LYNX S.A.L. FILM MODULE
OWNER'S MANUAL

TIMELINE

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1 INTRODUCTION

1.1 THE LYNX FILM MODULE S.A.L. (STAND ALONE VERSION)

The Lynx Film Module is a compact, modular machine control device designed for use with pulse-interlock film transports such as dubbers, recorders, projectors, and telecines. Through the use of the Film Module, a film transport or an interlocked chain of film transports may be synchronized with a wide variety of audio or video tape transports using standard SMPTE/EBU timecode without the need for a code reel on any of the sprocketed machines. Each tape transport in such a system is controlled by a standard Lynx Time Code Module.

The overall film/tape system may be operated from an existing film chain controller (i.e. with the tape machines slaved to the film chain), or from any designated tape transport in the system (i.e. with the film chain and all other transports slaved to a master tape machine). Alternatively, the entire system may be controlled from a user-supplied set of motion control switches connected to the Lynx Film Module or from a Lynx Keyboard Control Unit.

Sprocketed transports that have a suitable pulse-type output signal but that do not accommodate external motion control via a pulse interlock bus, can be integrated into a Lynx system as the master transport. This category includes telecine units that have a biphase output, and synchronous motor film transports that have been fitted with a suitable shaft encoder.

Each individual slave transport in a Lynx system (including the entire film chain if it is slaved to a master tape transport) may be offset in time with sub-frame accuracy relative to the master .

1.2 THE LYNX FILM MODULE V.S.I. (VIDEO SYSTEM INTERFACE)

An alternate version of the Lynx Film Module is available to control sprocketed film transports from computerized video or audio editing systems.

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 that is generated by the module. Rather than communicating with other Lynx Modules on a common RS422 serial bus, however, 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 tape 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 video editing systems by Ampex, CMX, and Grass Valley Group/ISC, and the CASS and BOSS audio editing systems.

1.3 SOFTWARE VERSIONS

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

EPROM- 256K	U7	**FL-014A**
EPROM- 256K	U16	**FL-014A**

There is also software on the Film Processor PCB fitted with

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

1.4 HOW TO USE THIS MANUAL

The "Overview", "Front Panel Description", and "Rear Panel Description" chapters of this manual are intended as reference sections. They contain a wealth of information that we believe will enhance your effective use of the Lynx Film Module, but which is not necessary to the basic operation of the system. We suggest that you read these sections if you have the time and interest, and that you keep them handy for reference use.

If you are installing the Lynx Film Module for the first time, the chapter on "Connecting the Lynx Film Module" should cover your needs with occasional references to information contained in the Appendices, such as connector pin-outs and specifications.

If your goal is simply to set up and use a Lynx Film Module that is already connected in a Lynx system, you should find everything you need in the chapters "Setting Up the Lynx Film Module" and "Operating the Lynx Film Module".

1.5 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; (ie. "ONLINE" indicator or "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 THEORY OF OPERATION

2.1 SYSTEM OVERVIEW

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 (tape) machines in the same system. In the following paragraphs we have described the basic concepts of transport control and synchronization via remote control.

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 wheel 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 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 same pulse interlock signal that 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.

The Lynx Film Module has been carefully designed and programmed to meet these criteria. 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 Film Module contains four main functional blocks:

- Bi-phase Follower – Determines the speed of the film transport and keeps track of the position of the film relative to its start mark. (Receiver)
- Bi-phase Generator – Pulse interlock generator which controls the motion of the film chain. (Transmitter)
- SMPTE/EBU time code generator
- Serial communications port through which it communicates with other Lynx units. (RS-422)

With these four functions available, the Lynx Film Module is a universal module capable of slaving a film chain to any Lynx-equipped tape machine, or slaving any number of Lynx-equipped tape machines to a film chain without any additional hardware. Additionally, the entire film/tape system can be controlled from an external, user-supplied set of motion control switches connected to the Lynx Film Module, or from a Lynx Keyboard Control Unit.

The biphase sections of the Lynx 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 remembered in the module's battery backed-up memory. The module can also be readily reconfigured for speed & direction interlock 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 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.

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

The Lynx Film Module also generates a speed signal and Lynx system frame numbers which it transmits to other Lynx modules via the RS422 serial port. These signals are always tied to the biphase follower. The speed signal always reflects the actual running speed of the film transports and the system frame numbers 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 Lynx Module with the film transports at their start marks using the module's front panel controls. From that point on, the biphase follower in the Lynx Film Module keeps track of all film motion relative to the start mark and the module generates the proper system frame numbers at any running speed up to 40x the nominal speed. The frame numbers generated are displayed in real time on the Lynx Module's front panel for convenient visual reference, and are also transmitted to other Lynx Modules via the RS422 serial port.

When used with an existing biphase controller or the output of a shaft encoder on a synchronous film transport, the Lynx Film Module follows the biphase signal from the controller or shaft encoder and generates system frame numbers and a frame-rate speed signal locked to the biphase signal. It also interprets speed and direction from the biphase signal and issues appropriate transport mode and speed information to the other Lynx Time Code Modules via the RS422 port.

Alternatively, by connecting an external set of motion control switches to the Lynx Film Module, the module can become the master system controller, substituting for any existing film chain controller. In response to the motion control switches, the Lynx Module generates a properly ramped biphase signal to control the film chain directly, as well as generating system frame numbers and the appropriate mode and speed signals to transmit to the Lynx Time Code Modules controlling the tape machines. Normal, Fast, and Crawl speeds in both directions are available via the motion control switches.

2.3 FUNCTIONS SUPPORTED

The timecode generator in the Lynx Film Module generates SMPTE/EBU timecode in any of the common formats and nominal frame rates: 30 fps drop frame or non-drop frame (SMPTE standards), 25 fps (EBU standard), or 24 fps (film frame rate). The timecode from the generator is available as an electronically balanced, line level output on the module's back panel.

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 FL-014A. Earlier Film Module software versions did not support Drop Frame timecode.

The timecode generated by the Film Module may be at a different frame rate than the nominal film frame rate. For example, the film chain may run at a nominal 24 fps while the module generates timecode at 30 fps.

The Film Module can generate true SMPTE, EBU, or film timecode locked with the film chain when the film chain is being driven by the biphase generator in the Lynx Module.

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 when the film transport is running under the control of the Lynx Module.

A Lynx system may be run at the NTSC color frame rate of 29.97 fps rather than the nominal 30 fps and may be referenced to a "house sync" signal such as composite video sync. In this situation, the actual film frame rate is decreased by 0.1% as is standard practice.

When a film transport is added to a tape environment, it is most typically slaved to one of the tape machines. This mode of operation is necessary if video machines are involved to avoid picture breakup, but it also allows the use of a tape machine's autolocator to control the system. In this mode, the whole film chain or any slave tape transport may be individually offset relative to the master tape machine by programming an offset on the front panel of the appropriate Lynx Module.

The Lynx Film Module receives location, mode, and speed information from the Lynx Time Code Module which has been designated as the Master via the RS422 serial data bus. (The Master designation may be changed at any time with a single front panel keystroke on the old and new master modules.) The Film Module translates this information into a biphase control signal according to the programmed parameters for fast speed, acceleration, and locate approach speed. In this case, the film transport will chase the master tape machine just like any other transport.

2.4 COMPATIBILITY

The stand-alone version of the Lynx Film Module is compatible with any standard Lynx Time Code Module equipped with any current version of stand-alone (S.A.L.) software. These software versions are identified by an "L" prefix, such as "L409.6" or "L410-L". The software version installed in any Lynx Module is displayed briefly in the module's numeric display window each time the module is switched on.

2.4.1 PULSE INTERLOCK TYPES

The Lynx Film Module is compatible with both common pulse interlock transmission schemes. Jumpers are provided on the film processor circuit board inside the Lynx Film Module to accommodate:

Biphase transmission

OR

Tach & Direction

The standard method is Bi-phase (two pulse trains in quadrature).

In the Tach & Direction configuration, jumpers in the Film Module allows for either logic polarity of the Direction signal.

See Appendix I for details on configuring the Film Module for Tach & Direction operation.

2.4.2 PULSE VOLTAGES

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

5 Volt = TTL or CMOS compatible
OR
12 Volt = CMOS compatible

The following table shows the various nominal biphase frequencies along with the maximum multiples for the biphase generator and biphase follower sections of the Film Module:

2.4.3 PULSE FREQUENCIES

The Lynx 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 actual biphase frequency will be increased. In 25 fps systems, for example, the actual biphase frequencies at sync speed will be 50 Hz, 100 Hz, 250 Hz, etc. rather than the displayed nominal frequencies (48 Hz, 96 Hz, 240 Hz, etc.).

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 S.A.L. 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

DIAGRAM 1 - FILM MODULE FRONT PANEL

3.1 POWER SWITCH

Controls AC power to the Lynx Film Module. 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, but during normal operation there will be at least one indicator lit. If the top half of the power switch is depressed but there is no indication whatsoever on the module's front panel, check the AC mains cord connection and/or the module's fuse.

