LYNX TIME CODE MODULE

OPERATING MANUAL

Software Release: L409-6
Printing Release: 016
Printing Date: 9/2/86

TimeLine, Inc.
270 Lafayette St.
New York, N.Y. 10012
212-431-0330

LIMITED WARRANTY

TIMELINE, INC. ("TIMELINE") warrants this product against defects in material or workmanship, as follows:

1. For a period of 90 days from the date of purchase TIMELINE will, at its option, either perform necessary repairs at its expense or pay for the labor charges of others it it authorizes to repair the defective product. After this 90 day period, you must pay for all labor charges.

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

LABOR AND PARTS

To obtain warranty service, you must notify TIMELINE during the initial 90 day period. TIMELINE will then instruct you to take the product or deliver prepaid, to either TIMELINE or to its authorized repair station.

PARTS ONLY

During the remainder of the warranty period, any defective part will be replaced if it is taken, or delivered, to TIMELINE. Labor for removal and installations is available from TIMELINE, at your expense.

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

We suggest that you retain the dealers dated bill of sale as evidence of the date of purchase.

REPAIR OR REPLACEMENT AS PROVIDED UNDER THIS WARRANTY IS THE EXCLUSIVE REMEDY OF THE CUSTOMER. TIMELINE SHALL NOT BE LIABLE FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY ON THIS PRODUCT. EXCEPT TO THE EXTENT PROHIBITED BY APPLICABLE LAW AND EXCEPT FOR THE LIMITED WARRANTY DESCRIBED ABOVE, TIMELINE EXPRESSELY DISCLAIMS ANY WARRANTY WHETHER EXPRESS OR IMPLIED, OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Some states do not allow the exclusion or limitation of incidental or consequential damages, or allow limitations on how long an implied warranty lasts, so the above limitations or exlusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

TABLE OF CONTENTS

1.0 OVERVIEW

1.1 INITIALIZATION

2.0 FEATURES AND CONTROLS

2.1 FRONT PANEL DESCRIPTION
2.1.1 TRANSPORT MODE
2.1.2 GENERATOR MODE
2.1.3 GENERATOR ON
2.1.4 SYNC PT
2.1.5 SET/HOLD
2.1.6 ADJUST KEYS
2.1.7 SUBF/UBITS
2.1.8 STORE KEY
2.1.9 DISPLAY SELECT
2.1.10 CODE TYPE
2.1.11 REF SRC
2.1.12 MASTER
2.1.13 Power switch
2.1.14 RMT light
2.1.15 422 Light
2.1.16 Numeric Display
2.1.17 Reader source indicators

2.2 REAR PANEL DESCRIPTION
2.2.1 Power and FUSE
2.2.2 Serial no.
2.2.3 VITC Connector (OPTION)
2.2.4 External video reference input
2.2.5 Reader timecode input
2.2.6 Reader RESHAPE output (code or pilot)
2.2.7 Generator timecode output
2.2.8 Reader Pilot input
2.2.9 Generator Pilot out
2.2.10 TRANSPORT Connector
2.2.11 GEN LVL. Adjustment
2.2.12 RS 422 Connectors
2.2.13 GND/ISO Switch

3.0 INSTALLATION and SIMPLIFIED OPERATION

3.1 RACK MOUNTING INSTRUCTIONS

3.2 FIRST INITIALIZATION
3.2.1 Erasing battery ram
3.2.2 Menu 1: Transport
3.2.3 Menu 2: "done"
3.2.4 Signon message
3.2.5 Initializing as a generator or reader only
3.2.6 Initializing for code-only master use

3.3 INITIAL SETUP
3.3.1 Interconnections
3.3.2 Tach and cable checkout
3.3.3 Reading time code

3.4 INITIAL SYNCHRONIZATION
3.4.1 Chase operation.

3.5 ADJUSTMENTS AND JUMPERS
3.5.1 Output level adjustments
3.5.2 Reshape / reshaped pilot option
3.5.3 Reshape output level pots

3.6 KEY SENSITIVITY: Touch/hold explained

3.7 ENTERING NUMBERS INTO THE DISPLAY
3.7.1 Set/hold mode
3.7.2 Clearing and modifying the display
3.7.3 Storing a number
3.7.4 Negative numbers

4.0 GENERATOR SECTION

4.1 Generator Reference
4.1.1 Setting the generator reference
4.2 Generator code type
4.3 Generator on/off (hold)
4.4 Setting the generator
4.5 Generator modes
4.5.1 Normal
4.5.2 Jam Sync (MANUAL)
4.5.3 Jam sync (AUTOMATIC)
4.5.4 Jam sync (USER BITS)
4.5.5 Jam sync principles
4.6 Slaved generator principles
4.7 Recording time code
4.7.1 Generator output level
4.7.2 Pilot output

5.0 READER SECTION

5.1 Reader Display
5.2 Reader Source Code Indicators
5.3 Rate of Code Indicators
5.4 Reshaped code / reshaped pilot output

6.0 SYNCHRONIZER SECTION

6.1 Synchronizing Two or More Transports with Time Code
6.1.1 Master Selection
6.1.2 Master Reference Select
6.1.3 Synchronization without an Offset
6.1.4 Synchronization with an Offset
6.1.4.1 Manual Offset Entry
6.1.4.2 Automatic Offset Entry/Sync Point Select

6.2 Code only master synchronization
6.2.1 Code only master principles
6.2.2 Code only master applications
6.2.3 Code only master set-up

6.3 Synchronizing a Video or Digital Audio Transport
6.3.1 Set up procedure

6.4 ADVANCED FEATURES
6.4.1 Automatic switchover to pilot resolve
6.4.2 Setting and showing subframe offsets
6.4.3 Showing subframe errors
6.4.4 Notes on PILOT capabilities
6.4.5 Automatic Resync

7.0 USING THE LYNX AS A TRANSPORT SPEED RESOLVER

7.1 Resolving a Transport to Time Code
7.2 Resolving a Transport to Pilotone

8.0 APPENDIX

8.1 Transport Menu
8.2 Error Messages

8.3 SYSTEM RESTRICTIONS
8.3.1 Use of Mixed Time Codes
8.3.2 48hz pilot output
8.3.3 24-hour boundries

8.4 SUGGESTIONS
8.4.1 Recording speed
8.4.2 Recording level
8.4.3 Synchronization problems

8.5 Problem Solving

8.6 Timecode / User bits explained
8.6.1 Time Code Overview
8.6.2 Time Code "Types"

8.7 Rear Panel Connector Pin Designations
8.8 Circuit board interface components

1.0 OVERVIEW

TimeLine's LYNX is a high performance modular time code product which is actually four independent functional units contained in a single enclosure. Each module features the following:

- SMPTE / EBU time code generator.
- SMPTE / EBU time code reader (wide band)
- Transport synchronizer / resolver.
- SMPTE / EBU RS-422 port for external control.

The system architecture assigns one LYNX module to each transport to be controlled. When multiple modules are interconnected with standard 9 pin RS-422 cables, they form a time code system that can synchronize an unlimited number of transports on-line simultaneously.

The Lynx module is characterized by a lack of internal adjustments necessary for configurations to different transport types. Changeover from one transport type to another is accomplished by menu selection from the front panel. This action automatically reconfigures:

- Logic input levels.
- Logic input polarities.
- Tach rates
- Analog outputs
- Frequency outputs
- Toggle rates
- Ballistics information

Because this information is contained within the system and is selected by menu, the Lynx module wakes up with much of the information necessary to operate immediately. Typically, the only "learned" information necessary for proper operation is the tape speed (i.e. 15/30 ips) which is determined by reading time code for 10 seconds before first use.

The independent generator allows convenient local time code striping for each controlled transport.

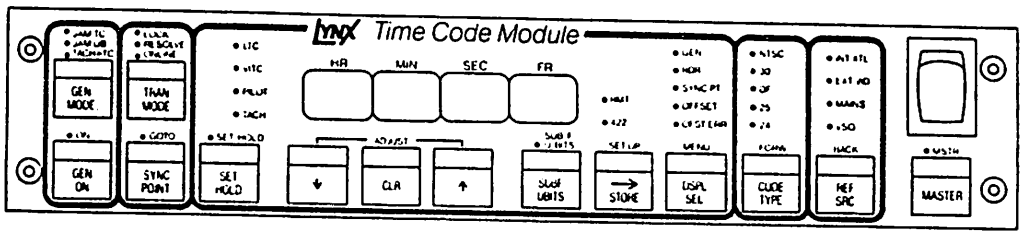
1.1 INITIALIZATION

A first initialization procedure done from the front panel allows the user to set up for the particular type of tranport to be used. All system information is then permanently maintained in battery backup RAM. See section 3.2.

