

**LEAMING SAP-1 and SAP-2**  
**SECOND AUDIO PROGRAM GENERATORS**  
INCLUDES SAP/R with SUBCARRIER RECEIVER

INSTRUCTION BOOK  
IB 9161-01D

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## QUICKSTART

If you are familiar with BTSC standards and SAP generators, perhaps these brief hints will be enough to set up your SAP generator. If not, refer to the following pages, which cover the subject in greater detail.

1. Connect power:

All versions of the SAP generator require external DC power, either +18 V regulated, or +24 V regulated/unregulated. Either voltage may be selected internally by (re)positioning a jumper. See Section 2.3.

The SAP-1 is normally shipped set up to operate from +24 V, provided by any general-purpose power supply, such as the Leaming PS 420.

The SAP-2 is normally shipped set up to operate from +18 V, as supplied by the Leaming MTS-2 or MTS-3 series.

2. Connect video sync:

to SAP-1 connect VIDEO LOOP.

to SAP-2 from Leaming BTSC generator (MTS-2 or -3 or -4).

3. Connect SAP subcarrier output to main TV audio modulator:

for SAP-1, to BTSC-compatible (mono) modulator.

for SAP-2, to Leaming (or compatible) BTSC stereo generator.

4. Connect audio program input(s).
5. Set SAP subCARRIER LEVEL/4.5 MHz deviation.
6. Set AUDIO LEVEL(s).

## LEARNING SAP/R OPERATING INSTRUCTIONS

**ADDENDUM:** To be used in conjunction with the full SAP instruction book

**INTRODUCTION:** The SAP/R is a standard Learning SAP generator to which has been added a subcarrier receiver on a sub-board. All features of the standard SAP generator remain, and the audio input to the A/SAP channel is internally connected to the subcarrier receiver. The receiver may be factory-configured for any frequency between 4.5 and 8.5 MHz.  $\pm 25$  kHz or  $\pm 50$  kHz deviation, with sliding de-emphasis, is standard.

**CONNECTIONS:** The audio subcarrier is carried along with the composite video delivered by the satellite receiver. This signal is to be connected to the INPUT of the VIDEO SYNC LOOP, a pair of "F" jacks on the rear panel of the SAP/R. The VIDEO SYNC LOOP, OUT, must be resistively terminated, if not connected to the input of any other unit requiring composite video.

The SAP/R is to have its power connected as described in Step 1 of the Quickstart section of the full SAP instruction book (see page 2).

Quickstart Step 2 is modified slightly; the VIDEO LOOP must be connected to composite video with subcarriers, not low-passed or sync-clamped video.

Quickstart Step 4 is also modified slightly; since the SAP channel gets its audio from its internal subcarrier receiver, the A/SAP audio input connector on the rear panel of the SAP/R should be unused, to avoid interfering with that signal. The B/MAIN audio input may be used normally.

Steps 3, 5, & 6 apply directly.

**RECONFIGURING:** The SAP/R may be used as a standard SAP generator, with direct audio input, by disconnecting the SAP/R receiver. This is done by simply repositioning the three jumper plugs to the front position on the sub-board, accessible by sliding back the top cover of the SAP/R.

Two of these jumpers connect/disconnect the audio output of the sub-board to the main SAP board. A third jumper, near the center of the sub-board, connects a carrier mute signal; when the specified audio subcarrier is not present on the video, the 5H (78,670 Hz) SAP carrier is switched off, if the jumper is installed. In certain applications, it may be desirable to provide a SAP carrier even in the absence of the desired audio subcarrier. In this case, the mute jumper plug should be disconnected. The subcarrier receiver will still mute its audio signal output upon subcarrier loss, but it will not mute (switch off) the 5H SAP carrier to the TV audio modulator. In any case, whenever an external SAP audio input is used without an audio subcarrier present, the mute jumper must be removed.

