UMC
Beaucart

TECHNICAL MANUAL

UMC
BEAUCART DIVISION
UMC ELECTRONICS CO.
460 Sackett Point Rd. North Haven, CT 06473
Telephone: (203) 288-7731

TECHNICAL MANUAL

TYPE 10 AND TYPE 20

MONO RECORDERS AND REPRODUCERS
STEREO RECORDERS AND REPRODUCERS

TABLE OF CONTENTS

9.0 (Continued)

CHANGES

UMC BEAUCART TECHNICAL MANUAL

TYPE 10 AND 20

MONO RECORDERS AND REPRODUCERS

STEREO RECORDERS AND REPRODUCERS

Page 14, Section 3.1 under

Motor On-Off Control Switch (Internal): Add: (Optional)

Adjacent paragraph change to read: When two cartridge-sensing snap action switches are installed on the deck plate then switch (S5) located nearest the deck, etc.

Next paragraph, first line change swtich to switch.

At end of section 3.1 add:

Cartridge Switch - When a cartridge is properly inserted, the cartridge switch (S1) supplies ready ground and turns on the stop switch indicator showing a ready mode.

Page 15, Section 3.3

Paragraph F, 3rd line from end - remote should be remotely

Page 17, Section 4.1

Last paragraph, first line - eliminate captive

Page 19, Section 4.9.3

Paragraph H, 2nd line - switches should be switch(es)

Page 20, Symbol 14

Quantity should be 1 or 2

Page 21, Symbol 25

Rotor should be rotator

Page 45, Figure 9.6

Left channel should be right channel

Mono or right channel should be mono or left channel

V101 and V102 should be U101 and U102

Add capacitor C121 to empty holes adjacent to pins 6 and 7 of U101, with (+) connected to 6.

For stereo also add capacitor C122 to empty hole adjacent to pins 6 and 7 of U102, with (+) connected to 6.

Delete R128

Page 46, under C110

C120	261254	10 mfd, 20 V. may be added

Page 47, under C120

C122	261254	10 mfd, 20 V. may be added

Page 48, FIG. 9.7

Diode CR212 may be shorted for reproducers only

Page 49

ADD: Inductor L201 31684 500 mH

Page 57, FIG. 9.10

Pins 6 and 7 on U401 and U402 may be shorted

Page 75, Schematic SL-1662

Add note 7: Jumper J7-N and K for single cue - Jumper J7-E and D for single cue

Color code for record head cables are as follows: J6-8 ORN, J6-9 RED, J6-10 WHT, J6-11 BLK, J6-12 BLU, J6-13 YEL

On reproduce amplifier (mono or left) C121 10/20 between pin 6 of U101 and pin 7 may be added (RIGHT). C122, 10/20 between pin 6 and pin 6, with (+) going to pin 6 in each case - may be added.

Page 76, Schematic SL-1663 on record amplifier

Pin 6 of U401 and U402 may be common with pin 7

Resistor R727 should be connected common point CR706 and R712 to common point J304-7 and Q704 collector.

INTRODUCTION

THE BEAUCART CARTRIDGE TAPE RECORDING AND REPRODUCING SYSTEMS WITH THE LATEST REFINEMENTS PROVIDE THE USER WITH A NEW DIMENSION IN MONOPHONIC AND STEREOPHONIC RECORDING AND REPRODUCING.

THE SMALLER SIZE, LOWER POWER AND HIGH RELIABILITY MAKE IT IDEALLY SUITED FOR BROADCASTING, AUDIO, AND OTHER INDUSTRIAL AND COMMERCIAL USES.

WARNING – REFER TO SECTION 10.0

LIABILITY

THE INSTALLATION, TESTING AND ALIGNMENT METHODS GIVEN IN THIS MANUAL ARE BASED ON THE INFORMATION AVAILABLE AT THE TIME OF PUBLICATION AND SHOULD PERMIT EQUIPMENT USE WITH LITTLE RISK. THE MANUFACTURER, HOWEVER, DOES NOT ASSUME LIABILITY WITH RESPECT TO USE OF ITS CONTENTS AND SHALL NOT IN ANY CASE BE RESPONSIBLE FOR DAMAGE OR INJURY TO PERSON OR PROPERTY.

TRANSIT DAMAGE

THE EXTERNAL CONTAINERS SHOULD BE INSPECTED FOR DAMAGE PRIOR TO SIGNING THE CARRIER'S RECEIPT. ANY VISIBLE SIGNS OF CONTAINER DAMAGE SHOULD BE SO NOTED ON THE RECEIPT.

THE EQUIPMENT SHOULD BE UNPACKED AND INSPECTED THOROUGHLY WITHIN 15 DAYS OF RECEIPT. IF SHIPPING DAMAGE IS DISCOVERED, A CLAIM SHOULD IMMEDIATELY BE FILED WITH THE TRANSPORTATION COMPANY.

WARRANTY

THE ITEMS OR EQUIPMENT AND THE WARRANTY CONDITIONS ARE DETAILED IN THE WARRANTY CONTRACT SUPPLIED AT TIME OF SALE. TO OBTAIN REPLACEMENT FOR WARRANTY ITEMS CONTACT THE BEAUCART DIVISION OF UMC ELECTRONICS CO. AND GIVE THE PRODUCT IDENTIFICATION INFORMATION, INCLUDING ORIGINAL INVOICE NUMBER, MODEL, TYPE AND SERIAL NUMBERS. FAILURE TO FURNISH IDENTIFICATION INFORMATION MAY DELAY REPAIR OR REPLACEMENT PROCEDURE.

REPLACEMENT PARTS

WHEN ORDERING REPLACEMENT PARTS, PLEASE PROVIDE PRODUCT IDENTIFICATION INCLUDING MODEL, TYPE AND SERIAL NUMBERS AS WELL AS REFERENCE NUMBER OF EACH ITEM ORDERED.

THE PART SUPPLIED AGAINST AN ORDER FOR A REPLACEMENT PART MAY NOT BE AN EXACT DUPLICATE OF THE ORIGINAL PART, HOWEVER IT WILL BE A SATISFACTORY REPLACEMENT AND WILL NOT IMPAIR THE OPERATION OF THE EQUIPMENT.

ORDERING INFORMATION

REPLACEMENT PARTS MAY BE ORDERED FROM:

Beaucart Division
UMC Electronics Co.
460 Sackett Point Road
North Haven, Connecticut 06473
(203) 288-7731

1.0 DESCRIPTION AND SPECIFICATIONS

1.1 GENERAL DESCRIPTION

The Beaucart cartridge tape recording and reproducing systems are designed to meet the NAB standards for cartridge tape recording and reproducing. The Beaucart systems are available in two basic configurations, the Type 10 and the Type 20. The Type 10 series will accept the NAB AA size cartridge. The Type 20 series will accept the NAB AA, BB, and CC size cartridges. The Type 10 and Type 20 systems are available in monophonic reproducer, monophonic record and reproducer; stereophonic reproducer and stereophonic record and reproducer. All reproducers and recorders are furnished with primary (1 kHz) cue capability, while the secondary (150 Hz) and tertiary (8 kHz) cue detectors are optional. Also optional is the fast forward feature which permits the rapid advance of the tape to the next primary cue tone. Special designs for use in automated systems are also available.

The unique circuit design for use in automation systems prevents false cueing and completely isolates the logging signals to ensure trouble-free operation.

1.1 (Continued)

The printed circuit boards, heads, motor and switches are accessible for easy maintenance.

The use of a unique pancake hysteresis synchronous motor, unencumbered by velocity sensors and external control circuits, offers the ultimate in reliability.

Its wide operating voltage range coupled with the closely controlled frequency of the public utilities power grids provides a constant speed drive of extreme accuracy.

The reinforced aluminum deck plate, machined to provide a stable and accurate location of all the transport components, ensures long and trouble-free operation. The stereo machines have several added features for accurate cartridge positioning to provide close phase control under continued use.

1.2 TECHNICAL SPECIFICATIONS

Dimensions

BEAUCART TYPE 10

	Height	Width	Length	Approximate Weight
Reproducer (Desk Top)	4-1/8"	5-3/4"	15-3/4"	18 lbs.
Reproducer (Rack Mounting)	3-5/8"	5-3/4"	15-3/4"	18 lbs.
Reproducer/Recorder (Desk Top)	4-1/8"	11-1/2"	15-3/4"	28 lbs.
Reproducer/Recorder (Rack Mounting)	3-5/8"	11-1/2"	15-3/4"	28 lbs.

BEAUCART TYPE 20

	Height	Width	Length	Approximate Weight
Reproducer (Desk Top)	4-1/8"	10-1/8"	13-1/16"	18 lbs.
Reproducer (Rack Mounting)	3-5/8"	10-1/8"	13-1/16"	18 lbs.
Reproducer/Recorder (Desk Top)	7-1/4"	10-1/8"	13-1/16"	28 lbs.

TYPE 10 AND 20 REPRODUCERS

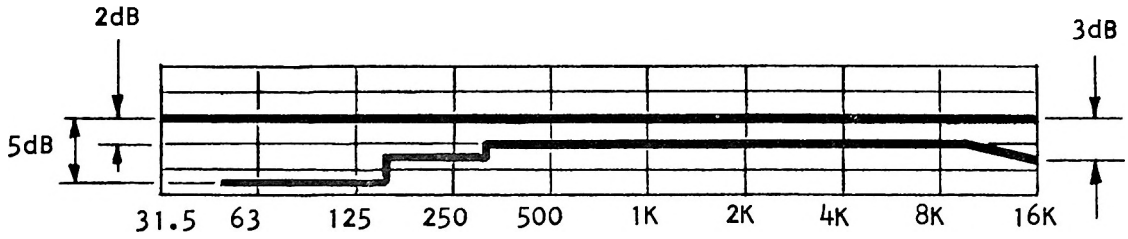
Power:	117 volts A.C., 60 Hz., 38 watts.
Tape Speed:	7-1/2 inches per second. Other optional speeds available.
Wow and Flutter:	0.15% or less, ANS1 S4.3 (DIN weighted).
Timing Accuracy:	0.1% or better
Audio Output Normal:	0 dBm from −10 dB recorded level. (amplifiers 18 dBm with .5% or less distortion).
Output Load Impedance:	600 ohms or 150 ohms.
Output Impedance:	75 ohms max. for 600 ohms rated load. 18.8 ohms max. for 150 ohms rated load.
Distortion:	2% or less, record to playback at 0 dB level, 1 kHz.
Signal/Noise Ratio Reproducer:	Ready mode 50 dB Mono, 47 dB Stereo.
Signal/Noise Ratio Record/Reproducer:	47 dB Mono, 44 dB Stereo.
Cross Talk Between Channels:	50 dB Mono, 45 dB Stereo.
Frequency Response:	When reproducing a test tape to NAB cartridge standard specifications, the output level of the reproducer is within a 2 dB window from 315 Hz to 10 kHz, 3 dB window from 150 to 314 Hz, 5 dB window from 50 to 149 Hz, and opening from 2 to 3 dB between 10 and 16 kHz, with the upper limit of the window flat from 20 Hz to 20 kHz. (Figure 1.2.1 and 1.2.2).
Equalization:	NAB. Adjustable to compensate for head wear.
Cue Signals Sensing:	NAB primary cue, 1 kHz, ±100 Hz, standard; secondary cue, 150 Hz, ±15 Hz, and tertiary cue, 8 kHz, ±800 Hz. optional. External information when tone is sensed furnished as relay contact closure (rating 2 Amps at 117 Volt A.C., 3 Amps at 26 Volt D.C.).
Playback Time:	
Type 10	2 seconds to 10 minutes, NAB size AA cartridges.
Type 20	2 seconds to 31 minutes, NAB size AA, BB, and CC cartridges.
Start Time:	120 ms maximum, at minimum solenoid damping.
Stop Time:	80 ms maximum, at minimum solenoid damping.
Temperature Rise:	30° F.
Remote Control:	All controls and indicators.

TYPE 10 AND 20 REPRODUCERS (Continued)

Mounting:	Table top mounting with rack mounting adapters optional.
Head Configuration:	NAB.

TYPE 10 AND 20 RECORDERS

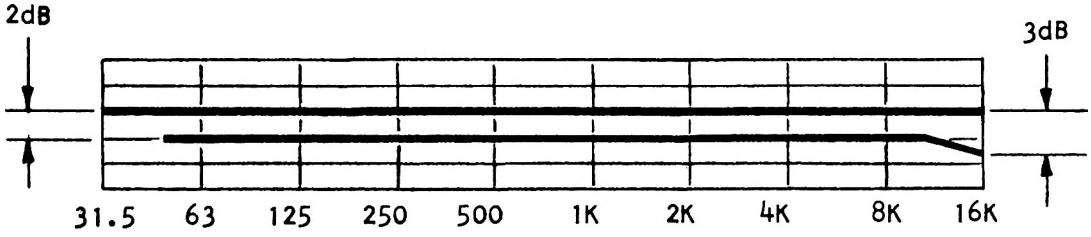
Power:	From reproducer's regulated power supply (24 vdc).
Audio Input(s):	8 (minimum) times the rated source impedance (4800 ohms minimum for 600 ohms rated source, 1200 ohms minimum for 150 ohms rated source), plus 10 K ohm minimum bridging over the frequency range from 50 Hz. to 16 kHz.
Metering:	Internal meter switch allows selection for metering the following levels: normal record, program play, cue bias, cue playback, peak recording, and program bias.
Distortion:	The total harmonic distortion of the record amplifier at 1 kHz, with a level 18 dB above that required to record 160 nWb/m on currently available magnetic tape, is less than 0.5%.
Noise:	The minimum signal-to-noise ratio measured unweighted with a bandpass of 20 Hz to 20 kHz, using a tape recorded with bias but with no signal, from 160 nWb/m at 1 kHz reference level is 47 dB for Mono, and 44 dB for Stereo.
Cross Talk Between Channels:	Stereo Program Crosstalk – Stereo program system crosstalk at 50 Hz, 1 kHz and 10 kHz, with 160, and 50 nWb/m respective fluxivities: –45 dB. Cue to Program Crosstalk – Cue to program system crosstalk at 150 Hz, 1 kHz, 3.5 kHz and 8 kHz: –50 dB.
Frequency Response:	When recording a tape and comparing its reproduced output with that of an NAB standard test tape, the difference is within a 2 dB window from 50 Hz. to 10 kHz, and from 2 to 3 dB between 10 and 16 kHz.
Stereo System Phasing:	The peak phase difference between stereo channels (record and subsequently reproduced) are less than 90° for all frequencies between 50 Hz. and 12.5 kHz.
Cue Signals:	Standard 1 kHz ±50 Hz primary cue, automatically recorded at start of recording (may be defeated and applied as required at user's option). Optional. 150 Hz ±8 Hz and 8 kHz ±400 Hz cues, (may be recorded during recording process or during playback); individual oscillators for each frequency with adjustable frequency and output level with 5% or less distortion.
Bias Oscillator:	Push-pull, 75 kHz; (nominal) individual gates and level controls for program and cue.



FREQUENCY IN HERTZ

REPRODUCER FREQUENCY RESPONSE

FIGURE 1.2.1



FREQUENCY IN HERTZ

RECORDER FREQUENCY RESPONSE

FIGURE 1.2.2

2.0 INSTALLATION

2.1 UNPACKING AND INSPECTION

Carefully remove all packing material and remove the unit from the container. Check the contents against the packing list and note any shortages. Visually inspect the unit for damage. If any damage is found follow the procedure for damage claims given in the Preface Section of this manual.

2.2 REPRODUCER - AUDIO OUTPUT CONNECTION

The location of the output connector and the terminal designations for both monophonic and stereophonic machines are shown on Figures 2.2.1 and 2.2.2.

The reproducers are shipped with the output transformer connected for 600 Ohms. For a 150 Ohm output refer to Figure 2.2.2 to change the transformer wires on connector J2. A mating connector for J2 is provided. Proper pin connections are provided below.

PIN	FUNCTION
1	Monophonic Shield (Ground) (Left Channel Stereo)
3	Monophonic Audio Output (Left Channel Stereo –)
5	Monophonic Audio Output (Left Channel Stereo +)
2	Right Channel Stereo Shield (Ground)
4	Right Channel Stereo Audio Output (–)
6	Right Channel Stereo Audio Output (+)

2.3 REPRODUCER - REMOTE OUTPUT CONNECTIONS

Connections for remote operation are provided by the 15 pin socket J1, Figure 2.2.1. The pin designation for the mating plug and its functions are shown on Figure 2.3.1.

2.4 RECORDER INPUT CONNECTIONS

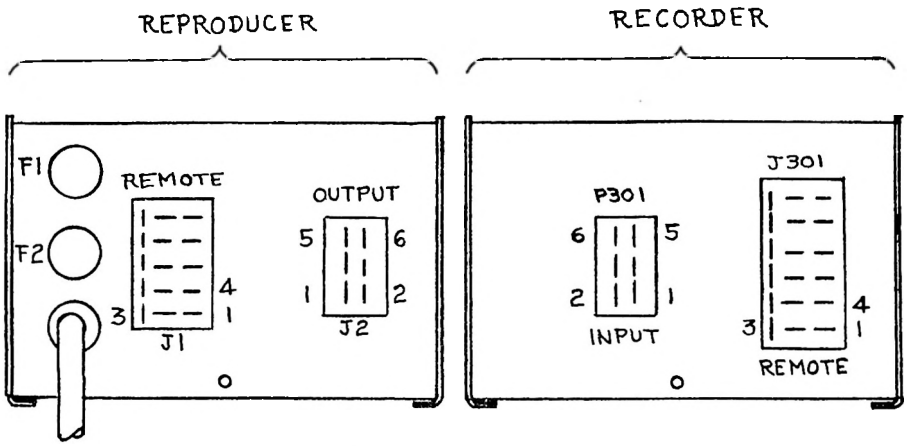
The location of the input connector P301 and the pin numbers are shown on Figure 2.2.1. The recorders are shipped with the input transformers connected for 600 Ohms. Figure 2.4.1 gives the connections for the available impedances for monophonic recording and Figure 2.4.2 the connections for stereophonic recording. A mating connector is provided for P301.

Proper phasing of the audio connections must be observed for stereophonic systems. Pin informais provided below.

PIN	FUNCTION
1	Monophonic Shield (Ground) (Left Channel Stereo)
3	Monophonic Audio Output (Left Channel Stereo –)
5	Monophonic Audio Output (Left Channel Stereo +)
2	Right Channel Stereo Shield (Ground)
4	Right Channel Stereo Audio Output (–)
6	Right Channel Stereo Audio Output (+)

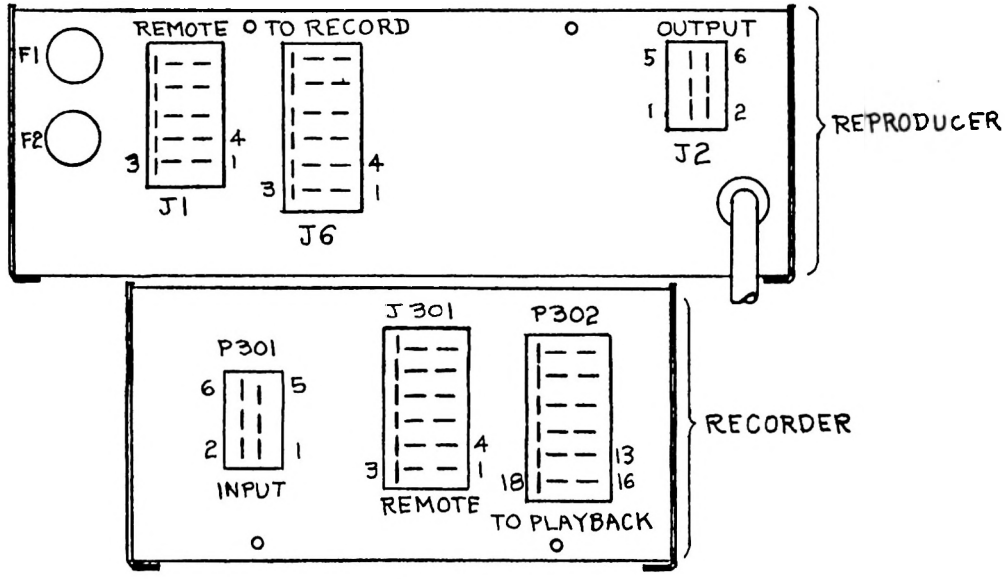
2.5 RECORDER REMOTE OUTPUT CONNECTIONS

Connection to the recorder for remote operations can be made through the 18 pin socket J301. A mating connector is supplied for making these connections. Figure 2.5.1 gives the pin numbers and their function.



TYPE 10
REAR VIEW

NOTE- REMOVE SCREWS FROM REAR OF CABINET BEFORE SLIDING OUT CHASSIS

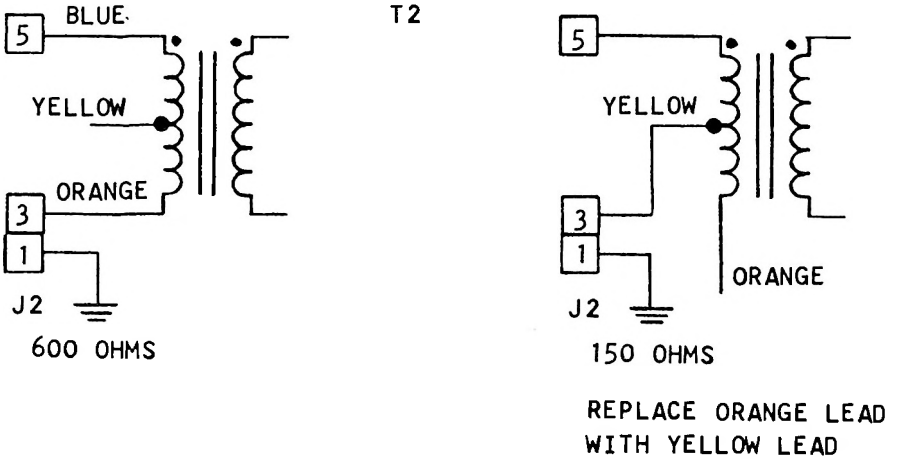


TYPE 20
REAR VIEW

FIGURE 2.2.1

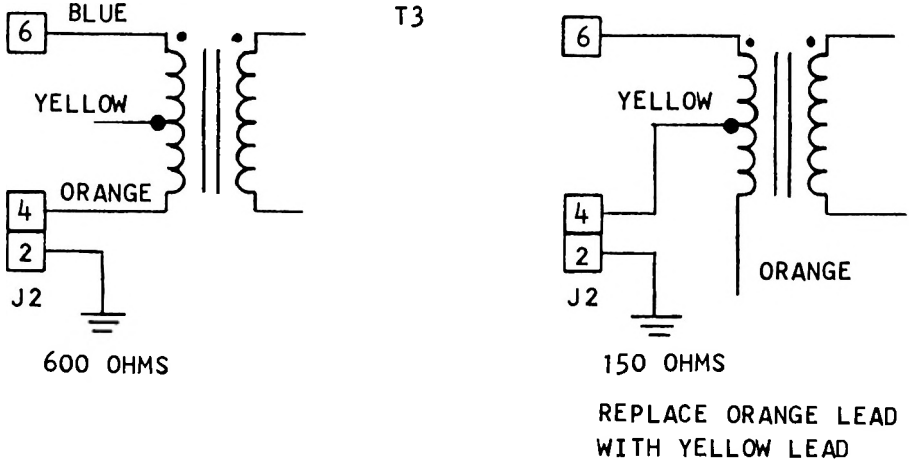
AUDIO OUTPUT - MONOPHONIC

OR LEFT CHANNEL STEREO



AUDIO OUTPUT

RIGHT CHANNEL STEREO



AUDIO OUTPUT CONNECTIONS

FIGURE 2.2.2

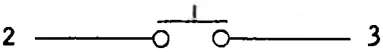
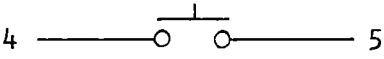
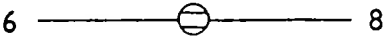
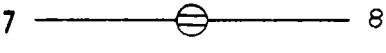
EXTERNAL CONNECTIONS FOR REMOTE OPERATION		
NOTE: CONNECTOR J1 (PIN NO. 8 IS PLUS 24 VDC & PIN NO. 1 IS INTERNAL GROUND		
FUNCTION	CONNECTION TO J1 CONNECTOR	COMPONENT REQUIREMENT
Start		Switch, SPST, N.O., Momentary - on.
Stop		Switch, SPST, N.O., Momentary - on.
Run indicator		Lamp, 28 volts, 40 ma max.
Ready indicator		Lamp, 28 volts, 40 ma max.

FIGURE 2.3.1

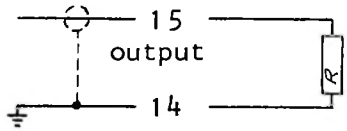
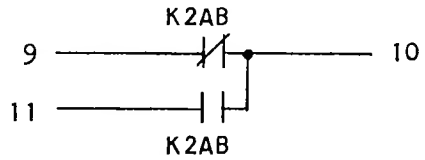
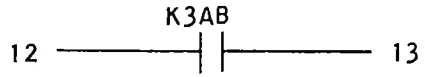
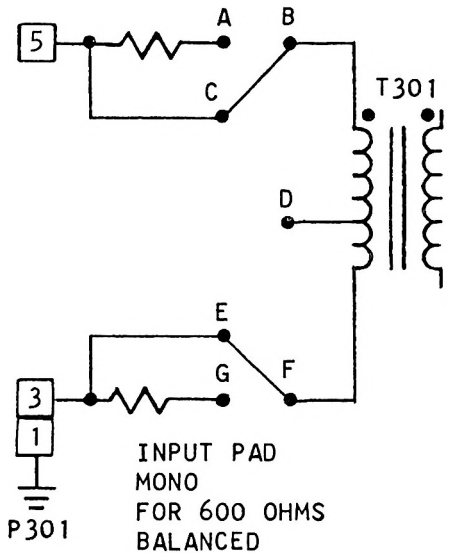
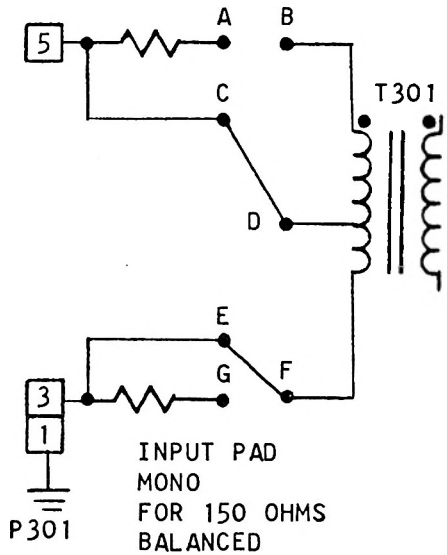
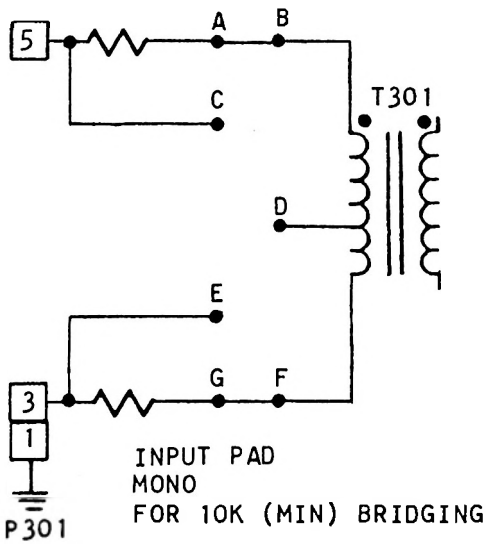
EXTERNAL CONNECTIONS FOR REMOTE OPERATION		
NOTE: CONNECTOR J1 (PIN NO. 8 IS PLUS 24 VDC & PIN NO. 1 IS INTERNAL GROUND		
FUNCTION	CONNECTION TO J1 CONNECTOR	COMPONENT REQUIREMENT
Logging output		Terminate with 10K-ohms minimum.
Secondary cue 150 Hz		None - Internal relay contacts rated 3 amperes at 26 VDC and 2 amperes at 120 VAC.
Tertiary cue 8 KHz		None - Internal relay contacts rated 3 amperes at 26 VDC and 2 amperes at 120 VAC.

