HD9045TR
4:4:4 Film Footage Encoder

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	First release	Mar 04
1.1	Updated System Parameter List	May 05
1.2	Updated Typos, added info for Spirit 2K/4K telecine, updated emulsion code table	Jan 07

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CHAPTER 1
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1. OVERVIEW

The Evertz 4:4:4 Film post production system is designed to simplify the management of your film to tape transfers for both 4:4:4 RGB and 4:2:2 YCrCb high definition video. At the heart of the system is the HD9045TR Film Footage Encoder. Under control of the powerful KeyLog TRACKER™ software, the HD9045TR Film Footage encoder permits the seamless integration of video and audio time codes, film KeyKode and production information whether you are transferring to 24, 25 or 30Fps high definition video. During the transfer, KeyLog TRACKER™, Evertz telecine logging and configuration management tool logs the relationships between these important parameters and outputs many industry standard interchange file formats for use by off-line editing systems.

The HD9045TR encodes the time codes, KeyKode and production information into industry standard SMPTE RP215 vertical ancillary (VANC) data packets on the dual link RGB output. In addition the HD9045TR converts the 4:4:4 RGB to a 4:2:2 YCrCb serial output with the VANC data and optional burned in characters for monitoring. The user can also apply one of 5 user programmable look up tables to the outputs to either output. Separate LTC inputs and outputs for the audio and video time codes, allows handling of mixed film rate and video rate time codes. The programmable telecine interface allows the encoder to interface to a wide variety of telecine configurations.

The HD9150Q and HD9155Q Afterburners are powerful devices designed to facilitate the creation of off-line tapes from the 4:2:2 high definition telecine master tapes. The Afterburners downconvert the HDTV input video to SDI and analog standard definition video. When the input video is in the 1080p/24sF format the Afterburners also create a 2:3 pulldown on the output video to create a 30Fps output. The Afterburners read the RP215 film transfer data that was encoded by the HD9045TR during the telecine transfer and makes burn-in windows. The essential timecode and KeyKode data are also converted into RP201 3-line VITC and output by the Afterburner. The Afterburner automatically generates video timecode for the standard definition VTR that is converted from 24 to 30Fps, and delayed to match the complete 'A' frame cycle of delay through the Afterburner.

The new multi-resolution version of Evertz popular KeyLog Tracker software allows the user to store multiple configurations for both the 9025TR Film Footage Encoders and the Afterburners. A simple on screen control in the Tracker software performs switching between 4:4:4 and 4:2:2 modes in the HD9045TR. Toolbar buttons allow the user to quickly choose which device is being addressed.

Features:

- Accepts dual link 4:4:4 RGB SMPTE 372M (1.485 Gb/s) 1080i/59.94, 1080i/50 1080p/29.97sF, 1080p/25sF and 1080p/23.98sF digital video.
- Dual link 4:4:4 RGB SMPTE 372M outputs with RP215 VANC and characters keyed in
- Converts dual link 4:4:4 RGB SMPTE 372M to 4:2:2 SMPTE 292M with user programmable colour look up tables
- Can be operated in single link 4:2:2 SMPTE 292M mode.
- Interfaces to Evertz 5550 or 5500 KeyKode Reader
- Separate LTC reader and generator for video and audio time codes operating at 30, 25 and 24 Fps
- Control from Evertz KeyLog TRACKER™ software
- Encodes film transfer information in SMPTE RP215 VANC for high definition video and SMPTE RP201 3-Line VITC for standard definition video
- Character burns and VANC available on 4:4:4 and 4:2:2 outputs – can be independently turned on and off

1.1. HOW TO USE THIS MANUAL

This manual is organised into 6 chapters: Overview, Installation, Operation, System Parameters, and Technical Description. The overview section contains a brief overview of the HD9045TR 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 HD9045TR should be connected into your system.

Chapter 3 shows how to calibrate the system timing and verify that the HD9045TR is accurately numbering the video frames.

Chapter 4 gives a discussion of how the default operation of the HD9045TR can be changed using System Parameters. The system parameters can affect the system timing through the Afterburner, placement of characters on the raster, 2:3 cadence control, functions of parallel inputs and outputs to name a few.

Chapter 5 lists the specifications, gives a discussion of how to update the firmware in the HD9045TR and also gives a troubleshooting section with an overview of the Debug character windows available.

Items of special note are indicated with a double box like this.

1.2. 2:3 PULLDOWN CREATION FROM 24P VIDEO

When an input video feed of 1080p/23.98sF is fed to the either HD9150Q or HD9155Q HD Afterburner, the HD Afterburner inserts extra fields to create a 2:3 pulldown of the picture on the downconverted output resulting in a 525i/59.94 output. Determination of the output sequence of the fields is determined from a 6 Hz input pulse on the HD Afterburner parallel I/O connector, or from ancillary or LTC time code if it is present. Figure 1-1 shows the process of creating the 2:3 pulldown from the progressive video input.

A 6 Hz pulse applied to the Parallel I/O connector will normally identify the input frame that will become an A frame at the output (called the *A frame candidate*). This 6 Hz pulse must be coincident with the start of an input frame and can be generated using the Evertz 7700SRG-HD Slave Reference Generator module. The output of the *A frame candidate* frame will start four input frames later and will consist of two video fields.

In the absence of a 6 Hz input, video timecode derived from film ancillary data present on the video input or LTC on the Video Timecode In connector of the HD9150 can be used to control the pulldown cadence. Input video frames with frame numbers divisible evenly by 4 will normally identify the input frame that will become an A frame at the output (the *A frame candidate*). The output of the *A frame candidate* frame will start four input frames later and will consist of two video fields.

The 4 input frame (5 output frame) delay through the HD Afterburner ensures that A frames on the output are aligned with A frame candidates on the input. The systems designer must take account of this delay through the HD Afterburner when designing the audio path. This delay may be accomplished using a model HD9155Q-AUD if you have embedded audio or a model 7740DLY-AES4 Quad AES Delay module

if you have discreet AES audio. This delay must also be compensated for when calibrating the edit timing for the Standard definition VTR.

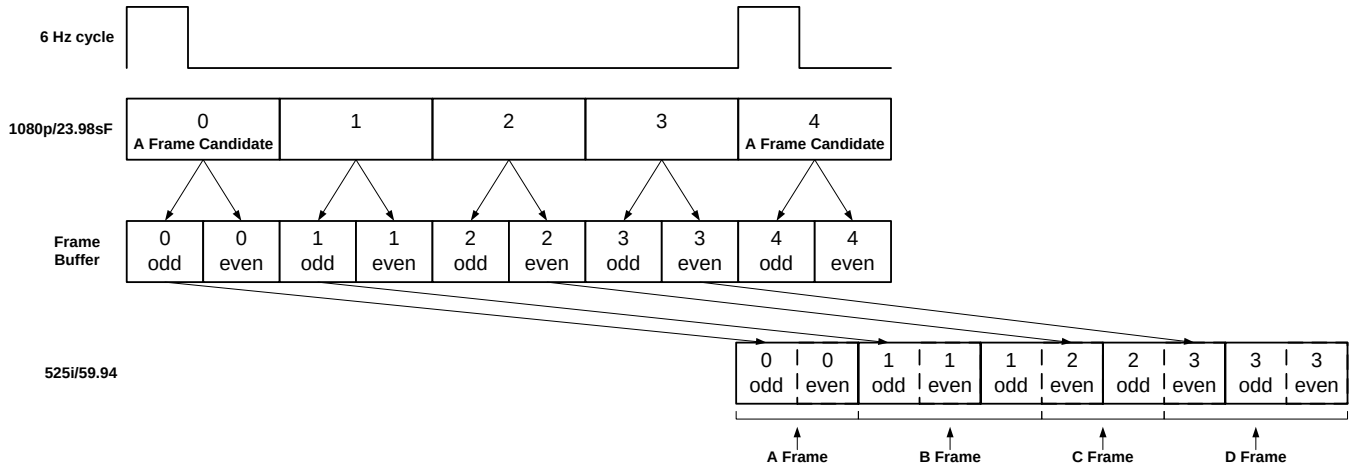

Figure 1-1: 3:2 Pulldown Creation

1.3. DEFINITIONS

2K: A Film image scanned into a computer file at a resolution of 2048 horizontal pixels.

2K: (DaVinci 2K) A colour corrector manufactured by DaVinci Systems. This colour corrector usually is accompanied with a TLC Edit Controller.

2:3 PULLDOWN: Film is typically viewed at 24 frames per second (Fps) while NTSC video is viewed at 30 Fps. To compensate for this difference in the frame rates, telecines use a 2:3 pulldown. Since each video frame is comprised of two video fields, video is viewed at 60 fields per second. Telecines can transfer 24 film frames to 60 video fields (30 video frames). The resulting ratio is 24:60 or 2:5, which means 2 film frames every 5 video fields. The 2:3 implies that one of the film frames is transferred to 2 video fields, the following film frame is transferred to 3 video fields, and so on.

24p: A progressively scanned high definition video format with 1920 pixels and 1080 lines. (See also description sF.)

3 Line VITC: A SMPTE recommended practice (RP201) for encoding Video and audio time code and KeyKode information into the vertical interval of a standard definition video signal. This method of encoding the information is intended for use in post production as a means of conveying the essential address elements that define the film to tape transfer. The encoded data is contained in a block of three consecutive lines of the vertical interval. The first line contains the video time code, the second line contains the KeyKode information, and the third line contains the audio timecode.

4K: A Film image scanned into a computer file at a resolution of 4096 horizontal pixels. 4K is considered to be a full-resolution scan of 35mm film.

4 Fsc Composite Digital video as used in D2 and D3 VTRs. Stands for 4 times the Frequency of Subcarrier, which is the sampling rate used.

4:2:2 The sampling ratio used in the D1 (CCIR 601) digital video signal. For every 4 samples of luminance there are 2 samples each of R-Y (Red minus Luminance) and B-Y (Blue minus luminance).

4:4:4 A sampling ratio that has equal amounts of the luminance and both chrominance channels.

16x9 A wide screen television format in which the aspect ratio of the screen is 16 units wide by 9 high as opposed to the 4x3 of normal TV.

A-Frame Edit: A video edit which starts on the first frame of the 5 video frame (4 film frame) sequence created when 24 frame film is transferred to 30 frame video (see 3:2 pulldown). The A-frame is the only frame in the sequence where a film frame is completely reproduced on one complete video frame. Here is the full sequence. (The letters correspond to film frames.) A-frame = video fields 1&2 (AA), B-frame = video fields 1&2&1 (BBB), C-frame = video fields 2&1 (CC), D-frame = video fields 2&1&2 (DDD).

AES/EBU: (Sometimes abbreviated as AES) Refers to the digital audio standard (AES3-1992) set by the Audio Engineering Society and European Broadcast Union and used by most forms of digital audio from CDs to professional digital video.

Aspect Ratio: The ratio of width to height in a picture. Theatre screens generally have an aspect ratio of 1.85 to 1, widescreen TV (16x9) is 1.77 to 1, and normal TV (4x3) is 1.33 to 1.

CCIR (International Radio Consultative Committee) An international standards committee. (This organisation is now known as ITU.)

CCIR-601: See ITU-R601.

CCIR-656 (This document now known as ITU-R656). The physical parallel and serial interconnect scheme for ITU-R601. CCIR-656 defines the parallel connector pinouts as well as the blanking, sync and multiplexing schemes used in both parallel and serial interfaces. It reflects definitions found in EBU Tech 3267 (for 625 line systems) and SMPTE 125M (parallel 525 line systems) and SMPTE 259M (serial 525 line systems).

Cliff effect: (also referred to as the 'digital cliff') This is a phenomenon found in digital video systems that describes the sudden deterioration of picture quality when due to excessive bit errors, often caused by excessive cable lengths. The digital signal will be perfect even though one of its signal parameters is approaching or passing the specified limits. At a given moment however, the parameter will reach a point where the data can no longer be interpreted correctly, and the picture will be totally unrecognisable.

Component analog: The non-encoded output of a camera, video tape recorder, etc., consisting of the three primary colour signals: red, green, and blue (RGB) that together convey all necessary picture information. In some component video formats these three components have been translated into a luminance signal and two colour difference signals, for example Y, B-Y, R-Y.

Component digital: A digital representation of a component analog signal set, most often Y, B-Y, R-Y. The encoding parameters are specified by CCIR-601. CCIR-656 and SMPTE 125M specify the parallel interface.

Composite analog: An encoded video signal such as NTSC or PAL video that includes horizontal and vertical synchronising information.

Composite digital: A digitally encoded video signal, such as NTSC or PAL video that includes horizontal and vertical synchronising information.

D1: A component digital video recording format that uses data conforming to the ITU-R601 standard. Records on 19 mm magnetic tape. (Often used incorrectly to refer to component digital video.)

D2: A composite digital video recording format that uses data conforming to SMPTE 244M. Records on 19 mm magnetic tape. (Often used incorrectly to refer to composite digital video.)

D3: A composite digital video recording format that uses data conforming to SMPTE 244M. Records on 1/2" magnetic tape.

D5: A component digital video recording format that uses data conforming to the ITU-R601 standard. Records on 1/2" magnetic tape.

HD-D5: A component digital video recording format that uses data conforming to the ITU-R709 standard. Records on 1/2" magnetic tape.

Drop frame: In NTSC systems, where the frame rate is 29.97002618 frames per second, the drop frame mode permits time of day indexing of the frame numbers by dropping certain frame numbers. Specifically, frames 0, and 1 at the beginning of each minute except minutes 0,10,20,30,40, & 50, are omitted, to compensate for an approximate timing error of 108 frames (3 seconds 18 frames) per hour. A flag bit is set in the time code to signal when the drop frame mode is in effect.

EBU (European Broadcasting Union): An organisation of European broadcasters that among other activities provides technical recommendations for the 625/50 line television systems.

EBU tech 3267-E: The EBU recommendation for the parallel interface of 625 line digital video signal. This is a revision of the earlier EBU Tech 3246-E standard that was in turn derived from ITU-R601.

EDH Error Detection and Handling (EDH) is defined in SMPTE RP-165 as a method of determining when bit errors have occurred along the digital video path. According to RP-165, two error detection check words are used, one for active picture samples, and the other on a full field of samples. Three sets of flags are used to convey information regarding detected errors, to facilitate identification of faulty equipment or cabling. One set of flags is associated with each check word, and the third is used to evaluate ancillary data integrity. The check words and flags are combined into a special error-detection data packet that is included as ancillary data in the serial digital signal.

Embedded audio: Digital audio is multiplexed onto a serial digital video data stream.

Edge number: The manufacturers of motion picture film stock print a frame identifying number along the edge of the film, during the manufacturing process. These numbers, also known as KEY NUMBERS, occur at one foot, or half-foot intervals, hence they have also become known as

footage numbers. The film frames between the edge numbers are identified by interpolation from one edge number to the next. (Also see KeyKode)

Traditionally, these numbers have been only human-readable. The task of properly identifying the correct number is somewhat tedious, and prone to error, so much care must be taken in establishing the reference frame's number.

Gen lock: In order to derive the 6 Hz relationship between 23.98 Fps and 29.97 Fps frame boundaries, and to ensure that the timecode to 6 Hz relationship is fixed, an NTSC colour black video reference must be supplied to the HD9025TR Film Footage Encoder. Normally, the gen lock signal is the colour black system reference to which the 24p tri-level sync generator is gen locked. The gen lock reference is only necessary when the system video type is 1080p/23.98sF.

Ink number: An identifying number is stamped along the edge of the work print and the associated magnetic audio stock. These numbers, also known as ACMADE NUMBERS, occur at one foot intervals, hence they have also become known as footage numbers. The film frames between the edge numbers are identified by interpolation from one edge number to the next.

These Ink Numbers are typically used to keep the picture and sound in sync throughout the work print conforming process.

ITU: The United Nations regulatory body governing all forms of communications. ITU-R (previously CCIR) regulates the radio frequency spectrum, while ITU-T (previously CCITT) deals with the telecommunications standards.

ITU-R601: An international standard for standard definition component digital television from which was derived SMPTE 125M and EBU 3246-E standards. ITU-R601 defines the sampling systems, matrix values and filter characteristics for both Y, B-Y, R-Y and RGB component digital television signals.

ITU-R709: An international standard for High definition component digital television from which was derived SMPTE 274M and SMPTE 296M standards. ITU-R709 defines the sampling systems, matrix values and filter characteristics for both Y, B-Y, R-Y and RGB component digital television signals.

Jam sync: Refers to the operation of slaving the generator to data coming from the reader. Jam sync should be used when dubbing time code from one tape to another, as the quality of the time code signal deteriorates with each generation, and will become unusable after the third generation.

In the jam sync mode, the generator and reader times are compared with each other during each frame, automatically compensating for the decoding offsets. If for any reason they are not equal, the jam is bypassed, and the next frame number is substituted by the generator. If the number of consecutive jam bypass errors exceeds 5, the last valid reader time is jammed into the generator again. In the absence of valid reader data within the last 5 frames, the generator continues to increment normally until valid reader code resumes. At this time it will be re-jammed to the reader, thus repairing large dropouts on the reader tape.

KeyKode: Machine readable bar-coded edge numbers introduced by Eastman Kodak in 1988, and subsequently standardised for all film manufacturers by the Society of Motion Picture and

Television Engineers as SMPTE 254M (35mm), SMPTE 271M (16mm), SMPTE 270M (65mm – 80 perf repetition) and SMPTE 313M (65mm – 120 perf repetition). AGFA refers to it as BAR Code, and FUJI as MR Code. For the sake of consistency throughout this manual we shall refer to it as KeyKode.

Key info: (also called KeyKode Prefix) The part of the KeyKode number that does not fit into the user bits of time code. The Key Info data normally consists of the film manufacturer ID, the film emulsion letter, and the first six KeyKode digits.

Letterbox: Placing a wide screen image on a conventional TV by placing black bands at the top and bottom of the screen.

Linear time code: (Also known as Longitudinal Time Code) A digital code used for timing and control purposes on videotape and associated audio tape machines. It is recorded on a linear track with audio characteristics and is referred to as LTC. Each 80 bit code word is associated with one television frame, and consists of 26 time bits, 6 flag bits, 32 user bits and 16 sync bits. This time code may run at 24, 25 or 30 frames per second depending on the video format. See also SMPTE 12M

LTC: See Linear Time Code

NTSC: National Television Standards Committee established the television and video standard in use in the United States, Canada, Japan and several other countries. NTSC video consists of 525 horizontal lines at a field rate of approximately 60 fields per second. (Two fields equal one complete Frame). Only 487 of these lines are used for picture. The rest are used for sync or extra information such as VITC and Closed Captioning.

PAL: Phase Alternating Line. The television and video standard in use in most of Europe. Consists of 625 horizontal lines at a field rate of 50 fields per second. (Two fields equal one complete Frame). Only 576 of these lines are used for picture. The rest are used for sync or extra information such as VITC and Teletext.

