HAMLET
EXCELLENCE IN VISION

MONITOR SCOPE 601

MULTI FORMAT WAVEFORM MONITOR

OPERATOR'S HANDBOOK

ISSUE D3

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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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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

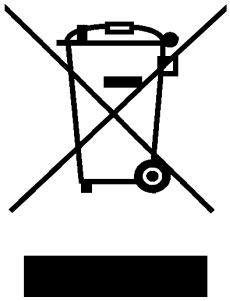
EMC COMPLIANCE

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 MONITOR SCOPE 601** 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 Monitor Scope 601 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 Monitor Scope 601 supplier to arrange for its return to Hamlet, who will safely dispose of it and ensure that this Hamlet Monitor Scope 601 is not mixed with other commercial waste for disposal.

FRONT and REAR PANELS

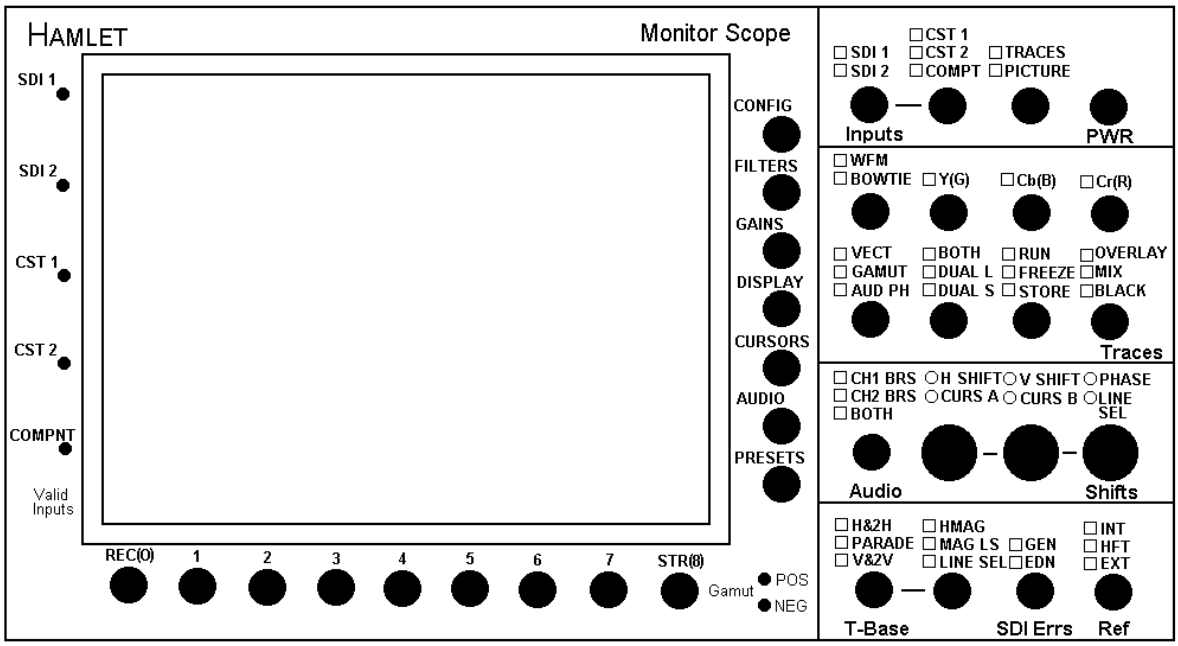


Fig 1

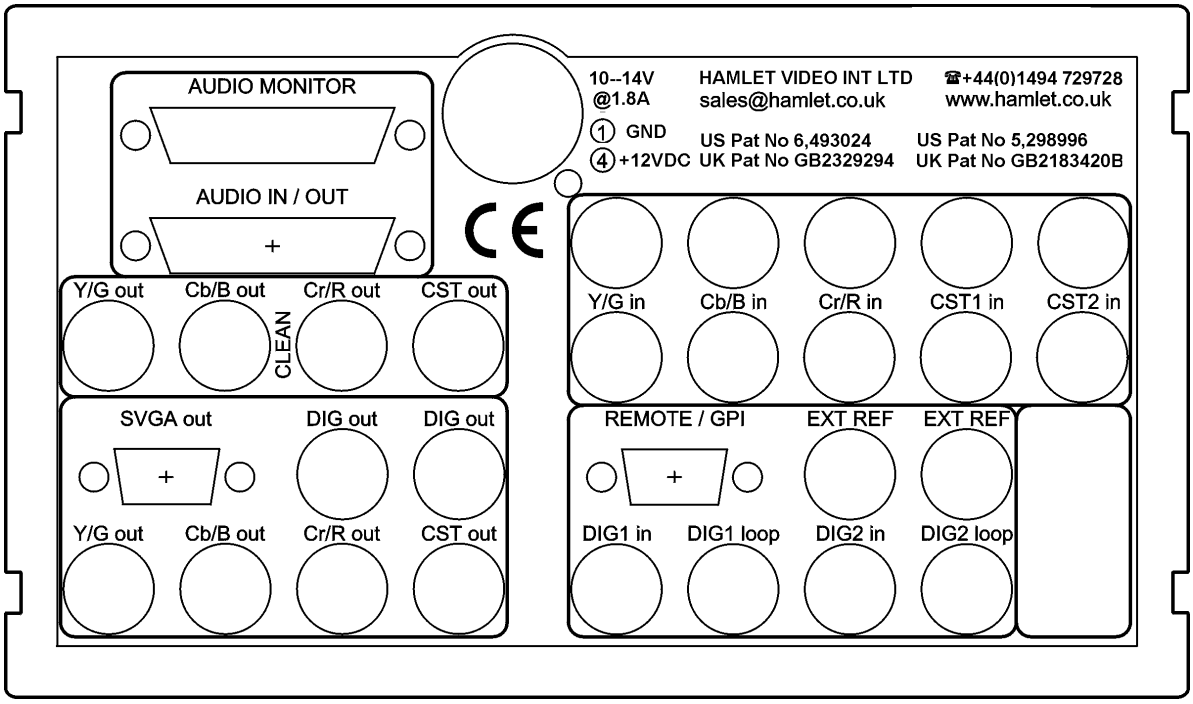


Fig 2

GENERAL INFORMATION

OVERVIEW

The Hamlet Monitor Scope 601 is a 3U high half width 19" rack mounted waveform and vector monitor designed to analyse two serial digital inputs (SMPTE 259) and display the picture and waveforms on the built in high quality colour LCD screen, 1024 x 768 pixel TFT with backlight. There are also outputs of broadcast quality analog component (YCrCb and RGB), composite and serial digital video signals with the waveforms burnt into the picture. An optional VGA output is also available.

Remote control software allows all functions to be controlled from a personal computer and for waveforms to be downloaded to the computer for display and storage.

Three different display sizes are selectable and the positions can be adjusted by the menu. The unit employs ten bit digital processing throughout, ensuring absolute accuracy. Proprietary digital signal processing produces displays with the 'look' of analog signals but without the inaccuracies involved in conversion to analog (patents applied for).

A further advantage of this system is the ability to display a horizontally magnified waveform from one selected tv line, at full brightness and fully sampled.

The video signals are also available without the burnt in waveforms from an optional internal accessory card. An option card is also available to input analog component and composite video in PAL and NTSC, providing full 10 bit analysis and outputs in all the above formats.

A further option is the audio card, which inputs two analog stereo pairs, two AES/EBU digital audio signals and extracts embedded audio from the digital video. Audio levels are displayed in vision with two stereo coloured bar graphs, with scales and ballistics menu selectable. There are further options of a stereo phase display produced on the vector waveform display and the selected audio source can be converted to a broadcast quality balanced analog output of the two stereo audio pairs and output on the rear panel at line level.

The serial digital signal itself is analysed to give on-screen readouts of the EDH/CRC word, various digital parameter errors and signal strength and jitter. The jitter is frequency weighted as higher frequencies are more critical to receiver phase locked loops.

Measurement cursors are provided to allow amplitude and timing differences to be measured between two points on the waveform display and to provide vector phase and amplitude on the vector display.

GENERAL INFORMATION

INSTALLATION

UNPACKING

The MS601 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

Hamlet can supply rack mount kits to fit the unit into a standard 19 inch equipment rack, where it occupies 3U of height. 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

The MS601 should be powered from the supplied adaptor or a regulated supply of 12VDC of at least 2 amps rating to the four pin XLR.

SIGNAL AND CONTROL CONNECTIONS

Input and output cable connections are all made to BNC sockets on the rear panel. To utilise all the Monitor Scope functions, the BNC inputs, outputs, and external reference (video or syncs) should all be wired.

CHECKOUT FOR INITIAL USE

After installation as above, switch on the MS601 and operate each control in turn, verifying correct response as described in the operating instructions.

PREVENTATIVE MAINTENANCE

The Hamlet MS601 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

GETTING STARTED

1. Connect the supplied 12V power adaptor output to the rear XLR input.

2. Apply AC mains (100 - 250VAC) to the power adaptor.

3. Connect a serial digital video feed to the rear DIG 1 in BNC.

4. Hold down the front panel Y(G) button whilst pressing the PWR button, see fig 1. This starts the MS601 in a pre - programmed state, see fig 2. When the unit is subsequently turned on, it will remember the panel settings used previously.

