Film-Tech

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INSTALLATION AND OPERATION MANUAL

SR 330 TIME DELAY

SMART THEATRE SYSTEMS
P.O. BOX 80881, ATLANTA, GEORGIA 30341 404/422-1082

SR 330 TIME DELAY

MADE IN U.S.A.

A MULTIPLE FEATURE PRODUCT THAT PROVIDES MAXIMUM PERFORMANCE FROM LOW PRICED OPTICAL STEREO DECODERS

FEATURES

Fully Adjustable Surround Time Delay
Front Channels Bass Boost
Electronic Muting
Highly Stable Circuitry
No Operator Controls
Easy Setup and Adjustments
Quality Engineered
Regulated Power Supply
Rack Mounted Chassis

The SR 330 Time Delay is another industry first. This contains several valuable features that optimize the stereo playback capability of the motion picture theatre. Only the high priced optical stereo processors contain internal time delay circuitry. All of today's lower cost systems rely on perfect cancellation of surround material in order to avoid annoying crosstalk between front and surround channels. Even though these systems are kept in alignment, occasionally crosstalk will appear because the motion picture release print was not properly recorded, or subject to poor quality control. This problem is minimized by masking the crosstalk with a time delay unit that allows the front channel sources to reach the listener before the same material is heard from the surround speakers (Haas Effect). The Smart SR 330 is not only for use with the SR 130 Optical Stereo Decoder, but with all brands of economy decoders. The analog time delay is continuously adjustable from 25 to 150 milliseconds to accommodate almost any auditorium. The easy setup does not require special test equipment.

In addition, the SR 330 contains three channels of bass boost for use with the front channels of a four channel stereo system. Up to 15 dB of bass boost can be added to the sound system with the individual gyrator bass peaking circuits. The boost occurs at 80 Hz and does not affect the soundtrack dialogue. Four independent input controls permit the unit to adapt to other brands of head end equipment. 10 dB of additional gain is available in each channel of the SR 330 to adapt to older less sensitive vacuum tube amplifiers. Internal electronic muting allows automation equipment to mute all four channels of the system during lamphouse ignitor strikes, if required. This quiet muting system is activated with a single wire ground.

The low cost SR 330 puts the finishing touches on your economy stereo system to provide results that rival the big, expensive optical stereo units.

SMART THEATRE SYSTEMS
P.O. BOX 80361, ATLANTA, GEORGIA 30341 404/422-1082

PERFORMANCE SPECIFICATIONS

Frequency Response:	Front Channels: 20 - 20,000 ± 1 dB Surround Channel: 20 - 5,000 Hz (Tailored Response)
Gain:	All Channels: 1.5 dB Minimum 10 dB Maximum
Maximum Input:	Front Channels: +8 dBm Surround Channel: -2 dBm
Maximum Output	
Before Clipping:	No Load: 8V RMS 600 Ohm Load: +18 (6.6V RMS)
Time Delay Range:	Continuously Adjustable 25-105 MS
Front Channel Bass Boost:	Up to 15 dB at 80 Hz
Signal to Noise Ratio:	Front Channels: 88 dB below Maximum Output Surround Channel: 57-62 dB Depending on Delay Setting
Size:	1 3/4" H X 6" X 19" Rack Mount
Weight:	4.5 Lbs.
Color:	Theatre Black