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 a following chapter on initializing the Film Module

3.2 [MASTER] KEY

This key selects a particular module as the System Master. A Lynx Module may only be selected as the Master if it has already been put Online (with the [TRAN MODE] key).

Since only one module may be the Master at any given time, designating one module as the Master deactivates the [MASTER] keys on all other Lynx Modules in the system. To designate a different module as the Master you must first de-select the current Master by touching its [MASTER] key (extinguishing its MSTR indicator), then select the new Master module by touching its [MASTER] key and lighting its MSTR indicator.

3.2.1 MASTER INDICATOR

Indicates when module has been designated as the System Master with [MASTER]. The MSTR indicator can only be lit when the module is Online. Only one module in the system can be designated as the Master at any given time.

3.3 [REF SRC] KEY

This key is used to make two different Reference Source selections depending on the module's current display mode:

- Display selected to GEN:

  This key now selects the reference source for the module's timecode generator.

- Display not selected to GEN:

  This key, only on the designated Master module, selects the source of the "frame clock" or reference that the system uses when it resolves the play speed of all transports.

The [REF SRC] key also has an alternate function in the module's Set-Up modes. When the [REF SRC] 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 current reference source selection. The specific meaning of the indication changes de-pending on whether or not the module's display is selected to GEN; both meanings are described under each indicator.

INT XTL INDICATOR

- Display selected to GEN:

  Indicates that the Film Module's timecode generator is clocked from the module's internal crystal.

- Display not selected to GEN:

  Indicates that the Film Module has been selected as the Master and that its internal crystal is the reference clock both for its own Generator and for the system's play speed frame rate. This indicator can never be lit in a non-GEN display mode unless the module has been selected as the Master.

EXT VID INDICATOR

- Display selected to GEN:

  Indicates that the Film Module's timecode generator is clocked from the external video signal connected to the module's EXT VID connector(s).

- Display not selected to GEN:

  Indicates that the module has been selected as the Master and that the external video signal is the reference clock both for its own Generator and for the system's play speed frame rate. This indicator can never be lit in a non-GEN display mode unless the module has been selected as the Master.

MAINS INDICATOR

- Display selected to GEN:

  Indicator will not light.

- Display not selected to GEN:

  Indicates module has been selected as Master and the AC line frequency is the reference for the system's play speed frame rate. This indicator will not light unless the module has been selected as the Master.

EXT CTRL INDICATOR

- Display selected to GEN:

  Indicator will not light.

- Display not selected to GEN:

  Indicates module has been selected as Master and the biphase signal being received from an external device is selected as the reference for the system's play speed frame rate.

  This is the Film Module's equivalent of the VSO (Variable Speed Override) mode available in the Lynx Time Code Module, and allows audio tape machines to be synchronized to a film transport running at a non-standard speed.

  This indicator will not light unless the module has been selected as the Master.

3.3.2 GENERATOR REFERENCE SELECTION

When the Lynx Film Module is displaying the Generator's timecode numbers (indicated by the GEN light above the [DSPL SEL] key being lit), touching the [REF SRC] key toggles between the two choices of reference clock source for the timecode generator. These two choices are:

(INT XTL) — The module's timecode generator is clocked from the module's own internal crystal.

(EXT VID) — The module's timecode generator is clocked from a video signal connected to the EXT VID connector on the back panel. This reference signal may be composite sync, black burst, color bars, or any other stable, composite video signal.

If you select EXT VID without an acceptable video signal connected to the module, or if the video signal disappears or is interrupted after EXT VID has been properly selected, the display will show "no uidEo" and the module will automatically revert to the INT XTL selection. This error message remains in the display until manually cleared with the [CLR] key as a warning that the module's generator reference has reverted automatically to INT XTL due to a lack of external video signal.

3.3.3 SYSTEM MASTER REFERENCE SELECTION

The [REF SRC] key on the current Master module is also used to select the source of the frame rate reference signal that the Master module transmits to the Slave modules via the RS422 serial connections. This frame clock signal is the reference against which each Lynx Module resolves the play speed of its transport when synchronizing. The selection of the system play speed reference is made when the Master module is displaying anything other than the Generator (i.e. FILM POS, SYNC PT, OFFSET, or OFST ERR). Touching [REF SRC] on the Master module toggles through the three available choices, which are:

Generator Reference — The system's play speed frame rate is referenced to the same source that was previously set for the timecode generator. This selection will be either INT XTL or EXT VID as chosen while displaying the Generator.

(MAINS) — The system's play speed frame rate is referenced to the frequency of the AC power line.

(EXT CTRL) — The system's play speed frame rate is derived from an external source of biphase signal. Typical sources of such an external biphase signal include an existing film chain controller, or a free-running (or self-resolved) film transport such as a projector or a telecine. This selection is the Film Module's equivalent of the VSO (Variable Speed Override) mode available on Lynx Time Code Modules.

3.4 [CODE TYPE] KEY

In the case of the Lynx Film Module, the Code Type selection sets 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 selection on the Film Module should agree with the type of timecode that is recorded on the tape machines being synchronized with the film equipment.

- Display selected to GEN:

  This key selects the type of timecode that the module will generate. Pressing this key when the display is selected to anything other than GEN has no effect on the module.

The [CODE TYPE] key steps sequentially through the various types of timecode the Film Module can generate. Each time the key is pressed the Lynx Module steps to the next code type. If the 24 indicator is lit, pressing [CODE TYPE] steps back to the top item in the list (30-frame non-drop code @ 29.97 fps).

The [CODE TYPE] key also has an alternate function in the module's Set-Up modes. When the [CODE TYPE] 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 has been selected for the "timecode side" of the Lynx 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 transmits serially to other Lynx Modules and displays in the FILM POS display mode. This selection should be made to agree with the timecode type that the rest of the Lynx Time Code Modules in the system are using.

GEN NTSC INDICATOR

Indicates that the module's timecode generator is set for SMPTE timecode and will be running at the NTSC color frame rate of 29.97 frames per second. It does not indicate whether the timecode format is drop frame or non-drop frame; that indication is provided by the DF light.

30 INDICATOR

Indicates that the module's timecode generator is set for SMPTE (30-frame) timecode in the non-drop frame format.

DF INDICATOR

Indicates that the module's timecode generator is set for SMPTE (30-frame) timecode in the Drop Frame format. (This format skips over or "drops" a total of 108 specific frame numbers for each hour of timecode.)

25 INDICATOR

Indicates that the module's generator is set for EBU (25-frame) timecode.

24 INDICATOR

Indicates that the module's generator is set for 24-frame, film-style timecode.

SELECTION	CODE TYPE GENERATED	INDICATION
30-frame (SMPTE)	non-drop frame timecode @ 29.97 fps	(GEN NTSC & 30 lit)
30-frame (SMPTE)	Drop Frame timecode @ 29.97 fps	(GEN NTSC & DF lit)
30-frame (SMPTE)	non-drop frame timecode @ 30 fps	(30 lit)
30-frame (SMPTE)	Drop Frame timecode @ 30 fps	(DF lit)
25-frame (EBU)	25 frame timecode @ 25 fps	(25 lit)
24-frame (film)	24 frame time code @ 24 fps	(24 lit)

TABLE 2: TIMECODE TYPES SUPPORTED

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 FL-014A. Earlier Lynx Film Module software versions did not support Drop Frame timecode.

3.5 [DSPL SEL] KEY

This key selects the numerical information which will be shown in the module's main display window. The [DSPL SEL] key steps sequentially through the available options in the same order as the LED indicators above the key. In addition to routing the generator's timecode numbers to the display window, selecting GEN mode also affects the functions and meanings of certain other keys and indicators as listed below:

- [CODE TYPE] KEY

  Only functions in the GEN display mode, and the [REF SRC] key and indicators relate to the generator reference rather than the system frame rate reference when GEN display is selected.

- [DSPL SEL] KEY

  This key 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 the module may have a timecode offset relative to the Master. 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 (ON indicator above the [GEN ON] key is lit).

When the GEN indicator is lit, the CODE TYPE and REF SRC indicators will display the type and frame rate of timecode and the reference clock source chosen for for the generator.

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 module is displaying the contents of the module's SyncPoint register. Since this selection is a memory register, the value displayed is static. The Lynx system uses the frame number in the SyncPoint register (if any) for automatic calculation of the offset between Master and Slave timecodes.

The SYNC PT light remains lit as a reminder whenever there is an active value 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 if it is the system Master; this would indicate that the Film Position frame numbers are being displayed and that a SyncPoint has been marked on this module. If the Film Module were a Slave rather than the Master in this example, the OFFSET indicator would also be lit since the module calculates an Offset value based on its own SyncPoint versus the Master module's SyncPoint.

The SYNC PT indicator on a Lynx Module flashes for several seconds whenever a new frame number is stored in that module's SyncPoint register. This serves as a warning that offsets may have just been automatically recalculated based on this new SyncPoint.