**TROUBLESHOOTING:** The subcarrier receiver is factory-tuned to a specified subcarrier frequency; no field-adjustments of the subcarrier receiver are recommended. If no audio is delivered:

Check that the composite video carrying the audio subcarrier is connected to the VIDEO SYNC LOOP INPUT;

Check that the A/SAP level control is rotated clockwise;

Check that the A/SAP - B/MAIN selector switch is in the A/SAP position;

Check that the SAP CARRIER switch is ON. (The green SAP carrier indicator should illuminate within one minute of power being applied and within a few seconds of the subcarrier being detected, if the front-panel CARRIER switch is in the ON position.)

Check that the internal Squelch control (a blue trimmer potentiometer adjacent to the green LED, to the right of the LM 3189, and toward the edge of the sub-board) is positioned sufficiently clockwise to unsquelch the receiver and permit the SAP carrier to switch on.

**LEARNING SAP-1 AND SAP-2  
SECOND AUDIO PROGRAM GENERATORS  
BTSC Format, dbx \ Companded**

**1.0 INTRODUCTION:**

The SAP-1 and SAP-2 are similar. Both are designed to encode a monaural audio signal into the standard BTSC format for use as a Second Audio Program channel for television transmission. Typical uses include transmission of second language programming, local radio stations, weather reports, and FSK data. The SAP-1 and SAP-2 differences are noted here.

**1.1 SAP-1:**

Two program-audio inputs are provided on the SAP-1; one for the SAP program and another for the MAIN (mono) program. A separate level control is provided for each input. The MAIN and SAP inputs are processed and combined into a composite multiplex signal which is sent to a wideband TV audio modulator. The SAP-1 feeds its SAP output to either of two inputs on the TV audio modulator, depending on the application:

- 1.1.1 Any BTSC-compatible wideband TV audio modulator may be used, if it is configured for BTSC SAP, which is the same configuration used for BTSC stereo (75  $\mu$ S pre-emphasis and 15 kHz low-pass defeated).

The SAP audio program is connected to the SAP generator, and the Main (mono) audio program is routed to the second audio input of the SAP-1, where it is pre-emphasized and mixed with the SAP program's subcarrier. Feed the output of the SAP generator to the wideband input of the TV audio modulator.

- 1.1.2 Alternatively, if the TV audio modulator (mono or stereo) is equipped with both a Main audio input and a SAP (or Auxiliary) subcarrier input, those inputs would normally be used. In this case, the Main audio program would not be connected to the SAP-1, but only to the primary input of the TV audio modulator. The SAP audio program would be connected only to the SAP-1, as usual. The output of the SAP-1 feeds the SAP (or Auxiliary) subcarrier input of the TV audio modulator.

The SAP-1 obtains its sync lock from baseband video, which may be looped-through to a video modulator or scrambler.

**1.2 SAP-2:**

The SAP-2 has two baseband audio inputs, A and B. The dual inputs permit switching to an alternate audio source, such as a local commercial, on the SAP channel. The alternate signal is selectable by either a front panel switch, or by remote control (contact closure to ground). Individual level controls are provided for each input.

The output of the SAP-2 feeds a dedicated SAP input on a companion BTSC stereo generator, such as the Leaming MTS-2, -3, or -4 series generators. There it is mixed with the BTSC stereo signal. This composite audio modulates the 4.5 MHz audio carrier, either within the BTSC stereo generator, or at an external wideband audio modulator in the TV channel modulator (depending on the BTSC stereo generator/TV modulator interface).

The SAP-2 obtains its video sync from its companion BTSC stereo generator.

## 2.0 **INSTALLATION, SAP-1 and SAP-2:**

Mount the SAP generator onto a Leaming PMU 401 rack adapter panel. The SAP-1 & -2 (and the PS-420 power supply) are each enclosed in extruded aluminum enclosures, and each occupies 1/3 of a Leaming PMU 401 19" panel mount (1-3/4" high). Connect Sync, Power, Audio Input, and SAP Subcarrier Output lines as follows:

**2.1 VIDEO SYNC LOOP IN-OUT (SAP-1 only, "F" connectors):** Connect the video (before scrambling) thru the SAP-1's video loop. This is a hard-wired loop with a high-impedance tap into the SAP-1, used to synchronize the audio subcarrier with the horizontal sync.

