Chapter 12
TimeCode Option

TimeCode Option Overview 12-3
Important Notes 12-4
About This Chapter 12-4
Basic TimeCode Operation 12-4
In A Nutshell 12-4
Starting A Timecode Production 12-5
Default Production Formats 12-5
Checking A Production's Frame Rate 12-6
Changing a Production's Frame Rate 12-6
VTR Remote Control 12-6
Basic Transport Commands 12-7
Advanced Remote Control 12-7
Jog 12-8
Chasing Timecode 12-8
Starting Chase 12-8
Recording With Timecode 12-9
Continuous Chase Versus Automatic Lock 12-10
Changing AutoLock Modes 12-10
Automatic Machine Control 12-11
Starting Automatic Machine Control 12-11
Working With Offsets 12-12
Changing Offset Dynamically 12-12
Capturing An Offset 12-13
Independent Offsets 12-13
Reading And Interpreting Offsets 12-13
Adjusting System Response 12-15
Chase Setup 12-16
Chase Input Settings 12-16
TimeCode Output Settings 12-17
SMPTE Status 12-17
Defaults? 12-18
Accept? 12-18

Machine Control Setup 12-18
VTR Control Settings 12-19
VTR Status Readout 12-20
Defaults? 12-21
Accept? 12-21
VTR Advanced Setup 12-22
Machine Control Settings 12-22
LTC Shuttle Compensate 12-23
Diagnostics 12-24
Offset Display 12-25
Defaults 12-26
Accept? 12-26
Working With Timecode and RS-422 12-26
By The Numbers 12-26
LTC: Longitudinal Timecode 12-27
VITC: Vertical Interval Timecode 12-27
Best of Both Worlds 12-28
9-Pin or RS-422 Code 12-28
BITC: Burn-In Timecode 12-29
Bi-phase Code 12-30
Timecode Formats 12-30
24 fps 12-30
25 fps 12-30
30 fps 12-31
29.97 fps 12-31
Non-Dropframe 12-32
Dropframe 12-32
Choosing Dropframe Or Non-drop 12-32
Sync Methods 12-33
Audicy Chase Modes 12-33
About House Sync 12-33
AutoLock Modes 12-34
Working Without House Sync 12-34
Connecting Audicy to a Video System 12-35
LTC Timecode Input 12-35
LTC Timecode Output 12-35
RS-422 12-36
Changes at the VTR 12-36
House Sync 12-36
Reading VITC 12-38

TimeCode Option Overview

This optional feature is a hardware/software package that lets you use fast, familiar Audicy-style editing in projects that require absolute lock to video. At the touch of a button you can make Audicy chase or locate to a videotape's timecode, or make an external VTR chase or locate to Audicy's timecode.

It relies on timecode standards set by SMPTE (Society of Motion Picture and Television Engineers), used in almost every television installation around the world. Its videotape control uses Sony RS-422 protocols, supported by most video and audio manufacturers.

Advanced features include very fast response, automatic VTR lock for noise-free video playback, the ability to change timecode types without realigning audio, phase-locked outputs, and adaptability for non-standard tapes and VTRs.

Audicy's timecode option has three primary functions:

- You can use Audicy's *Transport* controls as a remote control for an external VTR, including jog, shuttle, and twenty-four dedicated locate points.

- You can chase and lock to incoming timecode with virtually instant response. High-quality, step-free audio is available at any speed, forward or backward, from stillframe to 8x.

- You can make an external VTR chase and lock to Audicy while you scrub and play audio. Whenever possible, the VTR will simultaneously lock to house sync for high-quality video playback.

Control is completely symmetrical. Either the VTR or Audicy can be the slave without sacrificing audio or picture quality. At the press of a button, you can have Audicy follow timecode for transfers, sync verification, and on-air applications. Or press a different button to have the VTR follow Audicy for faster spotting of sound effects and music editing.

The system is designed for fast, easy use. Most functions are available from dedicated, clearly-marked buttons. Shortcut buttons speed up common operations. Adjustments are on easy-to-use forms. Status windows give constant visual feedback, and VTR states are reported in plain language.

The system is also designed to be robust and flexible. You can sync different dropframe formats and select whether the system will automatically catch up each minute or stay locked to house sync. You can even sync PAL and NTSC at scrub and jog/shuttle speeds. Sophisticated diagnostics and fine-tuning options make it easier to deal with non-standard tapes or VTRs.

Important Notes

While the system has virtually instantaneous control over Audicy's transport and audio, videotape dynamics are influenced by mechanical considerations. VTR design, what condition it's in, and how well the videotape was recorded will affect how well it will cue. The software is optimized for Sony BetacamSP and similar professional decks, and hard-disk VTR emulators: During a typical session, these decks will slew and lock to Audicy within a few seconds. Other units, such as older 3/4″ VTRs, will chase audio but may not be able to lock without sync errors. For these decks, we've included an AutoCue function to record or play flutter-free audio with these decks by using a combination of RS-422 control, LTC, and house sync.

The system requires a video reference signal to work properly. You must provide house sync to the two reference inputs on the Audicy System Unit, and to the video reference input on your VTR. Most functions will continue to operate without this signal, but frame-accurate VTR control isn't assured.

About This Chapter

The first part of this chapter covers basic operation, including starting a production, using VTR remote control, chasing timecode, and having the VTR chase Audicy. It assumes you're already familiar with audio-for-video techniques, and know how to use Audicy's other audio functions.

The second part explains the basic principles of timecode and RS-422 control, including concepts like "dropframe" and "House sync." Read it if you've never worked with this stuff, or you want to check up on terms mentioned in the first part.

The end of this chapter shows how to connect Audicy in a video facility.

Top production experts will probably want to read all of the TimeCode documentation. That's how they stay on top.

Basic TimeCode Operation

In A Nutshell

- To remotely control the VTR, hold *Ctrl* down while you press any other Audicy *Transport* button. With *Ctrl* held down, the scrubwheel acts as a shuttle knob.
- To make Audicy chase incoming timecode, press *Chase*. To cancel, press *Chase* again.

- To make the VTR automatically follow Audicy, press *Machine Control*. To cancel, press *Machine Control* again.

There are a lot of other functions to speed up audio-for-video editing, but the above three concepts are the ones you'll use most often.

Starting A Timecode Production

Audicy asks you to specify a frame rate when you start a production using Production Manager: Make New or Make Temp. Use the *up* and *down* arrows to go to the Frame Rate field of the form that appears. Then use the *left* and *right* arrows to select 24 fps, 25 fps, 29.97 DF, 29.97 ND, or 30 fps[1]. DF stands for Drop Frame; ND stands for Non-Dropframe.

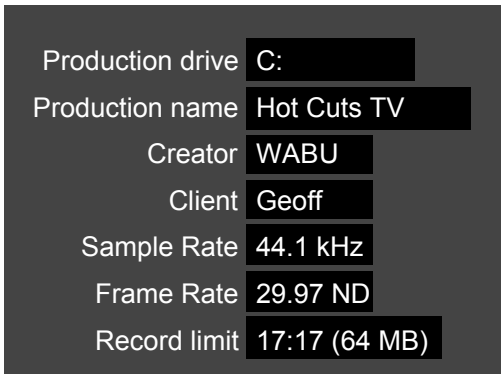

Figure 12-1: Typical Production Form

A production's format should match the master video for smoothest operation. But no matter which format you choose, you can:

- lock to other timecode formats for accurate recording of elements[2]
- change the production frame rate any time.

Default Production Formats

You can save time by setting a default for the Frame Rate in the Job Controller's System Utilities: Defaults form. The choices are the same as when you start a new production.

The choice you set here will automatically come up when you Make New or Make Temp. If you want a specific production to use a different format, you can change it at that time without affecting the default.

[1]The terms are discussed below.

[2]Within reason. Don't expect to lock a 29.97 DF production to 24 fps timecode without changing the production's Frame Format first.

Checking A Production's Frame Rate

The Frame Rate is displayed whenever you select a production for editing, copying, or renaming. This information is updated if you change the format.

While you're editing, the frame rate information appears to the right of the time counter on the Status Bar.

Changing a Production's Frame Rate

To change a production's frame rate from the Job Controller:

A) Select Production Manager: Rename. Use the scrubwheel to highlight a production, and *Enter*.

B) Use the *up* or *down* arrow to highlight that production's Frame Rate field on the right side of the screen. Then use the *left* or *right* arrows to choose a rate.

C) Press *Enter* a few times to exit the form, and the new rate will be applied.

You can also change the frame rate while you're editing a production: Make sure shadowing is turned on and select System: Quit. When the Job Controller appears, follow the steps above. Then re-open the production using Edit Old. Because the audio data is already in RAM, the production will load quickly.

