Chapter 4 - Basic ZETA-THREE Operations

How to use this chapter...

This chapter provides step-by-step instructions for operating the time code generator, recording time code on tape, reading time code from tape, and synchronizing a slave transport to a master time code source. Follow this Chapter carefully to become familiar with basic ZETA-THREE operation.

NOTE

If following these procedures step-by-step for the first time, DO NOT plug in the transport connector cables yet.

4.1 Time Code Generator Operation

One of the most important features of the ZETA-THREE is its ability to generate SMPTE/EBU time code. The time code numbers being output can be displayed whenever desired by accessing the Generator Time Code (G_TC) display.

4.1.1 Starting and Stopping the Generator

To start the generator, press the GEN RUN key [10]. Note that the amber LED on the GEN key will light when the key has been pressed, showing that the generator is running, and the cursor will disappear, as shown in Figure 4.1. Time code, counting up from the address displayed prior to GEN RUN being pressed, will be shown on the display.

The GEN RUN key acts as a toggle to start and stop the generator counting. To make the generator stop, press the GEN RUN key again. The amber GEN RUN LED will turn off and the display will show the last time code address generated.

The generator can be toggled on and off regardless of the current display. Therefore, it is possible to observe or adjust other displays while the generator is running. The amber LED on the GEN key will always light, no matter what is being shown on the display, whenever the generator is running.

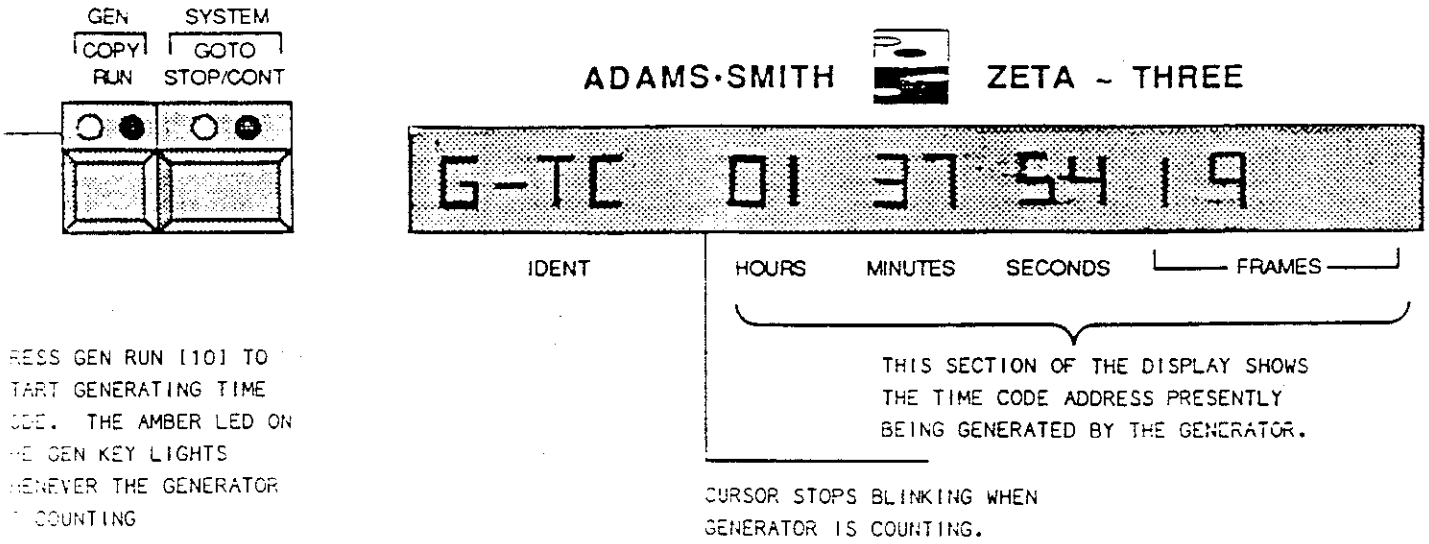


Figure 4.1 GENERATOR OPERATION

When the generator is stopped, it will continuously generate the number which is shown in the generator time code display. Because of this, it is advisable to stop a tape, on which time code is being recorded, before stopping the generator. This will avoid recording a series of identical time code numbers.

4.1.2 Setting the Generator Numbers

The address in the G_TC display may be changed anytime the generator is stopped and Generator Time Code is displayed on the screen.

When G_TC is being displayed, pressing the CLEAR key will reset the time code generator to 00 00 00 00. Alternatively, when G_TC is being displayed, pressing the CAPTURE key will set the G_TC display to the value which is stored in the "G01 PRESET" Menu item. The G01 item can be set to any valid time code number.

