

INSTRUCTION MANUAL

MASTER COPY

DURA-TRAK 90 SERIES CARTRIDGE MACHINES

March, 1990

IM No. 597-9100

BROADCAST ELECTRONICS, INC.



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Telex: 25-0142
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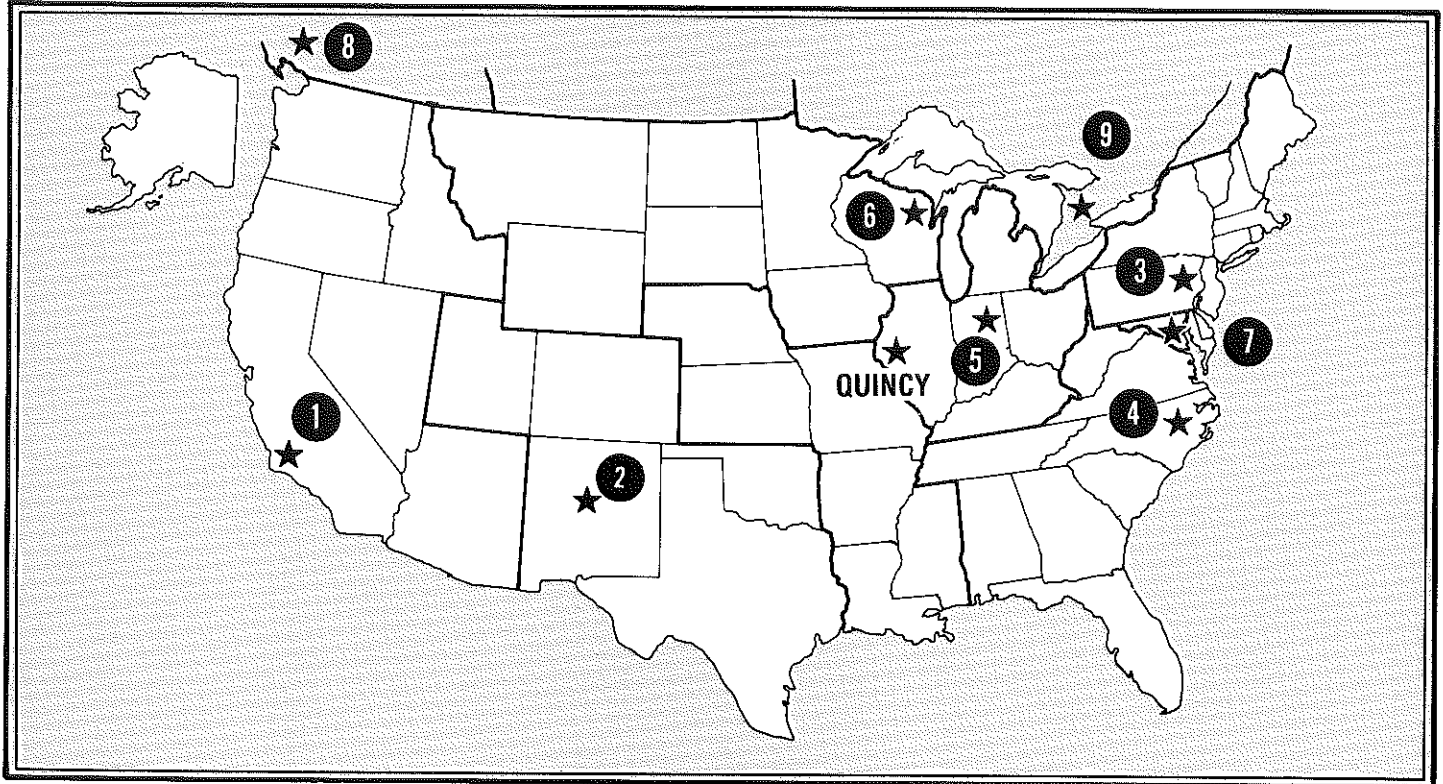
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TECHNICAL MANUAL
BROADCAST ELECTRONICS
DURA-TRAK 90 SERIES
TAPE CARTRIDGE MACHINES
597-9100

GENERAL INFORMATION	1
INSTALLATION	2
OPERATION	3
THEORY OF OPERATION	4
MAINTENANCE	5
PARTS LISTS	6
DRAWINGS	7
APPENDIX	8

TECHNICAL MANUAL
BROADCAST ELECTRONICS, INC.
DURA-TRAK 90 SERIES
CARTRIDGE MACHINES



DT-90 RECORD/PLAYBACK

DT-90 PLAYBACK

<u>MODEL</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
DT-90P	900-9100-000	Single-Deck Monophonic Playback Cartridge Machine with Primary, Secondary, and Tertiary Detection Circuitry. NAB A or AA Cartridge Operation, 117V ac 60 Hz Power Supply.
DT-90RP	900-9101-000	Single-Deck Monophonic Record Playback Cartridge Machine with Primary, Secondary, and Tertiary Detection Circuitry. NAB A or AA Cartridge Operation, 117V ac 60 Hz Power Supply.
DT-90PS	900-9102-000	Single-Deck Stereophonic Playback Cartridge Machine with Primary, Secondary, and Tertiary Detection Circuitry. NAB A or AA Cartridge Operation, 117V ac 60 Hz Power Supply.
DT-90RPS	900-9103-000	Single-Deck Stereophonic Record Playback Cartridge Machine with Primary, Secondary, and Tertiary Detection Circuitry. NAB A or AA Cartridge Operation, 117V ac 60 Hz Power Supply.

TABLE OF CONTENTS

<u>PARAGRAPH</u>		<u>PAGE NO.</u>
SECTION I	GENERAL INFORMATION	
1-1	Introduction	1-1
1-3	Equipment Description	1-1
1-5	Electrical Description	1-1
1-8	Mechanical Description	1-1
1-11	Options and Accessories	1-2
1-13	Equipment Specifications	1-2
SECTION II	INSTALLATION	
2-1	Introduction	2-1
2-3	Unpacking	2-1
2-6	Installation	2-1
2-7	Placement	2-1
2-9	DT-90 Circuit Board Programming	2-2
2-11	Start Lock-Out and Stop Indicator Flasher Operation	2-2
2-12	Automatic Fast Forward Operation	2-2
2-13	Primary Cue Tone Operation	2-2
2-14	EOM Mute Operation	2-2
2-15	Automatic Fast Forward/Record Drop-Out Jumper	2-2
2-16	VU Meter Operation	2-2
2-17	Audio Interfacing	2-4
2-18	Audio Output Connections	2-4
2-19	Record Input Connections	2-4
2-20	Remote Functions	2-4
2-22	Playback Remote Functions	2-4
2-31	Record Remote Functions	2-7
2-35	Automatic Audio Muting	2-7
2-37	Automatic Start Sequencing	2-8
2-39	Sequence	2-8
2-40	Ground Connections	2-10
2-42	AC Power Connection	2-10
2-46	Electrical Adjustments	2-10
2-47	Audio Output Level Adjustment	2-10
2-48	Optional Equipment Installation	2-10
SECTION III	OPERATION	
3-1	Introduction	3-1
3-3	Controls and Indicators	3-1
3-5	Operation	3-1
3-6	Playback Operation	3-1
3-12	Stop Indicator Flashing/Deck Start Lock-Out	3-6
3-14	Manual Fast Forward	3-6
3-15	Automatic Fast Forward	3-6
3-16	Terminating The Fast Forward Mode	3-6

<u>PARAGRAPH</u>		<u>PAGE NO.</u>
3-17	Maintenance Mode Operation	3-6
3-18	Record Operation	3-6
3-19	Preliminary Set-Up	3-6
3-24	Record Level Adjustment	3-7
3-29	Recording Program Material	3-7
3-34	Secondary and Tertiary Cue Tone Recording	3-8
SECTION IV	THEORY OF OPERATION	
4-1	Introduction	4-1
4-3	Functional Description	4-1
4-4	Playback Circuitry	4-1
4-6	Audio Processing Circuits	4-1
4-14	Cue Tone Detection Circuits	4-2
4-23	Start/Stop Logic Circuit	4-7
4-34	Flasher Logic Circuit	4-8
4-39	Fast Forward Logic Circuit	4-9
4-47	Mute Logic Circuit	4-10
4-53	Solenoid and Power Supply Circuits	4-10
4-60	Record Circuitry	4-12
4-62	Record Audio Processing Circuits	4-12
4-68	Metering Circuits	4-13
4-72	Program Bias Circuit	4-13
4-76	Cue Bias Circuit	4-17
4-79	Cue Tone Generator Circuits	4-17
4-84	Record/Primary Cue Tone Logic Circuits	4-18
4-96	Secondary/Tertiary Cue Tone Logic Circuits	4-19
SECTION V	MAINTENANCE	
5-1	Introduction	5-1
5-3	Safety Considerations	5-1
5-5	First Level Maintenance	5-1
5-7	General	5-1
5-9	Electrical	5-1
5-11	Mechanical	5-2
5-14	Second Level Maintenance	5-2
5-17	Mechanical Adjustments	5-2
5-20	Motor Alignment Procedure	5-3
5-30	Pressure Roller Indentation Adjustment	5-6
5-36	Head Adjustments	5-7
5-109	Electrical Adjustments	5-14
5-112	Playback Adjustments	5-15
5-113	Output Level Adjustment	5-15
5-122	Playback Equalization Adjustment	5-17
5-132	Cue Tone Detection Adjustment	5-17
5-142	Record Adjustments	5-18
5-143	Record Equalization	5-18
5-158	Program Bias Level Adjustment	5-19
5-168	Cue Bias Level Adjustment	5-21
5-178	Cue Tone Record Level Adjustments	5-21

<u>PARAGRAPH</u>		<u>PAGE NO.</u>
5-211	Meter Calibration	5-24
5-232	Mechanical Parts Replacement Procedures	5-25
5-235	Pressure Roller Replacement Procedure	5-25
5-241	Head Replacement	5-26
5-250	Motor Replacement	5-27
5-260	Conversion Kit Installation	5-27
5-262	Front-Panel Disassembly	5-27
5-271	Circuit Board Installation	5-28
5-274	Record Head Installation	5-28
5-286	Troubleshooting	5-29
5-290	Component Replacement	5-34
5-296	Integrated Circuits	5-35
 SECTION VI	 PARTS LISTS	
6-1	Introduction	6-1
 SECTION VII	 DRAWINGS	
7-1	Introduction	7-1
 SECTION VIII	 APPENDIX	
8-1	Introduction	8-1

LIST OF TABLES

<u>TABLE NO.</u>	<u>DESCRIPTION</u>	<u>PAGE NO.</u>
1-1	DT-90 Series Cartridge Machine Options and Accessories	1-2
1-2	DT-90 Series Cartridge Machine Specifications	1-4
3-1	Controls and Indicators	3-3
5-1	DT-90 Playback Logic Circuit Board Troubleshooting	5-30
5-2	DT-90 Record Logic Circuit Board Troubleshooting	5-32
6-1	Replaceable Parts Lists	6-1

LIST OF ILLUSTRATIONS

<u>FIGURE NO.</u>	<u>DESCRIPTION</u>	<u>PAGE NO.</u>
2-1	Playback Circuit Board Jumper Programming	2-3
2-2	Record Circuit Board Jumper Programming	2-3
2-3	Playback Remote Control Receptacle Connections	2-5
2-4	Record Remote Control Receptacle Connections	2-6
2-5	Automatic Audio Muting	2-8
2-6	DT-90 Cartridge Machine Start Sequencing	2-9
3-1	DT-90 Controls and Indicators	3-2
4-1	Playback Circuit Board Simplified Schematic	4-3
4-2	Power Supply and Solenoid Circuits	4-11
4-3	Record Circuit Board Simplified Schematic	4-14
5-1	Cartridge Deck Assembly	5-4
5-2	Motor Mounting Screws	5-4
5-3	Motor Alignment	5-5
5-4	Capstan Shaft/Pressure Roller Alignment	5-7
5-5	Head and Tape Guide Adjustments	5-8
5-6	Head Adjustment Controls	5-9
5-7	Height Cartridge Tape Tracking	5-10
5-8	Stereophonic Phase Response Lissajous Patterns	5-13
5-9	Playback Logic Circuit Board Controls	5-16
5-10	Record Logic Circuit Board Controls	5-19
5-11	Tape Head Configurations	5-26

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. Information presented by this section provides a general description of the Broadcast Electronics DT-90 series cartridge machines and lists equipment specifications.

1-3. EQUIPMENT DESCRIPTION.

1-4. The Broadcast Electronics DT-90 series cartridge machines are professional single-deck playback and record/playback units designed for continuous operation. The DT-90 series includes monophonic and stereophonic models equipped with secondary and tertiary cue tone detection circuitry. All models are designed to accept NAB A or AA size cartridges. A wide range of assemblies and accessories provide the flexibility required for any type of installation.

1-5. ELECTRICAL DESCRIPTION.

1-6. All DT-90 cartridge machines are equipped with a plug-in playback logic circuit board. The playback logic circuit board contains the deck control logic, audio amplifier circuitry, and the cue channel detection circuitry. NAB primary (1 kHz), secondary (150 Hz), and tertiary (8 kHz) cue tone detection is standard on all models. An automatic/manual fast forward feature is incorporated into the control logic design for rapid tape advance. The automatic fast forward circuitry can be defeated by a programmable jumper. A complete remote control system is incorporated into the circuitry for external manual control.

1-7. All DT-90 record/playback models are equipped with an additional plug-in record logic circuit board. The record logic circuit board contains the record amplifier and bias circuitry, the record control logic, and the cue tone generator circuitry. The front-panel circuit board contains the LED VU meter display(s) and record control switches.

1-8. MECHANICAL DESCRIPTION.

1-9. The cartridge machine deck is equipped with a cartridge guidance system, an air-damped solenoid, and the Broadcast Electronics PHASE LOK V head assembly. The cartridge guidance system is designed with spring-loaded components to channel and lock a cartridge into the proper play position. An air-damped solenoid provides a rapid response to start commands. The PHASE LOK V head assembly provides the tape heads with a secure and stable environment. The head assembly is designed to permit independent adjustment of the head height/zenith, and head azimuth.

1-10. The DT-90 series cartridge machine also features a direct-drive hysteresis-synchronous motor for precise tape movement. The motor is mounted to the half-inch thick rigid aluminum deck.

1-11. OPTIONS AND ACCESSORIES.

1-12. Refer to Table 1-1 for options and accessories available for the DT-90 series cartridge machines.

1-13. EQUIPMENT SPECIFICATIONS.

1-14. Refer to Table 1-2 for the electrical, mechanical, physical, and environmental specifications of the Broadcast Electronics DT-90 series cartridge machines.

TABLE 1-1. DT-90 SERIES CARTRIDGE MACHINE OPTIONS AND ACCESSORIES
(Sheet 1 of 2)

OPTIONS AND ACCESSORIES	PART NUMBER
<u>CONVERSION KIT OPTIONS</u>	
MODEL DT-90	970-0118
<u>Description:</u> The DT-90 conversion kit will convert a monophonic playback cartridge machine into a record/playback unit.	
MODEL DT-90	970-0119
<u>Description:</u> The DT-90 conversion kit will convert a stereophonic playback cartridge machine into a record/playback unit.	
<u>TELEPHONE ANSWERING EQUIPMENT</u>	
MODEL PC-1 TELEPHONE INTERFACE.	900-0010
<u>Description:</u> The PC-1 telephone interface provides cartridge machine/telephone network communication. The unit answers incoming telephone calls and enables a cartridge machine for the purpose of transmitting a pre-recorded message.	

TABLE 1-1. DT-90 SERIES CARTRIDGE MACHINE OPTIONS AND ACCESSORIES
(Sheet 2 of 2)

OPTIONS AND ACCESSORIES	PART NUMBER
<u>RACK MOUNTING ACCESSORIES</u>	
RACK MOUNT SHELF FOR EIA 19 INCH RACK, 7 INCH HEIGHT.	900-9013
1/3 RACK FILLER PANEL FOR 7 INCH RACK SHELF.	900-9014
SPARE PARTS KIT FOR DT-90 SERIES CARTRIDGE MACHINES.	970-0117
<u>TEST EQUIPMENT</u>	
50-PIN EXTENDER CIRCUIT BOARD AND CABLE ASSEMBLY, DT-90 PLAYBACK OR RECORD/PLAYBACK UNITS.	941-0017
TAPE HEAD AND TAPE GUIDE ALIGNMENT GAUGE KIT.	970-0102
MOTOR ALIGNMENT GAUGE KIT.	970-0103
CARTRIDGE MACHINE TEST TAPES:	
NAB Monophonic Reproduce Alignment Test Tape, 160 nWb/m.	800-1005-001
NAB Stereophonic Reproduce Alignment Test Tape, 160 nWb/m.	800-1005
NAB Cue Tone Calibration Cartridge	800-1095
Cut-Away Tape Alignment Test Cartridge	710-0132
SPLICE-TRAK 90	900-9120-000
<u>Description:</u> The ST-90 provides high speed tape splice detection and tape erasing for A or AA sizes cartridges.	

1

TABLE 1-2. DT-90 SERIES CARTRIDGE MACHINE SPECIFICATIONS
(Sheet 1 of 3)

PARAMETER	SPECIFICATIONS
<u>ELECTRICAL</u>	
MOTOR	Hysteresis-synchronous.
TAPE SPEED	
Standard	7.5 Inches/Second.
Optional	3.75 Inches/Second.
TAPE TRANSPORT SYSTEM STOP TIME	80 msec Maximum at 7.5 Inches/Second Operation.
TAPE TRANSPORT SYSTEM START TIME	120 msec or less with Minimum Damping.
WOW AND FLUTTER	0.12% Maximum DIN. Referenced at 7.5 Inches/Second.
AUDIO OUTPUT IMPEDANCE	75 Ohms, Source Impedance, 600 Ohms, Termination Impedance.
AUDIO OUTPUT LEVEL	-20 dBm to +20 dBm, Continuously Variable.
AUDIO INPUT IMPEDANCE	Greater than 10 k Ohms, Balanced, Floating.
AUDIO INPUT LEVEL	-18 dBm to +20 dBm, Continuously Variable.
DISTORTION	
Record/Playback System	1.5% or Less Total-Harmonic-Distortion. Reference: 1 kHz at 250 nWb/m.
Reproduce Amplifier	0.5% or Less Total-Harmonic-Distortion.
NOISE (See Note)	
Hum and Noise	
Monophonic	-58 dB. Reference: 1 kHz at 250 nWb/m.
Stereophonic	-56 dB. Reference: 1 kHz at 250 nWb/m.
<u>NOTE:</u> Specifications measured using 1975 NAB Standard Equalization.	

TABLE 1-2. DT-90 SERIES CARTRIDGE MACHINE SPECIFICATIONS
(Sheet 2 of 3)

PARAMETER	SPECIFICATIONS
CROSSTALK	-50 dB or greater, Program Channel-to-Program Channel or Program Channel-to-Cue Channel at 1kHz.
FREQUENCY RESPONSE (See Note)	±2 dB, 40 Hz to 16 kHz.
EQUALIZATION	
Standard	1975 NAB.
Optional	I.E.C., CCIR, 1965 NAB.
POWER REQUIREMENTS	
Standard	105V ac to 132V ac, 50/60 Hz.
Optional	210V ac to 264V ac, 50/60 Hz.
CUE TONES	1kHz (Primary), 150 Hz (Secondary), 8 kHz (Tertiary).
<u>MECHANICAL</u>	
NUMBER OF DECKS	One.
CARTRIDGE DECK SIZE	A or AA Size Cartridges.
TRANSPORT TYPE	Direct Drive Capstan.
<u>PHYSICAL</u>	
WEIGHT (Unpacked)	
Playback	18.6 Pounds (8.4 kg).
Record/Playback	18.87 Pounds (8.5 kg).
MOUNTING	
Standard	Desk-Top.
Optional	Rack Mount. 19 Inch (48.3 cm) EIA rack.
<p><u>NOTE:</u> Specifications measured using 1975 NAB Standard Equalization.</p>	

1

TABLE 1-2. DT-90 SERIES CARTRIDGE MACHINE SPECIFICATIONS
(Sheet 3 of 3)

PARAMETER	SPECIFICATIONS
DIMENSIONS	
Height	5.25 Inches (13.3 cm).
Width	5.75 Inches (14.6 cm).
Depth	16.5 Inches (41.9 cm).
<u>ENVIRONMENTAL</u>	
AMBIENT OPERATING TEMPERATURE	32°F to 122°F (0°C to 50°C).
HUMIDITY	95% Maximum. Non-Condensing.

SECTION II INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains the information required for the installation of the Broadcast Electronics DT-90 series cartridge machines.

2-3. UNPACKING.

2-4. The equipment becomes the property of the customer when the equipment is delivered to the carrier. Carefully unpack the cartridge machine. Perform a visual inspection to determine that no apparent damage has been incurred during shipment. All shipping materials should be retained until it is determined that the unit has not been damaged. Claims for damaged equipment must be promptly filed with the carrier or the carrier may not accept the claim.

2-5. The contents of the shipment should be as indicated on the packing list. If the contents are incomplete, or if the unit is damaged electrically or mechanically, notify both the carrier and Broadcast Electronics, Inc.

2-6. INSTALLATION.

2-7. PLACEMENT.

2-8. The standard DT-90 cartridge machine is designed for desk-top placement. However, the unit may be installed in a 19 inch EIA rack assembly if desired. To provide adequate structural support, it is recommended that rack mounted units be installed in a DT-90 rack shelf. Refer to illustration 597-9100-160 in SECTION VII for rack installation information. Install the cartridge machine by observing the following requirements and placing the unit in any convenient location.

- A. Place the cartridge machine within reach of signal and power cables.
- B. Do not place the cartridge machine near heat generating equipment.
- C. To minimize noise, do not place the cartridge machine near equipment generating excessive 50 Hz or 60 Hz radiation.
- D. For rack mounted cartridge machines, allow one inch of rack space above and below the unit for heat dissipation.

WARNING

ENSURE NO PRIMARY POWER IS CONNECTED TO THE UNIT BEFORE PROCEEDING.

2-9. DT-90 CIRCUIT BOARD PROGRAMMING.

2-10. The DT-90 series cartridge machines are designed with programmable operating characteristics to meet any installation requirement. The following text presents DT-90 control and operating parameters. Perform the circuit board programming and connection procedures as required for the desired operating or control parameter.

2-11. START LOCK-OUT AND STOP INDICATOR FLASHER OPERATION. A start lock-out circuit is provided to prevent duplicate on-air cartridge play. Start lock-out operation is initiated when cartridge play is terminated by a primary (1 kHz) stop tone and indicated by the stop indicator flashing at a 1 Hz rate. The playback logic circuit board is shipped from the factory with J213 installed. If start lock-out and stop indicator flasher operation is not desired, refer to Figure 2-1 and program the circuit board as required.

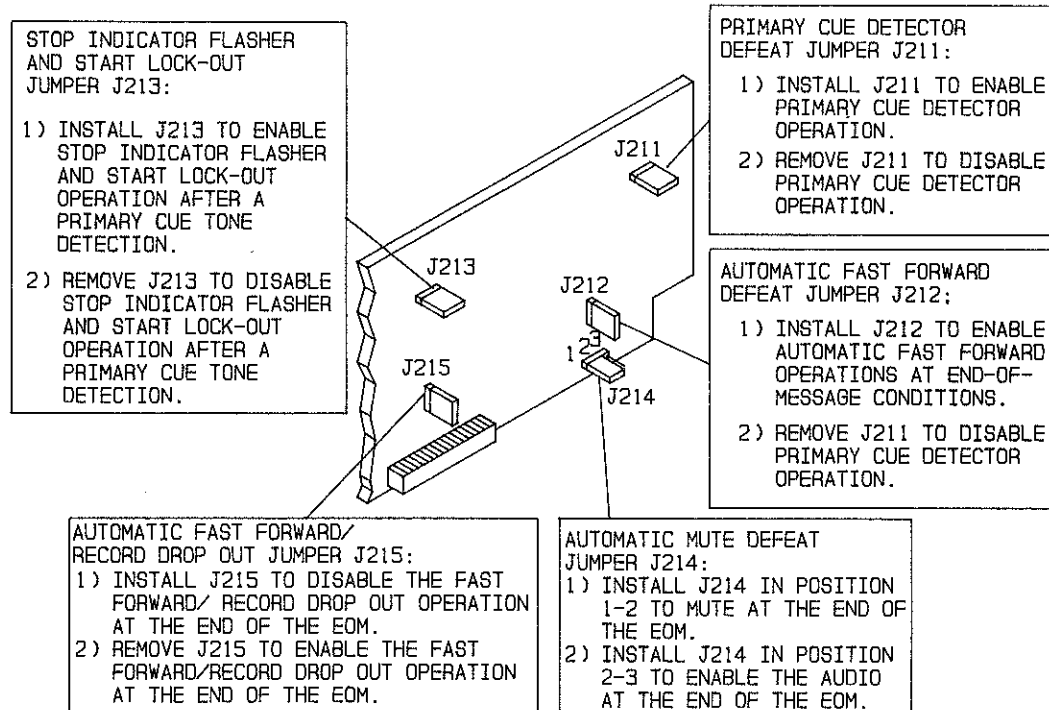
2-12. AUTOMATIC FAST FORWARD OPERATION. Fast forward advance is automatically initiated during EOM operations. The playback logic circuit board is shipped from the factory with J212 installed. If automatic fast forward operation is not desired, refer to Figure 2-1 and program the circuit board as required.

2-13. PRIMARY CUE TONE OPERATION. The primary cue tone detector circuit may be disabled to continuously reproduce program material. The playback logic circuit board is shipped from the factory with J211 installed. If continuous reproduction is desired, refer to Figure 2-1 and program the circuit board as required.

2-14. EOM MUTE OPERATION. Programmable jumper J214 on the playback logic circuit board provides automatic muting at the end of the EOM. The circuit board is shipped from the factory with J214 configured for automatic muting. If automatic muting is not desired, refer to Figure 2-1 and program the circuit board as required.

2-15. AUTOMATIC FAST FORWARD/RECORD DROP-OUT JUMPER. Programmable jumper J215 on the playback logic circuit board provides automatic fast forward/record drop-out at the end of the EOM during a record operation. The circuit board is shipped from the factory with J215 installed. If automatic fast forward/record drop-out is desired, refer to Figure 2-1 and program the circuit board as required.

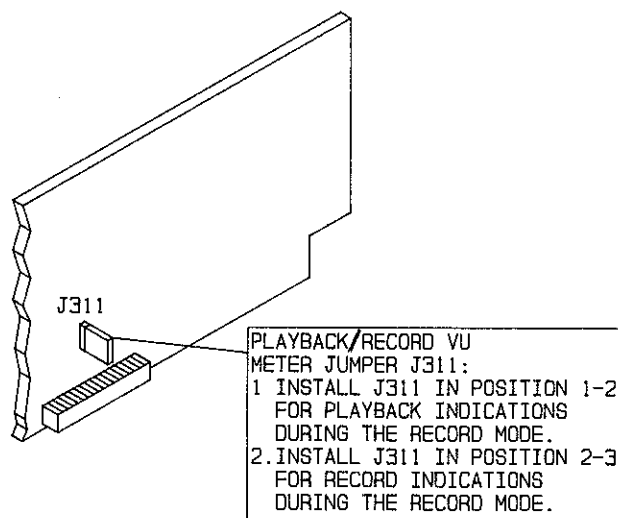
2-16. VU METER OPERATION. Programmable jumper J311 on the record logic circuit board selects playback or record level meter indications during the record mode. The circuit board is shipped from the factory with J311 programmed for playback level indications. If playback level indications are not desired, refer to Figure 2-2 and program the circuit board as required.



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597-9100-1

FIGURE 2-1. PLAYBACK CIRCUIT BOARD JUMPER PROGRAMMING



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597-9100-161

FIGURE 2-2. RECORD CIRCUIT BOARD JUMPER PROGRAMMING

2-17. AUDIO INTERFACING.

2-18. AUDIO OUTPUT CONNECTIONS. D-type playback connector J105 on the rear-panel provides interfacing to external equipment (refer to Figure 2-3). D-type mating receptacles are supplied with the unit for interface cable construction (located in the accessory parts kit). Refer to Figure 2-3 and construct audio output interfacing cables using the mating receptacles and 2-conductor shielded audio cable such as Belden 8451 or equivalent.

2-19. RECORD INPUT CONNECTIONS. D-type record connector J106 on the rear-panel provides interfacing to external equipment (refer to Figure 2-4). D-type mating receptacles are supplied with the unit for interface cable construction (located in the accessory parts kit). Refer to Figure 2-4 and construct record audio input interfacing cables using the mating receptacles and 2-conductor shielded audio cable such as Belden 8451 or equivalent.

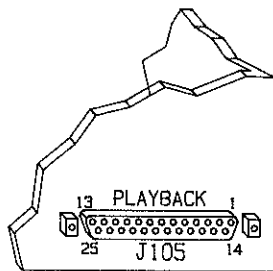
2-20. REMOTE FUNCTIONS.

2-21. The DT-90 series cartridge machines are equipped with playback and record remote control and status systems. Playback remote control and status interfacing is accessible at rear-panel remote connector J105. Record remote control and status interfacing is accessible at rear-panel remote connector J106. Remote mating connectors are supplied with the unit for interface cable construction (located in the accessory parts kit).

2-22. PLAYBACK REMOTE FUNCTIONS. If playback remote functions are desired, refer to Figure 2-3 and the following text to connect remote control and status interfacing circuitry to rear-panel PLAYBACK receptacle J105 as required.

2-23. Start Operation And Indications. Remote start control is accessible at J105 pin 1. A momentary contact to ground is required to initiate a remote start operation. Remote start indications are available at J105 pin 3. The unit will output a logic LOW to indicate a start operation. Attach the appropriate interface circuitry to connector J105 as required.

2-24. Stop Operation And Indications. Remote stop control is accessible at J105 pin 2. A momentary contact to ground is required to initiate a remote stop operation. Remote stop indications are available at J105 pin 4. The unit will output a logic LOW to indicate the termination of deck operation. Attach the appropriate interface circuitry to connector J105 as required.



PLAYBACK
CONNECTOR
J105 PIN NO.

DESCRIPTION

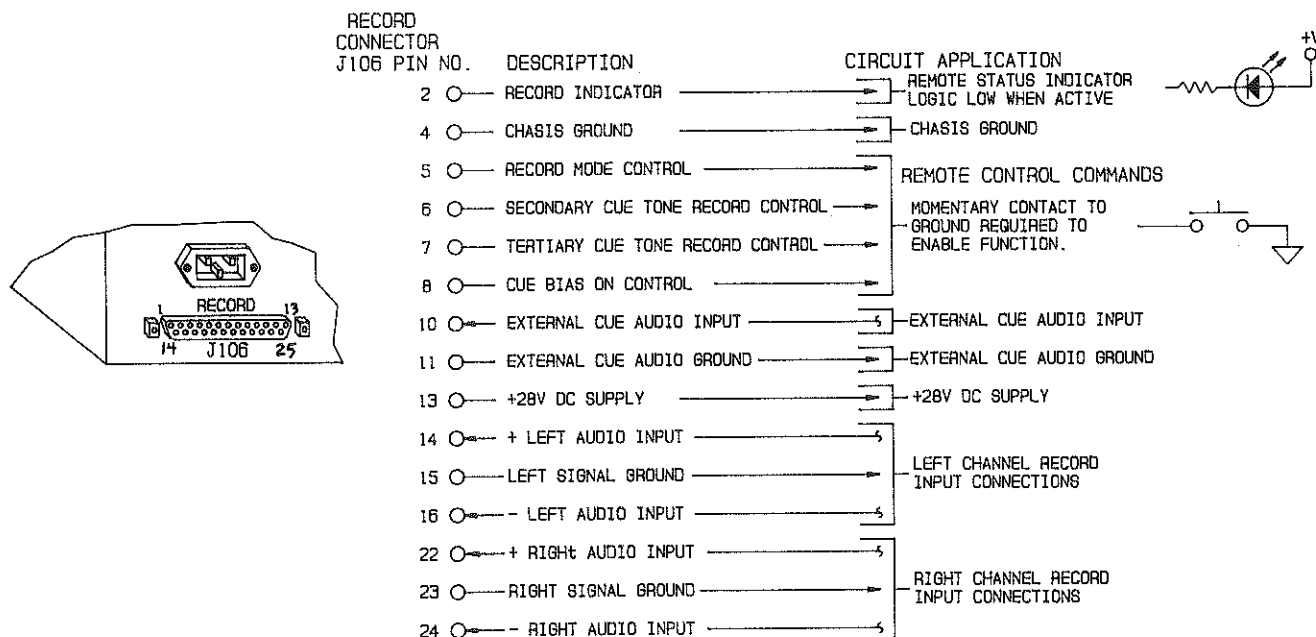
CIRCUIT APPLICATION

		-REMOTE CONTROL COMMANDS-		
1	START COMMAND		MOMENTARY CONTACT TO GROUND REQUIRED TO ACTIVATE FUNCTION.	
2	STOP COMMAND			
3	START INDICATOR		REMOTE STATUS INDICATORS- LOGIC 0 WHEN ACTIVE	
4	STOP INDICATOR			
		-REMOTE CONTROL COMMAND-		
5	AUDIO MUTE COMMAND		MOMENTARY CONTACT TO GROUND REQUIRED TO ACTIVATE FUNCTION.	
6	+ RIGHT AUDIO OUTPUT			
7	RIGHT SIGNAL GROUND		RIGHT CHANNEL AUDIO OUTPUT CONNECTIONS	
8	- RIGHT AUDIO OUTPUT			
9	SECONDARY CUE TONE INDICATOR		REMOTE STATUS INDICATORS- LOGIC 0 WHEN ACTIVE	
10	TERTIARY CUE TONE INDICATOR			
11	+28V dc SUPPLY		+28V dc SUPPLY	
12	TERTIARY CUE TONE CONTACT		CUE TONE RELAY CONNECTIONS- 100V dc AT 0.5 AMPERES MAXIMUM	
13	SECONDARY CUE TONE CONTACT			
14	POWER SUPPLY GROUND		POWER SUPPLY GROUND	
		-REMOTE CONTROL COMMAND-		
15	FAST FORWARD COMMAND		MOMENTARY CONTACT TO GROUND REQUIRED TO ACTIVATE FUNCTION.	
16	FAST FORWARD INDICATOR			
			REMOTE STATUS INDICATOR LOGIC 0 WHEN ACTIVE	
		-AUXILIARY START PULSE OUTPUT-		
17	AUXILIARY START PULSE OUTPUT		A LOW ACTIVE PULSE FOR EXTERNAL START OPERATIONS.	
18	POWER SUPPLY GROUND		POWER SUPPLY GROUND	
19	+ LEFT AUDIO OUTPUT		LEFT CHANNEL AUDIO OUTPUT CONNECTIONS	
20	LEFT SIGNAL GROUND			
21	- LEFT AUDIO OUTPUT			
22	CUE AUDIO OUTPUT		CUE AUDIO OUTPUT CONNECTIONS	
23	CUE AUDIO GROUND			
24	TERTIARY CUE TONE RELAY CONTACT		CUE TONE RELAY CONNECTIONS- 100V dc AT 0.5 AMPERES MAXIMUM	
25	SECONDARY CUE TONE RELAY CONTACT			

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597-9100-2

FIGURE 2-3. PLAYBACK REMOTE CONTROL RECEPTACLE CONNECTIONS



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597-9100-3

FIGURE 2-4. RECORD REMOTE CONTROL RECEPTACLE CONNECTIONS

2-25. Audio Mute Operation. Remote audio muting is accessible at J105 pin 5. A momentary contact to ground is required to initiate an audio mute operation.

2-26. Secondary Cue Tone Relay Contacts And Indications. Secondary cue tone relay contacts are accessible at J105 pins 13 and 25 for control of external equipment. The relay contacts are rated for 100V dc at 0.5 amperes maximum. Remote secondary cue tone indications are available at J105 pin 9. The unit will output a logic LOW to indicate a secondary cue tone detection. Attach the appropriate interface circuitry to connector J105 as required.

2-27. Tertiary Cue Tone Relay Contacts And Indications. Tertiary cue tone relay contacts are accessible at J105 pins 12 and 24 for control of external equipment. The relay contacts are rated for 100V dc at 0.5 amperes maximum. Remote tertiary cue tone indications are available at J105 pin 10. The unit will output a logic LOW to indicate a tertiary cue tone detection. Attach the appropriate interface circuitry to connector J105 as required.

2-28. Fast Forward Operation And Indications. Remote fast forward control is accessible at remote connector J105 pin 15. A momentary contact to ground is required to initiate a fast forward operation. Remote fast forward indications are available at J105 pin 16. The unit will output a logic LOW to indicate a fast forward operation. Attach the appropriate interface circuitry to connector J105 as required.

2-29. Auxiliary Start Pulse Output. An auxiliary start pulse is accessible at J105 pin 17 for control of external equipment. The unit will output a logic LOW for external start applications.

2-30. Cue Audio Output. Cue audio is accessible at J105 pins 22 and 23 for remote monitoring applications. Attach the appropriate interface circuitry to connector J105 as required.

2-31. RECORD REMOTE FUNCTIONS. If record remote functions are desired, refer to Figure 2-4 and the following text to connect remote control and status interfacing circuitry to rear-panel RECORD receptacle J106 as required.

2-32. Record Control and Indications. Remote record mode control is accessible at J106 pin 5. A momentary contact to ground is required to initiate a remote record operation. Remote record indications are available at J106 pin 2. The unit will output a logic LOW to indicate a record mode operation. Attach the appropriate interface circuitry to connector J106 as required.

2-33. Secondary and Tertiary Cue Tone Record Control. Secondary and tertiary cue tone remote record control is accessible at remote connector J106. A momentary contact to ground is required to initiate a remote record operation. Attach the appropriate interface circuitry to connector J106 as required. The following list presents secondary and tertiary cue tone record control pin locations.

<u>RECORD CONNECTOR J106 PIN NO.</u>	<u>DESCRIPTION</u>
6	Secondary Cue Tone Record Control
7	Tertiary Cue Tone Record Control

2-34. External Cue Record. An external cue tone record feature is incorporated into the remote control circuit design. The external cue record circuit includes an external cue control and a cue tone audio input. If external cue record operations are desired, connect a momentary contact to ground switch to the cue bias on terminal at J106 pin 8. Connect the external cue audio to J106 pin 10.

2-35. AUTOMATIC AUDIO MUTING.

2-36. An automatic audio muting feature is incorporated into the DT-90 control circuit design. The feature will automatically mute associated cartridge machines without the assistance of an audio switcher in multiple unit installations. Audio will be muted in all cartridge machines with the exception of the on-air unit. If automatic audio muting is desired, refer to Figure 2-5 and connect the units as shown.

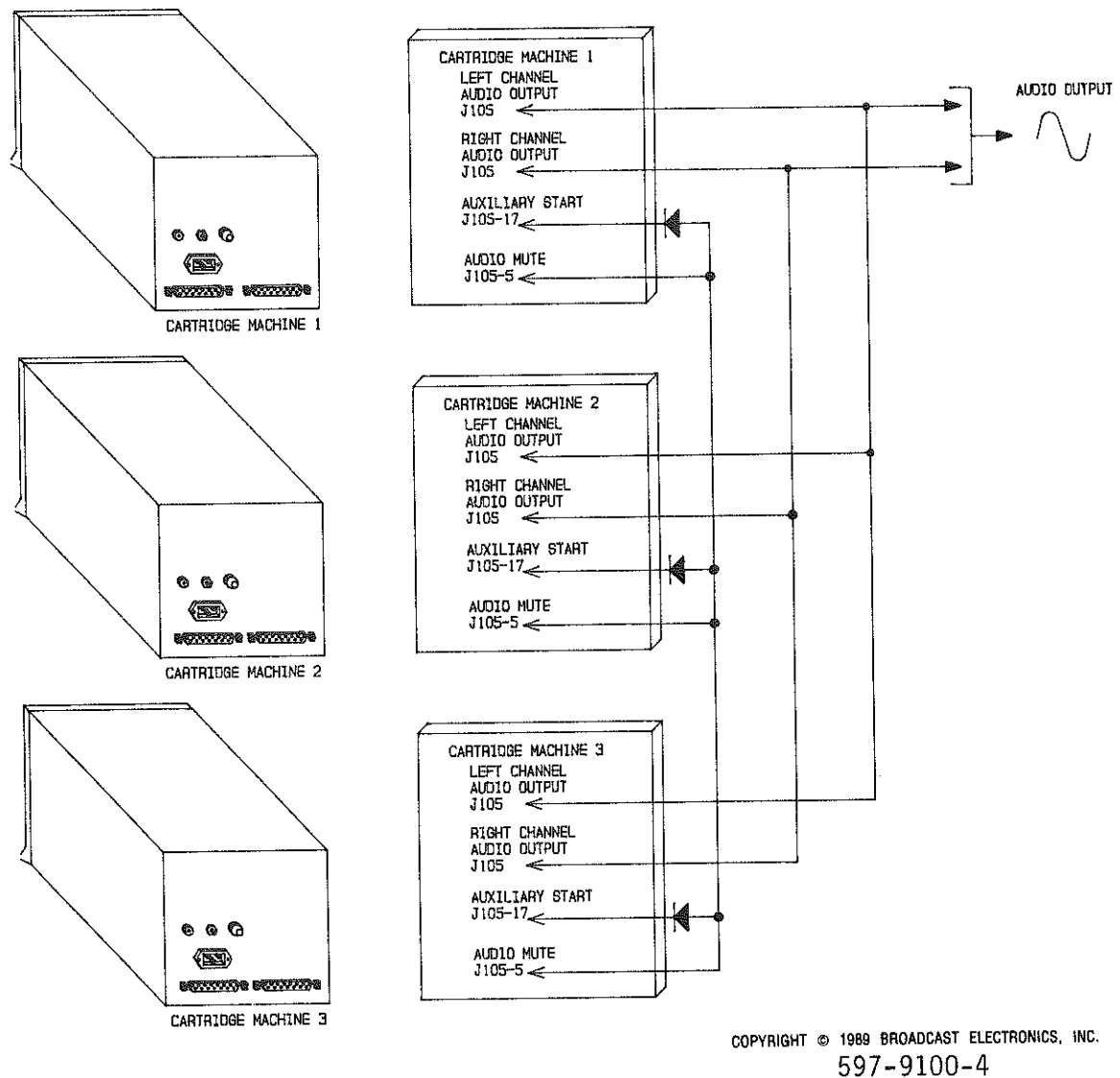


FIGURE 2-5. AUTOMATIC AUDIO MUTING

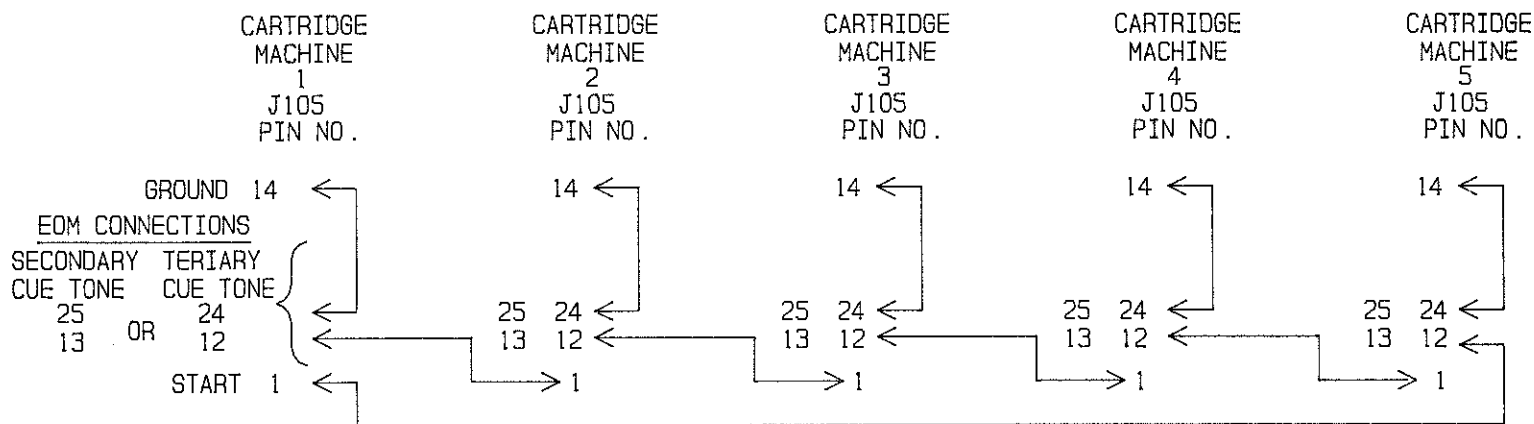
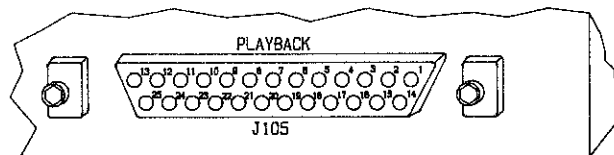
2-37. AUTOMATIC START SEQUENCING.