**2.2 THE AUDIO AND POWER CONNECTORS** on the SAP generator are a combination plug/screw-terminal type. To wire the connector, simply pull the body of the connector straight back, off the plug inside the chassis. Strip the insulation off the signal wires (approx. 3/16"), slip the wire into the clamp, and tighten the screw. After the wires have been secured, replace the connector body on the plug.

The SAP generator uses four separate connector blocks. To avoid possible connector damage, observe pin/body alignment when installing. The connector groups and pin assignments are noted on the chassis. They are as follows, as observed from the rear of the chassis:

**2.3 POWER INPUT/REMOTE CONTROL BLOCK:** Uses a 6-pin connector: Pin assignments are:

Pin 1; SYNC INPUT: Connect with shielded cable to sync output from Leaming BTSC stereo generator, unless using Video Loop on SAP-1 for sync.

*NOTE:* Connect only one video sync input to the SAP-1; either the Video Loop, or a Leaming stereo generator's stripped sync. If both were connected, the stripped sync would feed back onto the video line, causing interference.

Pin 2; GROUND: Connect to power supply 0 V. (Ground). Also connect to shield on sync cable if using pin 1.

Pin 3; POWER INPUT (+V): Connect a source of positive voltage to the SAP generator.

*NOTE:* All Leaming SAP generators may be powered by either +18 V or +24 V, selected by a jumper jack under the top cover of the SAP-2. The jumper, near the LM317T voltage regulator (at the right rear), is to be disconnected to operate from +24 V. To operate from +18 V, connect a jumper across the two pins. The SAP-1 is normally shipped set to operate from +24 V. This may be derived from a Leaming PS420 power supply, which may be mounted onto the same PMU 401 panel as the SAP-1.

The SAP-2 is normally shipped set to operate from +18 V, derived from certain Leaming BTSC stereo generators, such as the MTS-2 or MTS-3 series. Smaller stereo generators, such as the MTS-4, cannot deliver sufficient power to operate a SAP generator.

Pin 4; GROUND: Connect as convenient for remote controls.

Pin 5; REMOTE ON (SAP SUBCARRIER ENABLE): Connect (to ground via external switch) if remote SAP subcarrier on-off control is desired. The normal mode is Carrier Off with the remote line open (or at +5 V).

Pin 6; REMOTE A/B SELECT (SAP-2 only): Connect (to ground via external switch) if remote A/B control is desired. The normal mode is Input A selected with the remote line open (or at +5 V).

*NOTE:* Grounding the respective remote control line selects the alternate mode, SAP Subcarrier On and/or Input B, only if the respective switch on the front panel is in the Remote (center) position.

The remote ground may be made by hard-contact switch or relay, or by any suitable solid-state device which can pull a 10 k-ohm line from +5 V to within 2 V of ground, and release it with over 100 k-ohms.

- 2.4 **SAP SUBCARRIER OUTPUT:** Uses a 3-pin connector: 1, Ground; 2, High; 3, Low. (For optimum results, use twisted-pair cable with an overall shield).

The SAP-1's output, when used to process the MAIN and the SAP audio programs, must be connected to the wideband audio input of the main TV audio modulator. The TV audio modulator must be a wide-band type, set up in the BTSC mode (pre-emphasis defeated), even though no stereo is present.

The SAP-1's output, if used to process only the SAP audio, and not the MAIN (mono) audio, may be connected the same as a SAP-2: To a dedicated SAP or Auxiliary subcarrier input on a TV audio modulator.

The SAP-2's subcarrier output (78 kHz) should be connected to the SAP subcarrier input of a BTSC Stereo TV audio modulator, such as a Leaming MTS-2, MTS-3, or MTS-4 stereo generator.