OFFSET INDICATOR

When the OFFSET indicator is the only LED in the display column that is lit, it signifies that the module is displaying the contents of the module's Offset register. Since this is a memory register, the value displayed in this mode is static. The OFFSET indicator can only be lit on Slave modules since the Master module always has 0 offset by definition.

The number in a Slave module's Offset register represents the numerical difference the Lynx system will maintain between Master and Slave timecodes. The Offset will be a positive number if the Slave's timecode numbers are greater than the Master's; conversely, the Offset will be negative if the Slave's timecode numbers are smaller than the Master's.

A module's Offset may have a subframe component in addition to the hours, minutes, seconds, and frames. Touching [SUBF UBITS] and lighting the SUB-F U-BITS indicator above the key allows you to display the subframe component or to modify it in the Set/Hold mode; touching [SUBF UBITS] 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 whenever the module has an offset programmed in it, regardless of which display mode is actually selected. It is thus possible to have the FILM POS and OFFSET lights lit at the same time, for example; this indication would signify that the display is showing the Film Position frame numbers and that the module has an offset relative to the Master.

OFF ERR INDICATOR

Indicates that the module is dynamically displaying its Offset Error.

For a Slave module, the Offset Error value represents the difference between where the Slave transport actually is and where it is supposed to be (based on the Master's position any any programmed Offset). For the Master module, the Offset Error represents the "resolve error" which is the phase difference between the transport's timecode frames and the system frame reference. When the module has reduced the Offset Error to 2 subframes or less, an "L" appears in the window to the left of the displayed digits as an indication that the module has achieved resolved and locked status.

Offset Error may be displayed in whole frames or in subframes; touching [SUBF UBITS] toggles between the whole frame and subframe display modes. If the Offset Error is greater than 1 frame, the display window will be blanked when toggled into subframe mode.

NOTE:

Slave modules always have a non-zero Offset Error until the Slave is locked to the Master in Play mode. In particular, Slaves are parked or cued with an Offset Error of approximately 1 second; this deliberate "park-ahead" allows more rapid synchronization to the Master.

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 selected data in this situation is larger than 1 frame, the display will actually show the hours, minutes, and seconds of the value and will blank out the rightmost (FR) 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 FRAME RATE SELECTION

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 usually different than the timecode frame rate used by the Lynx Time Code Modules and their connected tape transports.

The film frame rate is set to the default value of 24 during the module initialization procedure, but may be changed to 25 or 30 in the Online Set-Up mode

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

Indicates that the Film Module's biphase follower is receiving a biphase signal that indicates film motion. This indicator will not be lit if the module is not receiving biphase or if the biphase is stationary.

30 INDICATOR

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

24 INDICATOR

When lit, indicates that the Film Module's 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

The [SET HOLD] 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 FR (frames) window also begin to flash. At this point the displayed numerical value may be adjusted one frame at a time with the [↑] and [↓] keys.

Touching [SET HOLD] a second time causes the digits in the SEC (seconds) window to flash, which indicates that the ADJUST keys will now modify the displayed value one second at a time. Successive touches of the [SET HOLD] key move the ADJUST function to the MIN (minutes) window, then the HR (hour) window, then back to the FR window, and so on.

When the module is displaying the SyncPoint or Offset register, it is also possible to enter or modify numerical data in subframe increments by touching the [SUBF UBITS] key and lighting up the SUB-F U-BITS indicator.

When the module is in the Set/Hold mode, holding [SET HOLD] for approximately 1/2 second "unfreezes" the display and returns it to its previous display mode without making effective any changes made with the ADJUST keys. Touching [STORE], on the other hand, loads the adjusted numeric value into the corresponding register and exits the Set/Hold mode.

The [SET HOLD] key is also used in combination with the [SYNC POINT] key to capture the current Film Position frame number and store it in the SyncPoint register.

3.7.1. SET/HOLD INDICATOR

Indicates Film Module's display has been frozen (if it is in the GEN or FILM POS modes) and that the module is in the Set/Hold mode, which allows manual adjustment of the value shown in the numeric display.

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).

The 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 the Film Module is in the Set/Hold mode, touching [↑] adds one unit at a time to the number 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 [CLR] 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 the Film Module is in the Set/Hold mode, touching [↓] subtracts one unit at a time from the numerical value in the flashing window of the display. Holding [↓] 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 the subframe (1/100 fame) component (if any) of the selected data. The [SUBF UBITS] key toggles between these two alternate modes each time it is touched.

When the display is selected to GEN mode, the [SUBF UBITS] 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 [SUBF UBITS] key toggles between these two alternate modes each time it is touched. The 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 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 [STORE] is pressed. Adjustments to the Offset, on the other hand, are recognized and acted upon in real time so that pressing [STORE] is simply an alternate means of exiting the Set/Hold mode.

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 menus 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

Indicates that some Lynx Module in the system has been designated as the Master and that this module is either the designated Master or is communicating serially with the designated Master via the RS422 bus.

When extinguished, indicates that the module is not in communications with a Master Lynx Module. This may be because there is no Master designated, or because the module in question is not properly communicating with the Master.

3.13 TRAN MODE KEY

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

When Offline, the Film Module's biphase generator is partially disabled so that the module will not make the film transport(s) connected to it chase any motion of the system Master. The film transport(s) may still be operated locally from the Film Module when Offline, however, via a set of external motion control switches.

If the Film Module is designated as the system Master (System mode 1 or 2), taking it Offline with the TRAN MODE key also cancels the Master selection. This means that any motion of the film transport will not cause tape machines to chase while the Film Module is Offline. Note that putting the module back Online by touching TRAN MODE again does not re-select the module as Master.

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.

3.13.1 TRAN MODE INDICATORS

ONLINE INDICATOR

Indicates that the Film Module is Online.

When extinguished, indicates that the Film Module is Offline.

RESOLVE INDICATOR

When lit, indicates that the film transport is running in Forward and that it is up to speed and within 20 subframes (1/15 frame) of the correct time relationship.

If the Film Module is being operated as a Slave (System Mode 3), the RESOLVE indication signifies that the Film Module is within 20 subframes of sync with the Master. If the Film Module is the Master and is controlling the film transports (System Mode 1), the RESOLVE indication signifies that the biphase control signal is within 20 subframes of phase lock with the selected frame rate reference.

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. One common cause of such an occurrence when the Film Module is a Slave is a timecode discontinuity in timecode on the Master tape machine. When the Film Module is the Master (in System Mode 1), this indication will occur if there is a non-zero value in the Film Module's Offset register (which is an error condition since the Master has 0 Offset by definition).

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 of a timecode frame) of the correct time relationship. If the display is selected to OFST ERR, an "L" will appear 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 Film Module is being operated as a Slave (System Mode 3), the LOCK indication signifies that the Film Module is within 2 subframes of sync with the Master. If the Film Module is the Master and is controlling the film transports (System Mode 1), the LOCK indication signifies that the biphase control signal is within 2 subframes of phase lock with the selected frame rate reference.

If the LOCK indicator is lit and the RESOLVE indicator is flashing, the module initially achieved Lock, but an Offset Error has developed. One common cause of such an occurrence when the Film Module is a Slave is a timecode discontinuity on the Master machine. When the Film Module is the Master (in System Mode 1), this indication will occur if there is a non-zero value in the Film Module's Offset register (which is an error condition since the Master has 0 Offset by definition).

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 Film Module is Offline (ONLINE indicator extinguished) pressing [SYNC POINT] causes the Film Module to cue the film transport(s) under its control to a position that corresponds to the frame number in the SyncPoint register.

If the Film Module is Online (ONLINE indicator lit), \X(SYNC POINT) is used in combination with [SET HOLD] to capture and store the current Film Position frame number as the SyncPoint; these two keys must be pressed simultaneously to effect this operation. Pressing [SYNC POINT] by itself has no effect while the module is Online, so that the recommended procedure for capturing a SyncPoint is to hold [SYNC POINT] and then touch [SET HOLD].

GO TO INDICATOR

This indicator flashes when the Film Module's biphase generator is running at non-sync speed. This means that the film transport will be moving at non-sync speed if it is under the Lynx Module's control.

The GO TO indicator flashes in response to a Go To command (initiated by touching \X(SYNC POINT) when the module is Offline), any command other than Forward or Stop from a set of external motion control switches connected to the TRANSPORT connector (module Online or Offline), or when it is chasing some motion of the Master transport. (module Online as a Slave in System Mode 3).

3.15 [GEN MODE] KEY

The [GEN MODE] key controls the operating mode of the Film Module's Timecode Generator.