Pixel: The smallest distinguishable and resolvable area in a video image. A single point on the screen. In digital video, a single sample of the picture. Derived from the words *picture element*.

Prefix: The edge numbers are usually composed of a group of digits that remain constant throughout the length of the roll, and a count number, which increments every foot or half foot. The constant numbers, are referred to as the prefix. The count numbers are referred to as the footage number.

RP201: The SMPTE recommended practice for encoding film transfer information into standard definition video signals (see 3 Line VITC).

RP215: The SMPTE recommended practice for encoding film transfer information into vertical ancillary data space for high definition video signals (VANC).

Serial digital: Digital information that is transmitted in serial form. Often used informally to refer to serial digital television signals.

SMPTE (Society of Motion Picture and Television Engineers): A professional organisation that recommends standards for the film and television industries.

SMPTE 12M: The SMPTE standard for Time and address code. SMPTE 12M defines the parameters required for both linear and vertical interval time codes.

SMPTE 125M: The SMPTE standard for bit parallel digital interface for component video signals. SMPTE 125M defines the parameters required to generate and distribute component video signals on a parallel interface.

SMPTE 244M: The SMPTE standard for bit parallel digital interface for composite video signals. SMPTE 244M defines the parameters required to generate and distribute composite video signals on a parallel interface.

SMPTE 259M: The SMPTE standard for 525 and 625 line serial digital component and composite interfaces.

SMPTE 274M: The SMPTE standard for bit parallel digital interface for high definition component video signals with an active picture of 1080 lines x 1920 pixels.

SMPTE 292M: The SMPTE standard for high definition serial digital component interfaces.

SMPTE 296M: The SMPTE standard for bit parallel digital interface for high definition component video signals with an active picture of 720 lines x 1280 pixels.

SMPTE 291M: The SMPTE standard for embedding audio in serial digital high definition (SMPTE 292M) video signals.

sF: (Also known as *segmented frame)* The picture is progressively scanned, however divided into two *segments*, containing the odd and even lines. The segments are then sent out the serial digital interface in the same way that the fields of an interlaced video signal are. This format is often used at nominal frame rates of 24, 25 or 30 frames per second.

TRS: Timing reference signals used in composite digital systems. (It is four words long).

TRS-ID: Abbreviation for "Timing Reference Signal Identification". A reference signal used to maintain timing in composite digital systems. (It is four words long.)

User bits: 32 bits in the time code are user assignable. They typically are used to contain reel numbers, scene and take numbers, or other user-oriented data.

Vertical interval time code: A digital code used for timing and control purposes on video tape which is recorded in the vertical blanking interval of the standard definition video picture, and is referred to as VITC. Each 90 bit code word is associated with one television field, and consists of 26 time bits, 6 flag bits, 32 user bits, 18 sync bits, and an 8 bit error check (CRC) code. See also SMPTE 12M.

White flag: A white pulse recorded on one or more lines in the vertical interval on the first video field of a new picture. This pulse is normally used on 24 frame per second transfers to NTSC video that will end up on video disc recorders. This pulse allows the disc recorder to match the disc frames to the 2/3 pulldown automatically, ensuring jitter free playback when the recorder is

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2. INSTALLATION

2.1. REAR PANEL

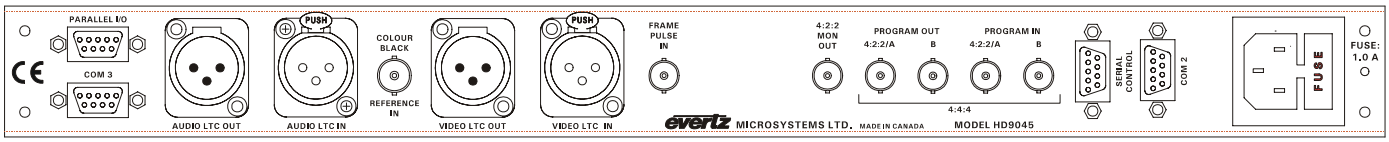

Figure 2-1: HD9045TR Rear Panel

The following sections describe the purpose of the rear panel connectors of the HD9045TR. Sections 2.1.1 to 2.1.9 describe the specific video, time code, and com port signals that should be connected to the HD9045TR.

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2.1.1. High Definition Video Connections

The HD9045TR uses the following connectors for video inputs and outputs.

4:4:4 PGM IN These two BNC connectors are for connecting dual link 10-bit 4:4:4 RGB serial digital video signals, compatible with the SMPTE 372M standard. The Link A input is for connecting the $GB_{(even)}R_{(even)}$ part of the signal. and the Link B input is for connecting the $AB_{(ODD)}R_{(odd)}$ part of the signal. If you are using 4:2:2 video, connect it to the Link A input. You will also have to set the HD9045TR to 4:2:2 mode as outlined in section xx. The HD9045TR is capable of working with the high definition video formats shown in Table 2-4.

4:4:4 PGM OUT These two BNC connectors are the dual link output of the 10-bit 4:4:4 RGB serial digital video signals with the RP215 metadata packets and optional characters inserted. The Link A output contains the $GB_{(even)}R_{(even)}$ part of the signal. and the Link B output contains the $AB_{(ODD)}R_{(odd)}$ part of the signal. If you are using 4:2:2 video, the Link A output will have the 4:2:2 program output.

4:2:2 OUT This BNC connector outputs serial component video, compatible with the SMPTE 292M standard. This 4:2:2 output is converted from the dual link 4:4:4 RGB input video and also has the RP215 metadata packets and optional characters inserted. The characters can be turned on and off independently of 4:4:4 outputs.

2.1.2. Colour Black Reference Connections

COLOUR BLACK REFERENCE IN Input BNC connector for a 27.97 frames per second reference. This should be the same reference used to genlock 29.97 frames per second audio sources in applications where the system video type is 1080p/23.98sF. The input can be either a 1 V p-p NTSC sync or colour black reference. This input is only required when the input video is 1080p/23.98sF.

2.1.3. Video Recorder Linear Timecode Connectors

These time codes will be at the system video frame rate.

VIDEO LTC OUT: A Male XLR connector for the output of SMPTE/EBU linear time code to the video recorder.

VIDEO LTC IN: A Female XLR connector for input of SMPTE/EBU linear time code from the video recorder.

2.1.4. Audio Timecode Connectors

AUDIO LTC OUT: A Male XLR connector for the output of SMPTE/EBU linear time code to the audio playback machine. The frame rate of this LTC input will correspond to the system audio frame rate. This output contains timecode that is locked to the telecine biphase, and will also be automatically updated from Film timecode being read by the 5550 Universal Film Data Decoder. It is only necessary to connect this output to the audio player's chase synchroniser LTC input when the audio machine is not being controlled by a telecine edit controller device.

AUDIO LTC IN: A Female XLR connector for input of SMPTE/EBU linear time code from audio playback machine.

This input is also used to connect to the Film TC output of the 5550 Universal Film Data Decoder in applications where Film timecode (ARRI or Matrix code) is being used. In this case the Audio LTC Out is connected to the chase synchroniser LTC input on the audio playback machine.

2.1.5. Telecine and GPIO Connections

PARALLEL I/O: A 9 pin female 'D' connector used for connection to the telecine biphase tach pulse. It also contains the FRID/SOF pulse input, used with BTS/Philips/Thomson telecines, and several other general purpose parallel remote control inputs and outputs. The inputs and outputs operate at TTL levels. Table 4-4 shows the power up default functions of the Parallel I/O connector pins, however, the functions of pins 1, 4, 5, 8, and 9 may be changed using system parameter values. Normally the System parameters (accessible from the Hardware tab of the Options screen in KeyLog TRACKER™) should be set to zero. (See section 4.4.1 for information about changing the default function of the inputs.)

Pin #	Name	Description
1	Film Rate	High to Low = 24 Fps, Low to High = 30 FPS Input (60i video only)
2	FRID/SOF	Philips/Thomson FRID/ SOF Frame Pulse Input
3	BIPH 1	Leading Biphase
4	Video Def	High to Low = Std Def, Low to High = High Def
5	Load Film	Film Frame Centred in Gate Input
6	GND	Ground
7	BIPH 2	Lagging Biphase
8	GPI	Event Log GPI
9	---	Not used

Table 2-1: Parallel I/O Connector Pin Definitions

FRAME PULSE: A BNC for input of film frame pulse. This input is only used with Cintel, ITK and Sony telecines. See the respective section for installing your specific telecine type for more information on the frame pulse requirements, and the frame handling settings required to configure the 9025TR correctly.

2.1.6. Key-Log Tracker Serial I/O Connections

COM1: A 9 pin female 'D' connector for establishing an RS-232 connection to a computer running the KeyLog Tracker software. This port is also used for firmware upgrades to the HD9045TR. See section 2.8.1 for a cable wiring diagram and more information on connecting the HD9045TR to KeyLog Tracker.

Pin #	Name	Description
1	GND	Chassis ground
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 2-2: Serial Control Connector Pin Definitions

2.1.7. KeyKode Reader Connections

COM 2: A 9-pin female 'D' connector for connection to the 5550 Universal Film Data Decoder (KeyKode Reader). The pinout of the COM 2 is shown in Table 2-3. The baud rate of the 5550 output must be set to 38400. See section 2.14 for further information about connecting the KeyKode reader.

Pin #	Name	Description
1	GND	Chassis ground
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: KeyKode Reader Connector Pin Definitions

AUDIO LTC IN: A Female XLR connector for input of the decoded Film time code (ARRI or Matrix code) from the Film TC output of the 5550 Universal Film Data Decoder in applications where Film timecode (ARRI or Matrix code) is being used. In this case the Audio LTC Out is connected to the chase synchroniser LTC input on the audio player. If you are not using Film timecode, the AUDIO LTC IN connector is usually connected to the LTC output of your audio play back device. (Nagra or DAT)

2.1.8. COM Port Connections

COM3: This 9-pin female 'D' connectors is an additional RS-232 communications port. The pinout of the COM3 port is the same as COM 2 and is shown in Table 2-3.

2.1.9. Power Connections

LINE: The HD9045TR Film Footage Encoder has a universal power supply operating on 100 to 240 volts AC, at either 50 or 60Hz.

2.2. MOUNTING

The HD9045TR 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 100 to 240 volts AC at 50 or 60 Hz. The HD9045TR 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 Fuse

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. SAMPLE CONFIGURATIONS

A sample installation setups is shown in Figure 2-2 to aid the user in properly connecting the HD9045TR into his system. Contact Evertz technical support for other applications.

Figure 2-2 shows the typical connections required for 1080P/24 video transfers when synchronising production audio using a telecine edit controller during the telecine transfer. In this configuration, the downconverted offline copy of the video tape will be made in a separate dubbing process.

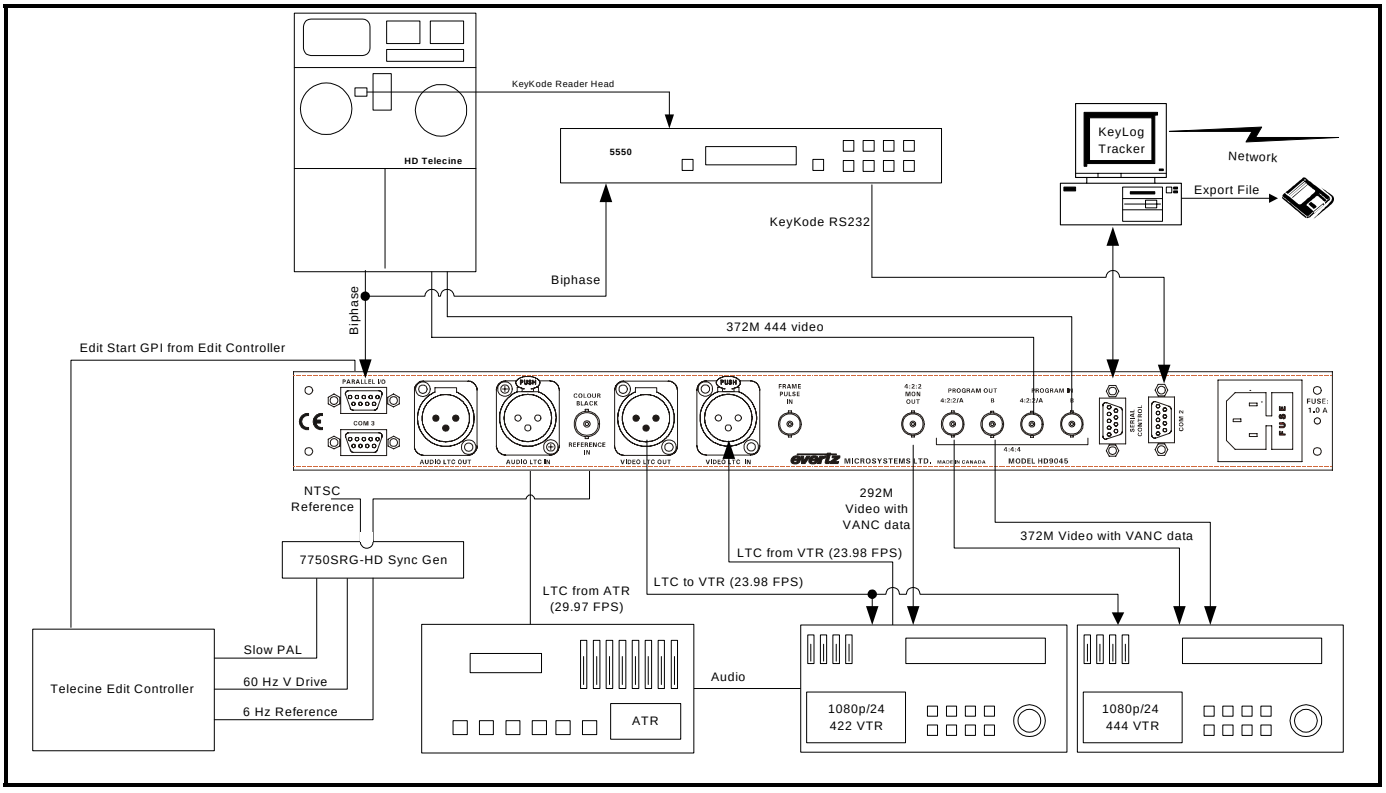


Figure 2-2: High Definition (1080p/24) Connections

2.5. CONNECTING THE VIDEO

2.5.1. Dual Link Video Input and Output

The dual link program video source should be connected to the 4:4:4 PGM IN BNCs. The Link A input is for connecting the $GB_{(even)}R_{(even)}$ part of the signal and the Link B input is for connecting the $AB_{(ODD)}R_{(odd)}$ part of the signal. The HD9045TR has built in line synchronizers to autotime the two inputs. The HD9045TR is normally configured to autodetect one of the high definition digital video in the formats shown in Table 2-4. The HD9045TR video standard may also be set manually to match the incoming video type using the KeyLog TRACKER™ software.

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/29.97sF	1920 x 1080	29.97 (30/1.001)	P (sF)	274M
1080p/25sF	1920 x 1080	25	P (sF)	274M
1080p/23.98sF	1920 x 1080	23.98 (24/1.001)	P (sF)	274M

Table 2-4: High Definition Video Input Formats

The 4:4:4 PGM OUT outputs contain the input 4:4:4 video with RP215 ancillary data (VANC) and optional characters keyed in. These outputs will normally be connected to the video recorder video input. The Link A output contains the $GB_{(even)}R_{(even)}$ part of the signal. and the Link B output contains the $AB_{(ODD)}R_{(odd)}$ part of the signal.

2.5.2. Single Link Video Input

When you want to operate the HD9045TR with single link 4:2:2 program video, the program video source should be connected to Link A/4:2:2 input. You must also set the HD9045TR to single link mode by setting the most significant bit of the Class 0 Parameter 0 System parameter to a value of 1. The HD9045TR is normally configured to autodetect one of the high definition digital video in the formats shown in Table 2-4. The HD9045TR video standard may also be set manually to match the incoming video type by setting the least significant bit of the Class 0 Parameter 0 System parameter to a value of 1 system using the KeyLog TRACKER™ software. See section 4.1 for more information about using system parameters.

Program Video	Video Standard	System Parameter Value	
		Decimal	Hexadecimal
Dual Link RGB	Auto	0	H0
	Manual	1	H1
Single Link YCrCb	Auto	-2147483648	H80000000
	Manual	-2147483647	H80000001

Figure 2-3: Video Standard System Parameter

2.5.3. 4:2:2 Single Link Video Output

In applications where you are using 4:4:4 program video the 4:2:2 output is converted from the dual link 4:4:4 RGB input video and also has the RP215 metadata packets and optional characters inserted. The characters can be turned on and off independently of 4:4:4 outputs. This output will normally be connected to a 4:2:2 video recorder. In applications where a standard definition video tape will be made concurrently with the high definition master, it can be connected to the HD PROG input of the HD Afterburner.

In applications where you are using 4:2:2 program video the Link A/4:2:2 PGM OUT contains the input 4:2:2 video with RP215 ancillary data (VANC) and optional characters keyed in. In addition the 4:2:2 output is contains a second copy of the output available on the Link A/4:2:2 output and also has the RP215 metadata packets and optional characters inserted. The characters on this output can be turned on and off independently of Link A/4:2:2 output. (At the time of writing this manual only the Link A/4:2:2 PGM OUT output is active in 4:2:2 mode.)

2.6. CONNECTING THE VIDEO RECORDER TIME CODE

The frame rate of the Video timecodes will be the same as the system video frame rate. 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 Generator

The Video LTC Generator output is available on the Video Timecode Out XLR connector on 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 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.

The HD9045TR records database index tags in the user bits of Video LTC. If the VTR is being slaved to the HD9045TR's Video LTC output, the time code generator built into the VTR should be set to the "EXTERNAL PRESET" mode of operation. The VTR's time code generator does not understand the counting sequences of the encoded data, and will introduce delays and possibly errors in the user bit data if it attempts to regenerate the timecode before recording it on tape.

2.6.2. Connecting the Video LTC Reader

Connect the LTC output from your video recorder to the HD9045TR's Video 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 is used to jam sync the HD9045TR's Video LTC generator to the code previously recorded on tape. This mode is used when the Record VTR is generating its own time code and the HD9045TR needs to read it to insert the VTR's timecode into the RP215 VANC packets.

2.7. CONNECTING THE AUDIO PLAYER TIME CODE

The frame rate of the Audio time codes may be different than the system video frame rate. Specifically, in applications where the video rate is 23.98 frames per second the Audio frame rate will usually be 29.97 frames per second. The Codes and Outputs tabs of the configuration screens in the KeyLog TRACKER™ software control the use of the Audio LTC reader and generator.

