SB6AR 6-STACT

Technical Manual

IB-16

VISUAL ELECTRONICS LABORATORIES

PASADENA, CALIFORNIA

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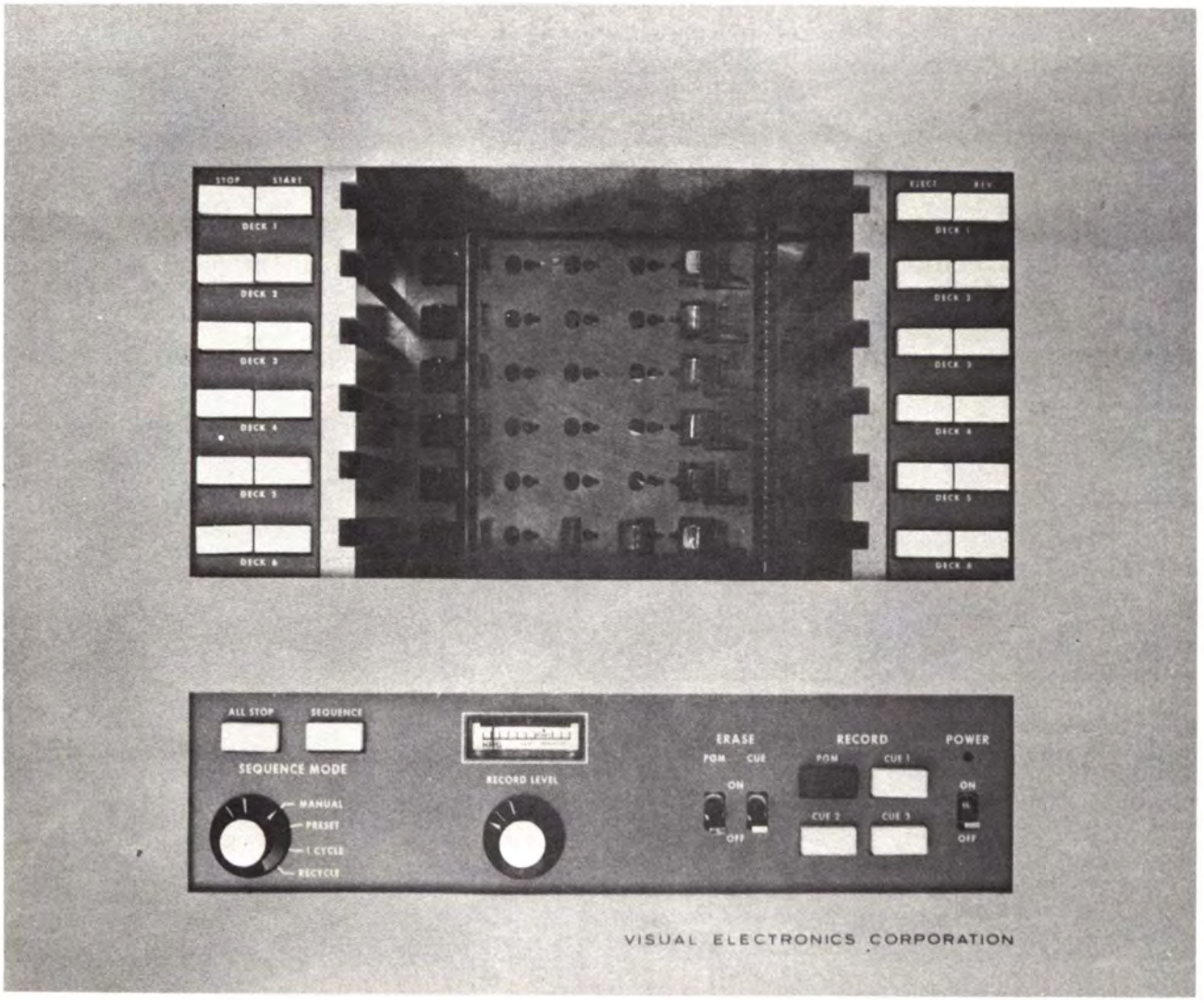


Visual SB6AR STACT Broadcaster

The desk-mount front panel is shown; also available is a rack-mount front panel.

SECTION I - GENERAL INFORMATION

1-1 DESCRIPTION

1-2 The Visual SB6AR STACT Broadcaster is a compact, six-deck tape recorder/reproducer system built to meet or exceed highest broadcast tape recording standards. Each of the six decks of the system is separately controllable and is designed to accept the STACTape RCL-100 series Reversing Continuous-Loop magnetic tape cartridge.

1-3 STACTape magnetic cartridges (see Section II) are endless-loop cartridges designed to combine all of the handling simplicity of a continuous-loop cartridge with the operating flexibility of a reel-to-reel recorder. STACTape cartridges permit all three normal tape motion modes: normal forward, fast forward, and fast reverse.

1-4 The six-deck transport system employs a common capstan and therefore requires only 14 inches of rack space. Solid-state electronics and an all-electrical cartridge control system allow unlimited flexibility in remote control, continuous sequencing, random access, automated switching, and other broadcasting operations.

Table 1-1. SPECIFICATIONS

ELECTRICAL CHARACTERISTICS	
Power Input:	105-125V, 60 Hz, 100W maximum (200-240V 50 Hz input available on special order). Fuse, 1.5A slow-blow.
Motor:	Single-speed hysteresis synchronous motor.
Power Supply Outputs:	-36V dc unregulated for cartridge relay and solenoid operation.
	-10V dc unregulated for cartridge solenoid hold-in.
	-24V dc regulated for electronics circuits.
	-24V dc regulated for lamp circuits and accessories.
Signal Input:	-15 to +15 dBm into 20,000Ω bridging, or 600Ω, both balanced.
Signal Outputs:	+8 dBm, 600Ω balanced for combined output all decks.
	0 dBm, 600Ω unbalanced for individual deck outputs.
PERFORMANCE CHARACTERISTICS	
Tape Speed:	7.5 inches per second (other speeds available).
Flutter and Wow:	Less than 0.18% rms for all components between 0.5 and 250 Hz.
Start Time:	Less than 0.1 second to playing speed after start is initiated.
Tape Overtravel:	Less than 1 inch after the trailing edge of stop cue passes the play head or STOP switch is depressed.
Timing Accuracy:	±0.4% (7.2 seconds in 30 minutes).
Reverse Speed:	15 inches per second.
Frequency Response:	50-15,000 Hz ±2 dB from standard alignment tape or for record/reproduce using Audio type 17 tape.

Table 1-1. SPECIFICATIONS (Continued)

PERFORMANCE CHARACTERISTICS (Continued)

Distortion:	Less than 2% THD at 10 dB above standard level from 50 to 15,000 Hz. Maximum output of combined line amplifier is +27 dBm.
Signal-to-Noise:	50 dB minimum, measured from 3% third harmonic point.
Record Pre-Emphasis:	Approximately 12 dB boost over 1000 Hz level at 18 KHz.
Bias Frequency:	Approximately 85 KHz.
Playback Equalization:	NAB 7.5 ips equalization is standard. Other speeds and CCIR equalization available.

PHYSICAL CHARACTERISTICS

Width:	17 inches (desk mounting), 19 inches (rack mounting)
Height:	14 inches
Depth:	17 inches
Weight:	55 pounds

MAGNETIC HEADS

Play Head

Type:	Stacked two-track reproduce head, all-metal hyperbolic face.
Gap:	100 μinches
Inductance:	400 mH
Impedance:	2500Ω at 1000 Hz
Dc Resistance:	410Ω
Track Width:	0.080 inch
Track Spacing	0.160 inch

Record Head

Type:	Stacked two-track record head, all-metal hyperbolic face.
Gap:	500 μinches
Inductance:	50 mH
Impedance:	320Ω at 1000 Hz
Dc Resistance:	130Ω
Track Width:	0.080 inch
Track Spacing:	0.160 inch
Record Current:	75 μA (typical)
Bias Current:	700 μA (typical)

Erase Head

Type:	Stacked two-track double-gap erase head.
Inductance:	8 mH
Impedance:	2000Ω at 60 KHz
Dc Resistance:	30Ω
Erase Current:	16-24 mA

STACTAP MAGNETIC CARTRIDGES

Duration:	10 seconds to 31 minutes at 7.5 inches per second.
Length:	75 inches to 1161 feet
Tape Type:	Audio type 17, lubricated, 0.25 inch wide, professional quality polyester-base magnetic tape.
Tape Loading:	Endless loop pulled from inner hub, B wind, on tape tray with hub containing both NAB and EIA standard mounting holes to permit tape tray loading on any tape recorder.
Reverse Capacity:	See page 2-1.

1-5 THE SB6AR STACT BROADCASTER

1-6 The SB6AR STACT Broadcaster is designed for program playback on all six decks. In addition, deck six may be isolated from the common playback line and used as a recording unit. The record deck incorporates facilities for recording both program and cue tones on the cartridge tape. In addition to recording a stop cue tone, it may optionally be equipped to record one or two additional cue tone frequencies, thereby providing a means for programing a cartridge to act as an automation switching or triggering command source. A cue tone sensing assembly (available as a rack-mounted accessory) detects the reproduced cue tone on each individual deck and provides separate trigger outputs for external use.

1-7 The exclusive STACT Broadcaster tape reversing capability may be ordered on one deck (deck 6) or on all decks. The reverse motion functions independently on each deck so equipped, and is interlocked with the PLAY, STOP, and RECORD controls to prevent erasure or tape damage.

1-8 OPTIONAL ACCESSORIES

1-9 Remote Control - A remote control unit is available which allows the remote control of all the electrical functions of the SB6AR Broadcaster except the SEQUENCE MODE switch and the ERASE PROGRAM and ERASE CUE switches, to avoid accidentally erasing the tape. The SEQUENCE MODE switch is usually set for one particular operating method and left alone. The remote control is mounted on a standard EIA 3.5" x 19" panel and is connected to the SB6AR through a 40-pin plug on the rear panel of the SB6AR.

1-10 Cue Tone Sensing Assembly - This rack-mounted unit contains selective filters and amplifiers, one set for each deck, for detecting the auxiliary cue tones when they are reproduced from the tape cartridges. The NAB standard secondary cue tone is 150 Hz and the standard tertiary cue tone is 8000 Hz. The cue tone sensing assembly may be ordered equipped for one or both cue tones. The output of each sensor provides a momentary contact closure for operating relays, discharging RC circuits, or other triggering functions. The unit obtains its operating power from the SB6AR Broadcaster. The model number of the auxiliary cue tone sensing assembly is SQ54.

1-11 Automatic Programmer - The SB6AR may be operated in conjunction with an automation control unit such as the model T.A.P.E. 20-50. This unit provides the control and audio mixing and sensing circuitry to program up to 20 different sources through 50 events. Unlike the SEQUENCE MODE switch, which allows only a single repetitive cycle, the T.A.P.E. 20-50 permits a completely random program.

1-12 TRANSPORT MECHANICAL ASSEMBLY

1-13 General - The cartridge transport unit provides tape motion for each of the six cartridges and is the supporting structure for the associated electronics and accessory equipment. The capstan motor and capstans are mounted on the bottom plate of the six-slot cartridge chamber.

1-14 Heads - All magnetic heads and tape guides are assembled onto a single integral head-mounting bracket. The heads are the rear-mount type and are held in place by epoxy-secured mounting nuts. Both left and right tape guides are adjustable within their oval mounting slots and have been carefully adjusted at the factory during final checkout to obtain precise tape tracking characteristics. The azimuth alignment of all playback heads is set by means of an industry standard alignment tape, and the azimuth of the record and erase heads are also matched to the alignment. See Figure 4-1 for locations of these components.

1-15 Wiring - All wiring interconnections are made with stranded wire laced in cable harnesses and fastened down at critical points. Audio circuits are run with shielded pairs through carefully selected routes to reduce hum pickup and crosstalk. Audio lines are grounded at selected points to prevent ground loops.

1-16 Capstan Motor Assembly - Driving power for tape motion is provided by a single hysteresis synchronous motor rotating at 1800 rpm. A two-diameter pulley is used to transmit power to the capstans by means of a flat molded and ground belt to the forward capstan and a molded O-ring to the reversing capstan. The capstan shafts are extended to provide tape motion to all decks.

1-17 Play Solenoids - The six play solenoids are mechanically coupled through a pivot point to the cartridge-engaging hooks. The pulling action of these hooks is balanced by adjustable calibrated springs to provide optimum pressure between the capstan in the transport and the pinch roller in the cartridge. All mating parts of the hook mechanism are cyanide hardened and will not wear out of tolerance during the life of the unit.

1-18 Reversing Assembly - The reversing solenoids are mounted at the left side of the transport on the plane of each deck so equipped. The solenoid plungers are mechanically coupled through a pivot point to roller and roller arm assemblies, located to the left of, and just out of contact with, the reversing

capstan. Actuation of the solenoid moves the roller forward into contact with the reversing capstan and the reversing idler in the cartridge.

1-19 Tape Speed - The Broadcaster is normally supplied for operation at 7.5 inches per second, but may be ordered for 3.75 or 1.875 inches per second. A smaller-diameter pulley is substituted on machines which operate at 3.75 inches per second and, in addition, a 900 rpm motor is used on machines which operate at 1.875 inches per second.

1-20 POWER DISTRIBUTION

1-21 Ac input power to the power transformer and the capstan motor is applied through an on-off switch and power fuse. The theory and functions of the multiple-dc-output power supply are discussed in the section entitled "Theory of Operation".

1-22 SYSTEM IDENTIFICATION

1-23 An identifying label is affixed to the rear panel of the SB6AR giving the model number, part number, and serial number. Always refer to these numbers when communicating with the factory or a sales representative.

1-24 FIELD SERVICE BULLETINS

1-25 Field service bulletins are issued by Visual whenever improvements in design or operation are made. Each bulletin includes such information as purpose, procedure, and time required. After the service has been accomplished, the bulletin should be kept with this manual for future reference.

1-26 SPECIAL SYSTEMS

1-27 Special tape transports are sometimes built at the request of a customer. Differences between a special system and the system described in this manual are noted by a special system insert located at the rear of this manual.

SECTION II - CARTRIDGES

2-1 GENERAL

2-2 The Visual STACTape magnetic cartridge is a unique, patented design based on the "endless loop" principle; that is, the end of the tape is spliced to its beginning. (See Figure 2-1.) When the tape is in motion, tape is pulled from the center of the tape pack past the magnetic heads and fed back onto the outside of the tape pack. The frictional pull of the inner layer of tape against the hub causes the tray to rotate, thereby taking up the tape after it is pulled by the capstan. The tape pack is loosely wound and the tape layers therefore slip on themselves as they feed forward toward the center. The tape tray is constructed of aluminum and is coated with liquefied Teflon. The Teflon coating and a lubricant on the tape both contribute to the "slipping" action without introducing flutter at the heads.

2-3 Visual STACTape cartridges use 1/4 inch lubricated tape. Tape loops of from a few inches up to 1161 feet may be loaded into the cartridge.

2-4 RCL-100 STACTape CARTRIDGE

2-5 The RCL-100 (RCL means "Reversing Continuous Loop") cartridge can be loaded with up to 1161 feet of tape (31 minutes at 7.5 inches per second) and may be operated at speeds from 15/16 to 30 inches per second, or driven fast forward at 30 inches per second or fast reverse at 15 inches per second. A reversing tape storage chamber above the tape pack permits reverse winding of up to 120 feet of tape.

2-6 The exclusive reversing feature of the RCL cartridge is intended as an aid to editing while recording, or as a "backspace" during playback. The amount of tape which may be safely reversed is limited as follows:

> Packs above 200 feet may be reversed up to 10% of their total length.
>
> Packs below 200 feet may be reversed 20 feet.
>
> Packs below 40 feet may be reversed for half their length.
>
> CAUTION
>
> Tape should NOT be shuttled over the same section more than three times before the entire rewound portion is run off. Allow one second between Fast Forward and Reverse operations.

