1M Byte of RAM.
A VGA type colour monitor.
A Hard Disk Drive.
An RS-232 Serial Port for connection to the Video Scope.
A Mouse.
A 3.5" Floppy Disk Drive.
The supplied cable to connect the Serial Port to the Video Scope.

SOFTWARE REQUIRED

Microsoft Windows Version 3.0 or greater.
MS DOS Version 3.3 or greater.
Hamlet Video 302WVR software (disk supplied)
The software consists of the following files:

302WVR.EXE          Executable file
VBRUN100.DLL        Runtime file
302WVR.HLP          HELP file. This is a text file which maybe
                    printed out or called from the HELP window
                    while running the application.
302WVR.SET          Setup file of 4 bytes.
INSTALL.EXE         Installs the software on your hard disk.

INSTALLATION FROM DOS:

To install the software on your hard disk first ensure the computer is in DOS, fit the application disk in the floppy drive,

Type A: to give the A:> prompt then type INSTALL <enter>

This will create a directory on your hard disk called C:\HAMLET then the application files will be copied to that directory.

Note: The files are not protected or compressed so they may be manually copied to any directory required.  The INSTALL program also sets up the serial port.

On first use of the software, a group window and application file are needed.

To Create a Group Window, start Windows in the usual manner, eg Type WIN <enter>
From the Program Manager Window select: FILE NEW. Select Program Group
In the description box type: HAMLET. Select OK
To Add the Application file, in the Group Window, select FILE NEW, select Program Item
In the Description box type 302WVR
In the Command box type the full path name of the application:

ie C:\HAMLET\302_WVR.EXE  Select OK.

The software is now installed on your hard disk and can be called from the Windows Program
Manager in the normal way. ie double click on the HAMLET Group icon, then double click on the
302WVR icon. The first time the software is run it may be necessary to set the COM PORT option
in the SETTINGS window. Remember to save it before you return to the main panel window

**OPERATION**
From the Hamlet Program Manager, double click on the 302WVR icon.

**BUTTONS**
Use the mouse to point and click the required buttons.

**VARIABLE CONTROLS**
These use arrows on the computer panel and can be operated in 2 ways.
1)      Point the mouse at the arrow of a slider control and hold down the left mouse button, this
        causes the control to increment or decrement slowly.
2)      Point the mouse at the arrow of a slider control and double-click the left mouse button, this
        causes the preset function to operate.

**THE OPTIONS MENU.**

BEEP ON/OFF.
When each control is pressed the computer issues a beep, this may be disabled if not required by
clicking the "beep off" button.

SERIAL PORT SUB MENU
Used to change the COM PORT used to control the Video Scope. See installation instructions.
This command will usually only be used when the Video Scope is first installed.

THE HELP WINDOW
Click on HELP for the information text, which can be scrolled with the mouse on the "vertical
scroll bar" on the right of the window or from the keyboard cursor or the PgUp and PgDn keys.

TO QUIT THE PROGRAM
Double click on the "control menu box" ( top left window button )

# ANALOG BASICS

## 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 3  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 4  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.

# PAL BASICS



0.934  0.933
0.824
0.700
0.703
0.620
0.652
0.491
0.411
0.393
0.307
0.289
0.209
0.080
0.048
0.000
-0.003
-0.124
-0.233  -0.234

