HD9155 and HD9155Q Series
High Definition
Production Afterburner

Instruction Manual

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INFORMATION TO USERS IN EUROPE

NOTE

CISPR 22 CLASS A DIGITAL DEVICE OR PERIPHERAL

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to the European Union EMC directive. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

INFORMATION TO USERS IN THE U.S.A.

NOTE

FCC CLASS A DIGITAL DEVICE OR PERIPHERAL

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

WARNING

Changes or Modifications not expressly approved by Evertz Microsystems Ltd. could void the user's authority to operate the equipment.

Use of unshielded plugs or cables may cause radiation interference. Properly shielded interface cables with the shield connected to the chassis ground of the device must be used.

REVISION HISTORY

REVISION	DESCRIPTION	DATE
1.0	Original Version	Oct 01
1.1	Added HD9155-AUD	May 02
1.1.1	Updated Firmware upgrade instructions for AES and AUD versions	Jun 02
1.2	Added HD9155Q and HD9155Q-AUD	Jun 02
1.3	Updated Specifications	Sep 02

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CHAPTER 1: OVERVIEW

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1. OVERVIEW

The HD9155 Series Production Afterburners are a family of powerful devices designed to facilitate the creation of off-line videotapes from field acquired HDTV masters. The Production Afterburner downconverts the HDTV input video to SDI and analog standard definition video. When the input video is in the 1080p/24sF format the HD9155 Series Production Afterburners also create a 2:3 pulldown on the output video to create a 30 Fps output.

The Production Afterburners read the LTC or RP188 ancillary timecode and make burn-in windows and new 30 Fps timecode that is in sync with the downconverted video. The original 24 Fps timecode numbers can be placed in the user bits of the VITC and displayed as a burned-in window. The 2:3 cadence can be controlled from the ancillary timecode or from the LTC. The Production Afterburners automatically generate video timecode for the standard definition VTR that is converted from 24 to 30 Fps, and delayed to match the complete A frame cycle of video delay through the Production Afterburner.

The HD9155 Production Afterburners can be easily configured using 9150 Configware™ software utility supplied with the unit. These graphical software interfaces allow the user to store multiple configurations for the HD9155 and load them as required.

The HD9155 Series Production Afterburners are available in two downconverter qualities. The original HD9155 versions have a monitoring downconverter and provide two SDI and two analog downconverted outputs with characters and VITC suitable for 'on the set' monitoring or compressed digitisation in an non-linear editing system. The HD9155Q versions have a high quality downconverter and provide two clean SDI downconverted outputs with VITC suitable for creation of high quality viewing copies. The HD9155Q versions also provide one SDI and one analog monitoring output with VITC and Characters suitable for 'on the set' monitoring or creation of tapes for non-linear editing systems.

When the AUD option is installed (model HD9155-AUD and HD9155Q-AUD), the Production Afterburner now has the ability to de-embed AES audio from the incoming HD bitstream, and delay it so that it is in time with the output video from the downconverter. The AUD option provides 2 AES outputs and 4 analog audio outputs and a front panel headphone jack for monitoring the audio.

Some early units were fitted with the AES option (model HD9155-AES - these units were discontinued with the introduction of the HD9155-AUD model). These units also have the ability to de-embed AES audio from the incoming HD bitstream, and delay it so that it is in time with the output video from the downconverter. The AES option provides 2 AES outputs and a reclocked HD video output in time with the input video.

The chart below summarises the features of each of the models.

Feature	HD9155	HD9155-AES (discontinued)	HD9155-AUD	HD9155Q	HD9155Q-AUD
Downconverter	Monitoring	Monitoring	Monitoring	Presentation	Presentation
Clean outputs with VITC *	---	---	---	2 SDI	2 SDI
Monitor outputs with VITC and Characters	2 SDI 2 Analog	2 SDI 2 Analog	2 SDI 2 Analog	1 SDI 1 Analog	1 SDI 1 Analog
Delayed Audio Outputs	---	2 AES	2 AES 4 Analog	---	2 AES 4 Analog
Front Panel Audio Monitoring	---	---	Yes	---	Yes

* Clean outputs can be programmed as additional monitor outputs with characters if required

Features:

- Accepts SMPTE 292M 1080i/59.94, 1080i/50, 1080p/29.97sF, 1080p/25sF, 1080p/23.98sF and serial digital video
- Downconverts HDTV inputs to SDTV and creates VITC and window burns on SDI and analog outputs
- Reads RP188 ancillary timecode
- Creates 2:3 pulldown when downconverting 1080p/23.98sF video to NTSC.
- 2:3 cadence is determined from a 6Hz pulse input, RP188 timecode or LTC
- Converts aspect ratio from 16:9 to 4:3 in anamorphic, letterbox or centre crop mode
- LTC timecode reader and generator converts 24 Fps to 30 Fps and re-times the timecode to the output video
- Control from 9150 Configware™ software
- AUD versions provides AES and analog audio delayed to match the video output
- AUD versions provides front panel monitoring of audio

1.1. HOW TO USE THIS MANUAL

Throughout this manual the term HD9155 will be used to refer to all members of the family of products. Where necessary specific model numbers will be used to distinguish features or specifications that do not apply to all models.

This manual is organised into 6 chapters: Overview, Installation, Operation, Configuring using Configware™, System Parameters, and Technical Description. The overview section contains a brief overview of the HD9155 series operation and features, a tutorial on 2:3 pulldown and a glossary to define concepts and terms used throughout the remainder of the manual. We highly recommend taking the time to become familiar with the terms and concepts described here before proceeding into the rest of the manual.

Chapter 2 gives a detailed description of the rear panel connectors, and how the Production Afterburner should be connected into your system.

Chapter 3 gives a detailed description of the operation of the Production Afterburner. It includes details on front panel switches and LED indicators and a detailed discussion of how to operate the Production Afterburner as a downconversion device for master tapes acquired directly in HDTV video.

Chapter 4 gives detailed information on installing and connecting the 9150 Configware™ software. The Configware™ software allows you to customise the operation of the HD9155.

Chapter 5 gives a discussion of how the default operation of the Production Afterburner can be changed using System Parameters. The system parameters can affect the system timing through the Production Afterburner, placement of characters on the raster, 2:3 cadence control, functions of parallel inputs and outputs to name a few.

Chapter 6 gives a discussion of how to update the firmware in the Production Afterburner and other technical details including specifications.

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CHAPTER 2: INSTALLATION

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2. INSTALLATION

There are currently five members of the HD9155 Series Production Afterburner family each one with a slightly different feature set. The five rear panels are shown below with a description of each of the input and output connectors.

2.1. REAR PANEL OVERVIEW

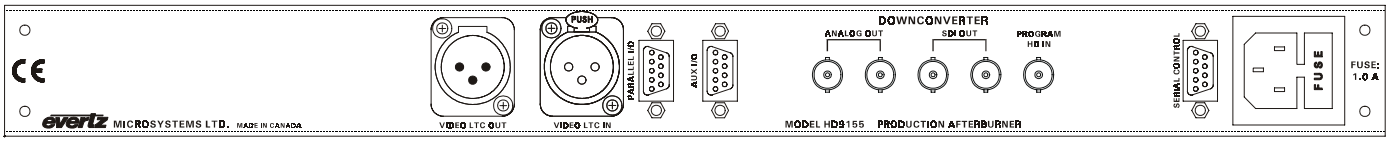

Figure 2-1: HD9155 Rear Panel

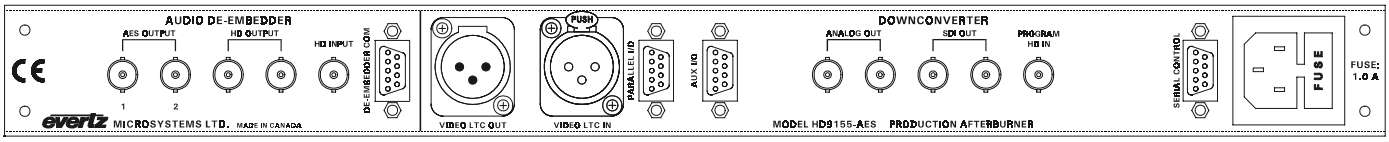

Figure 2-2: HD9155-AES Rear Panel

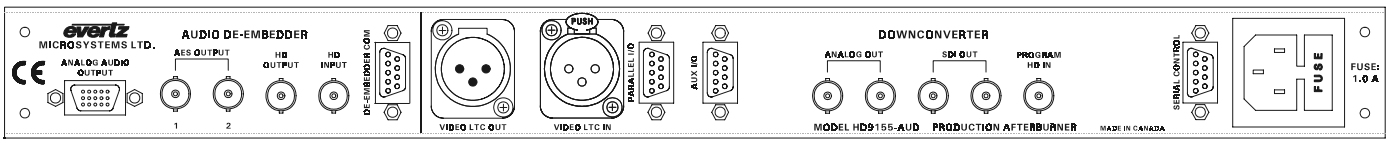

Figure 2-3: HD9155-AUD Rear Panel

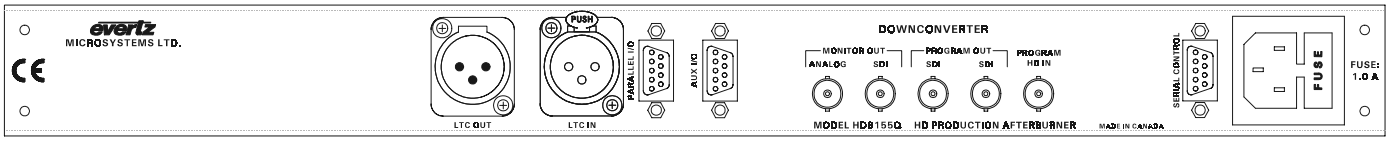

Figure 2-4: HD9155Q Rear Panel

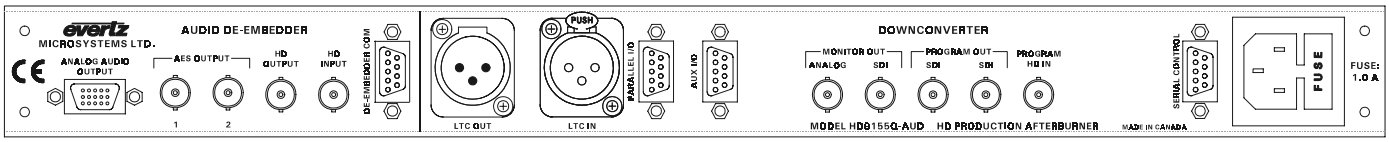

Figure 2-5: HD9155Q-AUD Rear Panel

The following sections describe the purpose of the rear panel connectors of the HD9155 series units. Sections 2.1.1 to 2.1.7 describe the specific video, audio, and timecode signals that should be connected to the HD9155. Some of the connectors are only present on certain versions.

-

2.1.1. Downconverter Video Connections (Models HD9155, HD9155-AES, HD9155-AUD)

HD PROG IN Input BNC connector for 10-bit serial digital video signals, compatible with the SMPTE 292M standard. The HD9155 is capable of working with video formats shown in Table 2-6. This input normally contains video from the camera with embedded RP 188 ancillary time code that is used to make character burns, VITC, and to control the 3:2 Pulldown of the output video. On the HD9155-AES and HD9155-AUD model this input will normally be connected to the HD active loop through output from the De-embedder section of the unit.

SDI OUT These 2 BNC connectors are used to output the downconverted input video as serial component video, compatible with the SMPTE 259M standard. When the input video format is 1080p/24sF, 3:2 pulldown will be inserted to generate the 29.97 Fps video output. These outputs may have VITC and character burn-ins inserted.

ANALOG OUT These 2 BNC connectors are a monitor grade composite analog output derived from the SDI output video and are normally connected to an analog monitor or video recorder.

2.1.2. Downconverter Video Connections (Models HD9155Q, HD9155Q-AUD)

HD PROG IN Input BNC connector for 10-bit serial digital video signals, compatible with the SMPTE 292M standard. The HD9155Q is capable of working with video formats shown in Table 2-6. This input normally contains video from the camera with embedded RP 188 ancillary time code that is used to make character burns, VITC, and to control the 3:2 Pulldown of the output video. On the HD9155Q-AUD model this input will normally be connected to the HD active loop through output from the De-embedder section of the unit.