2-7 STACTape cartridges are comprised of a two-piece outer shell housing the upper and lower tape trays and guiding the tape in its path across the heads. (See Figure 2-2.) The shell provides operating and storage protection for the tape pack, carries mechanical components which control tape motion, and supports the two side rails that slide into the load slots. All mechanical elements of the cartridge are mounted on the bottom part of the shell. The removable tape tray rides on a special plastic bearing on the center post of the bottom shell section. The hub is punched to the standards set by both NAB and EIA for 8

Table 2-1. STACTape Cartridges - Physical Characteristics

Outside Dimensions	7/8" H, 8" L, and 7-3/8" W
Maximum Tape Load	1161 feet
Minimum Tape Load	27 inches
Shipping Weight (empty)	10-1/2 ounces
Shipping Weight (fully loaded)	17 ounces
Cartridge Material	High-Impact Polystyrene
Operating Position	Within 30^{o} of horizontal

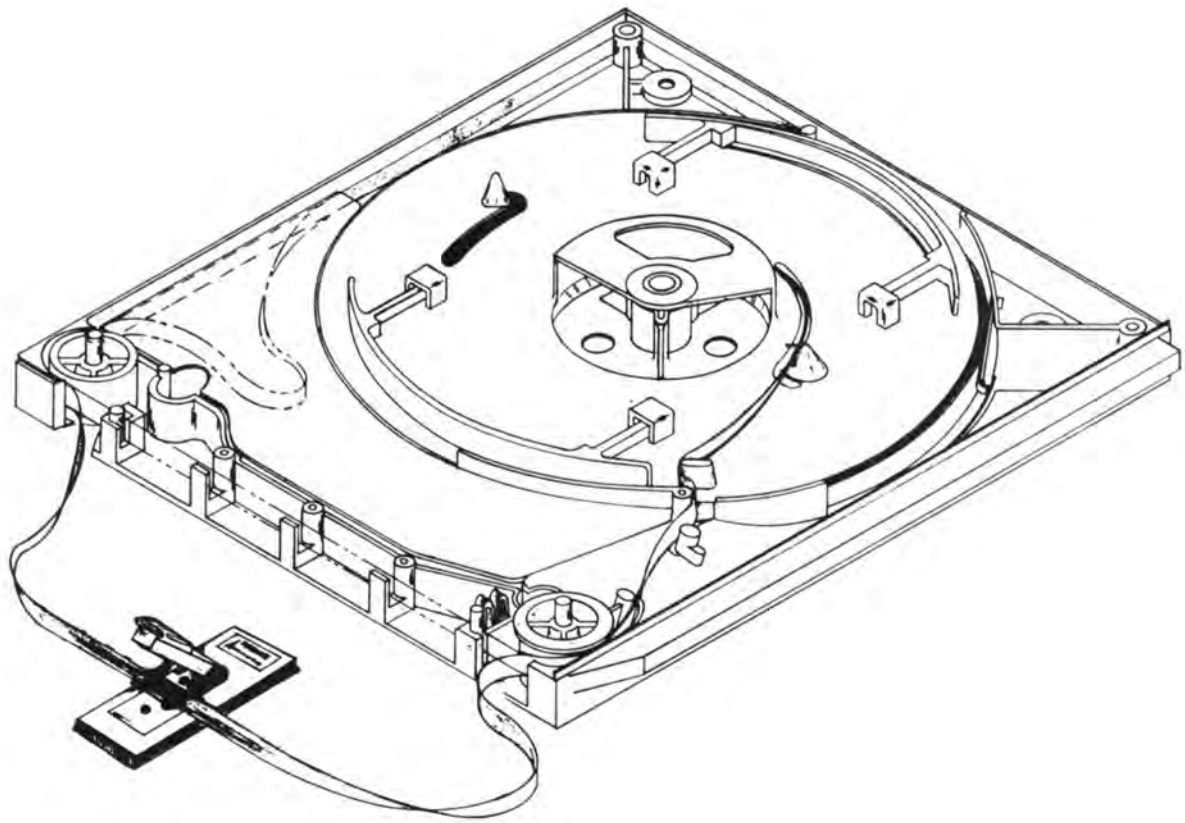


Figure 2-2.

Splicing of Endless Tape Loop

inch and larger metal flanged reels and 7 inch and smaller plastic tape reels. The tape tray can be placed on any reel-to-reel tape recorder for tape loading or transferring of recorded material to reels or loops for playback on other tape recorders. Table 2-1 lists the physical characteristics of Visual cartridges.

2-8 For tape lengths over 800 feet the 2.5-inch center hub is used to wind the tape on. When the cartridge is to carry less than 800 feet of tape, a 3.75-inch diameter concentric center hub is added to the tape tray, and a different top disc assembly is used.

2-9 ERASING THE CARTRIDGE

2-10 Visual cartridges can be cleanly erased on most commercial tape degaussers. The tape, however, is wound on an aluminum tray, and induced eddy currents in this tray tend to cancel the erasing field. For this reason the tape should be erased through the top only. To properly erase RCL cartridges, observe the following procedure:

(1) Locate the maximum field point on the tape degausser by observing the point at which maximum force is applied to a screwdriver blade.

(2) Turn the cartridge upside down (top toward the degausser) and make a series of parallel passes so that the maximum field point passes through every part of the cartridge.

(3) Rotate the cartridge 90° horizontally and repeat step 2. The last pass should bring the maximum field point into the center of the tape pack.

(4) Slowly pull the cartridge out of the field along a helical path so that the field is reduced uniformly throughout the pack. When the cartridge is 3 or 4 feet from the degausser, the erase unit may be turned off.

NOTE

Turning the erase unit on or off with the cartridge in the field, or erasing through the bottom of the cartridge may magnetize the tape in such a manner that it will take several degaussing operations to erase the tape.

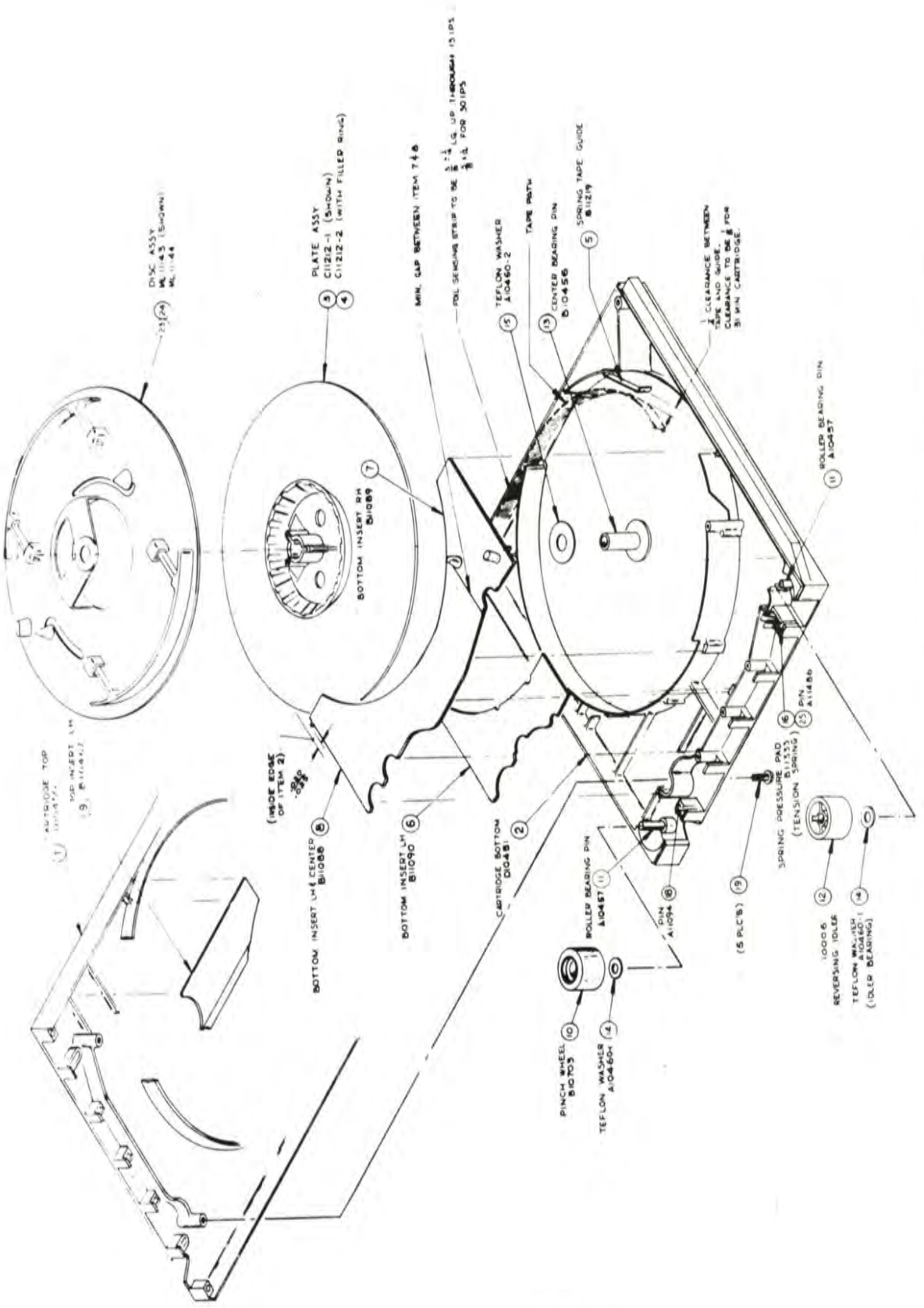


Figure 2-2. Exploded View of RCL-100 Stactape* Cartridge.

SECTION III-INSTALLATION

3-1 GENERAL

3-2 The Broadcaster is shipped in completely assembled form in a single shipping case. There are no assembly procedures required, and only normal unpacking care need be observed. The Broadcaster is completely assembled on its mounting tray, which is drilled to accommodate the mounting configurations of most popular rack slides.

3-3 INSPECTION

3-4 Before attempting to mount the Broadcaster in a rack, inspect the equipment carefully to determine that all relays and connections are firmly in place and that the equipment has not sustained damage in transit. A complete visual inspection before installation may save much time later.

3-5 If there is damage due to improper handling by the carrier, preserve packing container and call the carrier. He will provide instructions for filing the claim. Once the claim has been filed the carrier will forward it to Visual. Visual will notify you regarding the claim and arrange for repair or replacement.

3-6 If the Broadcaster malfunctions, contact your local sales office or the factory. Always be sure to include the model and serial numbers with any communications regarding the equipment.

3-7 MOUNTING

3-8 When supplied for rack mounting, the Broadcaster is designed to mount in a standard 19" rack providing 14" of vertical clearance and a minimum depth of 17". The rack slides selected should be located at a position in the rack that will permit the mounting tray to just clear the bottom of the rack opening. (The bottom of the mounting tray is exactly 2" below the mounting holes for the slide rails.

3-9 After mounting and securely fastening the slides to both the rack and the Broadcaster mounting tray according to the rack manufacturer's instructions, slide the Broadcaster into the rack and set the forward slide stops. Slide the Broadcaster back and forth several times the entire length of the slide travel, to determine that there is sufficient rack clearance and a proper front plate fit with the rack.

3-10 AC POWER

3-11 Power is applied to the Broadcaster by connecting the integral three-conductor grounded cord and plug to the appropriate power source (115V 60 Hz). If a two-wire ac distribution system is used, connect a polarized adapter plug to the cord plug and connect the pigtail to rack ground. Check the input power fuse adjacent to the power cord.

CAUTION

Be sure to allow wiring slack of about 24" on each cable and wire before cutting and connecting them.

3-12 SIGNAL OUTPUT CONNECTIONS

3-13 General - Required signal output connections are made to connectors J1, J5, and J6 on the rear panel of the unit. See Table 3-1 for a summary of all output connections.

3-14 Program Preamplifiers - The outputs of all program playback preamplifiers (top tape track) are connected to separate sets of terminals on connector J1. The mating plug for this connector is jumpered at the factory to connect the preamplifier outputs through a mixing network and line amplifier. Connections to the preamplifier outputs should be made as shown in Table 3-1.

3-15 Grouped Line Output - The combined program output of all six decks is available at connector J5, and may be applied to a single bridging or matching input on a mixing console. Using a Cannon XLR-3-11 cable connector (or equivalent), connect the shield of the audio program line to pin 1 and the balanced audio lines to pins 2 and 3. If the far end of the program line is unbalanced, connect pin 3 to the high (ungrounded) side of the input circuit. Jumper pins 1 and 2 and connect to the low (grounded) side of the input circuit.

3-16 Separate Preamplifier Output - The outputs of all program preamplifiers may be connected to separate inputs on a mixing console through terminals on J1.

Table 3-1. Signal Connections

DECK NUMBER	PROGRAM				CUE			
	PREAMPLIFIER OUTPUT		MIXER INPUT		PREAMPLIFIER OUTPUT		MIXER INPUT	
	High	Low	High	Low	High	Low	High	Low
1	J1-2	J1-3	J1-1	J1-3	J1-5	J1-3	J1-10	J1-3
2	J1-12	J1-13	J1-11	J1-13	J1-15	J1-13	J1-20	J1-13
3	J1-22	J1-23	J1-21	J1-23	J1-25	J1-23	J1-30	J1-23
4	J1-32	J1-33	J1-31	J1-33	J1-35	J1-33	J1-40	J1-33
5	J1-42	J1-43	J1-41	J1-43	J1-45	J1-43	J1-50	J1-43
6	J1-52	J1-53	J1-51	J1-53	J1-55	J1-53	J1-60	J1-53

Mixed (All Decks) Program Output:
J5-1, Shield
J5-2, High
J5-3, High

Mixed (All Decks) Cue Output:
J6-1, Shield
J6-2, High
J6-3, High

Disconnect the jumpers from the "Preamplifier Output" terminals and connect console input lines to the "High / Low" terminals as indicated in Table 3-1. If shielded twisted pairs are to be used, ground the shields to the low side of the circuit at one end of the cable only. If the grouped line output is to be used in addition to the individual preamplifier outputs, do not disconnect the jumpers connecting the preamplifier outputs to their respective line mixer inputs.

3-17 Cue Preamplifier Outputs - Cue preamplifier outputs are internally connected to the stop cue tone sensor and there are no special external connections required. If the optional Cue 2 and Cue 3 oscillators are employed, however, their sensor boards must be mounted externally. Connections between this auxiliary cue tone sensor and the cue preamplifier outputs are made to J1, as shown in Table 3-1. See instructions accompanying the auxiliary cue tone sensor assembly for complete installation and interconnection data.

3-18 In some applications, independent cue tone contact closures from each deck are not required and a single cue tone sensor may be installed in the SB6AR, with the sensor input connected to the output of the cue tone grouped line amplifier output (J6). Under these conditions the sensor will close its contacts whenever a cue tone of the correct frequency appears on any of the six decks of the transport.

3-19 The outputs of the six cue preamplifiers are connected by jumpers on J1 to the mixing input of the cue line amplifier. The independent isolated output of each of the cue preamplifiers is available on J1 even though connected to the mixing input. One or more of the six preamplifiers may be disconnected from the cue line amplifier by removing the appropriate jumpers on J1.

3-20 SIGNAL INPUT CONNECTIONS

3-21 Program Recording Input - Program recording input is made at J3 by means of a Cannon XLR-3-12 cable connector. To accept a balanced audio line, connect pin 1 of the connector to shield and the audio line to pins 2 and 3. If an unbalanced program line is used, the high side of the line should be connected to pin 3 and the low side of the line to pin 2. Do NOT ground pin 2 at the Broadcaster end of the line.

NOTE

The recording input is 20KΩ

Table 3-2. Remote Control Connections, J2

PIN NO.	DECK	FUNCTION	PIN NO.	DECK	FUNCTION
1	1	Start	21	5	Start
2	1	Stop	22	5	Stop
3	1	Reverse*	23	5	Reverse*
4	1	(Spare)	24	5	(Spare)
5	1	Common	25	5	Common
6	2	Start	26	6	Start
7	2	Stop	27	6	Stop
8	2	Reverse*	28	6	Reverse*
9	2	(Spare)	29	6	(Spare)
10	2	Common	30	6	Common
11	3	Start	31		Sequence
12	3	Stop	32		All Stop
13	3	Reverse*	33		(Spare)
14	3	(Spare)	34		(Spare)
15	3	Common	35		Control -24V
16	4	Start	36		(Spare)
17	4	Stop	37		(Spare)
18	4	Reverse*	38		(Spare)
19	4	(Spare)	39		(Spare)
20	4	Common	40		(Spare)

*Optional

NOTE: Terminals 5, 10, 15, 20, 25, and 30 are connected together internally and a single conductor may be used for the "Common" connection to the remote Start, Stop, and Reverse pushbuttons. If a remote control unit is not used, pins 30 and 32 must be jumpered together. This has already been done in the mating plug supplied with the SB6AR.

bridging. If the recording line must be terminated in 600Ω, connect a 680Ω resistor between pins 2 and 3.

3-22 Cue Tone Input - Cue tones originate within the Broadcaster and therefore require no external connections. If the optional CUE 2 or CUE 3 oscillators are added, however, the oscillator circuit boards should be mounted on the right side of the instrument on the electronics mounting plate (see page 8-6), the CUE 2 and CUE 3 pushbuttons added to the front panel (see page 4-2), and the CUE 2 and CUE 3 relays added to the relay mounting bracket (see page 8-2). Connections to the dc supply and the erase and bias oscillator should be made as shown on the Broadcaster (D11534) and cue oscillator (C10573) schematics.

3-23 REMOTE CONTROL

3-24 One or more remote stations may be used to control all electrical functions of the Broadcaster appearing on the front panel, except for the SEQUENCE MODE and ERASE switches, as explained in paragraph 1-9. All remote control connections are made to J2 on the rear of the Broadcaster. See Table 3-2 for all connections.

3-25 The remote switches should have normally-open momentary contacts except for the ALL STOP switch, which should be a normally-closed switch. If desired, the START switch may be sustained instead of momentary, in which case the cartridge will continue to run until the switch is opened, regardless of stop cue tones on the tape.

SECTION IV-OPERATION

4-1 GENERAL

4-2 Although the SB6AR Broadcaster comprises six separate tape recording systems, nontechnical personnel can nevertheless be trained to operate it with only a few minutes of instruction. See Table 4-1 for a lsit of all controls and indicators and their respective functions. See Figure 4-1 for locations of all controls and indicators.

4-3 MANUAL OPERATION

4-4 Ac Power - Ac power is applied to the Broadcaster by means of the POWER switch. The POWER ON indicator will illuminate only if power has been applied to the power supply and capstan motor. Power for all decks and all Broadcaster operations is supplied through this one switch.