2-38. All DT-90 cartridge machines may be configured for automatic start sequencing. The following text presents wiring procedures for a typical start sequence. However, the sequence may be modified as required to achieve any start sequence.

2-39. SEQUENCE. Figure 2-6 presents wiring connections for a start sequence described in the following text. Refer to Figure 2-6 and connect the units as shown.

START SEQUENCE

- A. Cartridge machine 1 will start cartridge machine 2.
- B. Cartridge machine 2 will start cartridge machine 3.
- C. Cartridge machine 3 will start cartridge machine 4.
- D. Cartridge machine 4 will start cartridge machine 5.
- E. Cartridge machine 5 will start cartridge machine 1.



START SEQUENCE

1. CARTRIDGE MACHINE 1 WILL START CARTRIDGE MACHINE 2.
2. CARTRIDGE MACHINE 2 WILL START CARTRIDGE MACHINE 3.
3. CARTRIDGE MACHINE 3 WILL START CARTRIDGE MACHINE 4.
4. CARTRIDGE MACHINE 4 WILL START CARTRIDGE MACHINE 5.
5. CARTRIDGE MACHINE 5 WILL START CARTRIDGE MACHINE 1.

NOTE:

1. THE START SEQUENCE MAY BE MODIFIED TO ACHIEVE ANY START SEQUENCE REQUIREMENT.
2. FOR SECONDARY CUE TONE EOM ASSIGNMENTS, CONNECT JUMPERS TO PINS 25 AND 13. FOR TERTIARY CUE TONE EOM ASSIGNMENTS, CONNECT JUMPERS TO PINS 24 AND 12.

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597-9100-5

FIGURE 2-6. DT-90 CARTRIDGE MACHINE START SEQUENCING

2-40. GROUND CONNECTIONS.

2-41. An important consideration in assuring low noise performance from the cartridge machine is the grounding and shielding of the various audio interconnections. First, ensure the cartridge machine circuit ground and any required internal ground terminal is connected to an earth ground using a braided or solid copper conductor. Second, the shields from audio conductors must be grounded to prevent the coupling of extraneous noise. Generally, the shields are grounded at the studio audio console. However, the shields may require grounding at the cartridge machine or at a point between the cartridge machine and the studio audio console. Particular care must be exercised to avoid ground loops at patch panels, external switching equipment, uninsulated jacks on associated equipment, and grounded racks or cabinets.

2-42. AC POWER CONNECTION.

WARNING

ENSURE ALL PRIMARY POWER IS DISCONNECTED
BEFORE PROCEEDING.

2-43. Terminal strip TB1 on the inside rear-panel of the DT-90 is wired for the proper power supply voltage when shipped from the factory. The operating voltage requirement for the unit is indicated on the cartridge machine identification plate which is located on the cartridge machine side-panel. If an alternate operating voltage is desired, refer to schematic SD900-9100-000 in SECTION VII, DRAWINGS and connect TB1 as required.

2-44. Remove the fuse from the rear-panel fuse-holder. For playback and record/playback units, ensure the fuse is a slow-blow type rated at 1.0A for 105V to 132V operation or 0.5A for 210V to 264V operation.

2-45. Ensure the rear-panel power switch is operated to OFF and connect the cartridge machine line cord to the appropriate power source.

2-46. ELECTRICAL ADJUSTMENTS.

2-47. AUDIO OUTPUT LEVEL ADJUSTMENT. The cartridge machine audio output level is factory adjusted to 0 dBm. If an alternate output level is required, refer to the ELECTRICAL ADJUSTMENTS procedures in SECTION V, MAINTENANCE and perform the OUTPUT LEVEL ADJUSTMENT procedure.

2-48. OPTIONAL EQUIPMENT INSTALLATION.

2-49. The following list presents related publications which provide data required for the installation of options and accessories associated with the DT-90 series cartridge machines.

<u>OPTION OR ACCESSORY</u>	<u>PUBLICATION NUMBER</u>
Model PC-1 Telephone Interface	597-0047

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. This section identifies all controls and indicators associated with the DT-90 series cartridge machines and provides standard operating procedures.

3-3. CONTROLS AND INDICATORS.

3-4. Refer to Figure 3-1 for the location of all controls and indicators associated with the unit. The function of each control or indicator is described in Table 3-1.

3-5. OPERATION.

NOTE THE FOLLOWING PROCEDURE ASSUMES THAT THE CARTRIDGE MACHINE IS COMPLETELY INSTALLED AND IS FREE OF ANY DISCREPANCIES.

NOTE

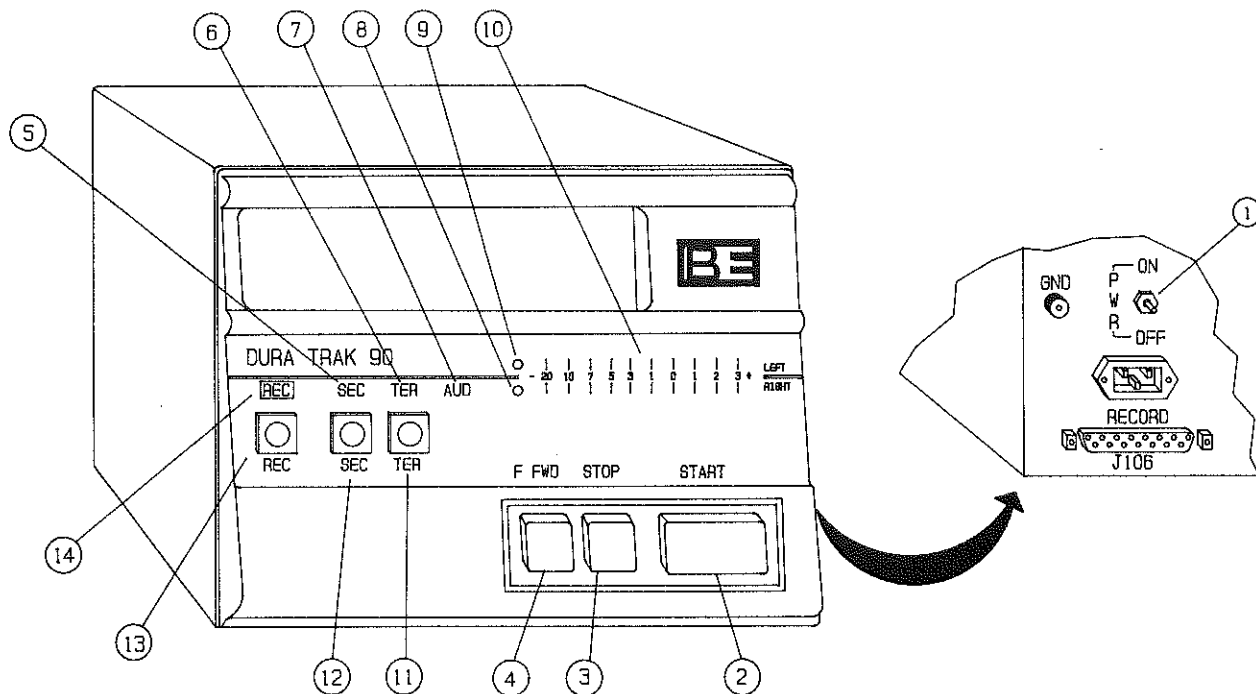
3-6. PLAYBACK OPERATION.

3-7. Operate the rear-panel PWR ON/OFF switch to the ON position. The capstan motor will operate.

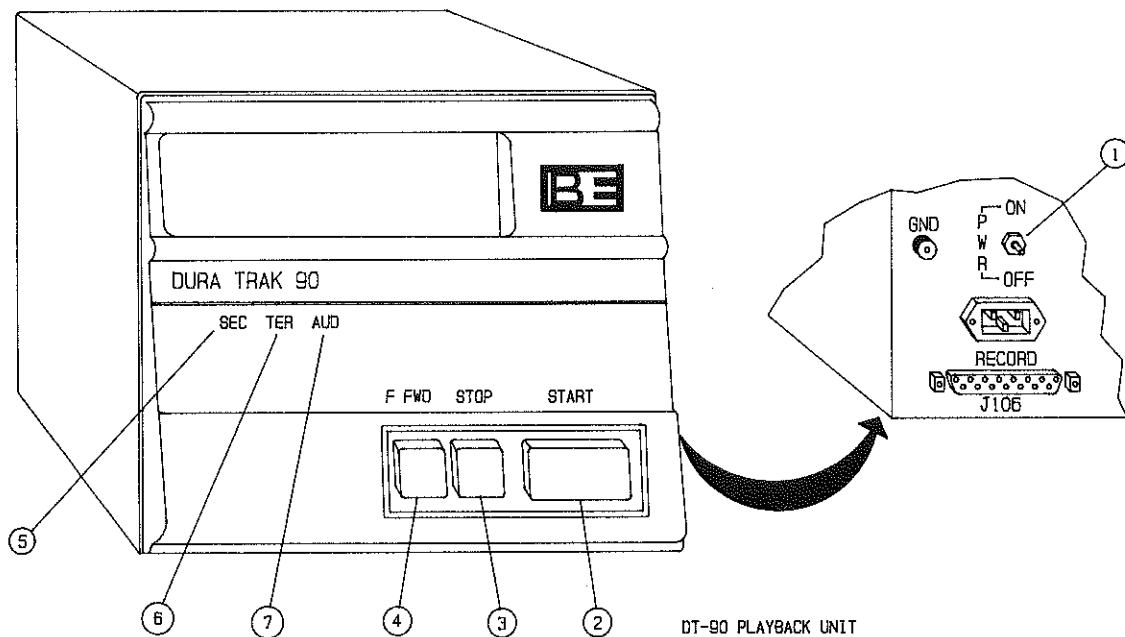
3-8. Insert an NAB A or AA size tape cartridge into the deck. The deck STOP switch/indicator will illuminate.

3-9. Depress the deck START switch/indicator to begin cartridge play operation. When the START switch/indicator is depressed, the following events will occur:

- A. The deck START switch/indicator will illuminate.
- B. The deck STOP switch/indicator will extinguish.
- C. The AUD indicator will illuminate.
- D. On record/playback models, the VU meter display will begin operation.



DT-90 RECORD/PLAYBACK UNIT



DT-90 PLAYBACK UNIT

• STEREOPHONIC MODELS ONLY
* OPTIONAL

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597-9100-6

FIGURE 3-1. DT-90 CONTROLS AND INDICATORS

TABLE 3-1. CONTROLS AND INDICATORS
(Sheet 1 of 3)

INDEX NO.	NOMENCLATURE	FUNCTION
1	Power Switch	Controls the application of ac power to the unit.
2	START Switch/ Indicator	<p>SWITCH:</p> <ul style="list-style-type: none"> A. Initiates tape movement for playback and/or record operations. B. When momentarily depressed during fast forward operation, returns the unit to the normal operating speed and audio is enabled. C. Initiates maintenance mode operation when simultaneously operated with the STOP switch/indicator. The solenoid will remain energized until the STOP switch/indicator is again depressed. <p>INDICATOR: Illuminates to indicate deck operation.</p>
3	STOP Switch/ Indicator	<p>SWITCH:</p> <ul style="list-style-type: none"> A. Terminates deck operation. B. Initiates maintenance mode operation when simultaneously operated with the START switch/indicator. The solenoid will remain energized until the STOP switch/indicator is again depressed. C. Resets start lock-out conditions. D. Resets stop indicator flashing conditions. <p>INDICATOR:</p> <ul style="list-style-type: none"> A. Illuminates to indicate the unit is in the ready mode (unit energized with a cartridge completely inserted into the deck). B. Flashes once per second to indicate a cartridge played condition.

TABLE 3-1. CONTROLS AND INDICATORS
(Sheet 2 of 3)

INDEX NO.	NOMENCLATURE	FUNCTION
4	F FWD Switch/	<p>SWITCH: When depressed, initiates fast forward operation. Tape advances at three times the normal speed until a 1 kHz stop tone is detected or the STOP switch/indicator is depressed. Audio is muted when the switch is released.</p> <p>INDICATOR: Illuminates to indicate the unit is in the fast forward mode.</p>
5	SEC Indicator	Illuminates to indicate a secondary (150 Hz) cue tone detection.
6	TER Indicator	Illuminates to indicate a tertiary (8 kHz) cue tone detection.
7	AUD Indicator	Illuminates to indicate audio is enabled.
8	Right Record Input Level Control	Adjusts the right channel record input level.
9	Left Record Input Level Control	Adjusts the left channel record input level.
10	VU Meter Display	A stereophonic multi-color LED display containing VU meter ballistics. Normal display operation provides level indications of record input audio and playback audio.
11	TER Switch	Records an 8 kHz tertiary cue tone on the cue channel for the duration of switch operation. The tertiary cue tone may be recorded when the unit is operating in the playback or record modes.
12	SEC Switch	Records a 150 Hz secondary cue tone on the cue channel for the duration of switch operation. The secondary cue tone may be recorded when the unit is operating in the playback or record modes.

TABLE 3-1. CONTROLS AND INDICATORS
(Sheet 3 of 3)

INDEX NO.	NOMENCLATURE	FUNCTION
13	REC Switch	<p>A. Configures the unit to the record mode with 1 kHz primary cue tone record operation when depressed once.</p> <p>B. Configures the unit to the record mode without 1 kHz primary cue tone record operation when depressed twice.</p>
14	REC Indicator	<p>A. Illuminates to indicate the unit is configured to the record mode with 1 kHz primary cue tone record operation.</p> <p>B. Flashes to indicate the unit is configured to the record mode without 1 kHz primary cue tone record operation.</p>

3-10. The deck will operate until a primary (1 kHz) stop tone is detected or the deck STOP switch/indicator is depressed. When deck operation is terminated, the following events will occur:

- A. The START switch/indicator will extinguish.
- B. The AUD indicator will extinguish.
- C. On record/playback models, the VU meter display will terminate operation.
- D. The STOP switch/indicator will illuminate or flash.

3-11. The DT-90 cartridge machines are equipped with secondary and tertiary cue tone detection indication circuitry. Cue tone detection is indicated as follows:

- A. The SEC indicator will illuminate to indicate the detection of a secondary (150 Hz) cue tone.
- B. The TER indicator will illuminate to indicate the detection of a tertiary (8 kHz) cue tone.

3-12. STOP INDICATOR FLASHING/DECK START LOCK-OUT. The STOP indicator circuitry is designed to indicate a special operating condition. If the function is enabled, the STOP indicator will flash once per second to indicate a cartridge played and start lock-out condition to prevent duplicate on-air cartridge play.

3-13. To reset the STOP indicator flashing and start lock-out circuitry, remove the cartridge or depress the STOP switch/indicator.

3-14. MANUAL FAST FORWARD. The manual fast forward feature may be operated with the muting circuit enabled or disabled. To operate the unit in the manual fast forward mode with audio muted, momentarily depress the front-panel F FWD switch/indicator. To operate the unit in the manual fast forward mode with audio enabled, continuously depress the F FWD switch/indicator. The F FWD switch/indicator will illuminate to indicate the fast forward mode.

3-15. AUTOMATIC FAST FORWARD. To operate the unit in the automatic fast forward mode, the appropriate circuitry on the playback logic circuit board must be enabled. Insert the cartridge into the deck and initiate playback operation. When the end of the EOM is detected, the unit will operate to fast forward advance with audio muted. The F FWD switch/indicator will illuminate to indicate the fast forward mode.

3-16. TERMINATING THE FAST FORWARD MODE. When initiated, the fast forward mode will continue until a stop tone is detected, the STOP switch/indicator is depressed, or the START switch/indicator is depressed. If the STOP switch/indicator is depressed or a stop tone is detected, the STOP switch/indicator will illuminate or flash. If the START switch/indicator is depressed, the unit will return to the playback mode.

3-17. MAINTENANCE MODE OPERATION. All DT-90 cartridge machines are equipped with a maintenance mode feature which energizes the solenoid to allow routine pressure roller and capstan shaft cleaning. To generate a maintenance mode command, remove any tape cartridge and simultaneously depress the START and STOP switch/indicators and release the STOP switch/indicator prior to the START switch/indicator.

3-18. RECORD OPERATION.

3-19. PRELIMINARY SET-UP. Select the program material to be recorded. Ensure the playback system output level is within the input level specifications.

3-20. Operate the rear-panel PWR ON/OFF switch to the ON position.

3-21. Select a bulk erased cartridge that is approximately 2 seconds longer than the selected material to be recorded.

3-22. Insert the cartridge into the deck. The STOP switch/indicator will illuminate.

3-23. Depress the START switch/indicator and play the tape for several seconds to align the tape in the guides and to locate the tape splice. Stop the deck just beyond the tape splice to avoid recording over the splice.

3-24. RECORD LEVEL ADJUSTMENT. To adjust the record level, proceed as follows:

3-25. Ensure the bulk erased cartridge is inserted into the deck.

NOTE THE CARTRIDGE MACHINE WILL NOT OPERATE TO THE
NOTE RECORD MODE UNLESS A CARTRIDGE IS INSERTED IN
THE DECK.

NOTE THE CARTRIDGE MACHINE RECORD CIRCUITRY IS SHIP-
NOTE PED FROM THE FACTORY FOR A RECORD LEVEL OF 0
dBm WHEN THE VU METERS INDICATE 0 VU.

3-26. Operate the cartridge machine to the record mode by depressing the REC switch. The REC indicator will illuminate.

3-27. Start the program material and adjust the record level control(s) until the VU meter(s) indicate 0 VU.

3-28. Stop and re-cue the program material and the bulk erased cartridge.

3-29. RECORDING PROGRAM MATERIAL. Program material can be recorded with or without a 1 kHz primary cue tone record operation. To select a record operation with a primary cue tone, operate the REC switch to illuminate the REC indicator. To select a record operation without a primary cue tone, depress the REC switch again. The REC indicator will flash.

3-30. Depress the deck START switch/indicator. The START switch/indicator and AUD indicator will illuminate.

3-31. Wait approximately one-half second, then start the program material. If the REC indicator is illuminated, a stop tone will be automatically recorded on the cue channel. The VU meter(s) will indicate record input audio.

NOTE THE RECORDING PROCESS MAY BE MONITORED IF
NOTE DESIRED BY CONNECTING A SPEAKER SYSTEM TO
THE PLAYBACK DECK OUTPUT.

3-32. At the end of the record operation, deck operation will terminate automatically when a 1 kHz cue tone is detected. To terminate deck operation manually, depress the STOP switch/indicator.

3-33. When deck operation is terminated, the following events will occur:

- A. The START switch/indicator will extinguish.
- B. The REC indicator will extinguish.
- C. The Aud indicator will extinguish.
- D. The STOP switch/indicator will illuminate or flash.
- E. The unit will be automatically operated to the playback mode.

3-34. SECONDARY AND TERTIARY CUE TONE RECORDING. Secondary and tertiary cue tones may be recorded in the playback or record modes of operation. If secondary and tertiary cue tone recording is desired, proceed as follows:

<u>NOTE</u>	DO NOT RECORD SECONDARY OR TERTIARY CUE TONES
	WITHIN THE FIRST 2.5 SECONDS OF THE PROGRAM
<u>NOTE</u>	MATERIAL.

3-35. Start the recording system in the playback mode or record mode of operation. Depress the SEC or TER switch for the amount of time the tone is desired.

SECTION IV

THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. This section presents the theory of operation for the Broadcast Electronics DT-90 cartridge machines.

4-3. FUNCTIONAL DESCRIPTION.

4-4. PLAYBACK CIRCUITRY.

4-5. Figure 4-1 presents a simplified schematic diagram of the playback logic circuit board. Refer to Figure 4-1 as required for a description of the following circuits.

- A. Audio Processing Circuits
- B. Cue Tone Detection Circuits
- C. Start/Stop Logic Circuit
- D. Flasher Logic Circuit
- E. Fast Forward Logic Circuit
- F. Mute Logic Circuit

4-6. AUDIO PROCESSING CIRCUITS. Stereophonic units are equipped with left and right channel audio circuits. Monophonic units are equipped with only the left channel audio circuit. The left and right channel audio circuits are identical; therefore, only the left channel circuit will be discussed.

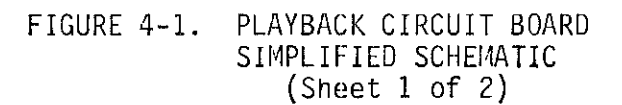
4-7. Audio Input Circuit. Left channel audio from the tape head is applied to operational amplifier U1B. U1B operates as an audio amplifier and equalization stage with a gain of approximately 50 dB. Potentiometer R4 provides ± 10 dB of high frequency equalization. Potentiometer R9 provides ± 6 dB of low frequency equalization. The output of U1B is routed to an audio/mute selector.

4-8. On record/playback models, the output of inverter U1B is routed to the record logic circuit board for metering applications.

4-9. Audio/Mute Selector Operation. Integrated circuit U20 will select one of the following modes of operation as determined by the mute control and fast forward control signals. U20 operates in the playback audio mode when both control signals are logic LOW. The left channel audio output of U20 is applied to mute switch Q1.

- A. Playback audio.
- B. Fast forward audio.
- C. Muted audio.

- 4-10. Left mute switch Q1 is a series field-effect-transistor. When audio muting is required, a HIGH from the mute control line is applied to Q1 which will bias Q1 off to mute the audio signal.
- 4-11. Output Amplifier Circuit. Audio from the mute switch is applied to amplifier U1A. Potentiometer R19 provides left channel output level adjustment. The output of U1A is applied to the left channel output amplifier network consisting of inverter U3A and amplifier stages U4A/B and U3B.
- 4-12. Audio from U1A is routed through inverter U3A and applied to the amplifier stage in an inverted and non-inverted format. Inverted audio is applied to amplifier stage U4A. Non-inverted audio is applied to amplifier U4B. Together, U4A and U4B operate as a balanced audio output amplifier with a gain of two. Amplifier U3B functions as a monitoring and gain stage for a shorted audio output condition.
- 4-13. When the audio output impedance is balanced, the input to U3B is at virtual ground which isolates the stage from the circuit. When either the positive or negative output terminal is grounded, an audio signal will be applied to U3B. U3B will output a signal to increase the gain of the remaining output amplifier network. Consequently, the network will maintain full output into an unbalanced load condition.
- 4-14. CUE TONE DETECTION CIRCUITS. The cue tone detection circuits consist of: 1) a cue input amplifier circuit, 2) cue tone filter circuits, and 3) individual cue tone detector circuits.
- 4-15. Cue Input Amplifier Circuit. Cue audio information from the tape head is applied to an input amplifier circuit consisting of U7A and U7B which provides approximately 30 dB of gain. The output of the amplifier circuit is routed to a rear-panel connector for external applications. Cue audio is also applied to the cue tone filter circuits.
- 4-16. Cue Tone Filter Circuits. The cue tone filters consist of integrated circuits U8A, U8B, U9A, and U9B which operate as active band-pass filters. These filters will convert valid cue information into dc levels for application to individual detector circuits.
- 4-17. Primary Detector Circuit. The primary cue tone output from the filter circuit is routed to comparator U10C through 1 kHz level control R78. When the output from the filter exceeds the reference level at U10C, the output of U10C will go HIGH. This HIGH is inverted by U19D for application to the primary cue tone detection bus.
- 4-18. 3 KHZ Detector Circuit. The 1 kHz primary cue tone will be detected at 3 kHz when the unit is operated in the fast forward mode. A HIGH applied to the fast forward control line will: 1) inhibit the primary, secondary, and tertiary cue tone detector circuits, and 2) operate the audio/mute selector to enable the input of comparator U10A.



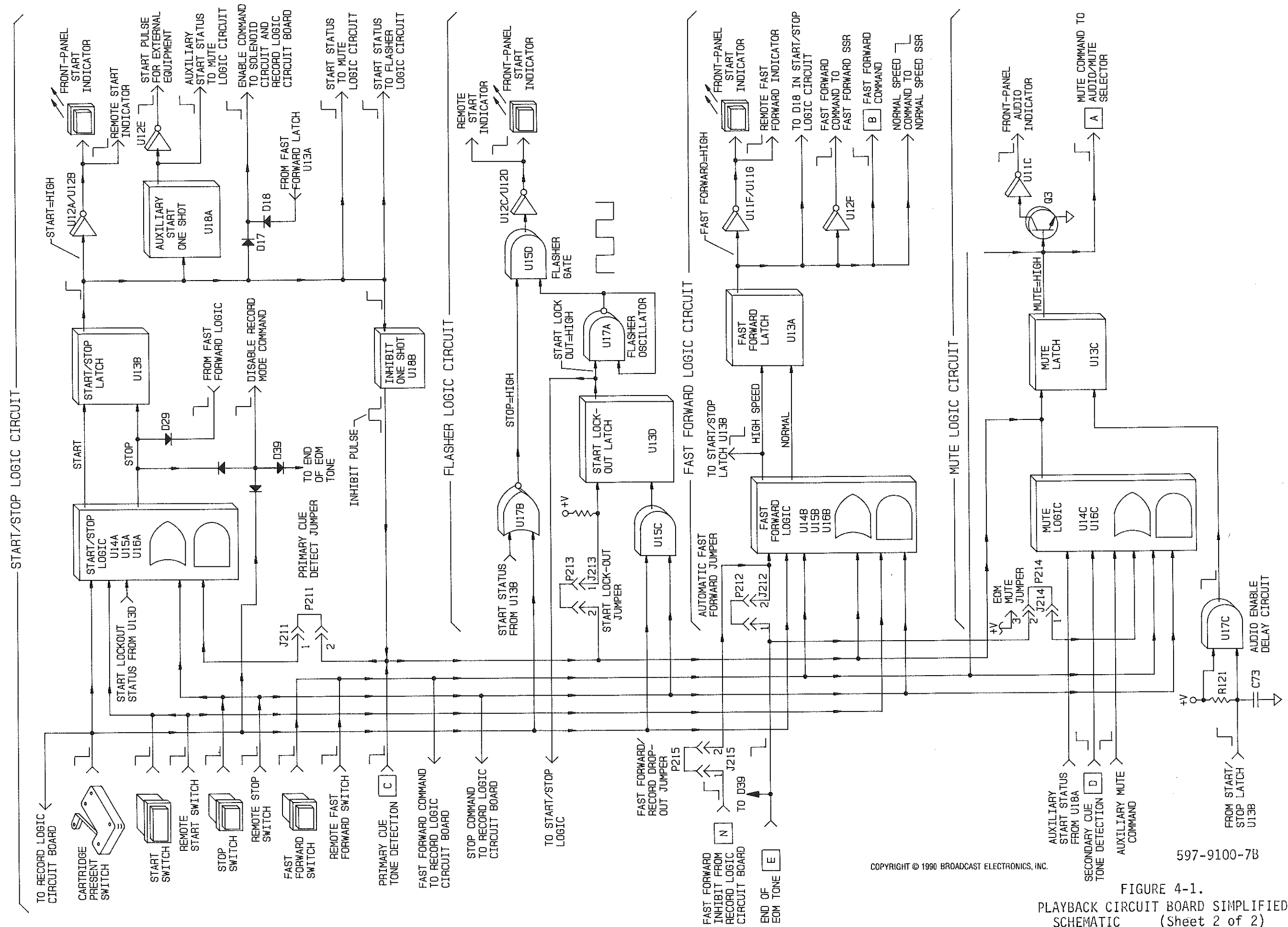


FIGURE 4-1.
PLAYBACK CIRCUIT BOARD SIMPLIFIED
SCHEMATIC (Sheet 2 of 2)

4-19. When the 3 kHz cue tone output from the filter circuit exceeds the reference level at comparator U10A, the output of U10A will go HIGH. This HIGH is inverted by U19A for application to the primary cue tone detection bus.

4-20. Secondary Detector Circuit. The secondary cue tone output from the filter circuit is routed to comparator U10B through 150 Hz level control R66. When the output from the filter exceeds the reference level at U10B, the output of U10B will go HIGH. This HIGH is inverted by U11A/U11B to energize secondary relay K1, and illuminate the front-panel and remote indicators.

4-21. The HIGH from comparator U10B is also applied to the secondary cue tone detection bus, and end-of-tone detector U19B/C. The end-of-tone detector provides a momentary LOW for application to the END of EOM tone bus.

4-22. Tertiary Detector Circuit. The operation of the tertiary detector circuit and secondary detector circuit is identical with the exception of an end-of-tone detector circuit.

4-23. START/STOP LOGIC CIRCUIT. The start/stop logic circuit controls deck start, auxiliary start, start indicator, manual and automatic stop, start lock-out, maintenance mode, and primary cue tone inhibit operations.

4-24. The start/stop logic circuit consists of: 1) start/stop logic U14A, U15A, and U16A, 2) start/stop latch U13B, 3) auxiliary start one-shot U18A, 4) inhibit one-shot U18B, and 5) inverters U12A/U12B.

4-25. Start and Start Lock-out Operations. A start operation is initiated when the front-panel start switch/indicator is depressed. A LOW from the start switch/indicator is applied to the start/stop logic for decoding. If the start lock-out and cartridge present switch status lines are LOW, the start output line of the start/stop logic will apply a LOW to start/stop latch U13B.

4-26. With the LOW from the start/stop logic, U13B will output a continuous HIGH through diode D17 to energize the solenoid. This HIGH is also routed to the primary cue inhibit circuit, auxiliary start circuit, start indicator circuit, mute logic circuit, and flasher logic circuit.

4-27. A start lock-out condition will occur when deck operation is terminated by a primary cue tone detection and the start lock-out status line from the flasher logic circuit is HIGH. This HIGH indicates a cartridge played condition and is applied to the start/stop logic to prevent consecutive start operations.

4-28. Start Indicator Operation. With the HIGH from the start/stop latch, inverters U12A/U12B will output a LOW to illuminate the start and remote start indicator.

4-29. Auxiliary Start Operation. With the HIGH from the start/stop latch, the auxiliary start one-shot will apply a momentary HIGH to the mute logic circuit and inverter U12E. U12E will output a momentary LOW for external equipment operations.

4-30. Manual and Automatic Stop Operation. A manual stop operation is initiated when the stop switch is depressed. A LOW from the stop switch is routed to the start/stop logic for decoding. The stop output line of the start/stop logic will apply a LOW to start/stop latch U13B. U13B will toggle LOW to disable the solenoid and extinguish the start indicators.

4-31. An automatic stop operation is initiated when a primary cue tone is detected. A HIGH from the primary cue tone status line is routed through primary cue detect jumper J211 to the start/stop logic for decoding. The stop output line will go LOW to terminate deck operations. This LOW is also routed to the record logic circuit board through diode D36 to terminate a record operation.

4-32. Primary Cue Inhibit Operation. During a start operation, a HIGH from the start/stop latch is applied to inhibit one-shot U18B. The output of U18B is connected to the primary cue detection status line. U18B will apply a momentary HIGH for approximately 1.75 seconds to the primary cue status line to delay a stop operation.

4-33. Maintenance Mode Operation. The start/stop logic will also decode a special maintenance mode command to energize the solenoid without a cartridge inserted into the deck. This command is applied to the start/stop logic when the start and stop switches are simultaneously depressed and the stop switch released prior to the start switch.

4-34. FLASHER LOGIC CIRCUIT. The flasher logic circuit generates the start lock-out status and controls the operation of the stop indicator depending on start lock-out jumper J213. This circuit consists of NOR gate U17B, AND gates U15C and U15D, inverters U12C/U12D, latch U13D, and NAND gate U17A.

4-35. Jumper Installed. When jumper J213 is installed, the start lock-out operation is enabled. A LOW from the primary cue tone detection status line will be applied to start lock-out latch U13D. U13D will apply a HIGH to the start/stop logic and flasher oscillator U17A. U17A will apply pulses at a 1 Hz rate to flasher gate U15D.

4-36. With the unit in the stop mode, U17B will gate a LOW from U13B and a LOW from the cartridge present switch status line to output a HIGH to U15D. U15D will gate the oscillator pulses from U17A for application to the stop indicator through inverters U12C/U12D. The stop indicator will flash at a 1 Hz rate for a cartridge played condition.

4-37. The start lock-out latch is cleared by AND gate U15C. The stop switch and cartridge present switch status lines are applied to U15C. With a LOW from either the stop switch or cartridge present switch, U15C will output a LOW to reset to latch U13D.

4-38. Jumper Removed. When jumper J213 is removed, the start lock-out function is disabled. U13D will apply a continuous LOW to U17A which will output a HIGH to U15D. With the unit in the stop mode, U17B will apply a HIGH to U15D which outputs a continuous HIGH through inverters U12C/U12D to illuminate the stop indicator.

4-39. FAST FORWARD LOGIC CIRCUIT. The fast forward logic circuit controls the speed of the capstan motor and operation of the solenoid. Depending on jumper J212, the automatic fast forward operation is enabled or disabled. The fast forward logic circuit consists of: 1) fast forward logic U14B, U15B, and U16B, 2) fast forward latch U13A, and 3) inverters U12F and U11F/U11G.

4-40. Automatic Fast Forward Operation. The automatic fast forward function is enabled when jumper J212 is installed. A fast forward operation is initiated when a secondary cue tone is detected. A LOW from the END of EOM tone status line will be applied to the fast forward logic for decoding.

4-41. With the LOW from the END of EOM tone status line and a LOW from the cartridge present switch status line, the fast forward output line of the fast forward logic will output a LOW to start/stop latch U13B through diode D29, and fast forward latch U13A. The LOW at U13B will extinguish only the start indicator. U13A will output a HIGH through diode D18 to maintain solenoid operation.

4-42. The HIGH fast forward command from U13A is also applied to inverters U11F/U11G to illuminate the fast forward indicator and the fast forward motor relay through inverter U12F.

4-43. In a record/playback unit, a HIGH applied to the fast forward logic through J215 inhibits a fast forward function when an END of EOM tone is detected during a record operation. With J215 removed during a record operation, an END of EOM tone will initiate a fast forward function and also disable the record operation by applying a LOW through diode D39.

4-44. Manual Fast Forward Operation. A manual fast forward operation is identical to an automatic except the manual operation is initiated when the fast forward switch is depressed. A LOW from the fast forward switch will be applied to the fast forward logic to begin a fast forward operation.

4-45. Automatic/Manual Termination of Fast Forward Operation. Automatic termination of the fast forward operation is initiated when a LOW from the primary cue tone detection line is applied to the fast forward logic for decoding. The normal output line of the fast forward logic will apply a LOW to U13A. U13A will output a LOW to energize the normal speed motor relay.

4-46. Manual termination of the fast forward operation is identical to an automatic except the manual operation is initiated when the start switch is depressed. A LOW from the start switch will be applied to the fast forward logic to begin a termination operation.

4-47. MUTE LOGIC CIRCUIT. The mute logic circuit generates the mute command, controls the operation of the audio indicator, and provides an audio delay. This circuit consists of mute logic U14C and U16C, mute latch U13C, NAND gate U17C, transistor Q3, and inverter U11C.

4-48. Mute Operation. A mute operation is initiated when a LOW from the stop switch bus, or the fast forward switch bus is applied to the mute logic for decoding. A LOW from the END of EOM through J214 will also initiate a mute operation. The mute logic will apply a LOW to U13C. U13C will output a HIGH to the audio mute selector and transistor Q3. The HIGH will bias Q3 ON which routes a LOW through inverter U11C to extinguish the audio indicator.

4-49. The mute operation is also initiated by a LOW on the primary cue tone detection bus. This LOW is directly applied to mute latch U13C which outputs a mute command.

4-50. In addition, an auxiliary mute bus provides external mute operations. If both the secondary cue tone detection and auxiliary start status lines are LOW, the mute logic will decode a LOW on the auxiliary mute bus to generate a mute command.

4-51. Audio Enable Operation. An audio enable operation is initiated when the start switch is depressed. A LOW from start/stop latch U13B will be applied to U17C and C73. U17C will output a momentary LOW to U13C for a duration established by capacitor C73 and resistor R121. This LOW resets U13C to enable the audio.

4-52. Audio can also be enabled during a fast forward operation. When the fast forward switch is continuously depressed, a LOW is directly applied to the output of mute latch U13C to enable the audio.

4-53. SOLENOID AND POWER SUPPLY CIRCUITS. Figure 4-2 presents a simplified schematic diagram of the solenoid and power supply circuits. Refer to Figure 4-2 as required for a description of the circuits.

4-54. Solenoid Operation. Prior to solenoid operation, transistor Q3 is biased ON which routes +28 volts through the solenoid winding to the collector of transistor Q1 and the base of transistor Q2. With a HIGH from the start/stop latch, Q1 will conduct to rapidly operate the solenoid.

4-55. With Q1 conducting, a LOW is applied to the base of Q2 which biases Q2 Off. The collector of Q2 will go HIGH which disables Q3 and allows +12 volts from solenoid driver U3 to be applied to the solenoid.

4-56. Power Supply Circuit. Primary power is applied to the DT-90 through line fuse F1 and switch S1 to the primary of power transformer T1. The secondaries of T1 provide 25 volt, 40 volt, and 9 volt ac potentials.

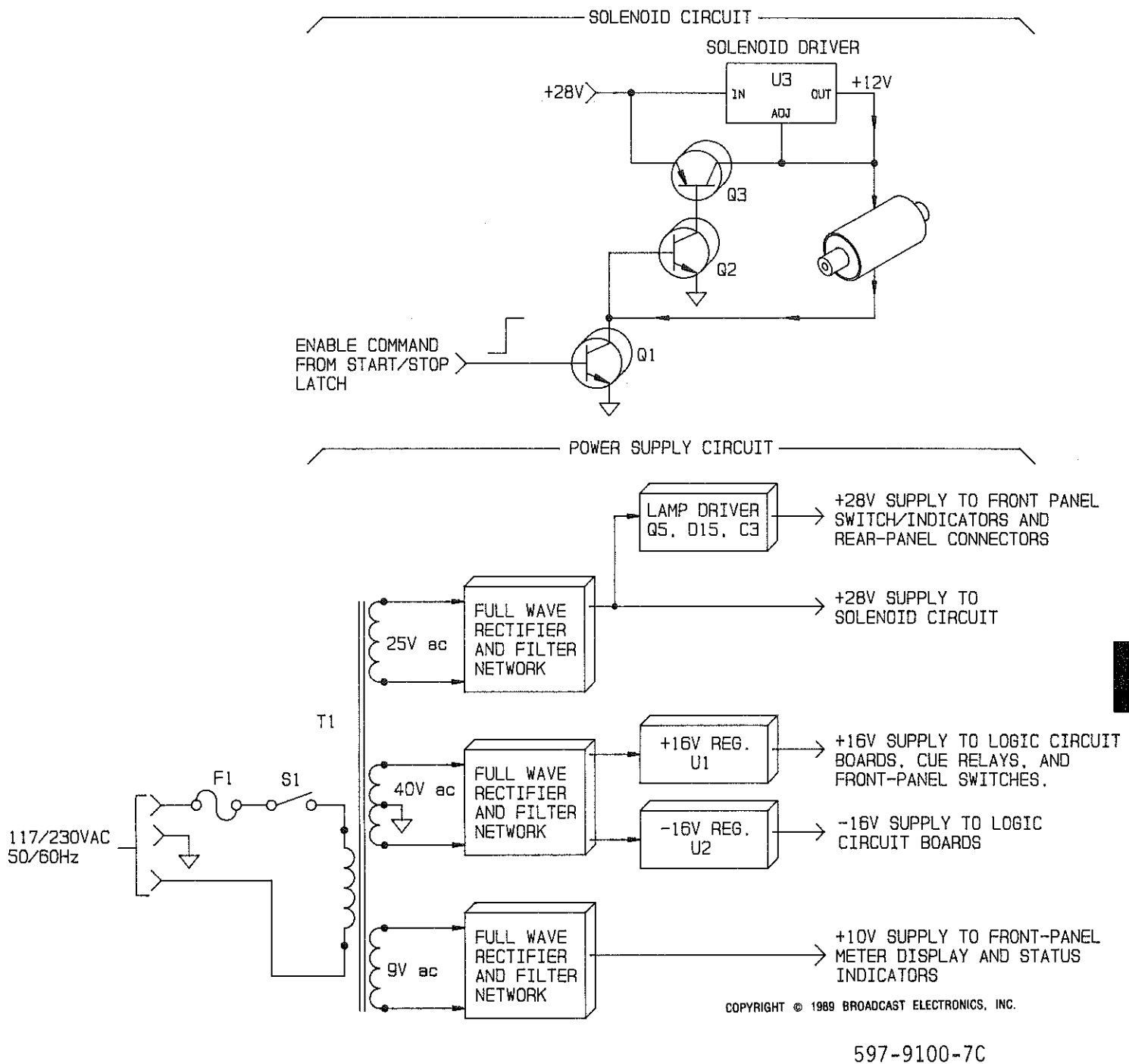


FIGURE 4-2. POWER SUPPLY AND SOLENOID CIRCUITS

4-57. The 40 volt ac potential is routed to a full-wave rectifier and filter network to provide +20 volt and -20 volt dc potentials at the output. The +20 volt dc is applied to the input of regulator U1 which supplies a regulated +16 volts to the logic circuit board, front-panel switches, and cue relays. The -20 volt dc is applied to the input of regulator U2 which supplies a regulated -16 volts to the logic circuit board.