PROGRAM SDI OUT These 2 BNC connectors are used to output the downconverted input video as serial component video, compatible with the SMPTE 259M standard. When the input video format is 1080p/24sF, 3:2 pulldown will be inserted to generate the 29.97 Fps video output. These “clean” outputs normally have VITC inserted but can be programmed to also have characters. (See section 5 for information about using the System Parameters) They are normally connected to a SDI video recorder for creation of presentation quality viewing copies.

MONITOR SDI OUT This BNC connector is used to output the downconverted input video as serial component video, compatible with the SMPTE 259M standard. When the input video format is 1080p/24sF, 3:2 pulldown will be inserted to generate the 29.97 Fps video output. These outputs normally have VITC and characters inserted and are normally connected to a SDI monitor or video recorder for creation of offline editing copies.

MONITOR ANALOG OUT This BNC connector is a monitor grade composite analog output derived from the monitor SDI output video and is normally connected to an analog monitor or video recorder for creation of offline editing copies.

2.1.3. Audio De-Embedder Video Connections (model HD9155-AES, HD9155-AUD and HD9155Q-AUD Only)

HD IN Input BNC connector for 10-bit serial digital video signals, compatible with the SMPTE 292M standard. The HD9155 Audio De-embedder is capable of working with video formats shown in

Table 2-6. This input normally contains video with embedded audio and should be connected to the video from the camera.

HD OUT BNC connector provides reclocked outputs from the HD IN video. This output will be connected to the HD PROGRAM IN connector of the Downconverter section of the unit. On the HD9155-AES there is an additional output that can be used to make a backup recording of the camera output.

AES OUT These 2 BNC connectors provide AES audio that has been de-embedded from group 1 of the HD bitstream and delayed so that it is in time with the video output of the downconverter.

ANALOG AUDIO OUTPUT (HD9155-AUD and HD9155Q-AUD only) This 15 pin high density D connector provides 4 channels of analog audio that has been de-embedded from group 1 of the HD bitstream and delayed so that it is in time with the video output of the downconverter. Connect the audio breakout cable (Part # WA-2EV) provided with the unit to the D connector. The other end of the breakout provides 4 Male XLR connectors, one for each of the channels.

HD9155-AUD End			**XLR End**		
15 pin High Density D Male with Shell	**Pin**	**Belden 9501**	**Pin**	**3 Pin XLR Male**	**Label:**
A1-	4	Black	3	Audio -	Audio 1
A1+	5	Red	2	Audio +	
A1 Gnd	3	drain	1	Sig Gnd	
Frame Gnd	Shield		Shield	Frame Gnd	
A2-	14	Black	3	Audio -	Audio 2
A2+	15	Red	2	Audio +	
A2 Gnd	7	drain	1	Sig Gnd	
Frame Gnd	Shield		Shield	Frame Gnd	
A3-	9	Black	3	Audio -	Audio 3
A3+	10	Red	2	Audio +	
A3 Gnd	8	drain	1	Sig Gnd	
Frame Gnd	Shield		Shield	Frame Gnd	
A4-	12	Black	3	Audio -	Audio 4
A4+	13	Red	2	Audio +	
A4 Gnd	11	drain	1	Sig Gnd	
Frame Gnd	Shield		Shield	Frame Gnd	

Table 2-1: WA-2EV Audio Breakout Cable

2.1.4. Video Recorder Timecode Connectors

VIDEO LTC IN: A Female XLR connector for input of SMPTE/EBU linear time code from video recorder. The frame rate of this LTC input will correspond to the HD9155's input video frame rate. This input is used as a Jam sync source for the Video time code generator when the Input Time code source is set to LTC using the 9150 Configware™ software. The LTC input will also be used to control the 2:3 cadence of the downconverter output video when there is no 6 Hz pulse or RP188 timecode present.

VIDEO LTC OUT: A Male XLR connector for the output of SMPTE/EBU linear time code to the video recorder. This output will be jam synced to the RP188 ancillary timecode on the incoming HD video, adjusted for the 5 frame (at 29.97 Fps) video processing delay through the HD9155. When the HD Video input is in the 1080p/24sF video format, the input timecode rate of 24 Fps will be converted to 30 Fps timecode such that the zero frame of the second is coincident. The LTC out can also be jam synced to incoming LTC by setting the Video TC source to LTC using the 9150 Configware™ software.

2.1.5. Parallel I/O Connections

PARALLEL I/O: A 9 pin female 'D' connector contains several general purpose parallel remote control inputs and outputs. Table 2-2 shows the default functions of the Parallel I/O connector pins. The functions of the pins shown are the power up defaults; however, the functions of pins 1, 4, 5, 8, and 9 may be changed by changing the default system parameter values. See chapter 5 for more information about the functions of the I/O connector pins by changing system parameters using the 9150 Configware™ software.

Pin #	Name	Description
1	6 Hz In	6 Hz Sequence Input
2	Reserved	
3	Reserved	
4	Vid Std	Video Standard Select
5	Vout SEQ	Output Video Sequence (3:2)
6	GND	Ground
7	Reserved	
8	VCGOnOFF	Characters On/Off
9	6 Hz	6 Hz Sequence Out

Table 2-2: Parallel I/O Connector Default Pin Definitions

2.1.6. Serial I/O Connections

SERIAL CONTROL: A 9 pin female 'D' connector for connection to a computer running the 9150 Configware™ software. This port is also used for firmware upgrades to the HD9155. The pinout of this connector is such that a ‘straight-thru’ cable can be used to connect to the computer COM port. See section 2.7 for a cable wiring diagram and more information on connecting the HD9155 to the computer.

Pin #	Name	Description
Shield	GND	Chassis ground
1		
2	TxD	RS-232 Transmit Output
3	RxD	RS-232 Receive Input
4		
5	Sig Gnd	RS-232 Signal Ground
6		
7	RTS	RS-232 RTS Input
8	CTS	RS-232 CTS Output
9		

Table 2-3: Serial Control Connector Pin Definitions

AUX I/O: A 9-pin female 'D' connector for connection to a PC terminal program. This port is used to output troubleshooting messages to a PC and should only be used with the instruction of Evertz Factory personnel.

Pin #	Name	Description
Shield	GND	Chassis ground
1		
2	TxD	RS-232 Transmit Output
3	RxD	RS-232 Receive Input
4		
5	Sig Gnd	RS-232 Signal Ground
6		
7	RTS	RS-232 RTS Input
8	CTS	RS-232 CTS Output
9		

Table 2-4: Aux I/O Connector Pin Definitions

DE-EMBEDDER COM: (HD9155-AES, HD9155-AUD and HD9155Q-AUD only) This 9-pin female 'D' connector is used for firmware upgrades to the Audio De-embedder module. The pinout of this connector is such that a ‘straight-thru’ cable can be used to connect to the computer COM port. See section 2.7 for a cable wiring diagram and more information on connecting the HD9155 to the computer.

Pin #	Name	Description
Shield	GND	Chassis ground
1		
2	TxD	RS-232 Transmit Output
3	RxD	RS-232 Receive Input
4		
5	Sig Gnd	RS-232 Signal Ground
6		
7	RTS	RS-232 RTS Input
8	CTS	RS-232 CTS Output
9		

Table 2-5: De-Embedder COM Connector Pin Definitions

2.1.7. Power Connections

LINE: The HD Production Afterburner has a universal power supply operating on either 115v/60 Hz or 230v/50 Hz AC operation.

2.2. MOUNTING

The HD Production Afterburner is equipped with rack mounting angles and fits into a standard 19 inches by 1.75 inches by 17.75 inches (483 mm x 45 mm x 451mm) rack space. The mounting angles may be removed if rack mounting is not desired.

2.3. POWER REQUIREMENTS

Power requirements are 115 or 230 volts AC at 50 or 60 Hz. The HD Production Afterburner has a universal power supply that automatically senses the input voltage. Power should be applied by connecting a 3-wire grounding type power supply cord to the power entry module on the rear panel. The power cord should be minimum 18 AWG wire size; type SVT marked VW-1, maximum 2.5 m in length.

The power entry module combines a standard power inlet connector, two 5 x 20 mm fuse holders and an EMI line filter.

2.3.1. Changing the Fuses

The fuse holder is located inside the power entry module. To change the fuses, disconnect the line cord from the power entry module and pull out the fuse holder from the power entry module using a small screwdriver. The fuse holder contains two fuses, one for the line and one for the neutral side of the mains connection. Pull out the blown fuse and place a fuse of the correct value in its place. Use slo blo (time delay) 5 x 20 mm fuses rated for 250 Volts with a current rating of 1 amp. Carefully reinsert the fuseholder into the power entry module.

Never replace with a fuse of greater value.

2.4. TYPICAL CONFIGURATIONS

Figure 2-6 shows the typical connections to the HD9155-AUD when it is used on the set. HDSDI video with embedded audio and RP188 timecode from the Camcorder is fed directly to the Audio De-embedder section. The audio is de-embedded, delayed to be in time with the downconverted video and output as AES and analog audio. An active loop through of the HDSDI video is available to connect to the downconverter section of the HD9155. When neither the AUD or AES option is installed connect the HDSDI video from the camera directly to the PROGRAM HDSDI input on the downconverter section of the unit.

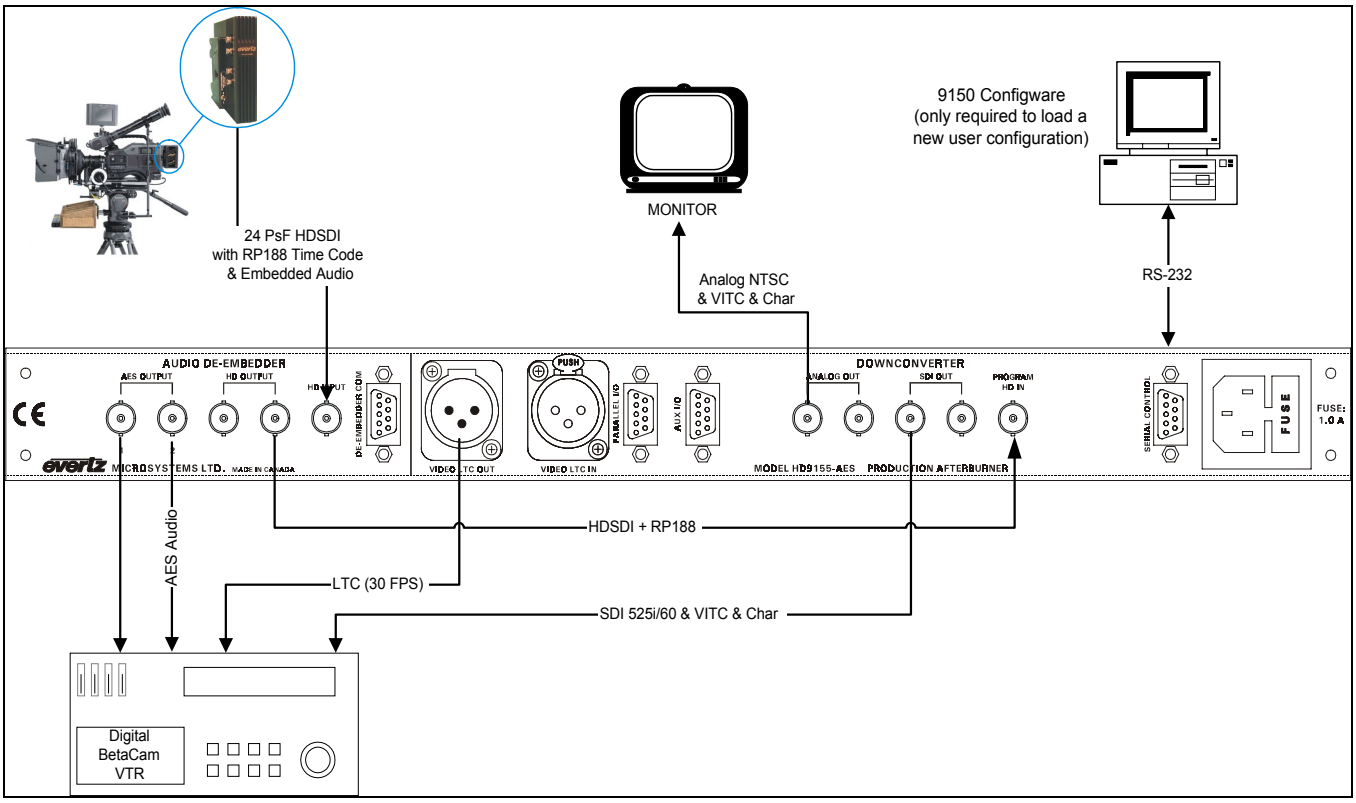

Figure 2-6: Typical Configuration "On the Set"

Figure 2-7 shows the typical connections to the HD9155-AUD when it is used in the studio. HDSDI video with embedded audio and RP188 timecode from the VTR is fed directly to the Audio De-embedder section. The audio is de-embedded, delayed to be in time with the downconverted video and output as AES and analog audio. An active loop through of the HDSDI video is available to connect to the downconverter section of the HD9155. When neither the AES nor AUD option is installed connect the HDSDI video from the VTR directly to the PROGRAM HDSDI input on the downconverter section of the unit.

