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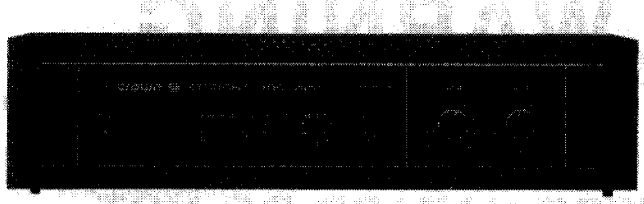
crown

SERVICE MANUAL



STRAIGHT LINE ONE
PREAMPLIFIER

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

REVIEW SECTION

I. Introduction

This manual contains complete service information on the SL-1 preamplifier. It is designed to be used in conjunction with the SL-1 Instruction Manual. However, some important information is duplicated in this Service Manual in case the Instruction Manual is not readily available.

NOTE: THE INFORMATION IN THIS MANUAL IS INTENDED FOR USE BY AN EXPERIENCED TECHNICIAN ONLY!

II. Warranty

As a Crown Warranty Service Station, you should be familiar with Crown warranty policies. Each Instruction Manual contains basic policies as related to the customer. However, under questionable circumstances, please contact the Technical Service Department or Director of Customer Service at: Crown International, Inc., 1718 W. Mishawaka Road, Elkhart, IN 46514.

III. Specifications

Frequency Response: Tape, Aux, Tuner or Phono In to Main Out, ±.1dB from 10Hz to 20KHz; +0, -1dB 10Hz-100KHz. Sl-1 remote module alone, within 0.5dB of RIAA curve, 20Hz-20KHz.

Hum and Noise: From 20Hz to 20KHz the hum and noise level is 97dB below the rated output; 101dB below rated output A weighted.

Phase Response: ±10°, 20Hz to 20KHz with IHF load.

Harmonic Distortion: Less than 0.0009% from 10Hz to 20KHz maximum rated output. Less than 0.0003% at 1KHz with IHF load.

Intermodulation Distortion (IM): Less than 0.00055% at rated output; 60Hz & 7KHz, 4:1.

Slewing Rate: 12 volts per microsecond.

Low Cut Filter: 18dB per octave slope, down 3dB at 33Hz.

Input and Output Characteristics

Input Impedance (RCA pin jacks, unbalanced): SL-1 rear panel jacks, 25K ohms ±10%. SL-1PM remote phono module, 47,000 ohms or 100,000 ohms in parallel with 5pf (switch selectable).

Input Sensitivity: At maximum VOLUME, 20dB (250mv RMS) applied to any SL-1 INPUT jack yields full rated output.

Output Impedance (RCA pin jacks, unbalanced): SL-1 Main Outputs, 600 ohms actual; will drive low or high impedance terminations.

Output Level: SL-1 Main Outputs, rated at 2.5V. SL-1 Tape Outputs carry same level as the output of the device selected with the SL-1 INPUT switches.

Transient Surge Protection: Relay grounds Main Outputs for 7 second delay when AC POWER is switched ON, and immediately when AC POWER is switched OFF.

Physical and Electrical Specifications

Controls: SL-1; POWER On/Off, INPUT selector switches (Phono, Tuner, Aux 1, Aux 2), low cut FILTER switch, stepped output BALANCE control (15dB in 1dB increments, plus full kill of either channel), stepped output VOLUME control (60dB range in 2dB increments, plus full kill of both channels).

Indicators: One POWER ON LED (light emitting diode); Left and Right OVERLOAD LED's flash ON whenever signal levels reach threshold of clipping in either channel (a peak hold circuit aids visibility in the event of brief transient overloads).

AC Mains Requirements: Power supply may be restrapped to any of 5 nominal line voltages: 100, 120, 200, 220 and 240 volts AC (±10%); line frequencies of 50Hz, 60Hz or 400Hz.
Total accessory AC outlet consumption is rated at 1500 watts (1200 watts maximum for all switched outlets, together).

Mains Fuse: Power transformer primary is protected by a series connected fuse, ⅛ amp.

Circuitry: All solid state, discrete transistors and diodes plus integrated circuits.

Construction: Machined front panel with black anodized finish; nickel-plated chassis parts; handles included.

Dimensions: SL-1 has 3½″ high x 19″ wide rackmountable front panel and measures 7¾″ deep behind the face of the rack. (8.89cm H x 48.26cm W x 19.69cm D).
SL-1PM is 1¾″ high x 4½″ wide x 5¾″ dep (4.5cm x 10.8cm x 14.6cm), excluding cables.