Pressing [GEN MODE] while the Generator is not switched On (GEN ON light extinguished) steps sequentially through Normal mode, Automatic Jam Sync mode, Jam User Bits mode, Tach-to-Timecode mode, and then back to Normal mode again. Note, however, that not all four of these operating modes are available in the Film Module. Specifically, only the Normal and Tach-to-Timecode modes are currently implemented; 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 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 INDICATOR

When lit, indicates that the Film Module's Generator is in the Tach-to-Timecode mode. This TACH>TC mode only operates when the Film Module has been designated as the Master, and when the module's biphase generator output is controlling the film transports (System Mode 1). Additionally, the system Reference Source must be selected to the Generator reference (either INTL XTL or EXT VID).

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 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 ON 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 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, Reference Source, 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 and Master status.

ON INDICATOR

Indicates Film Module's timecode generator is enabled. When lit, the module prohibits any changes in the Code Type, Reference Source, 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 modes, 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 these modes 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 and Master status.

3.17 ALTERNATE KEY FUNCTIONS (SET-UP MODE)

Several keys on the Lynx Film Module assume alternate, secondary functions when the module is in 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 the [STORE] key (or more accurately the [•SET UP•] key) while turning on the power switch (module initialization mode), or by holding the [•SET UP•] key for approximately 5 seconds 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, this key is also used to confirm that the biphase frequency selection is correct as the last step in the initialization procedure.

[•MENU•] KEY

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

The [•BACK•] 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

DIAGRAM 2 - FILM MODULE REAR PANEL

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 SELECT 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 biphase generator output and biphase 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 appendices to this manual contain a listing of all pin assignments of the TRANSPORT connector and a schematic diagram of the suggested connections

4.5 RS422 CONNECTORS

Two parallel-connected, 9-pin, female, D-subminiature connectors wired according to the RS422 standard. These connectors are used to serially interconnect the various Lynx Modules in a Master/Slave synchronization system.

In a normal Lynx synchronization system, all modules must be connected together in a "daisy chain" configuration using standard RS422 cables such as those supplied with each module. The two parallel connectors on each Lynx Module facilitate this kind of chained connection. Note that the two Lynx Modules on the ends of the chain will normally each have one unused connector. Do not connect these end modules together to form a loop.

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 if terminated in 600 Ω. The output level may be adjusted over a range of some 16 dB (roughly from -10 VU to +6 VU in most systems) using the GEN LVL trimmer described below.

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

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 plug, for example) will not cause any damage to the module, but should be avoided as a general practice.

4.11 PILOT IN CONNECTOR

Not installed in the Lynx Film Module.

4.12 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 dBu) into a balanced, bridging load. This output level produces 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 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 plug, for example) will not cause any damage to the module, but should be avoided as a general practice.

The pilot output signal is a square wave whose frequency is always twice the frame rate of the timecode type selected on the module's front panel, e.g. 50 Hz for 25-frame EBU timecode or 59.94 Hz for SMPTE timecode at NTSC color frame rate (29.97 fps).

4.13 GND/ISO SWITCH

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

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

4.14 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 trimmer 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), which will produce a reading of -5 VU in most systems. The trimmer provides a typical adjustment range of approximately -10 VU to +6 VU in most systems.

5 CONNECTING THE LYNX FILM MODULE

5.1 TRANSPORT CONNECTIONS

The primary interface to the Lynx 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 the following:

- Biphase generator output (for control of film transports)
- Biphase follower input (to follow the motion of film transports)
- Internal changeover relay (switches biphase connections based on operating mode)
- 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 Appendices to this manual for a complete listing of the pin assignments for the TRANSPORT connector and for schematic diagrams of the recommended connections for the biphase signals, external motion control switches and 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 which automatically reconfigures the connections for the various modes in which the Film Module may be used. This method of connection allows you to switch between the three operating modes (System Modes 1, 2, and 3) from the module's front panel without having to change any connections on the rear of the module.

If the Film Module will always be used with a film transport that is not controllable via a pulse interlock signal, you may simplify the cabling scheme by directly connecting the transport's biphase signal to the module's biphase follower input (Pins 16 & 17). This most commonly applies to telecines, or to synchronous-motor dubbers or projectors that have a pulse output or that have been fitted with a shaft encoder.

5.1.2 EXTERNAL MOTION CONTROL SWITCHES

When the Film Module is operated in System Mode 1 the module functions as both the Master for the Lynx system and as the master film chain controller. In this mode the operator directly controls the biphase generator in the Film Module via an external set of five motion control pushbuttons.

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 volts DC 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.

An additional set of switches may be connected in parallel with the first set for control from a second location if necessary. In this case the logic voltage used and the value of the pull-down resistors must be selected to ensure that the active logic state as received at the Film Module is at least +5 volts. Note that double-throw switches would have to be grounded through current-limiting resistors if multiple sets of switches will be installed.

5.1.3 EXTERNAL TRANSPORT MODE TALLYS

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

These 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.

Each optoisolator is rated at 80 volts maximum and is capable of sinking a maximum of 30 mA of current to the Tally Common.

NOTE:

The mode tally indication changes immediately upon receipt of a new mode command (from an external set of motion control switches, for example) while the module's biphase generator will take a finite amount of time to ramp its frequency between modes.

5.1.4 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 de-energized 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.

5.1.5 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.

The remote lock indicator output is an active-low, open collector, Darlington 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 COMMUNICATIONS CONNECTIONS

Besides the TRANSPORT connector, the other essential connection for most Film Module applications is the RS422 serial communications connection between the Film Module and the other Lynx Modules in the system. The only case when the RS422 connection is not used is when a single Film Module is operated by itself as a film chain controller/resolver.

To accomplish synchronization, the Master Lynx Module must communicate its position and speed to the Slave modules in the system, and this communication is done serially via the RS422 connection. All the modules in the system are connected in a "daisy chain" configuration which is facilitated by having two RS422 connectors that are wired in parallel on each Lynx Module. Additional modules and transports may be added to the system by simply connecting an RS422 jumper cable (such as the one provided with each Lynx Module) between the additional module and either end of the RS422 "daisy chain".

Physical order does not matter when you connect the various modules in the system as long as all modules are connected in an open-ended chain and not in a closed loop. Note that in a multi-module system the two modules at the ends of the chain will only have a single RS422 cable connection while all the other modules will have cables attached to both of their RS422 connectors.

To accommodate transports and modules that are located some distance from one another, any RS422 cables in the system may be extended by a reasonable amount using an appropriate RS422 extension cable. The RS422 standard specifies 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 conductor and all others in the cable. Appropriate pre-manufactured RS422 cables are available from many suppliers of computer cables and accessories.

If you choose 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 can be used successfully 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 the two Shield pins (4 & 6) are all connected to the isolated ground of each Lynx Module. It is therefore not necessary to make all four connections at both ends of the cable.

5.3. EXT VID CONNECTIONS

The connection of an external video reference signal such as "house sync" is generally required when using the Film Module to synchronize film transports with video tape machines. When synchronizing film transports with audio tape recorders, the connection of an external video reference signal is optional but recommended.

When using an external video reference signal, it should be connected to the EXT VID input of each of the Lynx Modules in the system and to the External Sync input of each VTR. 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 Lynx 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.

Note that 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 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 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 generally optional. 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 is always 2X the frame rate of the reference source selected for the Film Module's timecode generator (i.e. Internal Crystal or External Video) and that this frequency may or may not correspond to the system frame rate depending on the operating mode. The pilot signal is always present on the PILOT OUT jack regardless of whether or not the module's generator is currently switched On.

The generator 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 MODULE SET UP AND INITIALIZATION

Once the Film Module is connected to the film transport(s) and to the rest of the Lynx system, 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 film frame rate in the Online Set-Up mode if it is different from the 24 fps default value. At the same time you may also modify the biphase generator parameters from their default values if you wish.
- Setting the timecode frame rate, typically setting it to match the type of timecode in use in the rest of the Lynx system.
- 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 "re-boot" 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 [STORE] while turning on the power switch.

6.1.1 SETTING THE BIPHASE FREQUENCY

- When "F-48" is flashing in the display window, you may step through the list of available biphase frequencies with the [↑] and [↓] keys; the [↑] key steps toward higher biphase frequencies and the [↓] key toward lower biphase frequencies. In each case the nominal biphase frequency will be preceded by "F-" and 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 the [•MENU•] key. The display will now show "donE".
- Press [STORE] again to confirm your biphase frequency selection if it is correct. If your selection is not correct, press the [•MENU•] key again and you will return to the flashing biphase frequency display.

6.1.2 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 shown in the table on the following page .

Menu Selection	FPS Film Frames per Second	FASt Fast-wind Speed Multiple	LOC Locate Approach Rate	ACC Acceleration Ramp Rate
F-48	024	012	100	032(4x)
F-96	024	005	070	008(1x)
F-240	024	005	070	008(1x)
F-480	024	005	070	008(1x)
F-600	024	005	070	008(1x)
F-1200	024	005	070	008(1x)
F-2400	024	005	070	008(1x)

TABLE 3: FILM MODULE DEFAULT PARAMETERS

These parameters have the following functions and units:

FPS Sets the film frame rate and hence the actual frequency at which the Film Module's biphase generator and follower will run as opposed to the nominal frequency set in the initialization procedure. The available values for FPS are 024, 025, and 030.