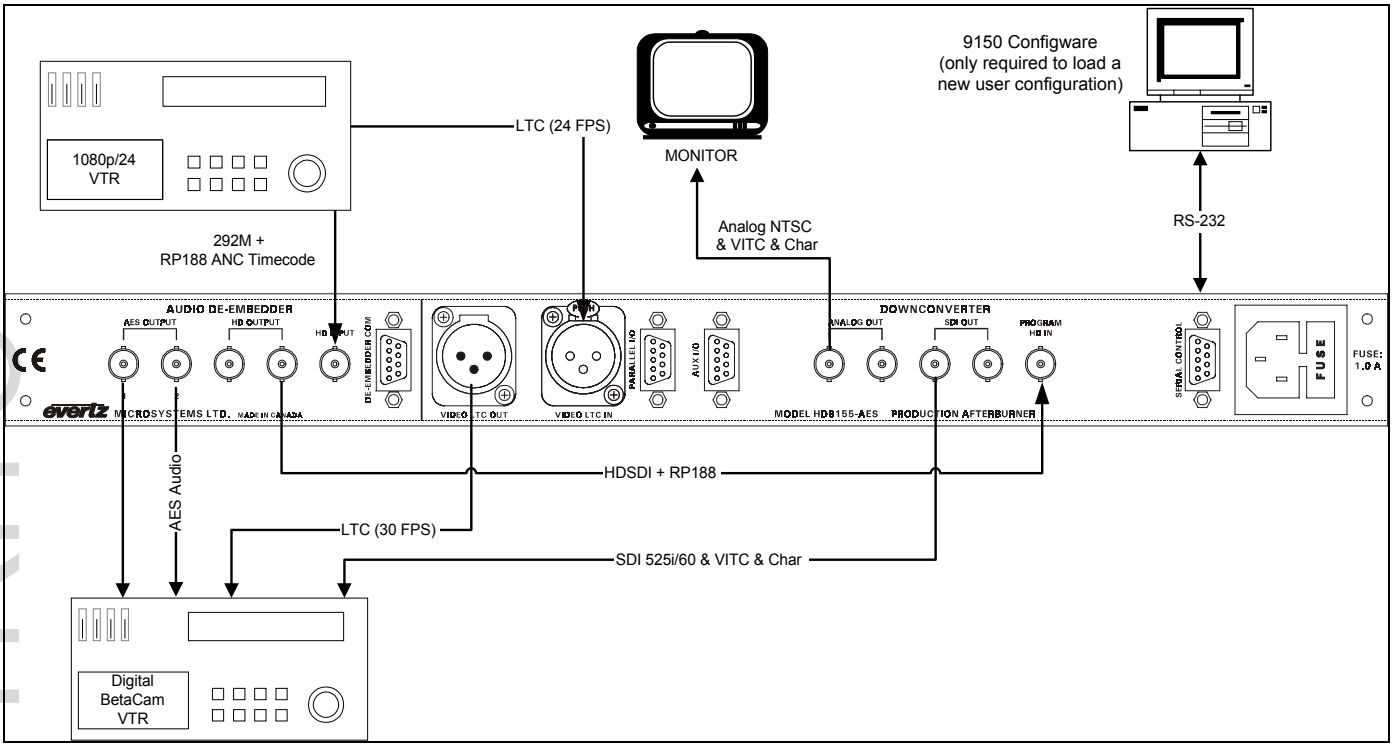

Figure 2-7: Typical Configuration in the Studio

The downconverted outputs of the original HD9155 versions are monitoring quality and contain VITC and burned in characters. There are two SDI and two composite analog (NTSC or PAL) outputs that contain the same video and may be connected to video input of the standard definition VTR or used for on the set monitoring.

The downconverted outputs of the HD9150Q versions are presentation quality. Two Program SDI outputs with VITC are “clean” of burned in characters and may be connected to an SDI VTR to create high quality viewing copies of the program material. There is also one SDI output and one composite analog (NTSC or PAL) output with VITC and Burned in characters and may be used for on the set monitoring or editing copies.

If the HD video tape has RP188 ancillary timecode there is no need to connect the LTC from the HD VTR. The Production Afterburner’s LTC output contains 30 Fps timecode that is in time with the downconverted video and should be connected to the LTC input of the record VTR.

2.5. CONNECTING THE VIDEO

2.5.1. Video Input and output

The Production Afterburner requires that a serial digital HDTV video source be connected to the HD PROGRAM IN BNC on the downconverter. The HD9155 may be configured to accept High definition digital video in the formats shown in Table 2-6. The HD9155 video standard will autodetect the input video type by default or may be set to specifically match the incoming video type using the 9150 Configware™ software. The HD program video will normally be connected to the video output of a HD video camera or HD VTR.

Common Name	Pixels / Active Lines	Frame Rate	Progressive /Interlace	SMPTE Standard
1080i/59.94	1920 x 1080	29.97 (30/1.001)	I	274M
1080i/50	1920 x 1080	25	I	274M
1080p/23.98sF	1920 x 1080	23.98 (24/1.001)	P (sF)	RP211

Table 2-6: Video Input Formats

When one of the audio de-embedder options is fitted (models HD9155-AES, HD9155-AUD or HD9155Q-AUD) the HD program video should be connected to the HD INPUT BNC on the De-embedder section of the unit. The active loop through HD Output from the de-embedder should be connected to the HD PROGRAM IN BNC on the downconverter section. On the model HD9155-AES the second HD output from the de-embedder may be used to provide a backup recording of the camera video.

On the HD9155 versions the SDI OUT outputs contain a monitoring quality downconverted copy of the input video with VITC and optional characters keyed in. The ANALOG OUT outputs are composite analog video outputs with the same information as the SDI OUT outputs. On the HD9155Q versions the MONITOR SDI OUT output contains a high quality downconverted copy of the input video with VITC and optional characters keyed in. The ANALOG OUT output is a monitoring quality composite analog video output with the same information as the MONITOR SDI OUT output. In addition the Hd9155Q versions provide two PROGRAM SDI outputs with VITC only. (The PROGRAM SDI outputs can be programmed to behave like the MONITOR SDI outputs with VITC and characters – see chapter 5)

When the input video format is 1080p/24sF, 3:2 pulldown will be inserted to generate the 29.97 Fps video output. The cadence of the 3:2 is determined by the input video timecode contained on either the LTC or in the RP188 Ancillary time code packets. The 3:2 cadence can also be controlled by connecting an external 6 Hz reference pulse connected to the Parallel I/O connector. (See section 3.2 for information on controlling the 3:2 cadence)

2.6. CONNECTING THE VIDEO RECORDER TIME CODE

The Video timecode is normally extracted from RP188 ancillary timecode packets on the incoming HD video and will be at the same rate as the input video frame rate. The output VITC and LTC will be jam synced to this code and will be delayed by the downconverter delay. The Codes and Outputs tabs of the configuration screens in the KeyLog TRACKER™ software control the use of the Video LTC reader and generator.

2.6.1. Connecting the Video LTC Reader

Connect the LTC output from your video recorder to the HD9155's LTC IN XLR connector. When using an unbalanced input to the reader, the signal should be applied to pin 3 of the reader input connector. Normally, the unused input (pin 2) should be connected to ground (pin 1). This input may used to jam sync the HD9155's Video LTC generator to the code previously recorded on tape.

2.6.2. Connecting the Video LTC Generator

The generator Video LTC output is available on the LTC OUT XLR connector at the rear panel. The output level of the generator is factory set to 1 volt peak to peak, but may be adjusted using the level adjustment (labelled RTP1) located on the 9000TCIO circuit card.

The generator code output should be connected to the time code input of your standard definition video recorder. Pin 1 of the XLR is ground, and pins 2 and 3 provide a balanced output. When using a machine with an unbalanced input the signal should be connected to Pin 3 of the generator output XLR. Pin 2 should be left open.

When the Factory configuration is in use, the LTC Generator output will be jam synced to the incoming RP188 ANC timecode. The LTC output will be delayed from the incoming timecode by the same delay as the video. In addition, when the incoming timecode is counting 24 frames per second, the time code output will be converted to 30 frames per second and will be synchronous with the 2:3 cadence of the output video. The 00 frames of each second of the incoming timecode will be aligned to the 00 frames of the output timecode unless the 2:3 cadence is altered by system parameter 10. See Chapter 5 for more information about System parameters and how they affect the operation of the HD9155.

2.7. CONNECTING THE HD9155 TO A COMPUTER

The 9150 Configware™ configuration software is used to customise the configuration the HD9155's hardware for different applications. Configuration sets can be saved and recalled to speed setups of the hardware. These configuration sets are loaded into the 'User Configuration' of the HD9155 that is loaded by operating the front panel *Configuration* switch.

2.7.1. Physical Connections

A nine pin sub-miniature 'D' connector **SERIAL CONTROL** is provided for connection to a computer running the software. This serial port provides a bi-directional RS-232-C data link at 57,600 baud. In order to connect your HD9155 to your computer make a cable as shown in Figure 2-8. Use this cable to connect the computer's COM port to the **SERIAL CONTROL** connector on the rear of the HD9155. The HD9155 serial port does not have connections for the DTR, DSR, DCD and RI handshake lines. A standard 9 pin 'straight through' cable may work with some computers if the handshake lines are internally pulled to the active state. See Chapter 4 for more information on installing the 9150 Configware™ software and configuring the HD9155.

HD9155 End			Computer End	
9 pin D Male	**Pin**	**Belden 9501**	**Pin**	**9 pin D Female**
TxD	2	———————	2	RxD
RxD	3	———————	3	TxD
Sig Gnd	5	----drain-----	5	Sig Gnd
	7		7	RTS
	8		8	CTS
	4		4	DTR
			1	DCD
	6		6	DSR
	9		9	RI
Frame Gnd	Shield	----drain-----	Shield	Frame Gnd

Figure 2-8: Cable to Connect HD9155 to PC Communications Port

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CHAPTER 3: OPERATION

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3. OPERATION

Videotapes acquired directly in field video recorders have the original field timecode recorded as linear time code (LTC) on an address track and as RP188 ancillary timecode recorded in the HANC area of the digital video bitstream. The Production Afterburner downconverts video from material acquired by HDTV video cameras and makes burn-in windows and new 30 Fps timecode that is in sync with the downconverted video. The original 24 Fps timecode numbers can be placed in the user bits of the VITC and displayed as a burned-in window. The 2:3 cadence can be controlled from the ancillary timecode or from the LTC.

The HD9155 Production Afterburner allows the user to load a factory default configuration or to load a user defined configuration that has been loaded using the 9150 Configware™ software. The user defined configuration will be remembered after a power cycle and will be reloaded every time the CONFIGURATION front panel switch is set to the User position. For more information on controlling the HD9155 using the 9150 Configware™ software see chapter 4.

The *factory* defaults are:

- Auto Video Standard
- Incoming VTR Time Code (Time and User Bits) will be taken from RP188 LTC ANC Timecode. For 1080p/24sF input video this is the 24 Fps code.
- Output timecode is delayed to match the video delay through the HD9155 (5 frames at the output video frame rate). For 1080p/24sF input video the output timecode is 30 Fps code jammed to the 24 Fps input Timecode. For other input video formats the output code will be at the same frame rate as the input code.
- Output LTC Time will be the at the frame rate of the output video jammed to the input RP188 ANC Timecode. Output LTC User bits will be the same as the input RP188 ANC User Bits.
- Output VITC will be on lines 14 and 16. VITC Time will be the same as the LTC time. VITC User Bits will be the original RP188 input code
- A white Flag pulse in the first field of each new picture will be on line 11
- The downconverter will operate in the Letterbox mode
- The character generator will be in Tiny size with the Video Time (VITC time at output video frame rate), Video User Bits (VITC user bits at input video frame rate) and pulldown windows On
- When the input video is 1080p/24sF, the output video will have a 2:3 pulldown cadence set according to the following priority scheme:
  6 Hz input (normally on pin 1 of the Parallel I/O connector - not usually required in Video Mode)
  LTC input if present
  RP 188 ANC timecode if present

If you need to override the default settings you will need to connect a computer to run the 9150 Configware™ software utility. (See section 4 for information about connecting the computer and installing the 9150 Configware™ software) There is no need to run the software to operate the Production Afterburner on a day to day basis unless you need to change any of the configuration items.

