LYNX V.S.I. FILM MODULE OWNER'S MANUAL

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TABLE OF CONTENTS

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TimeLine Inc. (TimeLine) warrants this product against defects in material or workmanship, as follows:

1. For a period of ninety (90) days from the date of purchase TIMELINE will, at it's option, either perform necessary repairs at it's expense or pay the labor charges of others it authorizes to repair the defective product. After the initial 90 day period labor charges are the responsibility of the purchaser.

2. In addition TIMELINE will supply at no charge, new or rebuilt replacements for defective parts for a period of one year from the date of purchase.

LABOR & PARTS

To obtain warranty service the purchaser must notify TIMELINE in writing during the initial 90 day period. TIMELINE will then authorize the purchase to take or deliver ,prepaid, the product to TIMELINE or it's authorized service center.

PARTS ONLY

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This Warranty does not cover any damage due to accident, misuse, abuse, or negligence.

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1. INTRODUCTION

The Lynx VSI Film Module is a compact, and modular machine control device designed for use with pulse-interlock film transports such as dubbers, projectors, and telecines. Using the Lynx VSI Film Module, a film transport or interlocked film chain controlled via a pulse-interlock bus may be operated from a external controller such as a video editor or an audio editing computer.

This version of the Film Module is analogous to the VSI version of the Lynx Time Code Module, which is used in video post production and broadcast facilities around the world.

On the transport side, the Lynx VSI Film Module operates much like the standard Film Module, controlling the motion of a film chain by means of a pulse interlock signal generated by the module.

On the controller side, the VSI version of the Film Module is programmed to communicate serially with an editing computer using the same serial communications protocol as an Ampex VPR-3 video recorder. This protocol emulation allows editing systems that are capable of serially controlling a VPR-3 to actually operate a film transport or interlocked film chain instead.

Computerized editing systems that are compatible with Lynx VSI Modules include systems by Ampex, CMX, and Grass Valley Group/ISC, the CMX CASS and Alpha Audio BOSS audio editing systems, and the Lynx Keyboard Control Unit (KCU).

1.1. SOFTWARE VERSIONS COVERED IN THIS MANUAL

This manual is written for Lynx VSI Film Modules manufactured after February, 1989 and fitted with the following software:

EPROM- 256K	U7	**FV-404R**
EPROM- 256K	U16	**FV-404R**

There is also software on the Film Procesor PCB fitted with:

EPROM- 128K	U15	**FI-017A**

1.2. CONVENTIONS USED IN THIS MANUAL

In this manual we will refer to items that physically exist on the Lynx Film Module in all upper case and using the designation as it appears on the unit; e.g. "the ONLINE indicator" or "the TRANSPORT connector".

Switches and keys on the Film Module's panel will be referred to by their printed designation enclosed in a box; e.g. "the CLR key". Where the meaning is clear from context, we may use just the key's name itself rather than using the designation as a description of the key; e.g. "touch TRAN MODE to put the module Online." When we refer to the alternate function of a switch key, we will use the designation that is printed on the panel above the key rather than the designation on the switch key itself, and we will bracket the designation with a pair of bullets (•); e.g., "hold •SET UP• for approximately 5 seconds".

When we refer to something that has a specific meaning within a Lynx system in general or within the Lynx Film Module in specific, we will capitalize the word. For example, we will refer to the "setting the Offset register" as opposed to "setting an offset between two transports".

When a switch is to be actuated with a normal, momentary keystroke we will generally use the term "touch" or sometimes "press" (for reliability, we suggest that you use a deliberate stroke of approximately 1/4 second duration when touching a key on the Lynx Module). When a switch is to be depressed and held for some period of time (specified or not), we will use "hold".

2. OVERVIEW

2.1. THEORY OF OPERATION

The movements of film transports are controlled by entirely different means than audio or video tape recorders. These differences have complicated previous attempts at integrated control of sprocketed and non-sprocketed machines in the same system.

The Lynx VSI Film Module has been carefully designed and programmed to meet these criteria.

2.1.1. CONTROL AND SYNCHRONIZATION OF TAPE TRANSPORTS

The synchronizer hardware issues the appropriate Rewind, Fast Forward, and/or Shuttle commands to wind each transport to its particular start point. The synchronizer finds these start points by reading SMPTE/EBU time code from the tape or by using the transport's tape tachometer or control track.

Only when the system is put into Play does the synchronizer assume direct control of the speed of each tape machine by supplying a variable reference frequency (or voltage, depending on the machine) to each transport's capstan motor servo circuitry. The synchronizer first slows down or speeds up each transport as necessary to bring its time code into precise synchronism with the master time code, and then resolves the transport's speed to assure that it stays in sync with the master.

The recorded time code's frame numbers are the reference for positioning and initial synchronization, and the time code's frame rate is the reference for resolving the running speed.

2.1.2. CONTROL AND SYNCHRONIZATION OF FILM TRANSPORTS

Unlike tape machines, film transports always run under the direct control of their sprocket drive motors. Once the various pieces of film or mag film stock have been physically aligned to their individual start points on their respective transports, they will continue to run in exact lock step because the motion of the drive sprockets on all transports is controlled from a single, common source known as a pulse interlock bus.

Film stock often has frame numbers physically printed on it at intervals, but these are only used as reference marks during the initial positioning of the film. Once the system is running, the sprocket holes provide all the reference that is necessary.

The pulse interlock bus which controls a film chain most commonly uses a two-component signal known as a "biphase" signal that conveys direction information in the phase relationship of the two components and speed information in their frequency. An less common alternate system uses separate speed (tachometer) and direction signals.

A film chain's Fast Forward and Fast Reverse modes are simply frequency and phase variations of the pulse interlock signal which also drives the system at normal play speed. Any device which is to control a film chain must generate the appropriate pulse interlock signal at all times, and must vary the frequency of the pulse interlock signal slowly and smoothly enough to ensure against damage to the sprocket holes in the film from too-rapid acceleration.

Additionally, the Film Module provides the user with control over critical speed and acceleration parameters to handle unusual circumstances such as fragile film stock.

2.2 FUNCTIONAL OVERVIEW

The Lynx VSI Film Module contains four main functional blocks:

- Bi-phase Generator – (Transmitter)
- Bi-phase Follower – (Receiver)
- SMPTE/EBU time code generator
- Serial communications port through which it communicates with the external control computer (editor). RS-422

The biphase sections of the Film Module can generate and follow biphase signals to all known frequency standards. All operating parameters are programmable from the unit's front panel and are retained in the module's battery backed-up memory.

The module may also be configured for tach & direction signals (rather than a biphase signal) via pin jumpers.

The nominal film frame rate can be set to 24, 25, or 30 fps. For compatibility with film equipment from any manufacturer, the Lynx VSI Film Module accommodates biphase frequencies ranging from 2x frame rate (DIN standard) to 100x frame rate (MTM standard).

Biphase control signals can be generated at up to 20x the nominal frequency, and followed at up to 40x the nominal frequency for fast-wind modes.

BI-PHASE GENERATOR

The biphase generator is programmable for fast mode (maximum frequency limit), acceleration, and locate approach speed. Default parameter set-ups are provided for the each of the biphase frequencies. These defaults may be conveniently overridden as necessary, and any changes will be retained in the module's non-volatile memory.

The Film Module generates "virtual" timecode frame numbers which it transmits to the editor via the RS-422 serial port. These frame numbers are always tied to the biphase follower and are always related to the actual position of the film just as if they were actually being read from the film itself. The user has only to program a starting frame number into the Film Module (using its front panel controls) with the film transports at their start marks.

The user may optionally connect an external set of motion control switches to the VSI Film Module so that the module can function as a master film chain controller when it is not online with the external editor. In response to the motion control switches, the Lynx Module generates a properly ramped biphase signal to control the film chain directly. Normal, Fast, and Crawl speeds in both directions are available via these external motion control switches.

BI-PHASE FOLLOWER

The biphase follower in the Film Module keeps track of all film motion relative to the start mark and the module generates the proper frame numbers at any running speed up to 40x the nominal speed. The frame numbers generated are displayed in real time on the Film Module's front panel for convenient visual reference, in addition to being serially transmitted to the editor.

TIME CODE GENERATOR

The timecode generator in the Lynx VSI Film Module generates either SMPTE or EBU timecode which is locked to an external video reference signal (e.g. "house sync"). As part of its power-up routine, the VSI Film Module detects whether the video reference signal is NTSC or PAL and automatically sets the generator to either SMPTE or EBU timecode standard as appropriate. Note that the nominal film frame rate may be different than the timecode frame rate. For example, the film chain may run at a nominal 24 fps while the Lynx generates 25 frame (EBU) timecode.

In 30-frame systems, if the video reference signal is an NTSC color video signal, the timecode frame rate is 29.97 fps rather than the nominal frame rate of 30 fps. In this situation, the actual film frame rate is decreased by 0.1% (e.g. from 24 fps to 23.976 fps) as is standard practice. If the video reference signal is a true monochrome signal rather than an NTSC signal, the timecode frame rate will be 30 fps and the actual film frame rate will be equal to the nominal frame rate.