Net Weight: 10 pounds (4.55kg), including SL-1PM.

IV. Panel Configuration

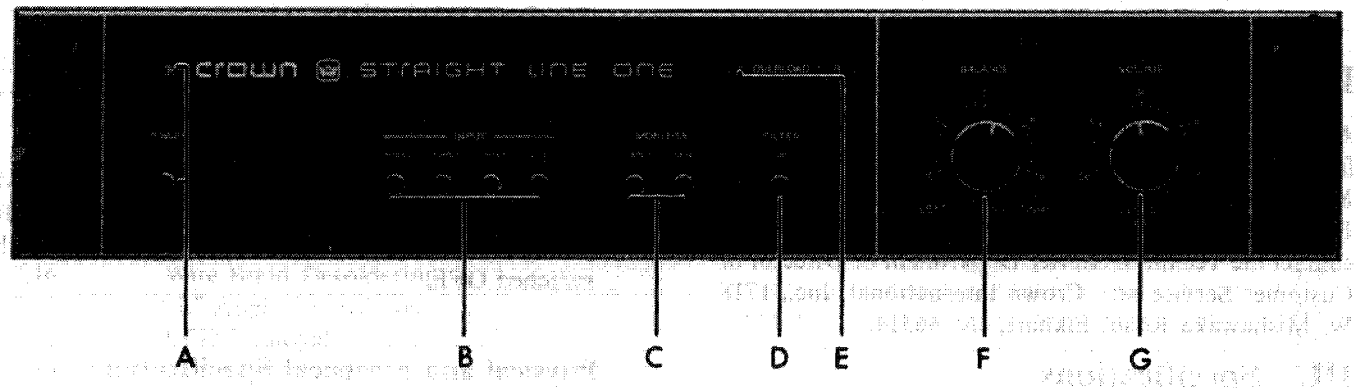


Fig. RVW.1 SL-1 Front Panel

A. POWER SWITCH AND INDICATOR
B. INPUT SELECTOR SWITCHES
C. MONITOR SWITCHES
D. FILTER SWITCH
E. OVERLOAD INDICATORS
F. BALANCE CONTROL
G. VOLUME CONTROL

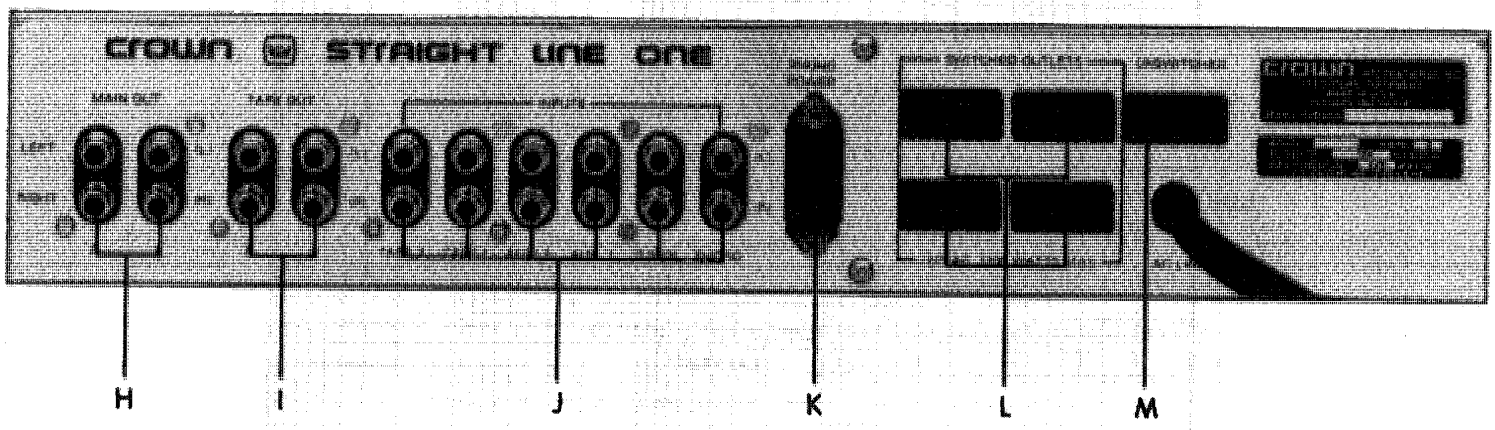
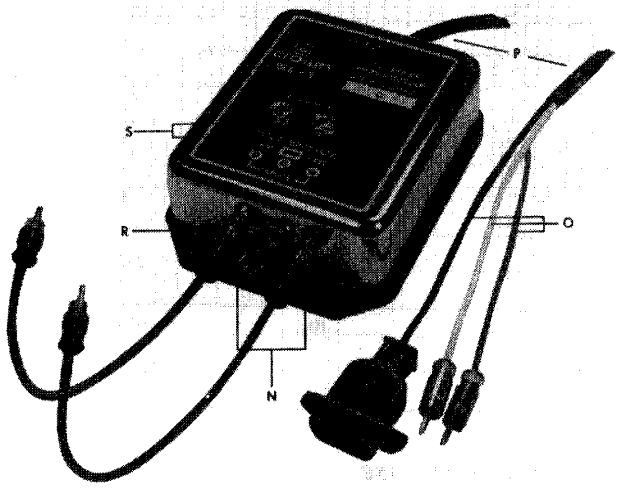


