Model 4025

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	Original issue - preliminary release	Dec 92
1.1	Updated with technical information and drawings	Feb 93
	Change sheet 1.1-1 added	May 93
	Change sheet 1.1-2 added for units fitted with ARRI-KIT	May 93
	Change sheet 1.1-1 revised for Kodak 5298 film emulsion code	Jan 94
	Change sheet 1.1-4 added	June 94
	Change sheet 1.1-1 revised for Kodak 5287 film emulsion code	
	Change sheet 1.1-5 added	Dec 94
2.0	Major update of manual incorporating all change sheets	May 95
	Technical Bulletin “Frequently Asked Questions” inserted	Jan. 96
	Manual change sheet 2.0-1 inserted	April. 96
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2.1	Revised manual with all change sheets inserted & chapters updated	May 96
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	Change sheet 2.1-1 incorporated into manual	Mar 97
	Updated Kodak Film Emulsion Codes (Chapter 9)	July 97
	Change sheet 2.1-3 inserted	Nov 97
	Manual change sheet 2.1-4 inserted	Dec 98

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1. OVERVIEW

The Model 4025 Film Footage Encoder is designed specifically to aid in the encoding of film footage and time code during the film to tape transfer process. The Model 4025 is a generator/reader for SMPTE/EBU Linear Time Code (LTC) and Vertical Interval Time Code (VITC), and contains a high resolution video character generator (VCG). The VCG is also used as an on screen programming aid to the many operational modes of the Model 4025. The Model 4025 uses the latest state of the art technology, combined with our extra intelligent firmware, to offer you the ultimate in performance, reliability, and adaptability.

The 4025 Film Footage Encoder is capable of working with both 35 mm and 16 mm film. Telecine transfer speeds of 24 or 30 frames per second in NTSC systems, or 25 frames per second in PAL are automatically sensed by the 4025.

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.

A video frame is always comprised of a field 1/field 2 sequence, and is defined by a unique time code number. The film frames will not always be in phase with the video frames. With the 2/3 pulldown, the film frames alternate between being 2 video fields long and 3 video fields long.

The 4025 Film Footage Encoder uses the telecine's bi-phase quadrature tach pulse to keep track of the film motion. In addition, a field sequence pulse from the telecine identifies which field of the 2/3 pulldown is in the current video field, thus enabling the 4025 Film Footage Encoder to identify the precise film frame that is contained in each video field.

Latent edge numbers have been present on motion picture negative film stocks for many years in human readable form. The edge numbering format has been specific to various manufacturers and film stock types, some having 4, 5, 6 or 7 digits with varying numbers of alpha-numeric roll numbers, or prefix numbers to the footage. Using normal BCD encoding, there is only room to encode a maximum of 6 digits of film feet plus 2 digits of frames into the user bits. By using a compressed binary format, up to 7 digits of feet plus frames can be encoded, however, special decoding routines in the time code readers are required to recover this information and display it as decimal digits. The 4025 Film Footage Encoder allows the user to select which encoding style he prefers. In addition, the maximum count of the footage can be preset, permitting a fixed numeric prefix to be encoded in the unused footage digits.

In 1988, Eastman Kodak, in conjunction with the Society of Motion Picture and Television Engineers devised a new edge print that not only standardizes the numbering format, but is also printed as a machine readable barcode. Kodak calls this numbering system KeyKode. Other film manufacturers have adopted this numbering standard and have each given their version a proprietary name. For the sake of clarity we shall refer to all of these implementations as KeyKode.

The 4025 Film Footage Encoder interfaces to external KeyKode readers manufactured by Evertz Microsystems, ARRI, Cinema Products or Research In Motion. Each of these units consist of a bar code reader pickup head, and a decoder device. The pickup head transforms the optical dark and light bar code into electronic signals and is designed 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 a serial link to the 4025.

KeyKode numbers occur approximately every half foot on the film stock, so the basic numbering of film edge numbers by the 4025 is still driven from the bi-phase input. The bi-phase base numbers are automatically updated from incoming KeyKode, taking into account the mechanical offset between the reader head and the gate, and other delays in the system.

The front panel contains a sixteen digit alphanumeric display to show the generator and reader time, and user bits, and the film edge numbers. The film key number of a reference frame may be entered from the front panel keypad, or can be automatically updated from the KeyKode reader in several ways. The time numbers may be entered from the front panel, or jam synced to the LTC / VITC time code reader.

The linear time code output may be used as a bi-phase to LTC translator providing a master time code reference for the integration of ATR chase synchronizers into your system.

By using VITC, the film edge numbers become a permanent part of the video and will remain throughout the editing process. The film numbers may be read from the edit master to produce an accurate negative cutters list using Evertz Model 623-EDL Edit Lister.

When film material is transferred to video disc, the relationship of the video frames and picture frames is very important. If the video disc's frames do not correspond exactly to the picture content (i.e.. film frames) then some pictures will flicker when viewed in still. The default length of disc frames is 2 video fields. The 4025 'White flag generator' inserts a white level pulse in the first video field of each new picture. As material is transferred to disc, this pulse is used by the disc recorder to match the disc frames to the 2/3 pulldown automatically. Still playback of all pictures on the disk is jitter-free.

The Model 4025 high resolution character generator provides separate windows for video time and user bits, audio timecode, film edge numbers (KeyKode) and absolute film frames from a reference. The four windows can be separately positioned anywhere on the raster. Selection of 1 of 3 sizes, white or black characters, with or without background are controllable using the on screen menu system. Characters may be keyed into the picture to which the generator is locked, or a separate program input.

The key to the operational flexibility of the 4025 Film Footage Encoder lies in the powerful on screen programming menu system. The programming menu system uses the built in character generator and provides an quick, intuitive method of configuring 4025 Film Footage Encoder, guiding you to the correct setup for your application. The six keys in the format key group (**FORMAT**, **SELECT,** ←, →, ↑, ↓) are used to cycle through the various items on the programming menu. The 4025 menu system consists of three drop down menus. The TIMECODE drop down menu is for overall operation modes such as selecting which information is put into the time and user bits, drop frame mode for the generator, setting reader modes, setting VITC line numbers, etc. The FILM drop down menu is used to set up specific film number modes such as KeyKode Jam, film type, film transfer rate,

etc. The CONFIG drop down menu is used to configure miscellaneous items such as video standard, character size and style, KeyKode head offset, video path delays, etc.

The 4025 can be used in conjunction with Evertz Key-Log™ Data logging software to build a database of the timecode/film relationships that are laid down during the transfer. The 4025 Film Footage encoder sends packets of information to the Key-Log™ program during the transfer session that uniquely define the relationships between Video tape time code, audio time code (if audio is synced at transfer time), film edge numbers, and the pulldown of the logged frames. Key-Log™ can sit passively in the transfer suite and log only the numeric information for each take. The operator also may enter Camera Roll, Sound Roll, Scene and Take numbers, scene descriptions, and other production related information for each take. this information can be entered 'on the fly' or 'off-line' after the session is complete.

Each pair of related numbers defines the In and Out point of an event. Events can be triggered by the telecine achieving sync speed, by a splice in the film material, or by a General Purpose Input (GPI) closure issued to the 4025. With the aid of a properly wired cable, Key-Log™ can issue the GPI's to the 4025 on activation of a 'hot key', so the operator has complete control over what material gets logged. The 4025 Event registers can also be used to trigger Key-Log™ packets at specific video timecode numbers.

Figure 1-1 below gives an overview of how a typical dailies transfer using KeyKode would be done using the 4025.

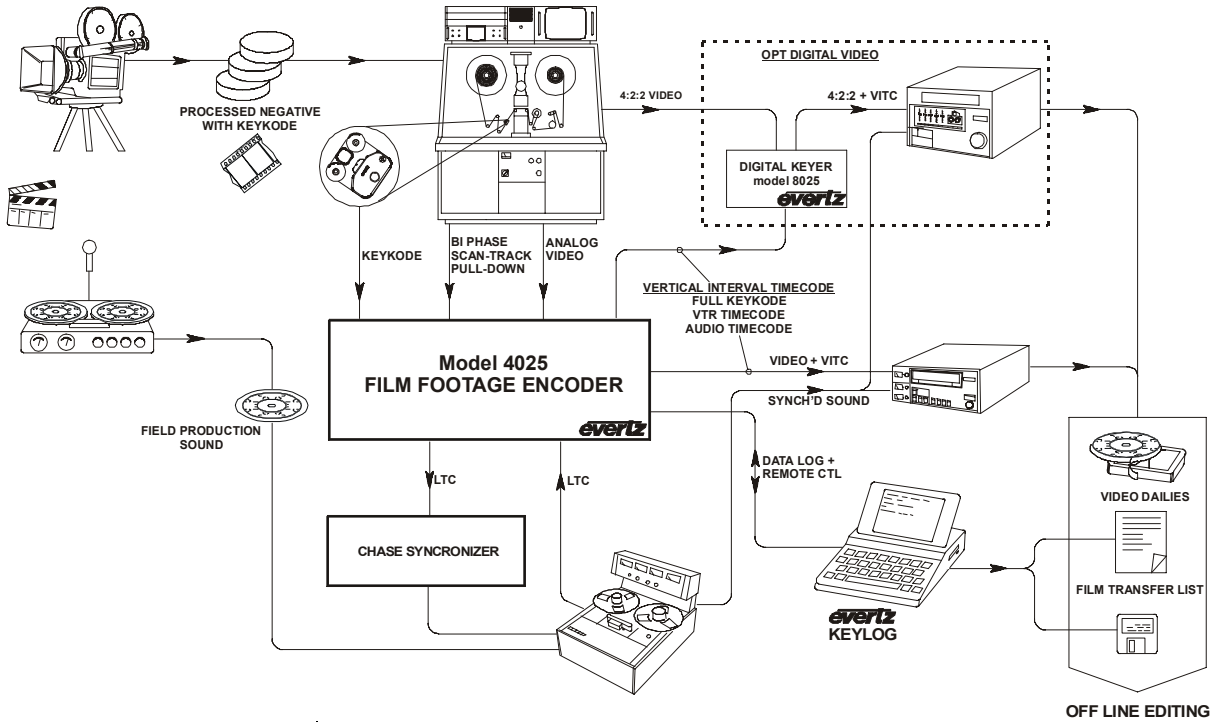
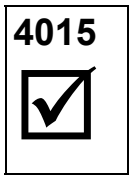


Figure 1-1: Dailies Transfer Using KeyKode

1.1. HOW TO USE THIS MANUAL

This manual is organized into 9 chapters : Overview, Installation, Operation, Optional Software System Diagnostics, Technical Description, Connector Pinouts & Cable Diagrams, Keykode Reader Installations and Film Emulsion Codes



If you are currently an owner of the Evertz 4015 Film footage Encoder, you will find that much of the installation is similar for the 4025. Items that are of particular not for 4015 users are marked with the following symbol in the margin.

Items of special note for all users are marked with a double box like this.

1.2. DEFINITIONS

LINEAR TIME CODE: (Also known as Longitudinal Time Code) A digital code used for timing and control purposes on video tape 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.

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 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.

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. The 4025 Film Footage Encoder can be used to put film footage and frame numbers into the user bits during the transfer process from film to video.

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.

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 drop outs on the reader tape.

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.

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.

KEYKODE: Machine readable bar-coded edge numbers introduced by Eastman Kodak in 1988, and subsequently standardized for all film manufacturers by the Society of Motion Picture and Television Engineers. 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: 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 four prefix digits. When using the 4025's "full KeyKode" modes, the complete KeyKode information is encoded into a secondary VITC line pair.

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.

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.

GEN LOCK: In order to ensure that the timecode to video relationship is fixed, according to SMPTE/EBU specifications, a video reference must be supplied to the 4025 Film Footage Encoder. Normally, the gen lock signal is the program video out from the telecine, onto which the vertical interval time code (VITC) is being applied. When VITC is not being used, the gen lock signal is usually the colour black system reference to which the telecine is itself genlocked. The gen lock

reference is necessary, even if vertical interval time code is not being used.

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 parked on a single frame.

SMPTE: Refers to the Society of Motion Picture and Television Engineers.

EBU: Refers to the European Broadcasting Union

Figures:

2. INSTALLATION

2.1. REAR PANEL

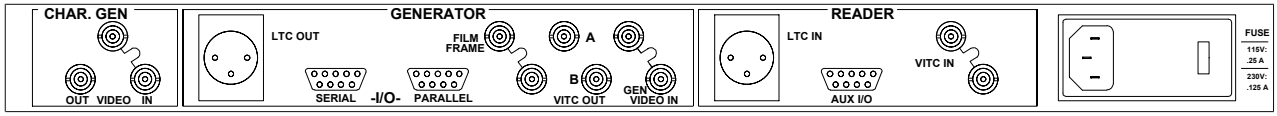


Figure 2-1: Rear Panel

The following sections describe the purpose of the rear panel connectors of the 4025. Figure 2-5 to Figure 2-9 give sample connection diagrams for various common configurations. Sections 2.7 to 2.11 describes the specific generator, reader, character inserter, and telecine signals that should be connected to the 4025.

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Evertz 4015 users who are upgrading to 4025 units will be familiar with most of the connections. Most of the connections are the same as for the model 4015. Pay particular attention to alerts identified with the symbol shown at the left.

2.1.1. Generator Connectors

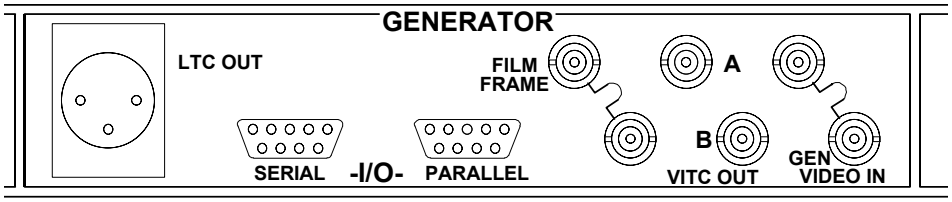

Figure 2-2: Generator Rear Panel Connectors

LTC OUT: A Male XLR connector for output of SMPTE/EBU longitudinal time code from the generator.

GEN VIDEO IN: A BNC loop for input of program video onto which vertical interval time code will be inserted. This signal is required for proper gen-locking of the Model 4025 VITC Generator.

VITC OUT: Two BNC outputs of program video with vertical interval time code inserted.

2.1.2. Telecine Connections

PARALLEL I/O: A 9 pin female 'D' connector used for connection to the telecine bi-phase tach pulse. It also contains the FRID pulse input, used with BTS telecines, and several other parallel remote control inputs.

FILM FRAME: A BNC loop for input of film frame pulse - used only with Rank Cintel Flying Spot scanners.

Connection of a Film frame pulse is required even with PAL video to permit the 4025 to distinguish the difference between the field 1 and field 2 dominant pull downs. For applications such as flatbed editing tables where a frame pulse is not available DIP switch #7 on the 615 card can be set to the CLOSED position. In this mode the 4025 will presume field 1 dominance for 1:1 transfers or an arbitrary pulldown for 3:2 transfers. See section 6.3 for further information about DIP switch settings

2.1.3. Reader Connectors

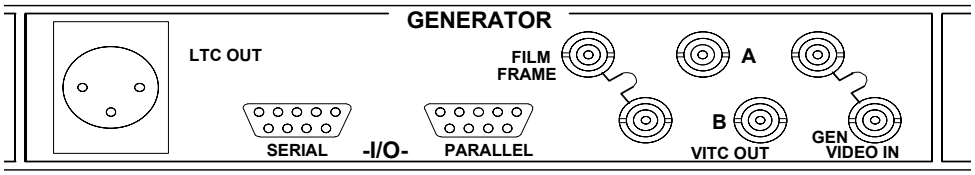

Figure 2-3: Reader Rear Panel Connections

LTC IN: A Female XLR connector for input of SMPTE/EBU longitudinal time code. This may be used as a Jam sync source for the time code generator, or to input the timecode from audio transports that are synchronized during the transfer. The function of this input is controlled by the RDR ASSIGN menu item in the TIMECODE Menu.

VITC IN: A BNC loop for input of program video with vertical interval time code. This may be used as a Jam sync source for the time code generator. When used in conjunction with a LTC to VITC translator, the timecode from audio transports that are synchronized during the transfer may also be connected here.

2.1.4. Character Generator Connectors

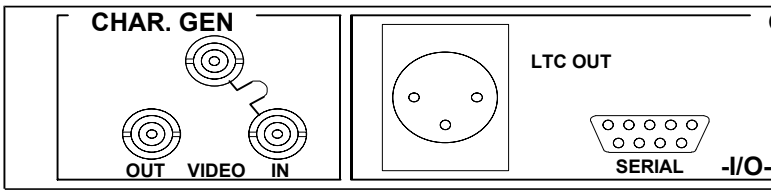

Figure 2-4: Character Generator Rear Panel Connections

IN: A BNC loop for input of program video onto which characters are to be inserted. This signal is required for proper gen-locking of Model 4025 Character Generator.

OUT: A BNC output of program video with characters inserted. This output is also used to display the Format menu system.

2.1.5. Serial I/O Connections

SERIAL I/O: A 9 pin female 'D' connector for connection to a computer for logging the timecode / keykode relationships to a data logging utility such as Key-Log™

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AUX I/O: A 9 pin female 'D' connector for connection to an external KeyKode Reader.

2.1.6. Power Connections

LINE: The 4025 may be set for either 115v/60 Hz or 230v/50 Hz AC operation. The voltage selector switch is accessible on the rear panel. The line voltage connector contains an integral slow blow fuse (and a spare one). (See section 2.4 for power and fuse specifications).

2.2. INSIDE THE 4025: REMOVING THE FRONT PANEL

During the installation procedure it may be necessary to remove the front panel to gain access to the programming switches located inside the 4025. You can accomplish this in a few seconds by turning the quick release fasteners, located at the left and right hand sides of the front panel, several turns counter clockwise. The front panel assembly pulls off showing the three circuit modules that comprise the 4025. The front panel assembly should be placed on the work bench, and should not be left suspended by the ribbon cable, as this may cause damage.

The module on the left is the 611 LTC/VITC time code reader, the one in the center is the 615 LTC/VITC generator, and the one on the right is the 631 character inserter and system controller. To replace the front panel assembly, slide it into place, and turn the quick release fasteners clockwise until they are firmly secured.

2.3. MOUNTING

The 4025 Film Footage Encoder is equipped with rack mounting angles and fits into a standard 19 inch by 1 3/4 inch (483mm x 45mm) rack space. The mounting angles may be removed if rack mounting is not desired.

2.4. POWER REQUIREMENTS

2.4.1. Selecting the Correct Mains Voltage

Power requirements are 115 or 230 volts AC at 50 or 60 Hz, switch selectable on the rear panel. 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.

Before connecting the line power, be sure to select the proper line voltage. Also, check that the line fuse is rated for the correct value marked on the rear panel.

The power entry module combines a standard IEC 320 power inlet connector, voltage selector switch, two 5 x 20 mm fuse holders (one active, one spare) and an EMI line filter.

To change the mains voltage setting, open the cover of the power entry module using a small screwdriver. Remove the drum selector switch, and re-insert it so that the desired voltage is visible through the opening on the mains connector cover. Check that the correct fuse is in use as shown in the section below.

2.4.2. Changing the Fuse

The fuse holder is located inside the power entry module. To change the fuse, open the cover of the power entry module using a small screwdriver. The fuse holder on the bottom contains the active fuse. The one at the top contains a spare fuse. Pull the bottom fuse holder out and place a fuse of the correct value in it. Use ‘slo blo’ (time delay) 5 x 20 mm fuses rated for 250 Volts with the following current ratings:

For 115 Volt operation	250 mA
For 230 Volt operation	125 mA

Never replace with a fuse of greater value.

Make sure that the arrow is pointing down when you replace the fuse holder. Close the door on the power entry module and connect the mains voltage.

2.5. SAMPLE CONFIGURATIONS

Several sample installation setups are shown below to aid the user in properly connecting the 4025 into his system. Contact Evertz technical support for other applications.

Figure 2-5 shows the minimum connections that are required to use the 4025. Figure 2-6 shows the typical connections required for encoding VITC on the master transfer roll and VITC and characters on an off-line copy. Figure 2-7 shows the typical connection when jam syncing to pre-striped code on the master transfer roll. Figure 2-8 shows the typical connection when synchronizing production audio during the telecine transfer. Figure 2-9 shows the typical connection when using the 4025 with the 8025 Digital VITC inserter.

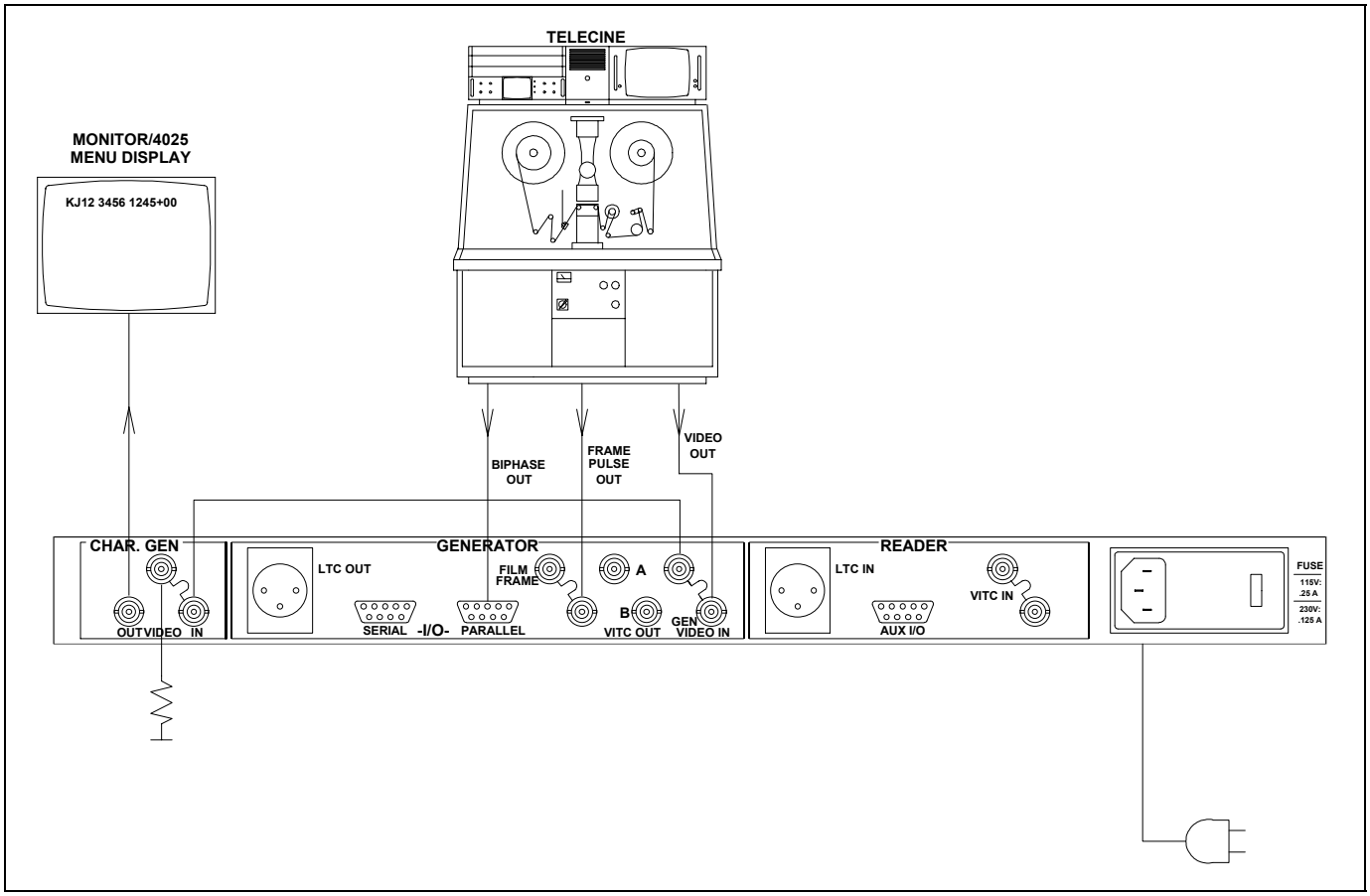


Figure 2-5: Minimum Connections

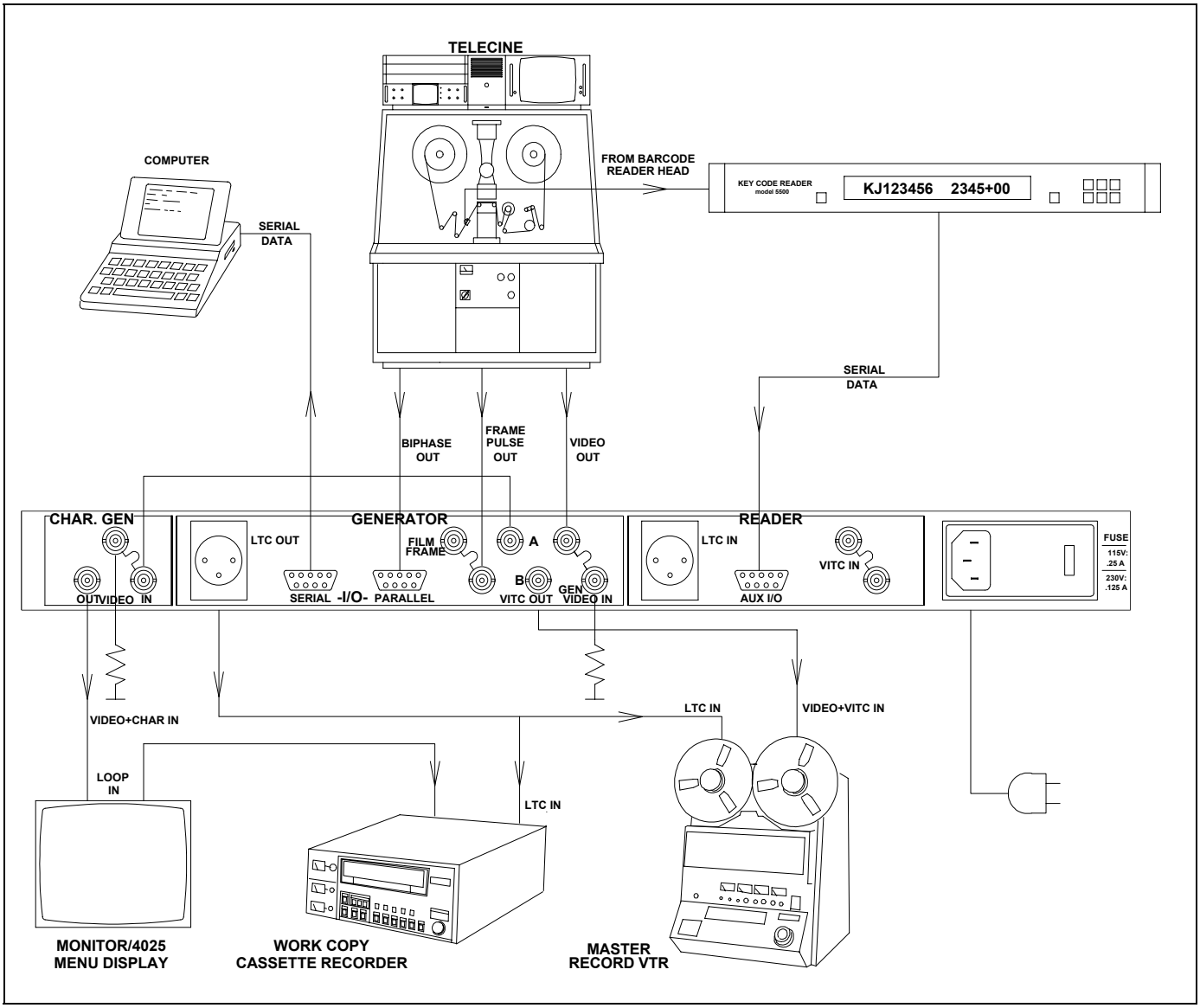


Figure 2-6: Basic Telecine Video Transfer

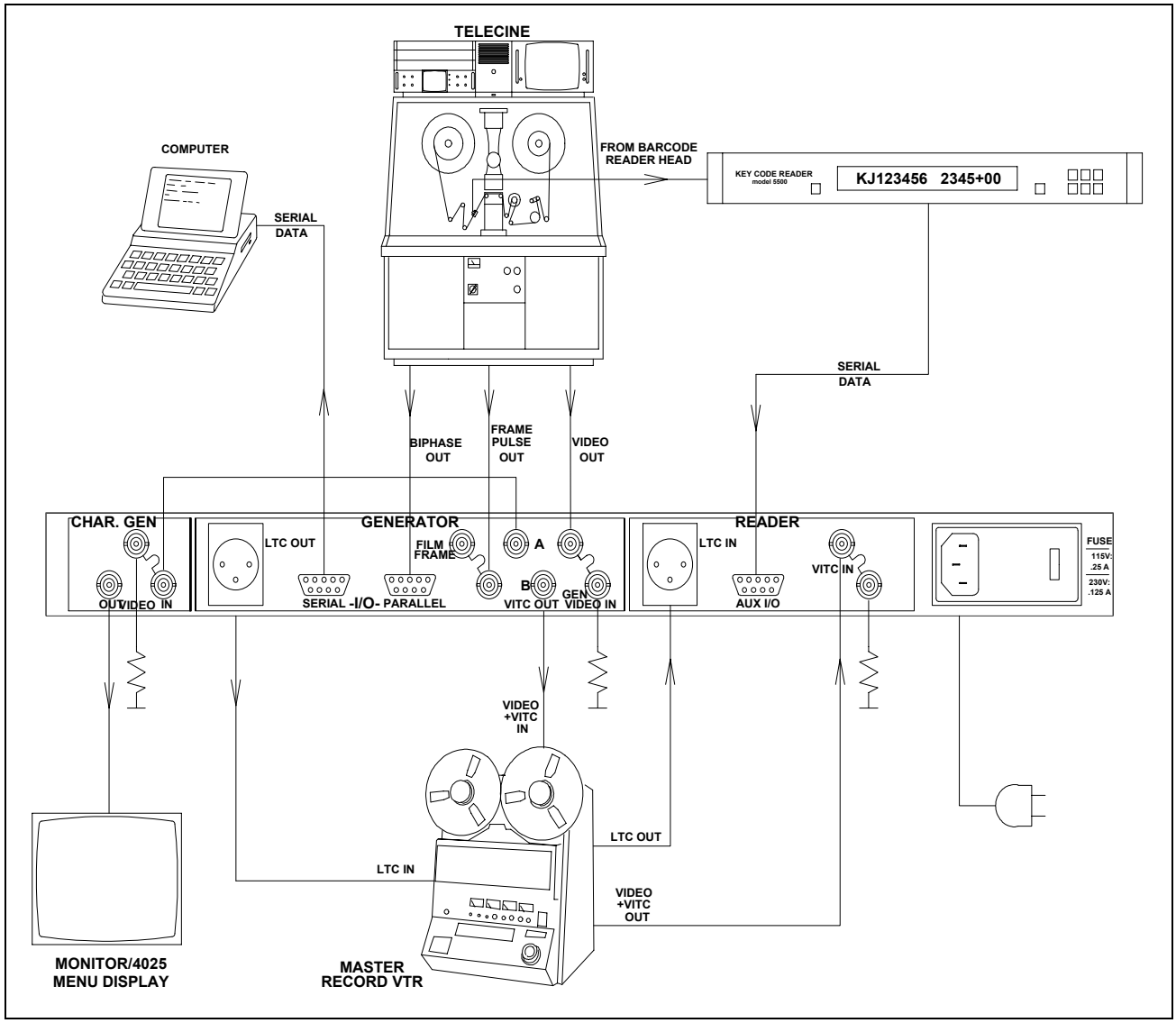


Figure 2-7: Telecine Transfer to Pre-Striped Tape (Jam)

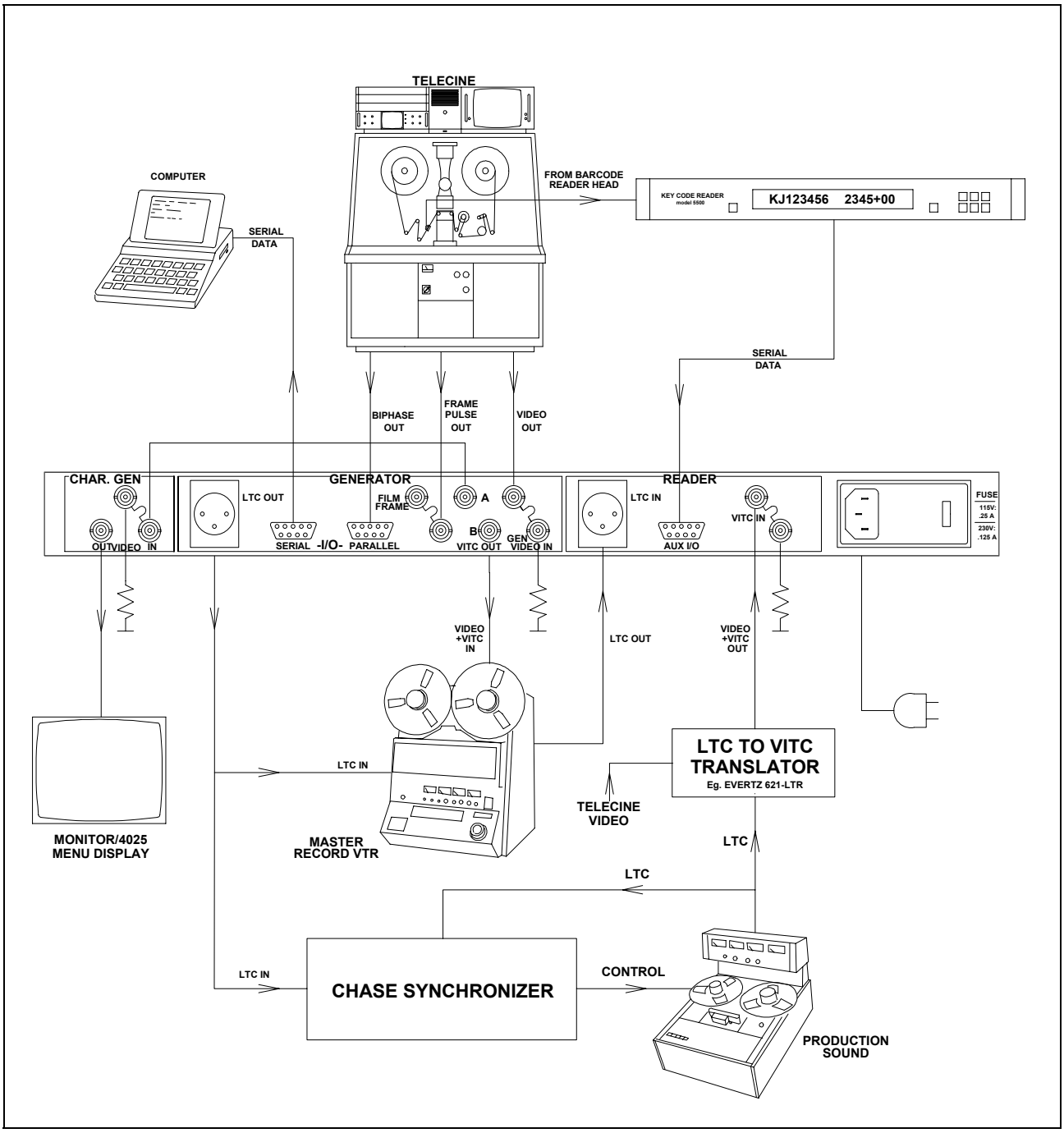


Figure 2-8: Telecine Transfer with Synchronized Audio, and Key-Log Data Logging (Jam syncing to LTC from the master VTR)

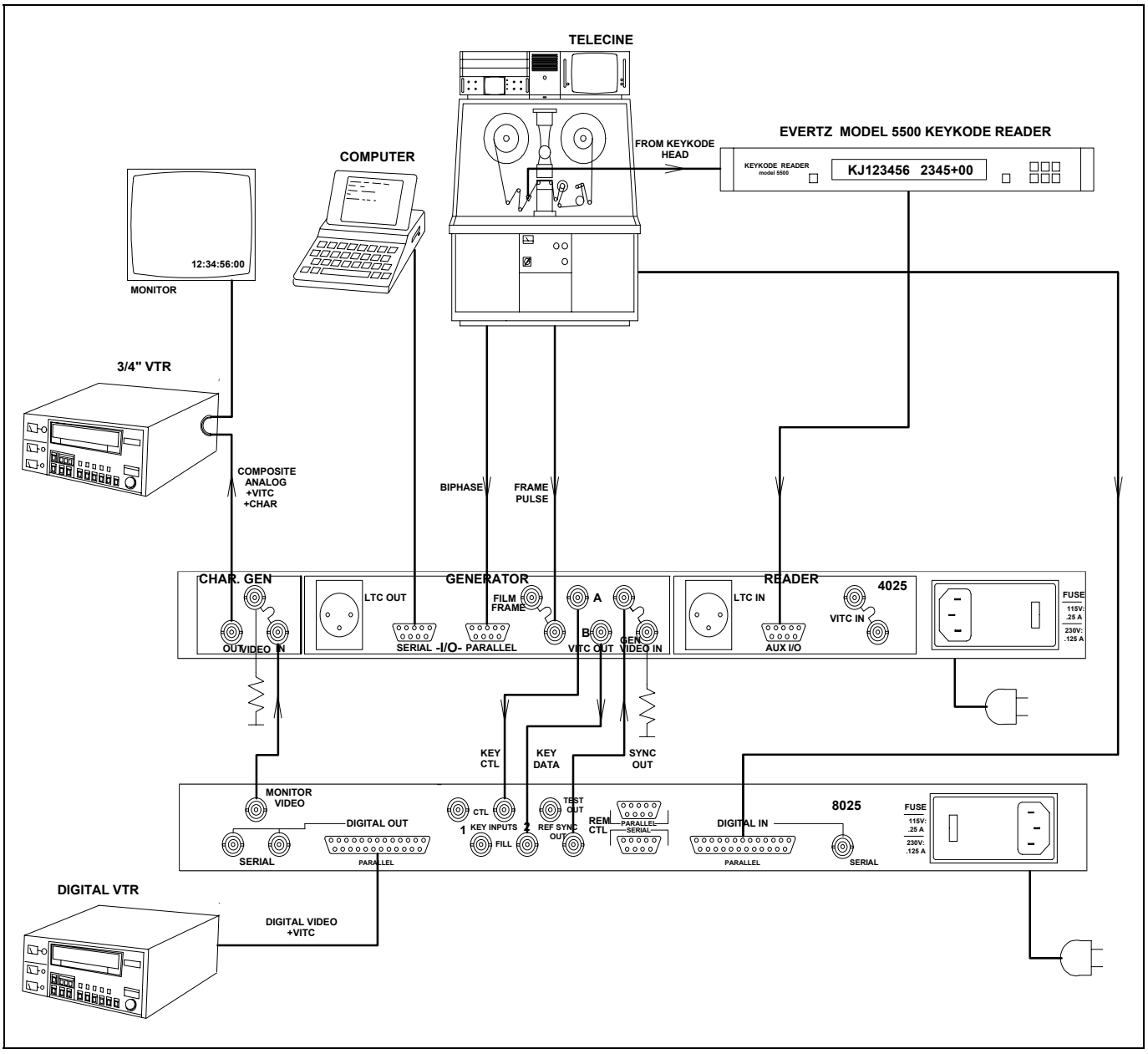


Figure 2-9: 4025 & 8025 Configuration for 4:2:2 Parallel Digital + VITC Applications

2.6. CONNECTING THE VIDEO REFERENCE

The 4025 requires a video reference regardless of whether the VITC or the Char GEN outputs are used. This video reference is usually the video output from the telecine. The video does not need to be the actual video output of the telecine, but it MUST be gen-locked to the telecine video. The reference video must be applied to both the "GEN VIDEO" input of the VITC generator and the "CHAR GEN IN." The loop-thru's on these inputs should make this relatively easy. The video input circuitry has a high impedance input tapped off the loop, therefore, the video signal must be properly terminated at the end of the line.