The output video will contain a 2:3 cadence of pictures from the input 1080p/24sF video with the A frames determined from the timecode being read by the HD9155. By default, if there is LTC present then it will control the pulldown, otherwise the RP188 ancillary timecode will control the pulldown. The default pulldown cadence can be changed using the HD9155 system parameters, but should not be necessary under most circumstances. Figure 3-1 shows the default 2:3 relationship. Note that there is a 5 video frame (30 Fps) delay between the input video and the output video.

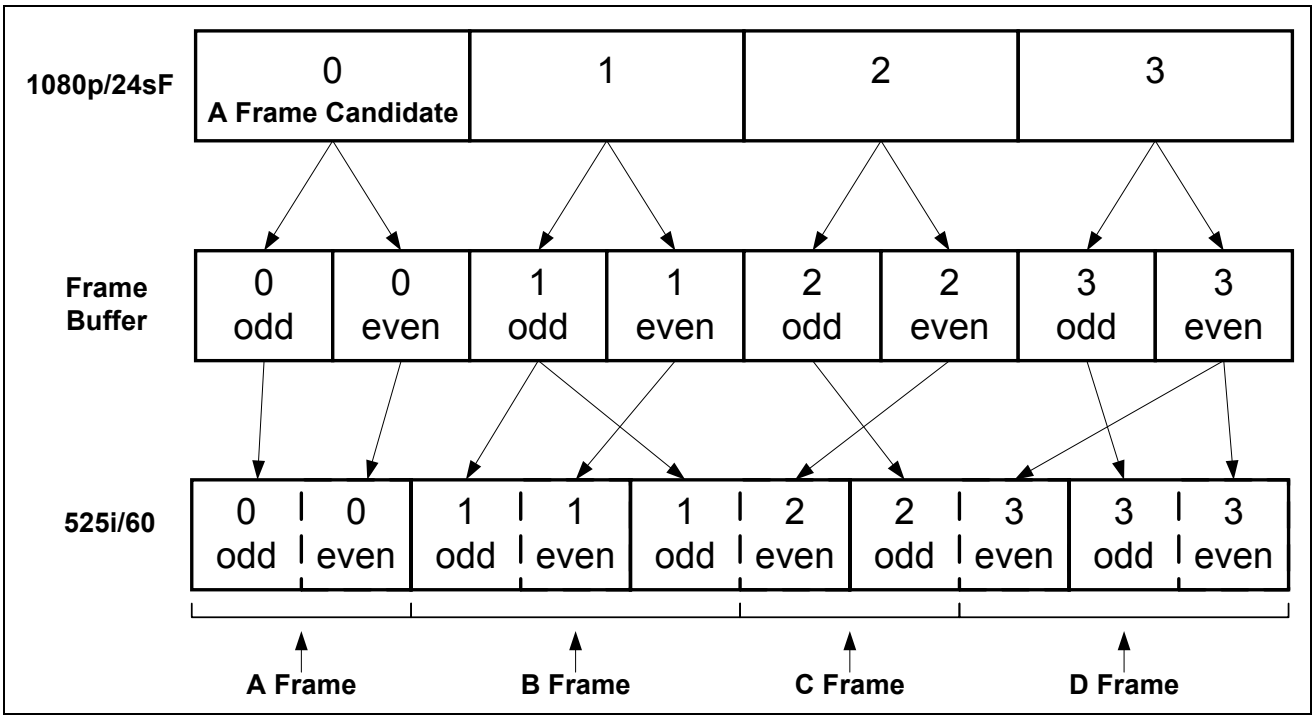

Figure 3-1: 2:3 Pulldown Cadence For Converting 1080p/24sf Video To 525i/60

3.1. FRONT PANEL CONTROL

There are currently five members of the HD9155 Series Production Afterburner family each one with a slightly different feature set. There are two basic versions of the front panels as shown below. The HD9155, HD9155-AES and HD9155Q units each have three switches, while the HD9155-Aud and HD9155Q-AUD have five switches and a headphone jack. Throughout this chapter all descriptions apply to a versions of the HD9155 unless specifically stated.

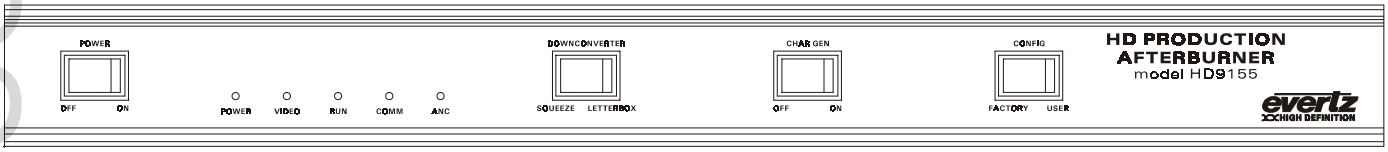

Figure 3-2: Front Panel HD9155 and HD9155Q

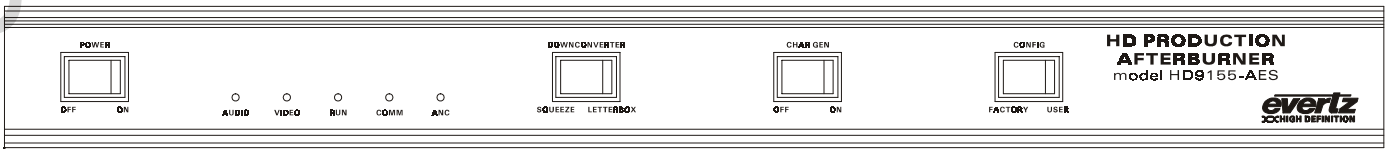

Figure 3-3: Front Panel HD9155-AES

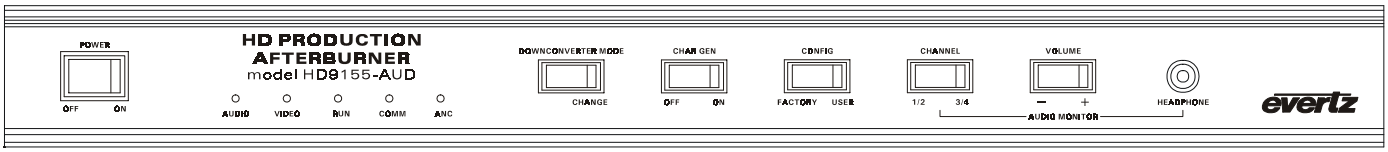

Figure 3-4: Front Panel HD9155-AUD and HD9155Q-AUD

3.1.1. Controlling the Downconverter Mode

The Downconverter in the HD9155 converts the 16:9 aspect ratio of the HD video to the 4:3 aspect ratio of the standard definition video in one of two modes

- Letterbox
- Anamorphic Squeeze
- Center Crop

Each time the **DOWNCONVERTER** front panel switch is pressed and released on the change side the downconverter mode will change. On the HD9155-AUD and HD9155Q-AUD models, the switch is spring loaded. On the other models the user will have to press the opposite side of the switch each time. The downconverter mode set by using the front panel **DOWNCONVERTER** switch will be overridden when user downloads a user configuration.

3.1.2. Turning the Characters On and Off

The Character generator keyer in the HD9155 can be turned on and off using the **CHAR GEN** front panel switch. The setting of the **CHAR GEN** switch will normally override the global character generator On/Off mode of a user configuration when the **CONFIG** switch is set to *USER.*

If you want to control the global Character on/off mode from the user configuration you will need to disable the Front panel **CHAR GEN** switch by setting system parameter class 15 parameter 8 to –255 in the 9150 Configware™ software. When the **CONFIG** switch is set to *USER*, the global character generator On/Off mode of the user configuration will be active. When the **CONFIG** switch is set to *FACTORY*, the front panel **CHAR GEN** switch will always control whether the character generator is on or off.

3.1.3. Loading the Factory Config or User Config

The HD9155 has two sets of presets that can be loaded using the **CONFIG** front panel switch. When the switch is set to *FACTORY*, the default configuration shown on page 1 will be loaded. The front panel **DOWNCONVERTER** and **CHAR GEN** switches will determine the downconverter mode, and whether the character generator keyer is on or off.

When the switch is set to *USER*, the user configuration that has been loaded using the 9150 Configware™ software will be loaded. The front panel **DOWNCONVERTER** and **CHAR GEN** switches will override the downconverter and character generator keyer on/off mode of the *User Config* unless you disable the Front panel switches using system parameters. See sections 0 and 3.1.2 for information on disabling the **DOWNCONVERTER** and **CHAR GEN** switches respectively.

3.1.4. Monitoring the Audio (models HD9155-AUD and HD9155Q-AUD only)

The HD9155-AUD and HD9155Q-AUD versions are fitted with a ¼ inch stereo headphone jack on the front panel for monitoring the audio being de-embedded from group 1 of the HD video. The **CHANNEL** switch will select whether you are monitoring audio channels 1 and 2 or channels 3 and 4. The **VOLUME** switch is used to set the headphone volume. Press it on the **–** side to lower the volume and on the **+** side to increase the volume.

3.2. CONTROLLING THE 2:3 PULLDOWN

When the input video to the HD9155 is 1080p/23.98sF, the HD9155 will insert 1 extra field every 4 to create a 29.97 Fps output video. This process, known as 2:3 Pulldown can be controlled by one of 3 sources.

- Video Timecode values being read from the RP188 ANC data packet encoded in the ancillary data space of the incoming video. (often referred to as VITC but not to be confused by SMPTE 12M VITC)
- LTC Timecode being read by the LTC reader
- External 6 Hz Reference pulse applied to the Parallel I/O connector

If more than one source is present then the HD9155 uses the RP188 Time Code as the highest priority and the 6 Hz input as the lowest priority. The preferred method of controlling 2:3 cadence is to use the RP188 ANC timecode that will be read directly from the incoming video. (See Figure 3-1). If the user wants to change the priority scheme of the HD9155 this can be accomplished using system parameters (see chapter 5

To confirm the HD9155 2:3 reference source, turn on the Debug character generator window (using the Window tab in the 9150 Configware™ software. Set the horizontal position to 11. You will see a display on the HD9155 Character generator that looks something like the following:

```
REF: ANC 1 0 3
```

Consult section 6.4 for a more detailed description of how to use the debug character window and specific information on the Pulldown Reference Source Window.

Figure 3-5 shows the relationship between the incoming 1080p/24sF video and the outgoing 525i/59.94 video, with the A frames of the output video correctly aligned to the incoming timecode. Then the A frames will be aligned with the 0 frames of either the input LTC or input RP188 ANC video timecode.

Note that there is a 5 video frame (1/6th of a second) delay inside the HD9155 to allow for the correct A frame alignment of the output video. If you have the AES option installed (model HD9155-AES) the AES audio outputs of the HD9155 will be delayed by an equivalent amount so that it is in time with the picture. Otherwise you will have to provide an external delay for the audio.