FIGURE 2.3.1 (CONTD)

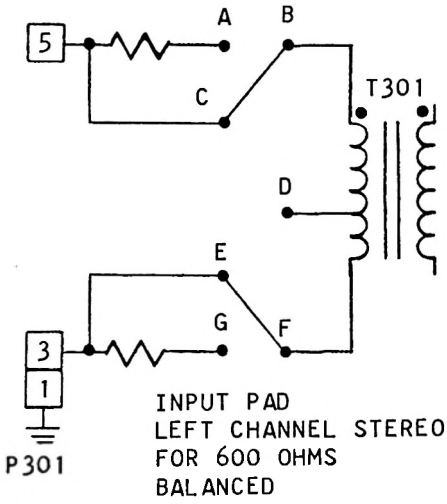




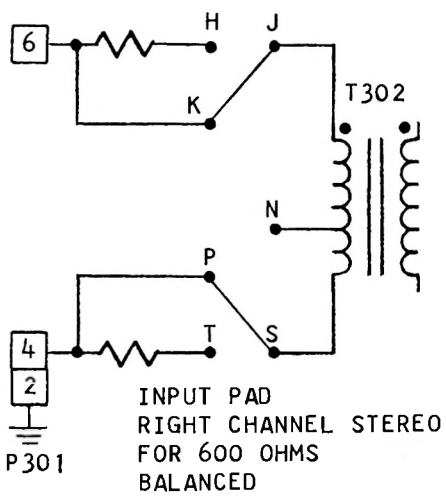


RECORDER INPUT CONNECTIONS (MONO)

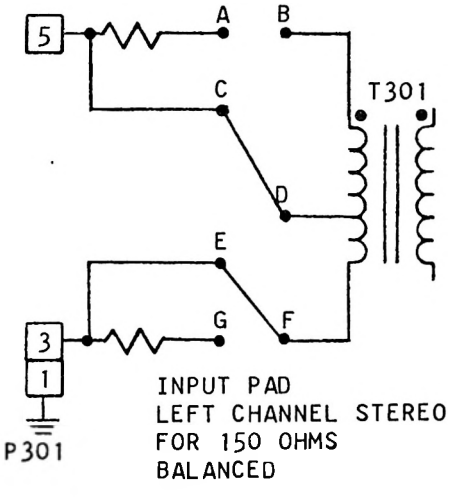
FIGURE 2.4.1



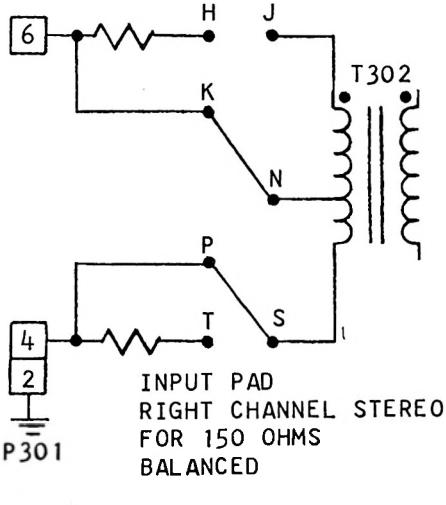
INPUT PAD
LEFT CHANNEL STEREO
FOR 600 OHMS
BALANCED



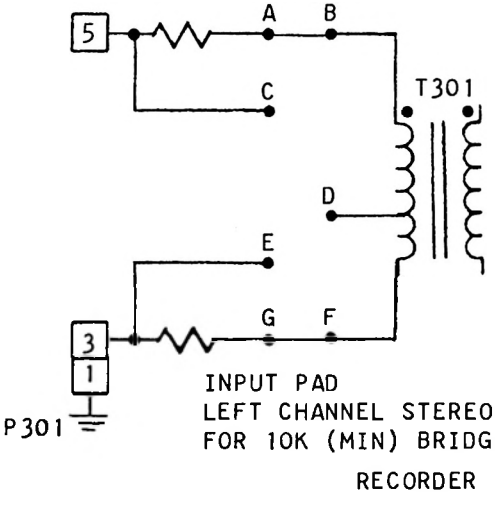
INPUT PAD
RIGHT CHANNEL STEREO
FOR 600 OHMS
BALANCED



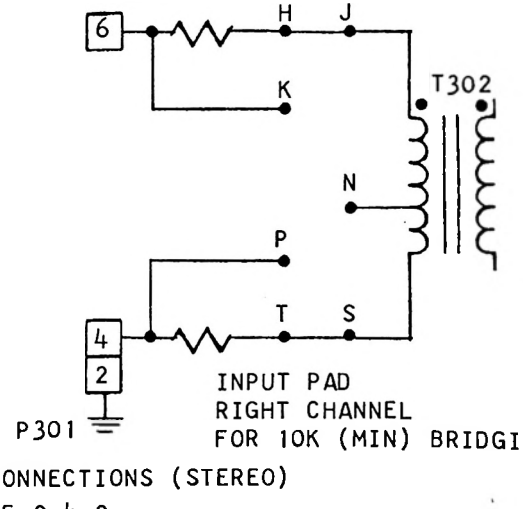
INPUT PAD
LEFT CHANNEL STEREO
FOR 150 OHMS
BALANCED



INPUT PAD
RIGHT CHANNEL STEREO
FOR 150 OHMS
BALANCED



INPUT PAD
LEFT CHANNEL STEREO
FOR 10K (MIN) BRIDGING



INPUT PAD
RIGHT CHANNEL
FOR 10K (MIN) BRIDGING

RECORDER INPUT CONNECTIONS (STEREO)

FIGURE 2.4.2

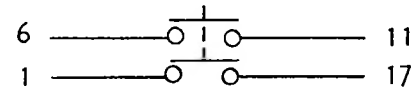
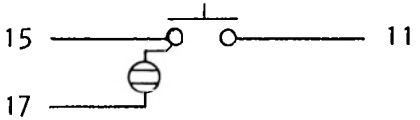
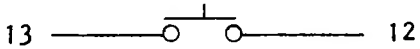
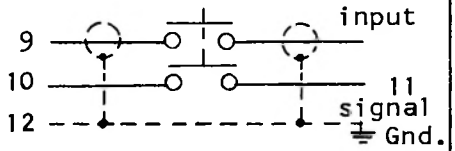
EXTERNAL CONNECTIONS FOR REMOTE OPERATION		
NOTE: CONNECTOR J301 (PIN NO. 11 IS PLUS 24 VDC & PIN NO. 17 IS INTERNAL GROUND)		
FUNCTION	CONNECTION TO J301 CONNECTOR	COMPONENT REQUIREMENTS
Primary cue tone 1 KHZ record.		Switch, DPST, N.O., Momentary - on.
Secondary cue tone 150 HZ record with indicator lamp.		Switch, SPST, N.O., Momentary - on. Lamp, 24 volts, 40 ma max.
Primary cue tone 1 KHZ defeat.		Switch, SPST, N.O., Momentary - on.
Cue record input from external source (logging).		Switch, DPST, N.O., Momentary - on.

FIGURE 2.5.1

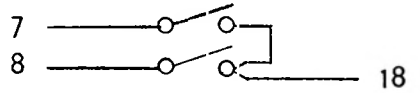
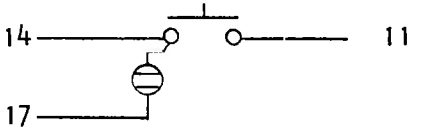
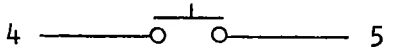
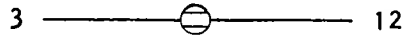
EXTERNAL CONNECTIONS FOR REMOTE OPERATION		
NOTE: CONNECTOR J301 (PIN NO. 11 IS PLUS 24 VDC & PIN NO. 17 IS INTERNAL GROUND)		
FUNCTION	CONNECTION TO J301 CONNECTOR	COMPONENT REQUIREMENTS
Left and right channel bias control.	 NOTE: Remove connector jumpers 7-8 & 7-18	Two switches, SPST, on-off. Use when in the record mode.
Tertiary cue tone 8 KHZ record with indicating lamp.		Switch, SPST, N.O., Momentary - on. Lamp, 24 volts, 40 ma max.
Record set (Pushbutton).		Switch, SPST, N.O., Momentary - on.
Record set (Indicating Lamp).		Lamp, 24 volts, 40 ma max.

FIGURE 2.5.1 (CONTD)

3.0 OPERATION

3.1 REPRODUCER CONTROLS AND INDICATORS

Both the Type 10 and Type 20 reproducers have indicators and control switches on the front panel as shown on Figure 3.1.1 which function as follows:

Power Indicator Light: The power indicator light shows that the reproducer is connected to an A.C. source and the unit operational.

Start Switch and Indicator: The green pushbutton switch initiates the start function which energizes the transport pressure roller solenoid (when a cartridge is in place) and puts the tape in motion and turns the lamp on. The intensity of the lamp will increase when a 150 Hz secondary cue signal is detected on the cue track.

Stop Ready Switch and Indicator: The amber stop switch and indicator function as follows: The lamp will turn on to show a cartridge is properly inserted in the machine. The lamp will turn off when the tape is put in motion. When an 8 kHz signal occurs on the cue track, the lamp turns on. When a 1 kHz primary cue tone is applied manually, the lamp will turn on.

Motor On-Off Control Switch (Internal): Two cartridge-sensing snap action switches are installed on the deck plate of all machines. Switch (S5) located nearest the deck, when utilized, will act as an on/off switch for the capstan motor.

The customer has the option as to the use of this swtich. The reproducer as supplied from the factory, has a strap across the switch which negates the action of the switch and allows the motor to run continuously (as long as A.C. is applied to the reproducer). This mode of operation provides two distinct advantages and is recommended for most installations. The motor is designed for continuous duty operation and the bearings in the motor will last longer if they are not subject to repeated starting and stopping of the motor. A second advantage is that a cartridge placed in the machine will start instantly without having to wait for the motor to come up to speed.

If it is desired the strap across the snap action switch (S5) may be removed to allow the motor to remain off when a cartridge is not in place, in those installations where the machine is not frequently used.

3.2 REPRODUCING PROCEDURE

Routine playback of program material is accomplished as follows:

A. Insert a properly recorded cartridge into the slot of the reproducer.
B. The stop-ready switch will turn on when the cartridge is inserted correctly, indicating that the machine is ready to provide audio output. This switch may be used to stop the tape at any time.
C. Depress the start switch. The tape will move and continue to provide an audio output until the primary cue tone is automatically detected and the tape stops. The reproducer will then return to a stop-ready mode with the tape in the proper position for subsequent use.

3.3 RECORDER CONTROLS AND INDICATORS

A. REC. – With a cartridge placed in the unit and the REC pushbutton momentarily depressed, a record mode exists and the integral lamp will so indicate.
B. SEC. – A 150 Hz secondary cue tone (when so equipped) may be recorded when the unit is in either the recording or reproducing mode, when the SEC pushbutton is depressed. An integral lamp will indicate when this function is active.
C. TER. – An 8 kHz tertiary cue tone (when so equipped) may be recorded when the unit is in either the recording or reproducing mode, when the TER

3.3 (Continued)

pushbutton is depressed. An integral lamp will indicate when this function is active.

NOTE

Operators are cautioned against inadvertently activating any control tone switches during playback.

D. Level Control(s) – The monophonic level (left channel stereo) and the right channel stereo level control potentiometer(s) (Figure 3.1.1) which are located behind the front panel, provide an adjustment of the input record level. A visual indication is provided by the meter(s) above the access hole(s). The unit is shipped with a plug button(s) to cover the access hole(s). As an accessory, shaft extenders and knobs are provided with each unit to allow the user the option of external level control adjustment or internal adjustments

E. 1 kHz Record – A (1 kHz) record switch is located behind the front panel. This switch, when depressed for one second minimum, allows the operator to record a 1 kHz "STOP" tone in the record or reproducing mode whenever required.

F. 1 kHz Defeat – A (1 kHz) defeat switch is located behind the front panel. This switch, when depressed and maintained for a minimum of one second after the start pushbutton is depressed, will prevent the recording of the 1 kHz primary cue. The 1 kHz record and the 1 kHz defeat switches may be remote controlled if easier operator access is desired.

A multi-function rotary switch is located on a support plate behind the front panel and is readily accessible to the operator when the recorder chassis is slid forward. The meter switch is used to select the output to be monitored on the front panel meter(s), to provide an aid in recording and maintenance.

1. Program Bias Level
2. Peak Recording Level
3. Normal Recording Level (VU)
4. Program Play Level
5. Cue Tone Play Level
6. Cue Bias Level

3.4 RECORDING PROCEDURE

A. Place the internal selector switch in the normal record (N. REC) position.

B. Insert an erased cartridge with the splice located just past the capstan (the Beaucart Splice Finder Model SFL is an excellent and reliable machine for finding the splice and stopping the tape with the splice just past the capstan) into the cartridge slot of the playback unit. The amber stop indicator will be illuminated to indicate that the cartridge is correctly located.

C. Momentarily press the record (REC) switch. The associated red lamp will turn on and the meter circuit activated.

D. Adjust the level controls (with the input signal applied) so the program record level indicated on the VU meter is your normal record level.

E. Press the start switch and start recording.

F. If more than one recording is to be made, press the stop switch at the completion of the first recording and follow Steps C, D and E. (The primary cue will automatically be recorded on the cue track at the beginning of each message.)

G. At the end of recording (single or multiple messages) the machine will run and automatically sense the primary cue at the beginning of the message and stop.

The Secondary and Tertiary cue tones may be inserted on the cue track as desired. With the machine in the playback mode, the recorded message may be monitored and the Secondary and Tertiary cues added as desired by depressing the pushbuttons.

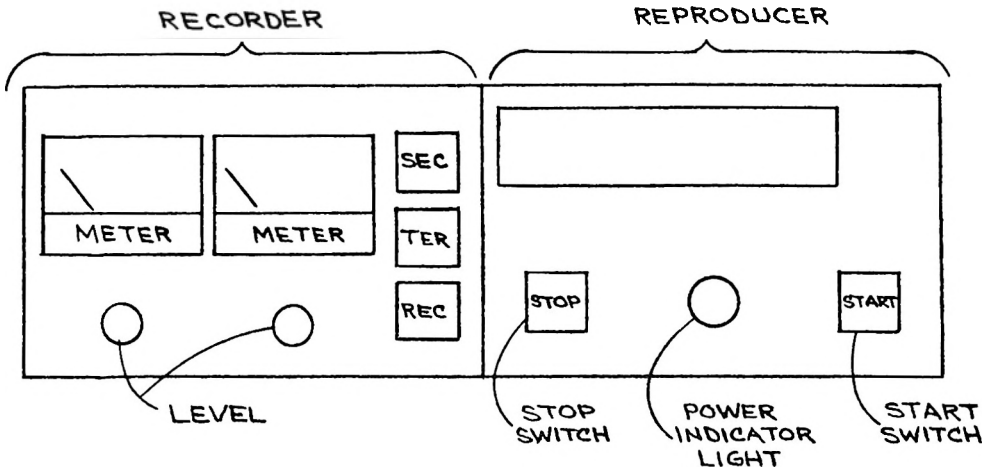
NOTE

The termination of the recording process by use of the "STOP" pushbutton will leave the cartridge in the "un-cued" state. It is recommended to always allow the machine to play to "CUE" after it is once started.

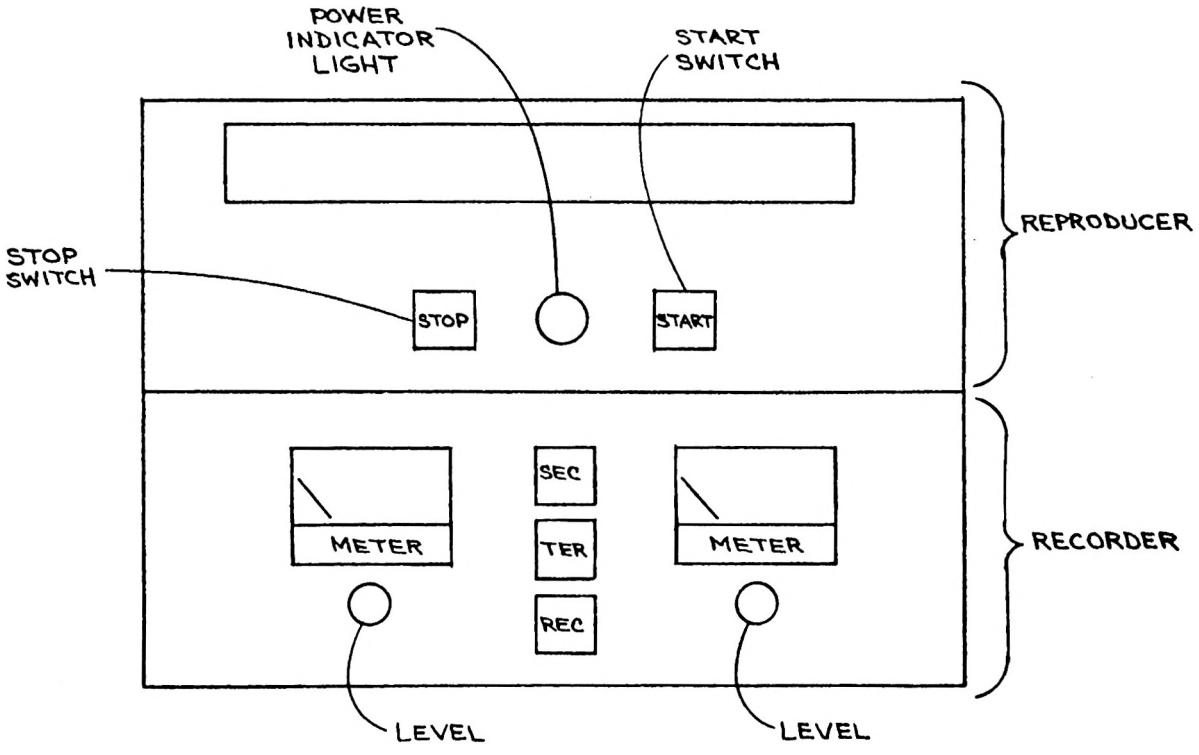
Recorder To Reproducer Inter-Connection

The inter-connection between the Type 10 recorder and the Type 10 reproducer is made by connecting the cable with the 18 pin connector from the reproducer, to connector P302 located inside the recorder.

The inter-connection between the Type 20 recorder and the Type 20 reproducer is made using the cable provided. This cable is connected to P302 on the recorder and J6 on the reproducer rear panels.



TYPE 10
FRONT PANEL



TYPE 20
FRONT PANEL

FIG. 3.1.1

4.0 MAINTENANCE AND ALIGNMENT, TRANSPORT ASSEMBLY

4.1 GENERAL DESCRIPTION

When performing maintenance or replacement of components refer to Figure 4.1.1 and Transport Assembly Parts List.

In order to interface with the NAB cartridges the location of the heads, capstan, tape and cartridge guides and other components must be carefully controlled. Figure 4.1.2 gives their locations. When it becomes necessary to remove or adjust any of these components they should be restored to the positions shown. Some cartridges of early manufacture may have smaller head openings and require the cartridge guide to be located at a dimension different from that given.

The condition of the cartridges used is important. Precautions should be taken to maintain the cartridges in good working condition.

Several gages will be most helpful in maintaining the transport. These are shown on Figure 4.2.1 and their use is delineated in the sections to follow. These gages are available as accessories.

Figure 2.2.1 gives the location of the captive screw(s) in the rear of the machine that must be loosened in order to remove the chassis from its enclosure.

4.2 TAPE GUIDE HEIGHT SETTING

There are several schools of thought regarding the use of tape guides on both monophonic and stereophonic cartridge machines. The machine is provided with three independently adjustable guides that are easily removed if desired. It is suggested that the recommendations of the manufacture of the cartridges be followed regarding their use.

The guides may be adjusted as follows using the guide height gage SL-1445 shown on Figure 4.2.1.

a. Loosen the guides 5 and 6, Figure 4.1.1.
b. Insert the gage into the guides as shown in Figure 4.2.1. The guides will be lifted and slid into the gage and the top and bottom edge of the guides will be in contact with the gage. This will be a tight fit. The guides will now be at the correct height and perpendicular to the top plate.
c. Carefully tighten the two screws holding each guide. Clearance is provided in the gage for access to the screws.

A number of different gages are available for setting the height of tape guides and may be used. It is suggested that all three guides be set at the same time with a common gage that spans the

4.2 (Continued)

guides so as to insure a tape path that is uniform in height over its entire length.

4.3 HEADS

Magnetic head design has gone through a number of changes over the years to extend the frequency range and provide better response with lower noise. The Beaucart heads used incorporate the latest in head design to provide superior performance. The heads will provide the best in performance if they are frequently checked. Cleaning should be done with a cotton swab and isopropyl alcohol or a commercial head cleaning solvent and the heads wiped with a soft dry cloth to remove cotton fibers. The heads should be degaussed after cleaning. When removing or adjusting the heads, care must be exercised so as not to scratch or otherwise damage the heads.

The elevation, Zenith, and Azimuth are controlled by the three adjusting screws, RH, FH and A shown on Figure 4.3.1.

4.4 CAPSTAN-PRESSURE ROLLER

The electrolized capstan shaft has a vapor honed finish to provide uniform and constant tape speed. It will become darkened by the continuous contact with the tape. A soft cloth dampened with isopropyl alcohol or a commercial head cleaning solvent will remove the particles. Care should be taken to prevent the solvent from flowing into the motor bearings. The capstan bearings (motor bearings) are permanently lubricated and need no attention.

The pressure roller surface should be cleaned to remove the tape lubricant that will accumulate with use. A soft cloth dampened with the same solvent used to clean the heads may be used. A drop of light oil may be added to the pressure roller bearing occasionally. Extreme care must be taken to insure that no oil gets on the outside of the pressure roller.

4.5 SOLENOID

The air damped solenoid is powered from a 125 Volt D.C. source for smooth and noise-free operation. The "dampening" (pull in and drop out time) is controlled by a spring loaded adjusting screw at the rear of the solenoid coil housing. Clockwise rotation of this screw increases the "dampening" and counterclockwise rotation decreases the "dampening". The solenoid plunger is Teflon coated and should be kept free of dust and dirt by wiping occasionally with a soft dry cloth. If used in the field under extreme dust and dirt, a solvent may be used to remove any build-up of material.

4.6 PRESSURE ROLLER CROSS SHAFT

The cross shaft rides in two sleeve bearings. These bearings have been oil impregnated and should not need attention unless a major overhaul of the unit is made.

4.7 HEAD REPLACEMENT

To gain access to the heads, first remove the cartridge hold down spring and head shield 3 and 4 of Figure 4.1.1. The tape guides 5 and 6 need not be removed when replacing heads. The two screws holding the head clamp in place may now be removed. Loosen the screws a 1/2 turn at a time until the clamp is free, then remove the screws and clamp completely. The heads fit snugly into the mount and a slight force may be required to remove the head from the mount. After the head is removed from the mount, remove the connector from the rear of the head and plug it into the new head. (Insert the Beaucart head with the name up to insure the head is properly oriented.)

Place the head in the mount. The head must seat squarely in the mount. Be sure it is in contact with the rear step of the mount and the bottom and sides. Replace the head clamp by first bringing the screws in contact with the clamp when the clamp is held tight aginst the top of the head. Then tighten each screw 1/4 turn at a time for a turn or so.

The replacement of heads on the stereo machines is similar except the cross shaft hold down spring replaces the cartridge hold down spring and the cross shaft carrying the rollers must be lifted from its guides before removing the heads. Note the relative positions of the rollers when the shaft is removed and replace the assembly in the same manner.

4.8 HEAD ADJUSTMENT, MECHANICAL

Figure 4.3.1 shows the location of the adjusting screws for both the record head (Head B) or the reproducer head (Head A). In the reproducer only, Head B will be a dummy head. Since tape guidance is dependent, to a degree, on Head B the same care should be taken in aligning this head as the active head.

The following steps provide a method of aligning the heads using the gages shown on Figure 4.2.1.

a. Turn the lock screw CCW 8 to 10 turns to release the mount.
b. Using gage SL-1656 as shown on Figure 4.2.1, adjust the upper edge of the top (program) pole face of the head to the scribed line (.559 above the deck surface).

4.8 (Continued)

Turning screws RH and FH CW at the same time will lower the head and CCW will raise the head. Turning one screw at a time will raise or lower and rotate the head (changes Zenith and should be considered at this time).

c. Using gage SL-1656, as shown in Figure 4.2.1, adjust the Zenith of the head with screw RH and FH. Turning screw RH CW will tilt the head back as will turning screw FH CCW. Correct adjustment will be achieved when little or no light is visible between the gage and the head *and* the upper edge of the top (program) pole face of the head is in line with the scribed mark on the gage.
d. Using gage SL-1656, as shown on Figure 4.2.1, adjust the Azimuth of the head. When screw A is turned CW the head will rotate CCW, when turned CCW the head will rotate CW. Adjust the head until the right side of both the upper and lower pole faces (program and cue) of the head are in line with the gage. Correct mechanical adjustment of Azimuth will then be achieved.
e. The lock screw L may now be tightened. The head alignment should be checked after the screw is tightened, since the assembly might shift during tightening. If this happens, repeat Steps a. through d. and then tighten the lock screw.
f. See Section 5.0 for final adjustment.

4.9 TRANSPORT MAINTENANCE

If excessive flutter or other tape drive problems occur, select several cartridges known to be in good working order and check the tape drive with these. If the problem still exists, check the machine and re-set the drive components as follows:

The pressure roller shaft is mounted on the cross shaft and its position relative to the motor must be carefully set to insure correct pressure and angularity.

4.9.1 Pressure Roller Replacement

The pressure roller should be replaced with pressure roller SL-1397. Figure 4.9.1.1 shows the assembly. First remove the "C" ring and nylon washer (note the nylon washer is on top), then lift off the pressure roller and polished steel washer. Clean the pressure roller shaft with a solvent and dry with a soft cloth. Inspect the OD and ID edges of the nylon washer. If any burrs or roughness

4.9.1 (Continued)

is found remove with a light sandpaper. Add a drop of light oil to the pressure roller shaft. Replace the polished steel washer, add the new pressure roller, nylon washer, and "C" ring.

4.9.2 Setting Pressure Roller Force

The pressure roller force is controlled by the position of the clevis with respect to the solenoid plunger, 1 of Figure 4.9.1.1. The pressure roller force is best set using a scale (SL-1657) and an easily modified cartridge as shown on Figure 4.9.1.1. Select a loaded erased cartridge and remove a section of the plastic directly over the pressure roller shaft (when the pressure roller is up) as shown on Figure 4.9.1.1. With the machine in the run mode (tape running) place the hook end of the scale through the opening for the cart on the front panel and over the pressure roller shaft (turn the "C" ring until the open end faces the capstan) and pull evenly until the tape stops running and note the force reading on the scale. A reading of 32 oz ± 8 oz (24 to 40 oz) is acceptable. If the reading is outside these limits it may be adjusted as follows:

a. Remove the solenoid shield.
b. Loosen lock nut N, Figure 4.9.1.1.
c. To decrease the force, hold the clevis and rotate the plunger CW.
d. To increase the force, hold the clevis and rotate the plunger CCW. (Be sure to tighten the lock nut before re-testing for pressure roller force.)

This adjustment should be made one turn at a time and the force checked after each turn until the correct setting is obtained. If the solenoid plunger bottoms out before the correct force is obtained, the motor capstan shaft position must be re-set.

4.9.3 Setting Motor Capstan Position

a. *DISCONNECT THE MACHINE FROM THE AC SOURCE.*
b. Remove the two screws holding the snap action switches and lift the switches to gain access to the two button head allen screws holding the motor.
c. Remove the pressure roller and replace with the gage SL-1654, Figure 4.9.1.1. It is not necessary to use the washers and "C" ring with this gage.

4.9.3 (Continued)

d. Loosen the motor mounting screws.
e. Rotate the pressure roller shaft up until the gage is in a vertical position.
f. With the thumb on the gage and the index finger on the motor shaft, squeeze the shaft and gage tightly in contact. The pressure roller shaft and the motor capstan shaft should be in line, or the capstan slightly to the left of the pressure roller shaft, but never to the right. While holding the gage and motor in tight contact, alternately tighten the motor hold down screws.
g. The capstan and the pressure roller shaft should now both be perpendicular to the top surface of the deck and spaced correctly. To check this, hold the gage in firm contact with the capstan shaft and rotate the capstan. This can best be done by rotating the motor from the underside of the machine. Remove the gage and a thin line from top to bottom of the gage should be visible. If this line does not extend the full length of the gage it indicates that the pressure roller shaft and motor capstan shaft are not correctly aligned. If the line does not extend to the bottom of the gage the motor is back too far. If the line does not extend to the top of the gage the motor is too far forward.
h. Replace the pressure roller and snap action switches.

