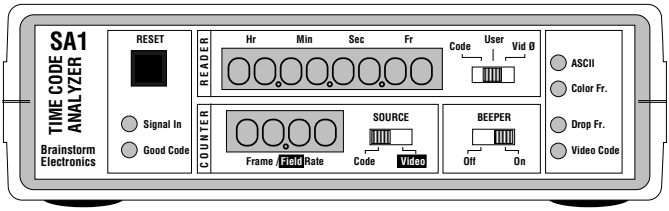
SA-1
TIME CODE ANALYZER

Operation Manual

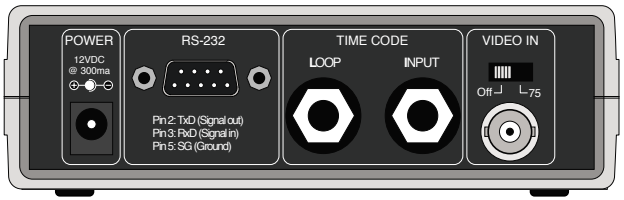
Software Version 3.05

BRAINSTORM
ELECTRONICS, INC.

...Intelligent Solutions For The Recording Studio



1. **Reset Switch:** Pushbutton to reset SA-1 or clear displays
2. **Signal In LED:** Lights up when signal is present. Any signal above -30db lights this LED.
3. **Good Code LED:** Lights up when valid code is present; blinks off momentarily if a "Fatal" time code error is detected.
4. **Reader (8 digit display):** Reads time code, user bits or video phase; also displays error types and faulty addresses.
5. **Reader Select:** Selects the mode of the 8 digit display: Time code/User bits/Video ø.
6. **Counter (4 digit display):** Reads the frame rate (fr/sec) of the incoming time code or video signal.
7. **Counter Select:** Selects the input of the 4 digit counter: Code / Video.
8. **Beeper Switch:** Turns beeper off.
9. **ASCII LED:** On when ASCII flags are set. On means User bits are ASCII; off means Hex.
10. **Color Frame LED:** On when Color flag is set (bit 11); off when flag is not set.
12. **Drop Frame LED:** On solid for drop frame code; blinks mostly on for missing DF flag (bit 10); blinks mostly off for false DF flag; off for non drop code.
13. **Video Code LED:** On solid if code is synchronous and in phase with video; blinks mostly on if code is out of phase; blinks mostly off if code is drifting; off if no video is present.



14. **Power jack:** 2.5mm power input jack. Requires 6 to 12VDC with center pin positive.
15. **Serial port:** DB-9M for RS-232 I/O.
16. **Time Code Loop:** 1/4" jack connected internally to the time code input jack.
17. **Time Code Input:** 1/4" for source time code.
18. **Video Input:** BNC connector for video reference.
19. **Termination switch:** turns on a 75Ω termination for video reference.

Introduction

The SA-1 is a powerful hand held analyzer designed to quickly and accurately identify time code problems. The SA-1 identifies the type, stability and frame rate of the incoming code; it verifies its proper synchronization (phase) with video; and it reports time code errors (i.e. drop outs...)

It is the same analyzer as the one found in the Brainstorm SR-15+ Distripalyzer so it should be easy for SR-15+ users to operate the SA-1.

Table of contents

Section 1: Setting up the SA-1

1. Connections

- **Time Code input**
  Connect your time code source to the rear panel input jack.
- **Time Code loop**
  This enables the user to analyze time code without breaking the normal chain. Connect the time code source to the "Input" jack and the time code destination to the "Loop" jack.
- **Video In**
  Connect Video Composite Sync or Composite Video to this BNC. This signal is used by the Analyzer to monitor phase with time code. A switchable 75Ω termination is also provided.
- **Serial Port (RS-232)**
  Connect a printer to this port to print a time code report or a computer such as a Mac or a PC to capture the report on the screen - see next page for proper wiring.
- **Power**
  The SA-1 requires a 6 to 12 VDC supply with center pin hot.

2. Wiring

- **1/4" Jacks:**

  The SA-1 uses stereo 1/4" jacks for time code input and loop. Pins are: Tip = high, Ring = low, Sleeve = ground.

  Since time code is bi-phase, a reversal of low & high wires would not cause a problem.

  The SA-1 works with balanced and unbalanced equipment. When using unbalanced equipment with the SA-1, wire your cables as described in the diagrams below.