4.1.3 Setting the System Standard

Prior to using the time code generator, it is important to set the ZETA-THREE generator to the proper system standard. The system standard determines the type of time code the generator will generate. The five types of time code and frame rate combinations which can be generated by the ZETA-THREE are:

30-frame SMPTE
29.97-frame (video rate)
NTSC/SMPTE drop-frame
29.97-frame NTSC/SMPTE non-drop-frame
25-frame PAL/EBU
24-frame film/SMPTE

See Appendix A for more information about time code.

The system standard is set by accessing the System (Z) Menu, Indexing up or down to System Menu item number "Z04 FRAMES=30.00", CURSORing to the right side of the display, and then Indexing up or down to change the frame rate to the appropriate system standard.

4.2 Recording Time Code on Tape

Recording time code on a tape (striping) is the first step in synchronizing and autolocating. The time code allows the ZETA-THREE to identify unique locations on the tape.

The following sections provide information about the procedures which should be followed when striping a tape. THE TYPES OF CABLES NEEDED FOR ALL CONNECTIONS ARE DESCRIBED IN APPENDIX C.

4.2.1 Setting a Tape Transport for Recording Time Code

When recording time code, the transport must always be set to run at **"internal" or "fixed"** speed so the transport will run at its standard play speed.

Some transports have front panel or rear panel internal/external switches. Others automatically remain in "internal" unless instructed to switch to "external" through their Remote connector. See your tape transport's manual to set your tape transport to "fixed" or "internal".

4.2.2 Sending Time Code to the Recorder

Connect the GEN CODE OUT jack [28] on the ZETA-THREE to the "audio in" jack on the tape transport which corresponds to the track on which time code is to be recorded. Some transports provide a special TIME CODE IN jack and a wide-band time code track specifically for this purpose.

Use shielded, twisted-pair audio cable with appropriate connectors on each end. The ZETA-THREE end of the cable requires a professional quality 3-wire audio plug (type XLR-

3J or equal). The transport end may require a similar plug (type XLR-3P or equal), an RCA phono plug, or other type, depending upon the transport. Consult the transport manual to determine the type needed.

The following figure shows proper connections between the ZETA-THREE's GEN CODE OUT jack and various types of tape transport audio in jacks.

NOTE

> To determine whether a plug should be male or female, remember that the pins of the male connectors should point in the direction of signal flow (in this case, from the ZETA-THREE to the transport).

Although there is no standard rule for recording time code, it is usually recorded on an outside audio track of a tape, most commonly on the highest-numbered track.

4.2.3 Recording Procedure

First enter the desired starting time code address into the G_TC display. A starting time code is usually a number rounded to the nearest hour or half-hour. If desired, the G01 PRESET address may be loaded into G_TC by pressing CAPTURE while G_TC is displayed and the Generator is stopped (the G01 PRESET default is 01:00:00:00, but the Preset may be any valid time code address). A starting time of 00:00:00:00 should not be used because crossing from 00:00:00:00 to 23:59:59:29 (NTSC) and back again during cueing can sometimes cause system problems.

On the audio track chosen to record time code, set the time code recording level as follows:

```
                1" vtr's = -5vu to -10vu
  3/4" & 1/2" vcr's = -3vu to -5vu
   audio transports = -5vu to -10vu
```

Values lower than -10 dB may make time code recovery unreliable; values higher than -3 dB may cause adjacent track cross talk. Select the time code track on the transport, put the transport into Record, and start the generator by pressing GEN RUN. When the desired length of time code has been recorded, stop the transport.

NOTE

The ZETA-THREE outputs time code (with unchanging numbers) even when the generator is not counting. Because of this, the recording level can be set without putting the generator into the RUN mode.

Until recording time code becomes a routine operation, the time code should be checked by following the steps described in Section 4.3 BEFORE using it for any synchronizing purposes. Checking the time code could prevent many future headaches by confirming that it has been recorded properly (i.e. a proper level, no discontinuous sections, etc.).

4.3 Reading Time Code From a Tape

After recording time code on a tape, it should be played back and read by the ZETA-THREE to confirm that it was recorded properly. Poor time code on tape is the primary cause of synchronizing problems. The ZETA-THREE is capable of recognizing good, readable time code and the MTC LED [2] or STC LED [3] turns on when good time code is present.

