HAMLET
EXCELLENCE IN VISION

MICROFLEX

HAND HELD 3G, HD, SD & CST WAVEFORM, VECTOR, AUDIO AND PICTURE MONITORING WITH EYE PATTERN AND SIGNAL GENERATION

OPERATOR'S HANDBOOK

V2.2B onwards

IN CORRESPONDENCE CONCERNING THIS INSTRUMENT
PLEASE QUOTE THE SERIAL NUMBER PRINTED ON THE

LABEL AT THE REAR OF THE UNIT

CONTENTS

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.

$$C\hspace{-0.5em}\in$$

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

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

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

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

PRODUCT DISPOSAL INSTRUCTIONS

B2B COMPLIANCE REG NO.
WEE/GJ0146QT

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

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

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

OVERVIEW

The Hamlet Microflex is a hand held digital video waveform, vector and embedded/AES audio monitor. It currently operates with one of six input/output option modules.

Option 1: HD/SD
accepts all major HD (high definition) and SD (standard definition) SDI (serial digital video) standards.

Option 2: SD/CST
accepts Serial Digital video in 625 and 525 line standards and Composite video in PAL and NTSC standards.

Option 3: HD/SD + TSG
accepts all major HD (high definition) and SD (standard definition) SDI (serial digital video) standards. Includes HD and SD Test Signal Generator output

Option 4: HD/SD + EYE
accepts all major HD (high definition) and SD (standard definition) SDI (serial digital video) standards. Includes EYE Pattern display with Jitter

Option 5: 3G/HD/SD
accepts all major 3G and HD (high definition) and SD (standard definition) SDI (serial digital video) standards

Option 6: 3G/HD/SD + EYE
accepts all major 3G and HD (high definition) and SD (standard definition) SDI (serial digital video) standards. Includes EYE Pattern display with Jitter

The Hamlet Microflex displays the waveforms on a 3.5" VGA resolution TFT liquid crystal display. All the standard displays are produced, including H and V Mag, Line Select, Component Parade and Bowtie.

Proprietary patented digital signal processing produces displays with the look of a CRT but without the problems of scan burn, EHT difficulties etc. The very low power consumption also allows it to be used in the field from an external 12V supply or its own internal rechargeable batteries.

An additional feature is a display of component vectors. The unit also contains a high specification audio de-embedder and an AES receiver, allowing audio bar graph displays of four channels of audio (two from AES) and a vector audio phase display. There is a stereo headphone monitor output jack and internal loudspeaker, fed from a high quality 1-bit DAC.

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.

The serial digital signal itself is analysed to give on-screen readouts of the EDH/CRC word, various digital parameter errors and signal strength in the top of screen status bar.

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.

CASE VIEW

Fig 1

GETTING STARTED

UNPACKING

The Hamlet Microflex 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, if severely handled.

CHANGING OPTION MODULES

The Hamlet Microflex will normally be supplied with the requested option module fitted. If an additional module is purchased, care is needed to protect the delicate electronics in the module and base unit when changing the module. All work should be carried out in an anti-static environment.

1.   Switch off the unit and remove the power lead and any cables to the option unit.
2.   Remove the two screws holding in the option module.
3.   Gently slide out the module and place in an anti-static bag or optional leather wrap.
4.   Remove the new option module from its bag and gently slide in to the base unit,
         checking it is the correct way up.
5.   Replace the two screws holding in the module.

POWER REQUIREMENTS

The Hamlet Microflex should be powered from the supplied adaptor, or a regulated supply of 12VDC of at least 1 amp rating, centre negative, to the 2.1mm power socket.
It can also be run from its internal rechargeable batteries, giving approximately three hours of continuous use (subject to module installed). **On first use, the 12V power supply should be connected for at least 3 hours, to fully charge the batteries.**

SIGNAL AND CONTROL CONNECTIONS

The 3G/HD/SD/CST input connection is made to the centre BNC socket, which is internally terminated at 75 ohms.

The left BNC provides either an equalised output of the input feed, or subject to module fitted user selected Test Signal, whilst the right BNC allows an external timing reference or AES audio signal to be input.

PREVENTATIVE MAINTENANCE

The Hamlet Microflex should be visually inspected and cleaned every one year of operation.

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

GETTING STARTED

1.   Connect the supplied 12V power adaptor output to the rear 2.1mm input jack.

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

3.   Connect a suitable video feed to the centre BNC.

   4.   Press the front panel power button. The software versions will be displayed for the first two seconds.

   5.   The Microflex remembers all the setting when it was previously used, so if the icon menu is not visible, press the far right key.

   6.   If the Microflex was previously used in a non standard set-up, it can be reset by switching on while holding down the left hand menu key. The key must be held down for at least 4 seconds.

TYPICAL STATUS DISPLAY
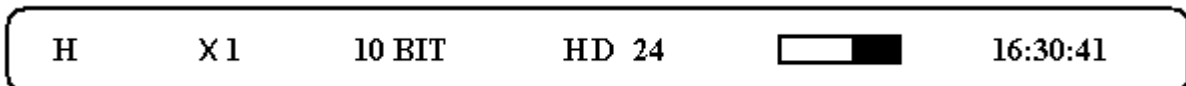
Fig 2

The following abbreviations are used:

H is horizontal time base range.

x1 is the vertical gain.

10 BIT shows that all the input 10 bits are active, otherwise shows **8 BIT**.

HD 24 (etc) is the television standard:
#HD 60PA is 1.001 1080/60/1:1   3G Level B encoding changes the displayed A to B.
HD 60PA is 1080/60/1:1
HD 50PA is 1080/50/1:1
HD 60 is 1080/60/2:1   **720 60** is 720/60/1:1
HD 50 is 1080/50/2:1   **720 50** is 720/50/1:1
HD 48 is 1080/24/sf
HD 30 is 1080/30/1:1
HD 25 is 1080/25/1:1   **SD 625** is 625 (composite displays **PAL**)
HD 24 is 1080/24/1:1   **SD 525** is 525 (composite displays **NTSC**)
1/1.001 standards show a **#** symbol before the standard number.

To the right of the television standard display is an indication of the state of battery charge or SDI cable attenuation in dbs, as set in the DISPLAY menu.

The internal real time clock displays on the right of the status screen and has a battery backup for at least 5 years. If there is a letter V in front of the number, it is showing the vertical interval timecode on the input video.

OPERATING INSTRUCTIONS

All Microflex functions are controlled from a simple menu structure.

TOP MENU

| WFM | VEC | AUDIO | CURSORS | LOGGER | ALARMS | DATA | DISPLAY | NORM/WIDE |
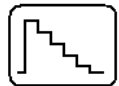
Selects the waveform sub menu.
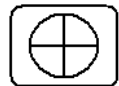
Selects the vector monitoring sub menu.

Selects the audio monitoring sub menu.
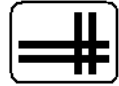
Selects the measurement cursor sub menu.

Selects the error logger and real time clock setting.

Selects which errors are logged or cause an audible alarm.

Selects the EYE pattern, Generator, Data or sundry functions

Selects the display options.

Selects picture mode in 16:9 or 4:3 aspect ratios.

Fig 3

OPERATING INSTRUCTIONS

WAVEFORM SUB MENU

SHIFT LEFT	SHIFT RIGHT	SHIFT UP	SHIFT DOWN		REF	HMAG H,2H,3H	VMAG V,2V,LS	BACK
←	→	↑	↓	AUX	INT	H	V	⬑

					EXT
					HFT

H BLANK	PERSIST	GAIN	FILTER	BOWTIE	PANEL SETTINGS			BACK
BNK	NOR	x4	FLT	BT-	STO	RCL		⬑
	STO		LPS	BTU				
	FRZ			BTV				
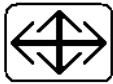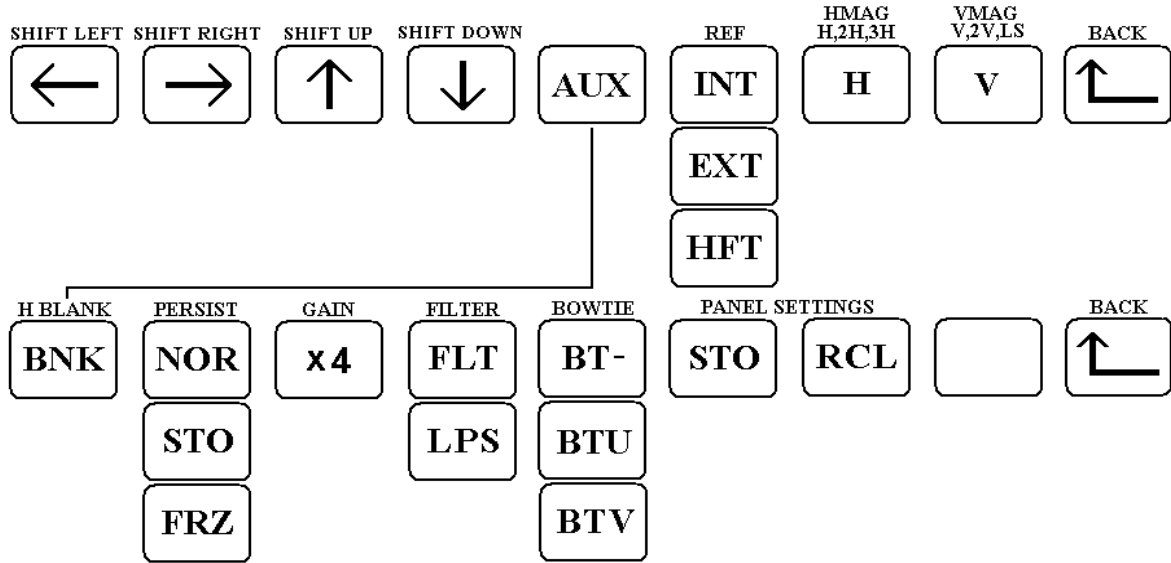
⬦ The horizontal and vertical shifts operate as a normal oscilloscope, except that the horizontal shift has a wrap round effect, so always shows a complete line. The vertical shift values are only stored when another key is pressed, or the menu is exited.

AUX

(BNK) Blanks out the horizontal blanking area (TRS, audio, aux data etc).

(NOR) Selects the display persistance to the normal frame rate.
(STO) Selects the display persistance to infinite.
(FRZ) Freezes the display.

(x4) Toggles the video gain between x1 and x4 values.

(FLT) Selects Flat video filter.
(LPS) Selects Low Pass video filter.

(BT-) Selects Bowtie OFF.
(BTU) Selects Bowtie Y-U.
(BTV) Selects Bowtie Y-V.

(STO) Reveals numbers 1 to 8, where the current panel settings can be stored.
(REC) Reveals numbers 1 to 8, where the current panel settings can be recalled.

(⬑) Up one level in the sub menu.

INT

(INT) Selects internal sync reference from the input video.
(EXT) Selects the EXT-REF bnc as the sync reference.
(HFT) Hands Free Timing™ automatically switches the display between internal and external syncs, so easily showing timing errors.

H   Selects horizontal timebase ranges of H, 2H, Parade and Hmag.

V   Selects horizontal timebase ranges of V, 2V, Vmag and Line Select.
The line is selected using the horizontal shift keys.

⬑   Up to top menu.

Fig 4

VECTOR SUB MENU

	GAIN	REF	PERSIST						BACK
	100	**INT**	**NOR**	**AUX**	**CDM**				↰
	75	**EXT**	**STO**						
	X 3	**HFT**	**FRZ**						

					PANEL SETTINGS		BACK
					STO	**RCL**		↰

100
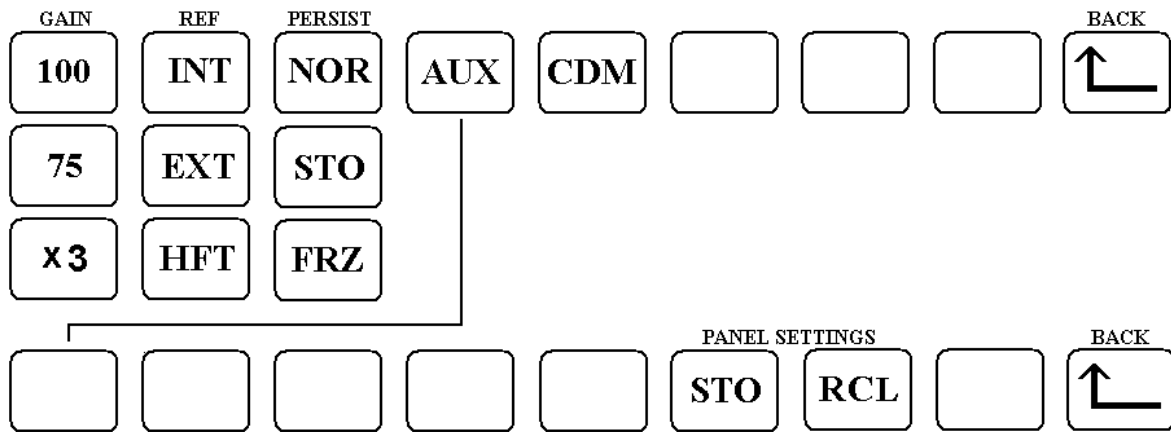
- 100 Sets the vectorscope gain for 100% vectors.
- 75   Sets the vectorscope gain for 75% vectors.
- x 3 Sets the vectorscope gain to 3 times the 100 setting.