2.7.1. Connecting the Audio LTC Generator

The Audio LTC output Generator is available on the Audio Timecode Out XLR connector at the rear panel. This time code output is driven from the telecine biphase and may also be updated from incoming film timecode being read by the 5550 Decoder. Normally the Audio LTC output is only required when using Film time code, or you wish to manually enter time code slate numbers and have the audio player follow the telecine movement. In applications where the audio player is being controlled by a telecine edit controller device, you do not need to connect the HD9045TR Audio LTC output. The output level of the generator is factory set to 1 volt peak to peak, but may be adjusted using the level adjustment (labelled RTP2) located on the 9000TCIO circuit card.

The generator code output should be connected to the chase synchroniser time code input of your audio player. 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.

2.7.2. Connecting the Audio LTC Reader

Connect the LTC output from your audio player to the AUDIO 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 is used to read timecode from the audio player when it is being controlled externally, so that the audio time code can be properly logged.

The AUDIO LTC IN connector is also used to read film time code from the 5550 decoder.

2.8. CONNECTING THE HD9045TR TO KEYLOG TRACKER™

The HD9045TR is controlled using version 2.0 or later of the Evertz Film system's Graphical User interface (GUI) KEYLOG TRACKER™.

System requirements for running KEYLOG TRACKER™:

- CPU: Pentium III
  - Operating System: Win 2000, Win XPPro
- RAM: 256 Mb recommended
- mouse
- Video: 2 Mb, 800 x 600 minimum
- CD-ROM
- Hard Disk: 20 Mb Free
- Serial Ports: 2 available
- local or network printer for printing reports (recommended)
- sound card with speakers used to generate system sounds when logging (recommended)

2.8.1. Physical Connections

A nine pin sub-miniature 'D' connector **(COM1)** is provided for connection to a computer running the Evertz Film system's Graphical User interface (GUI) KEYLOG TRACKER™. This serial port provides a bi-directional RS-232-C data link at 57,600 baud. The KEYLOG TRACKER™ software is used to configure the HD9045TR's hardware for different applications. Configuration sets can be saved and recalled to speed setups of the hardware. In addition, KEYLOG TRACKER™ logs the time codes, KeyKode, ink code and pulldown relationship of the film transfer during the transfer.

In order to connect your HD9045TR to your computer make a cable as shown in Figure 2-4. Use this cable to connect the computer's COM port to the **COM1** connector on the rear of the HD9045TR. The HD9045TR 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.

HD9045TR 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 2-4: Cable to Connect HD9045TR to PC Communications Port

In applications where you are making a standard definition work copy at the same time as the high definition master, you will also need to connect the HD9150Q or HD9155Q HD Afterburner to the PC using a similar cable. The preferred method of doing this is to connect each hardware device to a different COM port on the PC as shown in Figure 2-5. Using this method, the KEYLOG TRACKER™ software can automatically switch the communications to the appropriate hardware device.

If your PC needs to have additional com ports added, make sure that they are configured so that each com port has its own interrupt.

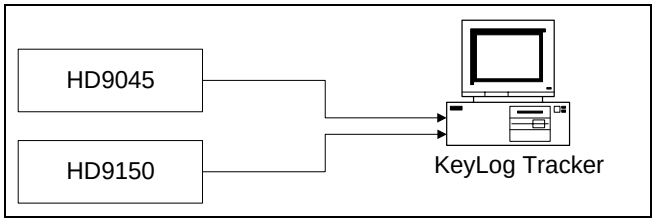


Figure 2-5: Connecting KeyLog Tracker to HD9045TR and HD9150Q using 2 COM Ports

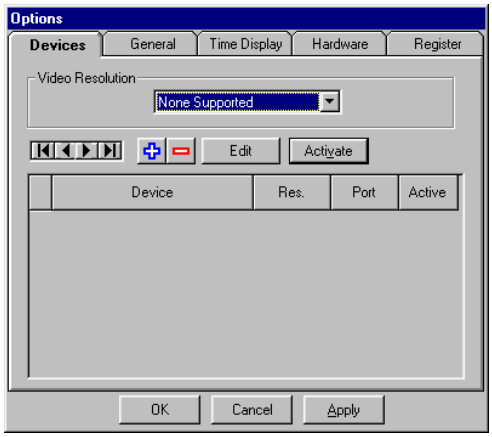
2.8.2. Installing KEYLOG TRACKER™

Insert the KeyLog TRACKER™ 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 KEYLOG TRACKER™ installation program will guide you through the installation procedure.

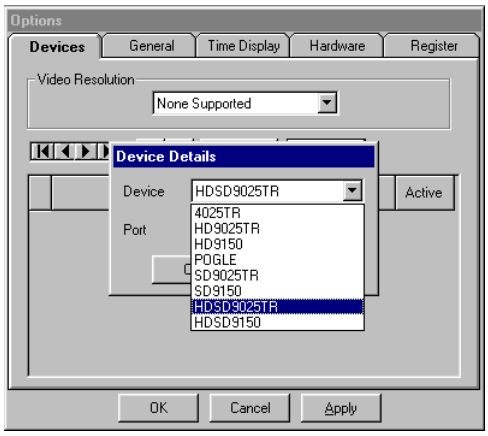
Once the installation is complete, click on the Start button and then click Programs. Select the "Evertz" program group and click on the KeyLog TRACKER™ icon.

You are presented with the KEYLOG TRACKER™ Splash screen and the "Login" dialog box. Enter "user" as a user name, leave the password area blank and click the "OK" button.

You are then presented with the "Devices" tab of the Options dialog box that prompts you to select the hardware devices you wish to control and configure the Communications ports on the computer.

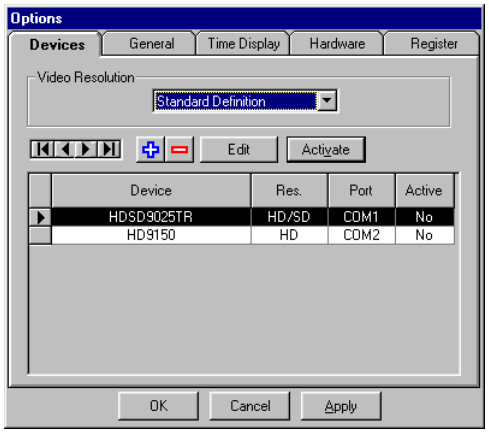


Press the button to add the HD9045TR to the list of controlled devices. Click on the down arrow beside the *Device* dropdown and choose the HD9045TR with the mouse.



Click on the down arrow beside the *Port* dropdown and choose the COM port that you connected to the HD9045TR. Press the Okay button to add the HD9045TR to the list of controlled devices. If you need to

add the HD9150Q or HD9155Q to the controlled devices repeat this procedure, selecting the correct device type and COM port. Make sure each COM port selector is set to a different COM port.



The "Resolution" control allows you to configure if the KEYLOG TRACKER™ will be operating in the Standard Definition or High Definition mode. When the resolution control is set to the high definition mode, KEYLOG TRACKER™ will *activate* the high definition capable devices. Only one encoder and one Afterburner device can be activated at any time. When you press the Okay button, KEYLOG TRACKER™ will attempt to communicate with the activated devices and change them to the desired video resolution. To verify communications with the HD9045TR, press Okay once you have verified the communications port settings. The *Encoder* button on the toolbar should be pressed down. If the KEYLOG TRACKER™ is communicating with the HD9045TR, the COMM LED on the HD9045TR front panel should be On and there should also be a green indicator in the COMM Status Bar at the bottom of the KEYLOG TRACKER™ screen. If the HD9045TR COMM LED is off or the KEYLOG TRACKER™ COMM indicator is red, that shows that the hardware is not responding. If you receive a "Communications Error" message box, check your cable connection and verify that you have selected the correct communications port on your computer.

If you have an Afterburner activated, you can press the *Afterburner* button on the toolbar to switch communications to the Afterburner. If the KEYLOG TRACKER™ is communicating with the Afterburner, the COMM LED on the HD Afterburner front panel should be On and there should also be a green indicator in the COMM Status Bar at the bottom of the KEYLOG TRACKER™ screen. If the HD Afterburner COMM LED is off or the KEYLOG TRACKER™ COMM indicator is red, that shows that the hardware is not responding. If you receive a "Communications Error" message box, check your cable connection and verify that you have selected the correct communications port on your computer.

Once you have correctly established communications with the KeyLog TRACKER™ software, consult the **First Time Setup** section of the KeyLog TRACKER™ manual or on line help system for information on configuring the system. The first time you run the KeyLog TRACKER™ software you should see a dialog box asking if you want to see the First Time Setup section of the Tracker online Help. Press the *Show Help* button to view the help file. Press the *Continue* button to proceed without opening the help file. Check the *Don't show this message again'* check box before pressing the *Continue* button if you don't want to see this message each time you start the KeyLog TRACKER™ software. The first time setup section of the manual and online help file guides you through the steps required to configure the system timing. It also introduces you to some of the basic concepts of controlling the HD9045TR from the KeyLog TRACKER™ software. We recommend that you read through this section before proceeding, ignoring the sections relating to KeyKode Head offsets and KeyKode Accuracy Tests.

2.9. CONNECTIONS TO AN EDIT CONTROLLER

2.10. CONNECTING A TLC EDIT CONTROLLER

If you wish to log the edit events created by the TLC edit controller, the easiest way to accomplish this is to connect the Slate GPI output of the TLC to the DLO GPI input on the HD9045TR. For the external TLC this GPI is available on connector J16, pin 2. Connect this GPI output to the GPI input on pin 8 of the Parallel I/O connector. Connect J16 pin 14 to the Parallel I/O ground on pin 6. For other models of TLC consult the instruction manual for the location of the GPI output.

When you are using the HD9045TR with 24p video, you need to use the 'Dual Sync' mode of the TLC. In order to accomplish this you need to connect three sync references to the TLC. These sync reference signals are all available on an Evertz 7750SRG-HD Slave Sync Generator module. Connect a 24 frames per second 'slow PAL' reference to the main TLC gen lock input, connect a 30 FPS Vertical Drive signal to the TLC Colour Frame ID input, and connect a 6 Hz pulse to the TLC J16 Pin 7. For simplicity in making cables to interconnect the HD9045TR with the telecine, 5550 and TLC, the 6 Hz connection should be made when you are wiring the biphase cable to the telecine. For more information about using the TLC in dual sync mode consult DaVinci technical bulletin TLC-052, available from the DaVinci web site. For Standard definition video operation calibrate the TLC as you normally would. For High definition video operation calibrate the system timing using the procedure outlined in Chapter 3.

2.11. CONNECTING A CINTEL TELECINE

Two signals, (biphase tach and Film Frame pulse) must be connected from the telecine in order to generate field accurate time code and KeyKode numbers. The location and description of these signals depend on the model of your telecine. Sections 2.11.1 and 2.11.2 provide an overview of the Cintel connections. Section 2.11.3 provides detailed instructions for your model of Cintel telecines. In addition to making the physical connections to the telecine you will have to select the Biphase rate, Telecine type and set up for any video processing delays between the output of your telecine and the input of the HD9045TR using the KeyLog TRACKER™ Telecine Setup Screen. Chapter 3 provides a procedure to verify that you have made the necessary connections and settings for your telecine.

2.11.1. Biphase Tach from the Cintel Telecine

The HD9045TR is fitted with a nine pin female 'D' connector (**PARALLEL I/O)** for connection to the telecine biphase. The pin connections are shown in Table 2-1.

The BPH1 and BPH2 inputs (pins 3 & 7 respectively) should be connected to biphase quadrature tach pulses from the telecine. These TTL level pulses usually come at a rate of 10 pulses per film frame. The HD9045TR can also accommodate tach rates of 1, 2 or 5 pulses per frame. For best results use the highest biphase rate possible. Use the BIPHASE RATE item of the Telecine Setup screen in

KEYLOG TRACKER™ to set the HD9045TR to the correct biphase rate. Correct connections will result in EDGE numbers that increment and decrement when the telecine moves forward and reverse respectively. In the event that the HD9045TR counts in the reverse direction when the telecine is in forward play, reverse the two biphase connections to the HD9045TR.

To minimize the effects of cross coupling and noise on the biphase signals, which can affect the counting reliability of the HD9045TR, you should use a cable, which provides separate shields for each phase of the biphase signal.

2.11.2. Cintel Film Frame Pulse

In addition to the biphase connections, a film frame pulse is required. This active low pulse occurs when a new film frame starts in the video output, while the telecine is in normal play speed. The HD9045TR uses the film frame pulse to lock its timecode output to the correct telecine pulldown sequence during the transfer.

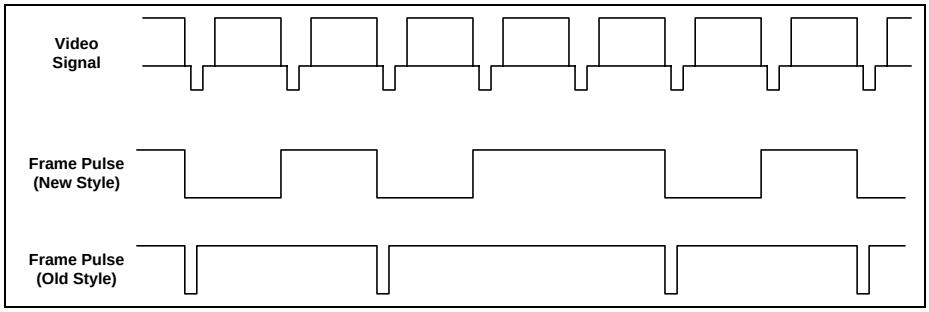


Figure 2-6: Cintel Frame Pulse (shown for 2:3 Transfers)

The actual DC voltage level of the film frame pulse is not critical as long as a 1 volt peak to peak minimum signal is applied. The HD9045TR is capable of working with a wide variety of different frame pulse waveforms. There are two different styles of Frame pulses on Cintel telecines. The new style pulse is used on URSA Gold and newer machines, The Old style pulse is used on MK III, Digi IV and URSA machines. Selecting the correct telecine type in the KeyLog TRACKER™ *Telecine Setup* screen also selects a default frame pulse handling method. The film frame pulse is sampled once per video field approximately mid-field.

It is essential that the HD9045TR be connected to the correct FILM FRAME pulse from the telecine. Generally this pulse is labelled “FRAME PULSE” on the Cintel Telecines and is found on the rear of the Telecine.

Setting the telecine type item of *Telecine Setup* screen in KEYLOG TRACKER™ also selects the default type of pulldown pulse used for the telecine. The telecine type should be set to match the Cintel telecine type being used to accept the Cintel style FRAME pulse input from the “FRAME PULSE” BNC connector on the rear panel.

2.11.3. Cintel C-Reality / DSX

The Biphase tach pulse is available on the 15 pin D Sep Mag connector on the rear of the telecine. These biphase signals must be connected to pins 3 & 7 of the 9 pin parallel I/O D connector of the HD9045TR and the Parallel I/O connector on the KeyKode Decoder as shown in Figure 2-7. Retain the separate shielding of each signal up to the HD9045TR in order to prevent cross-coupling which can adversely affect the biphase reliability.

5550 End			**HD9045TR End**			**C-Reality End**	
Parallel I/O (Male 9 pin D)			**Parallel I/O (Male 9 pin D)**			**Sep Mag (Female 15 pin D)**	
Frame Gnd		--drain--	Frame Gnd		--drain--	Frame Gnd	Shld
			Film Rate	1			
			FRID/SOF	2			
BIPH 1	3	--Pair 1--	BIPH 1	3	--Pair 1--	PH0_B	1
GND	6	--Gnd 1--	GND	6	--Gnd 1--	Ground	5
			Def	4			
			Load Film	5			
BIPH 2	7	--Pair 2--	BIPH 2	7	--Pair 2--	PH1_B	2
GND	6	--Gnd 2--	GND	6	--Gnd 2--	Ground	5

TLC End				
J16 (Female 25 pin D)				
GPO	2	--------	DLO GPI	8
Gnd	14	--------	GND	6
			-----	9
Gnd	13	6 Hz Ground		
6 Hz In	7	6 Hz Input from 7750SRG		

Figure 2-7: Cable to Connect C-Reality Biphase to HD9045TR

Connect the Read Frame Sequence BNC on the C-Reality to the FILM FRAME connector on the HD9045TR. If necessary, you can use a BNC "T" connector and continue the coax to the devices.

Do not terminate this signal.

Connection of a Film frame pulse is required even with 1:1 video transfers in 1080I to permit the HD9045TR to distinguish the difference between the field 1 and field 2 dominant pull downs.

The telecine type item on the KeyLog TRACKER™ *Telecine Setup* screen must be set to Cintel C-Reality. The film frame handling will be set to DIRECT when you set the C-Reality Telecine type.

2.11.4. Verifying the Connections to a Cintel Telecine

When you have completed the basic telecine connections, you will need to verify the frame accuracy of the basic system using the procedure in chapter 3.

2.12. CONNECTING AN ITK TELECINE

Two signals, (biphase tach and OPD pulse) must be connected from the telecine in order to generate field accurate time code and KeyKode numbers. The location and description of these signals depend on the model of your telecine. Sections 2.12.1 and 2.12.2 provide an overview of the ITK connections. Section 2.12.3 provides some additional information specific to the ITK telecine. In addition to making the physical connections to the telecine you will have to select the biphase rate, telecine type and set up for any video processing delays between the output of your telecine and the input of the HD9045TR. Chapter 3 provides a procedure to verify that you have made the necessary connections and settings for your telecine.

2.12.1. Biphase Tach from the ITK Telecine

The HD9045TR is fitted with a nine pin female 'D' connector (**PARALLEL I/O)** for connection to the telecine. The pin connections are shown in Table 2-1.

The BPH1 and BPH2 inputs (pins 3 & 7 respectively) should be connected to biphase quadrature tach pulses from the telecine. These TTL level pulses usually come at a rate of 10 pulses per film frame. The HD9045TR can also accommodate tach rates of 1, 2 or 5 pulses per frame. For best results use the highest biphase rate possible. Use the *Biphase Rate* item of the *Telecine Setup* screen in KEYLOG TRACKER™ to set the HD9045TR to the correct biphase rate. Correct connections will result in EDGE numbers that increment and decrement when the telecine moves forward and reverse respectively. In the event that the HD9045TR counts in the reverse direction when the telecine is in the forward direction, reverse the two biphase connections to the HD9045TR.

To minimize the effects of cross coupling and noise on the biphase signals, which can affect the counting reliability of the HD9045TR, you should use a cable, which provides separate shields for each phase of the biphase signal.

2.12.2. ITK Film Frame Pulse

In addition to the biphase connections, a film frame pulse is required. This pulse occurs when a new film frame starts in the video output, while the telecine is in normal play speed. The HD9045TR uses the film frame pulse to lock its timecode output to the correct telecine pulldown sequence during the transfer.