[!]	Less sophisticated systems mark just the starting frame for 'audio events', so changing the rate may destroy critical timings within sounds. Audicy uses its own timeline to keep track of every audio sample in the production. You can change Frame Rate without changing audio relationships or absolute timing.

VTR Remote Control

Audicy can control a VTR using RS-422 serial communications and Sony protocols, the defacto standard for professional videotape installations. These protocols are also known as the "Sony 9-pin" or "P2" standard. Other decks may also be controllable through third-party adapters. We deliberately use only the most basic commands (implemented in some very sophisticated ways), so control is possible over a wide range of machines. Since VTRs behave differently depending on their mechanical construction and internal software, some fine-tuning may be necessary: See VTR Setup, below.

Audicy can access address-track LTC, VITC, or control track pulses via RS-422 from properly-equipped decks. But for best results, a combination of matching

LTC and VITC are recommended and LTC should have been recorded in phase with video sync.

Basic Transport Commands

You can use Audicy's *Transport* controls as a manual remote control for your VTR. If you hold the *Ctrl* button down and press any other *Transport* button, its command is sent to the VTR instead of to Audicy's transport. No new button combinations have to be learned, other than the simple rule of holding *Ctrl* to control the VTR.

Audicy's *Transport* buttons and scrubwheel act as a VTR remote as long as you hold *Ctrl* down. When you release *Ctrl*, their function returns to normal.

- This works for basic transport motions. Hold *Ctrl* and press *Rewind*, *Fast Forward*, *Stop*, or *Play* and the VTR will move accordingly. *Ctrl+Stop* actually sends a pause command so the videotape doesn't unthread.

- This also works for video autolocators, which operate just like the audio autolocate points in normal Audicy editing. *Ctrl+Set* captures the current VTR timecode into one of 24 dedicated VTR locate points. *Ctrl+1*, *Ctrl+2* send the VTR to the first two points. *Ctrl+GoTo* lets you choose any VTR locate point, and *Ctrl+Shift+Set* lets you name and edit VTR locate points. *Ctrl+Shift+GoTo* sends the VTR to manually-entered timecode.

- Holding *Ctrl* turns Audicy's scrubwheel into a VTR shuttle knob. Then each 30° turn of the scrubwheel advances or retards the shuttle speed in 11 steps between .03x to 24x, in either direction. The scrubwheel's software mimics the front-panel shuttle knob on a Sony professional BetaSP deck. When you let go of *Ctrl*, shuttling stops and the VTR is set to pause.

Advanced Remote Control

Tapping *Ctrl* once and then holding it down (abbreviated *Ctrl+Ctrl*) gives you a second set of VTR controls. The *Transport* buttons and scrubwheel stay in this advanced mode for as long as you hold *Ctrl* down after tapping it. When you release *Ctrl*, the system returns to normal.

Ctrl+Ctrl+Rewind or *Ctrl+Ctrl+Fast Forward* steps the VTR to the beginning of the previous or next frame, a convenient way to jog through a video when looking for precise cues.

Ctrl+Ctrl+Stop sends Standby Off to the VTR, releasing tape tension. This protects the tape and VTR from wear if you're not going to be watching video for a while. Sending any other command to the VTR restores tension.

Ctrl+Ctrl+Play starts AutoCue. The VTR is pre-rolled to a location about five seconds ahead of Audicy's current timecode, and starts playing locked to house sync. Audicy then chases the videotape's LTC. Preroll timing is adjustable in the Machine Control Setup form.

AutoCue requires that separate RS-422 and LTC be connected to Audicy's timecode card.

[!] AutoCue assures stable playback of both audio and video, even if a VTR isn't precise enough to use Audicy's AutoLock feature.

Jog

Tapping and then holding *Ctrl* turns the scrubwheel into a VTR jog knob. For as long as *Ctrl* is held down after tapping it, each 30° turn of the scrubwheel moves the VTR a fraction of a frame. The amount of movement is determined by the VTR, and mimics the front-panel jog knob of a professional Betacam deck. When you let go of *Ctrl*, the VTR is set to pause.

Chasing Timecode

Audicy will chase any source of SMPTE LTC timecode. This can be from an address track or audio channel of a VTR, from VITC or a second RS-422 line through third-party converters, from the timecode output of analog or digital audio decks, or from properly-equipped MIDI sequencers and other devices.

Incoming timecode is continuously analyzed and its state is displayed in the Chase Setup form, described below.

All of the VTR remote control functions are usable during chase mode.

Starting Chase

Press the *Chase* button to start Audicy chasing external timecode.

- If play-speed timecode is coming to the Audicy, the transport will immediately jump to match that code and then start playing in sync with it. If not, the transport will pause and wait for timecode.

- If the video is being jogged, Audicy will snap to each new timecode location as it's received. This is highly dependent on the VTR and what kind of timecode it uses. For frame-accurate jogging, it's usually better to scrub Audicy and turn on automatic machine control (discussed below). This is because RS-422 communication is considerably faster than LTC.

- If the video is shuttling in either direction, Audicy will attempt to stay in sync and produce usable audio between .12x and 8x speeds. Audicy will jump to stay in sync if the video is winding or shuttling faster than 8x. Below .12x, behavior depends on how the VTR is generating timecode. As with jogging, automatic machine control will produce better results.

- While Audicy is in Chase mode, a green "chasing" icon appears in the status bar.

You can exit Chase mode any time by pressing the *Chase* button again, or by pressing any single *Transport* button, including *Play* or *Stop*.

Recording With Timecode

Make sure one or two channels' *Record* Ready buttons are lit and Audicy is already in Chase mode. Then press *Record*.

- If timecode is coming to Audicy, the transport will immediately jump to match that code and start playing in sync with it. If not, the transport will pause and wait for timecode.

- Once timecode is stable and at play speed — this may take a second or two, depending on VTR dynamics — Audicy will lock to house sync and start recording. Using house sync keeps wow or flutter in the timecode stream from affecting the recording, and lets the recording continue even if timecode drops out.

- The green "chasing" icon will also show a locked padlock, to indicate this condition.

- When you're finished recording, press *Play* to punch out and continue Chasing. Or press *Stop* to stop Audicy's transport and cancel Chase mode.

If house sync is not available, Audicy will lock to its own crystal during record. Depending on the VTR's stability, this will probably provide accurate sync for a few minutes.

[!] Since Audicy records by locking to a stable reference, it keeps going even if the timecode stops or jumps. You can use this feature to record sync material when the dropframe format doesn't match the production's, or if timecode is discontinuous.

If you want to record from a mismatched dropframe format and prefer to jump once a minute to keep frame numbers consistent, use automatic machine control instead.

You can also record while using AutoCue. Press *Ctrl+Ctrl+Play* to wind the VTR ahead of Audicy's current location and start it playing. Once LTC is received and Audicy's transport is moving, press *Record*.

Continuous Chase Versus Automatic Lock

Both Audicy's LTC chase and automatic VTR machine control can be used in two different ways:

- Normal Chase mode makes the slave machine follow timecode under all circumstances.
- AutoLock mode has the slave machine follow timecode at non-play speed. When sync is stable at exact play speed, the slave machine locks to house sync. Audio is then free from timecode-induced jitter, and video is free from noisebars or color shifts.

For maximum flexibility, AutoLock works slightly differently depending on whether Audicy or the VTR is being slaved.

- When Audicy enters lock from Chase mode, it stays locked to house sync. If the VTR's timecode drifts or jumps, Audicy continues its locked play or record. This way it can ignore momentary timecode errors. Even if LTC completely disappears, Audicy will continue rolling until you press the *Stop* button.
- When the VTR enters lock from automatic machine control, it continues to also chase Audicy. If its timecode drifts or jumps, it will drop out of locked play and slew to catch up. Then it will re-lock.

Changing AutoLock Modes

Press *Alt+Chase* to toggle between normal and AutoLock for Audicy LTC chase. and Lock mode. You can also use the AutoLock setting in the Timecode Chase setup form.

Press *Alt+Machine Control* to toggle between normal and AutoLock for VTR automatic machine control. You can also use the AutoLock setting in the MC Chase setup form.

- You can change modes while the transport is stopped or playing. If the transport is playing, Audicy makes the change as smoothly as possible so playback isn't disrupted.
- You can't exit AutoLock while Audicy is recording and chasing LTC, because speed variations would degrade audio quality.

Automatic Machine Control

Audicy can make a VTR chase its audio with subframe accuracy[3], using RS-422 commands. Since this requires a high degree of interaction between Audicy's software and a mechanical device, some fine-tuning might be necessary when you first install the system or change VTRs. See "Working With Video TimeCode" and "Connecting Audicy to a Video System," below.