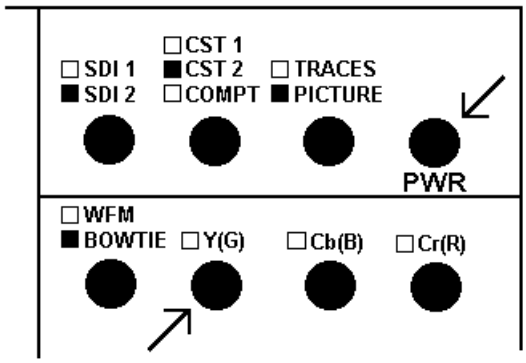


Fig 3

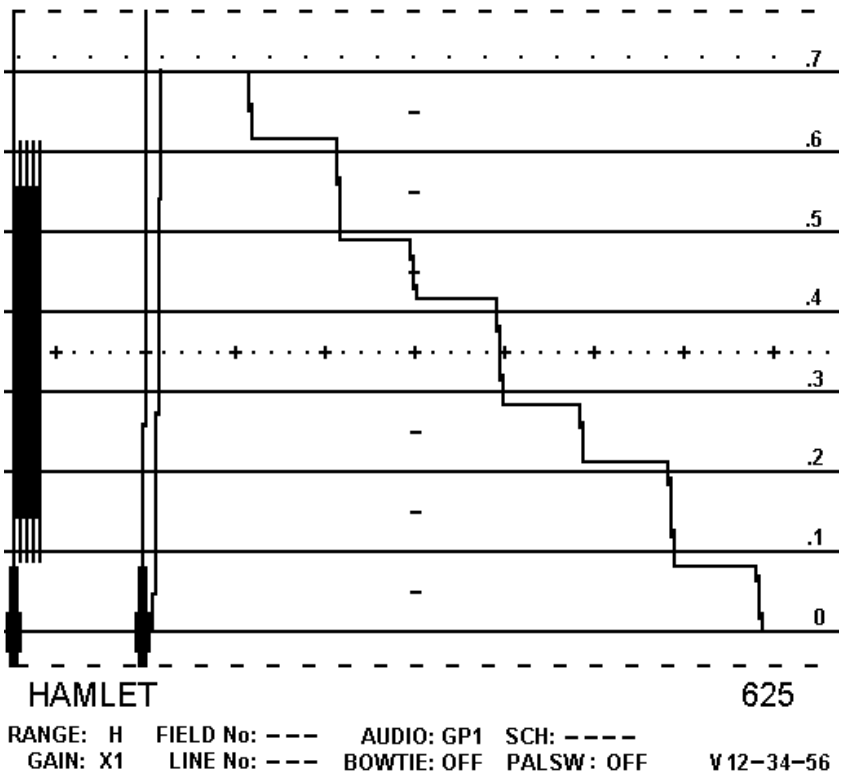
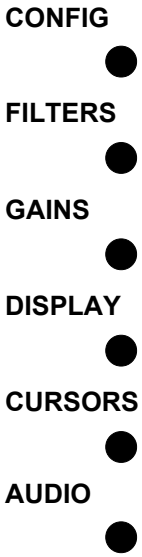


Fig 4

OPERATING INSTRUCTIONS



Most functions can be selected using the front panel keys.

The keys are illuminated and the colour shows which mode is selected.

Minor functions are selected from one of the six on screen menus

An area of the screen is reserved for displaying information on unit settings (status), signal measurements and menu selections.

Pressing a menu button toggles between that menu and status displays.

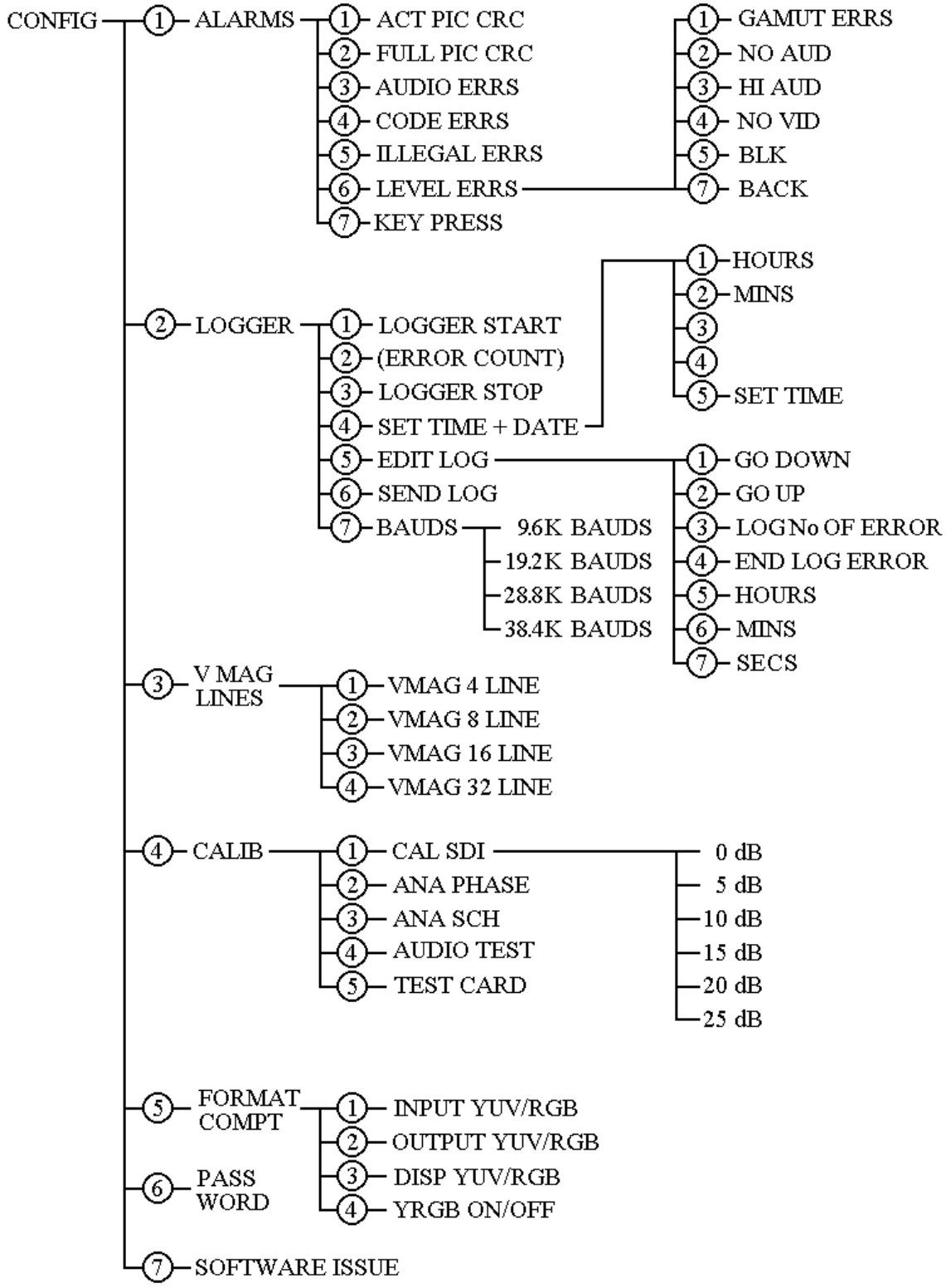
In a menu mode, to select a sub-menu press the appropriate key 1 to 7.
To select from the sub-menu press key 1 to 7 etc.

To return from a sub-menu back to the previous display, press the menu button again.

The video standard is displayed in the bottom right side of the main display (626, 525) for the digital inputs and (PAL, NTSC) for the analog inputs.

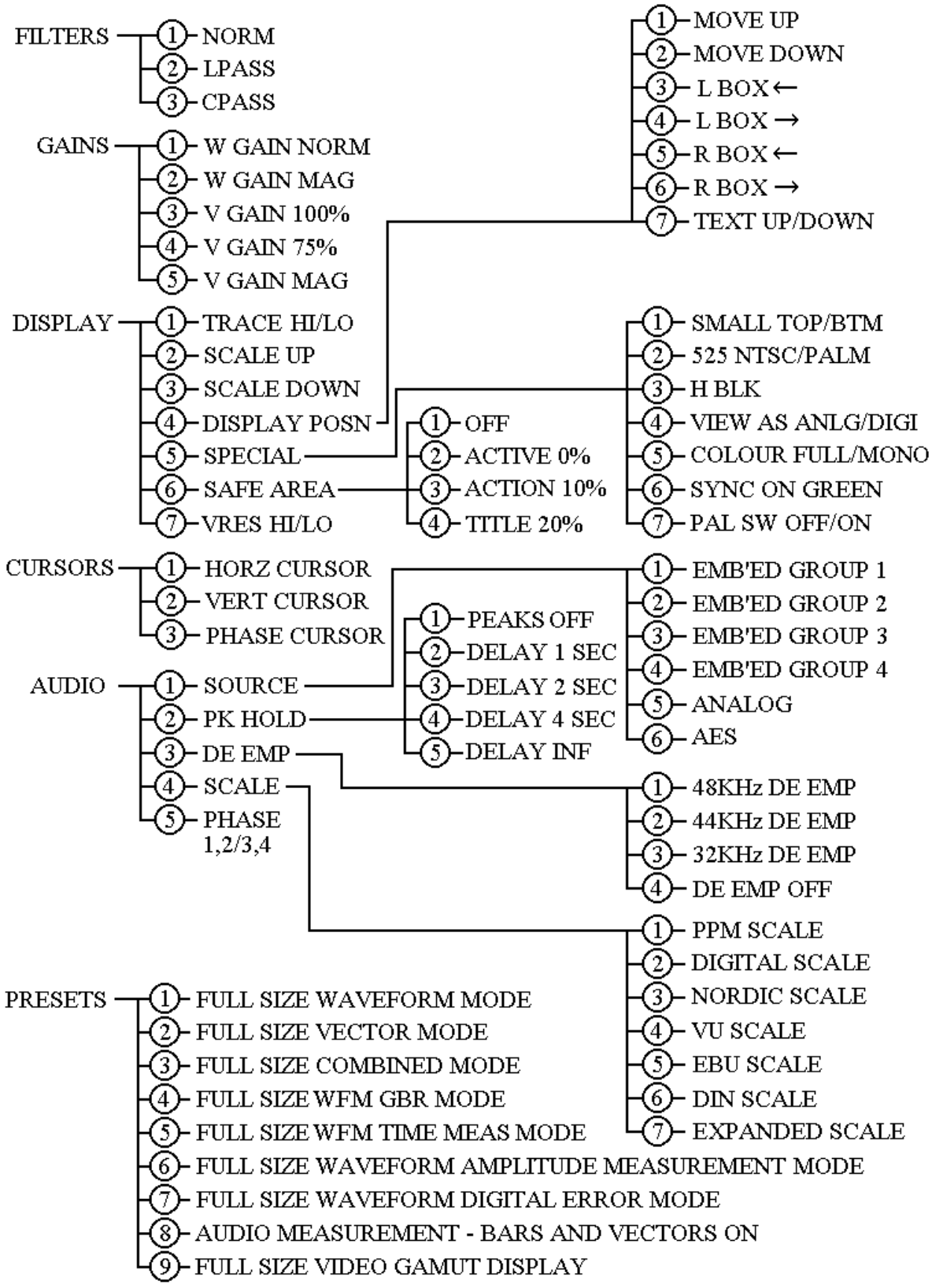
OPERATING INSTRUCTIONS

MENU TREE 1 of 2



OPERATING INSTRUCTIONS

MENU TREE 2 of 2



OPERATING INSTRUCTIONS

VIDEO INPUT AND OUTPUT

Video Source Selection
If a digital source is used, it must be connected to one of the rear BNCS labelled DIG1in or DIG2in.
If the analog option card is fitted, a component source can be applied to the rear panel BNCS labelled Y/Gin, Cb/Bin and Cr/Rin, or a composite source can be applied to the rear panel BNCS labelled CST1in or CST2in.
To select the video source, press the appropriate input format key.

Sync Reference Source Selection
The reference signal can be derived from the signal being used (internal) or from an analogue reference of video or sync (external) applied to the rear BNC labelled EXT-REF.
To select which is to be used press the 'EXT-REF' key, this key has three options, INTERNAL, EXTERNAL and HFT(hands free timing) which alternates between internal and external every second to facilitate synching two sources.