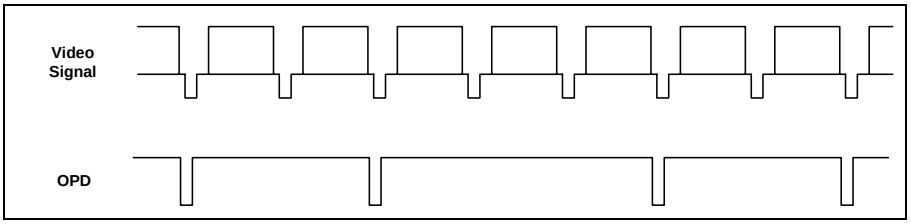


Figure 2-8: ITK OPD Pulse (shown for 2:3 Transfers)

The OPD pulse is a 2 msec wide active low pulse that goes low during the first field of each new film frame on the telecine output. This signal should always change level around VSYNC time. The OPD pulse is available on the rear panel of the telecine and must be connected to the **FRAME PULSE** connector on the HD9045TR rear panel.

Connection of a Film frame pulse is required even with 1:1 video transfers in 1080i to permit the HD9045TR to distinguish the difference between the field 1 and field 2 dominant pull downs.

Setting the *Telecine Type* item of *Telecine Setup* screen in KEYLOG TRACKER™ also selects the default type of pulldown pulse used for the telecine. The telecine type should be set to match the ITK telecine type being used to accept the OPD pulse input from the "FRAME PULSE" BNC connector on the rear panel.

2.12.3. ITK Millennium

The Biphase tach pulse is available on the 9 pin D Biphase 1 connector on the Millennium. These biphase signals must be connected to pins 3 & 7 of the 9 pin parallel I/O D connector of the HD9045TR as shown in Figure 2-9. Retain the separate shielding of each signal up to the HD9045TR in order to prevent cross-coupling which can adversely affect the biphase reliability. You should set the biphase rate of the Mag biphase in the Millennium Metaspeed menu to 10 pulses per frame.

5550 End			**HD9045TR End**			**Millennium End**	
Parallel I/O (Male 9 pin D)			**Parallel I/O (Male 9 pin D)**			**Biphase 1 (Male 9 pin D)**	
Frame Gnd		--drain--	Frame Gnd		--drain--	Frame Gnd	Shield
			Film Rate	1			
			FRID/SOF	2			
BIPH 1	3	--Pair 1--	BIPH 1	3	--Pair 1--	Mag 1+	7
GND	6	--Gnd 1--	GND	6	--Gnd 1--	Ground	6
			Def	4			
			Load Film	5			
BIPH 2	7	--Pair 2--	BIPH 2	7	--Pair 2--	Mag 2+	3
GND	6	--Gnd 2--	GND	6	--Gnd 2--	Ground	4

TLC End				
J16 (Female 25 pin D)				
GPO	2	--------	DLO GPI	8
Gnd	14	--------	GND	6
			-----	9
Gnd	13	6 Hz Ground		
6 Hz In	7	6 Hz Input from 7750SRG		

Figure 2-9: Cable to Connect Millennium Biphase to HD9045TR

The *Telecine Type* item on the KeyLog TRACKER™ *Telecine Setup* screen must be set to ITK Millennium. The film frame handling will be set to "Latch Negative Transition" Style when you set the ITK Millennium Telecine type.

2.12.4. Verifying the Connections to an ITK Telecine

When you have completed the basic telecine connections, you will need to verify the frame accuracy of the basic system using the procedure in chapter 3.

2.13. CONNECTING A PHILIPS/THOMSON TELECINE

Two signals, (biphase tach and SOF/FRID pulse) must be connected from the telecine in order to generate field accurate time code and KeyKode numbers. The location and description of these signals depend on the model of your telecine. Sections 2.13.1 and 2.13.2 provide an overview of the Philips connections. Section 2.13.3 provides some additional information specific to various telecine models. In addition to making the physical connections to the telecine you will have to select the biphase rate, telecine type and set up for any video processing delays between the output of your telecine and the input of the HD9045TR. Chapter 3 provides a procedure to verify that you have made the necessary connections and settings for your telecine.

2.13.1. Biphase Tach from the Philips/Thomson Telecine

The HD9045TR is fitted with a nine pin female 'D' connector (**PARALLEL I/O)** for connection to the telecine. The pin connections are shown in Table 2-1.

The BPH1 and BPH2 inputs (pins 3 & 7 respectively) should be connected to biphase quadrature tach pulses from the telecine. These TTL level pulses usually come at a rate of 10 pulses per film frame. The HD9045TR can also accommodate tach rates of 1, 2 or 5 pulses per frame. For best results use the highest biphase rate possible. Use the BIPHASE RATE item of the Telecine Setup screen in KEYLOG TRACKER™ to set the HD9045TR to the correct biphase rate. Correct connections will result in EDGE numbers that increment and decrement when the telecine moves forward and reverse respectively. In the event that the HD9045TR counts in the reverse direction when the telecine is in the forward direction, reverse the two biphase connections to the HD9045TR.

To minimise the effects of cross coupling and noise on the biphase signals, which can affect the counting reliability of the HD9045TR, you should use a cable, which provides separate shields for each phase of the biphase signal.

2.13.2. Philips/Thomson Film Frame Pulse

In addition to the biphase connections, a film frame pulse is required. This pulse from the Philips/Thomson telecine, (known as the SOF or FRID pulse), changes level when a new film frame starts in the video output, while the telecine is in normal play speed. The HD9045TR uses the film frame pulse to lock its timecode output to the correct telecine pulldown sequence during the transfer.

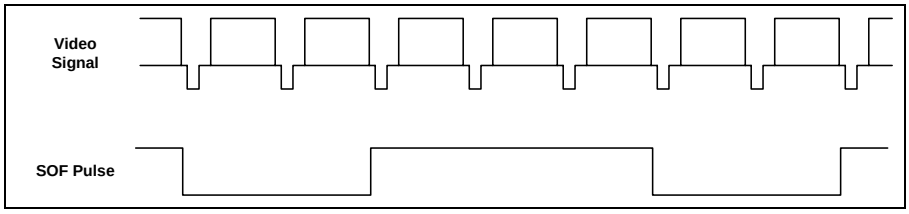


Figure 2-10: Philips SOF Pulse (shown for 2:3 Transfers)

The SOF pulse is a 'square wave' signal that goes high for 2 fields and then low for 3 fields (or vice versa) when running at 24 frames per second (in 1080p/24). The SOF pulse will be a square wave that is high for 2 fields and low for two fields in 25 frames per second transfers in 1080i/50 and 30 frames per second transfers in 1080i/60. This signal should always change level around VSYNC time. The SOF pulse is not present when the telecine is in STOP. Connect the SOF pulse to pin 2 of the 9 pin PARALLEL I/O connector.

Connection of a Film frame pulse is required even with 1:1 video transfers in 1080i to permit the HD9045TR to distinguish the difference between the field 1 and field 2 dominant pull downs.

Do NOT connect the SOF pulse to the "FRAME PULSE" BNC on the HD9045TR.

Selecting the correct telecine type in the KeyLog TRACKER™ telecine Setup screen also selects the FRID frame pulse handling method. The film frame pulse is sampled once per video field approximately mid-field.

2.13.3. Philips / Thomson Spirit / Shadow

5550 End			HD9045TR End			Philips End	
Parallel I/O (Male 9 pin D)			Parallel I/O (Male 9 pin D)			TC Gen Out (Male 9 pin D)	
Frame Gnd		--drain--	Frame Gnd		--drain--	Frame Gnd	Shld
			Film Rate	1			
			FRID/SOF	2	--Pair 3--	SOF	2
BIPH 1	3	--Pair 1--	BIPH 1	3	--Pair 1--	R	1
GND	6	--Gnd 1--	GND	6	--Gnd 1--	Ground	7
			Def	4			
			Load Film	5			
BIPH 2	7	--Pair 2--	BIPH 2	7	--Pair 2--	S	5
GND	6	--Gnd 2--	GND	6	--Gnd 2--	Ground	7

TLC End J16 (Female 25 pin D)				
GPO	2	--------	DLO GPI	8
Gnd	14	--------	GND	6
			-----	9
Gnd	13	6 Hz Ground		
6 Hz In	7	6 Hz Input from 7750SRG		

Figure 2-11: Cable to Connect Spirit/Shadow to the HD9045TR

The signals required to connect the Spirit or Shadow telecine are found on the 9 pin D TC GEN OUT connector (J23) on the telecine. Connect the TC Gen Out connector of the telecine to the 9 pin parallel I/O connector of the HD9045TR as shown in Figure 2-11. Retain the separate shielding of each signal up to the HD9045TR in order to prevent cross-coupling which can adversely affect the biphase reliability.

The telecine type item on the KeyLog TRACKER™ Telecine Setup screen must be set to Philips Spirit. The film frame handling will be set to FRID Style when you set the Spirit Telecine type.

2.13.4. GVG/Thomson Spirit 2K/4K

5550 End			9025TR End			GVG End	
Parallel I/O (Male 9 pin D)			Parallel I/O (Male 9 pin D)			TC Gen Out (Male 9 pin D)	
Frame Gnd		--drain--	Frame Gnd		--drain--	Frame Gnd	Shld
			Film Rate	1			
BIPH 1	3	--Pair 1--	BIPH 1	3	--Pair 1--	R	1
GND	6	--Gnd 1--	GND	6	--Gnd 1--	Ground	7
			Def	4			
			Load Film	5			
BIPH 2	7	--Pair 2--	BIPH 2	7	--Pair 2--	S	5
GND	6	--Gnd 2--	GND	6	--Gnd 2--	Ground	7
						CFR Out (BNC on Rack 3)	
			FRID/SOF	2	--Pair 3--	CFR	
			GND	6	--Gnd 3--	Ground	

TLC End		
J16 (Female 25 pin D)		
GPO	2	--------
Gnd	14	--------
Gnd	13	6 Hz Ground
6 Hz In	7	6 Hz Input from 7750SRG

DLO GPI	8	
GND	6	
-----	9	

Figure 2-12: Cable to Connect Spirit 2K/4K to the HD9045TR

The BIPH 1 and BIPH 2 signals required to connect the Spirit 2K or Spirit 4K telecine are found on the 9 pin D TC GEN OUT connector (J23) on the telecine. The CFR signal is a BNC on Rack 3 of the Telecine. Connect these connectors on the telecine to the 9 pin parallel I/O connector of the 9025TR as shown in Figure 2-12. Retain the separate shielding of each signal up to the 9025TR in order to prevent cross-coupling which can adversely affect the biphase reliability.

The telecine type item on the KeyLog TRACKER™ Telecine Setup screen must be set to Thomson/GVG Spirit 2K. The film frame handling will be set to FRID Style when you set the Thomson/GVG Spirit 2K Telecine type.

2.13.5. Verifying the Connections to a Philips Telecine

When you have completed the basic telecine connections, you will need to verify the frame accuracy of the basic system using the procedure in Chapter 3.

2.14. CONNECTING A SONY VIALTA TELECINE

Two signals, (biphase tach and SEQ pulse) must be connected from the telecine in order to generate field accurate time code and KeyKode numbers. Sections 2.14.1 and 2.14.2 provide an overview of the Sony connections. In addition to making the physical connections to the telecine you will have to select the biphase rate, telecine type and set up for any video processing delays between the output of your telecine and the input of the HD9045TR. Chapter 3 provides a procedure to verify that you have made the necessary connections and settings for your telecine.

2.14.1. Biphase Tach from the Sony Telecine

The HD9045TR is fitted with a nine pin female 'D' connector (**PARALLEL I/O)** for connection to the telecine. The pin connections are shown in Table 2-1.

The BPH1 and BPH2 inputs (pins 3 & 7 respectively) should be connected to biphase quadrature tach pulses from the telecine. The Biphase tach pulse is available on the 9 pin D AUX 6 connector on the Vialta. These biphase signals must be connected to pins 3 & 7 of the 9 pin parallel I/O D connector of the HD9045TR as shown in Figure 2-14. Retain the separate shielding of each signal up to the HD9045TR in order to prevent cross-coupling which can adversely affect the biphase reliability. Use the BIPHASE RATE item of the Telecine Setup screen in KEYLOG TRACKER™ to set the HD9045TR to the correct biphase rate. Correct connections will result in EDGE numbers that increment and decrement when the telecine moves forward and reverse respectively. In the event that the HD9045TR counts in the reverse direction when the telecine is in the forward direction, reverse the two biphase connections to the HD9045TR.

To minimise the effects of cross coupling and noise on the biphase signals, which can affect the counting reliability of the HD9045TR, you use a cable, which provides separate shields for each phase of the biphase signal.

2.14.2. Sony Film Frame Pulse

In addition to the biphase connections, a film frame pulse is required. This pulse occurs when a new film frame starts in the video output, while the telecine is in normal play speed. The HD9045TR uses the film frame pulse to lock its timecode output to the correct telecine pulldown sequence during the transfer.

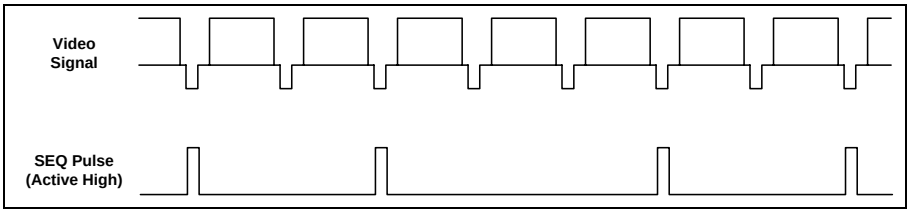


Figure 2-13: Sony SEQ Pulse (shown for 2:3 Transfers)

The SEQ pulse is a 1 msec wide active high pulse that goes high during the first field of each new film frame on the telecine output. This signal should always change level around VSYNC time. The SEQ pulse is available on the HD output module from the telecine and must be connected to the **FRAME PULSE** connector on the HD9045TR rear panel.

Connection of a Film frame pulse is required even with 1:1 video transfers in 1080i to permit the HD9045TR to distinguish the difference between the field 1 and field 2 dominant pull downs.

5550 End Parallel I/O (Male 9 pin D)			HD9045TR End Parallel I/O (Male 9 pin D)			Sony End Aux 6 (Male 9 pin D)	
Frame Gnd		--drain--	Frame Gnd		--drain--	Frame Gnd	Shld
			Film Rate	1			
			FRID/SOF	2			
BIPH 1	3	--Pair 1--	BIPH 1	3	--Pair 1--	tach10B-	6
GND	6	--Gnd 1--	GND	6	--Gnd 1--	Ground	4
			Def	4			
			Load Film	5			
BIPH 2	7	--Pair 2--	BIPH 2	7	--Pair 2--	tach10A-	9
GND	6	--Gnd 2--	GND	6	--Gnd 2--	Ground	4

TLC End J16 (Female 25 pin D)				
GPO	2	--------	DLO GPI	8
Gnd	14	--------	GND	6
			-----	9
Gnd	13	6 Hz Ground		
6 Hz In	7	6 Hz Input from 7750SRG		

Figure 2-14: Cable to Connect Sony Vialta Biphase to the HD9045TR

The telecine type item on the KeyLog TRACKER™ Telecine Setup screen must be set to Sony Vialta. The film frame handling will be set to “Active High” Style when you set the Vialta Telecine type. If your Telecine has an active low pulse then you will have to manually set the film frame handling to “Latch Negative Transition” style.

2.14.3. Verifying the Connections to a Sony Telecine

When you have completed the basic telecine connections, you will need to verify the frame accuracy of the basic system using the procedure in Chapter 3.

2.15. CONNECTING A FILM BARCODE READER

With the introduction of machine readable edge numbers by Eastman Kodak and other film stock manufacturers, (referred to as KeyKode numbers), the edge number information can now be read by a bar code reader. This eliminates the tedium and human error or manual entry, and provides an absolutely accurate identification, entry and tracking of film edge numbers.

The HD9045TR Film Footage Encoder interfaces to the Evertz Model 5550 Universal Film Data Decoder. This KeyKode reader is a self contained unit and consists of a bar code pickup head, and a decoder device. The pickup head transforms the optical dark and light bar code into electronic signals and is designed specifically to mount on the telecine feed roller just before the film enters the gate. The decoder receives these electronic signals from the pickup head, and sends the decoded KeyKode number via an RS-232 serial link to the Film Footage Encoder, for automatic placement into the time code.

The HD9045TR also interfaces to the older Evertz model 5500 and RIM DigiSync KeyKode Decoders. (See section 2.15.2 for information about connecting these decoders).

2.15.1. Hardware Installation

Consult the 5550 manual for information on installing the KeyKode reader head on your telecine. In order to connect your HD9045TR to your 5550, use the cable provided (Evertz part # WA-J18). If you need a longer cable you can make a cable as shown in Figure 2-15. Use this cable to connect the 5550 Aux I/O port to the **COM 2** connector on the rear of the HD9045TR. The SERIAL I/O port on the 5550 is typically used to connect to the TLC edit controller.

The Evertz 5500 and 5550 Decoders allow the automatic adjustment of Led intensity when connected to the telecine biphase. For simplicity of wiring this connection should be made when wiring the telecine to HD9045TR cable. See the sections on specific telecines for the correct connector pinouts.

By default the HD9045TR **COM 2** port operates at 38400 baud, while the TLC edit controller port operates at 9600 baud. You will need to set the baud rate of the AUX I/O port in the 5550 to 38400. This feature is only supported in 5550 software versions later than 990813. If your 5550 unit has an earlier software version installed, you can update it to the current version that you will find in the Firmware directory on the Tracker CD-ROM. Follow the instructions in the Read5550.Txt file in the firmware directory on the CD or consult your 5550 manual for information on updating the software.

HD9045TR End			**KeyKode Reader End**	
9 pin D Male	**Pin**	**Belden 9501**	**Pin**	**9 pin D Male**
TxD	2	Black	3	RxD
RxD	3	Red	2	TxD
Sig Gnd	5	drain	5	Sig Gnd
Frame Gnd	Shield		Shield	Frame Gnd

Figure 2-15: Cable to Connect HD9045TR to 5550 KeyKode Reader

When you have updated the 5550 software you will need to set the 5550 DIP switches as shown in the table below. Set DIP Switch 1 to the Open (38400 Baud) position and DIP switch 3 to the Closed (9600 Baud) position. DIP Switch 2 should be in the Closed position.

Dip Switch	Description	Function when Open	Function when Closed
1	Baud rate of AUX I/O port	38400	9600
2	Reserved to set more baud Rates for SERIAL I/O – Must be Closed	---	Default
3	Baud rate of SERIAL I/O port	38400	9600

2.15.2. Connecting an Evertz 5500 or RIM DigiSync KeyKode Readers

In order to connect your HD9045TR to an Evertz 5500 KeyKode reader, make a cable as shown in Figure 2-16. Use this cable to connect the 5500 Serial I/O port to the **COM 2** connector on the rear of the HD9045TR. You can use the same cable to connect the DigiSync reader to the HD9045TR. The serial ports on these readers operate at 9600 baud. In order to reduce the HD9045TR's KeyKode Reader baud rate to 9600 baud, set system parameter Class 25, parameter number 32 to a non-zero value. See Chapter 4 for more information on setting the HD9045TR system parameters.