4.3.1 Connecting Time Code to the ZETA-THREE

The ZETA-THREE reads time code through the MASTER CODE IN [29] and SLAVE CODE IN [31] jacks. To read the time code from the master transport, connect the appropriate "audio out" jack of the master transport (or "time code out" jack if the transport has a time code track) to the MASTER CODE IN jack [29] located on the rear panel of the ZETA-THREE. To read time code from a slave transport, connect to the appropriate "audio out" jack of the slave transport the SLAVE CODE IN jack.

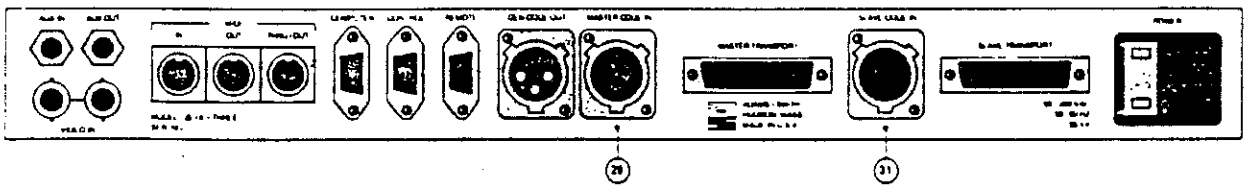


Figure 4.2 Connections for Reading Time Code

Use shielded, twisted-pair audio cable with appropriate connectors on each end. The ZETA-THREE end requires a professional quality 3-wire audio plug (type XLR-3P or equal).

4.3.2 Play-back Procedure

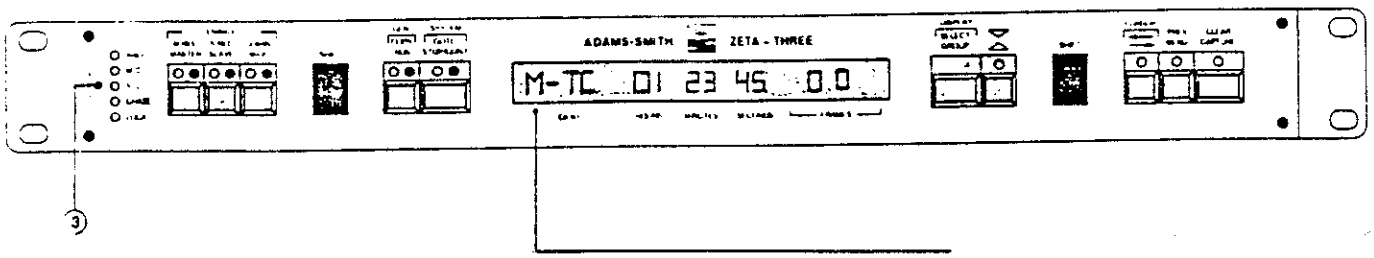
Rewind the tape to (approximately) the beginning of the time code on the tape.

Access the M_TC display.

Put the transport into Play. The numbers in the M_TC item will not change until the ZETA-THREE starts to read time code from the tape.

With the master tape playing, look at the green MTC LED [2], shown in Figure 4.3. IF the MTC LED is NOT lit, no time code is present. If the MTC LED flickers, the time code is discontinuous or is being received at a level which is too low. Check the play-back level on the transport to be sure the time code was recorded at an acceptable level. Adjust the play-back level, if possible. If the level remains too low, the time code must be re-recorded. Check the recording level on the transport before re-recording, because it is most likely the cause of the problem. If the recording level was set properly, then refer to section 6.1.1.

Use the S_TC display and the STC LED [3] for observing slave time code.



THE STC LED [3] WILL LIGHT SOLIDLY WHEN THE ZETA-THREE IS RECEIVING GOOD TIME CODE THROUGH THE SLAVE CODE IN JACK [31].

THE S-TC GROUP-ITEM WILL DISPLAY TIME CODE ADDRESSES THAT THE ZETA-THREE RECEIVES THROUGH THE SLAVE CODE IN JACK.

Figure 4.3 Reading Slave Time Code

4.3.3 Reading Time Code During Fast Forward or Rewind

Tape transports which have a wide-banded audio track, such as an "address track", can reproduce time code at a wide range of speeds. Time code from these transports can be read by the ZETA-THREE while the transports are in Fast Forward and Rewind as well as in Play, because the time code readers in the ZETA-THREE can decode time code from approximately 1/20 to 100X play speed.

If wide-band time code is not available (the transport does not reproduce time code in Fast Forward and Rewind), the ZETA-THREE keeps track of tape location by using tach pulses or control track pulses to update the last accurately-read time code address. The tach/control track pulses are fed to the ZETA-THREE over the same Interface cables which are used to control the master and slave transports.