The pressure roller force should then be checked and adjusted as outlined in 4.9.2.

4.9.4 Motor Replacement

The motor may be replaced by following the procedure outlined in 4.9.3, except completely remove the screws and remove the motor from the bottom of the assembly. To facilitate the removal of the motor the front panel should be removed. The removal of the wires to the switches is not necessary to gain sufficient clearance to remove the motor. The motor position and the pressure roller force should be set as previously outlined when a motor replacement is made.

TOP DECK—PARTS LIST

Refer To Figure 4.1.1

Symbol	Beaucart No.	Description	Quantity
1	SL-1399	Cartridge Guide Style 20 Machine Only	1
2	SL-1555	Extension Plate Style 20 Machine Only	1
3	SL-1393	Cartridge Hold Down Spring for Mono Machines	1
	SL-1629	Cartridge Hold Down Spring for Stereo Machines	1
4	SL-1526	Shield Heads	1
5	SL-1391	Tape Guide (center and right)	2
6	SL-1392	Tape Guide (left)	1
7	BH1001	Dummy Head (Mono or Stereo Reproducers Only)	1
	BH2001	Mono Record Head	1
	BH4001	Stereo Record Head	1
8	BH3001	Mono Reproducing Head	1
	BH5001	Stereo Reproducing Head	1
9	SL-1378	Clamp Head	2
10	72489	Compression Spring	6
11	SL-1477	Pin Alignment (Style 20 Machine Only)	2
12	SL-1446-2	Plate Deck	1
13	SL-1578	Guide Cartridge (Mono)	1
	SL-1630	Guide Cartridge (Stereo)	1
14	102558	Snap Action Switch	2
15	82300	Extension Spring	1
16	SL-1527	Shield Solenoid	1
17	SL-1381 and 202202	Stud-Solenoid with Chain	1
18	91379	"C" Ring	1
19	30633	Nylon Washer	1
20	SL-1397	Pressure Roller	1

PARTS LIST (Continued)

Symbol	Beaucart No.	Description	Quantity
21	72494	Washer	1
22	SL-1396	Shaft Pressure Roller	1
23	SL-1395	Cross Shaft	1
24	30638	Nylon Washer	1
25	SL-1398	Rotor	1
26	30634	Nylon Washer	1
27	P40H-12	Motor 450 rpm	1
	P40H-14	Motor 600/1800 rpm	1
28	724490	Solenoid	1
29	60590	Screws Adj. (Mono)	6
	SL-1575	Screws Adj. (Stereo)	6
30	60572	Screws, Cap	2
31	60575	Screws, Cap	2
32	60595	Screws, Button Head	4
	60596	Screws, Button Head	2
33	30129	Spade Lug	1
34	60571	Screw Button Head	1
35	60582	Set Screw	2
36	SL-1627	Assy. Cart. Guide	1
37	SL-1592	Roller	2
38	SL-1590-1	Shaft	1
39	SL-1590-2	Shaft (B Cart.)	1
40	SL-1590-3	Shaft (C Cart.)	1
41	SL-1591-1	Spacer	1
42	SL-1592-2	Spacer	1
43	SL-1592-3	Spacer (B Cart.)	1
44	SL-1592-4	Spacer (C Cart.)	1

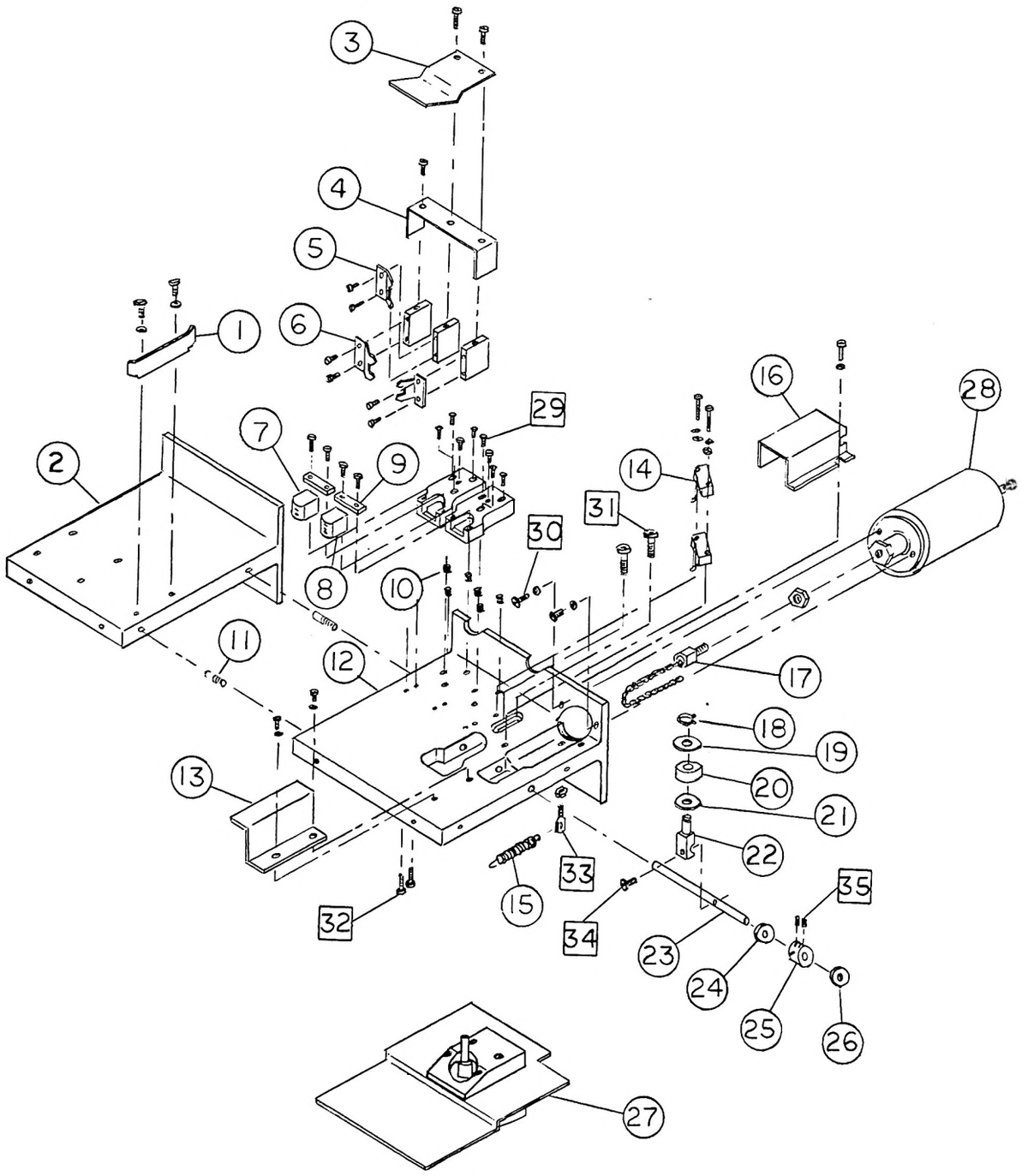
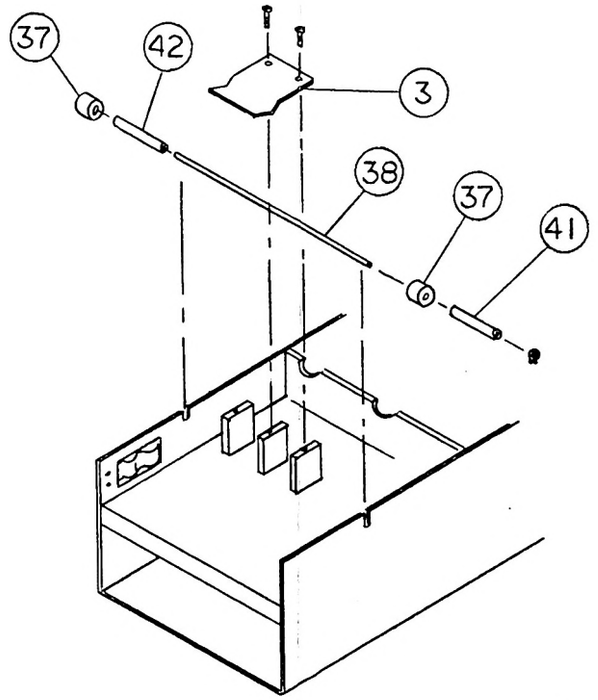
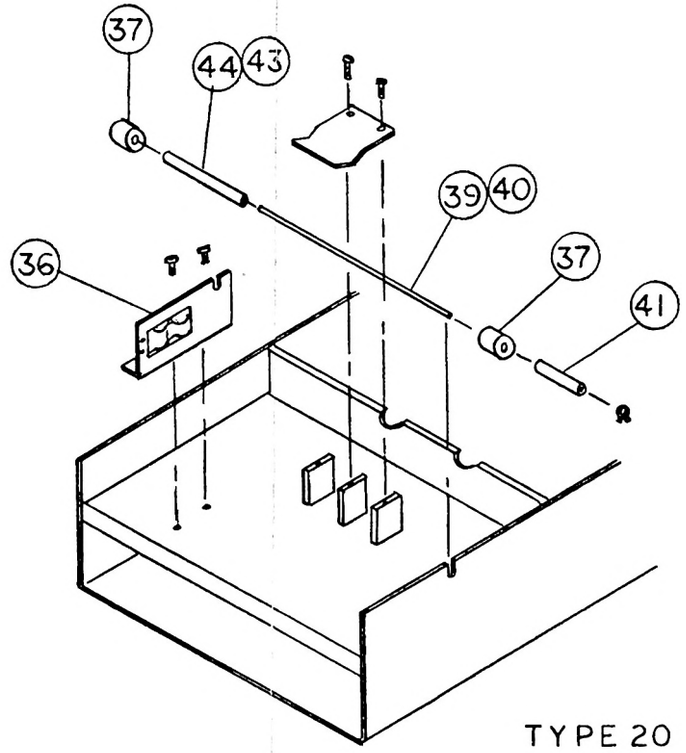


FIG. 4.1.1

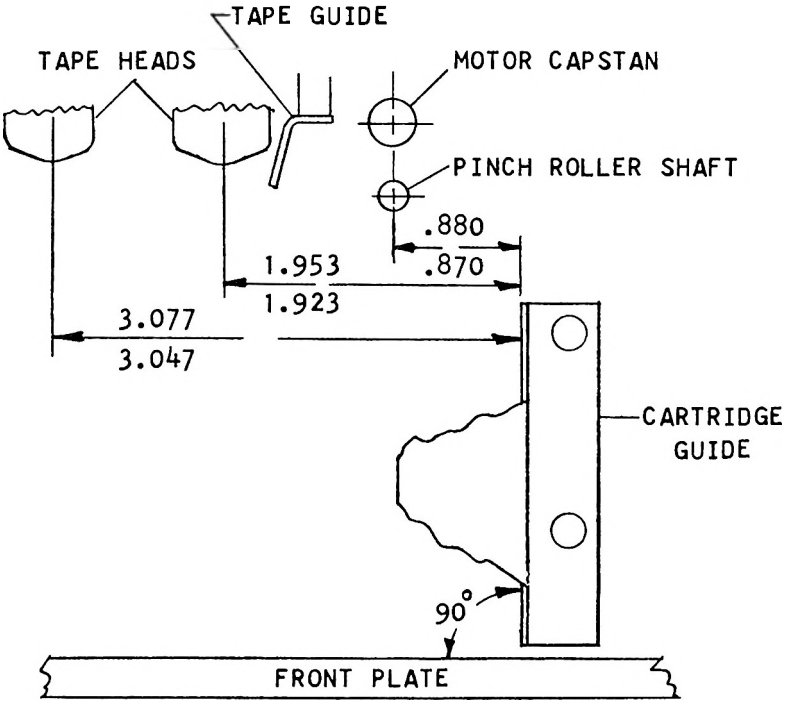


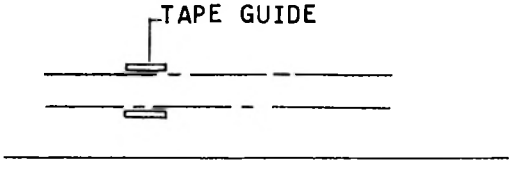
TYPE 10



TYPE 20

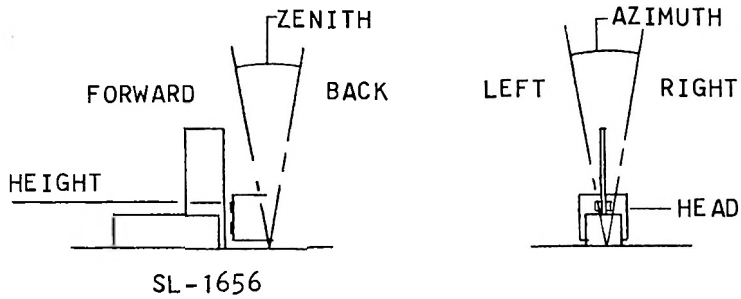
TOP DECK ASSY
FIG. 4.1.1

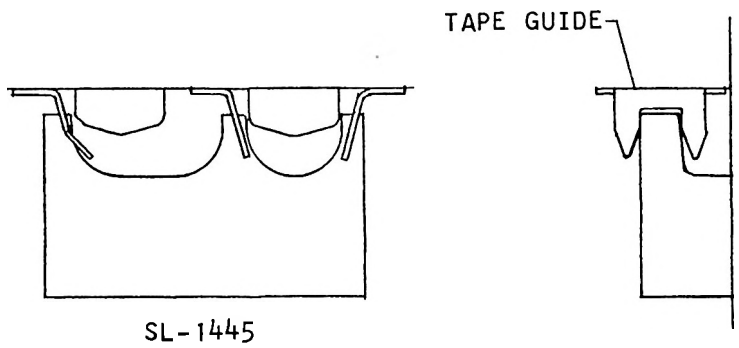


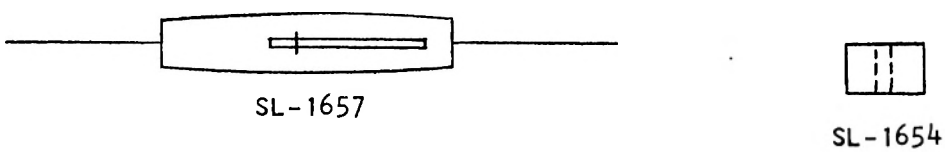


TOP DECK DIMENSIONS

FIGURE 4.1.2

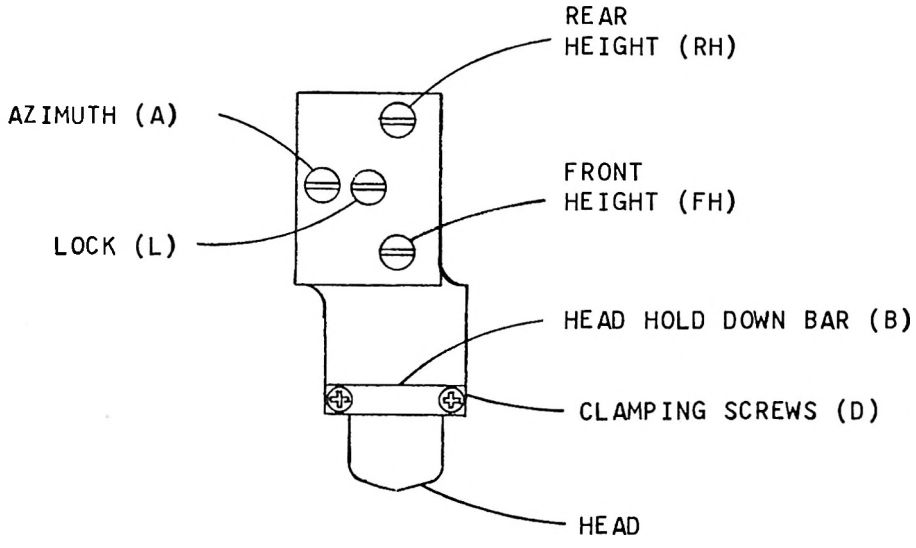






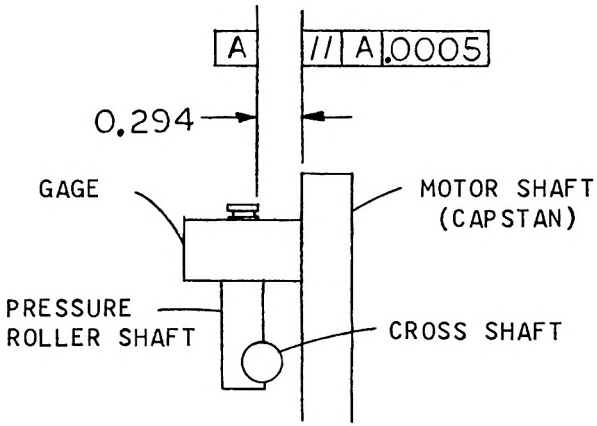
MECHANICAL ADJUSTMENTS

FIGURE 4.2.1



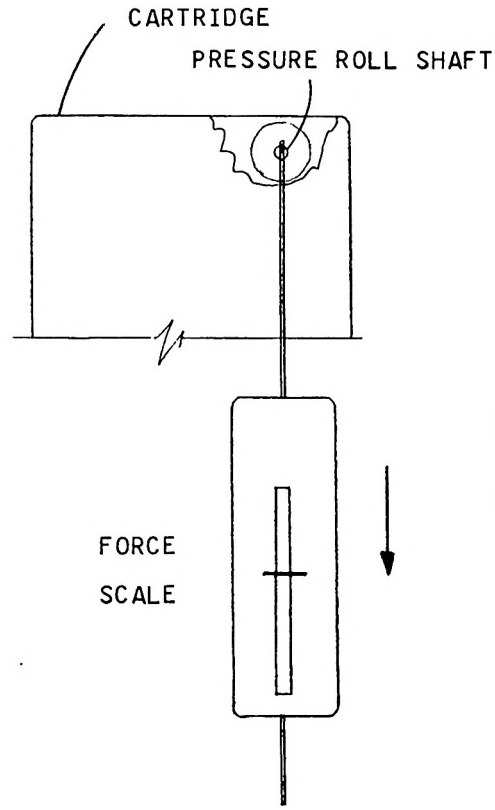
HEAD MOUNT

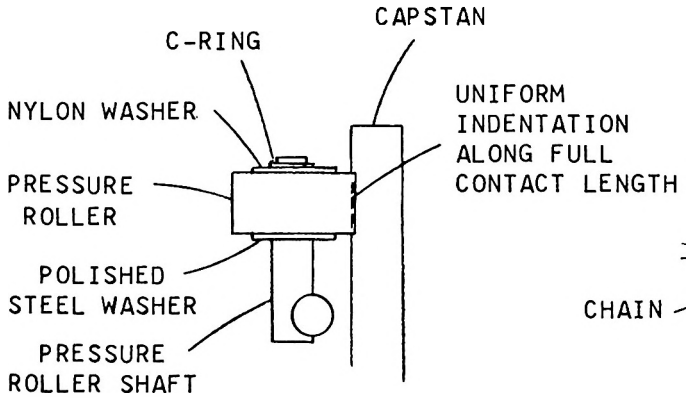
FIGURE 4.3.1



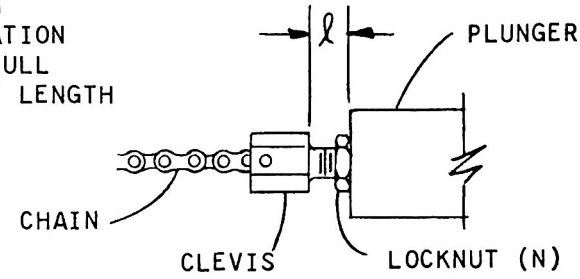
PRESSURE ROLLER

CAPSTAN RELATIONSHIP





PRESSURE ROLLER FORCE



SOLENOID ADJUSTMENT

PRESSURE ROLLER ADJUSTMENTS

FIGURE 4.9.1.1

5.0 ELECTRICAL ADJUSTMENTS, REPRODUCER

5.1 GENERAL DESCRIPTION

All Beaucart reproducers and record/reproducers are fully tested and adjusted at the factory for optimum performance and normally require no further adjustments prior to their installation.

A good maintenance schedule should include periodic checks (weekly or monthly), depending upon the operational requirements of the machine. Check the mechanical adjustments before proceeding further. Minor adjustments of the electronic controls may be required to compensate for normal head wear.

5.2 ADJUSTMENTS, REPRODUCER

The following alignment adjustments should be followed in the sequence presented to result in a fully aligned reproducer. It is necessary to provide a VTVM, oscilloscope (for use with stereo), and Standard Test Tapes. Refer to Figure 9.1 or Figure 9.3 for the location of controls and adjustments referred to in the following procedures.

Monophonic units incorporate left channel only. Stereophonic units incorporate both left and right channels.

5.3 PROGRAM LEVEL ADJUSTMENT

5.3.1 Connect the VTVM across a 600 ohm load to J2 pins 3 and 5+ (left), 4 and 6+ (right).

5.3.2 Insert and play the proper NAB Standard Reference Tape (1 kHz) or equivalent test tape.

5.3.3 Adjust level control R112 (left), R126 (right) to obtain 0 dBm on VTVM.

5.4 MONOPHONIC PROGRAM EQUALIZATION AND AZIMUTH

5.4.1 Connect the VTVM across a 600 ohm load to J2 pins 3 and 5.

5.4.2 Insert and play an NAB Standard Monophonic Frequency Response and Azimuth Test Tape or equivalent test tape.

5.4.3 Adjust Azimuth for a peak output at 12.5 kHz. Secure lock screw and adjust equalization trim-pot R104 while at 12.5 kHz to produce −10 dBm at the reproducer output.

5.4.4 Observe frequency response on VTVM. Equalization trim-pot R104 may be adjusted slightly for optimum frequency response.

5.5 STEREOPHONIC PROGRAM EQUALIZATION, AZIMUTH AND PHASE

5.5.1 Connect the VTVM across a 600 ohm load to J2 pins 3 and 5+ (left), 4 and 6+ (right).

5.5.2 Insert and play an NAB Standard Stereophonic Frequency Response and Azimuth Test Tape or equivalent test tape.

5.5.3 Adjust the Azimuth for a peak output at 12.5 kHz. Adjust equalization trim-pots R104 (left) and R118 (right) while at 12.5 kHz to produce −10 dBm at the reproduce outputs.

5.5.4 Connect an oscilloscope (vertical input) to the left channel output of the reproducer (J2, pins 3 and 5+). Connect the horizontal input to the right channel output of the reproducer (J2, pins 4 and 6+).

5.5.5 Insert and play an NAB Standard Stereophonic Fast Sweep Test Tape or equivalent test tape.

5.5.6 Adjust the vertical and horizontal gains of the oscilloscope to a suitable amplitude while at the 1 kHz −10 dBm level. (See Figure 5.5.7.1 and Figure 5.5.7.3). A Lissajous figure should appear as in Figure 5.5.7.2 increasing in amplitude from left to right across the oscilloscope at a 45° angle.

While the frequency is sweeping, carefully adjust the Azimuth to obtain the pattern in Figure 5.5.7.5. The pattern should not exceed 90° (Figure 5.5.7.4) or flip to 180° (see Figure 5.5.7.6). When optimum phase shift is obtained secure lock screw, and recheck frequency response and equalization.

5.6 CUE TONE SENSITIVITIES

5.6.1 Insert and play appropriate NAB Standard Cue/Logging Test Tape or equivalent test tape.

5.6.2 Adjust the 1 kHz sensitivity control R222 (clockwise increases sensitivity) to detect the 900 Hz and 1100 Hz tones.

5.6.3 Adjust the 150 Hz sensitivity control R827 (clockwise increases sensitivity) to detect the 135 Hz and 165 Hz tones.

5.6.4 Adjust the 8 kHz sensitivity control R817 (clockwise increases sensitivity) to detect the 7200 Hz and 8800 Hz tones.

VERTICAL GAIN

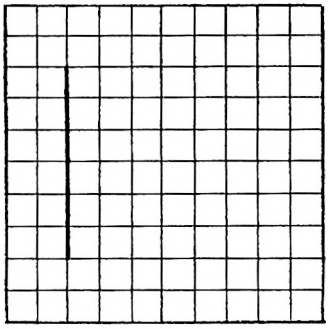


FIGURE 5.5.7.1

45 PHASE SHIFT

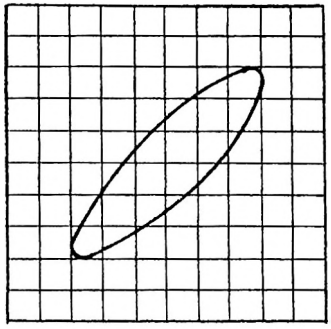


FIGURE 5.5.7.2

HORIZONTAL GAIN

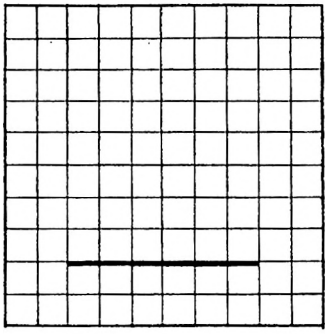


FIGURE 5.5.7.3

90 PHASE SHIFT

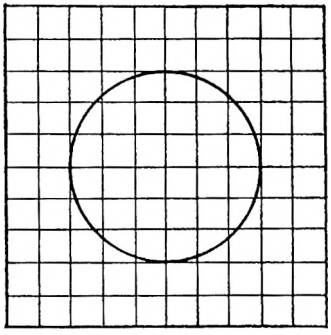


FIGURE 5.5.7.4

0 PHASE SHIFT

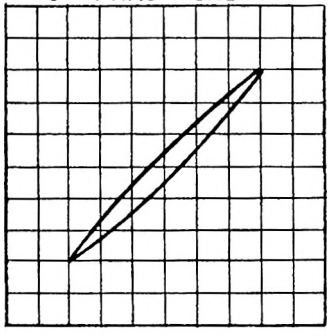


FIGURE 5.5.7.5

180 PHASE SHIFT

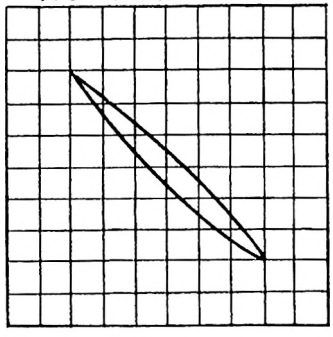


FIGURE 5.5.7.6

LISSAJOUS FIGURES

6.0 ELECTRICAL ADJUSTMENTS, RECORDER

6.1 GENERAL DESCRIPTION

All Beaucart reproducers and record/reproducers are fully tested and adjusted at the factory for optimum performance and normally require no further adjustment prior to their installation.

Adjustments of the recorder should not be undertaken unless a definite lack of performance exists and the reproducer has been carefully tested and found not to be contributing to the error.

Beaucart recorders are equipped with internal meter switching which allows the panel meter to be used for routine tests for proper operation of various circuits, and is valuable in the adjustment of these circuits. Many of the following adjustments will refer to the use of the panel meter, however, it is necessary to provide a VTVM, audio signal generator, oscilloscope and Standard Test Tapes. It is also useful to have a 12 pin (SL-1675) and an 18 pin (SL-1676) card extender for access to circuit adjustments.

Refer to Figures 9.1 or 9.3 for the location of the controls and adjustments referred to in the following procedures. These adjustments should be followed in the sequence presented to result in a fully aligned recorder.

Monophonic units incorporate left channel only. Stereophonic units incorporate both left and right channels.

6.2 PROGRAM BIAS TRAP ADJUSTMENT

6.2.1 The reproducer cartridge sensing switch S1 must be turned "on". This may be done by the use of a cardboard wedge between the lever arm and switch body.

6.2.2 Place meter switch S304 in the PR BIAS position.

6.2.3 Place the unit in the record/play mode by pressing REC on the recorder and START on the reproducer. A continuous bias reading should appear on the meter(s).

6.2.4 With a non-metallic screwdriver, adjust L401 (left) and L402 (right) for a maximum reading on the appropriate meter. If the reading exceeds the meter, reduce the reading by adjusting PROG BIAS trim-pot(s) R311 (left) or R317 (right).