If you want to quickly do simple synchronization before using the more sophisticated features of the Lynx module, see section 3.4.

2.0 FEATURES AND CONTROLS

2.1 Front Panel Description



2.1.1 TRANSPORT MODE

Selects whether or not the LYNX transport is ONLINE or OFFLINE. When OFFLINE the LYNX module will relinquish all control over the transport.

ON LINE light

Indicates the LYNX module is either a master or slave. If it is not the master, the transport is automatically made a slave to any other module selected as master.

When not lit, the Lynx module relinquishes all control over the transport, except that the SYNC POINT button can be used as a single point search-to-cue to the last sync point.

RESOLVE Light

Indicates that the transport is in 'play' and its timecode is resolved to within 20 subframes (20/100 frame) of the master's reference source.

LOCK Light

Indicates that the transport is in 'play' and its timecode is resolved to within 2 subframes (2/100 frame) of the master's reference source. This function is duplicated by the letter "L" which appears in the OFST ERR display, and by a remote lock light output connection, available on the rear panel connector.

NOTE:
In the special case when the LYNX is controlling a video or digital audio transport, the transport is brought into lock, and then completely released to its own servo reference. At this time the transport may cause itself to re-frame. The

lock/resolve lamps will stay lit under these conditions as long as the machine does not lose lock and stays within one frame of the correct position.

See section 6.3 for a more complete description of video or digital audio slave operation.

NOTE:

The master transport, as well as all the slave transports, is resolved to the master reference source. In this fashion, master wow, flutter, and bad frame codes will not be passed down to the slaves under normal conditions.

This is true unless the VSO mode is intentionally selected for the master, at which time the master capstan speed runs WILD, and the slaves follow the speed of its timecode. This is normally used when using a source of time code ("CODE ONLY MASTER") as the master, or when it is desired to vari-speed the master machine for off-speed audio mixing, or to eliminate "wow" when the master first goes into "play".

(See section 6.1.2 for a description of VSO mode and the function of the master reference key.)

2.1.2 GENERATOR MODE

Selects the GENERATOR MODE. This key can be used to PRESET the generator mode by touching it when the generator is stopped, or can be used to momentarily change mode "on the fly" if touched when the generator is already running.

WHILE STOPPED:

JAM TC or JAM UB may be 'preselected' as explained below.

WHILE RUNNING:

The GEN MODE key will cause the generator to immediately "jam sync" once to the reader input; that is to say, the generator will continue generating code but will instantaneously reproduce the timecode number present in the reader at the moment the GEN MODE key is touched, and will then continue running sequentially, locked to the generator's reference source.

GENERATOR MODE LIGHTS

If no generator mode lights are on, the generator will generate continuous time code locked to house reference, while running, and can be started and stopped with the GEN ON key. This is the "normal mode".

JAM TC Light

Indicates that generator will automatically jam sync to the reader input after three valid, consecutive reader frames are read. The transfer from reader to generator will re-occur if reader timecode is discontinuous when three new valid, consecutive frames are received. Otherwise the generator will produce consecutive frames.
This mode is used to re-generate code when making tape copies, or for reconstructing code that is poorly recorded or has dropouts. See section 4.5.

JAM UB Light

Indicates that simultaneously while generating normal timecode, the "user bits" (spare) portion of the timecode is being filled with the present reader time.
The user bits will faithfully follow the current reader time, whether the reader is stopped or moving. See section 8.6 for a description of user bits.

NOTE: The user-bits portion of the timecode is permanently set to 00:00:00:00 unless intentionally entered by means of the front panel or during the jam sync process.

TACH > TC LIGHT

Not used.

2.1.3 GENERATOR ON

This toggles the generator on/off. The light directly above the key indicates that the generator is running. When the light is not lit it indicates that generator is off, ready to resume at the last frame transmitted. There is no output from the generator when it is in the off/hold mode.

2.1.4 SYNC PT

When touched and released, cues to the current sync point, and the GOTO light flashes. The key operates only when OFFLINE. The light will also flash when executing a cue command received from the master.

SETTING A SYNC POINT

When touched simultaneously with SET, the sync point key load the sync point from the current tape time, either while the tape is stationary or while it is moving.

When a sync point is set, the Lynx module automatically compares the timecode number just loaded to that of the module previously assigned as the "master", and computes and stores the result in the Lynx offset memory, which can be displayed in the display OFST position.

At the moment a sync point is set, the display will switch to the SYNC PT position for approximately 2 seconds to show the number just loaded.

WARNING:

Before setting a SYNC PT, it is essential that a 'master' be assigned, for its sync point to be set, and for it to be stopped prior to assigning slave sync points.

2.1.5 SET/HOLD

Used to preset the generator, reader, or other displays. When first touched, holds (or "freezes") the display, and causes the set/hold light to flash.

At first, the frames column will flash. This will allow the frames value to be adjusted and set. When touched again, moves the flashing column to the left, allowing each succeeding column to be adjusted.

To release the display from hold mode, hold this key again until the set/hold light goes out. This will allow the display to resume counting.

NOTE: The set/hold mode does not affect the generator or reader input or outputs while the columns are being adjusted, unless the value is actually "stored" as described below.

2.1.6 ADJUST KEYS

These keys are used while in the SET HOLD mode.

ϕ Subtracts one from the number in the flashing column.

↑ Adds one to the number in the flashing column.

CLR When held, will clear the display to 00:00:00:00.

When the ^ or ϕ keys are touched numbers will increase or decrease one integer at a time. HOLDING these keys will cause the numbers to scroll automatically.

The CLR key can also be used to clear a permanent error message from the display, such as the "NO VIDEO" message which appears if loss of video sync is encountered.

2.1.7 SUBF/UBITS

In the GEN and RDR modes, causes the display to show the user-bit of the time code. The UBITS light will flash when user bits are being displayed. To resume showing timecode, touch this key again.

In the OFFSET and OFST ERR modes, this key allows access to setting and showing subframe offsets and offset errors.

NOTE: When there is a subframe offset in the system, the "SUBF" light will flash if you are displaying frame offsets as a reminder that there are also subframes loaded, which can be accessed with the SUBF key.

2.1.8 STORE

Allows you to store a timecode number when SET HOLD is flashing. The displayed value is stored into the location shown by the DSPL SEL leds, and the SET HOLD mode is released.

2.1.9 DISPLAY SELECT

Toggles through display to the various LYNX display registers.

The DSPL SEL also affects the CODE TYPE and REF SRC displays, as described elsewhere.

GEN

Indicates that the generator time is being displayed. The CODE TYPE and REF SRC lights show the current generator status.

RDR

Indicates that reader time is being displayed. If actual time code is being read, the LTC light is on and the actual incoming timecode value appears in the display. If timecode is not present, the display is then continually updated by tach time.

SYNC PT

AS A SLAVE:

Shows the point which is to be synchronized with a likewise selected point on the master transport.

AS A MASTER:

Shows the position that all slave sync points are to be synchronized with.

NOTE:

See SYNC PT key description for a full description of the sync point register.

OFFSET

Displays the intended number of frames difference between the slave transport relative to the master transport. Shows the full-frame offset, or the subframe offset if the SUBF key is lit.

Whenever there is an offset programmed in the system, the "OFST" light stays constantly illuminated as a reminder, even if the display select is in another position.

OFST ERR

Indicates the actual number of frames difference between the intended offset and the current position. Shows the full-frame error, or the subframe error if the SUBF key is lit.

When the transport is in 'lock' these values go to zero.

2.1.10 CODE TYPE

WHEN DISPLAYING THE GENERATOR, the display shows the type of time code being generated.

NTSC LIGHT

This is a generator SPEED indicator, and can be on when generating 30 or 30-DF timecode.

WHEN ON:
Indicates that the code being generated is running at a speed of 29.97 frames per second. This is normally referred to as NTSC color speed since this is the speed at which color video frames run, and is the speed at which most video timecode is generated.

