# LEAMING SG-100
# BTSC STEREO GENERATOR

INSTRUCTION BOOK
IB 097100-01 A



**LEAMING INDUSTRIES**
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## 1.0 INTRODUCTION TO THE SG-100

The SG-100 BTSC Stereo Generator provides an economical and space-efficient means of generating high-quality stereo TV audio. The SG-100 uses the U.S. broadcast-standard BTSC format. This generator utilizes dbx® companding and generates a BTSC stereo composite multiplex signal from Left and Right baseband audio inputs.

A Bessel-null calibration test tone is built-in to ensure a simple and accurate setup.

A SAP carrier input is provided; the SG-100 may be used with the Leaming SAP-1 Second Audio Program Generator.

## 2.0 INSTALLATION

Refer to the CONNECTIONS drawing at the end of this book for an illustration of how the SG-100 hooks to the other components in the system.

### 2.1 AUDIO INPUT

The SG-100 requires left and right audio input signals. For signals from a balanced source, run a pair of shielded two-conductor cables, one from the right channel of your program source to the right channel audio input of the SG-100. Run a second audio cable from the left channel of your source to the left input of the SG-100. Be sure that the "+" goes to the "+", and the "-" goes to the "-".

For signals from an unbalanced source, connect the high to the "+" and the shield to the "-". Also, tie the "-" to the "G" (Ground) terminal if the two chassis are not otherwise electrically grounded to each other.

### 2.2 VIDEO LOOP IN-OUT

The SG-100's "VIDEO LOOP IN" must be connected to a source of clean video (not scrambled video).

1) Run a coax cable from the video source to the connector marked "Video Loop In" on the SG-100.

2) Run another coax cable from the "Video Loop Out" on the SG-100 to the "Video In" on the TV modulator or scrambler.

### 2.3 BTSC STEREO MULTIPLEX FEED TO TV MODULATOR

The SG-100 provides a composite baseband output.

Verify that your TV modulator is capable of accepting a baseband BTSC composite stereo audio signal. Some modulators require modifications to pass a BTSC stereo signal at baseband. For example, the 75 microsecond pre-emphasis used for mono audio, and any audio limiting, if present in the 4.5 MHz modulator, must be removed. The modulator must have a wide (100 kHz) "audio" bandwidth. Please contact your TV modulator manufacturer for proper setup or modification instructions. In many cases, this may be accomplished by moving a few jump-jacks in the broadband audio modulator.

Run a shielded audio cable from the "BTSC Out" (Composite Multiplex Output) on the SG-100 to the "Audio In" on the TV modulator.

### 2.4 VIDEO SCRAMBLING

If you are using a baseband video scrambling system, be certain that you loop the video through the SG-100 before cabling the scrambler. The SG-100 will not function properly if it is receiving sync-suppressed scrambled video (i.e. the stereo pilot will not properly phase-lock to the horizontal sync of the video).

### 2.5 POWER/SYNC

Once the SG-100 is hooked up to the line voltage (115 V; 60 Hz), the front panel PWR/SYNC (green) LED should be lit. When fully illuminated, this LED indicates that power is present. However, the PWR/SYNC LED also indicates loss of video sync. When partially illuminated (dimly lit), this LED reflects the loss of video sync. If this is the case, recheck the cabling as specified in sections 2.2 through 2.4 and/or check the video source. With everything installed and functioning properly, the PWR/SYNC LED should be fully illuminated.

## 3.0 OPERATION

### 3.1 SETTING THE AUDIO CARRIER DEVIATION

The aural carrier deviation must be set using the control on the TV channel modulator.

A 25 kHz deviation test tone generator (10.4 kHz) is built into the SG-100 to facilitate accurate set-up. The test tone is activated by the "TEST MONO STEREO" switch located on the front panel of the SG-100.

The 10.4 kHz tone and a spectrum analyzer can be used to perform a Bessel-null. This is the most accurate method of setting the deviation. As alternate methods, you may use the deviation meter, or the peak deviation (±25 kHz) light on your TV modulator.

When setting the aural carrier deviation, the audio program level must be at minimum while using the test tone. This may be done by rotating the audio level controls on the front panel of the SG-100 fully counter-clockwise.