Fig. RVW.2 SL-1 Back Panel

H. MAIN OUT JACKS
I. TAPE OUT JACKS
J. INPUT JACKS
K. PHONO POWER CONNECTOR
L. SWITCHED AC OUTLETS
M. UNSWITCHED AC OUTLETS



N. INPUT JACKS
O. OUTPUT CABLES
P. UMBILICAL CABLE
R. INPUT IMPEDANCE SWITCH
S. GAIN CONTROLS

Fig. RVW.3 SL-1PM Phono Preamp Module

V. Performance Graphs

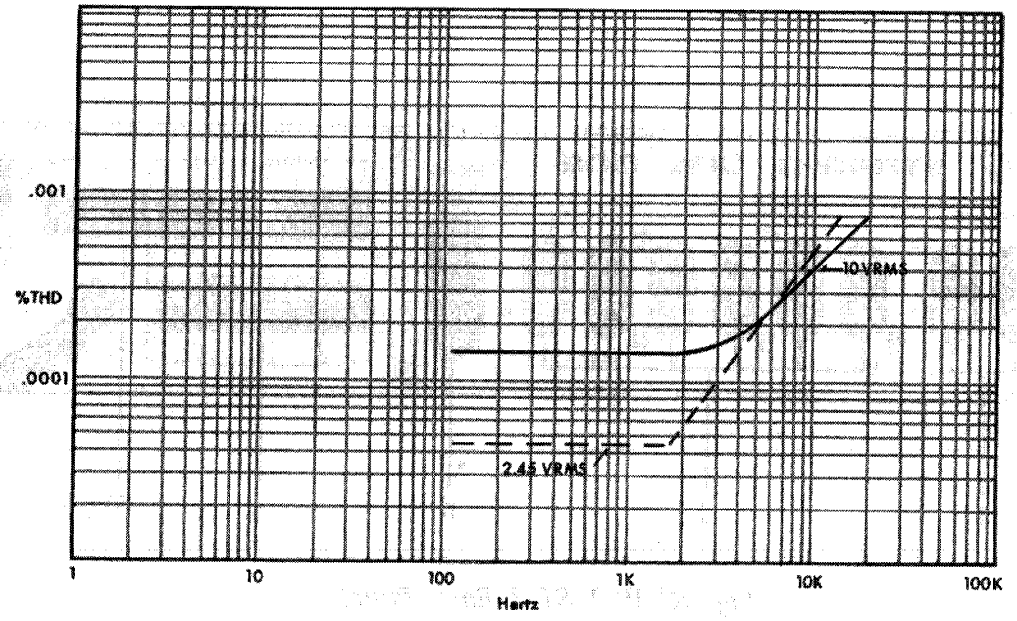


Fig. RVW.4 THD

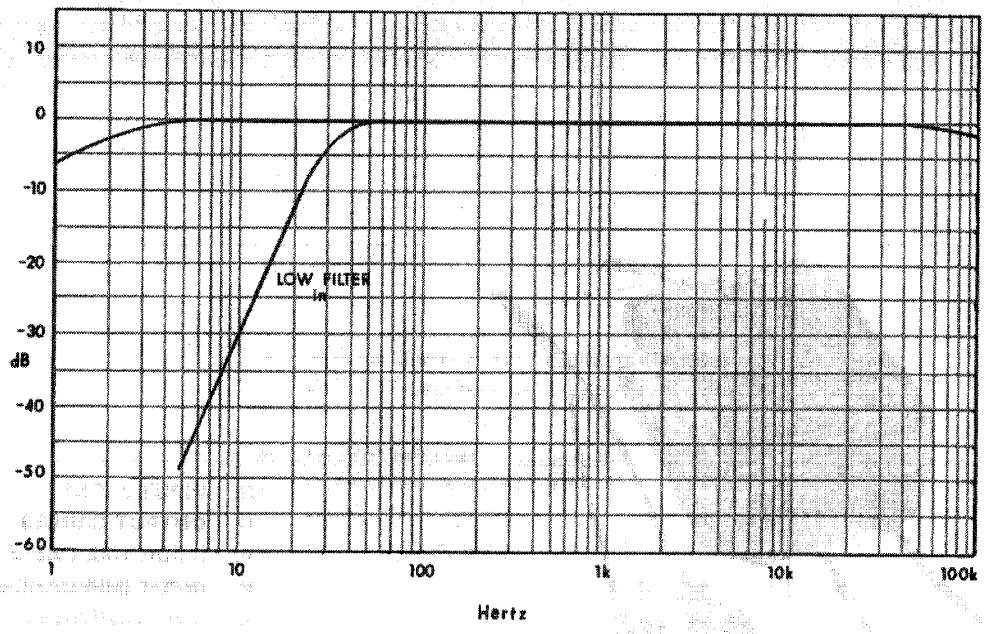


Fig. RVW.5 Frequency Response

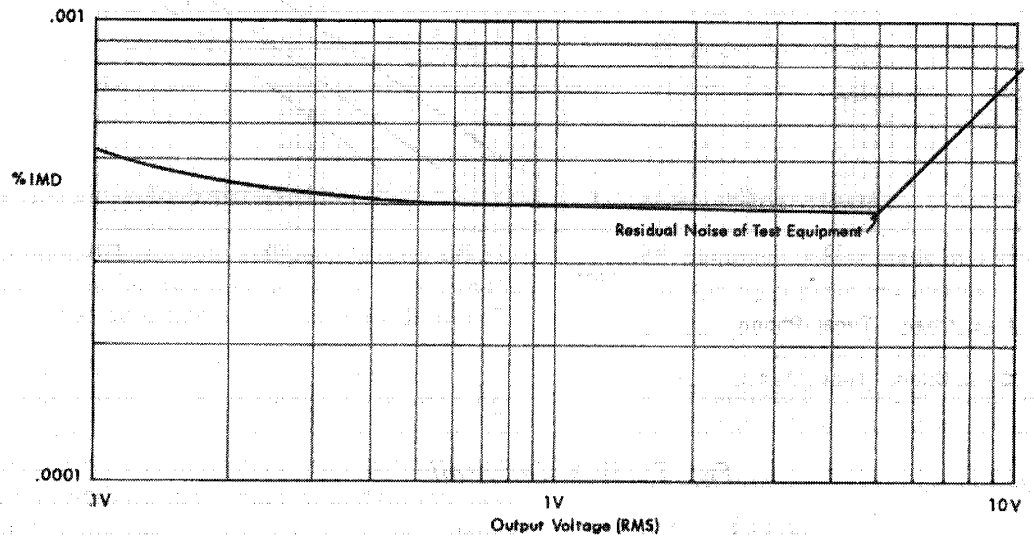


Fig. RVW.6 IM Distortion

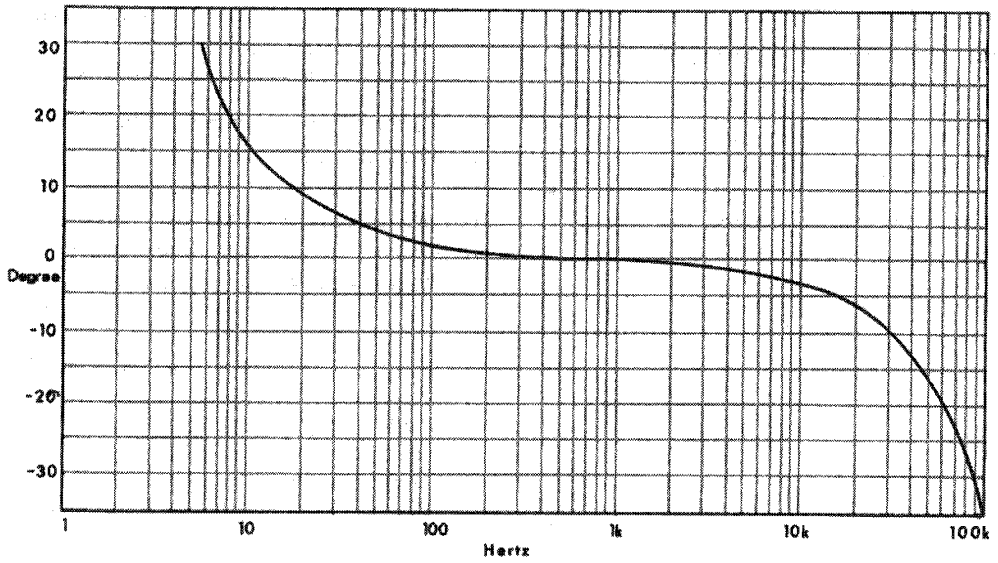
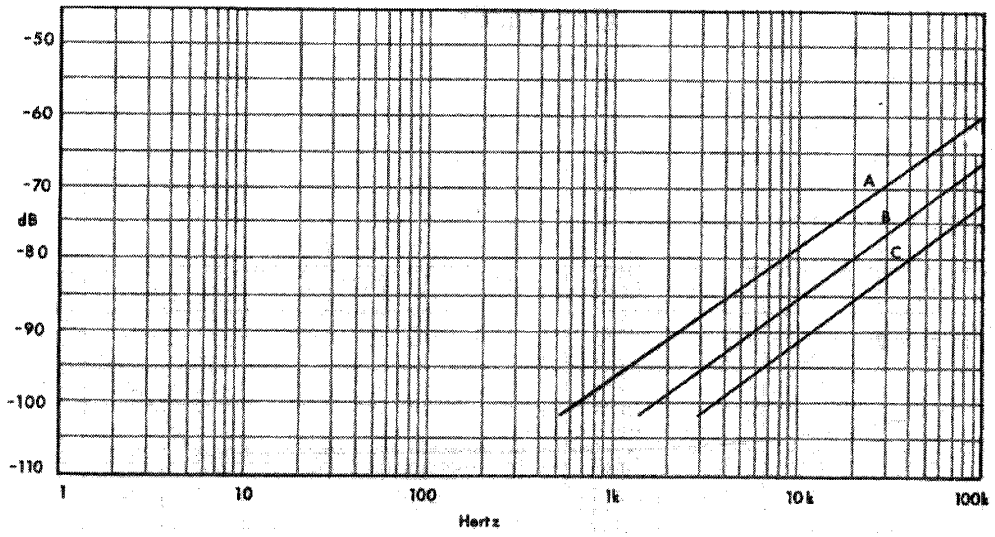


Fig. RVW.7 Phase Response



A - L. Chan. Tuner/Phono
B - R. Chan. Tuner/Aux 1
C - L. Chan. Tuner/Aux 1

Fig. RVW.8 Crosstalk

SECTION 6
ILLUSTRATED PARTS LIST

6.1 General Information

Section 6 contains illustrations and parts lists for the SL-1 preamplifier. This information should be used with the service, repair and adjustment procedure in Section 7.

Most of the mechanical and structural type parts are illustrated and indexed on exploded view drawings. Electrical and electronic parts on these illustrations are also identified by the circuit reference designation next to the illustration. Both the index number and the reference designation are included in the parts list in separate columns. The reference designations correspond to those shown in schematic diagrams in the Review Section.

Electrical and electronic parts located on printed circuit boards are illustrated by schematic symbols on the trace side and by component shape symbols on the component side. Reference designations also appear on these diagrams.

The quantity of each part used in each location is also shown in the parts listing.

6.2 Standard and Special Parts

Many electrical and electronic parts used in the SL-1 are standard items stocked by and available from electronic supply houses. However, some electronic parts that appear to be standard, are actually special. A part ordered from Crown will assure an acceptable replacement. Structural items, covers and panels are available from Crown only.

6.3 Ordering Parts

When ordering parts, be sure to give the amplifier model and serial number and include the part description and Crown Part Number (CPN) from the parts list. Price quotes are available upon request.