WHEN OFF:
Indicates that the code being generated is running at a speed of 30 frames per second. This is the reference many times used when timecode is to be used for purposes of syncing up with 35mm film.

NOTE:
The rest of the indicators in this row show the type of time code being generated.

30 LIGHT

Indicates that time code being generated is "non-drop frame" SMPTE time code. There are 30 frames for every second displayed.

When used with the NTSC light out (non color speed) this will produce 24 hours of time code for every 24 hours of elapsed time.

DF LIGHT

Indicates that time code being generated is "drop-frame" SMPTE time code. There are 30 frames for every displayed second, except for certain numbers which are skipped, or 'dropped'. The total number of frames dropped is 108 per hour.

When used with the NTSC light on (color speed), this will produce 24 hours of time code for 24 hours of elapsed time.

(See appendix 8.6 for an explanation of drop-frame time code.)

25 LIGHT

Indicates that time code being generated is 25 frames/second EBU (European Broadcast Union) time code. There are 25 frames for every displayed second.

24 LIGHT

Indicates that time code being generated is 24 frames/second film style time code. This is a non-standard timecode used for special usage with film systems.

WHEN NOT DISPLAYING THE GENERATOR, the display shows the type of time code being read by the time code reader, as follows:

30 LIGHT

Indicates that time code being read is 30 fps "non-drop frame" SMPTE time code.

DF LIGHT

Indicates that time code being read is 30 drop-frame SMPTE time code.

25 LIGHT

Indicates that time code being read is 25 frames/second EBU time code.

24 LIGHT

Indicates that time code being read is 24 frames/second film style time code.

2.1.11 REF SRC

Selects the reference speed of the generator, as well as the reference play speed of the transports. The particular function in use is determined by the DSPL SEL position. See below.

REF SRC LIGHTS

Shows the currently selected reference source of the generator and / or master machine, as follows.

WHEN DISPLAYING GENERATOR:

The lit indicator shows the source of the generator speed.

INT XTL

Indicates that the generator is locked to the internal crystal of the LYNX.

EXT VID

Indicates that the generator is locked to the external video reference plugged into the EXT VID jack. If no signal is present this position is disallowed, and the message "no video" appears in the timecode display.

WHEN NOT DISPLAYING THE GENERATOR:

The lit indicator shows the selected play speed reference which all machines use when being synchronized. It will only be lit when the LYNX module is selected as the current MASTER.

NOTE:

At any time, only THREE positions are available as the master system reference. The first position is the current selection of the generator reference, and the remaining two positions are MAINS and VSO.

INT XTL

Indicates the synchronizer is using the generator internal crystal as the system reference.

EXT VID

Indicates that the synchronizer is using the generator external video reference as the system reference.

MAINS

Indicates that the synchronizer is using the incoming power line frequency as the system reference.

VSO (variable speed override)

Indicates that the master is allowed to run at its own play speed (commonly called "wild speed") and the speed of its timecode will be passed down to the slaves as the play speed reference for synchronization.

This can allow the master transport's VSO control to be used to alter the play speed of the entire system for off-speed mixing, or can allow the use of "code only" as a master, without transport cables hooked up to the master machine.

The disadvantage of using this mode is that wow and flutter may be passed down from master to slaves, although this effect is minimized by digital filtering in the Lynx module.

2.1.12 MASTER

Selects the LYNX module as the system master. The unit must be previously have been put ON LINE for this function to operate. Once a master is selected, the MASTER keys on all other system LYNX modules are deactivated.

A new master can be chosen at any time by deselecting the current master first.

MSTR LIGHT

Indicates that LYNX has been designated as the system master.

2.1.13 POWER SWITCH

Controls AC power to the LYNX module. It is highly recommended that power not be turned on or off while tape is threaded and the attached transport is in 'ready' mode.

2.1.14 RMT LIGHT

Not used.

2.1.15 422 LIGHT

Indicates that the LYNX is either transmitting or receiving RS 422 to/from the edit system. This will normally be ON after the editor has been booted.

2.1.16 NUMERIC DISPLAY

Time Code/Message Display. Normally displays time code and user bits in hours, minutes, seconds and frames.

Displays all menus and error messages.

2.1.17 READER SOURCE INDICATOR LIGHTS

These indicators are active regardless of other information being displayed on the panel.

When all lights are out, it indicates that the source of the timecode showing in the RDR display was last received from incoming time code, not tach or pilot.

LTC

Indicates that valid time code is present at the reader input.

VITC Light

Not used.

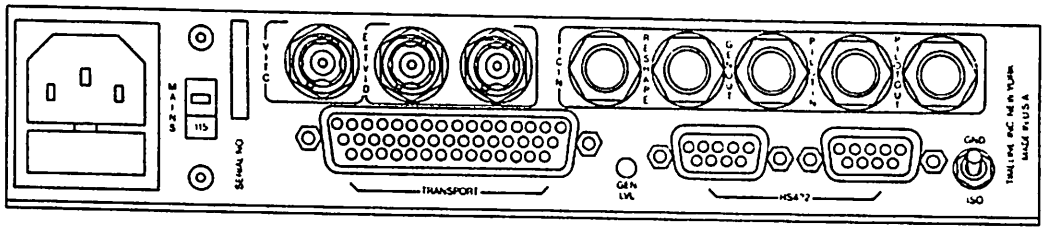
PILOT Light

Indicates that the synchronizer is locking to a PILOT signal on the PILOT IN jack.

TACH Light

Indicates that transport tach pulses are being used to drive the reader display.

2.2 REAR PANEL DESCRIPTION



2.2.1 POWER AND FUSE

Accepts factory supplied power cord. Switch to the right of male power socket selects voltage on which the LYNX will safely operate. This switch has two positions, 115 and 230.

Contains fuse drawer which holds the AC power fuse. The drawer is accessed by inserting the blade of a small screwdriver into the slot at the lower front of the power cord receptacle opening and twisting the blade. The fuse drawer will slide out. There are two positions in the drawer. The one furthest in is the active position the one nearest to the back panel is for a spare.

WARNING:
The LYNX is supplied with the proper fuse for operation on the voltage for which it is set at the factory. If you wish to change the voltage setting you MUST also change the fuse.

VOLTAGE SETTING	FUSETYPE
115	1/4 Amp GMA
230	1/8 Amp GMA

WARNING:
Operation of LYNX with mains switch in the wrong position can cause irreparable damage to the unit. This damage is not covered by the factory warranty. Be very sure this switch is in the correct position and the proper fuse is installed

before applying power to the unit.

2.2.2 SERIAL NO.

Individual LYNX serial number. Always refer to this number when consulting your dealer about your LYNX. These numbers are recorded at the factory to determine the software, hardware, and other engineering changes.

2.2.3 VITC Connector

Not used.

2.2.4 External video reference input

Either one of the two identical female BNC type connectors must be used to receive a reference signal for the generator and synchronizer. They are hardwired together so that the unused plug becomes an extension, used either to loop the video through the LYNX or terminate the video by attaching a 75 ohm terminating plug.

2.2.5 Reader timecode input connector

Electrically balanced, standard female 1/4" phone jack, tip-ring-sleeve type, used as the input for the reader time code. Time code output of transport is connected to this input. An UNBALANCED input configuration is recommended, with the RING tied to ground.

2.2.6 Reader RESHAPE output (code or pilot)

Electrically balanced, standard female 1/4" phone jack, tip-sleeve type, provides reshaped reader time code for dubbing. This can alternately supply a reshaped pilot signal derived from the incoming timecode. See section 3.5.

2.2.7 Generator timecode output Connector

Electrically balanced, standard female 1/4" phone jack, tip-ring-sleeve type. Provides output of generator time code when the generator is on.

2.2.8 Reader Pilot input connector

Electrically balanced, standard female 1/4" phone jack, tip-ring-sleeve type. Accepts pilotone input used by the synchronizer to resolve transport speed to a prerecorded tone which is 2x the system frame rate.

2.2.9 Generator Pilot out Connector

Electrically balanced, standard female 1/4" phone jack, tip-ring-sleeve type. Provides a 48/50/60 shaped square wave locked to the generator clock. The frequency of this signal is always 2X the frame rate of the time code being generated. It is always present, whether or not the generator is on or off.

2.2.10 TRANSPORT Connector

50 pin D style connector which accepts factory supplied transport interface cables.