4-5 Pre-Operating Check - The Broadcaster decks are numbered from top to bottom. Each deck is equipped with its own PLAY, STOP, REVERSE, and EJECT pushbuttons, in line with the cartridge loading slot for each deck. Operation of one deck has no effect on the others unless externally arranged to do so by the interconnection of special circuitry.

4-6 Without inserting a cartridge into any of the six slots, press each PLAY pushbutton and observe that the cartridge slot, pull in as each PLAY button is depressed. Press the ALL STOP button to return the hooks to normal position.

4-7 Loading and Unloading Cartridges - Insert an RCL cartridge into any one of the cartridge loading slots, with the label reading upright. Push the cartridge forward lightly until a snap is heard. This indicates that the cartridge is seated properly in the standby position, ready for play or recording.

CAUTION

A cartridge cannot be pulled out manually, but must be ejected by pressing the EJECT button for the appropriate deck.

4-8 Cartridges may be removed from the loading slots by firmly pressing the EJECT button at the right of the deck. The cartridge will be propelled forward an inch or two, and can then be completely removed by hand.

4-9 Playing a Cartridge - With a cartridge inserted as described above, press the PLAY button for the desired deck. The cartridge solenoid will pull the cartridge forward approximately 1/8" and the tape will move into contact with the heads and capstan. Playback will commence within 50 milliseconds. The cartridge will continue to play until it is stopped manually or a stop cue tone passes the cue (lower) stack of the playback head.

4-10 Stopping the Cartridge - The cartridge may be stopped manually at any time by pressing the ALL STOP button or the STOP button for the desired deck. This will cause the cartridge solenoid to release and the cartridge will be pushed back to its standby position.

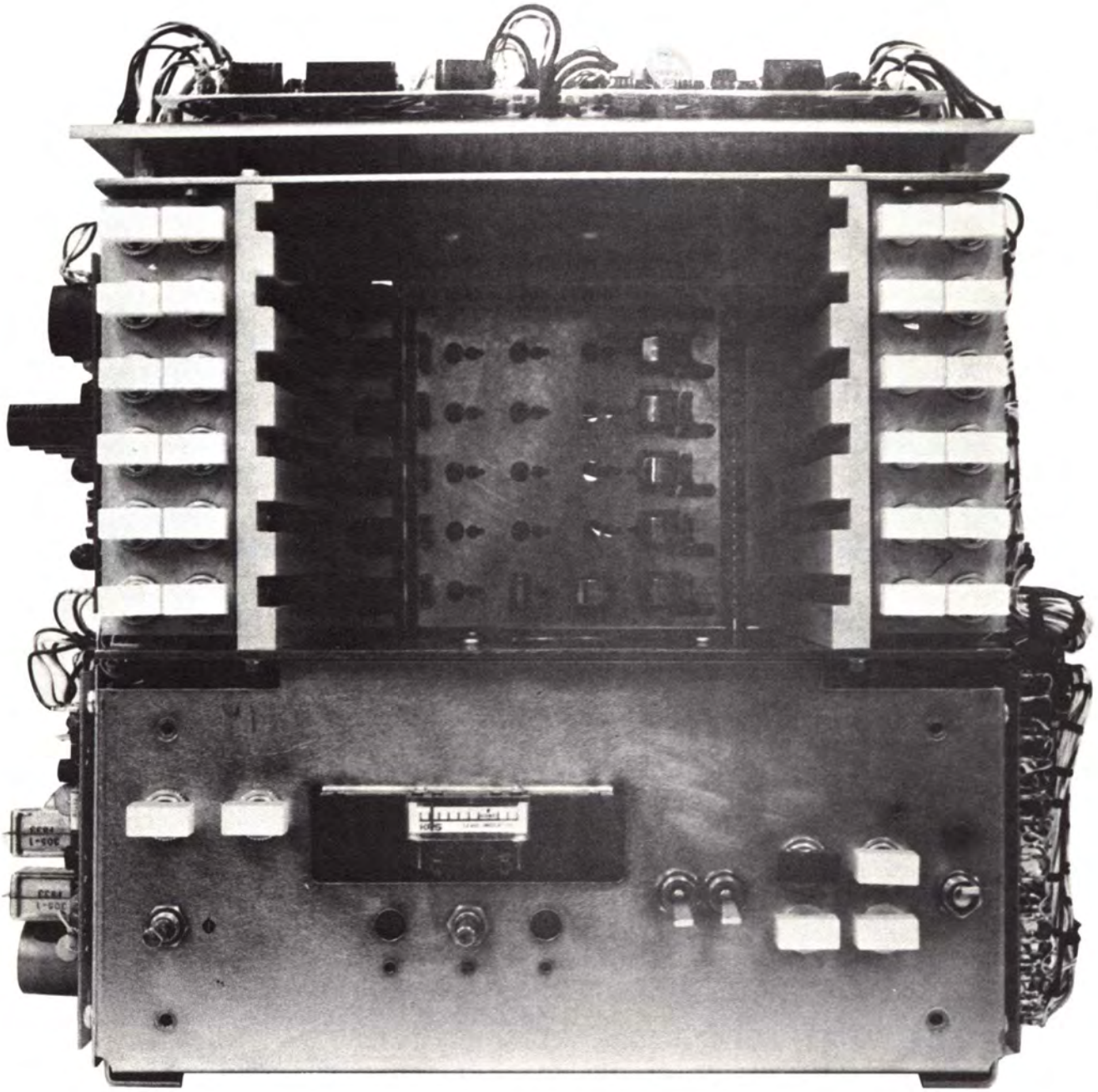
NOTE

The ALL STOP button stops all cartridges that are in operation. To stop just one cartridge press the associated STOP pushbutton.

4-11 Reversing the Cartridge - Broadcasters are equipped with a REV (reverse) pushbutton at the right of each deck equipped for reversing. When a deck is not equipped for reversing a dummy button is supplied.

4-12 Insert a cartridge into a deck equipped for reversing and start it in play. Push the REV button and hold it depressed. The cartridge will release to its standby position, the audio will be muted, and the reverse idler will drive the tape in the reverse direction for as long as the REV button is held depressed. Tape speed in the reverse direction is approximately 15 inches per second.

4-13 Release the REV button. The reverse motion of the tape will stop and the cartridge will remain in the standby position. Play - reverse operations may be performed up to the load limit of the cartridge's reverse storage chamber without affecting the play performance of the cartridge. See Section II. Never operate the PLAY and REV pushbuttons at



SB6AR, Front View

The transport may optionally be equipped with from one to six decks of reversing

CONTROL	INDICATOR	FUNCTION
POWER switch		Applies ac power to the regulated power supply and the capstan motor.
	POWER ON lamp	Indicates presence of ac power at regulated power supply and capstan motor.
PLAY pushbutton		Energizes cartridge relay, which actuates solenoid, pulling cartridge into contact with heads and capstan, initiating cartridge play.
	PLAY lamp	Indicates that cartridge solenoid is energized and that deck is "in use".
STOP pushbutton		Stops tape motion by releasing cartridge relay and solenoid.
REVERSE pushbutton		Energizes the reverse solenoid and actuates the reverse idler on decks so equipped. Idler returns to standby position and tape stops when pushbutton is released. Interlocks with PLAY pushbutton. PLAY must be reinitiated after tape has reversed.
EJECT pushbutton		Releases cartridge from its locked "standby" position, thereby enabling removal.
ALL STOP pushbutton		Releases cartridge relays and solenoids for all decks simultaneously and stops cartridge motion, returning cartridges to "standby" position.
REC LEVEL		Controls the level of the recording input signal.
	LEVEL meter	Indicates normal input signal level and provides a "Normal" indication.
RECORD PGM pushbutton		Initiates recording mode of operation. Interlocked with the ERASE PGM switch to prevent inadvertent erasure of tape. Deck 6 must be in operation before the RECORD PGM pushbutton is operative. Deck 6 automatically returns to the play mode when the tape is stopped.
	RECORD PGM lamp	Indicates that deck 6 of Broadcaster is recording and/or erasing.
CUE 1 pushbutton		Activates Cue 1 oscillator and causes a stop cue to be recorded on bottom track.
CUE 2 pushbutton		Activates Cue 2 oscillator and causes a secondary cue to be recorded.
CUE 3 pushbutton		Activates Cue 3 oscillator and causes a tertiary cue to be recorded.
ERASE PGM switch		Controls the program track of the erase head. Must be on to enable PGM recording.
ERASE CUE switch		Controls cue track of erase head. Must be on with RECORD button to erase cue track.
SEQUENCE MODE		Selects Broadcaster operating mode: Manual, Preset, 1 Cycle, or Recycle.
SEQUENCE switch		Causes next cartridge to be energized in Preset Sequence Mode.
	SEQUENCE lamp	Indicates that a cartridge has been preset awaiting play in the Preset Mode.

Table 4-1. Control and Indicator Functions

the same time.

4-14 Using Deck 6 to Record - Deck 6 is equipped to record program material on the upper track and cue tones on the lower track of the cartridge. The program input level is adjusted by the REC LEVEL control below the LEVEL indicator. The REC LEVEL control should be set so that audio peaks do not exceed "Normal" on the meter.

4-15 Table 4-2 lists the operating procedure for recording programs and cue tones.

NOTE

The stop cue (Cue 1) must be recorded on the tape immediately preceding the program material in order to assure accurate automatic stop and cue control over tape motion.

4-16 Selective Erasing - With the dual track erase head, either one of the two tracks may be erased without affecting the other, through the use of switches labeled ERASE PGM and ERASE CUE on the front panel. To erase the program track without affecting the cue track, turn on the switch marked ERASE PGM, turn off the switch marked ERASE CUE, turn the RECORD LEVEL control fully counter-clockwise, and depress the deck 6 PLAY and RECORD PGM pushbuttons simultaneously. If no stop cue had been recorded on the lower track, the tape will continue to run indefinitely until stopped manually. If a stop cue tone had previously been recorded on the lower track, the tape will run, erasing the upper track, and stop at the stop cue. If desired, a new program may be recorded as the old one is being erased by feeding an input signal into the Broadcaster and adjusting the RECORD LEVEL control for a "Normal" indication on the meter.

4-17 To erase the cue track without affecting the program track, turn on the switch marked ERASE CUE, turn off the switch marked ERASE PGM, and depress the deck 6 PLAY and RECORD PGM pushbuttons simultaneously. The tape will continue to run until stopped manually, since any cue tones previously recorded on the tape will be erased before passing the reproduce head. Recording the program (upper) track is not possible without the ERASE PGM switch being on. If desired, new cue tones may be recorded at the same time as the old ones are being erased by momentarily depressing the appropriate CUE 1, CUE 2, or CUE 3 pushbuttons. Internal circuitry provides for recording the tone for approximately 1/4 second even though the pushbutton is depressed for a longer or shorter time.

4-18 To erase the program and cue tracks simultaneously, turn on the ERASE PGM and ERASE CUE switches and depress the deck 6 PLAY and RECORD PGM pushbuttons simultaneously. Both the program and cue (upper and lower) tracks on the tape will be erased. A new program may simultaneously be recorded by applying an input signal and adjusting the RECORD LEVEL control as required. New cue tones may be recorded by depressing the appropriate CUE 1, CUE 2, or CUE 3 pushbuttons.

OPERATION	ACTION	RESULT
Prepare to record	Clean tape heads and tape guides; clean cartridge guides; turn on ERASE PGM and ERASE CUE switches; adjust RECORD LEVEL	All tape contact surfaces shine, cartridge engages smartly.
Put tape in motion	Depress deck 6 PLAY pushbutton	Cartridge moves to play position; play lamp (in PLAY pushbutton) comes on.
Enter record mode	Depress RECORD PGM pushbutton	Record lamp (in RECORD PGM pushbutton) comes on; erasure of cue and program tracks begins.
Record stop cue	Depress CUE 1 pushbutton	A 1000 Hz tone is recorded on the lower track for approximately 1/4 second.
Record program	Cue announcer	Program is recorded on the upper track.
Monitor during recording	Connect monitor amplifier or headphones to Record Monitor terminals, J1-53 and J1-54.	Playback will be heard approximately 0.26 seconds after input.
Control volume	Adjust RECORD LEVEL control for "Normal" indication on the meter	Keeping sound peaks at, but not above, the "Normal" indication on the meter produces a recording with optimum sound quality. Too high a level introduces distortion and too low a level results in excessive noise when playing back the tape.
Stop recording	Turn the RECORD LEVEL control all the way counter-clockwise	No more sound will be recorded on the tape. The tape will continue to run, erasing the program and cue tracks.
Record CUE 2 (end of message)	Depress the CUE 2 pushbutton while the tape is still in motion	A 150 Hz tone is recorded on the lower track. This tone may be used as an "end-of-message" tone to start the next event.
Stop the tape	Depress deck 6 STOP pushbutton	Tape stops and cartridge returns to the standby condition. Deck 6 automatically returns from record mode to play mode. (NOTE: Instead of stopping the tape manually, the ERASE CUE switch may be turned off; the cartridge will now stop at the next stop cue.)
Record a stop cue between program segments recorded continuously	Depress CUE 1 pushbutton	A 1000 Hz tone is recorded on the lower track between segments.

Table 4-2. Table of Operating Procedures

OPERATION	ACTION	RESULT
Play a tape	Depress the PLAY pushbutton corresponding to deck selected	Cartridge moves to play position; recorded signal on tape is reproduced through amplifiers and appears at output connector.
Stop a tape	Depress STOP pushbutton corresponding to deck selected	Tape cartridge moves out to standby position; tape motion stops.
Automatically stop a tape	(No action)	The tape will automatically stop whenever it comes to a point on the tape where a 1000 Hz tone has been recorded on the cue track.
Recue a manually stopped tape	Depress PLAY pushbutton	Tape will start and then automatically stop when it reaches the stop cue point.
Play and/or stop several cartridges	Depress the PLAY or STOP pushbuttons as required	Each cartridge may be started and stopped independently of the others when the SEQUENCE MODE switch is in the manual position.
Automatically play more than one cartridge in sequence	Set SEQUENCE MODE switch to 1 CYCLE; depress PLAY pushbutton of first cartridge desired	Selected cartridge will play through a complete cycle to its stop cue, stop, and start the next cartridge; process will continue through cartridge 6 and then stop.
Continuously repeat sequence of cartridges	Set SEQUENCE MODE switch to RECYCLE; depress PLAY pushbutton of first cartridge desired	Same as "1 CYCLE" (above), except that when cartridge 6 stops cartridge 1 will restart. NOTE: When deck 6 is in use for recording, the sequence mode automatically skips deck 6, either stopping at deck 5 (in the 1 CYCLE mode) or sequencing from deck 5 to deck 1 (in the RECYCLE mode). The recording process will not be affected.
Preset selected cartridge	Set SEQUENCE MODE switch to PRESET; depress PLAY pushbutton of selected cartridge	PLAY lamp of selected cartridge and SEQUENCE lamp will go on. Cartridge relay will be operated but cartridge solenoid will not be, so tape will not be in motion.
Start preset cartridge	Depress SEQUENCE pushbutton	Preset cartridge will start. When it comes to its stop cue it will stop and preset the next cartridge.
Start several cartridges simultaneously	Set SEQUENCE MODE switch to PRESET; depress PLAY pushbutton of selected cartridges; depress the	Selected cartridges will start simultaneously but stop independently when they reach their respective stop cue tones, automatically presetting the next cartridge. (To avoid presetting the next cartridges, return SEQUENCE MODE switch to

Table 4-2. Table of Operating Procedures (Continued)

OPERATION	ACTION	RESULT
	SEQUENCE pushbutton	the MANUAL position after starting the cartridges.)
Stop several cartridges simultaneously	Depress ALL STOP pushbutton	Stops all operating cartridges (including deck 6 even though it is in the recording mode) simultaneously.
Reverse a tape	Depress the REV push-button for the length of time that the tape is to be reversed	Tape is driven in the reverse direction at 15 ips up to a maximum of 120 feet (see pag 2-1). To return to the play mode the PLAY pushbutton must be depressed.
Remove cartridge	With the tape stopped, firmly depress the EJECT pushbutton	The cartridge hook mechanism is disengaged and the cartridge is partially ejected from the machine so that it may be easily grasped.
Turn off equipment	Turn POWER switch to off position	Motor stops; power to electronics is turned off; cartridges are disengaged from capstan (to prevent flat spots on pressure rollers).

Table 4-2. Table of Operating Procedues (Concluded)

SECTION V- THEORY OF OPERATION

5-1 GENERAL

5-2 The mechanical operation of the Broadcaster is described in Section I. This section contains the theory of operation of the electronic components and assemblies.

5-3 All electronic assemblies are solid state and are constructed on epoxy galss etched circuit boards of standard sizes. Each circuit board is individually mounted with #4-40 machine screws. Wiring connections to the boards are by means of snap-on connectors. No soldering is required. Schematic diagrams of all the electronic circuits are located in Section VII. Drawing 11534 is the schematic diagram of the Broadcaster.

5-4 POWER CIRCUITRY

5-5 General - The Broadcaster power circuitry includes the regulated power supply, the power transformer, the capstan drive motor, the power switch, the pilot light, and the primary fuse. Drawing 11620 shows the circuit.

5-6 Mains Supply - By changing the connections to the transformer primary, the SB6AR may be operated on 90, 110, 130, 200, 220, or 240 volts. The transformer will operate on either 50 or 60 Hz, but the motor and pulley assembly must be changed to correspond to the frequency of the supply voltage, since a synchronous drive is used.