4-58. The 9 volt ac potential is routed to a full-wave rectifier and filter network to provide an unregulated +10 volt supply for front-panel status indicators.

4-59. The 25 volt ac potential is routed to a full-wave rectifier and filter network to provide an unregulated +28 volt supply for solenoid operation. +28 volts is also routed to a lamp driver which supplies +28 volts to the rear-panel for external applications, and operating voltage for front-panel switch/indicators.

4-60. RECORD CIRCUITRY.

4-61. Figure 4-3 presents a simplified schematic diagram of the record logic circuit board. Refer to Figure 4-3 as required for a description of the following circuits.

- A. Record Audio Processing Circuits
- B. Metering Circuits.
- C. Program Bias Circuit.
- D. Cue Bias Circuit.
- E. Cue Tone Generator Circuits.
- F. Record/Primary Cue Tone Logic Circuits.
- G. Secondary/Tertiary Cue Tone Logic Circuits.

4-62. RECORD AUDIO PROCESSING CIRCUITS. Stereophonic units are equipped with left and right channel record audio circuits. Monophonic units are equipped with only the left channel audio circuit. The left and right channel audio circuits are identical; therefore, only the left channel record circuit will be discussed.

4-63. Input Amplifier Circuit. Left channel record audio from the rear-panel record connector is applied to a 600 Ohm impedance matching network. Audio from the impedance network is applied to integrated circuits U1A, U1B and U1D which operate as an instrumentation amplifier. The amplifier provides maximum noise rejection with a gain of one.

4-64. Audio from the input amplifier is applied to an amplifier and input level control stage consisting of U1C and front-panel potentiometer R7. U1C and R7 provide an input level range from -20 dBm to +20 dBm.

4-65. Equalization Amplifier Circuit. The output of U1C is applied to equalization amplifier stage U3B which provides unity gain. Potentiometer R14 provides ± 5 dB of low frequency equalization. Potentiometer R16 provides ± 3 dB of high frequency equalization. The output of U3B is routed to the metering circuit and the audio/mute selector.

4-66. Audio/Mute Selector Operation. Integrated circuit U5A will mute or enable the audio depending on the record mute command. When the mute command is LOW, U5A will enable the audio. The output of U5A is applied to the record head driver.

4-67. Record Head Driver Circuit. Intergrated circuit U3A operates as a constant current amplifier to drive the record head. Left channel record bias is applied at the input of U3A which eliminates the necessity for a bias trap circuit.

4-68. METERING CIRCUITS. Stereophonic units are equipped with left and right channel metering circuits. Monophonic units are equipped with only the left channel metering circuit. The left and right metering circuits are identical; therefore, only the left channel circuit will be discussed.

4-69. Audio from the left record amplifier is applied to left input selector U5B through calibration control R110. Audio from the left playback amplifier is applied to U5B through calibration control R106. With a LOW on the playback/record meter command line, U5B will route record audio to the left meter mute.

4-70. Left meter mute U5C will mute or enable the metering circuit depending on the meter mute command. When the meter mute command is HIGH, U5C will route audio to U21B through amplifier U23A. Full-wave rectifier circuit U21B converts the audio into dc for application to the left channel meter driver.

4-71. Left channel meter driver U21A and associated components establish the meter ballistics. The output of U21A is applied to a display driver. The display driver contains a resistive ladder network and comparator circuits which sequentially activate output lines in response to the input voltage. The output lines of the display driver are applied to a moving bar LED display which illuminate when the lines are activated.

4-72. PROGRAM BIAS CIRCUIT. The program bias circuit provides an accurate 128 kHz signal for application to the record head program channels. A 6.144 MHz frequency from crystal X1 is applied to bias oscillator/divider U6. U6 will divide the input signal by 4096 to provide a 1500 Hz signal to the cue tone generator circuit.

4-73. U6 also divides the 6.144 MHz input signal by 16 to provide a 348 kHz signal to divide-by-three counter U7A/U8 and the input of program bias mute Q2 through summing resistor R38. The output of U7A/U8 applies a 128 kHz signal to Q2 through summing resistor R40.

4-74. Program bias mute Q2 operates to the record mode when a LOW is applied to the gate. Program bias mute Q1 operates to the record mode when a HIGH is applied to the gate. With Q1 and Q2 in the record mode, a stepped sine-wave is applied to the input of amplifier U10A.

4-75. The output of U10A is applied to a low-pass filter consisting of U10B and associated components. The filter will convert the stepped sine-wave into a 128 kHz sinusoidal signal. The output of the filter is routed through bias level control R48 for application to the left record amplifier circuit. Program bias for the right record amplifier circuit is routed through bias level control R49.

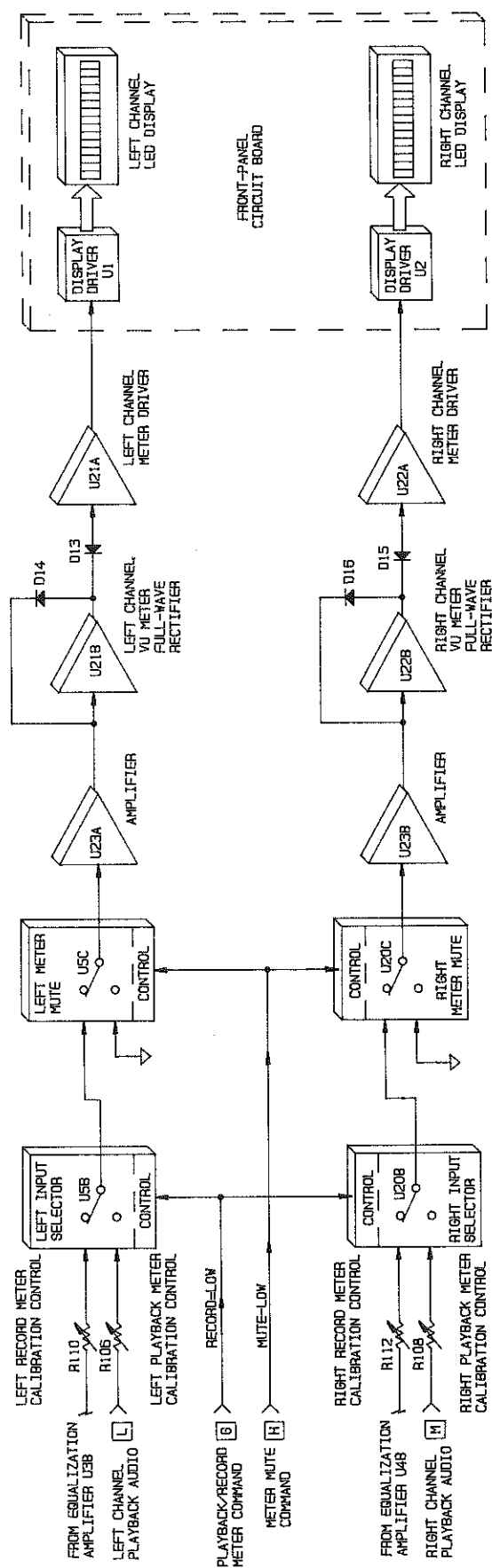
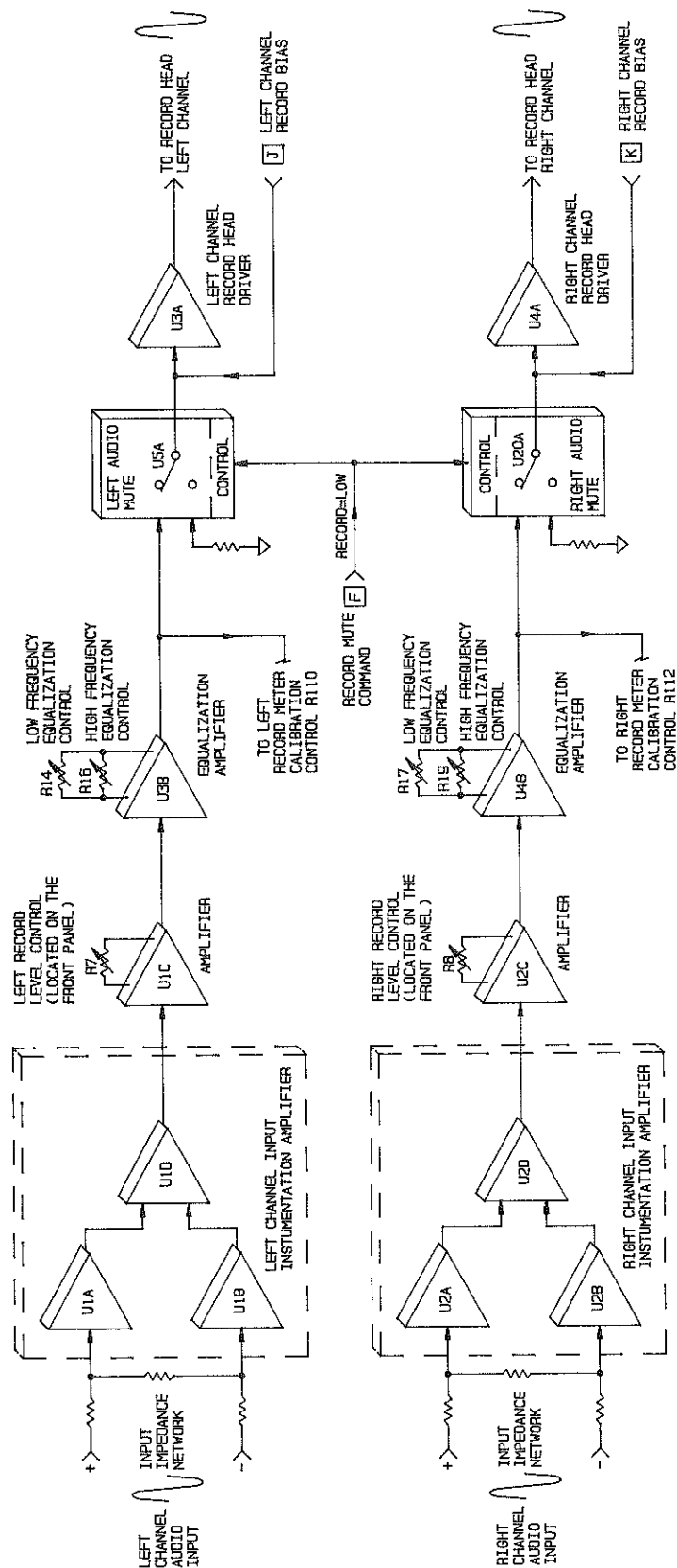


FIGURE 4-3. RECORD CIRCUIT BOARD SIMPLIFIED SCHEMATIC

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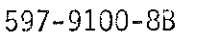


FIGURE 4-3. RECORD CIRCUIT BOARD
SIMPLIFIED SCHEMATIC (Sheet 2 of 2)

4-76. CUE BIAS CIRCUIT. The cue bias circuit generates a 128 kHz signal for application to the record head cue channel. The output of bias oscillator/divider U6 applies a 348 kHz signal to cue bias mute Q4 through summing resistor R54. Divide-by-three counter U7A/U8 applies a 128 kHz signal to Q4 through summing resistor R52.

4-77. Cue bias mute Q4 operates to the record mode when a LOW is applied to the gate. Cue bias mute Q3 operates to the record mode when a HIGH is applied to the gate. With Q3 and Q4 in the record mode, a stepped sine-wave is applied to the input of amplifier U9A.

4-78. The output of U9A is applied to a low-pass filter consisting of U9B and associated components. The filter will convert the stepped sine-wave into a 128 kHz sinusoidal signal. The output of the filter is applied to head driver U14B through cue bias level control R63. Cue tone audio is also applied at the input of U14B. The output of U14B is applied to the record head cue channel.

4-79. CUE TONE GENERATOR CIRCUITS. The primary, secondary, and tertiary cue tone generator circuits are contained on the record logic circuit board. Circuitry is also provided for external cue tone applications.

4-80. Primary Cue Tone Circuit. A 128 kHz signal from divide-by-three counter U7A/U8 is applied to divider U11. U11 will divide the input signal by 128 to output a 1 kHz signal to OR gate U12D. With a LOW from U7C, U12D will route the 1 kHz signal to a primary cue tone low-pass filter consisting of U14A and associated components. The sinusoidal output of the filter is applied to head driver U14B through primary cue tone level control R76.

4-81. Tertiary Cue Tone Circuit. Integrated circuit U11 will also divide the 128 kHz input signal by 16 to output an 8 kHz signal to OR gate U12A. With a LOW from U16D, U12A will route the 8 kHz signal to a tertiary cue tone low-pass filter consisting of U13A and associated components. The sinusoidal output of the filter is applied to head driver U14B through tertiary cue tone level control R70.

4-82. Secondary Cue Tone Circuit. Integrated circuit U15 will divide the 1500 Hz input signal by 10 to output a 150 Hz signal to OR gate U12C. With a LOW from U16C, U12C will route the 150 Hz signal to a secondary cue tone low-pass filter consisting of U13B and associated components. The sinusoidal output of the filter is applied to head driver U14B through secondary cue tone level control R82.

4-83. External Cue Tone Circuit. The record logic circuit board provides for external cue operations. External cue audio from the rear-panel is routed to record head driver U14B through external cue tone level control R84.

4-84. RECORD/PRIMARY CUE TONE LOGIC CIRCUITS. The record and primary cue tone logic circuits generate commands to control the program bias mute, and meter mute circuits. These circuits also control primary cue tone record and front-panel record indicator operations.

4-85. Record Operation. A record operation is initiated when the record switch is depressed. With a LOW on the solenoid enable command line and cartridge present switch status line, record control U12B/U16A will gate a LOW from the record switch to record latch U17C/U17D. The record control also applies a momentary LOW to OR gate U16B through a one-shot circuit consisting of C78 and R95.

4-86. With the LOW from the record control, the record latch will output a HIGH to NAND gate U18A, OR gate U19C, and the playback logic circuit board. The record latch also outputs a LOW to OR gate U16B.

4-87. When a start operation is initiated, a HIGH on the solenoid enable command line is applied to record enable U18A and OR gate U19C. U18A will output a LOW to operate audio mute logic U5A, U20A, and program bias mute Q2 to the record mode.

4-88. The LOW from U18A is also applied to transistor Q5 which outputs a HIGH to operate program bias mute Q1 to the record mode. With a HIGH from either the record latch or solenoid enable command line, U19C will output a HIGH to enable the meter circuit.

4-89. Primary Cue Tone Record Operation. A primary cue tone record operation is initiated when the record switch is depressed. The record latch applies a LOW to OR gate U16B which outputs a HIGH to 1 kHz cue tone disable latch U17A/U17B. The latch will apply a LOW to 1 kHz enable gate U19A.

4-90. With the LOW from U17A/U17B and LOW from U18A during a start operation, U19A will output a LOW to NAND gate U18C. U18C will output a momentary HIGH to exclusive OR gate U7C for a duration established by components C86/C87 and R101. U7C will apply a momentary LOW to activate primary cue tone enable gate U12D. A momentary LOW is also routed to the secondary/tertiary cue tone logic circuit to operate cue bias mute logic Q3 and Q4 to the record mode.

4-91. Primary Cue Tone Record Inhibit Operation. When a record operation is initiated, a momentary LOW from the one-shot circuit is applied to U16B prior to the continuous LOW from the record latch. When the record switch is depressed again, U16B will gate the momentary LOW to 1 kHz cue tone disable latch U17A/U17B.

4-92. The output of U17A/U17B will apply a HIGH to U19A to disable the 1 kHz control circuit. This HIGH is also applied to U18D to enable the flasher circuit. U18B generates pulses at a 1 Hz rate for application to flasher enable gate U18D. U18D applies the pulses to the input of exclusive OR gate U7D. With a LOW from the record latch during a record operation, U7D will gate pulses to transistors Q7/Q8. The output of Q7/Q8 will flash the record indicator at a 1 Hz rate for a 1 kHz cue tone inhibit condition.

4-93. Record Disable Operation. A record operation is terminated when a LOW on the stop, fast forward, or disable record command line is applied to the record latch and 1 kHz cue tone disable latch. The output of the record latch will go LOW to disable a record operation. The output of the cue tone disable latch will go LOW to enable a 1 kHz cue tone record operation.

4-94. Meter Operation. The front-panel meters will indicate record levels or playback levels during a record operation depending on programmable jumper J311. When the solenoid is deenergized, a LOW from the solenoid command line operates the meter select circuits on the playback circuit board for record level indications.

4-95. If J311 is in position 1-2 and deck operation is initiated, a HIGH from the solenoid command line operates the meters for playback level indications. However, if J311 is in position 2-3 and deck operation is initiated, a LOW from the record latch assures the meter select circuits are operated for record level indications.

4-96. SECONDARY/TERTIARY CUE TONE LOGIC CIRCUITS. The secondary and tertiary cue tone logic circuits generate the cue bias mute control signals and the tertiary and secondary cue tone enable signals. The secondary and tertiary circuits operate identically; therefore, only the secondary circuit will be discussed.

4-97. With a HIGH applied from the solenoid enable command line, exclusive OR gate U7B will output a LOW to 150 Hz enable gate U16C. When the secondary cue tone switch is depressed, a LOW is applied to U16C. U16C will output a LOW to activate secondary cue tone enable gate U12C.

4-98. The LOW from U16C is also routed to buffer U19B through steering diode D9. U19B will output a LOW to operate cue bias mute Q4 to the record mode. The LOW is also applied to transistor Q6. Q6 will output a HIGH to operate cue bias mute Q3 to the record mode.

SECTION V MAINTENANCE

5-1. INTRODUCTION.

5-2. This section provides general maintenance information, mechanical and electrical adjustment procedures, and troubleshooting information for the Broadcast Electronics DT-90 series cartridge machines.

5-3. SAFETY CONSIDERATIONS.

5-4. Low voltages are used throughout DT-90 cartridge machine playback and record circuit board assemblies. Maintenance with power energized is always considered hazardous and caution should be observed. Good judgment, care, and common sense must be practiced to prevent accidents. The procedures contained in this section should be performed only by experienced and trained maintenance personnel.

5-5. FIRST LEVEL MAINTENANCE.

5-6. First level maintenance consists of precautionary procedures applied to the equipment to prevent future failures. The procedures are performed on a regular basis and the results recorded in a maintenance log.

WARNING

DISCONNECT ALL CARTRIDGE MACHINE PRIMARY
POWER BEFORE ATTEMPTING ANY EQUIPMENT
MAINTENANCE.

WARNING

5-7. GENERAL.

5-8. Periodically remove abrasions from the cartridge machine chassis with a cloth moistened with a mild household cleaner. Remove dust from the chassis exterior with a brush and vacuum cleaner as required.

5-9. ELECTRICAL.

5-10. The cartridge machine circuitry should be periodically cleaned of accumulated dust using a brush and vacuum cleaner. Check the circuit boards for improperly seated semiconductors and components damaged by overheating.

5-11. MECHANICAL.

WARNING MOST SOLVENTS WHICH REMOVE TAPE RESIDUE ARE
VOLATILE AND TOXIC BY NATURE AND MUST BE
WARNING APPLIED IN SMALL AMOUNTS IN A WELL VENTI-
LATED AREA. OBSERVE THE SOLVENT CONTAINER
WARNING SAFETY INFORMATION AND DO NOT USE THE SOL-
VENT NEAR FLAME, CIGARETTES, AND HOT SOL-
DERING IRONS.

5-12. Each day clean the heads, tape guides, pressure roller, and capstan shaft with a cleaning solvent to remove accumulated oxide. Recommended cleaning solvents include: 1) Broadcast Electronics head cleaning kit 979-0064 and 2) isopropal alcohol. The pressure roller and capstan shaft may be cleaned utilizing the cartridge machine maintenance mode operation (refer to MAINTENANCE MODE OPERATION in SECTION III, OPERATION).

5-13. Approximately once a week, demagnetize the heads and other ferrous components in the tape path. Perform the demagnetizing with an appropriate degausser. Observe the degausser operating instructions to prevent damage to the heads.

5-14. SECOND LEVEL MAINTENANCE.

5-15. Second level maintenance consists of procedures required to restore a DT-90 cartridge machine to operation after a fault has occurred. The procedures are divided into mechanical adjustments, electrical adjustments, mechanical component replacement procedures, electrical component replacement procedures, and troubleshooting.

5-16. The DT-90 cartridge machine maintenance philosophy consists of isolating a problem to a specific assembly with subsequent troubleshooting to isolate defective components. The defective components may be repaired locally or the entire assembly may be returned to Broadcast Electronics, Inc. for repair or replacement.

5-17. MECHANICAL ADJUSTMENTS.

5-18. The following text provides adjustment procedures for mechanical components associated with the DT-90 series cartridge machines. The procedures are presented in the following order.

ADJUSTMENT PROCEDURES

- A. Motor Alignment Procedure.
- B. Solenoid Response Adjustment.
- C. Head Adjustments.

5-19. The following test equipment is required for the mechanical adjustment procedures. Refer to the following list as required for each procedure.

TEST EQUIPMENT

- A. Calibrated Oscilloscope, 5 MHz Bandwidth, Dual Channel With Lissajous Display of Inputs.
- B. Calibrated Low Distortion Audio Generator, 600 Ohm Output, 20 Hz to 20 kHz Audio Range.
- C. Tape Head and Tape Guide Alignment Gauge (BE P/N 300-0002).
- D. Motor Alignment Gauge (BE P/N 300-0700).
- E. Pressure Roller Indentation Gauge (BE P/N 300-0013).
- F. Allen Wrenches (supplied with the Cartridge Machine).
- G. Tape Alignment Cut-Away Test Cartridge (BE P/N 710-0132).
- H. Stereophonic/Monophonic Reproduce Alignment Tape (BE P/N 808-0004).
- I. No. 1 Phillips Screwdriver, 4 Inch (10.2 cm) Blade.

5-20. **MOTOR ALIGNMENT PROCEDURE.** The deck pressure roller operates in conjunction with the motor capstan shaft to provide tape movement. The pressure roller and the motor capstan shaft must be properly aligned to prevent improper tape movement across the heads.

5-21. Procedure. To align the cartridge machine motor and deck solenoid, proceed as follows:

5-22. Disconnect the cartridge machine primary power.

5-23. Manually retract the deck solenoid plunger (refer to Figure 5-1) and remove the pressure roller E-ring, pressure roller, and the nylon washers.

5-24. Refer to Figure 5-2 and loosen the two motor mounting screws to allow movement of the motor assembly.

5-25. Refer to Figure 5-3A and place motor alignment gauge 300-0700 on the deck pressure roller shaft.

5-26. Refer to Figure 5-3A and move the motor assembly until the capstan shaft is tangent with the alignment gauge.

5-27. Secure the two motor mounting screws. Secure the screws alternately to ensure correct motor alignment. Remove the alignment gauge.

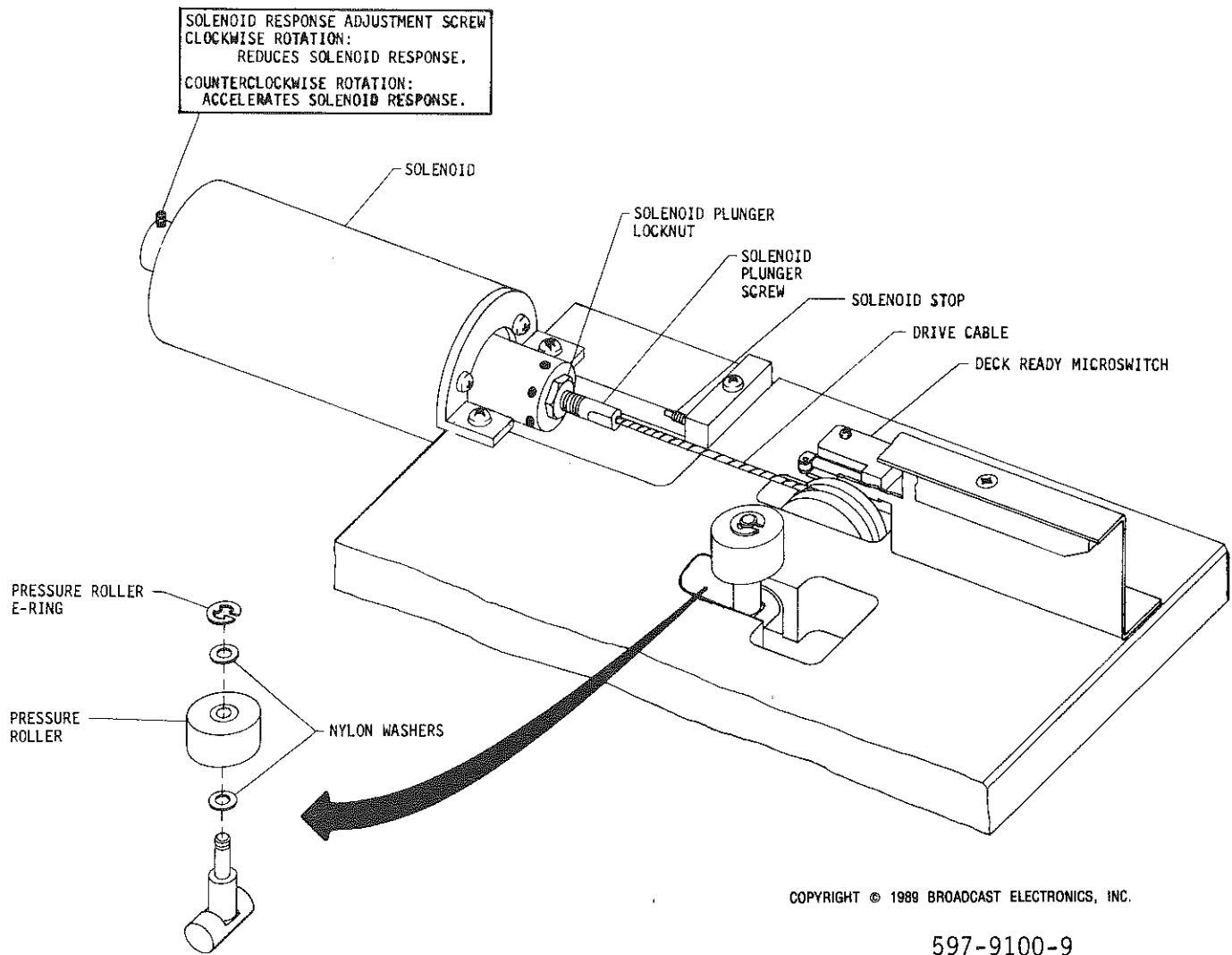


FIGURE 5-1. CARTRIDGE DECK ASSEMBLY

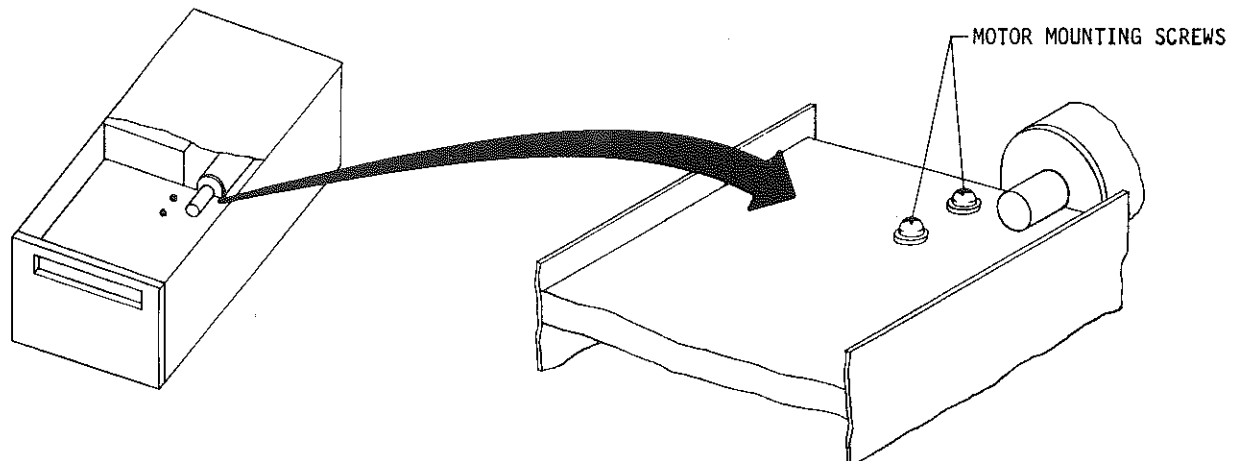
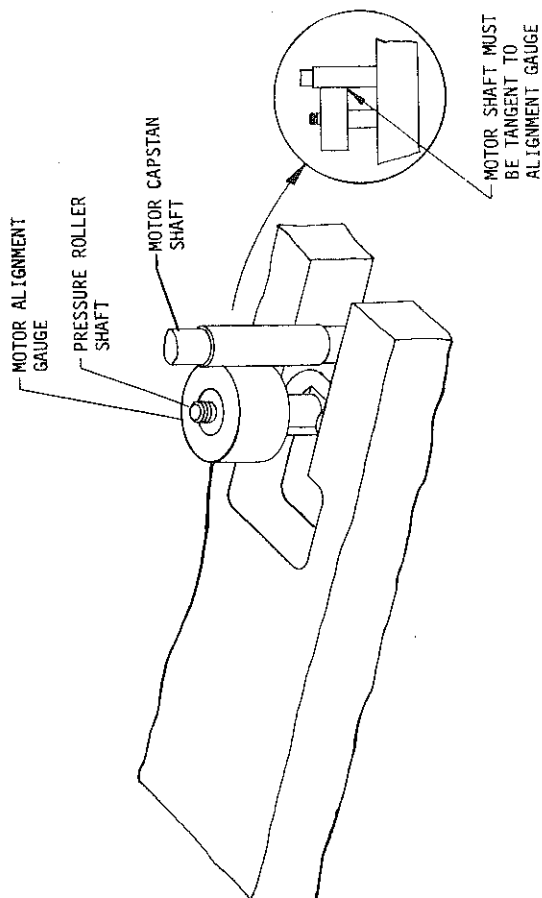
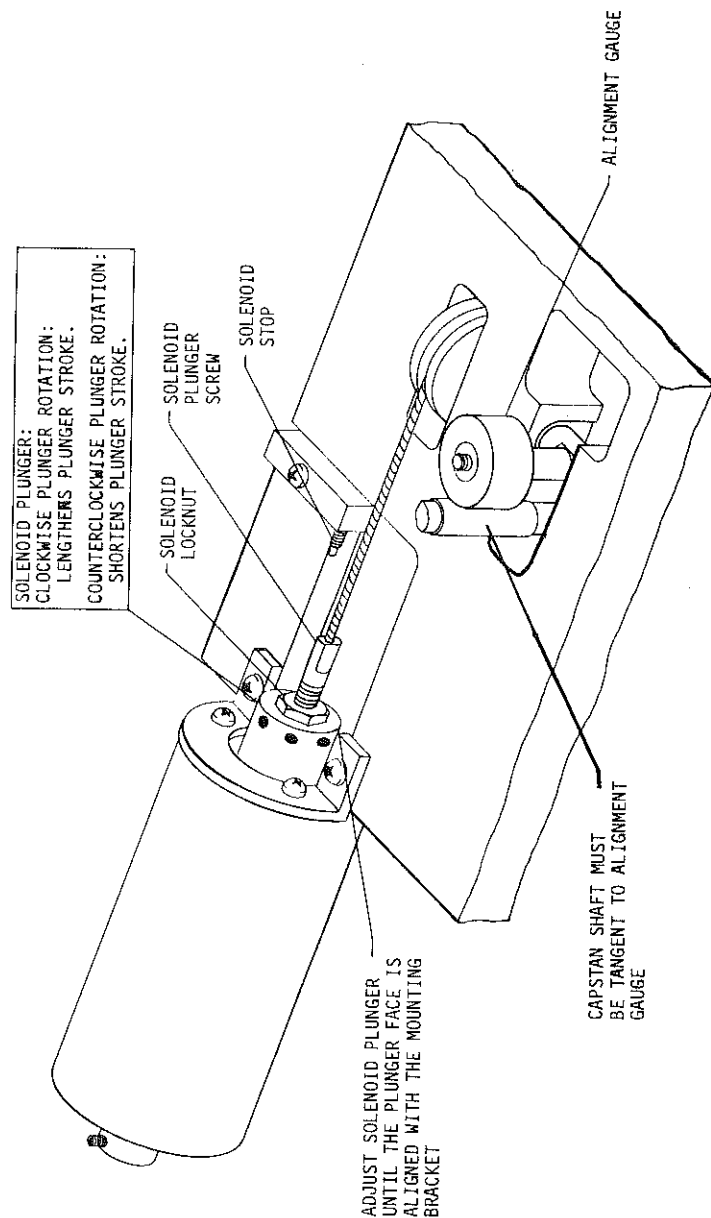


FIGURE 5-2. MOTOR MOUNTING SCREWS

A MOTOR ALIGNMENT



B SOLENOID PLUNGER STROKE ADJUSTMENT



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FIGURE 5-3. MOTOR ALIGNMENT

5-28. Refer to Figure 5-1 and re-install the pressure roller, the nylon washers, and the pressure roller E-ring.

5-29. Refer to Figure 5-1 and adjust the solenoid plunger stop until the pressure roller is just below the deck surface when the solenoid is deenergized.

5-30. PRESSURE ROLLER INDENTATION ADJUSTMENT. This procedure adjusts the correct pressure roller indentation. Proper pressure roller indentation determines the amount of tape pull. Refer to Figure 5-3 and coarse adjust the solenoid plunger as follows:

- A. Disconnect the cartridge machine primary power.
- B. Loosen the solenoid plunger locknut.
- C. Rotate the solenoid plunger clockwise or counterclockwise as required until the plunger front-surface is aligned with the solenoid bracket.
- D. Finger tighten the solenoid plunger locknut.

CAUTION

WHEN OPERATING THE DECK SWITCH TO THE ON POSITION, DO NOT USE A METALLIC OBJECT.

5-31. Temporarily operate the deck switch to the ON position.

5-32. Apply power to the cartridge machine. Depress the deck start switch/indicator to energize the solenoid.

WARNING

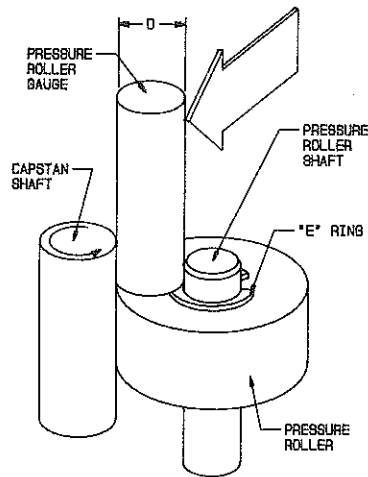
MAINTENANCE WITH MOVING PARTS IS ALWAYS CONSIDERED HAZARDOUS AND CAUTION SHOULD BE OBSERVED. DO NOT TOUCH THE CAPSTAN SHAFT OR THE PRESSURE ROLLER SHAFT WITH THE PARTS IN MOTION.

WARNING

WARNING

5-33. Fine adjustment of the pressure roller indentation is accomplished by using the pressure roller indentation gauge as shown in Figure 5-4. Insert the gauge between the capstan shaft and pressure roller shaft in the direction indicated while maintaining the gauge perpendicular to the deck surface.

5-34. Refer to Figure 5-4 and adjust the pressure roller indentation by rotating the solenoid plunger clockwise to decrease distance D or counterclockwise to increase distance D as required. Correct adjustment is obtained when the gauge will pass between the shafts with a slight resistance. Deenergize the solenoid between measurements to allow the solenoid to stabilize.



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FIGURE 5-4. CAPSTAN SHAFT/PRESSURE ROLLER ALIGNMENT

5-35. Disconnect the cartridge machine primary power. Secure the solenoid plunger locknut and restore the deck switch to normal operation.

CAUTION

TO PREVENT DAMAGE TO THE PHASE LOK V HEAD ASSEMBLY, PERFORM ALL HEAD ASSEMBLY ADJUSTMENTS USING THE ALLEN WRENCH PROVIDED WITH THE UNIT.

5-36. HEAD ADJUSTMENTS. The head adjustments involve the alignment of the tape guide height, head height, head zenith, head azimuth, and head phase response parameters. The head parameters are presented as individual adjustment procedures. Due to the design of the PHASE LOK V head bracket, only head azimuth and the related electrical parameters will require periodic adjustment (example: prior to extensive continuous operation). The following list presents the procedures required for periodic maintenance. When a replacement head is installed, all head adjustment procedures must be performed (refer to the HEAD REPLACEMENT PROCEDURE specific replacement information).

PERIODIC PLAYBACK HEAD ADJUSTMENT PROCEDURES

MONOPHONIC CARTRIDGE MACHINES

- A. The Playback Head Azimuth Adjustment Procedure.
- B. The PLAYBACK EQUALIZATION Procedure.

STEREOPHONIC CARTRIDGE MACHINES

- A. The Playback Head Azimuth Procedure.
- B. The Playback Phase Response Adjustment Procedure.
- C. The PLAYBACK EQUALIZATION Procedure.

PERIODIC RECORD HEAD ADJUSTMENT PROCEDURES

STEREOPHONIC CARTRIDGE MACHINES

- A. The Record Head Azimuth Adjustment Procedure.
- B. The Record Head Phase Response Adjustment Procedure.

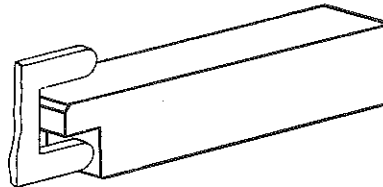
5-37. The following text presents adjustment procedures for the playback, dummy, and record heads. For playback only models, align the playback head before adjusting the dummy head. For record/playback models, align the playback head before adjusting the record head.

5-38. An adjustment tool (located in the Accessory Parts Kit) is provided with the unit for head assembly alignment. Perform all head alignment procedures using the adjustment tool.

5-39. Tape Guide Height Adjustment Procedure. To ensure proper tape movement, perform the tape guide height adjustment procedure for each tape guide. To adjust the tape guide height, proceed as follows:

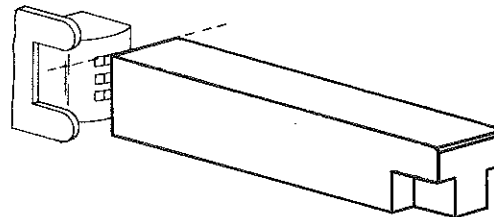
A
TAPE GUIDE ADJUSTMENT

THE INSIDE EDGE OF UPPER TAPE GUIDE MUST BE ALIGNED WITH THE T-END OF ALIGNMENT GAUGE.



B
HEAD HEIGHT ADJUSTMENT

THE UPPER HEAD POLE MUST BE ALIGNED WITH THE TOP OF THE ALIGNMENT GAUGE.



C
ZENITH ADJUSTMENT

THE HEAD MUST BE PERPENDICULAR TO DECK SURFACE.



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597-9100-13

FIGURE 5-5. HEAD AND TAPE GUIDE ADJUSTMENTS

5-40. Refer to Figure 5-5A and check the tape guide height. The inside edge of the upper tape guide must be aligned with the top surface of the alignment gauge as shown.

5-41. If adjustment is required, refer to Figure 5-6 and loosen the tape guide adjustment screws.

5-42. Adjust the tape guide to obtain proper alignment.

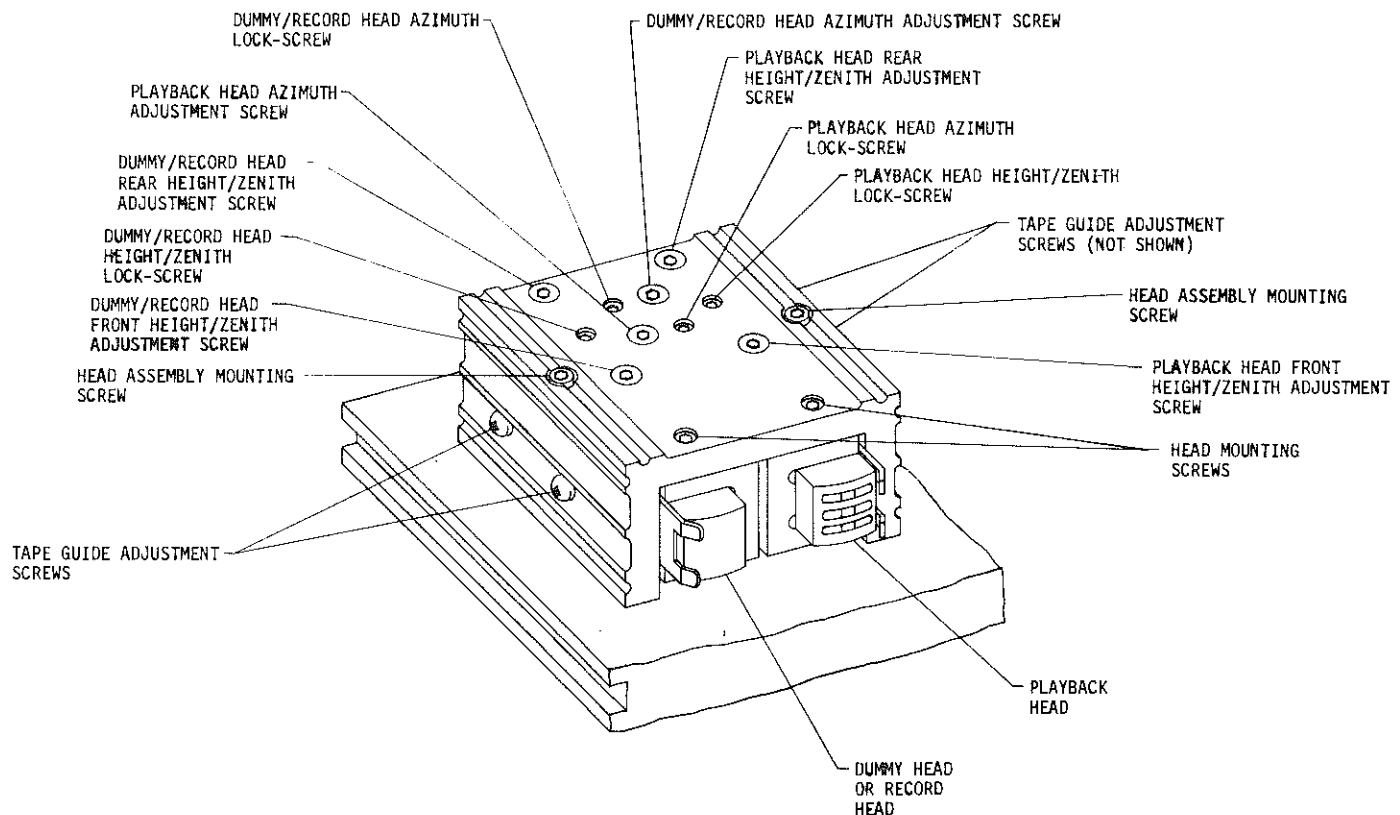
5-43. Secure the tape guide adjustment screws.