2.2.11 GEN LVL. Adjustment

Adjusts the output level of the generator from -10 to +6 dbm.

2.2.12 RS 422 Connectors

Standard 9pin female RS 422 connectors used to connect the LYNX module to other LYNX modules or to an external controller or editor. All LYNX modules in a system must be joined together using a standard RS422 cable. Both connectors labelled RS422 are parallel wired.

2.2.13 GND/ISO Switch

This toggle switch determines whether the chassis is grounded to the transport.

In the GND position, the transport is grounded to the chassis.

In the ISO position, the chassis is electrically isolated from the transport to preserve system grounding.

> WARNING:
> The EXT VID and RS422 connectors share the same ground, and are always ground isolated from both transport AND chassis ground. This means there may be a ground potential between the video BNC and the transport cables.

3.0 INSTALLATION and SIMPLIFIED OPERATION

NOTE:
It is strongly suggested that you save the factory supplied shipping carton as it is specially designed to protect your LYNX module if it ever requires re-shipment.

3.1 RACK MOUNTING INSTRUCTIONS

LYNX modules are designed to rack mounted side by side, if desired. Each module comes with a single rack "ear". To assemble two units for rack mounting:

- Remove the top covers of the two units. Install the rack "ear" on right hand side of one LYNX and the left hand side of its associated pair. Use the 8-32 flat head hex screws provided, and the #8 self locking nuts, required only on the left unit.

- To join two LYNX modules together at the center, temporarily lift up the small circuit card on the right unit by removing its four mounting screws.

- Using the the front and back mounting holes in the lift side of the Lynx chassis, screw the right unit to the left unit using the two 8-32 pan head phillips screws, and two split ring lock washers provided.

- Replace the reader card on the right unit.

- Replace the top covers on both units. The pair is now ready for mounting in a standard 19" rack.

3.2 FIRST INITIALIZATION

The blue labels on the front panel refer to the setup functions of the controls. They are referred to here in (parentheses).

3.2.1 ERASING BATTERY RAM

When the LYNX is powered on for the first time, or it is desired to erase information already stored in the battery memory, it may be necessary to erase any information in the battery memory. This is done by holding the (SETUP) key WHILE the power switch is being turned on. At this time a transport name will start flashing in the display.

At all other times the battery memory will restore all transport information in memory when power is applied.

3.2.2 MENU 1: TRANSPORT

- Use the (FORW) and (BACK) keys to step through the transport menu to find the transport name that corresponds to the transport which the LYNX will control. The transport menu is explained in APPENDIX Section 8.1.

- When the desired transport name appears in the display touch STORE (SETUP). The display will stop flashing.

- Verify that the correct transport name appears in the display.

- Touch the (MENU) key to step to the next menu selection.

3.2.3 MENU 2: "done"

- If there are no setup mistakes, hit the STORE (SETUP) key once more, and the system will be fully initialized.

- (If it is desired to go through the procedure again, hitting the (MENU) key will return you to the first menu.)

The transport parameters are now automatically stored in the LYNX memory. The display will now read 00:00:00:00, initialize to the RDR display, and the unit is now ready for operation.

3.2.4 SIGNON

The system will sign on by showing the following information, in sequence, on the front panel display:

L-409-0 (Version number)
Atr-100 (transport type)

3.2.5 INITIALIZATION AS A GENERATOR OR READER ONLY

When the Lynx is to be used as a generator or reader only, where no transport cable is connected, select any transport from the transport menu.

3.2.6 INITIALIZATION FOR CODE-ONLY MASTER USE

When the Lynx is to be used as a code-only master, select any AUDIO transport from the transport menu.

As a code only master, the REF SRC must be in VSO mode. See section 6.2.

3.3 INITIAL SETUP

The primary function of the Lynx module is to synchronize slave transports to a master, which can be a transport or a source of incoming timecode. The synchronizer is totally dependent on the timecode reader as its source of transport position information, so timecode must be present from the controlled machine to the reader input.

Be sure the RDR IN connection is made fromthe LYNX module to the transport before attempting any synchronization operations.

The LYNX module controls the search mode of the transport by using the transport's spooling motors, and achieves play-lock by controlling the capstan motor speed. This means that if a transport has an "external capstan" switch, it must be in the "EXTERNAL" position.

The ability to synchronize a transport is ABSOLUTELY dependent upon selecting the correct transport at power up.

3.3.1 INTERCONNECTIONS

- Connect all LYNX units together using a standard 9pin RS 422 cable.
- Connect appropriate transport control cables from each LYNX to its associated transport.

3.3.2 TACH AND CABLE CHECKOUT

- Load time coded tapes on the transports. If no time coded tapes are available see Section 4 for instructions on how to generate and record time code.
- Make sure that the TCIN (reader input) is DISCONNECTED at this time.
- Make sure the RDR display is active. If it is not, touch the DISPLAY key until the RDR light is lit.
- Operate each machine manually to verify that when the transport is moving that the TACH light is on and the

display is counting. The the display must count correctly in both forward and reverse.

- If the transport is running at 30ips, the display will count in 'clock time'. At 15ips, it will count 1/2 'clock time' (i.e. 1/2 real time).

3.3.3 READING TIME CODE

- Connect an audio line from the code output channel of each transport to the TCIN of each associated LYNX.

- Play each transport for 10 seconds and verify that time code is counting on the display and that the green LTC light is lit.

3.4 INITIAL SYNCHRONIZATION

To verify that the LYNX synchronizing system is operating, the following simplified operating procedure will serve as a simplified guide to synchronizing.

Once the system is operating, you can become more familiar with the advanced functions of the system by reading the complete operating instructions. The following instructions assume that two transports are to be synchronized with no timecode offset.

3.4.1 CHASE OPERATION

- Make sure that both modules are intialized as described above.

- Touch the TRAN MODE key on both LYNX modules. The ON LINE lights will now be on.

- Select one LYNX as master by touching MASTER. Its MSTR light will now go on. The 422 light on BOTH panels will now be on.

- Put the master transport in the play mode. The slave transport will now search, play, and lock to the master.

- Verify both transports are "locked" by checking the LOCK light on all LYNX modules.

- The slave transport should now 'chase' and lock to the master transport no matter how the master transport is moved. You can now exchange which transport is the master by touching the illuminated master key, causing it to go out, and touching the other master key, causing it to light.

NOTE:
The very first attempt at lock may take up to 10 seconds.

3.5 ADJUSTMENTS AND JUMPERS

3.5.1 Output level adjustments

There are three output level adjustments:

- Generator code output level (on rear panel).
- Reader reshaped code output level (under top cover).
- Reader reshaped pilot output level (under top cover).

A normal setting for any of these output levels would be approximately -5 Vu. The range of the outputs is -10 to +6 Dbm.

3.5.2 Reshaped time code / reshaped pilot option

There is an internal option to select either reshaped timecode or reshaped pilot output from the rear panel RESHAPE jack. This selection is a small jumper plug, marked on the reader circuit card, labelled P5.

The two positions of this jumper are marked as follows:

RESHAP = Reshaped code output
PILOT = Reshaped pilot output

This jumper is factory installed in the "reshaped code" position.

The reshaped timecode is a squared-up version of the reader input signal. No reclocking, or other changes to the incoming code are made, and this signal can be used for direct timecode dubbing when desired.

The reshaped pilot output is extracted from the time code coming into the reader input, and is equal to 2x the incoming frame rate. The following nominal frequencies result:

INCOMING CODE	EXPECTED PILOT OUT
SMPTE non-color speed	60 Hz
SMPTE color speed	59.94 Hz
EBU	50 Hz

3.5.3 Reshape output level pots

The individual level pots for reshaped timecode and reshaped pilot outputs are located on the reader card, and are designated R22 and R23.

3.5 KEY SENSITIVITY: TOUCH/HOLD EXPLAINED

Because certain keys, namely, SET/HOLD, CLR, and STORE, may cause an unwanted effect if bumped accidentally, they are programmed with a slight delay. When referring to these keys, the following terms will be used:

TOUCH = Depress for less than 1/4 second.
HOLD = Depress for at least one second.

3.6 ENTERING NUMBERS INTO THE DISPLAY

The ability to enter time code numbers into the eight digit display is a necessary part of many LYNX operations. This will normally be used to enter generator starting times, tach times, and offset and sync point values.