- 2.4.1 If driving an unbalanced load, the High line carries the signal and the Low line is to be connected to the chassis (low) of the load (TV audio modulator). The shield should be grounded at the load end only, in order to minimize noise and ground loops.
- 2.4.2 If driving a balanced load, the shield normally should be grounded at both ends (source and load), in order to minimize noise.

- 2.5 **AUDIO INPUTS; A/SAP AND B/MAIN:** Each of these uses a 3-pin connector: 1, Ground; 2, High; 3, Low. (For optimum results, use twisted-pair cable with an overall shield). On both the SAP-1 and the SAP-2, the A input is used for the (primary) SAP program. Use of the B input differs:

The SAP-1 uses the B input for the MAIN (Mono) audio program, if any, which is mixed with the SAP subcarrier and applied to the wideband audio input of a BTSC-compatible TV audio modulator.

The SAP-2 uses the B input for an alternate SAP program, such as a local commercial.

- 2.5.1 If the signal source is unbalanced, the High terminal carries the signal and the shield is to be connected to the Low terminal. The Low terminal may also be connected to the ground terminal at the SAP generator, if necessary in order to minimize noise.
- 2.5.2 If the signal source is balanced, the shield normally should be grounded at both ends in order to minimize noise.



### 3.0 **SETUP CARRIER LEVELS/DEVIATION:**

3.1 **SAP SUBCARRIER ON/OFF AND INDICATOR:** Following connection of the sync, power input, and SAP subcarrier output lines, observe the green SAP CARRIER ON LED on the front panel of the SAP generator; when power is first applied, the SAP ON LED should be dark. If the SAP CARRIER switch is in either the ON or TEST position, the SAP ON LED should illuminate after a delay of approx. one minute or less, indicating that the SAP carrier has achieved lock and is coupled to the output. Thereafter, the SAP On LED should illuminate immediately whenever the SAP carrier is switched on from the front panel, or, if the SAP carrier switch is in the center position, by grounding the Remote line on the back panel. Any flashing of the SAP CARRIER ON LED should be investigated, as it will result in the user losing the SAP program whenever the LED is dark.

### 3.2 **SAP SYSTEM CHARACTERISTICS:**

The following is a brief introduction to the SAP channel and its interface to the TV audio modulator.

The SAP audio program frequency-modulates a 78 kHz subcarrier. That 78 kHz SAP subcarrier is added to the main program audio (either mono baseband, or BTSC multiplex stereo composite), and this combination of the main audio and SAP subcarrier frequency-modulates the 4.5 MHz audio carrier. The 4.5 MHz audio carrier is then combined with the video and further processed, but that is beyond what need be considered for an understanding of the SAP interface.

Notice that the 4.5 MHz carrier is being frequency-modulated by another FM carrier, the 78 kHz SAP subcarrier. This 78 kHz subcarrier is at a constant amplitude (because it is frequency-, not amplitude-, modulated by the SAP audio program). This causes a constant deviation of the 4.5 MHz main audio carrier, independent of the SAP audio program. The deviation of the 4.5 MHz carrier by the SAP subcarrier is arbitrarily set at  $\pm 15$  kHz. Significantly lower deviation would result in noisy SAP audio, and a higher deviation could cause the 4.5 MHz carrier to exceed its allowed band occupancy. Consequently, it is important to accurately set the deviation of the 4.5 MHz audio carrier by the SAP subcarrier, even though it has no direct effect on the transmitted SAP audio level.

3.3 **SETTING THE 4.5 MHZ AUDIO CARRIER DEVIATION:** The procedure for setting the deviation of the TV audio modulator's 4.5 MHz carrier varies slightly, depending on the specific hardware being interfaced. Section 3.3.1 details the procedure used with the SAP-1; the SAP-2 is covered in Section 3.3.2.

#### 3.3.1 **SETTING SAP CARRIER LEVEL/4.5 MHZ AURAL CARRIER DEVIATION WITHOUT BTSC STEREO (SAP-1):**

First, equipment configuration check. Verify that the TV modulator is a wideband type and that the 75 micro-second pre-emphasis has been defeated, just as for BTSC stereo.