HD9045TR End			KeyKode Reader End	
9 pin D Male	Pin	Belden 9501	Pin	9 pin D Male
TxD	2			RxD
RxD	3	Red	2	TxD
Sig Gnd	5	drain	5	Sig Gnd
Frame Gnd	Shield		Shield	Frame Gnd

Figure 2-16: Cable to Connect HD9045TR to 5500 KeyKode Reader

2.15.3. Verifying Communications between the HD9045TR and the KeyKode Reader

Once the KeyKode reader head has been installed on the telecine, and the 5550 KeyKode decoder is connected properly to the HD9045TR, you are ready to verify that the reader is reading properly, and that the two units are communicating.

Put a piece of bar-coded film stock onto the telecine, and put the telecine in Play. You should observe that the reader unit is reading the KeyKode, as by the KeyKode LED on the 5550 Decoder unit. If the KK BEEP menu item on the 5550 is set to ON, a tone from the 5550 also indicates that it is reading successfully. The KK LED on the KeyLog TRACKER™ screen should blink On each time a barcode data record is sent to the HD9045TR.

Once you have verified proper communications, proceed to the system calibration procedure in chapter 3. After you verify the basic system timing without KeyKode you will be ready to learn the head offset parameters for each film gauge and transfer rate. If communications are not realised, check the installation procedure for the reader unit and connections to the HD9045TR as outlined in the previous sections.

CHAPTER 3
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3. CALIBRATING THE HD9045TR SYSTEM TIMING

In order to achieve frame accurate numbering the HD9045TR system timing must be properly calibrated according to the following procedure. It is important to follow the procedure closely as each step depends on the successful completion of the previous step.

The Biphase accuracy test verifies the basic system connections and allows you to compensate for video delays in the colour corrector, noise reducer and other devices in the system.

If you are using an edit controller such as the TLC or POGLE you will also need to calibrate the system edit timing to achieve frame accurate edits and proper 2:3 pulldown control. If you are using the system with high definition 24p video, you will also have to calibrate the edit timing to ensure that the edits are occurring at the 6 Hz reference point. Consult the relevant manuals for information on how to do this.

3.1. CONFIGURING THE BASIC SETUP

When using KeyLog TRACKER™ software to control the HD9045TR the first thing you must do is to switch the overall behaviour of the devices from telecine (film related) devices to video devices. Choose the *Telecine Setups* item from the *Edit* menu to open the Telecine Setup Screen that will be used to configure the overall behaviour of the HD9045TR.

The *Telecine Setups* window shows the System Default Telecine Setup that is installed with the software. Each Telecine Setup consists of a group of telecine related parameters including the telecine type, the telecine biphase rate, the type of frame pulse handling that's appropriate for your telecine, and *Video Delay* and *Prestore* film delay parameters that are appropriate for your installation. Each Telecine Setup also includes a set of KeyKode head offsets.

To change the default settings to match your video based system, click on the *Edit* button. You can change the description to something more appropriate if desired. Select the telecine type that most closely matches your installation by clicking on the down arrow on the telecine type combo box. You are now presented with a list of the possible telecine types supported by the HD9045TR hardware. Click on the telecine type to select it. The default biphase rate and Frame Pulse Handling for that telecine type will be automatically entered. Select the correct biphase rate or Frame Pulse Handling using the respective combo boxes. Consult the sections in chapter 2 for your specific telecine type for information for which settings you should use.

If you have video delays between the output of the telecine store and the input of the HD9045TR hardware then set the *Video Delay* parameter to the appropriate number of fields. If you have additional *Prestore* film processing delays that have been added for devices such as film grain reducers then enter in the appropriate number of film frames of delay for your system and press the *OK* button. Note that some telecines have internal *Prestore* delays that must also be compensated for. If you do not know what these are they can be adjusted for later.

The next step that you need to do is verify that the Telecine Setups that you have configured works correctly for biphase only applications. Close the *Telecine Setups* window by clicking on the x in the top right corner.

3.2. VERIFYING THE BASIC TELECINE SETUP TIMING

KeyLog TRACKER™ allows you to save multiple System Configurations. Each System Configuration is stored separately and consists of all of the parameters related to mapping of the Time code and KeyKode Inputs and Outputs, film type and rate, Telecine Setup, Capture modes and character window attributes and positions. KeyLog TRACKER™ ships with several System Default Configurations. These Default configurations can be copied but they cannot be changed.

To verify the accuracy of the basic telecine setup copy the biphase test configuration for the video standard you are using. Select one of the System Default biphase test configurations (depending on what video standard you are using) and press the  button. You are presented with the Add System Configuration screen that has six tabs on it. Enter the name "Engineering Test" for your new System Configuration. The video standard combo box should be the same as the video standard you are using. The mode combo box allows you to quickly set up the HD9045TR hardware for various applications. Clicking on the arrow presents a list of modes that are available with the HD9045TR and KeyLog TRACKER™. Choose the *Biphase Accuracy Test* mode if it is not already displayed. Selecting a mode automatically fills in appropriate information in most of the other boxes on the configuration screen. See the System Configurations help item in the KeyLog TRACKER™ help file for a full description of the System Configuration Screen.

The *Codes* tab is used to determine the source of the logical time codes and film codes that are used within KeyLog TRACKER™. The video and audio time code sources are shown in the respective boxes. KeyLog TRACKER™ keeps track of two sets of film numbers: the KeyKode and the ink numbers. For the biphase test we want to update the KeyKode numbers manually so that we can tell the accuracy of the system and for the moment we are going to ignore the ink numbers.

The *Outputs* tab allows you to select what timecode and KeyKode outputs are going to occur for the box. There are linear timecode (LTC) outputs for video and audio, three lines of vertical internal timecode (VITC) for standard definition video or Vertical Ancillary Data (VANC) for high definition video. Each of the combo boxes allows you to choose the outputs for your particular application. All of the outputs are preset when you choose the *Biphase Accuracy Test* mode.

The *Film* tab allows you to choose the type of film that you are using, the film transfer rate and the edge number encoding style and to adjust any of the KeyKode settings that are appropriate. Select the appropriate Film Gauge and Film Rate.

The *Capture* tab allows you to set various parameters that happen while you're capturing data from the HD9045TR. You can ignore the capture settings for the biphase test.

The *Telecine* tab allows you to choose a particular Telecine Setup. At this time the Default System Telecine Setup is the only one available.

The *Windows* tab allows you to configure the characters windows burned in on the video. Make sure that the Video Time Code and KeyKode windows are turned on. To do this, select the appropriate window from the list and press the Edit button or just double click on the window name. Make sure that the Window check box is checked, and press the *Okay* button. For more information about configuring the character window displays see the *Project Configuration - Window Settings* help topics in the KeyLog TRACKER™ help file.

Press the *Okay* button to send this information to the HD9045TR hardware and save the new System Configuration. Close the System Configurations window by clicking on the x in the top right corner.

After setting up the system configuration proceed to the Biphase Accuracy Test to verify the accuracy of your basic telecine setup.

3.3. BIPHASE ACCURACY TEST

The biphase accuracy test allows you to verify that you have compensated correctly for the system delays in the telecine and the video delays between the output of the telecine and the input of the HD9045TR. (Colour corrector and noise reducer delays typically) Once you have verified the basic connections, you may proceed to the KeyKode reader installation.

If you do not verify the frame accuracy of the system at this time, the accuracy of your system with KeyKode will also be affected.

The following simple procedure will help you establish that the HD9045TR is properly installed, and that it is configured correctly for your application.

1. Make note of the key number on a piece of reference film. This number is usually the Key number of the frame where a reference KeyKode dot is located (i.e. on the whole foot mark). Mark this reference frame with a punch or grease pencil.

2. Place this film on the telecine, with the reference frame in the gate.

3. If you have already set up the Telecine Parameters and sent the configuration to the hardware as described in section 3.1 and 3.2 you can proceed to step 4.

   a) Open the KeyLog TRACKER™ Telecine Setup screen from the *Edit* menu, and select the *System Default Telecine Setup*. Click the Edit button to make changes to the System Default Telecine Setup. Set the Video Delay parameter to match the path delay (in video fields) between the telecine output and the HD9045TR input.

   b) Open the System Configuration screen from the *Edit* menu and then open the System Default Configuration called Biphase Accuracy test for the video standard you are using. You will be prompted to make a copy so click *Okay*. Give the new configuration a suitable name such as 'Engineering Test'. Make sure that the telecine tab parameters match those of the System Default Telecine Setup. Press the *Okay* button to send the configuration to the HD9045TR. It will place the hardware in the correct mode to perform the following test. Close the System Configuration screen. (See the section titled "First Time Setup" in the KeyLog TRACKER™ manual or online help for detailed information).

   c) Open the Encoder Status window using the 

button on the toolbar. This window will allow you to see critical information on the telecine timing during the accuracy test.

4. a) Select *Load Film* from the *Tools* menu, or press the Load Film button  on the toolbar. (The Load Film procedure must be done each time a new piece of film is loaded onto the telecine. See the Load Film help item in the in the KeyLog TRACKER™ manual or Online Help for more information.)

b) Open the Set Codes window from the *Edit* menu (or press the F2 key) to enter the key number of the reference frame into the KeyKode register, and set the Video time code to 01:00:00:00

5. Back up the telecine and transfer a short piece of film (which includes the reference frame) to videotape. If you are using an edit controller, set the In point of the edit to occur before the reference frame so that you will be able to see the complete pulldown sequence before and after the reference frame. Make sure that the character generator output of the HD9045TR is recorded on the videotape. When the telecine achieves locked PLAY speed, the telecine FRAME and LOCK LEDs on the HD9045TR front panel should be on and there should be a '+' between the footage and frames in the character generator. Press the HELP button on the Encoder Status window if you are not seeing the '+' indicator.

6. While the telecine is in Play with the Lock indicator on, make a note of the "Scan Track" value on the Encoder status window. This value shows where the HD9045TR thinks the film frame boundaries are and how much the film is moving in the gate due to the effect of Scantrack on older Cintel telecines. When the telecine is first put into the PLAY mode, the Scan Track value should be approximately 00. If you have a Cintel Telecine with Scantrack enabled, the Scan Track value will change gradually, with expected values of less than ±15. On telecines that do not have Scantrack, this value should be relatively constant with a value of less than ±15 when in the locked PLAY condition.

If the Scan Track value exceeds ±19, a counting error will occur in the biphase based numbers. This may be due to a telecine with excessive Scantrack settings, or to improper centering of the film when it is loaded onto the telecine. It may also be due to the telecine type being set incorrectly.

7. If you are not using the film system in a 2:3 pulldown mode you can proceed to step 8. Play back the videotape in slow shuttle or jog mode. Examine at least 5 fields of video around the reference frame, and verify that the pulldown of the picture matches the pulldown of the edge number characters. Do not be concerned if the frame numbers do not match if you know that your telecine has a Prestore Delay.

   If the pulldown does not match, then adjust the *Video Delay* parameter in the Telecine Setup Screen. The *Video Delay* parameter will normally be an even number of fields. If the value you determine to be correct is an odd number then adjust it up or down by 5 fields. Park the telecine with the reference frame in the gate and repeat steps 5 and 6 until the pulldown matches. (See section 3.5.5 for more information about the *Video Delay* parameter).

8. Once you have verified that the pulldown is correct, verify that the timecode and edge code numbers that you entered for the reference frame are correct. If they are correct you can proceed to learn the KeyKode reader head offset. (See section 3.4.)

   If the Edge numbers are not correct, adjust the *Prestore Delay* parameter on the Telecine Setup Screen. (If the Edge number showing in the window is greater than the reference frame number on the film, increase the *Prestore Delay* parameter.)

   If the Timecode numbers are not correct, check that you have set the correct *Telecine Type* setting on the Telecine Setup Screen.

As a last resort, the Timecode numbers can be adjusted with respect to the Edge numbers by adjusting the Dynamic Trim parameters.

These values should be adjusted with caution, as they do not usually have to be changed from their default values.

In 24 Fps 60i transfers, the pulldown of the reference frame is not guaranteed unless you are using a device such as a Time Logic Controller to control the telecine. This means that the reference film frame may correspond to more than one video frame, and that the exact timecode / edge code numbering relationship is ambiguous except for A frame pulldowns.

9. After you have made any adjustments, park the telecine with the reference frame in the gate. The burn in windows should show the original numbers you entered in step 4a) and the Scan track value showing in the Encoder Status window should be the same as it was after you did the Load Film operation in step 4a). If these numbers do not agree, it may indicate that you are losing biphase counts. Check the instruction in the relevant section of Chapter 2 on connecting the biphase. If the values are the same, repeat steps 4 through 6 until you have satisfactory results. Once you have verified the basic system timing, you may proceed to the KeyKode reader installation.

3.4. LEARNING THE KEYKODE READER HEAD OFFSET

When installing the pickup head on the telecine, there will be a fixed mechanical mounting offset between the KeyKode reader head and the actual film frame in the gate. This offset will in general change from installation to installation, but will be fixed for any given installation. Care should be taken when installing and removing the reader head from the telecine, so that the same offset can be maintained. The angle of the reader head, when it is mounted on the telecine may affect the head to gate offset, and the reader reliability. In general it is desirable to align the reader head such that the angle that the film enters and leaves the reader head is approximately the same. It may be desirable to make an alignment mark on the telecine, to facilitate re-installation, should it become necessary to remove the reader head.

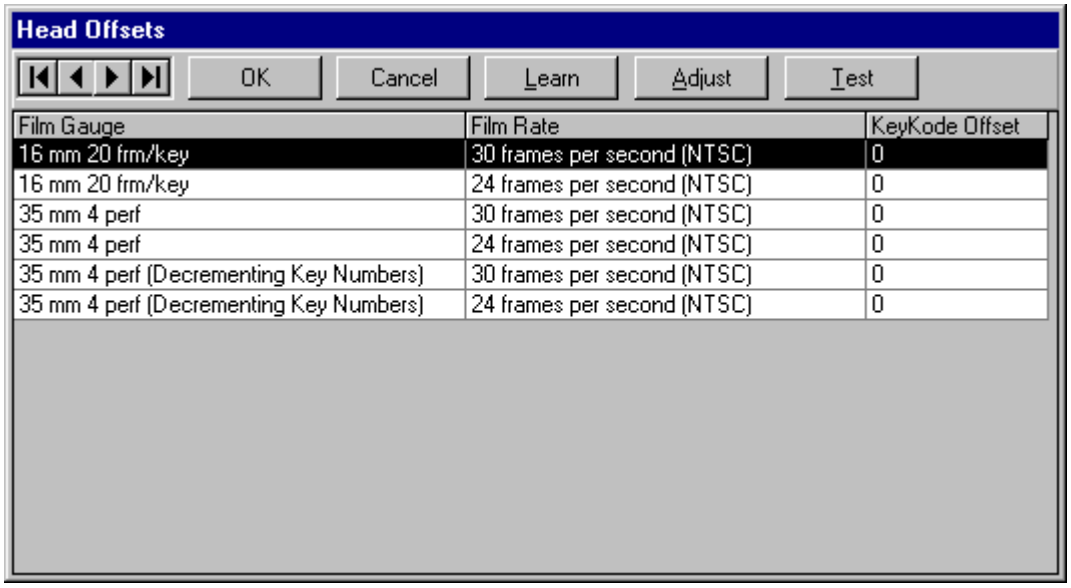
The HD9045TR uses separate head offset values for 16 mm and 35 mm film types for each transfer speed. The KeyLog TRACKER™ software provides a wizard to guide you through the process of learning each of the head offsets. Once calibrated, these head offsets are stored in the KeyLog TRACKER™ Telecine Setup and are sent to the HD9045TR each time a system configuration or project configuration is applied. There is a separate list of head offsets stored in each Telecine Setup, so it is desirable to learn all the head offset values you will need before creating additional Telecine setups. A summary of the Head offsets is available using the Edit Telecine Setup screen or from the Telecine tab of the configuration screen.

The Head offset learning procedure MUST be performed before the HD9045TR will use the KeyKode information it receives. The head offset for each film type and transfer speed MUST be initialised for each combination used. You will not be able to save configurations that use a film gauge with an unlearned head offset.

The head offset learning procedure calculates the exact offset between the head and the gate, and is normally required only during installation. The following the procedure is outlined in the KeyLog TRACKER™ manual section titled *Learning the KeyKode Head Offsets* and is also provided in the online help for KeyLog TRACKER™.

1. Put a piece of bar-coded film stock onto the telecine, and put the telecine in Play. You should observe that the reader unit is reading the KeyKode, as indicated on the reader electronics unit. Usually a beep or tone from the reader electronics unit indicates that it is reading successfully. Also, the KK indicator on the KeyLog TRACKER™ status bar should blink each time a barcode data record is sent to the HD9045TR.

2. The next step is to learn the KeyKode head offsets. This is done on the KeyLog TRACKER™ *Telecine Setups* screen. Select *Telecine Setups*... from the *Edit* menu. The Telecine Setups window will open and the System Default Telecine Setup will be selected. Press the *Edit* button to make changes to this telecine setup, and press the *Head Offsets* button to open the Head Offsets screen. This screen shows a summary of the possible head offsets available for the video standard you are using.



3. Select the head offset that you want to learn and press the Learn button. The head offset learning wizard will guide you through each of the steps necessary to properly learn the head offset. The first screen reminds you to perform the *Biphase accuracy test* before you attempt to learn the head offset. If you have already done that press the *Next* button to proceed. If not, then go back and perform the biphase accuracy test as described in section 3.1.

4. On a piece of bar-coded film stock, select a reference frame that is beside one of the barcodes. (The reference frame is located beside the reference dot of the barcode as shown in the graphic on the Head offset wizard screen.) Identify this frame with a punch mark or grease pencil. On 35 mm film, make sure that you don't choose one of the mid-foot bar codes but one of the whole foot ones which have a larger human readable font. The second screen shows what the reference frame KeyKode number should look like for the film type you are using. Press the *Next* button to proceed.

5. Thread this film onto the telecine, and place the reference frame in the gate. Enter the foot and frame number corresponding to the reference frame in the Frame Number box. Select the perf number that corresponds to the perf of the reference frame using the Perf pull down. The barcode in the graphic should look like it does beside the reference frame on the film. Press the *Next* button to proceed to the next step.