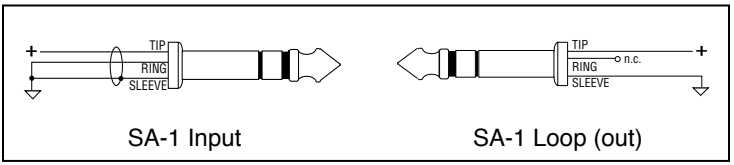


Figure 1. Proper unbalanced wiring diagrams

➪ **Serial Port (DB-9M)**

Only 3 pins are used on this connector: Pin 2 is RS-232 out (TXD); pin 3 is RS-232 in (RXD); pin 5 is ground. To connect a computer, follow the instructions below:

• **Mac:** make up a cable with an 8 pin mini Din connector on the Mac side and a 9 pin sub-D female connector on the SA-1 side. Solder the 3 pins needed as described in the table below.

8 pin Mini Din

Note: For convenience, you can use a standard modem cable and replace one of the Din connectors with a DB-9F. Pins 4 (SG) and 8 (RXD+) are usually tied on the Mac side which is OK.

	SA-1 9 pin Sub-D	Mac 8 pin Mini Din
Signal Out	2 (TxD) ———	5 (RxD)
Signal In	3 (RxD) ———	3 (TxD))
Ground	5 (SG) ———	4 (SG)

• **PC:** make up a cable with 25 pin sub-D on the the PC side and a 9 pin sub-D female connector on the A-1 side. Solder the 3 pins needed as described in the table below.

IMPORTANT: ON THE PC SIDE (25 PIN SUB-D), PINS 6 AND 20 (DSR - DTR) MUST BE TIED TOGETHER.

	SA-1 9 pin Sub-D	PC 25 pin sub-D
Signal Out	2 (TxD) ———	3 (RxD)
Signal In	3 (RxD) ———	2 (TxD)
Ground	5 (SG) ———	7 (SG)
		6 (DSR)
		20 (DTR)

• **Serial printer:** To connect an Apple ImageWriter printer, use the above described Mac cable. For serial printer with a DB25 connector, use the PC cable. For other printers, refer to your printer's manual for pin configuration.

Section 2: Using the SA-1

A. Time Code Format & Frame Rate

When playing time code into the SA-1, it first identifies its format:

- **Reader Display:** As soon as valid time code is recognized, its format (or frame count) is indicated in the **8 digit display** for about 2 seconds. The display then automatically switches to its selected mode (time code, user bits or video ø).

THE 3 STANDARD TIME CODE FORMATS ARE:
24, 25 OR 30 FR/SEC.

- The **4 LED's** on the right of the display further identify the time code:

• The **ASCII LED** indicates the user bits' format.

If the LED is off, UB format is Hex; if the LED is on, UB format is ASCII. ASCII is often used to identify a scene, reel, date or camera number .

• The **Color Frame LED** indicates whether code is "color framed" or not.

This LED comes on if the color flag is set (bit 11); it is off if the flag is not set.

• The **Drop Frame LED** indicates the drop-frame status.

This LED comes on as soon as the microprocessor detects a drop frame flag (bit 10 set). But the SA-1 also monitors the code to make sure the proper frames are actually being dropped. If they are not, the LED blinks mostly off (false flag). If frames are properly dropped but the DF flag was not detected, the LED blinks mostly on (missing flag).

Note: Since frames are dropped at the end of the minutes, this LED will not start blinking until the microprocessor sees a minute boundary of good code.

• The **Video Code LED** : Indicates whether code is in sync with video or not.

This LED comes on only if a video reference is present. For the different modes of this LED, see page 7.

➫ The **4 digit display** indicates the frame rate (or frequency). The SR-15+ strips the bit clock from the incoming time code and displays it as frames per seconds. It displays any rate from approximately 21 to 39 fr/sec.

The frame rate counter is updated 4 times per second. Since its resolution is ± .01 fr/sec, it can show potential problems such as jitter (see Appendix B "More on the frame rate counter"on page 17).

Format vs. Frame Rate

The SA-1's 4 digit display indicates frame rate, NOT format. There is a distinction. The format does not deal with frequency. It is a way of counting:

at 30 fr/sec, the frame sequence is: 28, 29, 00, 01, etc...
at 25 fr/sec, the frame sequence is: 23, 24, 00, 01, etc...
at 24 fr/sec, the frame sequence is: 22, 23, 00, 01, etc...