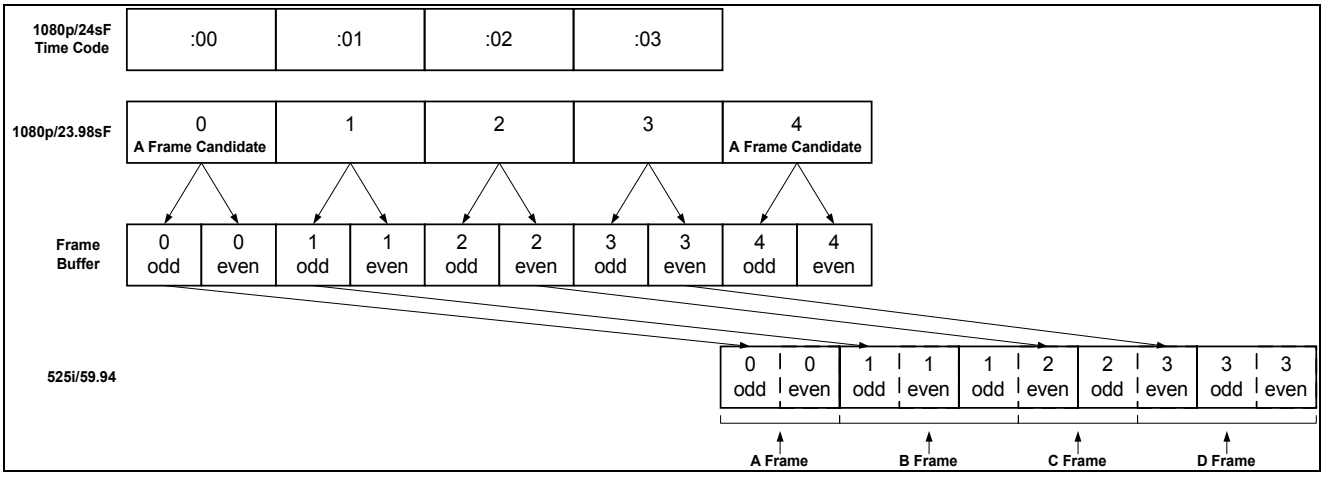

Figure 3-5: Timecode Referenced 2:3 Pulldown and Delay in HD9155

CHAPTER 4: CONFIGURATION USING 9150 CONFIGWARE™

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4. CONFIGURATION USING 9150 CONFIGWARE™

The 9150 Configware™ software is used to change the HD9155's default hardware setup for different applications. In addition to controlling the character inserter windows, VITC line placement and input time code selection, the HD9155 Systems parameters can also be controlled using the 9150 Configware™ software. Configuration sets can be saved and recalled to speed setups of the hardware. The HD9155 stores one user configuration which can be recalled by setting the front panel **CONFIG** switch to *USER*. Note that the Front panel **DOWNCONVERTER** and **CHAR GEN** switches will override the settings of the user configuration unless they are disabled by setting the Class 15 system parameters 7 and 8 to –255 respectively. (See section 4.1.4.4 for information about setting the system parameters.)

4.1. CONNECTING THE HD9155 TO THE 9150 CONFIGWARE™ SOFTWARE

4.1.1. Physical Connections

A nine pin sub-miniature 'D' connector **(SERIAL CONTROL)** is provided for connection to a computer running the 9150 Configware™ software utility. This serial port provides a bi-directional RS-232-C data link at 57,600 baud.

In order to connect your HD9155 to your computer make a cable as shown in Figure 4-1. Use this cable to connect the computer's COM port to the **SERIAL CONTROL** connector on the rear of the HD9155.

HD9155 End			**Computer End**	
9 pin D Male	**Pin**	**Belden 9501**	**Pin**	**9 pin D Female**
TxD	2	———————	2	RxD
RxD	3	———————	3	TxD
Sig Gnd	5	----drain-----	5	Sig Gnd
	7		7	RTS
	8		8	CTS
	4		4	DTR
			1	DCD
	6		6	DSR
	9		9	RI
Frame Gnd	Shield	----drain-----	Shield	Frame Gnd

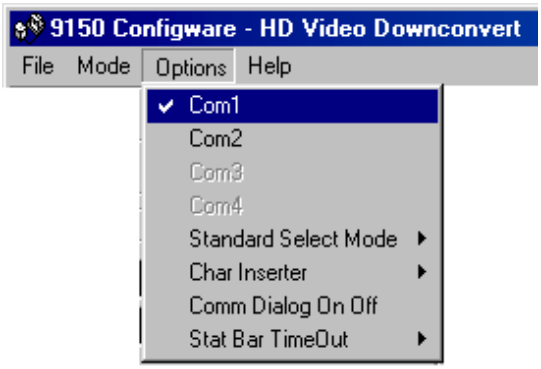
Figure 4-1: Cable to Connect HD9155 to PC Communications Port

4.1.2. Installing the 9150 Configware™ Utility

Insert the first 9150 Configware™ CD-ROM into the PC's CD-ROM drive and click on the Start button and then click Settings. Click on the Control Panel, then ADD/Remove Programs. The 9150 Configware™ installation program will guide you through the installation procedure.

Once the installation is complete, click on the Start button and then click Programs. Select the *9150 Configware™* program group and click on the *9150 Configware™* icon.

The first time you run the software you will need to configure the Communications ports on the computer that you are using to control the hardware devices. This is done from the Options menu.



Select the communications port used to connect the HD9155.

In order for the HD9155 to communicate with the *9150 Configware™* software you must first set the *Config* front panel switch on the Hd9155 to the *User* position. Communications to the *9150 Configware™* software are disabled when the *Config* switch is set to *Factory*.

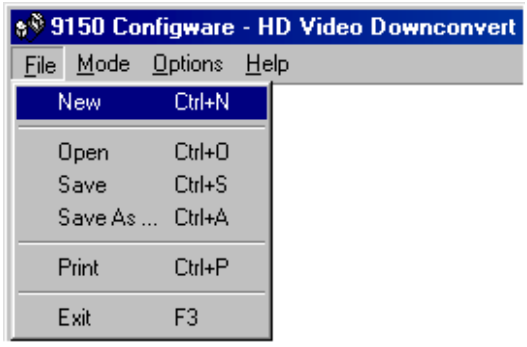
When with software is communicating with the HD9155, the COMM LED on the HD9155 front panel should be On and the COMM indicator in the Status Bar at the top of the *9150 Configware™* screen should also be green. If the *9150 Configware™* COMM indicator is red, that shows that the hardware is not responding. Check your cable connection and verify that you have selected the correct communications port on your computer.

4.1.3. 9150 Configware™ Menus

The 9150 Configware™ menu system is comprised of four drop down menus. Each menu is described in further detail in its own section.

4.1.3.1. File Menu

The *File* menu is used to load and save configurations to the hard disk, and to exit the program.



4.1.3.2. Mode Menu

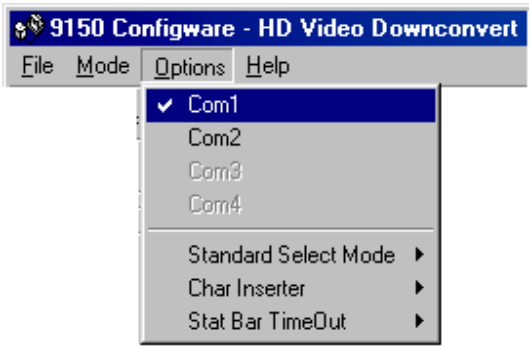
The 9150 Configware™ operates in one of two modes set on the *Mode* menu.

When the software is started up it is in *Offline* mode. This allows the user to make changes on the configuration screens of the computer without affecting the operation of the Production Afterburner. When you have the configuration items the way you want them, you can send them to the Production Afterburner using the *Send Config* button. In *Offline* mode, the COMM indicator on the screen will normally be yellow.

When the software is placed in the *Interactive* mode changes made on the configuration screens of the computer are immediately sent to the Production Afterburner so that you can see the effect of the changes. When you first enter *Interactive* mode the current configuration shown on the computer screen is immediately sent to the Production Afterburner. In *Interactive* mode, the COMM indicator on the screen will normally be green with an ***e*** and there will be some small dots changing in the indicator as the software dialogs with the hardware. You will also see various messages and their responses shown on the status bar at the bottom of the screen.

4.1.3.3. Options Menu

The *Options* menu is used to set the Communication port you are using to communicate with the Production Afterburner.



The *Standard Select* item is used to determine if you want to manually choose the input video standard of the Production Afterburner or have it automatically detect the incoming video standard.

The *Char Inserter* item is used to turn the Production Afterburner's character generator windows on or off. Individual windows can be turned on and off using the *Windows* screen.

The *Stat Bar Timeout* item is used to determine how often the status bar at the bottom of the screen will be refreshed. Status messages will be cleared out after the appropriate timeout selected by this item.

4.1.3.4. Help Menu

The *Help* menu is used to view the online help file and to see the version of the software.

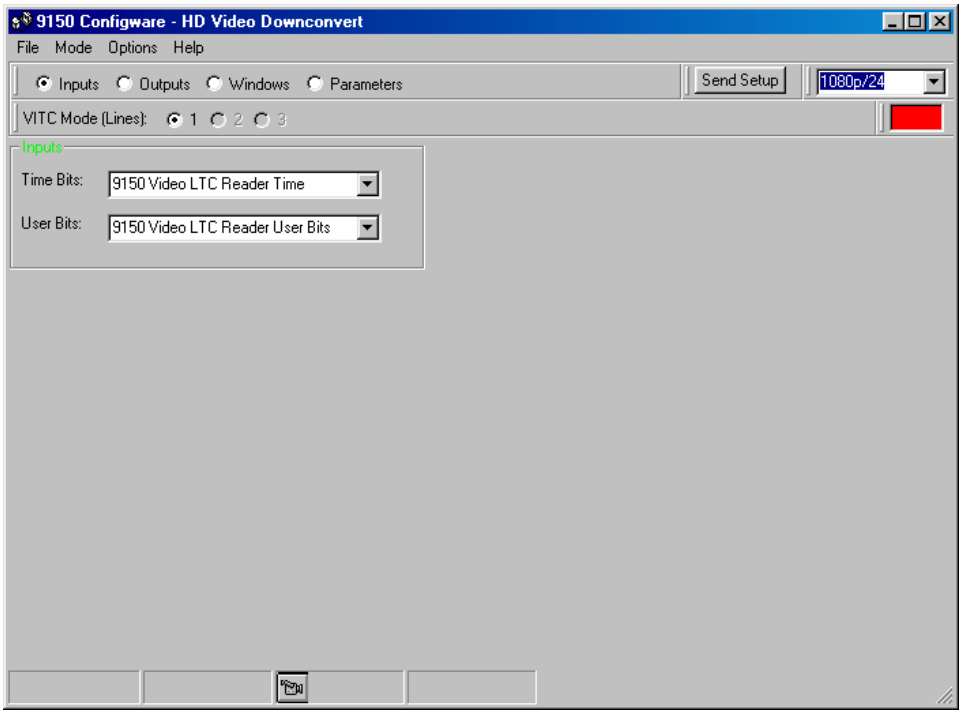
4.1.4. 9150 Configware™ Screens

The 9150 Configware™ has four main screens that hold the various configuration items for the Production Afterburner hardware. There are four radio buttons located under the menu bar that determine which screen you are working with. The values of all the configuration items can be saved to a configuration set and recalled at any time.

Many of the configuration items are display only items that do not allow any user choices. They are shown to give you a complete view of all the configuration items for the HD9155.

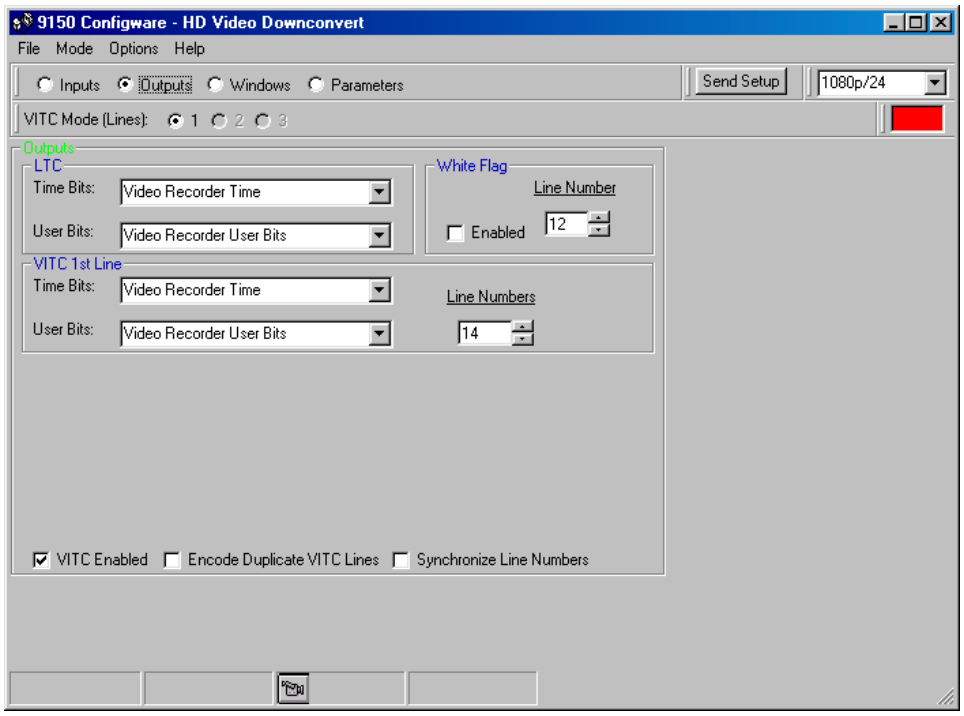
4.1.4.1. Inputs Screen

The *Inputs* screen is used to select what type of timecode input you want to read. Select the source for the Video Time code and user bits. Normally the time and user bits will come from the same source.