5-7 Power Requirements - Input power is a nominal 120V, 60 Hz, 1.0A maximum. A 1.5A slow-blow fuse is located on the rear panel of the unit adjacent to the line cord.

5-8 REGULATED POWER SUPPLY

5-9 General - The solid-state power supply provides dc power to all the solenoids, relays, lamps, and electronic circuits. It is comprised of two assemblies: a heat sink and a printed circuit board. The heat sink assembly contains the four rectifier diodes and the three power transistors. The remainder of the components are mounted on the circuit board. See drawing 10595.

5-10 High Voltage Section - CR1, CR2, C1A, and C1B comprise a full-wave rectifier/filter circuit which provides an unregulated -36V dc output from the red-red/yellow winding of transformer T1, to supply power to the solenoids and input voltage to the series regulator. The -24V dc regulated voltage for the electronic circuits is provided from this -36V dc source through a regulator consisting of transistors Q1, Q3, and Q4. The -24V dc regulated voltage for the indicator lamps is provided from the -36V dc source through regulator transistor Q2, which is referenced to the electronics -24V output. The sensing input to the regulator circuit is connected by a pair of sensing leads to the farthest common distribution point from the power supply, thereby extending regulation to the series resistance of the distribution and ground busses. The sensing voltage divider, R5/C5 and R6, provides the input voltage to the regulating amplifier Q4. Amplifier reference voltage is provided by diode CR6. This circuit arrangement provides extremely stable regulation and, as a result of its negligible source impedance, also reduces amplifier crosstalk.

5-11 Low Voltage Section - CR3, CR4, and C2 comprise a full-wave rectifier/filter circuit which provides an unregulated -10V dc for play solenoid holding voltage.

5-12 Regulation - The solenoid supplies (-36V and -10V) are unregulated and hence will vary with the mains voltage. Under no-load average conditions the two voltages will measure approximately -40 to -45V and -12 to -15V, respectively.

5-13 PLAYBACK PREAMPLIFIERS

5-14 General - The program and cue playback preamplifiers are identical. See drawing 10348. They are four-stage solid-state assemblies that deliver a 0 dBm, 600Ω unbalanced output when connected to a reproduce head of approximately 400 mH. Q1 and Q2 form a direct-coupled two stage amplifier. Standard tape equalization is provided by negative feedback from the collector of Q2 to the emitter of Q1. R8 and C5 determine the high-frequency turnover point and R7 and C5 determine the low-frequency turnover. These points are at 90 μseconds (approximately 3500 Hz) and at 3180 μseconds (50 Hz), respectively, for NAB equalization at 7.5 inches per second.

5-15 Gain Adjustment - Potentiometer

R10 is a gain adjustment to compensate for tape head output variations. It is intended for alignment procedure only. The output of the first two stages is capacitively coupled to Q3 for further amplification. Q4 is a direct-coupled emitter-follower to provide a low output impedance for the line. The amplifier output will appear as a voltage source for load impedances of 600Ω or greater. The output impedance is approximately 80 ohms.

NOTE

To avoid distortion, the load impedance on the amplifier should not be lower than 600Ω.

5-16 LINE AMPLIFIERS

5-17 General - A combined mixing network and output amplifier is provided for both the program and cue outputs of the Broadcaster. The outputs are transformer-coupled to the 600Ω line output connectors. See drawing 11623.

5-18 Combining Network - Each line amplifier is provided with a six-input combining network to couple to the output of each of the six decks. The input impedance is 60KΩ and so may remain connected even though the independent output of a deck may be in use. Typical isolation between inputs is greater than 90 dB (depending somewhat upon the setting of the gain control), with minimum isolation of 80 dB.

5-19 Amplifier - The amplifier output level may be adjusted by potentiometer R7. The input is capacitively coupled by C1 to a two-stage direct-coupled amplifier comprised of Q1 and Q2. The collector of Q2 is direct-coupled to the bases of the push-pull complementary output stage formed by Q3 and Q4. Negative feedback and dc stabilization are provided by R12. A small forward bias is applied to Q3 and Q4 to minimize crossover distortion. The emitters of the output stage are capacitively coupled to the output transformer, which provides a balanced 600Ω isolated output. A low-pass roll-off network is provided across the transformer secondary to attenuate the effects of recording bias that may be present in the reproduced output of the tape. A center-tap on the output transformer is available if required. Pin 1 on the output connector can be connected to the center-tap by a simple change of the snap-on connections at the line amplifier circuit board.

5-20 STOP CUE TONE SENSOR

5-21 General - The stop cue tone sensor detects the presence of the 1000 Hz cue tones on the lower track of the tape and automatically stops the tape at the end of each 1000 Hz tone. The six sensors required for the Broadcaster are mounted on a common printed circuit board. See drawing C12862.

5-22 Sensitivity Adjustment - A sensitivity control rheostat is provided at the input of each of the six sensors. It is factory-set so that the sensor will respond to a cue tone that may be reproduced as much as 5 dB low, but will not respond to noise or 1000 Hz signals that are lower than that in level.

5-23 Circuit Operation - The sensor input is taken from the output of the cue playback preamplifier. A parallel-resonant filter rejects signals of other than the desired 1000 Hz. Q1 amplifies the signal, which is rectified and applied to dc amplifier Q2. The output of Q2 is direct coupled to output switch Q3, which controls the release of the cartridge relay. When a tone is present, Q3 conducts, shunting the cartridge relay and causing it to release.

5-24 RECORD AMPLIFIER

5-25 Amplification - The signal input to the record amplifier is applied to the circuit board through the RECORD LEVEL control on the front panel of the Broadcaster. The input stage is a differential amplifier to provide a balanced input with good common mode rejection. With this circuit arrangement, longitudinal noise arrives simultaneously at the bases of both Q1 and Q2 and is cancelled. Normal input signals arrive at the input out of phase and are therefore added and amplified. See drawing 10559. The second stage (Q3) is an emitter-follower to drive the equalization network with a low source impedance. After equalization the signal is further amplified by Q4 and is applied to the bias oscillator through coupling capacitor C7 and the parallel time constant network formed by R18 and C9.

5-26 Equalization - Recording equalization of the signal is provided by the network comprised of R10, C3, C5, C8, and L1. R10 and C5 provide a 3 dB boost at 50 Hz. R10 and C3 provide pre-emphasis rising approximately 12 dB at 18,000 Hz. C8 and L1 are tuned for sharp attenuation above 18,000 Hz. R18 acts to provide a constant-current source for the recording head, and C9 provides a small amount of high-frequency boost to compensate for head losses.

5-27 Meter Driver - An additional unequalized output of Q3 is coupled through C10 to amplifier Q5 to provide for VU meter drive. The output at the collector of Q5 is applied to the meter through C11 and calibration potentiometer R23, a setup adjustment located on the board.

5-28 ERASE AND BIAS OSCILLATOR

5-29 Oscillator - Transistors Q1 and Q2 operate in a push-pull oscillator circuit with positive feedback from collector to opposite base through C3 and C4, respectively. Grounding of the common emitter by the control relays causes the circuit to oscillate. The oscillator waveform is adjusted for minimum distortion by R1, between the bases of Q1 and Q2. Any second harmonic distortion in the waveform will result in a higher noise level on the recorded tape. See drawing D11292.

5-30 Bias Mixer - The output of the oscillator appears at the secondary of transformer T1 and is applied to the record head through the bias adjusting controls, R4, R5, and R10. These controls are set for maximum reproduced output at 700 Hz. Capacitors C7, C8, and C12 provide decoupling at audio frequencies to prevent the audio signals on different tracks of the record head from mixing.

5-31 Erase - A tap on the oscillator transformer secondary feeds the erase circuitry. Capacitor C9 resonates with the inductance of the record head. LDR λ1 provides a gradual turn-on and turn-off time for the program erase head so as to prevent the recording of "pops" when erasure is turned on or off during recording.

5-32 Control - Relays K1 and K2 control the operation of the program and cue erase and bias circuitry. K1 is operated by the ERASE PGM toggle switch and the RECORD PGM pushbutton on the front panel of the Broadcaster. When it operates, one set of contacts removes a "short" across the record head and applies a ground to the emitters to start the circuit oscillating. The other set of contacts removes a "short" across the second program track (on stereo machines only) of the record head and also turns on the LDR to apply erase current to the erase head. Relay K2 is operated by the ERASE CUE toggle switch and the RECORD CUE pushbuttons on the front panel of the Broadcaster. When it operates, one set of contacts grounds the emitters to start the circuit oscillating, while the other set of contacts transfers the erase output of the oscillator from a dummy load to the cue erase head.

5-33 CUE OSCILLATOR

5-34 The cue oscillator is a two-stage current-derived phase-shift oscillator. See drawing 10573. Positive feedback from the collector of Q2 to the base of Q1 is provided by a three-section network consisting of C2, R2, C3, R3, C4, and R4. The circuit will not oscillate as long as this feedback loop is grounded at the junction of C3 and C4 through normally-closed contacts on the cue relays. Depressing the CUE pushbuttons closes the relay coil circuit through a timing capacitor to unground the feedback loop for the capacitor charging time of approximately 1/4 second. Oscillation occurs during this period and the output of the oscillator is coupled through the bias oscillator to the record head. R3 and R10 provide setup adjustment of the frequency and amplitude of the tone, respectively. Since there is some interaction of the controls, they should be set for best waveform at the desired amplitude and frequency.

SECTION VI - MAINTENANCE

6-1 GENERAL

6-2 A minimum amount of periodic maintenance is required to assure trouble-free, in-tolerance operation. This section contains only routine and general maintenance and alignment instructions. It is suggested that the Broadcaster be returned to the factory for any necessary major repairs or maintenance.

6-3 PREVENTIVE MAINTENANCE

6-4 Heads - The magnetic heads should be cleaned regularly to assure proper head-to-tape contact. No hard and fast rule for frequency of cleaning can be established, since this will vary greatly with amount of use and environmental conditions. In most continuous-use applications a cleaning once each day should suffice. A cotton-tipped swab dampened with alcohol should be used.

6-5 Capstans and Reverse Idlers - After continued use there will be an accumulation of magnetic oxide and graphite, resulting in tape slippage and flutter. Capstans and reversing idlers should be cleaned periodically with a lint-free cloth dampened with alcohol.

CAUTION

The heads, capstans, and idlers contain materials which may be attacked by strong commercial solvents or abrasives. To be safe use only the recommended procedure.

6-6 Demagnetization - After prolonged use heads and guides may become magnetized, resulting in higher distortion and increased noise. A commercially available head degausser should be used periodically to demagnetize all heads and guides. Follow the instructions supplied with the degausser. Be careful not to mar the surfaces of the magnetic heads. Be sure that no recorded cartridges are in the vicinity of the degausser or they may be partially erased.

6-7 Drive Assembly - The motor contains sealed bearings and should require no lubrication. Drive belts are molded of polyurethane and under ordinary use do not require cleaning. Should a belt become contaminated with oil or grease, use a cloth dampened with alcohol.

6-8 Electronics - All electronics in the Broadcaster is solid state, so no regular replacement of parts need be expected. At infrequent intervals the frequency response and levels should be checked, and if deviations from specifications are noted the adjustment procedures outlined below should be followed.

6-9 Main Assembly - It is desirable both for reasons of operation and for reasons of appearance to protect the Broadcaster from contamination from dirt and foodstuffs. The painted and plastic finishes should be wiped clean with a lint-free cloth dampened with alcohol or water.

6-10 CORRECTIVE MAINTENANCE

6-11 Parts Replacement - The exploded view of the Visual cartridge (Section II), the parts location photographs (Section VII), and the parts list (Section VIII) identify manner of assembly and part numbers of the replacement parts.

6-12 Equipment Required - In addition to conventional electronics tools, the following test equipment is required:

Standard alignment tape
Audio voltmeter
Audio signal generator
Audio amplifier and speaker

6-13 Head Alignment - All heads are secured in place with epoxy after alignment at the factory. Under normal conditions realignment in the field is not necessary. Misalignment is indicated by poor frequency response and/or low output on ALL tracks of a head. Similar effects can also be caused by dirty heads. Be sure that all other possibilities have been exhausted before attempting head realignment. If it becomes necessary to realign a play head whose azimuth has been disturbed by severe mechanical shock or other cause, proceed as follows:

(a) Thoroughly degauss the heads and guides.

(b) Connect the audio voltmeter to the program playback preamplifier output.

(c) Slightly loosen the nut holding the play head to the mounting plate. It should be possible to rotate the head

without disturbing its vertical adjustment.

(d) Play a standard alignment tape and adjust the azimuth of the play head by rotating a screwdriver, inserted from the rear, in the adjustment slot next to the play head.

(e) Position the head for maximum indication of the meter while the tape is playing 15 KHz at 7.5 ips (or 7500 Hz at 3.75 ips).

(f) Being extremely careful not to disturb the setting, tighten the nut holding the head to the mounting plate.

6-14 The procedure for alignment of the record head is similar except that in place of the standard alignment tape an unrecorded tape is used, and the azimuth of the record head is adjusted for maximum reproduced level while recording a 15 KHz tone.

6-15 The azimuth of the erase head is not critical and should not require adjustment.

6-16 Playback Preamplifier Alignment - Connect the audio voltmeter to the playback preamplifier output. Play the 700 Hz reference level tone of a standard alignment tape and adjust the level control (R10) on the preamplifier for 0 dBm output (0.774V). Repeat for both program and cue preamplifiers for all six decks.

6-17 Record Amplifier Alignment - Proceed as follows to set the Broadcaster for proper bias, equalization, and level adjustments:

(a) Thoroughly degauss the heads and guides.

(b) Connect an audio signal generator to the recording input connector. Set the frequency to 700 Hz and the output level to approximately -15 dBm.

(c) Connect the audio voltmeter to the program playback preamplifier output terminals.

(d) Adjust the RECORD LEVEL control for a "Normal" reading on the meter and start recording.

(e) Adjust the bias level control (R4) on the erase and bias oscillator for maximum reproduced output. Decrease the recording level if the reproduced output exceeds 0 dBm.

(f) Set the signal generator for a frequency of 15 KHz and a reproduced output of -15 dBm. This level is used to avoid saturating the tape because of high-frequency recording pre-emphasis.

(g) Without changing input level, change the generator frequency to 700 Hz and adjust the frequency compensating resistor (R10) on the record amplifier until the reproduced output is again -15 dBm.

(h) Check frequency response over the entire band. If there is a hump at the high end, increase the bias level slightly.

(i) Readjust the frequency compensating resistor (R10), if necessary. Because of interaction, it may be necessary to repeat the sequence of adjustments.

(j) Set the signal generator to 700 Hz and increase the level until a reproduced output level of 0 dBm is obtained. Adjust R23 on the record amplifier until the RECORD LEVEL meter reads "Normal".

6-18 Cue Oscillator Alignment - The playback electronics level adjustments should be made before attempting to set the cue tone record levels. Connect the audio voltmeter to the output of the cue playback preamplifier. Depress the CUE 1 pushbutton and observe the reproduced level. Adjust R10 on the cue oscillator to obtain 0 dBm. Repeat this procedure for CUE 2 and CUE 3, if supplied. Minor frequency trimming of the cue oscillator is possible by adjusting R3. If a frequency meter or an accurate oscillator is available the frequency of the cue oscillator may be checked and adjusted. The frequency adjust (R3) and the level adjust (R10) interact so it is necessary to check both whenever any adjustments are made.

6-19 Cue Sensor Alignment - The stop cue sensor is tuned to accept only tones of approximately 1000 Hz. A sensitivity control (R1) allows it to be set so that it will only respond to signals above -5 dBm. The control should be set so that the sensor will not operate on a 1000 Hz tone at -10 dBm but will always operate on a 1000 Hz tone at -5 dBm. This assures that it will properly respond to the normal stop cue tone at 0 dBm. The most convenient way to set the sensitivity is to play a test cartridge with 1000 Hz tones recorded at -5 and -10 dBm.

6-20 Line Amplifier Adjustment - The line amplifier input is the 0 dBm signal from the playback preamplifiers. It has a maximum output capability of +27 dBm, and has been factory set for an output level of +8 dBm. Resistor R7 on the circuit board adjusts the gain of the amplifier, and may be set for other output levels such as 0 or +16 dBm, if required. The level should be set using the 700 Hz reference level tone on the standard alignment tape.