The frame rate on the other hand does not deal with count but frequency. If the tape speed varies, the frame rate varies. For example, if a tape machine was running 5% too fast, a format of 24 fr/sec would have a frame rate of 25.20 fr/sec. Yet the format would remain 24 fr/sec.

29.97 vs. Drop Frame

Many people confuse 29.97 with drop-frame but they are not the same thing: 29.97 indicates a rate (frequency) and drop-frame indicates a format (count).

"29.97" time code is 30 fr/sec code with a rate of 29.97. When generating 29.97 time code, the generator locks to a field rate of 59.94 Hz (NTSC color rate) and pulls down the frame rate by .1% to 29.97. But the format or frame count remains 30 fr/sec.

Drop Frame on the other hand is another way of counting frames. It is a variation of 30 fr/sec format, invented to compensate for the color rate of 29.97. Drop frame code leaves certain frame numbers out so that one hour of code time equals one hour of stopwatch time when code is running at 29.97.

Drop and non-drop code can both be generated at a rate of 30 or 29.97 fr/sec. For that reason, the frame rate and the drop frame status are displayed separately on the SA-1's front panel.

Proper bit width

In LTC, each word is divided into 80 equal segments called bits, numbered 0 to 79 (for bit assignment, see appendix D on page 18). Each bit can either be a "one" or a "zero": a "one" has a level shift halfway though its width; a "zero" does not. The time between each level shift can easily be calculated:

At 30 fr/sec it is 417µs for a "zero"and 208µs for a "one",
At 25 fr/sec it is 500µs for a "zero"and 250µs for a "one",
At 24 fr/sec it is 521µs for a "zero"and 260µs for a "one".

The SA-1 has a ±25% window which means that at 30 fr/sec, the level of a "zero" could remain constant for 313 to 521µs and of a "one" for 156 to 260µs.

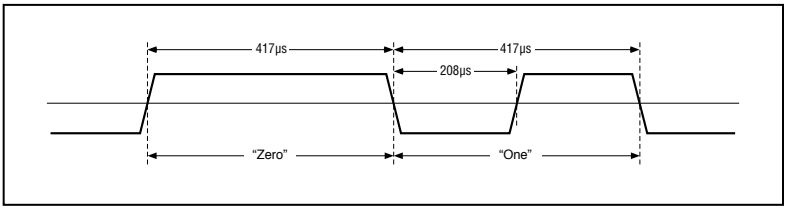


Figure 2. Bit width at 30 fr/sec.

However, some VCR's distort the bit width beyond that window (the "one's" become too narrow). If the SA-1 does not recognize valid time code with a signal present at its input for over 1 second, it switches automatically to an alternate setting to accommodate these distortions. If time code is then recognized, a "alternate bit width window" message is reported in the time code report.

The SA-1 remains on this alternate setting until reset (automatically or manually).

B. Time Code / Video Phase

What does it mean for time code to be in phase with video?

When time code is recorded on video tape, it must be synchronous with the video signal, meaning that the beginning of each time code word must coincide with the beginning of the video frame it describes. This is essential for video editing.

There is one time code word for each frame. Each word is made up of 80 bits, numbered from 00 to 79 (see diagram below). Time code is phased properly with video when the end of bit 79 of time code lines up with field 1 line 5 of video (± 1 line).

How can you check video phase with the SA-1?

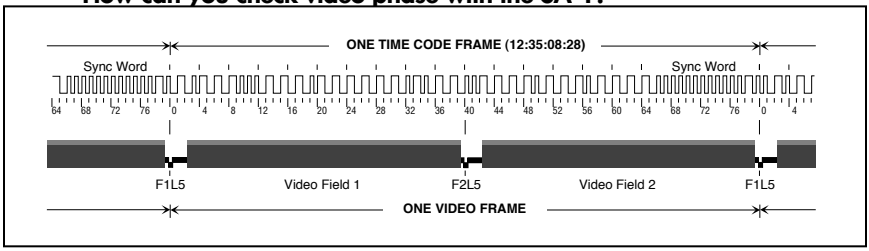


Figure 3. Proper alignment of time code and video

➪ The **Video Code LED** indicates 4 different conditions:

on: time code is properly phased with video;
blinking mostly on: time code is resolved with video but out of phase;
blinking mostly off : time code is non-synchronous (drifting);
off : no video is present.