ENGINEERS SPECIFICATIONS

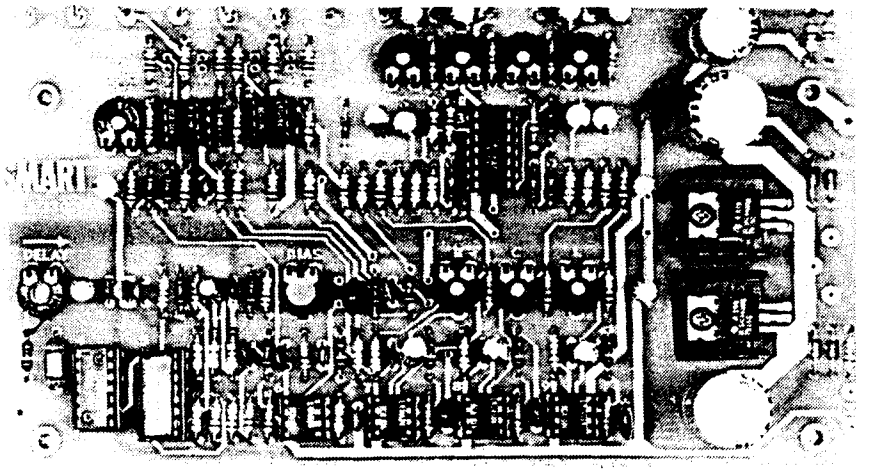
The Smart SR 330 contains four channels of post decoder processing. The three front channels can be boosted 15 dB in the bass (80 Hz) region through the use of special gyrator circuits. Additional gain of 10 dB is available in each channel to increase overall gain and drive capability of various brands of optical stereo decoders. A four channel electronic switch can be remotely actuated for muting of all channels to suppress ignitor noises. The time delay section is continuously variable from 25 to 105 millisecond delay and has adjustable input and output trim controls for optimum signal-to-noise ratio. Frequency response for the surround channel has been shaped through filter circuits for enhanced surround presentation.

SR 330 TIME DELAY

The SR 330 Time Delay incorporates several important circuits into one self-contained unit. In addition to the variable surround channel time delay section, there are three independent gyrator type bass boost circuits to enhance bass frequencies for each of the front channels. The adjustable boost circuits permit stage channel sources to be peaked to a maximum of 15 db at 80 Hz. This frequency is beyond the low end of the soundtrack dialogue region and will not add "tubbiness" or a "barrel sound" to voices. An electronic muting circuit quietly turns off all four channels upon external command to silence loud ignitor strikes that may be generated by some brands of lamphouses. These circuits, and their adjustment will be discussed in this manual. Although elaborate test equipment is not mandatory, it is helpful to use an oscilliscope to determine audio clipping points as the internal adjustments are made.

ABOUT THE CIRCUITRY.....

The SR 330 accepts the separate left, center, right and surround channels from the optical stereo decoder. Inputs to this device pass through individual input trim pots that permit balancing of the four channels in the system. When the input pots are set fully counterclockwise, 1.2 dB of gain is added to each signal. As the trim pots are rotated clockwise, up to 10 dB of gain may be realized for each input. Each signal passes through an electronic switch for signal muting. All four ganged switches are activated by a single terminal on the rear barrier strip. The three front channel signals progress through a bass boost circuit that allows bass to be increased in a one octave range centered at 80 Hz. This type of circuit does not act like a bass control, but more like a single section of a one octave equalizer with its frequency center remaining constant irrespective of the amount of boost. Each of the front channels continues on to independent line amplifiers with low impedance output characteristics.



ALL CONTROLS ARE EASILY ACCESSIBLE TO THE INSTALLING ENGINEER. SURROUND OUTPUT LEVEL IS IN THE UPPER LEFT HAND CORNER OF PC CARD.

The surround channel input passes through the input trim pot, the electronic muting switch, and on to an anti-alias filter-amplifier. This circuit also contains an active pre-emphasis network to improve the signal-to-noise ratio throughout the chain. The time delay chip is a serial analog delay device with 2048 stages of capacitive storage. This "bucket brigade" device "shifts" a sample of the audio signal input through the various stages within the chip at a rate controlled by the frequency of the square wave "clock" chip. A delay pot controls the frequency of the clock, thereby controlling the amount of time it takes to pass audio through the delay chip. The output of the delay device passes through another filter amplifier section to remove clock transitions. This filter also contains a de-emphasis network to restore the original response of the audio signal. A line amplifier circuit allows the surround channel to drive an external low impedance load.

The regulated and well filtered bipolar supply powers all internal devices. A third regulator isolates the clock and delay from other audio circuits, resulting in a very quiet unit.

INSTALLATION

INSTALLATION

When rack mounting the SR 330 be sure to leave sufficient slack in the input and output cables so the unit may be pulled forward, and the top cover removed. This is necessary in order to make internal adjustments.

VENTILATION

The SR 330 should be mounted in a relatively cool place in the rack. Avoid placing the unit next to heat generating components such as vacuum tube amplifiers. Usually the time delay is positioned directly below the optical stereo decoder so that cable connections are very short. Avoid running input and output cables next to AC or high level speaker lines.