SMPTE timecode may be generated in either drop-frame or non-drop frame format. NOTE: Generation of Drop Frame frame numbers and/or timecode is a feature that is new to the Lynx VSI Film Module as of software version FV404-R. Earlier VSI Film Module software versions did not support Drop Frame timecode.

A Tach-to-Timecode function is also provided which outputs timecode frame numbers at the standard timecode frame rate in a continuous jam sync mode. This pseudo-timecode signal provides frame-accurate position information in all motion modes but may not be readable by all timecode readers since timecode frame numbers may be skipped, repeated, or in reverse numerical sequence depending on the speed and direction of the film transport.

2.3. COMPATIBILITY

2.3.1.   PULSE INTERLOCK SELECTION

The Lynx VSI Film Module is compatible with both Biphase or Tach & Direction transmission schemes. Jumper JP2 and JP3 on the Biphase circuit board inside the Film Module allows selection of the pulse interlock format. Below is an illustration of the jumpers as they appear on the Film Processor PCB:
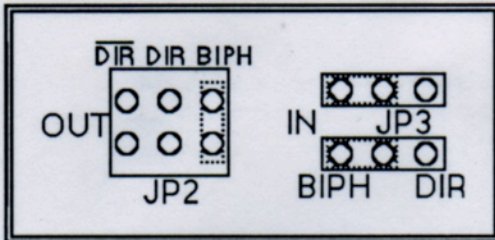
The standard method is Bi-phase
(two pulse trains in quadrature).

In the Speed & Direction configuration, the jumpers allow for either logic polarity of the Direction signal.

2.3.2   PULSE VOLTAGE SELECTION

The Lynx VSI Film Module is compatible with both TTL and CMOS Input/Output voltages. Jumper JP1 on the biphase circuit board inside the Film Module allows selection from the following voltage levels:

5 Volt	= TTL or CMOS
OR	
12 Volt	= CMOS
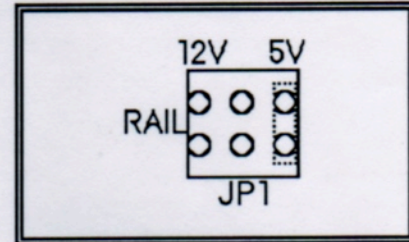
The factory setting is 5 Volts.

2.3.3   PULSE FREQUENCIES

The Lynx VSI Film Module can be operated at any of the standard pulse interlock or biphase frequencies. The biphase frequency is selected from a front panel menu during module initialization, and is retained in battery backed-up memory when the module is powered down.

The Lynx Film Module always displays the biphase frequency based on a 24 fps film sync speed. When the film speed is set to 25 or 30 fps, the biphase frequency will be increased proportionately.

NOTE: The actual biphase frequency will be decreased from their nominal value by 0.1% when the VSI Film Module is referenced to an NTSC color (29.97 fps) video signal.

Nominal Sync Frequency (@ 24 FPS)	Standard (or Mfr.)	Maximum Generator Speed Multiple (& Freq)	Maximum Follower Speed Multiple (& Freq)
48 Hz	DIN	20x (960 Hz)	40x (1920 Hz)
96 Hz		20x (1920 Hz)	40x (3840 Hz)
240 Hz	MTE	20x (4.8 kHz) [15x]	40x (9.6 kHz)
480 Hz		20x (9.6 kHz) [15x]	40x (19.2 kHz)
600 Hz		[7x]	32x (19.2 kHz)
1200 Hz		[7x]	16x (19.2 kHz)
2400 Hz	MTM	16x (38.4 kHz)[7x]	8x (19.2 kHz)

TABLE 1: BIPHASE STANDARDS IN LYNX V.S.I. FILM MODULE

NOTE: The listed maximum multiples for generator output frequencies are the electrical maximums. The actual maximum multiple available is defined in software and may be lower than the electrical maximum.

3. CONTROLS AND FEATURES

3.1. POWER SWITCH

Depressing the top half of the rocker switch turns the module power On, and depressing the bottom half of the rocker turns the power Off. The Lynx Film Module does not have a power indicator *per se*, but in all normal operating condition there will be at least one indicator LED lit.

It is recommended that any film transports connected to the Film Module be switched to a "local" mode rather than an "interlock" mode before turning the Film Module's power switch Off or On.

All Lynx Film Module operating parameters are retained in battery backed-up (non-volatile) memory when the power to the module is turned off. This retained data can be cleared from the battery memory by holding the STORE key while turning on the module's power switch as described in the chapter on initializing the Film Module.

3.2. MASTER KEY

This key is not active in the VSI Film Module. A VSI Module is always a "slave" to the editor or controller. In addition the indicator is not active.

3.3. REF SRC KEY

This key is not active in the VSI Film Module. VSI Modules are always referenced to an external video signal.

This key has an alternate function in the module's Set-Up modes. When the key is to be used in this alternate function mode, we will refer to it as the •BACK• key.

3.3.1. REFERENCE SOURCE INDICATORS

The column of four LEDs above the REF SRC key displays the reference source selection. In the VSI version of the Film Module the only allowed reference source is External Video so that only the EXT VID indicator can be lit. Additionally, this indicator will only be lit when the display is selected to GEN. to indicate that the Film Module's timecode generator is clocked from the external video reference signal connected to the module's EXT VID connector(s).

3.4. CODE TYPE KEY

When operating in an NTSC video system, this key selects whether the module will generate Drop Frame or non-Drop Frame SMPTE timecode. This selection can only be made when the module's display is selected to GEN; pressing this key when the display is selected to anything other than GEN has no effect.

When operating in a PAL video system, the CODE TYPE key has no function since the module automatically sets itself for EBU timecode if it detects a PAL video reference signal during the Video Detect routine in its power-up sequence.

Code Type refers to the frame rate and format for the "timecode side" of the module as opposed to the frame rate of the "biphase side" of the module (which is frequently different). The Code Type determines both the type of timecode that the generator will output when switched on and the type of timecode that the module will report to the editor or controller.

> NOTE: Generation of Drop Frame frame numbers and/or timecode is a feature that is new to the Lynx Film Module as of software version FV404-R. Earlier Lynx Film Module software versions did not support Drop Frame timecode.

This key also has an alternate function when the module is in the Set-Up modes.

When this key is to be used in this alternate function mode, we will refer to it as the •FORW• key.

3.4.1. CODE TYPE INDICATORS

The column of five LED indicators indicates what type of timecode in use in the "timecode side" of the Lynx VSI Film Module. This selection represents both the type of timecode that the module's generator will output when switched on, and the type of timecode numbers that the Film Module communicates to the editor or controller and that it displays in the FILM POS display mode. On the next page is a description of each selection and it's application related to bothg generator and reader modes.

GEN NTSC INDICATOR

• Display selected to GEN.

Indicates that the timecode generator is set for SMPTE (30-frame) timecode at the NTSC frame rate of 29.97 frames per second. This LED can only be lit if an NTSC video reference signal was detected during the Video Detect routine in the VSI Film Module's power-up sequence. This LED does not indicate whether the timecode format is drop frame or non-drop frame; that indication is provided by the DF light.

30 INDICATOR

Not used on the VSI Film Module. The module assumes that an NTSC-type video reference signal will be running at the NTSC color frame rate of 29.97 fps rather than the 30 fps monochrome frame rate.)

DF INDICATOR

Indicates that the SMPTE (30-frame) timecode generated by the module is Drop Frame format. (This format skips over or "drops" a total of 108 specific frame numbers for each hour of timecode.) This LED can only be lit if the VSI Film Module detected an NTSC video reference signal during its Video Detect routine in the power-up sequence.

25 INDICATOR

When lit, indicates that the module's is set for EBU (25-frame) timecode. This indicator will only be lit if the VSI Film Module detected a PAL video reference signal during its Video Detect routine in the power-up sequence.

24 INDICATOR

Not used on the VSI Film Module. VSI Modules only operate at video frame rates.

3.5. DSPL SEL KEY

This key selects the numerical information which will be shown in the module's main display window. The key steps sequentially through the available options in the same order as the LED indicators above the key.

In addition to routing the Generator timecode to the display window, selecting GEN mode also affects the functions and meanings of certain other keys and indicators on the Film Module. In particular, the CODE TYPE key only functions in the GEN display mode, and the REF SRC indicator only lights when GEN display is selected.

This key also has an alternate function in the module's Set-Up modes. When used in this alternate function mode, we will refer to it as the •MENU• key.

3.5.1   DISPLAY SELECTION INDICATORS

The column of five LEDs above the DSPL SEL key indicate which numerical data are currently shown in the module's display window.

In addition to the primary function of indicating the display selection, two of the indicators, namely SYNC PT and OFFSET, also function as reminder indications that data are stored in these memory registers. Since both of these indicators are programmed to remain lit as long as the associated memory register has an active value in it, it is possible to have more than one LED in the Display Selection column lit at the same time.

GEN INDICATOR

When lit, indicates that the module is displaying the output of the module's timecode generator. This display will be static unless the generator is switched on with the GEN ON key. (indicator above the key is lit).