5-44. Head Height Adjustment Procedure. To adjust the playback, record, or dummy head height, proceed as follows:

5-45. Refer to Figure 5-5B and check the playback or record head height. The head upper pole must be aligned with the top of the alignment gauge.

5-46. Insert the tape alignment cut-away test cartridge into the cartridge deck and begin deck operation to visually inspect the tape movement across the heads. The magnetic tape must cover the top and bottom of the head poles (refer to Figure 5-7).

5-47. If adjustment is required, refer to Figure 5-6 and loosen the appropriate head height/zenith lock-screw.

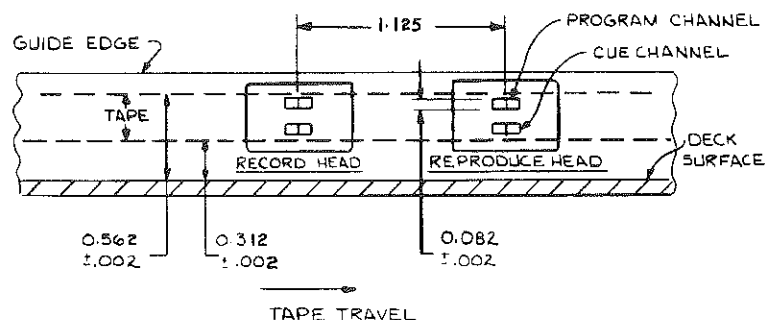


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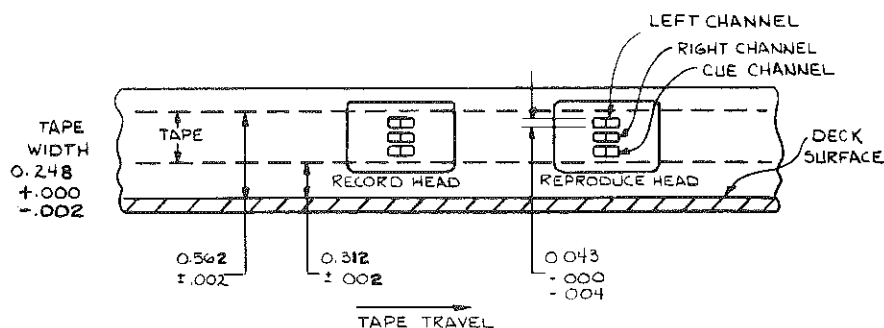
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FIGURE 5-6. HEAD ADJUSTMENT CONTROLS

MONOPHONIC STANDARD



STEREOPHONIC STANDARD



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597-9100-15

FIGURE 5-7. HEIGHT CARTRIDGE TAPE TRACKING

5-48. Refer to Figure 5-6 and adjust the appropriate front and rear head height/zenith adjustment screws as required to obtain the proper head height. The height/zenith screws must be adjusted equally to retain the zenith adjustment.

5-49. Secure the head height/zenith lock-screw.

5-50. For playback only cartridge machines, the top of the dummy head must be aligned with the top of the playback head. For record/playback units, the top of the record head must be aligned with the top of the playback head. Visually inspect the tape head heights. If required, adjust the dummy head or record head height as required. Refer to Figure 5-6 for the location of the dummy/record head height/zenith adjustment screws.

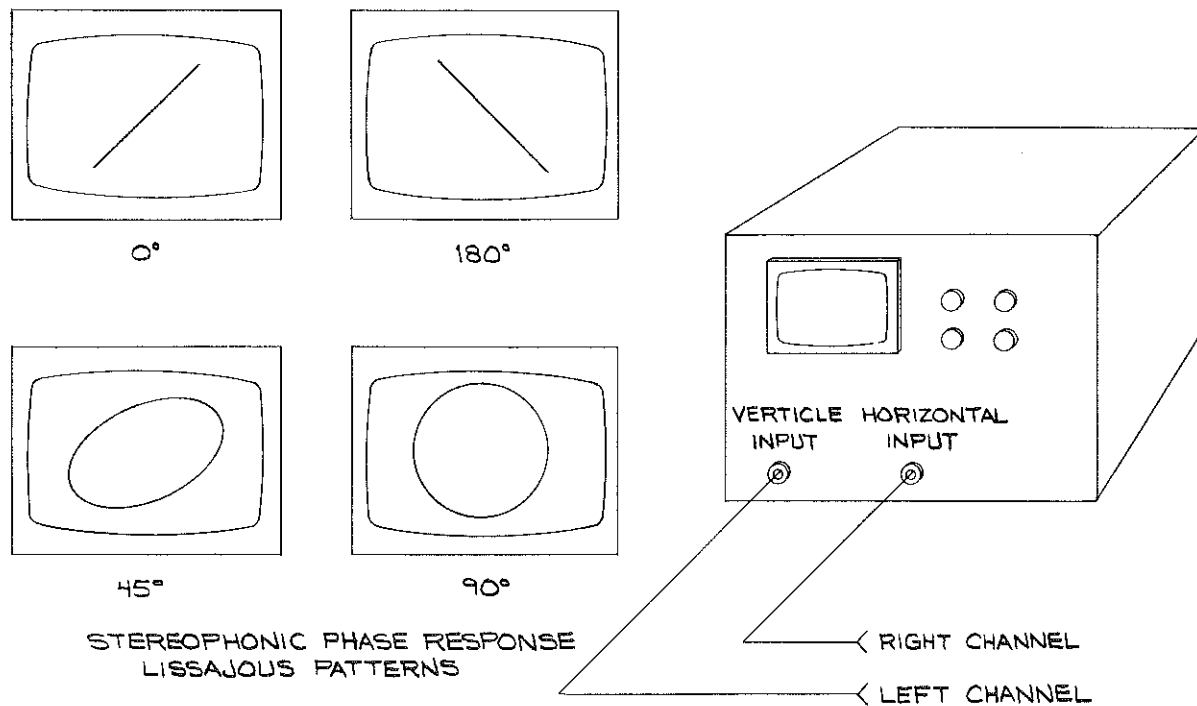
5-51. Head Zenith Adjustment Procedure. To adjust the playback, record, or dummy head zenith, proceed as follows:

5-52. Refer to Figure 5-5C and check the playback or record head zenith. The head must be perpendicular to the deck surface.

- 5-53. If adjustment is required, refer to Figure 5-6 and loosen the appropriate head height/zenith lock-screw.
- 5-54. Refer to Figure 5-6 and adjust the appropriate head front or rear height/zenith screw to obtain the proper alignment.
- 5-55. Refer to the Head Height Adjustment Procedure and check the head height. If required, re-adjust the head height.
- 5-56. Repeat the procedure until the head zenith and the head height is properly adjusted.
- 5-57. Secure the head height/zenith lock-screw.
- 5-58. For playback only cartridge machines, repeat the procedure for the dummy head. Refer to Figure 5-6 for the location of the dummy head height/zenith adjustment screws.
- 5-59. Playback Head Azimuth Adjustment Procedure. To adjust the playback head azimuth, proceed as follows:
- 5-60. Disconnect the cartridge machine primary power.
- 5-61. Demagnetize the playback head, the dummy/record head, and all surrounding ferrous components.
- 5-62. Refer to the OUTPUT LEVEL ADJUSTMENT procedure (located in the ELECTRICAL ADJUSTMENT procedures) and calibrate the cartridge deck for the desired output level.
- 5-63. Refer to Figure 2-2 in SECTION II, INSTALLATION and connect an oscilloscope to the left channel output terminals of rear-panel PLAYBACK receptacle J105.
- 5-64. Refer to Figure 5-6 and loosen the playback head azimuth lock-screw.
- 5-65. Apply power to the cartridge machine.
- 5-66. Insert the reproduce alignment test tape into the cartridge deck and reproduce the 12.5 kHz test tone.
- 5-67. Refer to Figure 5-6 and adjust the playback head azimuth screw for a maximum peak-to-peak voltage indication on the oscilloscope.
- 5-68. Secure the playback head azimuth lock-screw.
- 5-69. Disconnect power from the cartridge machine, remove the test equipment.
- 5-70. Record Head Azimuth Adjustment Procedure. To adjust the record head azimuth, proceed as follows:

- 5-71. Disconnect the cartridge machine primary power.
- 5-72. Demagnetize the record head, playback head, and all surrounding ferrous components.
- 5-73. Refer to the OUTPUT LEVEL ADJUSTMENT procedure (located in the ELECTRICAL ADJUSTMENT procedures) and calibrate the cartridge deck for the desired output level.
- 5-74. Refer to Figure 2-3 in SECTION II, INSTALLATION and connect an audio generator to the left channel input terminals of rear-panel RECORD receptacle J106.
- 5-75. Refer to Figure 2-2 in SECTION II, INSTALLATION and connect an oscilloscope to the left channel output terminals of rear-panel PLAYBACK receptacle J105.
- 5-76. Refer to Figure 5-6 and loosen the record head azimuth lock-screw.
- 5-77. Apply power to the cartridge machine.
- 5-78. Adjust the audio generator for a 12.5 kHz output at 0 dBm.
- 5-79. Operate the record/playback unit in the record mode and begin recording the 12.5 kHz tone.
- 5-80. Refer to Figure 5-6 and adjust the record head azimuth screw for a maximum peak-to-peak voltage indication on the oscilloscope.
- 5-81. Secure the record head azimuth lock-screw.
- 5-82. Disconnect power from the cartridge machine and remove the test equipment.
- 5-83. Playback Head Phase Response Adjustment Procedure. (For Stereophonic Cartridge Machines Only). The playback phase adjustment involves the fine alignment of the playback head azimuth for maximum phase response. To adjust the playback head phase response, proceed as follows:
- 5-84. Disconnect the cartridge machine primary power.
- 5-85. Demagnetize the playback head, the dummy/record head, and all surrounding ferrous components.
- 5-86. Refer to the OUTPUT LEVEL ADJUSTMENT procedure (located in the ELECTRICAL ADJUSTMENT procedures) and calibrate the cartridge deck for the desired output level.
- 5-87. Refer to Figure 2-2 in SECTION II, INSTALLATION and connect an oscilloscope to the left and right channel output terminals of rear-panel PLAYBACK receptacle J105.

- 5-88. Refer to Figure 5-6 and loosen the playback head azimuth lock-screw.
- 5-89. Apply power to the cartridge machine.
- 5-90. Operate the oscilloscope for lissajous display of inputs.
- 5-91. Insert the reproduce alignment test tape into the cartridge deck and reproduce the 15 kHz test tone.
- 5-92. Refer to Figure 5-6 and adjust the playback head azimuth screw for a 0° lissajous pattern as shown in Figure 5-8.
- 5-93. Secure the playback head azimuth lock-screw.
- 5-94. Disconnect power from the cartridge machine and remove the test equipment.
- 5-95. Record Phase Adjustment Procedure (For Stereophonic Record/Playback Models Only). The record phase adjustment involves the fine alignment of the record head azimuth for maximum phase response. To adjust the record head phase response, proceed as follows:



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597-9100-16

FIGURE 5-8. STEREOPHONIC PHASE RESPONSE LISSAJOUS PATTERNS

- 5-96. Disconnect the cartridge machine primary power.
- 5-97. Demagnetize the record head, the playback head, and all surrounding ferrous components.
- 5-98. Refer to the OUTPUT LEVEL ADJUSTMENT procedure (located in the ELECTRICAL ADJUSTMENT procedures) and calibrate the cartridge deck for the desired output level.
- 5-99. Refer to Figure 2-3 in SECTION II, INSTALLATION and connect an audio generator to the left and right channel input terminals of rear-panel RECORD receptacle J106.
- 5-100. Refer to Figure 2-2 in SECTION II, INSTALLATION and connect an oscilloscope to the left and right channel output terminals of rear-panel PLAYBACK receptacle J105.
- 5-101. Refer to Figure 5-6 and loosen the record head azimuth lock-screw.
- 5-102. Apply power to the cartridge machine.
- 5-103. Operate the oscilloscope for a lissajous display of inputs.
- 5-104. Adjust the audio generator for a 12.5 kHz output at 0 dBm.
- 5-105. Operate the record/playback unit in the record mode and begin recording the 12.5 kHz tone.
- 5-106. Refer to Figure 5-6 and adjust the record head azimuth screw for a 0° lissajous pattern as shown in Figure 5-8.
- 5-107. Secure the record head azimuth lock-screw.
- 5-108. Disconnect power from the cartridge machine and remove the test equipment.
- 5-109. ELECTRICAL ADJUSTMENTS.
- 5-110. The following text provides electrical adjustment procedures for all controls associated with the DT-90 cartridge machines. The procedures are presented in the following order:
- A. PLAYBACK ADJUSTMENTS.
 - 1. Output Level Adjustment.
 - 2. Playback Equalization Adjustment.
 - 3. Cue Tone Detection Adjustment.

B. RECORD ADJUSTMENTS.

1. Record Equalization.
2. Program Bias Level Adjustment.
3. Cue Bias Level Adjustment.
4. Cue Tone Record Level Adjustment.
5. Meter Calibrations.

5-111. The following equipment is required for the electrical adjustment procedures:

- A. Frequency Counter.
- B. Calibrated Oscilloscope, 5 MHz Bandwidth, Dual Channel with Lissajous Display of Inputs.
- C. DC Voltmeter.
- D. VU Meter (or decibel calibrated voltmeter).
- E. Extender Circuit Board and Cable Assembly (BE P/N 941-0017).
- F. Monophonic/Stereophonic Reproduce Alignment Test Tape (BE P/N 800-1005).
- G. Insulated Non-Metallic Adjustment Tool.
- H. Cue Tone Calibration Cartridge (BE P/N 800-1095).
- I. Audio Signal Generator (audio range: 20 Hz to 20 kHz).
- J. Audio Analyzer.

5-112. PLAYBACK ADJUSTMENTS.

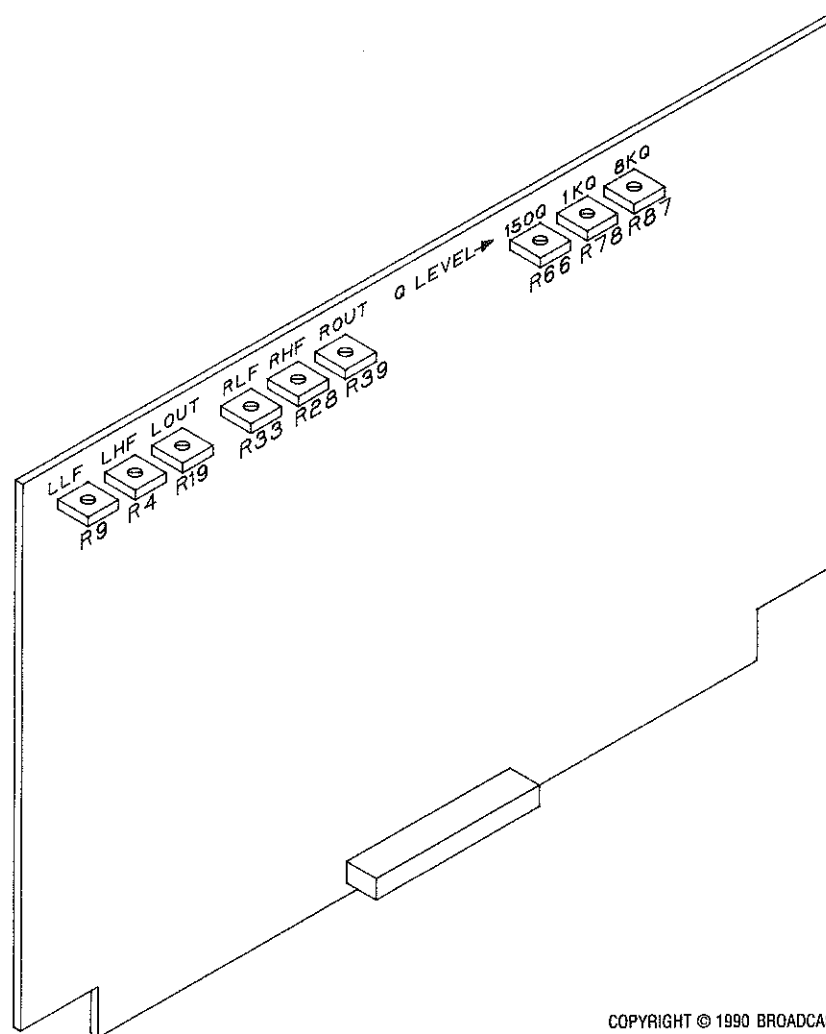
5-113. OUTPUT LEVEL ADJUSTMENT. Left channel level control R19 and right channel level control R39 on the playback logic circuit board adjust the output level of the cartridge machine. The output level control(s) are adjusted as follows.

5-114. Procedure. To adjust the cartridge deck output level, proceed as follows:

5-115. Disconnect the cartridge machine primary power and remove the top-panel.

5-116. Refer to Figure 2-2 in SECTION II, INSTALLATION and connect a VU meter to the left channel output terminals of rear-panel PLAYBACK receptacle J105.

- 5-117. Apply power to the cartridge machine.
- 5-118. Insert the reproduce alignment test tape into the deck and reproduce the operating level portion of the test tape.
- 5-119. Refer to Figure 5-9 and adjust L OUT control R19 for the desired output level.
- 5-120. For stereophonic cartridge machines, repeat the procedure for the right channel. Refer to Figure 5-9 and adjust the right channel with R OUT control R39 for the desired level.
- 5-121. Disconnect the cartridge machine primary power and remove the test equipment.



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597-9100-17

FIGURE 5-9. PLAYBACK LOGIC CIRCUIT BOARD CONTROLS

5-122. PLAYBACK EQUALIZATION ADJUSTMENT. Equalization controls R4, R9, R28, and R33 on the playback logic circuit board adjust the left channel and right channel playback response. The playback equalization circuitry is adjusted as follows.

5-123. Procedure. To adjust the equalization controls, proceed as follows:

5-124. Refer to the OUTPUT LEVEL ADJUSTMENT procedure in the preceding text and calibrate the cartridge deck for the desired level.

5-125. Disconnect the cartridge machine primary power and remove the top-panel.

5-126. Refer to Figure 2-2 in SECTION II, INSTALLATION and connect a VU meter to the left channel output terminals of rear-panel PLAYBACK receptacle J105.

5-127. Insert the reproduce alignment tape and reproduce the test tones portion of the tape.

5-128. At the 50 Hz test tone, adjust LLF control R9 (refer to Figure 5-9) until the VU meter indicates a level within -1 dB to 0 dB of the reference tone level.

5-129. At the 12.5 kHz test tone, adjust LHF control R4 (refer to Figure 5-9) until the VU meter indicates the level of the reference tone.

5-130. For stereophonic cartridge machines, repeat the procedure for the right channel. Refer to Figure 5-9 and adjust the right channel equalization with RLF control R33 and RHF control R28.

5-131. Disconnect the cartridge machine primary power and remove the test equipment.

5-132. CUE TONE DETECTION ADJUSTMENT. The cue tone controls on the playback logic circuit board adjust the sensitivity of the 1 kHz, 150 Hz, and 8 kHz cue tone detection circuits. The cue tone detection controls are adjusted as follows.

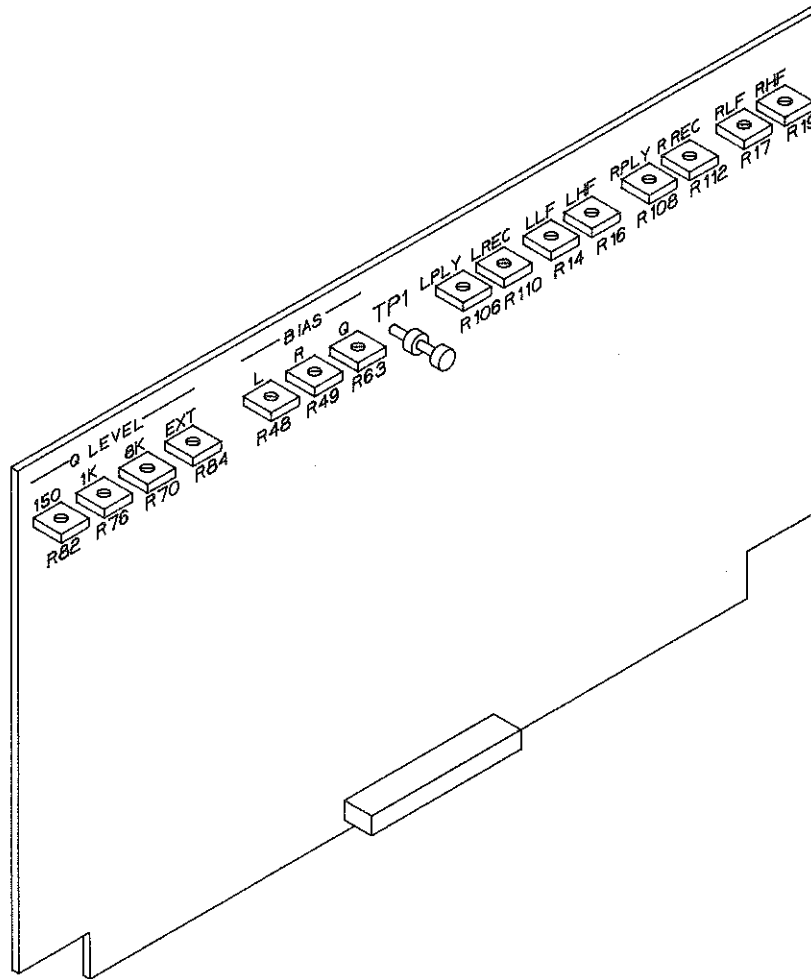
5-133. Procedure. To adjust the cue tone detection controls, proceed as follows:

5-134. Remove the top-panel.

5-135. Insert the cue tone calibration cartridge into the deck and reproduce the 1 kHz test tones.

5-136. Refer to Figure 5-9 and adjust Q LEVEL 1KQ control R78 to terminate deck operation during a test tone.

- 5-137. Insert the cue tone calibration cartridge into the deck and reproduce the 150 Hz test tones.
- 5-138. Refer to Figure 9 and adjust Q LEVEL 150Q control R66 until the front-panel SEC indicator illuminates.
- 5-139. Insert the cue tone calibration cartridge into the deck and reproduce the 8 kHz test tones.
- 5-140. Refer to Figure 5-9 and adjust Q LEVEL 8KQ control R87 until the front-panel TER indicator illuminates.
- 5-141. Replace the top-panel.
- 5-142. RECORD ADJUSTMENTS.
- 5-143. RECORD EQUALIZATION. Potentiometers R14, R16, R17, and R19 on the record logic circuit board adjust the record equalization to obtain the proper record response. The record equalization controls are adjusted as follows.
- 5-144. Procedure. To adjust the record equalization controls, proceed as follows:
- 5-145. Calibrate the cartridge machine record circuitry for a -10 dBm record level by performing the procedure described in the PROGRAM BIAS LEVEL ADJUSTMENT.
- 5-146. Disconnect power from the cartridge machine.
- 5-147. Refer to Figure 2-3 in SECTION II, INSTALLATION and connect an audio generator to the left channel input terminals of rear-panel RECORD receptacle J106.
- 5-148. Refer to Figure 2-2 in SECTION II, INSTALLATION and connect a VU meter to the left channel output terminals of rear-panel PLAYBACK receptacle J105.
- 5-149. Apply power to the cartridge machine.
- 5-150. Adjust the audio generator for a 50 Hz output at -10 dBm.
- 5-151. Operate the unit to the record mode and begin recording the 50 Hz tone.
- 5-152. Refer to Figure 5-10 and adjust LLF control R14 until the external VU meter indicates -10 dBm.
- 5-153. Adjust the audio generator for a 12 kHz output at -10 dBm.
- 5-154. Refer to Figure 5-10 and adjust LHF control R16 until the external VU meter indicates -10 dBm.



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597-9100-18

FIGURE 5-10. RECORD LOGIC CIRCUIT BOARD CONTROLS

5-155. Repeat the procedure for the right channel. Adjust the right channel equalization with RLF control R17 and RHF control R19 (refer to Figure 5-10).

5-156. Re-calibrate the record circuitry for a 0 dBm record level by performing the Record Meter Calibrations procedure in the following text.

5-157. Disconnect power from the cartridge machine and remove the test equipment.

5-158. PROGRAM BIAS LEVEL ADJUSTMENT. L BIAS control R48 and R BIAS control R49 on the record logic circuit board adjust the level of program bias. The bias level controls are adjusted as follows.

5-159. Procedure. To adjust the controls, proceed as follows:

5-160. Calibrate the cartridge machine record circuitry for a -10 dBm record level as follows:

- A. Disconnect power from the cartridge machine.
- B. Refer to Figure 2-3 in SECTION II, INSTALLATION and connect an audio generator to the left channel input terminals of rear-panel RECORD receptacle J106.
- C. Refer to Figure 2-2 in SECTION II, INSTALLATION and connect a VU meter to the left channel output terminals of rear-panel PLAYBACK receptacle J105.
- D. Apply power to the cartridge machine.
- E. Adjust the audio generator for a 1 kHz output at -20 dBm.
- F. Operate the record circuitry and begin recording the 1 kHz tone.
- G. Adjust the cartridge machine left channel level control until the external VU meter indicates -10 dBm.
- H. Depress the deck STOP switch/indicator.
- I. For stereophonic cartridge machines, repeat steps A through H for the right channel.
- J. Disconnect power from the cartridge machine and remove the VU meter.

5-161. Refer to Figure 2-2 in SECTION II, INSTALLATION and connect an oscilloscope to the left channel output terminals of rear-panel PLAYBACK receptacle J105.

5-162. Apply power to the cartridge machine.

5-163. Operate the unit to the record mode and begin recording the 1 kHz tone.

5-164. Refer to Figure 5-10 and adjust L BIAS control R48 for a maximum peak-to-peak 1 kHz waveform without distortion.

5-165. For stereophonic cartridge machines, repeat the procedure for the right channel. Adjust the right channel bias level with R BIAS control R49 (refer to Figure 5-10).

5-166. Re-calibrate the record circuitry for a 0 dBm record level by performing the Record Meter Calibrations procedure in the following text.

- 5-167. Disconnect power from the cartridge machine and remove the test equipment.
- 5-168. CUE BIAS LEVEL ADJUSTMENT. Potentiometer R63 on the record logic circuit board adjusts the cue bias level. The cue bias level is adjusted as follows.
- 5-169. Procedure. To adjust the cue bias level, proceed as follows:
- 5-170. Disconnect the cartridge machine primary power.
- 5-171. Refer to Figure 2-3 in SECTION II, INSTALLATION and perform the following:
- A. Activate the cue bias by connecting a jumper between pin 4 and pin 8 on rear-panel RECORD receptacle J106.
 - B. Connect an audio signal generator to RECORD receptacle J106 pin 10.
- 5-172. Refer to Figure 2-2 in SECTION II, INSTALLATION and connect an oscilloscope to the cue channel audio output on PLAYBACK receptacle J105.
- 5-173. Apply power to the cartridge machine.
- 5-174. Adjust the audio generator for a 1 kHz output at -10 dBm.
- 5-175. Operate the unit to the record mode and begin recording the 1 kHz cue tone.
- 5-176. Refer to Figure 5-10 and adjust Q BIAS level control R63 for a maximum peak-to-peak 1 kHz waveform without distortion.
- 5-177. Disconnect power from the cartridge machine, remove all test equipment, and remove the jumper from RECORD receptacle J106.
- 5-178. CUE TONE RECORD LEVEL ADJUSTMENTS. Primary cue tone control R76, secondary cue tone control R82, tertiary cue tone control R70 and external cue tone control R84 adjust the individual cue tone record levels. The cue tone record levels are adjusted as follows.
- 5-179. 1 kHz Cue Tone Record Level Adjustment. To adjust the 1 kHz cue tone level, proceed as follows:
- 5-180. Measure the NAB 1 kHz cue tone level standard as follows:
- A. Disconnect the cartridge machine primary power.
 - B. Refer to Figure 2-2 in SECTION II, INSTALLATION and connect an oscilloscope to the cue channel audio output on PLAYBACK receptacle J105.

- C. Apply power to the cartridge machine.
- D. Insert the cue tone calibration cartridge into the deck.
- E. Reproduce the reference level 1 kHz cue tone and record the peak-to-peak voltage indication _____.
- F. Depress the deck STOP switch/indicator and remove the cue tone calibration cartridge.

WARNING

DISCONNECT PRIMARY POWER TO THE CARTRIDGE MACHINE BEFORE PROCEEDING.

- 5-181. Disconnect primary power to the cartridge machine.
- 5-182. Remove the top-panel and record logic circuit board.
- 5-183. To activate the 1 kHz oscillator and cue bias circuits, refer to Figure 5-10 and connect a jumper between TP1 and ground.
- 5-184. Replace the logic circuit board.
- 5-185. Apply primary power to the cartridge machine.
- 5-186. Insert a bulk erased tape cartridge into the deck and operate the unit in the playback mode.
- 5-187. Refer to Figure 5-10 and adjust 1K Q LEVEL control R76 for the recorded NAB standard level.
- 5-188. Disconnect the cartridge machine primary power, remove all test equipment, and the temporary jumper.
- 5-189. 150 Hz Cue Tone Record Level Adjustment. To adjust the 150 Hz cue tone level, proceed as follows:
- 5-190. Measure the NAB 150 Hz cue tone level standard by performing the level measurement procedure described in the 1 kHz Cue Tone Record Level Adjustment procedure. Record the peak-to-peak voltage indication _____.
- 5-191. Insert a bulk erased tape cartridge into the deck and operate the unit in the playback mode.
- 5-192. Continuously depress the front-panel SEC switch and observe the oscilloscope indication.
- 5-193. Refer to Figure 5-10 and adjust 150 Hz Q LEVEL control R82 for the recorded NAB standard level.

5-194. Disconnect the cartridge machine primary power and remove all test equipment.

5-195. 8 kHz Cue Tone Record Level Adjustment. To adjust the 8 kHz cue tone level, proceed as follows:

5-196. Measure the NAB 8 kHz cue tone level standard by performing the level measurement procedure described in the 1 kHz Cue Tone Record Level Adjustment procedure. Record the peak-to-peak voltage indication _____.

5-197. Insert a bulk erased tape cartridge into the deck and operate the unit in the playback mode.

5-198. Continuously depress the front-panel TER switch and observe the oscilloscope indication.

5-199. Refer to Figure 5-10 and adjust 8 kHz Q LEVEL control R70 for the recorded NAB standard level.

5-200. Disconnect the cartridge machine primary power and remove all test equipment.

5-201. External Cue Audio Level Adjustment. Potentiometer R84 on the record logic circuit board adjusts the external cue audio level. The external cue audio level is adjusted as follows.

5-202. Procedure. To adjust the external cue audio level, proceed as follows:

5-203. Disconnect the cartridge machine primary power.

5-204. Refer to Figure 2-3 in SECTION II, INSTALLATION and perform the following:

- A. Activate the cue bias by connecting a jumper between pin 4 and pin 8 on RECORD receptacle J106.
- B. Connect the audio signal generator between RECORD receptacle J106 pins 10 and 11.

5-205. Refer to Figure 2-2 in SECTION II, INSTALLATION and connect an external VU meter to the cue channel audio output on PLAYBACK receptacle J105.

5-206. Apply power to the cartridge machine and insert a bulk erased tape cartridge into the deck.

5-207. Adjust the audio generator for a 1 kHz output at -10 dBm.

5-208. Operate the unit in the playback mode and begin recording the 1 kHz cue tone.

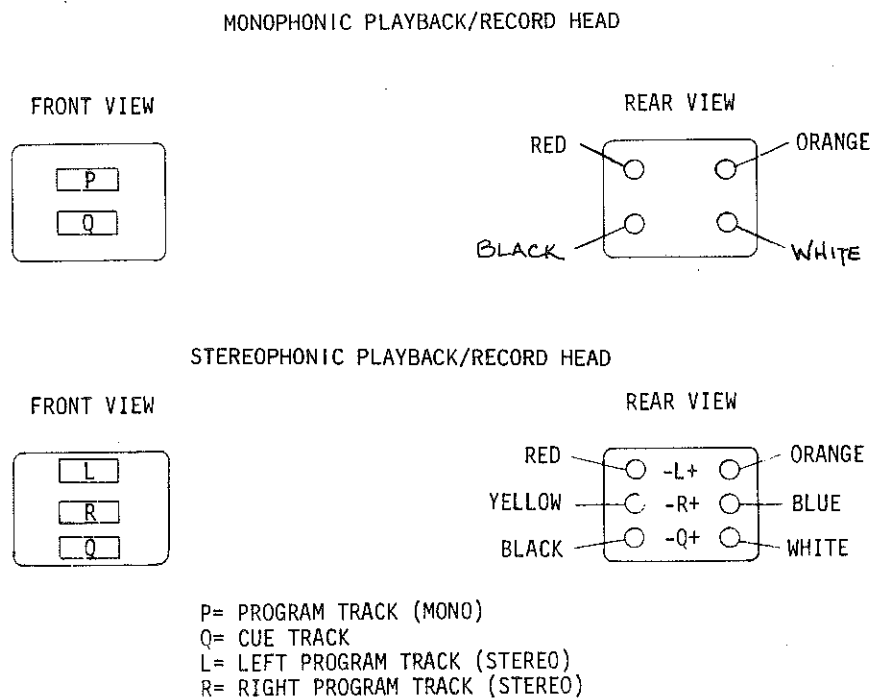
- 5-209. Refer to Figure 5-10 and adjust EXT Q LEVEL control R84 for a -10 dBm external VU meter indication.
- 5-210. Disconnect power from the cartridge machine, remove all test equipment, and remove the jumper from RECORD receptacle J106.
- 5-211. METER CALIBRATION. Potentiometers R106, R110, R108, and R112 calibrate the DT-90 record/playback unit front-panel VU meters. The front-panel VU meters are calibrated as follows.
- 5-212. Playback Meter Calibrations. To calibrate the playback VU meter parameters, proceed as follows:
- 5-213. Refer to the OUTPUT LEVEL ADJUSTMENT procedure in the preceding text and calibrate the cartridge machine for the desired output level.
- 5-214. Disconnect the cartridge machine primary power.
- 5-215. Refer to Figure 2-2 in SECTION II, INSTALLATION and connect a VU meter to the left channel output terminals of rear-panel PLAYBACK receptacle J105.
- 5-216. Apply power to the cartridge machine.
- 5-217. Insert the reproduce alignment test tape into the deck and reproduce the 1 kHz tone.
- 5-218. Refer to Figure 5-10 and adjust L PLY meter calibration control R106 until the front-panel VU meter left channel display is equal to the output level indicated on the external VU meter.
- 5-219. For stereophonic record/playback models, repeat the procedure for the right channel. Adjust the right channel VU meter with R PLY calibration control R108 (refer to Figure 5-10).
- 5-220. Disconnect the cartridge machine primary power and remove the external VU meter.
- 5-221. Record Meter Calibrations. To calibrate the record VU meter parameters, proceed as follows:
- 5-222. Disconnect the cartridge machine primary power.
- 5-223. Refer to Figure 2-2 in SECTION II, INSTALLATION and connect a VU meter to the left channel output terminals of rear-panel PLAYBACK receptacle J105.
- 5-224. Refer to Figure 2-3 in SECTION II, INSTALLATION and connect an audio generator to the left channel input terminals of rear-panel RECORD receptacle J106.

- 5-225. Apply power to the cartridge machine.
- 5-226. Adjust the audio signal generator for a 1 kHz output at 0 dBm.
- 5-227. Insert a bulk erased tape into the deck and operate the unit to begin recording the 1 kHz tone.
- 5-228. Refer to Figure 3-1 and adjust the front-panel left channel level control until the external VU meter indication is equal to the playback audio level.
- 5-229. Refer to Figure 5-10 and adjust left channel L REC control R110 until the front-panel VU meter left channel display is equal to the output level indicated on the external VU meter.
- 5-230. Repeat the procedure for the right channel. Adjust the right channel using right channel R REC control R112 (refer to Figure 5-10).
- 5-231. Disconnect the cartridge machine primary power.
- 5-232. MECHANICAL PARTS REPLACEMENT PROCEDURES.
- 5-233. The following text provides mechanical parts replacement procedures. The procedures are presented in the following order.
- A. Pressure Roller Replacement.
 - B. Head Replacement.
 - C. Motor Replacement.
- 5-234. The following equipment is required for the replacement procedures. Refer to the list as required for each procedure.

EQUIPMENT

- A. No. 1 Phillips Screwdriver, 4 Inch (10.2 cm) Blade.
 - B. Needle-nose pliers.
 - C. Allen Wrenches (supplied with the cartridge machine).
- 5-235. PRESSURE ROLLER REPLACEMENT PROCEDURE. To replace a cartridge deck pressure roller, proceed as follows:
- 5-236. Disconnect the cartridge machine primary power.
- 5-237. Refer to Figure 5-1 and manually retract the solenoid plunger.
- 5-238. Remove the pressure roller E-ring, the pressure roller, and the nylon washers (refer to Figure 5-1).

- 5-239. Refer to Figure 5-1 and replace the washers, the pressure roller, and the pressure roller E-ring.
- 5-240. Check the solenoid plunger stroke by performing the plunger adjustment steps described in the PRESSURE ROLLER INDENTATION ADJUSTMENT procedure.
- 5-241. HEAD REPLACEMENT. To replace a tape head, proceed as follows:
- 5-242. Disconnect the cartridge machine primary power.
- 5-243. Loosen the head assembly mounting screws (refer to Figure 5-6) and remove the entire head assembly from the cartridge deck.
- 5-244. Refer to Figure 5-6 and loosen the defective tape head mounting screw.
- 5-245. Remove the defective head from the head assembly and disconnect the head leads.
- 5-246. Refer to Figure 5-11 and connect the head leads to the replacement head.



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597-9100-19

FIGURE 5-11. TAPE HEAD CONFIGURATIONS

5-247. Firmly seat the replacement head into the head assembly and secure the mounting screw.

5-248. Replace the head assembly and secure the mounting screws.

5-249. Align the head by performing all the HEAD ADJUSTMENTS and associated ELECTRICAL ADJUSTMENT procedures.

5-250. MOTOR REPLACEMENT. To replace the cartridge machine motor, proceed as follows:

5-251. Disconnect the cartridge machine primary power.

5-252. Remove the cartridge machine top-panel and bottom-panel.

5-253. Place the cartridge machine on a side-panel.

5-254. Refer to Figure 7-2 in SECTION VII, DRAWINGS and disconnect P502 from the motor circuit board.

5-255. Refer to Figure 5-2 and locate the motor mounting screws. While supporting the motor, remove the motor mounting screws and carefully remove the motor from the cartridge machine chassis.

CAUTION

EXERCISE CARE WHEN HANDLING THE CARTRIDGE MACHINE MOTOR TO AVOID DAMAGING THE BEARINGS.
NEVER HANDLE THE MOTOR BY THE CAPSTAN SHAFT.

CAUTION

5-256. Carefully insert the new motor into the cartridge machine chassis and replace the motor mounting screws. Do not tighten the motor mounting screws at this time.

5-257. Refer to drawing SD900-9100-000 in SECTION VII, DRAWINGS, and reconnect the motor leads to terminal block TB1 and motor starting capacitor C1.

5-258. Align the motor by performing the MOTOR ALIGNMENT PROCEDURE and PRESSURE ROLLER INDENTATION ADJUSTMENT procedure described in the preceding text.

5-259. Replace the cartridge machine top-panel and bottom-panel.

5-260. CONVERSION KIT INSTALLATION.

5-261. Optional field installation kits are available for converting monophonic and stereophonic playback cartridge machines into record/playback units. To convert a playback machine into a record/playback unit, refer to the following procedures and Figure 7-5 in SECTION VII, DRAWINGS, as required.

5-262. FRONT-PANEL DISASSEMBLY. To disassemble the front-panel circuit board and status panel, proceed as follows:

WARNING

DISCONNECT THE PRIMARY POWER FROM THE DT-90
BEFORE PROCEEDING.

- 5-263. Disconnect the primary power from the DT-90.
- 5-264. Remove the top-cover and bottom-panel as shown.
- 5-265. Disconnect P401 from J401 on the front-panel circuit board as shown.
- 5-266. Remove the four front-panel mounting screws. With light pressure, carefully pull the front-panel from the side-panels as indicated.
- 5-267. Disconnect P402 from J402 on the front-panel circuit board.
- 5-268. Remove the three front-panel mounting nuts. Lift the front-panel circuit board from the mounting studs as indicated.
- 5-269. By applying light pressure to the mounting studs, separate the status panel from the front-panel casting as shown.
- 5-270. Install the new status panel and front-panel circuit board by following the procedure for disassembly in reverse order. Do not install the top-cover or remove the protective cling film from the status panel until installation is complete.
- 5-271. CIRCUIT BOARD INSTALLATION. To install the record logic circuit board, proceed as follows:

WARNING

DISCONNECT THE PRIMARY POWER FROM THE DT-90
BEFORE PROCEEDING.

- 5-272. Disconnect the primary power from the DT-90.
- 5-273. Install the record circuit board as shown. Ensure the connector on the record circuit board and mating connector on the mother-board circuit board are properly seated.
- 5-274. RECORD HEAD INSTALLATION. To install the record head, proceed as follows:

WARNING

DISCONNECT THE PRIMARY POWER FROM THE DT-90
BEFORE PROCEEDING.