INPUTS

Connect shielded audio cable from each output of the optical stereo decoder directly to the input of the SR 330 input terminals. The input terminals are coded ORANGE and ground is a BLACK terminal. A label above the rear barrier strip identifies each channel. Each unbalanced input has an impedance of approximately 5K ohms and will accept the low output impedance of the various brands of decoders on the market. If for some reason the brand you are using has an attenuator in the line between the decoder and amplifier, move the attenuator connections to a point after the SR 330.

COLOR CODED INPUT AND OUTPUT TERMINALS ON REAR BARRIER STRIP ARE CLEARLY LABELED.

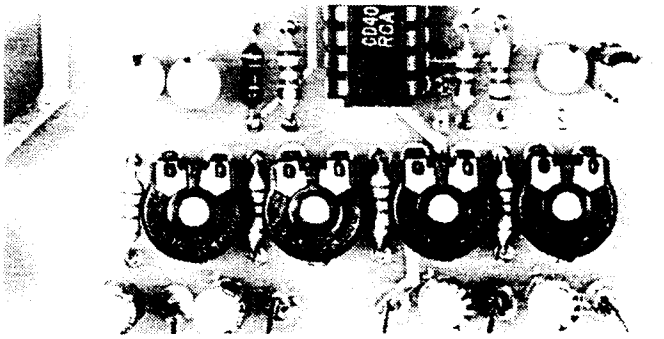
OUTPUTS

The BLUE colored terminals are outputs for each channel of the time delay unit. BLACK terminals are ground. Be sure to use shielded audio cables to connect the unit's outputs to the next component (equalizers, power amps, etc.).

MUTING

The RED terminal on the rear barrier strip allows access to the four channel audio muting function. An electronic switch mutes all channels for as long as the muting terminal is held to ground (BLACK terminal). This feature may be important in installations that have RF generating ignitors in the projector lamphouse. Shielded wire should be used when connecting the muting circuit to the house automation system to avoid 60 Hz modulation of the electronic switches if the control line is run near AC lines.

INPUT GAIN CONTROLS AT TOP OF PC CARD ALLOW AN ADDITIONAL 10 dB of GAIN PER CHANNEL.



LEVEL SET

Each input has its own input level trim control. These pots are located at the rear right hand side of the PC card. They are labeled (S) SURROUND, (R) RIGHT, (C) CENTER, and (L) LEFT. A good starting position is at the mid point of the controls. The SR 330 has 10 dB of gain built into each channel to make up gain from low output decoders, or to raise the overall drive level when feeding older insensitive vacuum tube amplifiers. The trim pots also provide a convenient point to balance each channel of systems where the optical stereo decoder does not have individual output trim capability. When you have finished the other setup procedures you may wish to go back to the input controls for final balance and gain adjustments.

LINE OUTPUT AMPLIFIER

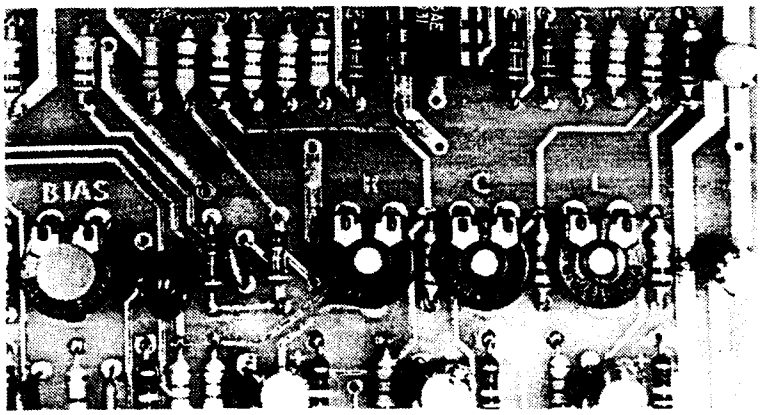
Four independent line amplifiers provide a low impedance source to the next components in the stereo system. Each line amp is capable of 8 volt RMS output to drive even the lowest sensitivity vacuum tube amplifier.

ADJUSTMENTS

Before making any adjustments in the SR 330 it is important to be sure that the optical stereo decoder feeding this unit has been properly adjusted and calibrated. Best results will be obtained when the previous equipment is operating at peak performance.