Sync On Green
This is enabled from the 'DISPLAY' 'SPECIAL' sub menu.

Video Component Selection, from the 'CONFIG' - 'FORMAT COMP' sub menu:

Key 1 selects the input in YCrCb or RGB formats.
Key 2 selects the output in YCrCb or RGB formats.
Key 3 selects the display in YCrCb or RGB formats.
Key 4 changes YCrCb parade to YRGB parade.

VIDEO WAVEFORM MEASUREMENTS

To use the Video Timebase Ranges
The full range of timebases are only available in the full size waveform mode.
The left timebase key toggles between H, 2H, 3H Parade, VMag, V & 2V.
The right timebase key toggles between HMag, HMag line select & line select.
The line number is selected by turning the phase/line select rotary control in line select ranges.
The current mode/line number is displayed on the status bar.
Vmag displays the waveform on a 4, 8, 16 or 32 line timebase. The number of displayed lines is set from the 'CONFIG' - 'V MAG LINES' menu.

To display analog waveforms in digital or analog forms
The analog input option card can be operated in two different modes:
'VIEW AS DIGI' Generates a true SDI digital signal therefore will not show syncs etc.
'VIEW AS ANLG' Digitises the full waveforms and displays on a black background.
Control is via the 'DISPLAY' 'SPECIAL' menu.

OPERATING INSTRUCTIONS

To measure Video Amplitudes and Timing

Two cursors may be placed on the screen to measure actual time periods or amplitudes of the video waveform. The unit must be in Expand Waveform mode (press 'WFM' key). Select the required timebase range, then select the appropriate option from the 'CURSORS' menu. Use 'HORIZ CURSOR' (key 1) to measure times or 'VERT CURSOR' (key 2) to measure amplitudes. Two cursor lines appear on the waveform display, these can be adjusted by using the arrowed shift controls on the front panel. The Phase control moves both cursors in tandem. The values of both cursors and the difference between them is shown in the status area. Press 'CURSORS' to cancel.

To measure video 'Out of Gamut' levels

Use the VECT-GAMUT-AUD PH key to select the gamut option. The two inside graticule lines indicate the black and peak white levels of an RGB superimposed display, required for the video to remain within gamut. The outer lines represent 5% over/under level limits.

To view 'Out of Gamut' areas in the picture

With Gamut selected as above, press the front panel TRACES/PICTURE button to display the picture. Areas which are out of gamut are highlighted with a crosshatch pattern.

To change the Video Gain

Video gain can be changed from normal (x1) to expanded (x4) using the ‘GAINS’ menu.

Component selection

Y(G), Cb(B) and Cr(R) keys allow selection of the components, either individually or superimposed. If two or more components are displayed together (overlaid), the timebase will only operate in H or HMAG modes.

Bowtie

These measurements may be made by setting the unit to expand waveform mode and H range. Press the WFM-BOWTIE key to enable. This key toggles between Bowtie U, Bowtie V and Bowtie OFF. The current state is displayed in the status area.

VIDEO VECTOR MEASUREMENTS

To change the Vector gain:

Vector gain can be toggled between 75% bars, magnified (x4)
and 100% bars by using the 'GAINS' menu. The current setting of vector gain is displayed in the Status Area.

To measure the Phase and Amplitude of vectors

Two cursors may be placed on the screen to measure actual phase angle and amplitude of the vector display. The unit must be in Expand Vector mode, (press 'VECT' key)
From the 'CURSORS' menu, select 'PHASE CURSOR' (key 3).
Two cursor lines appear on the vector display, one vertical, one horizontal, these can be adjusted by using the arrowed shift controls on the front panel. The values shown in the status area are the amplitude of the vector measured from the centre to the point where the cursors cross, and the phase angle is measured from the centre to the point where the cursors cross, the angle is measured clockwise from the 9 o'clock position.
To return to the main menu, press 'CURSORS'.

Analog vector measurements

If the analog input card is fitted the following options are available:

PAL Switch: Toggles the pal switch defeat on and off. Selected from the 'DISPLAY' 'SPECIAL' menu. The current state is displayed in the status area.

SC-H: Sch phase angle is displayed in the status area.

Phase Control: Adjusting the phase control knob on the front panel will rotate the vectors.

OPERATING INSTRUCTIONS

ERROR MONITORING AND LOGGING

To Monitor Digital Errors
The GEN-EDH key enables two pages for digital errors, see fig 3.

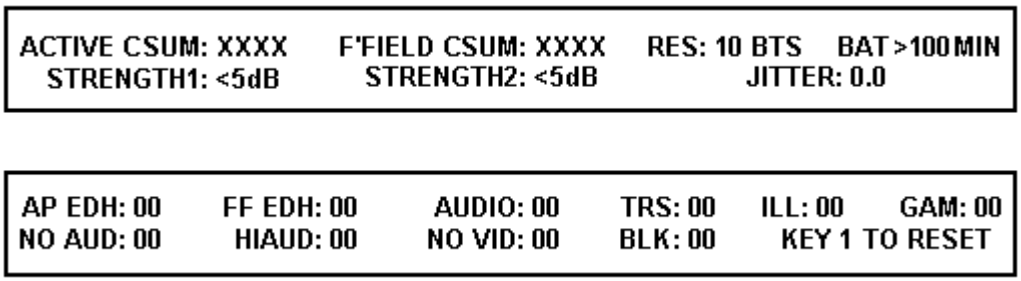


Fig 5

GEN DISPLAY

ACTIVE CKSUM Displays the 4 digit checksum calculated from the active picture of each frame. Note that a # will be displayed if no CRC packet is detected in the incoming SDI signal.

F'FIELD CKSUM Displays the 4 digit checksum calculated from the full field. Note that a # will be displayed if no CRC packet is detected in the incoming SDI signal.

RES Displays the resolution of the digital video signal as 8 or 10 bit.

STRENGTH 1,2 Displays the attenuation in the digital video signals at the inputs, and represent the loss in dBs due to cable runs etc and can be used to estimate signal headroom.

JITTER Jitter frequency and amplitude are both important in recovering the serial digital data, as receivers have more difficulty in tracking high frequency jitter. Low frequency jitter, below about 1kHz, is often caused by line-rate genlock circuits and is easily followed by receivers but higher frequencies, e.g. word based at 27MHz, is much more of a problem. The Jitter is therefore displayed in a frequency weighted form as nSec x MHz so that the jitter "headroom" can easily be seen.
A typical signal might have jitter of 0.2nS p/p at 27MHz which would display 5.4, whereas a signal near the limit at 1.5nS p/p at 27MHz would display 40.

BAT Displays approximate battery life left, in minutes. This is only valid when being operated from the internal batteries (option).

EDH DISPLAY

EDH Counts the occurrence of six types of error. The counters run from 0 to a maximum of 99 and can be reset by pressing key 1.

AP EDH: Counts EDH (CRC) errors that occur in the Active Picture. This needs CRC packets in the incoming video. With no CRC packets, it will calculate the CRC check-sum for 1 field and compare with that calculated from the same field in the previous frame giving confidence in the data integrity.

FF EDH: Counts EDH (CRC) errors that occur in the Full Field (otherwise as above).

AUDIO: Counts errors in the incoming audio data if the audio is embedded in the video or is an external AES source.

TRS: Counts errors caused by missing or corrupt TRS codes (EAV or SAV and Hamming Codes) See Serial Digital Basics section for detailed explanation.

ILL: Counts the occurrence illegal codes in the video stream. Illegal codes are Hex(3FF) and Hex(0). See Serial Digital Basics section for details.

GAM: Counts the occurrence of 'out of gamut' codes in the video stream. Out of Gamut values are legal values but lie outside the normal values of luminance and hue. See Serial Digital Basics section for detailed explanation.

NO AUD: Counts the occurrence of audio silence of more than five seconds in the selected audio feed.

HI AUD: Counts the occurrence of audio levels 10db or more above line up level in the selected audio feed.

NO VID: Counts the occurrence of no video sync in the selected video feed.

BLK: Counts the occurrence of video black (less than 50mV) of more than five seconds in the selected audio feed.

OPERATING INSTRUCTIONS

To set the alarm to 'Beep' on selected errors
The unit contains a beeper, which can be programmed to sound when any or all of the digital errors occur. To select which errors are to cause the alarm to sound:
Press 'CONFIG' then 'ALARMS'. Press keys [1..5] to arm or disarm the alarm on that error. Note that the # symbol appears if that error is armed.
To select which level errors cause the alarm to sound, press:
CONFIG -ALARMS -LEVEL ERRS
'KEY PRESS' is a facility which causes a beep every time a key is pressed, this may also be set to on or off

To Log selected errors for later analysis
Any or all of the six digital error types may be automatically logged for later analysis. First select the error types required, see previous paragraph.

To Start the Logger
Press 'CONFIG' then 'LOGGER' to select the logger menu then 'LOGGER START' (key 1). The unit will now log any of the selected error types that occur and record the time and date of occurrence. The number of errors logged appears in box 2 in the status area and up to 166 separate error occurrences may be logged. To stop, press 'LOGGER STOP' (key 3).

To View the Error Log
From the logger menu press 'EDIT LOG' (key 5), then use the 'GO UP' and 'GO DOWN' keys to scroll the logged errors. The error type, its log number and the time and date of occurrence are displayed.

To Set the Time and Date used by the Error Logger
From the logger menu, (LOGGER from CONFIG menu) select 'SETTIME & DATE' (key 4)

press key 1 repeatedly to increment the hours (0..23).
press key 2 repeatedly to increment the minutes (0..59).

When these are all correct press key 5 to store it.

DISPLAY ADJUSTMENTS

To select the main display modes

WFM-BOWTIE	Displays full size waveforms (normal or bowtie mode).
VECT-GAMUT-AUD PH	Displays full size vectors (or gamut or audio phase).
BOTH-DUAL L DUAL S	Toggles between combined and two sizes of small displays. Combined shows the expanded waveform and vector overlaid. Small gives two small displays, a waveform display on the left of the screen and a vector display on the right. The small boxes can selected top or bottom of screen from the 'DISPLAY' 'SPECIAL' menu.

To change the position of the display areas

From the DISPLAY menu select DISPLAY POS'N.
Use keys 1 and 2 to move the display up and down. In expanded modes keys 3 and 4 move the display sideways. In Small mode keys 3 and 4 move the small waveform box sideways, and keys 5 and 6 move the small vector box. Note that sideways movement is not allowed if audio bars are displayed. Key 7 is used to move the status area to the top or bottom of the screen.
Press DISPLAY to return to the main menu.

To change the displayed video

To change the graticule intensity, select the DISPLAY menu, then SCALE UP or DOWN.
To change the waveform trace intensity between bright and dim, select Trace LO/HI.

To change the display persistence

The RUN-FRZ-STR key toggles between:
Normal Run, Freeze and Store.