FASt Sets the maximum fast speed of the Film Module's biphase generator in Fast Forward and Fast Reverse modes. FASt is expressed as a multiple of sync speed.

LOC Sets the approach speed (deceleration rate) of the Film Module's biphase generator when locating to a cue point. LOC is expressed in arbitrary units with a range of 010 to 255.

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

6.2 ONLINE SET-UP MODE

The Online Set-Up mode provides access to the operating parameters of the Film Module. This mode is most commonly used to make changes to the default parameter values that are loaded automatically when you select the biphase frequency. Since any parameter changes you make are retained in non-volatile memory, you typically will not have to return to the Online Set-Up mode unless the film frame rate or the type of film transport changes.

In addition to providing access to the Film Module's parameters, the Online Set-Up mode provides access to several user option items. It also allows you to change the biphase frequency setting (and load the default parameters associated with that biphase setting) without powering the module down and re-initializing it.

The menus in the Online Set-Up mode are arranged hierarchically. The [•MENU•] key steps sequentially through the three menus in the Set-Up mode (Parameters, Biphase, and Options), the [•FORW•] and [•BACK•] keys step forward and backward through the list of items in the selected menu, and the [↑] and [↓] keys select the specific value for the item.

To change any of these items, the same basic procedure is used:

- Enter the Online Set-Up mode by holding [SET UP] for approximately 5 seconds until the normal timecode display disappears and is replaced by "FPS 024" or the menu item that was last accessed in the Online Set-Up mode.
- Press the [•MENU•] key as necessary to display any item from the desired menu (Parameters, Biphase, or Options) in the window.
- Press the [•FORW•] and [•BACK•] keys as necessary to display the desired item from the selected menu. Note that the Biphase menu has only a single item so that the [•FORW•] and [•BACK•] keys are inoperative in that menu.
- Press the [↑] and [↓] keys as necessary to adjust the displayed item to the desired value.
- Use the [•MENU•] key and [•FORW•] and [•BACK•] keys as necessary to access any other items you wish to modify.
- To exit the Online Set-Up mode, hold [SET UP] for approximately 5 seconds until the normal timecode display reappears in the window.

6.2.1 SETTING THE FILM (BIPHASE) FRAME RATE

The first item in the Parameters menu is "FPS", which sets the film frame rate for the biphase side of the Film Module. This determines the actual frequency of the biphase generator and follower sections of the Film Module and therefore the actual speed at which the module and film transport will run. For FPS = 24, the actual biphase frequency at sync speed is equal to the nominal biphase frequency set in the module initialization procedure; for FPS = 25 or 30, the actual biphase frequency at sync speed is proportionately increased from the nominal frequency.

All initial biphase frequency selections have a default value of 24 for the FPS parameter. This parameter only needs to be changed if the film transport(s) will be run at 25 or 30 frames per second.

6.2.2 MODIFYING THE DEFAULT BIPHASE GENERATOR PARAMETERS

The default biphase parameters are automatically loaded with the biphase frequency selection. They were chosen as "safe" values for a wide range of film transports. By their nature, however, default parameters may not be the optimum settings for use with any particular transport model. The Online Set-Up mode provides a convenient means of modifying these parameters to suit your individual combination of equipment and film stock. Any changes you make will be retained in non-volatile memory until you change the biphase frequency or re-initialize the module.

The functions and units of the biphase parameters are as follows:

FASt Sets the maximum fast speed of the Film Module's biphase generator in Fast Forward and Fast Reverse modes. The parameter is expressed as a multiple of sync speed. The value may range from a minimum of 001 (= sync speed) to a maximum that is set by software for each biphase frequency selection.

LOC Sets the approach speed (deceleration rate) of the Film Module's biphase generator when locating to a cue point. For any particular combination of FASt and ACC values, LOC can be adjusted to optimize the wind rate without overshooting the desired position. LOC is expressed in arbitrary units with a range of 010 to 255.

ACC Sets the ramp or acceleration rate of the Film Module's biphase generator. An ACC value of 8 is equal to an acceleration rate of 1 times sync speed per second. For example, if ACC = 8 it will take the module's biphase generator 5 seconds to go from stop to 5 times sync speed. The value of this parameter may range from a minimum of 004 to a maximum that is set by software for each biphase frequency selection.

Note that except for the FPS parameter, the other three items in the Parameter menu relate only to the Film Module's biphase generator. If the Film Module is not controlling the motion of the film transport via its biphase generator, these parameters are essentially irrelevant. This would be the situation if the Film Module is connected to an external film chain controller or some non-controllable machine such as a telecine or a synchronous motor dubber .

6.2.3 CHANGING THE BIPHASE FREQUENCY

The biphase frequency selection can also be changed from the Online Set-Up mode rather than switching the module off and re-initializing it.

In addition to accommodating the connection of a different manufacturer's film transport, the ability to reset the biphase frequency also provides a convenient means of reloading the default parameters for a particular biphase frequency selection. This is most easily accomplished by momentarily switching the biphase frequency to some other value and then back to the desired value.

NOTE:

As a safety precaution, always take the Film Module Offline (by pressing [TRAN MODE]) before changing the biphase frequency selection.

6.2.4 SETTING THE OPTIONS MENU ITEMS

The Options menu in the Online Set-Up mode provides access to several user option items which can adapt the module to particular operating circumstances.

The Options menu items are:

PHASE This item allows control over the lock mode of the module when operating as a Slave. Phase Mode On is the normal "resolve after initial lock" mode used by the Film Module. Phase Mode Off provides for automatic resynchronization in the event that a frame number difference or offset error develops (due to a discontinuity in the timecode on the Master tape machine, for example). The Phase Modes are:

PHASE 000 = PHASE MODE OFF

After initial synchronization, the module continues to observe frame numbers and corrects for frame number errors between itself and the Master if they occur. If such a frame number error (or Offset Error, to use Lynx terminology) occurs, the module will resynchronize at a constant, slow rate which should be audibly undetectable.

PHASE 001 = PHASE MODE ON (DEFAULT).

After initial synchronization, the module reverts to a phase-lock mode and maintains resolved speed while ignoring the actual frame numbers. The RESOLVE light on the module flashes as an indication if a frame number error occurs.

rLY This item allows selection of the operating mode for the Film Module's Mute relay. The Mute relay provides electrically isolated single-pole, double-throw contacts on three pins of the 50-pin TRANSPORT connector.The Relay modes are listed below :

rLY 000 = NORMAL MUTE RELAY MODE.

The Mute relay is energized in Fast Forward, Reverse, and Fast Reverse modes.

rLY 001 = MUTE UNTIL RESOLVED.

Same as Mode 000 except that an additional muting condition occurs in the Forward mode until the RESOLVE light lights. The relay opens only when the Film Module is within 20 subframes of Lock so that virtually all of the slewing done to achieve lock occurs while the mute relay is closed.

rLY 002 = MUTE UNTIL LOCKED.

Same as Mode 001, except that the module waits until the LOCK light comes on at less than 2 subframes offset error.

6.3 SETTING SYSTEM FRAME RATE

The System Frame Rate is used in the "timecode side" of the Film Module to determine the rate of the Film Position frame numbers as they appear in the display and are communicated serially with other Lynx Modules in a synchronization system. Consequently, the System Frame Rate should be set to match the type of timecode on the tape machine(s) that you are locking the Film Module with.

The System Frame Rate is determined by the Generator Code Type. The Film Module automatically sets a default Generator Code Type whenever the Film Frame Rate is changed.

These defaults are:

Selected Film Frame Rate	Default Generator Code Type
24	30-frame (SMPTE) non-Drop Frame timecode
25	25-frame (EBU) timecode
30	30-frame (SMPTE) non-Drop Frame timecode

These defaults may be overridden with the following procedure:

- Touch [DSPL SEL] as necessary to light the GEN indicator.
- Touch [CODE TYPE] as necessary to light the proper LED indication for the type of timecode being used in the rest of the Lynx system.
- Touch [CODE TYPE] again to light the FILM POS indicator.

If you have selected EXT VID as the Generator Reference in an NTSC system, the Code Type selection is limited to the two "GEN NTSC" (29.97 fps) settings. Switching the Code Type to any other setting causes the Film Module automatically to revert to INT XTL. Likewise, selecting EXT VID as the Generator Reference in a PAL (25-frame) system limits the Code Type to the "25" (EBU timecode) setting.

When the Film Module is being operated as a Slave (System Mode 3) or as a free-running Master (System Mode 2), selecting one of the "GEN NTSC" (29.97 fps) settings as the Code Type does not affect the running speed of any of the transports in the Lynx system since the Film Module's generator is not the frame rate reference in these modes. Setting the Code Type to one of the NTSC settings does, of course, affect the frame rate of the Film Module's own timecode generator.