The 4025 may be configured to accept either PAL or NTSC video reference, or to automatically detect the video standard of the video reference. If the 4025 is in NTSC mode and PAL video is connected, the NTSC GENLCK LED will blink. If it is in PAL mode and NTSC video is connected, the PAL GENLCK LED will blink. When a mismatched video reference is connected, the front panel display will show the message:

VIDEO STANDARD ERROR

The video standard setting is configured using the Format menu. See section 2.9 for information on connecting the character generator. (See section 3.5.3 for information on changing the video standard setting.)

The reference video is presumed to be in time with the video output of the telecine (with respect to the VSYNC timing). You will need to set the Video Delay parameter on the CONFIG menu if your system has any delays in the output video path between the telecine output and the 4025 input, such as noise reducers, colour correctors, etc. Colour timing the reference video to the 4025 is NOT required.

When the correct video reference is present, the front panel GENLCK LED corresponding to the video standard will be on.

2.7. CONNECTING THE GENERATOR

2.7.1. Connecting the VITC Generator

The program video source for the VITC generator is applied to the GEN VIDEO IN loop. Normally this is connected to the composite video output from the telecine. The video input circuitry has a high impedance input tapped off the loop, therefore, the video signal must be properly terminated at the end of the line. (See section 3.5.5 for information on setting the video delay).

The video output from the telecine should be connected to the GEN VIDEO IN Loop even if the VITC generator is not being used. (See Section 2.6)

Program video with VITC is available on 2 identical video outputs. The VITC1 and VITC2 LINES items on the TIMECODE menu are used to select the lines you wish to record VITC on. VITC 2 lines contain different information then VITC 1 lines. (See section 3.3.2)

When using KeyKode / edge number information in the user bits of VITC, the time code generator built into the VTR should be set to the "EXTERNAL DIRECT" 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. (See section 3.9.1)

2.7.2. Connecting the LTC Generator

The generator LTC output is available on an XLR connector at the rear panel. The output level of the generator is factory set to 1 volt peak to peak, but may be adjusted using the level adjustment (labelled VR3) located near the rear of the 615 (center) module, on the bottom circuit card.

The generator code output should be connected to the record input of the time code channel or audio track 2 of your video recorder. (Audio track 3 for 1" VTR's) 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 GEN ASSIGN item of the TIMECODE menu is used to set up the operational mode of the LTC and VITC generators. (See section 3.3.1)

When using KeyKode / edge number information in the user bits of LTC, the time code generator built into the VTR should be set to the "EXTERNAL DIRECT" 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. (See section 3.9.1)

2.8. CONNECTING THE TIMECODE READERS

The 4025 LTC/VITC time code reader is used to Jam sync the generator to off tape time code when assemble edits are being performed or when

transferring to previously striped tape. It is also used to bring in the audio time code when audio is synced during the transfer. The function of the Timecode Readers is controlled by the RDR ASSIGN item on the TIMECODE menu. (See section 3.3.4)

2.8.1. Connecting the VITC reader

The reader input video with VITC recorded on it is connected to the VITC IN loop. The video input circuitry has a high impedance input tapped off the loop, therefore, the video signal must be properly terminated at the end of the line. This may come from the video output of the VTR you are recording on to, or from a LTC to VITC translator to input production audio timecode as shown in Figure 2-7.

2.8.2. Connecting the LTC Reader

Connect the LTC output from your VTR to the 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 may come from a video based time code source as shown in Figure 2-7.

2.9. CONNECTING THE CHARACTER GENERATOR

The program video for the character generator is connected to the CHAR GEN IN loop. The program video with characters is available at the OUT BNC connector. Adjustments to the character size, position and display modes are accomplished by using front panel controls. See Chapter 3 of this manual for further information.

The video input circuitry has a high impedance input tapped off the loop, therefore, the video signal must be properly terminated at the end of the line.

There are internal jumpers located on the I/O assembly that allow the lower BNC of the loop to be used as an internally terminated input. In this mode, the upper BNC of the loop may be used as a second character generator output. (See section 6.3.1)

To make window dubs on your program video for off line editing, connect the character generator input to the video output from the telecine. If you also want to put VITC on with the burn in, connect the character generator input to one of the outputs of the VITC generator. (See Figure 2-6)

In addition to providing field accurate burn-ins of the video and audio time codes film edge numbers and absolute frames, the character inserter provides Format menus, to help configure the 4025 to your operational requirements quickly. The character generator is also used to display system diagnostics, which help users to quickly locate problems with the installation.

It is necessary to connect the character inserter to a video source to properly gen-lock the 4025. The character output must be connected to a monitor in order to use the Format menu, which is required to properly configure the 4025 Film Footage Encoder.

2.10. CONNECTING A RANK CINTEL TELECINE

Two signals, (bi-phase tach and Film Frame pulse) must be connected from the telecine in order to generate field accurate time code. The location and description of these signals depend on the model of your telecine. Sections 2.10.1 and 2.10.2 provide an overview of the Rank Cintel connections. Sections 2.10.3 to 2.10.6 provide detailed instructions for your models of Rank Cintel telecines. In addition to making the physical connections to the telecine you will have to select the Bi-Phase rate, Telecine type and set up for any video processing delays between the output of your telecine and the input of the 4025. Section 2.10.7 provides a procedure to verify that you have made the necessary connections and settings for your telecine.

This procedure should be followed before proceeding to KeyKode installation.

2.10.1. Bi-Phase Tach from the Rank Cintel Telecine

The 4025 is fitted with a nine pin female 'D' connector (**PARALLEL I/O)** for connection to the telecine. The pin connections are shown in Chapter 7.

The BPH1 and BPH2 inputs (pins 7 & 3 respectively) should be connected to bi-phase quadrature tach pulses from the telecine. These TTL level pulses usually come at a rate of 10 pulses per film frame. The 4025 can also accommodate tach rates of 1, 2 or 5 pulses per frame. For best results use the highest bi-phase rate possible. Use the BI-PHASE RATE menu item of the Toolbox Hardware menu To adjust the 4025 to the correct bi-phase rate. (See section 3.6.3) Correct connections will result in EDGE numbers that increment and decrement when the telecine moves forward and reverse respectively. In the event that the 4025 counts in the reverse direction when the telecine is in forward play, reverse the two bi-phase connections to the 4025.

To minimize the effects of cross coupling and noise on the bi-phase signals, which can affect the counting reliability of the 4025, you use a cable which provides separate shields for each phase of the bi-phase signal.

2.10.2. Rank Cintel Film Frame Pulse

In addition to the bi-phase 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 4025 uses the film frame pulse to lock its timecode output to the correct telecine pulldown sequence during the transfer.

Some telecines, such as Rank Cintel MKIIIC Digiscan 3 models, continue the frame pulse in an unbroken sequence even when they are in shuttle modes. When used with these telecines, the 4025 can be configured for AUTO rate detect. Changes in transfer rates by the telecine operator are automatically detected when the telecine is in still. (See sections 3.4.4 or 3.10.9 for information on how to select auto rate detect mode). Other telecines, such as Rank Cintel 4:2:2 Digiscan 4 and URSA models do not maintain coherent film frame pulse sequences in shuttle modes. When used with these telecines, the 4025 must be manually set to the correct transfer rate to accurately track the film/timecode relationship.

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 film frame pulse is sampled once per video field approximately mid-field.

Figure 2-10 shows the timing requirements for the Rank Cintel frame pulse. The frame pulse must be low at the trailing end of vertical sync and return high again before the end of the field.

Connection of a Film frame pulse is required even with PAL video to permit the 4025 to distinguish the difference between the field 1 and field 2 dominant pull downs.

It is essential that the 4025 be connected to the correct FILM FRAME pulse from the telecine. Generally this pulse is labelled “FRAME PULSE” on the Rank Telecines and is found on the rear of the Digiscan electronics rack. Figure 2-10 shows some specifications of the expected Frame Pulse into the 4025. This should allow you to locate the appropriate signal, regardless of the labelling on your telecine. The Rank telecine manuals or Rank technical support personnel may also be able to assist you.

The telecine type item of the Engineering toolbox hardware menu controls whether standard Rank Cintel, URSA Gold or BTS pulldown pulse is expected. The telecine type should be set to the Rank or URSA Gold settings accordingly to accept the Rank Cintel style FRAME pulse input from the “FRAME BNC connector on rear panel. (See section 3.6.4)

If the right hand LED on the 615 module (center card behind the front panel) is blinking, or dim, or flickering rapidly, that is an indication that the Frame Pulse input is not satisfactory.

This signal may be applied to either of the pair of connectors on the 4025 labelled "FILM FRAME". The loop-thru is provided to allow connections to other devices that may need this signal. This is NOT a video level signal. Do NOT terminate this signal.

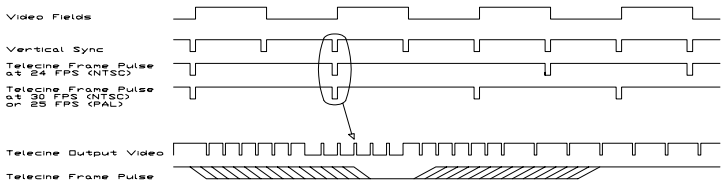


Figure 2-10: Rank Cintel Frame Pulse Specification

2.10.3. Rank Cintel MKIIIC Digiscan 3

For connection to a Rank Cintel MKIIIC telecine a pre-wired 'Y' interface cable (Part No WA-615) may be ordered. It permits the 4025 and the mag follower to both be connected to the same bi-phase connections. Figure 7-3 in Chapter 7 shows the correct cable wiring diagram if you decide to wire the cable yourself. Remove the mag follower cable from the SK24 connector on the Rank, and connect it to the female 12 pin McMurdo connector end of the WA-615 cable. Connect the male 12 pin McMurdo end to connector SK24 on the telecine. Connect the 9 pin 'D' connector end of the cable to the PARALLEL I/O connector on the rear of the 4025. On some models of Rank telecines the polarity of the bi-phase signals is reversed. In the event that the 4025 counts in the reverse direction when the telecine is in the forward direction, reverse the two bi-phase connections to the 4025 (at the 9 pin 'D" connector).

Remove the coax cable connected to the BSK 43 BNC on the telecine Digiscan frame, (if any) and connect it to one side of the FILM FRAME loop on the 4025. Connect the other side of the FILM FRAME loop to connector BSK 43

Do not terminate this signal.

The telecine type item on the Engineering Toolbox Hardware Menu must be set to RANK. The film frame item on the Engineering Toolbox Hardware Menu must be set to either LATCHED or SAMPLED. (See section 3.6.4 and 3.6.5) In NTSC configurations, the film rate setting on the FILM drop down menu may be set to Auto, 24 or 30 FPS. (See section 3.4.4 or 3.10.9)

2.10.4. Rank Cintel 4:2:2 Digiscan IV

The Bi-phase tach pulse is available on a pair of BNC connectors on the rear of the Mag follower. These bi-phase signals must be connected to

pins 3 & 7 of the 9 pin parallel I/O D connector. Connect ground to pin 6 on the rear of the 4025. Retain the separate shielding of each signal up to the 4025 in order to prevent cross-coupling which can adversely affect the bi-phase reliability.

Remove the coax cable connected to the Frame BNC (BSK 20) on the telecine Digiscan frame, (if any) and connect it to one side of the FILM FRAME loop on the 4025. Connect the other side of the FILM FRAME loop to the Frame BNC (BSK 20)

Do not terminate this signal.

The telecine type item on the Engineering Toolbox Hardware Menu must be set to RANK. The film frame item on the Engineering Toolbox Hardware Menu must be set to either LATCHED or SAMPLED. (See section 3.6.4 and 3.6.5) In NTSC configurations, the film rate setting on the FILM drop down menu may be set to Auto, 24 or 30 FPS. (See section 3.4.4 or 3.10.9)

Do not use AUTO rate detect when using a Time Logic Controller and Rank Cintel 4:2:2 telecines.

2.10.5. Rank Cintel URSA

The Bi-phase tach pulse is available on a pair of BNC connectors on the rear of the Mag follower. These bi-phase signals must be connected to pins 3 & 7 of the 9 pin parallel I/O D connector. Connect ground to pin 6 on the rear of the 4025. Retain the separate shielding of each signal up to the 4025 in order to prevent cross-coupling which can adversely affect the bi-phase reliability.

Remove the coax cable connected to the Frame BNC (BSK 33) on the telecine Digiscan frame, (if any) and connect it to one side of the FILM FRAME loop on the 4025. Connect the other side of the FILM FRAME loop to the Frame BNC (BSK 33)

Do not terminate this signal.

The telecine type item on the Engineering Toolbox Hardware Menu must be set to RANK. The film frame item on the Engineering Toolbox Hardware Menu must be set to either LATCHED or SAMPLED. (See section 3.6.4 and 3.6.5) In NTSC configurations, the film rate setting on the FILM drop down menu may be set to 24 or 30 FPS. (See section 3.4.4 or 3.10.9)

For URSA telecines do not use AUTO rate detect.

2.10.6. Connecting A Rank Cintel URSA Gold

URSA Gold telecines with firmware versions 5.01 and earlier had some indeterminate timing related to the Film Frame pulse (which is connected to the 4025) and certain other internal telecine pulses. These inconsistencies have been fixed in telecine firmware version 5.02 and later. Contact your Rank Cintel agent if you are unsure of what telecine firmware version you have, or how to upgrade to the latest version.

The Bi-phase tach pulse is available on a pair of BNC connectors on the rear of the Mag follower. These bi-phase signals must be connected to pins 3 & 7 of the 9 pin parallel I/O D connector. Connect ground to pin 6 on the rear of the 4025. Retain the separate shielding of each signal up to the 4025 in order to prevent cross-coupling which can adversely affect the bi-phase reliability.

Remove the coax cable connected to the Frame BNC (BSK 33) on the telecine Digiscan frame, (if any) and connect it to one side of the FILM FRAME loop on the 4025. Connect the other side of the FILM FRAME loop to the Frame BNC (BSK 33)

Do not terminate this signal.

The telecine type item on the Engineering Toolbox Hardware Menu must be set to URSA GOLD. The film frame item on the Engineering Toolbox Hardware Menu must be set to DIRECT. (See section 3.6.4 and 3.6.5)

For URSA GOLD telecines do not use AUTO rate detect.

2.10.7. Verifying the Connections to a Rank Cintel Telecine

When you have completed the basic telecine connections, you will need to verify the frame accuracy of the basic system. 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 4025 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. Using the Format menu set the 4025 to the following settings:

   - GEN MODE to CINE EDGE (See section 3.3.1)
   - DROP FRAME to NON DROP FRAME (See section 3.3.3)
   - KK JAM to NEVER (See section 3.4.1)
   - FILM TYPE to Match the film stock you have placed on the telecine (See section 3.4.3)
   - FILM RATE to match your telecine transfer rate (See section 3.4.4)

4. Turn on the 4025's character windows for Generator time and Edge code (KeyKode) as described in section 3.12.1

5. Enter the key number of the reference frame into the KKode register as described in section 3.10.2

6. Set the time of the VITC generator to 01:00:00:00 as described in section 3.9.3.

7. Back up the telecine and transfer a short piece of film (which includes the reference frame) to video tape. When the telecine achieves locked PLAY speed, the telecine FRAME and LOCK LEDs on the 4025 front panel should be on and there should be a '+' between the footage and frames in the character generator. Press the HELP key if the FRAME and LOCK indicators are not on. (See Chapter 5 for a full discussion of the various HELP messages and their probable causes)

8. Play back the video tape in slow shuttle or jog mode, and 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 install the KeyKode reader system. (See section 2.12.)

   If the Edge numbers are not correct, or do not match the picture pulldown, check to see that you have properly compensated for any delays in the video path from your telecine to the 4025. (See section 3.5.5)

   If the timecode numbers are not correct, check that you have set the correct FILM RATE setting (See section 3.4.4)

In 24 FPS NTSC 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.

In 30 FPS NTSC or 25 FPS PAL transfers; see section 3.12.6 for a discussion of Field 1 dominant and Field 2 dominant characteristics.

9. After you have made any adjustments, park the telecine with the reference frame in the gate and repeat steps 5 through 8 until you have satisfactory results.

2.11. CONNECTING A BTS TELECINE

Two signals, (bi-phase tach and FRID pulse) must be connected from the telecine in order to generate field accurate time code. The location and description of these signals depend on the model of your telecine. Sections 2.11.1 and 2.11.4 provide an overview of the BTS connections. Section 2.11.3 provides some additional information for FDL-60 models. In addition to making the physical connections to the telecine you will have to select the bi-phase rate, telecine type and set up for any video processing delays between the output of your telecine and the input of the 4025. Section 2.11.4 provides a procedure to verify that you have made the necessary connections and settings for your telecine.

This procedure should be followed before proceeding to KeyKode installation.

2.11.1. Bi-Phase Tach from the BTS Telecine

The 4025 is fitted with a nine pin female 'D' connector (**PARALLEL I/O)** for connection to the telecine. The pin connections are shown in Chapter 7.
The BPH1 and BPH2 inputs (pins 7 & 3 respectively) should be connected to bi-phase quadrature tach pulses from the telecine. These TTL level pulses usually come at a rate of 10 pulses per film frame. The 4025 can also accommodate tach rates of 1, 2 or 5 pulses per frame. For best results use the highest bi-phase rate possible. To adjust the 4025 to the correct bi-phase rate, use the bi-phase rate menu item of the Engineering toolbox hardware menu. (See section 3.6.3) Correct connections will result in EDGE numbers that increment and decrement when the telecine moves forward and reverse respectively. In the event that the 4025 counts in the reverse direction when the telecine is in the forward direction, reverse the two bi-phase connections to the 4025.

To minimize the effects of cross coupling and noise on the bi-phase signals, which can affect the counting reliability of the 4025, you use a cable which provides separate shields for each phase of the bi-phase signal.

2.11.2. BTS Film Frame Pulse

In addition to the bi-phase connections, a film frame pulse is required. This pulse from the BTS telecine, (known as the FRID pulse), changes level when a new film frame starts in the video output, while the telecine is in normal play speed. The 4025 uses the film frame pulse to lock its timecode output to the correct telecine pulldown sequence during the transfer.

The FRID 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 NTSC). The FRID pulse will be a square wave that is high for 2 fields and low for two fields in 25 frames per second transfers in PAL and 30 frames per second transfers in NTSC. (See Figure 2-11). This signal should always change level around VSYNC time. The FRID pulse is not present when the telecine is in STOP. Connect the FRID pulse to pin 2 of the 9 pin PARALLEL I/O connector.

Connection of a Film frame pulse is required even with PAL video to permit the 4025 to distinguish the difference between the field 1 and field 2 dominant pull downs.

Do NOT connect the FRID pulse to the "FRAME PULSE" BNC on the 4025.

The telecine type item on the Toolbox Hardware Menu must be set to BTS. To select the BTS style FRID pulse input (TTL levels) from Pin 2 of the "PARALLEL I/O" DB-9 connector on the rear panel. (See section 3.6.4) The film frame item on the Toolbox Hardware Menu is not used with BTS telecines.

In NTSC configurations, the film rate setting on the FILM drop down menu may be set to 24 or 30 FPS. (See section 3.4.4)

DO NOT AUTO frame rate with BTS telecines.

The BTS telecines can physically park the film in two places and show the same picture depending on which direction the reference frame is approached from. This is not usually a concern, except when doing the head offset learning. When you park on the reference frame, for head offset learning, always approach in the forward direction.

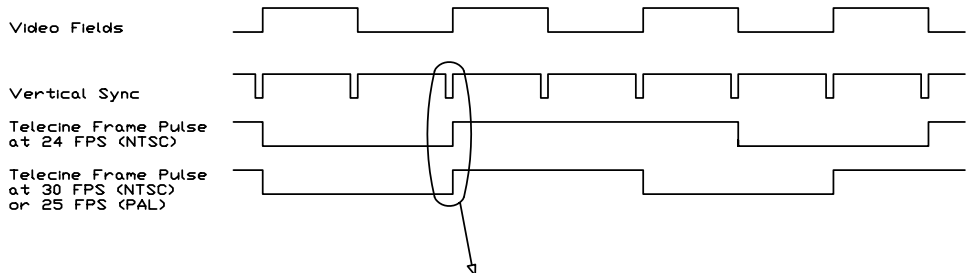


Figure 2-11: BTS FRID Pulse Specification

2.11.3. BTS FDL-60

The BTS documentation for the FDL-60 shows that the FRID pulse can be found as follows:

1. FDL 60 A11/A13/C11/C13:
   FD 353 Intermediate board/EXT 2/B25/pin 17, GND pin 18
2. FDL 60 B1/B3/C1/C3:
   FD AP DF 632-002, -003/EXT 2/B25 J34/pin 17, GND pin 18

3. FDL 60 B2/B4 up to Serial. No. 340:
   FD AP DF 632-001/FRAME ID OUT/J31/BNC with interface:
   FD AP DF 632-001/EXT PAN CONTROL/B15 J35/pin 13,
   GND pin 14

4. FDL 60 B2/B4 starting with Serial. No. 341 and C2/C4:
   FD AP DF 632-002, -003/EXT 2/B25 J34/pin 17, GND pin 18

TTL - output, max. current: 40 mA

Since there are a number of similar signals, we recommend that you check out the signal with an oscilloscope while the telecine is in play.

The telecine type item on the Engineering Toolbox Hardware Menu must be set to BTS QUADRA/FDL. (See section 3.6.4)

2.11.4. BTS FDL-90

The bi-phase tach pulse is available on the 9 pin D Sepmag connector on the telecine. Connect pins 1 and 5 from this connector to pins 3 and 7 of the 9 pin parallel I/O connector of the 4025 respectively. Connect ground (pin 7 on the telecine connector to pin 6 on the 4025 connector. Note that the pulse output should be set to 10 pulses per film frame by proper selection of the jumper on the sprocket Pulse card in the telecine (FY806 or FM735 card).

The FRID pulse is available on pin 17 of the External 2 25 pin D connector on the telecine. This pulse should be connected to pin 2 pf the Parallel I/O connector of the 4025. Ground for the FRID pulse on pin 18 of the External

2 connector should be connected to pin 6 of the 4025 Parallel I/O connector.

The telecine type item on the Engineering Toolbox Hardware Menu must be set to BTS QUADRA/FDL. (See section 3.6.4)

2.11.5. BTS QUADRA

The bi-phase tach pulse is available on the 9 pin D Sepmag connector on the telecine. Connect pins 1 and 5 from this connector to pins 3 and 7 of the 9 pin parallel I/O connector of the 4025 respectively. Connect ground (pin 7 on the telecine connector to pin 6 on the 4025 connector. Note that the pulse output should be set to 10 pulses per film frame by proper selection of the jumper on the sprocket Pulse card in the telecine (FY806 or FM735 card).

The FRID pulse is available on pin 17 of the External 2 25 pin D connector on the telecine. This pulse should be connected to pin 2 pf the Parallel I/O connector of the 4025. Ground for the FRID pulse on pin 18 of the External 2 connector should be connected to pin 6 of the 4025 Parallel I/O connector.

Connect the PRESTOP signal (Pin 3 on the WETGATE connector of the Quadra) to PIN 4 of the 4025 PARALLEL connector. You will also need to remove the cover of the 4025 and set Jumper J37 on the 7006 I/O board to the 4IN position.

The telecine type item on the Engineering Toolbox Hardware Menu must be set to BTS QUADRA/FDL. (See section 3.6.4)

2.11.6. BTS (Philips) Spirit

The signals required to connect the Spirit telecine are found on the 9 pin D TC GEN OUT connector (J23) on the Spirit. Connect the bi-phase tach pulse outputs (pins 1 and 5) from this connector to pins 3 and 7 of the 9 pin parallel I/O connector of the 4025 respectively. Connect ground (pin 7 on the telecine connector) to pin 6 on the 4025 connector. Note that the pulse output should be set to 10 pulses per film frame. Connect the Start of Frame (SOF) pulse (pin 2) to pin 2 of the Parallel I/O connector of the 4025.

The telecine type item on the Engineering Toolbox Hardware Menu must be set to BTS SPIRIT. (See section 3.6.4)

2.11.7. Verifying the Connections to a BTS Telecine

When you have completed the basic telecine connections, you will need to verify the frame accuracy of the basic system. 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 4025 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. Using the On Screen programming menu set the 4025 to the following settings:

   - GEN MODE to CINE EDGE (See section 3.3.1)
   - DROP FRAME to NON DROP FRAME (See section 3.3.3)
   - KK JAM to NEVER (See section 3.4.1)
   - FILM TYPE to Match the film stock you have placed on the telecine (See section 3.4.3)
   - FILM RATE to match your telecine transfer rate (See section 3.4.4)

4. Turn on the 4025's character windows for Generator time and Edge code (KeyKode) as described in section 3.12.1.

5. Enter the key number of the reference frame into the KKode register as described in section 3.10.2.

6. Set the time of the VITC generator to 01:00:00:00 as described in section 3.9.3.

7. Back up the telecine and transfer a short piece of film (which includes the reference frame) to video tape. When the telecine achieves locked PLAY speed, the telecine FRAME and LOCK LEDs on the 4025 front panel should be on and there should be a '+' between the footage and frames in the character generator. Press the HELP key if the FRAME and LOCK indicators are not on. (See Chapter 5 for a full discussion of the various HELP messages and their probable causes)

8. Play back the video tape in slow shuttle or jog mode, and 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 install the KeyKode reader system. (See section 2.12.)

If the Edge numbers are not correct, or do not match the picture pulldown, check to see that you have properly compensated for any delays in the video path from your telecine to the 4025. (See section 3.5.5)

If the timecode numbers are not correct, check that you have set the correct FILM RATE setting (See section 3.4.4)

In 24 FPS NTSC 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.

In 30 FPS NTSC or 25 FPS PAL transfers; see section 3.12.6 for a discussion of Field 1 dominant and Field 2 dominant characteristics.

9. After you have made any adjustments, park the telecine with the reference frame in the gate and repeat steps 5 through 8 until you have satisfactory results.

2.12. 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, eliminating the tedium and human error, and providing an absolutely accurate identification, entry and tracking of film edge numbers.

The 4025 Film Footage Encoder interfaces to reader systems from several manufacturers. These KeyKode readers are self contained units and consist 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 a serial link to the Film Footage Encoder, for automatic placement into the time code.

2.12.1. Hardware Installation

A nine pin female 'D' connector (**AUX I/O)** is provided on the rear panel for connection to an external KeyKode reader. Most of the KeyKode readers use RS-232-C level signals to communicate with the 4025.

4015

Evertz 4015 users note that this is NOT the same connector used to connect the KeyKode readers to the 4015 Film Footage Encoder.

Cable WA-C67 may be used to connect Evertz, RIM and Cinema Products readers to your 4025. Alternately, you can wire your own cable using the wiring diagrams shown in Chapter 7.

Consult Chapter 8 for specific information about installing your specific reader system and connecting it to the 4025.

2.12.2. Verifying Communications between the 4025 and the Reader

Once the KeyKode reader has been installed on the telecine, and connected properly to the 4025, 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 indicated on the reader electronics unit. Usually a beep or tone from the reader electronics unit indicates that it is reading successfully. Also, the KKODE LED on the 4025 front panel should blink On each time a barcode data record is sent to the 4025.

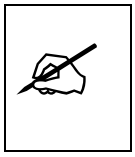
Once you have verified proper communications, proceed to learning the head offset. If communications are not realized, check the installation procedure for the reader unit and connections to the 4025 as outlined in the previous sections. Chapter 5 contains some additional trouble-shooting information that you may find helpful.

2.12.3. Learning the Mechanical Offset Between the Reader Head and the Telecine Gate

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.

Head offset values are saved in non-volatile memory when power is removed. The 4025 maintains separate head offset values for 16 mm and 35 mm film types for each transfer speed. Once calibrated, the 4025 automatically uses the correct head offset value for your configuration. A

summary of the Head offsets is available using the KK HEAD OFFSET item in the CONFIG drop down menu of the Format menu.



The following calibration procedure MUST be performed before the 4025 will use the KeyKode information it receives. The head offset for each film type and transfer speed MUST be initialized for each combination used.

The automatic alignment procedure in the 4025 calculates the exact offset between the head and the gate, and is normally required only during installation. Following this procedure should provide a quick, and error free method of calibrating the 4025.

The Format menu is used to perform manual adjustments or to invoke the head offset learning procedure. Press the **FORMAT** key to access the Format menu. Using the ← & → keys drop down the CONFIG menu. Use the ↑ & ↓ keys to highlight the KK HEAD OFFSET menu item and press the **SELECT** key to show the HEAD OFFSET SUMMARY. The current head offset numbers and the approximate number of film frames from the head to the gate are shown for each film type and transfer rate.

The head offset learning is protected from normal user access by the Engineering Mode DIP switch. With Engineering mode Off, you may look at the head offset summary page, but cannot proceed to any of the calibration steps described below. To enable Engineering mode, turn DIP switch #8 on the 631 module (right hand card inside the 4025) to the Closed (On) position.

```
TIMECODE    FILM  CONFIG

  NTSC HEAD OFFSET SUMMARY

  35 MM 24 FPS  0820   ( 41 FRM)

  35 MM 30 FPS  0840   ( 42 FRM)

  16 MM 24 FPS  NONE

  16 MM 30 FPS  NONE

↑↓PICK,SHIFT+SELECT TO CALIBRATE
```

Press the ↑ & ↓ keys one or more times to select the head offset you wish to calibrate. The programmed offset for that film type and transfer rate will be highlighted. Press the **SHIFT + SELECT** keys to calibrate the selected head offset, or press the **SELECT** key to return to the FILM drop down menu.

When you press **SHIFT + SELECT** a second screen appears that allows you to proceed with manual adjustments or automatic learning.

```
   TIMECODE FILM  CONFIG

   HEAD OFFSET ADJUSTMENT


  SELECT TO LEARN

  SHIFT + SELECT TO ADJUST

  CLR TO RETURN TO SUMMARY
```

If you want to perform manual adjustments to the head offset, press the **SHIFT + SELECT** keys. The manual adjustment screen appears. If you are installing the head for the first time, press the **SELECT** key to proceed with automatic head offset learning.

2.12.4. Manual Head Offset Adjustments

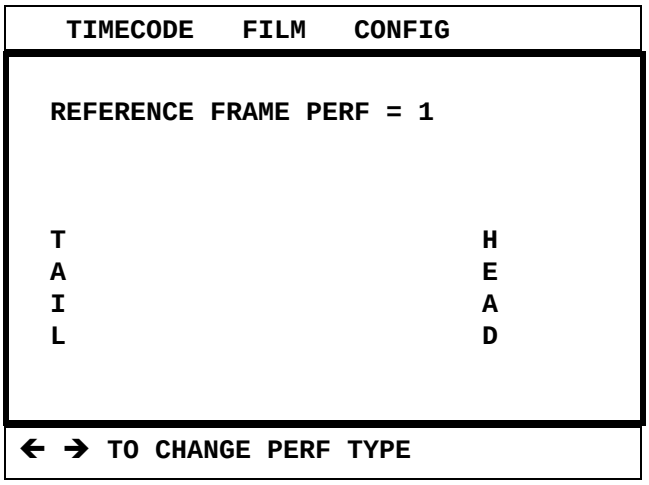
Improper Head Offsets may cause errors in the footage numbers. Manual adjustment is best suited for re-entry of previously auto-learned values.

```
TIMECODE    FILM  CONFIG

   HEAD OFFSET FOR 35 MM 24 FPS

 OFFSET     NONE  ERROR 000 : 00

↑↓SHIFT+↑↓ TO ADJUST OFFSET
HOLD KEYS DOWN TO ADJUST FASTER
```

The head offsets can be manually adjusted to fine tune the calibration. Press the ↑ & ↓ keys to adjust by 1. Press the **SHIFT+↑** & **SHIFT+↓** keys to adjust by 10. Holding down the keys will increase the adjustment speed.

2.12.5. Automatic Head Offset Learning

During the head offset learning procedure, you will be presented with several screens in succession to guide you through the calibration process.



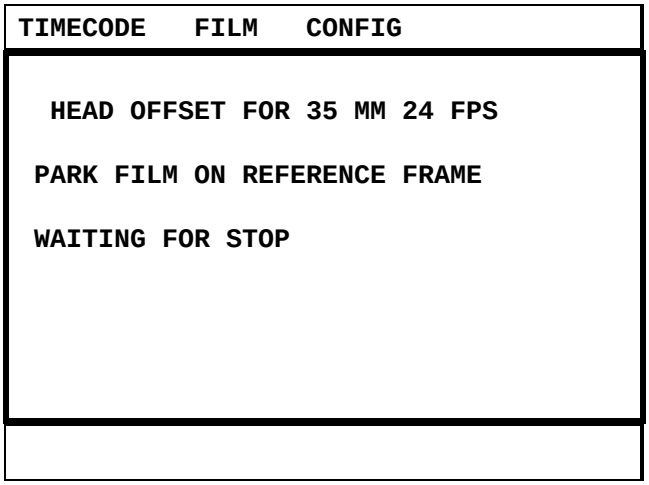
On a piece of bar-coded film stock, select a reference frame that is beside one of the barcodes. (The reference frame is located beside the reference dot of the barcode.) Identify this frame with a punch mark or grease pencil. Use the ← & → keys to select the perf that corresponds to the perf of the reference frame. Press **SELECT** to continue.

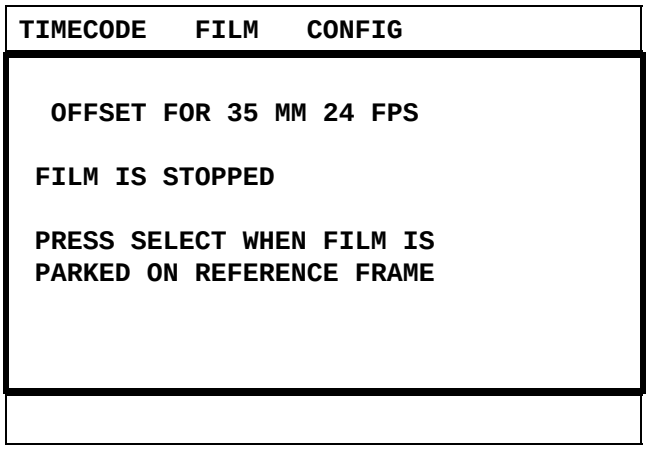
Improperly identifying the orientation of the reference dot to the perforations ("PERF type") may cause errors to be introduced into the footage numbers.

4015

The 4025's PERF numbering scheme has been changed from the 4015 so that it conforms to the industry standard head to tails orientation. The on screen graphic display accurately shows the KeyKode perf orientation so as to avoid confusion.

Thread this film onto the telecine, and place the reference frame in the gate.



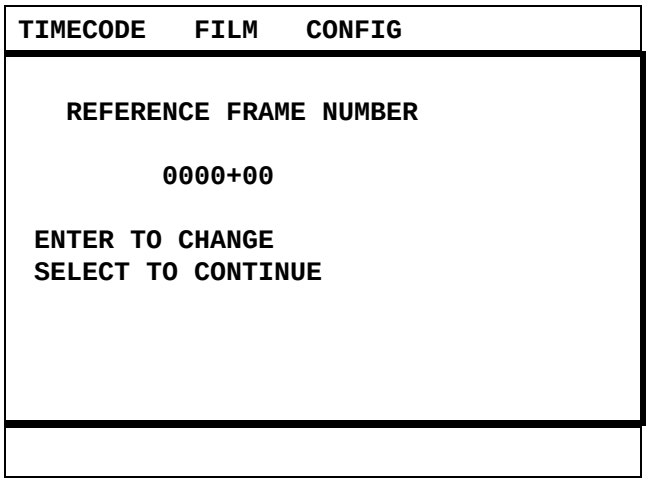


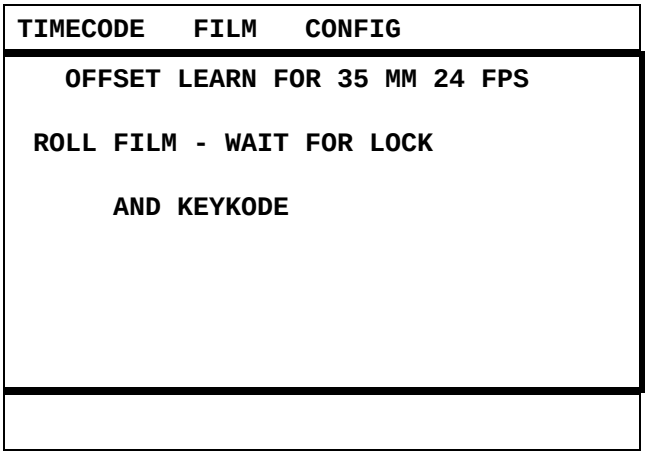
Make sure that the reference frame is properly framed in the gate. Press **SELECT** to proceed.

Enter the film edge number of the reference frame into the 4025 using the **ENTER** and numeric keys. The frame number will be in inverse video when you are in entry mode. Normally the reference frame number will have a +00 frame offset from the key number for 16 mm and +00 or +08 for 35 mm. Press **ENTER** to complete the reference frame number entry mode. Attempting to enter illegal frame numbers will cause the display to return to the last valid frame entry. Press **SELECT** to continue.

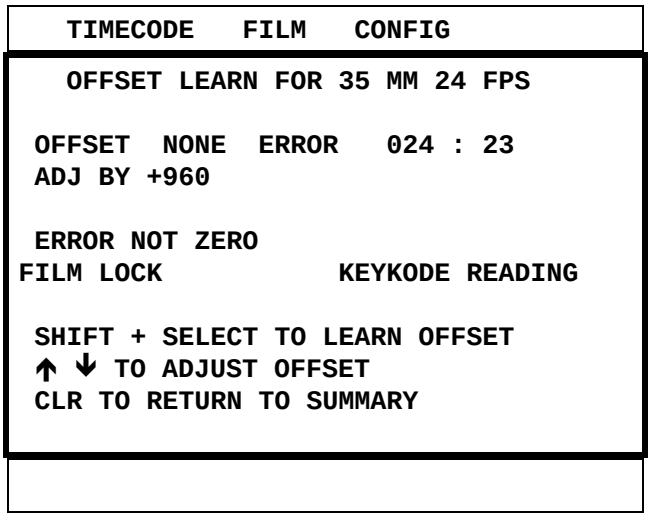
If you have entered a frame number with a non-standard frame offset, you must press **SHIFT + SELECT** to continue, or press **ENTER** to re-enter another value.