Second, interconnection check. Verify that the SAP generator is hooked into the system as described in Section 2, as it will now be necessary to have SAP carrier output to the TV audio modulator, and DC power.

Third, 4.5 MHz deviation test signal. Learning SAP generators produce a 2.5 V p-p signal when the CARRIER switch is in the TEST position, and when the CARRIER LEVEL potentiometer is in mid-position (These controls are on the front panel of the SAP generator). The SAP generator must be connected normally in order to produce the test signal. Switch the SAP generator to the TEST mode.

Fourth, zero (kill) the audio programs on the channel (mono and SAP), if any are present.

Fifth, set the TV audio modulator's deviation (aural carrier deviation). With the SAP generator producing the TEST signal, adjust the TV audio modulator's deviation control to produce approximately  $\pm 25$  kHz, as indicated by the peak flasher LED on the TV audio modulator (Not the audio-level LED's on the SAP generator).

*NOTE:* This will appear on a spectrum analyzer as two sidebands 16 dB lower in level and equally spaced 78,670 Hz above and below the 4.5 MHz carrier.

*NOTE:* The TV audio modulator's deviation control is the one previously used to set the TV mono audio program level, prior to BTSC SAP. This "master" deviation control, once set correctly for BTSC SAP carrier injection levels, must no longer be used to change audio levels in the system, as the result would be incorrect deviation of the 4.5 MHz audio carrier by the SAP subcarrier. The audio levels must be controlled at (or before) the BTSC SAP generator.

Sixth, switch the SAP generator from TEST to SAP ON. The deviation of the 4.5 MHz carrier will drop to  $\pm 15$  kHz and the 78 kHz SAP subcarrier sidebands will drop to 20 dB below the 4.5 MHz audio carrier level on the spectrum analyzer (View with no audio programs present).

Seventh, set the SAP and MAIN (mono) audio program levels. Use the controls and meter on the SAP generator (See 4.3 below). This completes the setup.

*NOTE:* The original mono audio-only deviation indicator on the 4.5 MHz TV audio modulator will indicate "EXCESSIVE" DEVIATION, as it will be reading mono audio deviation plus the deviation caused by the SAP carrier. THIS IS NORMAL with SAP (or BTSC stereo) active; switching the SAP carrier off will produce a "normal" deviation indication from the mono audio alone.

To recap SAP 78 kHz Carrier Level/4.5 MHz Carrier Deviation  
Set without BTSC Stereo:

- a) Verify that the TV audio modulator is set for BTSC SAP (same as for stereo), not mono.
- b) Verify that the SAP generator is correctly connected into the system.
- c) Kill the mono and SAP audio on the channel, and use the TEST signal built-into the SAP generator. Set the aural carrier deviation control on the TV audio modulator to produce approximately  $\pm 25$  kHz deviation of the 4.5 MHz audio carrier, as indicated by the LED flasher, or a deviation meter, or a spectrum analyzer.

*NOTE:* This carrier level/deviation setting is to be considered permanent. It has no effect on SAP audio program levels, and should not be used for mono program level adjustment. Set audio levels with the appropriate controls and meter on the front of the SAP-1. Ignore the peak flasher on the TV audio modulator, as it will now be subjected to  $\pm 40$  kHz deviation during peak mono-plus-SAP periods. It was calibrated for  $\pm 25$  kHz=100% (peak) deviation in regular mono, so it will flash often when the SAP carrier is on.

- d) Switch the SAP-1 Carrier to SAP ON.

Then set the audio levels, using the controls and meters on the SAP generator (Described in 4.3).

### **3.3.2 SETTING THE SAP CARRIER LEVEL/4.5 MHZ AURAL CARRIER DEVIATION WITH BTSC STEREO (SAP-2 GENERALLY, BUT POSSIBLY SAP-1):**

First, equipment configuration check. Be sure that the BTSC stereo generator has been set up correctly. Follow the instructions provided with the stereo generator. (If the channel is already functioning in stereo, it may safely be assumed that this has been done.)