BASS BOOST

Three pots located in the right-center of the PC card allow a bass boost of the three stage channels. Bass boost is not desirable for the surround channel. These controls are labeled (R) Right, (C) Center, and (L) Left. Full counterclockwise rotation of each pot will set the system for a flat bass response. As the pots are turned clockwise, more bass is added to each front channel. A 15 dB bass boost is available at the full clockwise setting. This is a large amount of boost. Be sure your speakers can handle this extra power in the low end of the audio spectrum without excessive cone excursion, or speaker doubling. The bass circuits are a special gyrator configuration and are not like a standard bass control found on commercial or home sound products. This unique approach was selected to lend itself to motion picture theatre applications. The center of the bass boost is at 80 Hz. As more boost is dialed in, the 80 Hz peak gets higher. This method allows a strong bass to be added to the system without creeping into the dialogue region, thereby avoiding a "tubby" or "barrel" sound in voices. Proper levels can be examined with a real time analyzer, or by listening to the playback of a soundtrack with known good bass response. We advise that moderate amounts of bass be added to each channel initially, then a listening test to avoid excessive bass.

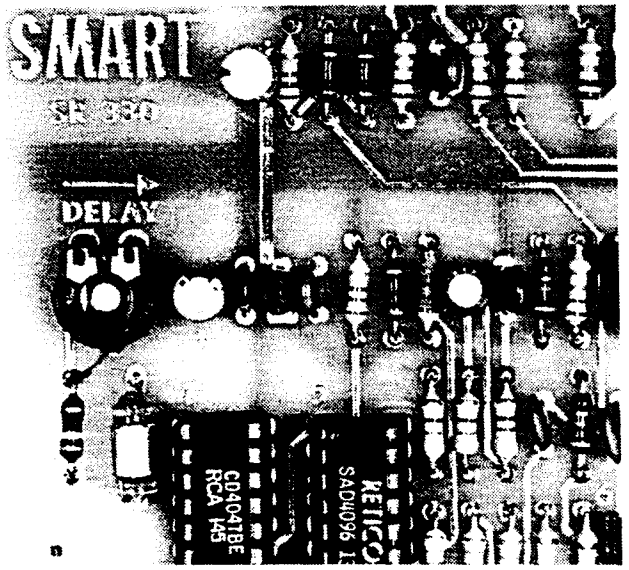


GYRATOR BASS CONTROLS PROVIDE BASS PEAKING AT 80 Hz WITHOUT AFFECTING MIDRANGE MATERIAL.

TIME DELAY LEVEL ADJUSTMENT

Because the SR 330 is capable of working with various brands of decoders, extra gain has been built into the unit to accommodate various drive levels. The surround input trim control allows the maximum level below clipping into the time delay circuitry to achieve the best signal-to-noise ratio of the analog delay. If the delay section is overdriven, nasty harmonics and clipping will occur in the surround channel. If the delay is not sufficiently driven, a poor signal-to-noise ratio will result. It is MANDATORY that careful attention be given to this adjustment in order to achieve good performance. You may continue to use the mono film and decoder solar cell hookup outlined in the previous section of this manual to perform the level adjustment.

An oscilliscope connected to the surround output of the SR 330 is helpful in setting delay operating level. With the film running, observe the audio waveform on the scope. Increase the input gain control until you are below waveform clipping on loud passages. If a trailer is used for this test, please be aware that some previews are recorded at maximum level in order to gain audience attention. Often, these soundtracks "square" as the recorded material trys to exceed the capability of the optical recorder. Clipping on the soundtrack will have a more rounded appearance on your scope than circuit clipping. The object of this adjustment is to achieve the highest input level without distortion.



TIME DELAY CONTROL IS ADJUSTABLE FROM 30 to 105 MILLISECONDS. CLOCKWISE ROTATION INCREASES DELAY.