Entering the wrong reference frame number will cause the automatic head offset learning to fail. Make sure you have entered the correct reference frame number before proceeding.





Put the telecine into the Play mode. When the telecine achieves stable lock speed, the next screen will appear. The FRAME, and LOCK LEDs on the front panel should be On.



Press the **SHIFT + SELECT** keys to learn the head offset. The head offset value shown will be automatically recalculated by the 4025, and the whole frame error shown should go to zero. It may be necessary to press the **SHIFT + SELECT** keys a second time if the initial value of the whole frame error is large. Underneath the offset number is a suggested manual adjustment. ADJ BY:. When press **SHIFT+SELECT** to do the learning, the ADJ BY and the ERROR value will show ???? for a few seconds. The ADJ BY value should go to 0000.

Beside the head offset there will be an ERROR number in the form `+EEE : ee`, where the `E` represents the whole frame error between the bi-phase based numbers entered and the KeyKode numbers. The `ee` represents the partial frame offset (i.e. it is related to the perforation offset). The partial frame offset shown should correspond to one of four values, depending on the perforation orientation of the film. The chart below shows the values for each of the perf orientations.

FILM PERF TYPE	TARGET PARTIAL FRAME OFFSET
35 mm Perf 1	+0:05
35 mm Perf 2	+0:15
35 mm Perf 3	+0:25
35 mm Perf 4	+0:35
16 mm	+0:20

It is normal for the target value to vary by up to +/- 2 counts.

4015

Evertz 4015 users note that the PERF numbering scheme has been changed from the 4015 so that it conforms to the industry standard head to tails orientation.

The partial frame offset value may be changing by one or two counts. Press the numeric ↑ & ↓ keys to adjust the head offset manually so that the average partial frame offset is as close as possible to the values shown in the chart above.

2.12.6. Verifying the accuracy of the KeyKode Numbering

When you have completed the KeyKode reader connections and have performed the head offset learning, you will need to verify the frame accuracy of the KeyKode reader in the system.

The following simple procedure will help you establish that the KeyKode reader is properly installed, and that it the Head offset has been learned correctly.

The 4025 maintains separate head offsets for 16 and 35 mm film and for each film transfer rate. Make sure that you check each combination to ensure that your system is fully configured.

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. Using the On Screen programming menu set the 4025 to the following settings:
   - GEN MODE to CINE EDGE (See section 3.3.1)
   - DROP FRAME to NON DROP FRAME (See section 3.3.3)
   - KK JAM to ALWAYS (See section 3.4.1)
   - KEYINFO to CHECK (See section 3.4.2)
   - FILM TYPE to Match the film stock you have placed on the telecine (See section 3.4.3)
   - FILM RATE to match your telecine transfer rate (See section 3.4.4)

4. Turn on the 4025's character windows for Generator time and Edge code (KeyKode) as described in section 3.12.1.

5. Set the footage + frames in the KKode register to 0000+00 as described in section 3.10.2.
6. Set the time of the VITC generator to 01:00:00:00 as described in section 3.9.3.

7. Back up the telecine and transfer a short piece of film (which includes the reference frame) to video tape. When the telecine achieves locked PLAY speed, the telecine FRAME and LOCK

LEDs on the 4025 front panel should be on and there should be a + between the footage and frames in the character generator. The KeyKode register on the front panel, and the KeyKode window in the character inserter should update so they are the same as the KeyKode of the reference frame, and the CODE LED above the KKODE pushbutton should be on. Press the HELP key if the FRAME and LOCK indicators are not on. (See Chapter 5 for a full discussion of the various HELP messages and their probable causes)

8. Play back the video tape in slow shuttle or jog mode, and verify that the timecode and KeyKode numbers for the reference frame are correct. If they are correct you can proceed to verify the accuracy of the other film gauges and transfer rates.

   If the Keykode display does not update at the same field as the picture updates, check for delays in the video path to the 4025. (See section 3.5.5. (See also section 2.10.7 or 2.11.4)

   If the KeyKode numbers are not correct, recheck the head offset learning procedure. (See section 2.12)

   If the timecode numbers are not correct, check that you have set the correct FILM RATE setting (See section 3.4.4)

   In 24 FPS NTSC 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.

   In 30 FPS NTSC or 25 FPS PAL transfers; see section 3.12.6 for a discussion of Field 1 dominant and Field 2 dominant characteristics.

9. After you have made any adjustments, park the telecine with the reference frame in the gate, and repeat steps 5 through 8 until you have satisfactory results. If you are still experiencing problems, recheck the accuracy of the numbers without KeyKode. (See section 2.10.7 if you have a Rank Cintel telecine or section 2.11.4 if you have a BTS telecine.)

2.12.7. Use of KeyKode with Low Tach Rate Flying Spot Telecines

Rank Cintel flying spot scanners have a feature called Scantrack which moves the scanning patch around on the CRT to prevent premature tube burn-in. This has the effect of varying the bi-phase to film frame relationship throughout the transfer. In order to track the scantrack position the 4025 keeps track of the bi-phase counts relative to the film frame pulse. When low tach rate telecines are used with their Scantrack turned on, the

4025 cannot properly determine the instantaneous Scantrack compensation value required for KeyKode calculations. This may introduce a possible error of ±1 film frame in the edge number encoding when used with KK JAM set to PLAY or WINDOW. One of the following methods may be used to overcome this problem:

1. Use a higher bi-phase tach rate. (10 cycles per film frame)
2. Turn Scantrack off.
3. Use the KK JAM ONCE mode. This works because the Rank telecine's Scantrack offset is zero when it is first put into play. (See section3.4.1)
4. Enable the Play-window function of the 4025 by:

    a. Adjust the PLAY WINDOW parameter in the Toolbox menu (SHIFT + FORMAT) to a value of 1 FRAME.
    b. Set the KK JAM mode to PLAY or ALWAYS.

When the Play-window function is On, a KeyKode jam will occur when the error between the KeyKode number and the bi-phase based number is greater than 1 film frame. The KeyKode number that the 4025 jams to when the telecine is first put into Play is correct because the Rank's Scantrack offset is zero when started. During the transfer, it is normal for the KeyKode status ERR display to show ±1. (See section **Error! Bookmark not defined.** for information about the KeyKode status display) This is due to the ambiguity in the instantaneous Scantrack value calculated. With the PLAY WINDOW VALUE = 00, the 4025 will re-jam when this condition exists. With the PLAY WINDOW VALUE = 1, the 4025 will ignore this apparent error and continue using the bi-phase based numbers, which will be correct if no splices have occurred.

If a splice is encountered, during the transfer, the 4025 will re-jam to the KeyKode numbers with the possibility of a ±1 frame error. To eliminate this error, the telecine must be stopped and restarted. This will zero the effect of Scantrack, and will allow the 4025 to jam unambiguously to the KeyKode numbers.

2.13. CONNECTING AN EXTERNAL COMPUTER - DATA LOGGING

2.13.1. Data Logging Output

A nine pin sub-miniature 'D' connector **(SERIAL I/O)** is provided on the I/O module for remote connection to a computer for logging the timecode / keykode relationships during telecine transfer. This serial port provides both RS-232-C and RS-422 levels (Jumper changes on the 7006 I/O Board inside the 4025 are required to enable the RS-422 mode). See Chapter 7 for the pinout of the connector. The transmit side of this serial port generates a binary FLEX format data output that documents the timecode, KeyKode and pulldown relationship of the film transfer to an

external data logging device such as a personal computer, during the transfer. This data output will input data directly to computer logging programs such as the Evertz Key-Log™ data logging application.

Chapter 7 shows the cable wiring diagram for connection to an IBM compatible computer. The composition of the bit serial data format is as follows:

9600 Baud, 1 Start + 8 Data + 1 Stop

2.14. CONNECTING THE PARALLEL REMOTE CONTROLS

The Parallel I/O connector has 4 remote control inputs to control various generator functions. The Serial I/O connector has 5 remote control inputs to control various character generator functions. (See Chapter 7 for a pinout drawing of the connectors).

2.14.1. Film Gauge and Film Rate Selection

Pins 1 and 9 on the **PARALLEL I/O** 'D" connector may be connected to tallies from the telecine, or to external toggle switches, to program the film gauge and transfer rate.

Mode changes will take effect when either a timecode or film edge number is entered from the front panel, or when the telecine has achieved a full stop condition.

Film Gauge select (pin 9)	Low	= 35 mm 16 Frms/key	
	High	= 16 mm 20 Frms/key	
Film Rate select (pin 1)	NTSC;	Low = 24	High = 30
	PAL:	Low = 25	High = 25

2.14.2. Film Centering

Pin 5 on the **PARALLEL I/O** 'D" connector may be connected to a tally from the telecine, or to an external toggle switches, to act as an alternate method of telling the 4025 that the film is centered in the gate. Momentarily ground this input to 'centre' the 4025's film frame boundary reference. See section 3.10.8 for a full description of centering.

2.14.3. Generator Run /Zero reference Frame and DLO GPI

Pin 8 on the **PARALLEL I/O** 'D" connector is used as a general purpose input. There are three different uses depending on the mode of the 4025 and the speed of your telecine.

In the GEN ASSIGN = RUN EDGE mode, a low level on this input (when the telecine is locked in PLAY) will act as an additional Run control. This will override the front panel Run/Hold function if the input is held low.

When the telecine is stopped, a high to low transition on this input will set the ABS frames register to zero.

In all modes and telecine speeds, a high to low transition on this input will trigger a GPI data logging event.

2.14.4. Character Generator Remote Controls

Pins 1,2,3,7 and 9 of the **SERIAL I/O** connector can be used to control some of the common functions of the character inserter. These inputs are internally pulled to +5 volts and may be grounded to pin 6. Jumpers J26, J27, J28 and J29 located on the 4025 I/O board (near the SERIAL I/O connector) must be in the RS232 position (factory default) for the remote inputs to be active. The assignment of the functions is as follows:

Pin 1 Master VCG On/Off
Pin 2 KeyKode VCG window On/Off
Pin 3 Generator Time VCG window On/Off
Pin 7 Reader 2 Time VCG window On/Off
Pin 9 Status screen On/Off

Theses inputs can be configured to operate in a Toggle, Edge activated or level activated mode by choosing the correct setting on the VCG GPI menu item on the Toolbox menu. (See section 3.7.8)

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Figures

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3 HOW TO OPERATE THE FILM FOOTAGE ENCODER

3.1 AN OVERVIEW OF KEY AND DISPLAY FUNCTIONS

Figure 0-1: Front Panel Layout

The display area consists a 16 digit alphanumeric display and 15 LED status indicators. The display key group is used to determine what data is being displayed. The 15 LED's provide operational status at a glance.

The keypad is divided into four logical groupings to control the front panel display, the data entry modes, the on screen format system, and the frequently used functions of the 4025. When the SHIFT key is held down, the meanings of many of the keys are modified, gaining quick access to a wider variety of functions. (Throughout this manual SHIFT + indicates that you should hold down the SHIFT key while pressing the second key.)

An on screen programming menu (referred to as the Format menu) is provided by the built in character generator. This method of configuring the 4025 Film Footage Encoder is quick and simple, guiding you to the correct setup for your application.

Sections 3.3 to 3.5 give detailed information on the specific operations required to control the 4025.

3.1.1 The Display Push-button Group

Figure 0-2: Display Pushbutton Group

The display keypad consists of ten dual function keys (**L-GEN, V-GEN, ABS, OFFSET, KKODE, RDR 1, RDR 2, EVENT 1** and **EVENT 2**) and the **TIME / UB** key. In their normal functions, these keys control only what data is being displayed on the front panel, (they do not change the operational modes of the 4025). The leftmost characters of the front panel display are used to prompt which data is being displayed. When the **ENTER** key is pressed, the dual function keys are changed to their numeric values and are used for numeric entry into various timecode and film edge number registers.

L-GEN Displays the time of the LTC generator. Pressing the TIME / UB key will alternately display the user bits.

V-GEN Displays the time of the primary VITC generator. Pressing the TIME / UB key will alternately display the user bits. The primary VITC generator time and user bits follow the LTC generator.

ABS Displays the absolute film frames register. The absolute frames register is slaved to the bi-phase input from the telecine and usually indicates the number of film frames that you are from a reference frame. Negative values indicate that the number has rolled under 00000 or over its maximum value.

OFFSET Displays the Jam sync offset register. The offset register is used when the generator time is slaved, or jam synced to Reader 1, and contains the difference between the reader and generator times. Negative values indicate that the generator is leading the reader, positive values indicate that the generator is lagging the reader.

KKODE Displays the film edge number. When reading Film edge numbers with a KeyKode reader, this display shows the complete key number. When the 4025 is not receiving data from a KeyKode reader, this display shows the current edge number, and is initialized using the data entry key group.

RDR 1 Displays the time of Reader 1. Pressing the TIME / UB key will alternately display the user bits. The format menu is used to determine whether Reader 1 will be assigned to the LTC, or VITC reader, or if it is configured as an AUTO LTC/VITC reader.

RDR 2 Displays the time of Reader 2. Pressing the TIME / UB key will alternately display the user bits. The format menu is used to determine whether Reader 2 will be OFF or will be assigned to the LTC, or VITC reader.

EVENT 1 Displays the Event 1 register. This event register is used to trigger data logging events. Press SHIFT + EVENT 1 to arm or

disarm the event register. When Event 1 is armed, the LED above the key will be flashing.

EVENT 2 Displays the Event 2 register. This event register is used to trigger data logging events. Press SHIFT + EVENT 2 to arm or disarm the event register. When Event 2 is armed, the LED above the key will be flashing.

TIME/UB Selects whether time or user bit data is being displayed on the front panel alphanumeric display. When the KeyKode register is being displayed, it selects whether the keykode Prefix or full number is being displayed.

3.1.2 Data Entry Push-button Group

The data entry keypad consists of ten dual function keys, the **SHIFT**, **ENTER** and **CLR** keys. In their normal functions, the dual function keys control what data is being displayed on the front panel. When the **ENTER** key is pressed, these keys are changed to their numeric values and are used for numeric entry into various timecode and film edge number registers. Pressing the **SHIFT** key and the numeric keys **0** to **5** will enter the corresponding hexadecimal values A to F.

When the 4025 is in data entry mode, the left characters of the display blink, indicating that the numeric keys are active.

ENTER The ENTER key is used to initiate data entry modes to the register currently displayed on the front panel. Pressing the ENTER key after numbers have been entered into the display window accepts the entered value, and presets the value into the register.

CLR The CLR key is used to terminate the data entry modes. Values entered into the display are discarded, and the register is restored to its previous value. The CLR key is also used to exit the format menu system.

3.1.3 The Format Push-button Group

Figure 0-3: Format Pushbutton Group

The format key group consists of the **FORMAT**, **SELECT** and **←, →, ↑, ↓** keys and is used to navigate the format menu system. When not in the format menus, the arrow keys are used for character positioning.

FORMAT Initiates the format menu. Pressing the FORMAT key again or pressing the CLR key exits the format menu.

SELECT When in format mode the SELECT key is used to choose items from the within a drop down menu or sub menu.

← → ↑ ↓ When in the format mode, the arrow keys are used to move between various items in the menu system.

When in the VCG window select mode, the arrow keys are used to position individual windows on the screen. (See also section 0)

When not in either the format or VCG window select modes, the arrow keys are used to position all the windows on the screen. (See also section 3.12.2)

3.1.4 The Function Push-button Group

Figure 0-4: Function Pushbutton Group

The function key group consists of eight keys and is used for controlling frequently used functions of the 4025. These keys are coloured RED to indicate that they affect the operation of the unit and should be used with caution.

CHAR GEN MODE Initiates VCG window select mode and highlights the selected window. Use the arrow keys to move the window, use the CHAR GEN ON / OFF key to turn the window on or off. Pressing the MODE key again selects the next VCG window, etc. Press CLR to exit the window select mode.

CHAR GEN ON / OFF Turns the character generator ON and OFF. When in the VCG window select mode, it is used to turn individual windows ON and OFF.

CONFIG A user configuration screen appears which is used to load and store user definable configurations. Press a numbered key corresponding to the desired configuration to load it or press SHIFT + a numbered key to save the current configuration.

GEN RUN / HOLD Alternately starts and stops the generator time when the generator is in the RUN EDGE mode.

HELP Displays error messages from the last error on the character inserter.

STATUS Displays a status screen on the VCG which summarizes the current operational modes of the 4025. Pressing SHIFT + STATUS displays the firmware versions of each module installed in the 4025 on the character generator screen.

VITC Turns the VITC generator ON and OFF. A status indicator to the left of this key shows whether the VITC generator is On or Off.

3.1.5

Overview of the Shifted Key Functions

When the **SHIFT** key is held down the standard meanings of many of the keys are modified. Following is an overview of the main shifted functions.

EVENT 1 Arms / Disarms Event 1 when the Event 1 register is displayed.

EVENT 2 Arms / Disarms Event 2 when the Event 2 register is displayed.

ENTER Capture offset when the Offset register is displayed.

STATUS Software revisions.

FORMAT Toolbox menu.

CLEAR Reset Help error messages.

SHIFT+* Toggles RAM VIEW ENTRY MODE when RAM VIEW is enables.

3.1.6 An Overview of the Status Indicators

There are 15 status indicators located on the front panel which show operational status of the 4025 at a glance.

Figure 0-5: System Status Indicators

PAL GEN-LOCK Indicates that the unit is properly gen locked to a PAL video reference. If it is blinking, it indicates that the PAL video standard is selected, but a valid PAL video reference is not present.

NTSC GEN-LOCK Indicates that the unit is properly gen locked to a NTSC video reference. If it is blinking, it indicates that the NTSC video standard is selected, but a valid NTSC video reference is not present.

FRAME Indicates that the 4025 has detected the presence of a valid film frame pulse from the telecine. If the 4025 is not set for the same video standard and film transfer rate as the incoming film frame pulse, this LED will be OFF.

LOCK Indicates that the telecine has achieved a stable play speed and that the 4025 is properly locked to the telecine's transfer sequence.

To ensure proper operation of the 4025, the GEN-LOCK, FRAME & LOCK indicators MUST be solidly on during the film to tape transfer.

COMM Indicates that a data packet has been sent to a logging computer.

ERROR Indicates that a system error has occurred. Press the HELP key to see further information about the nature of the error.

Figure 0-6: Register Status Indicators

KKODE Indicates that a valid KeyKode data record has been received from an external KeyKode reader system. This LED will normally be on when KeyKode data is being received and is updating the edge numbers. It will blink for each KeyKode data packet received when the Edge numbers are not being updated. This usually indicates that the head offset has not been learned, or that KK JAM is set to NEVER. The KKODE LED will also blink when a keykode discontinuity is detected by the 4025.

RDR 1 Indicates that Reader 1 is reading valid time code.

RDR 2 Indicates that Reader 2 is reading valid time code.

EVENT 1 READY When blinking it indicates that Event 1 register is armed. When it is on solid, it indicates that the Event 1 register has triggered an event.

EVENT 2 READY When blinking it indicates that Event 2 register is armed. When it is on solid, it indicates that the Event 2 register has triggered an event.

Figure 0-7: Function Status Indicators

JAM Indicates the unit is operating in the continuous jam sync mode. When the JAM indicator is blinking, it indicates a variety of problems in the jam sync process. If it is blinking on an irregular basis, the reader could be receiving bad code, there may be a discontinuity in the code, or the code was recorded in a different standard than the 4025 is locked to.

VITC Indicates when the VITC keyer is enabled.

1:1 Indicates that the telecine is set to transfer one film frame to each video frame. i.e. NTSC - 30 frames per second, PAL - 25 frames per second.

PULL NTSC: Indicates that the telecine is set to transfer for a 24 film frame per second transfer to NTSC video.

Setting the transfer rate is accomplished by using FILM RATE item on the FILM pulldown menu. The 4025 may be set to either 24 or 30 FPS transfer rates, or may be set to automatically detect the transfer rate in use by the telecine. (See section 3.10.9)

PAL: This LED should always be Off, as the transfer rate is always set to 25 FPS.

3.2 FORMAT MENU - OVERVIEW

The key to the operational flexibility of the 4025 Film Footage Encoder lies in the powerful Format menu system. . The format menu uses the built in character generator and provides an quick, intuitive method of configuring 4025 Film Footage Encoder, guiding you to the correct setup for your application. The six keys in the format key group (**FORMAT**, **SELECT** ← ➔ ↑ ↓) are used to cycle through the various items on the programming menu.

The 4025 menu system consists of three drop down menus. The titles of each of the drop down menus is shown on the top line of the character display. Selecting an item on one of the drop down menus reveals a sub-menu showing the choices for that item. Figure 0-8 is an overview of the on screen menu system, and shows all the menu choices and where you will find the menu items. Note that some menu choices will be hidden depending on the programmed mode of operation.

The TIMECODE drop down menu is for overall operation modes such as selecting which information is put into the time and user bits, drop frame mode for the generator, setting reader modes, setting VITC line numbers, etc. The FILM drop down menu is used to set up specific film number

modes such as KeyKode Jam, film type, film transfer rate, etc. The CONFIG drop down menu is used to configure miscellaneous items such as video standard, character size and style, KeyKode head offset, video path delays, etc.

To enter the Format menus, press the **FORMAT** key. The character generator will show the last drop down menu that was used with the currently selected item highlighted. The two horizontal arrow keys (🡐, 🡒) allow you to move horizontally to another drop down menu. Using these two keys you can quickly scan the entire menu system for the item you wish to change.

The two vertical arrow keys (🡑, 🡓) allow you to move vertically within the drop down menus. When you have selected the desired menu item, press the **SELECT** key to reveal the sub menu choices for that item. Use the two vertical arrow keys (🡑, 🡓) to move vertically within the sub menu. When you have selected the desired sub menu choice press the **SELECT** key to save your choice and you will return to the drop down menu.

When you have made all the desired changes, press the **FORMAT** or **CLR** keys to return to the normal display mode.

Each of the menu items are described in the following sections, with an explanation of what each choice does. Section 3.3 describes the items on the TIMECODE drop down menu. Section 3.4 describes the items on the FILM drop down menu. Section 3.5 describes the items on the CONFIG drop down menu.

TIMECODE
GEN MODE
- RUN EDGE
- CINE NUM
- CINE EDGE
- RDR1 EDGE
- CINE RDR2+KEYKODE
- RDR1 RDR2+KEYKODE
- CINE 3 LINE VITC
- RDR1 3 LINE VITC

VITC1 LINES
- GEN VITC1 LINES
- LINE1-10 LINE2-20

VITC2 LINES
- GEN VITC2 LINES
- LINE1-10 LINE2-20

DROP FRAME
- NON DROP FRAME
- DROP FRAME
- NOT AVAILABLE
- JAM RDR1

RDR ASSIGN
- R1: AUTO R2: OFF
- R1: LTC R2: VITC
- R1: VITC R2: LTC

FILM
KK JAM
- NEVER
- ONCE
- PLAY
- ALWAYS

KEYINFO
- INFO OFF
- INFO ON
- INFO CHECK

FILM TYPE
- 35 MM 16 FR/FT
- 16 MM 20 FR/KEY
- 16 MM 40 FR/FT

FILM RATE
- 24 FRMS/SEC
- 30 FRMS/SEC
- AUTO 24/30
- 25 FRMS/SEC

EDGE STYLE
- GENERIC
- EVERTZ

EDGE FORMAT
- 4 DIG FT + FRM
- 5 DIG FT + FRM
- 6 DIG FT + FRM
- 7 DIG FT + FRM

CONFIG
CHAR SIZE
- TINY
- SMALL
- LARGE

CHAR STYLE
- WHITE
- WHITE ON BLACK
- BLACK
- BLACK ON WHITE

VIDEO STANDARD
- AUTO
- NTSC
- PAL

KK HEAD OFFSET
- HEAD OFFSET SUMMARY

VIDEO DELAY
- 00 FIELDS

WHITE FLAG
- WHITE FLAG OFF
- WHITE FLAG ON

WHITE FLAG LINES
- START END
- 10 20
- WHITE FLAG OFF

Figure 0-8: Overview of the 4025 Format Menu System

3.2.1 Engineering Tool Box Menu

The Toolbox menu allows the advanced user to change various internal parameters of the 4025, or to invoke several advanced diagnostic modes. This menu should be used by advanced users only, as improper use can overwrite KeyKode Head offsets and other user setups.

The 4025 Toolbox menu system consists of three drop down menus. The titles of each of the drop down menus are shown on the top line of the character display. Selecting an item on one of the drop down menus reveals a sub-menu showing the choices for that item. Figure 0-9 is an overview of the Toolbox menu and shows all the menu choices and where you will find the menu items. Note that some menu choices will be hidden depending on the programmed mode of operation.

The HARDWARE pulldown menu is for hardware related adjustments such as selecting the telecine type and bi-phase rate, adjusting the VCG horizontal character width, the front panel display brightness, resetting the 4025 to factory defaults, etc. The PARAMETERS drop down menu is used to adjust software settings such as the KeyKode jam windows, how much film must pass without reading KeyKode before the INFO CHECK indicator turns on, whether the field and symbol indicators are shown in the VCG display, etc. The DEBUG drop down menu is to turn on various diagnostics displays on the VCG.

HARDWARE HORIZONTAL ← OR → TO ADJUST
HORZ CHAR SIZE CHAR SIZE = 10 **DISPLAY LEVEL**

FRONT PANEL
BRIGHTNESS = 2
↑ OR ↓ TO ADJUST
RAM TEST
TO ACTIVATE RAM TEST
PRESS THE → KEY
SERIAL TEST
FUTURE USE
BI PHASE RATE
1 PPF
2 PPF
5 PPF
10 PPF
TELECINE TYPE
RANK
BTS FDL/QUADRA
URSA GOLD
BTS SPIRIT
FILM FRAME
LATCHED
SAMPLED
DIRECT
IGNORED
FACTORY RESET
** WARNING **
THIS COMPLETELY RESETS UNIT

USE SHIFT - ENTER TO PROCEED

PARAMETERS
PLAY WINDOW
KK PLAY
WINDOW = 00
↑ OR ↓ TO ADJUST
SHUTTLE WINDOW
KK SHUTTLE
WINDOW = 30
↑ OR ↓ TO ADJUST
CHECK DELAY
INFO CHECK
DELAY = 10
↑ OR ↓ TO ADJUST
FULL STOP
FULL STOP
TIME = 1:00
↑ OR ↓ TO ADJUST
AUTO CENTRE
OFF
ON
VCG FIELDS
OFF
ON
VCG SYMBOLS
OFF
ON
NO CODE JAM
RUN
HOLD
OFF
VCG GPI
OFF
TOGGLE
EDGE ↓OFF
EDGE ↓ON
LEVEL

DEBUG
KK STATS VIEW
OFF
ON
RAM VIEW
OFF
ON
NOVRAM VIEW
TO DEBUG NOVRAM
PRESS THE → KEY

Figure 0-9: Overview of the Toolbox Menu

To enter the Toolbox menus press the **SHIFT + FORMAT** keys. The character generator will show the last Toolbox drop down menu that was used with the currently selected item highlighted. The two horizontal arrow keys (←, →) allow you to move horizontally to another drop down menu. Using these two keys you can quickly scan the entire menu system for the item you wish to change.

The two vertical arrow keys (↑, ↓) allow you to move vertically within the drop down menus. When you have selected the desired menu item, press the **SELECT** key to reveal the sub menu choices for that item. Use the two vertical arrow keys (↑, ↓) to move vertically within the sub menu, or follow the instructions on the sub-menu screen. When you have selected the desired sub menu choice press the **SELECT** key to save your choice and you will return to the drop down menu.
When you have made all the desired changes, press the **SHIFT + FORMAT** or **CLR** keys to return to the normal display mode.

Each of the menu items are described in the following sections, with an explanation of what each choice does.

3.3 PROGRAMMING THE BASIC OPERATIONAL MODES - THE TIMECODE MENU

The TIMECODE menu is used to configure the basic operational modes of the 4025 Film Footage Encoder such as selecting what information is put into the time and user bits, setting VITC line numbers for the generator, assigning the LTC and VITC readers, etc.

KeyKode numbers contain more information than will fit into the normal user bits. Evertz has developed the two-line VITC format which permits the complete Keykode number to be encoded each field (without multiplexing) into a special pair of VITC lines. In these ‘two-line’ modes, the Primary VITC (VITC1) contains the Video tape or 'editorial' timecode with the production sound timecode in the user bits. The secondary VITC, (VITC2) carries the full film Key number, including frames, and pulldown information. Because of the field rate of VITC, this information accurately reflects what is happening with the 3/2 pulldown during the transfer. The VITC2 information is encoded with a modified CRC. This is important because the Time bits of the VITC2 lines contain information that is not in the standard timecode format, and would be confusing to edit controllers.

In conjunction with other manufacturers, Evertz has developed a 3 Line VITC format . The 3 Line format allows readers to automatically detect the film type, film gauge, transfer rate as well as providing room to encode the VTR Time, film Keykode, pulldown and the production time code and user bits. The encoded data is contained in a block of three consecutive lines of the vertical interval. There is an optional block of 3 lines for redundancy.

Off-line transfers, can now be edited without burn-ins to obstruct the picture. Video and production timecode and Key number information can be extracted from the VITC after editing by the Afterburner Dual VITC reader, providing a field accurate cutting copies with film Key numbers burned in.

3.3.1 Selecting What Data Goes In To The Time And User Bits

GEN ASSIGN Is used to determine what data is in the time and user bits of the generator. The left column shows what data will be placed into the time bits of the LTC and primary VITC generators. The next column shows what data will be put into the user bits of the LTC and primary VITC generators. The third column shows what data will be put into the secondary VITC generator.

The first four modes are compatible with the timecode modes of the model 4015 Film Footage Encoder. The next two modes place the complete film key number read from an KeyKode reader into a second set of VITC lines (known as the secondary VITC lines.) The secondary VITC generator is turned off when the third column is not shown. The last mode uses the new 3

line VITC standard for encoding Film information. This standard has been agreed upon by a number of manufacturers and uses 2 blocks of 3 lines each to encode the information.

Figure 0-10 gives a summary of the first six GEN ASSIGN modes and their meanings. The 3 Line VITC standard uses 2 blocks of 3 lines each to encode the information. Figure 0-11 shows how the data is encoded in the 3 line VITC standard.

	VITC 1 & LTC TIME BITS	VITC 1 & LTC USER BITS	VITC 2 TIME & USER BITS
	RUN	EDGE	
	CINE	NUM	
1 Pair of VITC lines	CINE	EDGE	
	RDR1	EDGE	
2 Pair of VITC lines	CINE	RDR2	+ KEYKODE
	RDR1	RDR2	+ KEYKODE
	Standard VITC		Special format VITC (Inverted CRC)

Figure 0-10: How the Time and KeyKode numbers are encoded in various Time Code Modes

	TIME BITS	USER BITS	CRC
LTC & First Line	RDR 1	Set to zero	Normal
Second Line	KeyKode & Pulldown		Inverted
Third Line	RDR2	RDR2 UB	Nibble Inverted

Figure 0-11: How the Time and KeyKode numbers are encoded in 3 Line VITC Standard Mode

See section 0 and 0 for a complete discussion on the use of multiple VITC lines in the 4025.

When EDGE data is placed in the user bits, it may consist of a variable length footage and frame number plus a numeric prefix. See the FILM drop down menu items (See section 3.10 for a complete definition of the edge number modes.)
Select **RUN EDGE** to free run the generator time and put the film edge numbers into the user bits. You will be able to start and stop the generator time using the **HOLD** key.

Select **CINE NUM** to slave the generator time to the telecine's bi-phase, but allow non incrementing numeric (hexadecimal) user bits to be entered from the front panel. In this mode, user bits may be used for scene and take numbers, or roll numbers, etc.

Select **CINE EDGE** to slave the generator time to the telecine's bi-phase, and to put the film edge numbers into the user bits.

Select **RDR1 EDGE** to slave the generator time to the reader 1 time, and to put the film edge numbers into the user bits. This mode may be used when you are performing assemble or insert edit during the transfer process or when transferring to pre striped tape. The reader input should be connected to the time code output of the record VTR. Use the RDR ASSIGN menu item to configure the reader.

Select **CINE RDR2 + KEYKODE** to slave the generator time to the telecine's bi-phase, and to put the Reader 2 time into the user bits. The full edge number (KeyKode) data which consists of a manufacturer's code, and emulsion code, a six digit prefix, a four digit footage number plus the frame offset is placed in a second set of VITC lines known as the secondary VITC (or VITC2) lines. This mode is useful for placing audio timecode into the primary timecode user bits while retaining the full KeyKode information.

Select **RDR1 RDR2 + KEYKODE** to slave the generator time to the Reader 1 time, and put the Reader 2 time into the user bits. The full edge number (KeyKode) data which consists of a manufacturer's code, and emulsion code, a six digit prefix, a four digit footage number plus the frame offset is placed in a second set of VITC lines known as the secondary VITC (or VITC2). This mode is useful for placing audio timecode into the primary timecode, video tape timecode into the primary timecode user bits while retaining the full KeyKode information.

Select **3 LINE VITC STD** to encode the time and keykode information using the 3 line VITC standard which Evertz has developed along with other manufacturers. The encoded data is contained in a block of three consecutive lines of the vertical interval. There is an optional block of 3 lines for redundancy. See section 0 for a discussion on which lines to use. The LTC generator and the first VITC line contain the Reader 1 time, with the user bits set to zero. The full edge number (KeyKode) data (which consists of a manufacturer's code, and emulsion code, a six digit prefix, a four digit footage number plus the frame offset) as well as pulldown and film format information is placed in the second line. The Reader 2 time and user bits is put into the third line time and user bits.

When you are using the 3 Line VITC STD generator assignment the operation of some of the other menu items changes as follows

1. The VITC LINES are set using the VITC1 LINES menu item. You can only select the lines in block of 3 lines as shown on the menu item. The VITC2 LINES menu item is not used. See section 0 for further information.

2. The EDGE STYLE and EDGE FORMAT menu items are ignored as the 3 Line VITC standard defines the encoding method. See section 0, 0 and 0 for further information.

When using the 3 Line VITC STD a special reader such as the Afterburner is required to decode & display the film & production data.

3.3.2 Selecting the Line Numbers to Record VITC On

GEN VITC1 LINES Is used to set the lines that the primary VITC will be recorded on. Use the ← & → keys to select the first or second line. Use the ↑ & ↓ keys to select the line number.

When the using the 3 line VITC standard method of encoding, GEN VITC1 LINES sets the line numbers for each block of 3 lines.

GEN VITC2 LINES Is used to set the lines that the secondary VITC (containing full KeyKode information) will be recorded on. The secondary VITC is only enabled when the GEN ASSIGN mode is set to CINE RDR2 + KEYKODE or RDR1 RDR2 + KEYKODE. Use the ← & → keys to select the first or second line. Use the ↑ & ↓ keys to select the line number

3.3.3 Selecting the Generator Drop Frame Mode (NTSC Only)

DROP FRAME Is used to select the drop frame mode for the generator in NTSC. This item is not available when in PAL.

Select **NON DROP FRAME** to operate the generator in the NON DROP FRAME (sometimes called Full Frame) mode.

Select **DROP FRAME** to operate the generator in the DROP FRAME mode. The colon between the seconds and frames of the timecode will change to a period (.) to indicate Drop Frame mode is active.

When the generator is set to the RDR1 RDR2 + KEYKODE or RDR1 EDGE mode, the menu shows **JAM RDR1.** This means

that the generator drop frame mode is set to be the same as the incoming reader data's drop frame mode.

3.3.4 Selecting the Reading Mode of the LTC/VITC Reader

The LTC and VITC readers may be operated as separate readers and assigned to Reader 1 or Reader 2, or, they may be operated as one Auto reader which reads both LTC and VITC. In this case, the Auto reader is assigned to Reader 1 and Reader 2 is turned off. The RDR 1 and RDR 2 CODE IN LED's on the front panel will be on when the respective readers are receiving valid timecode.

To enable the Jam sync mode of operation select either the RDR1 EDGE or RDR1 RDR2 + KEYKODE settings on the GEN ASSIGN menu. (See section 3.3.1) The operation of the jam sync reader (RDR1) when there is no incoming code is controlled by the NO CODE JAM setting in the Toolbox menu. (See section 3.7)

RDR ASSIGN Is used to select the reading mode for the LTC/VITC timecode reader.

Select **R1:AUTO R2:OFF** to assign Reader 1 for reading of either longitudinal or vertical interval time code, whichever is present. Reader 1 continues reading from whatever source was previously selected. When it encounters invalid code, it will switch to the other source, provided code exists there. Otherwise it will continue to show the last valid time read until valid code resumes on one of the sources. Reader 2 is turned off.

Select **R1:LTC R2:VITC** to assign Reader 1 to the LTC reader and Reader 2 to the VITC reader.

Select **R1:VITC R2:LTC** to assign Reader 1 to the VITC reader and Reader 2 to the LTC reader.

3.4 PROGRAMMING THE FILM TRANSFER MODES - THE FILM MENU

3.4.1 Selecting when the Film Edge numbers are updated from the KeyKode reader

KK JAM Is used to select the way in which data received from an external KeyKode reader will affect the edge number information being encoded into the user bits. This setting is only applicable if the generator is set to one of the **EDGE** or **+ KEYKODE** modes. When KK JAM is set to ONCE, PLAY, or ALWAYS, the KeyKode numbers are read by the bar code reader and inserted with the appropriate offset compensation. The complete KeyKode number may be displayed in the character generator or placed into the secondary VITC. A truncated film barcode number may be placed in the user bits of

the timecode output in one of the **EDGE** modes. (See section 3.10.1 for a discussion of how the film edge numbers are encoded into the user bits.)

The 4025 permits three different methods of updating the bi-phase based numbers with the barcode data. The KKODE LED on the front panel, shows each time a valid barcode number is read.

Select **NEVER** to disable automatic data updates from the KeyKode reader. The 4025 will use the bi-phase exclusively to update the edge numbers. The front panel KKODE entry mode may be used to manually enter edge numbers from non-KeyKoded stock. This may also be helpful when transferring stock where a different film edge number (e.g. ACMAID number) than the latent edge number must be used.

When the 4025 is in the Ink number mode, you can only select KKJAM NEVER. To select one of the other KKJAM modes you must first take the 4025 out of the Ink number mode by entering a manufacturer's code other than I. (See section 0.)

Select **ONCE** to accept KeyKode numbers once, when the telecine is at stable play speed (the 4025 LOCK LED will be On), and the bi-phase based numbers disagree with the barcode numbers. After this the 4025 will use the bi-phase to update the edge numbers. This mode is useful for transferring stock which has undesired breaks in the keykode numbering.

Select **PLAY** to accept KeyKode numbers only when the telecine is at stable play speed (the 4025 LOCK LED will be On), and the bi-phase based numbers disagree with the barcode numbers. At other times updating is done from the bi-phase. This mode is useful when transferring uncut camera negative rolls.

