HAMLET

EXCELLENCE IN VISION

PICO SCOPE

VIDEO MONITORING SYSTEM

OPERATOR'S HANDBOOK

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

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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 PICO SCOPE 300W

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

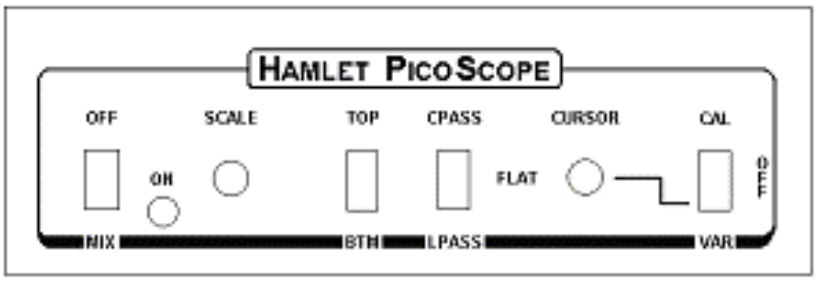
EN50081-1
Generic emissions standard for light industrial applications.

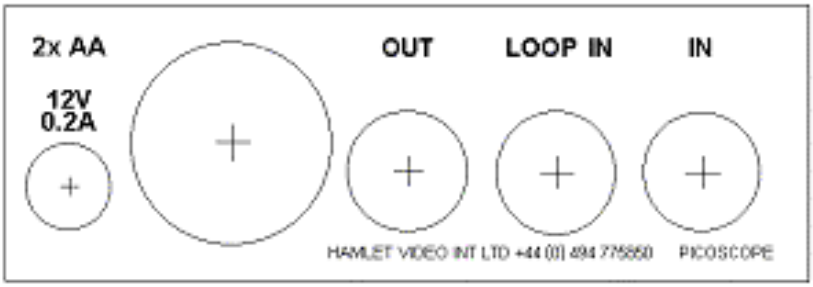
EN50082-1
Generic immunity standard for light industrial applications.

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





TECHNICAL SPECIFICATION

DISPLAY AREA

The waveforms are in boxes burnt into the video signal

Small modes: Box is 128 lines high, with a width of 14uSec.

Expand mode: Box is 512 lines high, with a width of 42uSec.

SIGNAL CONNECTIONS

Inputs: BNC connector with loop-through output. Return loss is better than 40db. Input impedance 15K ohm,max d.c.+/- 10 volts.

Output: Output to monitor is 1 Volt to 75 ohms.

Option: The Pico Scope can be factory set such that on power-down, the unit is bypassed so that the output is directly connected to the input, and the loop output is disconnected.

SPECIFICATION

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 band pass filter -3db at +/- 750KHz

Sensitivity: Black level displays 0%, white level displays 100%

Calibrator: Error in CAL position is less than 1% (0.007V).
Calibration line variable over full signal range.

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.

POWER

INT: 2 x 1.5V AA cells, life approx 4 hours (Lithium)
1.5 hours (Alkaline) or 1 hour (Nicad).

EXT: 8V-15V D.C. at 0.21 amp. Centre negative.

ENVIRONMENT

Indoor use, 5 to 45 deg.C. ambient to 2000m.
Max humidity 80% to 31 deg.C decreasing to 50% at 40 deg.C.
Overvoltage category 2. Pollution degree 1.

WEIGHT

450g or 500gr with batteries.

OPERATING INSTRUCTIONS

OFF - ON - MIX

Enables the power supply, provides a mix between the picture and waveform

SCALE

Controls the brightness of the internal electronic graticule

TOP - BTM

Gives small display at top of screen, full size display or small display at bottom of screen.

(LEFT-RIGHT)

An internal jumper selects left or right small displays.

CPASS - FLAT - LPASS

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

CURSOR

Provides a variable electronic cursor for measurement comparisons.

CAL - OFF - VAR

Gives a calibrated cursor position, cursor off or variable control.

CHOICE OF POWER SOURCE

If no external supply is present, the Pico Scope will operate from its internal batteries.
To conserve battery life, it will only operate when input video is applied.

The front panel LED will change from GREEN to RED when the batteries are nearly exhausted.

The correct battery polarity is with the caps (positive) facing outwards.

When a suitable external supply is present, this will automatically be used instead of the internal batteries.