4.1.4.2. Outputs Screen

The *Outputs* screen is used to select what information will go into the LTC and VITC outputs,



LTC: Select the source for the LTC Time and user bits. Normally this will be the 'Video Recorder Time' and 'Video Recorder User Bits'.

White Flag: Click on the check box to enable the white flag output of the HD9155. When the White Flag output is enabled, a white level pulse is inserted in the first video field of each new picture. Enter the line number that you wish the while flag pulse to be on.

Normally in *Video mode* the Production Afterburner runs in '1 line' VITC mode. In this mode there is one set of VITC data on the specified line and an optional duplicate line on the output video.

VITC 1st line: The sources for the Time and user bits in the first line of VITC are set here. Normally the Time bits will be set to the 'Output Video Recorder time'. When the input video is 1080p/24sF the input video time with the frame rate converted to 30 Fps. The user bits can be set to either the input video recorder user bits or the input video recorder time (the original 24 Fps time code).

Enabling the VITC Generator Click on the "VITC Enabled" check box to turn on the VITC generator. When the VITC generator is disabled, the white flag output is also turned off.

Setting the VITC Lines Click on the Up and down arrows on the line number to change the line where the VITC will be recorded.

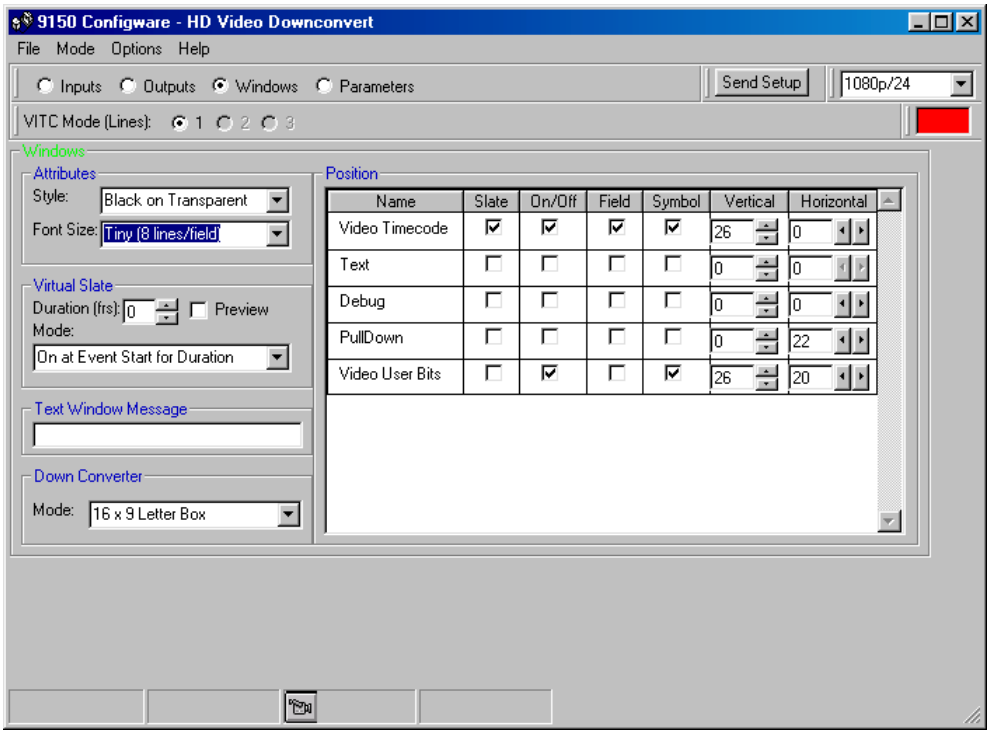
Click on the "Encode duplicate VITC lines" check box to record a redundant set of VITC Lines. Normally this is not required with modern video recorders.

Click on the "Synchronize lines" check box to move all the VITC lines together. In this mode you select the line number for the VITC 1st line and the line numbers for the remaining lines (and their duplicates) will stay the same distance away. When the Synchronize lines feature is off you can freely enter line numbers for each line.

4.1.4.3. Windows Screen

The *Windows* screen is used to control the Production Afterburner's character inserter. There is also a global Character generator on/off command available on the *Options* menu. It must be set to On in order to see any of the character generator windows.

The *Video Timecode* window displays the VITC time information.
The *Video User Bits* window displays the VITC user bit information.
The *Text* window allows the user to enter up to 32 characters of text to be displayed.
The *Pulldown window* displays a letter showing the pulldown of the video picture when the input video is 1080p/24sF
The *Debug window* can display additional debugging information on the output video. Normally this window is turned off and should only be used under direction of an Evertz Factory technician. Changing the horizontal position value for the *Debug* window controls the information displayed. (The window can not be moved horizontally). See section 6.4 for more information about the Debug Window displays.



Style: Choose the format for the Character Burn-in Windows displayed on the Video Monitor.

Font Size: Choose from one of 2 vertical character sizes for the character display windows.

Virtual Slate: The virtual slate allows you to configure various character display windows to be on for a specified length of time at the beginning of each shot.

Virtual Slate Length: Enter the length of time in video frames that the virtual slate is to be displayed.

Virtual Slate Preview: Check this box to turn on all the windows enabled for the virtual slate. This allows you to see the relative positions of the various windows when positioning other windows. Remember to turn off the Virtual slate preview when you are finished positioning the virtual slate windows.

Text Window Message: You can enter an alphanumeric text message up to 32 characters long to be displayed on the video monitor. The text window must be On and you must press be in *Interactive* mode or send the configuration to the Production Afterburner in order to view the Text window.

Position: This area shows a list of the available character windows with its attributes. The "Slate" column shows which windows are enabled for the virtual slate. The "On" column shows which windows are permanently On. The "Vertical" and "Horizontal" columns show the window's relative position on the screen.

When the mouse is over the row for a specific window, that character window will be highlighted on the video monitor. You can turn the window on or off or change its attributes by clicking on the appropriate check box.

Click on the Window check box to permanently turn on the window.
Click on the Virtual Slate check box to turn on the window only when the virtual slate is on.
Click on the Display Fields check box to display the field information for Timecode values.
Click on the Display Symbols check box to turn on Display Symbols to the left of the character window.

If there is a check mark in the box then the option is already enabled. To disable the option click on the appropriate box.

To position the window click the position buttons beside the position indicators with the mouse.

Downconverter Mode:
The downconverter in the Production Afterburner changes the 16:9 aspect ratio of the input HDTV signal to the 4:3 aspect ratio of the output SDTV in one of three ways. Letterbox mode reduces the overall picture proportionally so that the complete width fits in the width of the 4:3 raster. This produces a black 'letterbox' region above and below the active picture. Anamorphic mode squeezes the width of the picture to fit within the 4:3 raster while maintaining the height. Center Crop mode removes a 4:3 aspect ratio cut from the center of the picture while maintaining the full height of the picture. This loses picture information at the extreme left and right sides of the picture.

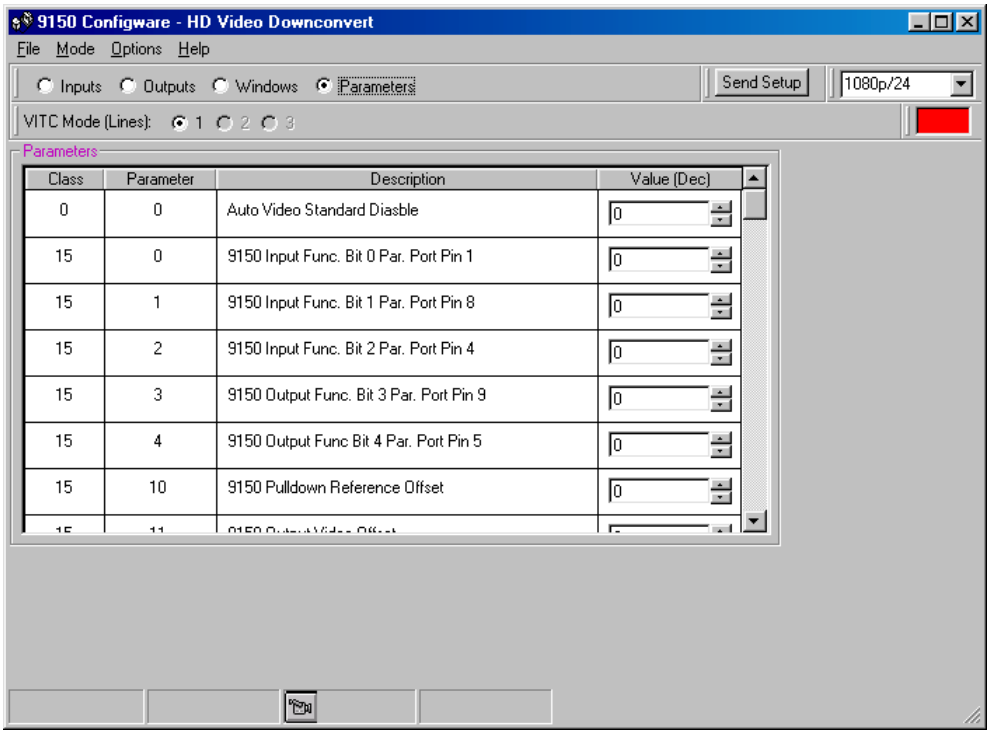
4.1.4.4. Parameters Screen

The *Parameters* screen is used to set various system parameters that control the Production Afterburner's behaviour. These parameters are grouped according to classes. Within each class a parameter number identifies individual parameters. Each parameter has a positive or negative value with the default value for each parameter being zero.

To change the value of a parameter press the up or down buttons beside the value indicators with the mouse. Clicking on the *Value* column heading will determine whether the parameters are displayed as

decimal or hexadecimal values. Clicking on the Class column heading will sort the parameter display by Class/parameter number. Clicking on the Description column heading will sort the parameter display by its description.

For more information on the use of parameters see chapter 5



CHAPTER 5: SYSTEM PARAMETERS

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5. SYSTEM PARAMETERS

The HD9155 Production Afterburner hardware allows the user to change the default behaviour of various functions by the use of parameters. Note that the System Parameters will only affect the behaviour of the HD9155 when the front panel **CONFIG** switch is set to *USER*. These parameters are grouped according to classes and can easily be changed using the 9150 Configware™ software. Within each class a parameter number identifies parameters. Each parameter has a value with the default value for each parameter being zero. Parameter class 0 and 15 apply to the HD9155 and will be described in this chapter. Table 5-1 and Table 5-2 show the currently defined parameters for each class with a brief description of what each parameter does. The parameter numbers shown in the tables below are decimal numbers. The following sections describe the operation of each parameter in detail.