Audicy's transport and editing functions are fully responsive during this mode, so audio editing can proceed at a fast pace. The VTR keeps up with you, rather than making you wait for it. With most professional decks, the picture will be in place by the time you're ready to look at it.

If you're using machine control's AutoLock feature, video playback will be stable and noise-free. As soon as the VTR and Audicy are in sync, Audicy locks the VTR to reference video instead of steering it via RS-422. If sync drifts for any reason, the VTR is automatically resynchronized.

- AutoLock requires that the VTR's Capstan Lock servo locks in 2 field units. Set the VTR's switch or menu setting, if it has one, to "2FD" or "2/4FD."

An LTC connection is not necessary for automatic machine control, but may be desirable for verifying sync.

Starting Automatic Machine Control

Press *Machine Control* to make the VTR chase Audicy. Any movement you do to the audio will be reflected in the video.

- The VTR will cue up to match Audicy's current location.
- If Audicy is playing at normal speed, the VTR will stay in sync. If AutoLock is turned on, it locks to reference video as soon as possible.
- If Audicy is playing at a random varispeed, the VTR will shuttle to match. If you put Audicy into half-speed play (*Shift+Rewind*) the VTR will shuttle with minimum offset: This is a good way to verify effects placement.
- If you wind, locate, or jump Audicy to another location, the VTR will re-cue to match.
- When you scrub Audicy audio, the VTR will jog or shuttle as necessary to stay in sync.

[3]Depending on VTR dynamics, and whether the videotape's LTC is in proper phase with the frame rate.

[!] This last feature is the key to fast, frame-accurate audio editing:

1. With automatic machine control turned on, scrub Audicy while watching a picture to find the cue frame.

2. Press the *Dest In* button

3. Use Audicy's Move or Copy functions to instantly insert a matching sound.

All of Audicy's other functions — including Time Fit, Loop, Flip, individual track Varispeed copy, and Orban and Lexicon special mixing effects — are available while the VTR is under machine control.

To turn off automatic machine control, press the *Machine Control* button again. Or use any VTR remote control function (*Ctrl*+ Audicy *Transport* button).

Working With Offsets

Audicy can be set to maintain a constant time difference between its location and VTR timecode. These offsets are useful for fixing sync errors, compensating for external processor delay, or simply making timecode numbers more workable.

Offsets are applied during Chase and automatic machine control. For consistency, they are always defined as Audicy's location minus the VTR location:

If Audicy location is:	and VTR timecode is:	then the Offset is:
00:00:01:00 *(one minute)*	01:00:00:00 *(one hour)*	-00:59:00:00
01:00:00:00 *(one hour)*	03:00:00:00 *(three hours)*	-2:00:00:00

Changing Offset Dynamically

Use the numeric keypad's *plus* and *minus* buttons to fine-tune the offset during chase or automatic machine control. This process is called 'bumping'.

- The *plus* button adds one full frame to the offset.
- The *minus* button subtracts one full frame from the offset.

Subframe bumping is available during when Audicy is chasing LTC, if you have selected a subframe amount in the Chase Setup form.

- Holding *Alt* while you press the *Plus* button adds the subframe amount.
- Holding *Alt* while you press *Minus* subtracts that subframe amount.

After you bump, allow a second or so for the system to smoothly sync to the new value.

You can bump while in machine control's AutoLock mode. The VTR will drop out of locked play, slew to the new offset, and then relock.

You cannot bump while in Chase AutoLock mode, since Audicy is locked to a fixed reference. Press *Alt+Chase* to convert to Chase mode, make necessary offset adjustments, and then press *Alt+Chase* again to relock.

Capturing An Offset

Hold *Alt* while you press *Offset*. The difference between Audicy's position and the incoming code, as of the moment you press *Offset*, will be applied as the chase input offset.

This lets you find the offset for randomly-coded productions quickly:

A) Scrub Audicy to the sound of the clapstick or "two pop."

B) Park the video deck on the appropriate frame[4].

C) Press *Alt+Offset* to capture the offset.

When you start chasing, the track will be in sync.

Independent Offsets

Normally, Audicy is operated with the same offset for chase input (as captured, or set in the Chase Setup form) and for automatic Machine Control. But you can set an independent offset in Machine Control Setup. This lets you chase one source (such as timecode DAT) while syncing to picture with a completely different offset.

Reading And Interpreting Offsets

Audicy's offset display can be turned on or off by pressing the *Offset* button, or set in VTR Advanced Setup to appear whenever Audicy or the VTR is chasing. The offset is shown above the Memory gauge on the right side of your screen. This is a dynamic readout of the actual offset between machines, not necessarily an offset you've chosen or captured.

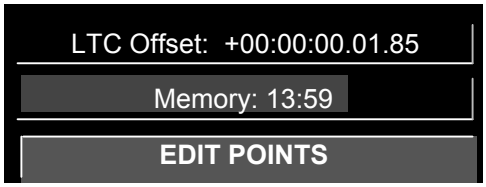

Figure 12-2: Offset Window

[4] This requires VITC or digital timecode, since normal analog code stops when the video is parked.

The offset will drift slightly when video starts, while the video speed stabilizes and the timecode sources catch up with each other. Once the system is in sync, it should remain stable.

You can display offsets either with subframes (as shown above) or without, by using the Subframe enable setting in Chase Setup.

You can tell Audicy to compute offsets using LTC or RS-422, by using the Timecode Source setting in VTR Setup. As a shortcut, toggle this setting by pressing *Ctrl+Offset*. Note that RS-422 readings will not be accurate unless both the VTR and Audicy have a common video sync reference.

LTC Offset +00:00:00.00, 01, 00, -01, 00, 00...

If the frames number keeps changing a digit or so above and below the chosen offset, it means Audicy is automatically smoothing over problems in the incoming code.

LTC Offset + 00:00:00.00, 00, 00, 24, 23, 22, 21...

If the frames number changes radically above and below the chosen offset, it probably means you're trying to sync to a timecode format different from the production's format.

LTC Offset +00:00:00.00, 01, 01, 02, 02, 03, 03...

If you're in an AutoLock mode and the frames number starts drifting slowly, chances are Audicy and the video deck are locked to different sync sources. This can be as simple as a switch setting on either unit. The system will keep playing or recording, so you can decide if the problem is severe enough to need correcting. The diagnostics section of MC Setup gives you more information about this problem.

LTC Offset +00:00:00.00, 00, 00, 01, 03, 05, 07...

If you're in Chase AutoLock mode and the frames number starts drifting rapidly, the video deck has probably gone into a different transport mode. Press *Stop* on the Console.

Adjusting System Response

Each Patchbay TimeCode menu opens a form where you can apply settings.

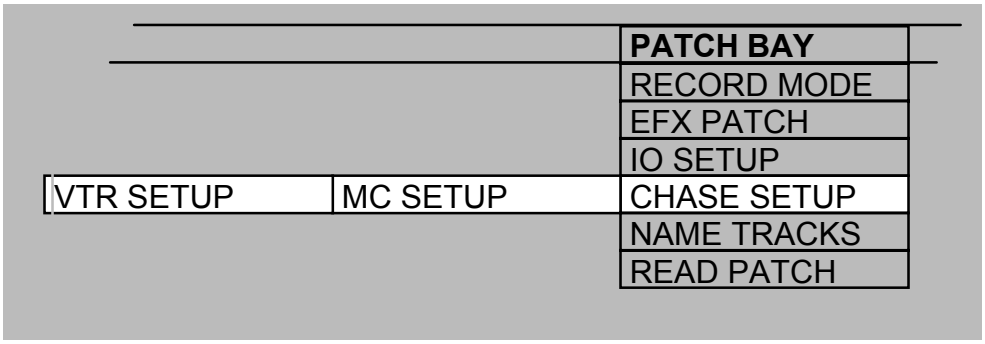

Figure 12-3: TimeCode Submenu Choices

Chase Setup provides basic settings for how Audicy chases incoming LTC. As a shortcut, you can open it by pressing *Shift+Chase*.

MC Setup provides basic settings for how the VTR will chase Audicy under automatic machine control. As a shortcut, you can open it by pressing *Shift+Machine Control*.

VTR Setup provides fine-tuning and diagnostics to integrate Audicy with your specific VTR. Generally, you won't need to open this form unless you change video equipment. As a shortcut, you can open it by pressing *Shift+Offset*.