6.3 CUE BIAS TRAP ADJUSTMENT

6.3.1 Turn "on" cartridge sensing switch S1 with cardboard wedge as previously described.

6.3 (Continued)

6.3.2 Place meter switch S304 in the "Q" BIAS position.

6.3.3 Remove Q706 from its socket on the control board. See Figure 9.5. This allows the 1 kHz cue oscillator and CUE BIAS to operate continuously.

6.3.4 Press the REC and START pushbuttons.

6.3.5 With a non-metallic screwdriver, adjust L501 for a maximum reading on the panel meter. If necessary, reduce the meter reading with the CUE BIAS trim-pot R316.

6.3.6 Replace Q706 in its socket.

6.4 PROGRAM PLAY METER ADJUSTMENT

6.4.1 Place meter switch S304 in the PR PLAY position.

6.4.2 Connect a 600 ohm load to J2 pins 3 and 5+ (left), 4 and 6+ (right) on the reproducer.

6.4.3 Insert and play the proper NAB Standard Reference Level Tape (1 kHz) or its equivalent and observe that the VTVM reads 0 dBm. If necessary, adjust R112 (left) and R126 (right) on the reproduce program amplifier to obtain this reading. If considerable change in level is necessary, recheck reproduce alignment.

6.4.4 Adjust R314 (left) and R320 (right) PROG PLAY trim-pot for a "0 VU" reading on the appropriate meter.

6.5 PROGRAM BIAS ADJUSTMENT

6.5.1 Connect a 600 ohm load to P301 pins 3 and 5+ (left), 4 and 6+ (right).

6.5.2 Connect an audio signal generator across the load on pins 3 and 5+ (left), 4 and 6+ (right). Set the output to approximately −10 dBm and the frequency to 1 kHz.

6.5.3 Connect the VTVM to a 600 ohm load on J2 pin 3 and 5+ (left), 4 and 6+ (right) of the reproducer output. Set the range to −10 dBm.

6.5.4 Insert an erased tape cartridge of several minutes time length and known good operating characteristics.

6.5.5 Press the REC and START pushbuttons.

6.5.6 Advance the record level control(s) to provide approximately mid-scale reading on the VTVM.

6.5 (Continued)

6.5.7 Adjust trimmer C606 (left) and C605 (right) on the bias oscillator card for maximum reading on the VTVM. (Note a delay of .15 seconds between recording and play is present. Make these adjustments slowly.)

6.6 MONOPHONIC PROGRAM RECORD EQUALIZATION

6.6.1 Connect the audio signal generator across the load on P301 pins 3 and 5+ (left). Set the frequency to 12.5 kHz and level to approximately −10 dBm.

6.6.2 Connect the VTVM to the load on pins 3 and 5+ of the reproducer output J2. Set the range to −10 dBm.

6.6.3 Insert an erased tape of several minutes time length and known good operating characteristics.

6.6.4 Press the REC and START push-buttons.

6.6.5 Advance the record level controls to provide a mid-scale reading on the VTVM.

6.6.6 Carefully adjust the record head Azimuth for maximum output as read on the VTVM. (Reduce record level as necessary to keep the VTVM on scale.)

6.6.7 Set the audio generator to 10 kHz and adjust the trimmer C606 on the bias oscillator card for maximum output on the VTVM.

6.6.8 Set the audio generator to 1 kHz and adjust the record level for −10 dBm on the VTVM.

6.6.9 Set the audio generator to 10 kHz and adjust the equalization trim-pot R406 located on the program record amplifier card to the same −10 dBm reading as obtained at 1 kHz as in Step 6.6.8. Compare these outputs by switching back and forth.

6.6.10 Adjust the audio generator slowly upward in frequency to 12.5 kHz. Evaluate the response between 10 kHz and 15 kHz carefully. If an excessive loss of more than a dB or so occurs, it may be desirable to look at the bias adjustment again. Excessive bias can cause large losses at the upper frequencies. Adjust the bias trimmer C606 carefully for the 10 kHz optimum recording level. (Which may occur slightly off peak. Repeat Steps 6.6.7 through 6.6.10.)

6.6 (Continued)

6.6.11 The overall frequency response can now be compared and R406 adjusted slightly for the flattest response from 1 kHz up. Tighten the lock screw and observe that no change occurs.

6.7 STEREOPHONIC PROGRAM RECORD EQUALIZATION AND PHASE

6.7.1 Connect the audio signal generator across the load on P301 pins 3 and 5+ (left), 4 and 6+ (right). Set the frequency to 12.5 kHz and level to approximately −10 dBm.

6.7.2 Connect the VTVM to the load on pins 3 and 5+ (left), 4 and 6+ (right) of the reproduce output J2. Set the range to −10 dBm.

6.7.3 Insert an erased tape of several minutes time length and known good operating characteristics.

6.7.4 Press the REC and START push-buttons.

6.7.5 Advance the record level controls to provide a mid-scale reading on the VTVM.

6.7.6 Carefully adjust the record head Azimuth for maximum output as read on the VTVM. (Reduce the record level as necessary to keep the VTVM on scale.)

6.7.7 Set the audio generator to 10 kHz, adjust the trimmer C606 (left) and C605 (right) on the bias oscillator card for maximum output on the VTVM.

6.7.8 Set the audio generator to 1 kHz and adjust the record level for −10 dBm on the VTVM.

6.7.9 Connect an oscilloscope (vertical input) to the left channel output of the reproducer (J2, pins 3 and 5+). Connect the horizontal input to the right channel output of the reproducer (J2, pins 4 and 6+).

6.7.10 Insert an erased tape of several minutes time length and known good operating characteristics.

6.7.11 Record a 1 kHz tone at −10 dBm from the audio generator.

6.7.12 Adjust the vertical and horizontal gains of the oscilloscope to a suitable amplitude (see Figures 5.5.7.1 and 5.5.7.3). A Lissajous figure should appear as in Figure 5.5.7.2 increasing in amplitude from left to right across the oscilloscope at a 45° angle.

6.7 (Continued)

6.7.13 While slowly increasing the frequency to 16 kHz carefully adjust the Azimuth to obtain the pattern in Figure 5.5.7.5. (Note, as the Azimuth and the frequency is changed, the vertical and/or horizontal amplitude will change.) Sweep the frequency again making sure the pattern does not exceed 90° (Figure 5.5.7.4) or flip to 180° (Figure 5.5.7.6).

6.7.14 Adjust the audio generator to 1 kHz −10 dBm.

6.7.15 Adjust the record level controls to obtain −10 dBm output with 600 ohm load across the left and right channel outputs of the reproducer.

6.7.16 Change audio generator to 10 kHz −10 dBm. Adjust equalization trim-pots R406 (left) and R432 (right) to obtain −10 dBm at the outputs of the reproducer.

6.7.17 Repeat Steps from 6.6.7 until optimum phase shift and frequency response are obtained. Tighten the lock screw and observe that no change occurs.

6.8 PROGRAM RECORD METER ADJUSTMENT

6.8.1 Connect the audio signal generator across the load pins 3 and 5+, 4 and 6+ of P301. Set the frequency to 1 kHz and level to approximately −10 dBm.

6.8.2 Set the meter switch S304 to PR PLAY.

6.8.3 Insert an erased tape and press the REC and START pushbuttons.

6.8.4 Increase the record level controls to provide an "0 VU" reading on the meter.

6.8.5 Turn the meter switch to NREC (normal record).

6.8.6 Adjust the NORM REC trim-pot(s) R313 (left) and R319 (right) to produce an "0 VU" reading on the meter.

6.8.7 Turn the meter switch to PK REC (peak record).

6.8.8 Adjust the PEAK REC trim-pot(s) R312 (left) and R318 (right) to produce an "0 VU" reading on the meter.

6.8 (Continued)

6.8.9 Adjust the audio generator frequency up toward approximately 7500 Hz and observe that the meters go full scale in this mode. This indicates that tape saturation is approached at this level and frequency, and is the desired result.

6.9 PROGRAM BIAS METER ADJUSTMENT

6.9.1 Turn the meter switch S304 to PR BIAS (program bias).

6.9.2 Insert an erased tape and press the REC and START pushbuttons.

6.9.3 Adjust the PROG BIAS trim-pot(s) R311 (left) and R317 (right) for 0 (100%) on the meter.

6.10 CUE BIAS, METER AND TONE LEVEL ADJUSTMENTS

6.10.1 Temporarily remove the head cable assembly connector from the 1 kHz cue detector and logging board, and insert in place of the normal connector on the program reproduce amplifier board.

6.10.2 Connect the VTVM to the load on pins 3 and 5 of the reproducer output J2. Set the range to 0 dBm.

6.10.3 Temporarily remove Q706 from its socket on the control board. See Figure 9.5.

6.10.4 Insert an erased tape and press the REC and START pushbuttons.

6.10.5 Turn up the 1 kHz oscillator gain control R512 for a mid-scale reading.

6.10.6 Adjust the cue bias trimmer C607 for maximum output on the VTVM. (Note the delay in reaction because of the head spacing.)

6.10.7 Now adjust the 1 kHz oscillator gain control R512 for a reading of 0 dBm on the VTVM.

6.10.8 Turn the meter switch S304 to Q BIAS position.

6.10.9 Adjust the CUE BIAS trim-pot R316 for "0" (100%) reading on the meter.

6.10.10 Replace Q706 in its socket.

6.10.11 With an erased tape, press the REC and START pushbuttons.

6.10.12 Press the SEC pushbutton and adjust the 150 Hz oscillator gain control R525 for +6 dBm reading on the VTVM.

6.10 (Continued)

6.10.13 Press the TER pushbutton and adjust 8 kHz oscillator gain control R532 for −10 dBm reading on the VTVM.

6.10.14 Connect the head cables back to their proper inputs.

6.11 CUE TONE METER ADJUSTMENT

6.11.1 Disable the reproducer 1 kHz primary cue detector by turning its sensitivity control R222 full counter-clockwise. (Observe the initial setting so that the control may be easily returned to this setting.)

6.11.2 With a short erased cartridge, start and stop the recorder and reproducer several times to record a number of 1 kHz primary cue tones.

6.11.3 Set the meter switch S304 to Q PLAY position.

6.11.4 Turn the CUE PLAY trim-pot R315 counter-clockwise and play the tape just prepared in the Step above.

6.11.5 Slowly advance the CUE PLAY trim-pot to provide a "0" (100%) reading of the tone bursts on the meter.

6.11.6 Return the reproducer 1 kHz primary cue detector gain control R222 to the proper setting.

6.11.7 Press the SEC pushbutton and observe the reading on the meter. This should be approximately −3 VU on the meter.

6.11.8 Press the TER pushbutton and observe the reading on the meter. This should be approximately −1.5 VU on the meter.

6.12 CUE TONE FREQUENCY ADJUSTMENT

6.12.1 Connect the vertical input of an oscilloscope to pin 9 of the recorder remote control jack J301.

6.12.2 Connect the horizontal input of the scope to an accurate audio signal generator. Set the frequency to exactly 1 kHz and the output level for a suitable display on the scope. (If a frequency counter is available, it may alternately be connected to pin 9 of J301 in place of the scope.)

6.12.3 Temporarily remove Q706 from its socket on the control circuit board. See Figure 9.5.

6.12.4 Press the REC and START pushbuttons (with no cartridge in place.)

6.12.5 Adjust the 1 kHz oscillator inductor L502 "zero beat" on the scope display, or 1 kHz reading on the frequency counter.

6.12.6 Return Q706 to its socket on the control board.

6.12.7 Set the audio signal generator to exactly 150 Hz.

6.12.8 Press the SEC pushbutton and adjust the 150 Hz oscillator inductor L503 for "zero beat" on the scope display, or 150 Hz reading on the frequency counter.

6.12.9 Set the audio signal generator to exactly 8 kHz.

6.12.10 Press the TER pushbutton and adjust the 8 kHz oscillator inductor L504 for "zero beat" on the scope display, or 8 kHz reading on the frequency display counter.

7.0 THEORY OF OPERATION, REPRODUCER

7.1 GENERAL DISCRIPTION

This section describes the circuitry of the reproducer in detail. Sub-sections are divided into functional groups. Component designators used in the text are the same symbol and number used on the reproducer schematic diagram. See Section 10.0.

7.2 POWER SUPPLY, LOW VOLTAGE

Input voltage is stepped down by transformer T1, (see Figure 9.1 or Figure 9.3) whose isolated center tap secondary, along with diodes CR205 and CR206, (located on the 1 kHz detector board) provides full wave rectified power to the input of regulator U1. The design of the transformer assures proper input voltage to the regulator, (even at 117 Volt ±10% extremes) without over stressing at the high limit. Capacitor C3, located on the utility board, (see Figure 9.2 or 9.4 and Figure 9.8) is the input filter.

Regulator U1 (see Figure 9.1 or Figure 9.3) is integrated into a TO-3 package, which regulates at +24 Volts D.C. The bracket and chassis supply ample heat sink for its power dissapation. The combination of internal current limiting and thermal shutdown makes the regulator immune to failure modes normally associated with power regulators. The regulated output is represented by a triangle symbol, and is common to all other triangles shown on the schematic diagram. Resistor R3 and capacitor C4 on the utility board provides additional filtering for the reproduce amplifiers.

The low voltage supply is protected by F1, rated at 1/2 Amp (fast acting), located on the rear panel (see Figure 2.2.1).

Diode CR9, resistor R8, and capacitor C5 make up a low voltage negative supply that is used in conjunction with the recorder whose function will be discussed in Section 8.0.

7.3 POWER SUPPLY, SOLENOID

The solenoid supply components are located on the 1 kHz detector board. Diodes CR201, CR202, CR203 and CR204 convert line voltage to full wave D.C. Resistor R201 and capacitor C201 make up the first section of the dual filter, while R202 and C202 are the second section. The output is about 165 Volts D.C. until the solenoid is energized in which case the load drops it to 125 Volts. The two normally closed contacts K201C and K201D shunt base drive current from power transistor Q201 keeping the solenoid de-energized. When the start function causes K201 to pull in, the base drive current is allowed through R203,

7.3 (Continued)

saturating Q201 which turns on solenoid L1. R204 and C203 across L1 serves as transient protection when the solenoid is turned off.

7.4 CONTROL CIRCUITRY

The control circuitry explanation is by the "sequence of events" method starting with the insertion of a cartridge. The cartridge switch S1 closes, which supplies ground to one side of the STOP switch S3 and to the wiper of contact K201A by way of pin N or J5. This ground goes to pin K on J7 by way of N.C. contact of K201A, turning on the ready lamp I3 through diode CR8 and resistor R4 located on the 150 Hz and 8 kHz CUE DETECTOR board (see Figure 9.1 or 9.3 and Figure 9.9). A remote ready lamp connected between remote connector J1 pins 8 and 7 will illuminate through R5.

When the START switch S2 is pressed, J5 pin L becomes grounded momentarily and relay K201 becomes energized. The N.O. contact K201B closes which latches the relay in the energized state. B+ is supplied by way of R232 and CR210. Transfer of this relay accomplishes the following:

1. N.C. contact K201A opens, disabling the ready lamp circuit.
2. Opening of the N.C. contact K201A also initiates the primary cue sensor inhibit timer by removing the ground discharge path of capacitor C214, which will charge to approximately 12 Volts and allow normal bias for Q206 in approximately 1.75 seconds.
3. N.C. contacts K201C and K201D open, initiating transistor "turn on" of the solenoid as described in the Power Supply Solenoid Section.
4. N.O. contact K201A closes, grounding pin M of J5, pins 6 and 12 of J4 which turns on optical relays LDR101 and LDR102 (located on the program reproduce amplifier board) allowing audio to the output transformer(s).
5. N.O. contact K201A also turns on the run lamp by way of pin D of J7 and R7 (located on the 150 Hz and 8 kHz detector board) and also through R6 to remote connector pin 6 of J1.

The stop function occurs when a 1 kHz tone is detected on the cue channel or the STOP switch S3 is depressed. In the first case, transistor Q208 switches positive holding voltage on K201 coil to ground, causing drop out which removes the coils latch. The STOP switch accomplishes the same function by grounding the holding voltage via

7.4 (Continued)

CR212. A remote momentary switch (N.O.) wired between pin 4 and 5 of J1 will do likewise without need of a series stop circuit with its inherent problems. If a momentary stop switch (N.C.) function is desired, remove the jumper between pin 4 and 3 of J1 and connect the N.C. remote switch in its place. When initiated it will complete the stop function by removing ground from the coil of K201.

When a secondary (150 Hz) tone on the cue track is detected, relay K2 is energized by Q809 and will stay in as long as the tone is sensed. K2A and K2B form "C" contacts are in parallel (located on the 150 Hz and 8 kHz board) and go to remote connector pins 9, 10 and 11 of J1 by way of pins F, H, and J of J7. N.O. contact K2C shorts out dropping resistor R7 to brighten the run lamp for visual indication of the 150 Hz cue detection. N.O. contact K2D does likewise for remote indication.

An 8 kHz tone detection will turn on Q806 and energize K3 for the duration of the 8 kHz tone. N.O. contacts K3A and K3B are wired to remote connector pins 12 and 13 of J1. N.O. K3C and K3D contacts supply ground to the ready lamp by way of R4 to indicate the presence of 8 kHz. Remote indication is supplied likewise through R5 to pin 7 of J1.

7.5 CUE AND LOGGING CIRCUITRY

The circuitry is located on two P.C. boards. The 1 KHZ CUE DETECTOR AND LOGGING P.C. board contains the equalized pre-amplifier and limiter, the 1 kHz detector and output, the logging output, and the solenoid power supply (see Figure 9.1 or 9.3 and Figure 9.7). The latter has been explained previously in Section 7.3. The other board contains both the 150 Hz and 8 kHz detectors as well as their respective outputs. (See Figure 9.1 or 9.3 and Figure 9.9).

Transistors Q203 and Q204 are part of the pre-amplifier stages that provide approximately equal voltage for each of the specified cue tone levels to the common signal bus of all detectors. The 1 kHz primary cue detector and the optional 150 Hz and 8 kHz detectors, when so equipped, are designed to operate as specified in the NAB standards.

The signal from the pre-amplifier goes through and emmiter follower stage Q205 that isolates the back-to-back clipping action of diodes CR207 and CR208. The signal from the base of Q205 is therefore coupled without clipping to buffer stage of Q202. This supplies the logging output of 0.5 Volts ±0.25 Volts RMS into a load impedance of 10 K ohms (minimum), with better than 40 dB of

7.5 (Continued)

isolation from output to input. This gets to the remote connector through pin X of J5 to pin 15 and (shielded ground) to pin 14 of J1.

Getting back to the limited signal at the anti-parallel diodes CR207 and CR208, this signal goes to pin AA of J5 and feeds the 150 Hz to 8 kHz detector board. It also feeds the 1 kHz detector whose sensitivity is controlled by the setting of variable resistor R222, which controls the level applied to the base of Q206. The base also is tied in with the inhibit timer already described in the Control Circuitry Section 7.4.

A series circuit consisting of inductor L201, resistor R227, capacitor C217 and sometimes trim capacitor C218 is tuned and resonates at 1 kHz ±100 Hz. This provides a low impedance which amplifies through Q206. Negative developed pulses across R228 cause half wave rectification from Q207. Time constant from R229 and C219 prevents transient false cueing. During normal 1 kHz sensing, the voltage builds up across C219 to forward bias Q208 by way of voltage divider R230 and R231. This brings the positive holding voltage of K201 coil to ground, causing drop out.

The 150 Hz and the 8 kHz detector operate in a like manner with relay K2 being the output for 150 Hz and K3 for the 8 kHz. The tuned circuits resonate at their respective center frequencies, and the relays transfer for the duration of their respective tones.

7.6 PROGRAM REPRODUCE CIRCUITRY

The program reproduce circuitry, except for the output transformer, is located on the PROGRAM REPRODUCE AMPLIFIER P.C. board. (See Figure 9.1 or Figure 9.3 and Figure 9.6). A single amplifier design meets the need for the monophonic version, while a duplication of that amplifier fills the requirement for stereo. The mono, or left channel amplifier, fills the right half of the P.C. board looking from the component side. The following description will be for mono only to keep from being redundant.

The pre-amplifier stages consist of Q101 and Q102. Adjustable feedback is provided for equalization from the collector of Q102 through capacitor C104, equalization trimpot R104 and resistor R103.

Between the pre-amplifier and the output amplifier is optical relay LDR101. This functions as an audio switching device and is off except in the run mode. The output amplifier is an integrated circuit with a fixed gain of approximately 34 dB. The output is automatically self-entering to one half the supply voltage which enables maximum

7.6 (Continued)

headroom. Variable resistor R112 serves as the level control. Capacitor C110 is coupled to the output transformer (see Figure 9.1 or Figure 9.3) by way of pin 13 of J4. The transformer is wired for rated 600 ohm load impedance, but may be changed for 150 ohm load by changing the secondary wire (see note on schematic as well as Section 2, Figure 2.2.2). The output stage is designed to have an output impedance of less than 75 ohms for the 600 ohm rated load and less than 18.8 ohms for the 150 ohm rated condition.

8.0 THEORY OF OPERATION, RECORDER

8.1 GENERAL DESCRIPTION

This section describes the circuitry of the recorder in detail. Sub-sections are divided into functional groups. The component designators used in the text carry the same symbol and number that appear on the schematic diagram.

The recorder derives all of its power and related control requirements from the reproducer by way of J6 and P302. Type 10 is internally connected in the record section, while Type 20 uses a cable assembly from rear panel to rear panel. For recorder schematic reference see Section 10.0.

8.2 CONTROL CIRCUITRY

The control circuitry explanation is done by the "sequence of events" method starting with the insertion of a cartridge. The cartridge switch closes and grounds pin 18 of J6 and P302, and pin 18 of J304, as well as the latching silicon control rectifier (SCR) circuit Q703 on the CONTROL P.C. Board. (See Figure 9.1 or Figure 9.3 and Figure 9.11). If the reproducer is not running, then pin 15 of P302 is at ground by way of N.C. contact K201B in the reproducer. (This interlock would prevent ground if the reproducer were running, thus not allowing the recorder to come on.) Remote pin 5 of J301, one side of REC set switch S301 and pin 13 of J304 are also at ground potential. Momentary closure of REC set switch S301 supplies ground to pin 17 of J304 and saturates transistor Q701 which gates on SCR Q703. The SCR is "latched on" because of the holding current supplied by B+ on pin 16 of J304 through R706 and R707. Transistor Q702 is biased on by this holding current also, which makes B+ available at the collector of Q702. This action powers up the record amplifier(s) by way of J304 pin 9 to pins 9 and 18 of J302. If the meter switch S304 is in either the PEAK REC or the NORM REC positions, then the same B+ finds its way to the meter circuit(s) pin 1 and 10 of J302. The record set in-

8.2 (Continued)

dicator lamp I301 turns on through R710 and pin 12 of J304, while voltage is available through R711, pin 10 of J304 to remote connector pin 3 of J301.

When the reproducer start switch S2 is initiated, N.O. contact of K201A closes, supplying ground to pin 14 of both J6 and P302, as well as pin 8 of J304 which impresses forward bias on Q704 via R709, R708, and CR701. B+ is now at the collector of Q704 which turns on the bias oscillator and program bias by way of pin 7 of J304 and pins 11, 8, and 7 of J303. It also gates on Q707 which turns on Q708, supplying B+ to pin 3 of J304 and pin 8 of J305, finally turning on the 1 kHz primary cue oscillator and its output stage. B+ from the collector of Q704 through CR702, meanwhile supplies the unijunction Q705 timing circuit whose time constant R718, R713, and C703 builds up to the trigger voltage of Q705 in 500 milliseconds (minimum), 750 milliseconds (maximum) and pulses on SCR Q706. The SCR is latched on by the holding current through R718 and diverts bias current from Q707 which turns off and consequently Q708 turns off the 1 kHz oscillator and its output. The above explanation therefore explains the automatic timed 1 kHz cue tone generation.

If the primary 1 kHz is not to be automatically recorded, press and hold the 1 KHZ DEF switch S306 during the record set condition and for a second after the start switch has been pressed. This will ground pin 4 of J304 and the base of Q707, keeping the tone from being recorded until the unijunction has timed out.

A 1 kHz tone can also be recorded at any time, either while recording or while only reproducing, by depressing 1 kHz record switch S305. This double pole momentary switch provides B+ to pin 2 of J304 and through CR703 to R718 to accomplish the same thing as previously discussed when B+ was supplied via the collector of Q704. The second pole of S305 supplies ground to pin 6 of J304 and (if in the recording mode) the capacitor charging of C702 will commutate SCR Q706 off, so as to record 1 kHz tone for the prescribed time. The ground of S305 also appears at pin 16 of P302 and J6, pin Z of J5 to initiate inhibit of the 1 kHz detect circuit, and pin K of J7 which turns on the ready lamp I3 for a visual indication.

If the record set switch is depressed with no requirement to record, the depression of the stop switch will reset SCR Q703 by grounding pin 17 of J6 and P302, and pin 1 of J304, and diverting SCR Q703 holding current by way of C704.

In the normal sense, if the reproducer is running and then stops by sensing the 1 kHz cue, then the ready contact K201B goes to its N.C.

8.2 (Continued)

position to switch ground to pin S of J5 to pin 15 of J6 and P302, and pin 13 of J304 which grounds C701 and unlatches SCR Q703.

8.3 PROGRAM RECORD CIRCUITRY

The program record circuitry, except for the input board assembly and the record head with its associated cable assembly and the level control, is on the program record amplifier board assembly (see Figure 9.1 or Figure 9.3 and Figure 9.10).

The input is applied to P301 pins 5 and 3 with pin 1 being the ground connection for shield. Just the left or mono channel will be described in as much as the right channel is only a duplication. The recorder is normally wired for 600 ohm rated. To change to 150 ohms balanced or 10 K ohm (minimum) see Section 2.0 Figure 2.4.1 and Figure 2.4.2. The transformer design in conjunction with the input circuit affords greater than 4800 ohms input impedance as normally connected, better than 1200 ohms for 150 ohms connection, and about 25 K ohms bridging. The input P.C. board assembly (see Figure 9.1 or Figure 9.3 and Figure 9.14) consists of the connector, P301, transformer T301 and bridging resistors R301 and R302. The board itself has wire designations for ease in reconnecting. The secondary of T301 is wired in parallel to "LEVEL" control R326. This can handle input level from -22 dBm to 0 dBm as normally connected for 600 ohm rated input.

The wiper feeds pin 6 of J302 to voltage amplifier Q401. The combination of high-pass network R405 and C403 along with mid-range filter consisting of C405 and R407 to ground, shapes the response curve.

Variable resistor R406 with C404 can be adjusted to equalize the high end as required for head wear and variations in tape. The next stage Q402 provides high frequency boost through emitter by-pass capacitor C407. Capacitor C406 is sized to roll off frequency above 20 kHz. Audio is then coupled to capacitor C408, through divider R413 and R414, and through C409 to the integrated amplifier U401. This amplifier is of the same type as described in the Reproducer Amplifier Output Section. The output is self-centering from a D.C. standpoint for maximum headroom. Resistor R415 and capacitor C410 is a decoupling network. Variable inductor L401 along with parallel capacitor C412 forms a tuned circuit that is tuned for high impedance between the output stage and the bias frequency. The mixed audio is then coupled to the record head through resistor R417, pin 8 of J302, pin 8 of P302, pin 8 of J6 and record head connector.

8.4 BIAS OSCILLATOR

The bias oscillator is comprised of a standard push-pull circuit Q601 and Q602. (See Figure 9.1 or Figure 9.3 and Figure 9.12.) It is a form of a Hartley oscillator, with B+ being fed to the primary center tap of transformer T601 by way of delay circuit R611 and C604. Diode CR602 and pin 11 of J303 or diode CR601 and pin 9 of J303 (as previously discussed in the Control Circuitry Section) must supply this B+. The SEC 150 Hz switch S302, the TER 8 kHz switch S303 and remote application of B+ from pin 11 to pin 16 (SEC CUE), to pin 14 (TER CUE) and pin 10 (Logging) will turn on the bias oscillator.