6. Put the telecine in play and proceed to learn the head offset. When the telecine is running and KeyKode is reading the learn button becomes active and the KeyKode/Biphase error will show the number of frames of discrepancy between the KeyKode coming in from the reader and the number that you manually entered. Press the *Learn* button. KeyLog TRACKER™ will automatically calculate the head offset and send it to the HD9045TR. The KeyKode/Biphase error and KeyKode perf offset will show ?? for a few seconds and then they will be updated with the information based on the new head offset. The KeyKode/Biphase error should be zero. The KeyKode perf offset should match the target perf offset shown. The target perf offset is calculated by KeyLog TRACKER™ based on the perf orientation of the reference frame's KeyKode. If necessary you will be prompted by a red warning message to manually adjust the head offset or to press the *Learn* button again. When you have learned the correct head offset press the *Next* button to proceed.

If you are using a reference film with discontinuities of the KeyKode numbers (such as the Kodak KeyKode Verification film) you must complete the learning process before you go across the splice.

7. Press the *Finish* button to complete the head offset learning for this film type and store the new head offset in the head offset table. You may now proceed to learn other head offsets or you may proceed to do the KeyKode accuracy test. Make sure you press the *OK* button to save the head offsets. Press the *OK* button one more time to save the head offsets along with your telecine setup.

3.5. KEYKODE ACCURACY TEST

To verify the accuracy of the system with KeyKode, modify the Engineering Test system configuration created previously. Choose *System Configurations* from the *Edit* menu. Double-click on the Engineering Test Setup. You are presented with the *Edit System Configuration* screen for the Engineering Test System Configuration. Choose the "KeyKode Accuracy test" mode. This will automatically fill in appropriate information in most of the other boxes on the configuration screen. For the KeyKode test we want to update the KeyKode numbers when the Telecine is in Play and Shuttle. Select the appropriate Film Gauge and Film Rate from the Film Tab. Make sure that the Video Time Code and KeyKode character windows are visible using the *Windows* tab. Press the *Okay* button to send this information to the HD9045TR hardware and save the edited System Configuration. Close the System Configurations window by clicking on the x in the top right corner.
In order to proceed with the KeyKode Accuracy test use the following procedure:

1. Make note of the key number on a piece of reference film. This number is usually the Key number of the frame where a reference KeyKode dot is located (i.e. on the whole foot mark.). Mark this reference frame with a punch or grease pencil. Place this film on the telecine, with the reference frame in the gate. Select Load Film from the Tools menu, or press the Load Film button  on the toolbar. (The Load Film procedure must be done each time a new piece of film is loaded on to the telecine. See the "Load Film " help item for more information.)

2. Open the Set Codes window in KeyLog TRACKER™ by selecting Set Codes... from the Edit menu, or press the F2 key. Set the Video timecode to 01:00:00:00 and set the KeyKode footage number to 0000+00 by entering the values into the respective fields. (This will allow you to tell when the KeyKode numbers have been automatically updated from the

incoming KeyKode information.) Press the *OK* button. Open the Encoder Status window by pressing the  button on the toolbar.

3. Back up the telecine to allow at least 5 seconds pre-roll time. Transfer a short section of film (which includes the reference frame) to videotape. When the telecine achieves locked PLAY speed, the telecine FRAME and LOCK LEDs on the KeyLog TRACKER™ status bar should be on and there should be a '+' between the footage and frames in the character generator. The KeyKode number on the KeyLog TRACKER™ time bar should update so they are the same as the KeyKode of the reference frame. The KK indicator on the KeyLog TRACKER™ status bar should be on. Press the HELP button in the Encoder Status window if the FRAME, LOCK or KK indicators are not on.

4. Play back the videotape in slow shuttle or jog mode, and verify that the Video timecode and KeyKode numbers and the pulldown letter (in 60i 24 Frames per second transfers) for the reference frame are correct.

5. If the KeyKode numbers are not correct, recheck the head offset learning procedure as described in section 3.4

6. If the timecode numbers are not correct, check that you have set the correct Film Rate setting in the System Configuration that you created for this test.

7. In 24 FPS 60i transfers, the pulldown of the reference frame is not guaranteed unless you are using a device such as a Time Logic Controller or POGLE to control the telecine. This means that the reference film frame may correspond to more than one video frame, and that the exact timecode / edge code numbering relationship is ambiguous except for A frame pulldowns.

8. In 30 FPS 60i or 25 FPS 50i transfers the film frame and timecode numbers should change when the picture content changes.

9. After you have made any adjustments, park the telecine with the reference frame in the gate and repeat steps 2 through 4 until you have satisfactory results. If you are still experiencing problems, recheck the accuracy of the numbers without KeyKode as described in section 3.3. To verify the accuracy for other film formats or transfer rates, Select *System Configurations...* from the *Edit* menu and double click on the Engineering Test System Configuration. Select the appropriate Film type or Film transfer rate on the Film tab and press *Ok*. Then repeat the verification procedure outlined above.

3.6. CALIBRATING THE SYSTEM TIMING IN 24P DUAL SYNC MODE

The following sections describe the procedure for calibrating the film system consisting of an HD9045TR and a HD9150Q or HD9155Q operating in HD 24p mode used in conjunction with a HD telecine, DaVinci 2K colour corrector, and External TLC edit controller. Throughout this chapter we will refer to either the HD9150Q or HD9155Q generically as 9150.

The following procedure should be used to calibrate the edit timing. Figure 3-1 shows edit timing that is properly aligned with the system 6 Hz reference pulse. Figure 3-2 shows edit timing that is not properly aligned with the system 6 Hz reference.

3.6.1. Setting up the System Timing for 24p Video

1. Switch the system to 24p mode. Make sure that the telecine is receiving 24p tri-level sync. Make sure that the TLC has been modified for Dual Sync mode according to the instructions in TLC Technical bulletin TLC-052.

2. If you are using the Evertz 7750SRG-HD to provide the reference pulses to your system make sure that it is configured correctly. Table 3-1 shows the most common switch settings. Make sure that the 7750SRG-HD is receiving an NTSC genlock reference and that DIP switch 6 is set to the On position.

DIP Switch					Output				Genlock		
1	2	3	4	5	1	2	3	4	Type	Lock	Phased Outputs
On	Off	Off	Off	Off	1080i/59.94	1080p/23.98sF	625i/47.96	6Hz Pulse	NTSC	Phase	1
On	On	Off	Off	On	59.94 V drive	1080p/23.98sF	625i/47.96	6 Hz Pulse	NTSC	Phase	1

Table 3-1: 7750SRG-HD Sync Output Selection Switch Settings

Connect the 23.98psF tri-level sync from output 2 the 7750SRG-HD to the telecine. Connect the slow PAL sync from output 3 of the 7750SRG-HD to the TLC Black input. Connect the 59.94 Hz V-Drive from output 1 of the 7750SRG-HD to the TLC CFID input. Connect the 6Hz reference pulse from output 4 of the 7750SRG-HD to the TLC Aux (J16) pin 7. You will also need to connect this output to pin 1 of the 9150 parallel I/O Connector.

3. Perform the Biphase Accuracy test for 24 P video as described in section 3.3. You should not have to adjust the *Prestore* delay parameter in the Telecine setup screen. You may have to adjust for different video path delays if for example you do not have a noise reducer in the 24p video path. If you need to change the *Video Delay* parameter you are better to create a new Telecine Setup for 24p.

   You do not need to calibrate the edit timing in the TLC before doing the 24p Biphase accuracy test. You just need to make sure the Biphase based film numbers in the burn-ins agree with those on the film. Also, verify that the Biphase based time code is 1:00:00:00 at the reference film frame.

4. Perform the KeyKode Head offset learning for 24p video as described section 3.4. When you have done that, performs the KeyKode-accuracy test as described in section 3.5. Now that you have confirmed the accuracy of the HD9045TR character windows in 24p video mode you will use them to adjust the timing of the rest of the system.

3.6.2. Calibrating the Telecine Sync Timing

1. Park the film on a reference frame (preferably one at the beginning of a foot e.g. 7345+00).

2. Record one or two minutes of colour bars on the 24 from HD VTR starting at timecode 00:59:50:00.

3. Mark the film reference frame number as the Edit In point and set 1:00:00:00 as the Edit In point for the HD VTR.

4. While the film is parked on the reference frame enter 01:00:00:00 into the HD9045TR's VTR time code register using the *Set Codes* screen (accessible from *Edit* menu or by pressing the F2 key). Make sure that the HD9045TR is still set to the KeyKode Accuracy test mode. The VTR Time code generator should be set to *Internal Regen* mode.

5. Perform an open-ended edit using the previously entered In points. Make sure you record the Character windows of the HD9045TR.

6. Turn on the HD9045TR Status screen in Tracker. While the edit is in progress, look at the "Video Timecode pulldown value on the HD9045TR Status Screen in Tracker. If it shows "A", then the *Film *Sync Trim* in the TLC is correct. If it is not "A", then adjust the *Film *Sync Trim* in the TLC by the number of frames shown in the chart below.

   NOTE: The Timecode Pulldown value is only valid while the edit is being performed.

Time Code Pulldown Value	Adjust * Sync Trim by:
A	0
B	+3
C	+2
D	+1

   Repeat steps 5 and 6 until the Timecode pulldown value is A.

3.6.3. Calibrating the HD VTR Timing

1. Once you have an edit where the Timecode pulldown value is "A", then go back to the first frame of the edit. Compare the character burn-in of the HD9045TR video time code with the TLC's display of the VTR's time code. If they are the same then proceed to step 8.

   If they are different, adjust the *HD VTR *Sync Trim* value in the TLC by the number of frames of difference between the burn-in and the VTR's timecode. Perform the edit again. In order to be able to distinguish the new edit from the previous edit it is recommended that you change the colour correction significantly before performing the edit. Doing this each time you perform an edit will minimise confusion in determining accuracy at the edit point.

2. Once you have an edit where the HD9045TR Video Time Code burn-in agrees with the TLC's reporting of the VTR timecode, and then park the tape on the first field of the edit. Compare the time code reported by the TLC with the Edit In point you selected for the VTR. Adjust the *HD VTR *In Trim* value in the TLC until the edit occurs where you wanted it to be. Once you have set the value, you will have to set the *HD VTR *In Trim* to the same value.

3.6.4. Calibrating the SD VTR Timing

3. If you are using a SD VTR in the Edit suite you will also have to calibrate its timing. Connect the Video Out of the HD9045TR to the Video In of the 9150. Make sure that the 6 Hz pulse from the 7750SRG-HD is connected to pin 9 on the 9150 Parallel I/O connector. Connect the Video output of the 9150 to SD VTR.

Repeat the same edit but add the SD VTR as a second recorder. Make sure that you record the Character burn-in windows from both the HD9045TR and 9150 on the SD VTR. Locate a frame early in the edit where the HD9045TR Video timecode burn-in has the frames at 00. Compare the character burn-in of the HD9045TR and 9150 video time code. The 9150 and HD9045TR burn-ins should agree when the frames numbers of the HD9045TR are divisible by 4. These frames should also be A frames on the 9150 output video. Also compare the character burn-in of the 9150 video time code with the TLC's display of the SD VTR's time code. If they are the same then proceed to step 8.

If they are different, adjust the *SD VTR *Sync Trim* value in the TLC by the number of frames of difference between the 9150 burn-in and the VTR's timecode. Perform the edit again. In order to be able to distinguish the new edit from the previous edit it is recommended that you change the colour correction significantly before performing the edit. Doing this each time you perform an edit will minimise confusion in determining accuracy at the edit point.

Note: there is a 5 frame delay (4 frames at 24 FPS) in the 9150, so the **Sync Trim* value you would expect is 5 frames more than the HD VTR.

4. Once you have an edit where the 9150 Video Time Code burn-in agrees with the TLC's reporting of the SD VTR timecode, and then park the tape on the first field of the edit. Compare the time code reported by the TLC with the Edit In point you selected for the SD VTR. Adjust the *SD VTR *In Trim* value in the TLC until the edit occurs where you wanted it to be. Once you have set the value, you will have to set the *SD VTR *In Trim* to the same value.

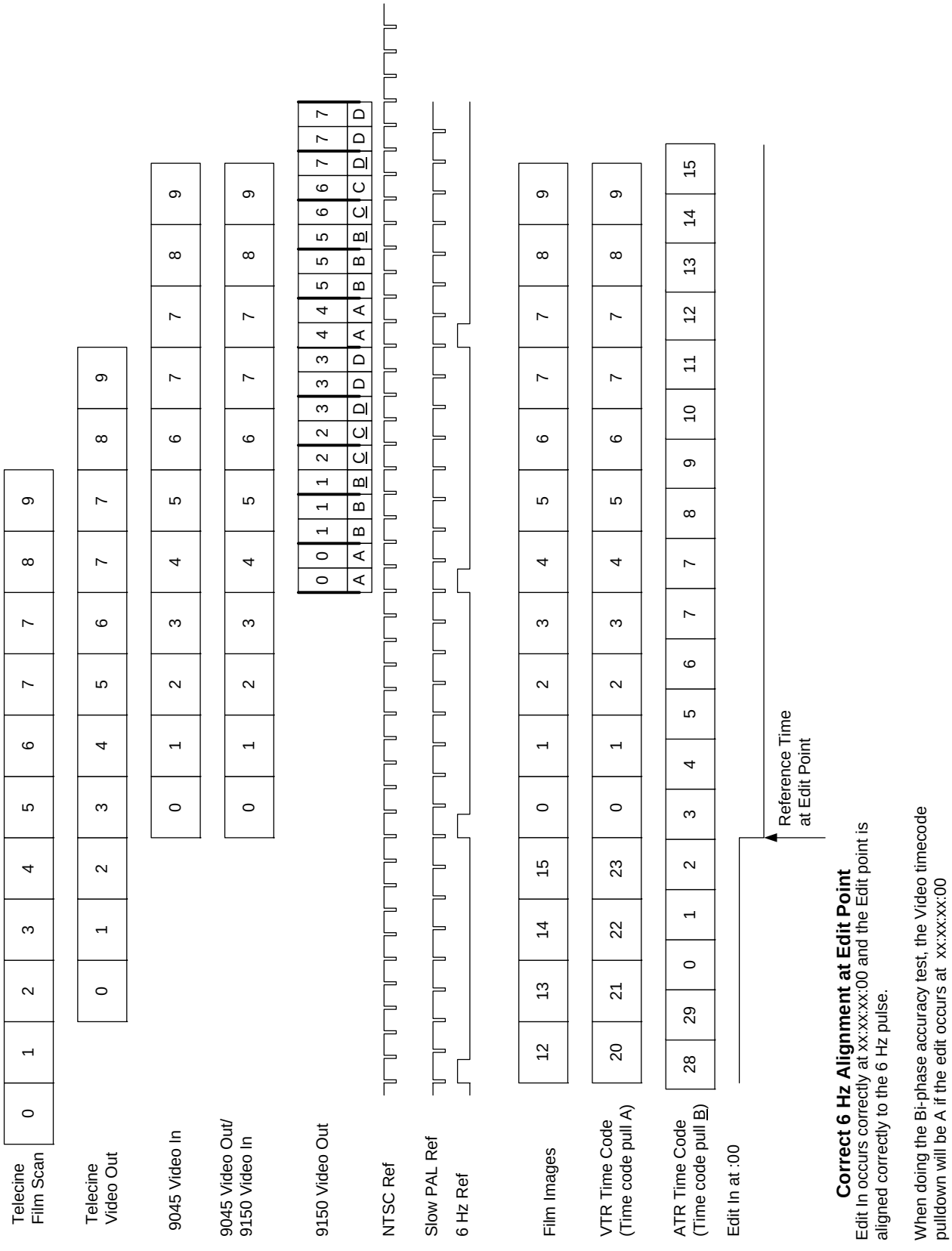


Figure 3-1: Correct 24P Edit Timing

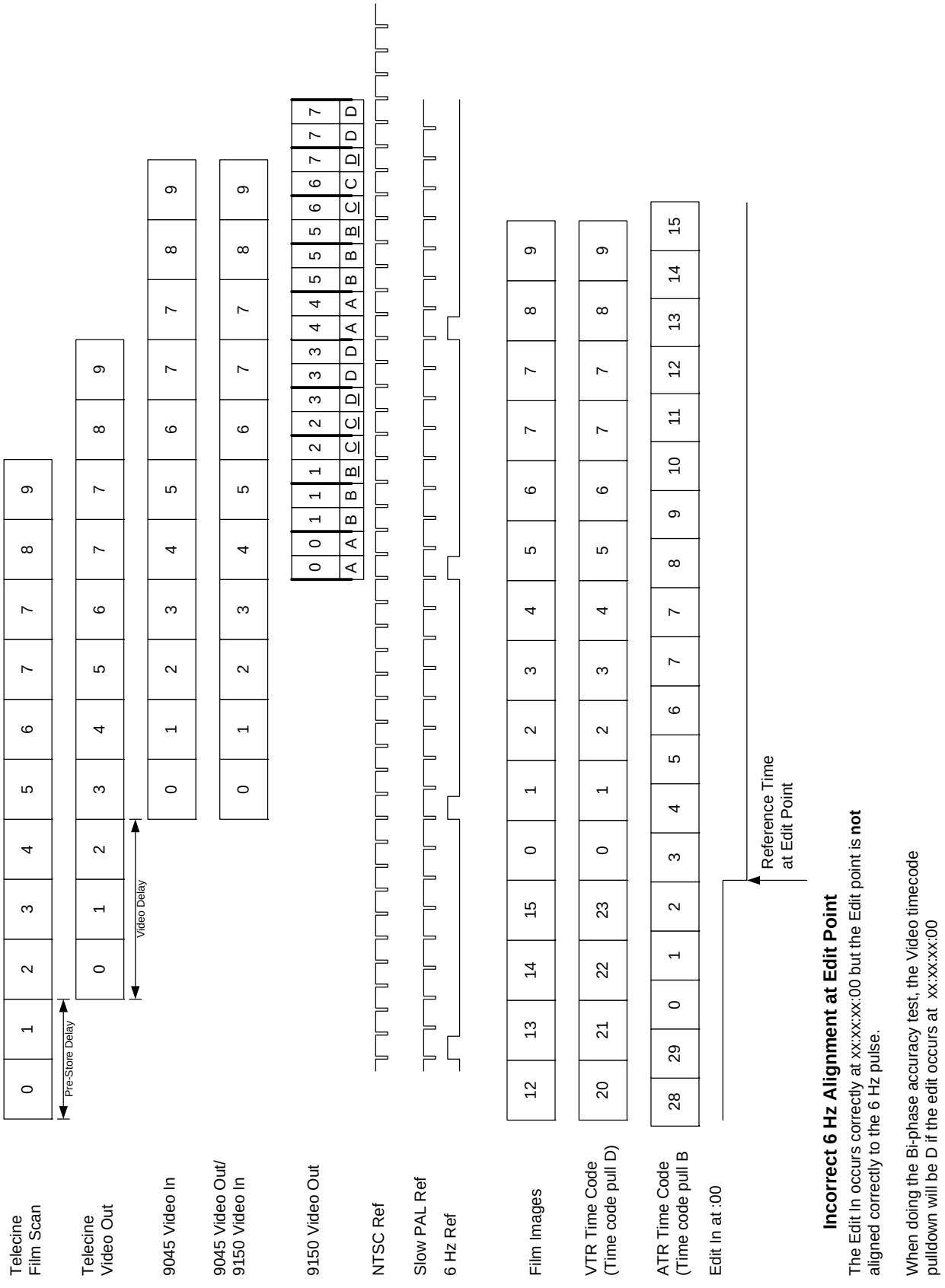


Figure 3-2: Incorrect 24P Edit Timing

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4. SYSTEM PARAMETERS

4.1. SYSTEM PARAMETERS OVERVIEW

The HD9045TR Film Footage Encoder hardware allows the user to change the default behaviour of various functions by the use of parameters. These parameters are grouped according to classes. Within each class parameters are identified by a parameter number. Each parameter has a value with the default value for each parameter being zero. Parameter classes 0 and 25 apply to the HD9045TR and will be described in this chapter. (Table 4-1 to Table 4-4 show the currently defined parameters for each class with a brief description of what each parameter does.) The parameters in class 1 are specific to different telecine types. Each Telecine Setup in the Tracker software stores a separate set of Class 1 parameters. 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