SECTION VII - REPLACEMENT PARTS

ELECTRONIC ASSEMBLIES

Power Supply Regulator	10594
Record Amplifier (7.5 ips)	11047-3
" " (3.75 ips)	11047-4
Erase and Bias Oscillator	11291-2
Cue 1 (Stop) Oscillator	10575-1
Cue 2 (150 Hz) Oscillator	10575-5*
Cue 3 (8000 Hz) Oscillator	10575-4*
Playback Preamplifier (7.5 ips)	10340-3
" " (3.75 ips)	10340-4
Stop Cue Tone Sensor	12859-5
Line Amplifier	11621-1
Auxiliary Cue Tone Sensor (150 Hz)	11412-2*
" " " " (8000 Hz)	11412-1*

ELECTRONIC COMPONENTS

Power Transformer	10952
Power Cord	17130-004
Fuse, 1.5A Slow-Blow	15472-000
Pilot Light (120V)	15450-028
" " (240V)	15450-027
Power Supply Series Transistor (2N1535)	12455-009
Switch, Toggle: Power	15280-014
" " Erase Program & Erase Cue	15280-013
Switch, Rotary: Sequence Mode	11545
Switch, Pushbutton: Play, Cue, Record, Sequence	15450-026
" " Stop & All Stop	15450-038
" " Reverse	15450-029
Lens Cap, White	10679-1
" " Red	10679-2
Switch Lamp (327)	15450-027
Cartridge Solenoid	10833
Reversing Solenoid	10725
Cartridge Relay	13241-000
Record Relay	13241-000
Cue Relay	13241-000
Record Level Meter	10304
Record Level Control	10113-103

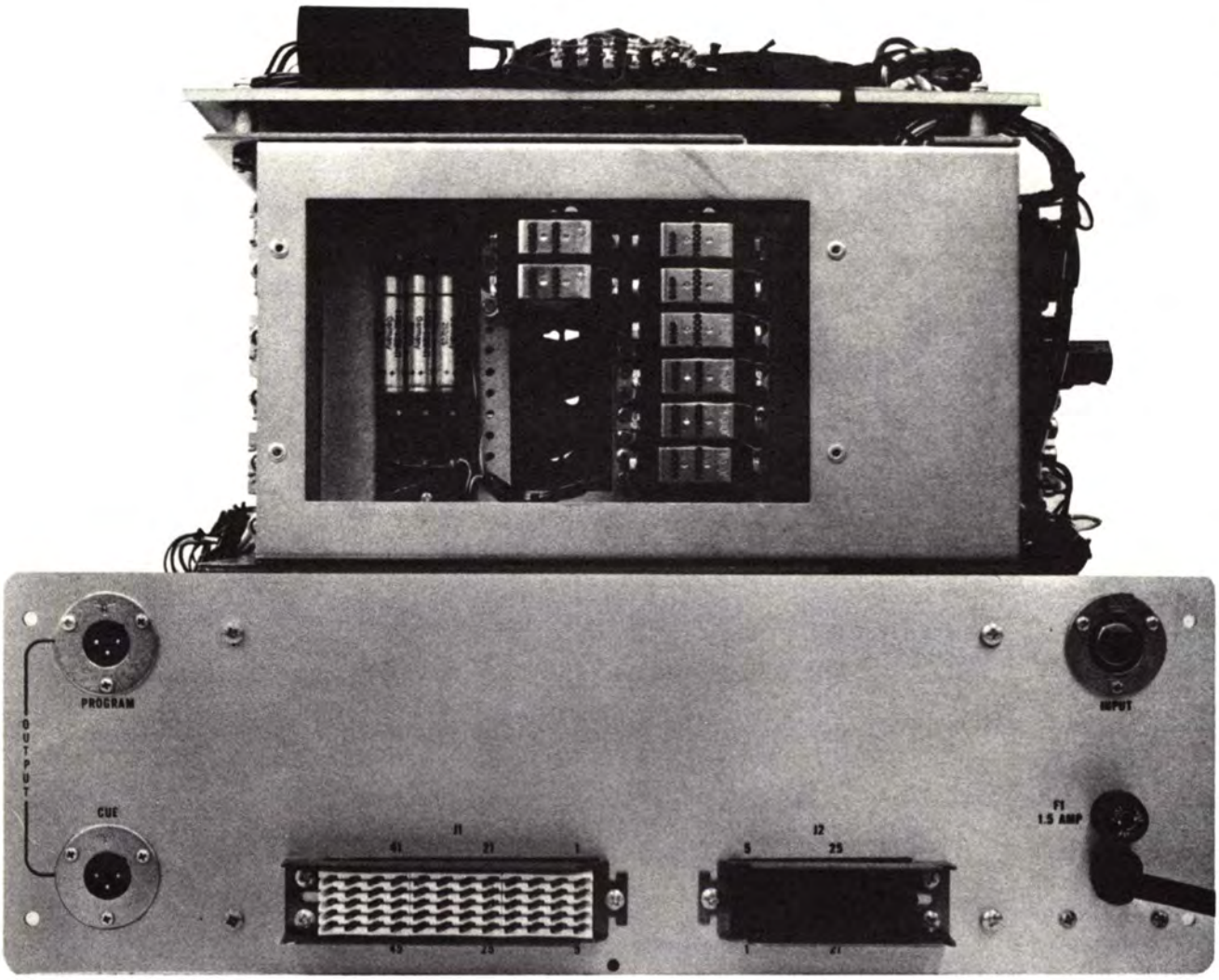
MECHANICAL COMPONENTS

Drive Motor (60 Hz)	11189-1
" " (50 Hz)	11189-2
Motor Capacitor (60 Hz)	11194-105
" " (50 Hz)	11194-455
Motor Pulley (60 Hz) (7.5 ips)	11471-1
" " (60 Hz) (3.75 ips)	11471-2
" " (50 Hz) (7.5 ips)	11471-3
" " (50 Hz) (3.75 ips)	11471-4
Forward Drive Belt	10202
Reverse Drive Belt	15550-502
Forward Capstan Assembly (including flywheel)	10571
Reverse Capstan	10963
Reverse Pulley	11473
Reverse Drive Wheel	10747
Capstan Bearing Assembly	11319
Capstan Thrust Disc	11647