The secondary tap 5 of T601 is coupled to the cue track by means of resistor R609 and variable capacitor C607 through pin 6 of J303, pin 12 of P302, and pin 12 of J6 and on to the head connector. Switching stage Q603 is normally biased on, shorting cue bias to ground through C608. The negative supply located on the utility board in the reproducer (as previously discussed) finds its way to pin 10 of J303 for this purpose. When the unit is in the record set mode and then started, the timed positive pulse is supplied to pin 9 of J303 and overcomes the negative supply which turns off Q603 allowing bias to the head.

The bias is supplied to the program track in a like manner with both the left (mono) and right program bias taken from the full secondary winding. Left or (mono) goes through R608 and C606 with Q604 serving as the shunt switch, while R607 and C605 along with its shunt control transistor Q605 make up the right channel circuit.

Individual remote bias control for each program channel can be attained by cutting the straps between pins 18, 7, and 8 of J301 and controlling continuity between pin 18 and 7 for left, and 18 and 8 for right channel bias.

8.5 CUE OSCILLATOR CIRCUITRY

The three tone cue oscillator circuit is composed of a primary 1 kHz oscillator, a secondary 150 Hz oscillator, a tertiary 8 kHz oscillator, and a common output amplifier stage. (See Figure 9.1 or Figure 9.3 and Figure 9.13.) The 1 kHz oscillator is keyed from the control board by supplying B+ to pin 8 of J305. Variable tapped inductor L502 along with capacitor C507 is the frequency determining network for stage Q502 while variable resistor R512 controls the output level. This signal is coupled by way of R513 and a common BUS, through C504 to output amplifier Q501. The head's cue track is coupled to this amplifier by way of capacitor C503, bias trap (L501 and C502), resistor R502, pin 11 of J305, pin 12 (pin 13 shield) of P302 and J6 and through the head con-

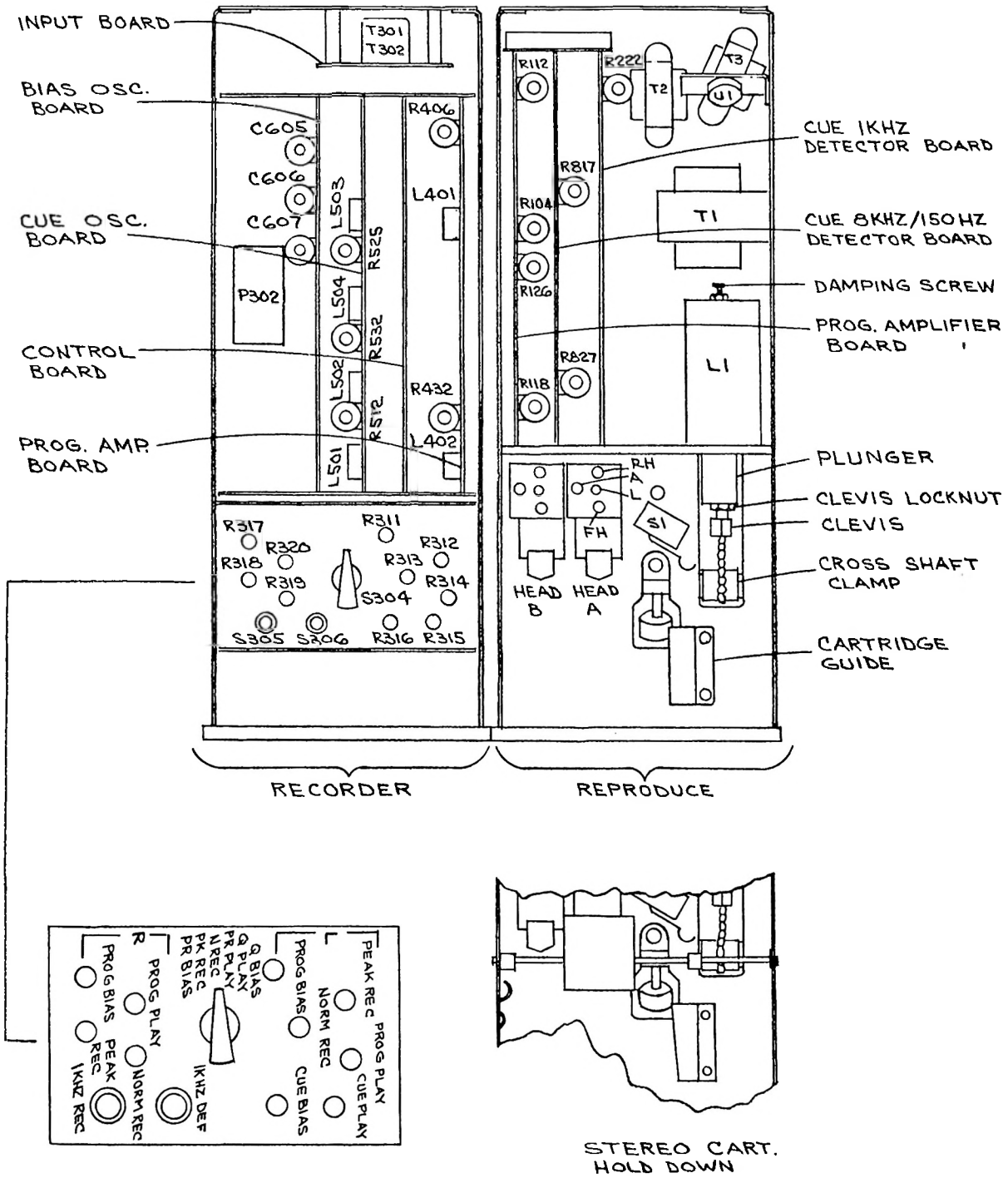
8.5 (Continued)

nector itself.

The secondary and tertiary oscillators operate in the same manner, however, the secondary oscillator has two buffer stages Q504 and Q503 which aid the 150 Hz oscillator to operate with less distortion. Diodes CR501, CR502, CR503 and CR504 directs B+ to the bias oscillator board, enabling the cue bias. All oscillators are designed for less than 5% distortion.

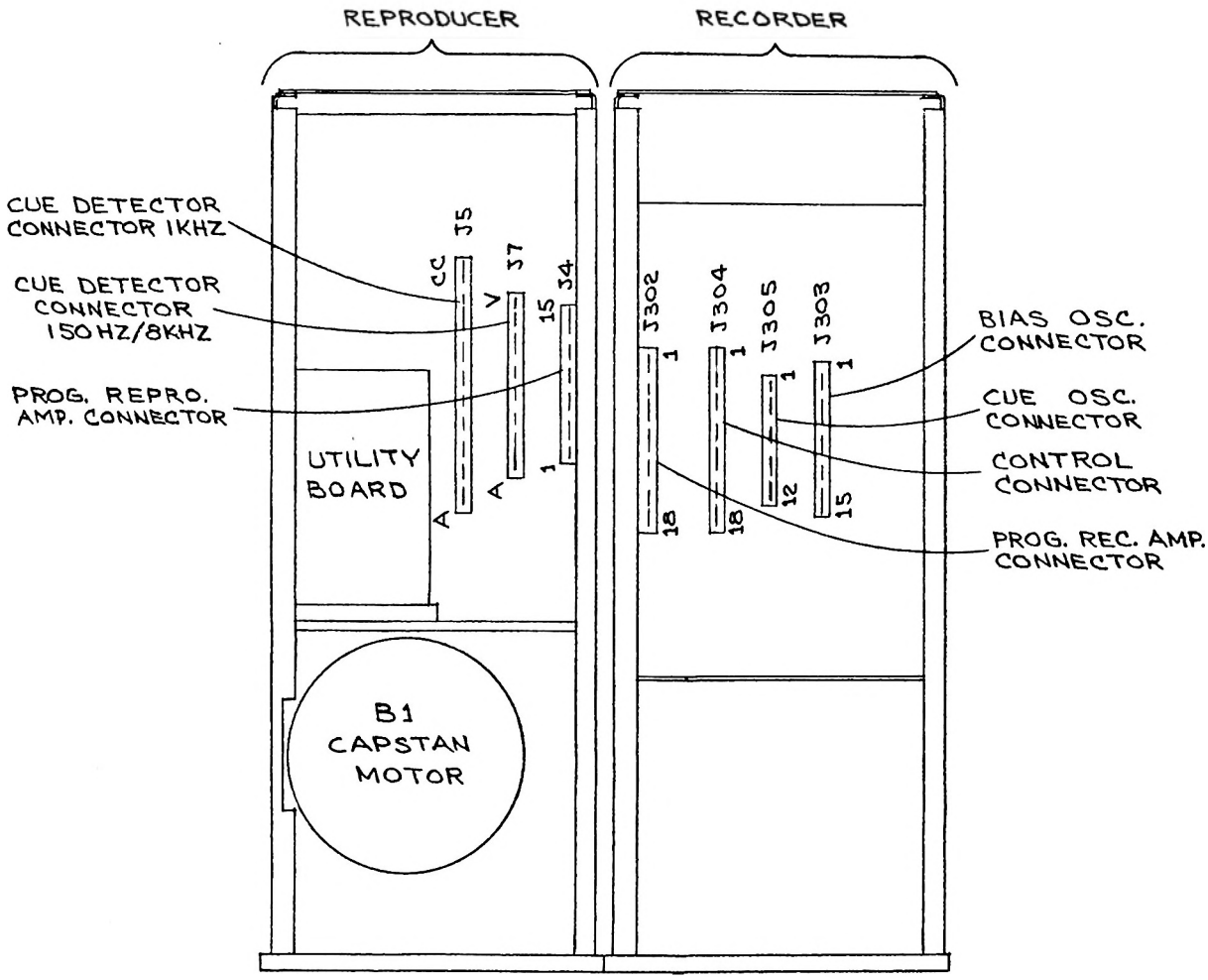
8.6 METER CIRCUITRY

The meter circuitry consists of a meter board assembly (see Figure 9.1 or 9.3 and Figure 9.15) and an amplifier rectifier circuit located on the record amplifier board, as well as the meter(s) on the front panel. The six position, 3 pole rotary switch S304 directs appropriate signals through calibration controls and dividers. The meter can monitor program bias, peak record, normal record, program play, cue play, and cue bias. Taking the mono or left channel for illustration, the appropriate signal is switched to pin 4 of J302. Q403 and Q404 amplifiers and along with R426 matches to the meter for VU indication. CR401, CR402, CR403 and CR404 make up the full wave bridge.



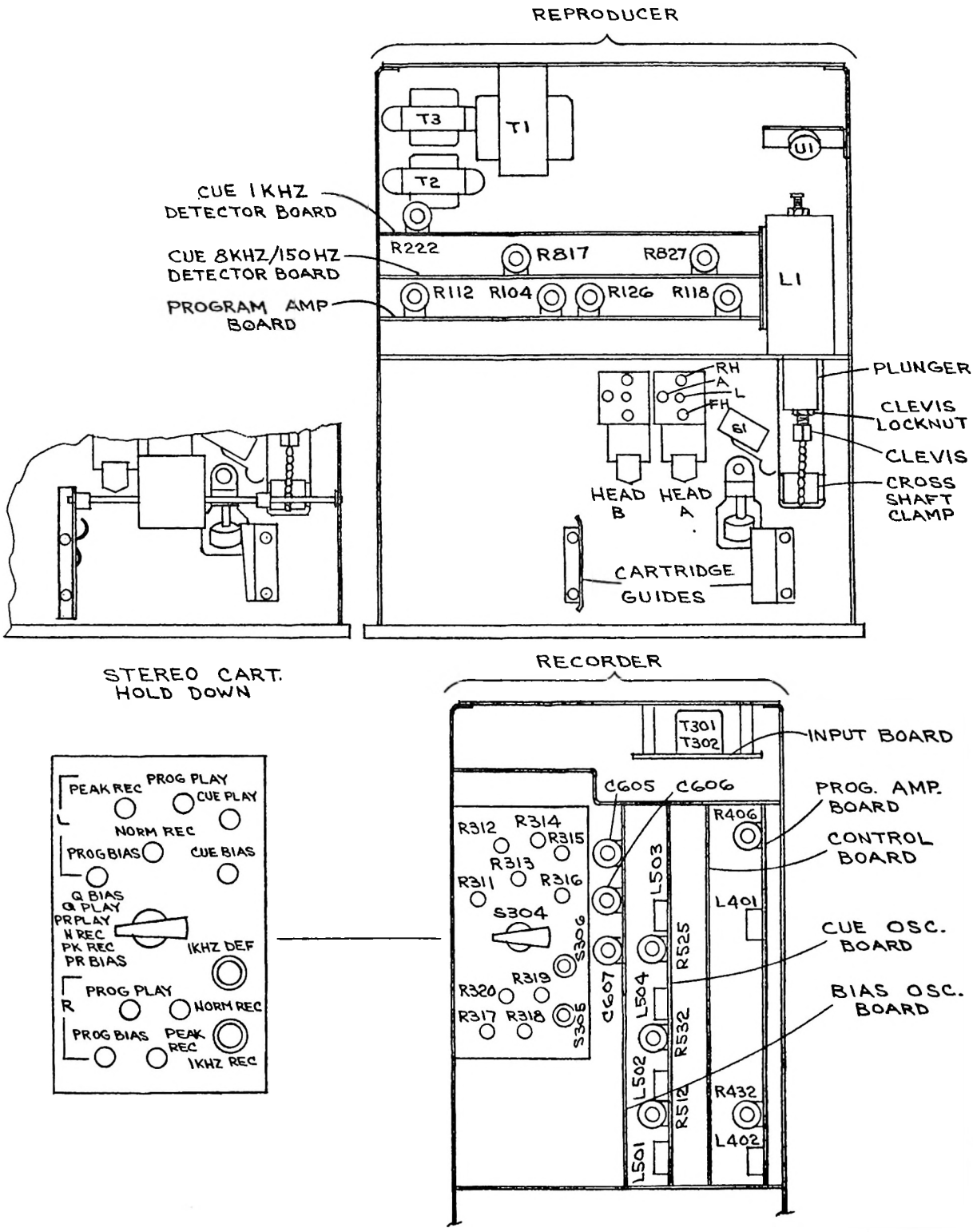
TYPE 10, TOP VIEW

FIGURE 9.1

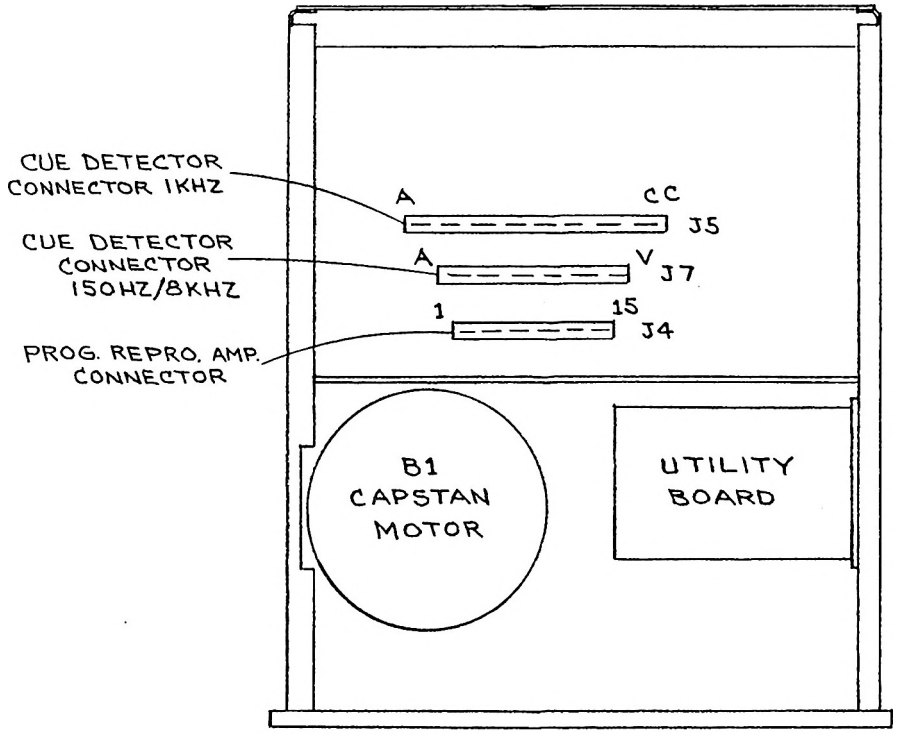


TYPE 10
BOTTOM VIEW

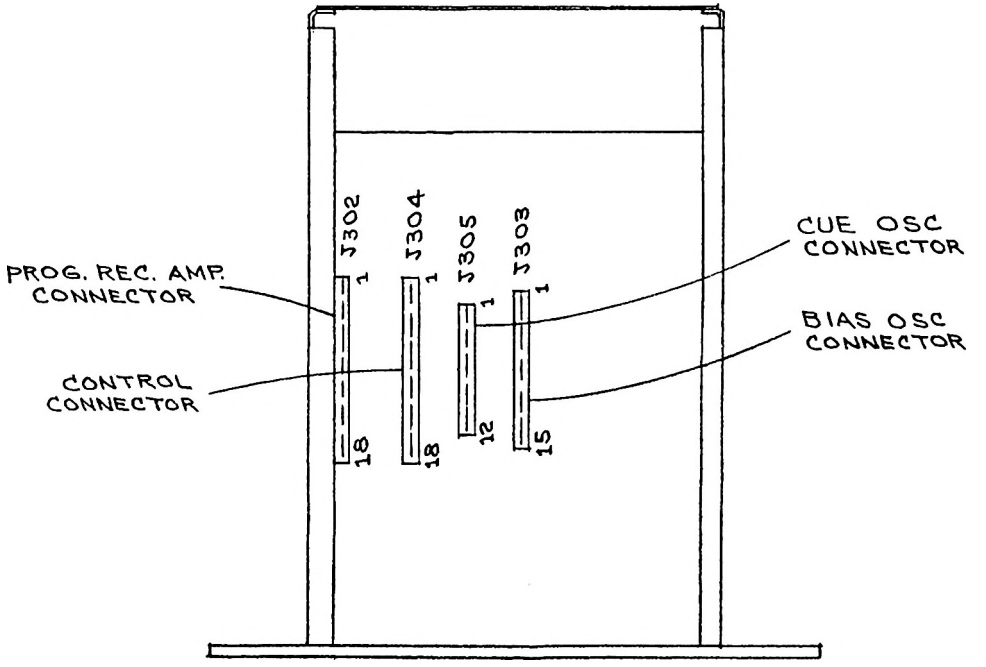
FIGURE 9.2



TYPE 20, TOPVIEW
FIG. 9.3

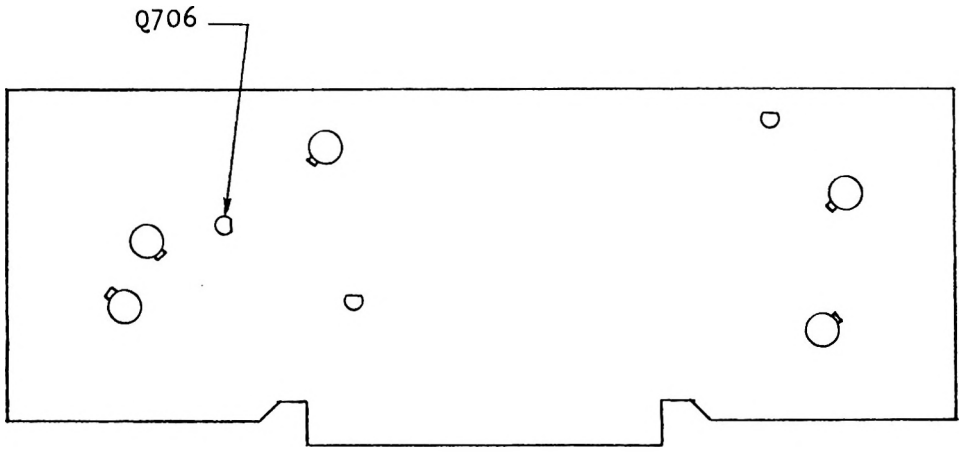


BOTTOM VIEW
REPRODUCER



BOTTOM VIEW
TYPE 20 RECORDER

FIG. 9.4



CONTROL BOARD

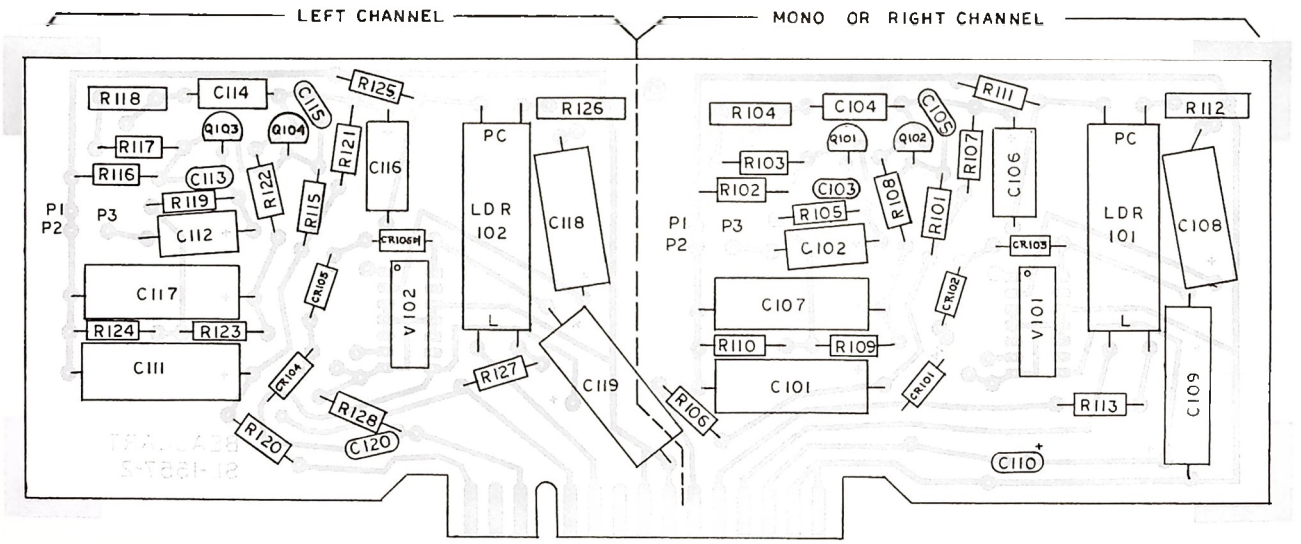
FIGURE 9.5

CHASSIS (REPRODUCER) – PARTS LIST

Symbol	Part Number	Description
MOTOR		
B1	P40H-12	Capstan, 450 RPM, 110 V., 60 Hz
SWITCHES		
S1	102558	Snap Action (Cartridge Sensing)
S2	112517	Push-Button (Start)
S3	112517	Push-Button (Stop)
S5	102558	Snap Action (Cartridge Sensing – Motor)
LAMPS		
I1	71822	Power Indicator, 28 V.
I2	71816	No. 327, 28 V. (Run)
I3	71816	No. 327, 28 V. (Ready)
FUSES		
F1	721432	1/2 AMP, 3AG
F2	721433	1 AMP, Slow-Blow, 3AG
INTEGRATED CIRCUIT		
U1	202233	Regulator, 24 V. Nominal
TRANSFORMERS		
T1	133667	Power
T2	142601	Audio
T3	142601	Audio (Stereo)
INDUCTIVE DEVICES		
L1	72490	Solenoid, 110 VDC
MP	BH3001	Head, Mono Reproduce, Model MP
SP	BH5001	Head, Stereo Reproduce, Model SP
MR	BH2001	Head, Mono Record, Model MR
SR	BH4001	Head, Stereo Record, Model SR
XX	BH1001	Head, Dummy, Model XX
CONNECTORS		
J1	261285	15 Pin (Remote)
J2	261286	6 Pin (Output)
J3	271212	3 Pin (Motor)
P3	271213	3 Pin (Motor)
J4	271228	15 Pin (Program Reproduce)
J5	271251	25 Pin (Cue Detector, 1 kHz)
J6	261287	18 Pin (To Record)
J7	271250	18 Pin (Cue Detector, 150 Hz/8 kHz)
J8	271219	12 Pin (Utility Board)
J9	271211	5 Pin (Power Transformer)
P9	271210	5 Pin (Power Transformer)

CHASSIS (REPRODUCER) — PARTS LIST (Continued)

Symbol	Part Number	Description
MISCELLANEOUS		
	271209	Plug, 18 Pin (Type 20 Series, Interconnect)
	72491	Socket, TO-3 (U1 Regulator)
	751418	Holder, Fuse
	261283	Cord, AC Power
	311296	Strain Relief, AC Power Cord
	SL-1505	Head Lead Cable Assembly (Mono)
	SL-1612	Head Lead Cable Assembly (Stereo)
	SL-1506	Head Lead Cable Assembly (Mono Record)
	SL-1613	Head Lead Cable Assembly (Stereo Record)
	261288	Plug, 15 Pin (Accessory)
	261289	Plug, 6 Pin (Accessory)
	SL-1581	Extractor, P/C Board (Accessory)
	SL-1590-2	Shaft, "B" Size Carts, Stereo (Accessory)
	SL-1590-3	Shaft, "C" Size Carts, Stereo (Accessory)
	SL-1591-3	Spacer, "B" Size Carts, Stereo (Accessory)
	SL-1591-4	Spacer, "C" Size Carts, Stereo (Accessory)



REPRODUCE AMPLIFIER
BOARD ASSEMBLY
MONO SL-1659
STEREO SL-1599

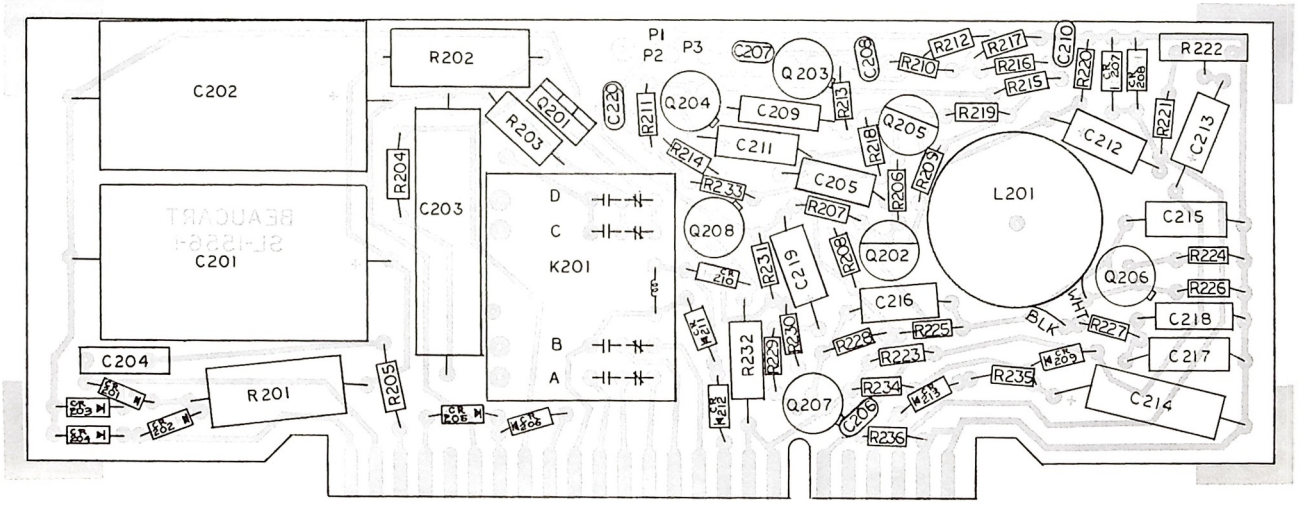
FIG. 9.6

PROGRAM REPRODUCE AMPLIFIER – PARTS LIST

MONO SL-1559
STEREO SL-1599

Symbol	Part Number	Description
RESISTORS		
R101	202283	47 K ohms, 1/2 watt, 5%
R102	202284	220 ohms, 1/2 watt, 5%
R103	202242	1.8 K ohms, 1/2 watt, 5%
R104	192296	Variable, 10 K ohms, 1/4 watt
R105	202243	100 K ohms, 1/2 watt, 5%
R106	202244	6.8 K ohms, 1/2 watt, 5%
R107	202245	2.2 K ohms, 1/2 watt, 5%
R108	202285	180 ohms, 1/2 watt, 5%
R109	202286	1.5 K ohms, 1/2 watt, 5%
R110	202247	470 ohms, 1/2 watt, 5%
R111	202248	22 K ohms, 1/2 watt, 5%
R112	192296	Variable, 10 K ohms, 1/4 watt
R113	202249	820 ohms, 1/2 watt, 5%
RESISTORS (STEREO ONLY)		
R115	202283	47 K ohms, 1/2 watt, 5%
R116	202284	220 ohms, 1/2 watt, 5%
R117	202242	1.8 K ohms, 1/2 watt, 5%
R118	192296	Variable, 10 K ohms, 1/4 watt
R119	202243	100 K ohms, 1/2 watt, 5%
R120	202244	6.8 K ohms, 1/2 watt, 5%
R121	202245	2.2 K ohms, 1/2 watt, 5%
R122	202285	180 ohms, 1/2 watt, 5%
R123	202286	1.5 K ohms, 1/2 watt, 5%
R124	202247	470 ohms, 1/2 watt, 5%
R125	202248	22 K ohms, 1/2 watt, 5%
R126	192296	Variable, 10 K ohms, 1/4 watt
R127	202249	820 ohms, 1/2 watt, 5%
CAPACITORS		
C101	261236	100 mfd, 25 V.
C102	261246	5 mfd, 25 V.
C103	261243	100 pfd, 100 V.
C104	261240	0.015 mfd, 200 V.
C105	261243	100 pfd, 100 V.
C106	261246	5 mfd, 25 V.
C107	261236	100 mfd, 25 V.
C108	261237	10 mfd, 25 V.
C109	261236	100 mfd, 25 V.
C110	271232	6.8 mfd, 35 V.