6.4 Shipment

1. Shipment will be made by UPS or best method unless you specify a preferred method.

2. Shipments are made F.O.B. Elkhart, Indiana only.

3. Established Crown accounts will be freight prepaid and billed unless shipped by truck or air freight.

4. All others will be shipped freight collect.

6.5 Terms

1. Normal terms are C.O.D. unless the order is prepaid.

2. Net 30 days terms apply only to those firms who have an established line of credit with Crown.

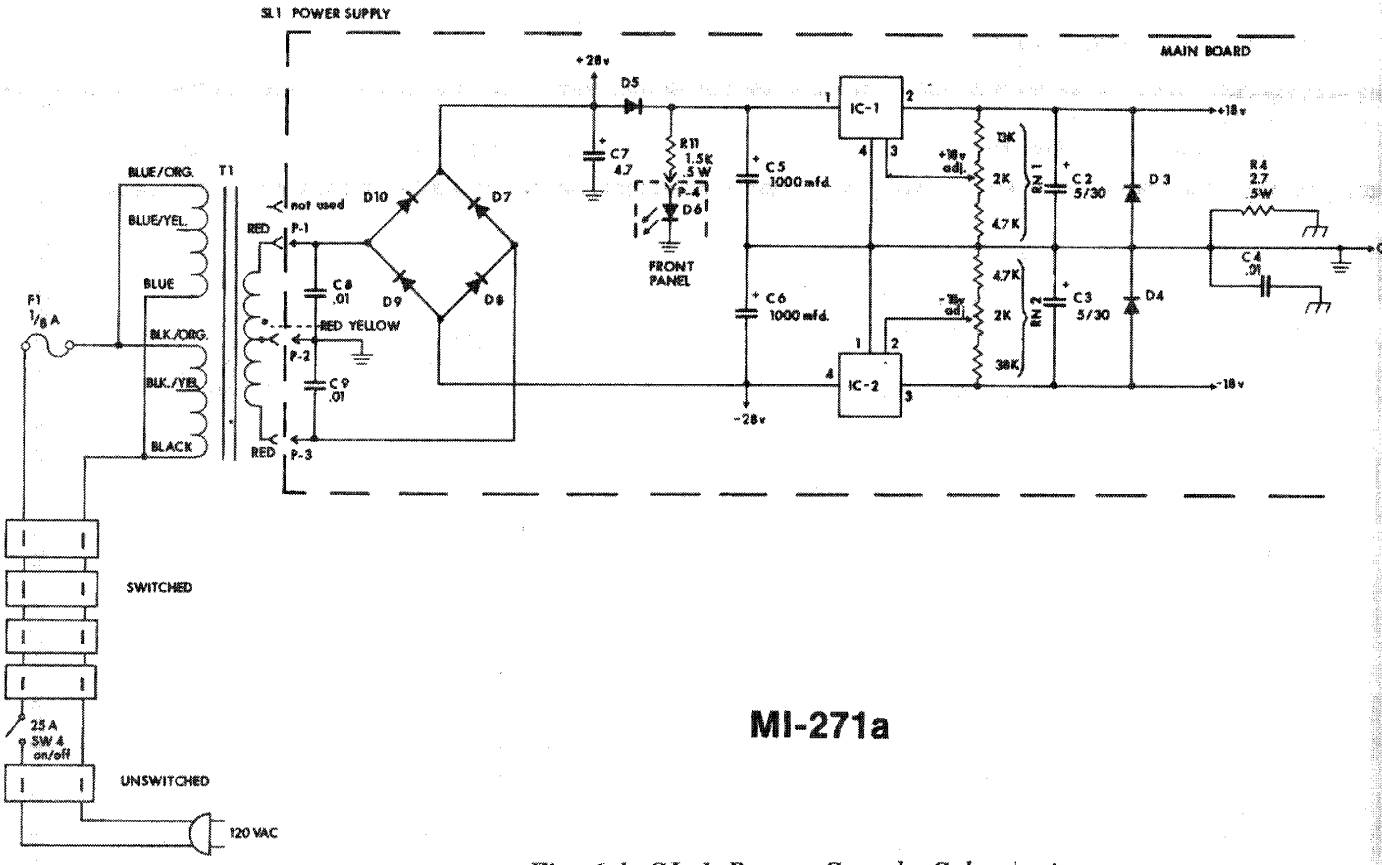
3. If prepaying please add an amount for the freight charge. $1.00 is average for an order under one pound.

NOTE: Part prices are subject to change without notice.

4. New parts returned for credit are subject to a 10% restocking charge.

5. You must receive authorization from the Parts Dept. before returning parts for credit.

6. We are not a general parts warehouse! Parts are available for servicing Crown products only.



MI-271a

Fig. 6.1 SL-1 Power Supply Schematic

SCHEMATIC NOTES: STRAIGHT LINE

- **CIRCUIT SHOWN STARTS WITH SN 5370 AND APPLIES ONLY TO PC BOARD #9813 (MAIN BOARD).**
- **ALL RESISTORS ARE IN OHMS, ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE NOTED.**
- **ALL RESISTORS ARE .25 WATT UNLESS OTHERWISE NOTED.**
- **COMPONENTS COMMON TO BOTH CHANNELS ARE NUMBERED 10 TO 99.**
- **LEFT CHANNEL COMPONENTS ARE NUMBERED FROM 100 TO 199.**
- **RIGHT CHANNEL COMPONENTS ARE NUMBERED FROM 200 TO 299.**
- **WIRE COLOR CODES ARE GIVEN FOR THE MAIN POWER SUPPLY.**
- **MUTE RELAY SHOWN ACTIVE (NORMALLY CLOSED).**
- **TAPE MONITOR SWITCHES INACTIVE (OUT).**
- **RESISTOR NETWORKS ARE INDICATED WITH "RN" PREFIXES.**
- **PHONO MODULE SCHEMATIC NOT SHOWN (CONTACT CROWN FOR SERVICE INFORMATION).**
- **LOW FILTER SW3A,B SHOWN INACTIVE (OUT).**