6.3.1 NTSC VIDEO FRAME RATE

When the Film Module is being operated as a resolved Master (System Mode 1), the sync speed of the Film Module's biphase generator and the play speed of all audio tape machines locked to the Film Module will be resolved to the frame rate selected by the Code Type and Reference Source selections on the Film Module.

If INT XTL is selected for the Reference Source for the Film Module in System Mode 1, the Generator Code Type setting determines the actual running speed of the biphase generator and slaved audio tape machines. If either of the "GEN NTSC" (29.97 fps) settings is selected for the Generator Code Type, the Film Module's biphase generator will run 0.1% slower than nominal speed to match the NTSC video frame rate selected for the "timecode side" of the Film Module. Likewise, all audio tape machines will be resolved to a 29.97 fps timecode frame rate.

Likewise, if EXT VID is selected for the Reference Source in System Mode 1 and an NTSC video signal is connected to the EXT VID connector on the back of the Film Module, the Film Module's biphase generator will run 0.1% slower than nominal speed to match the NTSC video frame rate and all audio tape machines will be resolved to 29.97 fps video frame reference.

Note that if you are slaving a video tape machine to the Film Module as the Master, you must use System Mode 1 with EXT VID as the Reference Source, and the video tape machine must be connected to the same video reference signal as its External Sync signal. This is necessary because Lynx Time Code Modules are designed to bring a slaved VTR into the proper sync relationship with the Master and then release its control of the VTR's speed to let it self-resolve (since attempting to control the running speed of a video tape machine generally causes visible artifacts such as picture break-up). Therefore, to maintain sync between the released VTR and the rest of the Lynx system, it is necessary to resolve all the other transports in the system, including the Master, to the same video reference signal that the slaved VTR is self-resolving to.

6.3.2 DROP FRAME TIMECODE

A new feature of the FL-014A software version is full support for Drop Frame SMPTE timecode. With this software version the Film Module's generator can be set to generate Drop Frame timecode and display Film Position frame numbers in the proper Drop Frame sequence.

When the Film Module is set to Drop Frame, its Film Position display will agree numerically with Drop Frame timecode as displayed on Time Code modules that it is synchronized with.

In the past, if the Film Module were used with Time Code Modules running in Drop Frame, it had to be treated as a "mixed code" situation. In such a situation the Film Module would properly chase and lock with a Drop Frame tape, but the Film Position numbers and the Drop Frame timecode numbers would disagree by an ever-increasing amount as the two machines rolled from the marked SyncPoint.

6.4 SETTING THE START MARK

The final step in the Film Module set-up procedure is to enter a starting Film Position frame number. In a sense this step is optional because any Film Position frame number can be made to synchronize with any timecode frame number by entering the appropriate Offset value in the Slave module. But since the Film Position numbers themselves are arbitrary (they only exist within the Lynx system), there is no reason not to make them agree with the timecode on the tape that is being synchronized with the film and thus eliminate any numerical Offset.

To set a starting Film Position:

- Position the film on the film transport(s) to a start mark or other identifiable position.
- Touch [DSPL SEL] as necessary to light up the FILM POS indicator.
- Touch [SET HOLD] to enter the Set/Hold mode. The SET/HOLD indicator and the digits in the FR window should be flashing.
- Use the ADJUST keys (the [↑] and [↓] keys) to set the Frames portion of the desired starting Film Position number.
- Touch [SET HOLD] again so that the digits in the SEC window are flashing, and then use the ADJUST keys to set the Seconds portion of the number.
- Repeat the same process for the Minutes and Hours portions of the Film Position number.
- When the number in the display is correct, touch the [STORE] key to enter that value in the Film Position register and leave the Set/Hold mode.

7 OPERATING THE LYNX FILM MODULE

The Film Module's biphase generator and biphase follower are conceptually and electrically separate circuit modules. When the module's TRANSPORT connector is wired as shown in the Suggested Interconnect diagram, the module may be configured from its front panel controls to operate as either the Master or Slave as far as the Lynx synchronization system is concerned, and if it is the Master to either resolve the speed of the film transport or to make all the Slave tape transports resolve to the speed of an externally-controlled film transport. For convenience, we describe these operating conditions as System Modes 1, 2, and 3.

7.1 SYSTEM MODE 1:

RESOLVED GENERATOR, LYNX AS MASTER

In this mode, the Film Module's biphase generator is fed to the interlock bus to control the motion of the film transport(s). The module's biphase follower is also connected to the biphase generator and interlock bus via the module's internal changeover relay to keep track of the Film Position. This Film Position information is transmitted serially to other Lynx Modules which will operate as Slaves and chase the film transport when they are Online.

The biphase generator and hence the motion of the film transport is controlled by a set of external motion control pushbuttons (user-supplied) which are connected to the Film Module's TRANSPORT connector.

In Forward mode (sync speed play), the biphase generator is resolved and locked to the reference clock that is selected with the Film Module's [REF SRC] key. This reference may be the AC mains frequency, or it may be the same reference as the Film Module's timecode generator, which in turn may be either the module's internal crystal or an external video reference signal.

This operating mode for the Film Module is analogous to operating a standard Lynx Time Code Module as a Resolved Master, except that the overall system is controlled from switches connected to the Film Module rather than the Master transport's control panel.

Selecting System Mode 1 operation:

- Touch [TRAN MODE] to light ONLINE indicator.
- Touch [MASTER] to light MSTR indicator.

Verify that the 422 indicator lights up.

- Touch [DSPL SEL] to select other than GEN.
- Touch [REF SRC] to select Generator reference (INT XTL or EXT VID) or MAINS (but not EXT CTL)

7.1.1 USING THE EXTERNAL SWITCHES & TALLIES

In System Mode 1, the module functions as the master film chain controller as well as the Master module in the Lynx system. All motion of the film transports and slaved tape transports is controlled from a set of user-supplied pushbuttons connected to the Film Module's TRANSPORT connector.

The five pushbuttons connected to the Film Module function as conventional film-style motion-control switches, providing direct selection of Stop, Forward, Reverse, Fast Forward, and Fast Reverse modes. In addition, the Film Module supports both forward and reverse slow-speed or crawl modes which are selected by simultaneously pressing the Stop & Forward or Stop & Reverse pushbuttons. These slow-speed modes operate at approximately 2 frames per second, and are useful for positioning the film to a start mark.

The Film Module's TRANSPORT connector also has connections for an external set of five mode tally indicators corresponding to the five pushbuttons.

NOTE:

These tallies change immediately to the new mode indication when you press one of the pushbuttons although the Film Module is designed to take a finite amount of time to ramp its biphase generator from mode to mode.

7.1.2 USING THE FILM MODULE AS A RESOLVER

The Lynx Film Module may also be used as a film chain resolver using the System Mode 1 setup. The only difference between this Resolver mode and the normal System Mode 1 situation is that there are no tape machines slaved to the Film Module when it is used as a resolver. Any Lynx Time Code Modules that are connected to the Film Module via the RS422 bus would be switched Offline so that they do not chase the film transport.

When used as a resolver, the module can resolve the sync speed of the controlled film transport(s) against its internal crystal, an external video reference signal, or the AC mains frequency depending on the selection made with the [REF SRC] key.

7.2 SYSTEM MODE 2:

BI-PHASE FOLLOWER, LYNX AS MASTER

In this mode the Film Module's biphase generator output is not used. The module's biphase follower is connected to an external source of biphase signal (an external film chain controller or the biphase output of an individual film transport) and monitors the film's position, speed, and direction from the biphase signal. This information is transmitted serially to other Lynx Modules which operate as Slaves and chase the film transport when they are Online.

When the film transport is running in Forward mode (sync speed play), the Film Module derives a system (timecode) frame rate from the biphase frequency and transmits this via the RS422 bus to the other Lynx Modules as the frame rate to which they will resolve.

This operating mode for the Film Module is analogous to operating a standard Lynx Time Code Module as an Unresolved Master in the VSO (Variable Speed Override) mode.

Note that this mode cannot be used when slaving a video tape machine to the Film Module unless the telecine or film chain controller is set up to resolve itself to the same video reference signal that the VTR is self-resolving to. If the film transport is not independently resolved to the video frame rate, the Lynx system will initially bring the film and video machines into proper sync, but the VTR will tend to drift out of sync with the Film Module since Lynx Modules releases VTRs to self-resolve mode once lock is achieved.

Selecting System Mode 2 operation:

- Touch [TRAN MODE] to light ONLINE indicator.
- Touch [MASTER] to light MSTR indicator.

Verify that the 422 indicator lights up.

- Touch [DSPL SEL] to select something other than GEN.
- Touch [REF SRC] as necessary to select EXT CTL.

7.3 SYSTEM MODE 3:

SLAVED BIPHASE GEN., LYNX AS SLAVE

This mode is similar to System Mode 1 in that the Film Module's biphase generator is fed to the interlock bus to control the film transport(s) and the module's biphase follower is connected to the generator and the interlock bus to keep track of the Film Position. In System Mode 3, though, the Film Module operates as a Slave to another Lynx Module that has been designated as the Master. This Master Lynx Module may be either a Time Code Module connected to a tape transport or another Film Module.