Table 4-1: Class 0 - Global System Parameters

Parameter	Name	Description
0	9025/9045 VideoAdjust	Trim for video time code dynamic numbers
1	9025/9045 FilmAdjust	Trim for film dynamic numbers
2	9025/9045 AudioAdjust	Trim for audio timecode dynamic numbers
18	6Hz Phase Adjust	Adjust 6Hz cycle: frames of 24P input video w.r.t. 30fps ref.
21	9025/9045 Biphase Max X Play	Biphase filter max, as a multiple of play speed
22	9025/9045 Biphase Reverse	Non-Zero reverses Biphase direction
23	9025/9045 Biphase Average Size Adjust	Adjusts size of average from default of 8
29	9045 LUT Select	RGB LUT Table select
		Logging Control 0 = Tracker/GPI, non-zero= RP215 VANC
32	9025/9045 6Hz Source	6 HZ ref Src 0 = Black, –1=Video TC, -2=RP215 ANC
33	9045 Output LUT/ANC Control	Bitmapped -alters the default ANC, and LUT controls

Table 4-2: Class 1: Telecine Parameters (linked to a specific telecine type)

Parameter	Name	Description
0	9025/9045 Parallel I/O Port Pin 1	Input/Output function for this pin (See section 2)
1	9025/9045 Parallel I/O Port Pin 8	Input/Output function for this pin (See section 2)
2	9025/9045 Parallel I/O Port Pin 4	Input/Output function for this pin (See section 2)
3	9025/9045 Parallel I/O Port Pin 9	Input/Output function for this pin (See section 2)
4	9025/9045 Parallel I/O Port Pin 5	Input/Output function for this pin (See section 2)
20	9025/9045 Deferred event end enable	Non-zero enables special event end handling
27	9025/9045 Legacy Ink frames Enable	Non-Zero to enable binary/legacy ink frame ANC numbers
30	9025/9045 Character Horizontal Offset	Signed Horizontal pixel offset from default
31	9025/9045 Character Vertical Offset	Signed Vertical scan line offset from default
32	9025/9045 KK port low baud enable	Non-zero enables 9600 baud KK interface
33	9025/9045 KK Decoder Control Enable	Non-Zero enables remote control of 5550 on KK port
34	9025/9045 KK Decoder Status Enable	Non-zero disables polling for 5550 status
35	9025/9045 Lock Exit Control	Non-Zero disables grabbing Lock Exit 1 A Frame early

Table 4-3: Class 25 - HD9045TR System Parameters

4.2. GLOBAL PARAMETERS (CLASS 0)

4.2.1. Auto Video Standard Disable - Parameter [0][0]

zero Unit autodetects video standard
non-zero Video Standard must be set manually

On HD9045 Parameter 0-0 uses bit 31, the uppermost bit, to enable the 9045 to run in 4:2:2 mode.

Bit 31 zero 4:4:4 mode
Bit 31 one 4:2:2 mode

Eg. you can set the value to hex &H80000000 to enable 4:2:2 auto video standard

4.3. TELECINE PARAMETERS (CLASS 1)

4.3.1. 6 HZ Reference Offset - Parameter [1][18]

Parameter, 1-18 ("6 Hz Reference Offset") in the 9025 and 9045, allows you to alter the position of the 6Hz relationship derived from the 6Hz reference source defined by parameter 1-32.

When parameter 1-32 is set to 0, then parameter 1-18 has a range of 0-9. Each value slides the 6Hz point by one video field.

When parameter 1-32 is set to 1, then parameter 1-18 has a range of 0-3.

0 (default) 6Hz point will be on Video Timecode Frame 0 (and multiples of 4)
1 6Hz point will be on Video Timecode Frame 1 (and multiples of 4)
2 6Hz point will be on Video Timecode Frame 2 (and multiples of 4)
3 6Hz point will be on Video Timecode Frame 3 (and multiples of 4)

4.3.2. LUT Selector - Parameter [1][29]

The system parameter 1-29 control which LUT will be used in the HD9045. Bits 0-2 of that parameter select RGB table 0 through 5. RGB table 0 can never be overwritten by Tracker. The default values for tables 1,2 & 3 are just 1:1. The default values for table 4 are Fred's sample table (which gives a slightly green look on the 4:2:2 output.) The default values for table 5 are Kill red, Kill green, Kill Blue. To use different LUTs, before you send a LUT file, change parameter 1-29 to one of the user LUT tables (1-5). Use the KeyLog TRACKER™ TOOLS/UPLOAD PARAMETER FILE menu item to sent the sample LUT control files *.LT to the 9045. This file will now be preloaded into the specified user LUT table. Table 0 is always 1:1.

4.3.3. 6 HZ Source Control - Parameter [1][32]

Parameter, 1-32 ("6 Hz Source Control"), allows you to alter the source of the 6Hz reference in the 9025 and 9045.

0 (default) 6Hz reference by comparing the frame pulse derived from the Black Reference input to the Frame flag of the 24 PsF HDSDI program input. Alternately you can provide a 6Hz pulse from the 7750SRG-HD or 5600MSC sync generators to one of the input pins on the Parallel I/O connector by setting the parameter for that pin to the INP_FUNC_6HZREF value (-13 decimal) as shown in Table 4-5

-1 6 Hz reference derived from Video Timecode Frame 0 (and multiples of 4)

-2 6 Hz reference extracted from RP215 encoded reference information

4.3.4. Output ANC/LUT Controls - Parameter [1][33]

Parameter, 1-33 ("Output ANC/LUT Controls"), allows you to alter the default ANC, and LUT controls.

The defaults will be the LUT to apply to only the 4:2:2 output, blank upstream ANC on both outputs when ANC is enabled, and the 9045 to generate ANC on both outputs when ANC is enabled. So if you are satisfied with those defaults DO NOT EVEN ADD PARAMETER 1-33 TO YOUR SYSTEM PARAMETERS. You should be able to just upgrade the firmware and everything will work properly, and when you next change your LUT selection, you can just use values 0-5. Simple.

If you wish to alter the defaults, the definition for parameter 1-33 is as follows: (note the bits have shifted down for simplicity)

bit 0 is the 4:4:4 LUT pre(0)/post(1) selector.

bit 1 is the 4:2:2 LUT pre(0)/post(1) selector

bit 2 is the 4:4:4 VANC blank enable (1 - enables blanking of upstream ANC when the ANC generator is turned on)

bit 3 is the 4:4:4 VANC enable (1)

bit 4 is the 4:2:2 VANC blank enable (1 - enables blanking of upstream ANC when the ANC generator is turned on)

bit 5 is the 4:2:2 VANC enable (1)

bit 6 is unused

bit 7 is the 4:2:2 filter bypass (1)

If you do adjust parameter 1-33, and wish to set it back to the default conditions, set the value to &H3E. Do not just delete it.

4.4. 9045 PARAMETERS (CLASS 25)

4.4.1. HD9045TR Input/Output Pin Functions

Parameters 0 to 4 of Class 25 control the functions of the five input/output pins on the Parallel I/O Connector. (See Table 4-4) When the parameter value is set to zero (0), or the parameter is not defined, the default function of the I/O pin is selected as shown in Table 4-4.

To change the functions of the input/output pins change the respective parameter for the pin (see Table 4-4) to the values shown below. The input functions are selected by negative values as shown in Table 4-5. The output functions are selected by positive values as shown in Table 4-6.

For example:

To change the function of pin 4 to select the film transfer rate (falling edge selects 24 Fps) set the pin 4 function parameter (class 25 parameter 2) to value –5.

To change the function of pin 4 to output a pulse at the start of each internal 6 Hz cycle, set the pin 4 function parameter (class 25 parameter 2) to value 23.

Pin	Controlled by Class 25 Parameter	Signal Name	Description
1	0	INP_FUNC_RATE	Input: Falling edge -> 24Fps, Rising edge -> 30Fps (60I only)
4	2	INP_FUNC_VSTD	Input: Falling edge -> 1080i/60, Rising edge -> 1080p/24
5	4	INP_FUNC_CENTER	Input: Falling edge -> activates centering function
8	1	INP_FUNC_GPI	Input: Falling edge -> activates data logging GPI
9	3	INP_FUNC_NONE	No input function

Table 4-4: Default HD9045TR I/O Pin 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
-3	INP_FUNC_GPI	Falling edge -> activates data logging GPI
-4	INP_FUNC_GPI_INV	Rising edge -> activates data logging GPI
-5	INP_FUNC_RATE	Falling edge -> 24Fps, Rising edge -> 30Fps (60I only)
-6	INP_FUNC_RATE_INV	Falling edge -> 30Fps, Rising edge -> 24Fps (60I only)
-7	INP_FUNC_CENTER	Falling edge -> activates centering function
-8	INP_FUNC_CENTER_INV	Rising edge -> activates centering function
-9	INP_FUNC_GAUGE	Falling edge -> 35mm, Rising edge -> 16mm
-10	INP_FUNC_GAUGE_INV	Falling edge -> 16mm, Rising edge -> 35mm
-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	Pin is active high, TTL, 1 field wide 6Hz reference pulse input
-14	INP_FUNC_6HZREF_INV	Pin is active low, TTL, 1 field wide 6Hz reference pulse input
-15	INP_FUNC_CHRTOGL	Falling edge -> toggles character on/off
-16	INP_FUNC_CHRTOGL_INV	Rising edge -> toggles character on/off inverted
-17	INP_FUNC_RUNHOLD	Falling edge -> timecode hold, Rising edge -> timecode run
-18	INP_FUNC_RUNHOLD_INV	Rising edge -> timecode hold, Falling edge -> timecode run
-19	INP_FUNC_RUNHOLD_TOGL	Falling edge -> toggles timecode run/hold
-20	INP_FUNC_RUNHOLD_TOGL_INV	Rising edge -> toggles timecode run/hold
-23	INP_FUNC_PRESTOP	Active Low Pre-Stop from Quadra Telecine
-24	INP_FUNC_PRESTOP_INV	Active High Pre-Stop from Quadra Telecine
-25	INP_FUNC_SLTONOFF	Falling edge -> Virtual Slate On, Rising edge ->Virtual Slate Off
-26	INP_FUNC_SLTONOFF_INV	Falling edge -> Virtual St Off, Rising edge -> Virtual Slate On
-27	INP_FUNC_SLTTOGL	Falling edge -> Toggles Virtual Slate On/Off
-28	INP_FUNC_SLTTOGL_INV	Rising edge -> Toggles Virtual Slate On/Off
-255	INP_FUNC_NONE	No input function

Table 4-5: Alternate HD9045TR Input Pin Functions

Parameter Value	Signal Name	Description
0	DBUG_RATE_NONE	Functions as **default** input
1	DBUG3_IOTEST	Pin Toggles once per second
2	DBUG_RATE_RATE	High output indicates 1:1 frame rate, low PULLED
3	DBUG_MISC_VSYNC	Spike for duration of HD Field 1 Vsync interrupt process
6	DBUG_MISC_VFLD1	Hi=Video field 1, tic based
7	DBUG_MISC_AFLD1	Hi=Audio time base field 1, tic based
8	DBUG_MISC_F0	Lo=Video fields where output KeyKode frame number = 0
9	DBUG_MISC_V0	Lo=Video fields where output VTR timecode frame number = 0
10	DBUG_MISC_A0	Lo=Video fields where output ATR timecode frame number = 0
18	DBUG_MISC_VMOD	Lo=Video fields where output VTR timecode frm no. mod N = 0
19	DBUG_MISC_AMOD	Lo=Video fields where output ATR timecode frm no. mod 5 = 0
20	DBUG_GAUGE_KMOD	Lo=Video fields where output KK abs frames no. mod N = 0
23	DBUG_MISC_VCYCL0	Tic Frame 0 of internal video sequence (6 Hz pulse in 24P)
24	DBUG_MISC_ACYCL0	Tic Frame 0 of internal audio sequence
25	DBUG_MISC_FCYCL0	Tic Frame 0 of internal film sequence
38	DBUG_GAUGE_6HZI	Raw sample of 6Hz or 30Hz reference input
39	DBUG_GAUGE_30HZI	Frame 0 of 6Hz or 30Hz reference input

Table 4-6: Alternate HD9045TR Output Pin Functions

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CHAPTER 5
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5. TECHNICAL DESCRIPTION

5.1. SPECIFICATIONS

5.1.1. HDTV Dual Link Serial Digital Video Input

Standard: Dual Link 4:4:4 GBRA 1.485 Gb/sec HDTV Serial component digital SMPTE 372M
or 4:2:2 YCrCb HDTV Serial component digital SMPTE 292M
standards supported shown in Table 2-4
software selectable or autodetect
Connector: 2 BNC per IEC 60169-8 Amendment 2.
Equalisation: Automatic to 75m @ 1.5Gb/s with Belden 1694 or equivalent cable

5.1.2. HDTV Dual Link Serial Digital Video Outputs

Standard: same as input
Outputs: Program video with RP215 Ancillary Data embedded and optional characters
Connectors: 2 BNC per IEC 60169-8 Amendment 2.
Signal Level: 800mV nominal
DC Offset: 0V ±0.5V
Rise and Fall Time: 200ps nominal
Overshoot: <10% of amplitude
Wide Band Jitter: < 0.2 UI

5.1.3. HDTV 4:2:2 Serial Digital Video Outputs

Standard: SMPTE 292M, same as input
Outputs: 1 Program video with RP215 Ancillary Data embedded and optional characters
Connectors: BNC per IEC 60169-8 Amendment 2.
Signal Level: 800mV nominal
DC Offset: 0V ±0.5V
Rise and Fall Time: 200ps nominal
Overshoot: <10% of amplitude
Wide Band Jitter: < 0.15 UI

5.1.4. LTC Generators

Standard: SMPTE 12M
Frame Rate: 24, 25 and 30 Fps nominal
Number of Outputs: 2
Connectors: 3 pin male XLR type connector.
Level: Adjustable, 0.5V to 4.5V p-p

5.1.5. LTC Readers

Standard: SMPTE 12M
Frame Rate: 24, 25 and 30 Fps nominal
Number of Outputs: 2
Connectors: 3 pin female XLR type connector
Level: 0.2 to 4V p-p, balanced or unbalanced

5.1.6. Serial Remote Control

Standard: RS-232, 57600 baud
Connector: 9 pin female “D”
Control: Computer control of all functions, firmware upgrade

5.1.7. KeyKode Reader Port

Standard: RS-232; 38400 or 9600 baud
Connector: 9 pin female “D”
Protocol: Evertz 5550, 5500 KeyKode Decoder, RIM DigiSync

5.1.8. Telecine Interface

Connector: 9 pin female “D”
Tach Input: bi-phase quadrature pulses - 1,2,5, or 10 x film rate, TTL level
Frame Pulse:
Cintel: > 1.6 V p-p active low,, 1 pulse per film frame, (BNC per IEC 60169-8 Amendment 2)
Thomson: TTL level SOF, 1 edge per film frame (9 pin female D)
Sony: > 1.6 V p-p active high, 1 pulse per film frame, (BNC per IEC 60169-8 Amendment 2)

5.1.9. GPIO Interface

Connector: 9 pin female “D”
Type: Opto-isolated bi-directional I/O – TTL level
Number: 5
Function: user programmable

5.1.10. 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)

5.1.11. Electrical

Power: Autoranging 100 to 240 VAC 50/60 Hz, 30 VA.
Safety: ETL listed.
Complies with EU safety directive
EMI/RFI: Complies with FCC Part 15 Class A,
EU EMC Directive

5.2. UPGRADING FIRMWARE

The HD9045TR contains 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. If you have the KeyLog Tracker software successfully interfaced to your HD9045TR, then it is very simple to upgrade its firmware from Tracker using the procedure outlined in section 5-3. Otherwise use the procedure outlined in section 5-4 to upload new firmware from your computer.

5.3. UPGRADING FIRMWARE USING KEYLOG TRACKER

KeyLog Tracker allows firmware upgrades to the hardware directly from within the Tracker software.

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

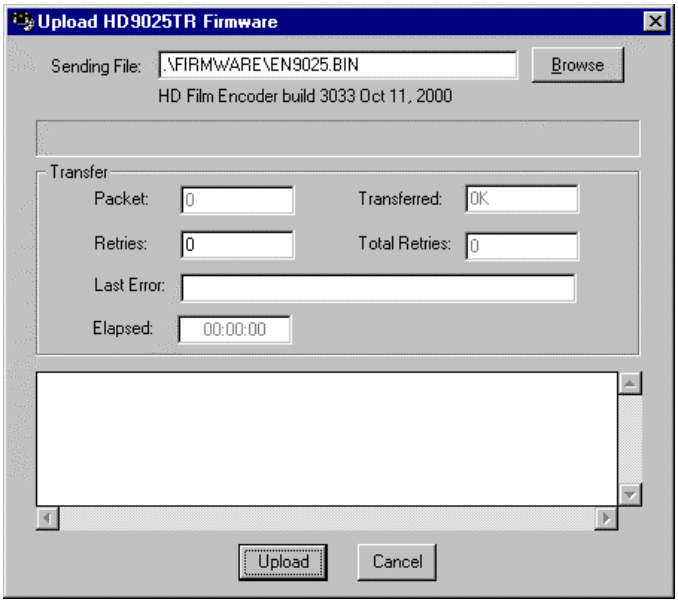
1. Power up the HD9045TR unit.

5.3.2. Step 2 – KeyLog Tracker Setup

2. Start KeyLog Tracker

3. Confirm that you have established communications to the HD9045TR that you wish to upgrade. (a green COMM indicator will show at the bottom of the Tracker screen)

4. From the TOOLS menu of Tracker choose the UPGRADE FIRMWARE option. A dialog box titled UPGRADE FIRMWARE will appear.



5. Use the BROWSE button to open the file dialog and choose the new firmware file. Typical filenames will be LP9045_xxxx.BIN. (xxxx will be the build number of the software). The build version of the firmware will be shown in the dialog box.