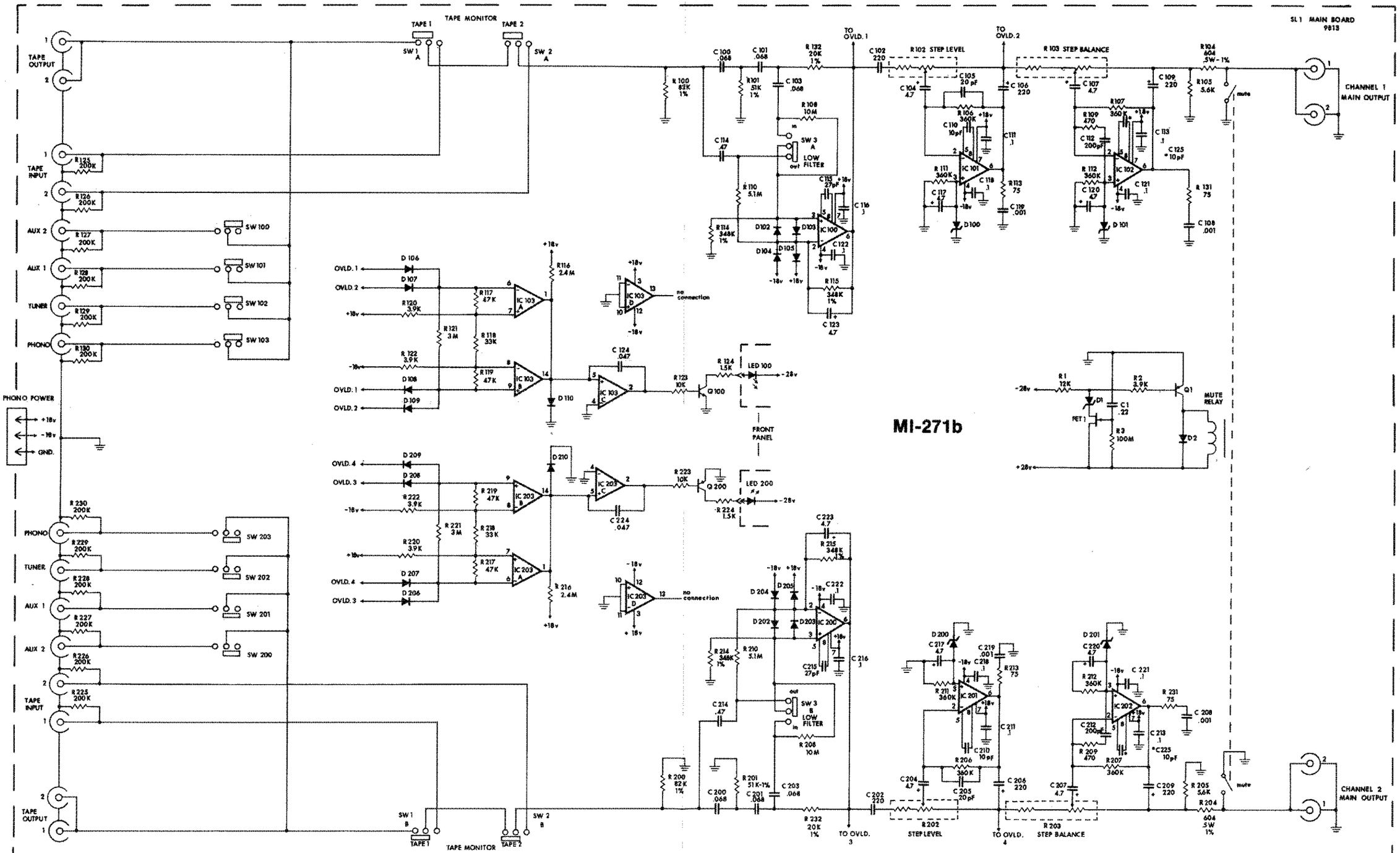


Fig. 6.2 SL-1 Main Board Schematic

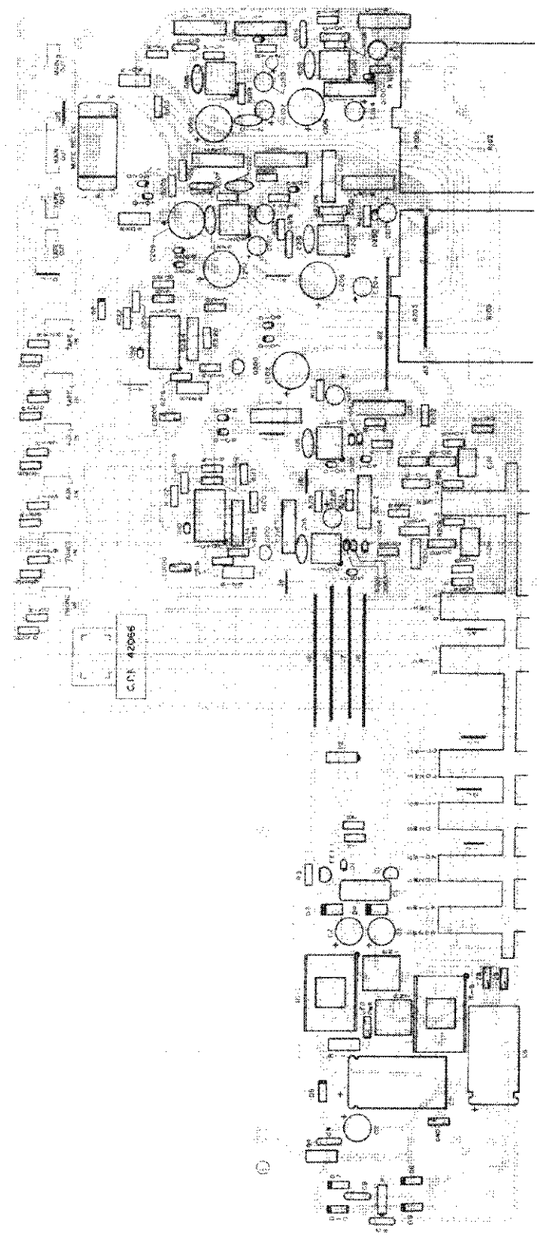