INT

- INT Selects internal sync reference from the input video.
- EXT Selects the EXT-REF bnc as the sync reference.
- HFT Hands Free Timing™ automatically switches the display between internal and external syncs, so easily showing timing errors.

NOR

- NOR Selects the display persistance to the normal frame rate.
- STO Selects the display persistance to infinite.
- FRZ Freezes the display.

AUX

- STO Reveals numbers 1 to 8, where the current panel settings can be stored.
- REC Reveals numbers 1 to 8, where the current panel settings can be recalled.
- ↰   Up one level in the sub menu.

CDM   Custom vector graticule.

↰   Up to the top menu.

Fig 5

OPERATING INSTRUCTIONS

AUDIO SUB MENU

SOURCE	SCALE	PEAK HOLD	DE EMPH		VOL UP	VOL DOWN	OUTPUT	BACK
SRC	H-H-H	ı ı		AUX	V ↑	V ↓	OUT	⌐

								BACK
GP1	GP2	GP3	GP4	AES				⌐
BBC	EBU	VU	NOR	DIG	DIN	EXP		⌐ BACK
OFF	1S	2S	4S	INF				⌐ BACK
2KH	3KH	4KH	OFF					⌐ BACK

SHIFT LEFT	SHIFT RIGHT	SHIFT UP	SHIFT DOWN		PANEL SETTINGS			BACK
←	→	↑	↓		STO	RCL		⌐

SRC
- [GP1] Selects embedded audio Group 1.
- [GP2] Selects embedded audio Group 2.
- [GP3] Selects embedded audio Group 3.
- [GP4] Selects embedded audio Group 4.
- [AES] Selects AES audio input and overrides the NO SIGNAL display.

H-H-H
- [BBC] Selects BBC Type II audio scale.
- [EBU] Selects EBU audio scale.
- [VU] Selects VU audio scale.
- [NOR] Selects NORDIC audio scale. — See following page.
- [DIG] Selects DIGITAL audio scale.
- [DIN] Selects DIN audio scale.
- [EXP] Selects EXPAND DIN audio scale.

ı ı
- [OFF] Selects audio bars peak hold to off.
- [1S] Selects 1 second audio bars peak hold time.
- [2S] Selects 2 seconds audio bars peak hold time.
- [4S] Selects 4 seconds audio bars peak hold time.
- [INF] Selects infinite audio bars peak hold time.

- [2KH] Selects 2KHz de emphasis.
- [3KH] Selects 3KHz de emphasis.
- [4KH] Selects 4 KHz de emphasis.
- [OFF] Selects de emphasis to off.

AUX
- [↔] The shift keys can be used to centre the vector audio phase display.
- [STO] Reveals numbers 1 to 8, where the current panel settings can be stored.
- [REC] Reveals numbers 1 to 8, where the current panel settings can be recalled.
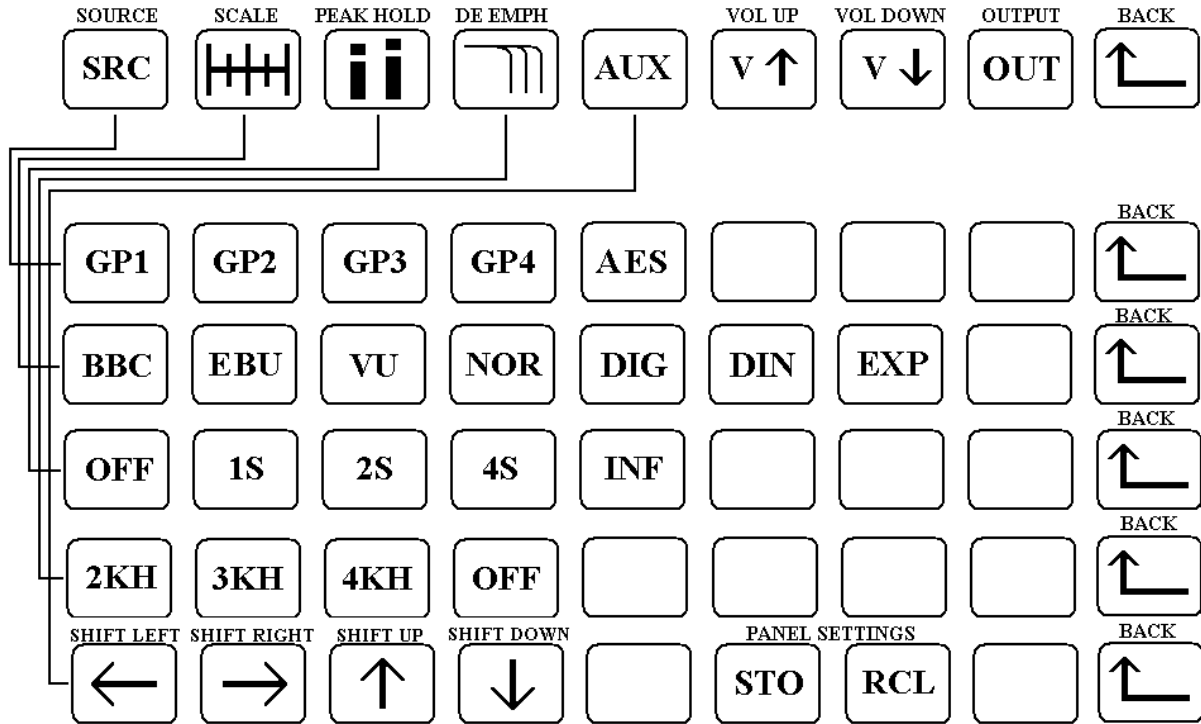- [⌐] Up one level in the sub menu.

Fig 6

AUDIO SUB MENU

V ↑ Increases the audio output volume.
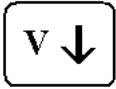
V ↓ Decreases the audio output volume.

OUT

CH:1 MONO
CH:2 MONO } Outputs individual channels to the headphone socket.
CH:3 MONO } The audio vector display will not show phases.
CH:4 MONO

CH: 1&2 } Outputs stereo pairs to the headphone socket
CH: 3&4 } and audio vector display.
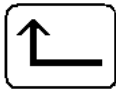
⌐┘ Up to the top menu.

A small internal loudspeaker and a 3.5mm stereo headphone jack socket are provided to monitor the displayed audio signal.

AUDIO SCALES

Fig 7

CURSOR SUB MENU

AMPLITUDE   TIMING   PHASE   BACK

| AMP | TIM | PHS | | | | | | ⬑ |

MOVE UP MOVE DOWN MOVE UP MOVE DOWN   BACK

| A↑ | A↓ | B↑ | B↓ | | | | | ⬑ |

MOVE LEFT MOVE RIGHT MOVE LEFT MOVE RIGHT   BACK

| ←A | A→ | ←B | B→ | | | | | ⬑ |

MOVE UP MOVE DOWN MOVE LEFT MOVE RIGHT   BACK

| A↑ | A↓ | ←B | B→ | | | | | ⬑ |
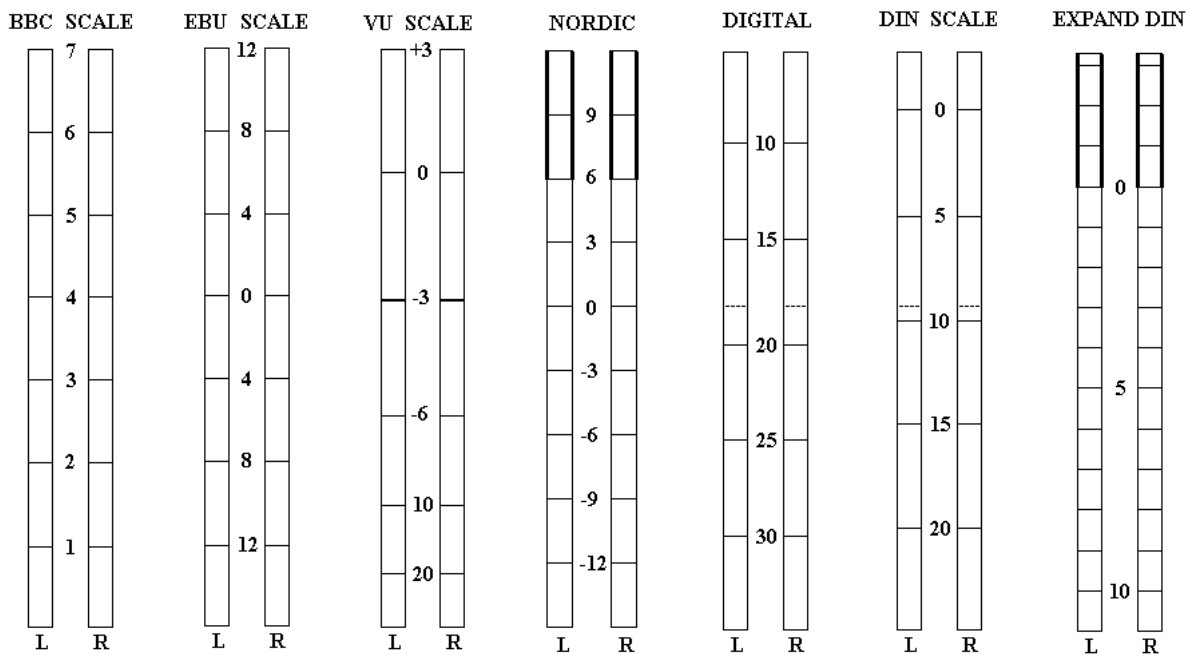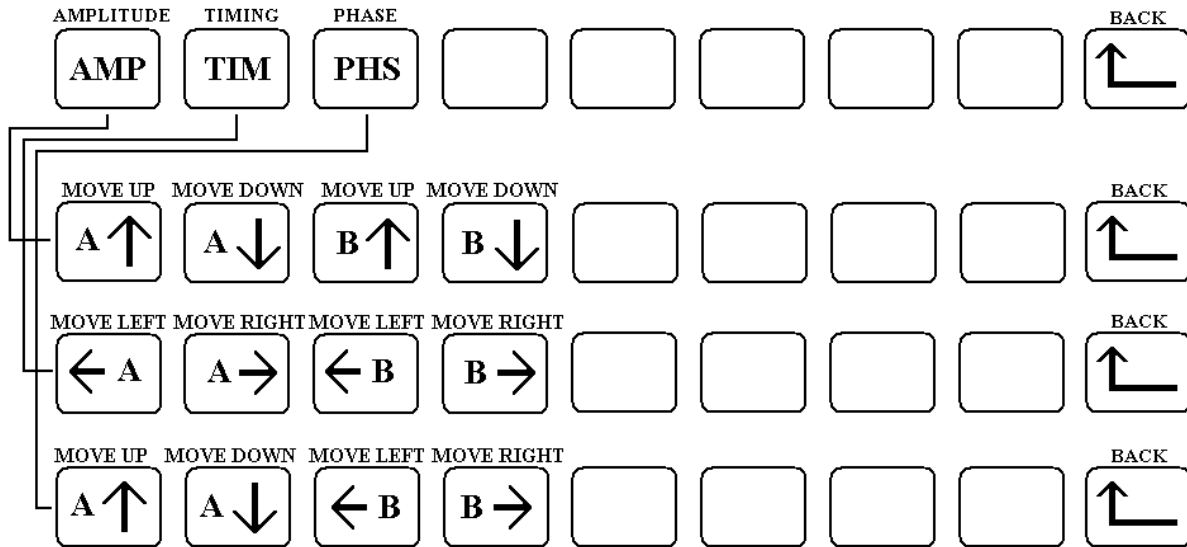
AMP

A↑ Moves the Green measurement cursor up.
A↓ Moves the Green measurement cursor down.
B↑ Moves the Red measurement cursor up.
B↓ Moves the Red measurement cursor down.
The amplitude corresponding to each cursor in mV, is displayed in the status area, along with the difference between the two values.