Chase Setup

When you select Chase Setup and *Enter*, or press *Shift+Chase*, this form appears:

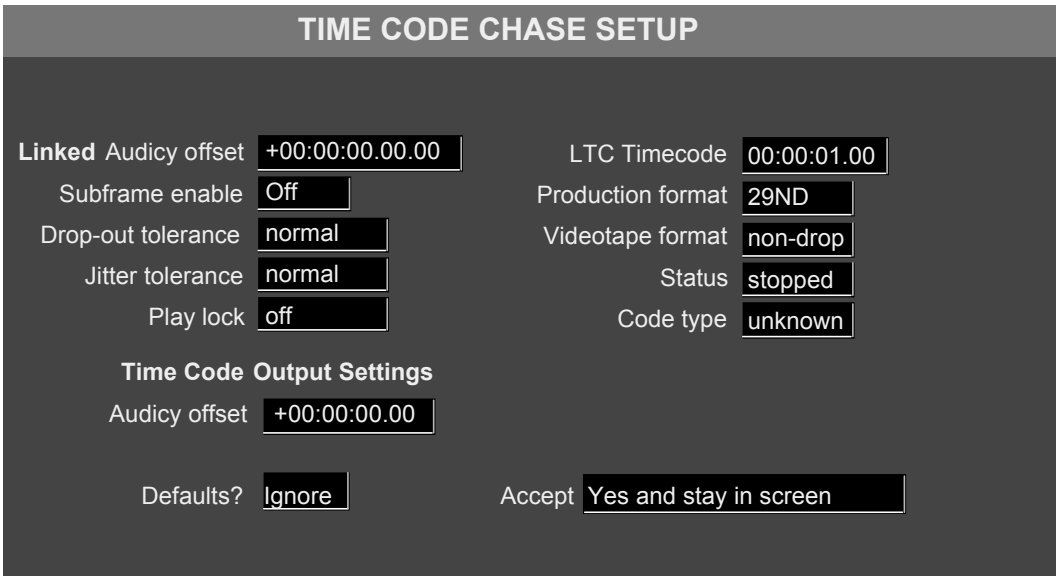

Figure 12-4: TimeCode Chase Setup Form

Move around the form by using the *Enter* button or the *up* or *down* buttons. When a field is highlighted, you can get information about its specific function by pressing *Help*.

To exit the form quickly without making any changes, press *Escape*. To exit it quickly and save your changes, press *Shift+Enter*.

Chase Input Settings

This side of the form lets you adjust how Audicy will respond to LTC.

Audicy Offset

This field sets how Audicy chases incoming LTC. Use the *left* and *right* arrow buttons to select digits and the scrubwheel to change them, or type the desired offset on the numeric keypad. If "Linked" appears, the same offset will be applied to automatic machine control. You can change the link status in the MC Setup form.

Subframe Enable

This field lets you display the offset to 1/100 frame[5], and sets the subframe bump amount. The choices are Off, On ±0.10, On ±0.25, and On ±0.50.

When you turn subframes on, the offset displays in this form and above the Memory Gauge are extended to show hundredths. These last two digits appear in gray

[5]That's about 300 microseconds, more than accurate enough for the most critical video.

since you can't enter them directly. But you can adjust them when the form is closed by turning on Chase mode and pressing *Alt+Plus* or *Alt+Minus* on the numeric keypad.

Drop-out Tolerance/Jitter Tolerance

Audicy adapts intelligently to a number of timecode problems, and continues chasing under circumstances that could shut other systems down. For each of these categories you can select low, normal, or high tolerance. If you're seeing unpredictable behavior during Chase modes and suspect a timecode problem, try different settings here.

- Drop-out Tolerance lets the system keep playing smoothly if code momentarily disappears because of tape damage, or shows a wildly-variant number for a single frame (typical of VITC problems). A high tolerance forgives more of these errors. A low tolerance lets Audicy respond faster when you stop the video.

- Jitter Tolerance corrects for wow and flutter in the video deck, and for badly-timed code from some 9-pin translators. A high tolerance results in smoother playback. A low tolerance lets Audicy respond more quickly when jogging single frames.

TimeCode Output Settings

Audicy generates frame-accurate timecode at all times, phase-locked to the house sync rate. This can be used to lock a video hard-disk recorder with perfect accuracy while you scrub Audicy's audio.

Audicy Offset

The generator transmits the current time in the production's timecode format, modified by any offset set in this part of the form. A negative offset means the transmitted timecode is less than the current time; a positive offset means it's higher.

SMPTE Status

This side of the form displays information about incoming LTC and your production.

Production Format

This field shows the frame rate you've chosen in the Job Controller. It can read 24 fps, 25 fps, 29.97 DF, 29.97 ND, or 30 fps.

Incoming Timecode

This field shows the last timecode Audicy received in the production, less any shuttle compensation (discussed in VTR Setup section).

Format

This field shows the last incoming timecode format. It can take as much as thirty consecutive frames for Audicy to determine this value, so if you're shuttling video slowly there's a delay before this field can respond.

Status

This shows whether the incoming timecode is running or stopped. If the code is unreadable because of tape damage or a problem in the video deck, it reports bad code.

Code Type

This shows Audicy's analysis of incoming timecode at less than play speed, information used by the Shuttle compensate software.

Defaults?

Use this field to apply factory-recommended generic settings, or to save or apply your own default settings. These defaults are also automatically applied to new productions. If defaults haven't been set, Audicy starts new productions with the factory recommended settings.

Accept?

Use the *left* and *right* arrow buttons to select Yes, remain in setup screen, or Yes, and leave setup screen, or No, leave setup screen. Press *Enter* while in this field to confirm your choice.

Machine Control Setup

When you select MC Setup and *Enter*, or press *Shift+Machine Control*, this form appears:

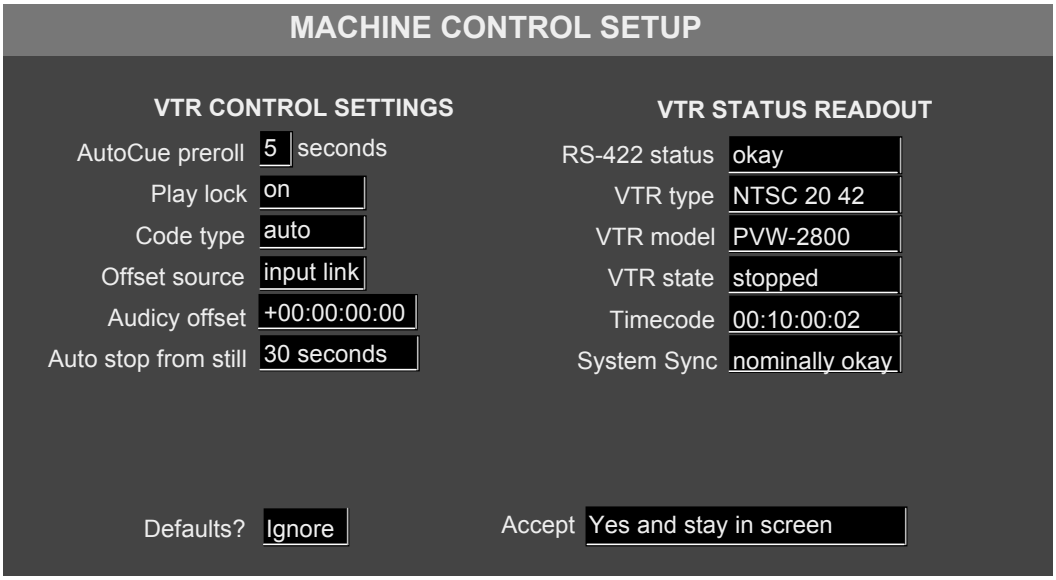

Figure 12-5: Machine Control Setup Form

Move around the form by using the *Enter* button or the *up* or *down* buttons. When a field is highlighted, you can get information about its specific function by pressing *Help*.

To exit the form quickly without making any changes, press *Escape*. To exit it quickly and save your changes, press *Shift+Enter*.

VTR Control Settings

This side of the form is used for adjusting how a VTR will behave under RS-422 control during a session.

AutoCue Preroll

This sets where a VTR will cue at the start of an AutoCue sequence, to give it enough time to stabilize before Audicy locks to it. Use a larger value for VTRs that need to rethread between cueing and playing. High-quality decks may need only a few seconds.

Play Lock

This turns Audicy's automatic machine control AutoLock on or off. As a shortcut, you can toggle AutoLock by pressing *Alt+Machine Control*.

Code Type

Audicy asks the VTR for its current location based on LTC or VITC, or can have the deck choose the best code type based on the tape and playing speed. Usually you'll leave this set to auto, but you can specify a type if a tape has timecode problems.

Offset Source

This can be linked to be the same value as Audicy's LTC input or output offsets or be set manually. Offsets are defined as Audicy's location *minus* the VTR location — if you set an offset of one minute and Audicy is parked at one hour, the VTR will cue to 00:59:00:00.