- 5-275. Disconnect the primary power from the DT-90.
- 5-276. Disconnect the playback head leads from the playback circuit board.

- 5-277. Loosen the head assembly mounting screws and remove the entire head assembly from the cartridge deck.
- 5-278. Loosen the head locking screw and remove the dummy head from the head assembly.
- 5-279. Refer to Figure 5-11 and connect the head leads to the record head as shown.
- 5-280. Firmly seat the record head into the head assembly and secure the head locking screw.
- 5-281. Replace the head assembly and secure the mounting screws.
- 5-282. Refer to drawing AD910-0112/-001 in SECTION VII, DRAWINGS, and connect the record head leads to the record circuit board.
- 5-283. Refer to drawing AD910-0113/-001 in SECTION VII, DRAWINGS, and connect the playback head leads to the playback circuit board.
- 5-284. Align the record head by performing all the HEAD ADJUSTMENT and associated RECORD ADJUSTMENT procedures.
- 5-285. Replace the DT-90 top-cover, and remove the cling film from the status panel.
- 5-286. TROUBLESHOOTING.
- 5-287. Low voltages are used throughout the DT-90 series cartridge machine playback and control circuitry. The power supply circuitry contains primary ac line voltage. Therefore, do not perform any maintenance or troubleshooting procedures on the power supply circuitry with power energized. Troubleshooting with power energized is always considered hazardous and caution should be observed. Good judgment, care, and common sense must be practiced to prevent accidents.
- 5-288. The troubleshooting philosophy for the DT-90 cartridge machines consists of isolating a problem to a specific circuit board. The problem may be isolated by referencing the following information and Tables 5-1 and 5-2 which present the DT-90 series cartridge machine troubleshooting.

TABLE 5-1. DT-90 PLAYBACK LOGIC CIRCUIT BOARD TROUBLESHOOTING
(Sheet 1 of 2)

SYMPTOM	DEFECT
NO MOTOR, SOLENOID, AND INDICATOR OPERATION	1. Check the ac line fuse on the DT-90 rear-panel.
NO NORMAL SPEED MOTOR OPERATION	1. Check motor relay K1 on the side-panel. 2. Check fast forward latch U13A. 3. Check integrated circuits U12G and U17D.
NO FAST FORWARD MOTOR OPERATION	1. Check solid state motor relays K1 and K2 on the motherboard circuit board. 2. Check fast forward latch U13A. 3. Check integrated circuits U14B and U15B. 4. Check integrated circuit U12F. 5. Check front-panel fast forward switch/indicator S2.
NO MOTOR OPERATION	1. Check the capstan motor.
NO SOLENOID OPERATION	1. Check front-panel start switch/indicator S1. 2. Check start latch U13B. 3. Check integrated circuit U14A. 4. Check transistor Q1 on the motherboard circuit board. 5. Check the deck solenoid. 6. Check the deck microswitch.

TABLE 5-1. DT-90 PLAYBACK LOGIC CIRCUIT BOARD TROUBLESHOOTING
(Sheet 2 of 2)

SYMPTOM	DEFECT
NO LEFT CHANNEL AUDIO OUTPUT	<ol style="list-style-type: none"> 1. Check input amplifier U1B. 2. Check audio selector U20A and mute transistor Q1. 3. Check amplifier circuit U1A. 4. Check output amplifier circuits U3 and U4.
NO AUDIO OUTPUT	<ol style="list-style-type: none"> 1. Check the playback head. 2. Check mute latch U13C. 3. Check audio delay circuit U17C and associated components. 4. Check integrated circuits U14C and U16C.
NO 1 KHZ STOP OPERATION	<ol style="list-style-type: none"> 1. Check integrated circuits U9B, U10C, and U19D. 2. Check primary cue tone inhibit jumper J211.
NO CUE TONE OPERATIONS	<ol style="list-style-type: none"> 1. Check cue input amplifier U7. 2. Check the playback head.
NO START LOCK-OUT OPERATION	<ol style="list-style-type: none"> 1. Check start lock-out jumper J213. 2. Check flasher latch U13D. 3. Check integrated circuit U15C.
NO MUTE OPERATION	<ol style="list-style-type: none"> 1. Check integrated circuit U16C. 2. Check mute latch U13C.

WARNING

DISCONNECT ALL CARTRIDGE MACHINE PRIMARY POWER BEFORE REMOVING OR INSERTING PRINTED CIRCUIT BOARDS OR REPLACING ANY COMPONENTS.

WARNING

CAUTION

INADVERTENT CONTACT BETWEEN ADJACENT COMPONENTS OR CIRCUIT BOARDS WITH TEST EQUIPMENT MAY CAUSE SERIOUS DAMAGE TO THE CARTRIDGE MACHINE.

CAUTION

5-289. Once trouble is isolated and power is totally deenergized, refer to the schematic diagrams and the theory of operation to assist in problem resolution. The defective component may be repaired locally or the entire device may be returned to Broadcast Electronics Inc. for repair or replacement.

WARNING

DISCONNECT POWER BEFORE REMOVING OR REPLACING CIRCUIT BOARDS OR COMPONENTS.

CAUTION

WHEN REPLACING A COMPONENT MOUNTED ON A HEAT-SINK, ENSURE A THIN FILM OF A ZINC-BASED HEAT-SINK COMPOUND IS USED TO ASSURE GOOD HEAT DISSIPATION.

CAUTION

5-290. COMPONENT REPLACEMENT. The circuit boards used in the DT-90 cartridge machines are double-sided with plated-through holes. Due to the plated-through hole design, solder fills the holes by capillary action. This condition requires that defective components be removed carefully to avoid damage to the circuit board.

5-291. On all circuit boards, the adhesion between the copper trace and the circuit board fails at almost the same temperature as solder melts. A circuit board trace can be destroyed by excessive heat or lateral movement during soldering. Use of a small soldering iron with steady pressure is required for circuit board repairs.

5-292. To remove a soldered component from a circuit board, cut the leads from the body of the defective component while the device is still soldered to the board. Grip a component lead with needle-nose pliers. Touch the soldering iron to the lead at the solder connection on the circuit side of the board. When the solder begins to melt, push the lead through the back side of the board and cut off the clinched end of the lead. Each lead may now be heated independently and pulled out of each hole. The holes may be cleared by careful re-heating with a low wattage iron and removing the residual solder with a soldering vacuum tool.

5-293. Install the new component and apply solder from the circuit side of the board. If no damage has been incurred to the plated-through holes, soldering of the component side of the board will not be required.

WARNING

MOST SOLVENTS WHICH REMOVE ROSIN FLUX ARE VOLATILE AND TOXIC BY NATURE AND SHOULD BE USED ONLY IN SMALL AMOUNTS IN A WELL VENTILATED AREA AWAY FROM FLAME, CIGARETTES, AND HOT SOLDERING IRONS.

WARNING

WARNING

WARNING

OBSERVE THE MANUFACTURERS CAUTIONARY INSTRUCTIONS.

5-294. After soldering, remove residual flux with a suitable solvent. Rubbing alcohol is highly diluted and is not effective.

5-295. The board should be checked to ensure the flux has been completely removed. Rosin flux is not normally corrosive, however in time, the flux will absorb enough moisture to become conductive and create problems.

5-296. INTEGRATED CIRCUITS. Special care should be exercised with integrated circuits. Each integrated circuit must be installed by matching the integrated circuit notch with the notch on the socket. Do not attempt to remove an integrated circuit from a socket with your fingers. Use an integrated circuit puller to lightly pry the component from the socket.

SECTION VI PARTS LISTS

6-1. INTRODUCTION.

6-2. This section provides descriptions and part numbers of electrical components, assemblies, and selected mechanical parts required for maintenance of the Broadcast Electronics DT-90 cartridge machines. Each table entry in this section is indexed by reference designators appearing on the applicable schematic diagram.

TABLE 6-1. REPLACEABLE PARTS LISTS

TABLE	DESCRIPTION	PART NO.	PAGE
6-2	DT-90 CARTRIDGE MACHINE FINAL ASSEMBLY	900-910X-XXX	6-2
6-3	DT-90 ACCESSORY KIT	979-0086	6-4
6-4	HEAD BOX ASSEMBLY	950-0302	6-4
6-5	DECK ASSEMBLY	950-0300-006	6-4
6-6	CABLE ASSEMBLY	940-0033/-001	6-5
6-7	MOTHERBOARD CIRCUIT BOARD ASSEMBLY	910-0110	6-5
6-8	RECORD/PLAYBACK FRONT-PANEL CIRCUIT BOARD ASSEMBLY	910-0111/-001	6-6
6-9	PLAYBACK FRONT-PANEL CIRCUIT BOARD ASSEMBLY	910-0111-002	6-7
6-10	MONOPHONIC/STEREOPHONIC PLAYBACK CIRCUIT BOARD ASSEMBLY	910-0112/-001	6-7
6-11	MONOPHONIC/STEREOPHONIC RECORD CIRCUIT BOARD ASSEMBLY	910-0113/-001	6-11

TABLE 6-2. D1-90 CARTRIDGE MACHINE FINAL ASSEMBLY - 900-910X-XXX
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C2	Capacitor, Motor, 3.0 uF \pm 10%, 300V ac	029-1076	1
----- 117V 50/60 Hz -----			
F1	Fuse, AGC, 1 Ampere, 250V, Slow-Blow (for 115V Operation)	334-0100	1
----- 220V 50 Hz -----			
F1	Fuse, AGC, 1/2 Ampere, slow-Blow	330-0050	1
K1,K2,K3	Relay, Solid State	270-0061	3
S1	Switch, Pushbutton, Rectangular, Momentary Contact, Illuminated, (START Switch)	340-0103	1
S2,S3	Switch, Pushbutton, Square, Momentary Contact, Illuminated, (F FWD and STOP Switches)	340-0104	2
Y1	Transformer, Toroid Primary: 115V AC 50/60 Hz 0.68 Ampere 230V AC 50/60 Hz 0.34 Ampere Secondary: 1) 20V AC 0.40 Ampere 2) 25V AC 1.0 Ampere 3) 9V AC 150 mA	370-4390	1
YB1	Barrier Strip, 6 Terminals	412-0060	1
P101,P502	Connector, 9-Pin (for Transformer Y1)	417-0059	2
----	Connector, Power, AC Input	418-0042	1
----	Pins, Connector for P101	417-0053	8
----	Fuse Holder, AGC	415-2012	1
----	Switch, Miniature, Toggle, SPDT, 5A @ 120V ac or 2A @ 250V ac (PWR)	348-7101	1
----	Switch Cap, Green, Rectangular (START)	340-0089	1
----	Switch Cap, Blue, Square (F FWD)	340-0059	1
----	Switch Cap, Yellow, Square (STOP)	340-0014	1
----	Lamp, Wedge Base, No. 85, 28V @ 0.04 Amperes	321-0085	3
----	Blank Circuit Board, (Motor)	510-0114	1
----	Blank Circuit Board, Front-panel Switch	510-9002	1
----	Motherboard Circuit Board Assembly	910-0110	1
----	Deck Assembly	950-0300-006	1
----	Head Box Assembly	950-0302	1
----	Kit, Final Assembly	950-0189	1
----	Accessory Kit	979-0086	1
----- 60 Hz ASSEMBLY -----			
C1	Capacitor, Motor, 0.7 uF, 300V ac	029-1067	1
----	Motor, Synchronous, 60 Hz	382-2070	1
	Speed 1: 600 rpm 7 oz-in, 7.5 IPS (19.05 cm/s), 17W 117V ac		
	Speed 2: 1800 rpm 9 oz-in, 22.5 IPS (57 cm/s), 52W 117V ac		
	Model: NAH-4125B6C		
----- 50 HZ ASSEMBLY -----			
C1	Capacitor, Motor, 0.95 uF, 300V ac	029-1075	1
----	Motor, Synchronous, 50 Hz	382-2080	1
	Speed 1: 500 rpm 10 oz-in, 7.5 IPS (19.05 cm/s), 25W 117V ac		
	Speed 2: 1500 rpm 10 oz-in, 22.5 IPS (57 cm/s), 60W 117V ac		
	Model: NAH-4125B5C		

TABLE 6-2. DT-90 CARTRIDGE MACHINE FINAL ASSEMBLY - 900-910X-XXX
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
ADDITIONAL PARTS FOR MONOPHONIC PLAYBACK 900-9100-XX0			
----	Head Playback, Monophonic, 2-Channel, Model NPD1484 Inductance at 1 kHz: 475 mH Impedance at 1 kHz: 3.3 Ohms DC Resistance: 500 Ohms	250-0006	1
----	Head, Dummy, H801016	407-0001	1
----	Front-Panel Circuit Board Assembly	910-0111-002	1
----	Playback Logic Circuit Board Assembly	910-0112-001	1
----	Playback Cable Assembly	940-0033	1
ADDITIONAL PARTS FOR MONOPHONIC RECORD/PLAYBACK 900-9101-XX0			
----	Head Playback, Monophonic, 2-Channel, Model NPD1484 Inductance at 1 kHz: 475 mH Impedance at 1 kHz: 3.3 Ohms DC Resistance: 500 Ohms	250-0006	1
----	Head Record, Monophonic, 2-Channel, Model F53B9302 Inductance at 1 kHz: 0.10 mH Impedance at 1 kHz: 3.0 Ohms DC Resistance: 3.6 Ohms	250-0012	1
----	Front-Panel Circuit Board Assembly	910-0111-001	1
----	Playback Logic Circuit Board Assembly	910-0112-001	1
----	Record Logic Circuit Board Assembly	910-0113-001	1
----	Playback Cable Assembly	940-0033-001	1
ADDITIONAL PARTS FOR STEREOPHONIC PLAYBACK 900-9102-XX0			
----	Head, Playback, Stereophonic, 3-Channel, Model NPD1496 Inductance at 1 kHz: 475 mH Impedance at 1 kHz: 3.3 Ohms DC Resistance: 500 Ohms	250-0007	1
----	Head, Dummy, H801016	407-0001	1
----	Front-Panel Circuit Board Assembly	910-0111-002	1
----	Playback Logic Circuit Board Assembly	910-0112	1
----	Playback Cable Assembly	940-0033	1
ADDITIONAL PARTS FOR STEREOPHONIC RECORD/PLAYBACK 900-9103-XX0			
----	Head, Playback, Stereophonic, 3-Channel, Model NPD1496 Inductance at 1 kHz: 475 mH Impedance at 1 kHz: 3.3 Ohms DC Resistance: 500 Ohms	250-0007	1
----	Head, Record, Stereophonic, 3-Channel, Model F38B9303 Inductance at 1 kHz: 0.10 mH Impedance at 1 kHz: 4.6 Ohms DC Resistance: 4.9 Ohms	250-0010	1
----	Front-Panel Circuit Board Assembly	910-0111	1
----	Playback Logic Circuit Board Assembly	910-0112	1
----	Record Logic Circuit Board Assembly	910-0113	1
----	Playback Cable Assembly	940-0033-001	1

TABLE 6-3. DY-90 ACCESSORY KIT - 979-0086

REF. DES.	DESCRIPTION	PART NO.	QTY.
P105	Connector, 25-Pin (PLAYBACK)	417-0251	1
P106	Connector, 25-Pin (RECORD)	417-0252	1
----	Pins, Connector (RECORD)	417-0158	25
----	Pins, Connector (PLAYBACK)	418-0048	25
----	Housing, Connector With Clamp	418-2501	2
----- 117V 50/60 Hz -----			
----	Fuse, AGC, 1 Ampere, Fast-Blow	334-0100	1
----- 220V 50 Hz -----			
----	Fuse, AGC, 1/2 Ampere, slow-Blow	330-0050	1
----- 60 Hz ASSEMBLY -----			
----	AC Line Cord, N.E.M.A. 3-Wire North American Plug	682-0001	1
----- 50 Hz ASSEMBLY -----			
----	AC Line Cord, CEE 7/7 3-Wire European Plug	682-0003	1

TABLE 6-4. HEAD BOX ASSEMBLY - 950-0302

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Tape Guide	445-0004	2
----	Spring, Head Box	430-0012	6

TABLE 6-5. DECK ASSEMBLY - 950-0300-006

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Solenoid, 32V dc, 1.75 Diameter, Resistance: 37.5 Ohms $\pm 10\%$	280-0003	1
----	Switch, Micro, Roller Actuator, SPDT, 5 Amperes @ 125V ac	346-0027	1
----	Pressure Roller	444-0700	1
----	Pressure Roller Shaft	446-0056	1
----	Pressure Roller Cross Shaft	446-0049	1
----	Retainer "E" Ring	454-3318	1
----	Solenoid Return Spring	430-0014	1
----	Cartridge Guide, Right	445-0006	1
----	Cartridge Guide, Left	445-0008	1
----	Pressure Pad, Cartridge Guide	459-0123	1
----	Spring, Pressure Pad	430-0011	4
----	Spring, Left Cartridge Guide	430-0010	1
----	Washer, Nylon (for Pressure Roller)	423-5008	1
	Outside Diameter: 0.312 Inches (0.792 cm)		
	Inside Diameter: 0.190 Inches (0.483 cm)		
	Height: 0.010 Inches (0.254 cm)		
----	Washer, Nylon (for Pressure Roller)	423-5009	1
	Outside Diameter: 0.312 Inches (0.792 cm)		
	Inside Diameter: 0.190 Inches (0.483 cm)		
	Height: 0.015 Inches (0.381 cm)		

TABLE 6-6. CABLE ASSEMBLY - 940-0033/-001

REF. DES.	DESCRIPTION	PART NO.	QTY.
P102	Plug Ribbon Cable, 26-Pin Dual In-Line	418-2600	1
P401	Plug Ribbon Cable, 26-Pin Dual In-Line	418-2600	1
----	Connector Housing, 12-Pin (for P501)	418-1271	1
----	Connector Housing, 5-Pin (for P103, P104)	417-0165	2
----	Connector Housing, 10-Pin (for P402)	417-0148	1
----	Pins, Connector	417-0053	30
----	Pins, Crimp Type	417-8766	20

ADDITIONAL PARTS FOR PLAYBACK CABLE ASSEMBLY
940-0033

----	Pins, Connector	417-0142	9
------	-----------------	----------	---

ADDITIONAL PARTS FOR RECORD/PLAYBACK CABLE ASSEMBLY
940-0033-001

----	Pins, Connector	417-0142-001	18
------	-----------------	--------------	----

TABLE 6-7. MOTHERBOARD CIRCUIT BOARD ASSEMBLY - 910-0110
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1,C2	Capacitor, Electrolytic, 2200 uF, 35V	014-2293	1
C3	Capacitor, Electrolytic, 10 uF, 35V	023-1076	1
C4	Capacitor, Electrolytic, 4700 uF $\pm 20\%$, 50V	020-4794	1
C5	Capacitor, Electrolytic, 10,000 uF 20%, 16V	020-1094	1
C6	Capacitor, Monolithic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	1
C7,C8	Capacitor, Electrolytic, 1 uF, 50V	024-1064	2
C9,C10	Capacitor, Electrolytic, 10 uF, 35V	023-1076	2
C11,C12	Capacitor, Electrolytic, 4.7 uF, 35V, Low Leakage	024-4753	2
C13 THRU C16	Capacitor, Electrolytic, 10 uF, 35V	023-1076	4
C17 THRU C24	Capacitor, Monolithic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	8
D1 THRU D12	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	12
D13,D14	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	2
D15	Diode, 1N4750A, Zener, 27V $\pm 10\%$, 1 Watt	200-0027	1
D16,D17	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	2
J101	Connector, 9-Pin	418-0900	1
J102	Receptacle, Male, 13-Pin Dual In-Line	417-2600	1
J103,J104	Receptacle, Male, 20-Pin In-Line	417-0200	2
J105	Connector, 25-Pin D-Type	418-2500	1
J106	Connector, 25-Pin	417-0153	1
J201,J301	Connector Header, 50-Pin Dual In-line	417-0146	2
K1,K2	Relay, Coil: 12V dc, 800 Ohms Contacts: 100V dc @ 0.5 Amperes Maximum	270-0056	2
Q1	Transistor, TIP 120, NPN Darlington-Connected Silicon Power, 65W @ 25°C Case	210-0120	1
Q2	Transistor, 2N3904, NPN, Silicon, TO-92 Case	211-3904	1
Q3	Transistor, TIP125, Silicon, PNP, Darlington, TO-220 Case	210-0125	1
Q5	Transistor, TIP31A, Silicon, NPN, TO-220 AB Case	219-0031	1
R1	Resistor, 470 Ohm $\pm 5\%$, 1/4W	100-4733	1
R2	Resistor, 22 k Ohm $\pm 5\%$, 1/4W	100-2253	1
R3	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
R4	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R5,R6	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	2
R7	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	120-5011	1
R8,R9	Resistor, 1.5 k Ohm $\pm 1\%$, 1/4W	103-1504	2
R10,R11	Resistor, 124 Ohm $\pm 1\%$, 1/4W	103-1241	2
R12,R13	Resistor, 200 Ohm $\pm 5\%$, 1/4W	100-2033	2

TABLE 6-7. MOTHERBOARD CIRCUIT BOARD ASSEMBLY - 910-0110
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R14 THRU R21	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	8
R22	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	1
R23	Resistor, 47 Ohm $\pm 5\%$, 1/2W	110-4723	1
R24	Resistor, 22.1 Ohm $\pm 1\%$, 1/4W	103-2212	1
R25	Resistor, 10 Ohm $\pm 5\%$, 2W	130-1023	1
U1	Integrated Circuit, LM317T, Adjustable Positive Voltage Regulator, 1.2V to 37V, 1.5 Ampere, 10-220 Case	227-0317	1
U2	Integrated Circuit, LM337T, Adjustable Negative Voltage Regulator, 1.2V to 37V, 1.5 Ampere, 10-220 Case	227-0337	1
U3	Integrated Circuit, LM317T, Adjustable Positive Voltage Regulator, 1.2V to 37V, 1.5 Ampere, 10-220 Case	227-0317	1
----	Blank Motherboard Circuit Board	510-0110	1

TABLE 6-8. RECORD/PLAYBACK FRONT-PANEL CIRCUIT BOARD ASSEMBLY - 910-0111/-001

REF. DES.	DESCRIPTION	PART NO.	QTY.
DS5 THRU DS7	LED, Green, MV54173, Light Intensity I	320-0016	3
DS8	LED, Red, MV57173, Light Intensity G	320-0017	1
J401	Receptacle, Male, 13-Pin Dual In-Line	417-2600	1
J402	Receptacle, Male, 20-Pin In-Line	417-0200	1
J501	Receptacle, 12-Pin	417-1276	1
J502	Connector, 9-Pin	418-0900	1
R9 THRU R11	Resistor, 470 Ohm $\pm 5\%$, 1/4W	100-4733	3
R12	Resistor, 560 Ohm $\pm 5\%$, 1/4W	100-5633	1
R13	Resistor, 1 Ohm $\pm 5\%$, 1/4W	100-1013	1
S4,S5	Switch, Push, Illuminated, S120601H1, Contacts: SPST, N.O., 24V ac at 125 mA Nominal (SEC and TIER Switches)	340-0107	2
S6	Switch, Push, SN10202N1, Contacts: SPST, N.O., 24V dc at 125 mA Nominal (REC Switch)	340-0118	1
----	Blank Circuit Board	510-0111	1

ADDITIONAL PARTS FOR STEREOPHONIC RECORD/PLAYBACK
910-0111

C2	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	1
C4	Capacitor, Electrolytic, 10 μ F, 35V	023-1076	1
D2	Diode, 1N4004, Silicon, 400V @ 30 μ A	203-4004	1
DS3	LED, Green, MV54164, High Efficiency 10-Segment Bar Graph Array	320-4164	1
DS4	LED, Red, MV57164, High Efficiency 10-Segment Bar Graph Array	320-7164	1
R2	Resistor, 22 Ohm $\pm 5\%$, 1W	120-2223	1
R5	Resistor, 2.26 k Ohm $\pm 1\%$, 1/4W	103-2264	1
R6	Resistor, 6.04 k Ohm $\pm 1\%$, 1/4W	103-6044	1
R8	Potentiometer, 50 k Ohm $\pm 10\%$, 1/2W	177-5054	1
U2	Integrated Circuit, LM3916N, Dot/Bar Display Driver, 18-Pin DIP	220-3916	1
XU2	Socket, 18-Pin DIP	417-1804	1

ADDITIONAL PARTS FOR MONOPHONIC RECORD/PLAYBACK
910-0111-001

C1	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	1
C3	Capacitor, Electrolytic, 10 μ F, 35V	023-1076	1
D1	Diode, 1N4004, Silicon, 400V @ 30 μ A	203-4004	1
DS1	LED, Green, MV54164, High Efficiency 10-Segment Bar Graph Array	320-4164	1
DS2	LED, Red, MV57164, High Efficiency 10-Segment Bar Graph Array	320-7164	1
R1	Resistor, 22 Ohm $\pm 5\%$, 1W	120-2223	1
R3	Resistor, 2.26 k Ohm $\pm 1\%$, 1/4W	103-2264	1
R4	Resistor, 6.04 k Ohm $\pm 1\%$, 1/4W	103-6044	1
R7	Potentiometer, 50 k Ohm $\pm 10\%$, 1/2W	177-5054	1
U1	Integrated Circuit, LM3916N, Dot/Bar Display Driver, 18-Pin DIP	220-3916	1
XU1	Socket, 18-Pin DIP	417-1804	1

TABLE 6-9. PLAYBACK FRONT-PANEL CIRCUIT BOARD ASSEMBLY - 910-0111-002

REF. DES.	DESCRIPTION	PART NO.	QTY.
DS5 THRU DS7	LED, Green, MV54173, Light Intensity I	320-0016	3
J401	Receptacle, Male, 13-Pin Dual In-Line	417-2600	1
J402	Receptacle, Male, 20-Pin In-Line	417-0200	1
J501	Receptacle, 12-Pin	417-1276	1
J502	Connector, 9-Pin	418-0900	1
R9 THRU R11	Resistor, 470 Ohm $\pm 5\%$, 1/4W	100-4733	3
----	Blank Front-Panel Circuit Board	510-0111	1

TABLE 6-10. MONOPHONIC/STEREOPHONIC PLAYBACK CIRCUIT BOARD ASSEMBLY - 910-0112/-001
(Sheet 1 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Electrolytic, 10 μ F, 25V, Non-Polarized	023-1075	1
C3	Capacitor, Electrolytic, 47 μ F, 16V	013-4750	1
C4	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	1
C5	Capacitor, Electrolytic, 4.7 μ F, 35V, Low Leakage	024-4753	1
C6	Capacitor, Ceramic, 0.001 μ F $\pm 10\%$, 200V	030-1033	1
C7,C8,C9	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	3
C10	Capacitor, Electrolytic, 10 μ F, 25V, Non-Polarized	023-1075	1
C11,C12	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	2
C13	Capacitor, Electrolytic, 10 μ F, 25V, Non-Polarized	023-1075	1
C26	Capacitor, Electrolytic, 10 μ F, 35V	023-1076	1
C27	Capacitor, Monolythic Ceramic, 0.0047 μ F $\pm 5\%$, 100V	003-4723	1
C28	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	1
C29	Capacitor, Electrolytic, 10 μ F, 25V, Non-Polarized	023-1075	1
C30	Capacitor, Electrolytic, 2.2 μ F, 50V	020-2264	1
C31	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	1
C32	Capacitor, Mica, 50 pF $\pm 5\%$, 500V	040-5013	1
C33,C34	Capacitor, Monolythic Ceramic, 0.0047 μ F $\pm 5\%$, 100V	003-4723	2
C35 THRU C37	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	3
C38	Capacitor, Electrolytic, 1 μ F, 50V	024-1064	1
C39,C40	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	2
C41,C42	Capacitor, Monolythic Ceramic, 0.047 μ F $\pm 5\%$ 50V	003-4733	2
C43	Capacitor, Electrolytic, 1 μ F, 50V	024-1064	1
C44	Capacitor, Electrolytic, 2.2 μ F, 25V dc	013-2064	1
C45 THRU C47	Capacitor, Monolythic Ceramic, 0.0047 μ F $\pm 5\%$, 100V	003-4723	3
C48	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	1
C49	Capacitor, Monolythic Ceramic, 0.047 μ F $\pm 5\%$ 50V	003-4733	1
C50,C51	Capacitor, Monolythic Ceramic, 0.0047 μ F $\pm 5\%$, 100V	003-4723	2
C52	Capacitor, Electrolytic, 1 μ F, 50V	024-1064	1
C53	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	1
C54	Capacitor, Electrolytic, 33 μ F, 35V	024-3335	1
C55	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	1
C56	Capacitor, Electrolytic, 33 μ F, 35V	024-3335	1
C57	Capacitor, Electrolytic, 3.3 μ F $\pm 20\%$, 50V, Non-Polarized	024-3364	1
C60 THRU C62	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	3
C63	Capacitor, Electrolytic, 4.7 μ F, 35V, Low Leakage	024-4753	1
C64	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	1
C65	Capacitor, Electrolytic, 4.7 μ F, 35V, Low Leakage	024-4753	1
C66 THRU C68	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	3
C69	Capacitor, Electrolytic, 4.7 μ F, 35V, Low Leakage	024-4753	1
C70, C72	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	2
C73	Capacitor, Electrolytic, 1 μ F, 50V	024-1064	1
C74	Capacitor, Ceramic, 0.001 μ F $\pm 10\%$, 200V	030-1033	1
C75 THRU C77, C80,C81	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	5
C82	Capacitor, Monolythic Ceramic, 0.0047 μ F $\pm 5\%$, 100V	003-4723	1
C83	Capacitor, Ceramic Disc, 10 pF $\pm 10\%$, 1kV, Non-Polarized	001-1014	1
C85 THRU C88	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	4
D1,D2	Diode, 1N4737, Zener, 7.5V $\pm 10\%$, 1W	200-4737	2
D3 THRU 10, D14 THRU D27, D29 THRU D39	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	33
J202 THRU J210	Receptacle, Single Pin	417-0071-001	9

TABLE 6-10. MONOPHONIC/STEREOPHONIC PLAYBACK CIRCUIT BOARD ASSEMBLY - 910-0112/-001
(Sheet 2 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
J211, J212, J213	Receptacle, Male, 2-Pin In-line	417-4004	3
J214	Connector, Header, 3-Pin	417-0003	1
J215	Receptacle, Male, 2-Pin In-line	417-4004	1
P201	Receptacle, 50-Pin Dual In-line	417-0147	1
P211 THRU P215	Jumper, Programmable, 2-Pin	340-0004	5
Q1	Field Effect Transistor, J271, P-Channel JFET, Y0-92 Case	210-0271	1
Q3	Transistor, 2N3904, NPN, Silicon, Y0-92 Case	211-3904	1
Q4	Field Effect Transistor, J271, P-Channel JFET, Y0-92 Case	210-0271	1
R1	Resistor, 270 k Ohm $\pm 5\%$, 1/4W	100-2763	1
R2	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	1
R3	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R4	Potentiometer, 250 k Ohm $\pm 10\%$, 1/2W	180-0001	1
R5	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R6	Resistor, 68 k Ohm $\pm 5\%$, 1/4W	100-6853	1
R7	Resistor, 470 Ohm $\pm 5\%$, 1/4W	100-4733	1
R8	Resistor, 1.2 k Ohm $\pm 5\%$, 1/4W	100-1243	1
R9	Potentiometer, 10 k Ohm $\pm 10\%$, 1/2W	178-1054	1
R10, R11	Resistor, 47 k Ohm $\pm 5\%$, 1/4W	100-4753	2
R12, R13	Resistor, 470 Ohm $\pm 5\%$, 1/4W	100-4733	2
R14	Resistor, 1 Meg Ohm $\pm 5\%$, 1/4W	100-1073	1
R15	Resistor, 1.1 Meg Ohm $\pm 5\%$, 1/4W	100-1173	1
R16	Resistor, 510 k Ohm $\pm 5\%$, 1/4W	100-5163	1
R17	Resistor, 330 k Ohm $\pm 5\%$, 1/4W	100-3363	1
R19	Potentiometer, 250 k Ohm $\pm 10\%$, 1/2W	180-0001	1
R20	Resistor Network, 8-10 k Ohm $\pm 1\%$, 1/4W, 16-Pin DIP	226-1055	1
R21	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	1
R22	Resistor, 33 Ohm $\pm 5\%$, 1/4W	100-3323	1
R23	Resistor, 5.11 k Ohm $\pm 1\%$, 1/4W	103-5141	1
R24	Resistor, 33 Ohm $\pm 5\%$, 1/4W	100-3323	1
R36	Resistor, 1 Meg Ohm $\pm 5\%$, 1/4W	100-1073	1
R37	Resistor, 1.1 Meg Ohm $\pm 5\%$, 1/4W	100-1173	1
R45	Resistor, 270 k Ohm $\pm 5\%$, 1/4W	100-2763	1
R46	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	1
R47	Resistor, 665 k Ohm $\pm 1\%$, 1/4W	103-6654	1
R48	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
R49	Resistor, 15 k Ohm $\pm 5\%$, 1/4W	100-1551	1
R50	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R52	Resistor, 2.2 k Ohm $\pm 5\%$, 1/4W	100-2243	1
R53	Resistor, 56.2 k Ohm $\pm 1\%$, 1/4W	103-5651	1
R54	Resistor, 1.15 k Ohm $\pm 1\%$, 1/4W	103-1156	1
R55	Resistor, 113 k Ohm $\pm 5\%$, 1/4W	103-1136	1
R56	Resistor, 510 k Ohm $\pm 5\%$, 1/4W	100-5163	1
R57	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R58	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-5653	1
R59	Resistor, 30 k Ohm $\pm 5\%$, 1/4W	100-3053	1
R60	Resistor, 1 Meg Ohm $\pm 5\%$, 1/4W	100-1073	1
R61, R62	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	2
R63	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	103-1062	1
R64	Resistor, 2.32 k Ohm $\pm 1\%$, 1/4W	103-2341	1
R65	Resistor, 226 k Ohm $\pm 1\%$, 1/4W	103-2276	1
R66	Potentiometer, 100 k Ohm $\pm 10\%$, 1/2W	178-1064	1
R67	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
R68	Resistor, 51.1 k Ohm $\pm 5\%$, 1/4W	100-5153	1
R69	Resistor, 220 k Ohm $\pm 5\%$, 1/4W	100-2263	1
R70	Resistor, 30 k Ohm $\pm 5\%$, 1/4W	100-3053	1
R71	Resistor, 1.1 Meg Ohm $\pm 5\%$, 1/4W	100-1173	1
R72	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R74	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R75	Resistor, 84.5 k Ohm $\pm 5\%$, 1/4W	103-8456	1
R76	Resistor, 3.57 k Ohm $\pm 1\%$, 1/4W	103-3574	1
R77	Resistor, 348 k Ohm $\pm 1\%$, 1/4W	103-3486	1
R78	Potentiometer, 100 k Ohm $\pm 10\%$, 1/2W	178-1064	1
R79	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
R80	Resistor, 51.1 k Ohm $\pm 5\%$, 1/4W	100-5153	1
R81	Resistor, 1.5 Meg Ohm $\pm 5\%$, 1/4W	100-1573	1

TABLE 6-10. MONOPHONIC/STEREOPHONIC PLAYBACK CIRCUIT BOARD ASSEMBLY - 910-0112/-001
(Sheet 3 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R82	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R83	Resistor, 620 Ohm $\pm 5\%$, 1/4W	100-6233	1
R84	Resistor, 3.57 k Ohm $\pm 1\%$, 1/4W	103-3574	1
R85	Resistor, 475 Ohm $\pm 1\%$, 1/4W	103-4753	1
R86	Resistor, 42.2 k Ohm $\pm 5\%$, 1/4W	103-4225	1
R87	Potentiometer, 100 k Ohm $\pm 10\%$, 1/2W	178-1064	1
R88	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
R89	Resistor, 51.1 k Ohm $\pm 5\%$, 1/4W	100-5153	1
R90	Resistor, 1.5 Meg Ohm $\pm 5\%$, 1/4W	100-1573	1
R91	Resistor, 1 Meg Ohm $\pm 5\%$, 1/4W	100-1073	1
R92 THRU R94	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	3
R95	Resistor, 1.5 k Ohm $\pm 5\%$, 1/4W	100-1543	1
R96	Resistor, 620 Ohm $\pm 5\%$, 1/4W	100-6233	1
R97	Resistor, 510 k Ohm $\pm 5\%$, 1/4W	100-5163	1
R98	Resistor, 374 k Ohm $\pm 1\%$, 1/4W	103-3746	1
R99 THRU R101	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	3
R102,R103	Resistor, 1 Meg Ohm $\pm 5\%$, 1/4W	100-1073	2
R104	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R105	Resistor, 1 Meg Ohm $\pm 5\%$, 1/4W	100-1073	1
R106	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
R107	Resistor, 470 k Ohm $\pm 5\%$, 1/4W	100-4763	1
R108,R109	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	2
R110	Resistor, 1.5 k Ohm $\pm 5\%$, 1/4W	100-1543	1
R111,R112	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	2
R113	Resistor, 1.5 k Ohm $\pm 5\%$, 1/4W	100-1543	1
R114,R115	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	2
R116	Resistor, 1.5 k Ohm $\pm 5\%$, 1/4W	100-1543	1
R117 THRU R119	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	3
R120	Resistor, 1 Meg Ohm $\pm 5\%$, 1/4W	100-1073	1
R121	Resistor, 220 k Ohm $\pm 5\%$, 1/4W	100-2263	1
R122	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
R123	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R124	Resistor, 5.1 Meg Ohm $\pm 5\%$, 1/4W	100-5173	1
R125	Resistor, 220 k Ohm $\pm 5\%$, 1/4W	100-2263	1
R126	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R127	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R128	Resistor, 20.0 k Ohm $\pm 1\%$, 1/4W	103-2051	1
R130 THRU R133	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	4
R134	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R135	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R136	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
R137	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	3
R138	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	1
U1	Integrated Circuit, NE5532A, Dual Low Noise Operational Amplifier, 8-Pin DIP	221-5532	1
U3,U4,U7,U8, U9	Integrated Circuit, RC4559NB, Operational Amplifier, 8-Pin DIP	221-4559	5
U10	Integrated Circuit, LM339AN, Quad Comparator, 14-Pin DIP	221-0339	1
U11,U12	Integrated Circuit, ULN2004, 7 NPN Darlington Driver Pack, 16-Pin DIP	226-2004	2
U13	Integrated Circuit, MC14044BP, Quad NAND R-S Latch, CMOS, 16-Pin DIP	228-4044	1
U14	Integrated Circuit, CD4075BE, RCA	225-0006	1
U15	Integrated Circuit, CD4081B, Quad 2-Input AND Gate, CMOS, 14-Pin DIP	225-0008	1
U16	Integrated Circuit, MC14073B, Triple 3-Input AND Gate, CMOS, 14-Pin DIP	228-4073	1
U17	Integrated Circuit, MC14093B, CMOS, Quad 2-Input NAND Schmitt Trigger, 14-Pin DIP	220-4093	1
U18	Integrated Circuit, MC14538B, Dual Retriggerable, Resettable Monostable Multivibrator, CMOS, 16-Pin DIP	228-4538	1
U19	Integrated Circuit, MC14093B, CMOS, Quad 2-Input NAND Schmitt Trigger, 14-Pin DIP	220-4093	1
U20	Integrated Circuit, MC14053B, Analog Multiplexers/Demultiplexers, CMOS MSI, 16-Pin DIP	220-4053	1

TABLE 6-10. MONOPHONIC/STEREOPHONIC PLAYBACK CIRCUIT BOARD ASSEMBLY - 910-0112/-001
(Sheet 4 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
XU1,XU3,XU4, XU7,XU8,XU9	Socket, 8-Pin DIP	417-0804	6
XU10	Socket, 14-Pin DIP	417-1404	1
XU11,XU12, XU13	Socket, 16-Pin DIP	417-1604	3
XU14 THRU XU17	Socket, 14-Pin DIP	417-1404	4
XU18	Socket, 16-Pin DIP	417-1604	1
XU19	Socket, 14-Pin DIP	417-1404	1
XU20	Socket, 16-Pin DIP	417-1604	1
----	Blank Playback Circuit Board	510-0112	1

ADDITIONAL PARTS FOR STEREOPHONIC PLAYBACK
910-0112

C2	Capacitor, Mica, 68 pF $\pm 5\%$, 500V	040-6813	1
C14	Capacitor, Electrolytic, 10 μ F, 25V, Non-Polarized	023-1075	1
C15	Capacitor, Mica, 68 pF $\pm 5\%$, 500V	040-6813	1
C16	Capacitor, Electrolytic, 47 μ F, 16V	013-4750	1
C17	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	1
C18	Capacitor, Ceramic, 0.001 μ F $\pm 10\%$, 200V	030-1033	1
C19	Capacitor, Electrolytic, 4.7 μ F, 35V, Low Leakage	024-4753	1
C20	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	1
C21	Capacitor, Electrolytic, 10 μ F, 25V, Non-Polarized	023-1075	1
C22,C23	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	2
C24	Capacitor, Electrolytic, 10 μ F, 25V, Non-Polarized	023-1075	1
C25	Capacitor, Mica, 68 pF $\pm 5\%$, 500V	040-6813	1
C71	Capacitor, Electrolytic, 3.3 μ F $\pm 20\%$, 50V, Non-Polarized	024-3364	1
C78,C79	Capacitor, Monolythic Ceramic, 0.1 μ F $\pm 20\%$, 50V	003-1054	2
Q2	Field Effect Transistor, J271, P-Channel JFET, Y0-92 Case	210-0271	1
R18	Resistor, 1.3 k Ohm $\pm 5\%$, 1/4W	100-1343	1
R25	Resistor, 270 k Ohm $\pm 5\%$, 1/4W	100-2763	1
R26	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	1
R27	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R28	Potentiometer, 250 k Ohm $\pm 10\%$, 1/2W	180-0001	1
R29	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R30	Resistor, 68 k Ohm $\pm 5\%$, 1/4W	100-6853	1
R31	Resistor, 470 Ohm $\pm 5\%$, 1/4W	100-4733	1
R32	Resistor, 1.2 k Ohm $\pm 5\%$, 1/4W	100-1243	1
R33	Potentiometer, 10 k Ohm $\pm 10\%$ 1/2W	178-1054	1
R34,R35	Resistor, 47 k Ohm $\pm 5\%$, 1/4W	100-4753	2
R38	Resistor, 1.3 k Ohm $\pm 5\%$, 1/4W	100-1343	1
R39	Potentiometer, 250 k Ohm $\pm 10\%$, 1/2W	180-0001	1
R40	Resistor Network, 8-10 k Ohm $\pm 1\%$, 1/4W, 16-Pin DIP	226-1055	1
R41	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	1
R42	Resistor, 33 Ohm $\pm 5\%$, 1/4W	100-3323	1
R43	Resistor, 5.11 k Ohm $\pm 1\%$, 1/4W	103-5141	1
R44	Resistor, 33 Ohm $\pm 5\%$, 1/4W	100-3323	1
R51	Resistor, 150 k Ohm $\pm 5\%$, 1/4W	100-1563	1
R73	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R129	Resistor, 20.0 k Ohm $\pm 1\%$, 1/4W	103-2051	1
U2	Integrated Circuit, NE5532A, Dual Low Noise Operational Amplifier, 8-Pin DIP	221-5532	1
U5,U6	Integrated Circuit, RC4559NB, Operational Amplifier, 8-Pin DIP	221-4559	2
XU2,XU5,XU6	Socket, 8-Pin DIP	417-0804	3