ADJUSTMENTS AND CALIBRATION

AMPLITUDE CALIBRATION

Preset controls are provided on the analog board for fine adjustment of waveform gain and lift in relation to the electronic graticule.

Adjust R5 for gain and R28 for lift.

Adjust R4 for cursor cal at 100%.

MIX LEVEL

Adjust R13 (mix) for desired background level in mix mode

FILTERS

Adjust L1 for minimum residual chroma in LPASS mode.

Adjust L2 for maximum chroma in CPASS mode.

DIGITAL BOARD

Using a meter with input resistance greater than 1M ohm:
Adjust L1 with a plastic tool for 1.5 volts at R7

GENERAL DESCRIPTION

INTRODUCTION

The Pico Scope is basically an oscilloscope, but with the CRT tube replaced by an analogue to digital converter circuit and a television field store, which act as a digital scan converter
In order to obtain a display identical to that produced on an analogue CRT, the field store is addressed in the same way as the electron beam in a conventional instrument scans its phosphor

INPUT VIDEO

The incoming video signal is buffered and DC restored, then split in two ways. One path is via the output waveform inserter and out to the t.v. display monitor. The second path is to the oscilloscope section, which contains the usual filters, gain controls and sync separators. The resultant video signal is then digitised to provide the Y axis data for the video memory.

DIGITAL STAGES

Video memory X axis data is obtained from a line locked counter.
The memory is read-out from in synchronism with the input video signal to produce the required output display areas, with their size and position being selectable.

GRATICULE

The internally generated electronic graticules are stored in the master gate array, which allows custom designs to be implemented. They are superimposed on to the output video in synchronism with the field store to give exact calibration with no parallax errors

The Pico Scope is split into two circuit boards, Analog and Digital.

ANALOG BOARD

VIDEO IN/OUT

The input video is amplified at U2B and DC restored using feedback restoration at U5A. Video is then fed to switcher U3 which gates in the waveform display on black or variable background video for mix, and is output via video buffer U2A. The waveform information is formed at T1 and T8 by adding the field store and scale signals.

SYNC SEPERATOR

U4 provides sync separation for clamp pulse use and for output to the digital board.

CURSOR

During field blanking, U3 switches the ADC input to a DC level from the cursor control or cal preset.

VIDEO PATH

The video signal is fed via the gain preset and filters and goes to the digital converter U1.

A to D CONVERTION

The ADC is fed with a 10 MHz timing clock from the digital board which governs the sample point and output latch clocking.

DIGITAL BOARD

This board is the digital scan converter, comprising clock and control signal generators for the analogue board and memory, two field memories and graticule generator. It is split into read and write sections. All the logic is implemented in a single gate array.

READ ADDRESS

Syncs from the analogue board are digitally separated to produce horizontal and vertical trigger pulses. The horizontal pulses lock the 18.5MHz clock oscillator, which clocks the horiz read timing counter. Similarly, vertical sync phases up the vertical timing counter. These two counters determine the output display sizes and positions for full screen displays, small screen top and small screen bottom displays. The 25Hz EVEN signal enables the memories to changeover between reading and writing in synchronism with the input video.

WRITE ADDRESS

Horizontal pulses are used to phase-up the write counter to incoming video. The 18.5MHz clock is divided by two to produce the clock for the ADC and the memory write enable. This clock is then divided by two again for the timebase clock.
The two 64Kx4 fast static rams are the two fields of memory for the scan converter.
During television field one, the first memory is written into and the second is read out from. During television field two the action is reversed, allowing totally separate reading and writing, and doubling memory speed.

ADDRESSING

Memory A0 to A7 is the horizontal address, with A0 held low in the small display mode and being the least significant bit in expand mode. Memory A8-A15 is the vertical address, with A8 the least significant bit in full screen mode, but not used in normal mode (held low).

WRITING

The memory is written into in a read-modify-write manner, so that at each write address, previous memory data is read out, incremented by one and written back in. This gives true 4 bit (15 level) brightness output.

OUTPUT

The memory outputs are latched and fed to a four bit DAC to provide the waveform brightness information to feed back to the analogue board, where it is inserted into the output video signal.

ERASURE

Erasure is carried out by writing a logic 0 into each memory address during its readout frame. Each bit is erased straight after it has been read out.