*NOTE:* If using an audio carrier generator external to the BTSC stereo generator, such as a wideband audio modulator in a TV channel modulator, the "master" deviation control, once set correctly for BTSC stereo injection levels, must never be used to change SAP carrier level, or any audio levels, in the system. The result would be drastically impaired stereo channel separation, due to incorrect deviation of the 4.5 MHz audio subcarrier level. The audio levels must be controlled at (or before) the BTSC stereo generator and the SAP generator.

Second, interconnection check. Verify that the SAP generator is hooked into the system as described in Section 2, as it will now be necessary to have SAP carrier output to the TV stereo audio modulator, and DC power.

Third, Aural carrier deviation test signal. Learning SAP generators produce a test signal when the CARRIER switch is in the TEST position (This control is on the front panel of the SAP generator). The SAP generator must be connected normally in order to produce the test signal. Switch the SAP generator to the TEST mode. Switch the stereo generator to MONO to kill the stereo pilot.

Fourth, zero (kill) all the audio programs on the channel (stereo and SAP), if any are present.

*NOTE:* SAP-1 and SAP-2 generators with serial numbers above 8904001 will automatically switch off the SAP audio in the TEST mode. However, the stereo audio program levels must be zeroed manually. (Do not place the stereo generator in its TEST mode, because that will produce an audio signal).

Fifth, set the SAP carrier level/audio carrier deviation. Use the CARRIER LEVEL control on the front panel of the SAP generator to set the 4.5 MHz audio carrier deviation to  $\pm 25$  kHz. If using an internal 4.5 MHz audio modulator built into a Learning BTSC stereo generator, and if no auxiliary aural carrier deviation meter is available, the correct SAP carrier level may be closely approximated by setting the CARRIER LEVEL control to half-rotation (12 o'clock). If using an external TV audio modulator, the peak flasher/deviation meter on the modulator should indicate  $\pm 25$  KHz deviation.

*NOTE:* The correct deviation of the 4.5 MHz audio carrier by the 78 kHz SAP carrier, when in the TEST mode, will appear on a spectrum analyzer as two sidebands 16 dB lower in level and equally spaced 78,670 Hz above and below the 4.5 MHz audio carrier.

Sixth, switch the SAP generator from TEST to SAP ON. The deviation of the 4.5 MHz carrier will drop to  $\pm 15$  kHz, and the spectrum analyzer display will show the 78 kHz SAP subcarrier sidebands 20 dB below the 4.5 MHz audio carrier level on the spectrum analyzer (View with no audio programs present).

Seventh, set the SAP audio program level. Use the control and meter on the SAP generator (See 4.3 below).

Eighth, switch the stereo generator to the stereo mode, and restore the stereo audio. Set the stereo audio levels, using the controls and meters on the BTSC stereo generator. This completes the setup.

*NOTE:* If using a 4.5 MHz wideband audio modulator external to the stereo generator, the deviation indicator on the TV audio modulator may indicate "EXCESSIVE" DEVIATION, as it will be reading stereo audio deviation plus the deviation caused by the SAP carrier. THIS IS NORMAL with either BTSC stereo or SAP active, and more so with both; switching the SAP carrier off, and the BTSC stereo to mono, will produce a "normal" deviation indication from the mono audio alone.

To recap SAP 78 kHz Carrier Level/4.5 MHz Carrier Deviation  
Set with BTSC Stereo:

- a) Confirm that the BTSC stereo generator was correctly installed, following the instructions which came with it.

*NOTE:* Leave the "master" aural carrier deviation control on any (external) TV audio modulator set per the procedure in the BTSC stereo generator instruction manual.