ADDITIONAL PARTS FOR MONOPHONIC PLAYBACK
910-0112-001

C2,C25	Capacitor, Mica, 150 pF $\pm 5\%$, 500V	040-1522	2
R18	Resistor, 750 Ohm $\pm 5\%$, 1/4W	100-7533	1
R51	Resistor, 56 k Ohm $\pm 5\%$, 1/4W	100-5653	1

TABLE 6-11. MONOPHONIC/STEREOPHONIC RECORD CIRCUIT BOARD ASSEMBLY - 910-0113/001
(Sheet 1 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1,C2	Capacitor, Electrolytic, 10 uF, 35V	023-1075	2
C5,C6	Capacitor, Mica, 390 pF $\pm 5\%$, 100V	042-3922	2
C9,C10	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	2
C13	Capacitor, Ceramic Disc, 10 pF $\pm 10\%$, 1kV, Non-Polarized	001-1014	1
C15	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	1
C16	Capacitor, Mica, 120 pF $\pm 5\%$, 500V	042-1222	1
C19	Capacitor, Ceramic Disc, 10 pF $\pm 10\%$, 1kV, Non-Polarized	001-1014	1
C21,C22	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	2
C25	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	1
C26	Capacitor, Mylar Film, 0.022 uF $\pm 10\%$, 100V	031-2243	1
C28	Capacitor, Electrolytic, 10 uF, 35V	023-1075	1
C30,C31	Capacitor, Electrolytic, 33 uF, 35V	024-3335	2
C32,C33	Capacitor, Mica, 22 pF $\pm 5\%$, 500V	042-2212	1
C34,C35	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	2
C36	Capacitor, Electrolytic, 1 uF, 50V	024-1064	1
C37	Capacitor, Mica, 220 pF $\pm 5\%$, 500V	040-2223	1
C38,C39	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	2
C40	Capacitor, Polyester, 0.0022 uF $\pm 10\%$, 100V	031-2033	1
C41	Capacitor, Mylar, 0.01 uF $\pm 10\%$, 100V	031-1043	1
C42	Capacitor, Silvered Mica, 100 pF $\pm 5\%$, 500V	040-1022	1
C43 THRU C45	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	3
C46	Capacitor, Mica, 220 pF $\pm 5\%$, 500V	040-2223	1
C47,C48	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	2
C49	Capacitor, Polyester, 0.0022 uF $\pm 10\%$, 100V	031-2033	1
C50	Capacitor, Mylar, 0.01 uF $\pm 10\%$, 100V	031-1043	1
C51	Capacitor, Silvered Mica, 100 pF $\pm 5\%$, 500V	040-1022	1
C52 THRU C55	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	4
C56	Capacitor, Mica, 470 pF $\pm 1\%$, 500V	040-4721	1
C57	Capacitor, Mica, 47 pF $\pm 5\%$, 500V	040-4713	1
C58	Capacitor, Mica, 470 pF $\pm 1\%$, 500V	040-4721	1
C59 THRU C61	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	3
C62	Capacitor, Monolythic Ceramic, 0.0047 uF $\pm 5\%$, 100V	003-4723	1
C63	Capacitor, Mica, 470 pF $\pm 1\%$, 500V	040-4721	1
C64	Capacitor, Monolythic Ceramic, 0.0047 uF $\pm 5\%$, 100V	003-4723	1
C65	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	1
C66	Capacitor, Electrolytic, 10 uF, 35V	023-1076	1
C67	Capacitor, Monolythic Ceramic, 0.047 uF $\pm 5\%$, 50V	003-4733	1
C68	Capacitor, Monolythic Ceramic, 0.0047 uF $\pm 5\%$, 100V	003-4723	1
C69	Capacitor, Monolythic Ceramic, 0.047 uF $\pm 5\%$, 50V	003-4733	1
C70	Capacitor, Electrolytic, 10 uF, 35V	023-1075	1
C71	Capacitor, Mylar Film, 0.022 uF $\pm 10\%$, 100V	031-2243	1
C72	Capacitor, Electrolytic, 10 uF, 35V	023-1075	1
C73 THRU C75	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	3
C76	Capacitor, Electrolytic, 1 uF, 50V	024-1064	1
C77 THRU C80, C82,C83	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	6
C84	Capacitor, Electrolytic, 4.7 uF, 35V, Low Leakage	024-4753	1
C85	Capacitor, Electrolytic, 1 uF, 50V	024-1064	1
C86,C87,C89	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	3
C90,C91	Capacitor, Electrolytic, 10 uF, 35V	023-1075	2
C92,C93	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	2
C96	Capacitor, Electrolytic, 1 uF, 50V	024-1064	1
C98	Capacitor, Monolythic Ceramic, 0.047 uF $\pm 5\%$, 50V	003-4733	1
C100,C101	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	2
C102	Capacitor, Electrolytic, 10 uF, 35V	023-1075	1
C104	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	1
C105	Capacitor, Electrolytic, 10 uF, 35V	023-1075	1
D1,D2	Diode, 1N4737, Zener, 7.5V $\pm 10\%$, 1W	200-4737	2
D3 THRU D10, D13,D14,D17	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	11
J302 THRU J310	Receptacle, Single Pin	417-0071-001	9
J311	Connector, Header, 3-Pin	417-0003	1
P301	Receptacle, 50-Pin Dual In-line	417-0147	1
P311	Jumper, Programmable, 2-Pin	340-0004	1
Q1 THRU Q4	Field Effect Transistor, J271, P-Channel JFET, TO-92 Case	210-0271	4
Q5,Q6	Transistor, 2N3904, NPN, Silicon, TO-92 Case	211-3904	2
Q7,Q8	Transistor, MPS-A14, Silicon, NPN, Darlington, TO-92 Case	211-0014	2
R1,R2	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	2

TABLE 6-11. MONOPHONIC/STEREOPHONIC RECORD CIRCUIT BOARD ASSEMBLY - 910-0113/001
(Sheet 2 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R6	Resistor, 270 Ohm $\pm 5\%$, 1/4W	100-2733	1
R8	Resistor, 1 Meg Ohm $\pm 5\%$, 1/4W	100-1073	1
R10,R11	Resistor, 22 k Ohm $\pm 5\%$, 1/4W	100-2253	2
R14	Potentiometer, 500 k Ohm $\pm 10\%$, 1/2W	178-5064	1
R15	Resistor, 22 k Ohm $\pm 5\%$, 1/4W	100-2253	1
R16	Potentiometer, 500 k Ohm $\pm 10\%$, 1/2W	178-5064	1
R20,R21	Resistor, 22 k Ohm $\pm 5\%$, 1/4W	100-2253	2
R24,R25	Resistor, 665 Ohm $\pm 1\%$, 1/4W	103-6653	2
R28,R29	Resistor, 470 Ohm $\pm 5\%$, 1/4W	100-4733	2
R30,R31	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	2
R32	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R34	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	1
R36	Resistor, 10 Meg Ohm $\pm 5\%$, 1/4W	100-1083	1
R37	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	1
R38	Resistor, 33.2 k Ohm $\pm 1\%$, 1/4W	103-3325	1
R39	Resistor, 35.7 k Ohm $\pm 1\%$, 1/4W	103-3575	1
R40	Resistor, 11.3 k Ohm $\pm 1\%$, 1/4W	103-1135	1
R41	Resistor, 470 k Ohm $\pm 5\%$, 1/4W	100-4763	1
R42	Resistor, 220 k Ohm $\pm 5\%$, 1/4W	100-2263	1
R43	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R44	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	1
R45 THRU R47	Resistor, 1 k Ohm $\pm 1\%$, 1/4W	100-1041	3
R48	Potentiometer, 1 k Ohm $\pm 10\%$, 1/2W	178-1044	1
R50	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	1
R52	Resistor, 11.3 k Ohm $\pm 1\%$, 1/4W	103-1135	1
R53	Resistor, 35.7 k Ohm $\pm 1\%$, 1/4W	103-3575	1
R54	Resistor, 33.2 k Ohm $\pm 1\%$, 1/4W	103-3325	1
R55,R56	Resistor, 470 k Ohm $\pm 5\%$, 1/4W	100-4763	2
R57	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R58	Resistor, 4.7 k Ohm $\pm 5\%$, 1/4W	100-4743	1
R59 THRU R61	Resistor, 1 k Ohm $\pm 1\%$, 1/4W	100-1041	3
R62	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	1
R63	Potentiometer, 1 k Ohm $\pm 10\%$, 1/2W	178-1044	1
R64	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	1
R65	Resistor, 43.2 k Ohm $\pm 1\%$, 1/4W	103-4325	1
R66	Resistor, 301 k Ohm $\pm 1\%$, 1/4W	103-3061	1
R67	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R68	Resistor, 53.6 k Ohm $\pm 1\%$, 1/4W	103-5365	1
R69	Resistor, 5.1 k Ohm $\pm 5\%$, 1/4W	100-5143	1
R70	Potentiometer, 20 k Ohm $\pm 10\%$, 1/2W	178-2054	1
R71	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R72	Resistor, 34.8 k Ohm $\pm 1\%$, 1/4W	103-3485	1
R73	Resistor, 294 k Ohm $\pm 1\%$, 1/4W	103-2946	1
R74	Resistor, 44.2 k Ohm $\pm 1\%$, 1/4W	103-4425	1
R75	Resistor, 2 k Ohm $\pm 5\%$, 1/4W	100-2043	1
R76	Potentiometer, 10 k Ohm $\pm 10\%$, 1/2W	178-1054	1
R77	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R78	Resistor, 24.9 k Ohm $\pm 1\%$, 1/4W	103-2495	1
R79	Resistor, 169 k Ohm $\pm 1\%$, 1/4W	103-1696	1
R80	Resistor, 32.4 k Ohm $\pm 1\%$, 1/4W	103-3245	1
R81	Resistor, 1.2 k Ohm $\pm 5\%$, 1/4W	100-1243	1
R82	Potentiometer, 5 k Ohm $\pm 20\%$, 3/4W	178-5044	1
R83	Resistor, 200 Ohm $\pm 5\%$, 1/4W	100-2033	1
R84	Potentiometer, 5 k Ohm $\pm 20\%$, 3/4W	178-5044	1
R86	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R87,R88	Resistor, 10 Ohm $\pm 5\%$, 1/4W	100-1023	2
R89	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	1
R90,R91	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	2
R92	Resistor, 470 k Ohm $\pm 5\%$, 1/4W	100-4763	1
R93	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
R94,R95	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	2
R96	Resistor, 470 k Ohm $\pm 5\%$, 1/4W	100-4763	1
R97	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
R98	Resistor, 470 k Ohm $\pm 5\%$, 1/4W	100-4763	1
R99	Resistor, 220 k Ohm $\pm 5\%$, 1/4W	100-2263	1
R100	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R101	Resistor, 3.3 Meg Ohm $\pm 5\%$, 1/4W	100-3373	1

TABLE 6-11. MONOPHONIC/STEREOPHONIC RECORD CIRCUIT BOARD ASSEMBLY - 910-0113/001
(Sheet 3 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R102	Resistor, 22 k Ohm $\pm 5\%$, 1/4W	100-2253	1
R103,R104	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	2
R105	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R106	Potentiometer, 10 k Ohm $\pm 10\%$ 1/2W	178-1054	1
R107	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	1
R110	Potentiometer, 10 k Ohm $\pm 10\%$ 1/2W	178-1054	1
R111	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	1
R114 THRU R117	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	4
R120,R121	Resistor, 169 k Ohm $\pm 1\%$, 1/4W	103-1696	2
R122	Resistor, 150 k Ohm $\pm 5\%$, 1/4W	100-1563	1
R123	Resistor, 300 k Ohm $\pm 5\%$, 1/4W	100-3063	1
R124	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R125	Resistor, 1 Meg Ohm $\pm 5\%$, 1/4W	100-1073	1
R132	Resistor, 5.1 k Ohm $\pm 5\%$, 1/4W	100-5143	1
R133	Resistor, 51.1 k Ohm $\pm 5\%$, 1/4W	100-5153	1
R136	Resistor Network, 8-10 k Ohm $\pm 1\%$, 1/4W, 16-Pin DIP	226-1055	1
R138	Resistor, 1.5 k Ohm $\pm 5\%$, 1/4W	100-1543	1
R139	Resistor, 220 k Ohm $\pm 5\%$, 1/4W	100-2263	1
R140	Resistor, 470 k Ohm $\pm 5\%$, 1/4W	100-4763	1
R141	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
Y1	Terminal, Yurret, Double Shoulder	417-1597	1
U1	Integrated Circuit, TL074CN, Quad JFET-Input Operational Amplifier, 14-Pin DIP	221-0074	1
U3	Integrated Circuit, NE5532AP, Dual Low Noise Operational Amplifier, 8-Pin DIP	221-5532-001	1
U5	Integrated Circuit, MC14053B, Analog Multiplexers/Demultiplexers, CMOS MSI, 16-Pin DIP	220-4053	1
U6	Integrated Circuit, MC14060B, 14-Bit Binary Counter and Oscillator, CMOS MSI, 16-Pin DIP	220-4060	1
U7	Integrated Circuit, MC14070BCP, Quad Exclusive OR Gate, CMOS, 14-Pin DIP	228-4071	1
U8	Integrated Circuit, MC14013BCP, Dual D-Type Flip-Flop, CMOS, 14-Pin DIP	228-4013	1
U9,U10	Integrated Circuit, NE5532AP, Dual Low Noise Operational Amplifier, 8-Pin DIP	221-5532-001	2
U11	Integrated Circuit, MC14040B, CMOS MSI, 12-Bit Binary Counter, 16-Pin DIP	220-4040	1
U12	Integrated Circuit, CD4071B, OR Gate, CMOS, 14-Pin DIP	225-0005	1
U13	Integrated Circuit, TL072CP, Dual JFET-Input Operational Amplifier, 8-Pin DIP	221-0072	1
U14	Integrated Circuit, NE5532AP, Dual Low Noise Operational Amplifier, 8-Pin DIP	221-5532-001	1
U15	Integrated Circuit, MC14018BP, Presettable Divide-By-N Counter, CMOS, 16-Pin DIP	220-4018	1
U16	Integrated Circuit, CD4071B, OR Gate, CMOS, 14-Pin DIP	225-0005	1
U17,U18	Integrated Circuit, MC14093B, Quad 2-Input NAND Schmitt Trigger, CMOS, 14-Pin DIP	220-4093	2
U19	Integrated Circuit, CD4071B, OR Gate, CMOS, 14-Pin DIP	225-0005	1
U21	Integrated Circuit, TL072CP, Dual JFET-Input Operational Amplifier, 8-Pin DIP	221-0072	1
U23	Integrated Circuit, TL072CP, Dual JFET-Input Operational Amplifier, 8-Pin DIP	221-0072	1
X1	Crystal, 6.144 MHz $\pm 0.01\%$ from 0°C to $+70^{\circ}\text{C}$, 30 pF Load Capacitance, HC-18 Case	390-0020	1
XU1	Socket, 14-Pin DIP	417-1404	1
XU3	Socket, 8-Pin DIP	417-0804	1
XU5,XU6	Socket, 16-Pin DIP	417-1604	2
XU7,XU8	Socket, 14-Pin DIP	417-1404	2
XU9,XU10	Socket, 8-Pin DIP	417-0804	2
XU11	Socket, 16-Pin DIP	417-1604	1
XU12	Socket, 14-Pin DIP	417-1404	1
XU13,XU14	Socket, 8-Pin DIP	417-0804	2
XU15	Socket, 16-Pin DIP	417-1604	1
XU16 THRU XU19	Socket, 14-Pin DIP	417-1404	4
XU21,XU23	Socket, 8-Pin DIP	417-0804	2
----	Blank Record Circuit Board	510-0113	1

TABLE 6-11. MONOPHONIC/STEREOPHONIC RECORD CIRCUIT BOARD ASSEMBLY - 910-0113/001
(Sheet 4 of 4)

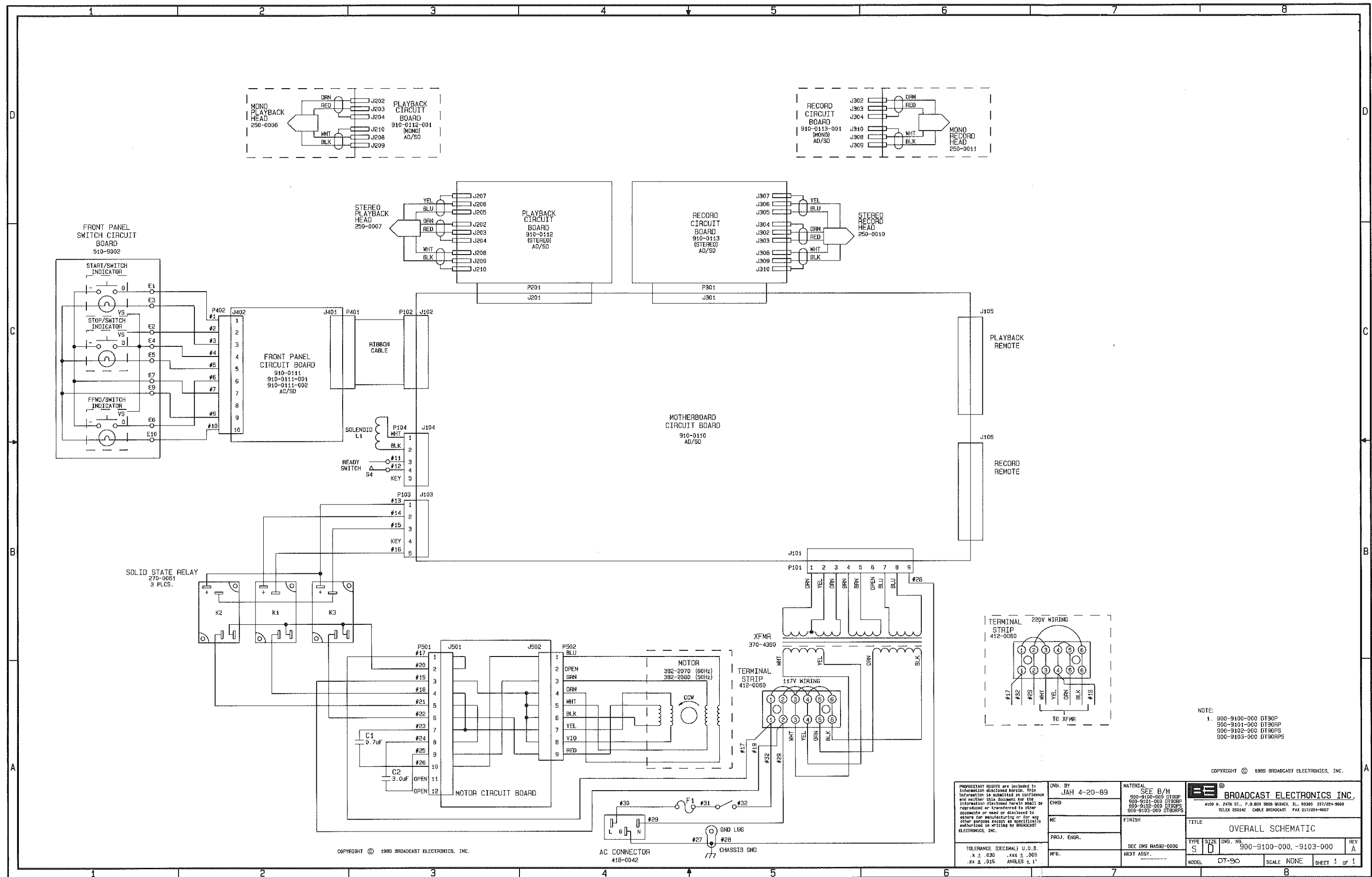
REF. DES.	DESCRIPTION	PART NO.	QTY.
ADDITIONAL PARTS FOR STEREOHONIC RECORD CIRCUIT BOARD 910-0113			
C3,C4	Capacitor, Electrolytic, 10 uF, 35V	023-1075	2
C7,C8	Capacitor, Mica, 390 pF $\pm 5\%$, 100V	042-3922	2
C11,C12	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	2
C14	Capacitor, Ceramic Disc, 10 pF $\pm 10\%$, 1kV, Non-Polarized	001-1014	1
C17	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	1
C18	Capacitor, Mica, 120 pF $\pm 5\%$, 500V	042-1222	1
C20	Capacitor, Ceramic Disc, 10 pF $\pm 10\%$, 1kV, Non-Polarized	001-1014	1
C23,C24	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	2
C27	Capacitor, Mylar Film, 0.022 uF $\pm 10\%$, 100V	031-2243	1
C29	Capacitor, Electrolytic, 10 uF, 35V	023-1075	1
C94,C95	Capacitor, Monolythic Ceramic, 0.1 uF $\pm 20\%$, 50V	003-1054	2
C97	Capacitor, Electrolytic, 1 uF, 50V	024-1064	1
C99	Capacitor, Monolythic Ceramic, 0.047 uF $\pm 5\%$, 50V	003-4733	1
C103,C106	Capacitor, Electrolytic, 10 uF, 35V	023-1075	2
D11,D12	Diode, 1N4737, Zener, 7.5V $\pm 10\%$, 1W	200-4737	2
D15,D16	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	2
R3,R4	Resistor, 10 k Ohm $\pm 1\%$, 1/4W	100-1051	2
R5	Resistor, 150 k Ohm $\pm 5\%$, 1/4W	100-1543	1
R7	Resistor, 270 Ohm $\pm 5\%$, 1/4W	100-2733	1
R9	Resistor, 1 Meg Ohm $\pm 5\%$, 1/4W	100-1073	1
R12,R13	Resistor, 22 k Ohm $\pm 5\%$, 1/4W	100-2253	2
R17	Potentiometer, 500 k Ohm $\pm 10\%$, 1/2W	178-5064	1
R18	Resistor, 22 k Ohm $\pm 5\%$, 1/4W	100-2253	1
R19	Potentiometer, 500 k Ohm $\pm 10\%$, 1/2W	178-5064	1
R22,R23	Resistor, 22 k Ohm $\pm 5\%$, 1/4W	100-2253	2
R26,R27	Resistor, 665 Ohm $\pm 1\%$, 1/4W	103-6653	2
R33	Resistor, 10 k Ohm $\pm 5\%$, 1/4W	100-1053	1
R35	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	1
R49	Potentiometer, 1 k Ohm $\pm 10\%$, 1/2W	178-1044	1
R51	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	1
R108	Potentiometer, 10 k Ohm $\pm 10\%$, 1/2W	178-1054	1
R109	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	1
R112	Potentiometer, 10 k Ohm $\pm 10\%$, 1/2W	178-1054	1
R113	Resistor, 100 Ohm $\pm 5\%$, 1/4W	100-1033	1
R118,R119	Resistor, 470 Ohm $\pm 5\%$, 1/4W	100-4733	2
R126,R127	Resistor, 169 k Ohm $\pm 1\%$, 1/4W	103-1696	2
R128	Resistor, 150 k Ohm $\pm 5\%$, 1/4W	100-1563	1
R129	Resistor, 300 k Ohm $\pm 5\%$, 1/4W	100-3063	1
R130	Resistor, 100 k Ohm $\pm 5\%$, 1/4W	100-1063	1
R131	Resistor, 1 Meg Ohm $\pm 5\%$, 1/4W	100-1073	1
R134	Resistor, 5.1 k Ohm $\pm 5\%$, 1/4W	100-5143	1
R135	Resistor, 51.1 k Ohm $\pm 5\%$, 1/4W	100-5153	1
R137	Resistor Network, 8-10 k Ohm $\pm 1\%$, 1/4W, 16-Pin DIP	226-1055	1
R142	Resistor, 1 k Ohm $\pm 5\%$, 1/4W	100-1043	1
U2	Integrated Circuit, TL074CN, Quad JFET-Input Operational Amplifier, 14-Pin DIP	221-0074	1
U4	Integrated Circuit, NE5532AP, Dual Low Noise Operational Amplifier, 8-Pin DIP	221-5532-001	1
U20	Integrated Circuit, MC14053B, Analog Multiplexers/Demultiplexers, CMOS MSI, 16-Pin DIP	220-4053	1
U22	Integrated Circuit, TL072CP, Dual JFET-Input Operational Amplifier, 8-Pin DIP	221-0072	1
XU2	Socket, 14-Pin DIP	417-1404	1
XU4	Socket, 8-Pin DIP	417-0804	1
XU20	Socket, 16-Pin DIP	417-1604	1
XU22	Socket, 8-Pin DIP	417-0804	1

SECTION VII
DRAWINGS

7-1. INTRODUCTION.

7-2. This section provides assembly drawings, wiring diagrams, and schematic diagrams as listed below for the Broadcast Electronics DT-90 cartridge machine.

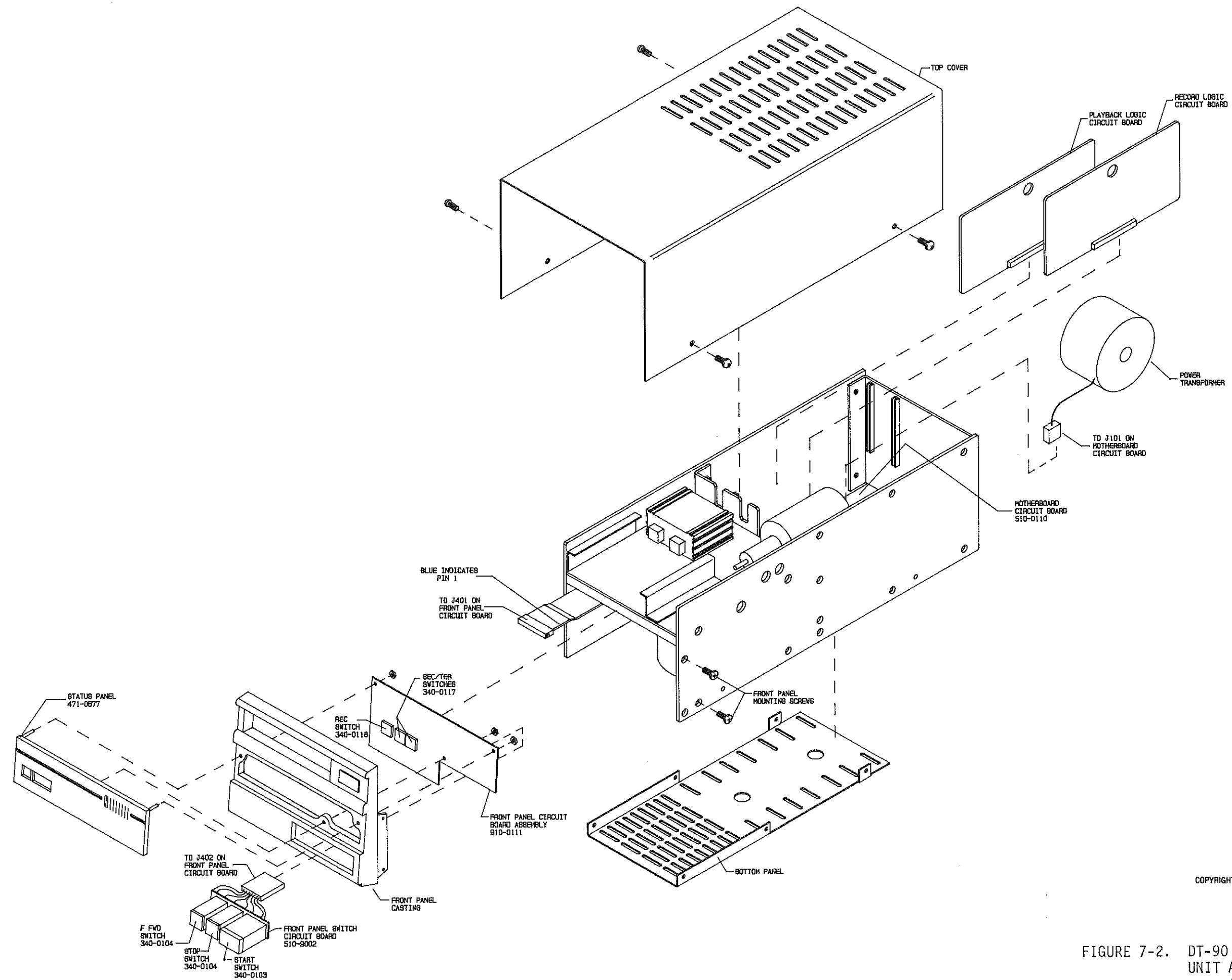
<u>FIGURE</u>	<u>TITLE</u>	<u>NUMBER</u>
7-1	DT-90 OVERALL SCHEMATIC DIAGRAM	SD900-9100-000
7-2	DT-90 ASSEMBLY DIAGRAM	597-9100-71
7-3	MOTHERBOARD SCHEMATIC DIAGRAM	SD910-0110
7-4	MOTHERBOARD ASSEMBLY DIAGRAM	AD910-0110
7-5	PLAYBACK LOGIC CIRCUIT BOARD SCHEMATIC DIAGRAM	SD910-0112/ -001
7-6	PLAYBACK LOGIC CIRCUIT BOARD ASSEMBLY DIAGRAM	AD910-0112/ -001
7-7	RECORD LOGIC CIRCUIT BOARD SCHEMATIC DIAGRAM	SD910-0113/ -001
7-8	RECORD LOGIC CIRCUIT BOARD ASSEMBLY DIAGRAM	AD910-0113/ -001
7-9	FRONT-PANEL CIRCUIT BOARD SCHEMATIC DIAGRAM	SD910-0111
7-10	FRONT-PANEL CIRCUIT BOARD ASSEMBLY DIAGRAM	AC910-0111
7-11	DT-90 RACK ASSEMBLY DIAGRAM	597-9100-160



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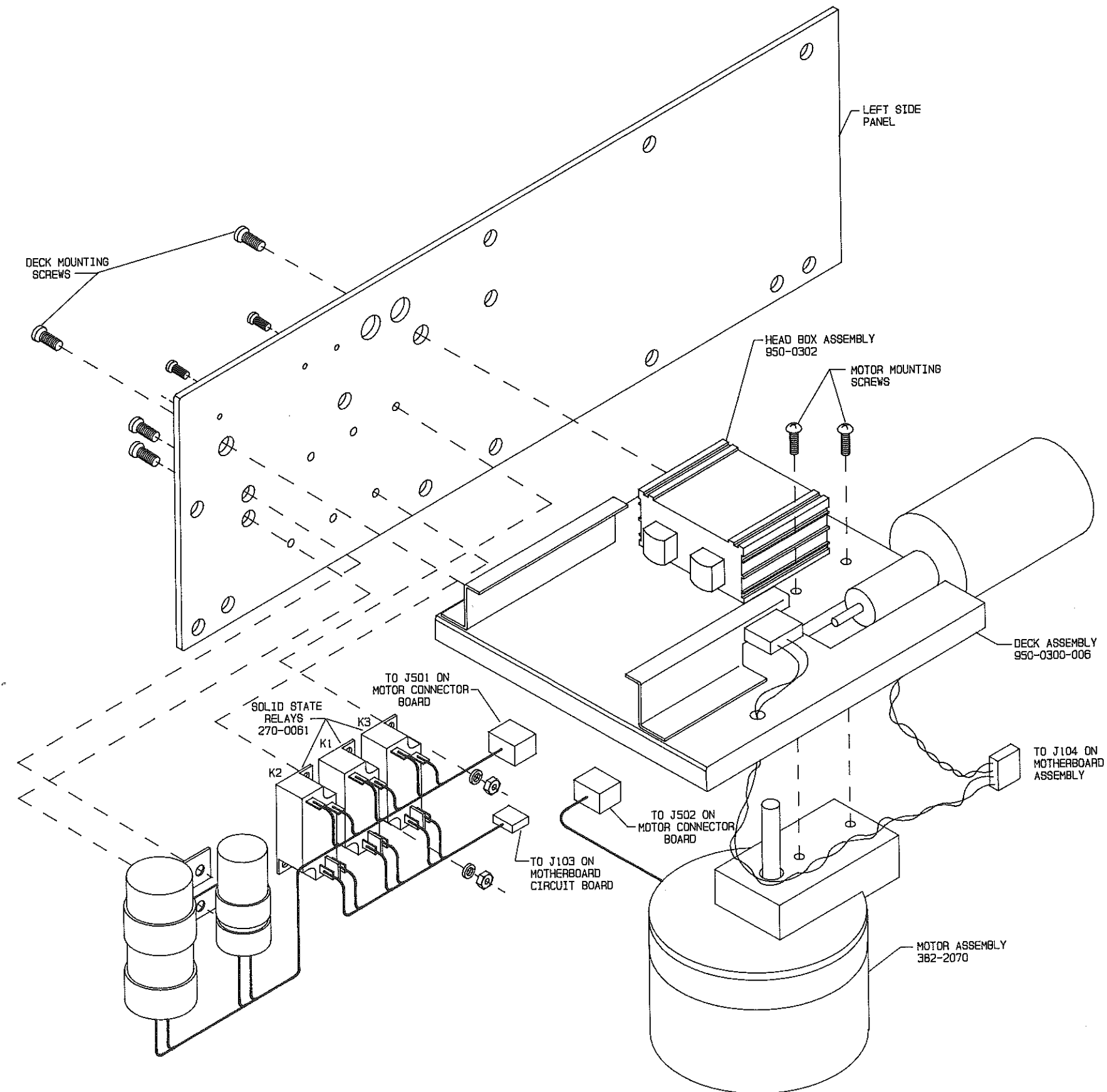
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TOLERANCE (DECIMAL) U.O.S. X ± .030 .XXX ± .005 XX ± .015 ANGLES ± .1°		ME PROJ. ENGR.	FINISH SEE DMS HAS92-0000 NEXT ASSY.	TITLE OVERALL SCHEMATIC TYPE SIZE DWG. NO. 900-9100-000, -9103-000 REV A MODEL DT-90 SCALE NONE SHEET 1 OF 1



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597-9100-71A

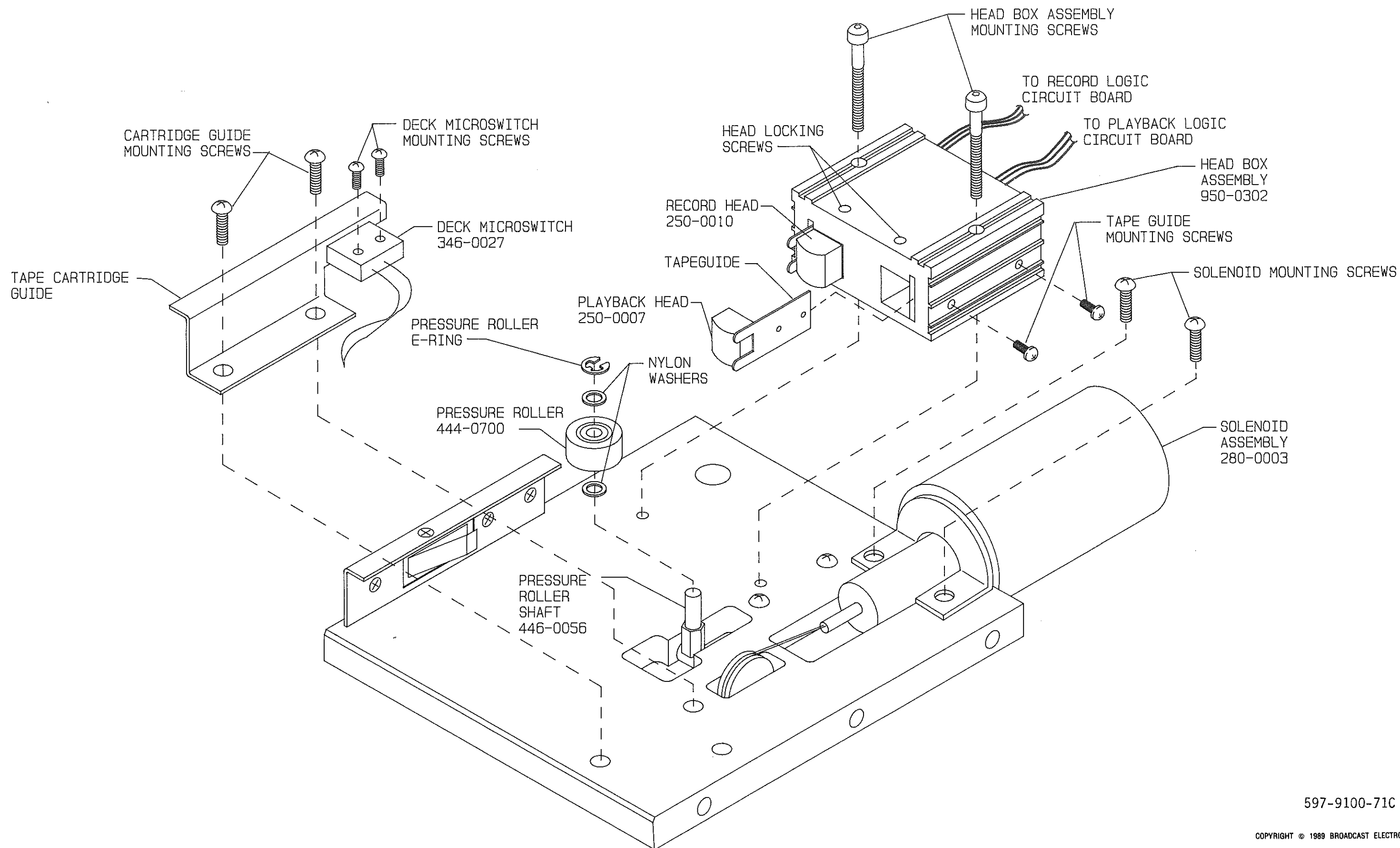
FIGURE 7-2. DT-90 SERIES RECORD/PLAYBACK UNIT ASSEMBLY DIAGRAM (Sheet 1 of 4)



597-9100-71B

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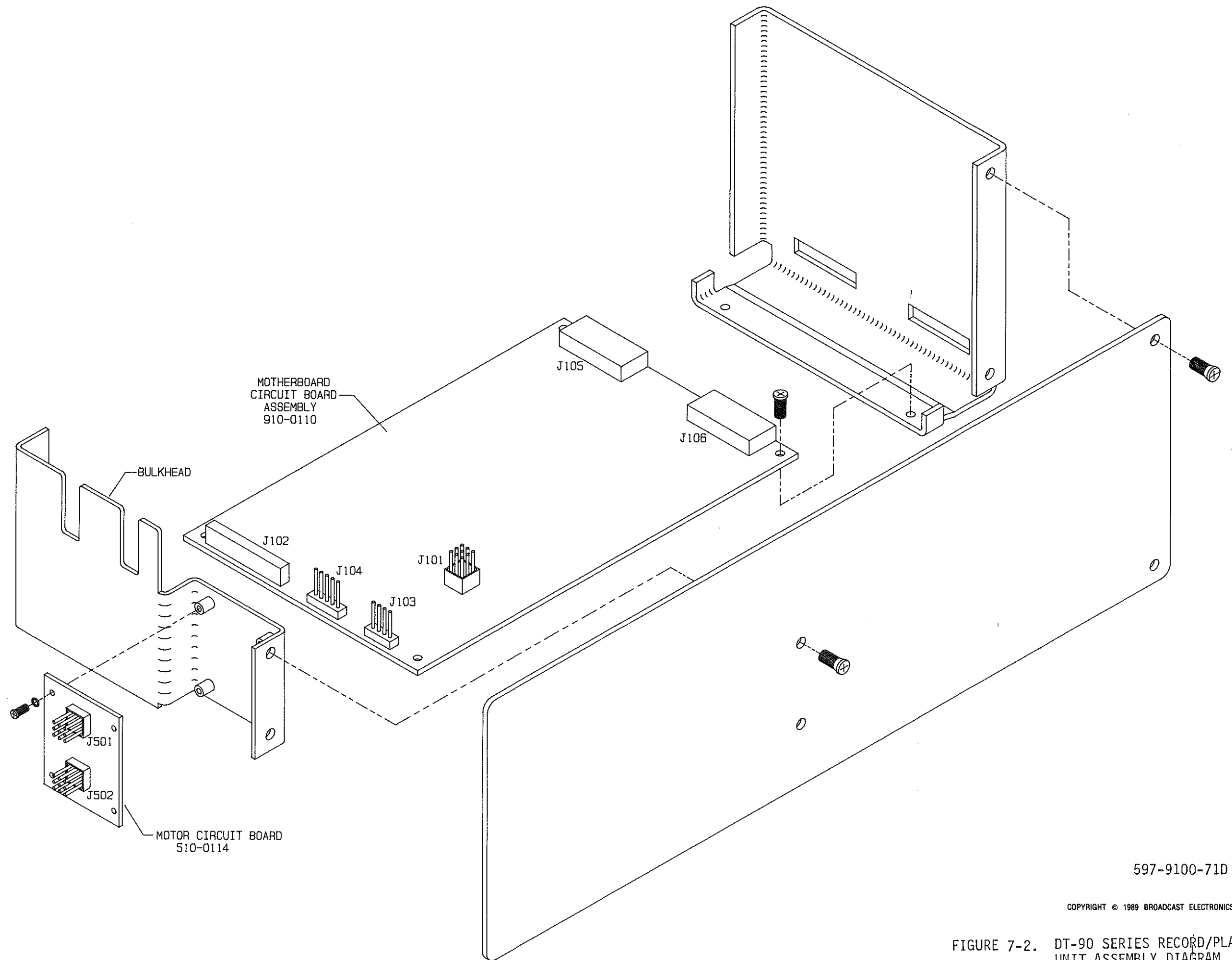
FIGURE 7-2. DT-90 SERIES RECORD/PLAYBACK
UNIT ASSEMBLY DIAGRAM
(Sheet 2 of 4)