Parameter	Name	Description
0	Auto Video Standard disable	Non-zero value disables auto video standard
2	Num-Print disable	Non-zero disables debug print of KK,TC numbers
3	Q Program SDI Char Control	>= 0 Off < -256 = slate, < 0 = Char on SD Prog video output

Table 5-1: Class 0 - Global System Parameters HD9155's

Parameter	Name	Description
0	9155 Parallel I/O Port Pin 1 Input	Input function for this pin
1	9155 Parallel I/O Port Pin 8 Input	Input function for this pin
2	9155 Parallel I/O Port Pin 4 Input	Input function for this pin
3	9155 Parallel I/O Port Pin 9 Output	Output function for this pin
4	9155 Parallel I/O Port Pin 5 Output	Output function for this pin
7	9155 DownConverter Switch Function	Controls function of Front panel Downconverter switch
8	9155 Char Gen Switch Function	Controls function of Front panel Char Gen switch
9	9155 Config Switch Function	Controls function of Front panel Config switch
10	9155 Pulldown Reference Offset	Output pulldown in relation to 6Hz cycle in 24P
11	9155 Output Video Offset	In/Out video offset (+50 lines)
12	9155 6Hz Ref Control	Negative = ignore 6Hz pulldown reference input
13	9155 LTC Ref Control	Negative = ignore LTC as a pulldown reference input
14	9155 ANC Ref Control	Negative = ignore ANC as a pulldown reference input
20	9155 Debug Ram Display Address	Display Address for DB_WIN_RAM display
23	9155 Debug Pulldown Output Enable	Non-zero enables debug pulldown o/p on video
24	9155 Colour Space Conversion Disable	Non-zero disables colour space conversion
25	9155 LTC Fallback Enable	Non-zero enables fallback to LTC in absence of ANC
26	9155 Auto Ink Frame Disable	Non-zero disables auto detection of Ink Frame # format
30	9155 Character Horizontal Offset	Signed Horizontal pixel offset from default
31	9155 Character Vertical Offset	Signed Vertical scan line offset from default

Table 5-2: Class 15 - 9155 System Parameters

5.1. 9155 PARALLEL I/O PIN FUNCTIONS

Parameters 0 to 2 of Class 15 control the functions of the three input pins on the Parallel I/O Connector. Parameters 3 and 4 of Class 15 control the functions of the two output pins on the Parallel I/O Connector. When the parameter value is set to zero (0) the default function of the I/O pin is selected as shown in Table 8.

The default pin functions are:

Pin	Signal Name	Description
1	INP_FUNC_6HZREF	Rising edge -> Start of 6Hz reference cycle
4	INP_FUNC_VSTD	Falling edge -> 1080i60, Rising edge -> 1080P24
5	DBUG_FRID	Output toggles with picture pulldown (FRID 3:2)
8	INP_FUNC_CHRONOFF	Falling edge -> Chars off, Rising edge -> Chars on
9	DBUG_SEQ_6HZ	Hi = start field of output video 6Hz cycle

Table 5-3: Default 9155 I/O Pin Functions

To change the functions of the input pins change the respective parameter for the pin to the following values. (Negative values are input functions, and positive values are output functions).

Parameter Value	Signal Name	Description
0	INP_FUNC_DEFAULT	Functions as **default** input
-1	INP_FUNC_VSTD	Falling edge -> 1080i/60, Rising edge -> 1080p/24
-2	INP_FUNC_VSTD_INV	Falling edge -> 1080p/24, Rising edge -> 1080i/60
-11	INP_FUNC_CHRONOFF	Falling edge -> Chars off, Rising edge -> Chars on
-12	INP_FUNC_CHRONOFF_INV	Falling edge -> Chars on, Rising edge -> Chars off
-13	INP_FUNC_6HZREF	Rising edge -> Start of 6Hz reference cycle
-14	INP_FUNC_6HZREF_INV	Falling edge -> Start of 6Hz reference cycle
-15	INP_FUNC_CHRTOGL	Falling edge -> toggles character on/off
-16	INP_FUNC_CHRTOGL_INV	Rising edge -> toggles character on/off inverted
-21	INP_FUNC_VDEF	Falling edge -> standard def, Rising edge -> high def
-22	INP_FUNC_VDEF_INV	Falling edge -> high def, Rising edge -> standard def
-25	INP_FUNC_SLTONOFF	selects virtual slate on/off
-26	INP_FUNC_SLTONOFF_INV	selects virtual slate on/off inverted
-27	INP_FUNC_SLTTOGL	toggles virtual slate on/off
-28	INP_FUNC_SLTTOGL_INV	toggles virtual slate on/off inverted
-29	INP_FUNC_DCMD_LQ	selects downconverter mode letterbox/squeeze)
-30	INP_FUNC_DCMD_LQ_INV	selects downconverter mode inverted (letterbox/squeeze)
-31	INP_FUNC_DCMDTOGL	cycles downconverter mode
-32	INP_FUNC_DCMDTOGL_INV	cycles downconverter mode inverted
-33	INP_FUNC_CONFIG	selects user/factory config
-34	INP_FUNC_CONFIG_INV	selects user/factory config inverted
-35	INP_FUNC_DCMD_LC	selects downconverter mode (letterbox/crop)
-36	INP_FUNC_DCMD_LC_INV	selects downconverter mode inverted (letterbox/crop)
-37	INP_FUNC_DCMD_QC	selects downconverter mode (squeeze/crop)
-38	INP_FUNC_DCMD_QC_INV	selects downconverter mode inverted (squeeze/crop)
-39	INP_FUNC_DCMDTOGL_RF	cycles downconverter mode on both rise and fall transitions

Table 5-4: Alternate 9155 Input Pin Functions

Parameter Value	Signal Name	Description
0	DBUG_MISC_NONE	Functions as **default** input
30	DBUG_FRID	Output toggles with picture pulldown (FRID 3:2)
31	DBUG_FRAME	1 field active low pulse on new picture (FRAME)
32	DBUG_SEQ_6HZ	Hi = start field of output video 6Hz cycle
33	DBUG_UPDVOFLDDB	Active low Blip at start of each field
34	DBUG_ANCERR	Active low pulse on ANC errors
35	DBUG_ANCF1DUPERR	Active low pulse on ANC VTR TC field 1 error
36	DBUG_ANCF2DUPERR	Active low pulse on ANC VTR TC field 2 error
37	DBUG_VTRSTARERR	Active low pulse on VTR TC displays stars (errors)
38	DBUG_IO_SAMPLE	Toggles at each sampling of the inputs

Table 5-5: Alternate 9155 Output Pin Functions

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CHAPTER 6: TECHNICAL DESCRIPTION

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Tables

6. TECHNICAL DESCRIPTION

6.1. SPECIFICATIONS

6.1.1. HDTV Serial Digital Video Input

Standard: 1.485 Gb/sec HDTV Serial component digital SMPTE 292M
standards supported shown in Table 2-6
software selectable or autodetect
Connector: 1 BNC per IEC 169-8
Equalization: Automatic to 130m @ 1.5Gb/s with Belden 1694 or equivalent cable

6.1.2. SDTV Serial Digital Video Output

Standards: Serial component 270 Mb/s (SMPTE 259M-C)
525i/59.94 if input is 1080i/59.94 or 1080p/23.98sF video
625i/50 if input is 1080i/50
Connectors: BNC per IEC 169-8
Std versions: 2 monitor
Q versions: 2 program, 1 monitor
Signal Level: 800mV nominal
DC Offset: 0V ±0.5V
Rise and Fall Time: 470ps nominal
Overshoot: <10% of amplitude
Return Loss: > 15 dB
Wide Band Jitter: < 0.2 UI

6.1.3. Analog Monitor Video Output

Standards: Analog composite NTSC if input is 1080i/59.94 or 1080p/23.98sF video
Analog composite PAL if input is 1080i/50
Connectors: BNC per IEC 169-8
Std versions: 2
Q versions: 1
Signal Level: 1 V p-p nominal, internally adjustable
DC Offset: 0V ±0.1V
Return Loss: >35dB up to 5 MHz
Frequency Response: 0.8dB to 4 MHz
Differential Phase: <0.9°(<0.6° typical)
Differential Gain: <0.9% (<0.5 % typical)
SNR: >56dB to 5 MHz (shallow ramp)
Impedance: 75 ohm

6.1.4. LTC Generator

Standard: SMPTE 12M
Frame Rate: 25 and 30 Fps nominal
Connector: 3 pin male XLR type connector.
Level: Adjustable, 0.5V to 4.5V p-p

6.1.5. LTC Reader

Standard: SMPTE 12M
Frame Rate: 24, 25 and 30 Fps nominal
Connector: 3 pin female XLR type connector
Level: 0.2 to 4V p-p, balanced or unbalanced

6.1.6. Ancillary Timecode Reader

Standard: SMPTE RP188
Line Select: Autodetect valid lines in vertical interval
Frame Rate: 24, 25 and 30 Fps nominal

6.1.7. Serial Communications

Standard: RS-232, 57600 baud, 8 bits, no parity
Connectors: 9 pin female “D”

6.1.8. Physical

Dimensions: 19“ W x 1.75” H x 18.75” D.
(483mm W x 45mm H x 477mm D)
Weight: 8 lbs. (3.5Kg)

6.1.9. Electrical

Power: 115/230 V AC 50/60 Hz, 30 VA. ETL listed.
Complies with EU safety directive
EMI/RFI: Complies with FCC Part 15 Class A,
EU EMC Directive

6.2. DIP SWITCHES

The main circuit board contains an 8 position DIP switch (S1) that invokes setup and diagnostic functions. Most users will have no need to alter the factory switch settings. The functions of each switch are described below.

Switch	Name	Normal	Function when Open	Function when Closed
1	Aux Port Msg	Open	Normal	Enable Aux Port Messages
2	Not used	Open		
3	Not Used	Open		
4	Not used	Open		
5	Not used	Open		
6	Mode	Closed		Must be closed for 9155
7	Tracker Msg	Open	Normal	Enable Tracker Messages
8	Debug Msg	Open	Normal	Enable Debug Messages

Table 6-1: DIP Switch Functions

6.3. UPGRADING THE FIRMWARE

The HD9155 series products contain firmware that is contained in a FLASH EPROM device. From time to time firmware updates will be provided to add additional features to the unit. Use the procedure outlined below with the computer connected to the SERIAL REMOTE connector to upload new firmware from your computer. If you have a HD9155 series unit with an audio de-embedder card installed you will need to use the same procedure with the computer connected to the DE-EMBEDDER COM connector to update the de-embedder firmware.

You will need the following equipment in order to update the HD9155 Firmware

- PC with available communications port. The communication speed is 57600 baud, therefore a 486 PC or better with a 16550 UART based communications port is recommended.
- “Straight-thru” serial extension cable (DB9 female to DB9 male) or (DB25 female to DB9 male). You may also use the same cable you are using if you are running the 9150 Configware™ software with the HD9155.
- Terminal program that is capable of Xmodem file transfer protocol. (such as HyperTerminal)
- New firmware supplied by Evertz.

6.3.1. Step 1 – Configuring the unit for Firmware upgrades.

1. Connect the serial cable to the SERIAL REMOTE DB9 connector on the rear panel. If you are updating the Audio De-embedder firmware in units so equipped, connect the serial cable to the DE-EMBEDDER COM connector on the rear panel.

2. Connect the 9 pin connector on the end of the serial update cable to the PCs’ RS-232 communications port

6.3.2. Step 2 – Terminal program Setup

3. Start the terminal program.

4. Configure the port settings of the terminal program as follows:

Baud	**57600**
Parity	**no**
Data bits	**8**
Stop bits	**2**
Flow Control	**None**

5. Power up the HD9155 unit. After the unit powers up, a banner with the boot code version information should appear in the terminal window. The cursor to the right of the word “BOOT>” should be spinning for about 5 seconds then the unit will continue to boot.

   For example:

```
EVERTZ 7700PB MONITOR 1.2
COPYRIGHT 1997, 1998, 1999 EVERTZ MICROSYSTEMS LTD.
COLD BOOT |
```

6. The following is a list of possible reasons for failed communications:

   - Defective Serial Upgrade cable.
   - Wrong communications port selected in the terminal program.
   - Improper port settings in the terminal program. (Refer to step 7 for settings). Note that Hyperterminal will not change port settings while connected. Click on Hyperterminal’s “Disconnect” Button then click the “Reconnect” button to activate changes to the port settings.

7. While the cursor is spinning press the <CTRL> and <X> keys on your computer keyboard at the same time, this should stop the cursor from spinning. The spinning prompt will only remain for about 5 seconds. You must press <CTRL-X> during this 5 second delay. If the unit continues to boot-up, simply cycle the power and repeat this step.

8. Hit the <ENTER> key on your computer once.

9. Type the word “upgrade”, without quotes, and hit the <ENTER> key once.

10. The boot code will ask for confirmation. Type "y", without quotes.

11. You should now see a prompt asking you to upload the file.

6.3.3. Step 3 – Uploading the new firmware

7. Upload the "*.bin" file supplied using the X-Modem transfer protocol of your terminal program. If you do not start the upload within 10 minutes the unit's Boot code will time out. You can restart the upgrade process by power cycling the unit. The following table indicates the file names of various firmware for these units.