- b) Verify that the SAP generator is correctly installed.
- c) Switch the SAP-2 Carrier to TEST and the stereo generator to MONO (not TEST).
- d) Kill the stereo audio program levels (or stereo test signal), and kill the SAP program, if switching the SAP unit to TEST didn't do it. (Do not change the "master" deviation control setting on the TV audio modulator.)
- e) Adjust the 78 kHz SAP CARRIER LEVEL on the front of the SAP-1 to cause the 4.5 MHz TV audio carrier to deviate  $\pm 25$  kHz, as indicated by the LED flasher, or a deviation meter, or by a spectrum analyzer at the TV audio modulator. (78 kHz Sidebands down 16 dB from audio carrier in TEST, down 20 dB in CARRIER ON.)  
If using a Learning stereo generator, set the SAP CARRIER LEVEL control to mid-position. This will be very close to the specified  $\pm 25$  kHz test/ $\pm 15$  kHz run deviations.

*NOTE:* This carrier level setting is to be considered permanent. It has no effect on SAP audio program levels.

- f) Switch the SAP-2 Carrier from TEST to SAP ON. Set SAP audio levels with the appropriate controls and LED bar meters on the front of the SAP-2.
- g) Switch the stereo generator to STEREO. Set the stereo audio levels with the appropriate controls and meters on the front of the stereo generator.

*NOTE:* If using the Composite Baseband Multiplex feed to an external TV audio modulator, instead of a 4.5 MHz modulator built into the BTSC stereo generator, ignore the overly-active peak flasher on the TV audio modulator, as it will now be subjected to  $\pm 70$  kHz deviation during peak stereo-plus-SAP periods. It was calibrated for  $\pm 25$  kHz=100% (peak) deviation in regular mono, so it will flash often when the stereo is on, and even more when the SAP carrier is also on.

### **3.4 A FURTHER EXPLANATION OF SAP DEVIATION:**

The SAP carrier (5H, or 78,670 kHz) is to cause a constant deviation of  $\pm 15$  kHz of the 4.5 MHz audio carrier. (The SAP subcarrier itself may deviate  $\pm 10$  kHz when fully modulated by SAP program audio, but that is factory-set within the SAP generator and is not part of the installation setup). When viewed on a spectrum analyzer, the SAP subcarrier sidebands appear at 78,670 kHz displacement from, and 20 dB below, the (4.5 MHz) audio carrier, when in the normal SAP CARRIER ON ( $\pm 15$  kHz) mode. In the TEST mode ( $\pm 25$  kHz), the SAP subcarrier sidebands are 4 dB higher, at an amplitude 16 dB below the audio carrier. These sidebands are most easily viewed on a spectrum analyzer when all audio modulation is removed from both the stereo and the SAP channels, and when the stereo generator is switched to mono, to remove the 15,734 Hz stereo pilot.

### **3.5 VIDEO SYNC VERIFICATION:**

Observe the red SYNC UNLOCKED LED on the front panel of the SAP generator. When power is first applied, with video sync connected, the UNLOCKED LED should flash briefly, then extinguish, indicating that sync lock has been achieved. If the LED continues to illuminate, verify that the SAP generator is receiving either clean horizontal sync from a Leaming BTSC stereo generator, or, in the case of the SAP-1, clean video. Be sure the SAP-1 is not connected to both horizontal sync (pin 1 of the 6-pin connector on the rear panel) and video (the "F" or BNC connectors on the rear panel). The SAP-1 must see one or the other, not both. If a videotape is the source, and if it is not time-base corrected, the SYNC UNLOCKED LED may flash periodically as the SAP generator attempts to track the variations of the incoming sync. This is normal, and will not degrade the SAP program noticeably. The SAP carrier is crystal-controlled, and can even operate with no video sync whatsoever, although some SAP receivers may not be able to function properly unless the SAP subcarrier is sync-locked.

### **4.0 OPERATION:**

**4.1 SET THE SAP CARRIER SWITCH** to the SAP ON mode (up).

4.2 **SET THE A/B INPUT SELECTOR SWITCH** to correspond with the input you are using (see 2.5, above).