4.4 Synchronizing Two Transports

The ZETA-THREE tape synchronizer's primary job is to control the capstan of a "slave" tape transport in such a way that the transport's tape runs in synchronism with the the tape on the "master" transport whenever the master is in Play. At other speeds -- Fast Forward, Rewind, and Stop -- the ZETA-THREE keeps the slave in the proper relationship to the master to re-establish synchronism, as quickly as possible, when the master is returned to Play. Most professional audio tape transports and video tape transports (ATRs and VTRs) can be used by the ZETA-THREE as master transports; most ATRs and a number of VTRs/VCRs can be used as slaves. This section explains how to use the ZETA-THREE to synchronize tapes. Appendix B provides a general discription of tape synchronizing.

When using the ZETA-THREE to synchronize a slave tape to a master tape, some limitations on types of transports must be observed. If the master is to be a video transport, then the slave may be either an audio or video transport. If the master is an audio transport, then the slave can only be another audio transport. A single ZETA-THREE can NOT, by itself, synchronize a video transport to an audio transport.

4.4.1 External Connections

In order for a tape transport to be controlled and/or synchronized by the ZETA-THREE, it must be connected to the ZETA-THREE by means of an Interface Cable. Interface cables are available for most popular professional quality tape transports and are listed on the ZETA-THREE price sheet. When looking up transports for use with the ZETA-THREE, make

sure to use the most recent price list because cables for new transports are added very frequently.

The Interface Cables handle all of the control signals described in Section 4.1.1 with the exception of time code. Time code connections between a transport and the ZETA-THREE must always be made by means of shielded, twisted pair audio cables, as described in Sections 4.2 and 4.3.

The slave tape transport must always be connected to the ZETA-THREE by means of both a time code cable and a ZETA-THREE Interface Cable.

If the master tape transport is to be controlled by its own controls or by another controller, and never by the ZETA-THREE, and if the transport is capable of reproducing readable time code reliably in fast forward and rewind, as well as at play speed, then the only connection needed between the master transport and the ZETA-THREE is a time code cable.

If the master tape transport is to be controlled by its own controls or by another controller, and never by the ZETA-THREE, but the transport is not capable of reproducing readable time code reliably in fast forward and rewind, as well as at play speed, the connections needed between the master recorder and the ZETA-THREE are a time code cable and a cable connnecting the tach/control track and direction signals to the ZETA-THREE's MASTER TRANSPORT connector.

If the master tape transport is to be controlled by the ZETA-THREE, then, a ZETA-THREE Interface Cable as well as a time code cable must be used between the master transport and the ZETA-THREE.

WARNING

The power switch [33] for the ZETA-THREE should be OFF when the transport cables are plugged into, or unplugged from the ZETA-THREE's MASTER TRANSPORT connector [30] or SLAVE TRANSPORT connector [32].

4.4.2 Synchronizer Set-up for Controlling Transports

The ZETA-THREE contains within itself the information it needs to control the transports which are connected to it, **but it MUST be told which transports are indeed connected to it.** This is done through the ZETA-THREE's transport list.

To choose a slave transport:

1) Access the Slave (S) Menu.

2) Index to Menu item "S05 TRANSPORT ->".

3) Access the next higher Menu level (the list of Slave Transports).

4) Index up or down through the list of Slave Transports to the name of the desired Slave Transport.

5) When the desired Slave Transport is shown on the display, CAPTURE it into the ZETA-THREE's memory by pressing the CAPTURE key.

The Slave Transport in the ZETA-THREE's memory can be changed at any time simply by Indexing to another transport on the list and pressing CAPTURE again.

Choosing a Master Transport is accomplished in the same manner, through Master Menu item number "M04 TRANSPORT ->".

4.4.3 Transport Set-up for Synchronizing

Before the ZETA-THREE can synchronize the slave to the master transport, the transports must be set up as described below. (Note that some of the conditions may have already been implemented by following the procedures mentioned in previous sections.)

1. The Master transport MUST be set to internal (fixed) speed control.

2. The Slave transport MUST be set to **external** speed control, allowing the transport's speed to be controlled by the ZETA-THREE.

3. The Master and Slave transports must be chosen as described above.

NOTE

Once transport selection has taken place, it is not necessary to re-select transports whenever the ZETA-THREE is turned on. Even after the ZETA-THREE has been powered-down it will remember transports last chosen.

4.4.4 Controlling the Transport Through the Front Panel Keys

4.4.4.1 The ENABLE Keys

The ENABLE keys [6, 7, and 8] determine what devices will obey ZETA-THREE commands in a particular ZETA-THREE installation.