When the GEN indicator is lit, the CODE TYPE indicators will display generator's timecode type and the EXT VID indicator in the REF SRC display will be lit.

When the GEN indicator is lit and the SUB-F U-BITS indicator is flashing, it indicates that the display is showing the "user bits" portion of the generated timecode. The Film Module normally sets the user bits to 00 00 00 00, but the user may set them to some static value, if desired, using the module's Set/Hold mode.

FILM POS INDICATOR

When lit, indicates that the module is displaying the timecode frame number that corresponds to the film's current position. These are "virtual" timecode frame numbers that are generated by the Film Module based a user-programmed starting frame number that is incremented and decremented based on biphase pulses. This display directly reflects any motion of the film transport.

SYNC PT INDICATOR

When the SYNC PT indicator is the only indicator in the display column that is lit, it indicates that the display window is showing the contents of the module's SyncPoint memory register; the value displayed is static since it represents a memory register. The frame number in the SyncPoint register (if any) represents the point which is to be synchronized by the editor, such as the Edit In point. The SyncPoint also represents the point to which the VSI Film Module will cue the film transport if the SYNC POINT key is touched while the module is Offline.

The SyncPoint value is transmitted to the Film Module from the editor or controller and is available for display only on the module's front panel.

The SYNC PT light remains lit as a reminder as long as there is an active value stored in the SyncPoint register, regardless of the actual display mode selected. For example, you might see both the FILM POS and SYNC PT indicators lit on the Film Module.

OFFSET INDICATOR

When the OFFSET indicator is the only LED in the display column that is lit, it signifies that the display window is showing the contents of the module's Offset register. Since the OFFSET display shows the contents of a memory register, the value displayed in this mode is static.

The number in a VSI Module's Offset register represents the numerical difference the module will maintain between its timecode and the "timeline" transmitted from the editor or controller. The Offset will be a positive number if the module's timecode numbers are greater than the timeline; conversely, the Offset will be negative if the module's timecode numbers are smaller than the timeline. The Offset value is calculated by the VSI Film Module based on data transmitted from the editor or controller and is available on the module's front panel for display only (for reference and diagnostic purposes). The Offset value may not be modified in the Set/Hold mode.

When used with a Lynx Keyboard Control Unit (KCU) or another audio editing system (rather than a video editing system), the VSI Film Module's Offset register may contain a subframe component in addition to the hours, minutes, seconds, and frames. Touching SUBF UBITS and lighting the indicator allows you to display the subframe component of the offset; touching the key a second time toggles back to the normal display mode. If the module's Offset has a non-zero subframe component, the SUB-F U-BITS indicator flashes whenever the module is in the OFFSET display mode as a reminder.

The OFFSET light remains lit as a reminder as long as the module has an offset programmed in it, regardless of what has been selected to the display window. It is thus possible to have the FILM POS and OFFSET lights lit at the same time.

OFF ERR INDICATOR

When lit, indicates that the window is showing a dynamic display of the module's Offset Error.

The Offset Error value represents the difference between where the transport actually is and where it is supposed to be (based on the timeline from the editor and any programmed Offset). When the module has reduced the Offset Error to 2 subframes or less, an "L" appears in the window to the left of the digits as an indication that the module has achieved resolved and locked status.

Offset Error may be displayed in whole frames or in subframes. If the Offset Error is greater than 1 frame, the display window will be blanked when the module is toggled into the subframe display mode.

NOTE : The module always has a non-zero Offset Error until it is locked to the editor's timeline in Play mode. In particular, the VSI Module normally parks or cues its transport with a small positive Offset Error; this deliberate "parkahead" allows more rapid synchronization.

3.5.2 NUMERICAL DISPLAY WINDOW

The four, two-digit numerical windows normally display timecode numbers in Hours : Minutes : Seconds : Frames format.

If the display is selected to GEN and the SUB-F U-BITS indicator is flashing, the window is displaying the user bits portion of the generated timecode.

If the display is selected to OFFSET or OFST ERR, and the the SUB-F U-BITS indicator is lit the display normally shows the subframe (1/100 frames) component of the selected data in the rightmost window. If the total value of the Offset Error is larger than 1 frame, the display will actually show the hours, minutes, and seconds of the value and will blank out the rightmost (frames) window as a reminder that the display is in Subframes mode.

The display window is also used to display all menu selections and error messages. Note that since the window uses seven-segment (numeric) display devices, there are compromises in forming some alphabetic characters and some interpretation on the operator's part may be required to read error messages. In this manual we will use a special typeface that was designed to closely resemble the actual characters formed in the display.

3.6. FILM INDICATORS

The column of four LEDs to the left of the display window show the frame rate of the "biphase side" of the Lynx Film Module as opposed to the "timecode side" of the module. The frame rate on biphase side is the actual frame rate of the film on the sprocketed transports which is often different than the timecode frame rate used by the editing system to which the module is connected.

The film frame rate that is indicated by these LEDs is automatically set to a default value based on the type of video reference signal sensed in the Video Detect routine during the module's power-up sequence, but may be changed to any other value in the Online Set-Up mode. If NTSC sync is detected the module defaults to a 24 fps film frame rate, and if PAL sync is detected the module defaults to a film frame rate of 25 fps.

NOTE :

Setting the film frame rate to 25 or 30 proportionately increases the nominal frequency of the module's biphase generator and biphase follower to accommodate the higher film speed. (The nominal biphase frequency is based on 24 fps operation.)

3.6.1. FRAME RATE INDICATORS

ON INDICATOR

When lit, indicates that the Film Module's biphase generator is outputting a biphase signal to produce film motion, and that the module's biphase follower is receiving that signal. This indicator will not be lit if the the biphase is stationary.

30 INDICATOR

Indicates that the biphase generator and biphase follower are set for a film frame rate of 30 frames per second at sync speed.

25 INDICATOR

Indicates that the biphase generator and biphase follower are set for a film frame rate of 25 frames per second at sync speed.

24 INDICATOR

Indicates that the biphase generator and biphase follower are set for a film frame rate of 24 frames per second at sync speed.

3.7 [SET HOLD] KEY

This key controls access to the Set/Hold mode which allows the user to hold or "freeze" the current value of a running timecode display (the Hold function), or to modify or enter numeric data into any of the module's registers (the Set function).

The first time [SET HOLD] is touched the Film Module "freezes" or holds the number in the numeric display. The SET/HOLD indicator begins to flash, signifying that the module is in the Set/Hold mode, and the digits in the frames window also begin to flash which indicates that the displayed number may be adjusted one frame at a time with the [↑] and [↓] keys.

Successive touches of the [SET HOLD] key move the Adjust function to the seconds, minutes, and then the HR hours window, then back to the FR window, and so on. Touching [STORE], on the other hand, loads the adjusted numeric values into the corresponding register and exits the Set/Hold mode.

When the module is in the Set/Hold mode, holding [SET HOLD] for a second will "unfreeze" the display and return it to the previous display mode without making any changes.

3.8 ADJUST KEYS

The primary function of the three ADJUST keys is to modify the numerical data shown in the display window in the Set/Hold mode (SET/HOLD indicator lit).

These keys are also used in the module's Set-Up modes to increase or decrease the value of the displayed parameter or to scroll through items in a hierarchical menu structure.

3.8.1 [↑] KEY

When in the Set/Hold mode, touching [↑] adds one to the value shown in the flashing window of the numeric display. Holding [↑] continuously increments the value in the flashing window until the key is released.

3.8.2 [CLR] KEY

When the module is in the Set/Hold mode, holding the CLR key for approximately 1/2 second clears the value in the numeric display to 00 00 00 00.

The [CLR] key is also used to clear certain error messages which may appear in the display window.

3.8.3 [↓] KEY

When in the Set/Hold mode, touching [↓] will subtract one unit from the value in the flashing window of the numeric display. Holding the [↓] key continuously decrements the value in the flashing window until the key is released.

3.9 [SUBF UBITS] KEY

When the display is selected to the OFFSET or OFST ERR mode, the [SUBF UBITS] key selects whether the module's display will show the hours, minutes, seconds, and frames or any subframe (1/100 fame) component of the selected data. This key toggles between these two alternate modes each time it is touched.

When the display is selected to GEN mode, the key selects whether the module's display will show the hours, minutes, seconds, and frames of the generator's timecode, or whether it will show the "user bits" portion of the timecode. The VSI Film Module normally sets the user bits to 00 00 00 00, but you may set them to any desired static value using the Set/Hold mode while the display is in the User Bits mode.

When the display is selected to FILM POS or SYNC PT pressing [SUBF UBITS] has no effect, since subframe display is not available for these two modes.

3.9.1 SUB-F U-BITS INDICATOR

When the display is selected to OFFSET or OFST ERR and the SUB-F U-BITS indicator is lit, it signifies that the display window is showing the subframe component of the selected data rather than the hours, minutes, seconds, and frames.

When the display is selected to OFFSET and the SUB-F U-BITS indicator is flashing, it signifies that the display window is showing the hours, minutes, seconds, and frames of the Offset, but that there is a non-zero subframe component of the Offset (which can be viewed or adjusted by toggling to the Subframe mode).