To filter the displayed video waveform

The FILTERS menu allows selection of flat and low-pass filters (and chroma pass with analog option).

To select sync area blanking

Press 'DISPLAY' 'SPECIAL' 'H BLK' to toggle on and off.

Background video and display video mixing

The TRACES-PICTURE key toggles between background picture and waveforms overlaid on picture.
The OVERLAY-MIX-BLACK key toggles between waveforms cut into the picture, on a black background or mixed with the background picture.

Colour / Mono display

'DISPLAY' 'SPECIAL' 'MONO COLOUR' makes the traces coloured or monochrome. The background picture is not affected.

ADDITIONAL FUNCTIONS

To show the video 'safe' areas
The unit can be set to display the three standard video safe area boxes:
1) 0% ACTIVE area.
2) 10% ACTION area.
3) 20% TITLE area.
Press 'DISPLAY' then 'SAFE AREA' to select the safe area required.

To start the unit in a known state
Powering on the unit normally will recall the settings previously used, but if previous settings were non-standard, a standard mode can be established to allow faster use.
With the power switched off and a serial digital signal applied to the DIG1in BNC, hold down the Y (G) button whilst powering up the unit. It will then be in the following mode:

INPUT:	SDI1	DISPLAY SIZE:	EXP WFM
TIMEBASE:	H	AUDIO BARS:	ON
REF	INT	AUDIO SCALE:	PPM
SAFE AREA:	OFF	VIDEO SELECT:	Y
FREEZE:	OFF	FILTER:	FLAT
PERSIST:	OFF	BOWTIE:	OFF
WFM GAIN:	X1	CHOP:	OFF
VECTOR GAIN:	100%	CURSORS:	OFF
PAL SWITCH:	OFF	MIX-BLK:	OFF

To store and recall user settings
When the unit is switched off the current setting are stored, then recalled when the unit is switched on again. In addition, nine sets of front panel setting can be stored for later recall.
To Store Settings:
When the unit is set up as required press 'STR(8)' key on the front panel then press a key 0...8 to store the settings at that location.

To Recall the settings:
Press the ‘RCL (0)' key on the front panel followed by the required location number 0...8.

Vertical resolution
The horizontal trace line thickness can be increased from one line to two lines to reduce flicker. Press 'DISPLAY' then 'V RES' to select HI or LO.

ADDITIONAL FUNCTIONS

Vertical Interval Timecode

In video tape systems, timecode may be inserted into the vertical sync period of the video frame signal, so it can be read even while the video tape is paused. This is called Vertical Interval Time Code or VITC ("vitsy") and is defined by the SMPTE 12M standard. VITC needs to be incorporated into the video signal during the initial recording or while copying between tapes.

The VITC word is ninety bits long and occupies 1 line of video during the vertical sync period, it is usually repeated 2 lines later and this 2 line VITC pair appear on the same 2 lines of every field. The data consists of: the frame number, the time (hours, minutes & seconds), user defined bits and a CRC code used to detect any transmission errors in the data.

The VITC data if present is extracted from the incoming video by the Monitorscope. It is checked against the CRC code and, if correct, the time code is displayed in the status area of the display with a V in front of the time. If no VITC lines are found, the internal clock is displayed instead. The Monitorscope looks for VITC data between lines 10 to 20 for NTSC / 525 video or lines 6 to 22 in PAL / 625 video.

To recall standard settings

To facilitate fast measurements, nine preset 'factory settings' modes are available.

To select these, press key 'PRESETS' then a number key:

Number 0:	**WFM**	Full size Waveform mode.
Number 1:	**VECT**	Full size Vector mode.
Number 2:	**DUAL**	Full size Combined mode.
Number 3:	**GBR**	Full size Waveform GBR parade mode.
Number 4:	**H-MEAS**	Full size Waveform time measurement mode.
Number 5:	**V-MEAS**	Full size Waveform amplitude measurement mode.
Number 6:	**D-ERRS**	Full size waveform digital error mode.
Number 7:	**AUD**	Audio measurement bars and vectors on.
Number 8:	**GAM**	Full size video gamut display.

AUDIO

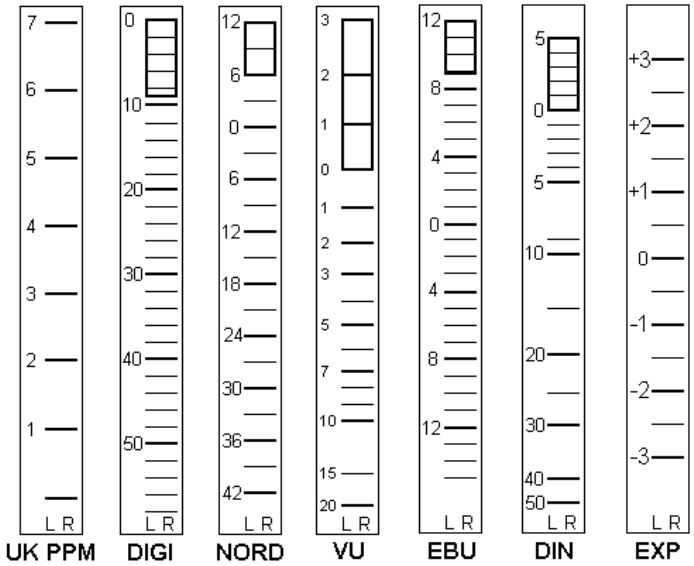
When the audio option card is fitted to the unit:

To select the audio source
Press the 'AUDIO' then 'SOURCE' keys, then select required source.

1) Selects Embedded Audio Group 1 from the SDI signal.
2) Selects Embedded Audio Group 2 from the SDI signal.
3) Selects Embedded Audio Group 3 from the SDI signal.
4) Selects Embedded Audio Group 4 from the SDI signal.
5) Selects Analog audio input from rear panel 25 way D connector.
6) Selects AES/EBU serial digital Audio from the 25 way D connector.

Audio level bars
The key 'CH1 BARS-CH2 BARS-BOTH' selects the audio bar graphs.

To select audio scales,
see fig 4.
Press 'AUDIO' then 'SCALE' . Select from the following scales:
1) PPM scale.
2) DIGITAL scale.
3) NORDIC scale.
4) VU scale.
5) EBU scale
6) DIN scale.
7) EXP scale. This is a scale expanded around the 0dbU line up level.



Line up level (0dbu = 0.775 v rms)
UK PPM = 4
DIGI =18, (USA -20)
NORD = 0
VU = -4db (from -20)
EBU = 0
DIN = -9

Fig 6

AUDIO

To select peak hold
Press 'AUDIO' then 'PK HOLD'. Select from the following values:
1) AUDIO PEAK HOLD OFF.
2) AUDIO PEAK HOLD 1 SECOND.
3) AUDIO PEAK HOLD 2 SECONDS.
4) AUDIO PEAK HOLD 4 SECONDS.
5) AUDIO PEAK HOLD INFINITE.

Audio Vectors (option)
Press the 'VECT-GAMUT-AUD PH' key to select audio vectors. To select which of the 2 audio pairs is to be displayed press 'AUDIO' then 'PHASE'.

Audio Output (option)
To select required output de-emphasis:
Press the 'AUDIO' key then 'DE EMP' to select the required de-emphasis:

1) 48KHz De-emphasis.
2) 44KHz De-emphasis.
3) 32KHz De-emphasis.
4) De-emphasis off.

The AUDIO MONITOR connector is reserved for the AMU audio loudspeaker option.

PINOUT OF AUDIO CONNECTOR

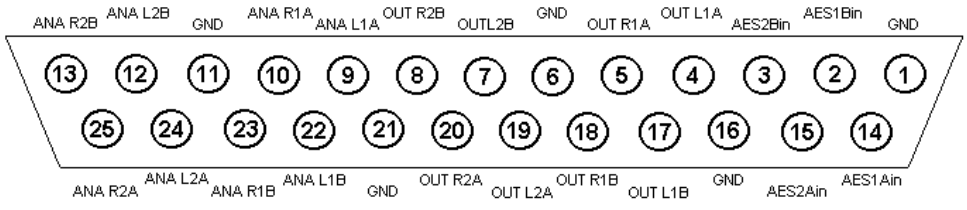


Fig 7

CALIBRATION AND TEST

The unit is calibrated and tested before leaving the factory and should not normally require adjustment.

If SDI calibration or testing is required, Press the CONFIG button and select CALIB.

To calibrate the SDI signal strength meter
This is set up in the factory and should not normally need to be changed. If recalibration is required, a cable clone is needed with switched attenuation between 0 and 25dBs in 5dB steps.
e.g. Hamlet Cable Clone or Faraday SC75A37B.
With a full level serial digital source e.g. Hamlet Digi Gen or Protean connected to rear BNC socket DIG1in via the cable clone. Select 'CALIB SDI' (key 1).

Set Cable Clone to 0dB, Press 0dB button (key 1).
Set Cable Clone to 5dB, Press 5dB button (key 2).
Set Cable Clone to 10dB, Press 10dB button (key 3).
Set Cable Clone to 15dB, Press 15dB button (key 4).
Set Cable Clone to 20dB, Press 20dB button (key 5).
Set Cable Clone to 25dB, Press 25dB button (key 6).
Press 'EXIT' (key 8) to return to the normal display.
Remove the cable clone from the input feed.

Analog Phase Calibration

With an accurate source of PAL analog composite colour bars, select 'VIEW AS ANALOG' mode from the 'DISPLAY' 'SPECIAL' menu. Adjust the front panel PHASE control so that the vector dots fit centrally into their boxes.

Press key 7 (PAL SW) to give a six vector display. Trim the front panel PHASE control for the smallest vector dots.

Press 'CONFIG' then key 4 (CALIB). Press key 2 to store the calibrated phase value.

Repeat with an NTSC composite input, omitting the 'PAL SW' section.

NOTE: The MS601 needs to be turned OFF and ON again for these values to take effect.

CALIBRATION AND TEST

Analog Sc-h calibration

With an accurate and sc-h coherent source of PAL analog composite colour bars, select 'VIEW AS ANALOG' mode from the 'DISPLAY' 'SPECIAL' menu. Adjust the front panel PHASE control so that the vector dots fit centrally into their boxes.
Press 'CONFIG' then key 4 (CALIB). Press key 3 to store the calibrated sc-h value. Repeat with an NTSC composite input.

525 Composite standard

Key 4 selects between NTSC and PAL-M analog input and output standards.

Audio Test

Selects an internally generated pseudo random audio bars signal, which overrides any audio input. Key 5 toggles this function on and off.

Video Test Card

Key 6 selects an internally generated 100% colour bar signal. Pressing any key will cancel this.

Issue

Pressing CONFIG shows the software version currently fitted to the unit, in box 8.
This number should be quoted in any correspondence concerning the unit.