Audicy Offset

When sources are linked, this field displays the value that you've linked to. When they're not linked, this field can be used to enter a value.

Auto Stop From Still

After Audicy has kept the VTR in stillframe mode for this preset time, it will automatically send it a "stop" command. Depending on the VTR, this may do different things:

- Professional VTRs will keep a picture on the screen, relax their capstan, and start an internal tape-protection timer. After about eight minutes (user-definable within the VTR) the tension is released and picture is turned off. Restarting takes less than a second from stop, and only a few seconds if tension has been released.
- Semi-professional units may disable the picture and unthread the tape when they get a stop command. Rethreading can take five or ten seconds with older 3/4″ units.
- Most hard-disk virtual VTRs treat stillframe and stop the same way, so this setting makes no difference for them.

A lower value will give you more tape protection. A higher one may give you better VTR response, if your working style involves long pauses between edits. You can also set this field to Never for systems such as laser disk and virtual VTRs, or if you want the fastest response under all circumstances. If you choose Never, a warning will appear that you may be disabling a mechanical VTR's tape-protection feature.

VTR Status Readout

This side of the form gives you basic information about how the RS-422 system and your VTR are responding. For more detailed information, see VTR Setup.

RS-422 Status

This readout monitors serial communications between the VTR and Audicy. Errors are reported here in plain English. They may be the result of bad connections in the 9-pin line, user mistakes (such as leaving a VTR in local-control mode), or hardware problems.

VTR Type

This readout reports the television standard (NTSC or PAL) and two-byte identification code as sent by the VTR.

VTR Model

If Audicy recognizes the identification code, it will post the model number of the VTR here. But it may get fooled: Not every id code from every manufacturer is documented, and some VTR emulators deliberately use codes from tape-based machines.

VTR State

VTR State reports VTR status codes in plain English. These messages give a higher priority to unusual error conditions so you can diagnose them. The full status code, tracking many conditions simultaneously, is shown in VTR Setup.

Timecode

As reported over the RS-422 line. This may not agree with LTC code on the same tape; if you suspect an error in this reporting, check the diagnostics in VTR Setup.

System Sync

This readout reports setup errors, such as missing video references or drop/non-drop conflicts, that can influence how well the system responds. Audicy can tell if the VTR is receiving a reference signal, but has no way to determine if it's the same signal as sent to Audicy's own two video inputs. If sound and picture drift out of sync during AutoLock play, check the video wiring and make sure all three jacks are connected to the blackburst generator.

Defaults?

Use this field to apply factory-recommended settings for a Sony Betacam SP deck, or to save or apply your own default settings. These defaults are also automatically applied to new productions. If defaults haven't been set, Audicy starts new productions with the recommended settings.

Accept?

Use the *left* and *right* buttons to select Yes, remain in setup screen, or Yes, and leave setup screen, or No, leave setup screen. Press *Enter* while in this field to confirm your choice.

VTR Advanced Setup

This form is used for system installation and debugging, and probably won't be opened during normal sessions unless you need to connect to a different type of VTR or suspect a timecode problem. Open it by selecting VTR Setup and pressing *Enter*, or press *Shift+Offset*.

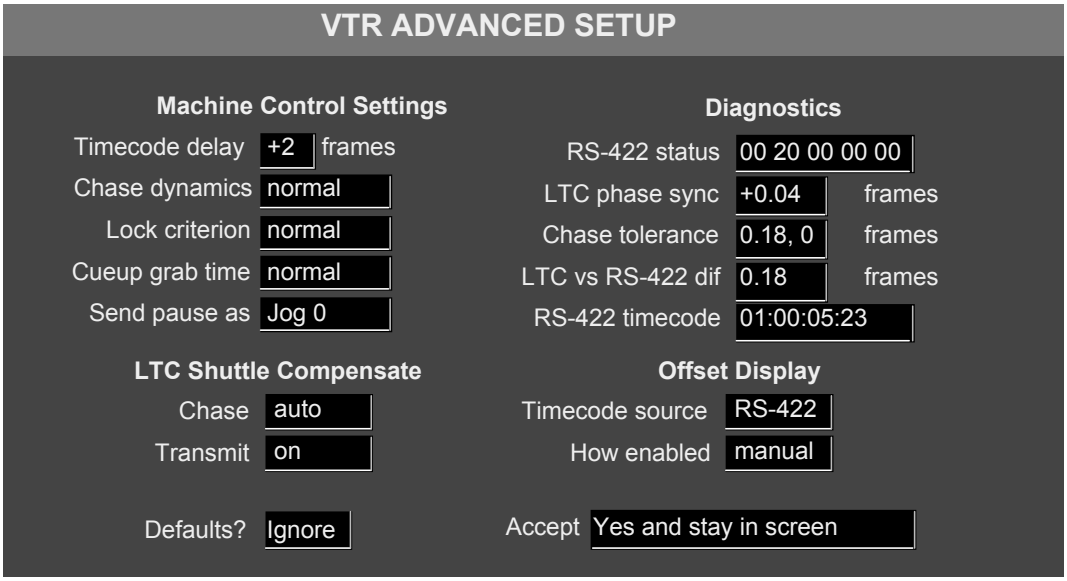

Figure 12-6: VTR Advanced Setup Form

Move around the form by using the *Enter* button or the *up* or *down* buttons. When a field is highlighted, you can get information about its specific function by pressing *Help*.

To exit the form quickly without making any changes, press *Escape*. To exit it quickly and save your changes, press *Shift+Enter*.

Machine Control Settings

These settings adjust how Audicy compensates for various VTR responses, and lets you optimize automatic machine control behavior.

Timecode Delay

VTRs typically delay time data over RS-422 when video is moving, and then remove the delay during still frames. (The reason lies buried in the history of timecode, and the constant need for upward compatibility.) This control compensates for that delay, and is usually set to +2 frames. Older decks may need a different settings.

- Most modern VTRs require a setting of +2 frames. If you're using modern professional equipment and another setting appears to work better, suspect a problem elsewhere.

Chase Dynamic

Chase Dynamics controls how aggressively Audicy's Machine Control servo loop slews the VTR. Older decks and VTR emulators may require a slower setting; newer types with small-format digital tape may be able to use a faster one.

Lock Criterion

Some professional VTRs help Audicy's AutoLock process by aligning themselves to the nearest frame when switching from shuttle to play. A looser setting takes advantage of this by issuing the play command when the videotape is only loosely in sync; the VTR's internal logic completes the synchronization process faster than it can be done via RS-422. If your VTR is constantly dropping in and out of locked play mode when AutoLock is on, try a tighter setting

Cueup Grab Time

This field allows you to set how quickly Audicy attempts to take control back from the VTR after its cued to a specified frame. Many VTRs go to full stop once they're cued, and release their capstan solenoid. Audicy can intelligently grab control before the this happens and force a freeze frame instead. This eliminates excessive solenoid wear. The setting may require some experimentation: A faster time can give better control but may also result in communication errors. This function is irrelevant if using a tapeless system such as laser disk or virtual VTR.

Send Pause As

Audicy normally sends the VTR command to "scan picture with a speed of zero" for precise control of professional VTRs during freeze-frames. Some semi-professional units and virtual VTRs might creep forward instead of freezing. Choose Jog 0 for tighter control and to eliminate solenoid bounce if your VTR freezes properly; otherwise, choose Stop to assure the picture won't move.

LTC Shuttle Compensate

Chase

This setting helps Audicy achieve absolute sync to LTC even during slow shuttle speeds, by guessing what frame is being transmitted even when the data is ambiguous. Guessing is necessary because timecode is serial data, and the system can't be sure of a frame's value until all the bits have been transmitted. Most professional equipment — Audicy included — tries to predict the current frame by adding one digit to the previous frame.

Unfortunately, sometimes this gives you the wrong answer. At less than play speed, code from analog audio or address tracks gets stretched so a frame of timecode matches a single frame of video. But digital video or VITC[6] readers generate

[6]While Audicy properly interprets timecode from a VITC source, it must be converted to an audio signal first. Many professional video decks do this conversion internally, or you can use an external device such as the Horita VLT-50.

constant-speed code: It's always transmitted at the house sync rate. At less than play speed, each video frame may have more than one repeated timecode frames. At precisely half-speed play (illustrated below) there are exactly two timecode frames for each video frame. At other speeds, the pattern gets more complicated.