The SA-1 considers time code "properly phased" if the time code bit lined up with video F1L5 is between numbers 75 and 04.

The SA-1 considers it "non-synchronous" if time code moves by more than 2 bits with respect to video F1L5.

If the time code generator was mistakenly set to internal crystal instead of external video, there would be a very slow drift between time code and video. The SA-1 reports this drift as soon as time code moves by more than 2 bits with respect to F1L5, even if it is within the "properly phased" window.

➨ On the **reader display** you can monitor the sync between time code and video:

With its selector switch in the "video ø" position, the reader shows which bit of the time code word lines up with video Field 1 Line 5 ("V" drive).

With synchronous code, the display should read: "bit 79". In the real world however, things are different and phase will often be slightly off. For example, if the display reads "bit 68" or "bit 07", the address track was possibly misaligned on the VCR and your synchronizer may show some slight sub-frame offset (i.e. 03,12, etc) when locked to code like this. So long as you are within a few bits of 79 and the bit number stays the same, you should have no problems.

Note: If "V" drive is at the edge of a time code bit, 2 bit numbers (those on either sides of that edge) will flicker in the display.

WARNING: IF THE BIT NUMBER DRIFTS, TIME CODE IS ASYNCHRONOUS AND MAY BE USELESS FOR YOUR APPLICATION.

C. Reporting Time Code Errors

One of the functions of the SA-1 is to detect and report time code errors. Errors considered serious enough to cause a synchronizer problem (such as a repeated frame) are labeled "fatal" by the SA-1. Others are "non-fatal". For a complete list, see appendix A on page 16.

Reporting errors on the SA-1 front panel

All "fatal" errors are reported on the front panel; "fatal" and "non fatal" errors are both reported on the printed report.

➨ The **8 digit display**:

Every time the SA-1 detects a "fatal" error, the reader is momentarily interrupted and displays a description of the error (i.e. "Drop-out" etc...) for about 2 seconds. Then it returns to its selected mode of operations (time code, user bits or video ø).

After the SA-1 has detected a "fatal" error, the first digit of the

reader display blinks continuously (until cleared or reset). This way, if you leave the room, you will know if an error occurred while you were away.

After tape has been stopped (code must be interrupted for at least 5 seconds), the 8 digit display shows a description of the first "fatal" error detected for about 2 seconds. After these 2 seconds, it indicates where the error occurred and then alternates between the faulty address and its description.

If no error occurred, the display alternates between a "Code Stopped" message and the last valid time code address.

View the first five errors: The SA-1 keeps the first 5 errors detected in memory. After time code has been stopped, tap the reset button to toggle through them. Each tap advances the display to the next error until the fifth one. Then it returns to the first. For each error, the display alternates between the faulty address and its description.

Front panel error messages:

Here is a list of error messages as they are reported on the 8 digit display:

DROP OUT: Drop out - Code interruption for less than 1 second.

CODESTOP: Code Stopped - Code interruption for 1 sec. or more.

DISCONT: Discontinuous Address or repeated frame

INVALID: Invalid Address - Any non valid number i.e. 39 frames.

VID-LOST: Video Loss - Any interruption in the video signal.

FORM CHG: Format Change

DROP X: Wrong number of frames dropped (X indicates the number of frames)

DROP CHG: Change in the Drop Frame Status

COLR CHG: Change in the Color Frame status

In addition to the 8 digit display, the SA-1 also alerts you of errors as follows:

- The **"Good Code" LED** (input section) blinks off momentarily whenever a "fatal" error is detected.
- The **Beeper** sounds whenever the "GOOD CODE" LED changes from on to off. If necessary, the beeper can be turned off via the front panel on/off switch.

The SA-1 keeps track of errors and statuses on the front panel and it may be useful at times to reset the SA-1 or clear some of its displays.

What is the difference between Reset and Clear?

- **Reset:** When you reset the SA-1, it is as if you were playing new time code. After a reset, the SA-1 begins its normal sequence again:
  - the SA-1 identifies the time code format and displays it for about 2 seconds in the 8 digit display (see page 4);
  - the front panel LED's are all reset;
  - the "first 5 errors" register is erased;
  - a new time code report is initiated (through the serial & parallel ports).
- **Clear:** A "Clear" command clears some of the SA-1's displays:
  - If an error has been detected and the 1st digit of the reader is blinking, a clear command stops the blinking and clears the "first 5 errors" register (i.e. the next error detected will now be considered to be the first error).
  - If the video code LED is blinking, a clear command stops the blink and resets the LED.