CALIBRATION AND TEST

Due to the fully digital processing used, there are no adjustments on the basic unit, but the analog video and audio input and output cards have provision for calibration.

Analog video output
On the MSVID pcb, adjust R384 for 1V p/p video from the main analog outputs.

Clean analog video output
On the MSANOUT pcb, adjust R532 for 1V p/p video from the clean analog outputs.

MSENG
On the MSENG pcb, R201 is factory set and should not be adjusted.

ANALOG VIDEO INPUT OPTION

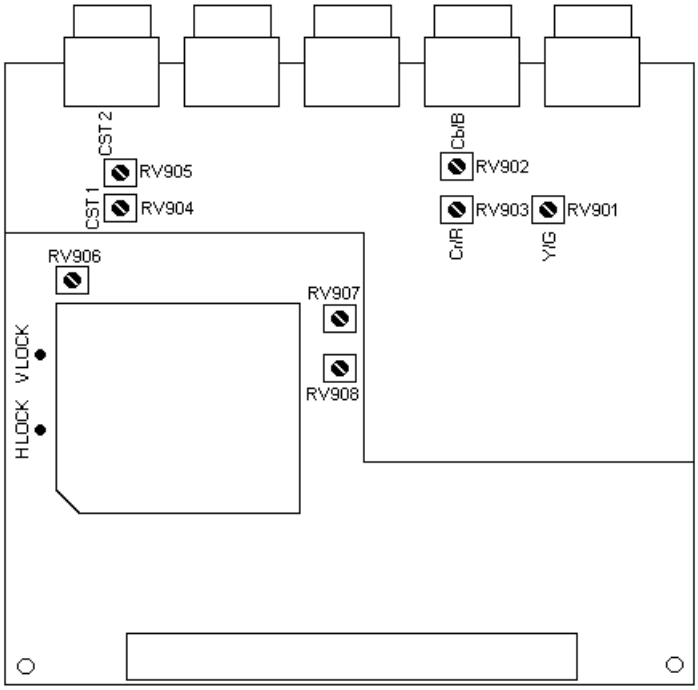


Fig 8

With 100% PAL colour bars to the CST 1 input and "CST 1" and "View as Digital" selected,
Set RV906 for 2.0V on the H LOCK test point.
Set RV907 for 2.0V on the V LOCK test point.
Set CST 1 (RV904) for 0.7V displayed video waveform.
Set CST 2 (RV905) for 0.7V displayed video waveform from the CST 2 input.

With an NTSC video input, set RV908 for 2.0V on the V LOCK test point.

With 625 100% component bars to the Y,Cr,Cb inputs and Compt input selected,
Set Y/G (RV901) for 0.7V displayed Y waveform.

Set Cb/B (RV902) for 0.7V displayed Cb waveform.
Set Cr/R (RV903) for 0.7V displayed Cr waveform.

CALIBRATION AND TEST

AUDIO OPTION

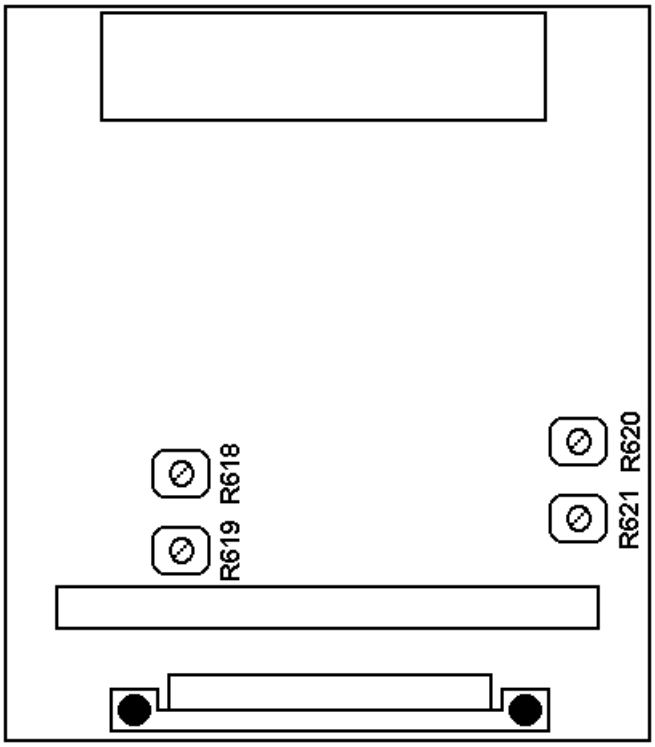


Fig 9

The AES/EBU decoder and the audio de-embedder have totally digital processing, so no adjustment is possible or needed, but the analog inputs can be calibrated.

The line up level tone (775mV rms @ 1kHz) applied to the four analog audio inputs, adjust the four presets so that the on screen bar graphs read line up level on the graticules.

OPERATION WITH A PERSONAL COMPUTER

The Monitorscope can be operated from a personal computer using the supplied software. This enables the PC to control the unit and has the following features.

1) The unit may be remotely controlled fully from the PC by using the mouse to click on command buttons

2) The Monitorscope display can be downloaded and displayed on the PC where it can be stored as a .BMP file to hard disk, recalled from disk or be sent to a printer etc.

3) It enables 'real time' error logging to take place where selected errors detected by the Monitorscope are sent to the PC and displayed in a table as they happen.

4) Selected errors detected by the Monitorscope and stored in its internal memory may be downloaded later and displayed as a table on the PC.

To install the supplied software.
PC requirement: An RS232 serial port, 1MB hard disk space, Win98 or later.

Insert floppy Disk 1 or CD disk.
Using 'My Computer' double click on the drive a: or d: icon then double click on the setup.exe icon and follow the onscreen instructions to complete the installation.

The software will be installed in the \Program Files \ Digi5 folder.
For ease of operation go to this folder and drag the digi5.exe icon onto the desktop to create a shortcut, then just double click on this icon to run the application.

Hardware Connection to the Monitorscope.
Connect an RS232 cable from the serial port on the PC to the 9 way D connector on the unit.
A 3 wire implementation of the RS232 interface is used, ie only Tx, Rx & Gnd are required.
Before the interface can be used by the PC, the baud rate of the Monitorscope must be set to be the same as the PC, to do this from the Monitorscope control panel select the **Config** menu then the **Logger** option, press the **Baud** button till the required rate appears,
it is recommended that the highest rate is used (38.4kB).

Operation of the Software
Double click on the Digi5.exe icon to start the application, the first time this is done it may be necessary to select the PC's serial port being used by the Monitorscope,
using the mouse click on **Special** on the task bar then select the **Setup** option and select the Port to be used (Ports1 to 4). When this is changed it is necessary to exit from the application and double click on the icon to run it again.**Control of the Monitorscope functions using the PC.**
Control of the main functions is exactly the same as on the front panel of the Monitorscope. The rotary controls are now the arrow buttons, using the mouse select an arrow key and hold down the left mouse button until the required action has occurred.

The main differences are in the selection of the menu options, these follow the Windows standard format instead of using the number buttons on the unit itself.
For example to change the audio scale to be EBU select the **Audio** caption on the toolbar then select **Scale** from the submenu then select **EBU** from the list displayed.
This button will download to the PC the current display on the Monitorscope as the previous button, but will repeat continuously at a rate dependant on the buadrate until the **Stop Download** button is pressed.

Print The currently set option will be indicated by a tick.

Downloading the Monitorscope display to the PC.
To download the display from the Monitorscope to the PC, click on the **Special** icon on the toolbar then on the **Download** option, this will open the Download control window which has the following controls.

Download Single.
This button will download to the PC the current display on the Monitorscope, the time taken will depend on the baudrate and the complexity of the image but will take several seconds at least. As well as the image being displayed the time, date, range and gain are appended to the bottom of the screen.

Continuous Download (Frame).
This button will print the downloaded frame currently displayed by the PC to the default printer, as the image is usually a black background with white video it is often better to convert this to a white background with black video before printing, this is done using the **Convert to Black on White** button before printing.

Store or Recall Frames.
This button calls a window that allows downloaded images from the Monitorscope to be stored to your hard disk or to a floppy drive, also to recall stored images to be displayed or printed. To store an image as a .BMP file edit the destination directory and folder if necessary and the file name in the text area at the top of the download window the just click the **Store File** button.

To recall stored .BMP files, select the Drive and directory from the option boxes in the lower part of the download window then select the file required from the list and press the **Display File** button.

Clear Display
Clears the image from the download window.

Exit
Returns to the main window

Monitoring selected errors in Real time.
From the main window select **Config** then **Alarms** to select the errors to be logged.
Use the mouse to place a tick against each error type required. From the main window select **Special** from the toolbar then **Logger** to open the Logger window.

Click on the **Start Realtime Log button** to start the logger. Each time a selected error is detected it will appear on the list. The type of error and the time it occured will be displayed along with the source of the time code.
The 'VITC' caption means that the timecode was extracted from the incoming video, if no VITC data was detected in the video stream or it had CRC errors then the Monitorscope's real time clock is used and the caption 'RTC' is displayed.

To stop real time logging click on the **Stop Realtime Log** button.

Monitoring stored selected errors.
From the main window select **Config** then **Alarms** to select the errors to be logged.
Use the mouse to place a tick against each error type required. From the main window select **Special** from the toolbar then **Logger** to open the Logger window.

Click on the **Start Logging button** to start the logger.
Each time a selected error is detected it will be stored in memory in the Monitorscope.

To stop real time logging click on the **Stop Realtime Log** button.

After stopping the logger the contents of the Monitorscope's logger memory can be downloaded by clicking on the **Read Stored Log** button. The type of error and the time it occurred will be displayed along with the source of the time code.
The 'VITC' caption means that the timecode was extracted from the incoming video, if no VITC data was detected on the video or it had CRC errors then the timecode from the Monitorscope's real time clock is used and the caption 'RTC' is displayed.

Clear Screen
Clears the logged error list.

Exit
Returns to the main window.

Trouble Shooting
If the PC can't communicate with the Monitorscope, an Error message will appear in the application window. It is necessary to check that RS232 link is correctly setup.

1) Is the serial port on the PC used by the Monitorscope specified by the application?
2) Is the baud rate used by the Monitorscope the same as specified by the application?
3) Is the RS232 cable connected and correctly wired?

Monitorscope 9 Way D connector pin 2 is an output from the unit, for status & downloads.
Monitorscope 9 Way D connector pin 3 is an input to the unit, for PC commands.
Monitorscope 9 Way D connector pin 5 is ground.

BATTERIES

The MS601 can be powered from the supplied adaptor, providing 12V @2.5 amps regulated, or from the optional internal 3.8Ahr NiMh rechargeable batteries. These will provide operation for approximately 2 hours if the unit is equipped with all options, or 3 hours with no options fitted.

If external power is applied to the unit when it is switched off, the batteries are automatically charged. It will take 14 hours to fully charge the batteries from flat, but it can be left charging permanently without damage to the batteries. The unit doesn't charge when switched on, to reduce current consumption and heat generation.