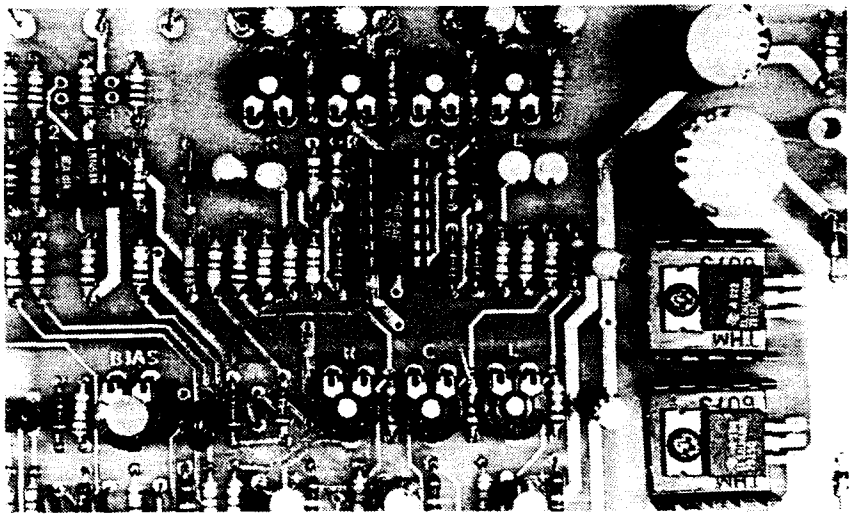
A more precise method of setting delay input level is with a scope, a service meter with a dB scale, and a reference film loop. (A Dolby tone 50% modulation loop is fine for this purpose). Adjust the input gain until you have a clean signal. With your meter across the SR 330 surround output, decrease the level an additional 6 dB. This is the point that will accommodate the maximum surround signal level from a stereo film.

With no test instruments, a reasonably close setting can be achieved by running a mono film with the setup procedure mentioned earlier. Increase the surround input level to a point where "edginess" or "raspiness" is noticed on very loud passages. Decrease the input level slightly until the symptom disappears.

DELAY OUTPUT

This control is located in the left-rear section of the PC card. Turning the pot clockwise increases the output of the surround channel. A suitable setting will provide sufficient drive to external equipment.

BIAS POT AT FAR LEFT OF THE PHOTO IS FACTORY SET TO THE INDIVIDUAL TIME DELAY CHIP AND SHOULD NOT BE CHANGED UNLESS SAD4096 IS REPLACED.



BIAS ADJUSTMENT

The control is factory set and sealed with a round, colored label. This pot should be adjusted ONLY if the SAD4096 time delay chip is replaced. NEVER remove the SAD4096 chip from its socket. A static discharge to the pins of the chip can destroy this device instantly when the chip is unprotected. The replacement cost of this device is $75.00. Refer to the service section of this manual for further explanation of the service procedure.

MUSIC THROUGH SURROUND

The Smart SR 130 Optical Stereo Decoder has built in music handling circuitry. It allows music to be sent to all four channels by actuating the REAR ON switch inside the unit. This feature is even more pleasing when heard through the surround time delay. Any echo that was present is removed by the delay so that all channels are in "sync". The result is a very big, full surround music effect.

MATING TO THE SMART SR 130

When the SR 330 is used with the SR 130 Optical Stereo Decoder the setup procedure for the bass boost and delay setting is the same as described in this manual for all brands of decoders. However, the surround channel of the SR 130 contains a compander circuit that should be defeated while making adjustments in the SR 330. Turn the threshold control (THS) fully counterclockwise inside the SR 130. This will allow you to make adjustments and then set the compander to a new setting that drops out the film noise only, without trying also to remove surround crosstalk.

CAUTION: When servicing the SR 330 NEVER remove the SAD4096 integrated circuit unless you are positive it has failed. This is a NMOS device and is highly vulnerable to destruction from static discharge while being handled. The chip is safe in the socket, but will be subject to harm outside the circuit. This vital component has a replacement cost of $75.00. Follow the time delay service procedure to determine if there is a problem with the SAD4096 chip.

AUDITORIUM LEVEL BALANCE

Front channel balance of the left, center, and right sources can be performed by adjusting the power amplifier input controls or by re-trimming the input controls of the SR 330. The SR 330 surround channel input control however, has been set for the best signal-to-noise ratio performance of the time delay circuit. An output control has been provided to make level adjustments to the next component. Use a front-surround test loop in setting auditorium balance for the surround track. With an actual feature release print, it is only a guess at the amount of level recorded on the rear channel. The end result could be adequate for the print you are presently using, but incorrect for the next print. A front-rear balance test loop (choo choo track) will give you an absolute reference.