How do you reset or clear the SA-1?

- **Manual Reset:** To manually reset the SA-1, press and hold the reset button for at least 1 second. The 8 digit display will say: "- reset -"
- **Auto Reset:** When code is interrupted for at least 5 seconds an end of report is initiated. When code is reintroduced, the SA-1 is automatically reset.
- **Manual Clear:** Tapping the reset button while code is running clears the displays as described above.
- **Auto Clear (partial)**: When code is interrupted for at least 1 second, the video code LED is automatically cleared when code is reintroduced.

D. Transmitting a Time Code Report

A complete report including “fatal” and “non-fatal” errors as well as format information can be sent to an external printer or computer through the rear panel serial port.

Using a Printer with the SA-1

To send a time code report to a printer, connect it to the RS-232 port, turn it on and set it so that it is ready to print (“on line”).

If you are using a parallel printer, you need to connectit through a serial to parallel converter. If using a serial printer, connect it directly to the SA-1

When you play time code into the SA-1, a report is immediately initiated (see time code report on page 12).

The header is first printed, as well as the format, the video reference information and the start time.

The SA-1 then prints the title “address errors” and waits for errors to happen. As soon as they occur, the faulty address and a description of the error is printed.

An end of report is printed automatically when time code is interrupted for at least 5 seconds. This includes a summary and the end time. In the summary, the SA-1 reports general comments such as Time Code properly synced with Video (or not) and non standard formats such as Color Framed Code not synced with Video or 25 Drop code etc...

Both serial and parallel printers can be used with the SA-1. However, you should use the kind of printer that prints one line at a time such as dot matrix printers and not full page printers such as laser printers.

If you want to use a laser printer, you should first send the report to a computer, as described below, then send the report from the computer to the laser printer. This would also allow you to customize the report, if needed, by adding information such as the date, the name of the studio, the name the client, etc...

Using a Computer with the SA-1

1. Connect the SA-1 to a serial port of your computer (see page 2 for wiring information). On the Mac, you can use the Modem or the Printer port.

2. Launch any communication program (i.e. modem program), set your computer for direct connection (not through phone connection), select the proper serial port and set the speed and format as follows:

Transmission speed:	9600 baud
Bits per character:	8
Stop bits:	1
Parity:	None

3. The procedure to send a report to a computer is identical to the one for a printer:

- As soon as you play time code into the SA-1, a report appears on the screen
- If any errors are detected, they will be reported as they occur.
- An end of report will automatically be generated as soon as input is interrupted for at least 5 seconds.

Time Code Report

The time code report includes 7 sections:

1. Header

Line 1: BRAINSTORM SR15+ VER #.##
Line 2: TIME CODE DISTRIPALYZER
Line 3: TIME CODE REPORT

2. Format:

Frame count & drop status :
24, 25, 30 Drop Frame or *30Non Drop*
Color bit status: reported only if active :
Color Bit active
Parity bit status: reported only if active:
Parity bit active
User Bits format:
User Bits: HEX or *ASCII*
User Bits message:

first UB message detected is printed

NOTE: If SA-1 had to switch to the alternate setting to read time code (see "Proper bit width" on page 6), the following message is printed just above the "Format" heading:

Alternate bit width window

3. Video Reference

If video is present, the SA-1 reports which bit of time code is lined up with "V" drive (video field 1 line 5) 3 seconds after time code is detected (to allow for ramp up time);

if video is not present, the SA-1 reports: *Video not present.*

4. Start Time

First valid Time Code address.

5. Address Errors

The SA-1 prints the title "*ADDRESS ERRORS*", then waits for errors to occur. As soon as an error is detected, the faulty address and the error description are transmitted.

6. Summary

When input is interrupted for 5 seconds, an end of report is printed which includes the following:

Video Sync (if video reference was present):

code properly synced
code resolved but out of phase
code non synchronous

Non-standard formats (if applicable):

24DF
25 DF
non synchronous color code
Undefined bit set

7. End Time

The last valid address is printed at the very end of the report.