NiMh batteries are more environmentally friendly than the traditional NiCd type and don't suffer from the memory effect, i.e. don't need to be fully discharged before recharging for full capacity. They are also safer than LiIon types though are slightly larger and heavier.

The battery discharge characteristics are non-linear, see Fig 8.

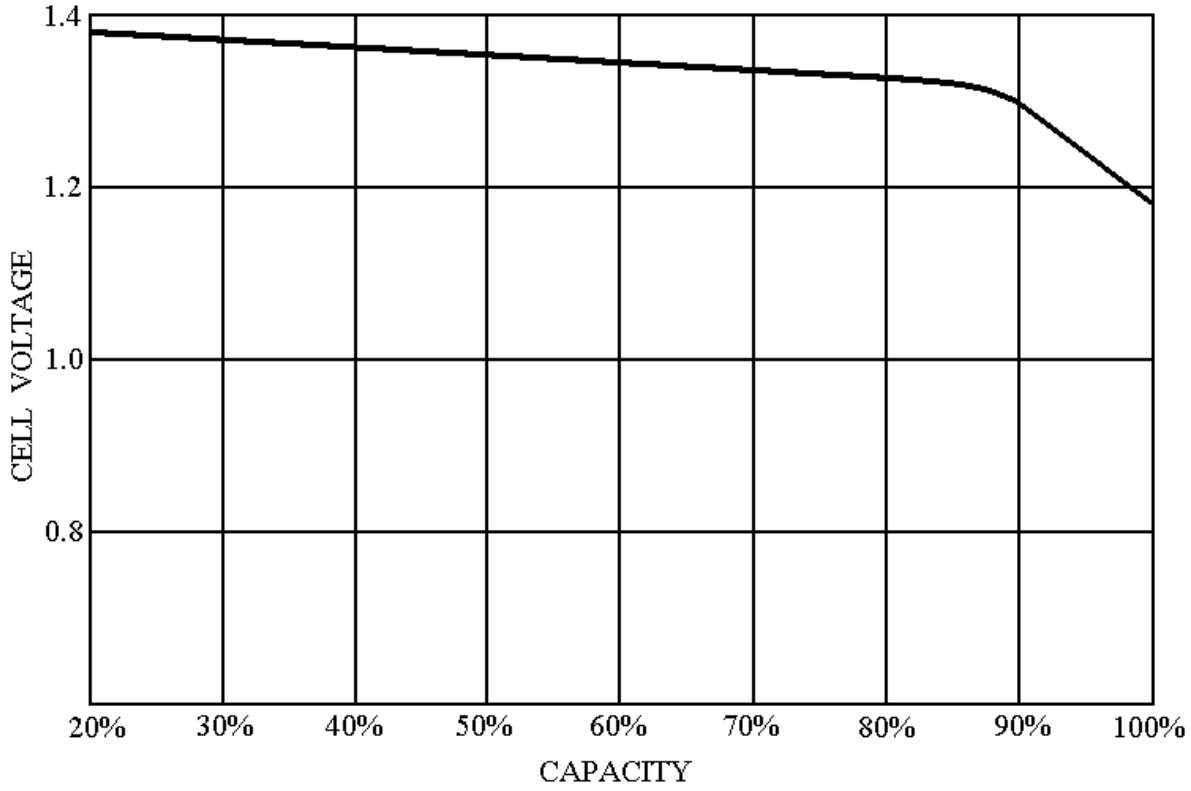


Fig 10

The remaining battery life is displayed in the GEN error display box. If the batteries have been charging immediately before, the reading will be high for a few seconds.

TECHNICAL SPECIFICATION

INPUTS

Serial digital inputs. BNC connectors. Input impedance 75 ohms. Max d.c. +/- 10V. SMPTE 259M, ITU-R BT.601/656 serial component. 800mV pp +/-10% auto equalised up to 300 metres.

Serial digital outputs. BNC connectors. Output impedance 75 ohms. Equalised versions of the serial digital inputs.

External ref input. BNC connector with loop through output. Return loss better than 40dB. Zin of 22k. Max dc +/- 3 volts.

Composite inputs. 2 x BNC connectors with loop through outputs. Return loss better than 40dB. Zin of 22k. Max dc +/- 3 volts.

Component inputs. 3 x BNC connectors with loop through outputs. Return loss better than 40dB. Zin of 22k. Max dc +/- 3 volts. YCrCb or RGB.

OUTPUTS

Serial digital outputs. BNC connectors. 800mV to 75 ohms.

VGA output. 15 pin high density D socket. Analog 0.7V R,G,B and H and V sync.

Composite output. BNC connector. 1V to 75 ohms.

Component outputs. BNC connectors. 1V to 75 ohms. YCrCb or RGB.

AUDIO

4 x Analog balanced inputs. Zin 22K.

2 x AES/EBU digital audio inputs @ 48KHz, 44.1KHz or 32KHz. Zin 200R.

4 x Analog balanced outputs, line level.

REMOTE CONTROL

9 pin D socket for GPI, data up/down load and remote control. RS232 8bits, no parity, 1 stop bit. Baud rate selectable to 9600, 4800, 2400, 1200.

Pin 1 GPI, closure to common. **Pin 2** RS232 output. **Pin3** RS232 input.
Pin 4 Joined to pin 6. **Pin 5** Ground. **Pin 6** Joined to pin 4.
Pin 7 Joined to pin 8. **Pin 8** Joined to pin 7. **Pin** 9 n/c.

POWER

10 to 14V d.c. to 4 pin XLR. Pin 1 = ground, pin 4 = +12V @ 2A max.

Can also be powered by the optional internal battery pack.

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 3.5Kg.

TECHNICAL SPECIFICATION

DISPLAY AREAS

Waveform cutout boxes	38uS x 512 lines or 19uS x 256 lines or 9.5uS x 128 lines. Horizontal and vertical positions are menu selectable.
Text cutout box	38uS x 32 lines at top or bottom of frame.
Audio cutout boxes	3.6uS x 512 lines at left and right of frame.

WAVEFORM MONITOR

Resolution	Full 10 bit processing. Display resolution 512 x 512.
Response	Flat is unprocessed digital data stream Low Pass is -3db @ 1.5MHz, -60db @ 6.75MHz.
Sensitivity	1volt encoded video reads 1 volt on screen. Totally digital processing guarantees accuracy. Mag is x 4 gain.
Timebase	H, 2H, 3H and Hmag, which is selectable to x5 or x10. V, 2V, Line select and Vmag, selectable to 2,4,8,16 or 32 lines. Line select is a fully sampled and bright display. Chop provides parade and overlay displays.

VECTOR MONITOR

Video	Traditional component or composite (option) display. Digital component accuracy 0.2%. Bandwidth 3.375MHz . Composite accuracy 1%. Bandwidth 1.0MHz .
Audio	Stereo phase display of left or right audio pair. Phase accuracy 2 deg. Display compression 30db.
Gamut	Poly™ display of RGB signal shows up illegal colours.

AUDIO MONITOR

Accuracy	Better than 0.1db over full scale range.
Characteristics	BBC Type 2, Digital, Nordic, VU EBU, DIN and Expanded.

EXTERNAL CONNECTIONS

75 ohm BNCS for the SDI inputs 1 & 2 (SMPTE 259M).
75 ohm BNCS for re-equalised SDI outputs 1 & 2.
75 ohm BNCS for external reference input and loop output.
75 ohm BNCS for two analog composite and one analog component inputs (option).

75 ohm BNCS for display composite and component analog video outputs.
75 ohm BNCS for display SDI outputs 1 & 2.

15 pin High density D socket for VGA output (option).

25 pin D socket for audio input and output (option).

4 pin XLR plug for external 12V DC power.

9 pin D plug for serial control port & data download output.

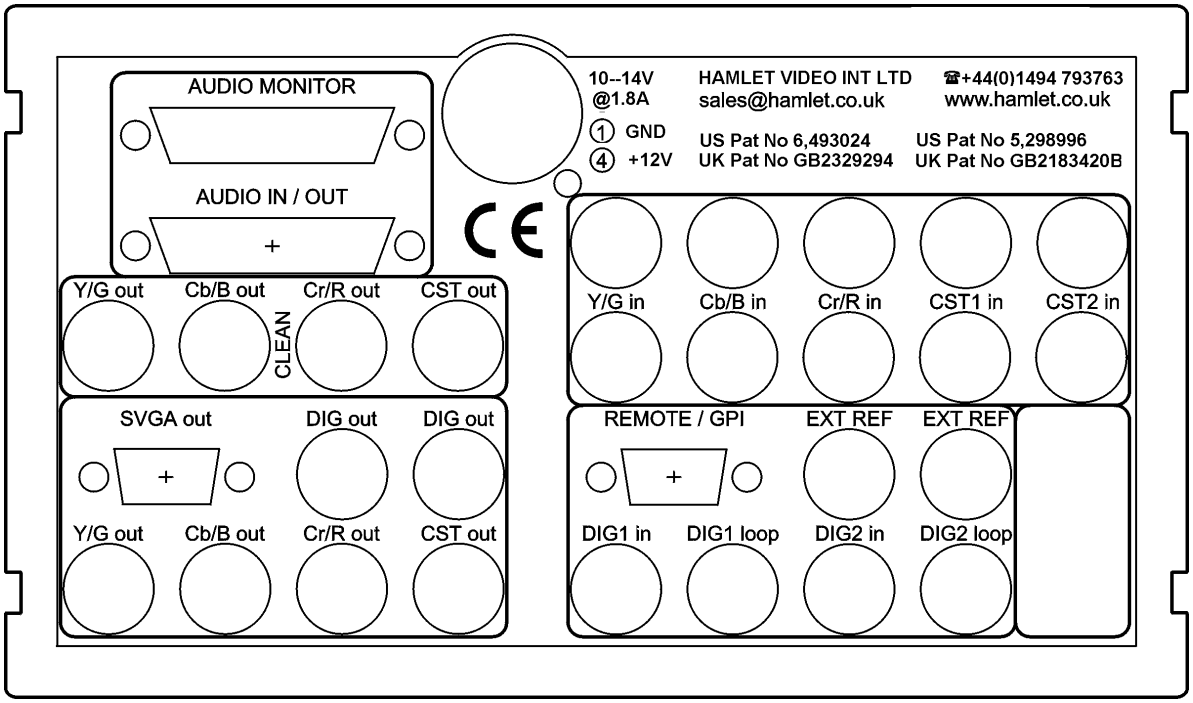


Fig 11

TROUBLE SHOOTING

No Video displayed:
If there is no video signal connected to the selected input, the screen will display:

NO SIGNAL PRESENT AT THE SELECTED INPUT

Observe the front panel INPUT VALID lights to see what inputs are available.