WHITE  YELLOW  CYAN  GREEN  MAGENTA  RED  BLUE  BLACK

## 100% COLOUR BARS

10 +/- 1 CYCLES
0.3V P/P

-0.300

| 1.5uS | 4.7uS | 0.9uS | 2.25uS | 2.65uS |

FRONT PORCH        SYNC        BREEZEWAY        BACK PORCH

**Fig 3 .**

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# NTSC BASICS



100     100

89

77.0

77      72

46

38

- 5

- 16    - 16

WHITE   YELLOW   CYAN   GREEN   MAGENTA   RED   BLUE

SMPTE COLOUR BARS

9 +/- 1 CYCLES
40 IRE P/P

-40

| 1.54uS | 4.71uS | 0.71u | 2.31uS | 1.83uS |

FRONT PORCH     SYNC     BREEZEWAY     BACK PORCH

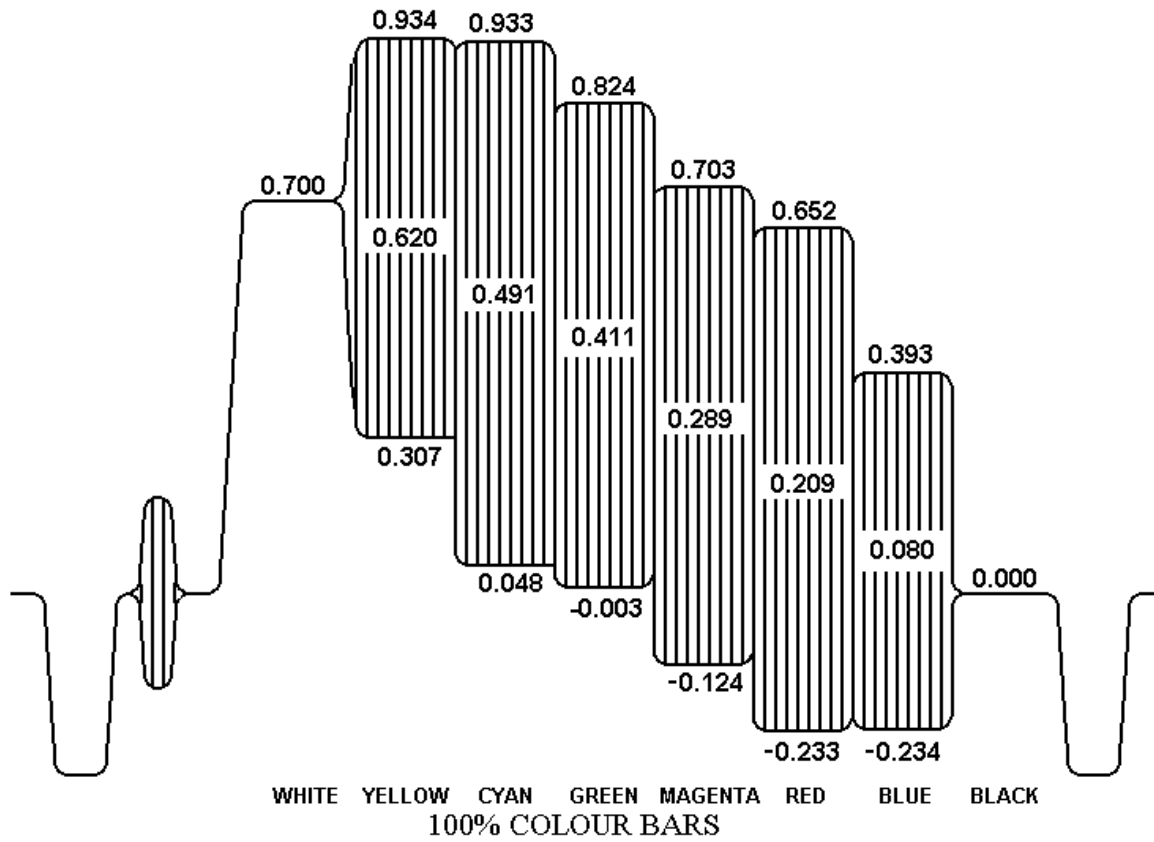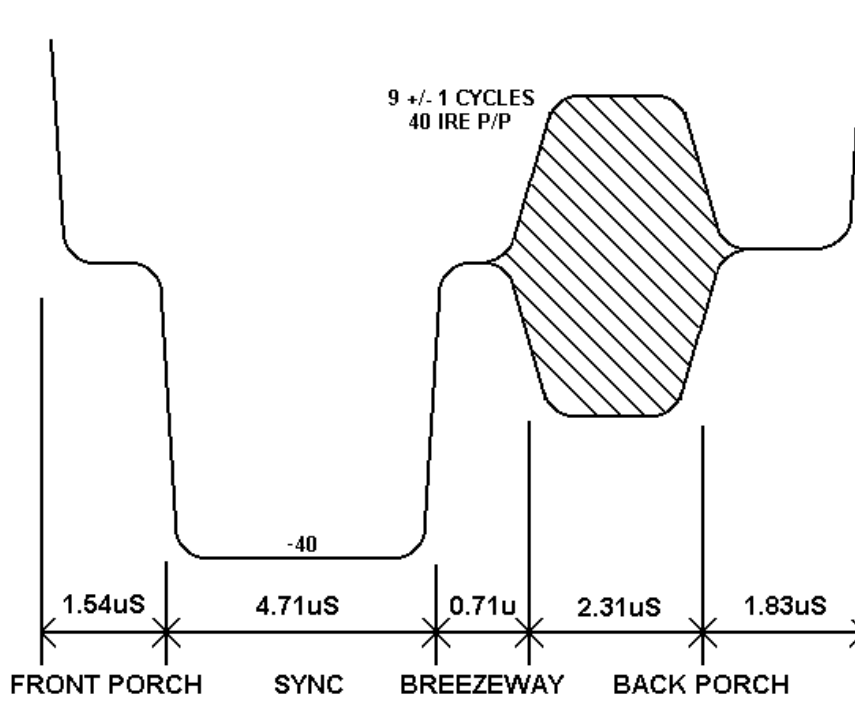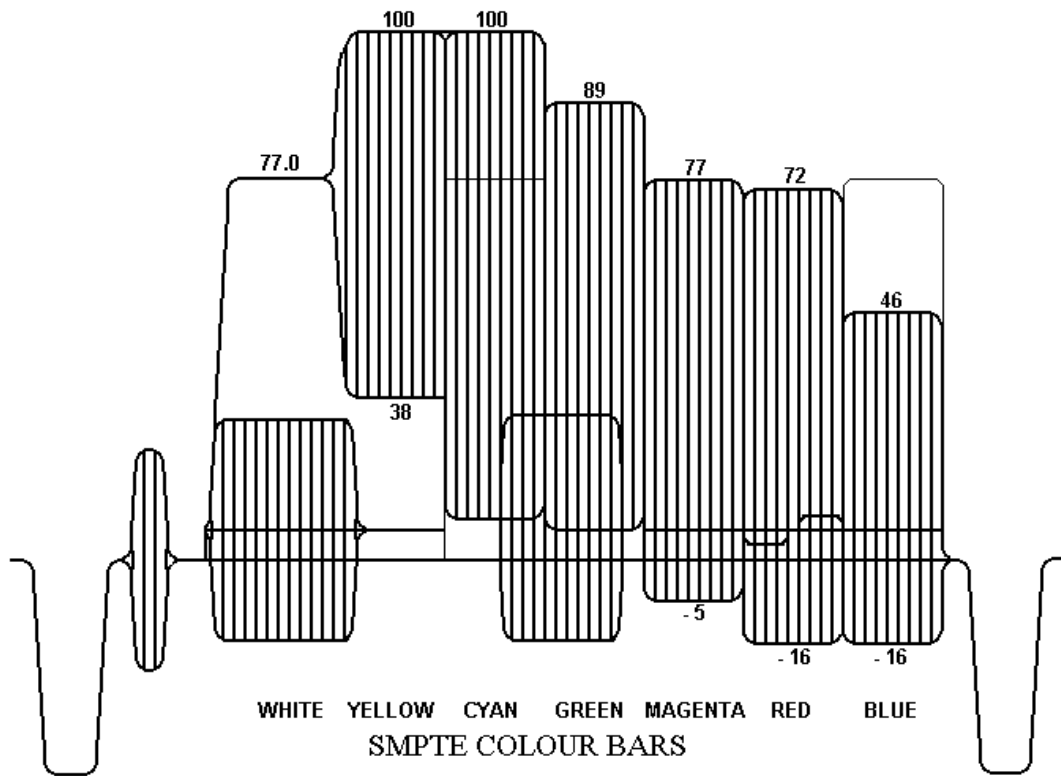**Fig 4 .**

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# 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.

# 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 VideoScope, 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.