TIM

←A Moves the Green measurement cursor left.
A→ Moves the Green measurement cursor right.
←B Moves the Red measurement cursor left.
B→ Moves the Red measurement cursor right.
The time corresponding to each cursor is displayed in the status area, along with the difference between the two values.

PHS

A↑ Moves the Green measurement cursor up.
A↓ Moves the Green measurement cursor down.
←B Moves the Red measurement cursor left.
B→ Moves the Red measurement cursor right.
The intersection of the cursors represents a phase amplitude measured from the centre and a phase angle value. The phase angle is taken as 0 degrees at the 9 o'clock position. The phase magnitude and angle at the intersection is displayed in the status area.

⬑ Up to the top menu.

Fig 8

LOGGER SUB MENU

CLOCK	START LOG	STOP LOG		SCROLL LOG		ERASE LOG		BACK
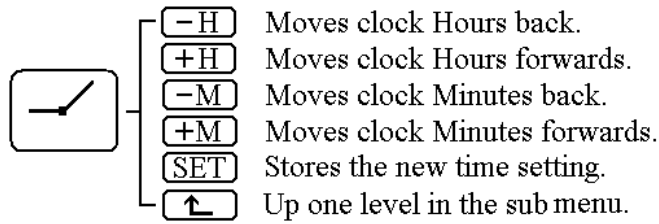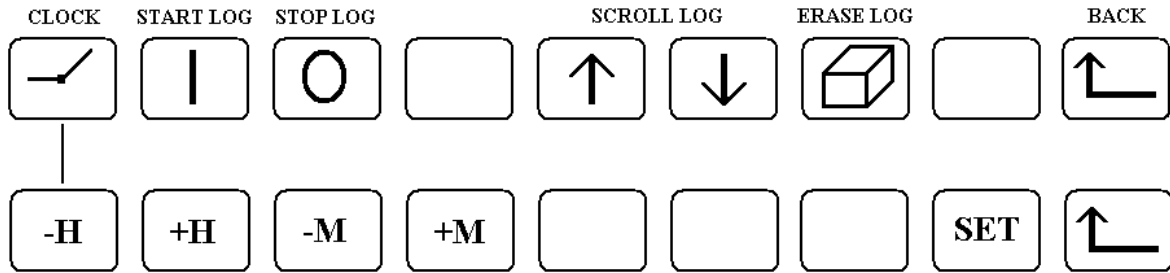
Starts the logger. Stores the time of occurrence, the video standard and type of all errors that have been enabled in the top level Alarms menu.
All logged errors have a number starting at 1 and going up to a maximum of 940.

Stops the logger.

Scrolls up the list of logged errors displayed on the top status bar.
Says "End of Log" when at the top of the list.

Scrolls down the list of logged errors displayed on the top status bar.

Erases all logged errors.

Up to the top menu.

−H Moves clock Hours back.
+H Moves clock Hours forwards.
−M Moves clock Minutes back.
+M Moves clock Minutes forwards.
SET Stores the new time setting.
⌐ Up one level in the sub menu.

The log can be downloaded to a computer via the USB port. See the Remote Control section for more details.

Fig 9

OPERATING INSTRUCTION

ALARM SUB MENU

These alarms can be set individually. When set and an error of that type occurs, they will
have the following effects:
If the logger is running the error will be logged
If the logger is not running the error count will be displayed in the top status bar in Data mode and an audible
warning will sound.

With SD Video Input

SETS THE LOGGER AND AUDIBLE ALARMS

ILLEGAL CODES	GAMUT ERRORS	RECEIVER LOCK	ANCILLIARY DATA ERRORS	FULL CRC ERRORS	ACTIVE CRC ERRORS		TRS ERRORS	BACK
ILL	GAM	LCK	ANC	FCR	ACR		TRS	↰

ILL Detects illegal values in the incoming video data stream.
GAM Detects out of gamut values in the incoming video data stream (+3%, -1%)
LCK Indicates the unit is not locked to the incoming video.
ANC Detects illegal values in the ancillary data packets in the the video data stream.
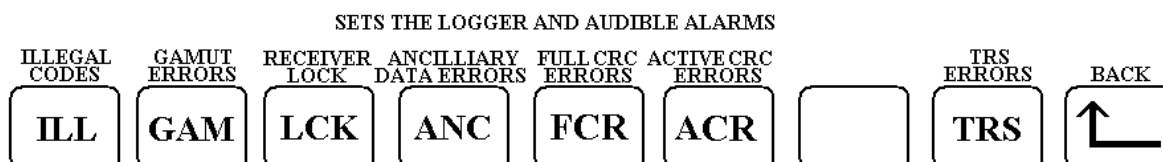FCR Detects errors in the Full Field CRC of the incoming video data stream.
ACR Detects errors in the Active Picture Area CRC of the incoming video data stream.
TRS Detects errors in the EAV and SAV values in the incomming video data stream.
↰ Up to the top menu.

Fig 10a

With HD Video Input
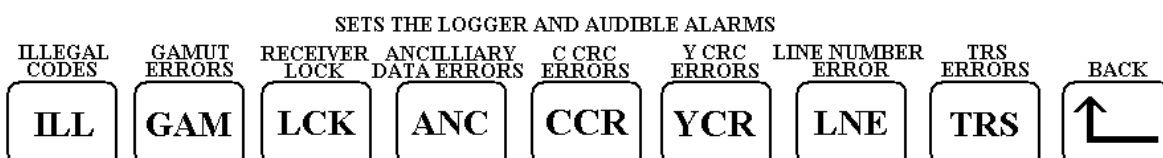
SETS THE LOGGER AND AUDIBLE ALARMS

ILLEGAL CODES	GAMUT ERRORS	RECEIVER LOCK	ANCILLIARY DATA ERRORS	C CRC ERRORS	Y CRC ERRORS	LINE NUMBER ERROR	TRS ERRORS	BACK
ILL	GAM	LCK	ANC	CCR	YCR	LNE	TRS	↰

ILL Detects illegal values in the incoming video data stream.
GAM Detects out of gamut values in the incoming video data stream (+3%, -1%)
LCK Indicates the unit is not locked to the incoming video.
ANC Detects illegal values in the ancillary data packets in the the video data stream.
CCR Detects errors in the Chroma CRC of the incoming video data stream.
YCR Detects errors in the Luma CRC of the incoming video data stream.
LNE Detects line numbering errors in the incoming video data stream.
TRS Detects errors in the EAV and SAV values in the incomming video data stream.
↰ Up to the top menu.

Fig 10b

DATA SUB MENU

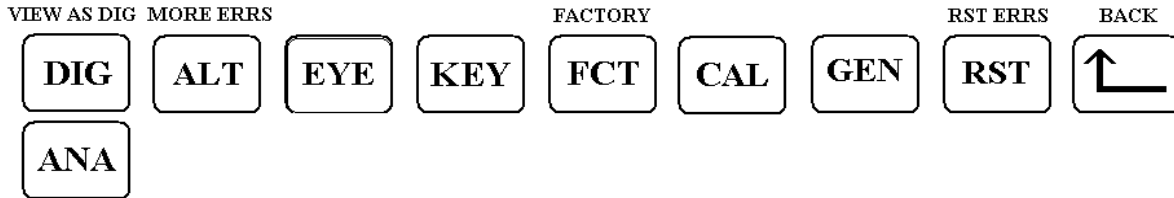The DATA sub menu provides the main accessibility to the EYE Pattern and Generator functionality of the unit. The mainframe is intelligent and automatically senses the Option module installed; therefore if the Generator/TSG module (option3) is installed – then GEN will appear as a selectable function (See Page 21). Likewise if either of the EYE Pattern modules (option 4 or 6) are installed, then EYE will appear as a selectable function (See Page 24)

VIEW AS DIG   MORE ERRS   FACTORY   RST ERRS   BACK

| DIG | ALT | EYE | KEY | FCT | CAL | GEN | RST | ⬑ |

| ANA |

DIG
[DIG] This is the totally digital display mode.
[ANA] This allows an analog representation of the digital input, complete with analog syncs.

ALT
Toggles between two error displays on the top status bar.

HD: | TRS: 0 | Y-CRC: 0 | C-CRC: 0 | LINE: 0 | LCK: 0 |
SD: | TRS: 0 | APCRC: 0 | FFCRC: 0 | | LCK: 0 |
or
| ANC: 0 | ILLEGAL: 0 | GAMUT: 0 |

KEY
Causes an audible "beep" when any key is pressed.

FCT
Resets the unit to a standard default "Factory Setting".
Holding FCT down for more than 2 seconds also resets all the shift settings.

CAL
[0DB] [-5] [-10] [-15] [-20] [-25] [SET] [ ] [⬑]
This calibrates the cable level meter. Use a cable clone to provide the six signal levels in the above sub menu, pressing SET each time.

RST
Resets all the error counters.

⬑
Up to the top menu.

EYE
Selects EYE Pattern features and functionality

GEN
Selects Generator features and functionality.

Fig 11

OPERATING INSTRUCTIONS

DISPLAY SUB MENU

SCALE   H/V DELAY   BATTERY   BACK

| S ↑ | S ↓ | ┼ | SFE | BAT | | | PNG | ↰ |

CABLE LEVEL
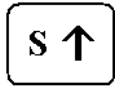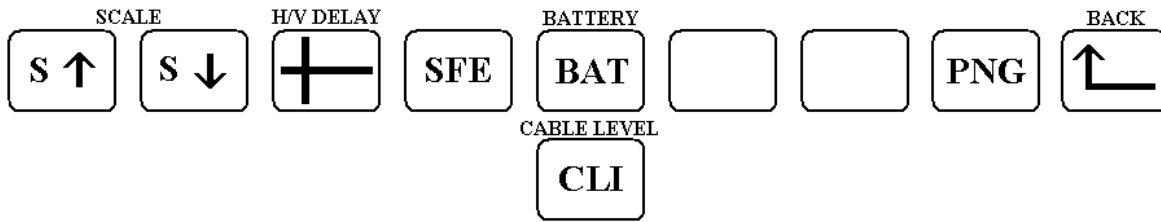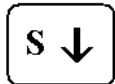
| CLI |

| S ↑ | Increases the scale brightness. |

| S ↓ | Decreases the scale brightness. |

| ┼ | Picture H/V delay to show blanking areas. |
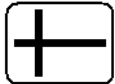
SFE	OFF
	169 Safe area box for 16:9 aspect added to the picture display.
	149 Safe area box for 14:9 aspect added to the picture display.
	4:3 Safe area box for 4:3 aspect added to the picture display.

(Each safe area toggles between safe graphics and safe action as shown in the top status line.)

| BAT | BAT The top status bar displays the battery charge state. |
| | CLI The top status bar displays the signal attenuation caused by the input cable length, in decibels. Displays <5, -10 or -20. If the display reads -20 (db) the signal level is quite low and errors in the signal may begin to occur. |

| PNG | With no signal input, this enables the traditional ping pong game. |

| ↰ | Up to the top menu. |

Fig 12

GENERATOR MODULE

This option provides all the features of Option 1 with the addition of a high specification test signal generator for standard and high definition signals. The control menu is accessed by selecting DATA then GEN in the top menu. The output state is described in the top Status line.

STD : 50HZ   PAT : PLUGE   AUD : GP1

| SD | HD | INT | 101 | STD | PAT | AUD | AUX | ⌐ |

SD Selects standard definition patterns.

HD Selects high definition patterns.

INT
- INT Selects interlaced standards.
- PRG Selects progressive standards.

101 Selects 1/1.001 standards.

STD Selects INT standards 60Hz, 50Hz, 48Hz.
Selects PRG standards 30Hz, 25Hz, 24Hz, 720-60Hz, 720-50Hz.

PAT
- BAR Selects 100% or 75% Colour Bars.
- BOW Selects Bowtie or Split Colour Bars.
- COL Selects full screen Red or White.
- RMP Selects Ramp or Limit-Ramp patterns.
- SWP Selects Sweep or Multiburst patterns.
- PUL Selects Pulse & Bar or Pluge patterns.
- MOD Selects Mod Steps or SDI check patterns.
- OPT For optional patterns, default is SMPTE or Convergence patterns.

AUD
- FRQ Selects frequency to 125Hz, 250Hz, 500Hz, 1kHz, 2KHz, 4KHz, 8KHz.
- AMP Selects amplitudes to 0dB, - 2, - 6, - 8, - 12, - 14, - 18, - 20.
- GP Selects audio group (1 of 4).
- L1 Selects Left channel 1 on/off.
- R1 Selects Right channel 1 on/off.
- L2 Selects Left channel 2 on/off.
- R2 Selects Right channel 2 on/off.