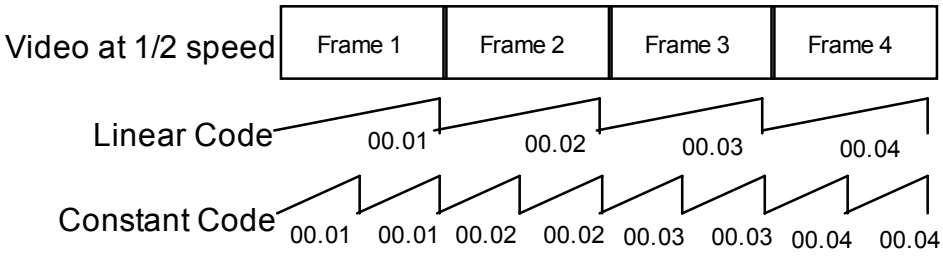

Figure 12-7: VITC and LTC might not agree at non-play speeds

If an audio system tries to follow constant-speed timecode precisely while you're shuttling audio, the repeated frames will cause excessive wow and flutter. So Audicy analyzes the transmission speed as well as the frame number, and adapts its prediction based on the type of timecode it sees.

This should work perfectly all the time... except some constant-speed timecode devices try to compensate as well, resulting in a one-frame error.

- Select Auto to have Audicy automatically detect the timecode type, and add a frame only when it's appropriate.
- Select Always to have Audicy add one frame at all times.
- If you're not sure which to use, play the video at half- or quarter-speed and see which setting gives you the best synchronization. These settings make no difference during normal play.

Transmit

Turn this on to have Audicy subtract one frame from the output at slow speeds to emulate analog equipment. If your other equipment shows a one-frame error when chasing Audicy at slow speeds, change this setting.

Diagnostics

This area of the form gives you detailed information on external factors that can affect how well Audicy deals with timecode. Use it if you suspect a tape or VTR problem, and be prepared to read from it if you need to call Orban Customer Support.

RS-422 Status

This diagnostic readout displays the first five hex bytes of the VTR's status code, updated once every few seconds. We might ask you to read this code to us during a support call. If you want to interpret it yourself, check the chart in the back of your VTR's protocol manual.

LTC Phase Sync

LTC Phase Sync measures errors between the start of an LTC word as received at Audicy's timecode input, and the edge of the closest reference video frame.

- A small, stable value (typically less than .25 frame) is usually attributable to system delays and won't affect sync.
- Larger stable values usually indicate problems with the videotape. Since no system can determine absolute time at play speeds via RS-422 alone, you may see occasional one-frame errors during *Machine Control Play*. Use Audicy's Chase and AutoCue features for more precise synchronization.
- Large oscillating values indicate that timecode and video weren't locked together when the tape was made, typical of some desktop non-linear editing systems. Tapes like this are likely to have wow or flutter under Machine Control, and never achieve AutoLock. Use Audicy's Chase and AutoCue features for more stable synchronization. Unfortunately, this symptom usually also means timecode isn't reliable over the long term: You may see drastic differences between off-line and on-line versions of the same project.

Chase Tolerance

The first number indicates how closely the VTR is chasing Audicy. The second number is used only during the Acquire phase of an AutoLock sequence, and indicates how many consecutive frames have been within the Lock criterion. Once a Play command is sent, the second number is reset to 0.

LTC versus RS-422 diff

This diagnostic readout displays the difference between LTC as received at the Audicy Timecode card, and timecode sent via RS-422. This can be used to diagnose problems with the VTR, or in the LTC signal path. If you set the Code type to VITC in Machine Control Setup, this field will also tell you if the tape's VITC and LTC values don't agree.

- Any difference reported in this field will also be reflected as a difference between Audicy Chase and Automatic Machine Control.

Offset Display

Audicy displays the difference between its own location and the current VTR location. This information appears above the Memory Gauge on your screen, sharing space with the Splice Memory indicator.

Timecode Source

TimeCode Source switches the display to consider the VTR's location as received at the LTC input of Audicy's timecode card, or as reported via RS-422. As a shortcut, you can toggle this setting by pressing *Ctrl+Offset* when the form is closed.

How Enabled

Automatic switches the display from Splices to Offset whenever either the VTR or Audicy is chasing. Manual lets you switch the display by pressing the Offset button. For most installations, it's probably most convenient to leave this set to Manual: This lets you keep a constant eye on splice memory, and still check the Offset is you suspect timecode problems.

Defaults

Two independent pages of user settings can be stored or read, and factory-recommended settings for Sony Betacam SP decks can be read.

- Read or Save my defaults should be used for your primary VTR. These settings are automatically applied to new productions. If no defaults have been specified, Audicy starts new productions with the factory-recommended settings.

- Use Read or Save my alternate if you sometimes connect to machines of a different type during a session (typically for layback).

Accept?

Use the *left* and *right* buttons to select Yes, remain in setup screen, or Yes, and leave setup screen, or No, leave setup screen. Press *Enter* while in this field to confirm your choice.

Working With Timecode and RS-422

By The Numbers

Timecode was developed by the Society of Motion Picture and Television Engineers (SMPTE), to help TV editors keep track of what they were cutting. It identifies each video frame with a unique number, constantly counting up from the beginning of the tape. The numbers are recorded in a computer-readable format as hours: minutes: seconds: frames.

This is incredibly handy. It lets producers edit television shows precisely and repeatably, keeping track of the start and end of every scene. They can rehearse, fine-tune, and (with some limitations) measure any sequence by simply subtracting the beginning timecode from the end.

The European Broadcast Union (EBU) quickly adopted the format. So did audio producers, who realized they could use it to sync soundtracks with video. Today, SMPTE is the universal timing language for audio and video production, multimedia, film editing, and theatrical effects. Most professional music sequencing hardware can also read it, converting it to MIDI timecode for post-scoring.

LTC: Longitudinal Timecode

The code itself is an 80-bit digital word, appearing as a bi-phase squarewave about 2400 Hz[7]. It sounds something like a fax machine signal. It was designed to be recorded on a standard audio channel of a videotape. Since audio tracks run parallel to the tape motion (as opposed to video tracks, which are slanted or perpendicular), the code is called 'longitudinal'.

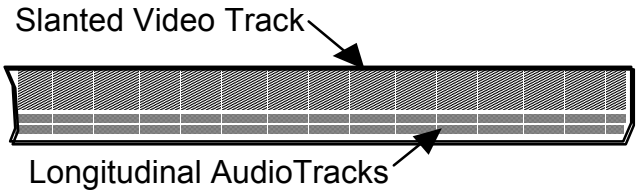

Figure 12-8: It's called Longitudinal Timecode because it isn't slanted

Most analog videotape formats now include a special 'address track', designed specifically for this signal. Digital formats, of course, can record the data directly. But the name stuck, and — no matter how it's recorded — both the timecode track and the squarewave flowing through the studio wiring are referred to as Longitudinal Timecode, or LTC.

VITC: Vertical Interval Timecode

Tape heads work like little generators: As the tape moves past their coils, they develop a voltage based on the magnetism. If the tape slows down, the voltage drops. Since address-track timecode is recorded this way, it's a problem for video editors who like to freeze the picture to find precise editing points[8].

So the video industry invented a way to make timecode part of the picture itself. Vertical Interval Timecode, or VITC, uses the blank space at the top of each image. (This is the rolling black bar you see when your vertical hold is badly adjusted.) A series of white dots, spread over two lines of the video, form a 90-bit serial code with the same data as LTC. The VITC numbers are read by logic circuits, and converted to LTC for the editing system.

[7]The precise frequency depends on the frame rate.

[8] The tape stops moving, and that kills the longitudinally-recorded address track. But the video heads keep spinning against the tape, so there's still a picture.

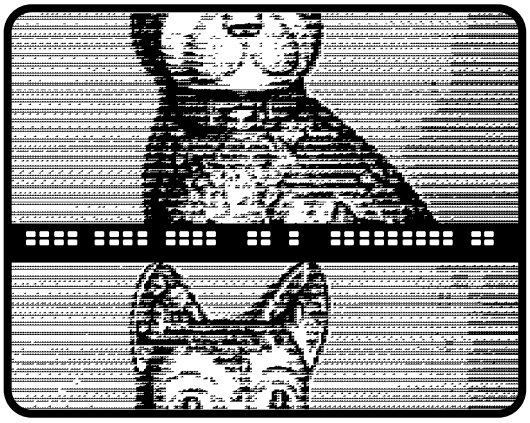

Figure 12-9: VITC on an Image

If the picture is rolling, you may be able to see VITC as a series of white dots between parts of the image.

Because VITC timecode is recorded as part of the video image, it has some disadvantages:

- VITC can't be changed without re-recording the picture.
- VITC isn't readable during fast wind and rewind.
- Some high-end special video effects, and most home video formats, don't pass the VITC signal.