3.6.1 SET HOLD MODE

- Touching the SET/HOLD button will freeze the display. A flashing digit (cursor) will appear in the HR column, and the set/hold light will also flash.

3.6.2 CLEARING AND MODIFYING THE DISPLAY

- The display can be cleared to 00:00:00:00, if desired, by holding CLR.
- Touch v to subtract one from the cursor column, or touch^ to add one.
- Touching SET/HOLD again will move the flashing cursor to the next column to the right.
- Repeating the above procedure will allow you to enter numbers into all the columns.

3.6.3 STORING A NUMBER

- When the desired time code number appears in the display it can be stored by holding the STORE key. The register to which the number will be stored is indicated by current position of DSPL SEL.
- The set/hold light will go out, and the display will now resume normal counting.

3.6.4 NEGATIVE NUMBERS

In the OFST and OFST ERR positions, values can be either positive or negative since these positions indicate a relationship between the master and slave transport positions, not an actual timecode value.

A positive number in the slave's offset register indicates the slave is ahead of the master the indicated amount, and a negative number indicates it is behind the master. Negative numbers appear with a flashing - (minus) sign in the tens of hours column.

To enter a negative number clear the display and use the v key to subtract from 00:00:00:00.

4.0 GENERATOR

Each LYNX module contains an independent Jam Sync time code generator. SMPTE drop and non-drop code, EBU 25 frame code and 24 frame film style codes are available from the LYNX.

In addition to the time code output signal, the LYNX provides a generator pilotone output signal.

4.1 GENERATOR REFERENCE

Before generating time code, it is important to know how the speed of the generator is derived, since speed control is an inherent part of using timecode.

In the Lynx module the REF SRC key selects either the internal crystal or external video sync as the reference for the generator. These are the two reference sources for the LYNX generator.

The generator must be stopped to change the generator reference. This helps to prevent the generator reference from being changed inadvertently.

4.1.1 SETTING THE GENERATOR REFERENCE

To set or change the generator reference:

- If generator is running, touch GEN ON to stop the generator.
- Touch REF SRC until light next to desired setting is lit.
- Press GEN ON. The generator will begin to run locked to the appropriate reference.

NOTE:

Since it is impossible to lock to external video unless that video signal is supplied, the "no video" error message will appear on the display if that is attempted. The LYNX will then automatically revert to its internal crystal reference. To clear the error message, touch CLR.

4.2 GENERATOR CODE TYPE

The time code frame rate is selected using the CODE TYPE key. The generator must be stopped to change this setting. This prevents accidental change of the frame rate by a single inadvertent key stroke.

Under normal conditions, it is suggested that 30 be selected

as the standard frame rate, since this type of code can normally be read by almost all other timecode readers. In Europe, 25 (EBU) is the code standard.

- If generator is running, touch GEN ON to stop the generator.
- Touch CODE TYPE until the light adjacent the desired position is lit.

4.3 GENERATOR ON/OFF (HOLD)

Once the generator reference and frame rate have been set:

- Touch the GEN ON key. The generator will begin generating time code from 00:00:00:00 or will continue generating from the last number displayed prior to stopping the generator. The ON Light above the GEN ON key will light.

4.4 SETTING THE GENERATOR

- Press the DISPLAY key until light adjacent GEN is lit.
- Touch the SET/HOLD key. This will freeze the display and the cursor will flash.
- Enter the TIME CODE Point at which you want the generator to begin counting. See section 3.7 for an explanation of accessing the display if you are unfamiliar with the numeric entry procedure.
- Press STORE. The generator will now begin generating from that point. The display automatically leaves the SET/HOLD mode.

4.5 GENERATOR MODE

The GEN MODE key selects the four generator modes in which the generator locks to an external code or tachometer pulse source.

4.5.1 NORMAL GENERATOR MODE

When the LYNX is powered on, it automatically selects the normal generate mode. In this mode, when the generator is started, it runs sequentially from the starting number visible in the GEN display.

4.5.2 JAM SYNC MODE (MANUAL)

The generator can be loaded momentarily from the reader timecode input by touching the GEN MODE key while the generator is running.

This mode can be used to generate brand new timecode to replace already existing, poorly recorded code. This is done by causing the incoming timecode number to be transferred to the generator, at which time the generator will revert back to "normal mode" and generate sequential numbers.

The light adjacent JAM TC will momentarily light. At this point, the generator "looks" at the reader input and loads that time code value. It then continues to generate code counting from that reset value. It does not reload the reader code again unless the GEN MODE key is touched again.

The generator runs in normal generator mode after it has loaded the reader value, so it is necessary to make the new code and the old code are run at the same speed from that point on. This is done by making sure that source machine is resolved to the generator speed reference. See section 7.1.

4.5.3 JAM SYNC MODE (AUTOMATIC)

The automatic jam sync mode can be selected by depressing the GEN MODE key when the generator is stopped.

This is identical to the manual jam sync mode, except that the reader value is made to load automatically if the timcode goes out of sequence for more than three frames.

This mode can be used to create new code from a reel which has varying ("discontinuous") timecodes because the reel was spliced, or is composed of various material recorded at different times.

If the timecode input stops, the generator will continue to free run as described above. It only does an "autmoatic" jam when continuous new code is present, for more than three frames.

Again, the code speed must be resolved to the generator speed in order to operate correctly.

4.5.4 JAM SYNC TO GENERATOR USER BITS

This mode is normally only used by remote editing systems.

In this mode, the reader number is recorded into the spare "user bits" portion of the timecode waveform. Normal generator operation is not affected while in this mode.

If reader code stops, the last time code value will be repeated in the generator user bits.

The Jam > UB mode can be selected by touching the GEN ON key when the generator is stopped.

4.5.5 JAM SYNC PRINCIPLES

The LYNX generator always emits timecode at normal play speed. In order for the reader and generator frames to be counting at the same rate during jam-sync operation, it is necessary for the incoming timecode coming into the reader be resolved to the generator reference. This is accomplished by making the transport a MASTER during the jam sync operation.

See section 7.0 on using the LYNX module as a resolver.

WARNING:

We do not recommend using the automatic jam mode with video machines as a source, because if the incoming timecode was not correctly recorded, or if it is not framed correctly it is possible to generate faulty code. In software release 4.10, a warning message will be present to avoid this condition.

4.6 RECORDING TIME CODE

The output signal from the generator appears at the GEN OUT connector on the rear panel. To record time code, connect an audio cable from the GEN OUT connector to the appropriate audio input of the recorder.

WARNING:

As with any synchronizer, when recording original timecode, make ABSOLUTELY CERTAIN that the recorder has its capstan switch on "internal" position and that the Lynx module is OFFLINE, so that the timecode is recorded at an accurate tape speed. If possible, double check this with the transport tape speed display, if present.

4.6.1 GENERATOR OUTPUT LEVEL

The generator output level is adjustable with a rear panel trimpot. A typical code level would be -5 Vu.

4.6.2 PILOT OUTPUT

The pilot output is a shaped square wave output which is always 2 times the frame rate of the code being generated. This signal appears at the PILOT OUT connector on the rear panel, and can be recorded on a separate track along with the generator time code.

This signal can then later be used to allow the Lynx module to maintain synchronization, if for some reason the time code track becomes damaged or unusable. Under these conditions the Lynx module will use the pilot signal as a synchronizing reference during timecode dropouts.

Code type	Pilot frequency	
30	60Hz	
30-DF	60Hz	
30 NTSC	59.94Hz	
30-DF NTSC	59.94Hz	
25	50Hz	
24	48Hz	* non-standard

NOTE:
The PILOT OUT signal is continuously present at its output jack, even when the generator is off.

5.0 READER SECTION

Each LYNX contains a wide band time code reader. It will read all SMPTE and EBU code formats as well as 24 frame "film" code from 1/10 to 60x speed. The reader is also an integral part of the LYNX synchronizer.

5.1 READER DISPLAY

To access the reader display, press the DISPLAY key until the RDR light is illuminated. The numeric display will now indicates the incoming value, either time code, pilot tone, or tach.

Time code will automatically be displayed if there is valid time code present on the rear panel. If no code is present, the display will indicate either pilotone or tach pulse time.

When the LYNX is used as a synchronizer this code/time will come from the transport associated with the LYNX.