Select **ALWAYS** to accept KeyKode data immediately when the telecine is at stable play speed (the 4025 LOCK LED will be On), and the bi-phase based numbers disagree with the barcode numbers. In shuttle speeds the edge numbers will be updated after a pre-settable error window between bi-phase counts and barcode numbers is detected. (See section 3.7.2 for information on how to set the error window.) This is necessary to track the discontinuous edge numbers that would be encountered when searching select take rolls in shuttle. This value shows the amount of error in film frames that the 4025 will allow, (in shuttle modes), between the bi-phase based numbers and the barcode numbers. When this window value is exceeded, the barcode numbers will approximately update the bi-phase based numbers. The bi-phase based numbers will be

exactly updated the next time the telecine achieves locked play speed. The default value for the window is 30 frames.

JAM ALWAYS is the preferred mode for most circumstances where KeyKode is being used.

In JAM ALWAYS mode, if you shuttle across a splice to a marked frame there maybe a small discrepancy between picture & numbers. To eliminate this, put the telecine in PLAY for a few seconds.

3.4.2 Selecting how the KeyKode Prefix is Displayed in the VCG

KEYINFO Is used to select the way in which the KeyKode numbers will be displayed in the character inserter.

Select **INFO OFF** when using non-KeyKoded stock and you wish to blank the prefix part of the KeyKode display. The character generator will show only the footage and frames.

Select **INFO ON** to display the entire KeyKode number.

When using an external barcode reader it is important to know if the edge numbers being displayed in the 4025 are being updated from the barcodes, or only from the telecine bi-phase. With **INFO CHECK** the 4025 will change the font of the Key info part of the film edge number window when 4025 detects that the barcode information is missing, and the edge numbers are being updated only by the telecine bi-phase. In the Tiny character size, the Key Info part of the edge number will be shown in inverse video.

Barcode missing is detected when no barcode information has been received for greater than the number of feet set in the CHECK DELAY parameter of the Toolbox menu, or KK JAM is set to NEVER. (See section 3.7.3 for information on setting the CHECK DELAY window.)

It is highly recommended to use INFO CHECK, so that KeyKode reading problems can be identified and corrected immediately.

3.4.3 Selecting the Film Gauge

FILM TYPE Is used to select the film stock gauge and the number of film frames per key number.

Select **35 MM 16 FRMS/KEY** if you are using normal 4 perf 35 mm film stock.

Select **16 MM 20 FRMS/KEY** if you are using 16 mm film stock with key numbers every 20 perforations.

Select **16 MM 40 FRMS/KEY** if you are using 16 mm film stock with key numbers every 40 perforations.

16 MM 40 FRM/KEY should NOT be used with KeyKode readers.

3.4.4 Selecting the Film Transfer Rate

FILM RATE Is used to select the film transfer rate that the telecine is currently operating in.

In NTSC, the user can select from one of three transfer rate modes.

Some telecines continue the frame pulse in an unbroken sequence even when they are in still or shuttle modes. When used with these telecines, the 4025 can be configured for **AUTO** rate detect. Changes in transfer rates by the telecine operator are automatically detected when the telecine is in still. The front panel PULL and 1/1 indicators will show the transfer rate that has been detected.

Other telecines do not maintain coherent film frame pulse sequences in still or shuttle modes. When used with these telecines, the 4025 must be manually set to the correct transfer rate to accurately track the film / timecode relationship.

24 FRMS / SEC manually selects a transfer rate of 24 (23.97) frames per second. The front panel PULL LED should be On.

30 FRMS / SEC manually selects a transfer rate of 30 (29.97) frames per second. The front panel 1:1 LED should be On.

Do not use AUTO rate detect with Rank Cintel URSA or BTS telecines. Do not use AUTO rate detect when using a Time Logic Controller and Rank Cintel 4:2:2 telecines.

In PAL systems the film rate is fixed at **25 FRMS / SEC.** The front panel 1:1 indicator should always be On.

An alternate method of setting the film rate is to use the parallel inputs provided on the rear panel. See section 2.10.3 or 2.11.3 for information about using the parallel remote inputs.

3.4.5 Selecting the Encoding Format of the Film Edge Numbers

EDGE STYLE Is used to select whether the edge numbers will be encoded in the timecode output as packed BCD digits, or in a compressed binary format (which allows more digits to be encoded.)

Select **GENERIC** if you want to use standard BCD encoding which can be read by most readers. When Generic style is used, either 4, 5 or 6 digits of feet may be used. Digits that are not used for footage numbers are utilized for a static prefix number.

Select **EVERTZ** if you want to use binary encoding to compress more data into the available space. When EVERTZ style is used, either 4, 5, 6 or 7 digits of feet may be used. Digits that are not used for footage numbers are utilized for a static prefix number. In addition, three flag bits are encoded into the user bits which contain the pulldown of the given field. EVERTZ style encoding requires an Evertz reader such as ***Afterburner*** fitted with special software to read and display the data as decimal digits.

EDGE FORMAT Is used to select the number of counting digits in the footage. This is primarily useful for non-keykoded applications. EDGE FORMAT determines the maximum footage count possible before it returns to zero. For example when 4 DIG FT+FRM is selected, the maximum footage is 9999. When 5 DIG FT+FRM is selected the maximum footage is 99999, etc.

When using the 4025 with KeyKoded stock 4 DIG FT+FRM format should be used.

When using the data logging output of the 4025, 4 DIG FT+FRM format MUST be selected. No data packets will be transmitted to the logging computer in 5,6 or 7 digit formats.

3.5 PROGRAMMING MISCELLANEOUS ITEMS - THE CONFIG MENU

3.5.1 Selecting the Character Size

CHAR SIZE Is used to select one of three sizes for the character generator's display. The format menus always use the small character size.

The **TINY** character size occupies 8 lines per field for each character row. This permits 28 vertical positions on the raster in NTSC or 32 in PAL.

The **SMALL** character size occupies 16 lines per field for each character row. This permits 14 vertical positions on the raster in NTSC or 16 in PAL.

The **LARGE** character size occupies 32 lines per field for each character row. This permits 7 vertical positions on the raster in NTSC or 8 in PAL.

3.5.2 Selecting the Character Style and Background

CHAR STYLE Is used to select whether the characters will be white or black, and whether a background mask will be used when the characters are displayed. The Format menus are always keyed into a black background mask.

Select **WHITE** to disable the background and key white characters directly into the picture.

Select **WHITE ON BLACK**, to key white characters over a black background mask.

Select **BLACK** to disable the background and key black characters directly into the picture.

Select **BLACK ON WHITE**, to key black characters over a white background mask.

3.5.3 Selecting the Video Standard of Operation

VIDEO STANDARD Is used to select the operating video standard for the 4025. The proper video standard setting must be selected in order to obtain a positive gen-lock reference to the 4025.

Select **AUTO** to allow the 4025 to auto detect the standard of the gen-lock video reference. This is the factory default condition. When the 4025 detects a mismatch between the current mode and the input video reference, it will automatically restart in the correct standard.

Select **NTSC** to manually select operation with NTSC reference video. If PAL video is applied, the NTSC GEN LCK LED will

blink and a warning message will be displayed on the front panel.

Select **PAL** to manually select operation with PAL reference video. If NTSC video is applied, the PAL GEN LCK LED will blink and a warning message will be displayed on the front panel.

3.5.4 Programming the Head Offset for the KeyKode Reader

The KeyKode Head Offset item on the CONFIG menu is only accessible when the Engineering mode switch (DIP switch #8 on the right hand circuit card inside the 4025) is in the On (Closed) position.

KK HEAD OFFSET Is used to view / calibrate the 4025's mechanical offset registers. This item allows the 4025 to compensate for the distance between the KeyKode reader head and the film gate of the telecine. There are separate head offsets maintained for each film type and film rate. Press the **SELECT** key to view a summary of the head offset values. To calibrate the head offsets see section 2.12.4.

3.5.5 Compensating for Video path Delays between the telecine and the 4025

VIDEO DELAY Is used to adjust for whole field delays which put the 4025 input video out of sync with the bi-phase and Frame pulse inputs. Delay compensations affect the VITC, LTC and Character Generator outputs. These delays can occur through the use of devices such as noise reducers and encoders. The value may be changed by pressing ↑ & ↓ keys. Selecting 00 fields turns off the video delay compensation. The 4025 is generally capable of ignoring small cumulative delays on the order of several video lines.

3.5.6 Setting up the White Flag Generator

WHITE FLAG Is used to enable or disable the White flag generator. When film material is transferred to video disc, the relationship of the video frames and picture frames is very important. If the video disc's frames do not correspond exactly to the picture content (i.e., film frames) then some pictures will flicker when viewed in still. With **WHITE FLAG ON**, a white level pulse is inserted in the first video field of each new picture. As material is transferred to disc, this pulse is used by the disc recorder to match the disc frames to the 2/3 pulldown automatically. Still playback of all pictures on the disk is jitter-free. Select **WHITE FLAG OFF** to disable the white flag generator.

WHITE FLAG LINES Is used to set the lines that the White Flag will be recorded on. Use the ← & → keys to select the Start or Ending line. Use the ↑ & ↓ keys to select the line number. The normal location of the white flag is on the 1st field of each new

film frame, on line number 11. Consult the operating manual for your disc recorder to make sure that you are using the correct line(s) for the white flag pulse.

3.6 PROGRAMMING THE HARDWARE CONFIGURATION - THE HARDWARE MENU

The HARDWARE menu of the Toolbox menu is used to configure various hardware related items of the 4025 such as character width, display brightness, Telecine Type, Bi-phase Rate, etc. Press SHIFT+FORMAT to enter the Toolbox menu system. See section 3.2.1 for an overview of the Toolbox menu system.

3.6.1 Adjusting the Horizontal Character Size

HORZ CHAR SIZE Is used to adjust the character width. Use the ← & → keys to adjust the right side of the raster

3.6.2 Adjusting the Front Panel Display Brightness

DISPLAY LEVEL Is used to adjust the brightness of the front panel display. Use the ↑ & ↓ keys to adjust.

3.6.3 Selecting the Telecine Bi-Phase Rate

BI PHASE RATE Is used to select the number of bi-phase pulses per film frame. See section 2.10.2 or 2.11.2 for information about connecting bi-phase from your telecine.

In some early versions of the 4025 firmware DIP Switches #3 & 4 on the 615 module were used to set the bi-phase rate. They are used for other purposes now and should be set in accordance with the figure 6-6 in section 6.3.7.

3.6.4 Selecting the Telecine Type

TELECINE TYPE Is used to select the type of telecine you are using. See section 2.10.2 or 2.11.2 for information about connecting the frame pulse from your telecine.

In some early versions of the 4025 firmware DIP Switch #7 on the 615 module was used to select between RANK and BTS type telecines. It is now used for other purposes and should be set according with the chart in Figure 6-6. Make sure the appropriate frame pulse is connected to the 4025. (See section 2.10.2 or 2.11.2 of the 4025 manual.)

Make sure the FILM FRAME SETTING is set correctly for the telecine type you are using.

Select RANK if you are using a Rank Cintel MK III Digiscan 3, 4:2:2 Digiscan IV or URSA telecine. Select URSA GOLD if you are using a Rank Cintel URSA Gold telecine. Select BTS if you are using a BTS, FDL-60, FDL-90 or Quadra telecine. Select OTHER for custom implementations of telecine types. At this time OTHER enables a mode that is compatible with Rank Cintel ADS 1 telecines. This may change in the future. Contact the factory for custom applications should they be required.

URSA Gold telecines with firmware versions 5.01 and earlier had some indeterminate timing related to the Film Frame pulse (which is connected to the 4025) and certain other internal telecine pulses. These inconsistencies have been fixed in telecine firmware version 5.02 and later. Contact your Rank Cintel agent if you are unsure of what telecine firmware version you have, or how to upgrade to the latest version.

3.6.5 Selecting the Correct Frame Pulse Handling

FILM FRAME Is used to control how the 4025 handles the FILM FRAME pulse from the telecine.

In the **LATCHED** mode the 4025 sets a latch internally when the pulse is low any time during the field. The latch is reset at the beginning of VSYNC each field. The 4025 is looking for a high to low edge on the input after the leading edge of vertical sync. The high to low edge must occur somewhere in the first third of the field. The pulse must return high before the end of the field. This mode is useful in situations where the timing of the FILM FRAME pulse input does not coincide with the sampling time (at the end of VSYNC) or the pulse is too short to be sampled. This is the preferred mode for most Rank Cintel telecines except URSA GOLD (See DIRECT mode).

In the **SAMPLED** mode the 4025 is looking for the FILM FRAME input to be low at the end of VSYNC (approximately coincident with the first post equalizing pulse) This mode is useful in situations where the FILM FRAME pulse input begins before VSYNC, and is the mode used by 4025's with 615 software versions prior to 941208. This mode is provided for backwards compatibility.

In the **DIRECT** mode the 4025 uses the FILM FRAME input directly This mode is useful in situations where the FILM FRAME pulse input is low for the duration of the field. This is the preferred mode for Rank Cintel URSA GOLD telecines.

In the **IGNORED** mode the 4025 ignores the FILM FRAME input and the Frame LED on the 4025 front panel will be ON all the time. This mode is useful in situations where the film transfer

device does not provide a frame pulse. This function was previously available on DIP switch #7 of the 615 board.

Do not use AUTO rate detect when you have selected IGNORE mode. Select the correct film transfer rate that you are using.

The following limitations apply when operating the 4025 without a frame pulse from the telecine.

1. The field dominance for 30 FPS NTSC and 25 FPS PAL transfers is assumed to be field 1. That is, the picture content changes at the beginning of field 1 of a video frame.

2. The pulldown for 24 FPS NTSC transfers will be random and the 4025 will track the film frames to within +/- 1 frame of accuracy. In flat bed editing tables and other devices that do not have a frame pulse available there is usually no real pulldown of the picture, but rather a blending of pictures as they change mid-frame.

Do not use IGNORE mode unless your telecine device does not have a frame pulse available. Using IGNORE mode affects the accuracy of the film frame numbering.

3.6.6 Resetting the 4025 to Factory Defaults

FACTORY RESET Is used to reset the 4025 to the factory default parameters. Press SHIFT + ENTER when the sub menu screen is displayed to reset the 4025 to factory defaults. The 4025 will perform a power-on configuration before returning to the normal operating mode.

Proceeding with the Factory reset will cause all user configured parameters including KeyKode head offsets, horizontal char size, user configurations, etc. to be lost. PROCEED WITH CAUTION!!!

3.7 PROGRAMMING THE SOFTWARE - THE PARAMETERS MENU

3.7.1 Controlling the KeyKode Jam when the Telecine is in Play speed

PLAY WINDOW Is used to adjust accuracy of the KeyKode Jam function when the telecine is in locked play speed.

In some early versions of the 4025 firmware DIP Switch #5 on the 615 module was used to set the PLAY WINDOW. It is used for other purposes now and should be set in accordance with the chart in Figure 6-6.

The KK PLAY WINDOW sets how many film frames of difference are allowed between the KeyKode numbers and the bi-phase based film edge numbers (when the telecine is in PLAY and the KKJAM mode is set to PLAY or ALWAYS). When this limit is exceeded the bi-phase based edge numbers will be updated from the KeyKode numbers. The factory default setting of 00 means that any differences between the KeyKode and bi-phase based numbers (when the telecine is in PLAY) will cause a KeyKode jam to occur. Set this value to 01 or 02 when using telecines with Scantrack and low tach rates. Use the ↑ & ↓ keys to adjust. See section 3.4.1 for a description of the KK JAM PLAY and ALWAYS modes.

3.7.2 Controlling the KeyKode Jam when the Telecine is in Shuttle speeds

SHUTTLE WINDOW Is used to adjust accuracy of the KeyKode jam function when the telecine is not at locked play speed, and when the KK JAM mode is set to ALWAYS. (When the KK JAM mode is set to NEVER, ONCE or PLAY this parameter is ignored.) See section 3.4.1 of the manual for a description of the KK JAM ALWAYS mode. The KK SHUTTLE WINDOW sets how many film frames of difference are allowed between the KeyKode numbers and the bi-phase based film edge numbers (when the telecine is in SHUTTLE). When this limit is exceeded the bi-phase based edge numbers will be updated from the KeyKode numbers. The factory default setting of 30 means that differences between the KeyKode and bi-phase (when the telecine is in SHUTTLE) or more than 30 film frames will cause a KeyKode jam to occur. Use the ↑ & ↓ keys to adjust.

3.7.3 Selecting How Soon the 4025 Detects Loss of KeyKode

CHECK DELAY Is used to adjust how quickly the KEY INFO CHECK warning in the VCG becomes active when KeyKode is not present, and the KEYINFO mode is set to INFO CHECK. The CHECK DELAY WINDOW sets how many feet of film can pass without reading KeyKode before the INFO CHECK warning in the VCG is activated. See section 3.4.2 in the manual for a full description of the INFO CHECK DISPLAY. The factory default setting of 10 means that ten feet of film without reading KeyKode will trigger the KeyKode check display of the VCG. Use the ↑ & ↓ keys to adjust.

3.7.4 Setting the Full Stop Time

FULL STOP Is used to adjust length of time with no film motion (measured in seconds and frames) before the 4025 detects a Full Stop condition. This parameter is used in determining when the Full Stop Data packet is sent to a logging computer. It is also used to determine when the auto centering function will take place (If auto centering is turned ON). The factory default setting of 1:00 means that the 4025 will detect FULL STOP when the film is stationary for at least 1 second. Use the ↑ & ↓ keys to adjust.

3.7.5 Setting the Centering Method

AUTO CENTRE Is used to select whether the 4025 will automatically reframe its bi-phase counters when the telecine is in the full stop condition. (See FULL STOP item above). Also see section 3.7.4.

When OFF is selected (the factory default setting) the 4025 will only re-frame its bi-phase information when edge numbers or absolute frames are entered from the front panel, or when the centering remote input is closed to ground.

When ON is selected the 4025 will re-frame its bi-phase information each time the telecine achieves a FULL STOP condition.

3.7.6 Configuring the VCG field and Symbol Displays

VCG FIELDS Is used to select whether the field indicators will be used in the character inserter.

When OFF is selected the 4025 field indicators on the time displays will be turned off.

When ON is selected (the factory default setting) the field indicators on the time displays will be on if the data being displayed is from a VITC source.

VCG SYMBOLS Is used to select whether the VCG window identifier symbols will be used in the character inserter. Each symbol character takes up one additional character in the window size so some users may wish to turn off the symbols to simplify the display.

3.7.7 Configuring the Operation of the Jam Sync Mode when there is no Incoming Time Code

NO CODE JAM Is used to control the operation of the generator in RDR1 EDGE or RDR1 RDR2 +KEYKODE modes when the jam sync source timecode is no longer readable.

Select **RUN** when you want the generator to free run when there is no incoming Reader code. When the reader code resumes, the generator will re-jam to the incoming code. Using this mode will allow the user to repair large dropouts in the incoming code. The generated code will be continuous if the incoming code is also continuous.

Select **HOLD** when you want the generator to stop when there is no incoming Reader code. When the reader code resumes, the generator will re-jam to the incoming code. Use this mode if you want the output of the generator to stop when you stop the tape machine supplying the incoming code to the reader.

Select **OFF** when you want the generator to completely turn Off when there is no incoming Reader code. When the reader code resumes, the generator will turn on and re-jam to the incoming code.

3.7.8 Configuring the operation of the VCG Remote Control Inputs

VCG GPI Is used to select how the VCG remote control inputs will be used. See section 3.12.9 for a full description of the various remote control functions.

Select **OFF** to disable the remote control VCG functions.
Select **TOGGLE** to configure the remote control VCG inputs to toggle the VCG displays On and Off on high to low edges of the remote inputs.

Select **EDGE ⮝OFF** to configure the remote control VCG inputs so that low to high edges turn the windows Off and high to low edges turn the windows On.

Select **EDGE ⮝ON** to configure the remote control VCG inputs so that low to high edges turn the windows On and high to low edges turn the windows Off.

Select **LEVEL** to configure the remote control VCG inputs so that the VCG windows are Off when the inputs are LOW and On when the inputs are HIGH. (The Status screen will be On when the Status input is LOW and Off when the status input is HIGH.) When you have selected LEVEL, the front panel control of the VCG windows is disabled.

You can only control the windows from the remote control port in the LEVEL mode.

3.8 TURNING ON DIAGNOSTICS AIDS - THE DEBUG MENU

3.8.1 Displaying KeyKode Status Information

KK STATS VIEW Is used to select whether the KeyKode status diagnostic display will be shown in the character inserter. See Figure 0-10 of the manual for further information about the KK STATS window.

3.8.2 Displaying RAM Diagnostics

RAM VIEW Is used to select whether the internal data memory (RAM) diagnostic display will be shown in the character inserter. This display is used to aid in troubleshooting problems in the field and should not be used during normal operation or maintenance procedures. When you exit the toolbox menu with RAM VIEW turned ON, (a special window appears at the top of the screen which indicates that you are in RAM VIEW - ENTRY MODE. See section 3.8.2 for a complete description of RAM VIEW mode.

3.8.3 Displaying Non Volatile Memory Diagnostics

NOVRAM DEBUG Is used to select whether the Nonvolatile memory (NOVRAM) diagnostic display will be shown in the character inserter. This display is used to aid in troubleshooting problems in the field and is not used during normal operation or maintenance procedures.

Proceeding with the NOVRAM VIEW will allow the user configured parameters including KeyKode head offsets, horizontal char size, user configurations, etc. to be overwritten. PROCEED WITH CAUTION!!!

3.9 TIME CODE FUNCTIONS

The 4025 Film Footage Encoder contains a multi-line vertical interval (VITC) and a linear (LTC) time code generator. The primary VITC generator follows the LTC generator, except that it is updated at the field rate instead of the frame rate. The secondary VITC generator is used to encode the full KeyKode edge number including frames in certain modes. The 4025 also supports encoding the data in VITC according to the 3 Line VITC Evertz has developed with other manufacturers. Both the VITC 2 line of the two line format and the second and third line of the three line format have special encoding applied such that they require a special Evertz reader such as the ***Afterburner*** to decode the data. With this special encoding applied, conventional readers will not become confused by the special film numbering systems required to encode the data. Figure 0-10 shows the various ways that the 4025 will encode time and KeyKode numbers, showing what data is placed in each set of VITC lines. Figure 3-11 shows how the data is encoded in the 3 Line standard.

The 4025 also contains an LTC/VITC reader which can be operated as two separate readers (known as Reader 1 and Reader 2), or, they may be operated as one Auto reader which reads both LTC and VITC. In this case, the Auto reader is assigned to Reader 1 and Reader 2 is turned off.

The generator time may be preset from the front panel, or slaved to the incoming bi-phase tach pulses from the telecine. It may also be jam synced to the Reader 1 time. An optional Offset between the reader and generator may be applied during jam sync.

The generator user bits may be used as numeric (hexadecimal) data preset from the front panel, slaved to the incoming bi-phase tach pulses from the telecine, or slaved to the Reader 2 time. When slaved to the telecine, the user bits normally contain the film edge number (counting footage with frames) plus an optional fixed prefix number. In the VITC, the film edge numbers follow the actual film frame numbers on a field by field basis, accurately tracking the 2/3 pulldown in NTSC 24 frame per second transfers. See section 3.10.1 for a full description of the various edge code numbering modes available in the 4025.

The time numbers are normally the same for both the LTC and the primary VITC generators. However, because the LTC is only a frame rate code, the film edge numbers in the user bits are only accurate to the closest frame in the LTC output. The VITC output is field accurate when the LOCK LED is On.

The L-GEN, V-GEN, RDR1 or RDR2 keys in the display key group are used to display either the LTC or primary VITC generator, or either of the readers on the front panel display. The leftmost characters of the front panel display are used to prompt which data is being displayed. The TIME / UB key selects whether the generator time or user bits is being displayed. Each time it is pressed, the display alternates between the time and user bits. The colons of the display are blanked when user bits are displayed.

3.9.1 Understanding Time Code 'Add One' Compensation- How it Affects the Accuracy of the Timecode and Burn-ins

Most time code readers assume that the user bit information is not changing, and hence make no provision to compensate the user bits for the delays involved with reading the numbers. Timecode generators that are built in to the VTR's also suffer from this problem when they are 'slaving' to external timecode. Specifically, they read the incoming user bits and transfer this information to the generator, with one or two fields of delay. The time numbers are compensated for the reading delays, so this problem affects only the user bits. This phenomena applies to the timecode being recorded on tape using the ‘re-gen’ mode of the VTR’s generator and to the character generator outputs from the VTR's build in readers.

The following precautions should be taken to ensure that the numbers being laid down on tape, and window dubs of them are accurate:

1. Record VITC from the 4025 onto all your transfer tapes, even if the client does not specify them specifically.

2 When recording timecode from the 4025, the timecode generator in your VTR should either be turned off, or set to an 'external direct' mode. In this mode, the VTR's generator does not attempt to read the incoming code, but merely passes the 4025's code through the signal amplifiers without intervention.

3. When making window burn-ins of the 4025 data, use the 4025 Character inserter, which accurately compensates for the film pulldown. Separate video paths are provided for the 4025 VITC and Character generators, so you can make one tape without burn-ins, and a simultaneous tape with a burn-in.

4. The ***Afterburner*** reader can be used to make a frame accurate window dub from a previously transferred tape. In order for the ***Afterburner*** to recover the 'Key Info' part of the keykode number, make sure that the 4025's VITC generator is on and use one of the 4025's + KEYKODE modes.

3.9.2 Configuring the Time Code Operating Modes

Selection of the desired mode of operation for the generator is performed using the Format menu displayed on the character generator. Press the **FORMAT** key to access the Format menu. Using the ← & → keys drop down the TIMECODE menu. Use the ↑ & ↓ keys to highlight the GEN ASSIGN menu item and press the **SELECT** key to show the generator operational modes sub menu. The currently programmed generator assignment mode is shown in reverse video. Press the ↑ & ↓ keys one or more times to select the desired mode of operation. Press the **FORMAT** or **CLR** keys to exit the format menu, or press the **SELECT** key to return to the TIMECODE drop down menu. (See section 3.3.1 and Figure 0-10 for more information about the various time code modes).

3.9.3 How to Set the Generator Time

When entering time data make sure that the generator is not in one of the JAM modes (indicated when the JAM LED is on). If it is use the format menu as described above to select one of the RUN or CINE time modes. Press the **L-GEN** or **V-GEN** keys to display the LTC or VITC generator time respectively. (Currently the LTC and VITC generators are the same.) Press the **TIME / UB** key to display the generator time if it is not already displayed. The **ENTER** and **CLR** keys are used in conjunction with the numeric keys to set the generator time.

The telecine must be stopped before you attempt to set the generator time.

Press the **ENTER** key to recall the last time that you entered into the generator. The display prompt at the left of the display will blink while data

entry mode is active, and the dual functioned keys are now changed to their numeric values. If you want to re-enter this time press the **ENTER** key to complete the data entry into the generator time.

Pressing any numeric key will clear the previous value and place the new value into the numeric display, starting at the right. Unentered digits are assumed to be zero, hence leading zero digits are not required. When the required number of digits are entered, then press the **ENTER** key to complete the data entry into the generator time.

Attempts to enter too many digits, or make illegal entries, i.e. 65 minutes, will result in the display returning to the last valid time entry made. Re-enter the correct value and press the **ENTER** key. Pressing the **CLR** key will cancel the data entry mode without changing any data.

The numeric keys return to their normal display functions when the data entry has been completed by pressing **ENTER** or cancelled by pressing the **CLR** key. The display prompt will return to its steady on state when data entry mode has been completed.

Numeric entry mode must be terminated (the display prompt will be on steady) before any of the front panel keys will resume normal operation.

In the RUN modes, press **GEN RUN / HOLD** to start or stop the generator clock. In the CINE modes, the generator will start and stop with the telecine film motion.

3.9.4 How to Set the Generator User Bits

When entering user bits data make sure that the generator is programmed for NUM user bits mode. If it is in one of the EDGE OR RDR2 modes, use the format menu as described in section 3.2 to select the NUM user bit mode. Press the **L-GEN** or **V-GEN** keys to display the LTC or VITC generator respectively. (Currently the LTC and VITC generators are the same.) Press the **TIME / UB** key to display the generator user bits if they are not already displayed. The colons of the display are blanked when user bits are displayed. The **ENTER** and **CLR** keys are used in conjunction with the numeric keys to set the generator user bits.

Press the **ENTER** key to recall the last User Bits that you entered into the generator. The display prompt at the left of the display will blink while data entry mode is active, and the dual functioned keys are now changed to their numeric values. If you want to re-enter these User Bits press the **ENTER** key to complete the data entry into the generator.

Pressing any numeric key will clear the previous value and place the new value into the numeric display, starting at the right. Pressing the **SHIFT** key and the numeric keys 0 to 5 will enter the corresponding hexadecimal values A to F. Unentered digits are assumed to be zero. When the

required number of digits are entered, press the **ENTER** key to complete the data entry into the generator User Bits.

Attempts to enter too many digits will result in the display being blanked. Re-enter the correct value and press the **ENTER** key. Pressing the **CLR** key will cancel the data entry mode without changing any data.

The numeric keys return to their normal functions when the data entry has been completed by pressing the **ENTER** key or cancelled by pressing the **CLR** key. The display prompt will return to its steady on state when data entry mode has been completed.

Numeric entry mode must be terminated (the display prompt will be on steady) before any of the front panel keys will resume normal operation.

3.9.5 Selecting the Generator Drop Frame Mode (NTSC only)

In NTSC, the video frame rate of approximately 29.97 frames per second causes an error between real time and 'colour time'. To overcome this problem, the drop frame mode was created. This mode compensates for the approximate 4 minute per day error by dropping the first two frame counts (0, 1) at the start of each minutes, except minutes 0, 10, 20, 30, 40, and 50. A drop frame flag bit is set in the code when the drop frame format is used. When the 4025 is operating in the NTSC video standard, the generator may be programmed to operate in either the drop frame or non drop frame mode.

Selection of the desired drop frame mode for the generator is performed using the Format menu displayed on the character generator. Press the **FORMAT** to access the Format menu. Using the ← & → keys drop down the TIMECODE menu. Use the ↑ & ↓ keys to highlight the DROP FRAME menu item and press the **SELECT** key to show the drop frame sub menu. The currently programmed generator drop frame mode is shown in reverse video. Press the ↑ & ↓ keys to select the desired mode of operation. Press the **FORMAT** or **CLR** keys to exit the format menu, or press the **SELECT** key to return to the TIMECODE drop down menu. See section 3.3 for more information about the various time code modes.

When the generator is operated in the one of the Jam Sync modes (RDR1), or the 3 Line VITC Mode, the generator drop frame mode is the same as the incoming Reader1 data. The Drop Frame sub menu shows JAM RDR1. When the 4025 is operating in the PAL video standard, the Drop Frame sub menu shows NOT AVAILABLE.

3.9.6 Setting up the 4025 for Jam Sync to the VTR Time Code

The preferred method of configuring the 4025 to Jam sync to the Record VTR's time code is to use the internal time code generator in the VTR to generate continuous LTC, and have the 4025 jam to it. The VITC from the 4025 has encoded film numbers and should be recorded on the VTR

directly. (See section 3.9.1 for information about the use of your VTR's time code generator with film edge numbers.) Audio time code may be connected to the 4025's VITC reader with the use of an LTC to VITC translator such as the Evertz 621-LTR.

This configuration prevents the 4025 from jamming to its own timecode, which can cause instabilities in the number sequences when the VTR goes E-E during recording.

3.9.7 Selecting the Lines to Record VITC on - (Except 3 Line VITC Standard)

The 4025 contains a multi-line VITC generator capable of generating multiple sets of VITC data. When the generator assignment is not set to **3 LINE VITC STD,** the primary VITC generator (VITC1) follows the LTC generator, except that it is updated at the field rate instead of the frame rate. The secondary VITC generator (VITC2) is used to encode the full KeyKode edge number including frames in the **CINE RDR 2 + KEYKODE** or **RDR1 RDR 2 + KEYKODE** time code modes.

Selection of the lines for recording the VITC is performed using the Format menu displayed on the character generator. Press the **FORMAT** to access the Format menu. Using the ← & → keys drop down the TIMECODE menu. Use the ↑ & ↓ keys to highlight the GEN VITC1 LINES or GEN VITC2 LINES menu item to set the VITC lines. Press the **SELECT** key to show the VITC LINES sub menu. Line1 and line2 are the two lines currently selected for the VITC1 or VITC2 generator.
When the VITC LINES sub menu is first selected, the Line1 will be in reverse video indicating it can be changed. Press the ↑ & ↓ keys to change Line1. Press the ← & → keys to highlight Line2 indicating that it can be changed. Press the ↑ & ↓ keys to change Line2. Press the **FORMAT** or **CLR** keys to exit the format menu or press the **SELECT** key to return to the TIMECODE drop down menu. The user will have to determine by experience the most suitable lines for recording VITC, according to the following criteria.

In order to protect the VITC reading process against dropouts, the VITC is usually repeated on 2 non-adjacent lines in the vertical interval of the video signal, not earlier than line 10 (6 for PAL) or later than line 20 (21 for PAL). For certain recordings, the use of some of these lines may interfere with other signals inserted into the vertical interval.

To avoid decoding errors, an adequate margin should be allowed between the video head switching points and the recorded VITC word. Also note that type C VTRs with a sync head have a head switching point in the middle of the permitted lines. Type C VTRs without a sync head do not reproduce some of the permitted lines at all, therefore these lines should not be used for recording VITC. See your VTR manual for further information.

It is recommended that two non-adjacent lines be used, however adjacent lines and a single line (selected when both lines are the same) are permitted.

3.9.8 Selecting the Lines to Record VITC on - (3 Line VITC Standard)

When the generator assignment is set to **3 LINE VITC STD**, two blocks of 3 lines are encoded. The first VITC line follows the LTC generator, except that it is updated at the field rate instead of the frame rate. The second VITC line is used to encode the full KeyKode edge number including frames and pulldown information. The third line is used to encode the RDR 2 time and user bits. (See section 0 for a complete description of the 3 line VITC mode).
Although the actual choice of lines is up to the user, the following line ranges are recommended.

	NTSC	PAL
Block 1	18-19-20	19-20-21
Block 2 (optional)	13-14-15	14-15-16
White Flag (optional)	12	12

3.9.9 Turning the VITC Generator On

The **VITC** key is used to turn the VITC keyer on and off. When the VITC generator is Off, the program video passes through the VITC keyer with nothing added. When the VITC generator is On, the primary VITC will always be added. In addition, the secondary VITC and white flag pulse will be added if they are enabled (using the Format menu).

3.10 FILM EDGE CODE FUNCTIONS

Latent edge numbers have been present on motion picture negative film stocks for many years in human readable form. The edge numbering format has been specific to various manufacturers and film stock types. In 1988, Eastman Kodak, in conjunction with the Society of Motion Picture and Television Engineers devised a new edge print that not only standardizes the numbering format, but is also printed as a machine readable barcode. Kodak calls this numbering system KeyKode. Other film manufacturers have adopted this numbering standard and have each given their version a proprietary name. For the sake of clarity we shall refer to all of these implementations as KeyKode.

See section 3.9.1 for a discussion of how your VTR's generator may affect the accuracy of edge numbers encoded into the user bits.

The 4025 Film Footage Encoder encodes the latent film edge numbers (also known as footage numbers or key numbers), with the frame offset from the edge number and an optional numeric prefix, into the user bits of the generator in one of several formats.

Using normal BCD encoding, (**GENERIC** mode) there is only room to encode a maximum of 6 digits of film feet plus 2 digits of frames into the user bits. The maximum footage number is programmed using the Format menu. The number of prefix digits permitted is dependent on the maximum footage number that is selected. (See section 3.10.7.)

By utilizing a compressed binary format, (**EVERTZ** mode) up to 7 digits of feet plus frames can be encoded, along with the pulldown information, however, special decoding routines in the time code readers will be required to recover this information and display it as decimal digits. These modes are sufficient to record all of the numeric edge number information from the older edge number styles.

When used with KeyKode numbers, only part of the edge number can be encoded into the user bits in the **EDGE** modes. The full KeyKode number with frame offset can be encoded by using the secondary VITC lines (the **+ KEYKODE** modes) while leaving room for auxiliary timecode information (e.g. production sound time code) in the user bits of the LTC and the primary VITC generators.

In the **+ KEYKODE** modes, the Key Info data consisting of the manufacturer code, the emulsion code and the first four digits of the prefix are stored in the time bits of the secondary VITC generator. The user bits contain the same information as would go into the primary VITC in the **EDGE** modes as determined by the EDGE STYLE and EDGE FORMAT menu settings (See sections 3.10.6 and 3.10.7 for further information about edge numbering modes.)

In the **3 Line VITC STD,** the film type, film gauge and transfer rate are encoded along with the keykode number, film frame & pulldown information in the second line of the 3 Line block.

In any of the **EDGE** user bit modes, the user bits of the primary VITC generator follow the actual film frame numbers on a field by field basis, accurately tracking the pulldown of the telecine. However, because the LTC is only a frame rate code, the film edge numbers in the LTC user bits are only accurate to the closest frame. In the **+ KEYKODE** modes, the secondary VITC generator follows the actual film pulldown on a field by field basis, and the LTC output follows the primary VITC output.

The KKODE key is used to display the film edge number and frames. When used with an external KeyKode reader, the complete film edge number may be displayed on the front panel and in the character inserter. Selection of the desired format for the film edge numbering is performed using the FILM drop down menu on the Format menu displayed on the character generator.

3.10.1 Configuring the Film Edge Number Operating Modes

Selection of the desired mode of operation for the generator is performed using the Format menu displayed on the character generator. Press the **FORMAT** key to access the Format menu. Using the ← & → keys drop down the TIMECODE menu. Use the ↑ & ↓ keys to highlight the GEN ASSIGN menu item and press the **SELECT** key to show the generator operational modes sub menu. Figure 0-10 summarizes how the KeyKode numbers are encoded in the various modes The currently programmed generator assignment mode is shown in reverse video. Press the ↑ & ↓ keys one or more times to select the desired mode of operation.

- To put edge numbers in the user bits of the LTC and primary VITC generators, select one of the **EDGE** modes.
- To put the full KeyKode into the secondary VITC generator select on of the **+ KEYKODE** modes.

Press the **FORMAT** or **CLR** keys to exit the format menu, or press the **SELECT** key to return to the TIMECODE drop down menu. (See section 3.9.2 for more information about the various time code modes)

3.10.2 How to Set the Film Edge Code Numbers - Manual Entry

When entering Film Edge numbers manually, make sure that the generator is in one of the EDGE modes. Use the format menu as described in section 3.2 to select one of the EDGE modes. Press the **KKODE** key to display the film footage number if it is not already displayed. The front panel display is formatted to correspond to the number of digits of prefix, footage and frames. The **ENTER** and **CLR** keys are used in conjunction with the numeric keys to set the film edge codes.

The 4025 is fitted with an interface for connection to an external KeyKode reader. These readers can automatically read the film edge codes from KeyKoded stock and the 4025 can automatically place them into the user bits. See section 3.10 for further information about operation with KeyKode.

Press the **ENTER** key to recall the last film edge number that you entered. The prefix digits (leftmost digits of the display) will blink to indicate that data entry mode is active, and the dual functioned keys are changed to their numeric values.

Pressing any numeric key will place the new value into the numeric display, starting at the right. Unentered digits are assumed to be zero, hence leading zero digits are not required. When the required number of digits of footage and frames are entered, press the **ENTER** key to complete the edge number data entry.