AUX
- YON Selects Y data on/off.
- CON Selects C data on/off.
- MPG Selects Mpeg test moving bar on/off.
- IDT Selects Ident Text on/off.
- EDT Selects Text Edit mode ——— Move cursor [←][→] Select character [↑][↓] Clear text [CLR][⌐]
- CCL Selects circle off, 4:3, 16:9. Freq Change [↑][↓] VCO/GLK [VCO] [SET][⌐]
- CAL Controls the master oscillator
- BNC Switches the EXT-REF BNC to AES out, Sync out, AES/Sync input.

Fig 13
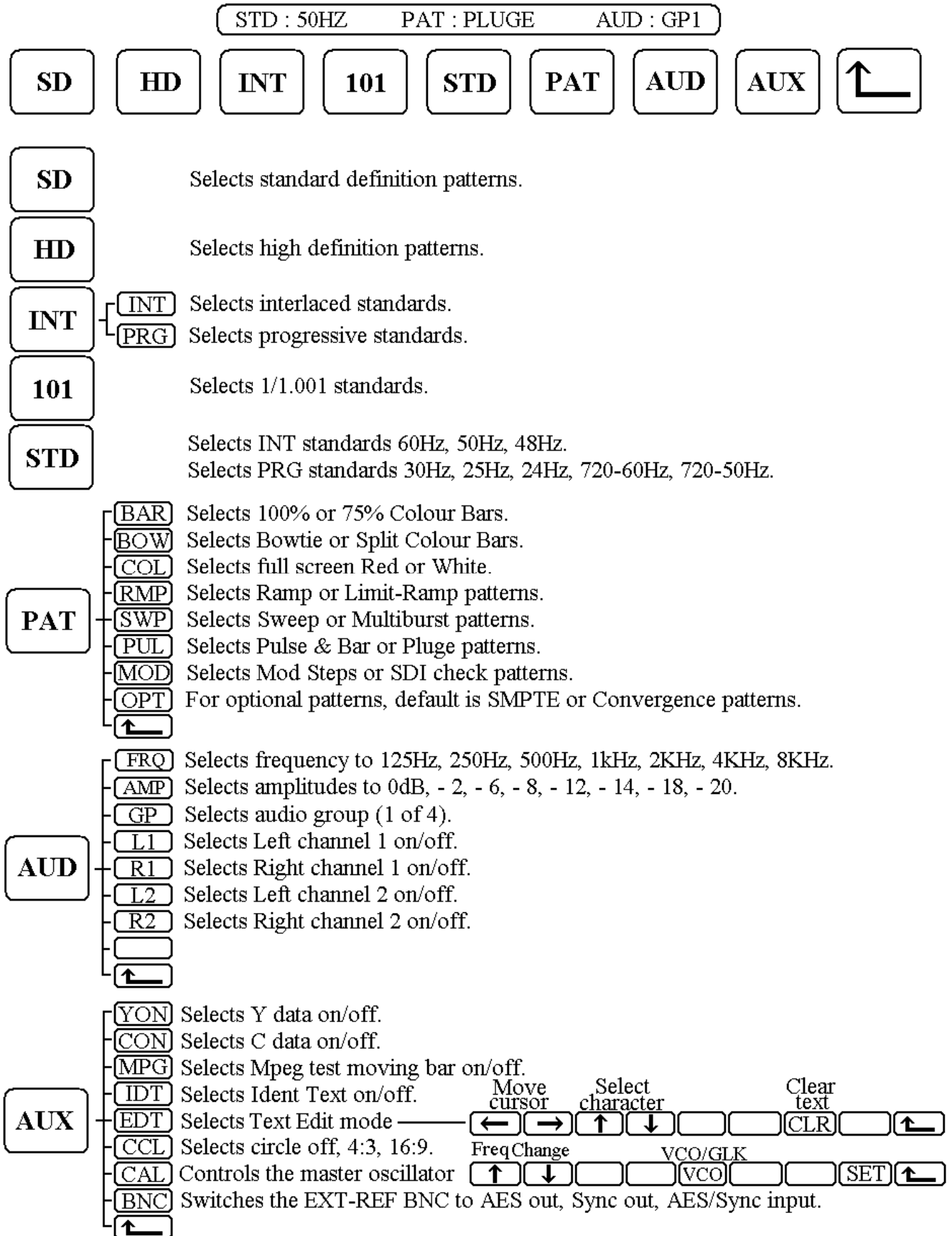
21

<div align="center">**FEATURES**</div>

VIDEO

The video Y and C components can be individually disabled from both outputs.

EMBEDDED AUDIO

Audio tone, with seven frequencies and eight amplitudes, can be embedded into any of the four groups, with individual channel control.

AES AUDIO

Audio tone, as above, can be output in AES format to the EXT BNC.

MPEG TEST

A moving black bar can be added to any pattern to check for stuck frames and MPEG coding errors.

IDENT TEXT

16 of 64 text characters can be superimposed on the selected pattern. To enter new characters or edit an existing ident caption, go to the GEN - AUX - EDT menu. The cursor can be moved to any 1 of 16 positions using the left/right arrows. The character over the cursor can be selected using the up/down arrows, Selecting from 0-9, A-Z, ( ) ! & @ # . + - thus all character spaces can be set. The CLR key sets all characters to a white space.

CIRCLE

A white circle can be added to any pattern in 4:3 or 16:9 aspect ratios.

MASTER OSCILLATOR

The generator clock free running frequency can be calibrated using the menu, in 5ppm steps. Alternatively, it can Genlock to the external reference input.

EXT-REF BNC

This has four functions, selectable in the AUX menu.
1.   AES audio input.
2.   Analogue external reference input.
3.   AES audio output.
4.   Analogue black and syncs output.

All settings are stored when the unit is switched off.

STANDARDS SUPPORTED

SMPTE 259

STANDARD	FRAME RATE		CLOCK
711 x 487 (525)	59.94	2:1 I	13.5MHz
702 x 575 (625)	50	2:1 I	13.5MHz

SMPTE 274M

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

SMPTE 296M

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

PATTERNS

100% BARS
100% full colour bars.
Digital levels are Yblack =64, Ywhite = 940, Cr and Cb are 512 +/- 448 max.

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

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

BOWTIE
Y channel is 500KHz. Cr,Cb channels are 502KHz phase adjusted so equal to Y in mid line. Suitable monitoring equipment, e.g. the Hamlet LCDScope 292WVA, produce (Y-Cr) and (Y-Cb) displays to accurately check system gains and timings, with the traditional bowtie displays.
Y Waveform is 438 bits (350mV) p/p centred on 502 bits (350mV).
C Waveform is 448 bits (350mV) p/p centred on 512 bits (350mV).
Timing markers at +/-5nSec and at every 20nSec.

SWEEP

SD sweeps from 500KHz to 5MHz over the line period, with markers at 1,2,3,4,5 MHz.
HD sweeps from 1MHz to 30MHz over the line period, with markers at 5,10,15,20,25 MHz.
Waveform is 600bits (480mV) p/p centred on 502 bits (350mV).

PLUGE
Grey scale block for colour monitor gain tracking adjustment and grey/superblack stripes for brightness setting.
Block is 940 bits (700mV), 502 bits (350mV), 239 bits (140mV).
Stripes are at 64 +/- 18bits (+/- 14mV).

MULTI
525 SD is a white bar at 765 bits (560mV) followed by six frequency bursts at 500KHz, 1.25MHz, 2MHz, 3MHz, 3.58MHz, 4.2MHz at 526 bits (370mV) p/p centred on 502 bits (350mV).
625 SD is a white bar at 765 bits (560mV) followed by six frequency bursts at 500KHz, 1MHz, 2MHz, 3MHz, 4MHz, 5MHz at 526 bits (370mV) p/p centred on 502 bits (350mV).

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

PULSE+BR
2T luma pulse at 940 bits (700mV), 10T chroma pulse at 502 bits (350mV), bar at 940 bits (700mV).

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

WHITE
Plain full white screen.
Y waveform 940 bits (700mV), Cr is 512 bits, Cb is 512 bits.

RED
Plain full red screen.
Y waveform is 250 bits (149mV), Cr is 960 bits, Cb is 409 bits.

CONVERGE
Crosshatch pattern for colour monitor convergence adjustment.

DIG CHK
Top half of the screen is the equaliser test and contains several examples of 19 "0"s followed by 2 "1"s per frame.
Bottom half of the screen is the phase locked loop test and contains several examples of 20 "0"s followed by one "1" per frame.

RAMP
Y waveform is an ascending ramp, running from 64 bits (0mV) to 940 bits (700mV).
Cr and Cb waveforms are ascending ramps, running from 64 (-350mV) to 960 (+350mV)

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

OUTPUTS - Full 10 bit pattern generation.

SD Serial digital	BNC connector. Output impedance 75 ohms.
	SMPTE 259M, ITU-R BT.601/656 serial component. 800mV pp
HD Serial digital	BNC connector, output impedance 75 ohms.
	SMPTE 292, serial component. 800mV pp

EYE OPTION MODULE

This module provides all the features of the Option 1 module, with the addition of operation at 3G standards and an EYE pattern display in SD, HD and 3G standards. Please read the following in conjunction with the operation manual of the main instrument.

Compatibility

This option is designed to operate in the Hamlet MS9000, DS9000, Flexiscope and Microflex.

Overview

This module allows the display of waveforms, vectors and picture for all SMPTE serial digital video standards from standard definition (525 & 625) up to 3G (1080P50/60). It will also show an EYE pattern display in all these standards. There is a high specification audio de-embedder and an AES receiver, allowing audio bar graph displays of four channels of audio (two from AES) and a vector audio phase display. There is a stereo headphone monitor output jack from a stereo high quality 1-bit DAC.

The serial digital signal itself is analysed to give on-screen readouts of the EDH/CRC word, various digital parameter errors and signal strength in the top of screen status bar.
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.
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.

SMPTE 425M mapping.

The option supports 3G level A and level B mapping.
Level A is the standard single channel 3G interface and the input standard is displayed in the status bar at the top of the screen as HD50P**A**, HD60P**A** (or #HD60P**A** for 1/1.001).
Level B is two channels of HD video and the standards suffix is changed to **B**.
The menu allows selection either channel.

EYE pattern operation in a Flexiscope or Microflex

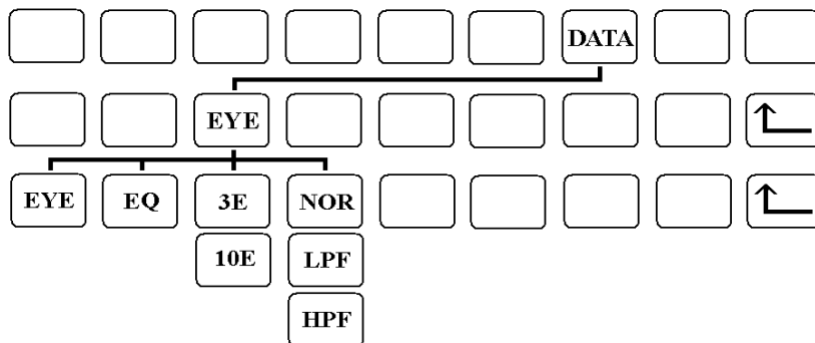Select DATA in the top menu, then select EYE in the sub menu.

Fig 14

EYE turns on the EYE display. The ICON will turn blue.
EQ enables or disables the input equaliser, the icon is coloured blue when enabled.
3E/10E selects a display of 3 eyes or 10 eyes.

NOR/LPF/HPF selects the frequency response of the clock recovery circuit. The loop-bandwidth is normally 1/1000 of the input clock frequency. This is doubled in HPF or halved in LPF, to help identify the frequency of any jitter present.

Cursor measurements

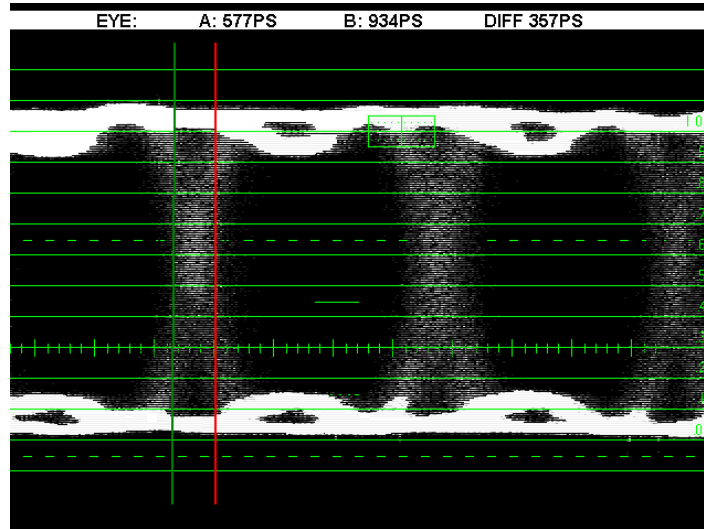Select CURSOR mode in the main menu, then select EYE.