Best of Both Worlds

Professional video decks often use both VITC and LTC recording for reliability. Both signals are handled internally as data, and the most dependable one at any time is sent to the timecode output jack as LTC. The LTC squarewave signal is the standard for connecting timecode devices. Depending on the equipment, it may appear as a balanced signal on XLR connectors or unbalanced on RCA or BNC.

Audicy uses LTC (unbalanced, RCA) for synchronization. If you prefer to work with VITC within the video environment and your deck can't handle it, there are a number of third-party converters available.

9-Pin or RS-422 Code

Sony-protocol compliant VTRs can send their current location through the serial control cable, in response to queries from the controller. Since this isn't a continuous data stream, it's not suitable for audio sync by itself: There's no way for the audio device to know when a frame started.

Audicy uses the video reference signal to determine when to ask for 9-pin timecode, and then adjusts the response based on how long it took to get an answer from the VTR. However, both the VTR and Audicy can get fooled by badly-

recorded LTC tracks. If the timecode is out of phase with the video signal, the VTR might respond with the wrong frame number.

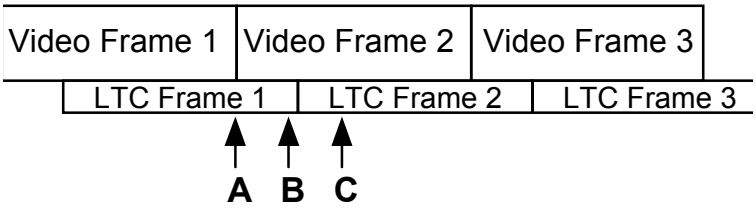

Figure 12-10: Example Of A Badly-Recorded LTC Track

Take this example of a videotape where the leading edge of each timecode word has been recorded slightly later than the edge of its video frame.

- At point **A**, Audicy sees a new video frame and sends a time query to the VTR...
- ...which the VTR interprets by point **B** and it sends a response. But at **B**, it was still reading data from frame 1...
- ...so by point **C** when Audicy receives the answer — "I'm at frame 1" — the video is well into frame 2.

One typical result of this kind of error is a consistent one-frame offset during automatic machine control, but only when Audicy and the VTR are at near-play speeds. When Audicy is scrubbing or parked, the error disappears. Another result could be failure of the VTR to achieve or stay in AutoLock, when it's been successfully locking with other tapes.

If you suspect this kind of problem. check LTC Phase Sync in VTR Setup. If the phase is off by more than a tenth of a frame, ask the video engineers for a different tape or adjust Audicy's offset for the best compromise during automatic machine control.

Since this problem can't occur with VITC, you might be able to continue working by specifying Code Type: VITC in the MC Setup form.

BITC: Burn-In Timecode

Some editors prefer "burn-in" tapes with timecode superimposed on the picture. These are for human convenience, and aren't read by the editing equipment.

Figure 12-11: Typical Burn-in Timecode Window
(00 hours, 1 minute, 15 seconds, 25 frames)

A few desktop video editing systems use optical character recognition to read BITC, but the technique isn't reliable. If you request a BITC dub from a video facility, be sure to ask for computer-readable timecode (VITC or LTC) as well.

Bi-phase Code

Film uses sprocket holes for synchronization, instead of timecode. So some video film equipment includes a tachometer to measure the running speed. The tach's bi-phase output is converted to LTC with an arbitrary starting time.

Timecode Formats

Timecode, no matter how it's recorded, has to match picture on a frame-by-frame basis. The nominal[9] rate — how many frames per second — and the counting format are related.

24 fps

Movies run at 24 frames a second, so film studios typically use 24 fps timecode in their computerized editing systems.

This format counts frames from 0 through 23. The frame after 00:00:00.23 (zero seconds, 23 frames) is 00:00:01.00.

25 fps

Most television systems outside North America run at 25 frames per second, historically related to European AC power systems running at 50 Hz. This is the PAL

[9]A timecode's rate assumes the video moving at normal speed. So PAL video is always considered 25 fps, even though there are 30 individual frames a second if you turned the speed knob up 20%.

and SECAM standard, used by most television and radio production around the world.

This format counts frames from 0 through 24. The frame after 00:00:00.24 (zero seconds, 24 frames) is 00:00:01.00.

30 fps

This was the North American standard before color television, derived from a power system running at 60 Hz. It's now obsolete for video. But since 30 fps is easy to count and is *almost* the color video rate, it's used by some audio and MIDI equipment. North American radio productions are often counted at 30 fps.

This format counts frames from 0 through 29. The frame after 00:00:00.29 (zero seconds, 29 frames) is 00:00:01.00.

√	The three formats above count differently, but it doesn't change the length of each second. Hours, minutes, and seconds agree perfectly with the 'standard' time on a well-calibrated wristwatch. You can't say that about color television in North America and Japan.

29.97 fps

When NTSC color TV was introduced in the US, it had to be compatible with sets already in peoples' homes. Since more information is transmitted, the inventors made each frame a tiny bit longer than the standard 30 fps. The difference was only 1/10%, easily adjusted by the viewers' vertical-hold knob[10].

Thirty frames of NTSC take slightly *longer* than a second. But you can't advance the seconds counter until that 29th frame is finished, so *timecode for US television doesn't run at the same speed as a clock on the wall*.

The difference is insignificant for a lot of users. Commercials are too short to worry about the 1/10% error. Corporate and educational production isn't timed precisely enough to care.

But it makes a difference to broadcasters. A tape starting at 00:00:00.00 and ending at 01:00:00.00 must be exactly an hour long. A 1/10% error would make it 3.6 seconds too long and it would overlap the next program — or worse, cut into a valuable commercial.

So two different ways of counting 29.97 fps timecode were developed.

[10]Those of us who remember the first color TV sets also remember jumping up to adjust the vertical hold whenever the programming switched from B&W to color.

Non-Dropframe

In this format frames are counted from 0 to 29. The frame after 00:00:00.29 (zero seconds, 29 frames) is *called* 00:00:01.00 (one second), even though it's actually 1/1000 more than a second.

This format, usually called 29.97 NDF, is preferred by video production houses.

Dropframe

In this format most seconds are counted from 0 to 29 frames, but a few start counting at 2 frames. The other numbers are skipped in those seconds, which is why the format is called dropframe (or 29.97 DF). It's important to remember that no video or audio frames are actually dropped, just the numbers that count them.

- Seconds within a minute, and the first second of any minute ending in zero, are counted normally. The frame after 00:00:01.29 is 00:00:02.00, as you'd expect.

- The first second of any minute *not* ending in zero starts counting with frame 2. The frame after 00:00:59.29 is 00:01:00.02.

Over the course of ten minutes this format agrees with wall-clock time, so it's preferred by broadcasters. But it can confuse some editing equipment, because certain numbers just don't exist.

Choosing Dropframe Or Non-drop

The decision to use drop or non-drop code is up to the videotape producer. Most video editing equipment doesn't let you mix formats, so this has to be planned in advance. Audicy lets you start a production in one format and then switch to another; instructions are in the first chapter of this manual.

You can check a tape's format using Audicy's setup forms. MC Setup uses RS-422 to query the VTR for what it thinks the format is. Chase setup analyzes the incoming LTC:

- SMPTE uses one bit to designate drop-frame mode. If Audicy sees this bit, it'll display 29.97 DF.

- SMPTE data does not distinguish 24 fps, 25 fps, or 29.97 non-dropframe. However, Audicy keeps track of how the incoming signal counts frames, and displays the proper timecode as the result.

- 29.97 non-dropframe and 30 fps look almost identical to a computer — it takes a few thousand frames to tell the difference. But 30 fps isn't used in professional videotape, so Audicy never displays this format.

Sync Methods

Audicy gives you multiple ways to sync audio and video. You can switch among the methods freely.

Audicy Chase Modes

Normal Audicy LTC chasing follows incoming timecode exactly. You can start, stop, or reverse the video, jog it a single frame at a time, or shuttle at any speed down to 12% of normal and Audicy will stay in sync.

Of course, this only works if the video deck supplies accurate timecode at all those speeds. Semi-professional decks often don't, and you may want to add an external VITC encoder and decoder for most reliable operation.

Normal automatic machine control makes the VTR continuously follow Audicy's timecodes. At least once per frame, the VTR's location is queried and a speed correction or locate command is sent. This keeps the video closely synchronized no matter what you do to the audio, but may result in video noise or picture disturbances.

About House Sync

Most video decks — even better-quality home units — lock their playback speed to an external video signal, relying on a control track recorded with the picture. (If no external reference is supplied, the decks use an internal crystal.) This system is much more precise than using SMPTE code to control the speed.