Attempts to enter too many digits, or make illegal entries will result in the display returning to the last valid edge number entry. Re-enter the correct

value and press the **ENTER** key. Pressing the **CLR** key will cancel the data entry mode without changing any data.

The numeric keys return to their normal functions, and the prefix digits stop blinking when the data entry has been completed by pressing the **ENTER** key or cancelled by pressing the **CLR** key.

Numeric entry mode must be terminated (the prefix digits will be on steady) before any of the front panel keys will resume normal operation.

3.10.3 Entering Edge Code Prefixes Manually

When using ACMAID edge numbers, or when the KeyKode numbers are not machine readable, it will be desirable to enter the edge code prefix manually into the 4025.

Note that if the KK JAM mode of the 4025 is set to ONCE, PLAY, or ALWAYS, the next valid data from the KeyKode reader will overwrite the data that was manually entered from the front panel. Use the KK JAM OFF mode to prevent this from happening.

When entering KeyKode prefixes, the 4025 automatically cross references between the human readable manufacturer's ident and film emulsion letter codes, and numeric codes that are contained in the machine readable barcodes on the film.

When the 4025 generator is operating in one of EDGE modes, the prefix information is only displayed in the character inserter, and will be sent to the Key-Log logging software if it is running. When the 4025 is in one of the Full KeyKode modes, the prefix information will also be encoded into the secondary VITC.

When entering Film Edge number prefixes manually, make sure that the generator is in one of the EDGE modes. Use the format menu as described in section 3.6.1 of the manual to select one of the EDGE modes. Press the **KKODE** key and then the **TIME/UB** key to display the film number prefix on the front panel. The **ENTER** and **CLR** keys are used in conjunction with the arrow and numeric keys to set the film edge prefix. Entering prefixes is a three step process. First you select the manufacturer, then the film type, and then the numeric prefix. The chart in Appendix C shows the supported manufacturer film types as of the printing of this manual. Additional codes may be added in the future.

Press the **ENTER** key to recall the last film manufacturer code that you entered. The leftmost digits of the display will indicate MANFCTR. The KeyKode manufacturer letter from the human readable edge code is displayed along with its numeric equivalent. Press the vertical arrow keys (↑, ↓) to select the correct manufacturer code. Hold the **SHIFT** key while

pressing the vertical arrow keys to select other film manufacturer codes than are shown in. Appendix C. A special manufacturer code (99) is reserved for ACMAID (Ink) numbered stock. When this manufacturer code is selected, the front panel and character generator displays the edge numbers formatted accordingly. (See section 3.10.4 for a full description of ACMAID modes.

Note that there are may be two manufacturer codes for each film stock manufacturer. The lower code is for 35mm and the other code is for 16mm.

When you have selected the correct manufacturer, press the ENTER key to proceed to film type selection. The leftmost digits of the display will indicate FILM TYPE. The film emulsion letter from the human readable edge code is displayed along with its numeric equivalent. Press the vertical arrow keys (↑, ↓) to select the correct film type code. Hold the **SHIFT** key while pressing the vertical arrow keys to select from unknown film types. (A '?' will be displayed to show that the film ident letter is unknown) Note that there may be more than one film type for each letter, so take care to select the correct numeric film type code. (See the film emulsion code table on page 9-1 for a list of the film emulsions currently supported)

When you have selected the correct film type, press the **ENTER** key to proceed to the numeric prefix entry. The leftmost digits of the display will indicate PREFIX and the dual functioned keys assume their numeric values. Pressing any numeric key will place the new value into the display, starting at the right. Leading blank digits are assumed to be zero. When the required number of digits of prefix are entered, press the **ENTER** key to complete the edge number prefix entry.

Attempts to enter too many digits will result in clearing of the display. Re-enter the correct value and press the ENTER key. Pressing the CLR key will cancel the prefix entry mode without changing any data.

The numeric keys return to their normal functions, and the prefix message stops blinking when the data entry has been completed by pressing the ENTER key or cancelled by pressing the CLR key.

Prefix entry mode must be terminated (the prefix message will stop blinking) before any of the front panel keys will resume their normal operation.

3.10.4 ACMAID Number Entry

When KeyKode Jam is turned off, the 4025 edge code registers may be used to hold ACMAID Ink numbers in place of the KeyKode numbers in the character inserter and on the front panel display. They are also encoded into the timecode and Data log outputs in place of the KeyKode numbers.

To enter the footage and frames part of the number follow the procedure outlined in the manual section 3.10.2 -"How to Enter Film Edge Code Numbers - Manual Entry". To enter the prefix part of the number. follow the procedure outlined in section 3 above. Select manufacturer code '99' which is represented by letter code 'I'. For the film types, you may select any of the permitted ACMAID letter suffixes as shown in Figure 0-12. For the numeric part of the prefix you are permitted a 3 digit number only.

When operating in the INK number mode the KK JAM menu item must be set to NEVER. Otherwise, incoming KeyKode will overwrite the manually entered Ink Number. You must now take the 4025 out of Ink number mode (by manually entering a keykode number with manufacturer other than 'I' (See section 3.10.3) before you can set the KKJAM menu item back to one of the other settings.

			Letter Suffix	
	Code	**Letter**	**Code**	**Char**
ACMAID	99	I	32	Space
			45	dash (-)
			65	A
			66	B
			67	C
			68	D
			69	E
			70	F
			71	G
			72	H
			73	I
			74	J
			75	K
			76	L
			77	M
			78	N
			79	O
			80	P
			81	Q
			82	R
			83	S
			84	T
			85	U
			86	V
			87	W
			88	X
			89	Y
			90	Z

Figure 0-12: ACMAID Letter Suffix Codes

3.10.5 Selecting the Film Type

Selection of the Film Gauge is performed using the Format menu displayed on the character generator. Press the **FORMAT** key to access the Format menu. Using the ← & → keys drop down the FILM menu. Use the ↑ & ↓ keys to highlight the FILM TYPE menu item and press the **SELECT** key to show the FILM TYPE sub menu. The currently programmed film type is shown in reverse video. Press the ↑ & ↓ keys one or more times to select the desired film type. Press the **FORMAT** or **CLR** keys to exit the format menu, or press the **SELECT** key to return to the FILM drop down menu.

- Select **35 MM 16 FR/FT** if you are using normal 4 perf 35 mm film stock.

- Select **16 MM 20 FR/KEY** if you are using 16 mm film stock with key numbers every 20 perforations. (Use this setting for KeyKoded film stocks.)
- Select **16 MM 40 FR/FT** if you are using 16 mm film stock with key numbers every 40 perforations.

3.10.6 BCD or Binary Edge Number Encoding?

Film stock manufacturers traditionally have each had their own method of numbering the film stock, some having 4, 5, 6 or 7 counting footage digits with varying numbers of fixed alpha-numeric roll numbers, or prefix numbers to the footage. Using normal BCD encoding, there is only room to encode a maximum of 6 digits of film feet plus 2 digits of frames into the user bits. By utilizing a compressed binary format, up to 7 digits of feet plus frames can be encoded, along with the pulldown information, however, special decoding routines in the time code readers such as the ***Afterburner*** will be required to recover this information and display it as decimal digits.

Selection of the BCD or Binary encoding style is performed using the Format menu displayed on the character generator. Press the **FORMAT** key to access the Format menu. Using the ← & → keys drop down the FILM menu. Use the ↑ & ↓ keys to highlight the FILM TYPE menu item and press the **SELECT** key to show the EDGE STYLE sub menu. The currently programmed edge encoding style is shown in reverse video. Press the ↑ & ↓ keys to select GENERIC or EVERTZ style.

Select **GENERIC** if you want to use standard BCD encoding which can be read by most readers. (See section 3.9.1 for a discussion on how timecode readers built in to VTR's handle Film edge numbers.) When Generic style is used, 6 digits of Edge number information plus frames will be placed into the user bits in the EDGE modes. Maximum footages of 4, 5 or 6 digits may be used. Digits that are not used for footage numbers are utilized for the prefix number.

Select **EVERTZ** if you want to use binary encoding to compress more data into the available space. When EVERTZ style is used, 7 digits of edge number information plus frames will be placed into the user bits. Maximum

footages of 4, 5, 6 or 7 digits may be used. Digits that are not used for footage numbers are utilized for the prefix number. In addition, to the prefix, footage and frames, three flag bits are encoded into the user bits which contain the pulldown of the given field. EVERTZ style encoding requires an Evertz ***Afterburner*** reader to read and display the data as decimal digits. (See section 3.4 for information about EVERTZ style encoding.)

Press the **FORMAT** or **CLR** keys to exit the format menu, or press the **SELECT** key to return to the FILM drop down menu.

GENERIC (BCD)	PREFIX MAX'm #	PREFIX DIGITS	COUNT MAX'm #	COUNT DIGITS	FRAMES MAX'm #	FRAMES DIGITS
4 DIGIT KEY + FRM.	99	2	9,999	4	39	2
5 DIGIT KEY + FRM.	9	1	99,999	5	39	2
6 DIGIT KEY + FRM.	-	0	999,999	6	39	2

EVERTZ (Binary)	PREFIX MAX'm #	PREFIX DIGITS	COUNT MAX'm #	COUNT DIGITS	FRAMES MAX'm #	FRAMES DIGITS
4 DIGIT KEY + FRM.	999	3	9,999	4	39	2
5 DIGIT KEY + FRM.	99	2	99,999	5	39	2
6 DIGIT KEY + FRM	9	1	999,999	6	39	2
7 DIGIT KEY + FRM	-	0	9,999,999	7	39	2

Figure 0-13: Summary of Edge Number Encoding Styles

3.10.7 Selecting the Maximum Footage Count

Selection of the Edge number format is performed using the Format menu displayed on the character generator. Press the **FORMAT** key to access the Format menu. Using the ← & → keys drop down the FILM menu. Use the ↑ & ↓ keys to highlight the FILM TYPE menu item and press the **SELECT** key to show the EDGE FORMAT sub menu. The currently programmed edge number encoding scheme is shown in reverse video. Press the ↑ & ↓ keys to select the format that matches your film stock. (See Figure 0-13.)

The newer barcoded film stocks use a consistent numbering system consisting of a film manufacturer's letter, an emulsion letter, a six digit prefix and a four digit key number. When using KeyKoded film stock, the 4025 should be set for the 4 DIG FT + FRM format.

3.10.8 Centering the 4025's Framing Reference

For the 4025 Film Footage Encoder to detect where the film frame boundaries are (with respect to the bi-phase pulses and the barcode numbers), it is necessary to properly calibrate the 4025's framing.

The following procedure must be used to calibrate the 4025's framing reference each time a new film is loaded on the telecine, or when the telecine framing changes due to splices, panning or zooming, etc.

After you stop the telecine with the film properly framed in the gate use one of the following methods of centering.

1. Enter a new timecode or film edge number using the front panel when the film is properly still framed in the gate. If you are using a Film Barcode reader you may set the edge numbers to 0000+00, as they will be updated from the barcode reader when the telecine is at Play speed. (See section 3.11.1 for information on selecting the KK JAM mode.)

2. Pin 5 on the parallel I/O connector on the 4025 rear panel may be used as a centering input. Momentarily close this input to ground and release it when the film is properly still framed in the gate.

3. On telecines that always stop with the film centered in the gate, you can use the AUTO CENTER function. With AUTO CENTER turned on, the framing reference will be recalibrated each time the telecine is stopped for the amount of time programmed in the FULL STOP parameter. Care should be taken to stop the telecine with the film properly framed in the gate for at least the FULL STOP time each time a new film is loaded onto the telecine. (See section 3.7.5)

When the 4025 is properly framed, the SCAN value in the KeyKode Status information should be at or near zero, each time the telecine is put into PLAY. (Rank Cintel telecines only)

3.10.9 Setting the Film Transfer Rate

Selection of the Film Transfer Rate is performed using the Format menu displayed on the character generator. Press the **FORMAT** key to access the Format menu. Using the ← & → keys drop down the FILM menu. Use the ↑ & ↓ keys to highlight the FILM RATE menu item and press the **SELECT** key to show the FILM RATE sub menu. The currently programmed film transfer rate is shown in reverse video. Press the ↑ & ↓ keys one or more times to select the transfer rate you are currently using. Press the **FORMAT** or **CLR** keys to exit the format menu, or press the **SELECT** key to return to the FILM drop down menu.

In NTSC, the user can select from one of three transfer rate modes.

Some telecines continue the frame pulse in an unbroken sequence even when they are in still or shuttle modes. When used with these telecines,

the 4025 can be configured for **AUTO** rate detect. Changes in transfer rates by the telecine operator are automatically detected when the telecine is in still. The front panel PULL and 1:1 indicators will show the transfer rate that has been detected.

Other telecines do not maintain coherent film frame pulse sequences in still or shuttle modes. When used with these telecines, the 4025 must be manually set to the correct transfer rate to accurately track the film / timecode relationship.

24 FRMS / SEC manually selects a transfer rate of 24 (23.97) frames per second. The front panel PULL LED should be on.
30 FRMS / SEC manually selects a transfer rate of 30 (29.97) frames per second. The front panel 1:1 LED should be on.

Do not use AUTO rate detect with Rank Cintel URSA or BTS telecines. Do not use AUTO rate detect when using a Time Logic Controller and Rank Cintel 4:2:2 telecines.

In PAL the film rate is fixed at **25 FRMS / SEC.** The front panel 1:1 indicator should always be on.

3.10.10 Using the Parallel Remote Control to select Film Control Modes

The 4025 is fitted with a nine pin sub miniature 'D' connector for connection to the telecine. Three pins on the remote control connector may be connected to tallies from the telecine, or to external toggle switches, to program the film type and transfer rate. The pin connections are described in Chapter 7 of this manual.

Mode changes will take effect when either a timecode or film edge number is entered from the front panel, or when the telecine has achieved a full stop condition.

Film Type select	Low = 35mm 16 Frms/key			
	High = 16mm 20 Frms/key			
Film Rate select	NTSC:	Low = 24	High = 30	
	PAL:	Low = 25	High = 25	

Figure 0-14: Parallel Remote Control of Film Type and Rate

3.11 OPERATING THE 4025 WITH BARCODED FILM STOCK

Latent edge numbers have been present on motion picture negative film stocks for many years in human readable form. The edge numbering format has been specific to various manufacturers and film stock types. In

1988, Eastman Kodak, in conjunction with the Society of Motion Picture and Television Engineers devised a new edge print that not only standardizes the numbering format, but is also printed as a machine readable barcode. Kodak calls this numbering system KeyKode. Other film manufacturers have adopted this numbering standard and have each given their version a proprietary name. For the sake of clarity we shall refer to all of these implementations as KeyKode.

The 4025 Film Footage Encoder interfaces to external KeyKode readers manufactured by Evertz Microsystems, ARRI, Cinema Products or Research In Motion. Each of these units consist of a bar code reader pickup head, and a decoder device. The pickup head transforms the optical dark and light bar code into electronic signals and is designed 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 a serial link to the 4025. The 4025 Film Footage Encoder automatically 'jams' the edge numbers into the time code user bits or the secondary VITC.

When installing the pickup head on the telecine, an automatic alignment procedure in the 4015 calculates the exact perforation offset between the head and the gate. This calibration procedure must be performed before the 4025 will use the KeyKode information it receives. The 4025 maintains separate head offset values for 16 mm and 35 mm film types for each transfer speed. Once calibrated, the 4025 automatically uses the correct head offset value for your configuration. The head offset calibration is normally only required during installation. A summary of the Head offsets is available using the KK HEAD OFFSET item in the CONFIG drop down menu of the Format menu. (See section 2.13.3 for a full description of the head offset learning process).

3.11.1 Selecting When the Barcode Numbers Update the Edge number Information

Selection of the way in which data received from the KeyKode reader will affect the edge number information is performed using the Format menu displayed on the character generator. This setting is only applicable if the generator is set to one of the **EDGE** or **+ KEYKODE** modes. When KK JAM is set to ONCE, PLAY, or ALWAYS, the KeyKode numbers are read by the bar code reader and inserted with the appropriate offset compensation. The complete KeyKode number may be displayed in the character generator or placed into the secondary VITC. A truncated film bar code number may be placed in the user bits in one of the EDGE modes.

Press the **FORMAT** key to access the Format menu. Using the ← & → keys drop down the FILM menu. Use the ↑ & ↓ keys to highlight the KK JAM menu item and press the **SELECT** key to show the KK JAM sub menu. The currently programmed KeyKode jam mode is shown in reverse video. Press the ↑ & ↓ keys one or more times to select the desired KeyKode jam mode. Press the **FORMAT** or **CLR** keys to exit the format menu, or press the **SELECT** key to return to the FILM drop down menu.

The 4025 permits three different methods of updating the bi-phase based numbers with the barcode data. The KKODE LED on the front panel, shows each time a valid Barcode number is read.

Select **NEVER** to disable automatic data updates from the KeyKode reader. The 4025 will use the bi-phase exclusively to update the edge numbers. The front panel KKODE entry mode may be used to manually enter edge numbers from non-KeyKoded stock. This may also be helpful when transferring stock where a different film edge number (e.g. ACMAID number) than the latent edge number must be used.

When the 4025 is in the Ink number mode, you can only select KKJAM NEVER. To select one of the other KKJ modes you must first take the 4025 out of the Ink number mode by entering a manufacturer's code other than I. See section 0.

Select **ONCE** to accept KeyKode numbers once, when the telecine is at stable play speed (the 4025 LOCK LED will be On), and the bi-phase based numbers disagree with the barcode numbers. After this the 4025 will use the bi-phase to update the edge numbers. This mode is useful for transferring stock which has undesired breaks in the keykode numbering.

Select **PLAY** to accept KeyKode numbers only when the telecine is at stable play speed (the 4025 LOCK LED will be On), and the bi-phase based numbers disagree with the barcode numbers. At other times updating is done from the bi-phase. This mode is useful when transferring uncut camera negative rolls.

Select **ALWAYS** to accept KeyKode data immediately when the telecine is at stable play speed (the 4025 LOCK LED will be On), and the bi-phase based numbers disagree with the barcode numbers. In shuttle speeds the edge numbers will be updated after a pre-settable error window between bi-phase counts and barcode numbers is detected. (See section 3.7.2 for information on how to set the error window.) This is necessary to track the discontinuous edge numbers that would be encountered when searching select take rolls in shuttle. This value shows the amount of error in film frames that the 4025 will allow, (in shuttle modes), between the bi-phase based numbers and the barcode numbers. When this window value is exceeded, the barcode numbers will approximately update the bi-phase based numbers. The bi-phase based numbers will be exactly updated the next time the telecine achieves locked play speed. The default value for the window is 30 frames.

In the three KK JAM modes the bi-phase based numbers take priority and will be updated only when they disagree with the barcode numbers.

3.11.2 How to verify that your KeyKode is Updating the Edge Numbers

When using an external barcode reader it is important to know if the edge numbers being displayed in the 4025 are being updated from the barcodes, or only from the telecine bi-phase. The KK CHECK item on the Format menu enables a visual indicator in the character inserter when the KeyKode is not updating.

Press the **FORMAT** key to access the Format menu. Using the ← & → keys drop down the FILM menu. Use the ↑ & ↓ keys to highlight the KK CHECK menu item and press the **SELECT** key to show the KK CHECK sub menu. The currently programmed KeyKode check mode is shown in reverse video. Press the ↑ & ↓ keys to select the desired mode. Press the **FORMAT** or **CLR** keys to exit the format menu, or press the **SELECT** key to return to the FILM drop down menu.

With **KEYINFO CHECK** the 4025 will change the font of the Key info part of the film edge number window when 4025 detects that the barcode information is missing, and the edge numbers are being updated only by the telecine bi-phase. In the Tiny character size, the Key Info part of the edge number will be shown in inverse video. Barcode missing is detected when no barcode information has been received for the number of feet of film travel set in the CHECK DELAY parameter, or KK JAM is set to NEVER. With **KEYINFO ON** the font of the key info will be the same as the rest of the numbers. With **KEYINFO OFF** the key info will be blanked and only the footage and frames will be displayed. (See section 3.7.3 for information on setting the CHECK DELAY).

It is highly recommended that you operate the 4025 with KEYINFO CHECK

3.11.3 Displaying Status Information from the Film Barcode Reader

The Film Barcode status information display is controlled from the KKSTATS item of the Toolbox DEBUG menu. There are five pieces of information contained in the status line which can be used to verify correct operation of the Film Barcode reader. This display is updated at each barcode read.

PERF:1 ERR:00 SCAN:+00 PULL:C KJ

PERF Shows the perf type (the perf that the barcode reference dot lines up with), of the currently running film stock. This value may change if a splice is encountered or if the 4025's film centering is wrong. On 35 mm film, perf 1 is at the head of the frame, perf 4 is at the tail of the frame. On 16 mm film the perf value is not applicable.

4015

Evertz 4015 users note: The 4025's PERF numbering scheme has been changed from the 4015 so that it conforms to the industry standard head to tails orientation. The on screen graphic display in the Head offset learning procedure accurately shows the KeyKode perf orientation so as to avoid confusion.

SCAN On Rank Cintel flying spot scanners, the SCAN value shows how much the film is moving in the gate due to the effect of Scantrack. When the telecine is first put into the PLAY mode, the **SCAN** value should be approximately 00. When Scantrack is enabled on your Rank Telecine, the **SCAN** value will change gradually, with expected values of less than ±19.

On CCD scanners such as BTS telecines, this value should be relatively constant and should be in the 15 to 18 range when in the locked PLAY condition.

On all telecines, if the SCAN number exceeds ±19, an error in the bi-phase based numbers is likely. 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. (See section 3.10.8).

ERR Indicates the whole frame error between the bi-phase based edge numbers, and the barcode numbers being read. If the installation is correct, the **ERR** value will be 00.

When the **KKODE JAM** mode is set to **OFF**, the error display will continually show the difference between the bi-phase based numbers and the corrected KeyKode numbers. If the KeyKode number of the reference frame is manually entered, the error display can be used to compare the accuracy of the bi-phase, the keykode, or the head offsets.

When the **KKODE JAM** mode is set to **ONCE**, the error should be 00 when the telecine is in Play, and the film has continuous edge numbers. It will be non-zero after a splice is encountered. A **KJ** indicator will appear at the right of the status line should the bi-phase based numbers be updated with a different barcode value.

When the **KKODE JAM** mode is set to **PLAY**, the error should be 00 when the telecine is in Play, and the film has continuous edge numbers. It will be non-zero momentarily when a splice is encountered. A **KJ** will appear at the right of the status line when the bi-phase based numbers are updated with a different barcode value. When the telecine is in shuttle, non-zero **ERR** values are normal.

When the **KKODE JAM** mode is set to **ALWAYS**, the error should be 00 when the telecine is in Play, and the film has continuous edge numbers. It will be non-zero momentarily when a splice is encountered. When the telecine is in shuttle, non-zero values are normal. If the **ERR** value exceeds 30 film frames, the edge numbers will be updated from the barcode reader values. A **KJ** will appear at the right of the status line when the bi-phase based numbers are updated with a different barcode value.

PULL Indicates the film to video pulldown relationship in 24 FPS NTSC transfers. This value is measured at the first film frame of each foot, in video field 2.

The 2/3 sequence creates four types of picture frames, called A, B, C, and D. The 'A' frame is always a f1/f2 picture, the 'B' frame is a f1/f2/f1 picture, the 'C' frames is a f2/f1 picture, and the 'D' frames is a f2/f1/f2 picture. See Figure 0-15.

This indicator shows whether film frame 00 of each foot is A, B, C, or D type. An underscore (_) shows whether this video frame contains a complete picture. The indicators used are show in the following table:

Indicator	Type of Frame Indicated
A	A Frame
B	B Frame first 2 video fields
B	B Frame third video field
C	C Frame
D	D Frame first video field
D	D Frame last 2 video fields

During 30 frame per second transfers in NTSC, and 25 frame per second transfers in PAL, the **PULL** status is blanked.

KJ Indicates when the KeyKode Reader actually updates the bi-phase based numbers.

3.12 CHARACTER GENERATOR CONTROLS

The four arrow keys ↑,↓,←, and→, and the **CHAR GEN ON / OFF** and **MODE** keys, control the display of information in the character generator. The generator time, film key number (KeyKode number), auxiliary reader time (RDR 2 time) and absolute frames data may be displayed in separate positionable windows. Each window may be positioned anywhere on the raster, or turned off. One of three character sizes and four character styles apply to all the windows, and are selectable using the CONFIG drop down menu of the Format menu.

3.12.1 Selecting and Positioning the Individual Character Windows

Press the **CHAR GEN MODE** key to enable the VCG window select mode. All four windows will appear on the character screen, with the window for

the generator 1 Time highlighted. Use the ↑, ↓, ←, → keys to position the generator time window on the screen. Press the **CHAR GEN ON / OFF** key to turn the window on or off. Press the **MODE** key again to select the next window. Use the ↑, ↓, ←, → keys and the **ON / OFF** key to move the window to the desired location and turn it on or off. Select the remaining windows using the **MODE** key until all four windows are where you want them on the screen. Press the **MODE** key one more time or press the **CLR** key to exit the VCG window select mode.

The 4025 can position the characters in the vertical interval of the picture, causing them to 'disappear' or to overwrite the VITC. Caution should be used when placing the characters in the vertical interval.

3.12.2 Positioning the Overall Character Display

In the normal display mode, when none of the windows are highlighted, the four arrow keys (↑, ↓, ←, →) move all the displayed windows by the same relative amount. For example, to move the generator time and KeyKode windows both down by one line press the ↓ key. To move only the Time window down, leaving the KeyKode window in the same place, press **CHAR GEN MODE** key and then press the ↓ key. Press the **CLR** key to return to the normal display mode.

3.12.3 Selecting the Character Size

Selection of the character size is performed using the Format menu displayed on the character generator. Press the **FORMAT** key to access the Format menu. Using the ← & → keys drop down the CONFIG menu. Use the ↑ & ↓ keys to highlight the CHAR SIZE menu item and press the **SELECT** key to show the Character size sub menu. The currently selected character size is shown in reverse video. Press the ↑ & ↓ keys one or more times to select the desired size. Press the **FORMAT** or **CLR** keys to exit the format menu, or press the **SELECT** key to return to the CONFIG drop down menu.

The TINY character size occupies 8 lines per field for each character row. This permits 28 vertical positions on the raster in NTSC or 32 in PAL.

The SMALL character size occupies 16 lines per field for each character row. This permits 14 vertical positions on the raster in NTSC or 16 in PAL.

The LARGE character size occupies 32 lines per field for each character row. This permits 7 vertical positions on the raster in NTSC or 8 in PAL.

3.12.4 Selecting the White or Black Characters and Turning Off the Background

Selection of the desired style of the character display (black or white characters, with or without background) is performed using the Format menu displayed on the character generator. Press the **FORMAT** key to

access the Format menu. Using the ← & → keys drop down the CONFIG menu. Use the ↑ & ↓ keys to highlight the CHAR STYLE menu item and press the **SELECT** key to show the Character style sub menu. The currently selected character style is shown in reverse video. Press the ↑ & ↓ keys one or more times to select the desired style. Press the **FORMAT** or **CLR** keys to exit the format menu, or press the **SELECT** key to return to the CONFIG drop down menu.

3.12.5 VCG Drop Frame Indicator (NTSC Only)

The following special indicators are used between the seconds and frames digits in the character generator to identify non drop frame and drop frame code (NTSC only).

		Example
Non Drop Frame	Colon (:)	01:10:50:20
Drop Frame (NTSC)	Period (.)	01:10:50.20

3.12.6 VCG Film number Pulldown Indicator (NTSC only)

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 composed 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.

A video frame is always composed of a field 1/field 2 sequence, and is defined by a unique time code number. The film frames will not always be in phase with the video frames. With the 2/3 pulldown, the film frames alternate between being 2 video fields only and 3 video field long. The 2/3 sequence creates four types of picture frames, called A, B, C, and D. Figure 0-15 shows the relationship between the time code, video and film frames.

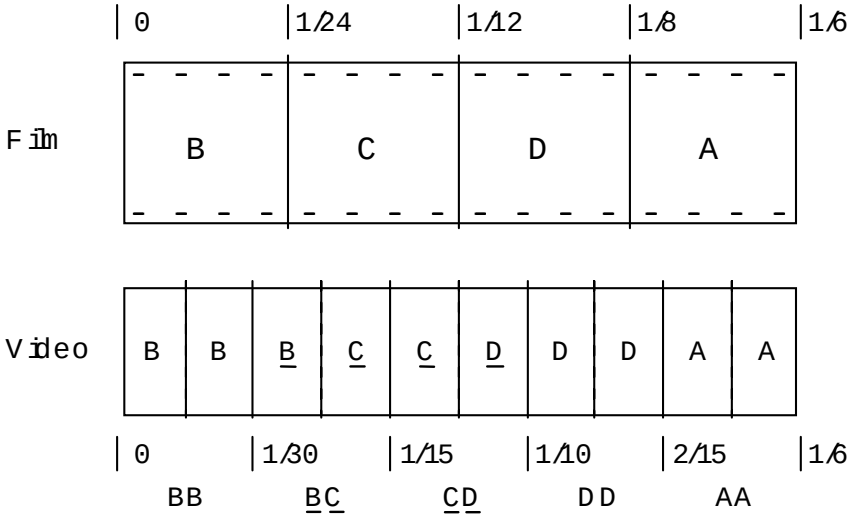

Figure 0-15: Film to Video Relationships

The 'A' frame is always a f1/f2 picture, the 'B' frame is a f1/f2/f1 picture, the 'C' frames is a f2/f1 picture, and the 'D' frames is a f2/f1/f2 picture.

During 24 frame per second transfers in NTSC, a pulldown indicator is added to the right of the film frame numbers. This indicator shows whether the transferred frame is A, B, C, or D type. An underscore (_) shows video frames that contain two different film frames. The indicators used are shown in the following table:

Indicator	Type of Frame Indicated
A	A Frame
B	B Frame first 2 video fields
B	B Frame third video field
C	C Frame
D	D Frame first video field
D	D Frame last 2 video fields

During 30 frame per second transfers in NTSC, and 25 frame per second transfers in PAL, the pulldown indicator is blanked. The pulldown indicator is also blanked in 24 frame per second transfers when the telecine is not in normal run speed.

In 30 frame per second NTSC transfers or 25 frame per second PAL transfers the field dominance of the transfers will affect the film frame numbering. In field 1 dominant transfers, where the film frame changes at the beginning of the video frame, the timecode and film numbers should both update together in field 1 of the video. In field 2 dominant transfers, where the film frame changes at the beginning of video field 2, the timecode numbers will change in field 1 of the video, and the film numbers will change in field 2.

3.12.7 VCG Film Sequence Lock Indicator

When film edge codes are displayed, a plus sign (+) is used between the feet and frame numbers to indicate when the telecine has achieved a stable play speed and the 4025 has properly locked onto the transfer sequence.

3.12.8 Counting Sequence Error Indicator

When the Engineering DIP switch is ON, an asterisk (*) is used between the seconds and frames digits to indicate when the timecode burn-in does not follow the expected sequence of numbers. An asterisk is used between the footage and frames digits of the film edge number display to indicate then the film frame burn-ins do not follow the expected sequence.

3.12.9 Remote control of Character Generator Windows and Status Screen

Some of the common character generator functions cannot be operated with a GPI trigger or remote switch connected to the Serial I/O connector of the 4025. These inputs are internally pulled to +5 volts and may be grounded to pin 6. The Toolbox software parameters VCG GPI menu item allows you to select from one of several methods of VCG remote control.

See section 3.7.8 for information on how to configure the VCG remote control inputs.

The chart below summarizes the operation of the VCG remote control inputs. An X on the chart indicates that this action is ignored.

Pin	Input Name	Action	Software Toolbox Menu Setting				
			OFF	TOGGLE	EDGE ↓OFF	EDGE ↓ON	LEVEL
1	Master VCG	↓	X	Master Toggle	Master On	Master Off	X
		Low	X	X	X	X	Master Off
		↑	X	X	Master Off	Master On	X
		High	X	X	X	X	Master On
3	Generator time	↓	X	Gen Tm Toggle	Gen Tm On	Gen Tm Off	X
		Low	X	X	X	X	Gen Tm Off
		↑	X	X	Gen Tm Off	Gen Tm On	X
		High	X	X	X	X	Gen Tm On
7	Reader 2 time	↓	X	Rdr 2 Tm Toggle	Rdr 2 Tm On	Rdr 2 Tm Off	X
		Low	X	X	X	X	Rdr 2 Tm Off
		↑	X	X	Rdr 2 Tm Off	Rdr 2 Tm On	X
		High	X	X	X	X	Rdr 2 Tm On
2	KeyKode	↓	X	KeyKode Toggle	KeyKode On	KeyKode Off	X
		Low	X	X	X	X	KeyKode Off
		↑	X	X	KeyKode Off	KeyKode On	X
		High	X	X	X	X	KeyKode On
9	Status	↓	X	Status Toggle	Status On	Status Off	X
		Low	X	X	X	X	Status On
		↑	X	X	Status Off	Status On	X
		High	X	X	X	X	Status Off
	Front Panel VCG On/Off key		Enabled	Enabled	Enabled	Enabled	Disabled

Figure 0-16: Summary of VCG Remote Control Functions

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4. OPTIONAL SOFTWARE

4.1. ARRI FILM IDENT INTERFACE

4.1.1. Hardware Requirements

The following software versions are required:

631: DC31M2.M
615: TG15C2.D (contains TG15C2.N and TG15C2.P)
611: JR11L2.D (contains JR11L2.N and JR11L2.P)

The following jumpers must be configured specially:

611 J5 must be set to the Ext. Sync position (to the right) in order to transfer the Sync from the ARRI timecode to the 615 board.

4.1.2. Connecting the ARRI Film Ident System.

Follow the directions in the 4025 manual for connecting the KeyKode reader portion of the Film Ident system. These are contained in section 8.4.2 of Chapter 8.

Connect the timecode output from the Film Ident System to the LTC input of the 4025. The Film Ident system timecode output is unbalanced, and should be connected to pin 2 of the LTC input on the 4025. Set the READER ASSIGNMENT to RDR1: LTC RDR2: VITC using the READER ASSIGN menu item of the On screen program menu. When valid code is coming in to RDR1, the RDR1 code LED will be on. If you remove the front panel of the 4025, there are two additional indicators which will help determine the presence of ARRI code. The left LED on the 611 board will be ON when code is coming in and is being properly decoded by the LTC reader. The left LED on the 615 board will be flickering when the ARRI code is being processed by the 615.

The incoming code is assumed to be at the same speed as the film transfer rate setting of the 4025. This means for films transferred at 25 frames per second, that the timecode frames will be numbered from 0 to 24, etc. (i.e. film was shot at 25 FPS)

4.1.3. Generator modes

Two new modes of the generator have been added. They are ARRI EDGE and ARRI RDR2 + KEYKODE, and are accessed using the GEN ASSIGN menu of the Format menu.

In the ARRI EDGE mode, the timecode from the Film Ident system is placed in the generator time bits and the truncated Keykode numbers are placed into the user bits of the LTC and primary VITC. Secondary VITC is

turned off. In the ARRI RDR2 + KEYKODE mode, the timecode from the Film Ident system is placed in the generator time bits and the time data from RDR2 (The VITC reader) are placed into the user bits of the LTC and primary VITC, and the Full Keykode is placed in the secondary VITC. Insertion of the ARRI timecode into the generator time is identical in both modes.

The timecode is read from the Film Ident systems using RDR1 (assigned to the LTC reader). These numbers are adjusted for the head offset (KK head offset & ARRI offset). The compensated timecode numbers are backed up with bi-phase and rate converted to the video transfer rate (in 24 frame NTSC transfers) before being inserted into the time bits of the generator.

An ARRI JAM control permits the generator time numbers to be updated either from the Film timecode or only from bi-phase. When the generator numbers are being updated by bi-phase only, the GT symbol beside the generator timecode character window will be in inverse video. When the generator numbers are being jammed to the ARRI timecode, the symbol will be normal. When in one of the ARRI modes, press the JAM key to enable ARRI JAM (the JAM LED will be ON). Press the JAM key again to disable ARRI JAM and update the generator time numbers from bi-phase only. (the JAM LED will blink). Note that the GEN ASSIGN will still be set to one of the ARRI modes even though the time numbers are being updated by bi-phase only.

4.1.4. Additional ARRI code status displays.

Using the KK STATS Toolbox menu item of the 4025, the KeyKode status display can be enabled. To accomplish this press SHIFT + FORMAT, select the DEBUG drop down menu and the KK STATS item. Turn KK STATS ON. When the 4025 is operating in one of the ARRI modes, the KK STATS will contain an additional line, known as the ARRI STATS, which is necessary to determine the accuracy of the installation. The ARRI STATS contains the following information:

APERF: 1 AERR 00 ASFERR -02 AJ1

APERF is an internal register used in the ARRI timecode offset calculations.

AERR is the whole frame error between the bi-phase based Film timecode numbers, and the numbers being read from the Film Ident system.

ASFERR is the partial frame error between the bi-phase based Film timecode numbers, and the numbers being read from the Film Ident system.

AJ1 Is an optional display that occurs when the bi-phase based numbers re-jam to the numbers being read.

AJ1 means that differences in the time numbers caused the re-jam

AJ3 means that differences in the user bits caused the re-jam
- (minus sign) means that ARRI Jam is Off.
? means that ARRI timecode is missing.

4.1.5. Setting the head offset

The ARRI timecode reader head contains both the Timecode and Keykode sensors, and is mounted on the telecine several frames before the film enters the gate. There are two settings in the 4025 which are used to compensate for the head offset. This could be expressed as follows:

TC Offset = KK Head Offset + ARRI Offset

The KeyKode reader head offsets are also used adjust the nominal timecode head offset. As such, there are separate Keykode head offsets maintained for each film gauge and transfer rate supported by the 4025. (See section 3.5.4 for information on calibrating the KeyKode head offset).

The KeyKode head offset should be set before proceeding, as it is used for both KeyKode and film timecode offset calculations.

Another register, known as the ARRI OFFSET is accessible from the front panel. When the 4025 generator is in one of the ARRI timecode modes, the ARRI OFFSET register is accessible by pressing the OFFSET key on the front panel. This register is a measure of the difference in position between the Keykode, and timecode sensors. There is one ARRI offset value for 16mm film type and another for 35mm film type.

To check the accuracy of the timecode head offset, select one of the ARRI modes from the GEN ASSIGN menu. Turn ARRI Jam Off using the Jam key. Park the telecine on a reference frame of film. Enter the film timecode number for the reference frame into the generator time as described in chapter 3 of the 4025 manual. A simple way of identifying the timecode number of the reference film frame, is to use a piece of film that has a timecode smart slate in the picture area. This smart slate should be showing the same timecode numbers as were being used in the film camera. (Note that this method is subject to the accuracy of the smart slate display.)

Turn on the ARRI STATS display (using the KK STATS menu item of the Toolbox) and put the telecine into play. The AERR value should be either 0, 1, or -1. Press the OFFSET key on the 4025 front panel to display the ARRI OFFSET register. Press the vertical arrow keys (↑, ↓) while holding down the SHIFT key to trim the ARRI OFFSET register. As you adjust this register, the AERR value on the ARRI STATS display should become 00. The ideal situation is that the ASFERR value on the ARRI STATS display should also become 00.