SURROUND DELAY SETTING

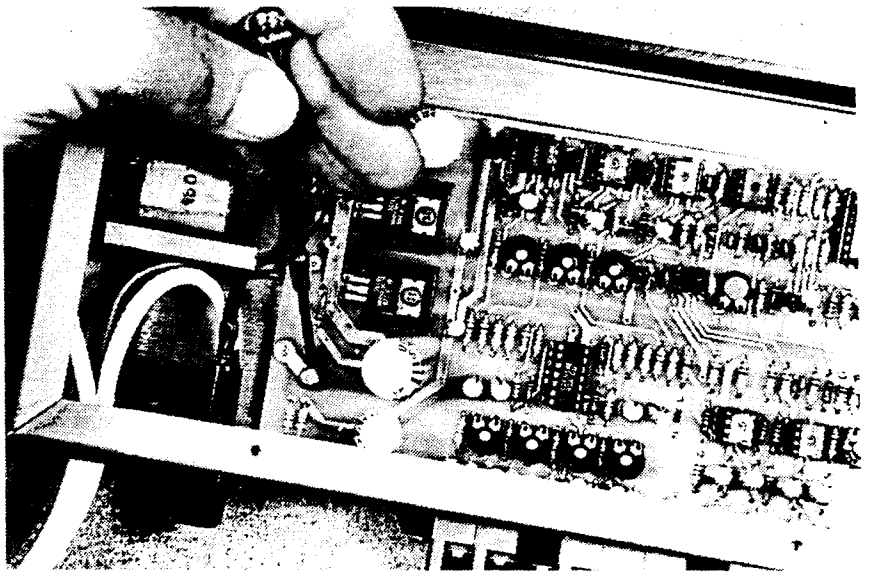
In order to adjust the surround speakers for the proper time delay, it will be necessary to play a sound source through the front speakers and the surround speakers simultaneously. The easiest way to accomplish this is to temporarily remove one of the split solar cell leads from the inputs of the optical stereo decoder and join it to the other lead so that both halves of the solar cell are feeding only one input channel. This will force an imbalance in the surround channel of the decoder resulting in full output of the surround channel. A mono film is ideal for this test because of the high recording level employed in monaural prints. The time delay pot is located in the left-front part of the PC card. A fixed delay of 25 milliseconds is built into the time delay when the delay control is fully counter-clockwise. As this control is rotated, more delay is added to the surround channel until the maximum 105 millisecond delay is reached. This long delay will accommodate an auditorium approximately 130 feet long. Settings are made to accommodate a listener position two-thirds to three-quarters of the distance from the screen to the rear seats. Unlike other systems that are adjustable in 10 millisecond steps, the SR 330 is continuously adjustable throughout its delay range.

It is helpful to have an assistant in the auditorium to signal to the sound engineer in the booth as adjustments are made. With a mono film running, using the hookup procedure mentioned earlier, a definite echo is present with the same sound originating from the front speakers and the surround system. As more delay is slowly added, the echo time interval will become shorter until a point is reached where the sound arrival time is equal at the listeners ears. A slight increase of delay beyond this point will abruptly make the source of the sound appear to jump to the front speakers. This is called the "Haas Effect". This psycho-acoustic trick is very effective in masking crosstalk between channels.

Sound travels at the approximate rate of 1 foot per millisecond in normal air temperature and humidity conditions. Therefore it takes 50 milliseconds for the sound from the stage speaker to reach a listener 50 feet away. If the nearest surround speaker is 15 feet from the observer, this amount is subtracted. Add approximately 10 milliseconds of delay for the Haas Effect, and the total delay required is 45 milliseconds for this situation. The oscillator used to drive the delay circuit in the SR330 is highly stable. A wide temperature, 2% tolerance capacitor assures a permanent setting without drift. Once the proper delay setting is determined, the system should not need to be readjusted in the future.