Example of File name	Description
DE9150_xxxx.BIN	Binary File for downconverter module in HD9155, HD9155-AES, HD9155-AUD
HQ9150_xxxx.BIN	Binary File for downconverter module in HD9155Q, HD9155Q-AUD
7720AD-HD_xxxx.BIN	Binary File for Audio De-embedder module in HD9155-AES
7720AD-A4-HD_xxxx.BIN	Binary File for Audio De-embedder module in HD9155-AUD, HD9155Q-AUD

(xxxx will be the build number of the software).

Table 2: Typical File names

8. The boot code will indicate whether the operation was successful upon completion of the upload.

   For Example:

```
UPLOAD OKAY
7700PB COLD BOOT> |
```

9. The following is a list of possible reasons for a failed upload:

   - If you get the message "transfer cancelled by remote" you must restart the terminal program and load the bin file, then remove and install the module again.
   - The supplied "*.bin" file is corrupt.
   - Wrong file specified to be uploaded.
   - Wrong file transfer protocol used – make sure you specify Xmodem, not Xmodem 1K.
   - The PCs' RS-232 communications port can't handle a port speed of 57600.
   - Noise induced into the Serial Upgrade cable.

6.3.4. Step 4 – Completing the Upgrade

10. Type the word "boot", without quotes, and hit the <ENTER> key once or power cycle the unit. The unit should now reboot.

11. You can now close the terminal program and disconnect the RS-232 serial cable from the PC.

6.4. DEBUG WINDOW FUNCTIONS

The HD9155 has a text window called "DEBUG". This window can be controlled using the WINDOWS tab of the project or system configuration in the KeyLog TRACKER™ software or using the Windows radio button of the 9150 Configware™ software. This window can display additional information on the output video. Changing the HORIZONTAL position value for the DEBUG window controls what information is displayed. (The window can not be moved horizontally).
The format and content of the displays may change as the firmware evolves, but here are the current displays. Some content is intended for use only by the Evertz engineers, and is not documented.

Some displays show a line of @@@@@@@@@@@@@@@@@@@@ characters under specific conditions. These displays are designed to be visible on an oscilloscope that is monitoring the output video (usually in some analog form).

Hor Pos Value	Debug Window Name	Description
0	WIN HW	IN: binary i/o pins DIP: binary dip switch input
1	WIN TFPHASE	VTF: video to film phase ATF: audio to film phase
2	WIN TFPHASERR	VTFX: error of video to film phase wrt target phase
3	WIN VFLD2	@@@@@ on field 2 characters
4	WIN VPULL	@@@@@ on new picture (pulldown)
5	WIN F0	@@@@@ on kk frames == 0
6	WIN V0	@@@@@ on VTR timecode frames == 0
7	WIN A0	@@@@@ on ATR timecode frames == 0
8	WIN VAPHASE	VPH: video phase APH: audio phase
9	WIN PULLT	PULL: pull type of kk
10	WIN ILTC	ILTC: LTC reader input
11	WIN REF	REF: ref src valid phase lock cnt
12	WIN VIDEO	VID: input video type -> output video type
13	WIN ANC VTR	ANC Video timecode
14	WIN ANC ATR	ANC Audio timecode
15	WIN MODES	RP215 Film ANC encoded information
16	WIN POP UP ERRORS	POP UP ERRORS
17	WIN IDLE	Processor Idle Measurement
18	WIN DLO	Data Logging Output
19	WIN GPI	GPI input frame number
20	WIN PRESET STS	STATUS: USER CONFIGURATION
21	WIN OP1 STS	Output 1 - Parallel connecter Pin 9 status
22	WIN OP2 STS	Output 2 - Parallel connecter Pin 5 status
23	WIN SLTC	Smoothed LTC stats
24	WIN REV	Firmware Revision
Last	WIN RAM	00000000: ram viewer values

Table 6-3: Debug Window Functions

6.4.0. WIN HW (0) Hardware Display

```
IN: 011 DIP:11111110 SW:001
```
IN: 011 real time display of parallel port inputs MSB (2) to LSB (0), including some internal inputs
DIP:11111110 realtime display of DIP switch, MSB (8) to LSB (1), where 0 indicates switch is in the DOWN/ON position.
SW:001 realtime display of front panel switch inputs MSB () to LSB () - only displayed for HD9155 and HD9155AES

6.4.1. WIN TFPHASE (1) Timecode to film phase indicator

```
VTF:0000000.0 A:0000000.0
```
VTF:0000000.0 video timecode abs frames extrapolated back to film abs frames 0.
A:0000000.0 likewise for the audio timecode

6.4.2. WIN TFPHASERR (2) Timecode to film phase error indicator

```
VTFX:0000000.0 ATFX:0000000.0
```
VTFX:00000000 error between displayed video timecode absolute frames extrapolated back to film absolute frames 0 (video-tfphase) and expect video-tfphase computed from Film ANC data.
ATFX:00000000 likewise for the audio timecode

6.4.3. WIN VFLD2 (3) Video Field 2

@@@@@ on video field 2 characters

6.4.4. WIN VPULL (4) Video Pulldown

@@@@@ on new picture (pulldown)

6.4.5. WIN F0 (5) KeyKode Frames 0

@@@@@ on KeyKode frames == 0

6.4.6. WIN V0 (6) Video Timecode Frames 0

@@@@@ on VTR timecode frames == 0

6.4.7. WIN A0 (7) Audio Timecode Frames 0

@@@@@ on ATR timecode frames == 0

6.4.8. WIN VAPHASE (8) Timebase Phase

```
VPH:0.000 APH:0.000 3
```

VPH:0.000	video timebase phase
APH:0.000	audio timebase phase
3	pulldown reference lock counter, 0=unlocked, 3=locked

6.4.9. WIN PULLT (9) Pulldown Type

```
PULL:K-A  V-A B A(L):+0
```

K-A	is the pulldown indicator (A,B,C,D) of KeyKode ffff+00 frames.
V-A	is the pulldown indicator (A,B,C,D) of video timecode hh:mm:ss:00 frames.
B	is the pulldown indicator (A,B,C,D) of the current picture field
A(L)	(L) indicates audio timecode derived from LTC input, otherwise from ANC input
:+0	phase of audio timecode at video frame 0.

6.4.10. WIN ILTC (10) LTC Reader Input Data

```
LTC:%100T0+1L23:59:59:23@24
```

':'	LTC threshold set at 50% of frame. or '.' LTC threshold set at 70% of frame.
%100	valid read rate as a percentage of expected read rate
T0	phase of LTC input (0-9) w.r.t video/audio timebase. T1 indicates LTC was complete somewhere between 0% and 10% of the frame.
+1	numeric difference of timecode between successful reads
L	dynamics flags L-locked, P-play, F-forward, S-stop, R-reverse
23:59:59:23	raw, uncompensated timecode read (NOT LIKELY TO EXACTLY MATCH picture content!) ':' will be replaced by '*' when timecode not valid, or not readable or discontinuous
@24	timecode counting rate. or shown as @24/30 timecode counting rate / expected rate

6.4.11. WIN REF (11) Pulldown Reference Source Indicator

```
REF:ANC 1 0 3 @24
```

ANC	Pulldown referenced to ANC/6HZ/LTC/NONE source
1	Valid indicator - 0 = not valid
0	Video Timecode frame number mod 4 wrt reference - 0,1,2,3
3	Pulldown reference Lock counter - 3 = locked, 0= unlocked
@24	timecode rate of reference timecode

6.4.12. WIN VIDEO (12) Video Mode Indicator

```
VID:1080P/23.98SF->525i/59.94 AV
```

1080P/23.98SF->525i/59.94	Displays the current input and output video standards,
AV	indicates autovideo standard switching is enabled

6.4.13. WIN ANC VTR (13) ANC Video timecode

```
VAL:%100 F1 L23:59:59:23@24/24
```

L	source type L=RP188LTC, 1=RP188VITC1, 2=RP188VITC2, F=RP215
%100	valid read rate as a percentage of expected read rate
F1	Fields in which data is read - F12 indicates both field 1 and field 2
L	dynamics flags L-locked, P-play, F-forward, S-stop, R-reverse
23:59:59:23	raw, uncompensated timecode read - NOT LIKELY TO EXACTLY MATCH picture content! ':' will be replaced by '*' when timecode not valid, or not readable or discontinuous
@24/30	timecode counting rate / expected rate
22	timecode dynamics flags

6.4.14. WIN ANC ATR (14) ANC Audio timecode

```
AAL:%100 F1 L23:59:59:23@24/24
```

L	source type L=RP188LTC, 1=RP188VITC1, 2=RP188VITC2, F=RP215
%100	valid read rate as a percentage of expected read rate
F1	Fields in which data is read - F12 indicates both field 1 and field 2
L	dynamics flags L-locked, P-play, F-forward, S-stop, R-reverse
23:59:59:23	raw, uncompensated timecode read - NOT LIKELY TO EXACTLY MATCH picture content! ':' will be replaced by '*' when timecode not valid, or not readable or discontinuous
@24/30	timecode counting rate / expected rate
22	timecode dynamics flags

6.4.15. WIN MODES (15) RP215 Film ANC encoded information

```
ENC:35MM-4P@24 1080P23.98
```

35MM-4P	Film gauge of transfer encoded in film ANC
@24	Film transfer rate encoded in film ANC
1080P23.98	Video standard at which transfer was recorded, encoded in film ANC

6.4.16. WIN ERRS (16) Pop up errors

Various error and warning messages will display briefly as they occur

6.4.17. WIN IDLE (17) Processor Idle Measurement

```
IDL: 374(73%) X:388 N:353 83
```

2737	Average Number of times through the task list per frame
(73%)	average percentage of frame spent idling
X:388	max idling
N:353	min idling
83	minimum microseconds to get through the task list

6.4.18. WIN DLO (18) Data Logging Output

```
DLO: NOT ENABLED
DLO:5 22:28:06:04@24 22:29:00:00
```

5	DLO Type Identifier
22:28:06:04	Video timecode value
@24	Video timecode counting rate
22:29:00:00	Audio timecode value

6.4.19. WIN GPI (19) GPI input frame number

```
GPI:12:59:59:23
```

Video timecode of frame number where GPI input is detected going from off to on

6.4.20. WIN PRESET STS (20) Preset status

```
USER CONFIG WRITE PENDING-20
```

Displays the above message and timer countdown until non-volatile settings are saved

6.4.21. WIN OP1 STS (21) Output 1 - Parallel Connector Pin 9 status

```
OP1H L22:00:00:22 H23:59:59:23
```

H	current status of output pin H/L depends on function programmed for this output
L22:00:00:22	Output Video Timecode at which output pin last went low
H23:59:59:23	Output Video Timecode at which output pin last went high

6.4.22. WIN OP2 STS (22) Output 2 - Parallel Connector Pin 5 status

```
OP2H L22:00:00:22 H23:59:59:23
```

H	current status of output pin H/L depends on function programmed for this output
L22:00:00:22	Output Video Timecode at which output pin last went low
H23:59:59:23	Output Video Timecode at which output pin last went high

6.4.23. WIN SLTC (23) Smoothed LTC Stats

```
STC:%100W1 N00E+1L23:59:59:23
STC:%100X12 N00E+1L23:59:59:23
```

':'	LTC threshold set at 50% of frame. or '.' LTC threshold set at 70% of frame.
%100	valid read rate as a percentage of expected read rate
W1	tolerance: number of frames of difference allowable between input LTC and smoothed LTC
X12	tolerance delay count: counts down frames where tolerance must be 0. After delay count runs to zero, then non-zero tolerance (if any) is used.
N00	jam error counter - counts number of frames where difference exceeds tolerance until jam counter reaches limit and smoothed LTC is jammed to input LTC
E+1	difference between input LTC and smoothed LTC
L	smoothed dynamics flags L-locked, P-play, F-forward, S-stop, R-reverse
23:59:59:23	smoothed LTC - NOT LIKELY TO EXACTLY MATCH picture content! ':' will be replaced by '*' when timecode not valid, or not readable, or discontinuous
@24	timecode counting rate. or shown as @24/30 - timecode counting rate / expected rate

6.4.24. WIN REV (24) Firmware Revision

```
REV DE9150B2 09 3157 U 020315
```

DE9150B2	Firmware name
09	
3157	Firmware build number
U	R = Released. U = unreleased
020315	Firmware build date

6.4.25. WIN RAM (always the last display) Ram Display

```
40000000:4f001000 08000402 4003a4b4
```

40000000: address, controlled by parameter 29-20, balance of line shows RAM contents for next 12 locations

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