597-9100-71C

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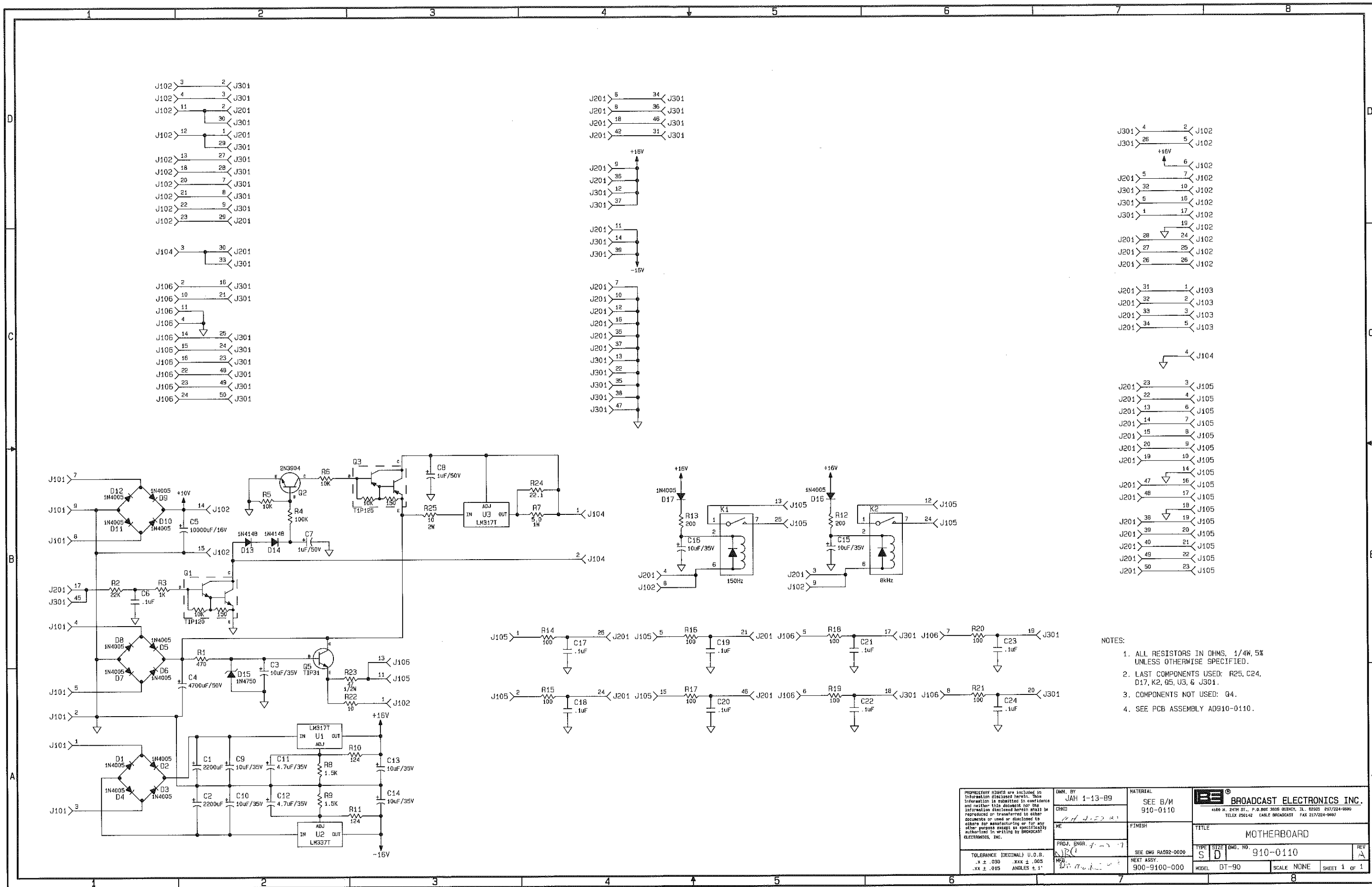
FIGURE 7-2. DT-90 SERIES RECORD/PLAYBACK
UNIT ASSEMBLY DIAGRAM
(Sheet 3 of 4)



597-9100-71D

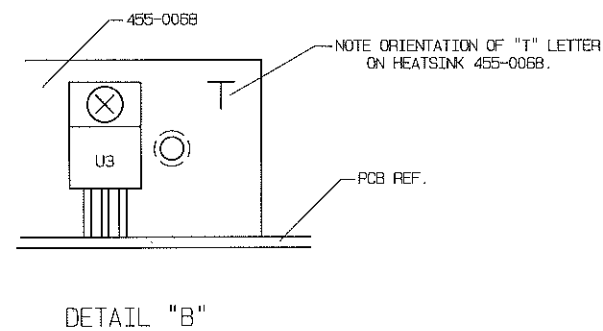
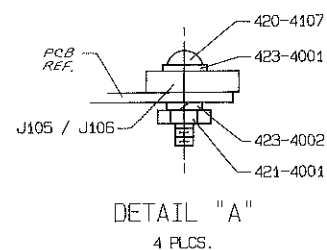
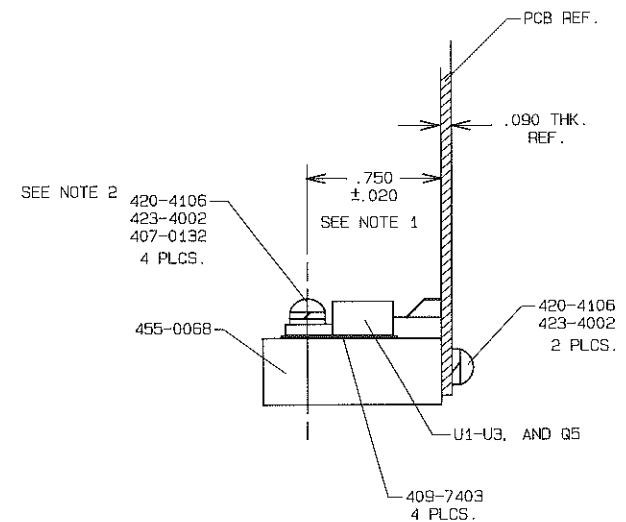
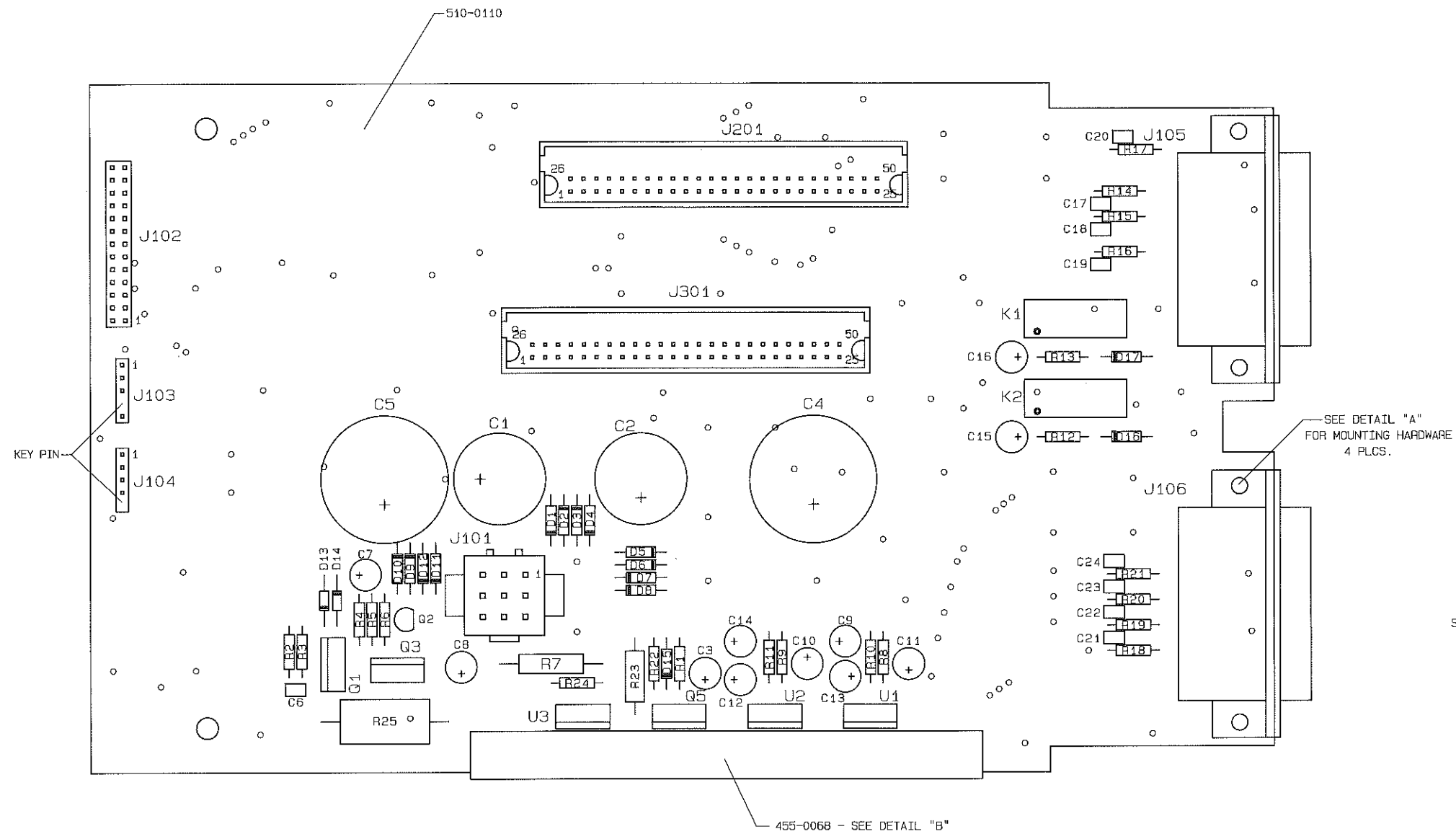
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FIGURE 7-2. DT-90 SERIES RECORD/PLAYBACK
UNIT ASSEMBLY DIAGRAM
(Sheet 4 of 4)



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	CHKD JAH 1-13-89	FINISH	
	PROJ. ENGR. 1-13-89	SEE QWS RA592-0000	TITLE MOTHERBOARD
	REV. 1	NEXT ASSY. 900-9100-000	TYPE SIZE DWS. NO. S D 910-0110
<small>TOLERANCE (DECIMAL) U.O.S. .X ± .030 .XXX ± .005 .XX ± .015 ANGLES ± 1°</small>	MODEL DT-90	SCALE NONE	REV. A

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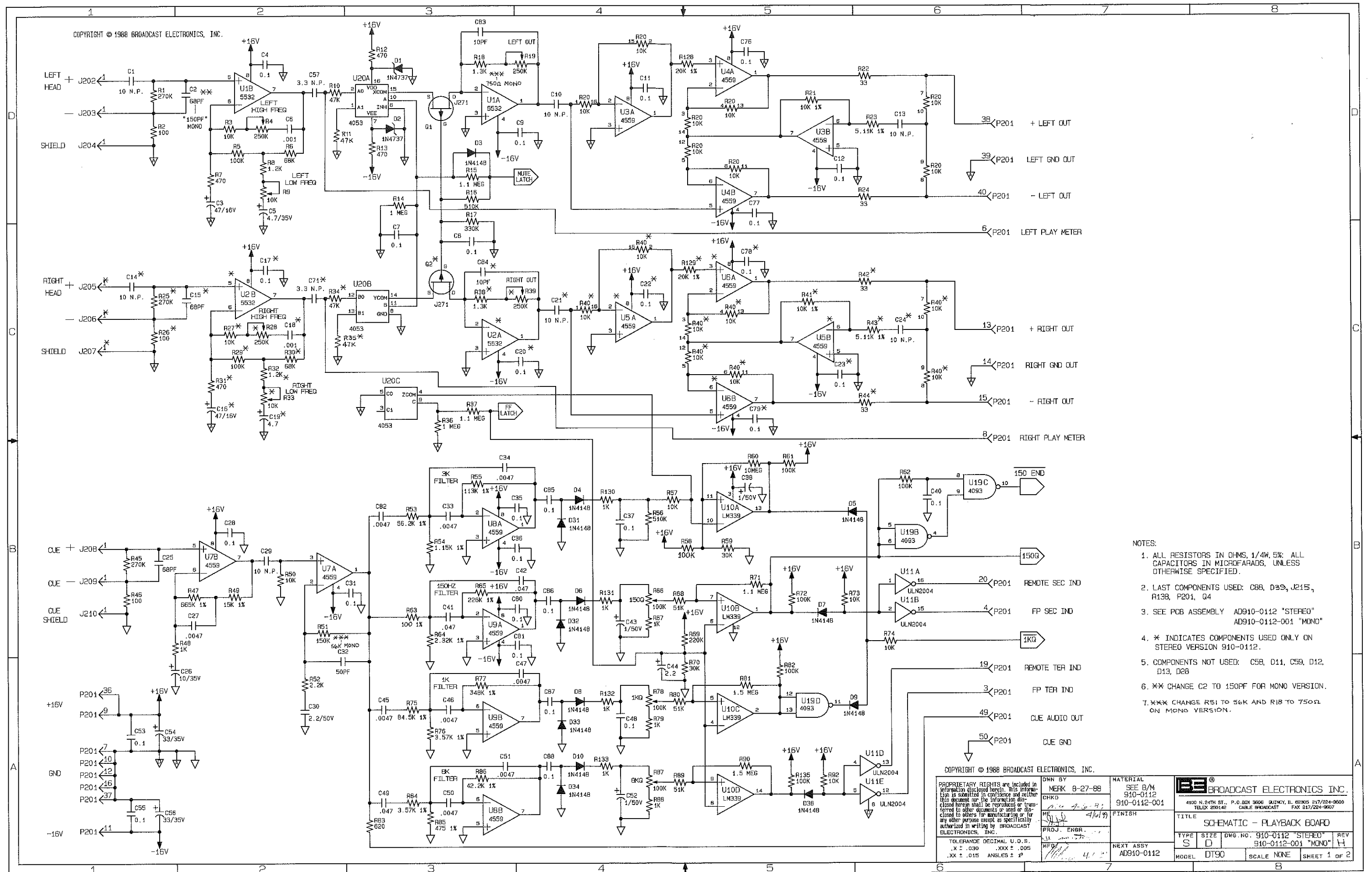


NOTE:

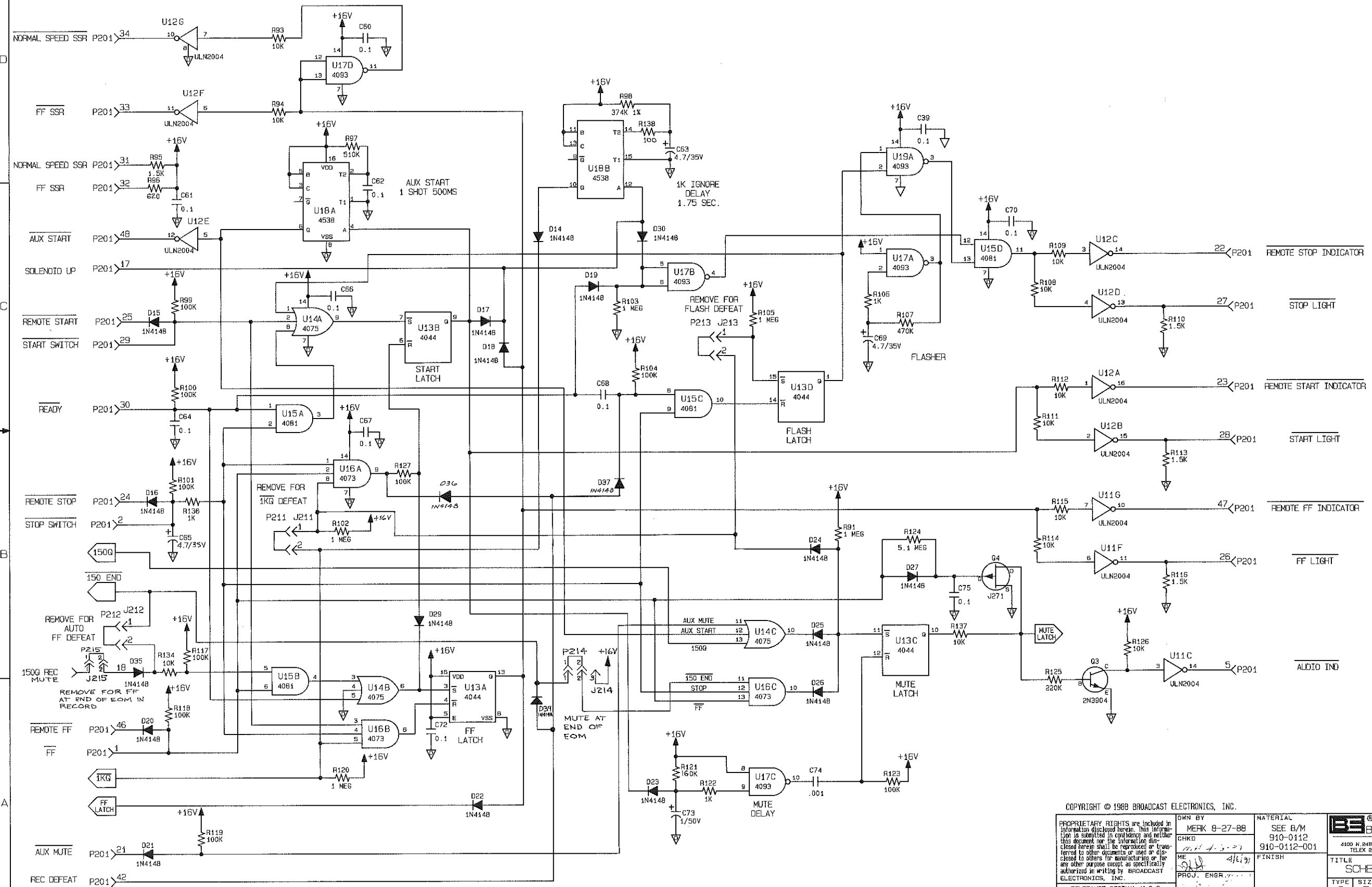
1. U1-U3, AND Q5 MUST BE LOCATED TO DIMENSION SHOWN BEFORE SOLDERING TO P.C. BOARD.
2. 420-4106, 6 PLCS. TO BE TORQUED 5-6 IN.-LBS.
3. J201 AND J301 TO BE SOLDERED IN PLACE AND THEN ALL LEADS TO BE TRIMMED TO $.04 \pm .010$

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	ME PROJ. ENGR.	FINISH	
TOLERANCE DECIMAL U.O.S. .X ± .030 .XXX ± .005 .XX ± .015 ANGLES ± 1°	MFG.	NEXT ASSY	TITLE PCB ASSEMBLY- MOTHERBOARD TYPE SIZE DWG. NO. 910-0110 REV A MODEL DT90 SCALE 2:1 SHEET 1 OF 1



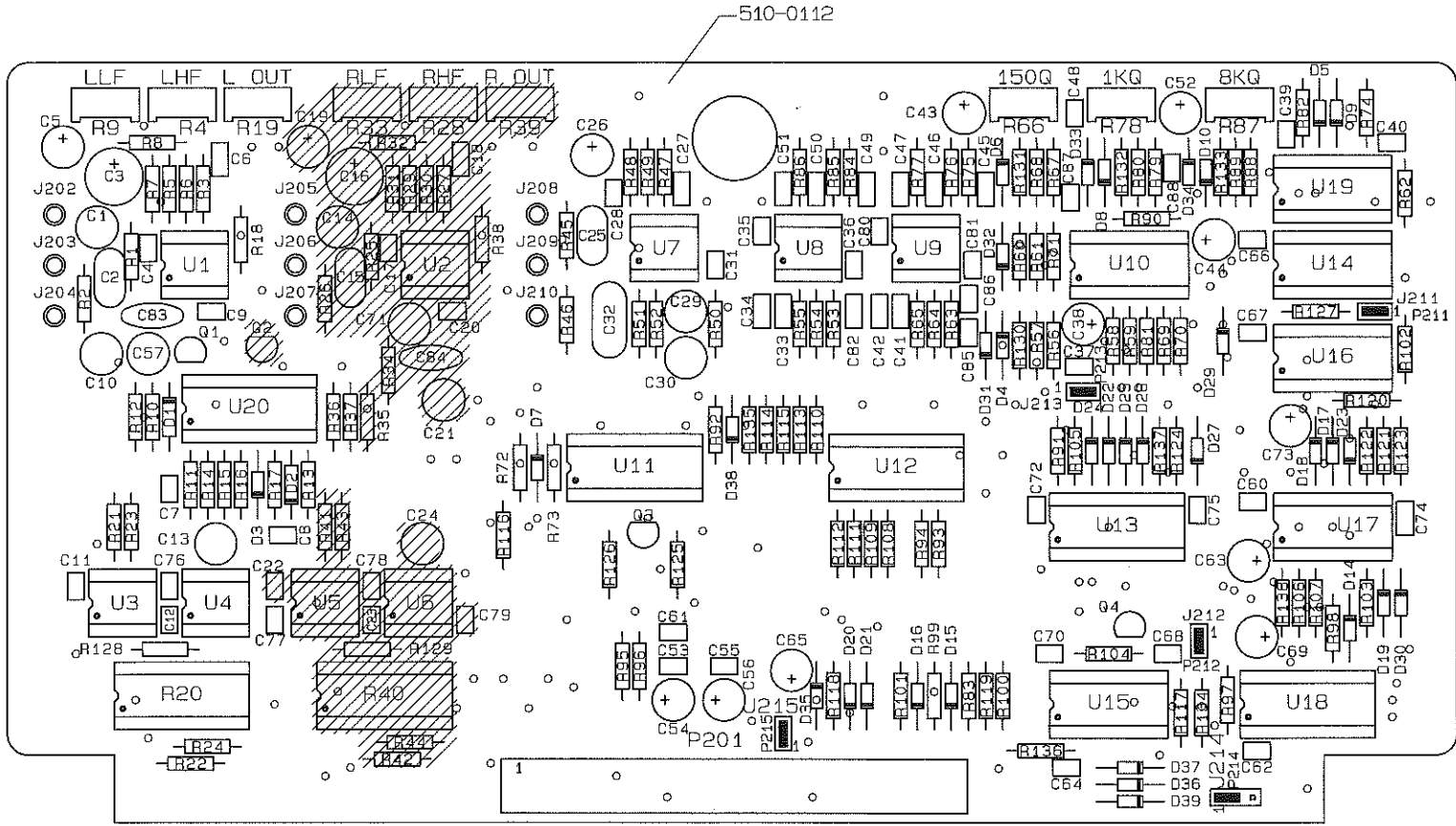
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	TITLE SCHEMATIC- PLAYBACK BOARD TYPE SIZE DWG. NO. 910-0112 "STEREO" REV S D 910-0112-001 "MONO" H MODEL DT90 SCALE NONE SHEET 2 OF 2		


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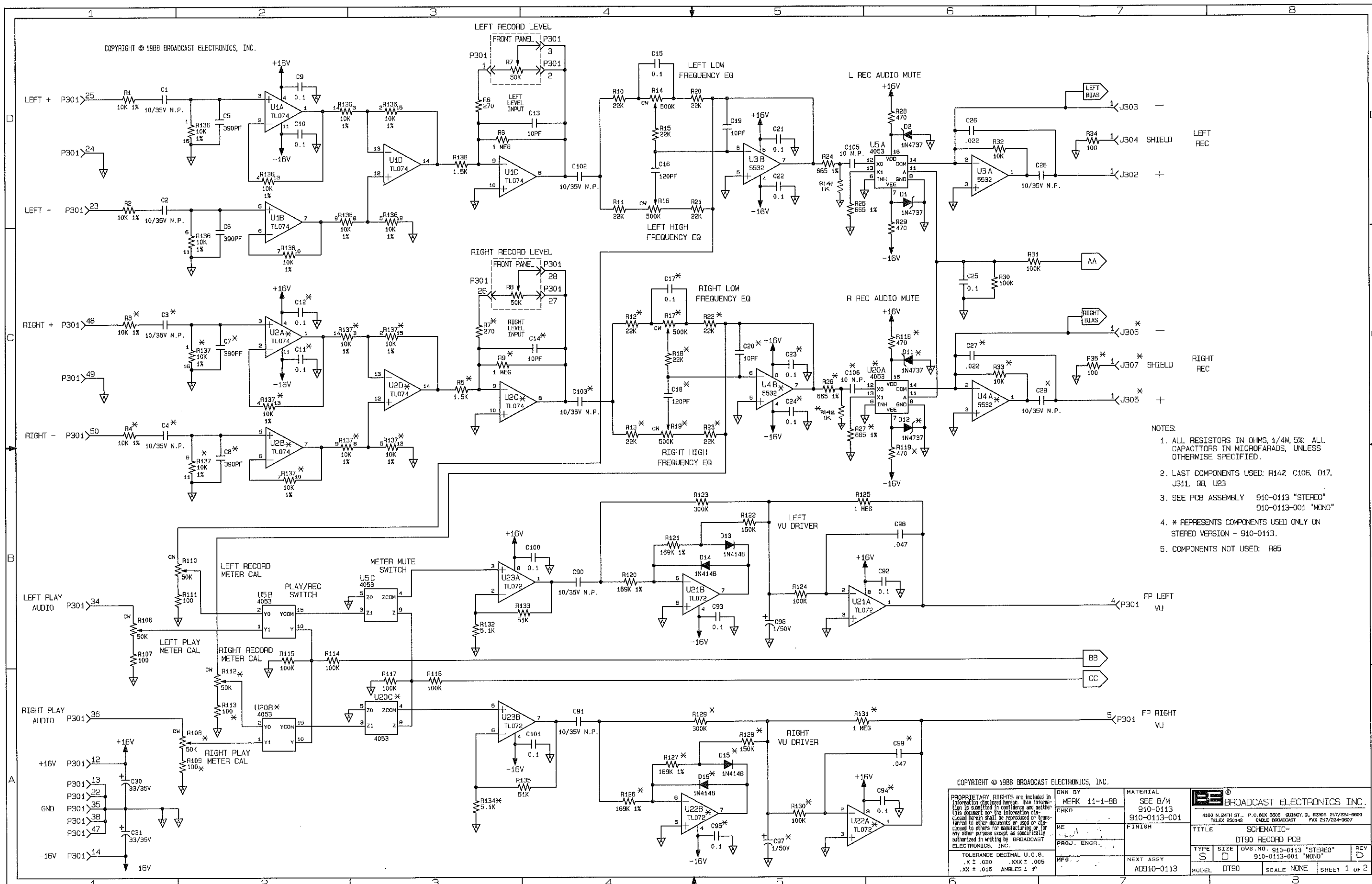
NOTE:

1. SEE SCHEMATIC SD910-0112.
2. 910-0112 "STEREO"
910-0112-001 "MONO"
3. AREA SHADED ON DRAWING REPRESENTS COMPONENTS
USED ONLY ON STEREO VERSION - 910-0112.

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		CHKD MH 4-6-89	910-0112-001	
		ME JHS 4-6-89	FINISH	TITLE PCB ASSEMBLY- PLAYBACK BOARD
		PROJ. ENGR. JRC 4-6-89		TYPE A D
		MFG. PRB 4-6-89	NEXT ASSY	SIZE DWB. NO. 910-0112 "STEREO" 910-0112-001 "MONO"
TOLERANCE DECIMAL U.O.S. .X ± .030 .XXX ± .005 .XX ± .015 ANGLES ± 1°				REV J
				MODEL DT90
				SCALE 2: 1
				SHEET 1 OF 1

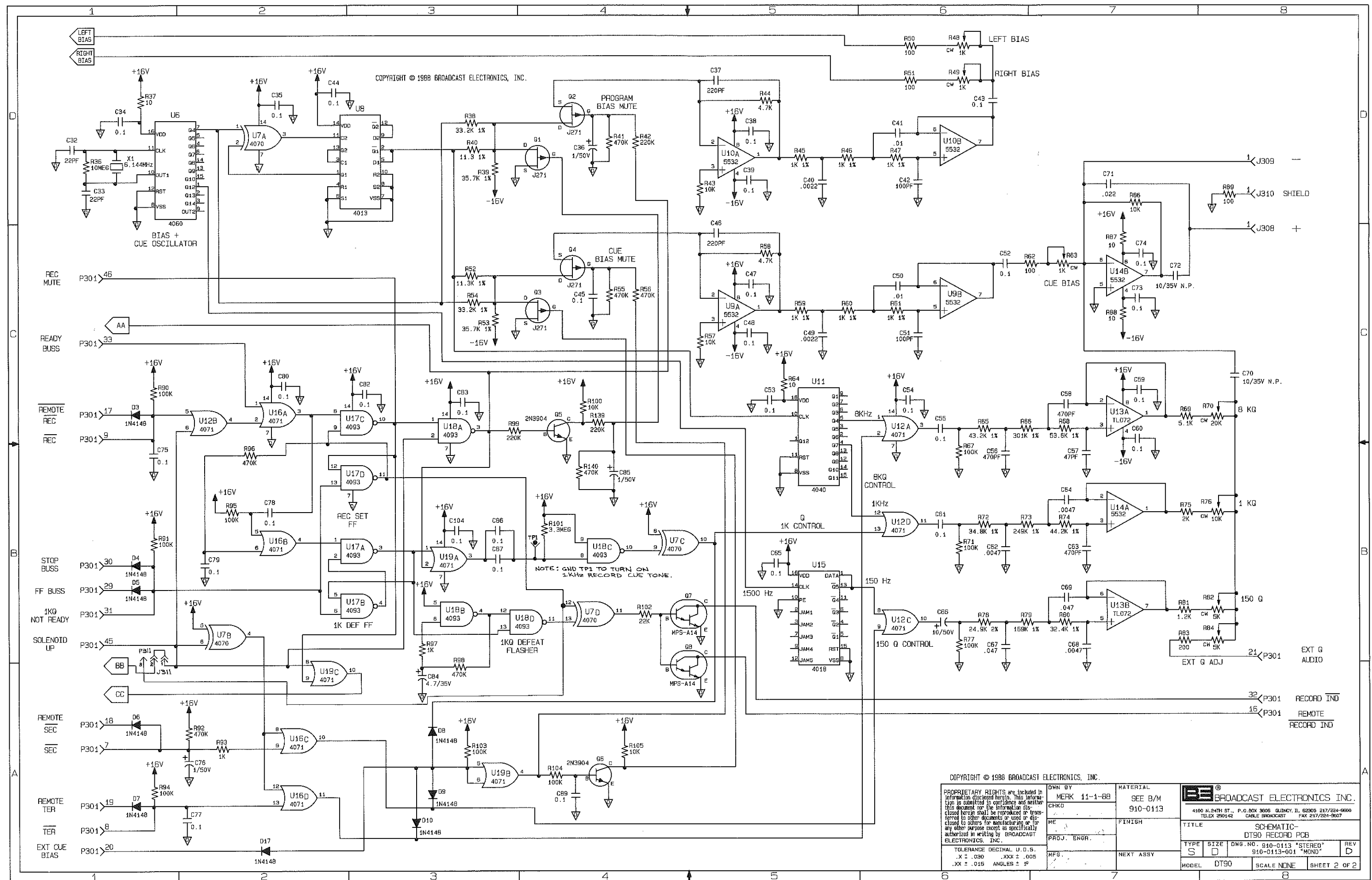
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- NOTES:
1. ALL RESISTORS IN OHMS, 1/4W, 5%. ALL CAPACITORS IN MICROFARADS, UNLESS OTHERWISE SPECIFIED.
 2. LAST COMPONENTS USED: R142, C106, D17, J311, Q8, U23
 3. SEE PCB ASSEMBLY 910-0113 "STEREO" 910-0113-001 "MONO"
 4. * REPRESENTS COMPONENTS USED ONLY ON STEREO VERSION - 910-0113.
 5. COMPONENTS NOT USED: R85

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	CHKD ME PROJ. ENGR	FINISH NEXT ASSY AD910-0113	
TOLERANCE DECIMAL U.O.S. .X ± .030 .XXX ± .005 .XX ± .015 ANGLES ± 9°	TITLE DT90 RECORD PCB	TYPE S D	MODEL DT90
	SCALE NONE	SHEET 1 OF 2	



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* NOTE *

INSTALL "PEM" STANDOFFS BEFORE ANY
OTHER COMPONENTS. TO BE INSTALLED
FROM SOLDER SIDE OF PCB. 3 PLCS.
B.E. NO. 426-4004

510-0113

SHIELD

420-4103
423-4002
3 PLCS.

426-4004
REF.

NOTES:

1. INSTALL "PEM" STANDOFFS FIRST.
2. SEE SCHEMATIC SD910-0113.
3. 910-0113 "STEREO"
910-0113-001 "MONO"
4. AREA SHADED ON DRAWING REPRESENTS COMPONENTS
USED ONLY ON STEREO VERSION - 910-0113.

BREAK SHIELD OFF BEFORE
FLOW SOLDER

SEE SIDE DETAIL FOR MOUNTING
OF SHIELD TO PCB

SHIELD FOR 510-0113

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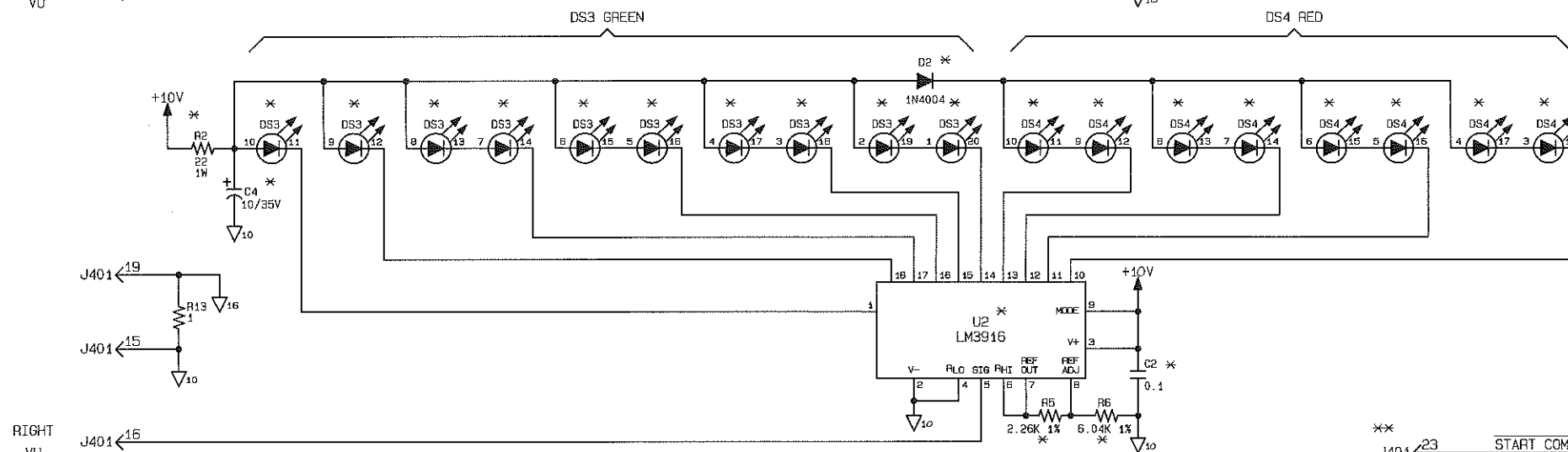
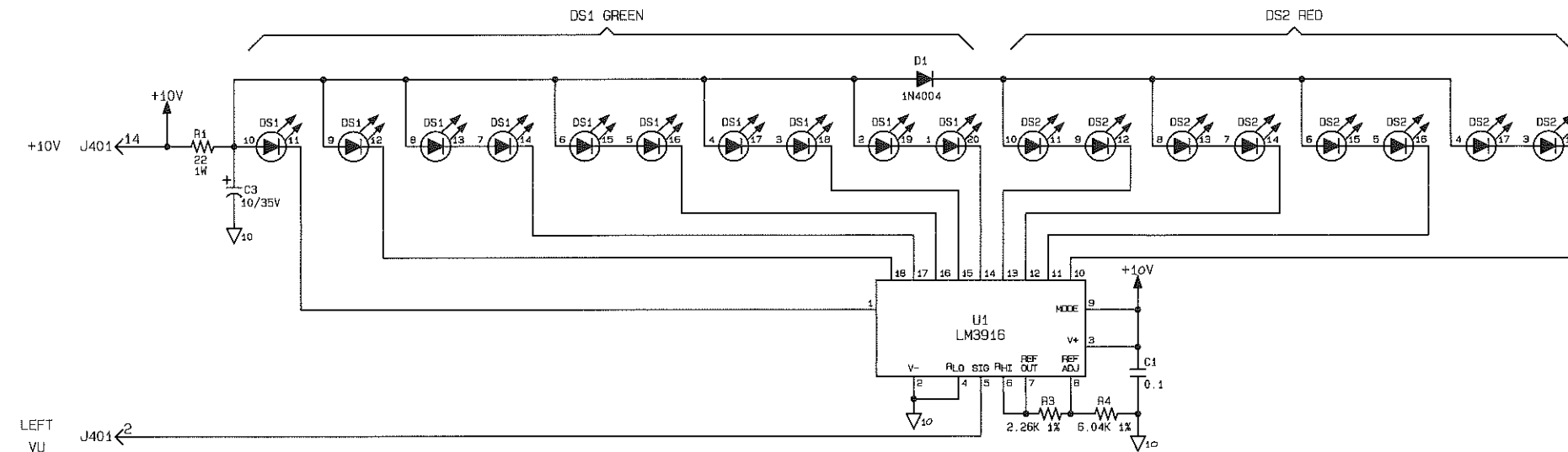
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DWN BY
MERK 11-5-88
CHKD
MH 4-6-89
ME
JHS 4-6-89
PROJ. ENGR.
JRC 4-6-89
HFG.
PRB 4-6-89

MATERIAL
SEE B/M
910-0113
910-0113-001
FINISH
NEXT ASSY

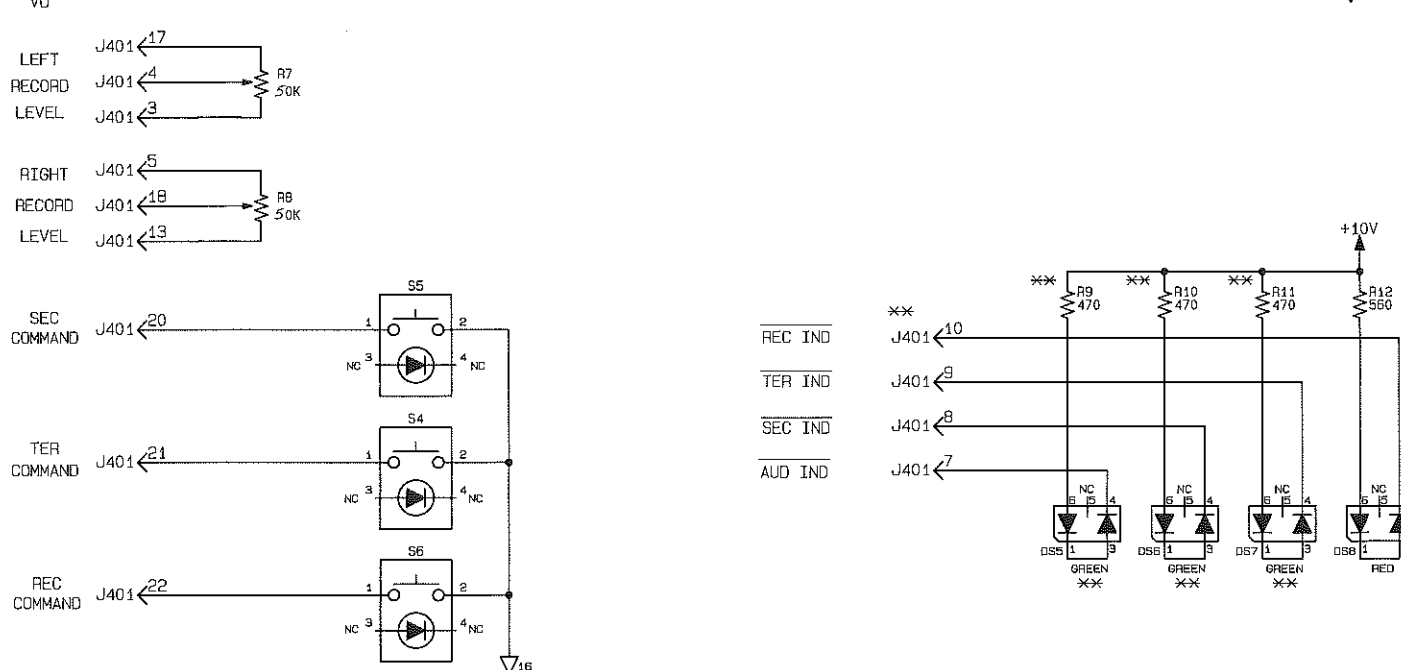
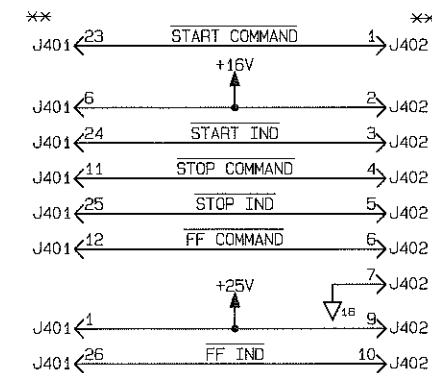
BROADCAST ELECTRONICS, INC.
4100 N. 24TH ST., P.O. BOX 2600 QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9907
TITLE
PCB ASSEMBLY- RECORD BOARD
TYPE SIZE DWS. NO. 910-0113 "STEREO" REV
A D 910-0113-001 "MONO" E
MODEL DT90 SCALE 2:1 SHEET 1 OF 1

TOLERANCE DECIMAL U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°



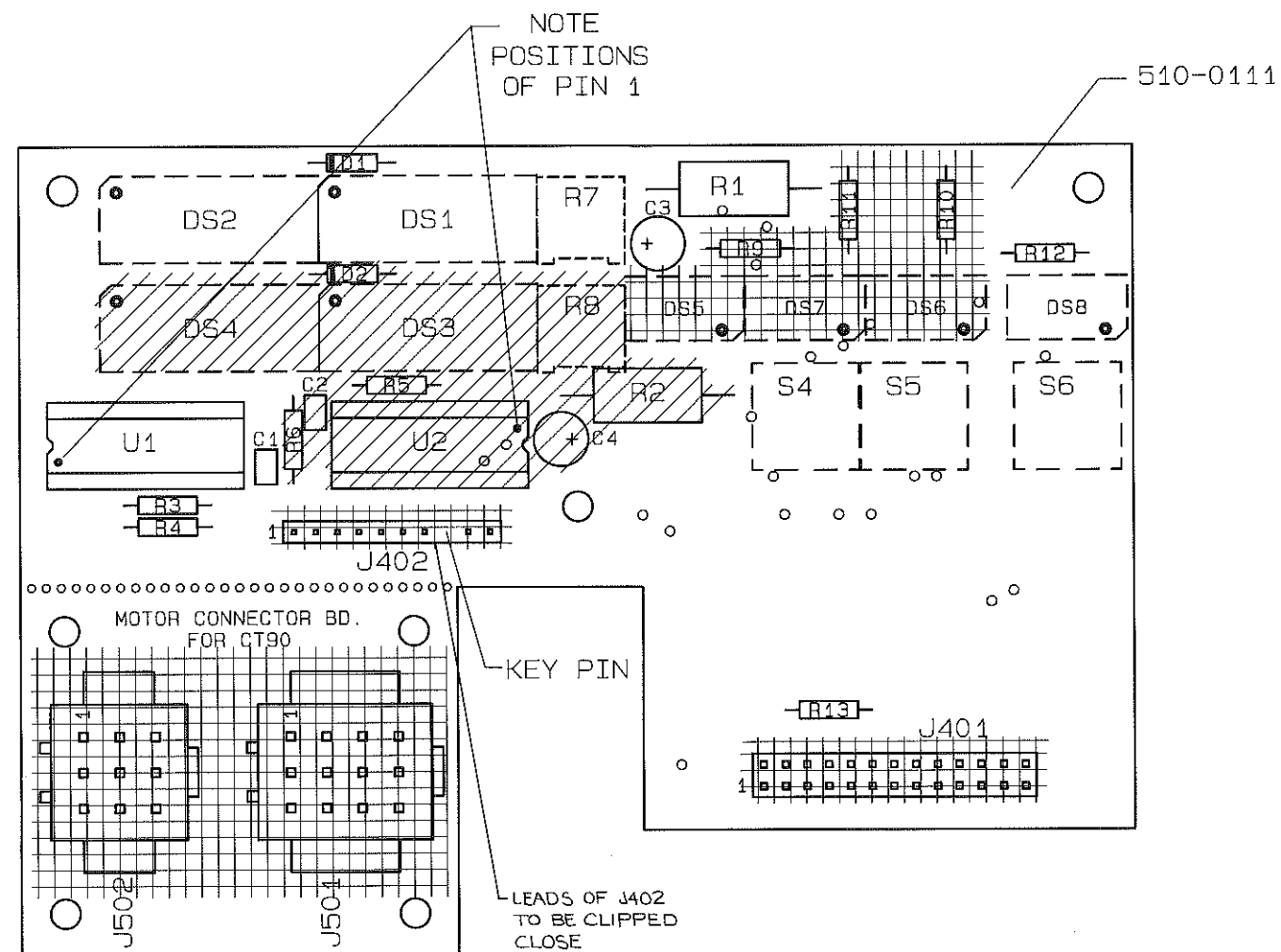
NOTES:

1. ALL RESISTORS IN OHMS, 1/4W, 5%: ALL CAPACITORS IN MICROFARADS, UNLESS OTHERWISE SPECIFIED.
2. LAST COMPONENTS USED: C4, D2, DS8, J502, R15, S6, U2
3. COMPONENTS NOT USED: S1-S3, R14, R15
4. SEE PCB ASSEMBLY AC910-0111 "STEREO" AC910-0111-001 "MONO" AC910-0111-002 "PLAYBACK"
5. * REPRESENTS COMPONENTS NOT USED ON MONO VERSION 910-0111-001.
6. ** REPRESENTS COMPONENTS USED "ONLY" ON PLAYBACK VERSION 910-0111-002.