Professional videotape editing depends on this lock function, since video sources have to be exactly in sync to switch between them. To edit video:

- The editing system uses SMPTE timecode to cue the tapes a few seconds before the edit point, and starts them all playing.
- The system then checks the timecode coming from the tapes and adjusts their speeds until all the pictures are in the right relationship.
- Finally, the system releases its speed control and lets all the video decks lock their control tracks to a single external reference. Timecode is essentially ignored from this point.

Multi-machine video facilities have a "house sync source": a video generator that provides a stable signal — usually a series of perfectly black color TV frames. Every piece of video equipment refers to this signal. Cameras regulate their scanning with it; video tape decks control their speed with it; switchers use it to cut between frames.

AutoLock Modes

If both Audicy and the VTR are connected to the same video reference signal, and Video has been selected as the sync source in Audicy's IO Setup form, both systems can play at precisely the same speed. This allows perfect audio and video, free from the mechanical variations and picture disruptions.

If Audicy is chasing LTC and AutoLock is turned on, the system will detect when audio and video are in sync and the video is at precise play speed. When this happens, Audicy will smoothly transfer to a locked play mode where its speed is controlled by house sync.

If the VTR is chasing Audicy and AutoLock is on, the system will detect when Audicy is in precise play speed and the VTR has remained closely synchronized for a number of frames. When this happens, it sends a command to force the VTR to control its own speed using house sync. The required sync accuracy and number of frames are adjustable in VTR Setup.

> If the VTR's Capstan Lock switch is set for precise color framing ("4FD"), a play command may force the VTR to slew two frames, causing an immediate offset. Audicy will see this offset, drop the VTR out of play, and resync. The process would repeat indefinitely.
>
> To avoid this, set the VTR to allow 2-field locking or turn Machine Control AutoLock off.

Working Without House Sync

If there isn't a valid video signal at Audicy's digital input sync connector, the system locks to an internal, high-precision crystal. The internal crystal assures high-quality audio, and should provide reliable sync for short-length videos. Audicy also uses this reference signal to phase-lock its digital audio output for use with advanced video systems.

If there isn't a valid video signal at Audicy's Timecode Card, automatic machine control will not function properly. Audicy also uses this signal to phase-lock its timecode output.

If there isn't a valid video signal at the VTR, the video system will probably revert to its own crystal. Picture quality might not be affected, but long-term sync accuracy is not assured.

If the video signal is missing from either of Audicy's sync inputs or the VTR, the Machine Control icon will turn red. Check MC Setup for a report on which signal is missing.

Connecting Audicy to a Video System

The hardware component of Audicy's TimeCode option includes a TimeCode card, mounted toward the bottom of your System Unit. The card's connector panel shows through, on the same side as the power jacks, and looks like this:

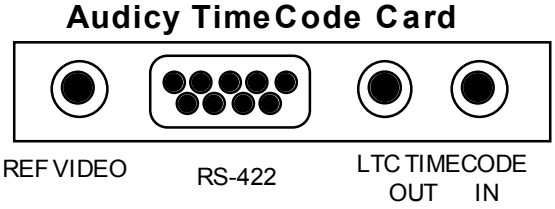

Figure 12-12: Audicy TimeCode Card Connections

LTC Timecode Input

This RCA jack is a high impedance (10kΩ) input tied to ground. The signal must be between .1 Vpp and 10 Vpp, and have a DC offset of no more than one volt.

LTC Timecode Output

This RCA jack provides a 1 Vpp LTC signal across 100Ω. The timecode output matches the current production format and time, plus any user-chosen output offset. It is aligned to reference video.

√	Timecode is an audio squarewave. Because the voltages tend to be fairly high and the wave is rich in harmonics, it can leak into other signal lines. While the input and output connectors are unbalanced, two-conductor cables with "telescoping" shields are recommended. Typical hi-fi cables can cause coupling and unpredictable operation.

RS-422

Audicy's RS-422 control port is a standard ES-bus tributary. You can use it as a Sony-protocol controller by switching TX and RX in an adapter cable. Use Orban part number 42048.000 or wire one yourself with DB-9 male or female connectors:

Audicy Pin	Signal	VTR Pin
1	Frame Gnd	1
2	To VTR –	8
3	To Audicy +	7
7	To VTR +	3
8	To Audicy –	2
9	Frame Gnd	9

Pins 4 and 6 are the common of each balanced pair, and don't have to be connected in most installations. While the adapter performs the same function as a null modem, computer-store null modems are designed for RS-232 and won't work with RS-422.

Connect the "VTR" end of the cable to the RS-422 remote input of a VTR, and make sure the deck is in remote-control mode. Control-L and other schemes may be connected through third-party protocol converters.

Changes at the VTR

To use Audicy's VTR AutoLock, 2-field servo locking must be enabled. On many machines, this is done through a "Capstan Lock" switch: Set it to 2FD or 2/4FD. If the switch doesn't seem to have any effect, check the VTR's setup menus: On many Sony professional machines, menu item 106 (Capstan Lock) should be set to either "0" or "Switch" — the factory default. If an edit system requires 4-field locking, you can reset the switch when you change the RS-422 connection from Audicy to the editor.

Obviously, the VTR should also have remote-control enabled.

House Sync

For reliable operation, Audicy and the video tape deck should have a common timebase, usually provided by a blackburst generator. This assures sync, gives Audicy a reference for interpreting RS-422 timecode, and isolates audio from problems in the timecode stream. In large facilities the video sync signal already

exists, and just needs to be extended to Audicy. Smaller studios can use a low-cost desktop unit, such as the Horita BSG-50[11].

- The VIDEO input on the Intelligent Digital Module controls Audicy's sample clock, for accurate timing and to phase-lock the AES/EBU outputs for digital VTRs. Patchbay: IO Setup must be set to video sync and to the local television standard. For details, see the Audicy manual.
- The REF VIDEO input on the Audicy Timecode Card controls the RS-422 communication, and is essential for accurately determining the VTR's location.
- Professional VTRs have a video sync input jack (semi-professional ones may sync to the normal video input). This is necessary for stable playback and long-term sync.

Video signals are high frequency, and require 75Ω cables (RG-59) and terminators. Both of Audicy's video inputs are high impedance for maximum flexibility.

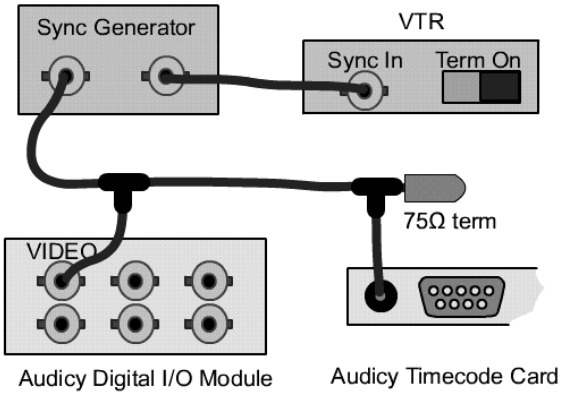

Figure 12-13: Connecting House Sync, Example 1

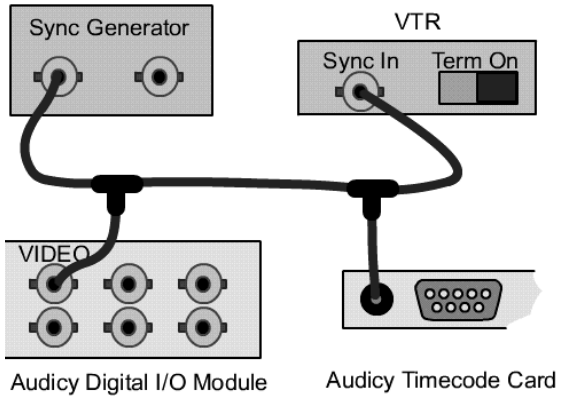

Figure 12-14: Connecting House Sync, Example 2

[11]Around $300 from video suppliers, or contact Horita Co., Box 3993, Mission Viejo, CA 92690 USA; telephone 714/489-0240.

Proper setup depends on your studio's physical layout and equipment. Here are two possible schemes, using BNC "T" connectors. The wires between the "T" connectors and Audicy inputs should be no more than six inches.

If the video deck has a termination switch at its sync input, turn it on. If you don't see a switch the input may be terminated internally or require an external 75½ ohm terminator; check the deck's documentation.

Reading VITC

Vertical Interval Timecode, or VITC, is a digital code embedded in each frame of video. It can be read at very low speeds and on still frames, when ordinary analog timecode tracks would drop out. On the other hand, VITC is unreadable during high-speed winding.

Most professional video decks support VITC internally, and convert the signal to LTC on their output. Audicy requires an LTC input for synchronization. If you want to use VITC with other video decks, use an external translator such as Horita's VLT-50.