If Syncs cannot be seen on a composite input:
Select 'Display' in menu
Select 'Special' (button 5)
Select 'VIEW AS ANLG' (button 4)
This will show the whole waveform on a black background

The Phase control has no effect in SDI/Clean modes.
The Filter menu has no effect in SDI/Clean modes

If the Display does not update:
Check that 'Run; has been selected in 'Traces'

No Audio indication:
Select SDI input
Select Audio Ch1, Ch2, or Both
In menu area select 'Audio'
Then check that the correct group has been selected
To do this, select Audio then 'Source' (button 1)
Then select the Embedded Group required (1,2,3,or 4)

Analogue Audio must be connected to inputs L2 and R2
AES Audio may be connected to AES1 or AES2

If the Waveform and Vector displays are not locked:
Check to see that the REF is set to INT (green indication)

Measurements:
If the timebase is altered after having set the cursor positions they will have to be reselected and reset. When making measurements cursors should be selected last.

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 12.

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

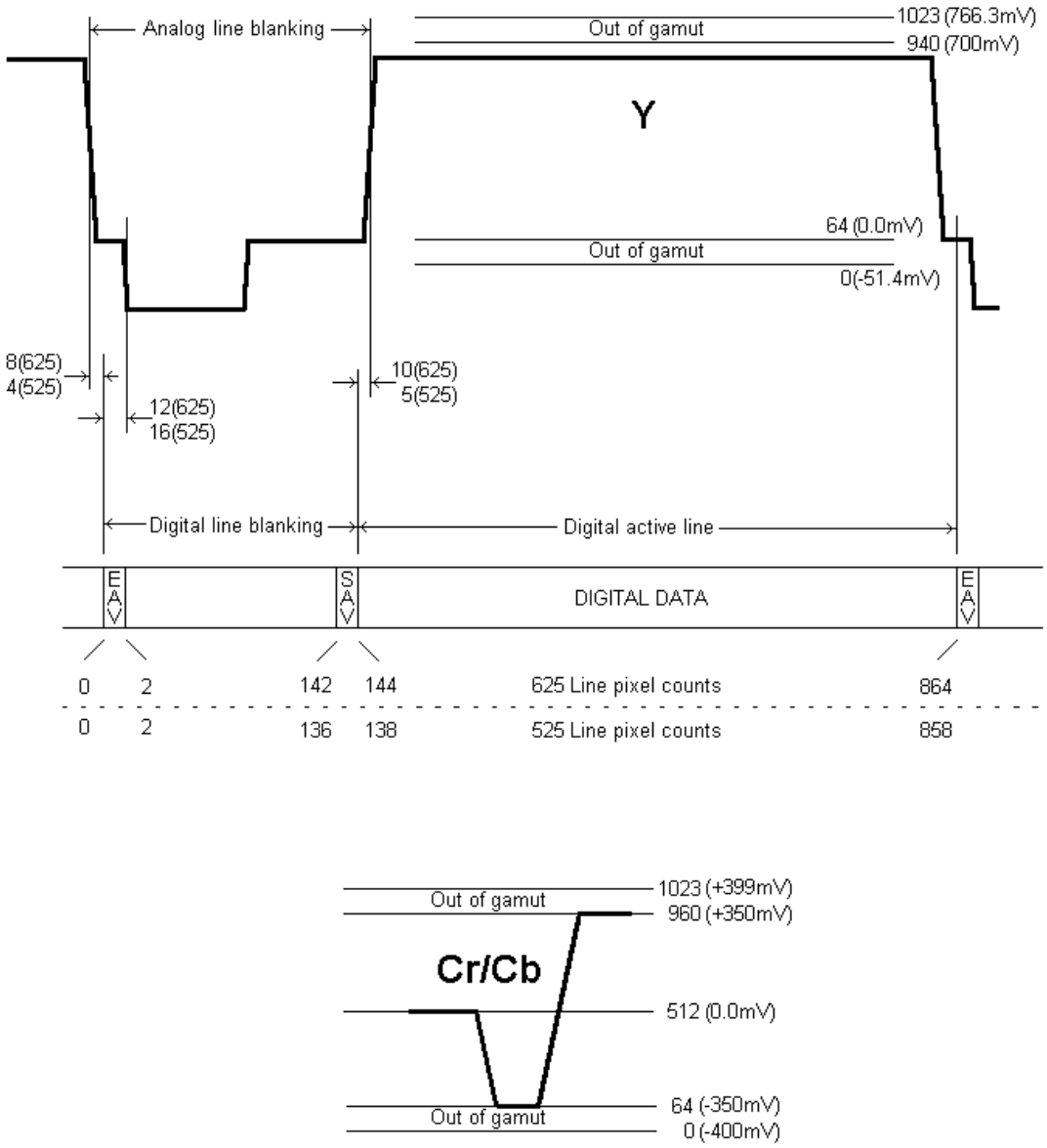


Fig 12 .

SD SDI Field Blanking – 625

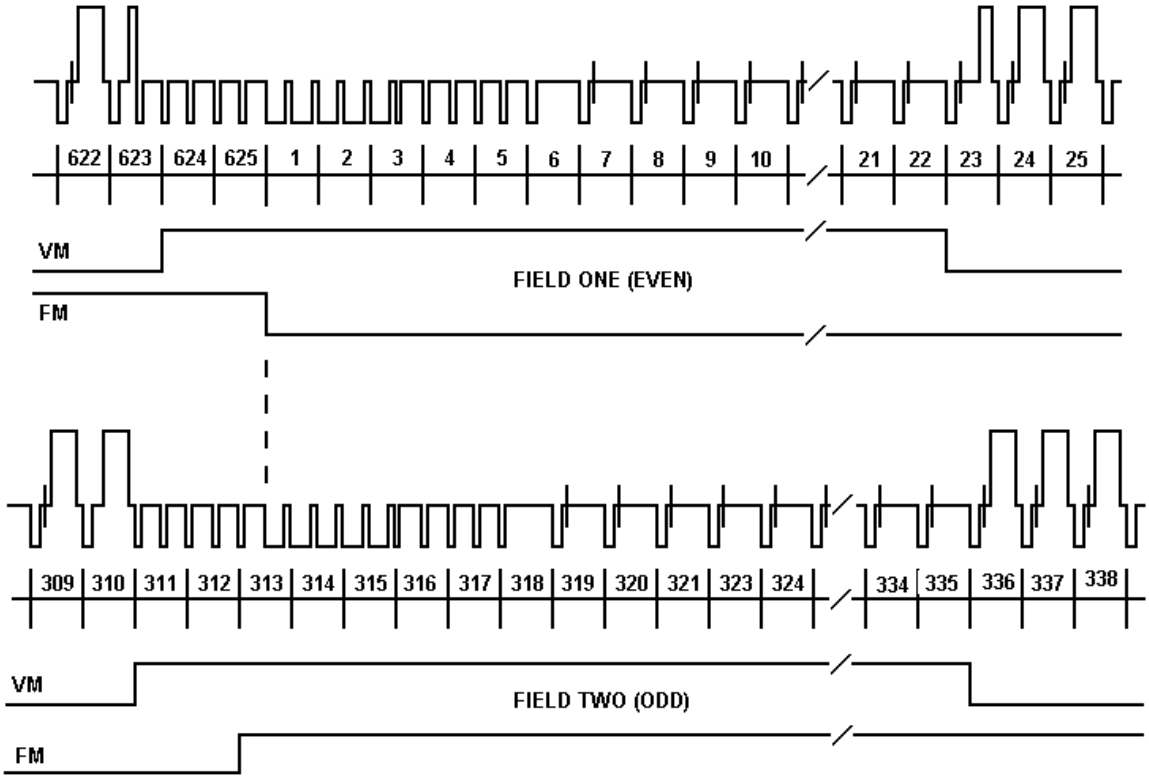


Fig 13 .

SD SDI Field Blanking – 525

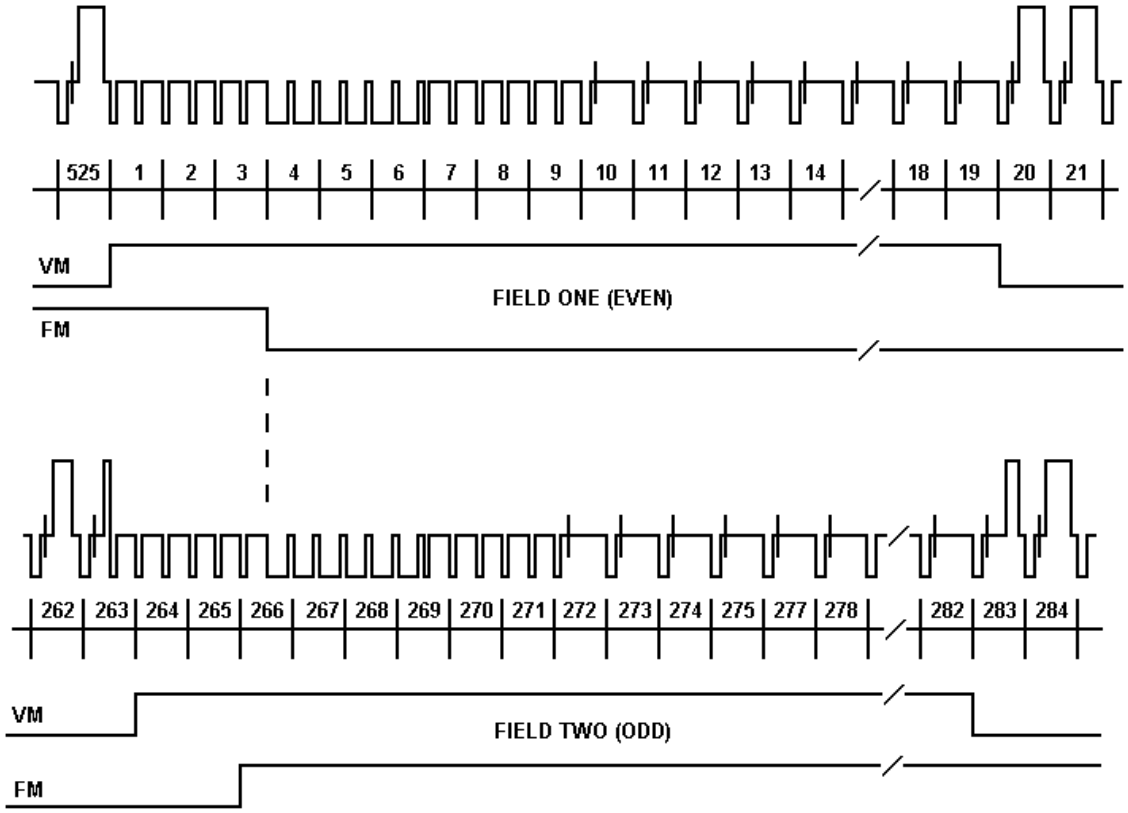


Fig 14 .