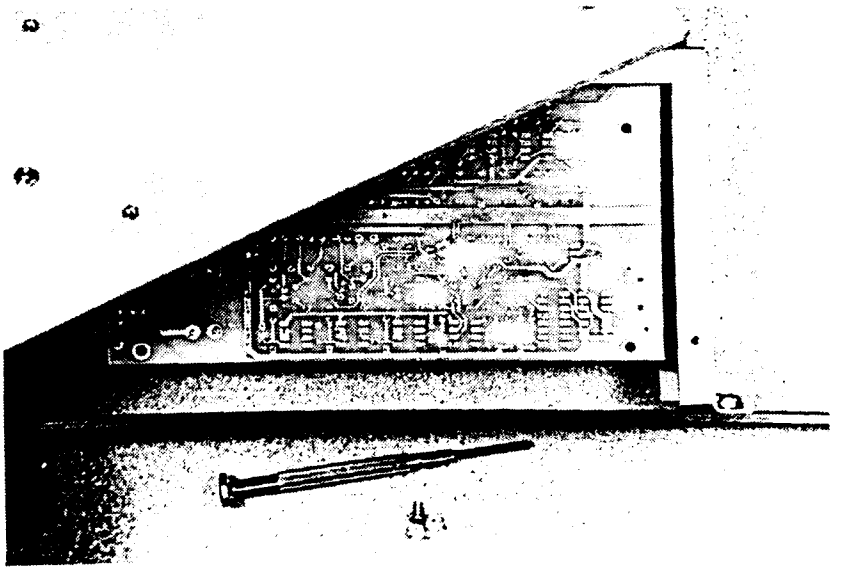
SERVICE

TO GAIN ACCESS TO BOTTOM OF THE PC CARD, REMOVE THE 4 PHILLIPS SCREWS THAT HOLD THE CARD TO THE CHASSIS.



POWER SUPPLIES

There are four separate power supplies in the SR 330. Three are regulated. The output of each supply can be checked with a service meter. All measurements are made with respect to ground. Pin three of the large 7815 regulator should read plus 15 volts DC. Pin three of the large 7915 negative regulator should read minus 15 volts DC. A small epoxy regulator is positioned above the time delay chip. This 78L15 should show plus 15 volts DC at its output. The purpose of this device is to localize the power requirements of the delay section and act as a "garbage collector" to prohibit clock transitions from getting into the other audio devices. The fourth supply is a 7.5 volt DC bias source that is derived from the output of the 7815 positive regulator. This voltage divider is composed of two resistors. and a large filter capacitor. Make voltage checks to verify that all circuits are receiving the proper power. Refer to the schematic diagram for voltage points.



BOTTOM COVER CAN BE MOVED OUT OF THE WAY FOR SERVICING THE UNDER SIDE OF THE PC CARD.

AUDIO CIRCUITS

The easiest way to troubleshoot each audio circuit is to follow a signal from the input to the output with a signal tracer or oscilliscope. Use the schematic diagram as your road map.

TIME DELAY

Signal tracing service procedures can also be employed when service problems occur in the surround channel time delay circuits. A signal at the input, through the electronic switch, filter amplifier, delay chip, second filter and line amplifier will reveal where the signal has stopped. Refer to the schematic for pin identification of the signal flow. The 4047 clock must be operating properly for the audio signal to pass through the delay chip. An oscilliscope will reveal square wave pulses on pin 10 and 11 of the 4047 when this device is operating. If either phase of the clock fails, there will be no audio output from the SAD4096.

Before signal tracing, check quiescent voltages on each of the opamps in the problem area. The DC output of an opamp in a bipolar powered circuit should read zero volts DC. If you see more than a volt at the output, look for a leaky electrolytic capacitor or similar malfunctioning components.

OTHER SERVICE TIPS

1. If the Mute terminal (RED) of the rear barrier strip is grounded, no audio will pass through the SR 330.

2. IC's can be vibrated out of their sockets during transit. Be sure they are firmly seated in their sockets.

3. Replace chassis fuse with 1/2 Amp 3AG type ONLY.

4. 1458 IC can be replaced with 4558, TL072, LM378.

The procedure for setting the time delay may vary from the procedure you are accustomed to with other brands of decoders. All of the economy decoders on the market use a cancellation principle for deriving the surround channel. This approach is not as sophisticated or expensive as the SQ or QS matrix surround decoders. The latter systems send surround information only to the surround speakers. All others send surround plus some left and right signal to the surround speakers. Because this composite information is duplicated on the front screen speakers, there will be a noticeable echo to listeners seated near the screen if the time delay unit is adjusted for the rear seats in the auditorium. The procedure we suggest in this manual is more effective when the SR 330 is used with economy decoders.

SR 330 TIME DELAY