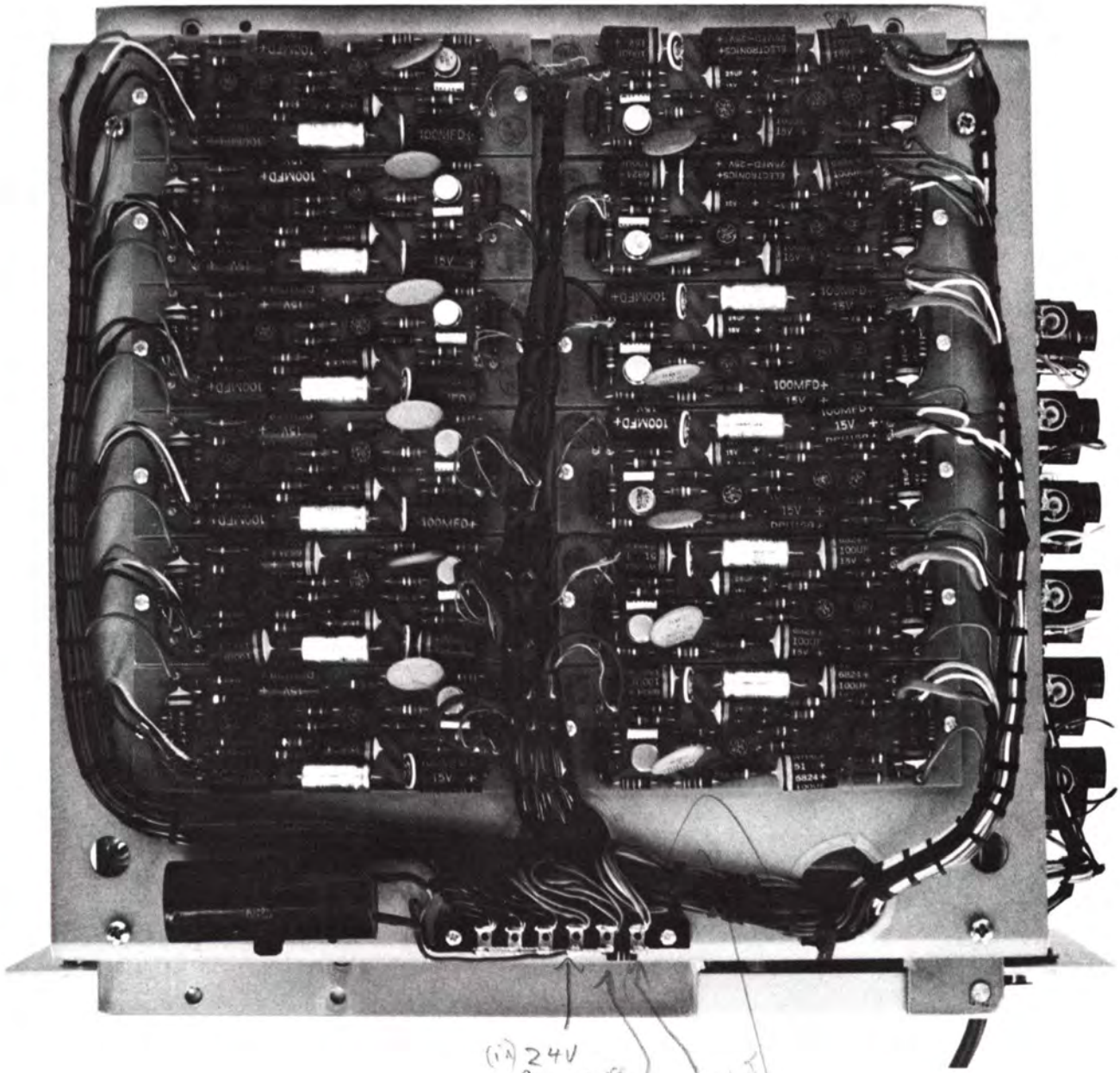
*Optional

SECTION VIII

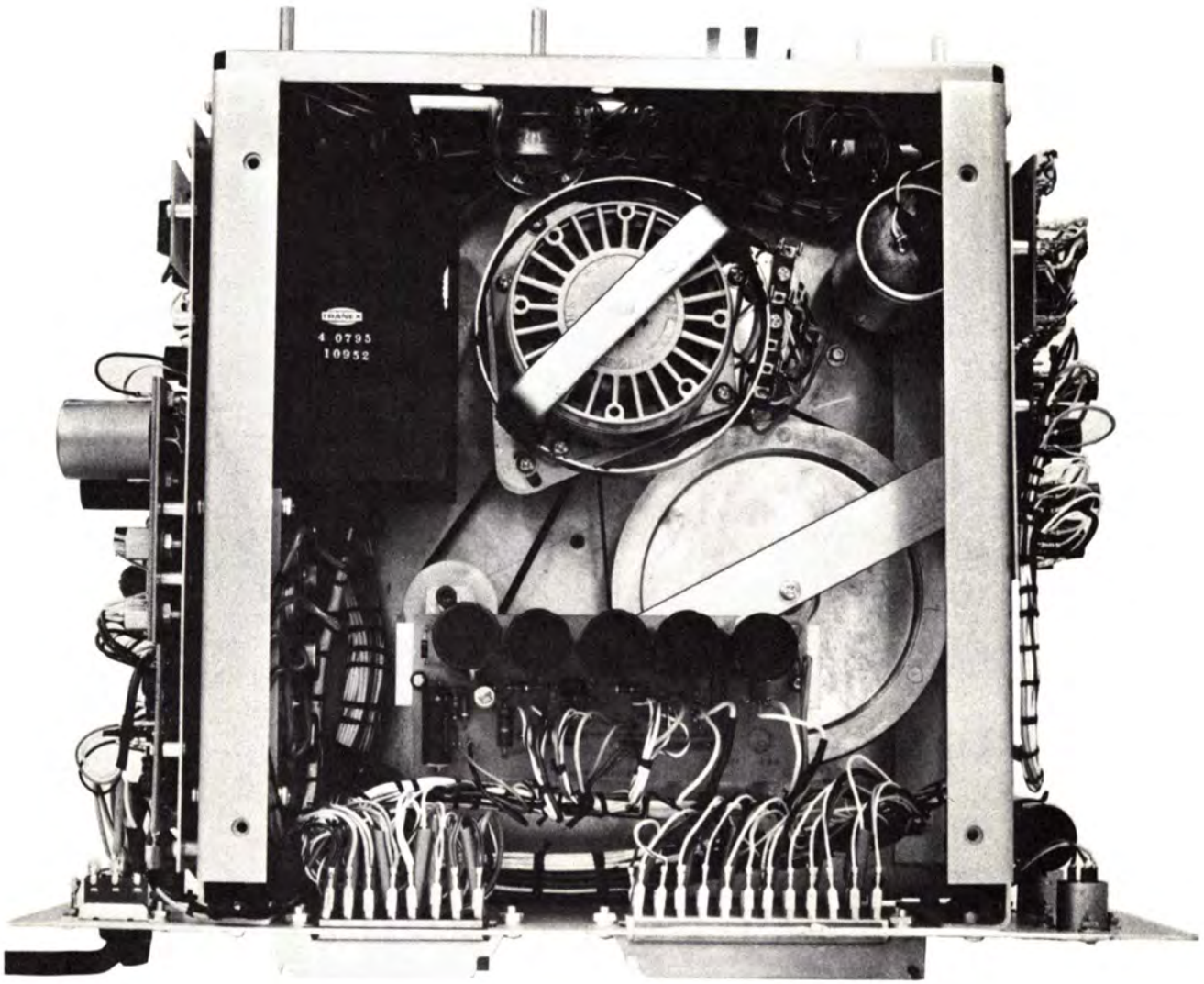
PHOTOGRAPHS AND SCHEMATICS



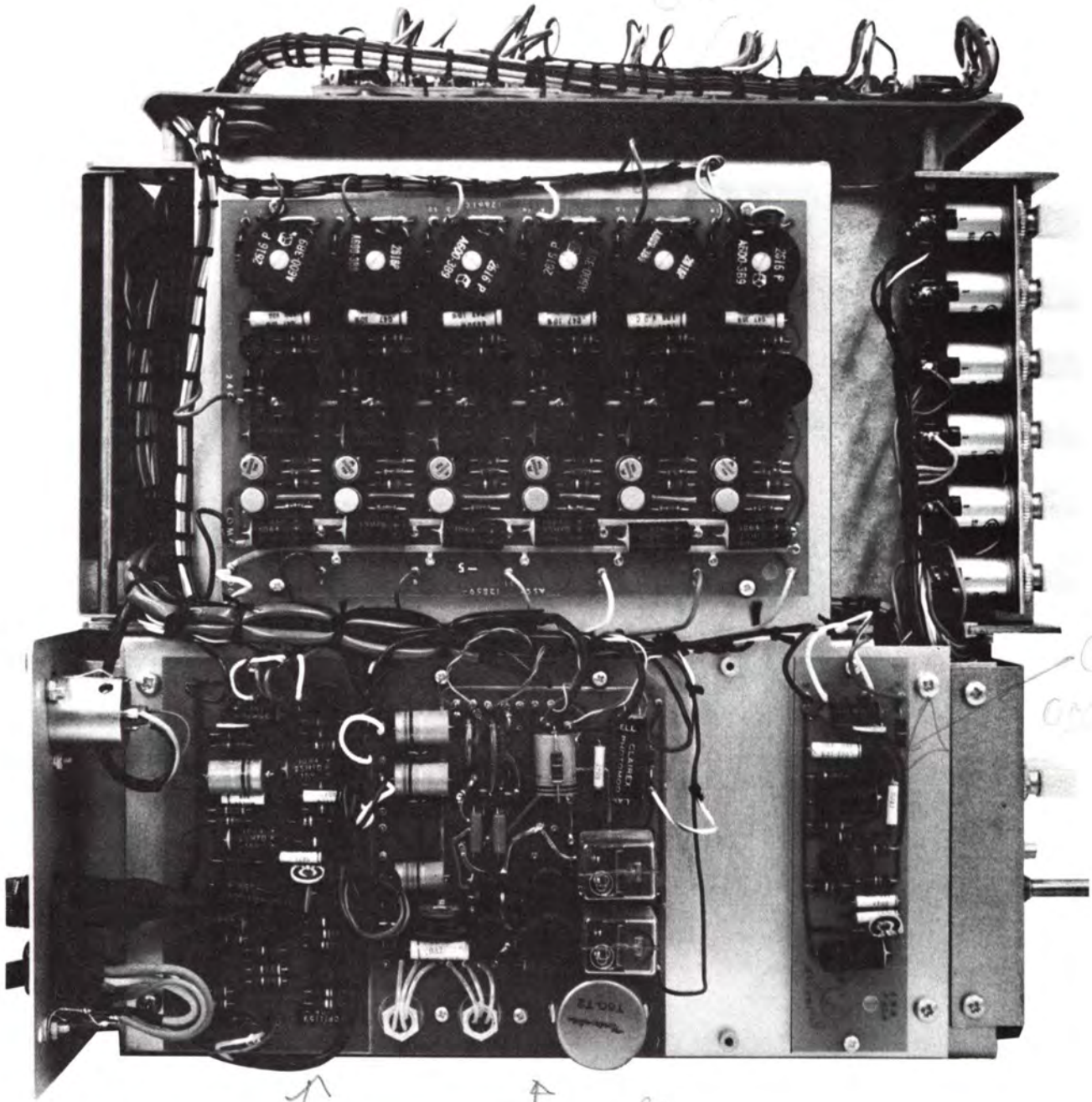
SB6AR, Rear View



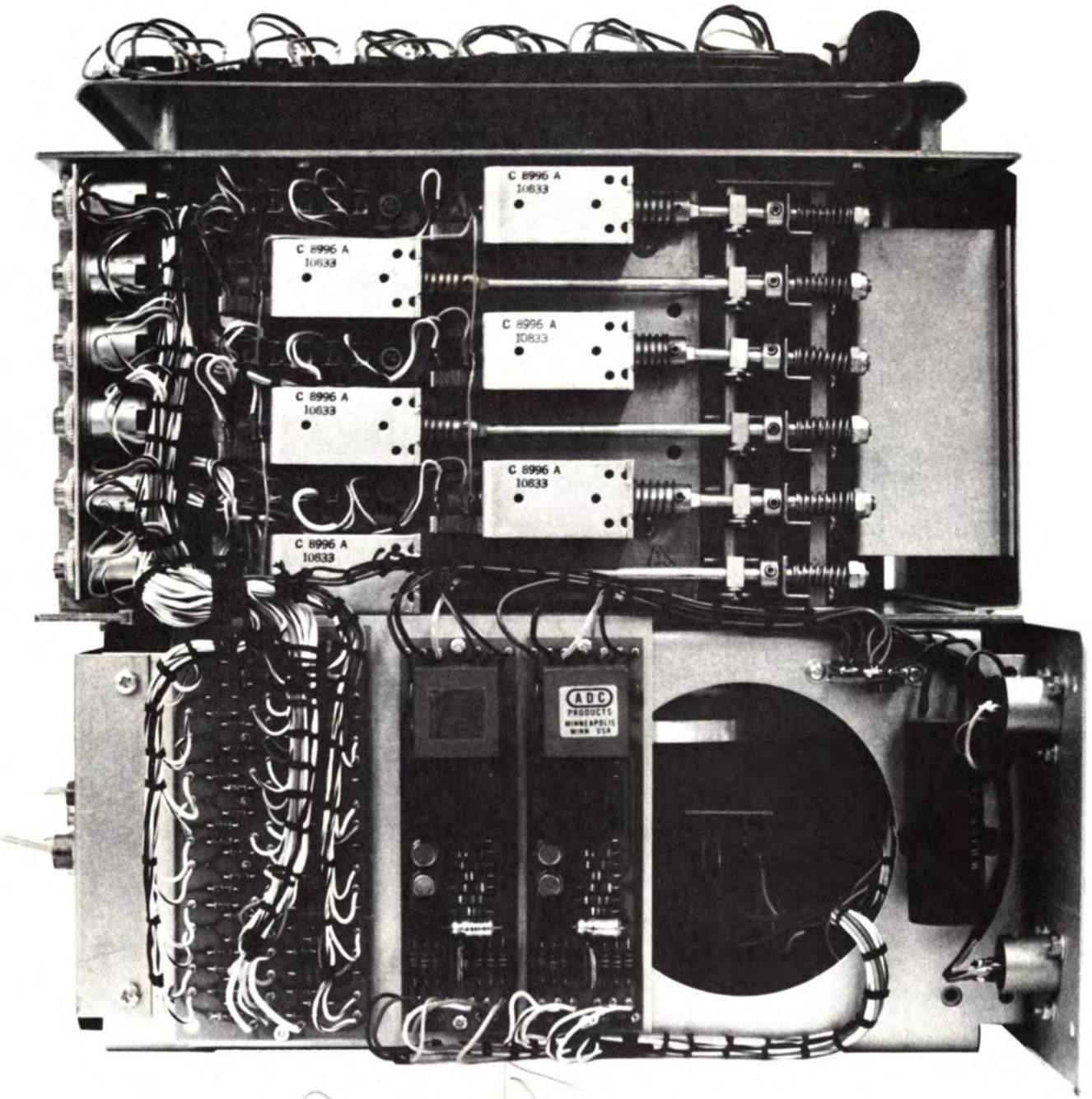
SB6AR, Top View



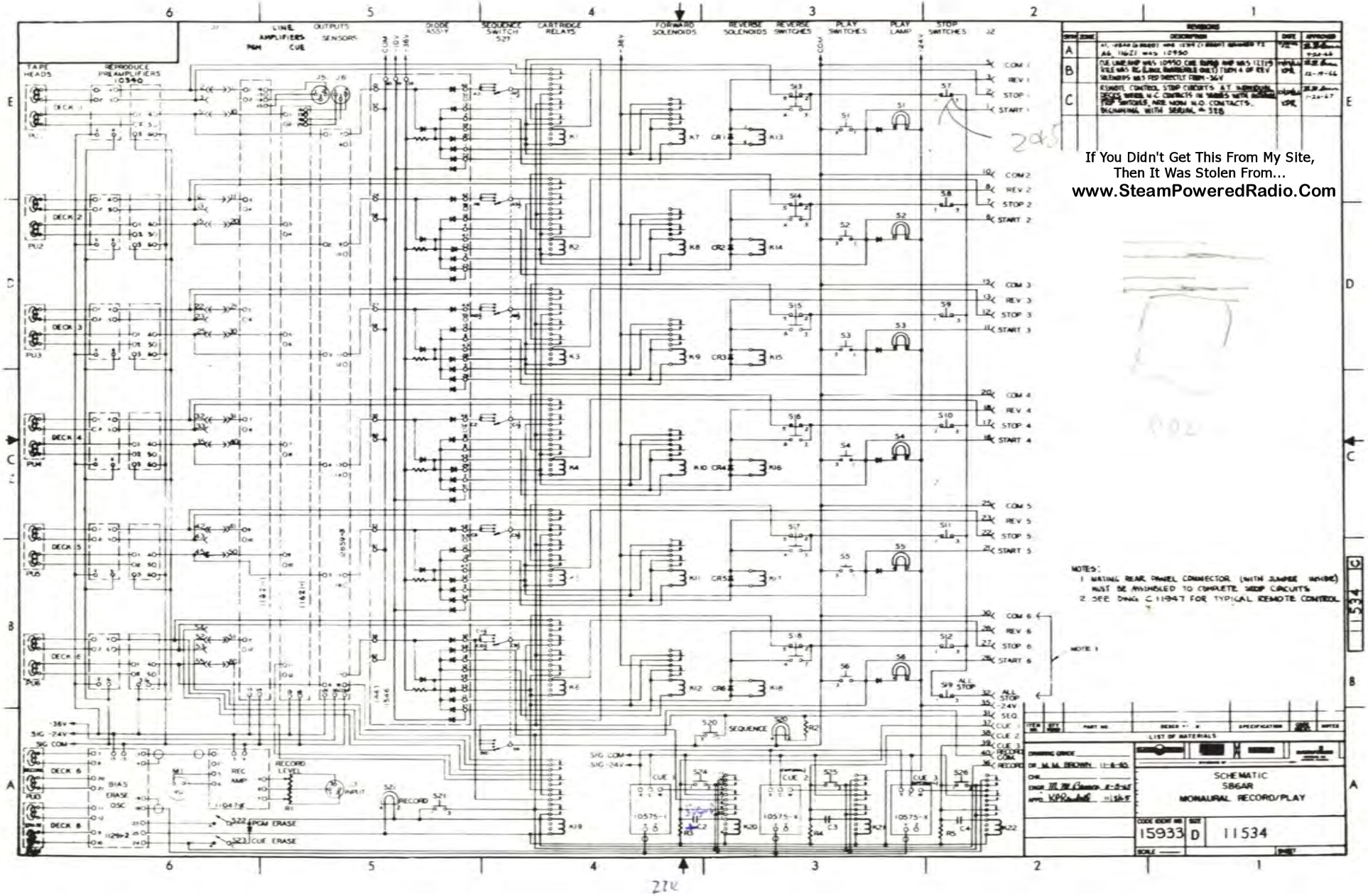
SB6AR, Bottom View



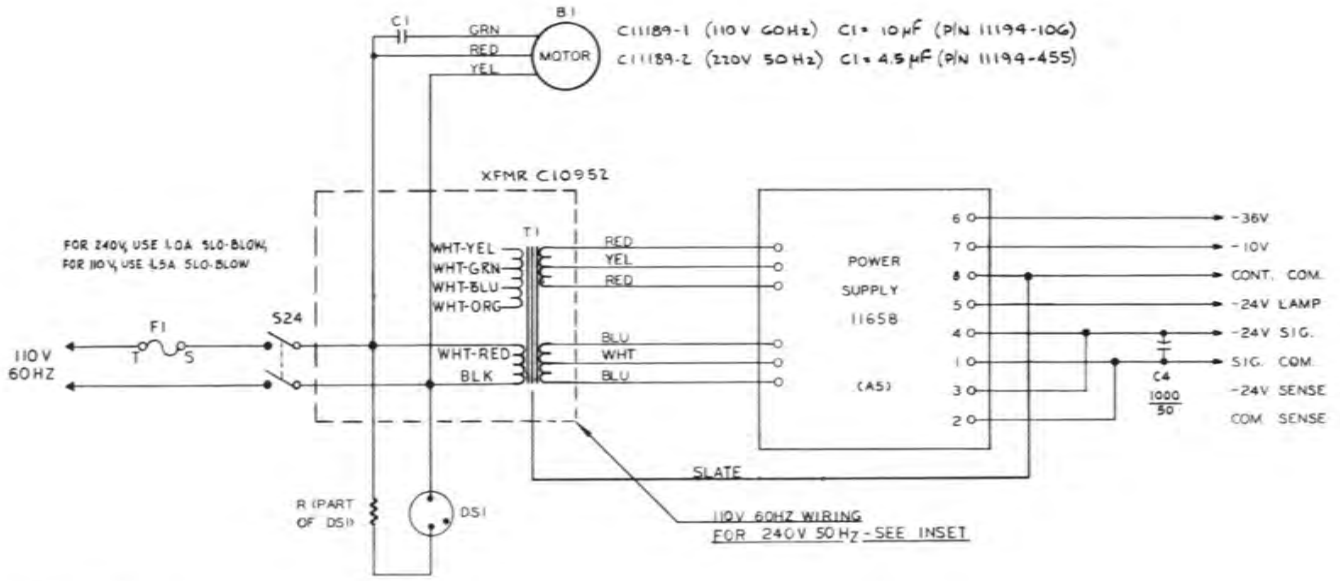
SB6AR, Left View

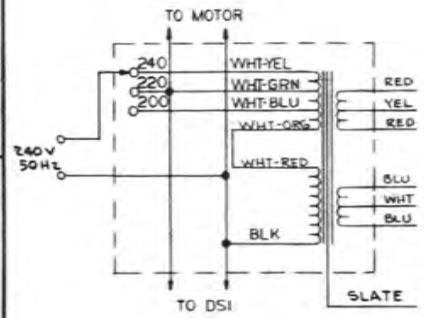


SB6AR, Right View



REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVED
E		REDRAWN	CHG 1-4-68	M.M. Brown





INSET
FOR 240V 50Hz

NOTES:
2. FOR POWER SUPPLY SCHEMATIC SEE 10595.
3. C4 MOUNTED ADJACENT TO PREAMPLIFIERS.

ITEM NO.	QTY REQD	PART NO.	DESCRIPTION	SPECIFICATION	CODE IDENT	NOTES

LIST OF MATERIALS

NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	

MANUFACTURE IN ACCORD WITH

APPLY PART NO. IN ACCORD WITH

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DIMENSIONS

DECIMAL	ANGULAR
2 PLACE ± .02	± 1/2°
3 PLACE ± .010	FRACTIONAL
4 PLACE ± .0005	± 1/64

MATERIAL

FINISH

DRAWING GRADE

DR CHUCK COOLEY 1-4-68

CHK L. A. Brabl 1-4-68

ENGR M. M. Brown 2 Jan 68

APPD.

VISUAL ELECTRONICS LABORATORIES
Pasadena, California

POWER CIRCUITRY
SBG&4 SEG MODEL MACHINES

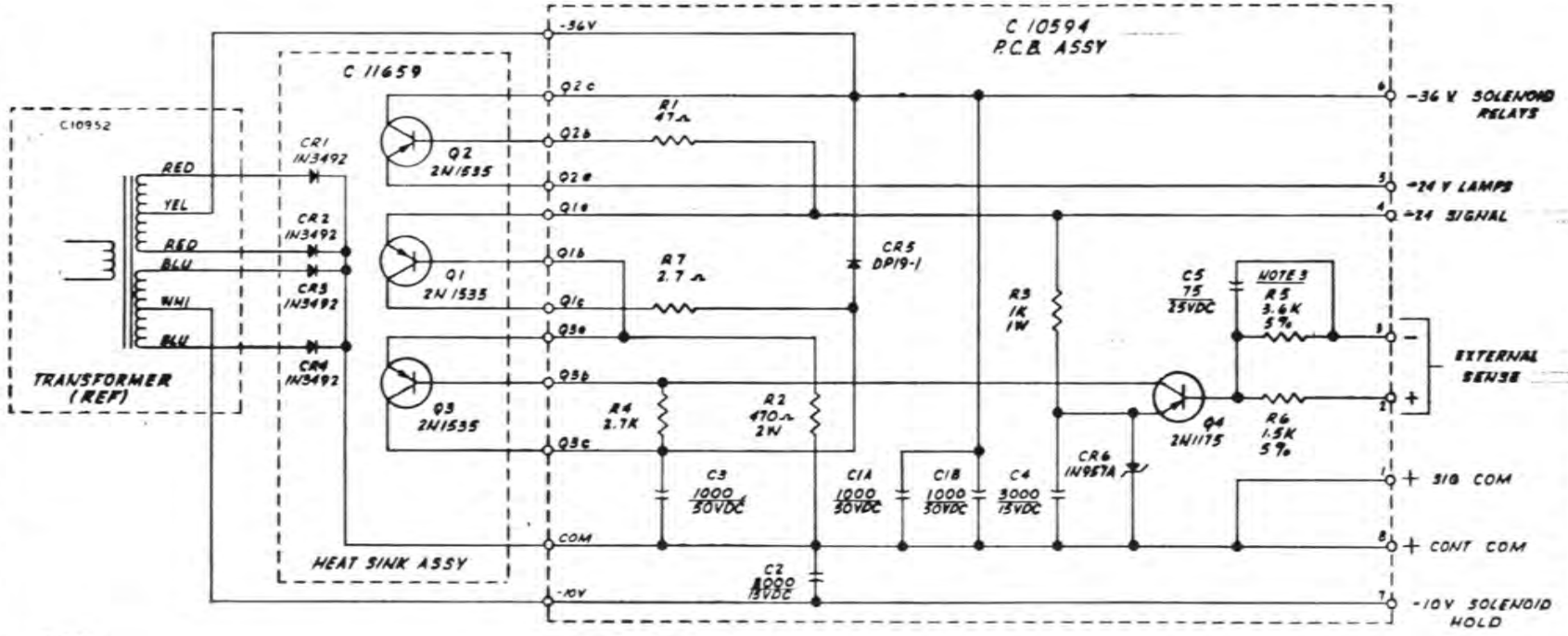
CODE IDENT NO.	SIZE	
15933	C	11620

SCALE | SHEET

11620 E

7-3

REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVED
D		REVISED & REDRAWN		W.M. Barcus
E		ON TRANSFORMER COLORS; YEL WAS RED-YEL, WHI WAS BLU-WHT. ADDED TERMINAL N°3 THRU 8 ON 10594 PCB.	3-16-66	W.M. Barcus 3-16-66
F		C10952 WAS C10334 (115V) OR C10776 (230V)	11-1-67	W.M. Barcus



C 10595 F

NOTE:
1. ALL UNMARKED RESISTORS ARE ½ W 10%.
2. ALL UNMARKED CAPACITORS ARE IN µF.
3. R5 FACTORY SELECTED.