*NOTE:* The A/B selector switch function on the SAP-1 differs slightly from that on the SAP-2:

The SAP-1 switch selects only the signal to the level meter, A/SAP or B/MAIN; the program output does not change.

The SAP-2 switch selects the overall input, program A or B, and the switch has a center position, which enables the remote A/B select line, pin 6 of the Power/Remote connector on the rear panel.

4.3 **ADJUST THE AUDIO LEVEL CONTROLS** (Input A or B) on the SAP generator so the Program Level meter reads approx. 0 VU (occasional flashing of the yellow LED on loud program material; the red +3 LED should flash only very rarely, if at all).

## 5.0 **SPECIFICATIONS**, SAP Channel, SAP-1 and SAP-2

Frequency Response	50 Hz - 10 kHz, $\pm 1$ dB
Distortion	1% max THD
Signal-to-Noise	50 dB min
Nominal Input Level (APL)	0 dBm, adjustable $\pm 10$ dB
Peak-to-Average ratio	10 dB
Audio Input Impedance	10 k-ohms, balanced
Audio Processing	BTSC standard companding, dbx \ licensed
Limiter	Peak clipper at 13 dB above APL
SAP Subcarrier Frequency	5H (78,670 Hz), locked to video sync
SAP Subcarrier Output Level	Adjustable, 0...2.5 V p-p 1.5 V p-p std. @ mid-position (to produce $\pm 15$ kHz deviation of 4.5 MHz)
SAP Subcarrier Test Level	1.67 X Output Level above, to produce $\pm 25$ kHz deviation
SAP Subcarrier Deviation	$\pm 10$ kHz at 100% modulation
Subcarrier Output Impedance	60 ohms, balanced or unbalanced, to drive 600 ohm or higher Z load
Front Panel Controls	Input Level (2) Input/Meter selector switch SAP Carrier Level SAP On/Off-Remote/Test switch
Audio Level Indicator	Peak-reading 5-segment LED bargraph
Status Indicators	SAP Carrier On LED SAP Carrier Sync Unlocked LED



## SPECIFICATIONS, Cont'd.

### Rear Panel Connectors

Three 3-pin plug blocks:

Audio Inputs (2)

SAP-1: SAP and Main

SAP-2: A and B

Subcarrier Output

Pin 1 Gnd

Pin 2 Hi,

Pin 3 Low:

One 6-pin plug block:

Pin 1 Sync Input

Pin 2 Ground

Pin 3 Power Input

Pin 4 Ground

Pin 5 Remote SAP Enable  
(Ground=active)

Pin 6 Remote A/B Select  
(SAP-2, Ground=B)

Two F-type connectors (BNC optional):

Video Sync Loop In & Out (SAP-1)

### Size & Mount (Std. 19" rack)

1.75" H x 5.5" W x 16" D

Requires 1/3 Leaming PMU 401 panel

### Power Requirement

18 or 24 VDC, int. jumper select

@ 100 mA; add 50 mA for /R option.

(18 VDC from MTS-2 or MTS-3

24 VDC from PS-420)

## 5.1 ADDITIONAL SPECIFICATIONS,

SAP-1 Main Channel only; not applicable to SAP-2.

### Frequency Response

50 Hz - 15 kHz,  $\pm 1$  dB

### Pre-emphasis

75 micro-seconds

### Limiter

Peak clipper at 13 dB above APL

### Noise (15 kHz BW)

-70 dB (-80 dB re PPL)

### Distortion

0.5 % max. THD

## 5.2 ADDITIONAL SPECIFICATIONS,

SAP/R Subcarrier Audio Receiver Input

### Subcarrier Frequency

4.5 to 8.5 MHz (specify according  
to program)

SPECIFICATIONS, Cont'd.

Subcarrier Deviation	$\pm 25$ kHz or $\pm 50$ kHz std. (specify)
Subcarrier Level	20-300 mV p-p
Audio Processing	Industry-std. Sliding De-Emphasis dynamic range expansion