Fig 15

The cursors are controlled by the menu A and B keys front to allow precise timing measurements to be made on the EYE pattern.

Module specification

SD/HD/3G digital input.
BNC connector. Input impedance 75 ohms. Max d.c. +/- 10V.
SMPTE 259M serial digital at 800mV p/p. Auto equalised up to 250 m of cable at 270Mb/s.
SMPTE 292M serial digital at 800mV p/p. Auto equalised up to 230 m of cable at 1.485Gb/s.
SMPTE 424M serial digital at 800mV p/p. Auto equalised up to 170 m of cable at 2.970Gb/s.

SD/HD digital output.
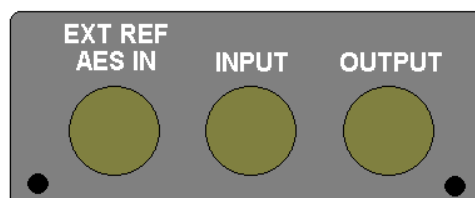BNC connector. Output impedance 75 ohms. Equalised version of the serial digital input.

Ext-ref / AES input.
BNC connector. Input impedance 75 ohms. Max dc +/- 3 volts.
Video 0.5 to 2.0V p/p.
Digital Audio min 150mV p/p, max 3V p/p conforming to S/PDIF,
AES3, IEC60958 or EIAJ CP1201.

Eye Measurement Basics

Eye diagrams are a very successful way of quickly and intuitively assessing the quality of a digital signal. A properly constructed eye should contain every possible bit sequence from simple 101's and 010's, through to isolated ones after long runs of consecutive zeros and other problem sequences that often show up weaknesses present in system design.
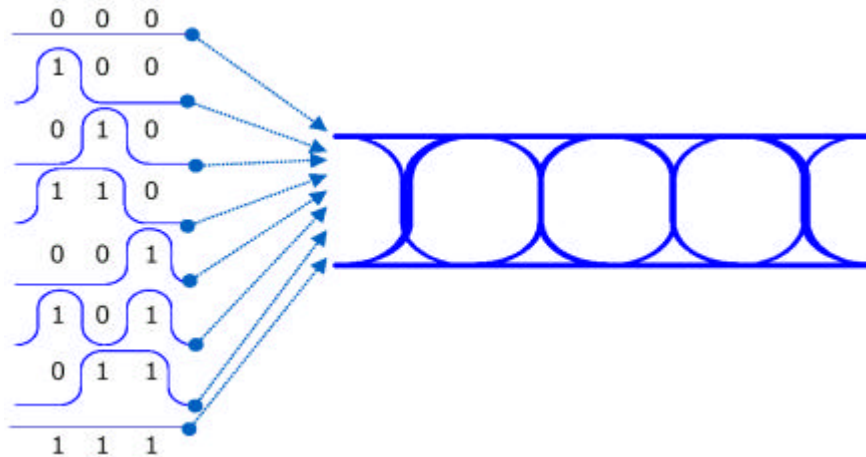

Fig 26
Overlaying of bit sequences to form and eye diagram.

Eye diagrams show parametric information about the signal – effects deriving from physics such as system bandwidth health etc. It will not show protocol or logical problems – if a logic 1 is healthy on the eye, this does not reveal the fact that the system meant to send a zero. However, if the physics of the system mean that a logic one becomes so distorted while passing through the system that the receiver at the far end mistakes it for a zero, this should be shown in a good eye diagram. Common ways of characterizing an eye are to measure the rise times, fall times, jitter at the middle of the crossing point of the eye, the overshoot present and many other numerical descriptions of eye behavior in order to compare devices being measured.

Jitter

As there is no separate clock available, the display has to trigger from recovered clock.
Circuits used for recovering clock typically have a loop bandwidth, or filtering function, that removes from the clock signal some of the jitter that was present on the data signal. Depending upon the measurement being made, this can be helpful or hurtful, but needs to be understood. Narrow loop bandwidth clock recovery tends to give a rock solid clock trigger signal as the reference, and any jitter, or movement of edges with time, in the data eye diagram that is present will be displayed. This is a useful absolute measure but might not properly represent the jitter seen by a real system if the receiver uses clock recovery to track some of the jitter out.

Clock recovered from the data signal using a narrow loop bandwidth clock recovery scheme.

Wide bandwidth clock recovery tends to let more of the jitter that was present on the data signal through on to the clock. This can mean that as the data jitters by moving edges in one direction, then the other; the recovered clock tracks it, and the resulting eye appears to have very little jitter present on it. This tracking function is the way many system receivers work to reduce the jitter passed on through the system.

Conditions can also conspire to create the opposite effect, where the delay between data signal and trigger signal is such that when the data edges are moving to their furthest extent in one direction, the recovered clock signal being triggered from it is moving to its furthest extent in the other, and the resulting eye shows as much as twice the jitter that was present on the data signal.

Equalisation

Long cable runs attenuate the higher frequency components in the serial data stream, effectively closing the eye. Although modern equalisers can compensate for this, there is still a limit, typically only 100 metres or so at 2.970Gb/s.
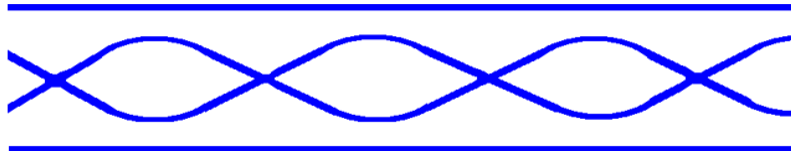
Closing eye due to high frequency attenuation.

Signal Specifications

SMPTE 259M
Amplitude 800mv +/- 10%
Rise and fall times between 0.4nS and 1.5nS. The difference should be less than 0.5nS.
Data rate is 270MHz
Cycle width is 1UI = 3.7nS
Jitter allowed is 0.2UI = 0.74nS

SMPTE 292M
Amplitude 800mv +/- 10%
Rise and fall times no greater than 0.27nS . The difference should be less than 0.1nS.
Data rate is 1485MHz
Cycle width is 1UI = 0.673nS
Jitter allowed is 1.0UI = 0.673nS

SMPTE 424M
Amplitude 800mv +/- 10%
Rise and fall times no greater than 0.27nS . The difference should be less than 0.1nS.
Data rate is 2970MHz
Cycle width is 1UI = 0.337nS
Jitter allowed is 2.0UI = 0.673nS

INSTALLATION OF SOFTWARE

Equipment needed to remote control the Hamlet Flexiscope or Microflex:

PC running Win98 or later.
Software: CDROM supplied by Hamlet
USB lead with type A to mini B connectors.

From the supplied CDROM

Fit the Hamlet MicroFlex CD to your CD-ROM Drive,
If the CD Drive does not start automatically double click on the setup.exe file on the CD.
Follow the onscreen instructions. This will install various utilities & programs in a folder C:\Program Files\Microflex_rem on your PC.

For Win XP Computers (disconnect from internet if using XP + SP1)

Power up the MicroFlex & plug in the USB cable from it to the PC.
The PC should detect the new USB device & launch the 'New Hardware Wizard'
which will ask for the location of the required drivers.
Tick the 'Install from list or specific location1' option....Next
Tick 'search for best driver in these locations and tick 'include this location in search'
Use Browse to navigate to folder C:\Program Files\Microflex_rem......Next

If a warning about 'Windows Logo testing' appears, click 'Continue anyway' ... Finish

For Win98 Computers

Power up the Microflex & plug in the USB cable from it to the PC.
The PC should detect the new USB device & launch the 'New Hardware Wizard'
which will ask for the location of the required drivers.
Tick the 'Search for best driver' option....Next
Use Browse to navigate to folder C:\Program Files\Microflex_rem........Next
If 'Insert Hamlet disk' message appears, ignore it & press OK.
If 'Can't find FTD2XX.CAT' message appears, ignore it & press 'Skip File'....Finish

If the PC does not launch the 'New Hardware Wizard'

1)   Check that the USB cable is correct & the MicroFlex switched is on.
2)   Some drivers may already be installed on your PC, to check:
        Go to Start...Control Panel...System...Hardware...Device Manager
        scroll down the list to look at the USB controllers, click Properties.
3)   You can delete old drivers using Control Panel:
        Start...Control Panel...Add/Remove Programs
        Scroll down list till see FTDI USB drivers or Hamlet MicroFlex USB Drivers
        then Delete.

TO RUN THE REMOTE CONTROL UTILITY

From the Desktop click Start then 'Programs' then select the MicroFlex option from the list
Double clicking will launch the utility or drag it onto the desktop to make a shortcut for easy use in future.

The utility consists of 2 main parts:
An Error logger, which can download a recorded list of errors gathered by the unit.
This list can be viewed on the PC by scrolling the displayed list, it can be printed out on the computer's printer
or the error logger in the unit can be deleted if required.

Commands which download the actual 'on screen picture' from the unit.
The Waveform, Vector or Audio displays can be downloaded.
This can be done once or continuously.
The picture can be stored on the PC as a .BMP file, also previously stored pictures
may be recalled for display.

Logger Commands

Get Log
This button downloads the stored errors from the MicroFlex.
They are displayed in the message area on the screen in the following format. The top 2 lines lists the types of
error that the unit has been set to monitor, these are as follows:

TRS Means the unit is monitoring CODE errors eg SAV & EAV errors.
LNE Means monitoring LINE number errors in HD video.
CRC1 Means monitoring AP CRC errors (Active picture CRC) in SD video streams
        or Y CRC errors in HD video.
CRC2 Means monitoring FF CRC errors (Full Field CRC) in SD video streams
        or C CRC errors in HD video streams.
ANC Means monitoring errors in the ancillary data packets in SD or HD video streams.
LCK Means monitoring for the unit not locking on the incoming video stream.
GAM Means monitoring for out of GAMUT levels in the active video area.
ILL   Means monitoring for ILLEGAL levels in the active video area.

The Errors are then listed in a table.
The error number is listed first starting at 1 and going up to a possible 940.
The type of error is next, taken from the selection the unit was set to monitor.
Note: If 2 or more errors occur at the same time the message MULTI is displayed
The video standard being input at the time the error occurred is next.
The time the error occurred is displayed at the end of the line.

The standards are abbreviated as follows:

60 Hz:	is 1929 x 1080 60Hz Interlaced
59.94 Hz	is 1929 x 1080 60/1.001Hz Interlaced
50 Hz	is 1929 x 1080 50Hz Interlaced
48 Hz	is 1929 x 1080 48Hz Interlaced
47.95 Hz	is 1929 x 1080 48/1.001Hz Interlaced
30 Hz	is 1929 x 1080 30Hz Progressive
29.97 Hz	is 1929 x 1080 30/1.001Hz Progressive
25 Hz	is 1929 x 1080 25Hz Progressive
24 Hz	is 1929 x 1080 24Hz Progressive
23.97 Hz	is 1929 x 1080 24/1.001Hz Progressive
525	is SD 525 lines 60Hz Interlaced
625	is SD 625 lines 50 Hz Interlaced
720 60	is 1280 x 720 60Hz Progressive
#720 60	is 1280 x 720 60/1.001Hz Progressive
720 50	is 1280 x 720 50Hz Progressive
Unknown	is unknown standard

A typical log may look like this:

```
---------------------------------------------------------------
MONITORED ERROR TYPES
TRS, GAM, LCK, ILL


    ERROR      STD HOUR MIN SEC
1: ILLEGAL  525    14     23  01
2: GAMUT    525    14     30  24
3: LOCK     525    15     24  56
4: LOCK     525    15     25  56
5: LOCK     525    15     31  56
6: LOCK     525    15     34  56
7: LOCK     525    15     44  56
8: LOCK     525    15     44  57
9: LOCK     525    15     44  03
----------------End of Log------------------------------
```

This means the MicroFlex was monitoring the following error types:
TRS (CODE), GAMUT, UNLOCK and ILLEGAL errors.

The first error was an ILLEGAL error in a 525 video stream and occurred at 14/23/01
The second error was an GAMUT error in a 525 video stream and occurred at 14/30/24
etc.

Print Log
This will print the displayed log to the PC's printer.

Erase Log
This will erase the logged error data stored in the Microflex.