GRATICULE

The graticules are generated in the gate array and output to the analog board.

PARTS LIST

ANALOG BOARD PART NUMBERS

C1 = 10nF	10% 0.2"
C2 = 0.1uF	10% 0.2"
C3 = 10uF	16V Tant
C4 = 270pF	Low K 0.2"
C5 = 470pF	Low K 0.2"
C6 = 0.1uF	10% 0.2"
C7 = 22uF	16V Rad
C8 = 100pF	Low K 0.2"
C9 = 0.1uF	10% 0.2"
C10 = 22uF	16V Rad
C11 = 220pF	Low K 0.2"
C12 = 10nF	10% 0.2"
C13 = 22uF	16V Rad
C14 = 0.1uF	10% 0.2"
C15 = 2.2uF	63V Rad
C16 = 10uF	16V Rad
C17 = 1nF	10% 0.2"
C18 = 1000uF	10V Rad Low ESR
C19 = 1000uF	10V Rad Low ESR
C20 = 0.1uF	10% 0.2"
C21 = 0.1uF	10% 0.2"
C22 = 0.1uF	10% 0.2"
C23 = 0.1uF	10% 0.2"
C24 = 47uF	6V Tant
C25 = 47uF	6V Tant
C26 = 0.1uF	10% 0.2"
C27 = 0.1uF	10% 0.2"
C28 = 0.1uF	10% 0.2"
C29 = 2.2uF	63V Rad
C30 = 0.1uF	10% 0.2"

D1 = 1N914
D2 = BAT85
D3 = 1N914
D4 = 31DQ03
D5 = 3MM
D6 = BAT85
D7 = 1N914
D8 = 1N914
D9 = 1N4002

L1 = 2.7uH	Toko 5mm Coil
L2 = 4.7uH	Toko 5mm Coil
L3 = 10uH	Toko Choke
L4 = 10uH	Power Toroid

L5 = 1.5uH	Toko 7BS
PL1 = BNC	R/A 75 ohm
PL2 = BNC	R/A 75 ohm
PL3 = BNC	R/A 75 ohm
PL4 = 12V	2.1mm Connector
PL5 = 3V	0.8mm Track Pins
PL6 = IDC20	20 Pin Header
R1 = 10K	1/4W 1%
R2 = 220R	1/4W 1%
R3 = 1K	Spectrol 149-18
R4 = 1K	Spectrol 63X
R5 = 500R	Spectrol 63X
R6 = 680R	1/4W 1%
R7 = 22K	1/4W 1%
R8 = 33K	1/4W 1%
R9 = 680K	1/4W 1%
R10 = 470R	1/4W 1%
R11 = 75R	1/4W 1%
R12 = 220R	1/4W 1%
R13 = 500R	Spectrol 63X
R14 = 1K	Spectrol 149-18
R15 = 470R	1/4W 1%
R16 = 120R	1/4W 1%
R17 = 1K	1/4W 1%
R18 = 1K	1/4W 1%
R19 = 470R	1/4W 1%
R20 = 4M7	1/4W 1%
R21 = 47K	1/4W 1%
R22 = 100K	1/4W 1%
R23 = 33K	1/4W 1%
R24 = 2.2M	1/4W 1%
R25 = 10M	1/4W 1%
R26 = 4.7K	1/4W 1%
R27 = 4.7K	1/4W 1%
R28 = 1K	Spectrol 63X
R29 = 1.2K	1/4W 1%
R30 = 100K	4 Sil 5 Pin
R31 = 1K8	1/4W 1%
R32 = 39K	1/4W 1%
R33 = 100K	1/4W 1%
R34 = 470K	1/4W 1%
R35 = 10M	1/4W 1%
R36 = 75R	1/4W 1%
R37 = 910R	1/4W 1%
RY1 = RELAY	(Option)

SW1 = SW_SPDT	C+K
SW2 = SW_SPDT	C+K
SW3 = SW_SPDT	C+K
SW4 = SW_SPDT	C+K

T1 = 2N3904	NPN Transistor
T2 = J113	J-Fet
T3 = 2N3904	NPN Transistor
T4 = BUK555-60B	VFet
T5 = RFP4N05L	VFet
T6 = ZVNL120A	MosFet
T7 = BD434	NPN Power Transistor
T8 = 2N3904	NPN Transistor
T9 = BD434	NPN Power Transistor