5.2 READER SOURCE INDICATORS

When in RDR mode, the source of code being displayed is indicated immediately to the left of the eight segment display. (See section 2.1.17 for a complete explanation of these indicator lights.)

5.3 RATE OF CODE INDICATORS

When displaying the RDR, the bank of lights immediately above the Code Type key indicate the type of time code being read.

5.4 RESHAPED CODE / RESHAPED PILOT

See section 3.5 for selecting reshaped code or pilot output.

Reshaped Code is used for dubbing (copying) timecode directly from one machine to another. This code is identical to the code being read with the square wave edges restored to their original exactness.

However, any inconsistancies in the code such as wow and flutter will be passed down from the original to the copy, and in some cases the original may be poor enough that a reshaped copy cannot be used. If possible, it is advised to use the generator jam sync feature to copy code.

NOTE: It is important that you do not "dub" code directly from one transport to another without using the 'reshape' output or the generator jam-sync feature. Otherwise, the resulting code may be intermittent, or impossible to read.

6.0 SYNCHRONIZER SECTION

One primary function of the LYNX module is to synchronize a transport to another transport or to another code source. The synchronizer is totally dependent on the reader as its source of transport position information, so in order to synchronize or resolve the speed of a transport either time code or pilotone must be present at the reader input.

All synchronization tasks require that time code is present from both the Master and Slave transport. Be sure this connection is made from the LYNX to the appropriate transport before trying any synchronization operation.s

The LYNX module controls the search mode of the transport by using the transport's spooling motors, and achieves play-lock by controlling the capstan motor speed. This means that if a transport has an "external capstan" switch it must be in the "external position.

NOTE: The ability to synchronize a transport is ABSOLUTELY dependent upon selecting the correct transport at power up. Be sure to follow section 3.2 specifically so that the proper parameters are selected by the LYNX.

6.1 SYNCHRONIZATION OF TWO OR MORE TRANSPORTS WITH TIME CODE

See section 3.4

6.1.1 MASTER SELECTION

See section 2.1.12.

One Lynx module must be designated as the system master. To change masters, you must first deselect the present master then select a new master. Do this by touching the appropriate MSTR key.

6.1.2 MASTER REFERENCE

See section 2.1.11.

The master transport, and all the slaves in any system, can lock to one of four different speed references:

1) The internal crystal of the LYNX selected as master.
2) External video sync.
3) The power line frequency.
4) The master transport's own internal crystal. (in this position the master speed is not controlled by the LYNX module.)

In some instances, such as off-speed audio mixing, you will want the MASTER transport to run "wild" or on its own vari-speed control.

To make too the Lynx slaves follow that speed, the Lynx REF SRC selection should be put in the VSO position.

6.1.3 SYNCHRONIZATION WITHOUT AN OFFSET

This is the typical condition for multi-machine audio synchronization, in which the timecodes on multiple reels are identical. See section 3.4.

6.1.4.1 MANUAL OFFSET ENTRY

If the offset between two transports is known it can be manually entered using the display entry key pad. This will represent the difference in the timecode numbers when they are playing in "lock".

. Select the OFST position of the display.

. See section 3.7 for information on entering and storing the desired number in the OFST register.

And "offset" is always defined as:

```
  slave timecode
- master timecode
= number of frames of offset
```

In other words, a +1 hour offset would cause the slave's time code to be at 1 hour when the master's time code is at 0.

The offset represents the number of frames of difference in the two timecodes at the point that you are asking that they be synchronized. In the Lynx module, this is always displayed as a non-drop-frame timecode number.

NOTE: The offset of the master machine is, by definition, always 0.

6.1.4.2 AUTOMATIC OFFSET ENTRY/SYNC POINT SELECT

Since an offset value can be difficult to calculate by hand, the Lynx module has an automatic offset calculation feature called SYNC POINT.

The SYNC POINT feature reverses the above equation for time code offset. Instead of position being determined from an entered offset, it causes the offset to be determined from position.

Using the sync point feature, an offset value of any slave machine can be calculated automatically by marking the point of synchronism on the master, and the corresponding point of synchronism on the slaves. These points can be entered manually, or can be caught "on the fly" while machines are rolling. The resulting offset is computed, and automatically entered into the OFST display register when the sync point is stored.

MASTER TRANSPORT (set this first)

- Make sure the master is ONLINE and has its MASTER light on.
- Locate the sync point on the master transport.
- See section 2.1.4 for information on how to set a sync point.
- Stop the master transport.

SLAVE TRANSPORT

- Find the sync point on the slave transport.
- See section 2.1.4 for information on how to set a sync point.
- Repeat for all other slave transports.

Each LYNX module will automatically calculate its OFST value from the relationship between the master's sync point and its own sync point. This value can be seen by selecting the OFST display.

WARNING:
It is essential that a 'master' be assigned, for its sync point to be set, and for it then to be stopped prior to assigning slave sync points.

NOTE: The sync point feature as described above can be used either when the transport is stopped or while it is moving, enabling a sync point to be captured "on the fly". Alternately, the sync points, if they are known ahead of time, can be entered manually by "storing" the known positions into the sync-point displays.

6.2 CODE ONLY MASTER SYNCHRONIZATION

6.2.1 CODE ONLY MASTER PRINCIPLES

The use of a synchronizer to cause a slave machine to chase and lock to an incoming source of timecode code is commonly referred to as 'code only master' operation.

This is different from locking a slave to a "master transport" because no master transport cable is used, and therefore tach and direction information cannot be used as a substitute for timecode in high speed wind because they are not available.

For this reason, a "code only master" must supply timecode at all times, even at wind speeds. This requires a wideband timecode playback amplifier and a defeat of tape lifter operation.

6.2.2 CODE ONLY MASTER APPLICATIONS

Code only master operation is used, typically, to cause an audio machine to slave to a video machine which has a wide-band timecode output available but is being already controlled from another source, such as a video editing computer.

It can also be used, in an emergency, to cause slave machines to chase a master where the master transport cable is broken, or none is available. Remember, however, that if the machine does not have "wideband" timecode available and the tape lifters are not defeated, the slave machines will stop as soon as timecode disappears. They will re-chase as soon as it reappears, such as when the machine is put back into "play" after fast wind.

Many machines, such as the OTARI MTR90 can be easily modified to supply wideband timecode from their standard playback electronics. Consult the machine instruction manual for details. Other machines, such as the Studer A800 comes supplied with a wideband timecode amplifier, dedicated to track 24 operation.

6.2.3 CODE ONLY MASTER SET-UP

See section 6.2.

- Verify that code is present at "master" LYNX.
- Put the LYNX on line by touching the TRAN MODE key until the ON LINE light is lit.
- Touch the MASTER key.
- Touch reference source switch to put in "VSO" mode.

The master LYNX is now enabled. Now when any slave LYNX is put ONLINE it will chase and synchronizes to master time code.

6.3 SYCHRONIZING A VIDEO OR DIGITAL AUDIO TRANSPORT

The LYNX may be used to synchronize a video or digital audio transport. The procedure is essentially the same as synchronizing an analog audio or film transport except for the fact that a video sync reference must be supplied to both the LYNX and the transport being sychronized.

In this special case the transport is brought into lock, and then completely released to its own servo reference. At this time the transport may cause itself to re-frame. The lock/resolve lamps will stay lit under these conditions as long as the machine does not lose lock and stays within one frame of the correct position.

At this point the machine will 'self resolve' to the video sync reference it is receiving. This is the same video reference being supplied to the LYNX video reference input. This common video sync signal allows the videotape frames and the audio frames to run at exactly the same rate after initial synchronization, holding the system in sync, while releasing the video machine's capstan and drum servos to their own internal control which is required for a stable picture.

Digital audio machines utilize the same type of operation, in that they require that the capstan servo be 'released' to their internal circuitry to allow correct internal clocking of the digital signals off the tape. Until lock is achieved, the digital audio outputs will typically be muted.

6.3.1 SET UP PROCEDURE (Video/Digital Audio)

Follow the same procedure as for sychronizing any transport as described in section 6.1. Be sure that LYNX has been initialized to the correct transport type after power-up.

Be sure to follow Sections 6.1.1 and 6.1.2 to establish a master and verify that all slaves are locked.

It is essential that the same source of video sync reference is connected to the video or digital audio transport and the LYNX which is "slaving" it. Be sure these connections are made before attempting to lock either video or digital audio transports.