Download Picture Commands

1 Frame
This command causes 1 frame to be downloaded from the unit and be displayed on the screen, this command only works with Waveforms, Vectors and Audio displays.

Continuous
This command causes frames to be downloaded from the unit continuously and be displayed on the screen, this command only works with Waveforms, Vectors and Audio displays.

Stop
This command cancels the Continuous mode.

Print
This command will send the display to your printer.

Files
This command calls the file handling window where the displayed picture can be
stored to disc or recalled.

To store a displayed picture as a .BMP file select the Drive required and the Folder in that drive using the list boxes provided, then type in the name you wish to call the file, eg mypicture.bmp Then click the **Store** button

To display a stored .BMP file select the Drive required and the Folder in that drive
using the list boxes provided, then click on the file you wish to use, eg mypicture.bmp
Then click the **Display** button, the file will be displayed in the main window.

The **Cancel** button returns to the main window.

Auxiliary Commands

Clear clears the display areas.
Exit closes the utility.

ADDITIONAL FUNCTIONS

Vertical interval timecode
If there is a VITC signal on the Composite or SDI input video, this is decoded and replaces the clock display on the status bar. A letter "V" is added to the left of the display to identify VITC display mode. The error logger will also use the VITC time.

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, factory set mode can be established to allow faster use.

Select the [DATA] icon, then the Factory settings icon [FCT].

To store and recall user settings
8 sets of front panel setting can be stored for later recall.

To Store Settings: From the WFM, VEC or AUD menus, select [AUX] then [STO] and a number from 1 to 8.

To Recall the settings: From the WFM, VEC or AUD menus, select [AUX] then [RCL] and a number from 1 to 8.

Power Source
The Hamlet Microflex can be powered from the supplied adaptor, providing 12V @ 1 amp regulated, or from internal rechargeable batteries.

To avoid damage to the Microflex when using a power source other than the supplied adapter, please ensure that it has a 12V regulated output rated at 1.0 amps minimum and has a 2.1mm plug with a negative ground and a negative centre lead.

Battery Charging
When external power is supplied, the internal batteries are automatically charged, whether or not the unit is switched on. Charging takes 3 hours from flat, when the charge current automatically drops to trickle.

TECHNICAL SPECIFICATION

INPUTS WITH SD-CST MODULE

INPUT   BNC connector. Input impedance 75 ohms. Max d.c. +/- 10V.
                      SMPTE 259M serial digital at 800mV p/p.
                      Auto equalised up to 350 metres of cable at 270Mb/s.
                      PAL or NTSC composite video 0.5 to 2.0V p/p.

SDI output.   BNC connector. Output impedance 75 ohms. Equalised version of the
      serial digital input.

Ext-ref / AES input. BNC connector. Input impedance 75 ohms. Max dc +/- 3 volts.
                      Video 0.5 to 2.0V p/p.
                      Digital Audio min 150mV p/p, max 3V p/p conforming to S/PDIF,
                      AES3, IEC60958 or EIAJ CP1201.

INPUTS WITH HD-SD MODULE

SD/HD digital input. BNC connector. Input impedance 75 ohms. Max d.c. +/- 10V.
                      SMPTE 259M serial digital at 800mV p/p.
                      SMPTE 292M high definition serial digital at 800mV p/p.
                      Auto equalised up to 350 metres of cable at 270Mb/s.
                      Auto equalised up to 140 metres of cable at 1.485Gb/s.

SD/HD digital output. BNC connector. Output impedance 75 ohms. Equalised version of the
      serial digital input.

Ext-ref / AES input. BNC connector. Input impedance 75 ohms. Max dc +/- 3 volts.
                      Video 0.5 to 2.0V p/p.
                      Digital Audio min 150mV p/p, max 3V p/p conforming to S/PDIF,
                      AES3, IEC60958 or EIAJ CP1201.

AUDIO MONITORING OUTPUT

3.5mm stereo jack socket and internal loudspeaker.

REMOTE CONTROL

USB

TECHNICAL SPECIFICATION

POWER

12V d.c. to 2.1mm jack, centre negative, 1.0A max.

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 0.95Kg with option 1 fitted.

DISPLAY AREAS

Display	72.0mm x 52.6mm viewing area.
Resolution	640 pixels wide x 480 pixels high.

WAVEFORM MONITOR

Response - SD	Flat is +/- 1% 50Hz to 5.5MHz (25.0MHz in HD modes). Low Pass is -3db @ 1.5MHz, -60db @ 6.75MHz.
Timebase	H, 2H and Hmag (x5). V, 2V and Vmag. Line select is any line from the frame. Parade is YCrCb left to right.

VECTOR MONITOR

Video	Traditional component display. Accuracy 0.2%. B/width 3.4MHz (12MHz in HD).
Audio	Stereo phase display of CH1 or CH2 audio pair. Phase accuracy 2 deg.

AUDIO MONITOR

Accuracy	Better than 0.1db over full scale range.
Characteristics	BBC, EBU, Nordic, VU, Digital & DIN.

TROUBLE SHOOTING

Unit appears dead:
Check that the 12V supply adaptor is plugged into the unit and that this is plugged into an operational mains supply, or if unplugged, that the batteries are charged.

No video displayed:
If there is no video signal connected to the selected input, the screen will display the message "No Signal".

Unusual display:
The unit may be set to a non-standard mode. Reset the unit as follows.
Select the [DATA] icon, then the Factory settings icon [FCT].
If the menus can't be accessed, the Microflex may need to be re-booted. Switch off the unit and then switch on again while holding down the left hand menu key. The key should be held down for at least four seconds.

Displays not locked:
May be in external reference mode. Press the menu EXT REF key to cancel. This may need pressing twice to step through the HFT mode.

No vector display:
Audio vectors may have been selected.

COMPOSITE 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 CRT 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 18 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 19 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.
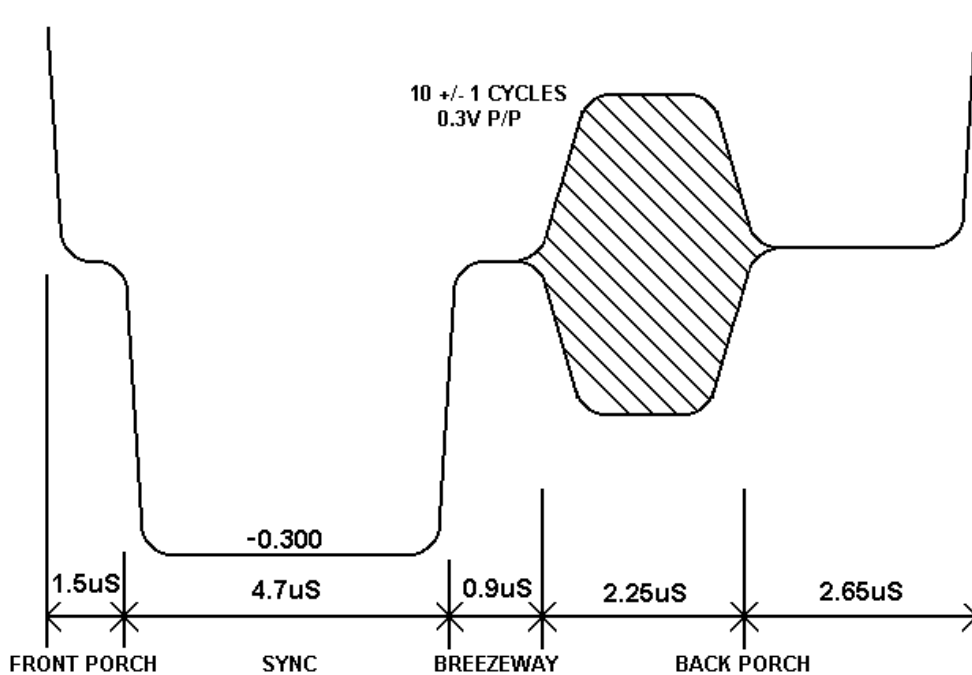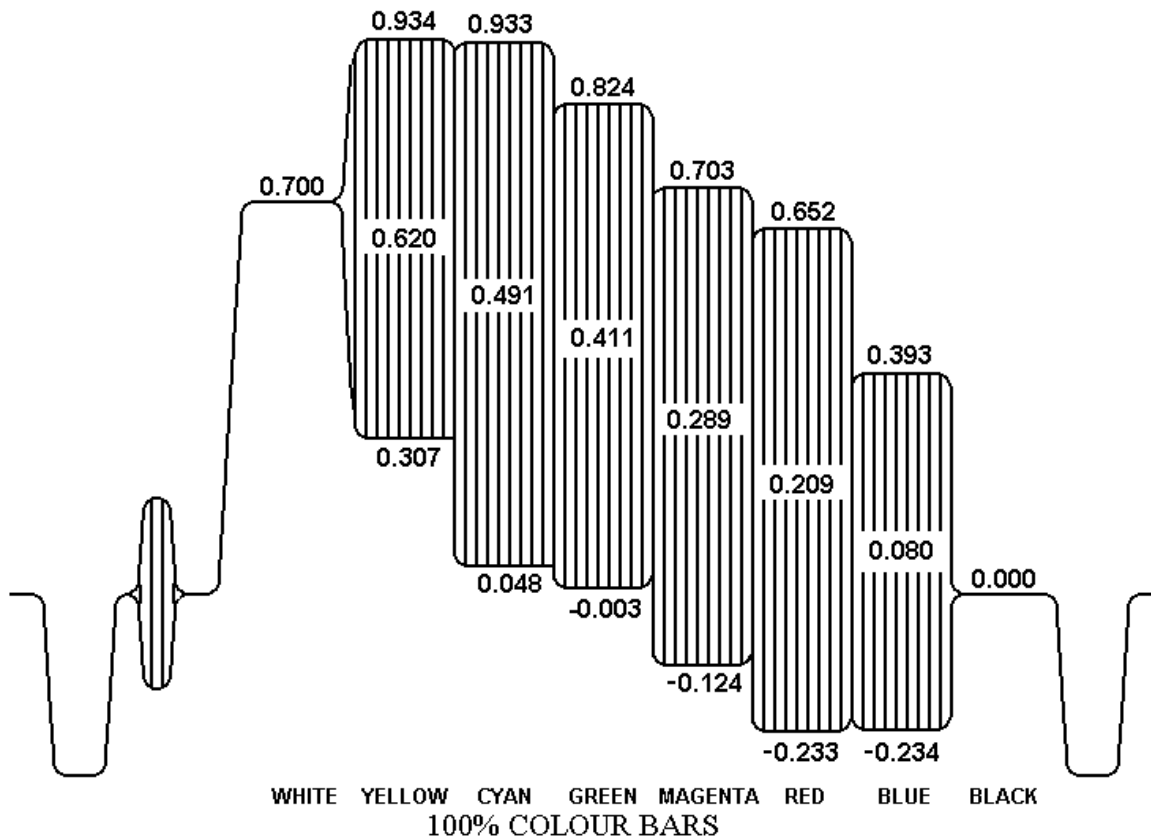
PAL BASICS

100% COLOUR BARS

Fig 17

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

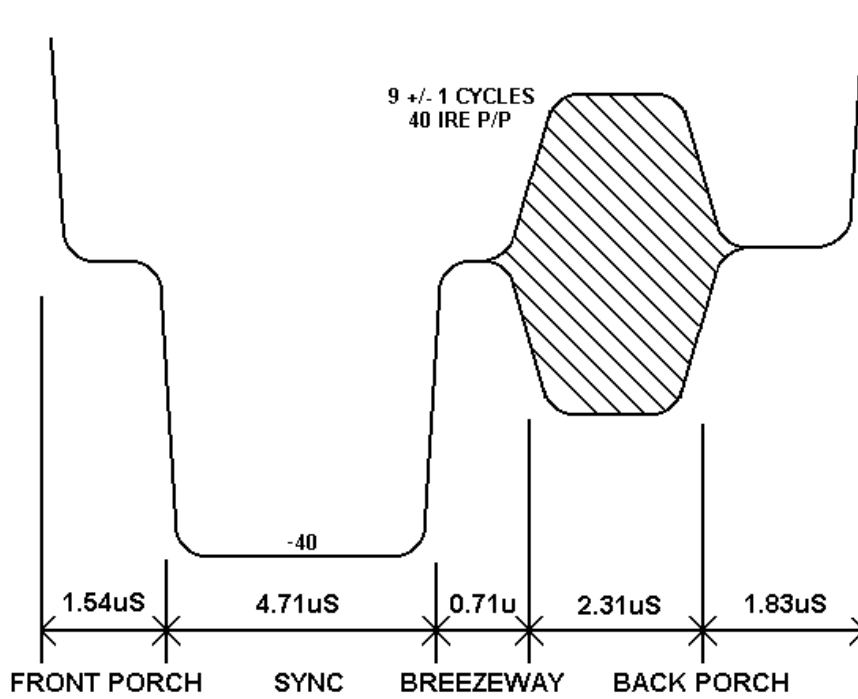| 1.54uS | 4.71uS | 0.71u | 2.31uS | 1.83uS |