BRAINSTORM SR-15+ Ver 3.05
Time Code Distripalyzer
TIME CODE REPORT

Alternate Bit Width Window

*** FORMAT ***
30 Drop Frame
Color Bit active
User bits: HEX
01234567

*** VIDEO REFERENCE ***
Present
"V" drive at bit 79

*** START TIME ***
01.00.00.00

*** ADDRESS ERRORS ***

01.12.36.05	Drop out
01.18.41.23	Bad bits: 28
01.18.41.27	Frame repeated
01.23.45.07	Code stopped

*** SUMMARY ***

VIDEO SYNC: Code Properly Synced

*** END TIME ***
01.23.45.07
END OF REPORT

Time Code Report

Section 3: Application notes

As a general rule, it is always better to know about time code problems early rather than late in a project. More options are available early on to fix the problem and if it cannot be fixed and you have to start over, at least less time has been wasted.

Here are some specific suggestions regarding the use of the SA-1:

1. When striping a tape, run time code through the SA-1

Don't take your time code generator for granted. Maybe you didn't set it properly, maybe one of the LED's is broken, maybe the instructions are not clear, maybe it is broken. There are plenty of good reasons why your generator could generate something different than what you wanted.

Patch the output of your time code generator into the SA-1 and the SA-1's loop into your tape machine. Through the SA-1 you can monitor your generator. At this stage, if there are any errors, you only have to re-stripe correctly to fix the problem. It could be a lot worse if discovered later...

You can even print a report during recording by analyzing the recorded time code off the playback head. The report will show any problem with the generator or with the recording.

2. Print a time code report from pre-striped tapes

When working with a pre-striped tape, you should run this time code through the SA-1 and print a complete report as soon as possible, preferably before you even start the session. See if the format is correct, check the video phase and make sure there are no drop outs or any other type of errors.

If a client brings a tape with faulty time code to your studio, he will usually blame your equipment for the sync problems and it can be very frustrating. The time code report ends any argument before it is even started.

If you are a composer and you receive a work copy from a transfer house, you can save a lot of aggravations by finding out about non-synchronous time code before you record any music.

If you do not have time to run the tape through the analyzer before the start of the session, make sure that the time code is running through the SA-1 during the session.

4. Align your VCR's address track

You can align the address track on your VCR by connecting the address track time code and the video signal into your SA-1.

Select "video ø" on the reader selector switch and move the address track head until you read" bit 00"; then move it back a little and stop as soon as you read "bit 79". This way, the trailing edge of bit 79 will be aligned with F1L5 (see figure 4 on page 18).

WHAT TO DO ONCE YOU DISCOVERED A PROBLEM?

There are many different types of problems that can occur with time code. Many times, the solution will depend of how early in the project it was discovered. Following are some very general suggestions

Problems	Solutions
Time code is synchronous but out of phase with video	Use a delay line to delay time code until the phase display reads "bit 79"
Time code is non synchronous with video	Generate new time code referenced to video
There is a hole in the time code track (i.e. accidental punch in)	Use a time code generator set to jam-sync and regenerate new code
Repeated frame or missing frame	Regenerate new time code
The wrong time code format was recorded	Regenerate new code with a generator that can do format conversions

NOTE: Many of the problems listed above can be solved with the **Brainstorm SR-3 Time Code Repair Kit**. For more information, call your Brainstorm Electronics dealer.

Appendix A: Time Code Error Messages:

"Fatal" errors are the ones considered serious enough to cause a synchronization problem. All "fatal" errors are reported on the front panel and activate the buzzer and the relay; "fatal" and "non fatal", both appear on the report, with their corresponding time code address.

FATAL ERRORS:

(fatal errors are reported on the front panel as shown in parentheses)

Drop out ("DROP OUT"):
Interruption of time code for less than 1 second. Level has to fall below input threshold of -30dB.
Code Stopped ("CODESTOP"):
Interruption of time code for more than 1 sec.
Repeated Frame ("DISCONT"):
Same frame address detected twice consecutively.
Discontinuous address ("DISCONT"):
Any non continuous address (either ascending or descending)
I**nvalid Address** ("INVALID"):
Any non valid number such as 39 frames or 75 minutes.
Video Loss ("VID-LOST"):
Any interruption in the video signal.
Format Change ("FORM CHG"):
Change in the time code count.
Wrong number of frames dropped ("DROP X"):
Reports errors in Drop Frame format. Indicates how many frames were dropped.
Change in DF status ("DROP CHG")
Reported if DF flag changes.
Change in Color status ("COLR CHG")
Reported if Color flag changes.