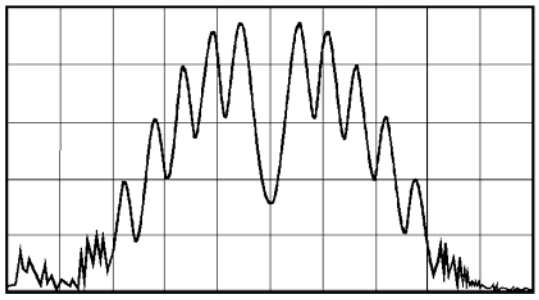
If you have a SAP generator, the SAP carrier must be off when setting the stereo deviation of the 4.5 MHz audio carrier. See section 3.3 to set the SAP carrier level, which must be done after the audio carrier deviation is set, as described in sections 3.1.1 and 3.1.2.

3.1.1 Using a Spectrum Analyzer & Test Tone:

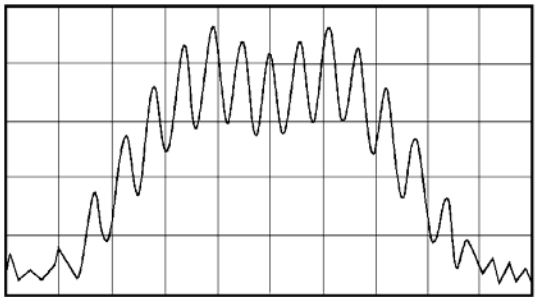
1) Reduce the audio program input to minimum.
2) If scrambling is being used, be sure that it is off or in the bypass mode.
3) Switch on the SG-100's test tone.
4) Observe the audio carrier at the output of the TV channel modulator with a spectrum analyzer.
5) Using the front panel deviation control on the TV modulator, null the carrier (See drawing 3-1A).

(For a clear picture, 20 kHz to 50 kHz resolution per division is suggested.)

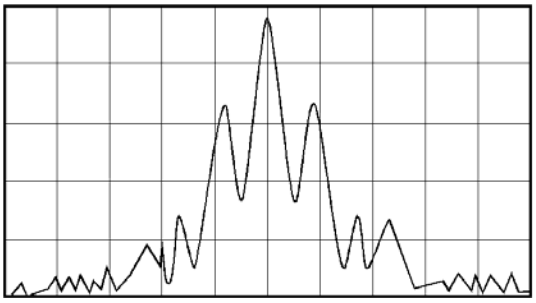
To verify that the deviation is adjusted correctly, check the amplitude of the 15,734 Hz stereo pilot sidebands relative to the audio carrier. To do so, set the test switch to the Stereo (right) position and, still with no audio program input, look at the audio carrier and both sidebands using the spectrum analyzer (one sideband will be 15,734 Hz above the audio carrier and another sideband will be 15,734 Hz lower than the audio carrier). If the deviation is properly adjusted, the two sidebands should be 16 dB down from the carrier. Refer to drawing 3-2. If they are not, after repeating the Bessel-null procedure, service or internal alignment of the modulator or the stereo generator is indicated. To determine which, observe the composite output of the SG-100 with an accurate oscilloscope or an audio voltmeter. With no audio input to the SG-100 and with the "TEST MONO STEREO" switch in the "STEREO" position, the output should be a 15,734 Hz pilot at 0.5 Vp-p. Switch to "TEST", still with no audio program input. The output should now be 10.4 kHz at 2.5 Vp-p. The absolute voltages are not critical, but the 1:5 voltage ratio is critical. If this ratio is correct, the SG-100 is probably functioning satisfactorily.



Drawing 3-1A
Correct Bessel-null



Drawing 3-1B
Incorrect Bessel-null



Drawing 3-2
Main Audio Carrier with
Pilot Carrier Sidebands

3.1.2 Using a Meter on the TV Modulator:

1) Reduce the audio program input to minimum.
2) If scrambling is being used, be sure that it is off or in the bypass mode.
3) Switch on the SG-100's test tone.
4) Set the audio level control on the TV modulator to produce ±25 kHz deviation.

   NOTE: The audio deviation meter on the TV modulator will indicate up to 55 kHz during normal stereo operation and up to 70 kHz if SAP is also on.

3.1.3 Using a Peak Flasher Light on the TV Modulator:

1) Reduce the audio program input to minimum.
2) If scrambling is being used, be sure that it is off or in the bypass mode.
3) Switch on the SG-100's test tone.
4) Set the audio level control on the TV modulator to produce ±25 kHz deviation by increasing the deviation until the light comes on. Then, back it off until the light "just" goes off.