4.1.6. Bit vs. 112 Bit reading

The 611 LTC reader in the 4025 needs to be specifically programmed for reading either 80 bit (form B) or 112 bit (form C) type code. To do this, there are two Hot Keys made available. To activate the Hot keys, press the TIME/UB key and the SHIFT key at the same time as the JAM or VITC ON/OFF keys.

TIME/UB + SHIFT + JAM Enable ARRI 112 bit mode
TIME/UB + SHIFT + VITC Enable ARRI 80 bit mode

A message will be displayed on the front panel to indicate if 112 Bit reading mode is enable or not.

4.2. 3 PERF SOFTWARE

4.2.1. Hardware Requirements

The following software versions are required:

631: DC31M3.M
615: TG15C3.D (contains TG15C3.N and TG15C3.P)
611: JR11L1.D (contains JR11L1.N and JR11L1.P)

4.2.2. 3 Perf Numbering

On 35 mm film, the KeyKode numbers change once per foot, or every 64 perforations. There is also a mid-foot KeyKode number which is indicated by a smaller human readable number and a perf offset of 32. In the 4 perf format there are 4 perfs per frame, giving 16 frames per foot or KeyKode number. In the 3 perf format there are 3 perfs per frame giving 21 1/3 frames per KeyKode number. Thus it takes 3 feet to give a whole number of frames. Evertz and several other manufacturers have agreed on a standard way of numbering the irregular 3 perf footage. The first two feet of the sequence have the Zero frame KeyKode reference dot at the head and centre perfs of the frame respectively and each contain 21 frames. The third frame of the sequence has the reference dot at the tail perf, and contains 22 frames. The drawing below illustrates the numbering sequence used for 3 perf.
.

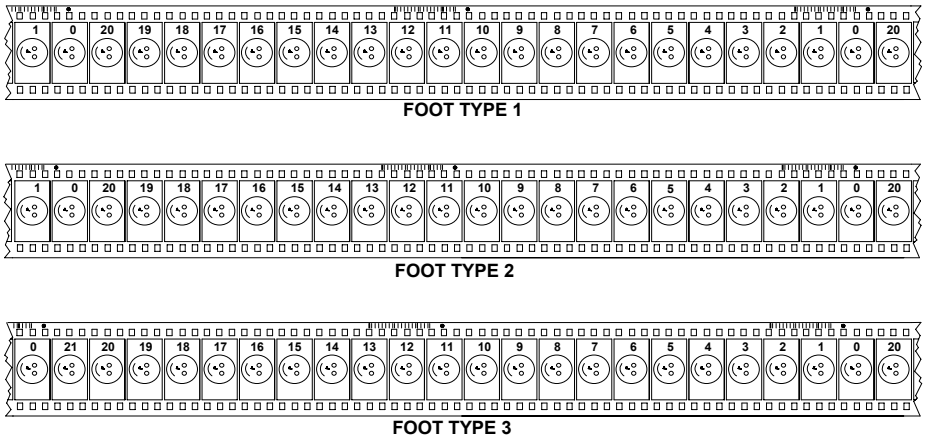


Figure 4-1: 3 Perf Film Numbering

4.2.3. Setting Up The 4025 To Operate In 3 Perf Mode

FILM TYPE
35MM 16 FR/FT
35MM 3 PERF
16MM 20 FR/KEY
16MM 40 FR/FT

A new menu item has been added to the FILM TYPE menu item.

Select 35MM 3 PERF to enable 3 perf operation of the 4025. Select 35MM 16 FR/FT for 4 perf operation.

In 3 perf mode there is additional information regarding whether a frame belongs to foot 1, foot 2, foot 3 that should be encoded into the VITC. In order to accomplish this you must set the GEN ASSIGN to 3 LINE VITC STD. If you use one of the two line modes the information about whether a frame belongs to foot 1, foot 2 or foot 3 is **not** encoded in the VITC.

4.2.4. 3 Perf Indicators

The KeyKode VCG window and the front panel KeyKode display have a special indicator between the prefix and the footage that indicates which foot of the 3 foot sequence the KeyKode number belongs to. This is important because two feet have 21 frames and the third foot has 22 frames. On the VCG, the indicator is a horizontal bar which is at the top for the first foot, in the centre for the second foot and at the bottom for the third (long) foot. On the front panel the indicator is an ↑ for the first foot, a horizontal bar in the center for the second foot and a horizontal bar at the bottom for the third (long). The example below shows the three indicators for both the VCG and front panel displays.

Description	Character Inserter		Front Panel	
	Indicator	Example	Indicator	Example
Foot 1 (21 frames)	Top Bar	KJ123456—7890+00	↑	KJ123456↑7890+00
Foot 2 (21 frames)	Middle Bar	KJ123456–7891+00	Middle bar	KJ123456–7891+00
Foot 3 (22 frames)	Bottom Bar	KJ123456_7892+00	Bottom Bar	KJ123456_7892+00

4.2.5. Manual Entry of KeyKode Numbers

In order to properly identify the film frames when manually entering key numbers it is necessary to enter which foot the frame belongs to in addition to the actual frame number. In 3 perf format, the Key number entry is now a two step process as follows:

Press the **KKODE** key to display the KeyKode register. The **ENTER** and **CLR** keys are used in conjunction with the arrow and numeric keys to set the 3 perf footage and frames. Press the **ENTER** key to recall the last foot type entered. The leftmost digits of the display will show FOOT TYPE, and will be blinking. Use the 1, 2, or 3 numbered keys, or the ↑ & ↓ keys to select the foot type for the frame you are entering. Press the **ENTER** key to proceed to the foot and frames entry. The leftmost digits of the display will show EDGE, and the last entry made will be recalled. Use the numeric keys to enter the correct footage and frame number. Press the **ENTER** key to complete the key number entry. The full keykode number will be displayed with the foot type indicator shown.

Entry of the prefix is the same as for other film formats (See section 3.10.3 for a description of manual prefix entry.)

4.2.6. KeyKode Head Offset Learning

Before proceeding with the head offset learning, you should verify the basic accuracy of the bi-phase based numbers by performing the procedure outlined in the 4025 manual section 2.10.1 for a Rank Telecine or section 2.11.1 for a BTS telecine.

See section 2.12.5 for a complete description of the KeyKode head offset learning procedure. Two new items have been added to the head offset learning menu for 3 perf 24 FPS and 3 perf 30 FPS. Follow the basic procedure outlined in section 2.12.5.

```
TIMECODE    FILM  CONFIG

   NTSC HEAD OFFSET SUMMARY

   35 MM  24 FPS  0820  (  41 FRM)
   35 MM  30 FPS  0840  (  42 FRM)

   16 MM  24 FPS  NONE
   16 MM  30 FPS  NONE

   3PERF 24 FPS   0820  (  41 FRM)
   3PERF 30 FPS   0840  (  42 FRM)

↑↓PICK,SHIFT+SELECT TO CALIBRATE
```

The final screen of the learning has been modified to include a suggested adjustment. ADJ BY: When press **SHIFT+SELECT** to do the learning, the ADJ BY and the ERROR value will show ???? for a few seconds. The ADJ BY value should go to 0000. The partial frame offset (labelled ERROR) shown should correspond to one of three values as shown in the chart below.

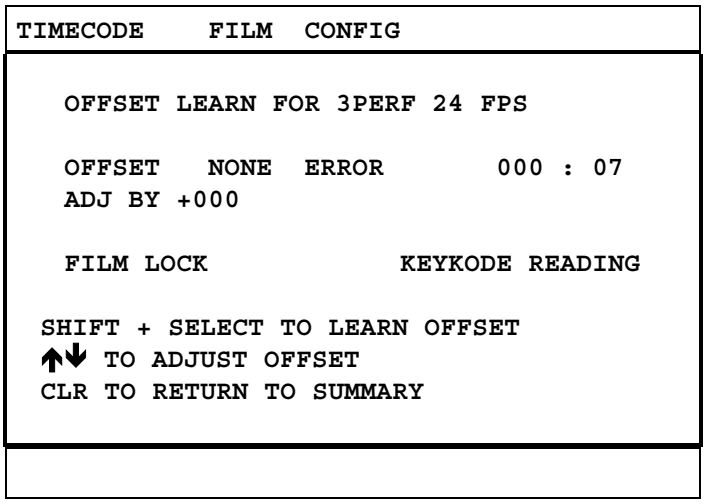
TARGET PARTIAL
FRAME OFFSET

000 :07
000: 20
000: 34

It is normal for the target value to vary by up to +/- 2 counts.

The value shown depends on which perf type your zero frame was, and whether the reference frame's footage number is divisible by 3 or not. It is not important to understand the complex calculations that are being done by the learning routine.

It is however very important to have only the target ERROR values as shown



When the Head offset learning is complete, verify the accuracy of the system by performing the verification tests as outlined in section 2.12.6 of the 4025 manual. When examining the video tape, make sure that you check the numbering for three consecutive feet of film, to ensure that the 4025 is properly identifying the short and long feet. The horizontal bar indicator on the character inserter window will tell you what the foot type is for a given film frame

.

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5. SYSTEM DIAGNOSTICS

A new System Diagnostics mode has been added to aid the user in finding system problems in his installation. A HELP screen with the latest message for each of the modules in the 4025 is displayed on the character inserter when the HELP key is pressed. (This function is not available from any format menu screen.) These messages are designed to give the user additional explanations about system level problems. They are NOT a replacement for the manual. Press the HELP key again or the CLR key to return to clear the help message screen and return to normal operating mode.

The messages display the most recent problem which occurred in the module, and are only reset when they have been viewed. This enables the user to look at probable causes for problems which may have occurred some time earlier. The message may be hours old or brand new.

When installing the unit, or adding an upgrade, it is recommended that the HELP screen be viewed when the telecine is in STOP. This will help discover possible wiring problems, or mode settings that are mismatched to your current configuration. Transitory problems which may have occurred during power up should be cleared first by viewing the HELP screen. If these problems persist, they will remain in the HELP screen when it is viewed again.

When you are trying to resolve difficulties that only occur in PLAY, (e.g. counting sequence, or KeyKode related problems), view the HELP screen when you first enter PLAY to clear any existing messages. View the HELP screen again before leaving PLAY mode to display the messages related to PLAY speed functions.

The following sections outline the current messages that you may find for each module, and give a brief explanation of the problem, and what should be done to correct it.
note

Note that although some messages may appear similar for different modules, the interpretation of them may be different, depending on the module generating the error message.

5.1. HELP MESSAGES

General Messages

NO NEW PROBLEMS	Indicates the 615 message has been reset and no further problems have been detected.
GENLOCK MISSING	Video is missing from PGM IN, (GENLOCK LED on front panel is actually the video reference for the 613 card).
NOVRAM 1ST BIRTHDAY	The Non-volatile memory has been reset to factory defaults.
EVCOM RESET	An inter-module communications reset occurred, usually caused by a power on reset of one or all the cards.
STACK RESET	The 615 needed to do some software error prevention - please call us if you get this message.
HARDWARE/SOFTWARE MISMATCH	The 615 has detected the firmware is incompatible with the hardware.
VIDEO STD SWITCH PROBLEM	The 615 was unable to switch video standards.
NOVRAM RETRY COUNT EXCEEDED	The nonvolatile memory was unable to be programmed
TIC COLLISION	Please call us if you get this message.
TO: UNEXPECTED INTERRUPT	Please call us if you get this message.
PLL VIDEO LOCK PROBLEM	The 615 has detected an instability in its Phase locked loop and cannot lock to the video reference.

Telecine Related Messages

FRAME PULSE MISMATCH @24FPS	The incoming FRAME or FRID signal does not match the selected rate of 24 frames per second.
FRAME PULSE MISMATCH @30FPS	The incoming FRAME or FRID signal does not match the selected rate of 30 frames per second.
FRAME PULSE MISSING	One or more frame pulses was missed. Either the FRAME/FRID inputs or the PGM VIDEO IN signal (which triggers the signal sampling) may be at fault.
NO-LOCK: SPEED NOT IN ZONE	The bi-phase indicates that the telecine speed is not in the lock zone around nominal play speed.
NO-LOCK: SPEED IS REVERSE	The bi-phase indicates that the telecine is in reverse

SCANTRACK TOO LARGE	The scantrack of the telecine has pushed the bi-phase into the next/previous film frame. This may also be caused by not centering the Film position when new film is loaded on the telecine. (See Section 3.10.8 of the manual).

Counting Sequence Problems

EDGE # CONTINUITY PROBLEM	The edge numbers did not continue in the normal (play speed) counting sequence.
TIMECODE: RE-JAMMED	The timecode had to be re-jammed to the reader code, therefore the timecode numbers may have momentarily fallen out of the normal (play speed) counting sequence.
BI-PHASE TIMECODE - SKIP	The bi-phase based timecode has dropped back 1 or more frames out of the normal (play speed) counting sequence.
BI-PHASE TIMECODE + SKIP	The bi-phase based timecode has skipped ahead 1 or more frames out of the normal (play speed) counting sequence.

Timecode Problems

A-TIMECODE: = INVALID	The alternate/audio timecode is invalid.
A-TIMECODE: = PREVIOUS TC	The alternate/audio timecode has repeated a number which usually indicates the timecode reader had an error.
A-TIMECODE: WRONG DIRECTION	The alternate/audio timecode is going in the opposite direction to the bi-phase.
LTC OUTPUT ERROR	The 615 has detected a problem with the LTC output.
WARNING:DROP FRAME CHANGE	The 615 has detected a change of drop frame mode when it is jam synced to RDR 1.

Improper Setups

35MM KK MISMATCH 16MM MODE	The incoming 35mm KeyKode data does not match the selected 16mm mode.
16MM KK MISMATCH 35MM MODE	The incoming 16mm KeyKode data does not match the selected 35mm mode.
16MM KK MISMATCH 16(40)MODE	16mm KeyKode should be used with 16(20) mode and not 16(40) mode.
UNKNOWN KK TYPE	An unknown KeyKode data type has been received. The 4025 only accepts KeyKode numbers which physically occur on the film. Interpolated values are not accepted.
35MM/24FPS HEAD OFFSET ZERO	The head offset for 35mm 24fps has not yet been initialized.
35MM/30FPS HEAD OFFSET ZERO	The head offset for 35mm 30fps has not yet been initialized.
16MM/24FPS HEAD OFFSET ZERO	The head offset for 16mm 24fps has not yet been initialized.
16MM/30FPS HEAD OFFSET ZERO	The head offset for 16mm 30fps has not yet been initialized.

KeyKode Related Messages

KK JAM: FEET DIFFERS KK JAM: FRAMES DIFFERS KK JAM: KEY INFO DIFFERS KK JAM: PREFIX DIFFERS	Indicates why the KeyKode was used to update the edge numbers.
KEYKODE OFF	Indicates KK JAM = OFF has been selected.
KEYKODE MISSING	Bi-phase is indicating that the telecine is in motion but no KeyKode is being received.
KEYKODE INVALID	An illegal or invalid KeyKode combination has been selected, usually this message is replaced by more specific messages.
RX INTERRUPT OVERLAP	Please call us if you get this message.
RX UNEXPECTED INTERRUPT	Indicates an unexpected receive interrupt has occurred on the KeyKode serial port.

KeyKode Reader Communications Problems

SERIAL: FRAMING/OVERRUN ERR SERIAL: PARITY ERROR SERIAL: RECEIVE TIMEOUT 1 SERIAL: RECEIVE TIMEOUT 2 SERIAL: UNIDENTIFIED CMD	Indicate problems with the serial input data from the KEYKODE reader. These include parity/baud problems and message format problems.
SERIAL: J-RECORD ENDING ERR	Usually indicates DigiSync console set to Welch Allyn Mod protocol. Set DigiSync to Welch Allyn protocol (See manual section 8.3.2).

5.2. HELP MESSAGES

General Messages

NO NEW PROBLEMS	Indicates the 631 message has been reset and no further problems have been detected.
GENLOCK MISSING	The CHAR GEN IN video input is missing or disturbed.
NOVRAM 1ST BIRTHDAY	The Non-volatile memory has been reset to factory defaults.
EVCOM RESET	An inter-module communications reset occurred, usually caused by a power on reset of one or all the cards.
STACK RESET	The 631 needed to do some software error prevention - please call us if you get this message.
HARDWARE /SOFTWARE MISMATCH	The 615 has detected the firmware is incompatible with the hardware.
VIDEO STD SWITCH PROBLEM	The 615 was unable to switch video standards.
NOVRAM RETRY COUNT EXCEEDED	The nonvolatile memory was unable to be programmed
VCG OVERRUN	Indicates an timing overrun related to the character inserter. It is normal for this message to occur after accessing the menu system.

KeyKode Related Messages

KK JAM: FEET DIFFERS KK JAM: FRAMES DIFFERS KK JAM: KEY INFO DIFFERS KK JAM: PREFIX DIFFERS	The character generator has updated to the new edge number.
KEYKODE OFF	Indicates KK JAM = OFF has been selected.
KEYKODE MISSING	Bi-phase is indicating that the telecine is in motion but no KeyKode is being received.
KEYKODE INVALID	Reserved for future use.

5.3. HELP MESSAGES

General Messages

NO NEW PROBLEMS	Indicates the 611 message has been reset and no further problems detected.
GENLOCK MISSING	The VITC RDR IN video input is missing or disturbed.
EVCOM RESET	An inter-module communications reset occurred, usually caused by a power on reset of one or all the cards.
STACK RESET	The 611 needed to do some software error prevention - please call us if you get this message.

Time Code Related Messages

LTC FAILED VALIDATION CHK VITC FAILED VALIDATION CHK	The incoming timecode was rejected because the time contained illegal numbers such as hours > 24, minutes > 60 , etc.
LTC FAILED FLAGS CHK VITC FAILED FLAGS CHK	The incoming timecode was rejected because the normally static timecode flags (drop frame, colour frame, binary group, etc.) had changed.
LTC FAILED COMPARE CHK VITC FAILED COMPARE CHK	The incoming timecode was rejected because it differed to much from the previous timecode input.
LTC FAILED WINDOW CHK VITC FAILED WINDOW CHK	The incoming timecode was rejected because it differed to much from the previous valid timecode.
LTC FAILED DATA PARITY CHK VITC FAILED DATA PARITY CHK	The incoming timecode was rejected because the parity checks failed (this is a special mode, not normally available).

LTC MISSING VITC MISSING	Valid timecode has not arrived within a reasonable time.
LTC PHASE LEADS VIDEO	Warning: the incoming LTC phase leads the reference video (the video on the VITC IN BNC) excessively.
LTC PHASE LAGS VIDEO	Warning: the incoming LTC phase lags the reference video (the video on the VITC IN BNC) excessively.
VITC FAILED SYNC BIT CHK	The incoming timecode was rejected because the embedded sync bits were not correctly detected. This may also occur when no VITC is present on the incoming signal and the video picture has triggered the VITC reader hardware.
NO VITC SUBMODULE	VITC reading has been selected but there is no VITC reader submodule present on the 611.
TIMECODE MISSING	There is no timecode present.
TIMECODE NOT ENABLED	Neither VITC, LTC or AUTO is enabled.
LTC COUNT MODULO ERROR	The incoming time code had a maximum frame count that was unexpected.

5.4. RAM VIEW

The RAM VIEW function is used to display the internal data memory (RAM) in the character inserter. This display is used to aid in troubleshooting problems in the field and should not be used during normal operation or maintenance procedures. To make use of RAM VIEW you need to have information on which RAM locations to view. This information is available from Evertz technical support staff if you are experiencing difficulties.

The RAM VIEW item of the Toolbox DEBUG menu is used to turn on RAM VIEW mode. (See section 5.5 for a full description of the DEBUG menu). When you exit the Toolbox menu with RAM VIEW turned ON, a special window appears at the top of the screen which indicates that you are in RAM VIEW - ENTRY MODE. A RAM view display is located near the bottom of the screen which indicates the information as follows:

```
          S P AA:DDDDDDDD
S    =    Board slot: 0=611, 1=615, 2=631
P    =    Page:  P =External RAM page
          Page : '-' =internal RAM page
AA   =    Starting address of the RAM being displayed
DDDDDDDD  =  4 bytes of  data
```

In RAM VIEW - ENTRY mode, the normal operation of the keyboard is suspended. The following keys allow you to change the data being displayed.

The Front panel display shows key scan codes, Key Down timer, and the Key Repeat timer

← & → select slot :0=611, 1=615, 2=631, or Off
↑ & ↓ change starting address by 1
SHIFT + ↑ & ↓ change starting address by 10 Hex
SELECT toggles between internal and external RAM data spaces (615 and 631 only)
SHIFT + * will toggle in and out of RAM VIEW ENTRY MODE when RAM VIEW is enabled
When RAM VIEW is enabled, and not in RAM VIEW - ENTRY mode, all the normal keyboard functions operate normally.

5.5. NOVRAM DEBUG

The Nonvolatile memory (NOVRAM) diagnostic display is shown in the character inserter. This display is used to aid in troubleshooting problems in the field and is not used during normal operation or maintenance procedures. The NOVRAM VIEW item of the Toolbox DEBUG menu is used to turn NOVRAM DEBUG on and off.

Proceeding with the NOVRAM VIEW will allow the user configured parameters including KeyKode head offsets, horizontal char size, user configurations, etc. to be overwritten. PROCEED WITH CAUTION!!!

When you have selected the NOVRAM VIEW item of the DEBUG menu, use the → key to enter the NOVRAM VIEW mode. In this mode a menu page appears showing the keystrokes that are active.

```
          NOVRAM DEBUG

  1 - VIEW PG    1 - VIEW PG 2
  3 - VIEW PG    3 - VIEW PG 4
           SHIFT +
  0 - CLR TO 00  5 - SET TO FF
  6 - DEFAULTS   7 - REBOOT

   * WARNING - SOME KEYS WILL
      ALTER 4025 PARAMETERS
 PRESS KEY FOR DESIRED FUNCTION
```

1, 2, 3, or 4 view one of the four NOVRAM pages.

The following keys may overwrite configuration data. PROCEED WITH CAUTION!!!

SHIFT + **0** clears all NOVRAM locations to 00
SHIFT + 5 sets all NOVRAM locations to FF.
SHIFT + 6 resets all NOVRAM locations to the factory defaults, and displays page 1 of the NOVRAM.
SHIFT + 7 re-initialize all the 4025 RAM parameters to the new NOVRAM values.
CLR exit NOVRAM VIEW mode and return to the Toolbox menu.

If you have changed any NOVRAM locations it is recommended that you exit the NOVRAM view function by pressing SHIFT + 7 to reinitialize the 4025.

5.6. HARDWARE DEBUG DISPLAY SCREEN

The Hardware Debug display screen allows viewing of hardware and operating system related parameters. The new display is accessed by pressing the **SHIFT + TIME/UB + STATUS** keys. This will bring up a full screen video display titled “4025 HARDWARE DEBUG SCREEN”. This screen shows the following items:

DIP SW is a hexadecimal representation of the status of the switches located at the front of each module. The right digit pair shows the settings for the 613 board, the centre digit pair shows the settings for the 615 board, and the left digit pair shows the settings for the 611 board. The left digit pair will show dashes, since the 611 does not have switches in this application.

INPUTS is a hexadecimal representation of the status of the parallel inputs to the 611, 615 and 613 cards, with the right digit pair showing the status for the 613 board, and the centre digit pair showing the status of the 615 board parallel inputs.

BIPHASE is a hexadecimal representation of the actual biphase hardware counter in the 4025. The value displayed has different meanings depending on the mode of the telecine. The number shown is actually 4 times the tach rate of the telecine (in decimal notation) (i.e.: If your telecine has 10 pulses per film frame tach rate, then the counter will change by 40 decimal (28 hex) counts for every film frame).

In STOP the value shown is the actual hardware count. The actual number is probably not of importance, as it will depend on what value it contained when the film was loaded onto the telecine. However, this display is useful for detection of gained or missing biphase pulses. To use this feature, make a note of the value when the telecine is parked at a reference frame. Running the telecine forward or reverse by a specific number of frames (or feet) and checking the value again when the telecine is stopped will enable the user to see if the biphase counter is accurately tracking the film position on the telecine. The counter rolls to 0000 after 4095.

In PLAY or SHUTTLE modes, the actual number would be changing so rapidly that it would not provide any useful information. Therefore, the number shown is the number of biphase pulses received per nominal film frame (1/24th of a second at 24 FPS, etc.). A star (*) will be displayed beside the number to indicate that the delta value is being displayed. The normal value at PLAY speed will be * 28 (hex = 40 decimal) for telecines with 10 pulse per frame biphase outputs.

EV-RST contains communications codes for the three processors in the 4025. You may be asked for this value by an Evertz technical support person.

EV-SAV contains initial communications codes for the three processors in the 4025. The high nibble shows the EVCOM reset code. You may be asked for this value by an Evertz technical support person.

615 PLL is a hexadecimal measurement of the 615 phase lock loop. The nominal value for PAL is 9600 and for NTSC is 7D00. You may be asked for this value by an Evertz technical support person.

HIGHWTR this value shows the amount of RAM (in hex) for each card which has never been used. You may be asked for this value by an Evertz technical support person.

5.7. ENGINEERING SHORTCUT KEYS

The following engineering shortcut keys are implemented in 4025 software version 930517. These functions are activated by pressing the TIME/UB key and the SHIFT key plus the indicated key:

0 Reset Character windows to default position, turns on all windows
1 Reset Horizontal Char size to the minimum
2 Reset 631 (right) board to factory defaults, and reboot
3 Reset 615 (centre) board to factory defaults, and reboot
4 Reset all boards to Factory defaults, and reboot
5 Reserved

6	Reserved
7	Freeze VCG updates
8	Display entire small character font
9	Display entire tiny character font
HELP	Reboot
STATUS	Hardware Debug Display

5.8. FRONT PANEL LED DIAGNOSTICS

To perform a Lamp test of the front panel LED's:

1. Turn on DIP switch #7 on the 631 board (Advanced Diagnostics Switch)
2. During power up, all the front panel LED's will be illuminated, and the microprocessor RAM tests will be done.

To return to normal operating mode turn DIP switch #7 Off and power the 4025 up again.

5.9. FRONT PANEL KEYBOARD DIAGNOSTICS

The following procedure should be used to verify that all of the Front panel keys are working as expected.

1. Using the Shift+Format keys enter the Engineering toolbox menu. For a full description of the Engineering toolbox see section 3.2.1.
2. Select the RAM view function from the Debug menu.
3. Turn on RAM view.
4. The Front panel display will show three memory locations related to the keyboard. The digit pair on the left of the display shows the SCAN code for each key when it is pressed. The table below shows the SCAN code for each key.

LTC GEN (NUM 0)	01	←	15
VITC GEN (NUM 1)	02	↓	16
* (NUM 2)	03	→	17
ABS FRMs (NUM 3)	04	HELP	18
OFFSET (NUM 4)	05	STATUS	19
KEYKODE (NUM 5)	06	CONFIG	20
RDR 1 (NUM 6)	07	VCG MODE	21
RDR 2 (NUM 7)	08	SELECT	22
EVENT 1 (NUM 8)	09	↑	23
EVENT 2 (NUM 9)	10	FORMAT	24
CLEAR	11	JAM	25
ENTER	12	VITC	26
TIME/UB	13	GEN HOLD	27
SHIFT	14	VCG ON OFF	28

5. To exit RAM view mode press **SHIFT+***. Then select the RAM view item from the tool box menu and turn it off.

5.10. MODULE LED DISASTER CODES

In the event that a fatal error is detected on one of the modules, the LED's that are on that module will blink in a regular pattern. The repetition pattern of the blinking is a code which indicates the nature of the error. You may be asked for this information from an Evertz Technical Support person.

5.11. VCG RAM DUMP

During some field diagnostics you may be asked by an Evertz Technical support person to do a RAM Dump to the character inserter, to print it out using a video printer and fax it to Evertz. The exact content of this information is not important to the user but only to Evertz Engineering personnel. To perform the VCG RAM Dump, press the **TIME/UB + SHIFT + FORMAT** keys. A full screen display showing the 631 internal RAM values appears. When you have printed this screen using a video printer, press the SELECT key to display the next screen. When the 4025 has accumulated all the values for the 615 board it will prompt you to PRINT and SELECT. After video printing, press the SELECT key to proceed to the 611 display. When it is ready, print out the screen and press the SELECT key to return to normal operating mode.

Figures:

6. TECHNICAL DESCRIPTION

6.1. OVERVIEW

The 4025 is built up from three EV-BLOC 610 series modules. Each of these modules is equipped with high speed serial communications hardware and a powerful protocol designed specifically for the EV-BLOC system, which permits data interchange between different modules within the 4025.

During servicing, it will be necessary to remove the front panel to gain access to the modules located inside the 4025. This can be accomplished in a few seconds by turning the quick release fasteners, located at the left and right hand sides of the front panel, several turns counter clockwise. The front panel assembly pulls off showing the three main circuit modules that comprise the 4025. The front panel assembly should be placed on the work bench, and should not be left suspended by the ribbon cable, as this may cause damage. It will be necessary to remove the grounding strap from the left side of the front panel assembly before it can be fully detached.

To replace the front panel assembly, attach the grounding strap to the mounting screw on the left side of the display board, making sure that the ground lug does not come into contact with the live circuitry on the display board. Slide the front panel assembly into place, and turn the quick release fasteners clockwise until they are firmly secured.

Figure 6-1 shows a block diagram of the 4025's internal construction. The module on the left is the LTC/VITC time code reader (611), the one in the centre is the LTC/VITC generator (615), and the one on the right is the video character inserter (631).

All communications within the 4025 are supervised by the 631 character inserter. The function of the system controller is to establish the location (i.e.. slot number) and type of each module installed in the frame, and to schedule the use of the serial bus by other modules. During normal operation, installation or removal of a module causes the bus controller to re-configure the system and add or delete the module from bus scheduling. In addition, the display/keypad circuit card is connected to the 631 character inserter module on the 4025.

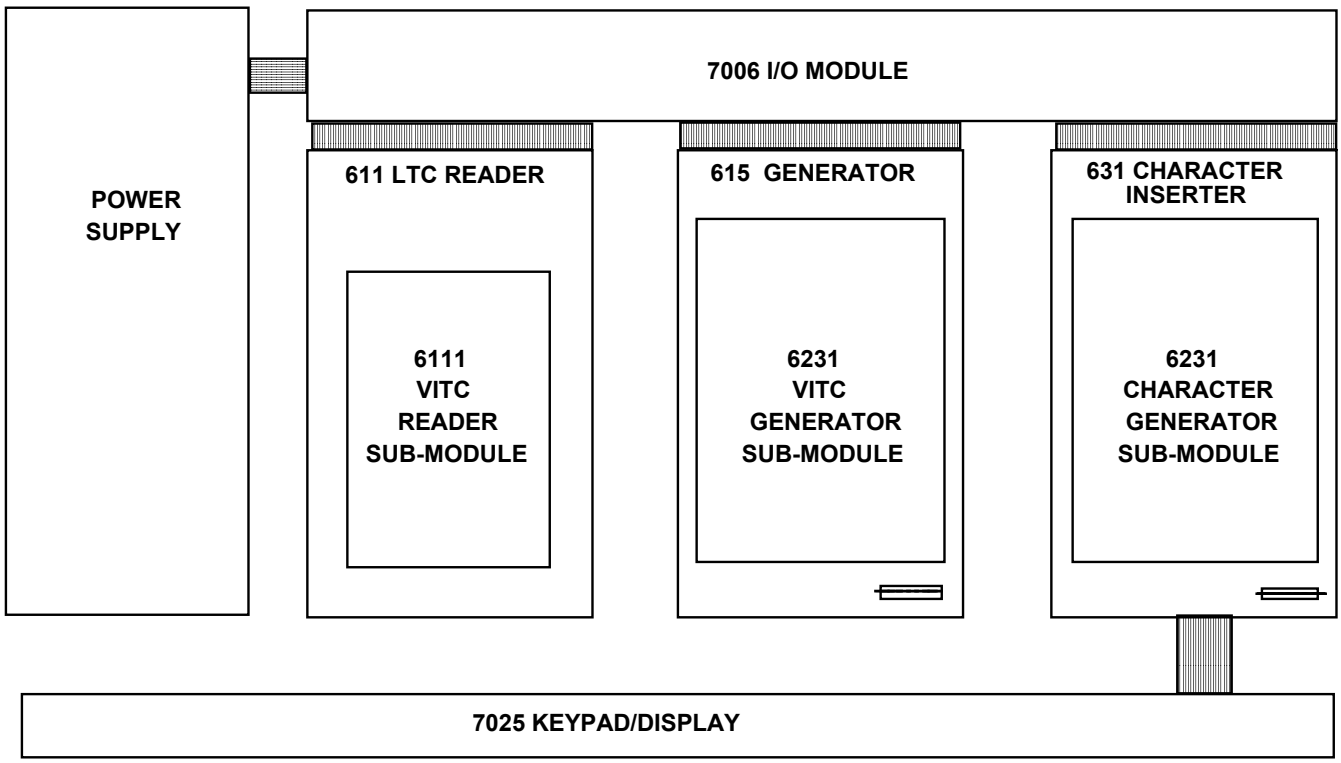

Figure 6-1: Inside View

The 615 LTC/VITC generator is comprised of a 6150 Base Processor board and a 6231 VITC generator submodule. The 615 interfaces to the telecine bi-phase and frame pulse and provides the interface for the external KeyKode reader. The 615 generator is capable of locking to the 2 field RS-170 (4 field PAL) video standards. A high impedance input tapped off the video input loop is used to provide correct framing for the 4025's built-in generator.

The 611 LTC/VITC reader module contains a full speed (1/30 to 70 times play) LTC reader, and a VITC reader which can read at speeds from still frame to in excess of 40 times play speed. The powerful MCU firmware automatically selects valid code from either source and provides accurate time code reading from still frame to 70 times play speed.

The recovery of recorded LTC time code at other than play speed has always presented some degree of difficulty, particularly with low end 3/4" recorders lacking a separate address track. The high speed LTC reader in the 611 employs sophisticated input conditioning and clock/data separator circuits to reliably recover LTC over the full shuttle and wind speed range of most VTR's.

The VITC reader sub-module contains a full wind speed (still to over 45 times play speed) VITC reader, designed for use with non time base corrected video signals. Although the use of time base correctors will enhance the recovery range of the VITC reader, the amount of improvement is dependent on the type of TBC and transport being used.

The module contains all the necessary video processing circuits and therefore, requires no external signals other than the video signal itself. Recovered VITC data is transferred to the companion LTC reader module for validation and further processing. The MCU presents valid data from whichever source it selects, to the 615 and 631 modules via the EV-COM bus.

The 631 module is comprised of a 6120 Base Processor board with a 6231 Character Generator Submodule. The 631 video character inserter provides white or black characters keyed into the video with or without a contrasting background. Character size and raster position are software selectable. The character display may be used to show generator time, user bits, film edge codes (KeyKode), or absolute frames from a reference. Each of the windows can be turned on and off and positioned independent of each other.

When displaying time recovered from a VITC source, the field number sequence will be displayed to the right of the frames display. When the data being read was recorded in the non colour frame mode the field number sequence will be 1,2,1, etc. (1,2,3,4,1, etc. for PAL). When the reader data was recorded in the colour frame mode, the field number sequence will be 1,2,3,4,1, etc. (1,2,3,4,5,6,7,8,1, etc. for PAL).

When displaying film edge numbers, a telecine lock flag indicates when the 4025 has properly locked on to the telecine transfer sequence at Play speed. In 24 frames per second transfers, a film sequence character is displayed, indicating where in the 3/2 sequence a particular frame belongs.

The character inserter is also used for the on Screen Programming menus which are used to set up the various operational modes of the 4025.

6.2. DIAGNOSTIC LEDs

Each of the main circuit cards inside the 4025 has one or more diagnostic LED indicators to aid in troubleshooting, should it become necessary. These LEDs are only visible with the front panel removed.

6.2.1. Power Supply LEDs

These appear to the extreme left of the interior of the 4025. From front to back they indicate the presence of +8V,-8V and +9V (which runs the 5V regulators for each board).

6.2.2. Reader LEDs`

The LTC/VITC reader module pair is located in the left slot of the 4025. There are two LEDs located at the front of this module.

LTC The left LED indicates LTC is being read.

VITC The right LED indicates VITC timecode being read.

6.2.3. Generator LEDs

The LTC/VITC generator module pair is located in the centre slot of the 4025. There are two LEDs located at the front of this module.

OK The left LED indicates that the microprocessor is operating and that it is communicating with the other modules.

The left LED is also used to indicate the presence of valid KeyKode packets being received from an external KeyKode reader device. The left LED will blink Off each time a keykode data record is received from the external keykode reader device.

GENLOCK The right LED indicates that the generator is properly referenced to the genlock signal when it is On.

The right LED is also used to indicate the presence and correct duty cycle and frequency of the Film Frame Advance pulse from the telecine. If the right hand LED on the 615 module is blinking, or dim, or flickering rapidly, this is an indication that the Frame Pulse input is not satisfactory. See section 2.10.2 or 2.12.2 for information about connecting the film frame pulse.

6.2.4. Character Inserter LEDs

The character inserter module pair is located in the right slot of the 4025. There are two LEDs located at the front of this module.

OK The left LED indicates that the microprocessor is operating and that it is communicating with the reader module.

GENLOCK The right LED indicates that the generator is properly referenced to the genlock signal when it is On.

6.3. LOCATION OF JUMPERS AND SWITCHES

Figure 6-2 to Figure 6-8 show the location and function of the switches and jumpers inside the 4025. The jumper positions marked in **bold** face type are the default settings used in the 4025.

6.3.1. I/O Board Jumpers

J22	Aux I/O Rxd	**Ser**	Configures Aux port (pin 8) for serial receive.
		Par.	Configures Aux port (pin 8) for parallel input
J24	Aux I/O Txd	**Ser**	Configures Aux port (pin 5) for serial transmit
		Par.	Configures Aux port (pin 5) for parallel output
J25	Aux I/O Select	**RS232**	Select Aux port (pin 5) For RS232 Transmit
		+8v	Select Aux port (pin 5) As +8 V DC source for external use. (minimal current draw available!)

J26, J27, J28, J29	Serial I/O Select		4 Jumpers must all be in the same position
		RS232	Set serial I/O port for RS232 operation.
		RS422	Set serial I/O port for RS422 operation.
J30	Pin 5 Select	**RS232**	Selects RS-232 Transmit for Serial port pin 5 (used for computer data logging output)
		+9V	Selects +9V DC on serial port pin 5 to power external devices.
		RS422	Disconnects Serial port pin 5 for use on RS-422 serial ports.
J31	Serial Port Select		Two sets of jumpers selects connections of Aux I/O And Serial I/O ports to 615 and 631 respectively.
	Rxd	**N**	Connects Aux I/O Receive To 615 Module and Serial I/O Port Receive To 631 Module.
		X	Connects Aux I/O Receive To 631 Module and Serial I/O Port Receive To 615 Module.
	Txd	N	Connects Aux I/O Transmit To 615 Module and Serial I/O Port Transmit To 631 Module.
		X	Connects Aux I/O Transmit To 631 Module and Serial I/O Port Transmit To 615 Module.
J32	VCG Out Select	**Loop Out B**	Selects high impedance video input loop and one character generator output.
		Term Char	Selects terminated VCG input and assigns Out A and Out B as outputs.
J37	Parallel Out Select	**4OUT**	Configures pin 4 of parallel I/O port as a general purpose open collector output from 615.
		4IN	Configures pin 4 of parallel I/O port as a general purpose input to 615.

