# BRAINSTORM
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SR-2
TIME CODE
FRAME RATE COUNTER

The SR-2 is a Frame Rate Counter designed for the Brainstorm Time Code Refresher model No. SR-1. It is available already installed in the SR-1 as the SR-2 (with 1/4" jacks) or the SR-2X (with XLR connectors). It is also available as a kit (SR-2K) to be installed into an SR-1.

SR-2 (Top)

3
2
1

SR-1 (Bottom)

C12

CR8
CR9

R1

CR1

CR2
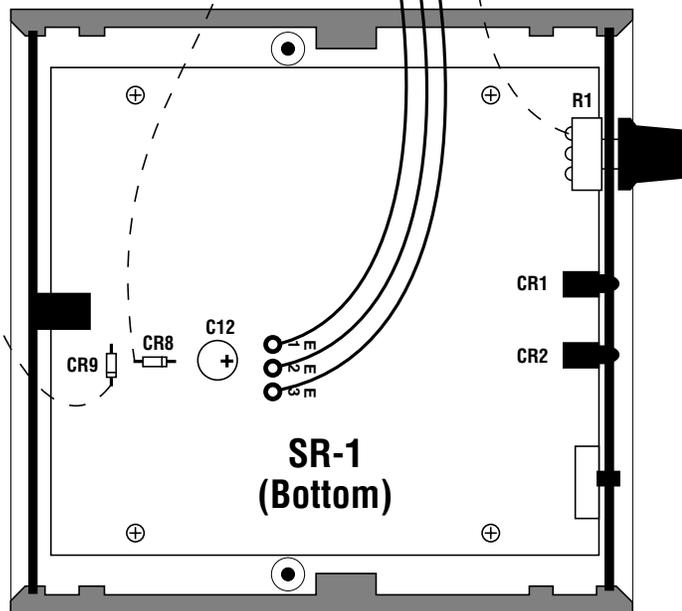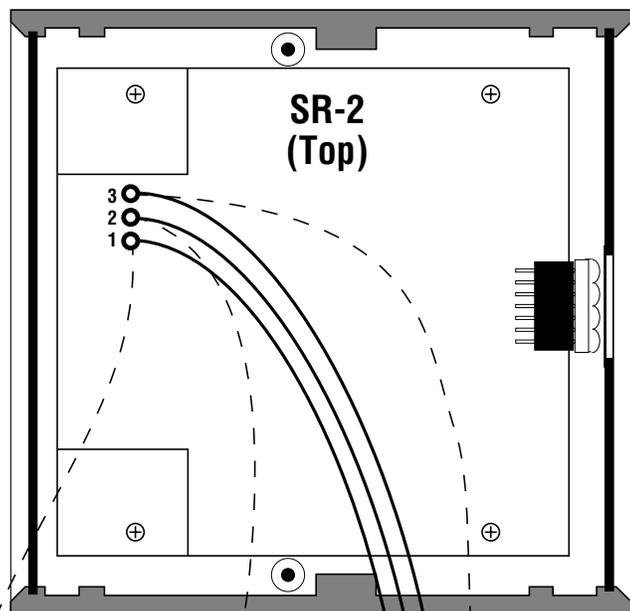
1. SR-2K INSTALLATION

If you purchased the SR-2 already installed in an SR-1, skip to the next section. If you are upgrading your SR-1, follow these instructions. The SR-2K should be installed by a qualified technician.

1. Disconnect power and open your SR-1.

2. Remove the 4 screws holding the SR-1 circuit board to the chassis and pull it out of the chassis. Remove the front panel knob by pulling it straight out. If it resists, gently pry it with a flat bade screwdriver. Unscrew the nut around the shaft of the pot and remove the front panel.

3. Remove the 2 front panel LED's CR-1 and CR-2. You can cut them or de-solder them.

4. Place the SR-2 front panel in place of the original SR-1 panel. Screw the nut back on the shaft of the pot and put the knob back in its place.