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	FINISH PROJ. ENGR. MFG.	NEXT ASSY AC910-0111	
TOLERANCE DECIMAL U.S.S. .X ± .030 .XXX ± .005 .XX ± .015 ANGLES ± °	TITLE PCB SCHEMATIC- FRONT PANEL	TYPE S D	REV A
MODEL DT90	SCALE NONE	SHEET 1 OF 1	

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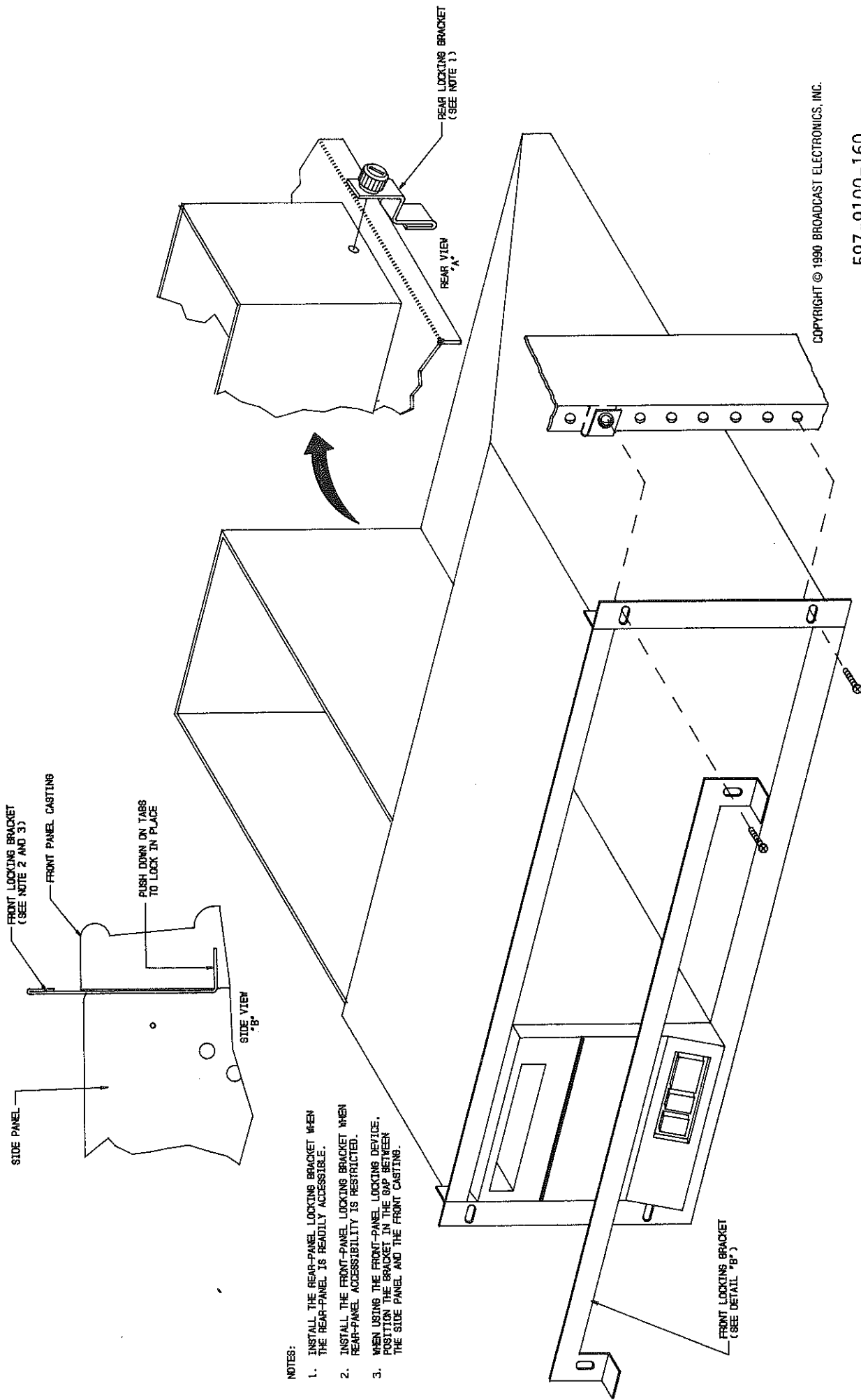


NOTE:

1. FOR STEREO VERSION - 910-0111 - USE ALL COMPONENTS SHOWN.
2. AREA SHADED WITH REPRESENTS COMPONENTS NOT USED ON MONO VERSION - 910-0111-001.
3. AREA SHADED WITH REPRESENTS COMPONENTS USED "ONLY" ON PLAYBACK VERSION - 910-0111-002.
4. SEE SCHEMATIC SD910-0111.
5. CUT PIN 8 OF J402.
6. DASHED COMPONENTS MOUNTED TO OPPOSITE SIDE SHOWN.
7. SEE B/M: 910-0111 "STEREO"
910-0111-001 "MONO"
910-0111-002 "PLAYBACK"

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	CHKD MH 4-2-89	FINISH	
	ME 4/6/89		
	PROJ. ENGR 4-6-89		
TOLERANCE DECIMAL U.O.S. .X ± .030 .XXX ± .005 .XX ± .015 ANGLES ± 1°	MFG 4-6-89	NEXT ASSY	TITLE PCB ASSEMBLY- FRONT PANEL TYPE A SIZE C DWG. NO. 910-0111, 910-0111-001, 910-0111-002 REV A MODEL DT90 SCALE 2:1 SHEET 1 OF 1



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597-9100-160

FIGURE 7-11. DT-90 RACK ASSEMBLY DIAGRAM

SECTION VIII

APPENDIX

8-1. INTRODUCTION.

8-2. This appendix provides technical data associated with the maintenance of the Broadcast Electronics DT-90 cartridge machines. The information contained in this appendix is presented in the following order.

A. The NAB Tape Cartridge and Associated Maintenance.

BROADCAST ELECTRONICS, INC.

The NAB Tape Cartridge and Associated Maintenance

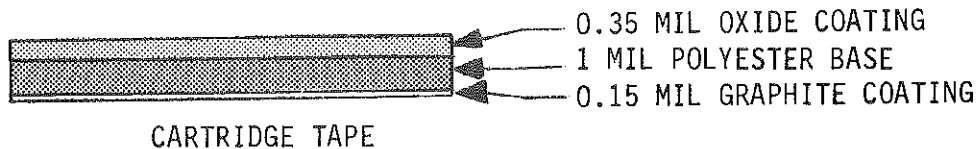
TABLE OF CONTENTS	PAGE NO.
The NAB Tape Cartridge	1
Cartridge Maintenance Tips	6
Cartridge Recording Procedure	10
Cartridges for Stereophonic Systems	10

THE NAB TAPE CARTRIDGE

The National Association of Broadcasters (NAB) defines a cartridge as "a plastic or metal enclosure containing an endless loop of lubricated tape, wound on a rotatable hub in such a fashion as to allow continuous motion". Cartridges from various manufacturers differ slightly in design, but all cartridges used in NAB standardized systems fit the preceding definition.

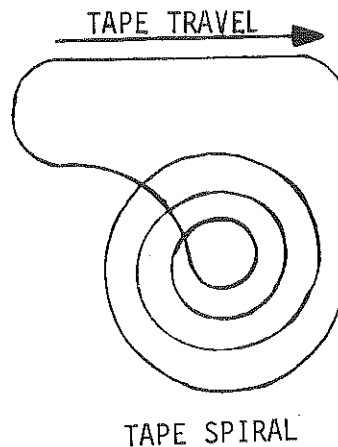
THE TAPE

Cartridge tape consists of a synthetic base material approximately 1 mil (0.001 inch) thick. One side of the base is coated with ferrite oxide particles for magnetic recording. The other surface is coated with a graphite layer. The total thickness of the tape is approximately 1.5 mils (0.0015 inch). The tape is 0.248 (+0/-0.002) inches wide.



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An endless loop is formed by wrapping the tape with the oxide side out into a spiral. The two ends are spliced together so that as the tape is pulled from the center, the tape passes across the tape heads and returns to the outside of the tape spiral.

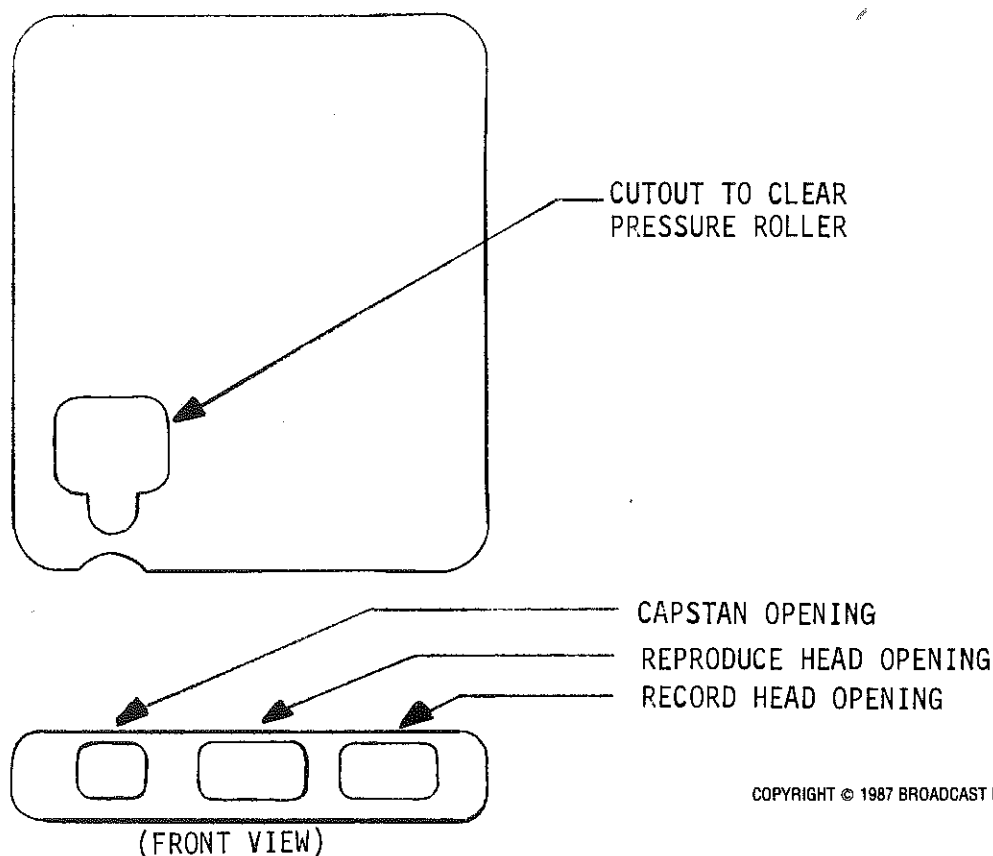


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THE SHELL

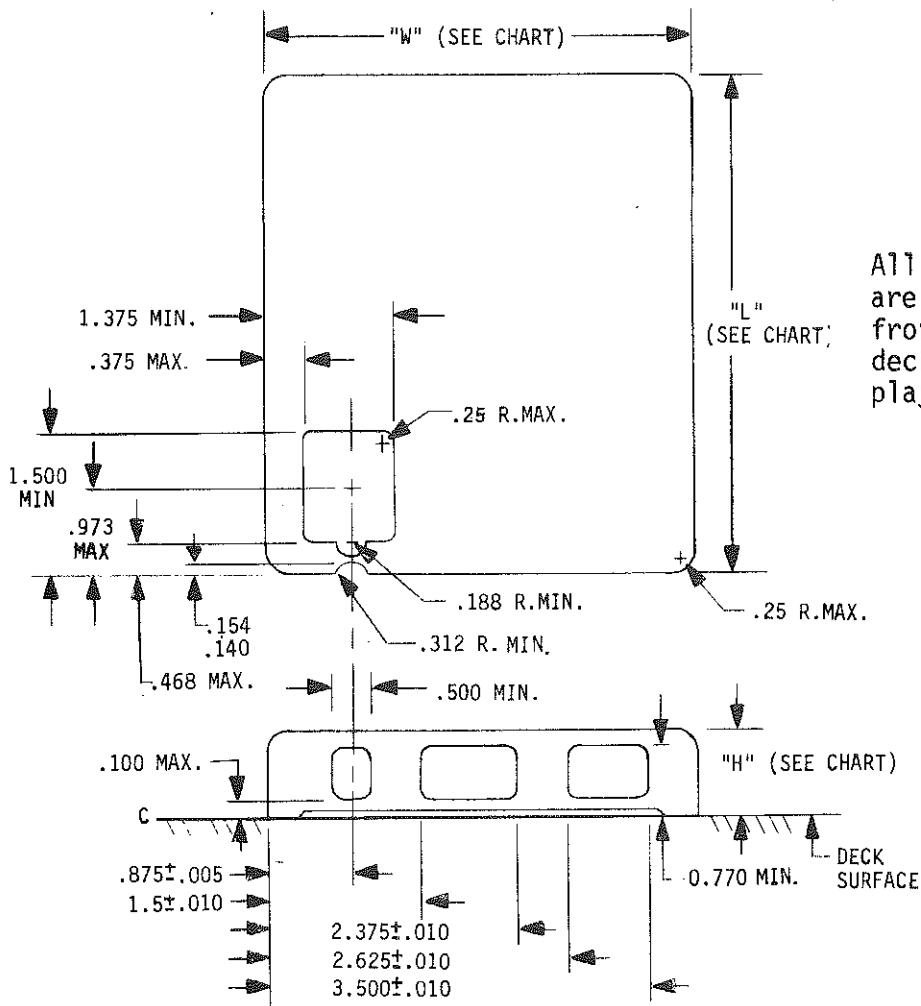
The shell houses the tape and other mechanical components. Three nominal NAB size shells are available: 1) A or AA, 2) B or BB, or 3) C or CC. Assuming 1.5 mil tape, the A/AA size cartridge can be installed with up to 395 feet of tape, the B/BB with 650 feet, and the C/CC with 1,250 feet.

Three openings across the front of the cartridge allows the heads and capstan to penetrate the shell and contact the tape. In addition, an opening in the bottom is provided for the pressure roller to rotate through the cartridge behind the tape. Unlike cartridges used in consumer entertainment systems, the pressure roller (pinch roller or capstan idler) is a component of the cartridge player and not the cartridge.



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NAB tape cartridge dimension standards are presented in Figure 1 and NAB tape head dimension standards are presented in Figure 2.



All dimensions are in inches and are referenced from the side and front of the cartridge and the deck surface of the cartridge tape player.

CARTRIDGE NAB TYPE	WIDTH ±0.015625	LENGTH MAXIMUM	HEIGHT MAXIMUM
A,AA	4"	5.25"	0.9375" FOR A 0.895" FOR AA
B,BB	6"	7"	0.9375" FOR B 0.895" FOR BB
C,CC	7.625"	8.5"	0.9375" FOR C 0.895" FOR CC

FIGURE 1. NAB CARTRIDGE DIMENSION STANDARDS

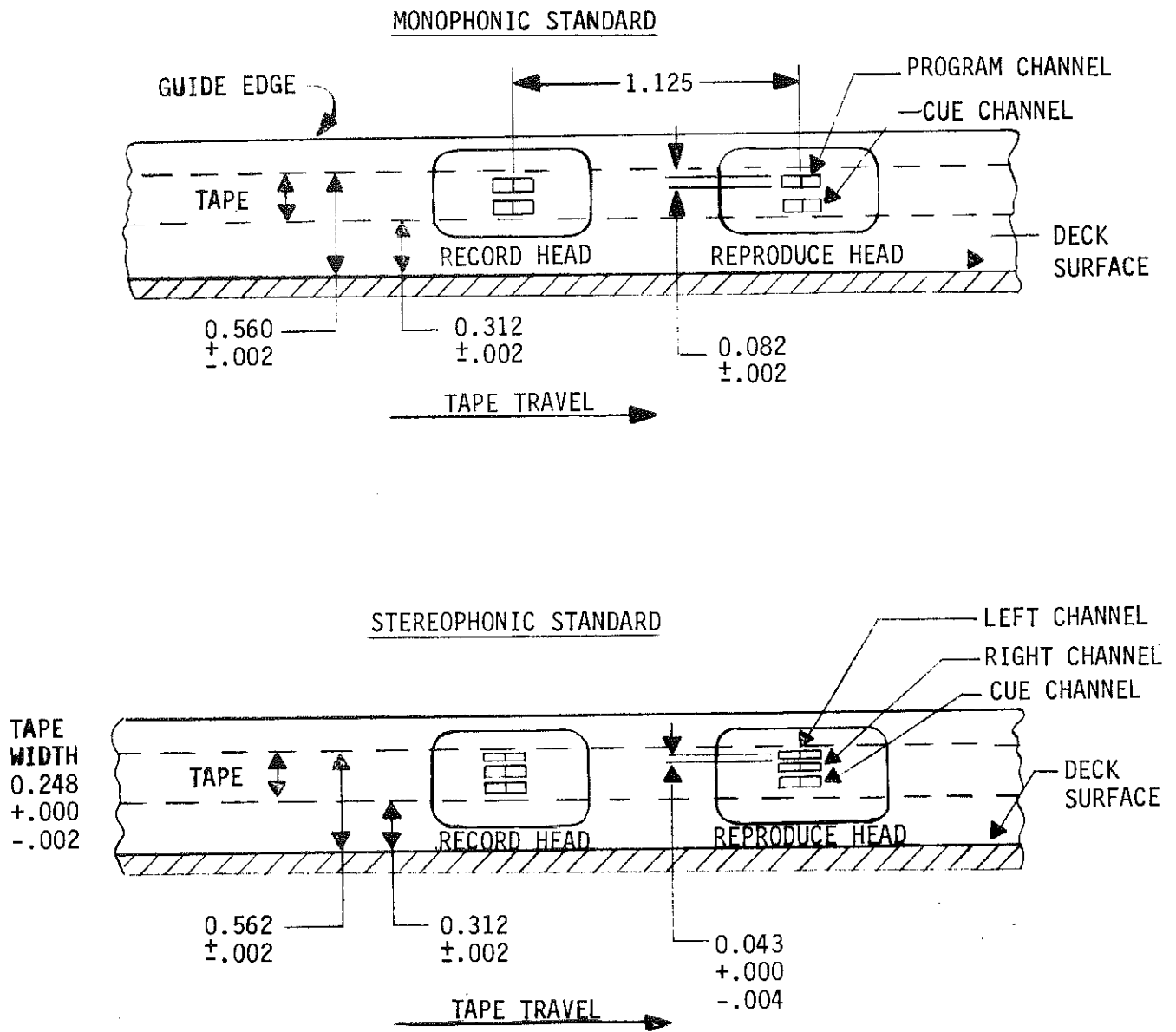
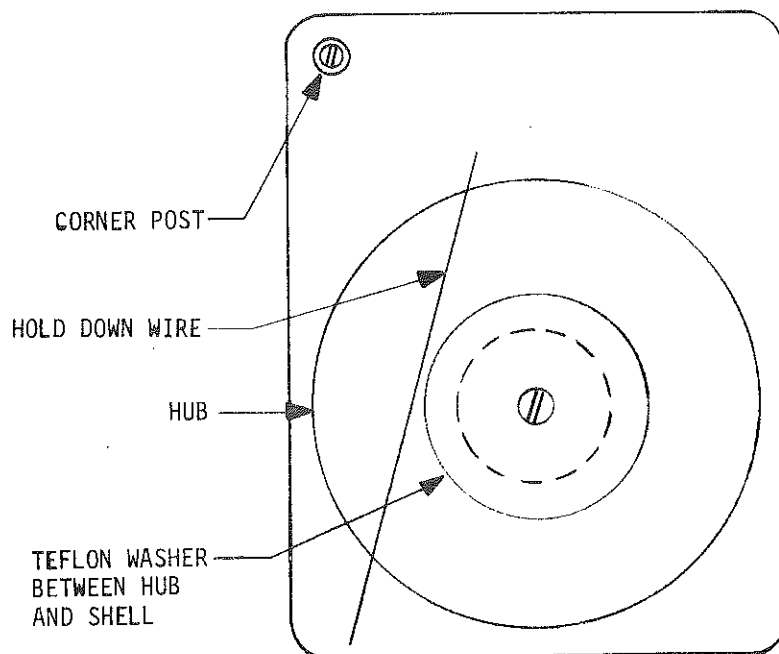


FIGURE 2. NAB TAPE HEAD DIMENSION STANDARDS

TAPE HUB, TEFLON WASHER, AND CENTER POST

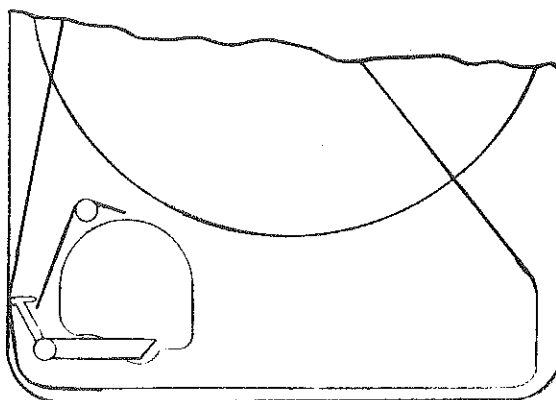
The tape hub contains all cartridge tape. The hub is designed to rotate around a center post. To allow free rotation, a teflon washer is installed between the hub and the shell. To maintain proper tape placement on the hub, the cartridge design will include: 1) a separate hub cover, 2) a close-tolerance molded cover, or 3) a hold-down wire.



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CLUTCH SPRING OR HUB BRAKE

The clutch spring or hub brake prevents tape movement when the cartridge is not in operation. This is accomplished by applying a brake to the hub or by pressing the tape against the shell. The clutch or brake is released by the shaft of the pressure roller when the roller is in the play position.

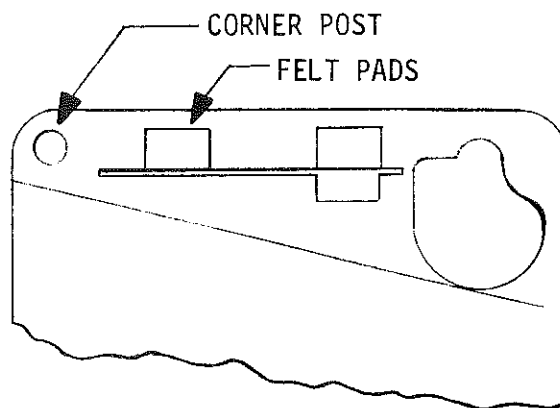


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PRESSURE PADS

The pressure pads maintain tape-to-head contact. A foam plastic is the most commonly used material for the pressure pads. The compression of the foam provides pressure to wrap the tape slightly around the heads.

The pads may be in a single block configuration mounted behind the two openings for the record and reproduce heads and secured to the cartridge shell. Alternately, the pads may be separated and fastened to a metal or plastic arm. A third type mounts the pads on a spring-loaded plastic block.



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TAPE GUIDANCE

Primary control of the tape as it moves across the heads is maintained by external guides in the head bracket. Guidance is provided within the cartridge to maintain tape travel in the same path. This is generally accomplished with tabs and grooves molded into the shell. Of primary importance is the corner post which must straighten the tape before it passes across the front openings of the shell. This post may be molded into the shell or a separate component molded into a recessed area in the shell.

CARTRIDGE MAINTENANCE TIPS

The cartridge is the second half of the tape cartridge system. The cartridge requires regular maintenance for proper operation. The service department of Broadcast Electronics has developed over the years a rule of thumb for troubleshooting: Check the cartridge before adjusting the machine.

TAPE

For maximum performance, the tape must be in good condition. The tape in cartridges wears rapidly, particularly in short length cartridges (70 seconds or less) and cartridges that are used frequently. The tape should be inspected regularly and frequently for obvious signs of wear.

Cartridges should be rewound or replaced when the oxide side of the tape is shiny. Likewise the tape should be discarded if it is wrinkled, or contaminated with fingerprints, grease, or dirt. Less obvious are areas where the iron oxide particles have worn from the base of the tape. Missing oxide areas may not be visible, but will cause a loss of audio signal.

If possible only one type of tape should be used in a single installation. Different brands, and even different types of the same brand of tape require different bias recording levels for optimum response.

When rewinding cartridges, use only a graphite lubricated tape. Silicone lubricated tapes will not provide adequate service in rugged NAB cartridge operation.

Every cartridge tape must have one splice, but multiple splices can cause problems. If the top tape ends overlap at the splice or do not meet squarely, the audio may not reproduce. In addition, a poor splice will catch on the cartridge or the hub. After a splice has been in use for some time, the tape tension may pull the two ends of the tape apart slightly opening the splice.

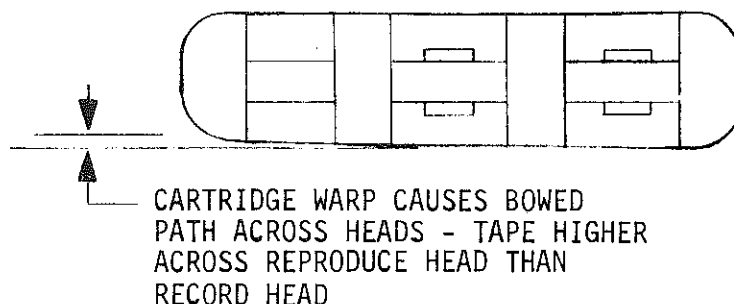
Proper tape tension is most critical. If the tension is too great, the tape will wear rapidly as it is squeezed against the hub, the pressure pads, the corner post, and the tape on the hub. If the tension is too light, the tape will not be pulled back into the hub.

The NAB specifies that tape tension at the capstan should not exceed 3 ounces. Cartridges greater than 70 seconds in length usually have less than 3 ounces, while cartridges less than 70 seconds usually have greater than 3 ounces. When in operation, a properly wound cartridge moves tape freely with no reluctance to wind onto the hub. To increase the tension in a cartridge, open up the splice and gently pull the tape as it wraps onto the hub. To decrease the tension, open up the splice and gently remove several loops from the center of the hub. Remove the excess and resplice the tape.

THE SHELL

A deformed shell can adversely affect frequency response by distorting the tape path. In particular, a warped cartridge may cause the tape to traverse the head openings in an arc or bowed path rather than a straight line. Also, an misaligned top can spread the sides of the cartridge enough to cause this same problem. Check suspect cartridges on a flat surface.

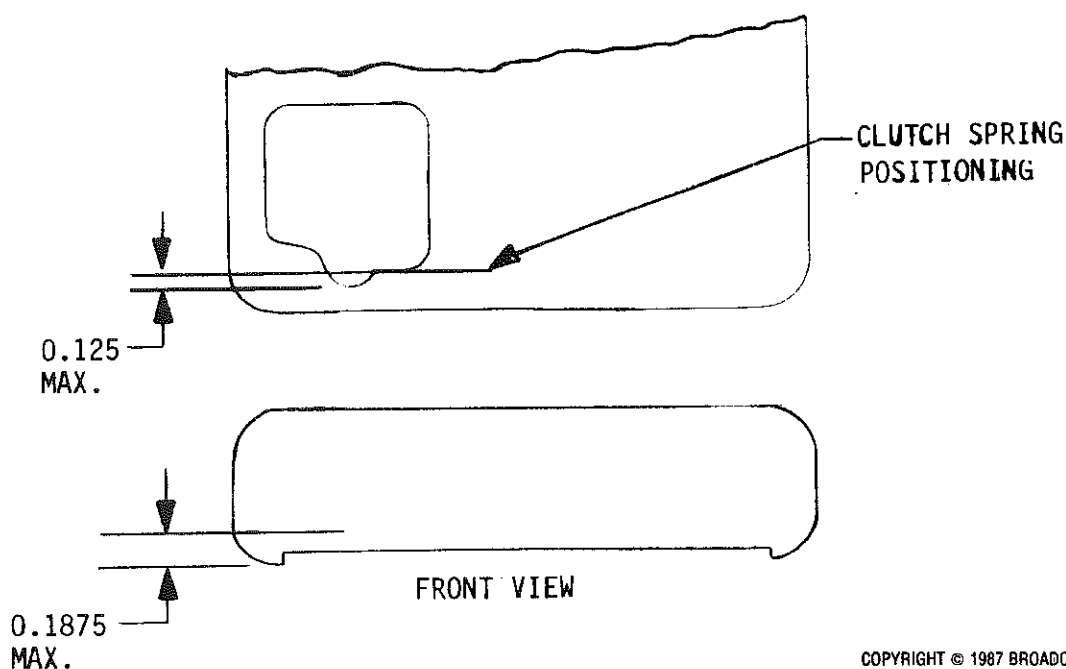
Periodically, the cartridge center post should be cleaned. Deposits on the post increase tape tension by not allowing the tape hub to rotate freely. Also, check the tape hub washer. This washer should always be in place underneath the tape hub, between the hub and the shell. This washer is easily misplaced when the cartridge is opened and the hub removed.



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CLUTCH SPRING OR HUB BRAKE

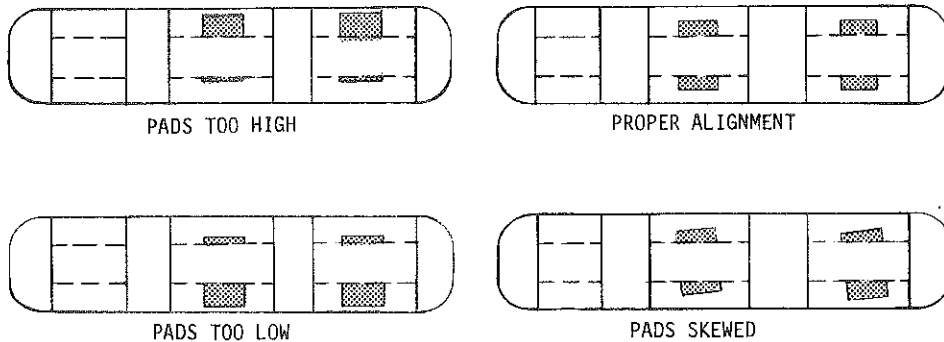
The clutch spring or hub brake should completely release when the pressure roller is in the vertical position. This allows the hub and the tape to move freely. An improperly adjusted clutch spring or defective hub brake may prevent the roller from engaging or dis-engaging. The clutch should be parallel to the bottom of the shell and no more than 0.1875 inches above the surface of the tape deck. The clutch must not protrude more than 0.125 inch into the opening for the pressure roller. Less than 8 ounces should be required to release the clutch.



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PRESSURE PADS

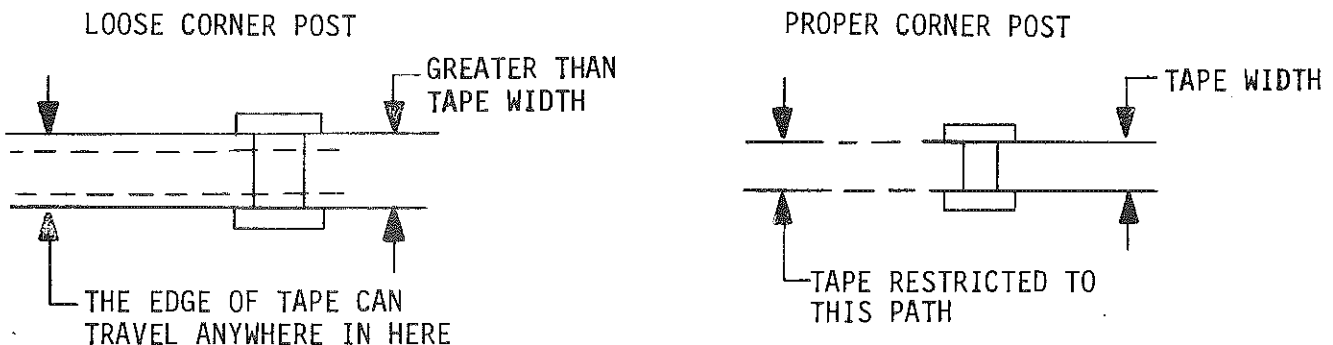
The pressure pads must wrap the tape around the front of the heads. The pressure applied must be uniform across the tape as it is in contact with the head. Periodically check the pads for proper alignment. If a portion of the tape is not in contact with the pads, the improper tape-to-head contact will occur. This will result in poor frequency response from an individual cartridge.



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THE TAPE PATH

The most frequent cause of distortion of the tape path in the cartridge is a loose corner post. The post must be mounted 0.250 inches from the bottom of the shell. If the distance between the shell and post is greater than 0.250 inches, the tape will not pass straight across the heads. A loose post frequently causes muffled-sounding audio when the cartridge unit starts.



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The hold-down wire used in many cartridges is important in maintaining proper tape travel. This wire maintains proper tape placement on the hub as tape is pulled from the center. The wire must not exert any pressure on the stored tape or the tape may wrinkle and jam. If a cartridge is dropped, this hold-down wire may unseat.

CARTRIDGE STORAGE

The cartridges should be stored away from direct sunlight, or heat from electronic equipment, radiators, etc. Ideal conditions are a temperature of 70° and a relative humidity of 50%. The cartridge storage area should be as free from dust as possible.

CARTRIDGE RECORDING PROCEDURE

The following procedure is particularly important when recording cartridges. When the cartridge is first inserted into the machine, operate the deck to allow the tape to seat properly in the tape guides.

Stop the tape. Do not remove the cartridge after the initial operation. Ensure the tape splice is between the end and the beginning of the program material.

CARTRIDGES FOR STEREOPHONIC SYSTEMS

MAINTENANCE

Cartridges operated in a stereophonic format require rigorous maintenance due to the generation of phase errors by improper tape movement. When the program material is combined, phase differences cause degradation of the frequency response.

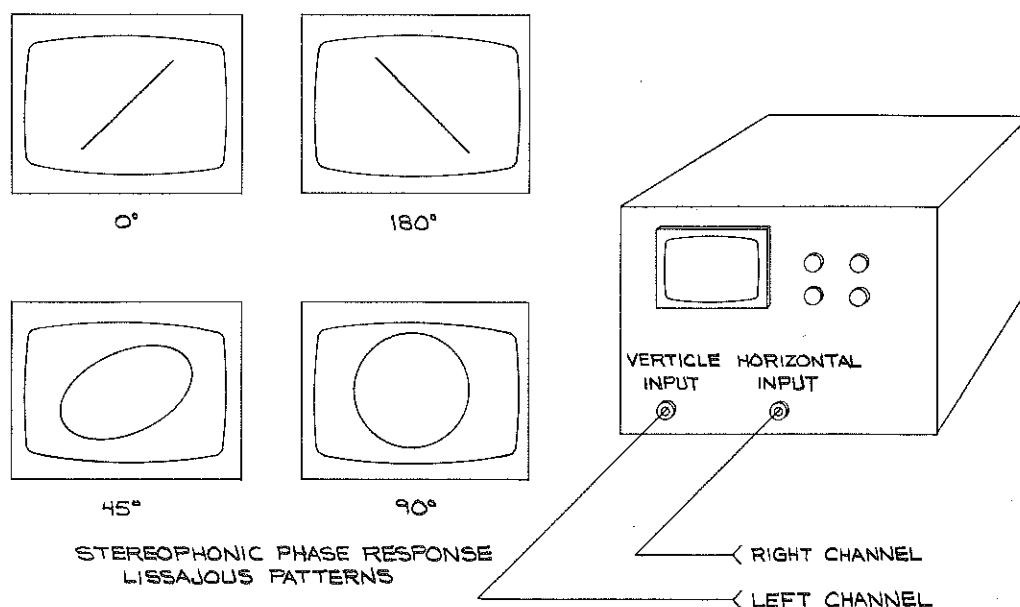
The most important characteristic of a cartridge operated in a stereophonic format is the ability to maintain an identical tape path each time the cartridge is inserted in the deck. This ensures reliable recording and subsequent accurate reproduction.

Cartridges used in a stereophonic system should initially be selected for phase repeatability using the phasing test outlined below. This test should be repeated on a regular basis throughout the life of the cartridge. A cartridge which fails this test should be discarded.

To provide better guidance within the cartridge, several manufacturers have introduced cartridges with an adjustable corner post. The post is threaded into the shell so that the precise post height may be maintained. These and other cartridges designed to improve performance should be considered for use in a stereophonic system.

STEREO PHASING TEST

Connect the output of a record/playback unit to an oscilloscope as shown. Connect an audio signal generator to both inputs of the recorder. While recording, observe the phase of the reproduce signals. Remove and re-insert the cartridge several times. Cartridges which exhibit poor phase repeatability or stability should be discarded. Do not test only at higher frequencies, also check selected frequencies across the audio band.



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PRODUCT WARRANTY

LIMITED ONE YEAR

While this warranty gives you specific legal rights, which terminate one (1) year (6 months on turntable motors) from the date of shipment, you may also have other rights which vary from state to state.

Broadcast Electronics, Inc. ("BE"), 4100 North 24th Street, P. O. Box 3606, Quincy, Illinois 62305, hereby warrants cartridge machines, consoles, transmitters and other new Equipment manufactured by BE against any defects in material or workmanship at the time of delivery thereof, that develop under normal use within a period of one (1) year (6 months for turntable motors) from the date of shipment. Other manufacturers' Equipment, if any, shall carry only such manufacturers' standard warranty. This warranty extends to the original user and any subsequent purchaser during the warranty period. BE's sole responsibility with respect to any Equipment or parts not conforming to this warranty is to replace such equipment or parts upon the return thereof F.O.B. BE's factory or authorized repair depot within the period aforesaid.

In the event of replacement pursuant to the foregoing warranty, only the unexpired portion of the warranty from the time of the original purchase will remain in effect for any such replacement. However, the warranty period will be extended for the length of time that the original user is without the services of the Equipment due to its being serviced pursuant to this warranty. The terms of the foregoing warranty shall be null and void if the Equipment has been altered or repaired without specific written authorization of BE, or if Equipment is operated under environmental conditions or circumstances other than those specifically described in BE's product literature or instruction manual which accompany the Equipment purchased. BE shall not be liable for any expense of any nature whatsoever incurred by the original user without prior written consent of BE.

BE shall not be liable to the original user for any and all incidental or consequential damages for breach of either expressed or implied warranties. However, some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. All express and implied warranties shall terminate at the conclusion of the period set forth herein.

Except as set forth herein, and except as to title, there are no warranties, or any affirmations of fact or promises by BE, with reference to the Equipment, or to merchantability, fitness for a particular application, signal coverage, infringement, or otherwise, which extend beyond the description of the Equipment in BE's product literature or instruction manual which accompany the Equipment. Any card which is enclosed with the Equipment will be used by BE for survey purposes only.

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