6. Click the UPLOAD button at the bottom of the upgrade dialog. Tracker will begin upgrading the firmware showing the communications and progress of the upgrade. On successful completion of the upload the unit should now reboot. After the unit reboots successfully with the new firmware the 'Upload Firmware' dialog will disappear. You can then resume normal operations with the Tracker software.

7. If the upgrade is interrupted or cancelled before completion, then Tracker may not be able to communicate to the HD9045TR. Press the UPLOAD button to attempt to send the firmware to the HD9045TR Boot Code. If this is unsuccessful you will have to manually upload the firmware using the procedure outlined in section 1.2.

5.4. UPGRADING FIRMWARE USING A TERMINAL PROGRAM

You will need the following equipment in order to update the HD9045TR 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) This is the same cable you are using if you are running the KeyLog Tracker software with the HD9045TR.
- Terminal program that is capable of Xmodem file transfer protocol. (such as HyperTerminal)
- New firmware supplied by Evertz.

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

1. Connect the straight through Serial cable to the SERIAL REMOTE DB9 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

5.4.2. 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 HD9045TR 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.

5.4.3. 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.

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.

5.4.4. 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.

5.5. HD9045TR DEBUG WINDOWS

Each Tracker configuration has one or more text windows called "DEBUG", on the WINDOWS tab of the project or system configuration. DEBUG windows can display additional information on the output video. Changing the HORIZONTAL position value for the DEBUG window can control the information format. (The window cannot 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 ("EV_ENG"). Some displays may be truncated when using Standard Definition video.

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).

Debug Window Value	Debug Window Name	Description
0	WIN BP	BP: decimal Biphase hw or delta hw
1	WIN HW	IN: binary i/o pins DIP: binary dip switch input
2	WIN TFPHASE	VTF: video to film phase ATF: audio to film phase
3	WIN SCAN	ERR: kk error FSCAN: scantrack
4	WIN VFLD2	@@@@@ on field 2 characters
5	WIN VPULL	@@@@@ on new picture (pulldown)
6	WIN F0	@@@@@ on kk frames == 0
7	WIN V0	@@@@@ on VTR timecode frames == 0
8	WIN A0	@@@@@ on ATR timecode frames == 0
9	WIN PULLT	PULL: pull type of keykode
10	WIN VAPHASE	VPH: video phase APH: audio phase FPH: film phase
11	WIN REF	REF: phase of 30Hz or 6HZ and lock count
12	WIN FRAME	FRAME: frame pulse rate counters
13	WIN GPI	GPI: VTR TC where GPI was detected
14	WIN DLO	DLO: VTRTC KK ATRTC of event
15	WIN VIDEO	VID: input video type
16	WIN BPPHASE	Biphase Reference Edge Phase
17	WIN KKSTAT	KeyKode Stats
18	WIN ASCAN	Film Time code Stats
19	WIN ABSREF	Reference Point for JAM After Reference Mode
20	WIN IDLE	Processor Idle Measurement
21	WIN VLTC	Video LTC reader stats
22	WIN ALTC	Audio LTC reader stats
23	WIN POP UP ERRORS	POP UP ERRORS
24	WIN ANC VTR	9025DDR ANC reader stats
25	WIN ANC ABS	9025DDR ANC ABS frame stats
26	WIN RP215	RP215 stats
2nd Last	WIN REV	Firmware Revision
Last	WIN RAM	00000000: RAM viewer values

Table 5-1: HD9045TR Debug Window Functions

5.5.0. WIN BP (0) Biphase Display

```
BP:04321:+100.3 DY:222222 B:+0 X:+4
```

`04321`	current biphase hardware counter value
`+100`	% of play speed
`.3`	state (0-3) of the two biphase inputs at sample time
`DY:222222`	dynamics flags of the biphase based film, video and audio systems respectively
`B:+0`	biphase 'noise' counter. Counts invalid biphase transitions
`X:+0`	For Evertz Engineering Use Only

5.5.1. WIN HW (1) Hardware Display

```
IN:0110011 DIP:11111110
```

`IN:0110011` real time display of parallel port inputs MSB (6) to LSB (0), including some internal inputs

`DIP:11111110` real time display of DIP switch, MSB (8) to LSB (1), where 0 indicates switch is in the DOWN/ON position.

5.5.2. WIN TFPHASE (2) Timecode to Film Phase Indicator

```
VTF:0000000B0 A:0000000B0 C
```

`VTF:0000000B0` video timecode absolute frames extrapolated back to film abs frames 0. The B is the pulldown indicator (A,B,C,D) of biphase video timecode hh:mm:ss:00 frames. The pulldown indicator acts as the decimal point of the timecode-to-film phase indicator

`A:0000000B0` likewise for the audio biphase timecode

`C` pulldown indicator for KeyKode ffff+00 frames

5.5.3. WIN SCAN (3) KeyKode Error And Scantrack Display

```
ERR:+00 F:+01 V:+02 A:+03 H:+04.3BC
```

`ERR:+00` difference between KeyKode input and biphase based KeyKode

`F:+01` Biphase Film numbers 'scantrack' , includes compensation for 'hardware scantrack'

`V:+02` Biphase Video numbers 'scantrack', includes compensation for 'hardware scantrack'

`A:+03` Biphase Audio numbers 'scantrack', includes compensation for 'hardware scantrack'

`H:+04` Hardware 'scantrack' relative to the reference edge of biphase chosen at 'Load Film' action. This is the value reported to Tracker and most closely resembles the scantrack of the Evertz 4025.

`.3` state of biphase at sample time

`B` is the pulldown indicator (A,B,C,D) of video timecode hh:mm:ss:00 frames.

`C` is the pulldown indicator (A,B,C,D) of audio timecode hh:mm:ss:00 frames.

5.5.4. WIN VFLD2 (4) Video Field 2

@@@@@ on video field 2 characters

5.5.5. WIN VPULL (5) Video Pulldown

@@@@@ on new picture (pulldown)

5.5.6. WIN F0 (6) KeyKode Frames 0

@@@@@ on KeyKode frames == 0

5.5.7. WIN V0 (7) Video Timecode Frames 0

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

5.5.8. WIN A0 (8) Audio Timecode Frames 0

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

5.5.9. WIN PULLT (9) Pulldown Type

```
PULL:A  V:B  A:C
```
PULL:A is the pulldown indicator (A,B,C,D) of KeyKode ffff+00 frames.
V:B is the pulldown indicator (A,B,C,D) of video timecode hh:mm:ss:00 frames.
A:C is the pulldown indicator (A,B,C,D) of audio timecode hh:mm:ss:00 frames.

5.5.10. WIN VAPHASE (10) Timebase Phase

```
VPH:0.000 APH:0.000 FPH:3.126 0 0
```
VPH:0.000 video timebase phase
APH:0.000 audio timebase phase
FPH:3.125 film timebase phase

5.5.11. WIN REF (11) 6Hz Reference Info

REF:.N/A not applicable unless video is 1080p/24sF
For all displays, the '.' after "REF:" - shows ' ' if display is too high vertically, '@' if reference input is active in this field, or '.' if reference input is inactive in this field.

```
REF:.6 01 8
```
REF:.6 Indicates 6Hz input signal detected
01 lock count
8 bit number of input

```
REF:.30-VAF 101 123 456 789 323 lC
```
REF:.30 Indicates 30Hz NTSC reference detected
-VAF video phase, audio phase, film phase
101 123 456 789 323 HD line numbers of NTSC Vsync
lC lock count

5.5.12. WIN FRAME (12) Frame Pulse Input Analysis

```
FRM: 5/2 3-2 2R 10H0 10S0 HIS.23
```

FRM: 5/2	2 pulses every 5 fields detected
3-2	a pulses 3 fields apart then 2 fields apart
2R	frame rate lock count and lock indicator
10H	hw seq lock count and lock indicator
0	difference between hw sequence count and internal sequence count
10S	sequence lock count and lock indicator
0	difference between iseq and seq
H	Hardware sequence field 0
I	Input sequence field 0
S	Sequence field 0
.	shows ' ' if display is too high vertically, '@' if Frame Pulse input is active in this field, or '.' if Frame Pulse input is inactive in this field.
2	Sequence field number
3	Output sequence number

5.5.13. WIN GPI (13) GPI Input Frame Number

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

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

5.5.14. WIN DLO (14) Data Logging Output

```
DLO:5 12:59:59:23 9999+00 13:01:01:05
```

DLO:5	DLO Type identifier
12:59:59:23	video timecode
9999+00	KeyKode feet and frames
13:01:01:05	audio timecode

5.5.15. WIN VIDEO (15) Video Mode Indicator

```
VID: 525i/59.94 AUTOSTD AUTODEF5
```

Displays the current video standard, indicates whether autovideo standard switching is enabled, and (HDSD9025 only) whether auto switching between Hi-def and Standard-def is enabled and how many seconds before auto-definition switching activates.

5.5.16. WIN BPPHASE (16) Biphase Reference Edge Phase

```
BF:159 BV:001 BA:001
```

BF:159	Film timebase tic number at Reference edge of biphase
BV:001	Video timebase tic number at Reference edge of biphase
BA:001	Audio timebase tic number at Reference edge of biphase

5.5.17. WIN KKSTAT (17) KeyKode Reader stats

5550 CTL DISABLED	Parameter 25-33 set to zero: 5550 Control not enabled
5550 POLL DISABLED	Parameter 25-34 set to non-zero: 5550 Polling disabled
NO 5550 CTL: TXT DEBUG OUT ON	Character debug output instead of 5550 Control
5550 CTL NOT SUPPORTED"	Software does not support 5550 control
KK COMM NOT ACTIVE	Communications has not been established

K%098 ASYM+020 IN:999 35RN AUT 5550 Status as described below

K%098	KeyKode percent valid read
ASYM+020	KeyKode asymmetry percent
IN:999	KeyKode intensity setting
35R	Film gauge 35: 35 mm, 35R: 35 mm reverse side, 16: 16 mm
N	N:Neg, P:Print
AUT	KeyKode mode MAN:Manual, AUT:auto, EXT:Extended Auto, or HNT:Hunt

5.5.18. WIN ASCAN (18) Film Timecode Stats

AERR:+00 P:02 C:03 T:0 %100 @24/24

AERR:+00	number of frames of difference between incoming Film Timecode and biphase based Film timecode number. may also show "AJAM6"" or "AJAMOFF:"
P:02	'perf' of film timecode
C:03	jam counter of film timecode
T:0	tic number (0-9) of audio timebase, when LTC detected as ready i.e. approximate phase
%100	actual number of frames read in a second, expressed as a percentage of the expected reads
@24/24	counting modulus detected on incoming LTC / vs. expected counting modulus and frame rate

5.5.19. WIN ABSREF (19) Reference Point for JAM After Reference Mode

KKREF: +1000 AK: +1001

KKREF: +1000	absolute frames of film KeyKode reference point
AK: +1001	absolute frames of film timecode reference point

5.5.20. WIN IDLE (20) Processor Idle Measurement

IDL: 2737(73%) X:2766 N:2700 9

2737	Average Number of times through the task list per frame
(73%)	average percentage of frame spent idling
X:2766	max idling
N:2700	min idling
9	minimum microseconds to get through the task list

5.5.21. WIN VLTC (21) Video LTC reader stats

```
VLTC:%100 T:0 23:59:59:24 @25/30
```

%100	actual frames read in a second, expressed as a percentage of the expected reads
T:0	tic number (0-9) of video timebase, when LTC detected as ready i.e. approximate phase
23:59:59:24	actual timecode value read, uncompensated
@25	counting modulus detected on incoming LTC
/30	expected counting modulus and frame rate

5.5.22. WIN ALTC (22) Audio LTC reader stats

```
ALTC:%100 T:0 23:59:59:23 @24/30
```

%100	actual frames read in a second, expressed as a percentage of the expected reads
T:0	tic number (0-9) of audio timebase, when LTC detected as ready i.e. approximate phase
23:59:59:23	actual timecode value read, uncompensated
@24	counting modulus detected on incoming LTC
/30	expected counting modulus and frame rate

5.5.23. WIN ERRORS (23) Pop up errors

Various error and warning messages will display briefly as they occur

5.5.24. WIN ANC VTR (24) ANC Video timecode

```
ANC:%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

5.5.25. WIN ANC ABS (25) ANC Absolute Frames

```
ABS:%100 F1 L00123456@24/24
```

%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
00123456	raw, uncompensated abs frames read - NOT LIKELY TO EXACTLY MATCH picture content!

5.5.26. WIN RP215 (26) RP215 Stats

Displays various RP215 Fields

5.5.27. WIN REV (always the 2nd last display) Firmware Revision

```
REV LP9045B2 09 0623 U 060630
```

LP9045B2	Firmware name LP9045 for HD9045TR
09	
0623	Firmware build number
U	R = Released. U = unreleased
060630	Firmware build date

5.5.28. 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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6. FILM EMULSION CODES

If you are seeing a question mark in place of the film manufacturer or film type when reading and displaying KeyKode, the reason is as follows. The film barcode has a human readable component that shows the film manufacturer as a letter ('A','K' or 'F' for Agfa, Kodak and Fuji) and the film type as a letter (ex. 'J' for Kodak 5296 type film). The actual barcode contains only numbers and so the manufacturer and type must be encoded as a numeric code. For clarity and the convenience of the user, Evertz has chosen to display these codes exactly as shown in the human readable portion of the film. We translate the codes into the alphabetic characters as established by each film manufacturer.

The film manufacturers introduce new film types with new codes from time to time. When these new films are read or displayed by the Film Footage Encoder, Afterburner or KeyLog TRACKER™, they may show as a question mark ('?') in place of either the film manufacturer or film type or both. The rest of the barcode is read and handled correctly. The actual codes are internally used by the software, and the KeyKode foot and frames are completely accurate. Only the display of the codes is affected.

Evertz takes great pains to ensure that the code translation tables are up to date and accurate and we endeavour to obtain the information from the film manufacturers in advance of the release of new film products. We regularly update the Emulsion code tables and provide updates on our website (http://www.evertz.com/ftp.html). We suggest you check this site regularly to make sure you have the most up to date emulsion codes.

The film manufacturers and film products supported at the time of writing this manual are shown on the following chart.

Manufacturer			Emulsion		Film Type	Added
	Code	Letter	Code	Char		
Agfa	01	A	20	N	XT 100	
	11		24	M	XTR 250	
			83	F	XT 320	
			84	S	XTS 400	

Table 6-1: Agfa Emulsion Codes

Manufacturer			Emulsion		Film Type	Added
	Code	Letter	Code	Char		
Kodak	02	K	00	P	5600 (obsolete)	Mar 22, 95
	12		14	X	SO-214 SFX 200T	Jan 6, 99
	22		20	Y	5620 Prime Time (obsolete)	
			22	E	5222/7222	
			24	L	5224 (obsolete)	
			31	H	5231/7231	
			34	D	5234/7234	
			43	A	5243/7243 (obsolete)	
			44	V	5244/7244 (obsolete)	
			45	K	5245/7245	
			46	I	5246/7246 Vision 250D	Feb 28, 97
			47	B	5247/7247 (obsolete)	
			48	M	5248/7248	
			49	O	5249 (obsolete)	
			72	S	5272/7272	
			74	Z	5274/7274 Vision 200T	Feb 28, 97
			77	Q	5277/7277	Feb 9, 96
			79	U	5279/7279	
			87	W	5287/7287 (obsolete)	May 13, 94
			89	R	5289 Vision 800T	Aug 10, 98
			92	N	7292 (obsolete)	
			93	L	5293/7293	Jul 15, 92
			94	G	5294/7294 (obsolete)	
			95	F	5295 (obsolete)	
			96	J	5296/7296 (obsolete)	
			97	C	5297/7297 (obsolete)	
			98	T	5298/7298 (obsolete)	Nov 23, 11
Eastman	02	E	01	K	5201/7201 Vision2 50D	Nov 2, 05
	12		05	Q	5205/7205 Vision2 250D	Nov 19, 04
	22		12	M	5212/7212 Vision2 100T	Jan 27, 04
			17	L	5217/7217 Vision2 200T	Jan 27, 04
			18	H	5218/7218 Vision2 500T	Nov 25, 02
			29	B	5229/7229 Vision2 Expression 500T	Jan 5, 04
			42	V	5242/7242 Vision Intermediate	Nov 25, 02
			63	E	5263/7263 Vision 500T	Mar 9, 01
			65	C	7265	Nov 19, 04
			66	D	7266	Nov 19, 04
			84	G	5284/7284 Vision Expression 500T	Mar 9, 01
			85	A	5285 100D	Nov 25, 99
			99	I	7299	Jun 30, 05

Table 6-2: Kodak Emulsion Codes

Manufacturer			Emulsion		Film Type	Added
	Code	Letter	Code	Char		
Fuji	03	F	01	I	F-CI (8501, 8601, 8701) (obsolete 95)	
	13		02	I	F-CI (8502, 8602, 8702)	May 4, 95
	23		10	N	F-64 (obsolete 05/95)	
			13	I	F-CI (obsolete)	
			14	N	F-500 (obsolete)	
			20	N	F-64D (obsolete 05/95)	
			21	N	F-64D (8521, 8621, 8721) (obsolete 98)	May 4, 95
			22	N	F-64D (8522, 8622)	Jun 24, 98
			30	N	F-125 (obsolete 05/95)	
			31	N	F-125 (8531, 8631, 8731) (obsolete 98)	May 4, 95
			32	N	F-125 (8532, 8632)	Jun 24, 98
			40	R	VELVIA color reversal (8540)	Apr 2, 03
			50	N	F-250 (obsolete 05/95)	
			51	N	F-250 (8551, 8651, 8751) (obsolete 99)	May 4, 95
			52	N	F-250 (8552, 8652,)	Apr 15, 99
			53	N	ETERNA 250 (8553, 8653)	Apr 5, 06
			60	N	F-250D (obsolete 05/95)	
			61	N	F-250D (8561, 8661, 8761) (obsolete 99)	May 4, 95
			62	N	F-250D (8562, 8662)	Apr 15, 99
			63	N	ETERNA 250D (8563, 8663)	Apr 5, 06
			70	N	F-500 (8570, 8670, 8770) (obsolete 95)	
			71	N	F-500 (8571, 8671) (obsolete 99)	Jun 12, 96
			72	N	F-500 (8572, 8672)	Apr 15, 99
			73	N	ETERNA 500 (8573, 8673)	Jun 30, 05
			82	N	F-400 (8582, 8682)	July 17,00
			83	N	ETERNA 400 (8583, 8683)	Jun 30, 05
			92	N	REALA 500D (8592, 8692)	Mar 09,01

Table 6-3: Fuji Emulsion Codes

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