Figure 6-2: 7006 I/O Board Default Jumpers

6.3.2. LTC Reader Main Board Jumpers

J3	Rx	**611**	Selects EV-COM use of MCU serial port
J4	Tx	**611**	Selects EV-COM use of MCU serial port
J5	Ext Sync	Ex.Sync	Connects LTC Sync to Back plane (Req'd for ARRI s/w)
		Open	Disconnects LTC Sync from back plane
J6	Genlock/Tach	**G**	Genlock frame pulse input from back plane
		T	Tach pulse input from Aux I/O connector
J7	Standard Select	**S**	Switchable PAL/ NTSC standard with 27128 EPROM and appropriate firmware.
		O	Single standard PAL or NTSC firmware only

6.3.3. VITC Reader Sub-module Jumpers

J2	VITC Clk	**2X**	Selects higher VITC Clock
		1X	Selects low VITC Clock

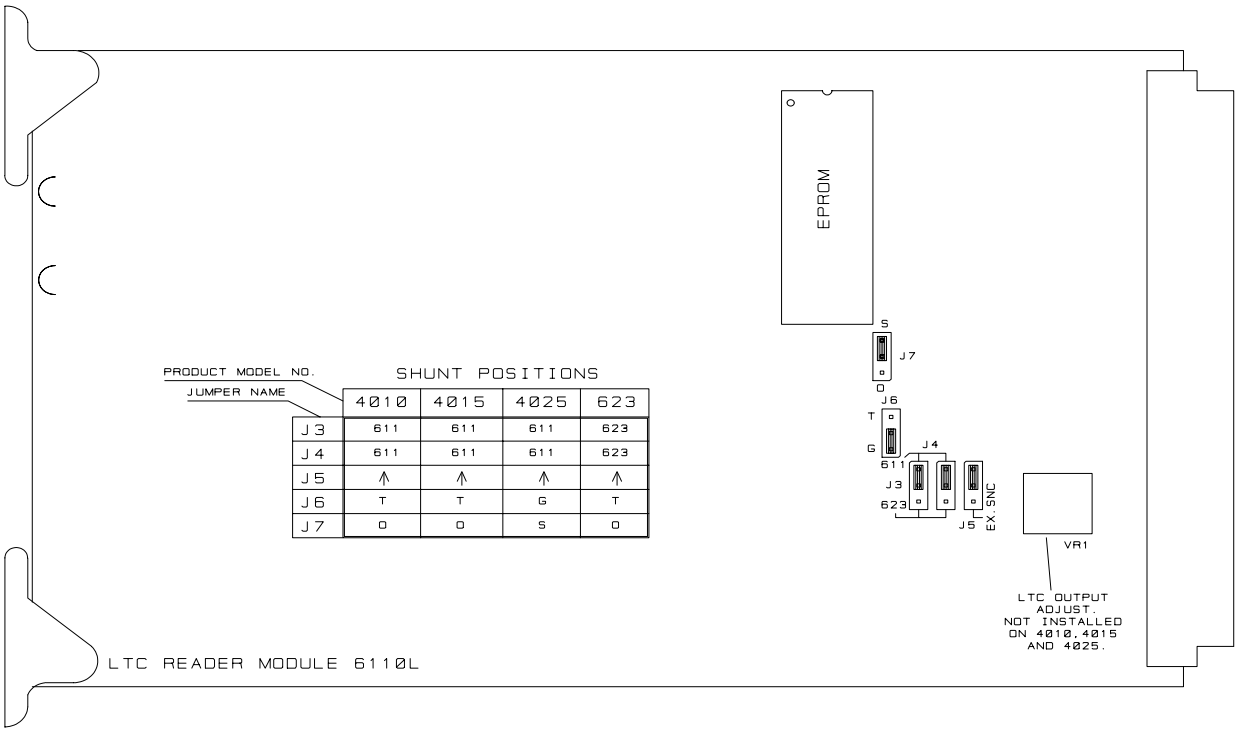

Figure 6-3: 6110 LTC Reader Board Default Jumpers

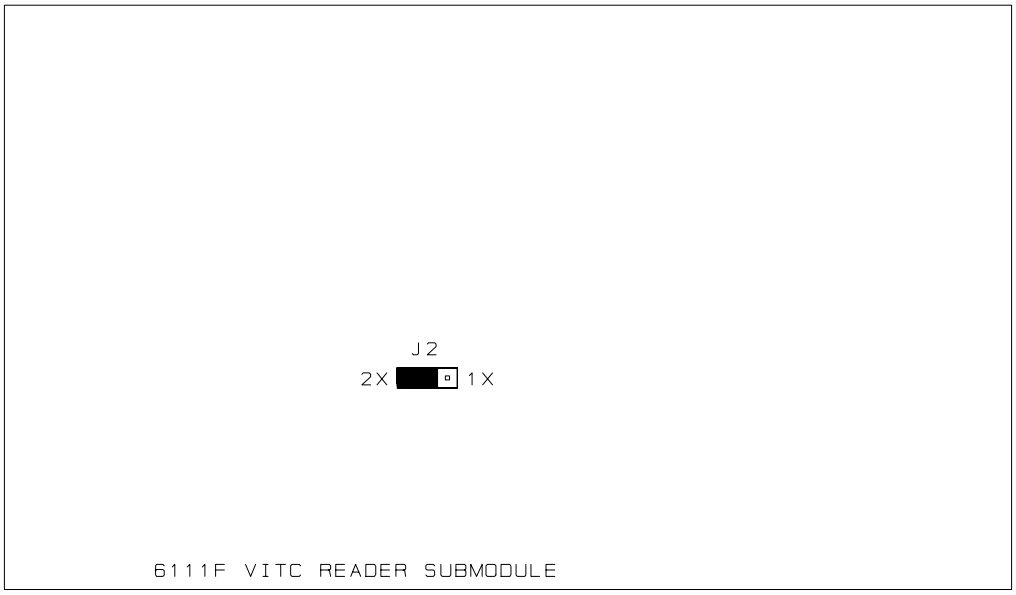

Figure 6-4: 6111 VITC Reader Sub-module Default Jumpers

6.3.4. Film Timecode Generator Main Board Jumpers and Switches

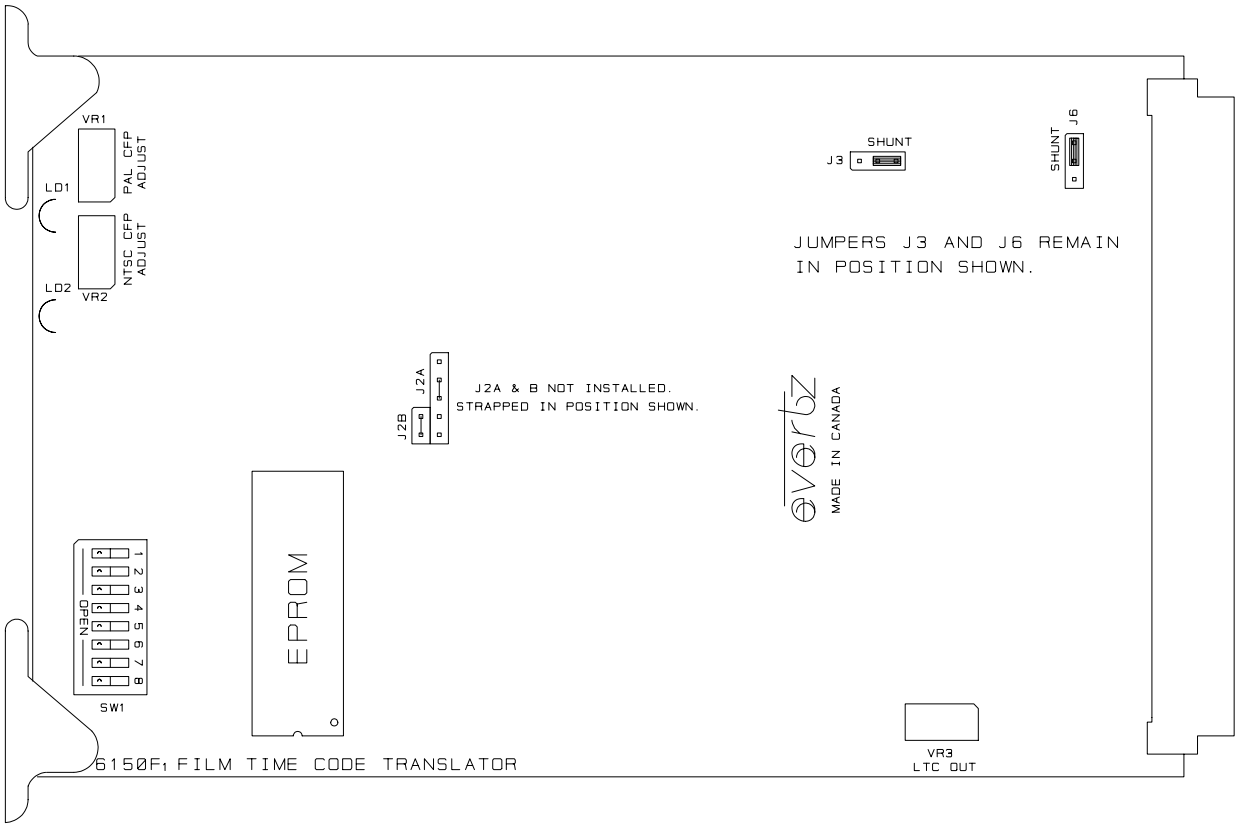

Figure 6-5: 6150 Film Timecode Generator Main Board Default Jumpers

J2A			Future EPROM expansion
J2B			Future EPROM expansion
J3	VITC Video	**To Rear**	DC restorer on sub-module is used for VITC Video
		To Front	DC restorer on main board is used for VITC Video
J6	Gen Lock Source	**To Left**	Program video used as Gen-lock source
		To Right	External Gen lock video used as Gen-lock source

Switch	Name	Normal	Function when Open	Function when Closed
1	Baud Rate	Closed	9600 Baud, 8 bits, no parity	9600 Baud, 7 bits, even parity - Used by most Film Barcode Reader systems
2	KK Disable	Open	Updates from Film Barcode readers are enabled by KK Jam function of programming menu	Updates from Film Barcodes are disabled. All calculations or ERR are displayed. Used for testing Only
3	Enhanced DLO	Open	Permits transmission of enhanced Data Log packets - may cause some compatibly problems with KeyKode logging programs	Disables enhanced Data Log packets - may be required for compatibility with some logging programs.
4	Not used	Open		
5	Ram Dump	Open	Normal	Enables Debug RAM dump on serial I/O port on certain error conditions
6	Parity	Open	LTC Parity disabled	LTC parity enabled Use of parity bit in LTC output may be incompatible with some readers.
7	Pulse Inputs	Closed	No Noise Filter	Improved Noise Filtering
8	3 Perf OPF	Open	Normal	Std and ARRI software - no function 3 Perf software - ignore mid foot KeyKodes.

Figure 6-6: 615 Dip Switch Definitions

6.3.5. Support For Telecine Devices That Do Not Have A Frame Pulse Available.

In order to accurately track the 3/2 pulldown in 24 FPS NTSC transfers, and to track the field dominance of 30 FPS NTSC and 25 FPS PAL transfers, the 4025 requires a 'frame pulse' signal. Some 'flatbed type' telecine devices that use a rotating prism combined with a video camera do not provide a frame pulse output.

To enable the 'no frame pulse operation' of the 4025, set DIP Switch # 7 on the 615 card (center module) to the On position. The Frame LED on the 4025 front panel will be ON all the time.

Do not use AUTO rate detect when you have DIP Switch # 7 turned ON. Select the correct film transfer rate that you are using.

The following limitations apply when operating the 4025 without a frame pulse from the telecine.

The field dominance for 30 FPS NTSC and 25 FPS PAL transfers is assumed to be field 1. That is, the picture content changes at the beginning of field 1 of a video frame.

The pulldown for 24 FPS NTSC transfers will be random. As there is usually no real pulldown of the picture, but rather a blending of pictures as

they change mid-frame, this method will track the film frames to within 1 frame of accuracy.

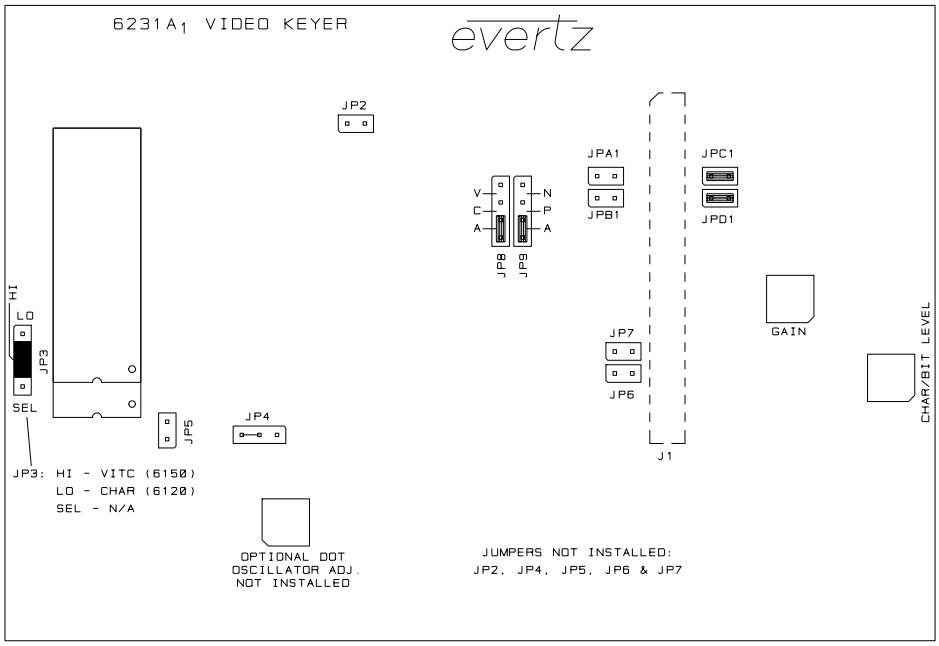

Figure 6-7: 6231 Versions Video Keyer Sub-module Default Jumpers

6.3.6. Video Keyer Submodule Jumpers

JPA1	Digital Key		Install for Digital Video Out
JPB1	Digital Key Fill		Install for Digital Video Out
JPC1	Analog Key	**Installed**	Install for Analog Video Out
JPD1	Analog Key Fill	**Installed**	Install for Analog Video Out
JP2			Board link Installed
JP3	Config Select	LO	Selects Character generator function of 6231 This is the default for use on the 631 Character generator module
		HI	Selects VITC generator function of 6231 This is the default for use on the 615 LTC/VITC generator module.
		SEL	Firmware selection of Character or VITC function of 6231
JP4	Bitrate Select		Board Link
JP6	Hsync	**Open**	HSync from main board
JP7	Vsync	**Open**	Vsync from main board
JP8	VITC/CHAR Select	**A**	Auto select of VITC/Char oscillator to LCA
		C	Selects Char oscillator to LCA
		V	Selects VITC bitrate oscillator to LCA

JP9	NTSC/PAL Select	**A**	Auto select of video standard from firmware
		P	Forces operation in PAL mode, NTSC VITC bitrate oscillator turned off.
		N	Forces operation in NTSC mode, PAL VITC bitrate oscillator turned off.

On the 6231A and 6231A1 revisions of the video keyer, jumpers JP8 and JP9 are incorrectly labelled. The correct labelling is shown in Figure 6-7.

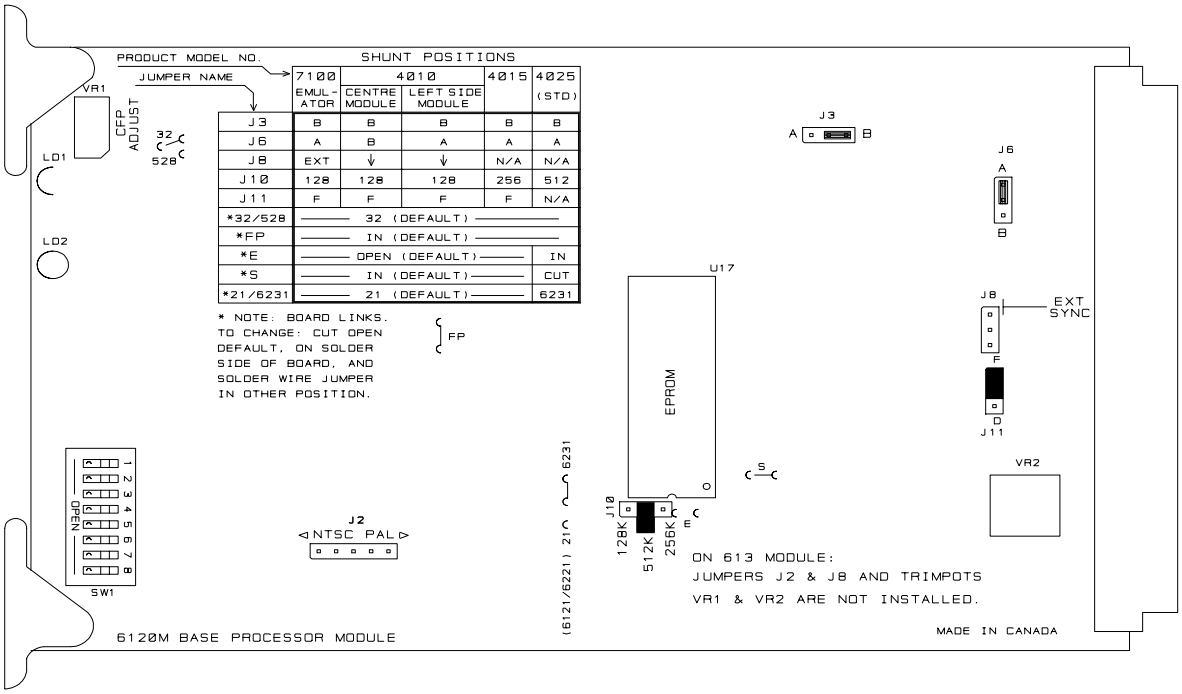

Figure 6-8: 6120 Base Processor Board (631 Main Board) Default Jumpers

6.3.7. Base Processor Board (631 main board) Jumpers and Switches

J3	VITC Video	**B**	DC restorer on sub-module is used for VITC Video
		A	DC restorer on main board is used for VITC Video
J6	Gen Lock Source	**A**	Program video used as Gen-lock source
		B	External Gen lock video used as Gen-lock source
J10	PROMSIZE	128K	27128 size EPROM
		256K	27256 size ERPOM

		512K	27512 size EPROM
J11	Standard	**F**	Single Standard EPROM
		D	Dual standard EPROM
E	EPROM Map	**IN**	Wire link installed
S	EPROM Map	**CUT**	Board link cut
21/6231	Submodule Select	21	For use with 6121 and 6221
		6231	For use with 6231 - Board link installed
FP		IN	Wire link installed
32/528		32	Wire link installed
J8			Wire link installed

Switch	Name	Normal	Function when Open	Function when Closed
1	Baud Rate	Open	19200 Baud, 8 bits, even parity	38400 Baud, 8 bits, even parity
2	Reserved	Open		
3	Reserved	Open		
4	Reserved	Open		
5	Reserved	Open		
6	Reserved	Open		
7	Diagnostics	Open	Normal running mode	Advanced Diagnostics functions enabled. These functions include power-on hardware tests that should be disabled during normal operation.
8	Engineering	Open	Normal running mode, engineering functions of On Screen programming menu are disabled.	Setup mode, engineering functions of On Screen programming menu are enabled.

Figure 6-9: 631 Switch Definitions

DIP Switch # 7 on the 631 board enables advanced diagnostics mode when it is in the Closed position. In this mode, several new diagnostic features have been added.

The internal ‘EV-COM’ reset codes are displayed on the ‘Configuring’ and ‘Software versions’ screens. (Software versions are invoked by pressing SHIFT+STATUS). Also visible on Hardware Debug screen (Invoked by TIME/UB+SHIFT+STATUS).

When the Configuring Screen appears, it will remain visible until the CLEAR key is pressed.

Pressing SHIFT+CLEAR when the timecode windows are visible sets up the 4025 to capture the next EV-COM reset codes.

6.4. RESETTING THE 4025 TO FACTORY DEFAULTS

There are three different methods of resetting the 4025 to factory defaults. Under most circumstances the Toolbox method will work fine.

Proceeding with the Factory reset will cause all user configured parameters including KeyKode head offsets, horizontal char size, user configurations, etc. to be lost. We recommend that you write down your Head offsets for PAL and NTSC and that you make a note of the settings shown on your STATUS screen before proceeding.

6.4.1. Resetting The 4025 Using The Toolbox Hardware Menu

The FACTORY RESET item of the Toolbox HARDWARE menu is used to reset the 4025 to the factory default parameters. Press SHIFT + ENTER when the sub menu screen is displayed to reset the 4025 to factory defaults. The 4025 will perform a power-on configuration before returning to the normal operating mode.

6.4.2. Resetting The 4025 Using The Engineering Shortcut Keys

The 615 and 631 modules may be individually reset to their factory defaults by using the Engineering shortcut keys. These functions are activated by pressing the TIME/UB key and the SHIFT key plus the indicated key:

2 Reset 631 (right) board to factory defaults, and reboot
3 Reset 615 (centre) board to factory defaults, and reboot
4 Reset all boards to Factory defaults, and reboot

6.4.3. Resetting The 4025 Using The DIP Switches

The 631 module can be reset to factory defaults by the following procedure.

1. Move timecode & edge number displays to bottom of screen.
2. Unplug the 631 or power down the 4025.
3. Flip the DIP switches to the exact opposite of the current switch settings.
4. Push the 631 back in/or power up the 4025.
5. Allow the 4025 to go through the normal power up displays.
6. Check that 631 has reset the character windows to the top left corner of the screen.
7. With power on reset the 631 DIP switches to their original settings.

The 615 module can be reset to factory defaults by the following procedure.

1. Unplug the 615 or power down the 4025.
2. Flip the DIP switches to the exact opposite of the current switch settings.
3. Push the 615 back in/or power up the 4025.
4. Allow the 4025 to go through the normal power up displays.
5. Check that 615 has reset the keykode head offsets to NONE.
6. With power on reset the 615 DIP switches to original settings.

6.5. LTC/VITC GENERATOR MODULE CIRCUIT DESCRIPTION

The 615 LTC/VITC generator is a microcontroller based module functionally divided into the following hardware subsystems:

1. Microcontroller & I/O
2. Sync Separator/Video processing
3. Colour Frame Detector
4. Telecine Interface
5. VITC Generator Logic
6. VITC Keyer

The microcontroller, LTC generator, and video processing circuits are contained on the main circuit card (6150). The VITC generator circuitry is contained on a separate sub-module (6231) which plugs into the main module. Input buffers and all input/output connectors are contained on a separate I/O module, (7006) to which the 615 module plugs in. Sections 6.4.1 to 6.4.5 inclusive describe the operation of circuitry on the 6150 main board. Section 6.7.1 to 6.7.3 describes the operation of the VITC generator / Character inserter circuitry contained on the 6231 sub-module. The relevant schematic drawings are shown in brackets for each section of the circuit.

6.5.1. Microcontroller & Programmable Logic (6150-32 & 6150-33)

At the heart of the 615 LTC/VITC generator module is an 8032 microcontroller, (MCU) U9. Its three 8 bit bi-directional ports and 8 bit bus provide peripheral interfacing to the rest of the circuits. Program memory is contained on EPROM U12. The EPROM is divided into two halves, with the upper addressing for the PAL video standard, and the lower addressing for the NTSC video standard. The correct half of the EPROM is selected by pin 33 of the LCA. Scratch pad and data RAM are provided internally by the MCU. A programmable logic cell array, (LCA) U10 contains address decoding and glue logic for various peripherals on the board.

An onboard oscillator, also part of the LCA, is crystal controlled. Its' 9.216 MHz frequency (test point T7) is used in conjunction with phase locked loop U15 to generate a microprocessor clock frequency of 11.50849 MHz

which is available on the µCLK test point. This frequency is internally divided by 12 in the MCU, resulting in a processor operating frequency of approximately 960 KHz.

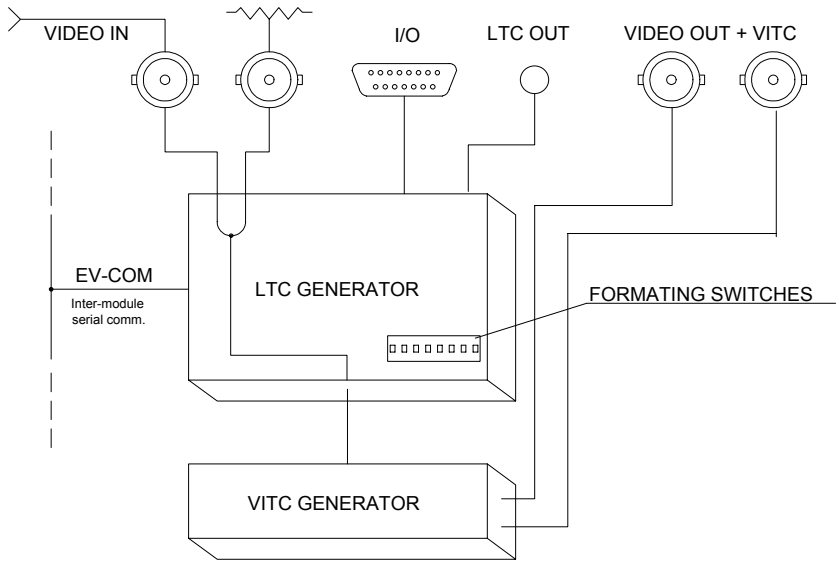

Figure 6-10: 615 Module Block Diagram

6.5.2. Adjusting the LTC Output Level

The time code out for the LTC translator/phase restorer is generated internally by the LCA, and is available on pin test point LTCO. U18 shapes the square wave to the correct rise and fall times. Buffer U19 is a low impedance driver to give a balanced time code output. The output level of the LTC generator is set at the factory to 0 dbm into a 600 ohm load, but may be adjusted using VR3.

6.5.3. Sync Separator (6150-31)

Composite video, buffered on the separate I/O module, and on the main PCB by Q5 and Q4, is AC coupled into the sync separator U8. The sync separator provides H Sync, V Sync, a Frame pulse (active low for field 1) and a back porch clamp pulse to drive the DC restorer circuitry U16 and associated components. The back porch clamp pulse allows U16 to compare the actual DC level of the video to ground potential. If they are not equal, U16 generates an error signal which adjusts the bias point of Q5 thus ensuring proper operation of the video keyer with varying video and sync levels. Comparator U7 switches when the negative sync tip goes below its half amplitude point, producing a stable sync called PRECN-SYNC.

6.5.4. Colour Frame Detector (6150-31)

Monostable U1a is triggered by the leading edge of PRECN-SYNC and times out about 6 µsec later. U1b is triggered by the trailing edge of U1a, generating a burst sample window CBWINDOW (available at test point

CBW) at the mid point of the burst. The length of CBWINDOW is slightly less than one half cycle of subcarrier (approx. 70 nsec) for colour frame operation, and slightly more than one subcarrier cycle (approx. 250 nsec) for non colour frame operation. CBWINDOW is used to drive a burst phase discriminator in the LCA.

Burst, (CB) extracted from the video by U4e and U4f is fed into the LCA. phase discriminator U1b. If a positive going transition of burst occurs during the WINDOW at the appropriate line, in the first field of a frame, then U9b is clocked on, generating a colour frame pulse (CFP) input to the MCU.

Calibration of the colour frame detector is accomplished by adjusting **CFP ADJ VR1** for NTSC or **VR2** for PAL The generator input must be connected to an RS-170-A (8 field PAL) video source and properly terminated. The unit must also be set up to operate in the colour frame mode.

You will need a sync pulse generator with a colour field #1 identification pulse output, and a dual channel oscilloscope to perform the calibration.

1. Display the colour field #1 ID pulse from your sync generator on channel A of your oscilloscope. Set up the time base to show two pulses.

2. Connect channel B of your scope to CFP test point.

3. Position VR1 near the centre of its range so that a pulse appears on channel B two frames before the second pulse of channel A. Continue adjusting VR1 clockwise until the pulse disappears. Mark the position of VR1 with a pencil. Adjust VR1 counter clockwise until the pulse reappears and disappears again. Mark the position of VR1 with a pencil.

4. Position VR1 halfway between the pencil marks. The LOCK LED should be on.

6.5.5. Telecine Interface Logic (6150-32 & 6150-33)

Bi-phase quadrature tach pulses from the telecine are fed from the 9 pin D Parallel I/O connector to quatrature decoder U14. These TTL level pulses usually come at a rate of 10 pulses per film frame. The 4025 can also accommodate tach rates of 1 or 2 pulses per frame. For best results use the highest bi-phase rate possible. Correct connections will result in EDGE numbers that increment or decrement when the telecine moves in the forward or reverse direction respectively. To adjust the 4025 to the correct bi-phase rate, use the BI-PHASE item of the Toolbox HARDWARE menu.

Once per frame the MCU reads the value of the derived counts from the quadrature decoder chip and uses this value to accurately track the telecine position.

The Film frame advance pulse from a RANK telecine is connected to the FRAME BNC connector on the 4025 rear panel. This active low pulse occurs when a new film frame starts in the video output, while the telecine is in normal play speed. The 4025 uses the film frame pulse to lock its timecode output to the correct telecine pulldown sequence during the transfer. Figure shows some specifications of the expected Frame Pulse into the 4025 for a RANK type of telecine. This should allow you to verify that you have connected the appropriate signal.

The actual DC voltage level of the film frame pulse is not critical as long as a 3 volt peak to peak minimum signal is applied. The film frame pulse is sampled in the LCA once per video field on the trailing edge of the VSYNC pulse.

The Film frame advance pulse from a BTS telecine is connected to the PARALLEL I/O connector on the 4025 rear panel. This active square shaped pulse changes state when a new film frame starts in the video output, while the telecine is in normal play speed. The 4025 uses the film frame pulse to lock its timecode output to the correct telecine pulldown sequence during the transfer. Section 2.11.2 shows some specifications of the expected Frame Pulse into the 4025 for a BTS type of telecine. This should allow you to verify that you have connected the appropriate signal.

If the right hand LED on the 615 module is blinking, or dim, or flickering rapidly, this is an indication that the Frame Pulse input is not satisfactory. See sections 2.10.2 and 2.12.2 for a complete description of connections between the 4025 and your telecine.

6.5.6. VITC Generator Interface

The VITC generator logic and video keyer is contained on a separate submodule (6231), which connects to the base module via header J4/5. Program video, VSYNC, SYNC as well as the MCU address and data bus are fed up the header to the submodule. Jumper J3 selects the video source for the VITC keyer. Placing J3 in the forward position routes the DC restored video used to provide a reference on the 6150 module to the VITC keyer. Placing J3 in the rear position connects the VITC keyer to a separate non-restored program video input. J3 should be placed in the rear position for correct operation of 6121 Sub Module.

The submodule used for the VITC generator is identical to the 631 Character generator submodule. Jumper JP3 at the front of the sub-module selects the VITC mode when it is in the HI position and the Character mode when it is in the LO position. See section 6.7 for the circuit description which applies to both the VITC and Character generator uses of this board.

6.6. LTC/VITC READER CIRCUIT DESCRIPTION

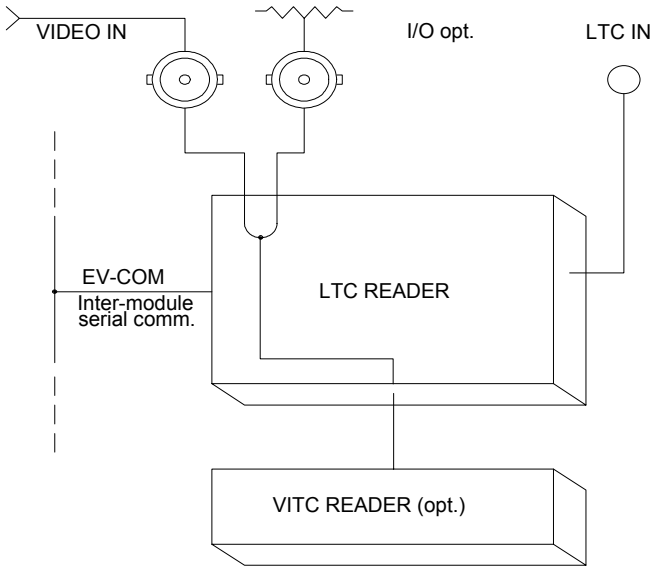

Figure 6-11: 611 Module Block Diagram

The 611 reader is a microcontroller based module functionally divided into the following hardware subsystems:

1. Microcontroller & I/O
2. High speed LTC Reader
3. Sync Separator/Video processing
4. High speed VITC Reader

The microcontroller, LTC reader, and video processing circuits are contained on the main circuit card (6110). The VITC reader circuitry is optional and is contained on a separate sub-module (6111) which plugs into the main module. Input buffers and all input/output connectors are contained on a separate I/O module, (7006) to which the 611 module plugs in. The relevant schematic drawings are shown in brackets for each section of the circuit.

6.6.1. Microcontroller (6110-30)

At the heart of the 611 reader module is an 8032 microcontroller, (MCU) U24. Its three 8 bit bi-directional ports and 8 bit bus provide peripheral interfacing to the rest of the circuits. Program memory is contained on EPROM U23. The EPROM is divided into two halves, with the upper addressing for the PAL video standard, and the lower addressing for the NTSC video standard. The correct half of the EPROM is selected by pin 26 of the MCU. Scratch pad and data RAM are provided internally by the MCU.

An onboard oscillator, also part of the MCU, is crystal controlled. Its' 11.50849 MHz frequency is internally divided by 12, resulting in a processor operating frequency of approximately 960 Khz.

A GENLOCK Field 1 pulse, generated by the 615 module, is received by U18 (jumper J6 must be in the G position) where it is inverted and sent to the MCU. This pulse is used to provide a proper gen-lock reference to the reader, irrespective of the input video to the 611 reader.

6.6.2. High Speed LTC Reader (6110-30)

Incoming code is decoupled and amplified by U8, U7, and U4, and associated components, to provide a regenerated reader data signal at U4 pin 4. A series of timing pulses, generated by U3 and U5, are used to properly decode 0 and 1 bits from the incoming code. A constant amplitude ramp is generated by U12 and associated components. Three quarters of the peak ramp level is used as a reference on comparator U1 to decode the data from the clock transitions. If the next code bit is a 0, then the ramp will exceed the reference before a transition occurs. If the next bit is a 1, an extra transition will occur before the ramp exceeds the reference, clocking flip flop U5a on. The LTC data is available at U5a pin 1, and is shifted through sync detector U19 and U21 into one half of shift register U16.

Twelve consecutive 1 bits, detected by U20, clock flip flop U15a on, freezing the sync word data at the outputs of U19 and U21, and generating an LTC RDY signal to the MCU when it has received one frame of data. Direction information (LTC DIR), derived from the last bit of the sync word is also fed to the MCU. A valid reader sync word toggles flip flop U15b, enabling the other half of shift register U16 to collect data from the next frame while the MCU is unloading data from the frame just completed through switch U17.

6.6.3. Video Processing (6110-30)

Reader composite video (with VITC, or as a reference for the LTC code translator) is buffered on the separate I/O module by Q6 & Q5 and fed to the VITC reader header J1. It is also AC coupled into the sync separator by C29. The sync tips are clamped to -0.3 volts by germanium diode D5. Comparator U11 detects the negative sync tips when compared to ground reference and provides a logic level composite sync signal (SYNC) at pin 7. Composite sync is integrated by U18f to derive vertical sync (VSYNC), which interrupts the MCU. A field 2 pulse is generated by U9a and U10.

6.6.4. High Speed VITC Reader (6111-30)

The clock and data separator circuitry for the VITC reader is contained on a separate sub-module which connects to the main circuit card via header J1. Composite video, VSYNC, and some control signals from the MCU are fed up the header from the main circuit board.

Composite video is buffered and DC restored by Q2, U14 and associated components, to provide REF VIDEO to comparator U15, which recovers VITC data from the DC restored video. U16 and associated components provide a reference level to U15, of approximately one half the peak VITC level, to ensure proper extraction of the VITC data regardless of the video level.

At VSYNC, the MCU releases the reset to U7b, enabling the VITC reader circuitry. The first VITC data bit turns on U7a, which releases the reset to CRC detector U1 and U3. A phase locked loop consisting of VCO U13, and U12, U17, and U18, provides an 8 times bit rate clock to divider U11, which generates a series of timing pulses at the VITC bit rate (1.78977 MHz for NTSC, 1.8125 MHz for PAL). Each positive going transition of the VITC data re-synchronizes the divider so that the VITC recovery clock at U5 pin 13 occurs in the middle of each bit.

Inverted VITC data is shifted into U3 which calculates the cyclic redundancy check (CRC) word for the recovered data. Valid CRC and 90 bits of code, detected by U1, clocks U7b on, disabling the VITC clock and generating a VITC RDY signal to the MCU. The MCU unloads the VITC data through switch U17, located on the main circuit board.

6.7. VIDEO CHARACTER INSERTER CIRCUIT DESCRIPTION

The 631 character generator is a microcontroller based module functionally divided into the following hardware subsystems:

1. Microcontroller & I/O
2. Sync Separator/Video processing
3. Character Generator logic
4. Character Generator Keyer

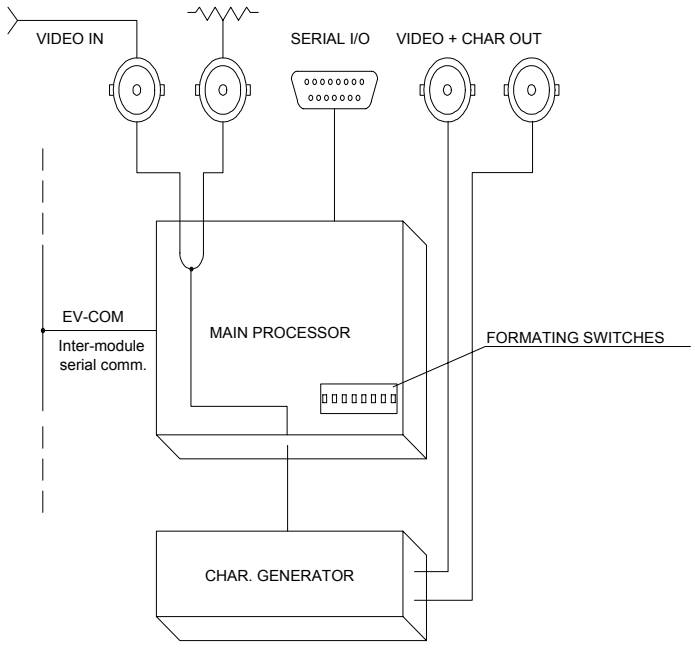

Figure 6-12: 631 Module Block Diagram

The microcontroller, sync separator and video processing circuits are contained on the main circuit card (6120). The character generator circuitry is contained on a separate sub-module (6231) which plugs into the

main module. Video input buffers and all input/output connectors are contained on a separate I/O module, (7006) into which the 631 module plugs in. The relevant schematic drawings are shown in brackets for each section of the circuit.