6.4 ADVANCED FEATURES

6.4.1 AUTOMATIC SWITCHOVER TO PILOT RESOLVE

If both LTC and PILOT signals are being supplied from the tape transport, the Lynx module will perform a sophisticated automatic switchover from LTC to PILOT which will keep a slave transport in "lock" if its timecode is interrupted. This is achieved by causing the Lynx module to automatically go into "resolve" mode to the pilot signal, and then restore to LTC synchronization automatically when the LTC reappears.

Because the "phase" of the pilot signal may not match the LTC, the Lynx module keeps continuous track of the phase angle between the two signals, and will maintain this phase angle when it switches to pilot resolve. This will result in a disturbance-free switchover.

6.4.2 SETTING AND SHOWING SUBFRAME OFFSETS

- Select "OFST" with the display select button.
- Touch the "SUBF" button.
- The SUBF light will go on, and the frames display will now show subframes. If the unit is just initialized, this will be preset to 0.
- SETHOLD mode will now allow you to scroll subframes. Use the UP and DOWN arrow keys, or CLEAR, to adjust the subframe value. (You can go back and forth between frames and subframes as you like).
- When adjusting subframes, the CLEAR button clears the subframes only. When adjusting frames, CLEAR will clear frames and subframes to zero.

- NOTE: when scrolling backwards, through zero, the subframes value becomes negative. This will be indicated by a minus sign when exiting the SETHOLD mode.

6.4.3 SHOWING SUBFRAME ERRORS

- With the display selected to OFST ERR, touching the SUBF button will show the subframe errors.
- Hours, minutes, and seconds will still display, so you can see the machine position error when it is searching.
- When the error is under one frame, the subframe display will come on as soon as the machine is into play and going into lock.

6.4.4 NOTES ON PILOT CAPABILITIES

An extremely sophisticated pilot resolve system has been implemented in the Lynx module, which can be used to resolve pilot signals without timecode, or allow the use of a pilot track as a timecode "backup" to maintain synchronization in case of code loss.

To use this feature, the timecode and pilot signals must be recorded on two separate tape tracks at the same time.

The following are the unique capabilities:

- Supports SUBFAME OFFSETS between the pilot source and the selected reference, if entered.
- AUTOMATICALLY will switch the system from longitudinal time code to pilot input, if the timecode disappears and pilot is present.
- AUTOMATICALLY will adjust the lock point of the pilot lock so that the pilot can have any phase relationship to the timecode at the point of code disappearance without any improper resync occuring. In this way the pilot input may be recorded out of phase, or with phase shift, and still always be used with confidence as a "control track".
- Continues to count tach while locking to pilot, so that the reader display stayes updated with machine position.
- OFST ERR shows subframe pilot lock, if in the subframe position.

NOTE: Be sure to initialize the machine tape speed with time code first, before using pilot lock.

6.4.5 AUTOMATIC RESYNC

If "sethold" is used to change an offset, and the slave ATR is already synchronized in "play" mode, the machine will slew in real-time, automatically storing the new offset and resyncing automatically.

This will occur at maximum capstan speed, in audio machines. It thus allows adjusting the timecode offset audibly by "ear" while synchronizing. This features works frame by frame, or will resync subframe-by-subframe.

7.0 USING THE LYNX AS A TRANSPORT SPEED RESOLVER

The LYNX can be used to resolve the speed of any audio transport using time code or pilotone already recorded on the tape.

To "resolve" a transport simply means to cause the transport to adjust its speed to cause the time code or pilot signal to run at precisely the same speed as the selected (master) reference source.

This feature can be used to allow jam-sync operation (see section 4.5), or for doing dubbing and transfers to other equipment which is running locked to the same reference source as the Lynx module. This is normally external video sync, but can be MAINS, which is sometimes used by film transfer equipment.

See section 2.1.11 for an explanation of the available reference source selections.

The following table shows the various reference frequencies for different combinations of frame rates:

Code type	Frame Freq.	Pilot freq. expected	
30	30Hz	60Hz	
30-DF	30Hz	60Hz	
30 NTSC	29.97Hz	59.94Hz	
30-DF NTSC	29.97Hz	59.94Hz	
25	25Hz	50Hz	
24	24Hz	48Hz	* non-standard

NOTE: When using the LYNX as a resolver make sure the transport selection has been accomplished at power-up. See section 3.2 for an explanation of this procedure.

7.1 RESOLVING TRANSPORT SPEED TO TIME CODE

Make the transport a MASTER as described in section 2.1.12.

When the transport is manually put into "play" mode, the Lynx module will control the speed of the capstan until the incoming code speed matches the selected reference source.

When the transport is not in "play" the Lynx module will hold the last speed at which resolve was achieved and run the capstan motor at that speed.

WARNING:

This may be slightly different than normal play speed. Be sure to take the Lynx module OFFLINE to restore the transport to its normal speed operation if you want the transport to run at its calibrated speed.

7.2 RESOLVING TRANSPORT SPEED TO PILOTTONE

The Lynx module will perform the same resolver function to a pilot signal feeding the PILOT IN jack, as long as time code is not present at the RDR IN jack. The Lynx module will always give LTC a higher priority than Pilot.

8.0 APPENDIX

8.1 TRANSPORT MENU

LYNX DISPLAY	TRANSPORT TYPE
atr-100	Ampex ATR 100, 102, 104
atr-124	Ampex ATR 124
atr-1200	Ampex MM 1100, 1200
8250-u	JVC 8250 Video Recorder
850-d	* Mitsubishi 850
850-a	* Mitsubishi 850
Otr10-1	Otari MTR10 series 1
Otr10-2	Otari MTR10 series 2
Otr12-1	Otari MTR12 series 1
Otr12-2	Otari MTR12 series 2
Otr20	Otari MTR20
Otr-70	Otari MX-70
Otr90-1	Otari MTR90 series 1
Otr90-2	Otari MTR90 series 2
5050-3	Otari MX 5050 MARK 3
3324	Sony 3324 Digital Audio
JH24	Sony JH24, JH110
JH114	Sony JH114
BvU 800-P	Sony BVU 800 Video Recorder (parallel port control)
BVH-2000	Sony BVH-2000 1", serial control (requires Lynx serial interface)
A80-16	Studer A80, 16Hz tach
A80-18	Studer A80, 18Hz tach
A800-3	Studer A-800 MARK 3
A810	Studer A-810
A820	Studer A-820
tasc-40	Tascam Series 40
tasc-50	Tascam Series 50

* The "A" position is the normal fully synchronized setting for the X850.
The "d" position allows the slave machine to stay resolved to the master using the digital "word clock" on the dubbing connector. This is used for true digital-to-digital dubbing between two X850 machines.

8.2 ERROR MESSAGES EXPLAINED

no CodE

Occurs if a LYNX module is ONLINE in PLAY and code is not being received. This usually occurs if the code is not patched into the unit, or code runs out on the tape.

This error message helps to eliminate the simplest of

the 'why doesn't it work' human errors. It is self-resetting, and turns off when code again is present.

no tAPE

Occurs if the LYNX module tries to move the position of the tape with no response from the transport. This will normally occur if the machine runs out of tape, but can also occur if the TRANSPORT CONTROL CABLE is not plugged in.

SEr Err

Occurs if the BVH-2000 transport is selected and the Lynx serial interface option is not present, or not functioning.

8.3 SYSTEM RESTRICTIONS

8.3.1 USE OF MIXED TIME CODES

It is not possible to sychronize time codes which have dissimilar frame rates. Both SMPTE 30 drop frame and 30 non drop frame time codes have the same 30 hertz frame rate so it is possible to synchronize tapes with these two disssimilar codes.

EBU 25 frame/second time code has a 25 hertz frame rate, while 24 frame film time code has a 24 hertz frame rate. Therefore, neither of these two code formats can be synchronized with one another or with either SMPTE code format.

8.3.2 48hz PILOT OUTPUT

The LYNX module generates standard pilot frequencies for 30, 30-DF, and EBU 25 frame timecodes.

It generates a non-standard 48hz frequency when generating 24fps film timecode, which is 2x the frame rate.

Standard 60Hz pilot can be resolved however. See section 7.0.