All ENABLE keys are toggles. Pressing ENABLE MASTER tells the ZETA-THREE that there is a master in the system. The Master is "ENABLEd" when the amber LED on the ENABLE MASTER key [6] is lit. Pressing ENABLE MASTER again removes the master from the system EVEN IF A MASTER TRANSPORT IS CONNECTED TO THE ZETA-THREE'S MASTER TRANSPORT CONNECTOR. The Slave transport or MIDI are ENABLEd or disabled in the same manner. Any combination of the ENABLE keys may be used. THE ZETA-THREE ASSUMES THAT THE LEFT-MOST ENABLE KEY HAS THE HIGHEST PRIORITY.

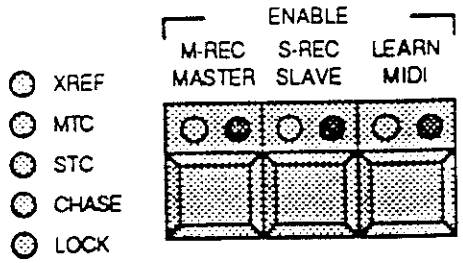


Figure 4.4

The following are examples of the ENABLE keys' prioritization:

1) If only a Master is ENABLEd (and proper cable connections have been established):

   the ZETA-THREE will be capable of sending to the Master transport either STOP/CONT commands, or GOTO commands.

2) If both a Master and a Slave are ENABLEd:

   paragraph 1 will be true;

   the ZETA-THREE will read the time code address in the M_TC, S_TC and S_OFS Group selections; and

the ZETA-THREE will synchronize the slave to the master (for best results, play the master and slave tapes for a few seconds prior to enabling either):

Also, whenever both Master and Slave are in either Fast-Forward or Rewind, and either is disabled, both transports will stop. If both transports are in Play, and either is disabled, both transports will continue in Play.

3) If the Master and MIDI are ENABLEd:

paragraph 1 will be true; and

MIDI sync will be synchronized to the Master time code and sent according to information in the ZETA-THREE's Beatmap.

4) If the Master, Slave, and MIDI are ENABLEd, paragraphs 1, 2 and 3 will be true.

5) If only the slave is ENABLEd, then the ZETA-THREE will send either STOP/CONT commands, or GOTO commands, to the Slave transport.

6) If the Slave and MIDI are enabled, the MIDI sync being sent will be synchronized to Slave time code.

7) If only MIDI is enabled, MIDI sync is transmitted at its own rate, as determined by the Beatmap.

NOTE

The ZETA-THREE will accept time code from the Master and/or Slave transport through the MASTER and SLAVE CODE IN jacks [29] and [31], and will display such time code, WHETHER OR NOT THE TRANSPORTS ARE ENABLED. If the transport is not ENABLEd, however, the ZETA-THREE will not make any effort to control or synchronize it.

4.4.4.2 The STOP/CONT Key

The SYSTEM STOP/CONT key [11] will toggle between Stop and Play commands to the left-most ENABLEd transport. For example, if only the Slave and MIDI are enabled, the Slave is ACTING as the master of the system and MIDI will follow it. If only MIDI is enabled, MIDI is ACTING as the master of the system (but, of course, there is nothing in the ZETA-THREE to follow it).

The amber LED on the key will be lit when the left-most ENABLEd transport is in Play (CONTinued). Immediately after the key has been pressed to issue a Play command, the amber LED on the key may blink before the transport starts to actually play the tape. The blinking LED indicates that the ZETA-THREE has acknowledged that the key has been pressed, but the transport has not yet begun to Play.

4.4.4.3 The GOTO Key

When the SYSTEM GOTO key [SHIFT SYSTEM STOP/CONT] is pressed, the left-most ENABLEd entity will "go to" the time code address stored in the Z_GO Group Selection (the address in this display is also known as the "GOTO address"). When the transport reaches the GOTO address it will stop and wait for a new command. This action (GOing TO the GOTO address and stopping at it) is called "cueing and parking". If no address is stored in the Z_GO Selection display when the GOTO key is pressed, the command will be ignored.

NOTE

> The time code address in the Z_GO Selection display will be used as the "cue point" for the left-most ENABLEd transport. If an offset has previously been established between the Master and Slave time codes, and left-most ENABLEment is switched between Master and Slave, the ZETA-THREE automatically adjusts the Z_GO address by the amount of the offset.

4.4.5 Reactions of the ZETA-THREE when Synchronizing

Synchronizing of the slave to the master will take place when both the Master and Slave transports are ENABLEd.