6.7.1. Microcontroller (6120-32)

At the heart of the 631 character generator module is an 8032 microcontroller, (MCU) U14. Its three 8 bit bi-directional ports and 8 bit bus provide peripheral interfacing to the rest of the circuits. Program memory is contained on EPROM U17. Scratch pad and data RAM are provided internally by the MCU. MUART U21 provides parallel inputs from the remote control connector, serial I/O for the external RS-232/RS-422 port, and other control pins for various circuit elements.

An onboard oscillator, also part of the MCU, is crystal controlled. Its' 11.50849 MHz frequency is internally divided by 12, resulting in a processor operating frequency of approximately 960 KHz.

6.7.2. Sync Separator (6120-33)

Composite video, buffered on the separate I/O module, and on the main PCB by Q3 and Q2, is AC coupled into U5b. Immediately following each horizontal sync pulse, a sample pulse is generated at U5c which allows U5a to compare the actual DC level of the video to ground potential. If they are not equal, U5a generates an error signal which adjusts the bias point of Q3 thus ensuring proper operation of the video keyer and sync separator with varying video and sync levels. Comparator U3 switches when the negative sync tip goes below its half amplitude point, producing composite SYNC. Composite SYNC is integrated by U2c to derive vertical sync (VSYNC) which sets flip flop U13a, enabling sync pulse counters U11 and U12. The next sync pulse, (the first vertical serration) generates an output on U11 pin 7 which, when ORed with 3/4 H from U7b and SYNC clocks on U9a, generating a frame pulse interrupt (FP INT) to the MCU.

6.7.3. Character Generator Interface

The character inserter logic and keyer are contained on a separate circuit sub-module (6231) which connects to the main circuit card via header J4 & J5. Video in and out, and the MCU address and data bus are fed up the header from the main board. Jumper J3 on the 6120 board should be installed in the rear position.

The submodule used for the 631 Character generator is identical to the VITC generator submodule. Jumper JP3 at the front of the sub-module selects the VITC mode when it is in the HI position and the Character mode when it is in the LO position. See section 6.7 for the circuit description which applies to both the VITC and Character generator uses of this board.

6.8. VITC GENERATOR AND CHARACTER GENERATOR CIRCUIT DESCRIPTION

The 6231 video keyer submodule is used for both the VITC generator and for the character generator in the 4025. This submodule can be used with either the 6150 or 6120 base processor boards, as needed. Video in and out, and the MCU address and data bus are fed up the header from the main board. The majority of the logic for the VITC and character generator functions is contained in a programmable logic device (LCA) U7. Its program is loaded from EPROM U8 on power up. Jumper JP3, located at the front of the board determines whether the VITC generator configuration or the character generator configuration will be loaded. The VITC generator configuration also has the ability to display some rudimentary characters, although this is not its primary function.

6.8.1. VITC Generator Logic (6231-32) & (6231-33)

The VITC bit rate for PAL and NTSC are generated by two crystal controlled oscillators consisting of XT1 and U14a (for PAL) and XT2 and U14b (for NTSC), and associated components. The NTSC/PAL control signal (NP test point) controls which crystal oscillator is active. Jumper JP8 controls whether the VITC oscillator, or character oscillator is present on the DCLK test point. Set JP8 to the V position to measure the VITC frequency. The oscillator output is buffered by U14c and may be measured at the **DCLK** test point when jumper JP8 is in the V position. Jumper JP9 controls whether the PAL or NTSC oscillator is active. Set JP9 to the P position to measure the PAL oscillator, position N to measure the NTSC oscillator. Both JP8 and JP9 should be set to the A position for normal operation. The frequency of 14.31818 MHz for NTSC, or 14.5 MHz for PAL is 8 times the VITC bit rate. The VITC oscillator is divided by 8 in the LCA to generate the correct VITC bit rate.

The starting position of the VITC on the line is fixed internally in the LCA such that the first bit of code is 10.5 µsec (11.5 µsec for PAL) after the leading edge of horizontal sync.

Once per field, the MCU loads the VITC bit pattern for a particular line into static RAM U9. It is thus possible for the 4025 to generate different VITC data for individual video lines. In practice, the 4025 will generate one line pair for the primary VITC generator and another for the secondary line pair. On lines where VITC is enabled, the LCA accesses the static RAM and fetches the VITC data one byte (8 bits) at a time. The VITC sync bits and cyclic redundancy check byte (CRC) are generated internally in the LCA and inserted into the VITC bit stream in the appropriate place. The VITC data is clocked out of the LCA on the KEYFILL output (U7 pin 7) and into buffer U8a. The VITC keyer is controlled by the KEY signal, generated in the LCA (U7 pin 6). The data is clocked out of the LCA with the VITC clock, so that the bit width is not dependent on propagation delays in the LCA. VITC bits are shaped by U6b and associated components, and presented to the video keyer when the VITC/CHAR signal is LOW.

6.8.2. Character Generator Logic (6231-32)

The character display is formatted to display 28 (32 for PAL) rows of 32 characters each in the tiny size, 14 (16 for PAL) rows the small size, and 7 (8 for PAL) rows in the large size. Each of the character positions corresponds to one location in static RAM U9. The MCU writes characters into specified locations in the RAM corresponding to the position of the characters on the screen. RAM locations are scanned during each television field. Valid characters address corresponding sections of the character PROM U8 and are loaded into the LCA one byte (8 bits) at a time. Each byte corresponds to either the left or right half of a character pixel line. The internal logic in the LCA control how many lines per character, and how many character lines there are on the raster, according to registers set by the firmware.

The character data is clocked out of the LCA on the KEYFILL output (U7 pin 7). A special character with all bits set to 1 is written into all positions of the RAM where no characters are to be displayed. These characters disable the keyer by the KEY signal, generated in the LCA (U7 pin 6). When other characters are present the KEY signal becomes active, allowing the characters to be keyed into the video signal. The character data is clocked out of the LCA with the dot clock, so that the pixel width is not dependent on propagation delays in the LCA. The pixels are presented to the video keyer when the VITC/CHAR signal is HIGH. A control register in the LCA selects whether the characters will be white or black, and whether they will be keyed into a contrasting background. Character style selection is accomplished by the on screen programming menu.

6.8.3. Character Position and Size (6231-33)

The pixel oscillator consists of monostable U11b and associated components. The oscillator frequency, which determines horizontal size, of the characters is adjusted by the digital trimpot (NVPOT) U13 and associated components. The MCU writes different values to the NVPOT which control the adjustment input to voltage regulator U12, which in turn sets the voltage present for the RC timing network of the monostable. The starting position of the characters at the left of the screen is controlled by U11-A. Resistor R27 may be replaced to alter the left position of the characters. Starting with board revision 6231A1, trim pot VR3 can be also used to adjust the character left edge.

6.8.4. Video Circuits (6231-31)

Composite video, which comes up the submodule header from the main board (J1 pins 1 and 2) is AC coupled and buffered by Q1 before going into the sync separator LM1881 U4. The sync separator provides H Sync, V Sync, a Frame pulse (active low for field 1) and a back porch clamp pulse to drive the DC restorer circuitry U1, Q2, and Q3 and associated components. The back porch clamp pulse allows U1 to compare the actual DC level of the video to ground potential. If they are not equal, U1 generates an error signal which adjusts the bias point of Q2 thus ensuring proper operation of the video keyer with varying video and sync levels.

The Video keyer U2 is controlled by the KEY signal generated in the LCA. KEY switches U2 between the program video path and the KEYFILL data. When the KEY signal is LOW the active video is passed through the keyer. When the KEY signal is HIGH the KEYFILL data is added to the black level of the video.

To calibrate the video keyer, connect colour bars from your sync generator to the Video input loop, of the 4025, and to channel A of your oscilloscope, and terminate it. Connect the video output to channel B of your scope and terminate it. Adjust the **GAIN** trimpot (VR2) so that the output amplitude matches the input. Adjust the **LEVEL** trimpot (VR1) so that the inserted VITC/characters are approximately 550 millivolts above video black level.

6.9. DISPLAY AND KEYPAD

6.9.1. LED Displays (7025-31)

A 16 digit alphanumeric display, and a 28 button keypad are contained on a separate circuit card (7025) which is connected to the 631 VCG module via a 20 conductor ribbon cable.

The 16 digit display is self scanning and contains its own character display memory. Data is written to the displays once per frame. Address Latch U1 generates chip enable and address information to the display devices to allow the MCU to write data to the display and control registers.

The status LED's are controlled by interface drivers U2 and U4. These drivers are accessed with a serial clock and data stream once per frame. When all the LED information has been shifted into the drivers, it is latched there by the LEDSTB signal from the MCU (display header pin 10).

6.9.2. Push buttons (7025-31)

The 28 push buttons are arranged in a 4 x 7 matrix. Data from 7 keys at a time is latched into U3 by signal SH/LD on U3 pin 1. Address decoder U1 selects which set of 7 switches is latched into U3.

Each time a key is pressed, the MCU firmware generates a key scan code corresponding to the position of the key in the key matrix. Keyboard diagnostics can be invoked by selecting the RAM VIEW from the Toolbox menu. The front panel display will show three sets of digit pairs, the leftmost being the keyboard scan codes. When no keys are depressed, the key scan code is 00. Pressing a key will show the corresponding key scan codes, as shown in the table below. To Exit the keyboard test, turn RAM VIEW off by pressing SHIFT* and then selecting RAM VIEW off from the Toolbox menu or remove and re-apply power to the unit. See section 5.9 for a complete description of keyboard diagnostics.

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7. CONNECTOR PINOUTS AND CABLE DIAGRAMS

7.1. CONNECTOR PINOUTS

7.1.1. Parallel I/O

The 4025 is fitted with a nine pin subminiature 'D' connector for connection to the telecine The pin connections are described below:

Pin	Name	Description
5	**CENTRE**	Centre Film Frame in Gate
9	**GAUGE**	Low=35 mm, High = 16 mm
4	**RESERVED**	Do not connect (GPO)
8	**GPI**	Run / Zero Reference Frame *
3	**BIPH 1**	Leading Bi-Phase
7	**BIPH 2**	Lagging Bi-Phase
2	**FRID**	FDL-60 FRID pulse input
6	**GND**	Ground
1	**RATE**	Transfer Rate NTSC: Low = 24, High = 30 PAL: Low = 25, High = 25

* Run/Hold function only in 'RUN EDGE' mode.
Zero ref function only when telecine stopped.
Data log trigger in all modes, stopped or in play.

7.1.2. Serial I/O

The 4025 is fitted with a nine pin subminiature 'D' connector for connection to a computer for logging timecode / keykode relationships to a data logging utility such as Key-Log™. The pin connections are described below:

Pin	Name	Description
5	**TxD**	RS-232 Transmit (+9V)
9	**STS**	Status display control input
4	**RxC**	Receive Common (Frame Gnd)
8	**RxA**	Receive "A" (-) & RS-232
3	**RxB**	Receive "B" (+) (In 5)/Gen time display control input
7	**TxB**	Transmit "B" (+) (In 4)/Reader 2 display control input
2	**TxA**	Transmit "A" (-) (In 7)/Keykode display toggle
6	**TxC**	Transmit Common (Frame Gnd)
1	**VCG**	Video display control input

7.1.3. Aux I/O

The 4025 is fitted with a nine pin subminiature 'D' connector for connection to a Film Barcode Reader. The pin connections are described below:

	Pin	Name	Description
	5	**TxD**	RS-232 Transmit
9		**In 0**	Aux In 0
	4	**In 3**	Aux In 3
8		**RxD**	RS-232 Receive
	3	**In 5**	Aux In 5
7		**In 4**	Aux In 4
	2	**In 7**	Aux In 7
6		**Gnd**	Frame ground
	1	**In 6**	Aux In 6

7.2. CABLE WIRING DIAGRAMS

7.2.1. to Evertz 5500 or RIM DigiSync & Cinema Products KeyKode Reader Cable

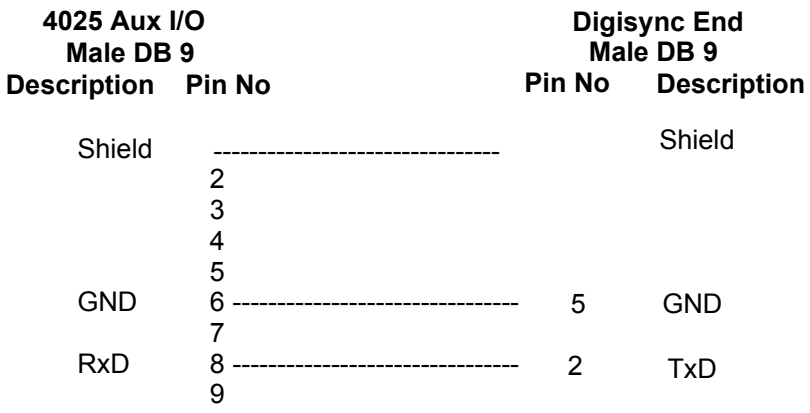

Figure 7-1: Evertz Part WA-C67

7.2.2. to ARRI KeyKode Reader Cable

4025 Aux I/O Male DB 9 Description	Pin No		ARRI End Male DB 9 Pin No	Description
Shield		----------		Shield
	2			
	3			
	4			
	5			
GND	6	----------	5	GND
	7			
RxD	8	----------	3	TxD
	9			

Figure 7-2: 4025 to ARRI Cable

7.2.3. Rank Cintel MKIIIC Mag Follower Y Cable

MACHINE TYPE: Rank Cintel MKIIIC (Y cable for use with mag follower) **EVERTZ PART #**WA-615

4025 END	CABLE	RANK CINTEL END	CABLE	MAG FOLLOWER END
9 pin Male D type	Belden #9501 or equivalent 10 feet long	McMurdo Connector XP12 Shell +XC112A	Belden #9501 or equivalent 6 inches long	McMurdo Connector Xp12 Shell +XC112A

FUNCTION	PIN #	COL'R	PAIR #	PIN NO	COL'R	PAIR #	PIN NO	FUNCTION
Bi-Phase 1	7	Black	1	10	Black	1	10	Bi-Phase 1
Bi-Phase 2	3	Red	1	11	Red	1	11	Bi-Phase 2
Frame ground	6	Drain	2	4	Drain	1	4	Frame ground

Figure 7-3: Rank Cintel MK III to 4025 Bi-phase Cable

7.2.4. 4025 Serial I/O to PC Cable Diagram

The wiring diagram below shows the correct cable wiring for connecting a computer to the 4025 Pinouts are given for both DB-25 and DB-9 types of serial ports connectors found on computers.

4025 Serial I/O Male 9		Computer End Female		
Description	DB9	DB-25	DB-9	Description
Ground	Shield ----------	1	5	Ground
	2			
	3			
GND	4			
RS 232 TxD	5 ----------	3	2	Rs 232 Receive
Ground	6 ----------	7	5	Ground
	7			
	8			
	9			

Figure 7-4: Serial I/O to PC Cable

The following connections are only required if you want to issue GPI triggers to the 4025 from Key-Log™ software running on your computer.

4025 Parallel I/O Male		Computer End Female		
Description	DB9	DB-25	DB-9	Description
GPI	8 - - - - - - - - - - - - - - - -	20	4	DTR
Ground	6 - - - - - - - - - - - - - - - -	7	5	Gnd

A 10K ohm resistor must be placed in series with the wire connecting pin 8 of the 4025 parallel I/O connector to the DTR of the computer. A 5 volt zener diode must be connected with its cathode to pin 8, and the anode to pin 6 of the 4025 parallel connector.

Use shielded wire for this cable to reduce harmful interference to surrounding equipment.

Figures:

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8. KEYKODE READER INSTALLATION

8.1. OVERVIEW

Latent edge numbers have been present on motion picture negative film stocks for many years in human readable form. The edge numbering format has been specific to various manufacturers and film stock types. In 1988, Eastman Kodak, in conjunction with the Society of Motion Picture and Television Engineers devised a new edge print that not only standardizes the numbering format, but is also printed as a machine readable barcode. Kodak calls this numbering system KeyKode. Other film manufacturers have adopted this numbering standard and have each given their version a proprietary name. For the sake of clarity we shall refer to all of these implementations as Film barcode.

This purpose of this chapter is to describe the installation procedures and day to day operating practices used when fitting an external Film Barcode reader to the 4025 Film Footage Encoder.

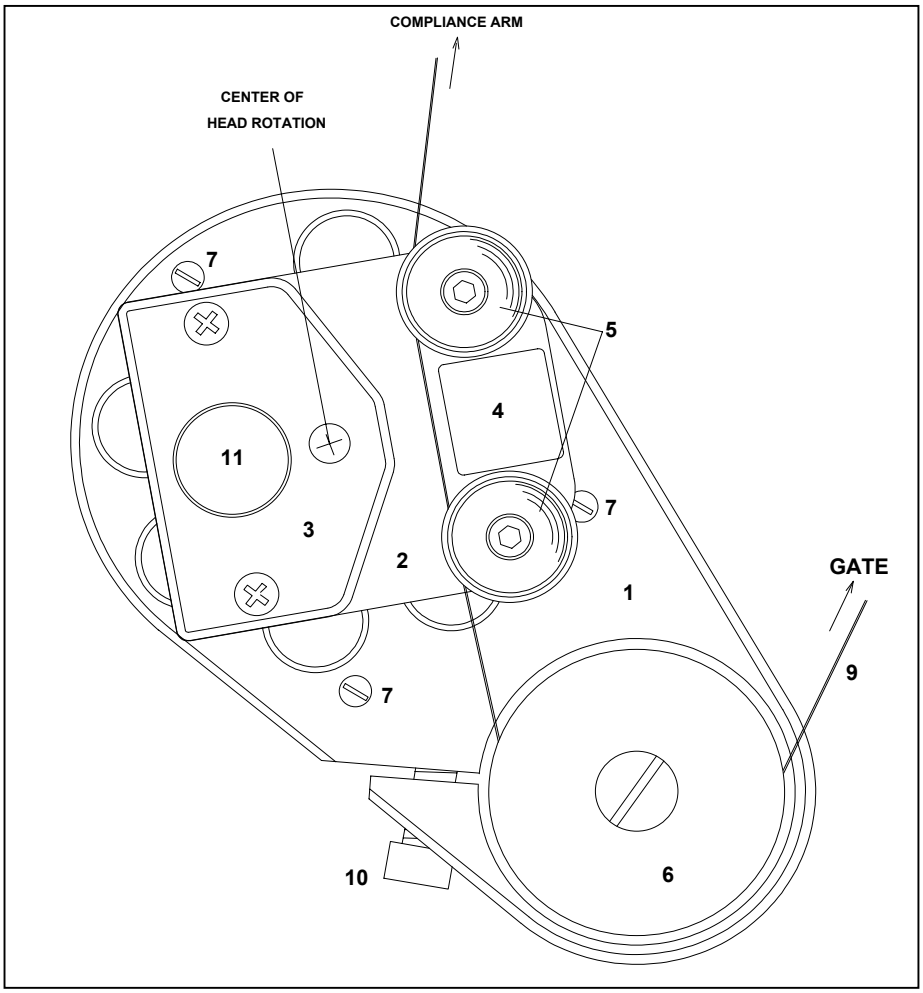
The 4025 Film Footage Encoder interfaces to external Film barcode readers manufactured by Evertz, ARRI, Cinema Products or Research In Motion. These units consist of a bar code reader pickup head, and a decoder device. The pickup head transforms the optical dark and light bar code into electronic signals and is designed 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 a serial link to the 4025. The way in which the 4025 uses the KeyKode information is set using the FILM drop down of the On screen menu system.

When installing the pickup head on the telecine, an automatic alignment procedure in the 4025 calculates the exact perforation offset between the head and the gate. The one-of-four perforation ambiguity with 35 mm KeyKode is automatically compensated for each time the film is rolled, making the day to day operation as effortless as possible. Operation with the KeyKode reader installed consists of entering the reference frame's time code number. An on screen KeyKode status display, which shows the perf that has been detected, and the error between the KeyKode number read and the bi-phase based value, is useful in verifying that the correct operational mode has been selected.

The following sections describe the installation for each of the Film Barcode reader systems supported. In addition to the physical installation, there are calibration procedures for the 4025 that need to be done. These are detailed in section 6.5.4.

8.2. INSTALLING THE EVERTZ KEYKODE READER HEAD ON YOUR TELECINE

8.2.1. Mounting the Reader Head



1	Mounting Bracket	6	Rank Fixed Roller
2	Reader Head Base	7	Nylon Adjusting Screw
3	Main Housing	8	Telecine Deck Plate
4	LED Housing	9	Film Path
5	Film Rollers	10	Binding Screw
		11	Quick Release Screw

Figure 8-1: Reader Head and Bracket - Top View

The Evertz KeyKode combination reader head system is capable of reading from 16mm and both edges of 35mm film. Single film gauge versions of the head are available for those who only deal with one film gauge. The floating head is designed so that it is self aligning to the film path. This is especially critical in 16mm applications. All that is necessary is to locate the bracket so the film passes approximately over the rollers. The head then follows the exact film motion, finding the optimal position for KeyKode reading.

The mounting bracket is typically fastened to the collar of the last roller on the telecine before the film enters the gate. The reader head is fastened to the mounting bracket by a quick release thumb screw. The head mounts over an alignment pin on the bracket. The angle of the head can be adjusted over almost 180 degrees, and should be set so that the film enters and leaves the head at about the same angle. A set screw on the side of the bracket can secure the angle of the head should you need to remove the head. Removing the head may be accomplished by merely loosening the thumb screw and disconnecting the cable. Figure 8-5 shows the proper installation of the reader head assembly onto the telecine feed roller collar. Figure 8-2 shows a side view of the reader head and bracket, and the film path.

When mounting the head on your telecine, the following procedure should be used to ensure that the head does not interfere with the film path.

1. Using the hex key tool provided, loosen the binding screw (10) Hold the bracket with the alignment post facing towards you, and the nylon adjusting screws towards the telecine deck plate.

2. **Rank Cintel Telecines:** Slide the large hole of the mounting bracket over the last roller before the gate (6) and onto the shaft that supports the roller. Tighten the binding screw finger tight to hold the bracket in place.

   BTS Telecines: Remove the last roller before the gate, from its mounting shaft. Slide the large hole of the mounting bracket over the shaft that supports the roller. Insert the adapter rings that were supplied with the mounting bracket between the roller shaft and the mounting bracket. Tighten the binding screw finger tight to hold the bracket and adapter rings in place. Re-install the roller onto the shaft.

3. Slip the reader head over the alignment pin on the mounting bracket and tighten the thumbscrew (11) to hold the head in place. The head should be positioned such that the film enters and leaves the reader head rollers at approximately the same angle.

4. Thread some film into the telecine as you would normally, making sure that it passes over the reader's rollers. Set the height of the mounting bracket so that the film is running smoothly through the reader head rollers. Rotate the bracket such that the reader head rollers deflect the film by 3 or 4 mm. This will ensure that the film will not climb over the flanges of the reader head rollers as it travels through.

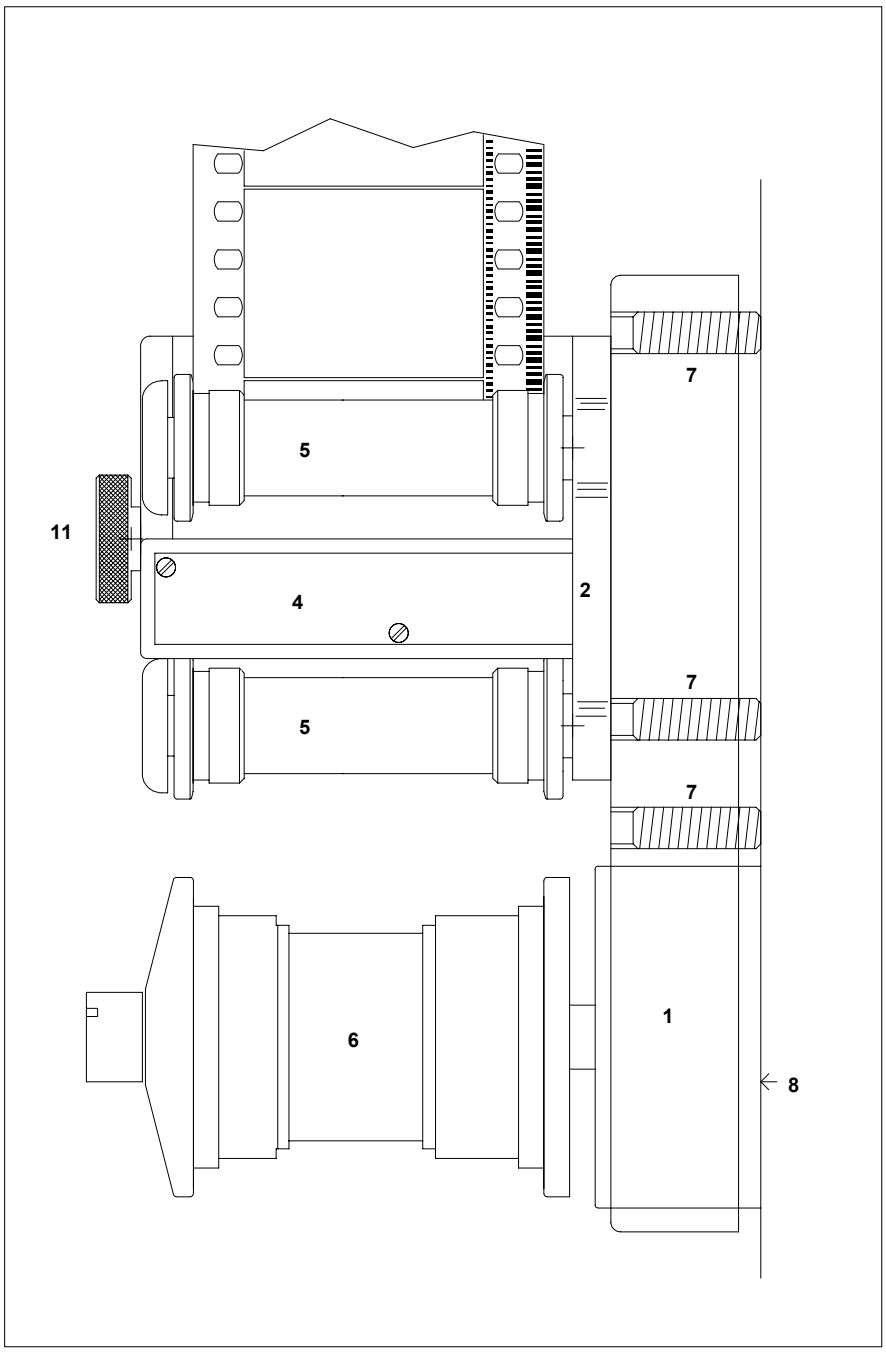


Figure 8-2: Reader Head and Bracket - Side View

5. Shuttle the film in both directions. You may find it necessary to modify either the rotational angle or the height of the reader head. Once you are satisfied with the position, tighten the binding screw with the hex key tool supplied. Using a small screwdriver, turn the nylon adjusting screws (7) so that they make contact with the deck plate of the telecine. This ensures that the height can be guaranteed if the bracket needs to be moved in the future.

8.2.2. Connecting the Reader Head to the 4025

A 10 foot long extender cable is supplied to connect the reader head to the model 4025. If you wish to mount the console more than 10 feet from the telecine, 50 foot extended cables may be purchased. The 4025 may be located up to a maximum distance of 100 feet from the reader head. Plug the extender cable into the connector on the reader head cable. Connect the other end of the extender cable to the 8 pin mini DIN HEAD connector on the rear of the 4025.

8.2.3. Connecting the Keykode decoder to the Film Footage Encoder

A 9 pin D connector on the rear of the KeyKode decoder labeled provides RS-232 serial data communications with the 4015 or 4025 Film Footage Encoder. Use the cable supplied (Part No. WA-C67) or wire a longer cable if required. Wiring information for the WA-C67 cable is as shown in Figure 7-1. Maximum suggested length of this cable is 50 feet, although longer cables may be used if the wire size is made larger. Care should be taken to ensure that shielded cable is used, and that the shield is connected through. The KeyKode reader connects to the Serial I/O connector on the 4015 and the AUX I/O connector on the 4025.

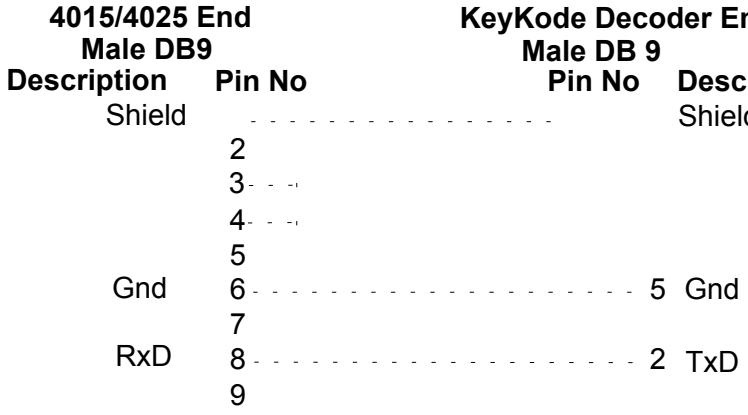


Figure 8-3: 4015 or 4025 to KeyKode Decoder Cable

8.2.4. First Time Set-Up

After applying power to the 5500, check to make sure that you are using the correct sensor for the film type you are using by pressing the **MODE** key. The active sensor will be shown in the front panel display.

SENSOR =35mm	lower 35mm KeyKode sensor is active
SENSOR =35mm REV	upper 35mm KeyKode sensor is active (this is used when the film was rewound before loading it into the camera)
SENSOR =16mm	16mm KeyKode sensor is active

To select a different sensor, press the **SHIFT + MODE** keys until the desired sensor is displayed. Press the **DISPLAY** key to return to the normal KeyKode display.
In addition you need to select whether you are reading from negative or print film stock. This is accomplished using the SETUP menu. To enter the front panel SETUP menus, press the **SETUP** key. Press the down arrow key (🡻) until you have selected the **type** menu item. If the film type is incorrect, press the 🡺 key to select other film type. When you have made the desired change, press the

SETUP key to return to the normal display mode. See section 3.1.4 of the 5500 manual for more information about the SETUP menu system.

8.3. CONNECTING THE EVERTZ READER HEAD TO THE DIGISYNC CONSOLE

A 12 foot long cable is supplied to connect the reader head to the DigiSync console. If you wish to mount the console more than 12 feet from the telecine, 50 foot Digi/Extender cables may be purchased. The console may be located up to a maximum distance of 100 feet from the reader head. Plug the cable into the connector on the reader head. (It is usually easier to connect the cable prior to mounting the head on the bracket.) Connect the other end of the cable to the DigiSync console. Refer to section 3 of the DigiSync manual for further information on connecting the reader head to the DigiSync console.

8.3.1. Connecting the DigiSync console to the 4025 Film Footage Encoder

A 9 pin D connector on the rear of the DigiSync console provides RS-232 serial data communications with the 4025. Use the cable supplied (Part No. WA-C67) or wire a longer cable if required. Wiring information for the DigiSync to 4025 cable is as shown in section 7.2.1. Maximum suggested length of this cable is 50 feet, although longer cables may be used if the wire size is made larger. Care should be taken to ensure that shielded cable is used, and that the shield is connected through.

8.3.2. Setting the Correct DigiSync Operating Modes

Consult the DigiSync operating manual section 4.4 for a full description of DigiSync operating modes that are relevant to its use with the 4025.
Several Function key sequences are available on the DigiSync to provide the user with the ability to control various features of the DigiSync. Each sequence consists of pressing the [FUNCTION SET] key followed by a numbered key ([1] through [9])

[FUNCTION SET 1] [1] allows the user to change between the Upper and Lower sensors on the dual sensor Evertz 35 mm head. The Lower sensor is located closest to the mounting bracket and is normally used when reading KeyKode. The Upper sensor is located farthest away from the mounting bracket, and is used for reading KeyKode on film that was rewound before it was loaded into the camera.

[FUNCTION SET 1] [4] enables and disables the "serial broadcast mode".

For use with the 4025, the DigiSync serial broadcast mode must be enabled.

[FUNCTION SET 1] [9] displays the version number of the current firmware inside the DigiSync unit. At the time of this writing, DigiSync version 4.0.03E is the recommended version for use with

the 4025. Although versions 3.1 and 4.0 have been tested for compatibility with the 4025, we recommend that you update to the current version. Contact the Evertz Factory for information on updating the DigiSync software version.

[FUNCTION SET 2] [5] sets the desired serial communications protocol to either WELCH ALLYN or WELCH ALLYN modified. Press **[ENTER]** to show the protocol which is selected.

For use with the 4025, the DigiSync serial protocol must be set to WELCH ALLYN.

After resetting to factory defaults, check the settings to make sure they are configured properly.

Once one of the above functions is selected, the [+] and [-] keys are used to change the current settings. Press **[ENTER | =]** or **[C/CE]** to exit the function select mode of the DigiSync.

8.4. INSTALLING THE ARRI KEYKODE READER ON YOUR TELECINE

8.4.1. Mounting the Reader Head

Refer to the ARRI operating instructions for information on mounting the read.

8.4.2. Connecting the Electronics Unit to the 4025 Film Footage Encoder

A 9 pin D connector on the rear of the ARRI electronics unit provides RS-232 serial data communications with the 4025. Wiring information for the ARRI to 4025 cable is as shown in section 7.2.2. Maximum suggested length of this cable is 50 feet, although longer cables may be used if the wire size is made larger. Care should be taken to ensure that shielded cable is used, and that the shield is connected through.

8.4.3. Setting the Correct Operating Modes

Consult the ARRI operating manual for information on determining the operating mode of the ARRI reader. The normal factory settings for the ARRI unit are those required for use with the 4025, so no adjustments should be necessary.
Consult the ARRI manual for information about the use of other toggle switches on the head.

8.5. INSTALLING THE CINEMA PRODUCTS KEYKODE READER ON YOUR TELECINE

8.5.1. Mounting the Reader Head

Follow the directions received with the Cinema Products unit. The installation instructions are contained in section 2 of the Cinema Products manual.

8.5.2. Connecting the Reader Head to the Cinema Products Electronics Unit

Refer to section 2.1 of the Cinema Products manual for information on connecting the reader head to the electronics unit.

8.5.3. Connecting the Electronics Unit to the 4025 Film Footage Encoder

A 9 pin D connector on the rear of the Cinema Products electronics unit provides RS-232 serial data communications with the 4025. Wiring information for the Cinema Products to 4025 cable is as shown in 7.2.1. Maximum suggested length of this cable is 50 feet, although longer cables may be used if the wire size is made larger. Care should be taken to ensure that shielded cable is used, and that the shield is connected through.

8.5.4. Setting the Correct Operating Modes

Consult the Cinema Products operating manual section 2.1 and 2.2 for information on determining the operating mode of the CP reader. If necessary, remove the top cover from the unit and select KeyKode Direct mode.

The Cinema Products unit must be set to KEYKODE DIRECT mode for proper operation with the 4025.

Connecting the bi-phase input of the Cinema Products unit is not required when operating in KeyKode direct mode. Setting the mechanical offset switches in the Cinema Products units is only required if bi-phase connections are hooked up.

A toggle switch on the front panel enables and disables the beep which indicates when a barcode has been successfully read. Enabling the beep is helpful when checking out the installation, but may be annoying during normal day to day operation.

Consult the Cinema Products manual for information about the use of other toggle switches on the unit.

8.6. INSTALLING THE RESEARCH IN MOTION KEYKODE READER ON YOUR TELECINE

8.6.1. Mounting the Reader Head

Follow the directions received with the Research in Motion DigiSync unit. The reader head and mounting bracket are separate and will have to be assembled before mounting on the telecine. The installation instructions are contained on

pages separate from the manual. Figure 8-4 shows how to install the reader head onto the mounting bracket. Figure 8-5 shows the proper installation of the reader head assembly onto the telecine feed roller collar.

Figure 8-4: Attaching DigiSync Reader Head to Mounting Bracket

8.6.2. Connecting the Reader Head to the DigiSync Console

Refer to section 3 of the DigiSync manual for information on connecting the reader head to the DigiSync console. The cable supplied with the DigiSync is 12 feet long. If you wish to mount the console more than 12 feet from the telecine, required, this cable may be extended to a maximum length of 100 feet. When extending the cable, care should be taken to ensure that shielded cable is used, and that the shield is connected through.

Figure 8-5: Mounting Reader Head on the Telecine

8.6.3. Connecting the DigiSync console to the 4025 Film Footage Encoder

Follow the directions outlined in section 8.3.1 for information on connecting the DigiSync to the 4025.

8.6.4. Setting the Correct DigiSync Operating Modes

Follow the directions outlined in section 8.3.2 for information on setting up the DigiSync correctly for use with the 4025.

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9. FILM EMULSION CODES

Manufacturer			Emulsion		Film Type
	Code	Letter	Code	Char	
Agfa	01	A	20	N	XT 100
	11		24	M	XTR 250
			83	F	XT 320
			84	S	XTS 400
Kodak	02	K	00	P	5600
	12		14	X	SO-214 SFX 200T
	22		20	Y	5620 Prime Time
			22	E	5222/7222
			24	L	5224 (obsolete stock)
			31	H	5231/7231
			34	D	5234/7234
			43	A	5243/7243 (obsolete stock)
			44	V	5244/7244
			45	K	5245/7245
			46	I	5246/7246 Vision 250D
			47	B	5247/7247
			48	M	5248/7248
			49	O	5249 (obsolete stock)
			72	S	5272/7272
			74	Z	5274/7274 Vision 200T
			77	Q	5277/7277
			79	U	5279/7279
			87	W	5287/7287
			89	R	5289 Vision 800T
			92	N	7292 (obsolete stock)
			93	L	5293/7293
			94	G	5294/7294 (obsolete stock)
			95	F	5295
			96	J	5296/7296
			97	C	5297/7297
			98	T	5298/7298
Fuji	03	F	01	I	FCI (8501, 8601, 8701)
	13		02	I	FCI (8502, 8602, 8702)
	23		10	N	F-64 (obsolete stock 05/95)
			13	I	FCI (obsolete stock)
			14	N	F-500 (obsolete stock)
			20	N	F-64D (obsolete stock 05/95)
			21	N	F-64D (8521, 8621, 8721)
			22	N	F-64D (8522, 8622)
			30	N	F-125 (obsolete stock 05/95)
			31	N	F-125 (8531, 8631, 8731)
			32	N	F-125 (8532, 8632)
			50	N	F-250 (obsolete 05/95)
			51	N	F-250 (8551, 8651, 8751)
			60	N	F-250D (obsolete stock 05/95
			61	N	F-250D (8561, 8661, 8761)
			70	N	F-500 (8570, 8670, 8770)
			71	N	F-500 (obsolete stock)
			91	N	RP (8691 16 mm B/W neg)
			92	N	FG (8592 35mm B/W neg)

Figure 9-1: Film Manufacturers and Film Types (as of January 11, 1999)