ITEM NO.	QTY REQD	PART NO.	DESCRIPTION	SPECIFICATION	CODE IDENT.	NOTES

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DIMENSIONS
DECIMAL: 2 PLACE ± .02; 3 PLACE ± .010; 4 PLACE ± .0005
ANGULAR ± 1/2°
FRACTIONAL ± 1/64

NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
	SBGA	-	-
APPLICATION		QTY REQD	

MANUFACTURE IN ACCORD WITH
APPLY PART NO. IN ACCORD WITH
MATERIAL
FINISH

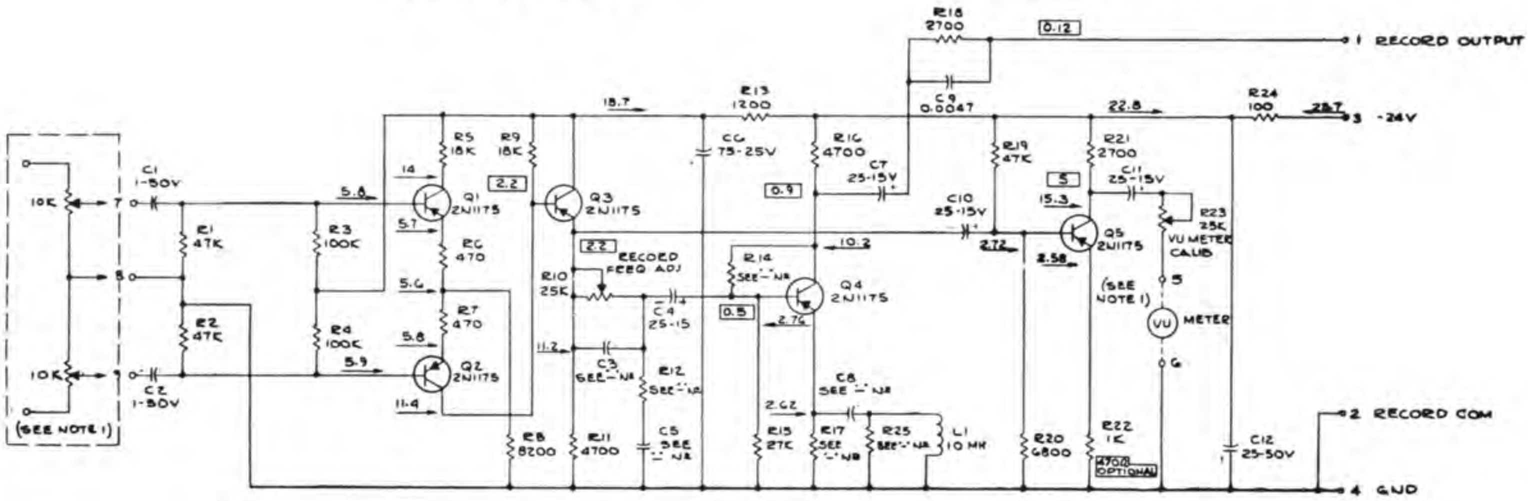
DRAWING GRADE
DR LaROSE 2/23/66
CHK
ENGR W.M. Barcus 3-7-66
APPD

VISUAL ELECTRONICS LABORATORIES
Pasadena, California

REGULATED POWER SUPPLY-BROADCAST MACHINE

CODE IDENT NO. 15933 | SIZE C | 10595
SCALE — | SHEET

REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVED
H		REDRAWN ON MIL-STD FORMAT	[illegible]	[illegible]
J		ADDED -5 (7½ IPS CCIR)	[illegible]	[illegible]
K		ON -2, R12 WAS 2200 ON -3, R17 WAS 470, R15 WAS 2700, C3 WAS .0068µF, ADDED -6 & PARTS	[illegible]	5-11-67
L		ON -5, R17 WAS: 560Ω, R25 WAS: 3900Ω C5 WAS: 1µF/15V, C3 WAS: .001µF C8 WAS: .022µF PER ECR #2366	[illegible]	11-1-67



NOTES:
1. NOT ON BOARD. SHOWN FOR REF ONLY.
2. ALL CAPACITORS IN MFD AND RESISTORS IN OHMS ½W 10% UNLESS OTHERWISE SPECIFIED
3. DC VOLTAGE
AC PP VOLTAGE

COMPONENT	-1	-2	-3	-4	-5	-6
	VALUE					
R12	5600	1.2K	1.2K	1K	3.3K	12K
R14	56K	100K	100K	100K	39K	100K
R17	1K	560	470	560	560	560
R25	—	2700	—	—	2.7K	3.9K
C5	0.33µf	1µf/15V	2.2µf/10V	1µf/15V	15µf/15V	1µf/15V
C3	.0015µf	.001µf	.0022µF	.15µf	.001µF	.0068µF
HEAD NO. (NORTRONICS)	TLAH5R	RB2H4R-R-185 (REC)				
@ SPEED IPS	7½	7½	3¾	15/16	7½ (CCIR)	1⅞
C8	.01µF	.01µF	.01µF	.01µF	.018µF	.022µF

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DIMENSIONS
DECIMAL 2 PLACE ± .03, 3 PLACE ± .010, 4 PLACE ± .0005
ANGULAR ± 1/2°
FRACTIONAL ± 1/64

ML1104T | A/R

DRAWING GRADE
DR W. W. 3-11-63
ENGR [illegible]
APPD [illegible]

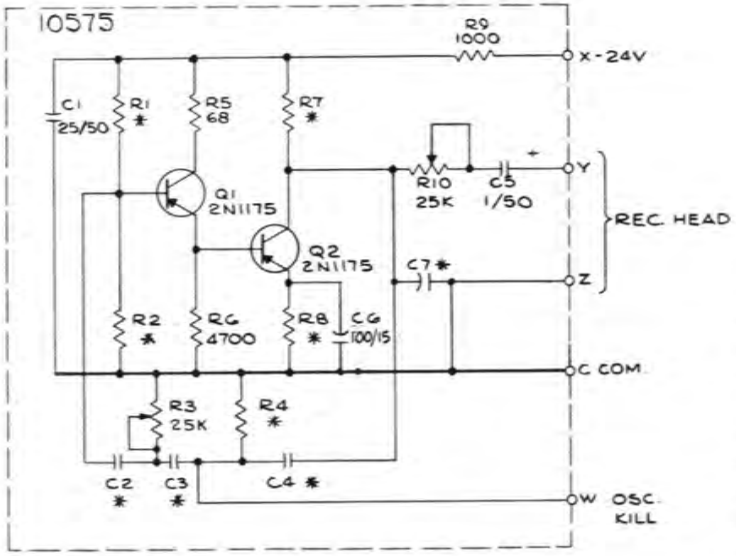
VISUAL ELECTRONICS LABORATORIES
Pasadena, California

SCHEMATIC,
RECORD AMPLIFIER

CODE IDENT NO 15933 | SIZE D | 10559
SHEET 1 OF 1

10559 L

REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVED
K		DELETED R2 FROM TAB. CHART IT WAS METAL FILM TYPE WITH 10K, 8200, 12K, 6.8K AND 12K VALUE FOR -1 THRU -5 RESPECTIVELY; THIS DWG REDRAWN ON MIL-STD FORMAT, WAS B SIZE	12 OCT 65	KPR 10/13/65
L		C2, C3, & C4 TOL WAS ± 5% (-4 PARTS ONLY,) R1 WAS 56K, C2 WAS 620pF C4 WAS 510pF	1/24/66	M.M. Brown 1-26-66
M		R4 WAS FIXED RES., -1 (10K), -2 (8200), -3 (12K); -4 (10K), -5 (12K). R2 WAS 25K VAR. RES. C4-5 WAS .022μF	3/14/66	M.M. Brown 4-20-66
N		REVISED PER S.I. 30015	6/23/66	M.M. Brown 6/29/66
P		R2 & R4 -4 WAS 6200 IN ERROR	11/18/66	M.M. Brown 11/22/66
Q		ADDED -6 & VALUES OF R1 THRU C7	1/20/67	M.M. Brown 1-23-67
R		C7, -4 WAS .0033, R2, -5 WAS 12K	4/6/67	



C7	.022	.004	.068	.0022	.1	.004
C4	.0047	.001	.01	620 PF	.022	.0015
C3	.0047	.001	.022	820PF	.033	.0015
C2	.0047	.001	.022	620PF	.027	.0015
R8	1800	1800	1200	1800	1K	1800
R7	10K	8200	10K	8200	12K	8100
R2	10K	8200	10K	6800	10K	8100
R4	10K	8200	12K	6800	12K	8200
R1	82K	56K	120K	47K	180K	56K
FREQ	1000	6000	200	8000	150	4000
DASH NO.	-1	-2	-3	-4	-5	-6

NOTES: UNLESS OTHERWISE SPECIFIED

1. * = SEE TABLE
2. ALL RESISTORS ARE IN OHMS/½W/10%
   ALL CAPACITORS ARE IN μF/100V/10%

ITEM NO.	QTY REQD	PART NO.	DESCRIPTION	SPECIFICATION	CODE IDENT.	NOTES

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DIMENSIONS
DECIMAL: 2 PLACE ± .02; 3 PLACE ± .010; 4 PLACE ± .0005
ANGULAR ± 1/2°
FRACTIONAL ± 1/64
MATERIAL
FINISH

DRAWING GRADE
DR E. THURSTON 7/64
CHK
ENGR M.M. Brown 10-13-65
APPD KPRandall 10/13/65

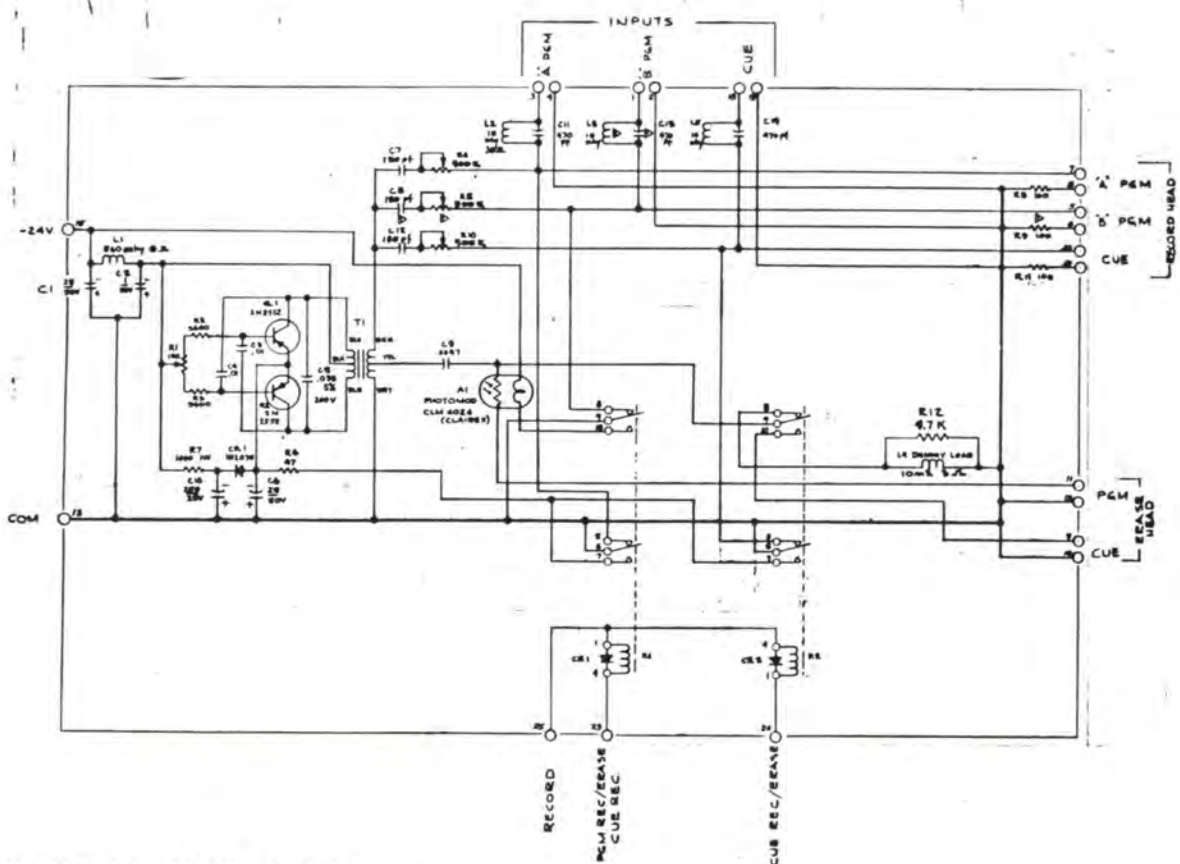
VISUAL ELECTRONICS LABORATORIES
Pasadena, California

SCHEMATIC, CUE OSCILLATOR

CODE IDENT NO. 15933 | SIZE C | 10573
SCALE | SHEET

NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	
MANUFACTURE IN ACCORD WITH			
APPLY PART NO. IN ACCORD WITH			

10573 R



NOTES:
1. USED ON 11291-1 & 11291-3 (STEREO SBC ONLY)

REVISIONS

SYM	ZONE	DESCRIPTION	DATE	APPROVED
E		R4, R5, R10 WERE 500K REDRAWN MIL-STD FORMAT		
F		C7, C8, C12 WERE 220pF R4, R5, R10 WERE INF		HMB 12-30-65
G		ADDED WIRE FROM K2-5 TO TERMINAL 20.	1-14-66	
H		CR1 & CR2 WERE SHOWN WITH POLARITY REVERSED		
J		ADDED LINE FROM -24V TO PHOTO MOD		
K		Q1 WAS 3N-1058-1, Q2 WAS 3N-1058-1		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DIMENSIONS
DECIMAL 2 PLACE ± .03, 3 PLACE ± .010, 4 PLACE ± .0005
ANGULAR ± 1/2°
FRACTIONAL ± 1/64
MATERIAL
FINISH

LM 11291 NEXT ASSY

DR. G.B. 5-18-65

VISUAL ELECTRONICS LABORATORIES
Pasadena, California

SCHEMATIC,
BIAS & ERASE OSC.

CODE IDENT NO 15933 | SIZE D | 11292

SHEET 1 OF 1

LET	REVISION	BY	APPR	DATE
N	REVISED & REDRAWN	P.I.L.	M.M. Brown	8 AUGUST 1967
P	SEE L/M REV "P"	P.I.L.	[illegible]	9 AUG 1968

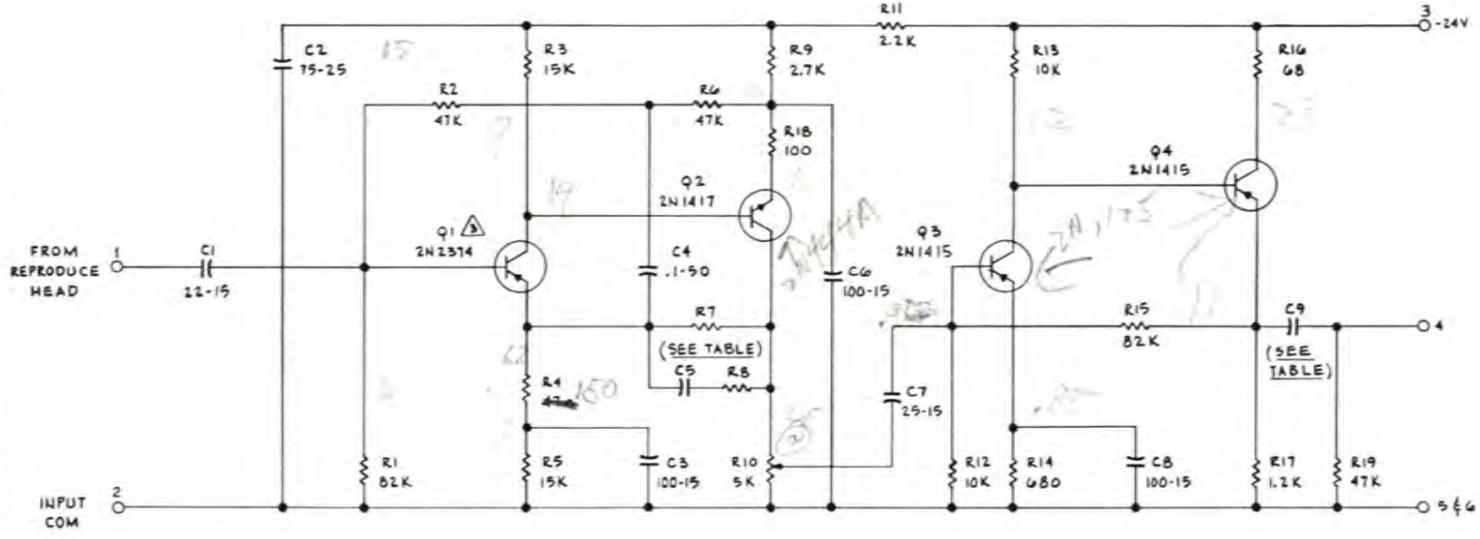


TABLE					
DASH Nº	C5	R7	R8	C9	USE
-1	.033	220K	2.2K	25-15	7½ IPS, TLAH4L
-2	.033	220K	6.8K	25-15	3¾ IPS, TLAH4L
-3	.033	220K	1.5K	25-15	7½ IPS, PB2H7K
-4	.033	680K	2K	25-15	3¾ IPS, PB2H7K
-5	.033	220K	1K	25-15	1⅞ IPS, PB2H7K
-6	3.3	220K	1.5K	25-15	MIC (FLAT)
-7	.2	220K	200Ω	25-15	7½ IPS, CCIR
-8	.033	220K	1.5K	1-50	SPECIAL

NOTES:
1. ALL RESISISTORS ARE IN Ω ½W 10%.
2. ALL CAPACITORS ARE IN μF, DC VOLTS.
3. MAY BE REPLACED BY 2N 3427, P/N 12405-015

VISUAL ELECTRONICS LABORATORIES
Pasadena, California

SCALE: —	APPROVED BY: M. M. Brown	DRAWN BY LaROSE
DATE: 11-11-67		REVISED 11-11-67

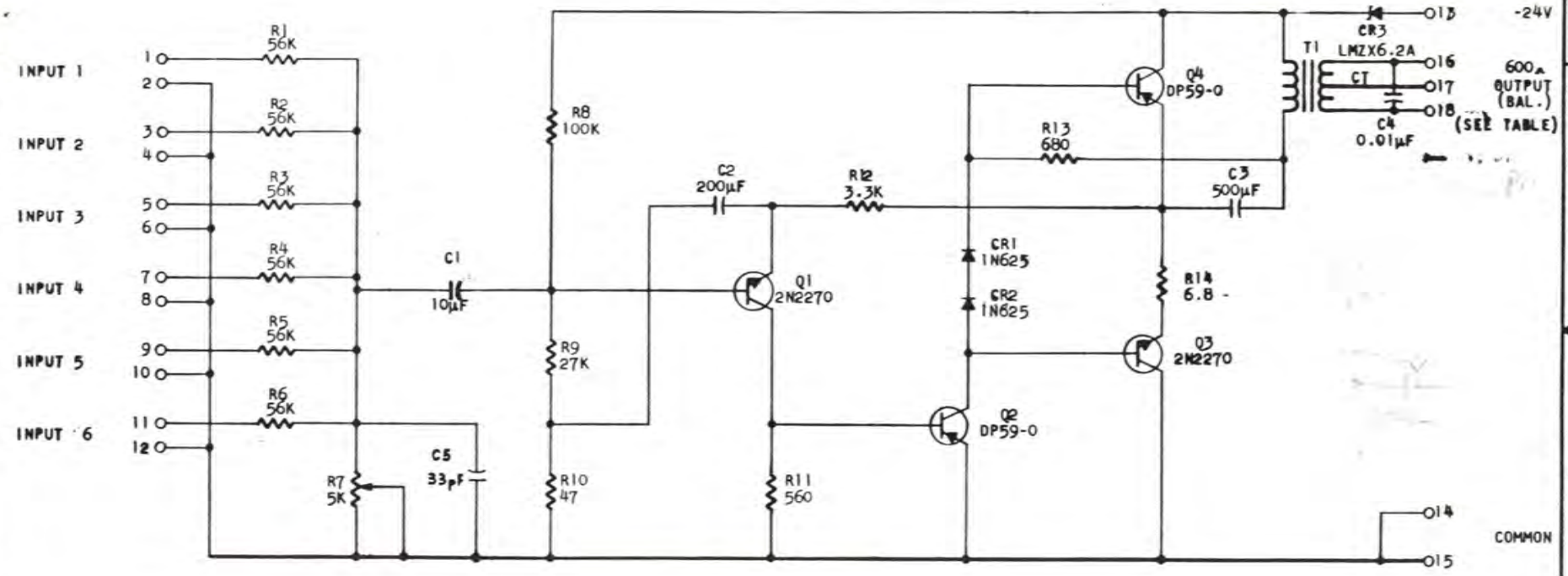
SCHEMATIC - REPRODUCE AMPLIFIER

LM 10340 — DRAWING NUMBER C 10348

Dash 1	As shown
Dash 2	Terminals, 16 and 18, 8Ω; 17, no connection; omit C4.
Dash 3	Same as -1 except omit R2-R6 and R1 = 560 ohms.