When the display is selected to GEN and the SUB-F U-BITS indicator is flashing, it signifies that the display window is showing the (static) user bits portion of the of the generated timecode rather than the timecode portion.

3.10 [STORE] KEY

If the VSI Film Module is in the Set/Hold mode (SET/HOLD indicator lit), touching [STORE] loads the numerical value in the display window into the register corresponding to the display selection, exits the Set/Hold mode, and extinguishes the SET/HOLD indicator. The right-hand arrow (→) above the "STORE" designation (pointing toward the [DSPL SEL] key) is a reminder that the displayed number will be stored into the register that corresponds to the display selection.

If the module is in the Set/Hold mode and the display is selected to GEN or FILM POS, changing the displayed value with the [↑] and [↓] keys does not have any effect until the modified value is entered by touching [STORE]; in other words, adjustments to the Generator or Film Position frame numbers are non-real time adjustments that only take effect when the [STORE] key is pressed.

Holding [STORE] for approximately 5 seconds causes the module to enter the Online Set-Up mode, providing access to the Film Module's biphase parameters and user options. The module continues to operate normally in the Online Set-Up mode except that the [DSPL SEL], [CODE TYPE], and [REF SRC] keys all assume their alternate, Set-Up mode functions, and the display window shows the various menu items rather than the normal timecode display. When the module is in the Online Set-Up mode, holding [STORE] for approximately 5 seconds returns the module to normal key functions and displays.

3.11 RMT INDICATOR

Not used in the Lynx Film Module.

3.12 422 INDICATOR

When lit, indicates that the VSI Film Module is in serial communications with the external editor or controller.

When extinguished, the VSI Film Module and the external editor or controller are not in serial communications and the module therefore cannot respond to the editor's commands. Common causes for this condition include:

- The module has not yet been put Online after power-up.

- The editor or controller has not yet sent a serial message to the module.

- There is a fault or poor contact in the serial connection between module and controller.

- There has been a communications fault in either the module or the controller.

3.13 TRAN MODE KEY

Touching this key puts the Film Module Online or Offline, alternately lighting and extinguishing the ONLINE indicator above the key.

When Online, the VSI Film Module may be controlled by the editor or controller. When Offline, the module may not be controlled by the editor, and it will report its status to the editor as "LOCAL".

When Offline, the Film Module's biphase generator will not respond to any motion commands from the external editor or controller. The biphase generator will, however, respond to commands from a set of external motion control switches connected to the Film Module so that the film transport may still be operated locally from the module when it is Offline.

The Film Module's biphase follower functions whether the module is Online or Offline so that the module is continuously aware of any movement of the transport and can update the current Film Position.

ONLINE INDICATOR

Indicates that the module is Online and may be controlled by the editor.

When extinguished, indicates that the Film Module is Offline, is not under editor control, and will report its status to the editor as "LOCAL".

RESOLVE INDICATOR

When lit, indicates that the film transport is running in Forward and that it is up to speed and within 20 subframes (1/5 frame) of sync with the editor's timeline.

If the LOCK indicator is lit and the RESOLVE indicator is flashing, it indicates that the module initially achieved Lock, but that an Offset Error has developed. .

The RESOLVE indicator can only be lit (or flashing) if the module is Online.

LOCK INDICATOR

When lit, indicates that the film transport is running in Forward and that it is within 2 subframes (1/50 frame) of sync with the editor's timeline. If the display is selected to OFST ERR, an "L" appears to the left of the numerical Offset Error display at the same time that the LOCK indicator lights up as an additional indication of Lock status.

If the LOCK indicator is lit and the RESOLVE indicator is flashing, it indicates that the module initially achieved Lock, but that an Offset Error has developed.

The LOCK indicator can only be lit if the module is Online, and if the RESOLVE indicator is also lit (or is flashing).

3.14 [SYNC POINT] KEY

If the VSI Film Module is Offline, pressing [SYNC POINT] causes the Film Module to cue the film transport(s) under its control to a position that corresponds to the current SyncPoint timecode.

If the VSI Film Module is Online, pressing [SYNC POINT] has no effect.

GOTO INDICATOR

This indicator flashes when the Film Module's biphase generator is running at non-sync speed.

The GOTO indicator will begin to flash in response to:

- Any command other than Forward or Stop from the editor or controller .(Module Online)
- A GOTO command initiated by touching the [SYNC POINT] key. (Module Offline only)
- Any command other than Forward or Stop from a set of external motion control switches connected to the TRANSPORT connector. (Module Online or Offline)

3.15 [GEN MODE] KEY

This key controls the operating mode of the Film Module's Timecode Generator.

Pressing [GEN MODE] while the Generator is not switched On steps sequentially through Normal mode, Automatic Jam Sync mode, Jam User Bits mode, Tach-to-Timecode mode, and then back to Normal mode again. Only the Normal and Tach-to-Timecode modes are currently implemented in the VSI Film Module. Specifically, attempting to select automatic Jam Sync mode (JAM TC indicator lit) or Jam User Bits mode (JAM UB indicator lit) actually results in Normal mode operation.

Pressing [GEN MODE] when the Generator is switched On in the Normal mode (GEN ON indicator lit but no GEN MODE indicators lit) initiates a manual Jam Sync operation. Touching [GEN MODE] under these conditions causes the generator to output the Film Position frame number that is current as of the moment the key is pressed and to continue to generate timecode sequentially from that frame number.

When the Film Modules executes a Jam Sync, it replaces the normal numeric display with "JJ JJ JJ JJ" for approximately 1 second as a warning indication.

Pressing [GEN MODE] when the Generator is switched On but is <u>not</u> in the Normal mode (i.e. GEN ON lit and one of the three GEN MODE indicators lit) has no effect on the generator mode as a safety feature.

3.15.1   GEN MODE INDICATORS

The three LEDs above the `GEN MODE` key display the current operating mode of the Film Module's timecode generator. The two generator modes available in the VSI Film Module are Normal mode (no indicators lit) and Tach-to-Timecode mode (TACH>TC lit or flashing). Note that these indicators do not signify that the generator is actually switched On; that indication is provided by the GEN ON light.

JAM TC INDICATOR

Not used in the Lynx Film Module. When lit, the module's timecode generator is actually in the Normal operating mode.

JAM UB INDICATOR

Not used in the Lynx Film Module. When lit, the module's timecode generator is actually in the Normal operating mode.

TACH>TC NDICATOR

When lit, indicates that the Film Module's timecode generator is in the Tach-to-Timecode mode.

When the Tach-to-Timecode mode is selected with the `GEN MODE` key and the generator is enabled with the `GEN ON` key, the generator output is switched on and off automatically in response to film motion:

If the generator is enabled in the Tach-to-Timecode mode but the Film Module is not designated as the Master, the generator will not output time code. The ON light above `GEN ON` will remain lit since the generator is still enabled, but the TACH>TC light will flash as a reminder that the generator output is switched off. (This flashing indication is suppressed if the display is selected to anything but GEN.)

If the Film Module is selected as Master and the generator is enabled in the Tach-to-Timecode mode, film motion automatically initiates timecode generation. When the film stops, the generator repeats the frame number for the stopped position for 1/2 second, then automatically switches itself off. As above, if the GEN display mode is selected, the GEN ON light will remain lit but the TACH>TC light will flash as a reminder that the generator is not currently putting out time code.

3.16 `GEN ON` KEY

Pressing `GEN ON` alternately enables and disables the module's timecode generator. When the generator is enabled, the module locks in the current selection of Code Type and Generator Mode as a safety feature; changes in these selections may only be made when the generator is disabled.

If the generator is in the Normal operating mode `GEN ON` switches the generator On and Off in real time. If the generator is currently Off (ON indicator not lit), pressing `GEN ON` causes the generator to begin to output timecode starting with the current generator frame number (which may be a manually preset starting value) plus one. Pressing `GEN ON` a second time stops the generator at the completion of the current timecode word; pressing it a third time resumes generation with the next frame number in sequence. Note that in the Normal mode the generator's function is totally independent of the Online/Offline status of the module.

If the generator is in the Tach-to-Timecode mode, pressing `GEN ON` alternately enables and disables the generator. This does not actually switch the generator On and Off because in the Tach-to-Timecode mode the generator only outputs timecode when there is film motion. Note that the function of the generator in the Tach-to-Timecode mode is <u>not</u> independent from the module's Online/Offline status.

ON NDICATOR

When lit, indicates that the Film Module's timecode generator is enabled. When the ON indicator is lit, the module prohibits any changes in the Code Type or Generator Mode as a safety feature; these changes may only be made when the ON indicator is extinguished.

If the generator is in the Normal operating mode, the ON indication signifies that the module's generator is running and is outputting timecode on the rear panel GEN OUT jack. Note that in this mode the generator's function is totally independent of the Online/Offline status of the module.

If the generator is in the Tach-to-Timecode mode, the ON indication signifies that the generator is enabled, although it actually will only be putting out timecode when there is film motion. Note that the function of the generator in the Tach-to-Timecode mode is <u>not</u> independent from the module's Online/Offline status.