   NOTE: The audio peak flasher light on the TV modulator will flash during normal stereo operation, and more so if SAP is also on.

3.1.4 Alternate Method

If no suitable test equipment is available to help set the aural carrier deviation, as discussed above in steps 3.1.1 thru 3.1.3, or no deviation meter or peak flasher is available on your TV modulator, consult your TV modulator's manual for the procedure to set audio carrier deviation to ±25 kHz (by using the SG-100's built-in test tone).

## 3.2 AUDIO LEVELS

The SG-100 is equipped with a pair of level controls on the front panel: LEFT and RIGHT. Audio program levels are monitored with dual peak-reading 4-LED indicators.

Adjust the audio program levels (with a small flat-blade screwdriver) so the meters read approximately 0 VU (yellow LED) on average program peaks, and only rarely light the red +3 LEDs.

### SAP LEVEL SETTING

When running both stereo and SAP, it is important to first set the audio carrier deviation on the TV audio modulator in the stereo mode, with the SAP carrier off. Thereafter, that control must not be changed; the SAP carrier level must be set at the SAP generator.

The SG-100 is set to accept a SAP carrier at 1.5 Vp-p to produce ±15 kHz deviation of the audio carrier by the $5F_H$ (78,670 Hz) SAP carrier. Leaming SAP generators produce 1.5 Vp-p when their carrier level control is at mid-position. The actual SAP carrier level setting (and resultant deviation of the 4.5 MHz audio carrier) is not extremely critical, and has no effect on the SAP audio level (as the SAP channel carrier is itself frequency modulated by the SAP audio). A too-high SAP carrier level will result in a slight over-deviation of the main/stereo audio carrier. A too-low SAP carrier level will result in the SAP audio becoming noisy and dropping out. The correct SAP carrier level is that which deviates the 4.5 MHz audio carrier ±15 kHz. This may be observed with a spectrum analyzer; view the main audio carrier at any point in the transmission chain. The SAP carrier sidebands appear adjacent to the main audio carrier, one 78,670 Hz above, and the other 78,670 Hz below, each at a level 20 dB below the main carrier. It is easiest to observe this if the main audio is switched off and is in the mono mode, not stereo. Do not attempt to set the SAP carrier level with the SG-100 in the Test mode, as the main carrier will be down in a Bessel-null.

> NOTE: Any scrambling, if present, should be switched off while setting the audio carrier deviation.

## 4.0 SPECIFICATIONS

| | | |
|---|---|---|
| Frequency Response | | 20 Hz to 14 kHz, ±1 dB |
| Distortion | | 0.5% max THD |
| Separation | | >26 dB, 20 Hz to 13 kHz, typ. |
| Signal-to-Noise Ratio | | >65 dB |
| Pilot Protection | | >50 dB at 15,734 Hz |
| Test Tone | | 2.5 $V_{P-P}$ @ 10.4 kHz |
| Compressor, L-R | | dbx® licensed (BTSC Standard) |
| Input Level | (APL)<br>(PPL) | 0 dBm, adjustable ±10 dB<br>10 dB above APL |
| Audio Input Impedance | | 100 kΩ, balanced or unbalanced |
| SAP Input Level | | 1.5 $V_{P-P}$ into 10 kΩ |
| BTSC Stereo Baseband Out | | 5 $V_{P-P}$ into hi-z load = ±50 kHz aural carrier deviation (Source impedance = 75 Ω) |
| Controls (Front Panel) | | Input Levels, Left & Right<br>Test/Mono/Stereo switch |
| Indicators | | Program Level: Bar, 4-LEDs/chan.<br>Power/Sync Locked: Green LED |
| Connectors (Rear Panel) | | F-type standard; BNC optional<br>Video (sync) Input Loop<br><br>8-lug screw-terminal strip:<br>1. BTSC Stereo MPX Output<br>2. Ground<br>3. SAP Input<br>4. Audio Input, R+<br>5. Audio Input, R-<br>6. Ground<br>7. Audio Input, L+<br>8. Audio Input, L- |

| | |
|---|---|
| Size | 1.6" H x 5.5" W x 16.5" D.<br>Mounts on 1/3 of an RM-1 19" x 1-3/4" panel mount. (Also fits Leaming PMU-413 panel mount.) |
| Weight | 3.2 lb. (7 kgm) |
| Power | 105-125 V, 50-60 Hz AC, 10 W. |