In System Mode 3, the Film Module's biphase generator is controlled indirectly by the motion of a transport connected to the Master Lynx Module rather than being controlled directly by an external set of pushbuttons. The biphase generator outputs the appropriate signals to position and synchronize the slaved film transport to the Master transport's position and lock it to the Master transport's frame rate. The module's biphase follower keeps track of the current Film Position for purposes of synchronization and front panel display.

Selecting System Mode 3 operation:

- Touch [TRAN MODE] to light ONLINE indicator.
- Make sure the MSTR indicator on the Film Module is not lit.
- Touch the [MASTER] key on the Lynx Module you wish to operate as the System Master.

Verify that the 422 indicator lights up on all modules in the system.

NOTE:

It is not necessary to select a Reference Source on the Film Module in System Mode 3 since the Film Module is not the System Master.

7.4 MANUAL OFFSET ENTRY

Any Slave Module in a Lynx system may be numerically offset relative to the Master Lynx Module by a subframe-accurate amount. If the necessary offset value is known, it may be entered manually into the Offset register of the Slave module using the ADJUST keys in the Set/Hold mode.

In the Lynx System the offset is defined as:

Slave timecode
- Master timecode
= Offset

NOTE:

A Slave requires a positive Offset when its timecode numbers are larger than the Master timecode and a negative Offset when the Slave timecode numbers are smaller than the Master timecode. Note, however, that the Lynx system defines Offset values to be between -11:59:59:29 and (+)12:00:00:00, so that a positive offset larger than 12 hours is actually entered and displayed as a negative offset of less than 12 hours magnitude. For example, 14:00:00:00 would actually be handled by a Lynx Module as -10:00:00:00 (which is mathematically derived by subtracting 24:00:00:00 from 14:00:00:00).

In System Mode 1 or System Mode 2, the Film Module is the Master so that the desired offset is set at each Slave Lynx Module rather than at the (Master) Film Module. In System Mode 3, the Film Module is operated as a Slave so that the offset is entered directly into the Film Module's Offset register. In either case, the procedure for entering an Offset is precisely the same:

- Touch [DSPL SEL] on Slave Lynx Modules as necessary to light up the OFFSET indicator.
- Touch [SET HOLD] once to enter the Set/Hold mode. SET/HOLD indicator and the digits in the FR window should be flashing.
- Use the [↑] and [↓] keys to set the Frames portion of the desired Offset. When starting at zero, the [↓] key is used to set negative offset values (for Slave timecode smaller than the Master timecode).
- Touch [SET HOLD] key again so that the digits in the SEC window begin to flash, and then use the ADJUST keys to set the Seconds portion of the Offset.
- Repeat the same process for the Minutes and Hours portions of the Offset.
- If desired, touch [SUBF UBITS] to light up the SUB-F U-BITS indicator and then use the ADJUST keys to set the Subframes (1/100 frame) portion of the Offset.
- When the number in the display is correct, touch [STORE] to enter that value in the Offset register and leave the Set/Hold mode.

The Master Lynx Module can never have an Offset. If you attempt to store a number in the Offset register of a module that is designated as the Master, the module will not accept it. Similarly, a Lynx Module clears its Offset register to zero when you designate it as the Master by pressing its [MASTER] key.

The Film Position frame numbers that are displayed on the Film Module and that determine the necessary offset value are essentially arbitrary since there is no timecode signal recorded on the film itself. It may therefore be possible to eliminate any need for an offset by setting the Film Position frame numbers themselves to match the timecode recorded on tape.

Lynx Modules allow you to adjust the current Offset in real time as the various transports in the system are running in sync. The procedure for adjusting the Offset in real time is precisely the same as that for initially setting the Offset as given in the preceding section.

When you change the value in the Offset register on a Slave module that has achieved Lock, the module only slews the speed of its transport by a small amount in its attempt to resynchronize with the new Offset. Once a Slave module has achieved Lock with the Master, it will not drop out of Play mode to chase and resynchronize regardless of how much the Offset changes. Consequently, small changes in Offset (on the order of a few frames up to a few seconds) may be made virtually undetectable, but the module will take an impractically long time to resynchronize if you make a large change in Offset.

The Offset of slaved video transports and some digital audio transports cannot be changed in real time. When a Lynx Module operates one of these machines as a Slave, it brings the transport into the proper synchronized position relative to the Master and then releases the transport to self-resolve once it has achieved Lock. Since the Lynx Module has relinquished its speed control of the transport, it then has no way to vary the speed to bring it into a new sync relationship with the changed Offset.

When you change the Offset of a Slave module that is not running in Lock, the change only becomes effective when you touch [STORE] to leave the Set/Hold mode. This ensures that the transport will not chase around unnecessarily while you are in the process of dialing in an Offset value.

7.5 AUTOMATIC OFFSET ENTRY

The Lynx system provides a convenient means for the automatic calculation of offsets using SyncPoints. If you electronically mark a point on a Slave module that you want to synchronize with a similarly marked point on the Master module, the Lynx Module will automatically take care of the calculation of the appropriate offset value.

SyncPoints function identically in Lynx Film Modules and Lynx Time Code Modules. When using SyncPoints it makes no difference whether either the Master or the Slave module is a Film Module or a standard Time Code Module.

7.5.1 SYNCPOINT FUNCTIONS EXPLAINED

Before discussing how to use SyncPoints, it will be useful to make a clear distinction between Offsets and SyncPoints. In a Lynx system, the contents of a Slave module's Offset register determines the position of that module's transport relative to the Master. (Remember that the Master cannot have an Offset.) The SyncPoint registers, on the other hand, provide a convenient way to automatically calculate a Slave's Offset by electronically marking a position on the Slave which is to be matched up to a similarly marked position on the Master. In other words:

- The SyncPoint register causes Offset calculations.
- The Offset register controls the Slave's position.

When a value is entered into the SyncPoint register of a Slave module, the Slave module will get the SyncPoint value from the Master module, subtract the Master SyncPoint number from its own SyncPoint number, store the result in its Offset register, and re-sync to this new Offset value. If there is no SyncPoint set on the Master, all Slave modules with SyncPoints will wait until a SyncPoint is entered on the Master module and then carry out the calculation just described. The same is true if the module that is to be the Master has a SyncPoint but is not Online or is not yet designated as the Master.

Entering a new SyncPoint or changing the value of the SyncPoint in a Slave module will cause an automatic recalculation of the Offset value for that one Slave assuming that there is still a SyncPoint in the Master module.

Entering a new SyncPoint or changing an existing SyncPoint on the Master module will cause automatic recalculation of the Offset in all Slave modules that have a number in their SyncPoint register.

If you enter SyncPoints on two or more Lynx Modules without any module having been designated as the Master, no Offsets will be calculated until you designate a Master. If you change to a different module as Master, all Slave modules that have SyncPoints will re-calculate their Offset relative to the new Master SyncPoint. This preserves the same time relationships among all modules with SyncPoints even though the numerical value of the Offset for each module may be different when you change to a new Master.

Clearing the SyncPoint register on a Slave module after the Offset has been calculated retains the current, calculated Offset value and prevents further automatic recalculations of the Offset. This can be particularly useful in a multi-machine situation because it allows the operator to perform separate SyncPoint operations to set the Offset independently for each Slave machine. For example, once the operator has performed a SyncPoint operation to set the Offset for Slave #1, he can clear Slave 1's SyncPoint to prevent an undesired recalculation of its Offset while he sets the Offset for Slave #2 using a different SyncPoint on the Master.

Whenever a Slave module's Offset is re-calculated because of a change in a SyncPoint, the module's SYNC PT light will flash and the display window will show the current SyncPoint value for approximately 2 seconds as a reminder that the Offset has just changed. This indication occurs whether the Offset recalculation is caused by a change in the Master SyncPoint or in the Slave SyncPoint.

7.6 MIXED TIMECODE OPERATION

In this manual we use "mixed timecode" to refer to a mixture of Drop Frame and non-Drop Frame SMPTE timecode formats on the various machines in the system. The Lynx system does not provide for synchronization of timecodes with different frame rates.

When a Lynx synchronization system consists of any number of Film Modules but only a single Time Code Module (i.e. only one tape machine in the system), mixed code situations may be avoided entirely. Since the "timecode side" of the Lynx Film Module uses "virtual" timecode generated by the Film Module itself (rather than a timecode signal that is recorded on any medium), the Film Module's timecode generator can simply be set to agree with the format of the timecode that is recorded on the tape. Note that this is possible only with Film Module software version FL-014A (or later) since earlier Film Module software versions did not support the generation of Drop Frame timecode.