3.17 ALTERNATE KEY FUNCTIONS (SET-UP MODE)

Several of the keys on the Lynx Film Module assume alternate, secondary functions when the module is in a Set-Up mode. These alternate functions are indicated by the blue markings on the module's face panel rather than by the designations on the keycaps themselves; in this manual we indicate these secondary designations in square brackets.

The Set-Up modes in which the keys assume their alternate functions are entered by holding STORE key while turning on the power switch (module initialization mode), or by holding TRAN and •SET UP• once the module has been initialized (Online Set-Up mode).

•SET UP• KEY

In addition to controlling access to the Initial Set-Up mode and the Online Set-Up mode, the •SET UP• key is also used to confirm that the biphase frequency and serial address selections are correct as the last step in the initialization procedure.

•MENU• KEY

Pressing this key steps sequentially through the various menus available in the Online Set-Up mode.

•FORW• KEY

This key steps in the "forward" direction through the various items that are available under the menu selected with the •MENU• key in the Online Set-Up mode.

•BACK• KEY

This key steps in the "backwards" direction through the various items that are available under the menu selected with the •MENU• key in the Online Set-Up mode.

4. REAR PANEL DESCRIPTION

4.1. POWER ENTRY MODULE

4.1.1. MAINS CORD SOCKET

The mains cord socket in the power entry module accepts a standard IEC type 3-wire power cord such as the one supplied with the Lynx Film Module. Only 3-wire power cords should be used with the Lynx Film Module.

4.1.2. FUSE HOLDER

The power entry module of the Lynx Film Module incorporates the holder for the AC power fuse.

To gain access to the AC power fuse, first remove the power cord from its socket. Then remove the fuse drawer by inserting the blade of a small screwdriver in the slot at the bottom center of the power cord socket and twisting the screwdriver. The fuse drawer has positions for two fuses, one position for the active fuse and one for a spare fuse. The fuse position nearest the back panel is for the spare.

The Lynx Film Module uses type GMA fuses. This is a 5 x 20 mm, quick-acting, 250 volt, glass cartridge fuse. Do not use time-delay or slow-blow fuse types, and do not use fuses rated at less than 250 volts.

The Lynx Film Module is supplied with two fuses of the correct rating for the operating voltage that was set at the factory. If you change the operating voltage setting, you *must* also change the fuse to the correct rating.

VOLTAGE	FUSE TYPE & VALUE
115	GMA 1/4 AMP
230	GMA 1/8 AMP

4.2. MAINS VOLTAGE SELECTOR SWITCH

Located alongside the power entry module is a two-position mains voltage selector switch. This switch selects either 115 volts or 230 volts as the nominal mains supply voltage.

WARNING: Operation of the Lynx Film Module with the mains selector switch in the wrong position can cause irreparable damage to the unit. Such damage is **not covered** by the manufacturer's warranty. Make very certain that the selector switch is in the correct position and the correct fuse type is installed before applying power to the unit.

4.3. SERIAL NUMBER

The unique serial number of each individual Lynx Module. Always refer to this serial number when communicating with your Lynx dealer or TimeLine regarding your Lynx Film Module. TimeLine keeps individual files by serial number to record the level of hardware and software revisions and other engineering changes.

4.4. TRANSPORT CONNECTOR

50-pin, female, D-subminiature connector carrying all transport interface signals. The bi-phase generator output and bi-phase follower inputs appear on this connector along with logic inputs for external motion control switches and optoisolator outputs for motion mode tallies.

The following chapter on connecting the Lynx Film Module contains information regarding the specific connections made via the TRANSPORT connector. Additionally, the appendiX to this manual contain a listing of the TRANSPORT connector pin assignments and a schematic of the suggested connections.

4.5. RS422 CONNECTORS

Two parallel-connected, 9-pin, female, D-sub-miniature connectors wired according to the RS422 standard. These connectors are used to serially interconnect Lynx VSI Modules with the external controller or editor.

In typical video editing systems the editing computer has separate serial I/O ports for each transport it controls. In such systems, each Lynx VSI Module would be connected to its own serial port on the editor via a separate user-supplied RS422 cable. In such systems only one of the RS422 connectors on each Lynx would be used; the other RS422 connector must be left unconnected. Also note that in such systems, there should be no continuity in the RS422 cable between Pin 5 at the editor and Pin 5 at the Lynx VSI Module. (Pin 5 is an "optional" connection in the RS422 standard which may be used for different purposes in different RS422 implementations.)

In audio editing systems that use Lynx VSI Modules for machine control interfaces, all the modules are generally connected to a single serial I/O port on the editing computer in a "daisy chain" or loop-through configuration. In such a system, the editor is connected directly to only one module, with all the other modules connected in parallel with that first module. The two parallel connectors on each Lynx Module facilitate this kind of chained connection using standard RS422 cables such as those supplied with each Lynx Module. Note that in this kind of connection configuration each Lynx Module typically will have cables connected to both RS422 connectors except for the module farthest from the editor which will have one unused connector.

NOTE: The RS422 connectors are totally isolated from the Lynx Module chassis and from the normal transport/module ground regardless of the position of the GND/ISO switch. (This isolated ground is shared with the EXT VID connectors, however.) This means that there may be a ground potential difference between the RS422 connectors and the transport cables.

4.6. VITC CONNECTOR

Not installed in the Lynx Film Module.

4.7. EXT VID CONNECTORS

Two parallel-connected, female, BNC connectors for the input of an external video reference signal such as composite sync, black burst, or color bars.

Either connector may be used for the input of the reference signal. The second BNC provides a convenient extension connection for looping the video signal through to another Lynx Module or to a video machine, or for terminating the video line with a 75Ω terminating plug. Note that a video transmission line should be terminated with a 75Ω resistance at one and only one point, usually the last device on the distribution line.

NOTE: The EXT VID connectors are totally isolated from the Lynx Module chassis and from the normal transport/module ground regardless of the position of the GND/ISO switch. (This isolated video ground is shared with the RS422 serial communications bus, however.) This means that there may be a ground potential difference between the BNC connectors and the transport cables.

4.8 TC IN CONNECTOR

Not installed in the Lynx Film Module.

4.9 RESHAPE CONNECTOR

Not installed in the Lynx Film Module.

4.10 GEN OUT CONNECTOR

3-conductor ("stereo") 1/4" phone jack carrying the electrically balanced output of the Film Module's timecode generator. A signal only appears on this jack when the generator is switched on.

The output of the timecode generator is a square wave at a nominal signal level of 1.38 volts peak-to-peak (= 0.69 volts RMS or -1.0 dBu) into a balanced, bridging load. This output level will produce a reading of approximately -5 VU in most systems, or approximately -12 VU when terminated in 600 Ω. The generator output level may be adjusted over a range of some 16 dB (roughly from -10 to +6 VU in most systems) using the GEN LVL trimmer as described below.

If the generator output is to be connected to an unbalanced load, the "hot" side of the load should be connected to the tip contact of a 3-conductor phone plug and the "cold" or common side of the load to the sleeve, leaving the ring contact of the plug unconnected. Shorting the ring contact of the module's GEN OUT jack to ground (by inserting a 2-conductor phone plug, for example) should not cause any damage to the module itself, but should be avoided as a general practice.

4.11 GEN LVL TRIMMER

This screwdriver-slotted trimmer adjusts the output level of the module's timecode generator over a range of approximately 16 dB. This square-wave output is adjusted at the factory for a nominal output level of 1.38 volts peak-to-peak (= 0.69 volts RMS or -1.0 dBu) into a balanced, bridging load, which produces a reading of approximately -5 VU in most systems. The trimmer typically provides an adjustment range from roughly -10 VU to +6 VU.

4.12 PILOT IN CONNECTOR

Not installed in the Lynx VSI Film Module.

4.13 PILOT OUT CONNECTOR

3-conductor ("stereo") 1/4" phone jack carrying the electrically balanced pilot output derived from the Film Module's timecode generator clock. The pilot output signal is always present on this jack regardless of whether or not the generator is switched on.

The pilot output is a fixed-level square wave at a nominal signal level of 1.54 volts peak-to-peak (= 0.77 volts RMS or 0.0 dBu) into a balanced, bridging load. This output level will produce a reading of approximately -4 VU in most systems.

The output impedance of each side of the electronically balanced pilot output is 560 Ω.

If the pilot output is to be connected to an unbalanced load, the "hot" side of the load should be connected to the tip contact of a 3-conductor phone plug and the "cold" or common side of the load to the sleeve, leaving the ring contact of the plug unconnected. Shorting the ring contact of the module's PILOT OUT jack to ground (by inserting a 2-conductor phone plug, for example) should not cause any damage to the module itself, but should be avoided as a general practice.

In the VSI Film Module the pilot output signal is always twice the frame rate video reference signal connected to the EXT VID connectors, e.g. 50 Hz for PAL video or 59.94 Hz for NTSC color video sync.

4.14 GND/ISO SWITCH

This toggle switch determines whether or not the Lynx Module's chassis is tied to the transport's ground.

In the GND position, the Lynx Module's signal ground, which is typically tied to transport ground via the biphase cable, is connected to the module's chassis.