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:

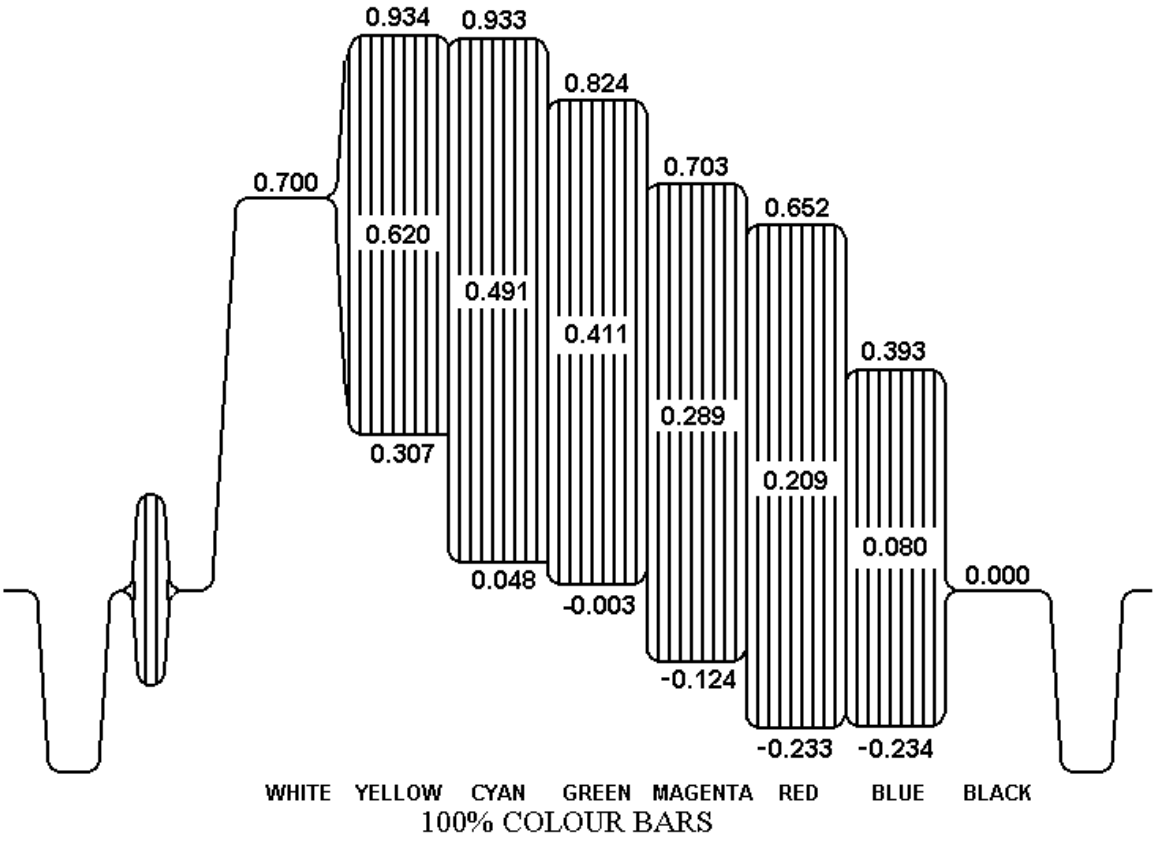
Cr = (R-Y) and Cb = (B-Y)
These are weighted to give maximum values of +/- 350mV and are bandwidth restricted to half that of the Y component.

PAL

Fig 15 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 16 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

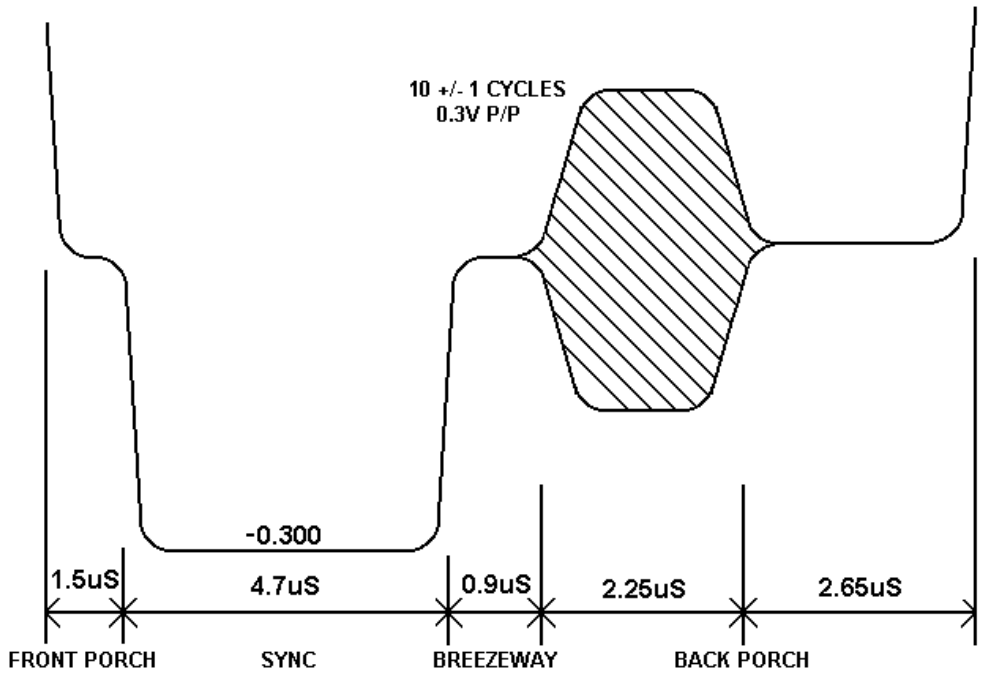
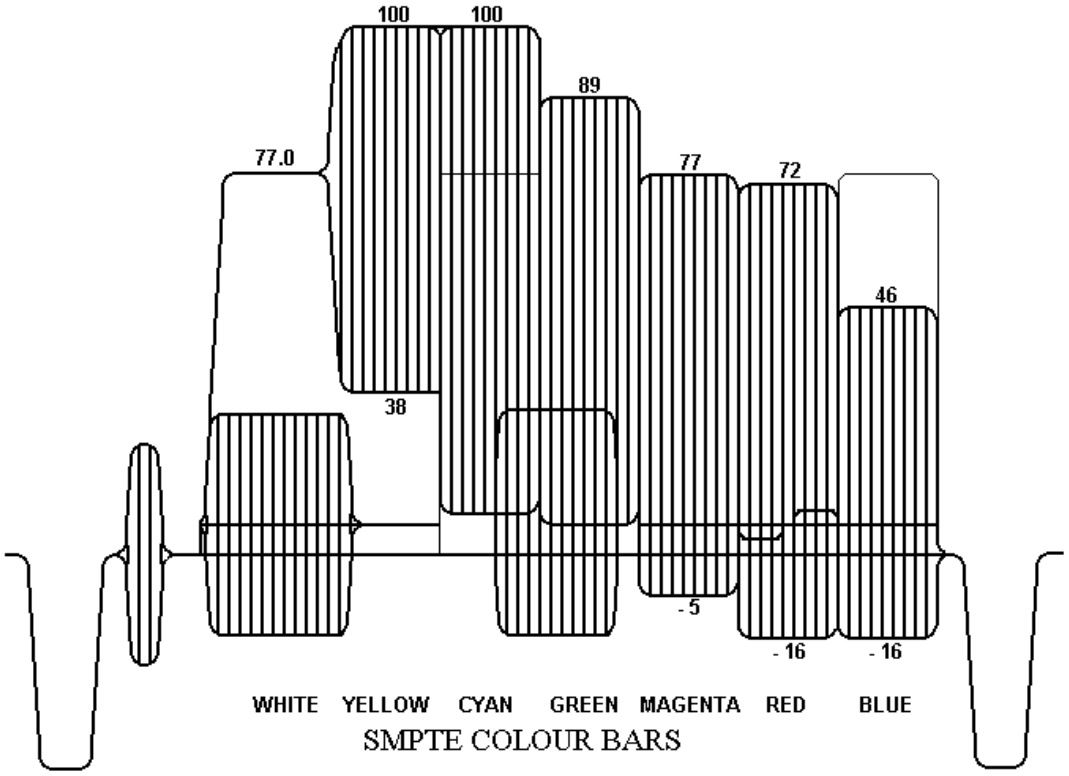


Fig 15 .


100
100
89
77.0
77
72
46
38
- 5
- 16
- 16
WHITE
YELLOW
CYAN
GREEN
MAGENTA
RED
BLUE
SMPTE COLOUR BARS

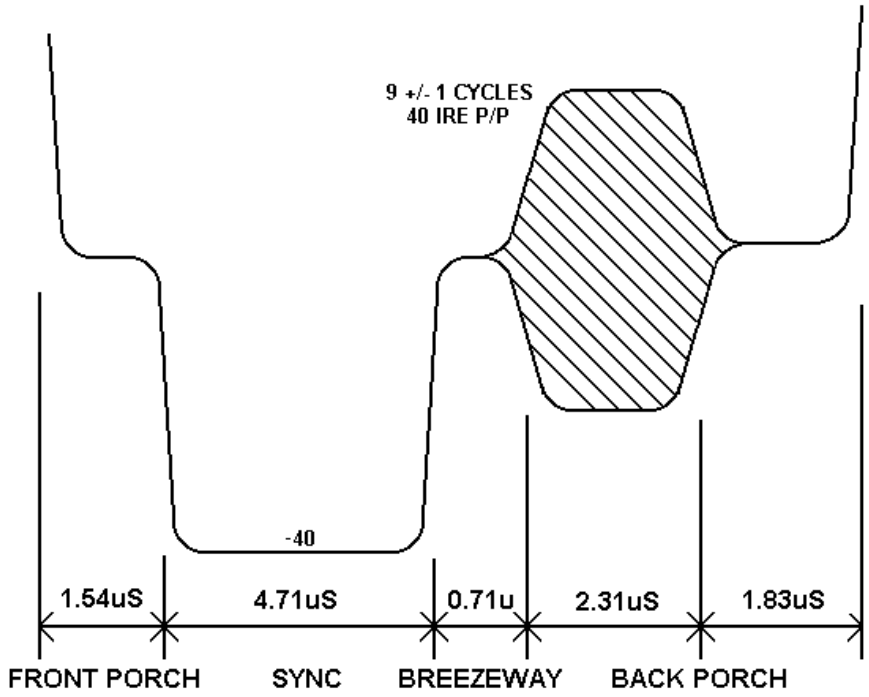

9 +/- 1 CYCLES
40 IRE P/P
-40
1.54uS
4.71uS
0.71u
2.31uS
1.83uS
FRONT PORCH
SYNC
BREEZEWAY
BACK PORCH

Fig 16.

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

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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.