NON FATAL ERRORS:

(some of these messages are not errors but just changes)

Bad Bit: XX
Any bit wider or narrower than ± 25% of time code specifications. XX indicates the number of bad bits for that frame.
Bad Sync Word
Reported if no Sync Word was detected after 256 bits.

Code not in Sync with Video
If time code slips by more than 2 bits with respect to video"V"drive.
Undefined Bit Set
Reported if one of the undefined bits is set (SMPTE: bit 58 / EBU: bits 10 & 58).
Alternate bit width window
Reported if the SR-15+ had to go to this setting in order to read time code (see pg 6).
Change in User status
Reported if UB flag changes.
User Bit Change
If User Bits messages change, the first 30 different messages are reported. After that, the SA-1 disregards any change until reset.
External trigger in
Reported with its coinciding time code address, when tip and sleeve of the 1/4" input jack are shorted.
Code Restarted
Follows a "Code Stopped" message. Indicates where time code reappeared.
Video Restarted
Follows a "Video Loss" message. Indicates where Video reappeared.
Still Frame:
Reported if the same address is detected consecutively, 3 times or more.

Appendix B: More on the Frame Rate Counter...

Since the least significant digit's (LSD) resolution is ± .01 frames per second (.033%), any wow, flutter or speed variation of your time code source is easily detected.

a. Time code generators generally display a very steady frame rate with no fluctuation, whether on internal crystal, external video or tone reference. A ± one LSD fluctuation probably would not cause any problems.

b. Analog tape machines have typical wow/ flutter speed specifications of ± .03% to ± .1% (or more). Therefore a fluctuation of 2 (or even 3) LSD is normal. Machines like the Sony APR-24 or Otari MTR-90 are quite stable and may only move 1 LSD every 5 to 10 sec.

c. 3/4" VCR's have wow/ flutter specs up to .3%. They can therefore fluctuate almost .1 frame; the address track is usually more stable than the 2 audio tracks. However a machine in good condition usually fluctuates less than ± .1 frames.

Appendix C: More on the video phase display...

When the SA-1 detects F1L5 (actually F1L4 ½ as detected by the LM1881 video sync detector), it looks at which bit is in the time code working register. The number of that bit is displayed in the video phase window. However, the highest resolution of time code is one bit which is about 417 µsec. while a video line is about 63 µsec. This means that there are approximately 6 ½ video lines per time code bit.

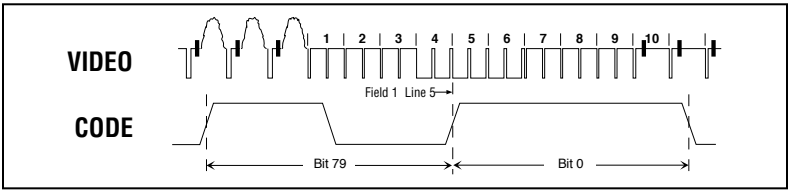


Figure 4. Proper alignment of video and time code

Appendix D: Longitudinal bit assignment:.

Each word of LTC is divided into 80 equal segments called bits, numbered 0 to 79. These bits are mainly grouped by four into Binary Coded Decimal words to form decimal numbers (0 to 9). Twenty six of these bits are assigned to the Time Address information (frames, seconds, minutes and hours); thirty two are assigned to the Binary Group information (user bits); sixteen are used for sync (sync word) and the remaining six are used for flags or are still unassigned.

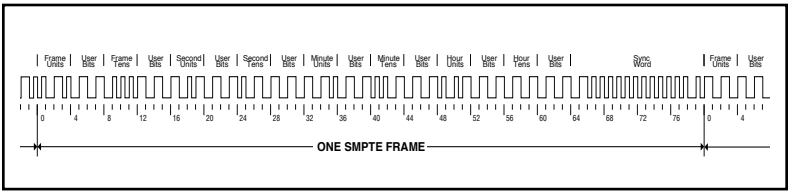


Figure 5. SMPTE Word
Address: 05:38:14:29 - User Bits: 00000000 - drop & color flags set

SMPTE has a frame rate of 30 fr/s and EBU 25 fr/s but both time codes have the same 80 bits per word. Most bits are the same but some of the flags are different.