In the ISO position, the Lynx Module's chassis is electrically isolated from the module's signal ground (and hence the transport ground) to preserve the overall system grounding scheme.

NOTE: The position of this switch does not affect the grounding of the EXT VID and RS422 connectors, which are always isolated from the module's chassis and from module/ transport signal ground. This means that there may be a ground potential difference between the ground contacts of the BNC and 9-pin connectors relative to the transport cable connections.

5 INTERFACE CONNECTIONS

5.1 TRANSPORT CONNECTOR

The primary interface to the Lynx VSI Film Module is the 50-pin TRANSPORT connector which contains all of the module's logic and control signal inputs and outputs that relate to external devices and systems. This includes:

- Biphase generator output (to control film transports
- Biphase follower input (to follow the motion of film transports)
- Internal changeover relay (switches biphase connections based on operating mode)
- Record command outputs
- Rehearse mode command output
- External motion control switch inputs
- Film transport mode tally outputs
- Mute relay (to initiate external muting or dimming functions)
- Remote Lock indicator output

TimeLine does not offer a manufactured interface cable for the Film Module due to the customized nature of most module installations. Please refer to the Appendix at the end of this manual for a complete listing of the pin assignments for the TRANSPORT connector and for schematic diagrams of the recommended connections for:
- Biphase Follower
- Bi-Phase Generator
- External Motion Control Switches
- Mode tallies.

5.1.1. BIPHASE CONNECTIONS

The only essential connections between the Lynx Film Module and the film transport(s) are the connections to the biphase generator input and the biphase follower output.
 NOTE

> Phase A leads phase B (by approximately 90°) for forward film motion. Also note that in Tach & Direction systems, the phase A connection is used for the Tachometer signal and the phase B connection for the Direction signal.

The biphase connections shown in the "Lynx Film Module Suggested Interconnect" drawing in the Appendices to this manual make use of the changeover relay inside the Film Module. In the standard (Master/Slave synchronization) version of the Film Module, this relay automatically reconfigures the biphase connections depending on whether the module's biphase output is controlling the transports or whether the Film Module is simply following the biphase from an externally-controlled film transport such as a telecine.

In the case of the VSI Film Module, the changeover relay is not used to reconfigure the connections because the film transport must always be under the control of the module's biphase output. The connections to the relay are therefore optional. You may either wire the cable as shown so that it may be used with either version of the Film Module, or you may hard-wire the biphase transmitter to the biphase receiver for use with the VSI Film Module only. This optional connection scheme is shown on the "Lynx VSI Film Module Optional Interconnect" drawing in the Appendices.

5.1.2. RECORD COMMAND CONNECTIONS

The VSI Film Module has separate outputs for Record In and Record Out commands to allow the module to initiate and terminate Record mode on the film transport in response to edit commands from the external editor or controller. Each of these commands is issued as a single pulse of approximately 30 milliseconds duration.

PIN #	SIGNAL NAME
40	RECORD IN Command

Darlington opto-isolator collector, 80 volts/ 30 mA max. Emitter connected to Tally Common (Pin 23).

PIN #	SIGNAL NAME
19	RECORD OUT Command +
35	RECORD OUT Command –

Darlington opto-isolator, 80 volts/30 mA max.

5.1.3. REHEARSE COMMAND CONNECTIONS

The VSI Film Module also supports a Rehearse command output to control any Rehearse or Preview function that is available on the film transport or in the audio control system. The VSI Film Module may send various combinations of Rehearse and Record commands to initiate and terminate the Rehearse mode in a variety of different systems.

PIN #	SIGNAL NAME
12	REHEARSE Command

Open-collector Darlington output, 50 volts/ 100 mA max. Emitter connected to Module Ground.

5.1.4. EXTERNAL MOTION CONTROL SWITCHES

The VSI Film Module provides for direct control of the biphase generator in the Film Module via an external set of five motion control pushbuttons. This would most commonly be used when the module is Offline (not under editor control) to allow the operator to position the film to a start mark. An alternate application is the connection of a local "emergency stop" switch in a remote machine room.

The switches used for this application should be a conventional momentary contact type in either single-throw or double-throw configurations; suggested circuits are shown for both switch types on the "Lynx Film Module Suggested Interconnect" drawing in the Appendices to this manual.

The logic inputs to the Film Module for the external switch connections are high-impedance, active-high inputs. Any voltage from +5 to +24 can be safely used for the high, or active, logic level. (The 20 mA +5 volt supply that is available on Pin 18 of the TRANSPORT connector may be used for this purpose.) Because of the high impedance of these logic inputs, we recommend using a pull-down resistor to ground or grounding the normally closed contact of a double-throw switch as shown on the "Lynx Film Module Suggested Interconnect" drawing to suppress transients that may be picked up when a long cable length is used between the Film Module and the switches.

PIN #	SIGNAL NAME
41	External STOP Switch
9	Ext. FORWARD Switch
8	Ext. REVERSE Switch
25	Ext. FAST FWD. Switch
26	Ext. FAST REV. Switch

5.1.5.   EXTERNAL TRANSPORT MODE TALLYS

The Film Module provides five tally outputs to indicate the motion mode of the sprocketed transport. These tally outputs appear on the TRANSPORT connector.

The tally outputs are the collectors of photo-Darlington optoisolators. The emitters of this group of five optoisolators are all tied together as the Tally Common. Note that all of these connections are isolated from Module Ground.

3	STOP Tally
37	FORWARD Tally
6	REVERSE Tally
7	FAST FORWARD Tally
24	FAST REVERSE Tally
23	Tally Common

Tally outputs are Darlington opto-isolator collectors rated at 80 volts/30 mA. All emitters of this group are connected to Tally Common.

NOTE:

> The mode tally indication changes immediately upon receipt of a new mode command from the editor or from the external motion control switches while the module's biphase generator will take a finite amount of time to ramp its frequency between modes.

5.1.6.   MUTE RELAY CONNECTIONS

The Film Module provides a single-pole, double-throw relay driven by the module's transport mode logic. This relay was originally intended to provide a "dry" closure that could be used to mute the audio output of the film transport or to mute the monitoring system, but its use is not limited to this type of muting function.

In the normal operating mode the relay is energized when the module is in Fast Forward, Reverse, or Fast Reverse modes and is unenergized in Stop, Forward and Crawl modes. Two optional operating modes are provided under the Options menu which will additionally energize the relay while the transport is accelerating up to sync speed and achieving Lock.

All three connections to the Mute relay are isolated from the Film Module's circuitry for maximum flexibility in making external connections. The relay contacts are rated at 2 Amps for low voltage DC applications (up to 30 Volts DC), or 600 mA for higher voltage use (up to 110 Volts DC or 125 Volts AC).

PIN #	SIGNAL NAME
48	Mute Relay, common
47	Mute Relay, normally-closed
46	Mute Relay, normally-open

5.1.7.   REMOTE LOCK INDICATOR CONNECTIONS

The Film Module supports a logic output to drive a remote Lock status indicator which essentially operates in parallel with the LOCK indicator on the module's front panel.

PIN #	SIGNAL NAME
10	Remote LOCK indicator

The remote lock indicator output is an active-low, open collector, Darlington-connected output. The output is rated at 50 volts maximum and is capable of sinking a maximum of 100 mA of current to Module Ground.

5.2. RS422 CONNECTIONS

The VSI Film Module operates under the control of an external editing computer or controller with which it communicates serially via the RS422 connection using the same serial communications protocol as an Ampex VPR-3 video transport.

To accommodate a module that is located remotely from the editor or controller, the RS422 connection may be extended by a reasonable amount using an appropriate RS422 extension cable. The RS422 standard provides for cable lengths up to 4000 feet if appropriate cabling is used

Since RS422 is a high speed (38.4 kilobaud) serial data system, it is somewhat sensitive to cable capacitance in long cable runs, and there is the potential for noise emission (into other equipment) if unshielded cables are used. Acceptable cable capacitance values for long runs are <65 picofarads per meter (20 picofarads per foot) between the conductors of a given pair, and <130 picofarads per meter (40 picofarads per foot) of stray capacitance between any single conductor and all other conductors in the cable. Appropriate pre-manufactured RS422 cables are available from many suppliers of computer cables and accessories.

If you opt to make you own RS422 extension cables, the 9-pin "D" connectors on each end of the cable should correspond pin-for-pin (Pin 1 to Pin 1, 2 to 2, etc.). The cable type you use should have three twisted pairs and either an overall shield or individual shields for the pairs, although unpaired cable is adequate for short runs (up to perhaps 20 feet).

In longer cable lengths it is very important to use a separate twisted pair for each balanced line in the RS-422 scheme; i.e. Pins 3 & 8 should be one twisted pair and Pins 2 & 7 should be another. The two Ground pins (1 & 9) and two Shield pins (4 & 6) are all connected to the Video/Communications ground of each Lynx Module. It is therefore not essential to make all four connections at both ends of the cable.

> NOTE: Pin 5 is an "optional" connection in the RS422 standard and may be used for different purposes by different manufacturers in their RS422 implementation. When using Lynx VSI Modules with video editing systems it is important that there is no connection between Pin 5 of the editor's serial I/O connector and Pin 5 of the VSI Module's RS422 connector.