U1 = CXD1175	Sony 8 Bit ADC
U2 = EL2244	Elantec Dual Video Op Amp
U3 = 74HC4053	HCmos Sw
U4 = LM1881	Sync Sep
U5 = TL062	Dual Op Amp
U6 = ICL7660	Voltage Convertor
U7 = 7805	Voltage Regulator
U8 = MAX641	Sw Regulator
U9 = TL062	Dual Op Amp
U10 = TK11640	Voltage Reference

DIGITAL BOARD PART NUMBERS

C1 = 27pF	Low K 0.2"
C2 = 220pF	Low K 0.2"
C3 = 0.47uF	63V Rad
C4 = 0.1uF	10% 0.2"
C5 = 0.1uF	10% 0.2"
C6 = 0.1uF	10% 0.2"
C7 = 47uF	6V Tant
C8 = 1nF	10% 0.2"
C9 = 0.1uF	10% 0.2"
D1 = KV1310	Dual Varicap Diode
D2 = 1N914	Diode
D3 = 1N914	Diode
D4 = 1N914	Diode
J1 = JUMPER	3 Pin 0.1"
J2 = JUMPER	3 Pin 0.1"
L1 = 4.7uH	Toko 5mm Coil
PL1 = IDC20	20 Pin Pcb Socket
R1 = 220K	4 Sil 8 Pin
R2 = 47K	1/4W 1%
R3 = 1M	1/4W 1%
R4 = 39K	1/4W 1%
R5 = 18K	1/4W 1%
R6 = 10K	7 Sil 8 Pin
R7 = 1K	1/4W 1%
R8 = 220R	4 Sil 8 Pin
R9 = 1K	1/4W 1%
R10 = 1K	1/4W 1%
U1 = 64K_X_4	Fast Static Ram
U2 = 64K_X_4	Fast Static Ram
U3 = ACT1020	Actel Gate Array

CASE PARTS

2 x Knobs, lined - SIFAM S111125B

2 x Knob Caps, lined, blue - SIFAM C111 (+colour)

3 x BNC r/a pcb sockets

1 x 12V Power connector - FARNELL 224-972

2 x Insulating Sheets, 135mm x 80mm

1 x Battery Holder, Bulgin 2 x AA in-line

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:

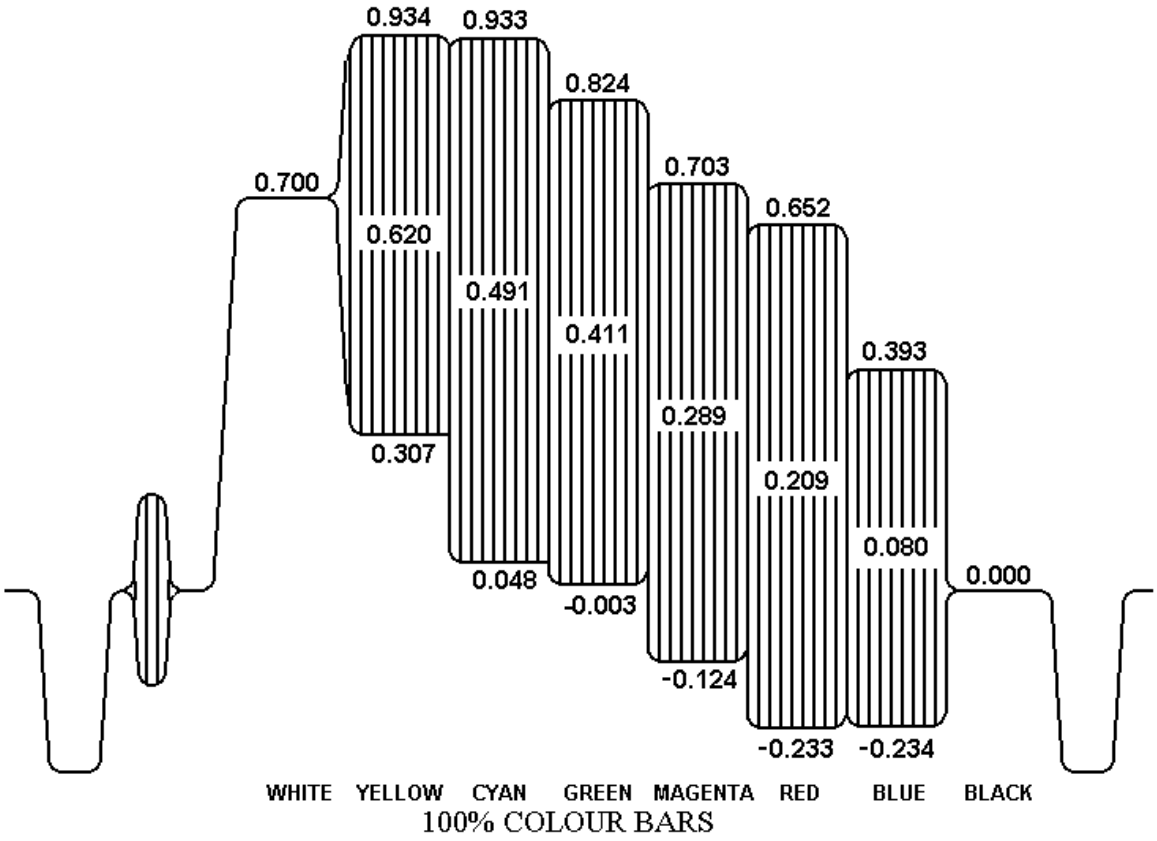
Cr = (R-Y) and Cb = (B-Y)
These are weighted to give maximum values of +/- 350mV and are bandwidth restricted to half that of the Y component.