Symbol	Part Number	Description
CAPACITORS (STEREO ONLY)		
C111	261236	100 mfd, 25 V.
C112	261246	5 mfd, 25 V.
C113	261243	100 pfd, 100 V.
C114	261240	0.015 mfd, 200 V.
C115	261243	100 pfd, 100 V.
C116	261246	5 mfd, 25 V.
C117	261236	100 mfd, 25 V.
C118	261237	10 mfd, 25 V.
C119	261236	100 mfd, 25 V.
C120	271232	6.8 mfd, 35 V.
DIODES		
CR101	51347	IN4005
CR102	51347	IN4005
CR103	51347	IN4005
DIODES (STEREO ONLY)		
CR104	51347	IN4005
CR105	51347	IN4005
CR106	51347	IN4005
TRANSISTORS		
Q101	133662	2N5089
Q102	133662	2N5089
TRANSISTORS (STEREO ONLY)		
Q103	133662	2N5089
Q104	133662	2N5089
INTEGRATED CIRCUIT		
U101	31692	Audio Amplifier
INTEGRATED CIRCUIT (STEREO ONLY)		
U102	31692	Audio Amplifier
RELAY		
LDR101	202251	Optical
RELAY (STEREO ONLY)		
LDR102	202251	Optical



1KHZ DETECTOR AND LOGGING
BOARD ASSEMBLY
SL-1558

FIG. 9.7

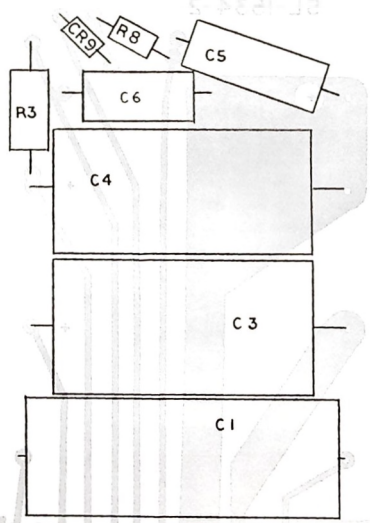
1 KHZ DETECTOR AND LOGGING – PARTS LIST

SL-1558

Symbol	Part Number	Description
RESISTORS		
R201	202224	75 ohms, 5 watt, 10%
R202	202224	75 ohms, 5 watt, 10%
R203	202237	33 K ohms, 1 watt, 10%
R204	202252	47 ohms, 1/2 watt, 5%
R205	202253	10 ohms, 1/2 watt, 5%
R206	202254	68 K ohms, 1/4 watt, 5%
R207	202258	10 K ohms, 1/4 watt, 5%
R208	202261	2.2 K ohms, 1/4 watt, 5%
R209	202280	1.2 K ohms, 1/4 watt, 5%
R210	202257	100 K ohms, 1/4 watt, 5%
R211	202258	10 K ohms, 1/4 watt, 5%
R212	202259	68 ohms, 1/4 watt, 5%
R213	202260	47 K ohms, 1/4 watt, 5%
R214	202261	2.2 K ohms, 1/4 watt, 5%
R215	202262	100 ohms, 1/4 watt, 5%
R216	202261	2.2 K ohms, 1/4 watt, 5%
R217	202263	680 ohms, 1/4 watt, 5%
R218	202264	15 K ohms, 1/4 watt, 5%
R219	202264	15 K ohms, 1/4 watt, 5%
R220	202255	4.7 K ohms, 1/4 watt, 5%
R221	202265	1 K ohms, 1/4 watt, 5%
R222	192296	Variable, 10 K ohms, 1/4 watt
R223	202264	15 K ohms, 1/4 watt, 5%
R224	202264	15 K ohms, 1/4 watt, 5%
R225	202266	3.3 K ohms, 1/4 watt, 5%
R226	202255	4.7 K ohms, 1/4 watt, 5%
R227	202267	39 ohms, 1/4 watt, 5%
R228	202261	2.2 K ohms, 1/4 watt, 5%
R229	202265	1 K ohms, 1/4 watt, 5%
R230	202255	4.7 K ohms, 1/4 watt, 5%
R231	202255	4.7 K ohms, 1/4 watt, 5%
R232	202268	150 ohms, 1 watt, 5%
R233	202269	470 ohms, 1/4 watt, 5%
R234	202254	68 K ohms, 1/4 watt, 5%
R235	202262	100 ohms, 1/4 watt, 5%
R236	202287	1.8 K ohms, 1/4 watt, 5%

1 KHZ DETECTORS AND LOGGING – PARTS LIST (Continued)

Symbol	Part Number	Description
CAPACITORS		
C201	271218	100 mfd, 250 V.
C202	271218	100 mfd, 250 V.
C203	261284	20 mfd, 150 V.
C204	261281	0.1 mfd, 500 V.
C205	261246	5 mfd, 25 V.
C206	261255	4.7 mfd, 35 V.
C207	261256	0.47 mfd, 35 V.
C208	261243	100 pfd, 100 V.
C209	261251	0.01 mfd, 200 V.
C210	261254	10 mfd, 20 V.
C211	261246	5 mfd, 25 V.
C212	261246	5 mfd, 25 V.
C213	261246	5 mfd, 25 V.
C214	261236	100 mfd, 25 V.
C215	261258	0.027 mfd, 80 V.
C216	261246	5 mfd, 25 V.
C217	261252	0.047 mfd, 200 V.
C218		Trim (Fixed)
C219	261246	5 mfd, 25 V.
C220	261254	10 mfd, 20 V.
DIODES		
CR201	51347	IN4005
CR202	51347	IN4005
CR203	51347	IN4005
CR204	51347	IN4005
CR205	51347	IN4005
CR206	51347	IN4005'
CR207	51348	IN462
CR208	51348	IN462
CR209	51347	IN4005
CR210	51347	IN4005
CR211	51347	IN4005
CR212	51347	IN4005
CR213	51347	IN4005
TRANSISTORS		
Q201	142606	1 amp, 40 w
Q202	133666	2N930
Q203	133666	2N930
Q204	133666	2N930
Q205	133666	2N930
Q206	133661	2N3053
Q207	133664	2N2905
Q208	133661	2N3053
RELAY		
K201	202236	4 PDT, 24 V.



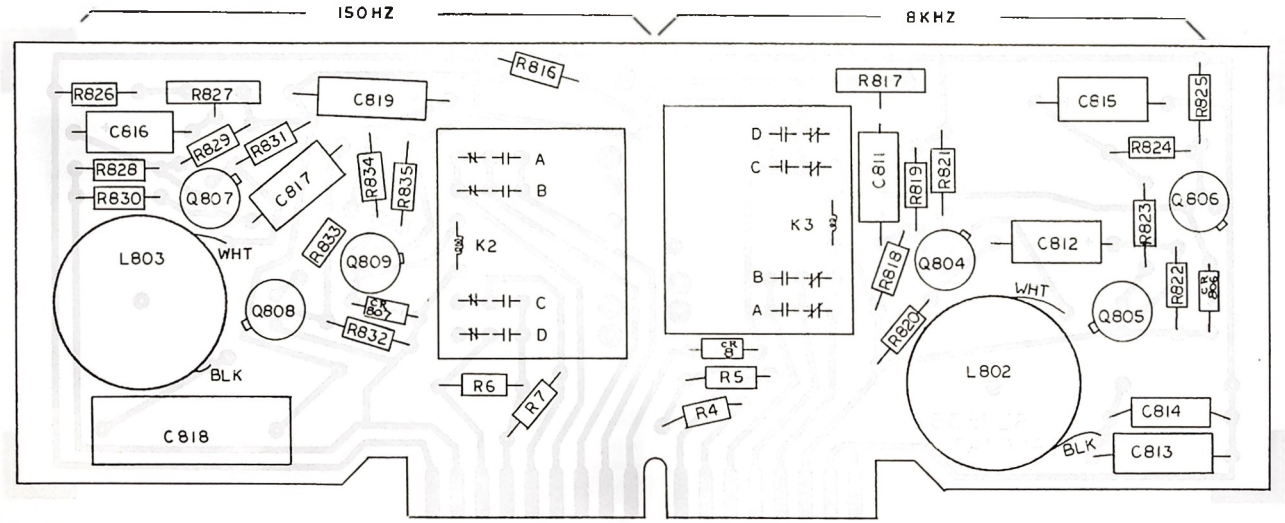
UTILITY BOARD ASSEMBLY
SL-1544-1

FIG. 9.8

UTILITY – PARTS LIST

SL-1544-I

Symbol	Part Number	Description
RESISTORS		
R3	192298	100 ohms, 1 watt, 10%
R8	202252	47 ohms, 1/2 watt, 5%
CAPACITORS		
C1	271217	1.0 mfd, 600 V.
C3	271233	1000 mfd, 50 V.
C4	271215	1000 mfd, 25 V.
C5	261268	100 mfd, 12 V.
C6	261263	25 mfd, 25 V.
DIODE		
CR9	51347	IN4005



CUE DETECTOR BOARD ASSEMBLY
(150HZ) (8KHZ)
SL-1545

FIG. 9.9

CUE DETECTOR (150 HZ) (8 KHZ) – PARTS LIST

SL-1545

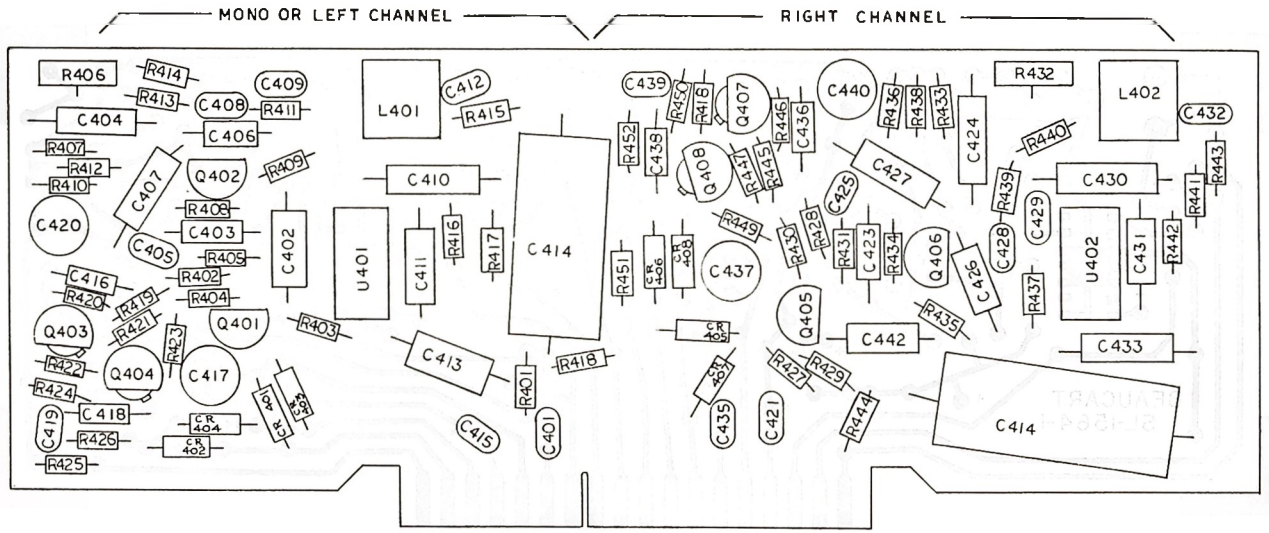
Symbol	Part Number	Description
RESISTORS		
R4	202241	100 ohms, 1/2 watt, 5%
R5	202241	100 ohms, 1/2 watt, 5%
R6	202241	100 ohms, 1/2 watt, 5%
R7	202241	100 ohms, 1/2 watt, 5%
R816	202277	15 K ohms, 1/2 watt, 5%
R817	192296	Variable, 10 K ohms, 1/4 watt
R818	202277	15 K ohms, 1/2 watt, 5%
R819	202277	15 K ohms, 1/2 watt, 5%
R820	202289	3.3 K ohms, 1/2 watt, 5%
R821	202272	4.7 K ohms, 1/2 watt, 5%
R822	202245	2.2 K ohms, 1/2 watt, 5%
R823	202271	1 K ohms, 1/2 watt, 5%
R824	202272	4.7 K ohms, 1/2 watt, 5%
R825	202272	4.7 K ohms, 1/2 watt, 5%
R826	202241	100 ohms, 1/2 watt, 5%
R827	192296	Variable, 10 K ohms, 1/4 watt
R828	202277	15 K ohms, 1/2 watt, 5%
R829	202277	15 K ohms, 1/2 watt, 5%
R830	202289	3.3 K ohms, 1/2 watt, 5%
R831	202272	4.7 K ohms, 1/2 watt, 5%
R832	202245	2.2 K ohms, 1/2 watt, 5%
R833	202272	4.7 K ohms, 1/2 watt, 5%
R834	202272	4.7 K ohms, 1/2 watt, 5%
R835	202272	4.7 K ohms, 1/2 watt, 5%
CAPACITORS		
C811	271244	22 mfd, 16 V.
C812	261249	1 mfd, 25 V.
C813	261250	0.068 mfd, 200 V.
C814		Trim (Fixed)
C815	261249	1 mfd, 25 V.
C816	271244	22 mfd, 16 V.
C817	261249	1 mfd, 25 V.
C818	261259	2.2 mfd, 250 V.
C819	261237	10 mfd, 25 V.

CUE DETECTOR (150 HZ) (8 KHZ) — PARTS LIST (Continued)

Symbol	Part Number	Description
DIODES		
CR8	51347	IN4005
CR806	51347	IN4005
CR807	51347	IN4005
TRANSISTORS		
Q804	133661	2N3053
Q805	133664	2N2905
Q806	133661	2N3053
Q807	133661	2N3053
Q808	133664	2N2905
Q809	133661	2N3053
INDUCTORS		
L802	31685	5.00 mh
L803	31684	500 mh
RELAYS		
K2	202236	4 PDT, 24 V.
K3	202236	4 PDT, 24 V.

CHASSIS (RECORDER) – PARTS LIST

Symbol	Part Number	Description
I301	71816	Lamp, No. 327, 28 V.
I302	71816	Lamp, No. 327, 28 V.
I303	71816	Lamp, No. 327, 28 V.
M301	101955	Meter, VU Scale
M302	101955	Meter, VU Scale (Stereo Only)
R326	502170	Potentiometer, 500 Ohms
R327	502170	Potentiometer, 500 Ohms (Stereo Only)
S301	112517	Switch, Pushbutton (REC)
S302	112517	Switch, Pushbutton (SEC)
S303	112517	Switch, Pushbutton (TER)
J301	261290	Connector, 18 Pin (Remote)
J302	271229	Connector, 18 Pin (Program Record Amplifier)
J303	271228	Connector, 15 Pin (Bias Oscillator)
J304	271229	Connector, 18 Pin (Control)
J305	271235	Connector, 12 Pin (Cue Oscillator)
P302	261291	Connector, 18 Pin (To Playback)
	261292	Connector, 18 Pin (Accessory)
	261293	Connector, 6 Pin (Accessory)
	91380	Extender, Shaft (Accessory)
	31780	Knob (Accessory)
	271208	Connector, 18 Pin (Type 20 Series Interconnect)
	502175	Hole Plug (Level Controls)



PROGRAM RECORDING AMPLIFIER
BOARD ASSEMBLY
MONO SL-1563
STEREO SL-1598

FIG. 9.10

PROGRAM RECORDING AMPLIFIER – PARTS LIST

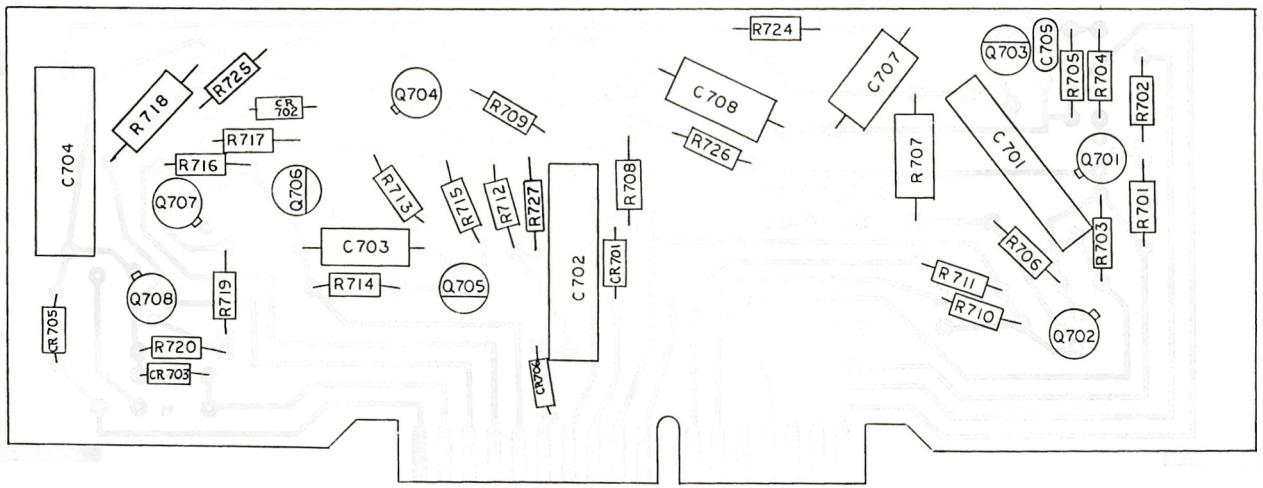
MONO SL-1563
STEREO SL-1598

Symbol	Part Number	Description
RESISTORS		
R401	202279	82 K ohms, 1/4 watt, 5%
R402	202258	10 K ohms, 1/4 watt, 5%
R403	202258	10 K ohms, 1/4 watt, 5%
R404	202280	1.2 K ohms, 1/4 watt, 5%
R405	202258	10 K ohms, 1/4 watt, 5%
R406	192296	Variable, 10 K ohms, 1/4 watt
R407	202266	3.3 K ohms, 1/4 watt, 5%
R408	202258	10 K ohms, 1/4 watt, 5%
R409	202257	100 K ohms, 1/4 watt, 5%
R410	202258	10 K ohms, 1/4 watt, 5%
R411	202258	10 K ohms, 1/4 watt, 5%
R412	202265	1 K ohms, 1/4 watt, 5%
R413	202281	8.2 K ohms, 1/4 watt, 5%
R414	202261	2.2 K ohms, 1/4 watt, 5%
R415	202269	470 ohms, 1/4 watt, 5%
R416	202258	10 K ohms, 1/4 watt, 5%
R417	202261	2.2 K ohms, 1/4 watt, 5%
R418	202265	1 K ohms, 1/4 watt, 5%
R419	202258	10 K ohms, 1/4 watt, 5%
R420	202254	68 K ohms, 1/4 watt, 5%
R421	202280	1.2 K ohms, 1/4 watt, 5%
R422	202258	10 K ohms, 1/4 watt, 5%
R423	202281	8.2 K ohms, 1/4 watt, 5%
R424	202255	4.7 K ohms, 1/4 watt, 5%
R425	202265	1 K ohms, 1/4 watt, 5%
R426	202282	5.6 K ohms, 1/4 watt, 5%
RESISTORS (STEREO ONLY)		
R427	202279	82 K ohms, 1/4 watt, 5%
R428	202258	10 K ohms, 1/4 watt, 5%
R429	202258	10 K ohms, 1/4 watt, 5%
R430	202280	1.2 K ohms, 1/4 watt, 5%
R431	202258	10 K ohms, 1/4 watt, 5%
R432	192296	Variable, 10 K ohms, 1/4 watt
R433	202266	3.3 K ohms, 1/4 watt, 5%
R434	202258	10 K ohms, 1/4 watt, 5%
R435	202257	100 K ohms, 1/4 watt, 5%
R436	202258	10 K ohms, 1/4 watt, 5%
R437	202258	10 K ohms, 1/4 watt, 5%
R438	202265	1 K ohms, 1/4 watt, 5%
R439	202281	8.2 K ohms, 1/4 watt, 5%
R440	202261	2.2 K ohms, 1/4 watt, 5%
R441	202269	470 ohms, 1/4 watt, 5%
R442	202258	10 K ohms, 1/4 watt, 5%
R443	202261	2.2 K ohms, 1/4 watt, 5%
R444	202265	1 K ohms, 1/4 watt, 5%
R445	202258	10 K ohms, 1/4 watt, 5%
R446	202254	68 K ohms, 1/4 watt, 5%

Symbol	Parts Number	Description
RESISTORS (STEREO ONLY) (Continued)		
R447	202280	1.2 K ohms, 1/4 watt, 5%
R448	202258	10 K ohms, 1/4 watt, 5%
R449	202281	8.2 K ohms, 1/4 watt, 5%
R450	202255	4.7 K ohms, 1/4 watt, 5%
R451	202265	1 K ohms, 1/4 watt, 5%
R452	202282	5.6 K ohms, 1/4 watt, 5%
CAPACITORS		
C401	261267	1 mfd, 35 V.
C402	261249	1 mfd, 25 V.
C403	261277	0.0047 mfd, 200 V.
C404	261241	0.022 mfd, 200 V.
C405	261256	0.47 mfd, 35 V.
C406	261277	0.0047 mfd, 200 V.
C407	261252	0.047 mfd, 200 V.
C408	261267	1 mfd, 35 V.
C409	261267	1 mfd, 35 V.
C410	241262	100 mfd, 25 V.
C411	261249	1 mfd, 25 V.
C412	261273	300 pfd, 100 V.
C413	261241	0.022 mfd, 200 V.
C414	271203	470 mfd, 25 V.
C415	261267	1 mfd, 35 V.
C416	261271	0.00047 mfd, 200 V.
C417	271230	100 mfd, 16 V.
C418	261269	0.001 mfd, 200 V.
C419	261255	4.7 mfd, 35 V.
C420	271231	47 mfd, 16 V.
CAPACITORS (STEREO ONLY)		
C421	261267	1 mfd, 35 V.
C422	261249	1 mfd, 25 V.
C423	261277	0.0047 mfd, 200 V.
C424	261241	0.022 mfd, 200 V.
C425	261256	0.47 mfd, 35 V.
C426	261277	0.0047 mfd, 200 V.
C427	261252	0.047 mfd, 200 V.
C428	261267	1 mfd, 35 V.
C429	261267	1 mfd, 35 V.
C430	241262	100 mfd, 25 V.
C431	261249	1 mfd, 25 V.
C432	261273	300 pfd, 100 V.
C433	261241	0.022 mfd, 200 V.
C434	271203	470 mfd, 25 V.
C435	261267	1 mfd, 35 V.
C436	261271	0.00047 mfd, 200 V.
C437	271230	100 mfd, 16 V.
C438	261269	0.001 mfd, 200 V.
C439	261255	4.7 mfd, 35 V.
C440	271231	47 mfd, 16 V.

PROGRAM RECORDING AMPLIFIER – PARTS LIST (Continued)

Symbol	Part Number	Description
DIODES		
CR401	51349	IN295
CR402	51349	IN295
CR403	51349	IN295
CR404	51349	IN295
DIODES (STEREO ONLY)		
CR405	51349	IN295
CR406	51349	IN295
CR407	51349	IN295
CR408	51349	IN295
TRANSISTORS		
Q401	142611	2N5816
Q402	142611	2N5816
Q403	13366	2N930
Q404	13366	2N930
TRANSISTORS (STEREO ONLY)		
Q405	142611	2N5816
Q406	142611	2N5816
Q407	13366	2N930
Q408	13366	2N930
INDUCTOR		
L401	31686	Variable, 8-20 mh
INDUCTOR (STEREO ONLY)		
L402	31686	Variable, 8-20 mh
INTEGRATED CIRCUIT		
U401	31692	Audio Amplifier
INTEGRATED CIRCUIT (STEREO ONLY)		
U402	31692	Audio Amplifier



CONTROL BOARD ASSEMBLY
SL-1379

FIG. 9.11

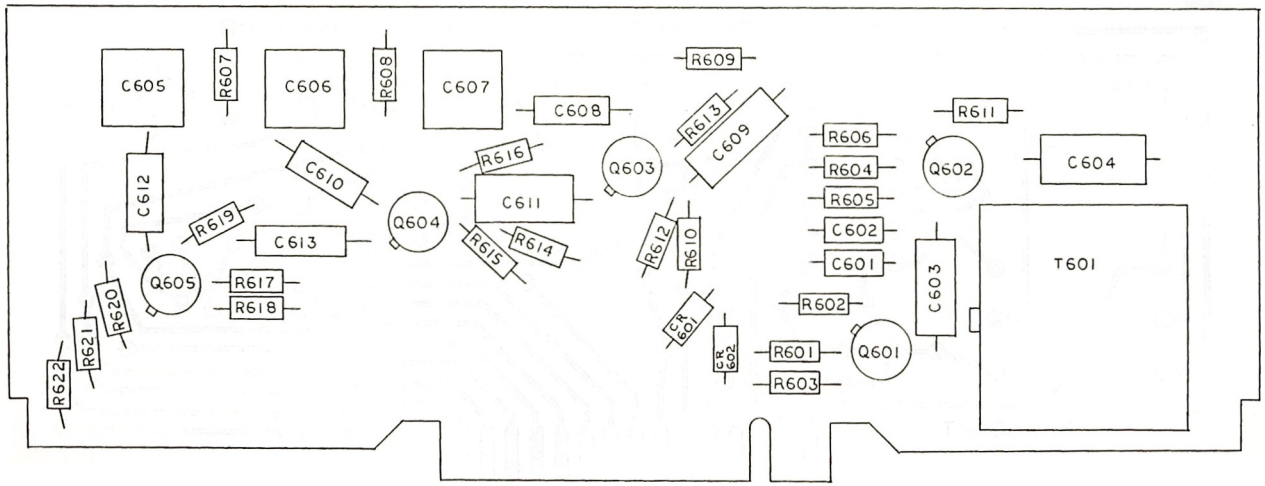
CONTROL – PARTS LIST

SL-1379

Symbol	Part Number	Description
RESISTORS		
R701	202247	470 ohms, 1/2 watt, 5%
R702	202291	10 K ohms, 1/2 watt, 5%
R703	202294	470 K ohms, 1/2 watt, 5%
R704	202245	2.2 K ohms, 1/2 watt, 5%
R705	202241	100 ohms, 1/2 watt, 5%
R706	202245	2.2 K ohms, 1/2 watt, 5%
R707	202230	620 ohms, 2 watt, 5%
R708	202245	2.2 K ohms, 1/2 watt, 5%
R709	202245	2.2 K ohms, 1/2 watt, 5%
R710	202241	100 ohms, 1/2 watt, 5%
R711	202241	100 ohms, 1/2 watt, 5%
R712	202274	33 K ohms, 1/2 watt, 5%
R713	202293	68 K ohms, 1/2 watt, 5%
R714	202292	33 ohms, 1/2 watt, 5%
R715	202284	220 ohms, 1/2 watt, 5%
R716	202245	2.2 K ohms, 1/2 watt, 5%
R717	202245	2.2 K ohms, 1/2 watt, 5%
R718	202225	1.2 K ohms, 1 watt 10%
R719	202245	2.2 K ohms, 1/2 watt, 5%
R720	202245	2.2 K ohms, 1/2 watt, 5%
R724	202253	10 ohms, 1/2 watt, 5%
R725	202253	10 ohms, 1/2 watt, 5%
R726	202245	2.2 K ohms, 1/2 watt, 5%
R727	202291	10 K ohms, 1/2 watt, 5%