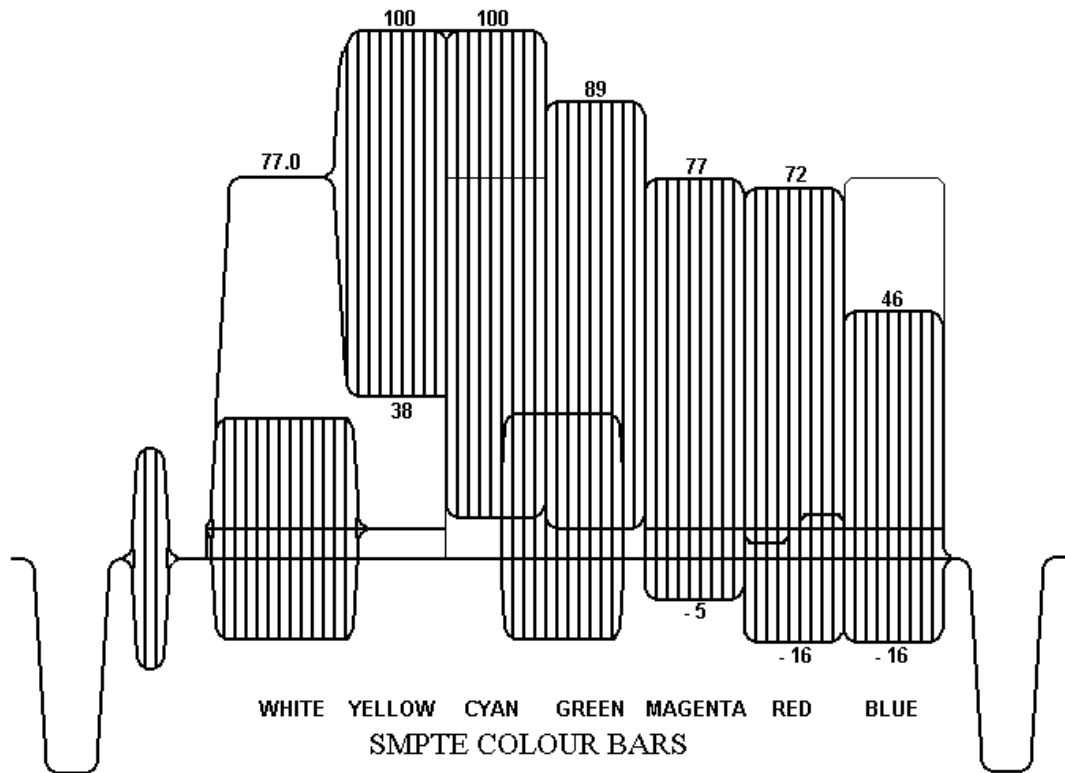FRONT PORCH   SYNC   BREEZEWAY   BACK PORCH

Fig 18

SD 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 15.

Each TRS consists of 4 words:
1) 3ff hex ie all '1's
2) 000 hex ie all '0's
3) 000 hex ie 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'

SD SERIAL DIGITAL BASICS

The period between EAV and SAV is not used by normal video and is available for other purposes eg: 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.

SD SERIAL DIGITAL BASICS

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.

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.
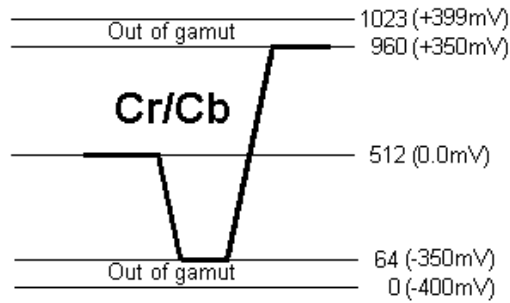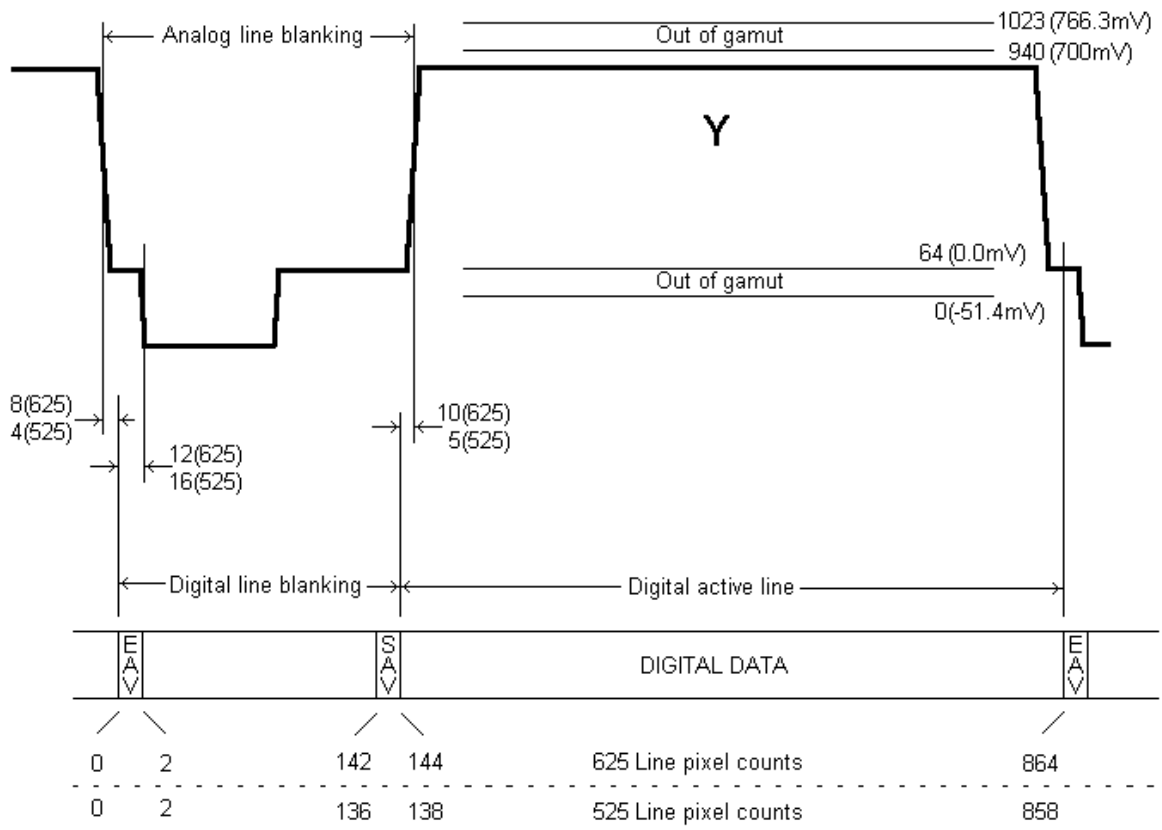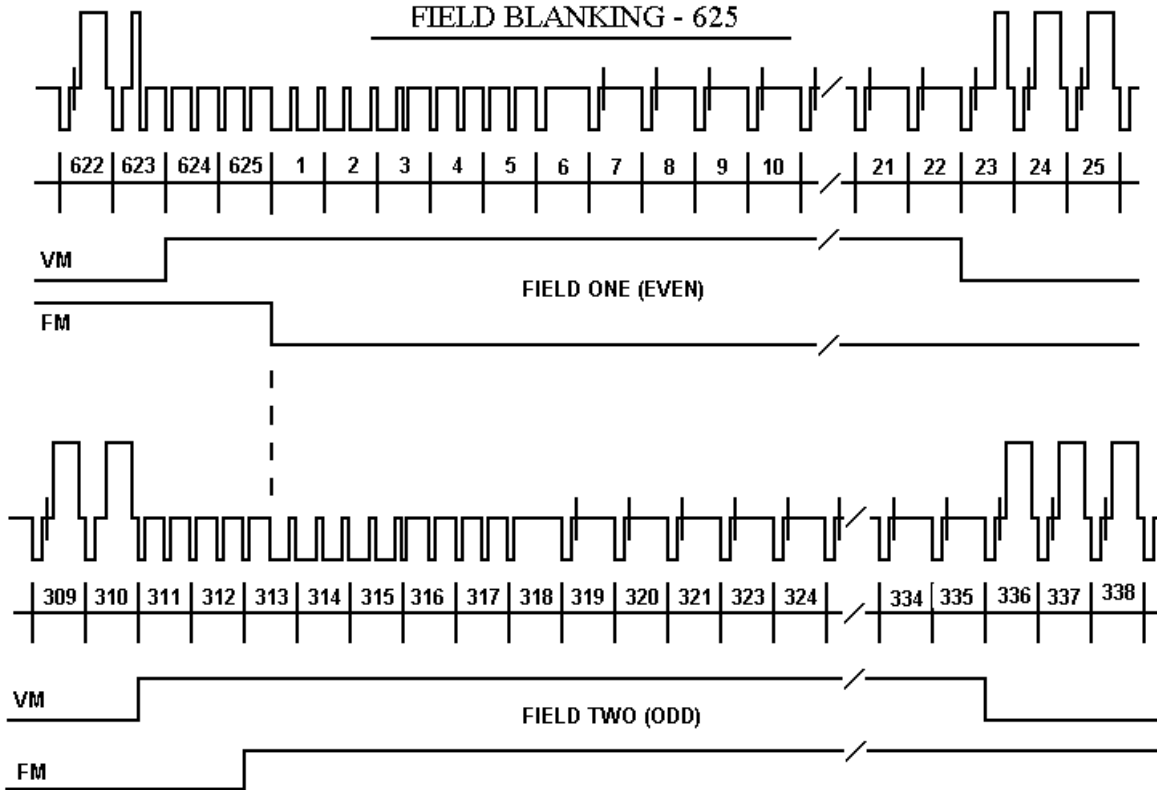
Fig 19

SERIAL DIGITAL BASICS
FIELD BLANKING - 625

| 622 | 623 | 624 | 625 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 21 | 22 | 23 | 24 | 25 |

VM

FIELD ONE (EVEN)

FM

| 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 323 | 324 | 334 | 335 | 336 | 337 | 338 |

VM

FIELD TWO (ODD)

FM

FIELD BLANKING - 525

| 525 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 18 | 19 | 20 | 21 |

VM

FIELD ONE (EVEN)

FM

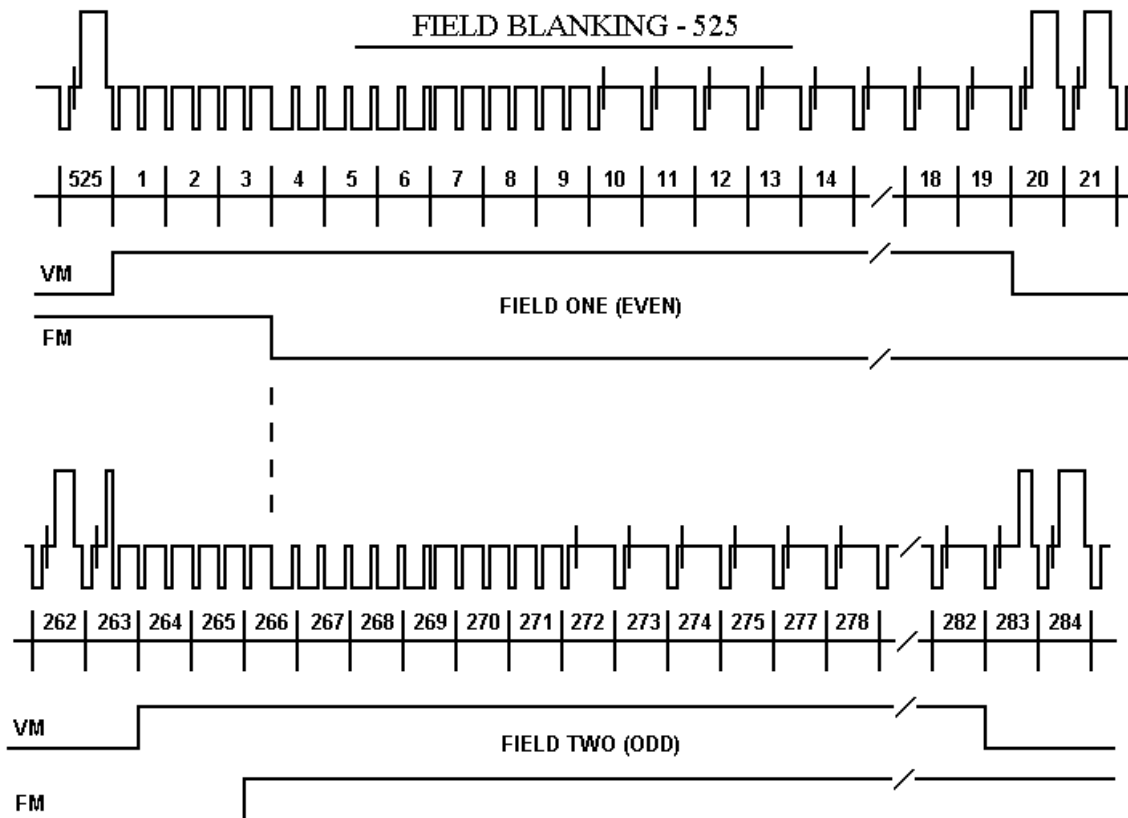| 262 | 263 | 264 | 265 | 266 | 267 | 268 | 269 | 270 | 271 | 272 | 273 | 274 | 275 | 277 | 278 | 282 | 283 | 284 |

VM

FIELD TWO (ODD)

FM

Fig 20/21

HD SERIAL DIGITAL BASICS

BIT SERIAL DIGITAL INTERFACE DEFINED BY SMPTE 292M.