5.3. EXT VID CONNECTIONS

The connection of an external video reference signal such as "house sync" is required by the VSI Film Module. The module will not complete its power-up sequence unless a suitable video reference signal is connected, and if the video reference signal is lost during normal module operation the module will cease operation and display the error message "no uid".

The external video reference signal should be connected to the EXT VID input of each Lynx VSI Module. The two BNC-type EXT VID connectors on the rear of the Film Module are wired in parallel to facilitate a "daisy-chain" type of connection between modules. The module's EXT VID input circuitry is a high impedance, bridging design so that any reasonable number of modules may be connected in parallel on the output of the video signal source or distribution amplifier. Note, however, that it is standard practice to resistively terminate a video distribution line with a 75Ω load at one and only point on the line (usually at the farthest point from the signal source), and that this typically requires a separate termination device.

The VSI Film Module can accept a variety of video signals as its external reference. The list of acceptable signals includes composite sync, black burst, color bars, or virtually any stable composite video signal. The video output of a VTR is generally unacceptable as the reference signal. Note that the the Film Module cannot accept low frequency sync pulse signals such as "V-drive" as its external reference; the external reference must be in the form of a composite video or composite sync signal.

5.4. GEN OUT CONNECTIONS

Connection to the GEN OUT jack on the Film Module is generally optional since there is no requirement to record a timecode signal on any of the dubbers or film transports. Many Film Module users bring this connection out to a patch point in their facility so that they may conveniently access the module's timecode generator or use the Tach-to-Timecode for external display of the Film Position frame numbers.

The timecode generator output is an active balanced signal as it appears on the 3-conductor (stereo 1/4") GEN OUT jack. When connecting this output signal to an unbalanced input, the "low" side of the balanced signal (the ring contact) should be left unconnected. Grounding the "low" side of the electronically balanced generator output (by inserting a 2-conductor phone plug into the GEN OUT jack, for example) should be avoided as a general practice, although it should not cause any damage to the Lynx Module itself.

5.5. PILOT OUT CONNECTIONS

Connection to the PILOT OUT jack on the Film Module is optional and generally not used. You may wish to bring this connection out to a patch point in your facility for more convenient access if there is any likelihood that you will use this pilot signal.

Note that frequency of the PILOT OUT signal from the VSI Film Module is a square wave that is always 2X the frame rate of the video reference signal, i.e. 59.94 Hz in NTSC video systems or 50 Hz in PAL video systems. The pilot signal is always present on the PILOT OUT jack regardless of whether or not the module's generator is currently switched On.

Note that the pilot output is an active balanced signal as it appears on the 3-conductor (stereo 1/4") PILOT OUT jack. When connecting this output signal to an unbalanced input, the "low" side of the balanced output (the ring contact) should be left unconnected. Grounding the "low" side of the balanced output (by inserting a 2-conductor phone plug into the PILOT OUT jack, for example) should be avoided as a general practice, although it should not cause any damage to the Lynx Module itself.

6. INITIALIZING THE VSI FILM MODULE

Once the VSI Film Module is connected to the film transport(s), the external controller, and a suitable video reference signal, it is necessary to set up the operating parameters of the module. This set-up procedure includes:

- Setting the nominal biphase frequency in the module initialization procedure. This also loads a set of default parameters for that particular biphase frequency setting.
- Setting the appropriate Serial Address number for proper communications with the external controller or editor.
- Setting the film frame rate in the Online Set-Up mode if it is different from the default value (which is determined by the type of video refernce signal connected to the module). At the same time you may also modify the biphase generator parameters from their default values if you wish.
- Setting a starting frame number for the module's Film Position counter.

All operating parameters of the Lynx Film Module are retained in a battery backed-up (non-volatile) memory device inside the Film Module. It is generally unnecessary to repeat any of the module set-up procedures unless the operational conditions change or unless it is desired to "reboot" the module and erase all the data stored in the battery memory.

6.1. MODULE INITIALIZATION

The basic module initialization is carried out after clearing the module's battery memory by holding the STORE key while turning on the power switch.

6.1.1. SETTING THE BIPHASE FREQUENCY

Hold STORE and turn on the module's power switch to erase the battery memory and enter the Initial Set-Up mode. The module will first display the software version number ("FU-404r") and then show "F-48" flashing in the window.

At this time, you may step through the list of available frequencies with the ↑ and ↓ keys. In each case the nominal biphase frequency will be flashing in the display.

When the desired biphase frequency is flashing in the window, press STORE to enter your selection. The display will stop flashing.

Press •MENU• to move on to the next selection. .

6.1.2. SETTING THE SERIAL ADDRESS

The VSI Film Module must have an appropriate Serial Address set in its software parameters in order to communicate properly with the external controller or editor.

In video editing systems, each video transport or Lynx VSI Module is generally connected to a separate serial port on the editor. In these systems, the proper Serial Address for a Lynx Module is generally determined by the editor's software according to the brand of editing system. The proper addresses for supported video editing systems are:

- AMPEX ACE SERIES EDITORS
  Address 0 (any address number is acceptable)
- GRASS VALLEY GROUP / ISC
  Address 1
- CMX
  Address 2

In audio editing systems, there are typically a number of Lynx VSI Modules connected to a single serial port on the control computer in a "daisy chain" configuration. In such systems each module must be set to a unique Serial Address so that the controller can address and communicate with each module individually. Please consult the operating manual for the particular editing system regarding appropriate serial address assignments.

To set the module's Serial Address:

- When "Addr 001" is flashing in the display window, you may step through the available Serial Address numbers (0 through 8) with the ↑ and ↓ keys. The address numbers wrap around from 8 to 0 for convenience.
- When the desired address number is flashing in the window, press STORE to enter your selection. The display will stop flashing.
- Press the •MENU• key. The display will now show "donE".
- Press the STORE key again to confirm that your your biphase frequency and serial address selections are correct. If your selections are not correct, press the •MENU• key again and you will return to the flashing biphase frequency display.

6.1.3. SIGN-ON MESSAGE

When you press [STORE] after setting the biphase frequency and serial address in the module initialization procedure, the VSI Film Module will display its Sign-On Message. This is the same sequence of displays that the module will perform each time you turn on power to it. The Sign-On Message comprises the following sequence:

- Software version   F U - 4 0 4 r
- Serial Address A d d r 0 0 2 (for example)
- Sync Parameter   S Y n c   0 0 0

6.1.4. VIDEO DETECT ROUTINE

Following the Sign-On Message described above, the VSI Film Module begins a Video Detect routine in which the module times the frame rate of the external video reference signal to determine whether it is NTSC or PAL and sets the timecode generator to the appropriate code type. This Video Detect routine is performed by the VSI Film Module each time power is turned on to the module. The VSI Film Module cannot be put Online and will not operate until it has completed the Video Detect routine.

While the module is performing the Video Detect routine the display window shows "u i d d E t". This message will remain in the window until an appropriate reference signal is connected to one of the EXT VID connectors on the rear of the VSI Film Module and is detected by the module. If the module loses its video reference signal after it has completed the Video Detect routine, it displays the error message "n o u i d" in the window until the reference signal reappears.

When the module completes the Video Detect routine, it briefly displays either "n t S c" or "P A L" as appropriate, sets its timecode generator frame rate to match the frame rate of the video it has detected, and then assumes its normal operating functions and displays. If the module has detected NTSC video it sets its generator to 30-frame SMPTE timecode (locked to the video's 29.97 fps frame rate), and if it has detected PAL video it sets its generator to 25-frame EBU timecode.

Additionally, when the VSI Film Module is re-initialized (i.e. when the battery memory is cleared) the module sets its film frame rate to a default value based on the video frame rate. In NTSC systems the film frame rate defaults to 24 fps, and in PAL systems the default film frame rate is 25 fps.

The timing tolerance of the Video Detect routine is set in software to ±0.25%. This should allow the VSI Film Module to properly detect an off-speed reference signal, or to recognize a true monochrome (i.e. 30 fps) video signal as an acceptable "NTSC" reference.

6.1.5. DEFAULT PARAMETERS

When you select the nominal biphase frequency, the Film Module automatically loads a set of default parameters. Any or all of these default parameters may be overridden as necessary in the Online Set-Up mode described in the next section. Any changes you make to these parameter will be retained in the module's non-volatile memory until you change the biphase frequency or re-initialize the module.

The default parameters for each of the biphase frequency selections are as follows:

Menu Selection	FPS Film Frames per Second	FASt Fast-wind Speed Multiple	LOC Locate Approach Rate	ACC Acceleration Ramp Rate
F - 4 8	0 2 4 / 0 2 5	0 1 2	1 0 0	0 3 2 (4 x)
F - 9 6	0 2 4 / 0 2 5	0 0 5	0 7 0	0 0 8 (1 x)
F - 2 4 0	0 2 4 / 0 2 5	0 0 5	0 7 0	0 0 8 (1 x)
F - 4 8 0	0 2 4 / 0 2 5	0 0 5	0 7 0	0 0 8 (1 x)
F - 6 0 0	0 2 4 / 0 2 5	0 0 5	0 7 0	0 0 8 (1 x)
F - 1 2 0 0	0 2 4 / 0 2 5	0 0 5	0 7 0	0 0 8 (1 x)
F - 2 4 0 0	0 2 4 / 0 2 5	0 0 5	0 7 0	0 0 8 (1 x)

FPS Sets the film frame rate of the biphase generator and follower depending on the type of video reference signal ; the default is 024 (24 fps) if NTSC video is detected or 025 (25 fps) if PAL sync is detected.