B11623-X

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	R14 WAS DP19-1 DIODE	2-8-66	M.M.Brown
	B	C1 WAS 0.47μF, ADDED C4	3-7-66	M.M.Brown
	C	ADDED DASH NUMBERS	5-11-66	M.M.Brown
	D	ADDED C5, 33PF CAP.	8/12/66	M.M.Brown
	E	ADDED DASH 3	3/1/67	M.M.Brown
	F	DASH 3- CHANGED R1 to 560Ω	6/29/67	M.M.Brown



NOTE: (1) DP59-0 may be replaced by 2N1132

(2) All resistances ½ watt.

LM 11621		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES; TOLERANCES ON DIMENSIONS: DECIMAL 2 PLACE ± .02, 3 PLACE ± .010, 4 PLACE ± .0005; ANGULAR ±1/2°; FRACTIONAL ±1/64	DRAWING GRADE
NEXT ASSY	USED ON	MAT'L	DR M M BROWN 1/6/66
APPLICATION		FINISH	CHK
			ENGR M.M.Brown 1-6-66
			APPD K.O.A. 4/20/66

VISUAL ELECTRONICS LABORATORIES
Pasadena, California

SCHEMATIC, +27 DBM LINE AMPLIFIER

CODE IDENT NO.	SIZE	
15933	B	11623-X
SCALE	LM 11621	SHEET

SYM	ZONE	DESCRIPTION	DATE	APPROVED
B		DELETED R9, 270/2W, ADDED R10 REDRAWN ON MIL-STD FORMAT	13 OCT 65	KPR 10/13/65
C		R1, 25K POT WAS 4700 Ω RESISTOR		KPR
D		ADDED -10 INFO (200 CPS) TITLE WAS "STOP CONTROL" C1 FOR -9 WAS .0033 IN ERROR	2/18/66	M.M. Brown 2-18-66
E		CR1, CR2, CR3, WAS 1N2070	3-8-66	M.M. Brown
F		2N2042 (Q2) WAS 2N1924, 2N698 (Q3) WAS 2N696, REMOVED R10 (68Ω) FROM BASE OF Q3 TO CATHODE OF CR3	1/27/67	M.M. Brown KPR 3-27-67

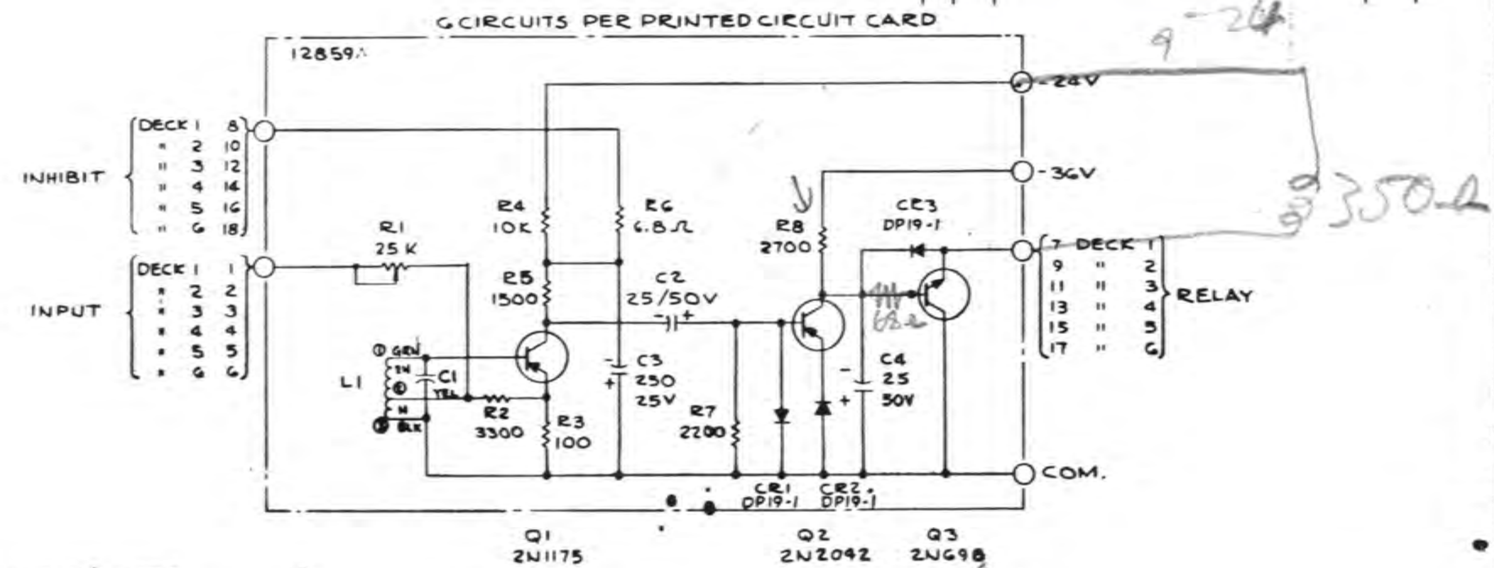


TABLE I L1-C1 VALUES

DASH NO.	FREQ. HZ.	L1 HY ±10%	C1 µF ±5%
1	70	4.5	1.2
2	150	4.5	.22
3	290	4.5	.068
4	550	.5	.18
5	1000	.5	.047
6	1900	.5	.015
7	3600	.15	.012
8	8000	.15	.0027
9	6000	.15	.0047
10	200	4.5	.15

ITEM NO.	QTY REQD	PART NO.	DESCRIPTION	SPECIFICATION	CODE IDENT	NOTES

LIST OF MATERIALS

NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
LM12859	586A		

APPLICATION | QTY REQD

MANUFACTURE IN ACCORD WITH

APPLY PART NO. IN ACCORD WITH

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DIMENSIONS
DECIMAL: 2 PLACE ± .02, 3 PLACE ± .010, 4 PLACE ± .0005
ANGULAR: ± 1/2°
FRACTIONAL: ± 1/64
MATERIAL
FINISH

DRAWING GRADE
DR G. BEUKERS 5-65
CHK
ENGR M.M. Brown 10-20-65
APPD KP Randall 10/18/65

VISUAL ELECTRONICS LABORATORIES
Pasadena, California

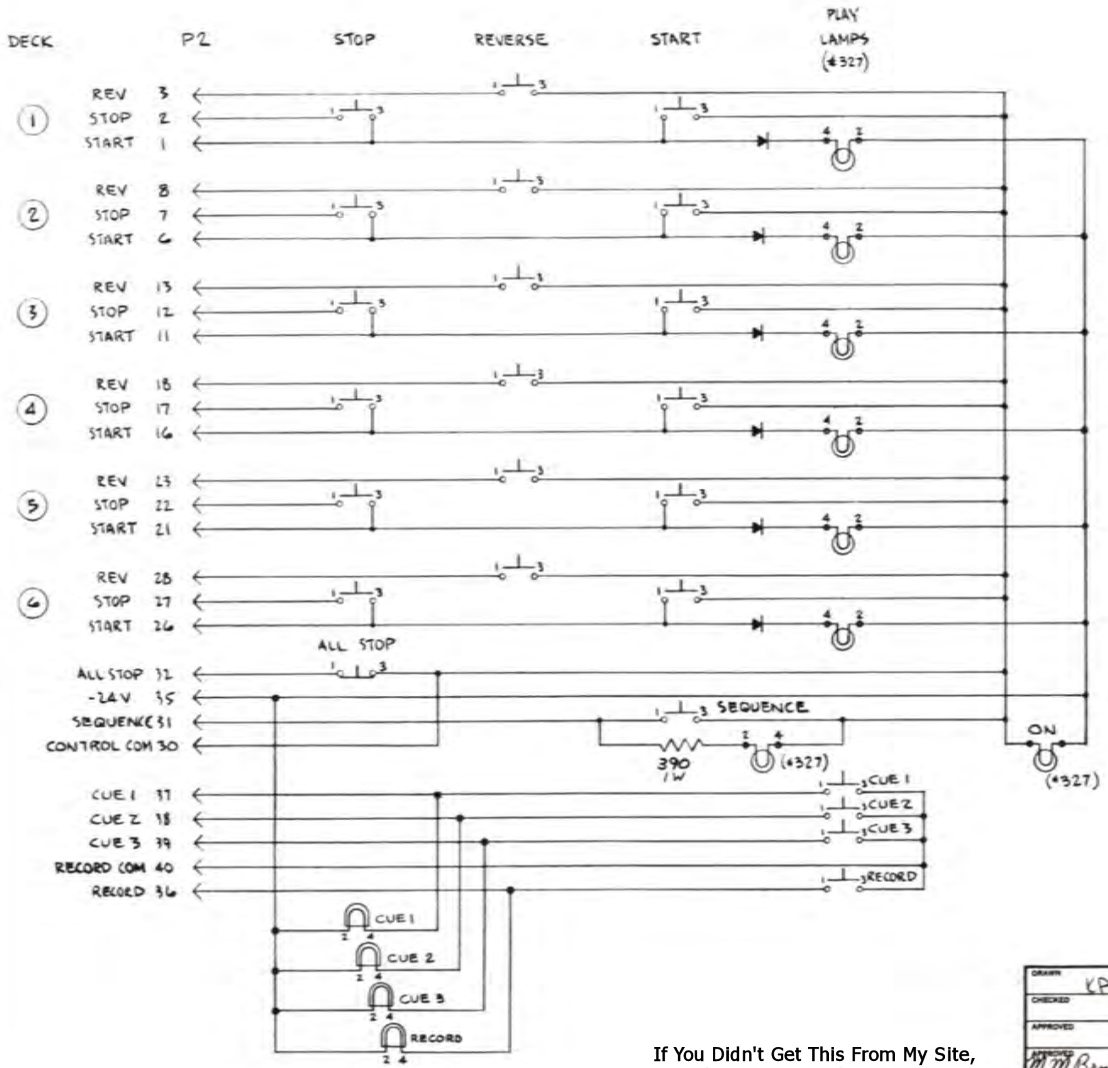
SCHEMATIC, CUE TONE SENSOR

CODE IDENT NO. 15933 | SIZE C | 12862A

SCALE — | SHEET 1 OF 1

C12862 E

BY	SYM	DESCRIPTION	DATE	APPROVAL
	A	ADDED CONTROL COMMON LEFT OFF IN ERROR, ALSO "ON" LITE, 390Ω WAS 180Ω	1/16/67 KPR	M.M. Brown 1-16-67
P.D.W.	B	ADDED CUE LAMPS.	5-13-68	[illegible]
P.J.L.	C	REVERSED WIRE DES. ON LAMPS	8-8-68	[illegible]



DRAWN	KPR	1/16/67
CHECKED		
APPROVED		
APPROVED	M.M. Brown	1-26-67
RELEASED	[illegible]	1/27/67

VISUAL ELECTRONICS LABORATORIES
Pasadena, California

SCALE: ~ | APPROVED BY: | DRAWN BY P.D. Weiss
DATE: 5-13-68 | REVISED

SCHEMATIC
RC6ARP REMOTE CONTROL SB6-A

SHEET 1 OF 1 | CHECKED BY: | SIZE C | DRAWING NUMBER 11947

C 11947 C

K+E

APPENDIX

The Visual Broadcaster is aligned and rated against the following U.S. recording industry standards:

A-1 Reproduce De-emphasis - The Visual Broadcaster uses the NAB standard playback curve. This curve reduces the gain of the amplifier at a 6 dB per octave rate between corner frequencies of 50 Hz and 3180 Hz. The playback amplifier partially compensates for the non-linear frequency characteristics of the head and tape systems. In so doing, low frequency noises such as power line hum, transistor noise, and inaudible high frequency noises such as 85 KHz bias are amplified. In order to increase the signal-to-noise ratio in the bandpass of 30 Hz to 15 KHz, a filter which attenuates signals outside of this band must be used. Elimination of stray 85 KHz bias frequency signals is necessary to assure accurate readings on the output meter.

A-2 Record Pre-emphasis - Compensation for part of the mon-linear characteristics of the head-to-tape process is accomplished in the playback amplifier. Compensation for mechanical variations in heads, amplifiers, and tape is accomplished by pre-emphasizing the record current. The record head current in the Visual Broadcaster drops 3 dB from 50 Hz to 200 Hz, levels off at 700 Hz, and then rises to 12 dB above the 700 Hz value at 15 KHz. Thus the induction in the tape rises with frequency. At 700 Hz the 0 dB "Normal" record level operating point is approximately 6 dB below tape saturation. If the same input signal level to the Broadcaster were maintained to 15 KHz, the tape would saturate because of the pre-emphasis and give the appearance of poor high frequency response. Therefore, frequency response tests must be conducted at least 15 dB below the operating point to avoid tape saturation at the higher frequencies.

The spectral energy distribution of speech and music is such that the relative amplitude drops rapidly at frequencies above 1000 Hz. The input recording level to the Broadcaster for normal program material may therefore be maintained at a high level to realize an improved signal - to - noise ratio without introducing distortion because of the pre-emphasis.

A-3 Operating Point - The operating point is defined as the maximum recommended recording level at 700 Hz, and corresponds to "Normal" on the Record Level meter. This is the level at which the third harmonic of 700 Hz is equal to 1% of the fundamental. This measurement must be made with a selective distortion analyzer. The operating point differs for different types of tape, and may vary as much as 5 dB between different tape production runs. The nominal operating point, which corresponds to 0 dB output, is equal to the reference level recorded on the standard tape. The reference level is nominally 6 dB below tape saturation when measured at 700 Hz. Tape saturation is defined as the point at which the third harmonic of 700 Hz is equal to 3% of the fundamental. The 3% third harmonic distortion point is the reference used for signal-to-noise specifications.

A-4 Distortion - Using the above definitions the operating point, signal-to-noise ratio, and distortion are related in such a manner that establishing one fixes the others. Total harmonic distortion is the rms value of all distortion components. This can only be measured with a selective system that measures only the harmonics of the 700 Hz signal being used. The popular "total harmonic distortion analysis" nulls out the fundamental and reads all noise and distortion components that remain. For example, a completely distortion - less tape recorder with a measured signal-to-noise ratio of 50 dB would measure "0.6% distortion" from the noise components alone, if the conventional "total harmonic distortion analyzer" were used. The apparent distortion measured would be further increased because it would be impossible to accurately null out the fundamental component of a complex signal being reproduced from tape. This is because tape flutter, even though small, would cause the apparent fundamental frequency to shift and prevent its being completely nulled out.

A-5 Signal-to-Noise - The signal-to-noise ratio is the ratio between the rms signal and the rms noise, measured at the 3% tape saturation point. Most vacuum tube voltmeters are average or peak-reading devices, calibrated in rms for single-frequency measurements only. It is impossible to obtain accurate quantitative measurements of noise from a high gain amplifier with such a device. In

particular, peak-detecting meters are not as sensitive to changes in rms noise level as the human ear. Most types of meters, especially audio reading units, will serve as a relative reading device for comparison measurements, but any quantitative noise measurements must be made with a true-rms meter.

A-6 Wow and Flutter - Variations in tape speed in an audio record/reproduce system produce distortions of the original signal described subjectively as "wow" and "flutter". A variation rate of 0.5 to 6 Hz is heard as wow, while above this rate up to 300 Hz the ear recognizes the variation as flutter. Both are numerically defined as being the change in reproduced frequency divided by the original frequency. Values are usually given as a percentage of the rms magnitude.

Tape speed variations below 0.5 Hz or above 300 Hz are not recognized by the ear as pitch fluctuations. Speed errors below 0.5 Hz may be recognized as a change in pitch if a direct comparison with the original is possible. Speed fluctuations above 300 Hz appear as a background noise present only when a recorded signal is present, and are therefore sometimes described as "modulation noise".