With both transports ENABLEd, and the master transport in Play, the ZETA-THREE will control the speed of the slave transport to keep it running in synchronism with the master.

With both transports ENABLEd, and the master stopped, the ZETA-THREE will move (cue) the slave and stop (park) it to the location which will permit the most rapid synchronization to occur when the master is returned to Play.

With both transports ENABLEd, and the master in Fast Forward or Rewind, the ZETA-THREE will cause the slave to chase the master by issuing fast forward and rewind commands to the slave. The CHASE LED [4] on the left side of the

ZETA-THREE's front panel lights whenever the slave is chasing the master, and turns out when the slave has parked.

4.4.6 Initial Synchronizing Setup

The purpose of tape synchronizing is to keep time-related material recorded on the slave tape running in synchronism with corresponding material recorded on the master tape. Therefore, good, readable time code MUST be recorded on both master and slave tapes. Thereafter, if the appropriate Interface and time code cables have been installed, and if the ZETA-THREE has been told what tape transports are in use (all as described in previous sections), then tape synchronizing can begin.

First, however, the ZETA-THREE must be told the address relationship between master and slave time codes. This relationship, determined by subtracting master time code address from slave time code, is called the offset, and is conventionally referred to as "slave minus master".

In many cases, the offset will be zero because corresponding master and slave material have the same time code addresses. In fact, zero-offset time code is often recorded, specifically to keep things straightforward.

When initially setting up the ZETA-THREE, it is usually convenient to begin with tapes which have the same time codes on them, so the offset can remain set to zero. During initial testing, it is the operation of the ZETA-THREE that must be tested and observed, and not the material recorded on the tapes. In fact, tapes containing only time code are perfectly acceptable for test synchronizing on the ZETA-THREE.

When synchronizing for the first time it is advisable to follow all the steps listed below.

Preparing Tapes and Transports

1. Load tapes on both master and slave transports. **Stripe a MINIMUM of 30 minutes of time code on both the master and slave tapes.** Set Z04 FRAMES=29.97 (25 PAL); set Z05 SYSTEM=UNRESOLVED. Refer to Sections 4.1, "Time Code Generator Operation" and 4.2, "Recording Time Code on Tape" when preparing tapes for synchronization.

2. Make SURE that the Internal/External Capstan Speed Control switch on the slave, if there is one, is in the External position.

3. Access the M_TC Selection, press ENABLE MASTER and then press SYSTEM STOP/CONT. The master transport will go into Play, the MTC LED [2] will light, and the M_TC display will show play-speed time code.

   It has now been confirmed that the Play line of the ZETA-THREE Interface cable is properly connected, and that the Master transport will output play-speed time code, and that the ZETA-THREE will read it.

4. Press SYSTEM STOP/CONT again to stop the Master.

   This will keep the Master from playing past the end of recorded time code while Step 5 is followed.

5. Access the Z_GO Selection. Press CAPTURE, and the time code address in the M_TC Selection display will be CAPTUREd into the Z_GO display.

   A cue point has now been CAPTUREd from incoming master time code.

6. Press SYSTEM STOP/CONT again to return the Master to Play. Let the Master continue to play for a minute or two. While it is Playing, access the M_TC display. After the Master has played for a minute or two, stop the Master. After the Master stops, press SYSTEM GOTO. The Master will cue (in this case, rewind) to the GOTO address. While the Master is cueing, the M_TC display will show master time code counting backwards at rewind speed. If the Master's time code channel is not wide-banded, the character "T" will appear on the right side of the M_TC display, showing that the ZETA-THREE is using tach/control track updating.

   It has now been confirmed: that the Rewind line of the ZETA-THREE cable has been properly connected; if the transport's time code channel is wide-banded, that wind-speed Master time code is being output and read; or, if the time code channel is not wide-banded, that tach/control track updating is taking place.

7. After the Master has cued and parked, disable the Master.

Slave Transport Operations

8. Make sure that the Master is disabled. Access the S_TC Selection, press ENABLE SLAVE and then press SYSTEM STOP/CONT. The slave transport will go into Play, the STC LED [3] will light, and the S_TC display will show play-speed time code.

9. Press SYSTEM STOP/CONT again to stop the Slave.

10. Access the Z_GO Selection. Press CAPTURE, and the time code address in the S_TC Selection display will be CAPTUREd into the Z_GO display.