8.3.3 24-HOUR BOUNDRIES

The LYNX module will handle code operations which "wrap" around from 24 hours to 0 hours, which are running the same timecode type. However, it will not handle mixed time codes around 24 hour boundries, including 30 and 30-DF.

8.4 SUGGESTIONS

8.4.1 RECORDING SPEED

As with any synchronizer, when recording original timecode, make ABSOLUTELY CERTAIN that the recorder has its capstan switch on "internal" position and that the Lynx module is OFFLINE, so that the timecode is recorded at an accurate tape speed. If possible, double check this with the transport tape speed display, if present.

If this rule is not observed, it is possible to record the original timecode at a non-standard speed.

8.4.2 RECORDING LEVEL

When recording time code, remember that there can be crosstalk to adjacent tracks if recorded at high levels.

A suggested recording level would be -5 Vu.

On multi-track tapes track 24 is the industry accepted track.

8.4.3 SYNCHRONIZATION PROBLEMS

1. The system will not synchronize without a master selected.

2. The synchronizer will not lock codes with disimilar time bases, that is you cannot lock 30 frame code to 24 or 25 frame code. However, you may lock 30 frame and drop frame together because both code formats are bases on a 60 Hz clock. See section 8.3 System Restrictions for an explanation about mixed codes.

3. A slave transport will not synchronize without a working transport cable.

8.5 PROBLEM SOLVING

There are basically two things that will cause the Lynx module to function incorrectly, especially in "chase" mode:

1. Bad tach source, caused by a bad transport cable.

2. No code source, caused by a bad patch, or running out of code.

Checking the code source:

- Look for the green LTC light when the transport is in "play".
- If the light is out or flickering the code is either not present or intermittently unreadable.

Checking the tach :

- Turn off the code signal and run the machine in PLAY at 30ips. The tach should count in real time, in the right direction.

- Try rewinding, making sure the direction changes correctly in the display.

- If the LYNX will not read tach you probably have a bad control cable or your transport is not properly transmitting tachometer and/or direction information.

  Once the system has been set up, the LYNX module will sense the tape speed automatically and change the tach rate to the speed in use automatically after reading five seconds of code.

8.6 TIME CODE/USER BITS EXPLAINED

8.6.1 TIME CODE OVERVIEW

SMPTE, both drop and non-drop formats, EBU, and 24 frame film style codes are electronic signals which are printed onto tape and film as an audio signal. Each second of time is broken up into 30 frames for SMPTE code formats, 25 frames for EBU code and 24 frames for film style code. The code contains two frequency components, which for 30 frame code are 2400 / 4800 Hz.

Each frame is broken down into 80 bits. Each one of these bits or groups of bits supplies a time code reader with particular information, and the complete 80 bits as a whole supplies the reader with the start of frame information.

Of the 80 bits in each frame of time code, 32 are devoted to numerical time code information. These bits signify the Hours, Minutes, Seconds, and Frames of each frame of code.

Another 32 bits are spare bits which are always present, and which may or may not be used. These are normally referred to as the "user bits".

These "user bits" can contain non-changing numbers, such as dates, times, an operator or client number, etc. The "user bits" can also be caused to change every frame, allowing parallel time code to be contained in the "user bits" portion of the timecode as regular generator code is being created in the "time" bits.

The LYNX accomplishes this function in the JAM USER mode. (See section 4.5.4).

8.6.2 TIME CODE TYPES

There is only one format of EBU 25 frame and film 24 frame timecode, but there are two formats for SMPTE code, 30 and 30-DF code.

30 frame SMPTE code (also known as "non-drop" timecode) is recommended. This contains 30 frame numbers for every elapsed second of time.

When the LYNX generator is running at code-type 30, and the NTSC light is out, one hour of code time will equal one hour of time on a stopwatch.

Drop frame SMPTE code leaves certain frame numbers out of the code, so that one hour of code time will equal one hour of stopwatch time, when the code is moving at 29.97 frame per second. THis is the frame rate of color video signals.

The exact frames that are dropped are 00 and 01 at all minutes which are not multiples of ten.

SPMTE drop and non-drop code formats are not numerically identical and care should be taken to avoid mixing the two code formats if possible. The Lynx module will synchronize mixed formats, however. See section 8.3.1.

8.7 REAR PANEL CONNECTOR PIN DESIGNATIONS

Indexed by pin number

1. GROUND
2. Tran. gnd. sense
3. Stop [still] cmnd
4. Capst. freq collector
5. Capst. freq emitter
6. Lifter drop cmnd
7. Forward [dir] cmnd
8. Record tally
9. Reserved
10. Reserved
11. Reserved
12. Warning o/c out
13. Servo relay-A n/c
14. Servo relay-B COM
15. Servo relay-B n/o
16. Reserved
17. Reserved

18. +5v (5 ma max)
19. Rec-off cmnd +
20. Search cmnd +
21. 1k pullup to +5v
22. Reserved
23. Tran cmnd common
24. Rewind cmnd
25. Reserved
26. Tach direction sense
27. Reserved
28. Tran-ready o/c out
29. Servo relay-A n/o
30. Servo relay-A COM
31. Servo relay-B n/c
32. Reserved
33. Reserved

34. GROUND
35. Rec-off cmnd -
36. Search cmnd -
37. Play cmnd
38. Search volts out
39. Capst. volts out
40. Rec-on cmnd.
41. Reserved
42. Tach pulse in
43. Reserved
44. -12v (5 ma max)
45. +12v (5 ma max)
46. Mute relay n/o
47. Mute relay n/c
48. Mute relay com
49. Reserved
50. Reserved

Indexed by function

POWER AND GROUND

GROUND	1, 34
Tran. gnd. sense	2
+5v (5 ma max)	18
-12v (5 ma max)	44
+12v (5 ma max)	45

TRANSPORT LOGIC COMMANDS

Tran cmnd common	23
Stop [still] cmnd	3
Rewind cmnd	24
Forward [dir] cmnd	7
Play cmnd	37
Rec-on cmnd	40
Lifter drop cmnd	6

These command outputs are opto-isolator collectors, capable of 80v/30ma. Emitters are all tied to 'tran cmnd common'.

Rec-off cmnd -	35
Rec-off cmnd +	19
Search cmnd -	36
Search cmnd +	20

These are opto-isolators which have both collectors and emitters available. Normally, the emitters would be connected to 'tran cmnd common'.

CAPSTAN CONTROL AND SEARCH OUTPUTS

Capst. freq collector	4
Capst. freq emitter	5
1k pullup to +5v	21
Capst. volts out	39
Search volts out	38

Opto-isolator output, pin 4 normally requires a pullup resistor to +5v, available on pin 21. These outputs are referenced to tran ground sense, pin 2.

MUTE AND SERVO RELAYS

Mute relay com	48	gray wire on cable pigtail
Mute relay n/c	47	violet wire on cable pigtail (open on mute)
Mute relay n/o	46	white wire or cable pigtail (closed on mute)

Servo relay-A COM	30
Servo relay-A n/c	13
Servo relay-A n/o	29
Servo relay-B COM	14
Servo relay-B n/c	31
Servo relay-B n/o	15

'A' and 'B' are the two poles of the same servo relay. This relay transfers control of servo speed to the LYNX module.

TACH AND TALLY INPUTS

Tach pulse in	42	Max freq approx 250Khz.
Tach direction sense	26	
Record tally	8	

ANNUNCIATOR OUTPUTS

		RELEASE 4.10:
Warning o/c out	12	Indicates loss of sync.
Tran locked o/c out	28	Indicates locked.

REMOTE LOCK LIGHT

Implemented on machine cable pigtail:

Yellow: Open collector (100ma, 50v)
Black: Gnd.

8.8 CIRCUIT BOARD INTERFACE COMPONENTS BY FUNCTION

OPTOISOLATORS

STOP	U27	All H11-G2
PLAY	U28	(GE, Motorola, Siemens)
RW	U9	
FF	U10	
LIFTER	U18	
SEARCH	U26	
REC IN	U19	
REC OUT	U35	

RELAYS

MUTE	K1	Aromat DS2
SERVO ENA	K2	

TACH/DIRECTION INPUTS

TACH	U4 pin 5	LM-339
DIR	U4 pin 7	
REC tally	U4 pin 11	

ANALOG OUTPUTS

Search Volt	U25 pin 1	TL084
Capstan volt	U25 pin 14	