CONTROL – PARTS LIST (Continued)

Symbol	Part Number	Description
CAPACITORS		
C701	261247	1 mfd, 200 V.
C702	261247	1 mfd, 200 V.
C703	261246	5 mfd, 25 V.
C704	261247	1 mfd, 200 V.
C705	261256	0.47 mfd, 35 V.
C707	261248	0.1 mfd, 200 V.
C708	261263	25 mfd, 25 V.
DIODES		
CR701	51347	IN4005
CR702	51347	IN4005
CR703	51347	IN4005
CR705	51347	IN4005
CR706	51347	IN4005
TRANSISTORS		
Q701	133664	2N2905
Q702	133664	2N2905
Q704	133664	2N2905
Q705	133665	2N4870
Q707	133661	2N3053
Q708	133664	2N2905
SILICON CONTROLLED RECTIFIERS		
Q703	72488	2N5061
Q706	72488	2N5061



BIAS OSCILLATOR BOARD ASSEMBLY
MONO SL-1387 (SEE PARTS LIST FOR DELETION OF COMPONENTS)
STEREO SL-1608

FIG. 9.12

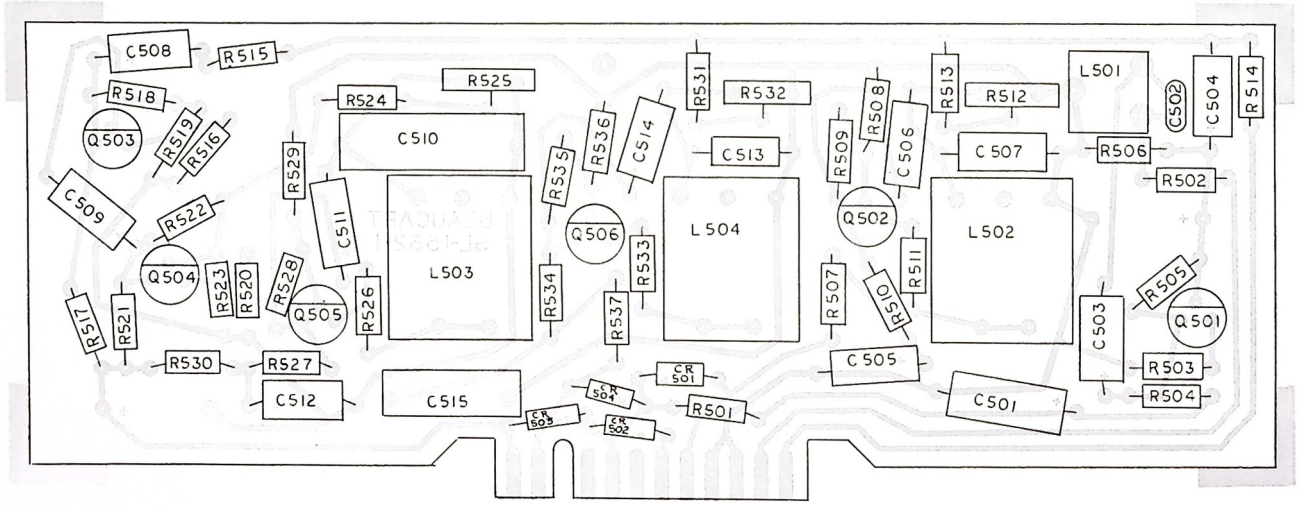
BIAS OSCILLATOR – PARTS LIST

MONO SL-1387
STEREO SL-1608

Symbol	Part Number	Description
RESISTORS		
R601	202241	100 ohms, 1/2 watt, 5%
R602	202283	47 K ohms, 1/2 watt, 5%
R603	202245	2.2 K ohms, 1/2 watt, 5%
R604	202245	2.2 K ohms, 1/2 watt, 5%
R605	202283	47 K ohms, 1/2 watt, 5%
R606	202241	100 ohms, 1/2 watt, 5%
R608	202291	10 K ohms, 1/2 watt, 5%
R609	202291	10 K ohms, 1/2 watt, 5%
R610	202272	4.7 K ohms, 1/2 watt, 5%
R611	202252	47 ohms, 1/2 watt, 5%
R612	202291	10 K ohms, 1/2 watt, 5%
R613	202272	4.7 K ohms, 1/2 watt, 5%
R614	202272	4.7 K ohms, 1/2 watt, 5%
R615	202291	10 K ohms, 1/2 watt, 5%
R616	202272	4.7 K ohms, 1/2 watt, 5%
R620	202240	220 K ohms, 1/2 watt, 5%
R621	202240	220 K ohms, 1/2 watt, 5%
RESISTORS (STEREO ONLY)		
R607	202272	4.7 K ohms, 1/2 watt, 5%
R617	202252	47 ohms, 1/2 watt, 5%
R618	202272	4.7 K ohms, 1/2 watt, 5%
R619	202252	47 ohms, 1/2 watt, 5%

BIAS OSCILLATOR — PARTS LIST (Continued)

Symbol	Part Number	Description
CAPACITORS		
C601	261261	0.0022 mfd, 200 V.
C602	261261	0.0022 mfd, 200 V.
C603	261262	0.033 mfd, 200 V.
C604	261263	25 mfd, 25 V.
C606	261265	Variable, 6-30 pfd, 350 V.
C607	261266	Variable, 11-75 pfd, 350 V.
C608	261251	0.01 mfd, 200 V.
C609	261264	100 mfd, 3V.
C610	261251	0.01 mfd, 200 V.
C611	261264	100 mfd, 3 V.
CAPACITORS (STEREO ONLY)		
C605	261265	Variable, 6-30 pfd, 350 V.
C612	261251	0.01 mfd, 200 V.
C613	261264	100 mfd, 3 V.
DIODES		
CR601	51347	IN4005
CR602	51347	IN4005
TRANSISTORS		
Q601	133661	2N3053
Q602	133661	2N3053
Q603	133664	2N2905
Q604	133664	2N2905
TRANSISTORS (STEREO ONLY)		
Q605	133664	2N2905
TRANSFORMER		
T601	133668	Bias Transformer



CUE OSCILLATOR BOARD ASSEMBLY
1 CUE SL-1653 (SEE PARTS LIST FOR DELETION OF COMPONENTS)
3 CUE SL-1560

FIG. 9.13

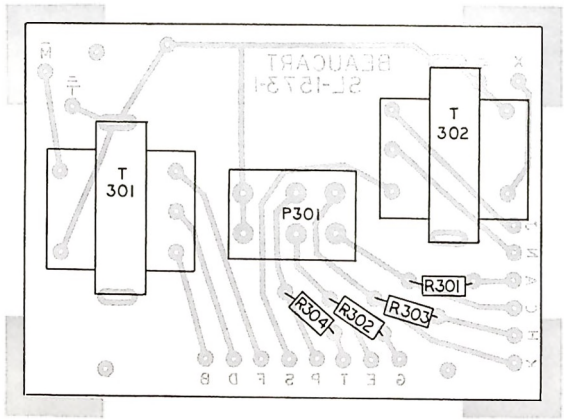
CUE OSCILLATOR – PARTS LIST

SL-1560 3 Cue
SL-1653 1 Cue (Delete – 150 Hz and 8 kHz)

Symbol	Part Number	Description
RESISTORS		
R501	202271	1 K ohms, 1/2 watt, 5%
R502	202245	2.2 K ohms, 1/2 watt, 5%
R503	202241	100 ohms, 1/2 watt, 5%
R504	202245	2.2 K ohms, 1/2 watt, 5%
R505	202248	22 K ohms, 1/2 watt, 5%
R506	202272	4.7 K ohms, 1/2 watt, 5%
R507	202245	2.2 K ohms, 1/2 watt, 5%
R508	202272	4.7 K ohms, 1/2 watt, 5%
R509	202248	22 K ohms, 1/2 watt, 5%
R510	202272	4.7 K ohms, 1/2 watt, 5%
R511	202273	390 ohms, 1/2 watt, 5%
R512	192296	Variable, 10 K ohms, 1/4 watt
R513	202274	33 K ohms, 1/2 watt, 5%
R514	202243	100 K ohms, 1/2 watt, 5%
R515	202274	33 K ohms, 1/2 watt, 5% (150 Hz)
R516	202276	560 ohms, 1/2 watt, 5% (150 Hz)
R517	202248	22 K ohms, 1/2 watt, 5% (150 Hz)
R518	202277	15 K ohms, 1/2 watt, 5% (150 Hz)
R519	202289	3.3 K ohms, 1/2 watt, 5% (150 Hz)
R520	202284	220 ohms, 1/2 watt, 5% (150 Hz)
R521	202245	2.2 K ohms, 1/2 watt, 5% (150 Hz)
R522	202277	15 K ohms, 1/2 watt, 5% (150 Hz)
R523	202272	4.7 K ohms, 1/2 watt, 5% (150 Hz)
R524	202274	33 K ohms, 1/2 watt, 5% (150 Hz)
R525	192296	Variable, 10 K ohms, 1/4 watt (150 Hz)
R526	202284	220 ohms, 1/2 watt, 5% (150 Hz)
R527	202272	4.7 K ohms, 1/2 watt, 5% (150 Hz)
R528	202248	22 K ohms, 1/2 watt, 5% (150 Hz)
R529	202272	4.7 K ohms, 1/2 watt, 5% (150 Hz)
R530	202241	100 ohms, 1/2 watt, 5% (150 Hz)
R531	202274	33 K ohms, 1/2 watt, 5% (8 kHz)
R532	192296	Variable, 10 K ohms, 1/4 watt (8 kHz)
R533	202273	390 ohms, 1/2 watt, 5% (8 kHz)
R534	202272	4.7 K ohms, 1/2 watt, 5% (8 kHz)
R535	202248	22 K ohms, 1/2 watt, 5% (8 kHz)
R536	202272	4.7 K ohms, 1/2 watt, 5% (8 kHz)
R537	202289	3.3 K ohms, 1/2 watt, 5% (8 kHz)

CUE OSCILLATOR – PARTS LIST (Continued)

Symbol	Part Number	Description
CAPACITORS		
C501	261263	25 mfd, 25 V.
C502	261273	300 pfd, 100 V.
C503	261249	1 mfd, 25 V.
C504	261246	5 mfd, 25 V.
C505	261246	5 mfd, 25 V.
C506	261246	5 mfd, 25 V.
C507	261252	0.047 mfd, 200 V.
C508	261246	5 mfd, 25 V. (150 Hz)
C509	261246	5 mfd, 25 V. (150 Hz)
C510	261247	1 mfd, 200 V. (150 Hz)
C511	261246	5 mfd, 25 V. (150 Hz)
C512	261246	5 mfd, 25 V. (150 Hz)
C513	261276	0.0082 mfd, 200 V. (8 kHz)
C514	261249	1 mfd, 25 V. (8 kHz)
C515	261245	0.47 mfd, 250 V. (8 kHz)
INDUCTORS		
L501	31686	Variable, 8-20 mh.
L502	31687	Variable, 475-525 mh
L503	31688	Variable, 1.045-1.155 hy (150 Hz)
L504	31689	Variable, 32.8-47.2 mh (8 kHz)
DIODE		
CR501	51347	IN4005
CR502	51347	IN4005
CR503	51347	IN4005 (150 Hz)
CR504	51347	IN4005 (8 kHz)
TRANSISTORS		
Q501	133662	2N5089
Q502	133662	2N5089
Q503	133662	2N5089 (150 Hz)
Q504	133662	2N5089 (150 Hz)
Q505	133662	2N5089 (150 Hz)
Q506	133662	2N5089 (8 kHz)



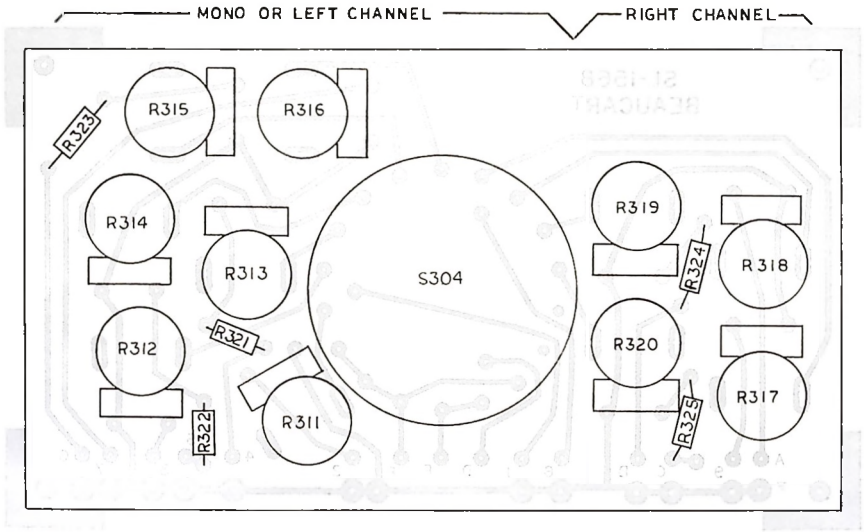
AUDIO INPUT BOARD ASSEMBLY
MONO SL-1574 (SEE PARTS LIST FOR DELETION OF COMPONENTS)
STEREO SL-1601

FIG. 9.14

AUDIO INPUT – PARTS LIST

MONO SL-1574
STEREO SL-1601

Symbol	Part Number	Description
RESISTORS		
R301	2002258	10 K ohms, 1/4 watt, 5%
R302	2002258	10 K ohms, 1/4 watt, 5%
RESISTORS (STEREO ONLY)		
R303	2002258	10 K ohms, 1/4 watt, 5%
R304	2002258	10 K ohms, 1/4 watt, 5%
TRANSFORMER		
T301	142614	Input Transformer
TRANSFORMER (STEREO ONLY)		
T302	142614	Input Transformer
CONNECTOR		
P301	261294	6 Pin Connector



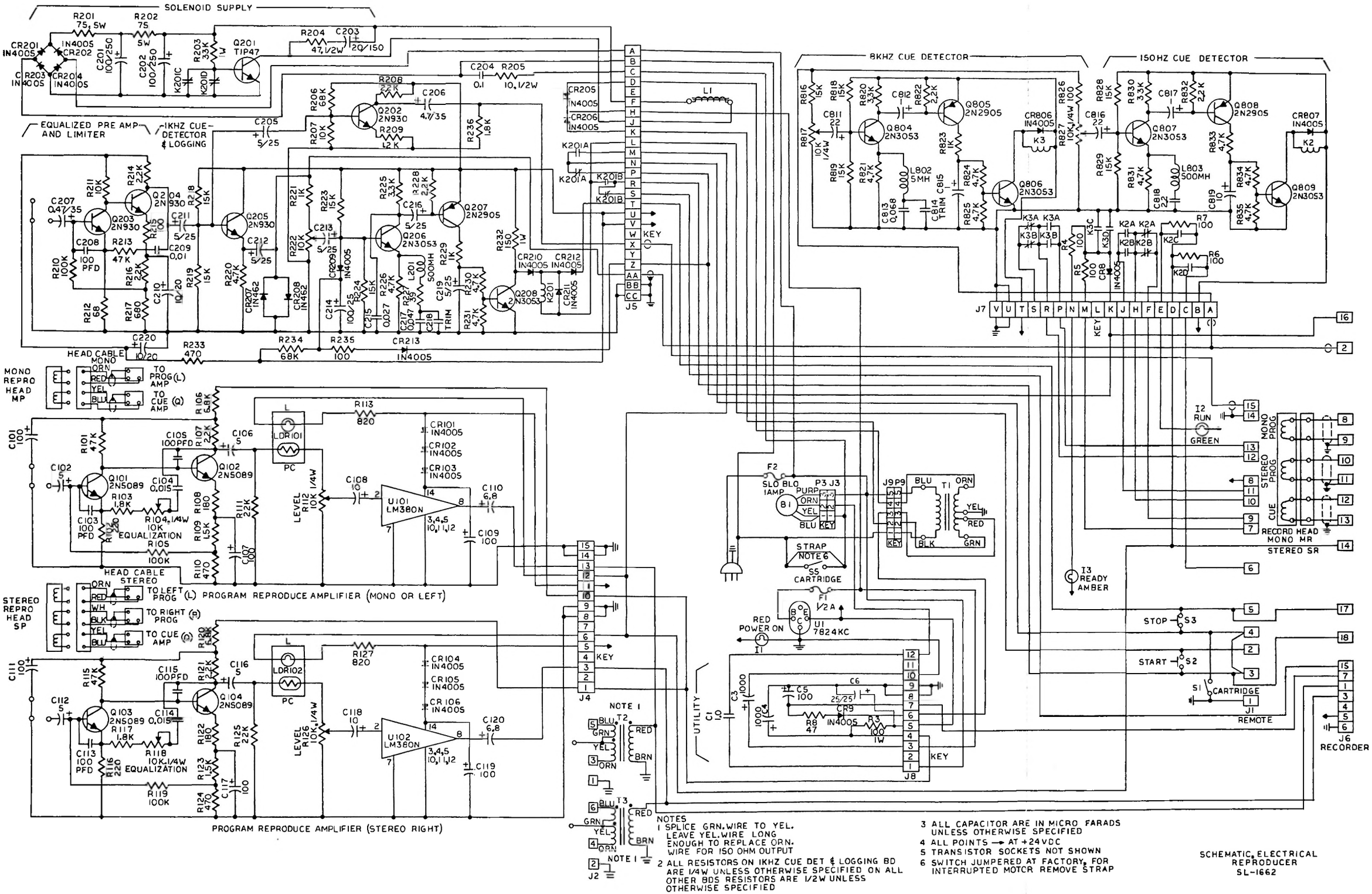
METER CIRCUIT BOARD ASSEMBLY
MONO SL-1569
STEREO SL-1600

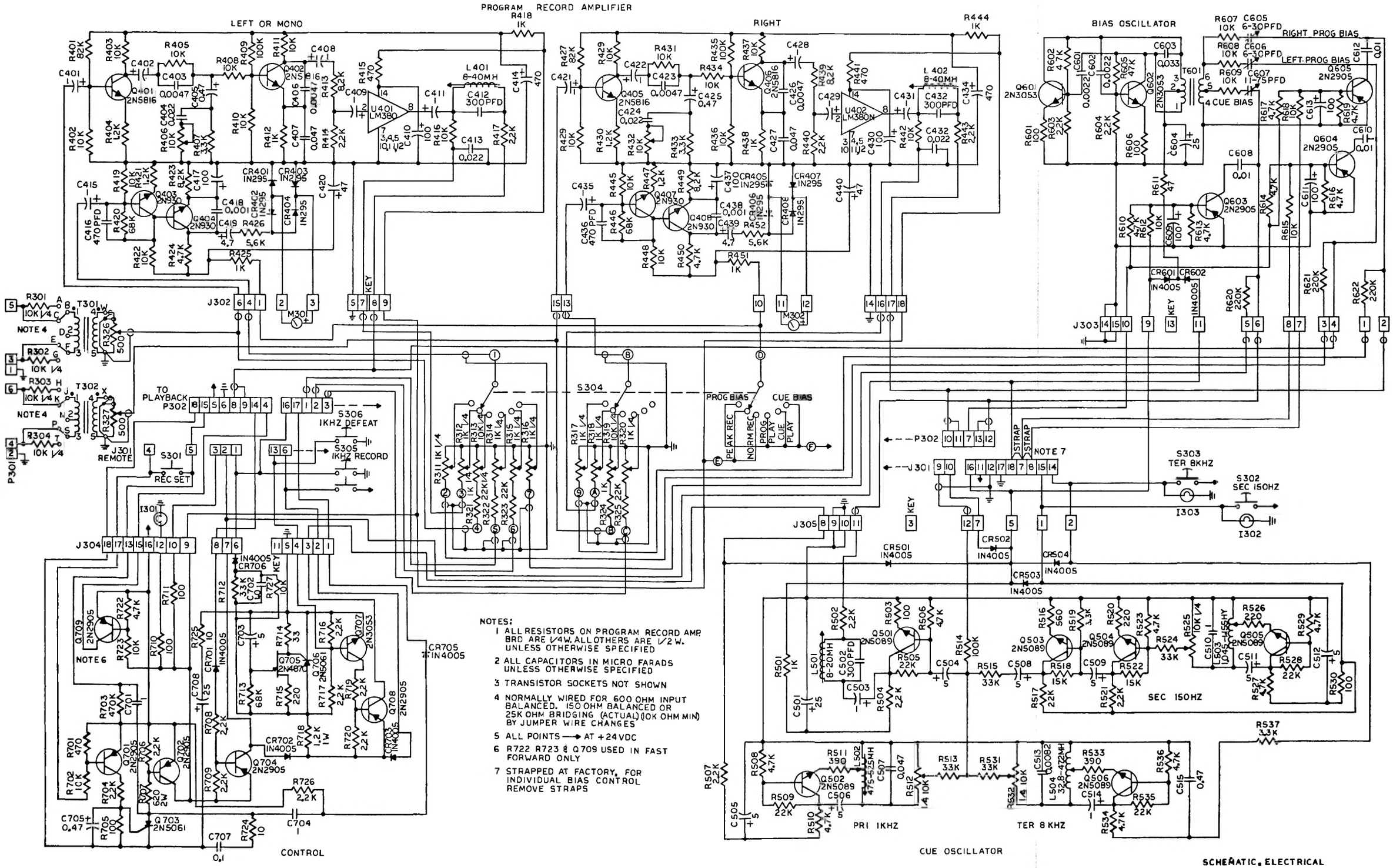
FIG. 9.15

METER CIRCUIT – PARTS LIST

MONO SL-1569
STEREO SL-1600

Symbol	Part Number	Description
RESISTORS		
R311	502168	Variable, 1 K ohms, 1/4 watt
R312	502168	Variable, 1 K ohms, 1/4 watt
R313	502169	Variable, 10 K ohms, 1/4 watt
R314	502168	Variable, 1 K ohms, 1/4 watt
R315	502168	Variable, 1 K ohms, 1/4 watt
R316	502168	Variable, 1 K ohms, 1/4 watt
R321	202265	1 K ohms, 1/4 watt, 5%
R322	202256	22 K ohms, 1/4 watt, 5%
R323	202248	22 K ohms, 1/2 watt, 5%
RESISTORS (STEREO ONLY)		
R317	502168	Variable, 1 K ohms, 1/4 watt
R318	502168	Variable, 1 K ohms, 1/4 watt
R319	502169	Variable, 10 K ohms, 1/4 watt
R320	502168	Variable, 1 K ohms, 1/4 watt
R324	202271	1 K ohms, 1/2 watt, 5%
R325	202248	22 K ohms, 1/2 watt, 5%
SWITCH		
S304	SL-1661	3 Pole, 6 Position Rotary Switch


SOLENOID SUPPLY
EQUALIZED PRE AMP AND LIMITER
1KHZ CUE DETECTOR & LOGGING
8KHZ CUE DETECTOR
150HZ CUE DETECTOR
HEAD CABLE
MONO REPRO HEAD MP
STEREO REPRO HEAD SP
HEAD CABLE STEREO
TO PROG(L) AMP
TO CUE (Q) AMP
TO LEFT PROG (L)
TO RIGHT (R) PROG
PROGRAM REPRODUCE AMPLIFIER (MONO OR LEFT)
PROGRAM REPRODUCE AMPLIFIER (STEREO RIGHT)
KEY
J5
J7
J4
J2
J8
J1
J6
RECORDER
REMOTE
I2 RUN GREEN
I3 READY AMBER
STOP S3
START S2
S1 CARTRIDGE
S5 CARTRIDGE
RED POWER ON
STRAP NOTE 6
RECORD HEAD MONO MR
STEREO SR
MONO PROG
STEREO PROG
CUE
UTILITY
NOTE 1
NOTES
1 SPLICE GRN. WIRE TO YEL. LEAVE YEL. WIRE LONG ENOUGH TO REPLACE ORN. WIRE FOR 150 OHM OUTPUT
2 ALL RESISTORS ON IKHZ CUE DET & LOGGING BD ARE 1/4W UNLESS OTHERWISE SPECIFIED ON ALL OTHER BDS RESISTORS ARE 1/2W UNLESS OTHERWISE SPECIFIED
3 ALL CAPACITOR ARE IN MICRO FARADS UNLESS OTHERWISE SPECIFIED
4 ALL POINTS → AT +24VDC
5 TRANSISTOR SOCKETS NOT SHOWN
6 SWITCH JUMPERED AT FACTORY, FOR INTERRUPTED MOTOR REMOVE STRAP
SCHEMATIC, ELECTRICAL REPRODUCER SL-1662



SCHEMATIC, ELECTRICAL
RECORDER
SL-1663

ADDENDUM

UMC BEAUCART

TECHNICAL MANUAL

TYPE 10 AND TYPE 20

STANDARD MACHINE

220 Volts ± 20 Volts 50 or 60 Hz

FAST FORWARD MACHINES

117 Volts ± 10% 50 or 60 Hz

220 Volts ± 20 Volts 50 or 60 Hz

TM 10-20-001
26 April 1976

FAST FORWARD

GENERAL

The Fast Forward Cartridge Machines have three modes of operation. These modes are selectable by the Fast Forward Switch S6 which is a three position toggle switch located on the reproducers front panel. See Fig. F/F1.

When the switch is placed in the "inhibit" position, fast forward operation is defeated and the machine will operate normally as described in Chapter 3.0 and 7.0.

When the switch is placed in the "auto" position, sensing of 150 Hz. cue (secondary) trailing edge will initiate fast forward automatically and remain in that mode until the stop cue is sensed. The time interval should be at least 3 to 4 seconds between the trailing edge of the secondary cue and the stop cue.

Actuation to the momentary "manual" position, when at normal speed, will initiate fast forward and remain in that mode until the stop cue is sensed.

The accelerate time from 7-1/2 $^{in}/s$ to 22-1/2 $^{in}/s$ is 8 to 10 seconds which prevents damage to the tape. The power indicator light is turned off when in the Fast Forward state.

THEORY OF OPERATION

General

When the machine goes into Fast Forward, automatically or manually, the following functions occur:

1. Audio output is squelched
2. Cue sensor inhibit timer is initiated
3. Motor winding and capacitor is transferred
4. 3 kHz detector is sensing

5. Cue signal is attenuated
6. 150 Hz. and 8 kHz cue detectors are disabled
7. Logging output stage is back biased
8. Start function is defeated until normal motor speed is attained.

Detail - See Fig. FF-2 through FF-4 and SL 1709

The following explanation will follow a "sequence of events" when the switch is in the auto position.

When an "end of message" 150 Hz. cue signal is detected in the ordinary manner (See Section 7.5) Relay K2 becomes energized. Normally open contact K2A closes, grounding Resistor R932 by way of J7-4, S6-5 and 3, and J7-3. Capacitor C914 charges to 24 volt d-c. Contact K2A also grounds J5-17 which disables the 1 kHz detector by shunting base drive of Q206 by way of diode CR209, resistor R235, and diodes CR213 and CR215. Normally closed contacts K2C opens, removing ground from optical relays LDR101 and LDR102. These relays prevent any extraneous pickup, that may be caused by high speed tape, from reaching the output.

When the 150 Hz. tone ends, Relay K2 de-energizes. Normally closed contact K2A goes back to its normally closed position which (1) initiates the primary cue sensor inhibit timer by removing the ground discharge path of capacitor C214, which will charge to approximately 12 volts and allow normal bias for Q206 in approximately 1.75 seconds; (2) allows relay coil K4 to be connected to the minus side of capacitor C914 by way of J7-15, J7-2, diode CR908, K2A N.C., and resistor 932. The time constant of this circuit assures pull in of relay K4 which is latched in through normally open contact K4C, normally closed contact K2C, J7-E, J5-M, normally open contact K201B, to J5-N which is at ground potential. Contacts K4A switches motor winding and capacitor

which increases the motor speed from 600 RPM to 1800 RPM in 8 to 10 seconds. Contacts K4D switches from a 1 kHz to a 3 kHz tuned circuit by way of J7-12, 13, 14, J5-14, 20, 23 from L201 to L202. The detector will now sense the 3 kHz stop tone. Because the stop tone is of higher magnitude, normally closed contact K5B opens, inserting resistor R237 to attenuate the signal to normal level. This is accomplished by way of J7-16 and 17, and J5-8 and 9.