11. Press SYSTEM STOP/CONT again to return the Slave to Play. Let the Slave continue to play for a minute or two. While it is Playing, access the S_TC display. After the Slave has played for a minute or two, stop the Slave. After the Slave stops, press SYSTEM GOTO. The Slave will cue (in this case, rewind) to the GOTO address. While the Slave is cueing, the S_TC display will show Slave time code counting backwards at rewind speed. If the Slave's time code channel is not wide-banded, the character "T" will appear on the right side of the S_TC display, showing that the ZETA-THREE is using tach/control track updating.

12. After the Slave has cued and parked, disable the Slave.

    The same cable connections and time code functions which earlier were confirmed for the Master transport have now been confirmed for the Slave.

Synchronizing

13. Access Menu number S01 LOCK MODE. Confirm that LOCK MODE equals ADR. If it does not, Index the display to ADR.

14. Access the Slave Offset Selection (S_OFS). If the display does not show all zeroes, press CLEAR [SHIFT CAPTURE].

    The offset has now been set to 00:00:00:00.00. Since this manual section (Section 4.5.6, Initial Synchronizing Setup) began with the identical time code number stream being recorded on both slave and master tapes, this is the correct offset between them.

15. Access the Slave offset ERRor selection (S_ERR). Since it is highly improbable that the two

transports are stopped at exactly the same time code address, there will be an error value shown on the display. This value is the difference between the time code address of the Master and the time code address of the Slave (calculated as slave minus master).

16. ENABLE both Master and Slave. The CHASE LED [4] will turn on and the Slave will immediately begin chasing the Master. Since the Master is stopped, the chasing will, in this instance, consist of cueing to the proper address, relative to the master's address, which will allow subsequent rapid synchronization. The S_ERR display will show the error value counting down towards zero. When the Slave has cued and parked, the CHASE LED will turn off, but a small value of offset error will remain on the display after the Slave has cued and parked.

17. Press SYSTEM STOP/CONT. The CHASE LED will turn on, the Master will Play, and the ZETA-THREE will commence achieving synchronization of the Slave to the Master. The S_ERR display will count down to zero. When it reaches zero the LOCK LED [5] will turn on and the CHASE LED will turn off. The Slave is now synchronized to the Master.

4.5 Offsets

4.5.1 What is an Offset?

Initial synchronizing setup as per the preceding section was accomplished with identical time code sequences on both Master and Slave tapes. When the Master and Slave tapes have DIFFERENT time code numbers, however, there must be an offset to establish a positional relationship between the master and slave tapes.

An offset is calculated as slave time code address minus master time code address and includes the sign of the difference, positive or negative. A negative offset occurs when the slave time code address is smaller than the master time code address. A negative offset can be calculated either as slave-minus-master, or, since the slave address is the smaller of the two, it can be subtracted from the master address and prefixed as a minus sign. An offset value is always shown as 10 digits -- hours, minutes, seconds, frames, and sub-frames (tenths and hundredths of frames).

The exact value of the desired offset must be entered or CAPTUREd in the S_OFS display in order for the master and

slave tapes to align correctly -- to achieve audio-to-video "lip-sync", for instance.

If the time code on the slave tape has been copied from the master tape along with audio material, the desired offset will be zero, as in the setup procedure in the previous section.

In many cases where an offset between the master and slave tapes is required, frame-accuracy will often be sufficient, and the sub-frames digits may be zeros.

If the exact offset is known, then it can be entered into the S_OFS Selection by means of CURSORing and Indexing, as explained above.

NOTE

If one (or more) of the tapes contains drop-frame code, refer to Section 4.6.6.

If the exact offset is not known, then it must be determined by a trial-and-error routine. A common way is to position the master and slave tapes, either manually or by use of the ZETA-THREE controls, in the approximately correct positional relationship. The approximate offset may then be CAPTUREd. Capturing an offset, and then adjusting the offset value by either "trimming" or "slewing" until the correct offset is established, is explained below.

Any CAPTUREd or entered offset will be retained on non-volatile (NV) memory when the ZETA-THREE is powered down. If it is desirable to reset the offsets to all zeros whenever the ZETA-THREE is turned on, refer to Menu item Z13, described in Appendix D.

4.5.3 Capturing an Offset

Offsets can be CAPTUREd while the tapes are playing or stopped. In either case, time code must have been read from both master and slave tapes since the ZETA-THREE was last powered up.

NOTE

For greatest accuracy when capturing an offset, it is recommended that both transports be playing when the CAPTURE key is pressed.

4.5.4 Trimming Offsets

Trimming an offset means changing the number in the S_OFS Selection display to a more accurate number (usually by a small amount). Offsets can be trimmed at any time by incrementing or decrementing any of the digits in the S_OFS display by CURSORing and Indexing.