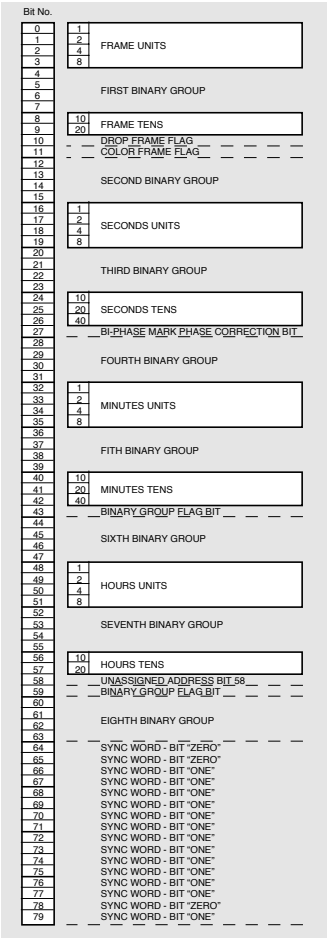


Figure 6. SMPTE longitudinal bit assignment

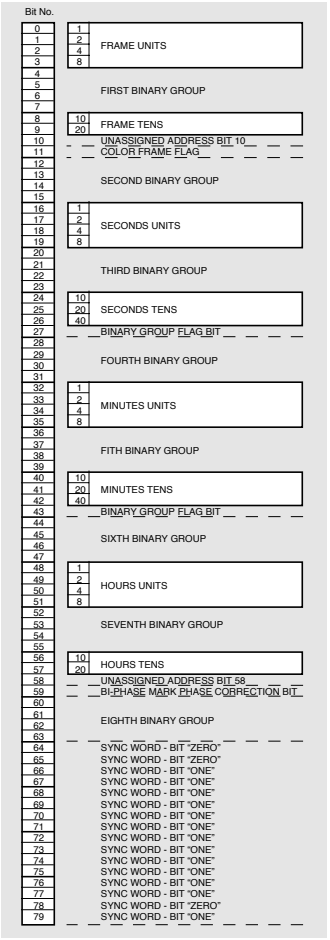


Figure 7. EBU longitudinal bit assignment

Specifications

Time Code Reader:
8 digit display - character height: .12″
Speed range: reads at play speed only (± 25%)

Frame Rate Counter:
4 digit display - character height: .12″
Reading range: ≈ 21 to 39 fr/sec
Display accuracy: ± 20 ppm plus ± ½ the least significant digit
Resolution: .01 Fr/sec
Update rate: 4x per sec.

Connectors:
1/4″ Jack (2): time code in & loop
BNC: Video In
DB-9M: Serial port
2.5mm jack: Power inlet (center pin hot)

Termination switch: 75Ω to ground - for Video In

Power: 6 - 9 VDC

Dimensions: 5″ x 1 ½″ x 5 ¼″

Other Brainstorm Products

SR-15+ Time Code Distripalyzer

Combines 3 units in a single space 19" chassis: a time code analyzer, a 1x5 Time code distributor (w/reshaping on all 5 outputs) and a pilot tone stripper. The analyzer identifies time code format, detects errors and monitors video sync and color field alignment. A comprehensive report can be sent to a printer or computer via the parallel and RS-232 ports.

SA-1 Time Code Analyzer

Same analyzer as the one found in the SR-15+, in a small portable package (same as the SR-3). It operates on an external 6VDC supply and can be used with a battery pack.

SR-26 Dual Time Code Distributor / Reshaper

Cleans up time code and distributes it through 6 individually buffered outputs. Can be used as 2 separate units: 1x4 (master) + 1x2 (slave) or as a single 1x6 unit - Same reshaping circuitry as the SR-1 with individual output level controls & switchable output rise times.

SR-1 Time Code Reshaper

Cleans up unreadable code by eliminating distortions and level fluctuations. Low input threshold (better than -30db) - Reshapes in fast forward and rewind modes - Balanced or unbalanced input and output - Adjustable output level - Switchable output rise time (SMPTE/EBU/square wave).

SR-2 Frame rate counter

Same unit as the SR-1 with a 4 digit counter that reads the incoming time code's frame rate. Ideal to identify the code's format and verify it's stability - Very accurate counter (4 updates per second) also shows potential problems such as wow and flutter or jitter.

TB-4 Communicator System (wireless talkback remote)

A high-performance infrared remote that allows the producer to activate the console's talkback from anywhere in the control room - 4 switchable talkback functions - Rechargeable transmitter - No aiming necessary - Easy to install - Includes transmitter and receiver.

For more information on these products, contact your Brainstorm Electronics dealer.

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