When the Lynx system includes more than one Time Code Module (and hence more than one tape machine) mixed code situations can arise because the various tapes may not have the same type of timecode recorded on them. When some tapes have Drop Frame and some have non-Drop Frame timecode, the Film Module obviously cannot be set to agree with both types. The choice of timecode type for the Film Module in such a situation is quite arbitrary, but the preferable choice may be determined by which type of timecode is predominant or which type of timecode is in use on the Master module.

Lynx Modules are programmed to bring the Slave transports into sync with the Master and then to keep them in sync on a frame-by-frame basis. In mixed code situations this can mean that the Slaves will initially sync with the Master based on the respective timecodes and any programmed Offset, but that any Slaves that have timecode of a different type than the Master can then appear to go out of sync as frame numbers are skipped in the Drop Frame timecode. (This situation is indicated by a flashing RESOLVE light on the mixed code Slave module, and by an Offset Error that periodically increases by 2 frames at a time as frame numbers are dropped.) In addition, if you stop a mixed code system and then re-start it at a different point than where you initially started it, the time relationship between the machines can be different because the frame numbers can have diverged and thus would require a numerically different offset value.

Fortunately, the function of the Lynx system's SyncPoints provides a very convenient solution to the potential problems of a mixed code system. If you mark corresponding SyncPoints on each of the machines in the system, each Lynx Module will then maintain its position based on the net number of frames it has moved from that fixed SyncPoint. The time relationships between the various machines are preserved from any start point even though their respective timecode frame numbers may have diverged. Likewise, the Offset Error display will show any deviation from true sync rather than indicating the accumulating numerical difference between the timecode formats.

Note, however, that the Offset value calculated by a Lynx Module during a SyncPoint operation in a mixed code situation is likely to look intuitively "wrong" since it includes the accumulated number of dropped frames since 00:00:00:00 as well as the apparent numerical offset between Master and Slave timecodes. For example, if you mark 1:00:00:10 as the SyncPoint on a non-Drop Frame Master and 1:00:00:10 as the SyncPoint on a Drop Frame Slave, the module will calculate and enter an Offset of 03:18 which represents the 108 frames that have been dropped in the first hour of timecode since "timecode midnight" rather than the expected Offset value of 00:00.

7.7 TACH>TIMECODE MODE

When the TACH>TC indicator is lit, the Film Module's Generator is in the Tach-to-Timecode mode. 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 as in System Mode 1. Additionally, the Reference Source must be selected to the Generator reference (either INTL XTL or EXT VID).

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 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 ON 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 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 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. For the 25 fps film frame rate, the Generator defaults to 25 fps timecode; for 24 or 30 fps film frame rates, the Generator defaults to 30 fps Non-Drop Frame timecode. These defaults may, of course, be overridden by the operator at any time as long as the generator's 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.

INTERNAL SWITCHES AND JUMPERS

A1.1 INTERNAL TEST SWITCH

A 10-position, rotary test switch is provided on the biphase processor board (the sub-board inside the Film Module). This switch allows technical personnel to select the following signals to be generated by the biphase generator for test purposes:

SWITCH POSITION	BIPHASE SIGNAL
0	Normal (non-Test) mode
1	Stop
2	Reverse Play
3	Stop
4	Forward Play
5	Fast Forward
6	Stop
7	Stop
8	Stop
9	Stop

In any Test position (1 through 9) the red indicator labelled LED1 on the biphase board will be lit.

NOTE:

The Test switch must be in Position 0 (Normal) when the Film Module is powered up for proper operation.

A1.2 INTERNAL JUMPERS BIPHASE PROC. PCB

Four pin jumper arrays on the biphase processor circuit board (the sub-board inside the Film Module) allow the Film Module to ba adapted to different operating environments. The settings of these jumpers may be cahnged as necessary by removing the jumper link with a pair of pliers and re-installing it on a different pair of pins. The jumpers and their functions are:

JP1 RAIL Sets the Film Module for either +5 volt or +12 volt biphase input and output levels. The +5 volt setting is compatible with either CMOS or TTL circuitry, while the +12 volt setting is compatible with CMOS only. JP1 is a 2x3 (3-position) pin array. One end position is labelled "5V" on the circuit board; the jumper is normally installed in this position at the factory. The other end position is labelled "12V". The middle position is inactive.

JP2 OUT Sets the Film Module's output for either Biphase or Tach & Direction operation to accommodate various types of film transports. The "Phase B" biphase output becomes the Direction signal in the Tach & Direction mode. JP2 is a 2x3 (3-position) pin array. One end position is labelled "BIPH", which is the normal position for the jumper when it leaves the factory. The middle position is labelled "DIR", and provides Tach & Direction output from the Film Module with normal polarity for the Direction signal. The other end position is labelled "$\overline{\text{DIR}}$", and provides Tach & Direction output with inverted logic polarity for the Direction signal.

JP3 IN Sets the Film Module's input for either Biphase or Tach & Direction operation to accommodate various types of film transports. The "Phase B" biphase input becomes the Direction signal input in the Tach & Direction mode. JP3 is a 1x3 (2-position) pin array. One position is labelled "BIPH", which is the normal position for the jumper when it leaves the factory. The other position is labelled "DIR", which switches the Film Module's biphase input to Tach & Direction mode.

JP4 Sets the circuitry on the biphase board for the size of the RAM chip installed in position U9. JP4 should not be moved.

A1.3 INTERNAL JUMPERS, MAIN PCB

In addition to the four jumpers on the Biphase Processor PCB, there are four jumpers on the main circuit board in the right, front corner of the module. Three of these jumpers are used to configure the module's circuitry for three different EPROM capacities. (The fourth jumper, JP2, is set for the capacity of the battery RAM chip that is installed, and should never be moved.) Lynx Modules may use a single, large capacity EPROM in position U16 or two smaller capacity EPROMs in positions U7 and U16, but it is the capacity of the EPROM(s) used rather than the number of EPROM chips used that determines the correct jumper settings.

The only time you need to check the positions of these jumpers is when installing a different firmware version in the module. If the new firmware version is furnished on the same capacity EPROM(s) as the old version, you will not have to move any jumpers; if the new version is on EPROMs of a different (presumably larger) capacity, the jumpers must be moved to the correct positions or else the module will not "wake up" when the power is turned on.

The capacity of the EPROMs used in Lynx Modules is indicated in the last digits of the chip's part number: e.g. 27C128 = 128k, 27C256 = 256k, and 27C512 = 512k. In addition, the TimeLine firmware label usually indicates the chip capacity as part of the printed designation. Note that all three capacities of EPROM are the same physical size and virtually identical in appearance except for printed designation.

For Lynx Modules with serial numbers 1454 and above, the correct positions for these three jumpers are as follows for the various EPROM sizes:

For **128k** EPROMs (27C128)

JP1	Position	"1"
JP3	Position	"1"
JP4	Position	"1 / 2"

For **256k** EPROMs (27C256)

JP1	Position	"2"
JP3	Position	"2/5"
JP4	Position	"1 / 2"

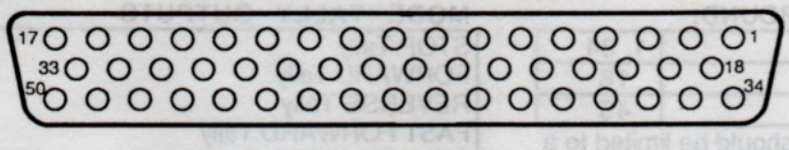
For **512k** EPROMs (27C512)

JP1	Position	"5"
JP3	Position	"2/5"
JP4	Position	"5"

In **all** cases, the correct position for JP2, which sets the battery RAM size, is Position "16" rather than position "64".

For Lynx Modules with serial numbers below 1453, contact TimeLine for details regarding the proper jumper positions if you are changing firmware versions.

TRANSPORT CONNECTOR PIN-OUT



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

SIGNALS INDEXED BY FUNCTION

POWER SUPPLIES AND GROUND:

Module Ground	1, 34
+5 volts	18
-12 volts	45

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

BIPHASE INPUTS AND OUTPUTS:

Biphase Generator, phase A	32
Biphase Generator, phase B	33
Biphase Follower, phase A	16
Biphase Follower, phase B	17

Phase A leads Phase B for forward motion

EXTERNAL SWITCH INPUTS

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

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.

ANNUNCIATOR OUTPUT

Remote LOCK indicator	12

Open-collector Darlington output, 50volts/100mA.

MODE TALLY OUTPUTS

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

Darlington opto-isolator collectors rated at 80 volts/ 30 mA. Emitters are tied to Tally Common.

CHANGEOVER RELAY

Changeover Relay A, common	14
Changeover Relay A, N/C	31
Changeover Relay A, N/O	15
Changeover Relay B, common	30
Changeover Relay B, N/C	13
Changeover Relay B, N/O	29

"A" and "B" are alternate poles of the same 2-pole relay. When wired as recommended, this relay connects the module's biphase input and output as appropriate for the three different System Modes.

MUTE RELAY

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

Mute Relay is available to dim or mute the studio monitors when in Reverse or Fast modes.