FASt Sets the maximum fast speed of the biphase generator i expressed as a multiple of sync speed.

LOC Sets the approach speed (deceleration rate) when locating expressed in arbitrary units with a range of 010 to 255.

ACC Sets the ramp or acceleration rate of the biphase generator. An ACC value of 8 is equal to an acceleration rate of 1X sync speed per second.

7.OPERATING THE LYNX VSI FILM MODULE

7.1. SERIAL COMMUNICATIONS

Once the VSI Film Module has been initialized and set up as described in the preceding sections it is necessary to establish communications between the module and the external editor or controller:

•Touch ⸢TRAN MODE⸣ to light the ONLINE indicator.

Reset or reboot the editor so that it polls or interrogates its serial port(s). The editor should now be in communications with the Lynx Module. Verify that the 422 light on the Film Module is illuminated, which indicates that the module has been addressed by the editor and is receiving valid messages from it.

Failure of communications can be caused by incorrect serial address setting or improper serial cable connections between the module and the editor.

7.2. TACH>TIMECODE MODE

The Tach-to-Timecode mode is selected with the ⸢GEN MODE⸣ key .This mode only operates when the Film Module has been designated as the Master (MSTR indicator lit), and when the module's biphase generator output is controlling the film transports. Additionally, the Reference Source must be selected to the Generator reference (either INTL XTL or EXT VID).

When the generator is enabled with the ⸢GEN ON⸣ key, it's output will be switched on and off automatically in response to film motion or if there is any change in the Film Module's Master status.

If the generator is enabled in the Tach-to-Timecode mode but the Film Module is not designated as the Master, the generator will not output time code. The light above the ⸢GEN ON⸣ key will remain lit since the generator is still enabled, but the TACH>TC light will flash as a reminder that the generator output is switched off. (This flashing indication is shown only if the display is selected to GEN.)

If the Film Module is selected as Master and the Generator is enabled in the Tach-to-Timecode mode, motion automatically initiates timecode generation. When the film stops, the Generator repeats the frame number for the stopped position for 1/2 second, then automatically switches itself off. As above, if GEN is selected to the display, the GEN ON light will remain lit but the TACH>TC light will flash as a reminder that the Generator is not currently putting out time code.

In the Tach-to-Timecode mode, the default frame rate for the module's Generator is determined by the film frame rate.

Film Frame Rate	Gen.
25 fps	25 fps
24 fps	30 fps
30 fps	30fps

These defaults may, of course, be overridden by the operator at any time as long as the GEN ON light is not lit.

The Tach-to-Timecode mode always generates timecode words at the same bit rate as normal sync speed time code (for example 30 frames/second X 80 bits/frame = 2400 bits/second) regardless of the actual running speed of the film to allow reading by devices which cannot read high-speed time code.

Whenever the film is moving but is not running at sync speed (i.e. the LOCK indicator not lit), the module's Generator performs a "flying jam" to the current Film Position on a frame-by frame basis so that each timecode frame number emitted corresponds to the instantaneous position of the film at the start of the timecode word. As a consequence, the timecode numbers will not be sequential if the film is not running at sync speed; timecode frame numbers will be skipped if the film is running faster than sync speed, and frame numbers will be repeated when the film is running slower than sync speed.

When the film achieves a Lock condition, the Generator performs a single Jam Sync operation and then continues to generate normal, sequential timecode that is locked to the Film Position as long as the Lock condition continues.

The individual timecode words generated by the Lynx Film Module are always generated in the normal, forward sequence (bit #1 to bit #80) regardless of the direction of film motion. If the film is moving in the reverse direction, the module generates normal timecode words which are in reverse numerical order. The Film Module does not generate reverse time code.

APPENDIX I: TRANSPORT CONNECTOR PIN-OUT
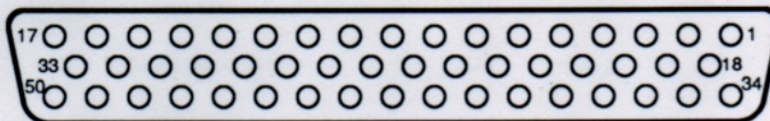
INDEXED BY PIN NUMBER:

1.	MODULE GROUND	2.	-RESERVED-
3.	STOP TALLY OUTPUT	4.	-RESERVED-
5.	-RESERVED-	6.	REVERSE TALLY
7.	FAST FORWARD TALLY	8.	EXTERNAL REVERSE COMMAND
9.	EXTERNAL FORWARD COMMAND	10.	REMOTE LOCK INDICATOR OUTPUT
11.	-RESERVED-	12.	REHEARSE COMMAND
13.	CHANGEOVER RELAY,B; N/C	14.	CHANGEOVER RELAY, A; COMMON
15.	CHANGEOVER RELAY, A, N/O	16.	BIPHASE FOLLOWER; PHASE A
17.	BIPHASE FOLLOWER; PHASE B	18.	+5 VOLTS (FOR EXTERNAL SWITCHES)
19.	RECORD OUT COMMAND +	20.	-RESERVED-
21.	-RESERVED-	22.	-UNUSED-
23.	TALLY COMMON	24.	FAST REVERSE TALLY
25.	EXTERNAL FAST FORWARD CMD.	26.	EXTERNAL FAST REVERSE
27.	-RESERVED-	28.	-RESERVED-
29.	CHANGEOVER RELAY, B; N/O	30.	CHANGEOVER RELAY, B; COMMON
31.	CHANGEOVER RELAY, A; N/C	32.	BIPHASE GEN. OUT, PHASE A
33.	BIPHASE GEN. OUT, PHASE B	34.	MODULE GROUND
35.	RECORD OUT COMMAND –	36.	-RESERVED-
37.	FORWARD TALLY OUTPUT	38.	-RESERVED-
39.	-RESERVED-	40.	RECORD IN COMMAND OUTPUT
41.	EXTERNAL STOP COMMAND	42.	-RESERVED-
43.	-UNUSED-	44.	–12 VOLTS (5MA MAXIMUM)
45.	+12 VOLTS (5MA MAXIMUM)	46.	MUTE RELAY, N/O
47.	MUTE RELAY, N/C	48.	MUTE RELAY, COMMON (SWINGER)
49.	-RESERVED-	50.	-RESERVED-

INDEXED BY FUNCTION:

POWER & GROUND

PIN #	SIGNAL NAME
1, 34	Module Ground
18	+5 volts
44	-12 volts
45	+12 volts

Use of these supply voltages should be limited to a maximum of 20mA, and preferably 5mA or less.

BIPHASE INPUTS AND OUTPUTS:

PIN #	SIGNAL NAME
32	Biphase Generator, phase A
33	Biphase Generator, phase B
16	Biphase Follower, phase A
17	Biphase Follower, phase B

Phase A leads Phase B during forward motion

RECORD AND REHEARSE COMMAND OUTPUTS:

40	RECORD IN Command

Darlington opto-isolator collector, 80 volts/ 30 mA max. Emitter connected to Tally Common (Pin 23).

19	RECORD OUT Command +
35	RECORD OUT Command −

Darlington opto-isolator, 80 volts/30 mA max.

12	REHEARSE Command

Open-collector Darlington output, 50 volts/ 100 mA max. Emitter connected to Module Ground.

EXTERNAL MOTION CONTROL SWITCH INPUTS:

41	External STOP Switch
9	Ext. FORWARD Switch
8	Ext. REVERSE Switch
25	Ext. FAST FWD. Switch
26	Ext. FAST REV. Switch

Momentary, active-high logic inputs, +5 to +24 volts. 1kΩ pull-down resistor to ground recommended when long cable is used between switches and module.

MODE TALLY OUTPUTS:

3	STOP Tally
37	FORWARD Tally
6	REVERSE Tally
7	FAST FORWARD Tally
24	FAST REVERSE Tally
23	Tally Common

Tally outputs are Darlington opto-isolator collectors rated at 80 volts/30 mA. All emitters of this group are connected to Tally Common.

CHANGEOVER AND MUTE RELAYS:

14	Changeover Relay A, COM
31	Changeover Relay A, N/C
15	Changeover Relay A, N/O

30	Changeover Relay B, COM
13	Changeover Relay B, N/C
29	Changeover Relay B, N/O

"A" and "B" are alternate poles of the same 2-pole relay.

48	Mute Relay, common
47	Mute Relay, normally-closed
46	Mute Relay, normally-open

The Mute Relay is available to dim or mute the control room monitors when the Film Module is in Reverse or Fast modes.

ANNUNCIATOR OUTPUT

10	Remote LOCK indicator

Open-collector Darlington output, 50 volts/ 100 mA max. Emitter connected to Module Ground.