5. Some early models of SR-1 were shipped with a 47μf capacitor at C12. If this is the case of your unit, change that capacitor to a 470μf @ 16v electrolytic (supplied with the SR-2K). CAUTION: Do not reverse its polarity.

6. Place the SR-1 circuit board back in the bottom half of the chassis with the front and rear panels in place and screw it to the 4 stand-offs.

7. Place the SR-2 circuit board in the top half of the chassis with the display facing the front of the unit and screw it to the 4 stand-offs.

8. Connect the three wires between the 2 circuit boards as shown on the drawing at left.
NOTE: Some early models of SR-1 do not have the 3 pads marked E1, E2 and E3 on the drawing at left. For those models, connect it as follows (see dotted lines on drawing):
Pad 1 (red) to the cathode of CR9 (+12VDC).
Pad 2 (green) to the anode of CR8 (ground)
Pad 3 (yellow) to the top of the pot R1 (signal),

9. Close the chassis and screw it back together.

When first turning power on, the display shows all zeros (00.00). Then, when you play time code into the SR-2, it will show the code's frame rate.

2. OPERATING INSTRUCTIONS

1. Plug in the 12VDC adapter supplied with the SR-2. The display indicates all zeros (00.00).

2. Play time code into the SR-2. The display now shows the frame rate of the incoming time code.

3. Follow the SR-1 instructions for time code reshaping.

3. HOW THE SR-2 WORKS

The SR-2 strips the bit clock from the incoming time code and displays it as frame rate in frames per seconds. Since there are 80 bits per frame, the standard rates are:

    2,400 bits / sec .... 30.00 fr / sec
    2,397.6 bits / sec .... 29.97 fr / sec
    2,000 bits / sec .... 25.00 fr / sec
    1,920 bits / sec .... 24.00 fr / sec

However, the SR-2 is not limited to preset numbers. It displays accurately any rate from approximately 21 to 39 frames per second within .01 fr/sec.

4. FRAME RATE VS. FORMAT

The SR-2 displays the code's frame rate, not its format. There is a distinction. The format defines how many frames are in one time code second. It is a way of counting: at a format of 30 fr/sec, the frame sequence will be: 28, 29, 00, 01, 02 etc...; at 24 fr/sec, it is 22, 23, 00, 01 etc... and at 25 fr/sec: 23, 24, 00, 01 etc...

Usually, if the tape machine is running at the right speed, the frame rate will match the frame count (i.e. 24 fr/sec format normally runs at a frame rate of 24 fr/sec.). But if the tape speed is off, the frame rate will change: if the tape machine is running 5% too fast, a format of 30 fr/sec would have a frame rate of 31.50 fr/sec.

But sometimes the frame rate is not supposed to match the frame count: NTSC color time code is actually 30 fr/sec format with a rate of 29.97. When generating 29.97 code, the generator pulls down the frame rate by .1% from 30 to 29.97. But the format or frame count remains 30 fr/sec.

This means that there wouldl be a discrepency between the time displayed on the time code reader and the time displayed on a real time clock. To compensate for this, Drop Frame Time Code was invented, a format where some frames are "dropped" (108 frames per hour).

Drop Frame is just another way of counting how many frames are in a time code second. But Drop Frame is not the equivalent of 29.97. There are 4 possible drop frame combinations: 30 drop, 30 non drop, 29 drop and 29 non drop. So if the SR-2 reads 29.97, do not automatically assume this is drop frame time code.

MORE ON THE FRAME RATE COUNTER...

The SR-2 counter is updated 4 times per second. 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 more stable than the 2 audio tracks. However a machine in good condition usually fluctuates less than ± .1 frames.

COUNTER SPECIFICATIONS

Reading Range:	Approx. 21 - 39 fr/sec
Resolution:	.01 fr/sec
Time base accuracy:	± 20 ppm
Display accuracy:	± 20 ppm plus ± ½ LSD
Counter update rate:	4 x per second (w/ auto zero)

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