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

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

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

The 74.25MHz Y and C streams are then interleaved to produce a single stream at 148.5MHz.
This data is then scrambled and serialised using a None Return to Zero (NRZ) code to produce a 1.485 GHz signal.

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

1) 3FF hex ie all '1;s
2) 000 hex ie all '0's
3) 000 hex ie all '0's
4) XYZ, which determines the type of TRS pulse, consisting of:

Bit 9:   Always '1'
Bit 8:   0=frame 1, 1=frame 2
Bit 7:   0=normal 1=field blanking
Bit 6:   0=SAV 1=EAV
Bit 5:   Bits used for Hamming correction.
Bit 4:   Bits used for Hamming correction.
Bit 3:   Bits used for Hamming correction.
Bit 2:   Bits used for Hamming correction.
Bit 1:   Always 0
Bit 0:   Always 0

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

ILLEGAL VALUES

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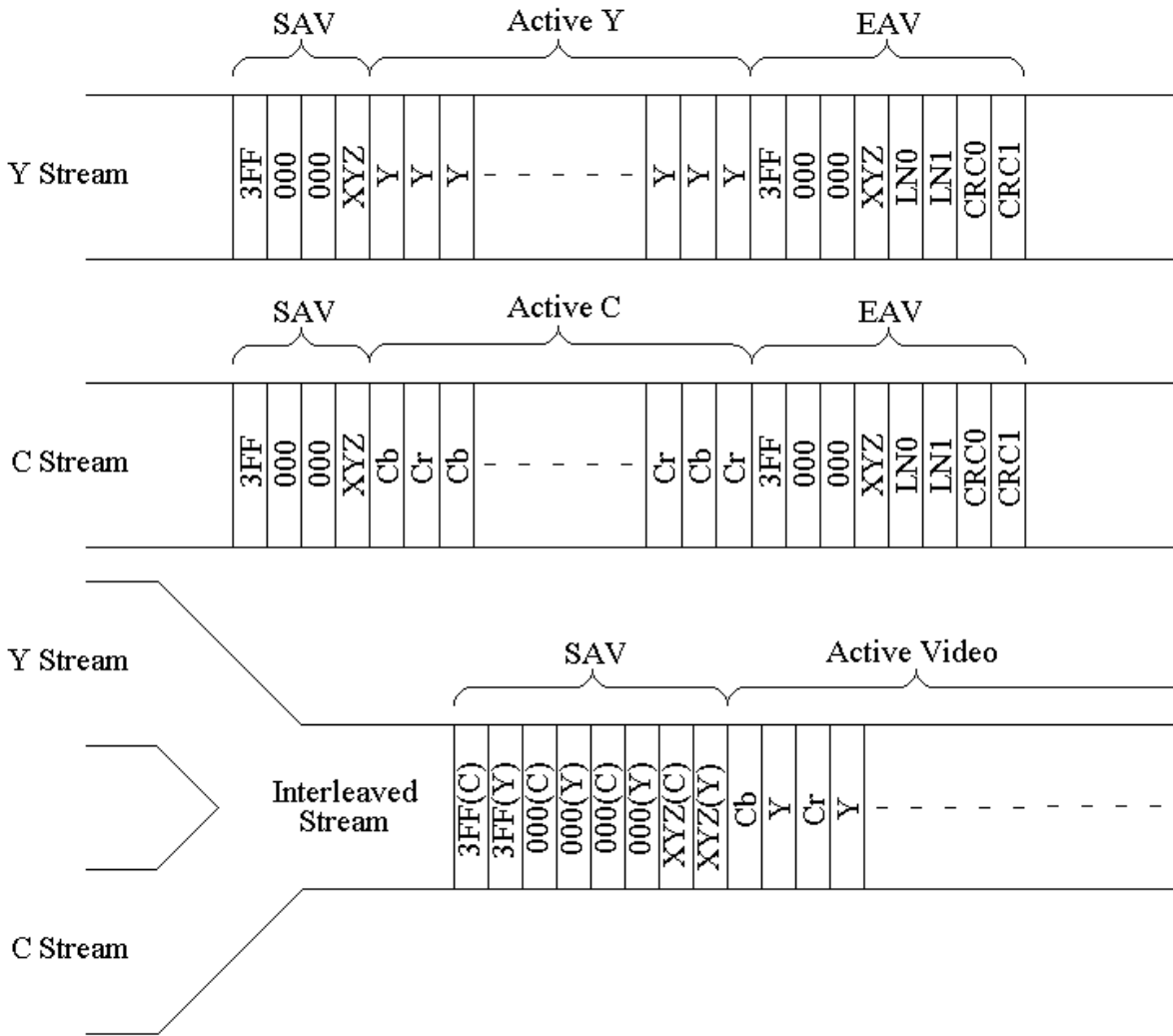
SAMPLE STRUCTURE

Fig 22

PARALLEL DIGITAL INTERFACES

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

SMPTE 274M

Several sub-standards for this are defined:

1920 x 1080/60/2:1
1920 samples/active line   1080 active line/frame   30PsF segmented format.
74.25 MHz Sample frequency   2200 total samples/line   1125 total lines/frame

1920 x 1080/59.94/2:1
1920 samples/active line   1080 active line/frame   29.97PsF segmented format.
74.176 MHz Sample frequency   2200 total samples/line   1125 total lines/frame
This standard gives an exact frame rate compatibility with NTSC.

1920 x 1080/50/2:1
1920 samples/active line   1080 active line/frame   25PsF segmented format.
74.25 MHz Sample frequency   2640 total samples/line   1125 total lines/frame

1920 x 1080/30/1:1
1920 samples/active line   1080 active line/frame   30 Hz Progressive scan.
74.25 MHz Sample frequency   2200 total samples/line   1125 total lines/frame

1920 x 1080/29.97/1:1
1920 samples/active line   1080 active line/frame   29.97 Hz Progressive scan.
74.176 MHz Sample frequency   2200 total samples/line   1125 total lines/frame
This standard gives an exact frame rate compatibility with NTSC.

1920 x 1080/25/1:1
1920 samples/active line   1080 active line/frame   25 Hz Progressive scan.
74.25 MHz Sample frequency   2640 total samples/line   1125 total lines/frame

1920 x 1080/24/1:1
1920 samples/active line   1080 active line/frame   24 Hz Progressive scan.
74.25 MHz Sample frequency   2750 total samples/line   1125 total lines/frame

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

1920 x 1080/23.98/1:1
1920 samples/active line   1080 active line/frame   23.98 Hz Progressive scan.
74.176 MHz Sample frequency   2750 total samples/line   1125 total lines/frame

SMPTE 296M

Several substandards for this are defined:

<u>1280 x 720/60/1:1</u>
1280 samples/active line   720 active line/frame   60 Hz Progressive scan.
74.25 MHz Sample frequency   1650 total samples/line   750 total lines/frame

<u>1280 x 720/59.94/1:1</u>
1280 samples/active line   720 active line/frame   59.94 Hz Progressive scan.
74.176 MHz Sample frequency   1650 total samples/line   750 total lines/frame

<u>1280 x 720/50/1:1</u>
1280 samples/active line   720 active line/frame   50 Hz Progressive scan.
74.25 MHz Sample frequency   1980 total samples/line   750 total lines/frame

EMBEDDED AUDIO

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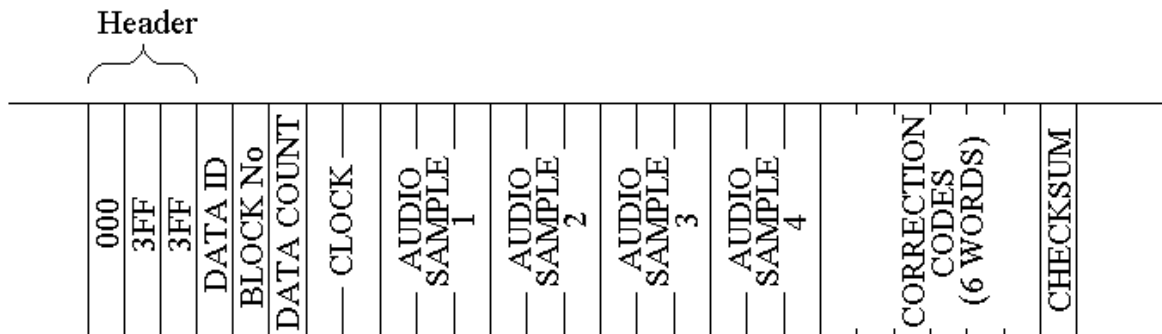
A packet consists of:

Fig 23

HD SERIAL DIGITAL BASICS

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

Data ID: This contains the Audio group number.

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

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

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

Audio Sample 1: Consists of four words

Audio Sample 2: Consists of four words

Audio Sample 3: Consists of four words

Audio Sample 4: Consists of four words

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

Check Sum This is the sum of all previous words in the packet except the header words.
Each audio packet contains a sample of all four audio signals
eg: Channel 1 left, Channel 1 right, Channel 2 left and Channel 2 right.
Each audio signal requires 3 words to hold all 24 bits, thus each audio packet has 12 words of audio data.
Typically one or two packets are sent in each EAV-SAV period.
These audio data packets are placed in the Chroma data stream only.

Audio Control Packets.
The audio control packet structure is similar to the audio data packet.
Data in the packet includes the audio sample rate eg 48 KHz,
the number of active channels out of the possible 4,
the delay information between Channel 1 audio and Channel 2
and delay information between Channel 3 audio and Channel 4.
Audio control packets are placed in the Luminance Stream, this is sent once per frame in the second line after the switching point.

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

USEFUL WEBSITES

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

CONTACT DETAILS AND CUSTOMER SUPPORT

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

Corporate Head Office
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: service@hamlet.co.uk   Web site: www.hamlet.co.uk

Hamlet USA
Sencore, Inc.
3200 W Sencore Drive, Sioux Falls SD 57107, U.S.A.
Phone: (605) 339-0100
Fax: (605) 339-7032
Toll Free: 1-800-SENCORE (736-2673)
Toll Free: 1-866-4-HAMLET (426-538)
Email: service@sencore.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.

INTERNAL BATTERIES FITTED

The Batteries and Accumulators (Placing on the Market) Regulations 2008 implement in the UK the Internal Market provisions of the European Parliament and Council Directive on Batteries and Accumulators and Waste Batteries and Accumulators 2006/66/EC.

In accordance with Regulation 7 of these regulations, information is provided on the battery specifications and on their ready removal.

MAIN BATTERIES

To access the batteries, undo the four posidriv screws on the rear of the case and lift off the case bottom part. The batteries are then immediately accessible.

Due to the need for a permanent connection to maintain data integrity for the clock, data logger and calibration information, the batteries are soldered in, so need to be de soldered. In the view of Hamlet Video International Ltd, for safety they should be removed by a suitably qualified person.

The battery type is 4 x NiMH tagged 1.2V AA cells with 2.7Ah capacity.

ANCILLARY BATTERY

There is also a small Lithium coin cell incorporated, which is not readily removable, but which is designed to out-last the life of the product.

NiMH
Li