Normally closed contact K4B opens B+ from both the 150 Hz. and 8 kHz cue detector relays to prevent false cueing. Normally open contact K4B closes doing two things:

1. Supplies B+ to diode CR905, charging capacitor C911 through R924 to store energy for later use. The other current path through blocking diode CR905 and resistor R925, J7-L, J5-15 and R209, provides back bias to the logging output state Q202.
2. Supplies B+ through blocking diode CR903, resistor R923 and capacitor C910 for energy storage for later delay. Divider R922 and R923 maintains forward bias on transisitor Q907 energizing relay K5. Normally closed contact K5A opens which is in series with start switch S2.

When the stop cue is detected (3 kHz. tone) K201 drops out as explained in Section 7.4. Normally open contact K201A opens, removing ready ground from J5-M, J7E, normally closed contact K2C, closed contact of normally open K4C, and K4, which drops out K4. This resets all functions to normal accept the following:

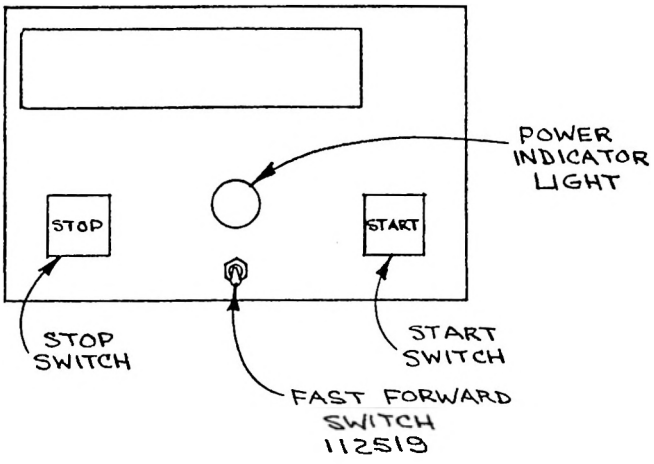
1. Capacitor C911 keeps the logging output back biased for the duration of the stop function to prevent

transients from outputting.

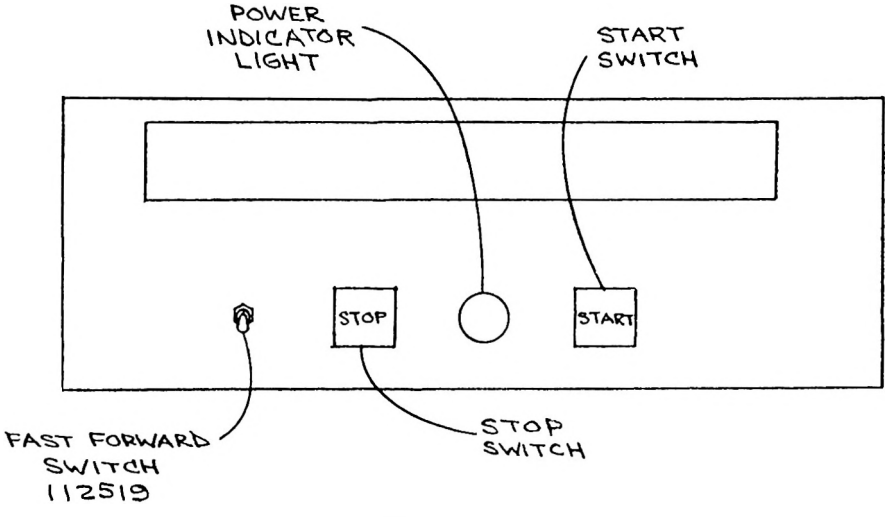
2. Capacitor C910 delays K5 from dropping out for approximately four seconds to inhibit the start function during motor speed transition time. This is accomplished by normally closed contact K5A being open and in series with the start switch S2.

FAST FORWARD

The Record/Reproducer is interlocked to prevent Fast Forward operation while in the record mode. This is accomplished in the following manner; B+ voltage is supplied to the recorder through pin 5 of J6, pin 5 of P302, pin 16 of J304 to the emitter of Q709. Q709 is normally turned on by R722 and R723, supplying B+ through pin 15 of J304, pin 4 of P302 and J6 to pin 18 of J7. However, in the record set and record mode transistor Q702 switches B+ voltage to R723, turning Q709 off, disabling the Fast Forward circuitry.

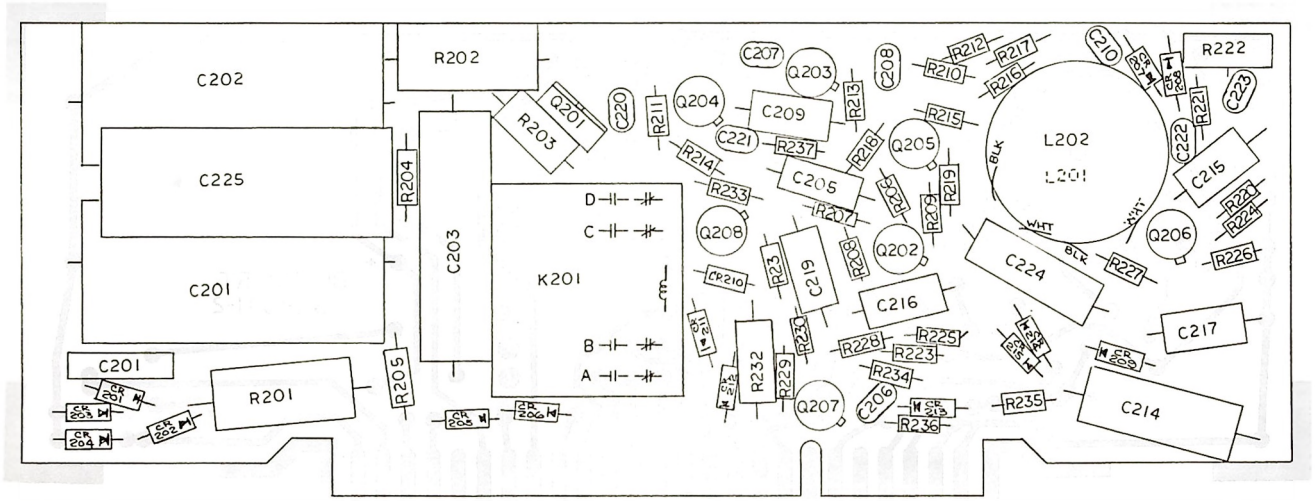


TYPE 10
FRONT PANEL



TYPE 20
FRONT PANEL

FIG. F/F-1



1KHZ DETECTOR AND LOGGING
BOARD ASSEMBLY
FAST FORWARD
SL-1655

FIG. F/F-2

1 kHZ DETECTOR AND LOGGING (FAST FORWARD) - PARTS LIST

SL-1655

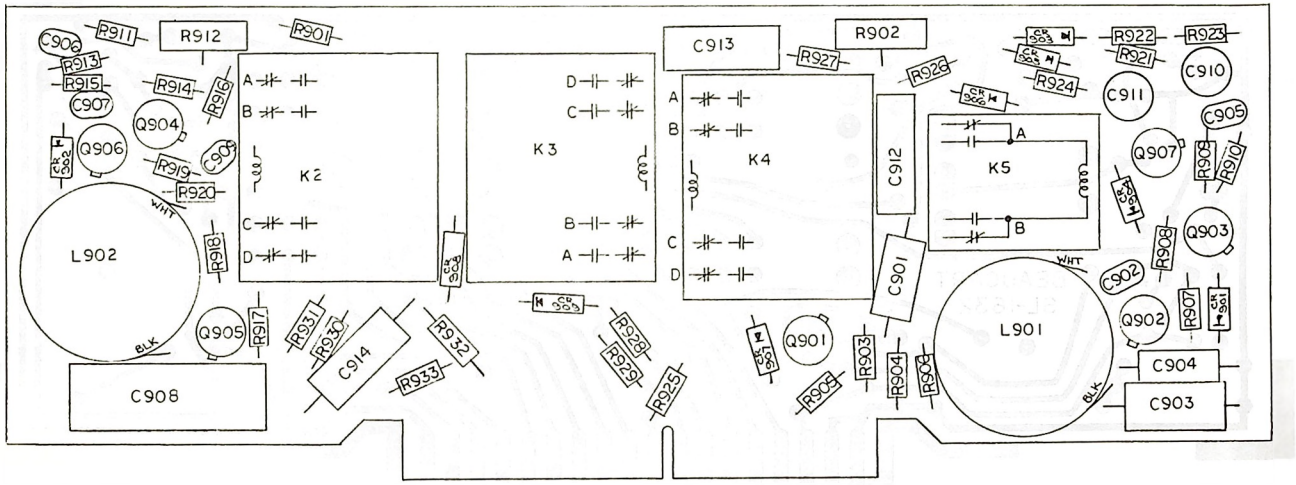
Symbol	Part Number	Description
RESISTORS		
R201	202224	75 ohms, 5 watt, 10%
R202	202224	75 ohms, 5 watt, 10%
R203	202237	33 K ohms, 1 watt, 10%
R204	202252	47 ohms, 1/2 watt, 5%
R205	202253	10 ohms, 1/2 watt, 5%
R206	202254	68 K ohms, 1/4 watt, 5%
R207	202258	10 K ohms, 1/4 watt, 5%
R208	202261	2.2 K ohms, 1/4 watt, 5%
R209	202280	1.2 K ohms, 1/4 watt, 5%
R210	202257	100 K ohms, 1/4 watt, 5%
R211	202258	10 K ohms, 1/4 watt, 5%
R212	202259	68 ohms, 1/4 watt, 5%
R213	202260	47 K ohms, 1/4 watt, 5%
R214	202261	2.2 K ohms, 1/4 watt, 5%
R215	202262	100 ohms, 1/4 watt, 5%
R216	202261	2.2 K ohms, 1/4 watt, 5%
R217	202263	680 ohms, 1/4 watt, 5%
R218	202264	15 K ohms, 1/4 watt, 5%
R219	202264	15 K ohms, 1/4 watt, 5%
R220	202255	4.7 K ohms, 1/4 watt, 5%
R221	202265	1 K ohms, 1/4 watt, 5%
R222	192296	Variable 10 K ohms, 1/4 watt, 10%
R223	202264	15 K ohms, 1/4 watt, 5%
R224	202264	15 K ohms, 1/4 watt, 5%
R225	202266	3.3 K ohms, 1/4 watt, 5%
R226	202255	4.7 K ohms, 1/4 watt, 5%
R227	202267	39 ohms, 1/4 watt, 5%
R228	202261	2.2 K ohms, 1/4 watt, 5%
R229	202265	1 K ohms, 1/4 watt, 5%
R230	202255	4.7 K ohms, 1/4 watt, 5%
R231	202255	4.7 K ohms, 1/4 watt, 5%
R232	202268	150 ohms, 1 watt, 5%
R233	202269	470 ohms, 1/4 watt, 5%
R234	202254	68 K ohms, 1/4 watt, 5%
R235	202262	100 ohms, 1/4 watt, 5%
R236	202287	1.8 K ohms, 1/4 watt, 5%
R237	202254	68 K ohms, 1/4 watt, 5%
CAPACITORS		
C201	271218	100 mfd, 250 V.
C202	271218	100 mfd, 250 V.
C203	261284	20 mfd, 150 V.
C204	261281	0.1 mfd, 500 V.
C205	261246	5 mfd, 25 V.
C206	261255	4.7 mfd, 35 V.

1 kHZ DETECTOR AND LOGGING (FAST FORWARD) - PARTS LIST (Continued)

Symbol	Part Number	Description
CAPACITORS (Continued)		
C207	261256	0.47 mfd, 35 V.
C208	261243	100 pF, 100 V.
C209	261251	0.01 mfd, 200 V.
C210	261254	10 mfd, 20 V.
C214	261236	100 mfd, 25 V.
C215	261258	0.027 mfd, 80 V.
C216	261246	5 mfd, 25 V.
C217	261252	0.047 mfd, 200 V.
C218		Trim (Fixed)
C219	261246	5 mfd, 25 V.
C220	261254	10 mfd, 20 V.
C221	261255	4.7 mfd, 35 V.
C222	261255	4.7 mfd, 35 V.
C223	261255	4.7 mfd, 35 V.
C224	271246	0.15 mfd, 200 V.
C225	271247	3 mfd, 400 V.
DIODES		
CR201	51347	IN4005
CR202	51347	IN4005
CR203	51347	IN4005
CR204	51347	IN4005
CR205	51347	IN4005
CR206	51347	IN4005
CR207	51348	IN462
CR208	51348	IN462
CR209	51347	IN4005
CR210	51347	IN4005
CR211	51347	IN4005
CR212	51347	IN4005
CR213	51347	IN4005
CR214	51347	IN4005
CR215	51347	IN4005
TRANSISTORS		
Q201	142606	1 AMP, 40 watt
Q202	133666	2N930
Q203	133666	2N930
Q204	133666	2N930
Q205	133666	2N930
Q206	133661	2N3053
Q207	133664	2N2905
Q208	133661	2N3053
RELAY		
K201	202236	4 PDT. 24 V.

1 KHZ DETECTOR AND LOGGING (FAST FORWARD) - PART LIST (Continued)

Symbol	Part Number	Description
L201	31684	500 mH
L202	31694	20 mH



(150)(8KHZ) CUE DETECTOR
BOARD ASSEMBLY
FAST FORWARD
SL-1640

FIG. F/F-3

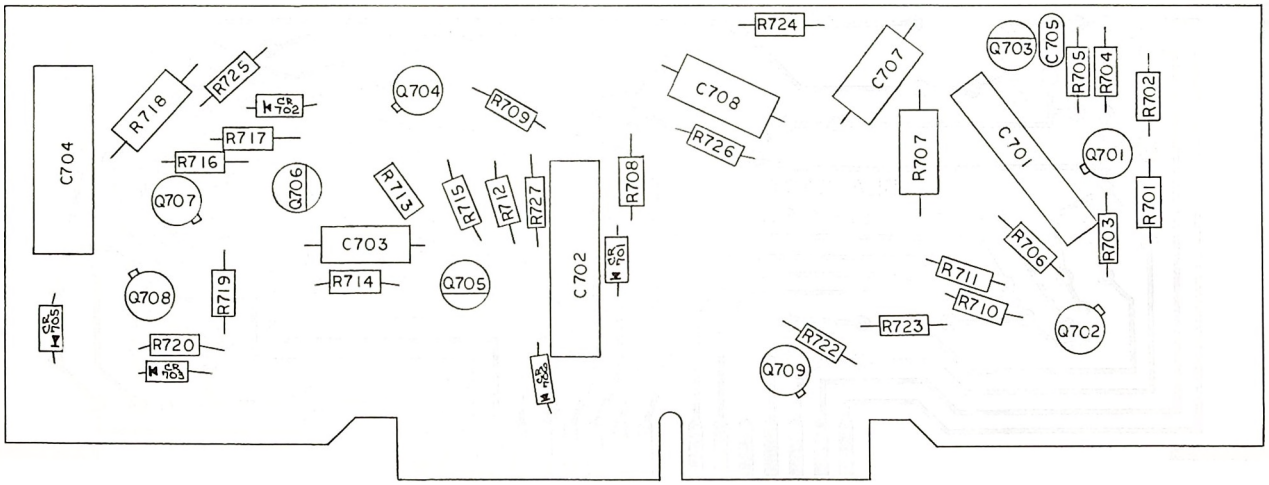
(150 HZ)(8 kHZ)
CUE DETECTOR BOARD (FAST FORWARD) - PARTS LIST

SL-1640

Symbol	Part Number	Description
RESISTORS		
R901	202264	15 K ohms, 1/4 watt, 5%
R902	192296	Variable 10 K ohms, 1/4 watt, 10%
R903	202264	15 K ohms, 1/4 watt, 5%
R904	202264	15 K ohms, 1/4 watt, 5%
R906	202255	4.7 K ohms, 1/4 watt, 5%
R907	202261	2.2 K ohms, 1/4 watt, 5%
R908	202265	1 K ohms, 1/4 watt, 5%
R909	202255	4.7 K ohms, 1/4 watt, 5%
R910	202255	4.7 K ohms, 1/4 watt, 5%
R911	202262	100 ohms, 1/4 watt, 5%
R912	192296	Variable, 10 K ohms, 1/4 watt, 10%
R913	202264	15 K ohms, 1/4 watt, 5%
R914	202264	15 K ohms, 1/4 watt, 5%
R915	202266	3.3 K ohms, 1/4 watt, 5%
R916	202255	4.7 K ohms, 1/4 watt, 5%
R917	202261	2.2 K ohms, 1/4 watt, 5%
R918	202255	4.7 K ohms, 1/4 watt, 5%
R919	202255	4.7 K ohms, 1/4 watt, 5%
R920	202255	4.7 K ohms, 1/4 watt, 5%
R921	202269	470 ohms, 1/4 watt, 5%
R922	202256	22 K ohms, 1/4 watt, 5%
R923	202255	4.7 K ohms, 1/4 watt, 5%
R924	202269	470 ohms, 1/4 watt, 5%
R925	202299	2.7 K ohms, 1/4 watt, 5%
R926	212200	10 ohms, 1/4 watt, 5%
R927	212200	10 ohms, 1/4 watt, 5%
R928	202262	100 ohms, 1/4 watt, 5%
R929	202262	100 ohms, 1/4 watt, 5%
R930	202262	100 ohms, 1/4 watt, 5%
R931	202262	100 ohms, 1/4 watt, 5%
R932	202252	47 ohms, 1/4 watt, 5%
CAPACITORS		
C901	271244	22 mfd, 16 V.
C902	261267	1 mfd, 35 V.
C903	261250	0.068 mfd, 200 V.
C904		Trim (Fixed)
C905	261267	1 mfd, 35 V.
C906	271248	22 mfd, 15 V.
C907	261267	1 mfd, 35 V.
C908	261259	2.2 mfd, 250 V.
C909	261254	10 mfd, 20 V.
C910	271249	68 mfd, 25 V.
C911	271249	68 mfd, 25 V.
C912	271252	0.1 mfd, 400 V.

(150 HZ)(8kHZ)
CUE DETECTOR BOARD (FAST FORWARD) - PARTS LIST (Continued)

Symbol	Part Number	Description
CAPACITORS (Continued)		
C913	271252	0.1 mfd, 400 V.
C914	261238	50 mfd, 25 V.
DIODES		
CR901	51347	IN4005
CR902	51347	IN4005
CR903	51347	IN4005
CR904	51347	IN4005
CR905	51347	IN4005
CR906	51347	IN4005
CR907	51347	IN4005
CR908	51347	IN4005
CR909	51347	IN4005
TRANSISTORS		
Q901	133661	2N3053
Q902	133664	2N2905
Q903	133661	2N3053
Q904	133661	2N3053
Q905	133664	2N2905
Q906	133661	2N3053
Q907	133666	2N930
RELAYS		
K2	202236	4 PDT, 24 V.
K3	202236	4 PDT, 24 V.
K4	202236	4 PDT, 24 V.
K5	212201	2 PDT, 24 V.
INDUCTORS		
L901	31685	5.00 mH
L902	31684	500 mH



CONTROL BOARD ASSEMBLY
SL-1685

FIG. F/F 4

FIG. F/F-4

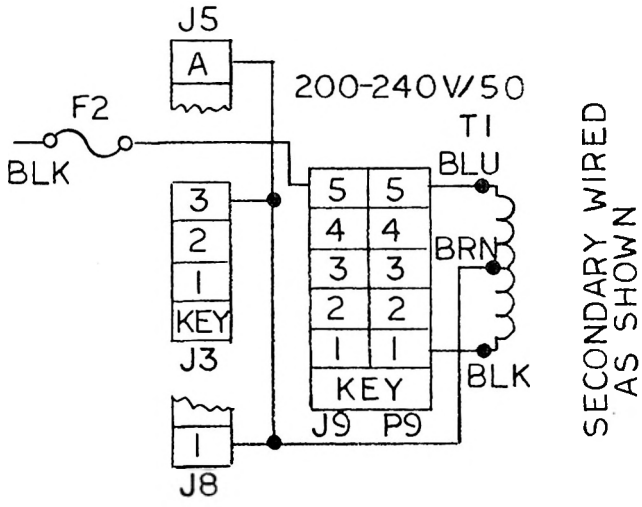
CONTROL (FAST FORWARD) - PARTS LIST

SL-1685

Symbol	Part Number	Description
RESISTORS		
R701	202247	470 ohms, 1/2 watt, 5%
R702	202291	10 K ohms, 1/2 watt, 5%
R703	202294	470 K ohms, 1/2 watt, 5%
R704	202245	2.2 K ohms, 1/2 watt, 5%
R705	202241	100 ohms, 1/2 watt, 5%
R706	202245	2.2 K ohms, 1/2 watt, 5%
R707	202230	620 ohms, 2 watt, 5%
R708	202245	2.2 K ohms, 1/2 watt, 5%
R709	202245	2.2 K ohms, 1/2 watt, 5%
R710	202241	100 ohms, 1/2 watt, 5%
R711	202241	100 ohms, 1/2 watt, 5%
R712	202274	33 K ohms, 1/2 watt, 5%
R713	202293	68 K ohms, 1/2 watt, 5%
R714	202292	33 ohms, 1/2 watt, 5%
R715	202284	220 ohms, 1/2 watt, 5%
R716	202245	2.2 K ohms, 1/2 watt, 5%
R717	202245	2.2 K ohms, 1/2 watt, 5%
R718	202225	1.2 K ohms, 1 watt, 10%
R719	202245	2.2 K ohms, 1/2 watt, 5%
R720	202245	2.2 K ohms, 1/2 watt, 5%
R722	202272	4.7 K ohms, 1/2 watt, 5%
R723	202291	10 K ohms, 1/2 watt, 5%
R724	202253	10 ohms, 1/2 watt, 5%
R725	202253	10 ohms, 1/2 watt, 5%
R726	202245	2.2 K ohms, 1/2 watt, 5%
R727	202291	10 K ohms, 1/2 watt, 5%

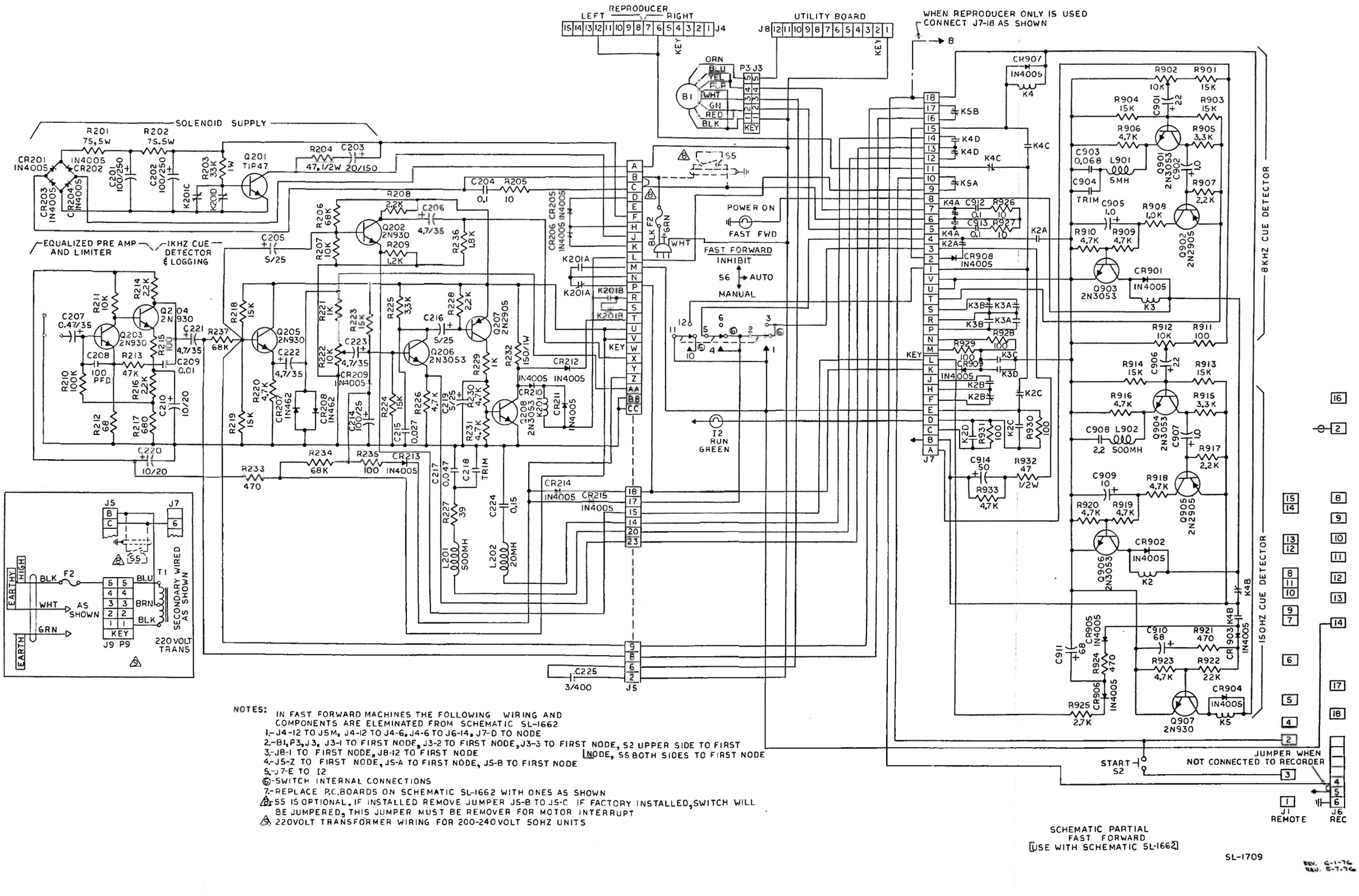
CONTROL (FAST FORWARD) - PARTS LIST (Continued)

Symbol	Part Number	Description
CAPACITORS		
C701	261247	1 mfd, 200 V.
C702	261247	1 mfd, 200 V.
C703	261246	5 mfd, 25 V.
C704	261247	1 mfd, 200 V.
C705	261256	0.47 mfd, 35 V.
C707	261248	0.1 mfd, 200 V.
C708	261263	25 mfd, 25 V.
DIODES		
CR701	51347	IN4005
CR702	51347	IN4005
CR703	51347	IN4005
CR705	51347	IN4005
CR706	51347	IN4005
TRANSISTORS		
Q701	133664	2N2905
Q702	133664	2N2905
Q704	133664	2N2905
Q705	133665	2N4870
Q707	133661	2N3053
Q708	133664	2N2905
Q709	133664	2N2905
SILICON CONTROLLED RECTIFIERS		
Q703	72488	2N5061
Q706	72488	2N5061



WIRING CONNECTIONS
FOR 220 VOLTS

FIG. 11.1



NOTES: IN FAST FORWARD MACHINES THE FOLLOWING WIRING AND COMPONENTS ARE ELEMINATED FROM SCHEMATIC SL-1662

1.-J4-12 TO J5M, J4-12 TO J4-6, J4-6 TO J6-14, J7-D TO NODE
2.-B1, P3, J3, J3-1 TO FIRST NODE, J3-2 TO FIRST NODE, J3-3 TO FIRST NODE, S2 UPPER SIDE TO FIRST NODE, S5 BOTH SIDES TO FIRST NODE
3.-J8-1 TO FIRST NODE, J8-12 TO FIRST NODE
4.-J5-Z TO FIRST NODE, J5-A TO FIRST NODE, J5-B TO FIRST NODE
5.-J7-E TO I2
6.-SWITCH INTERNAL CONNECTIONS
7.-REPLACE P.C.BOARDS ON SCHEMATIC SL-1662 WITH ONES AS SHOWN
⚠5 S5 IS OPTIONAL. IF INSTALLED REMOVE JUMPER J5-B TO J5-C IF FACTORY INSTALLED, SWITCH WILL BE JUMPERED. THIS JUMPER MUST BE REMOVER FOR MOTOR INTERRUPT
⚠4 220VOLT TRANSFORMER WIRING FOR 200-240VOLT SOHZ UNITS

SCHEMATIC PARTIAL
FAST FORWARD
[USE WITH SCHEMATIC SL-1662]

SL-1709

REV. 6-1-76
REV. 6-7-76