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.



100% COLOUR BARS

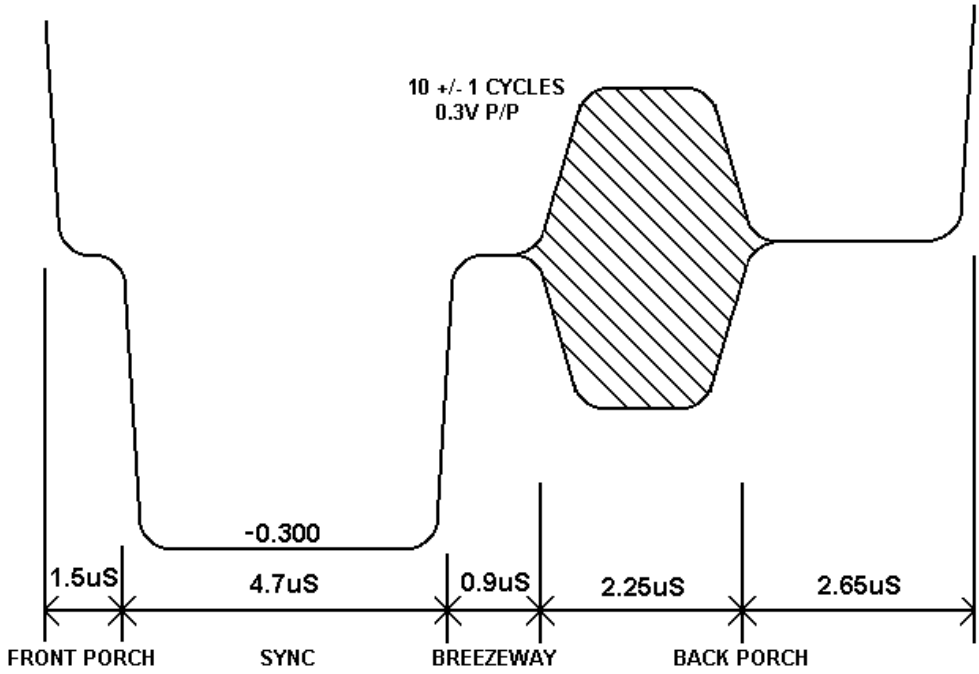
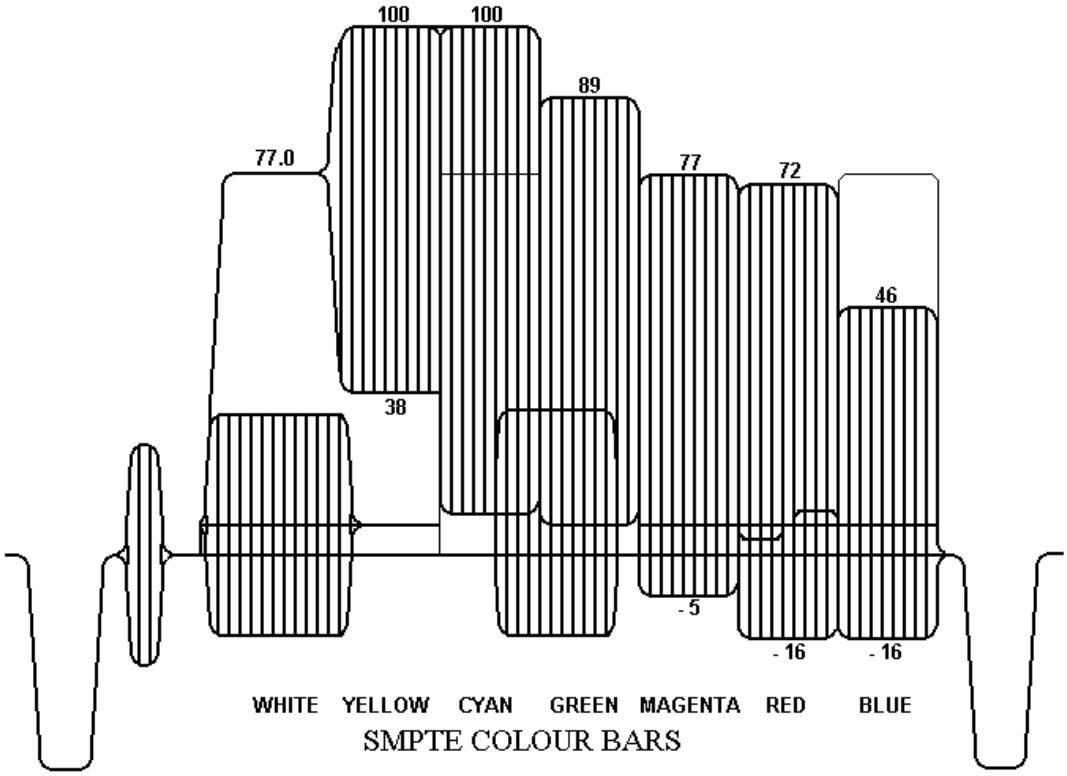