Whenever the offset is trimmed, synchronism will be temporarily lost and then regained, with the time to re-gain synchronism depending primarily upon how much the offset was incremented or decremented.

4.5.5 Slewing an Offset

Another method of changing the offset is to adjust the positional relationship of the master and slave tapes. This is accomplished by increasing or decreasing the speed of the slave transport while it is running in synchronism with the master, thereby changing the running position of the slave tape with respect to the running position of the master tape. The process is called "slewing".

Slewing can be done at either a slow (1/10 frame per second) or fast (1 frame per second) rate. Slewing can only be accomplished while the transports are running in synchronism.

When the slave transport's speed is increased, its running position advances with respect to the master. When the slave transport's speed is decreased, its running position retards with respect to the master. As the running position of the slave transport advances or retards (with respect to the master), the offset changes correspondingly.

The ZETA-THREE monitors the offset **change** caused by slewing and lists the amount of change in the S-SLEW display. Once the desired running position of the slave with respect to the master is reached, the amount of offset change caused by the slew can then be easily added to the value in the S_OFS display.

How to slew:

1. Establish synchronism of the slave to the master, in Play.

2. Access the S_SLEW Selection. The S_SLEW will show the cursor in the tenths-of-frames position in the display, indicating that the ZETA-THREE will slew the tape in increments of 1/10 of a frame (the fast-slew rate of one frame per second). If the cursor is moved to the hundredths of frames position in the display, the ZETA-

THREE will slew the tape in increments of 1/100 of a frame (the slow-slew rate of 1/10 of a frame per second)

3. For now, leave the cursor at the slow-slew position. Next, hold down the /\ key to speed UP the slave. The word "ADVANCE" will appear in the S-SLEW display, both the CHASE and LOCK status LEDs will begin to blink, and the offset change caused by the slew will appear at the cursor position. The slew value will continue to increase as long as the /\ key is held down. When the /\ key is released, the last slew value will remain in the display.

   To slew the slave in the opposite direction, press the \/ key to slow DOWN the slave. The word "RETARD" will appear in the S_SLEW display and, as when advancing the slave, the offset change caused by the slew will appear at the cursor position. The slew value will continue to decrease as long as the \/ key is held down. When the \/ key is released, the last slew value will remain in the display.

4. After slewing, the value in the S_SLEW display can then be captured by pressing the CAPTURE key. Pressing CAPTURE will cause the SLEW value to be added to the S_OFS value, the CHASE status LED to turn off, and the LOCK LED to light solidly.

   After slewing, if the decision is made not to retain the new running position of the slave with respect to the master, the S_SLEW value can be returned to zero by pressing the CLEAR key. The running position of the slave returns to the original offset as the slew value decreases to zero. When CLEAR is pressed, the slew value will return to zero (and the running position of the slave will return to the original offset) at the same speed (1/10 frame per second or one frame per second) as slewing took place. When the slave transport has returned to its original offset, the CHASE status LED will turn off, and the LOCK LED will light solidly.

4.5.6 Entering and Capturing Drop-Frame Time Code Offsets

In general, the techniques used to enter non-drop frame offset values are <u>not</u> valid when one or both time codes are drop-frame. Specifically, subtracting a master time code address from a slave time code address to determine an offset will yield an **incorrect** answer, with two exceptions. The only two special cases where slave-minus-master will be correct are: when the two values are equal (i.e. the offset is zero); and when the value of the master is zero (i.e., slave-minus-master equals the value of the slave time code address. Except for these two special cases, an offset

value should not be entered into the S_OFS register when one or both time codes are drop-frame, as it will lead to an incorrect running position of the slave with respect to the master.

While a drop-frame time code offset should not be calculated and manually entered, it can be CAPTUREd, and the ZETA-THREE will calculate the correct offset automatically. However, when the offset is captured and calculated by the ZETA-THREE, the offset value in the S_OFS display will be in non-drop-frame format; therefore, it will not necessarily be equal to the value which would be obtained by subtracting the slave from the master time code reading.

In order for the ZETA-THREE to calculate an offset involving drop-frame codes, however, it must know which tapes contain drop-frame code. Since the ZETA-THREE determines which codes are drop-frame by monitoring the drop-frame bits in the codes it is receiving, each tape **must** be played for a few seconds to allow the ZETA-THREE to read the code and determine the type of code the tape contains.

Once a drop-frame offset has been CAPTUREd, it can be trimmed and slewed, just as non-drop-frame offsets.