Fig 3.



SMPTE COLOUR BARS

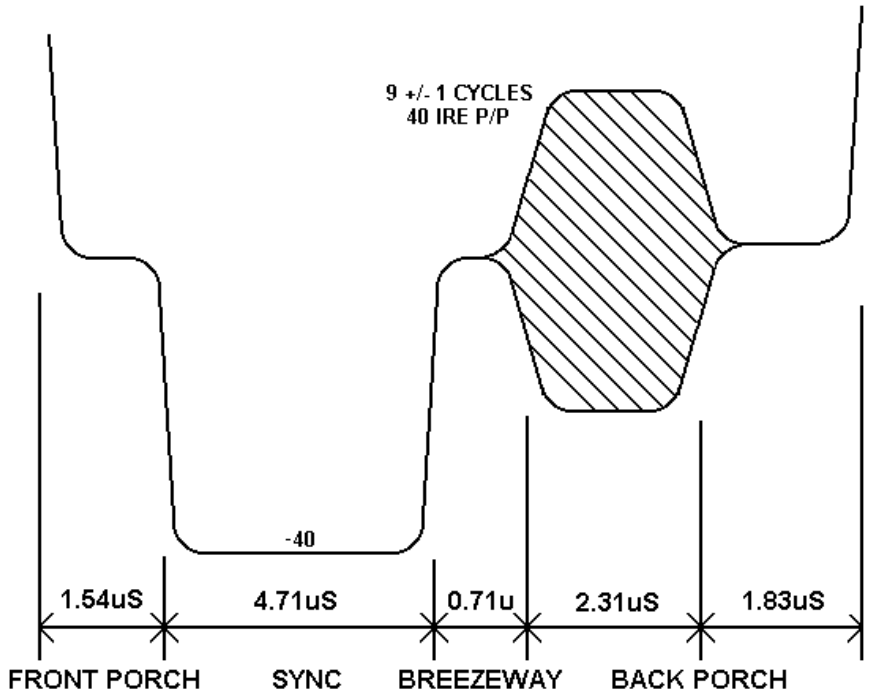


Fig 4.

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 Pico Scope, 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.