Fig. 6.3 Main Board Component Layout

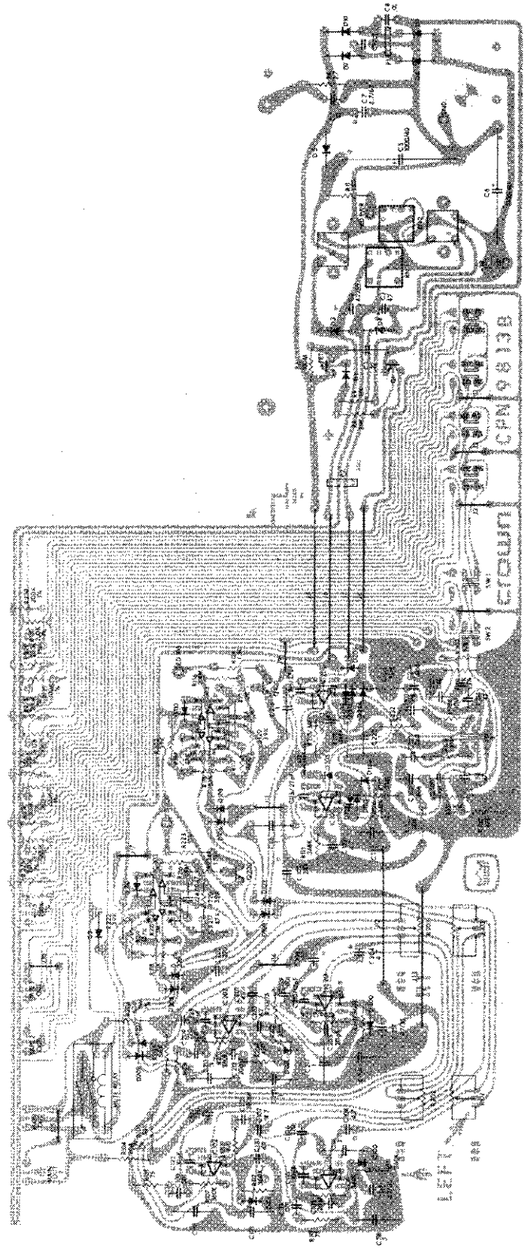


Fig. 6.4 Main Board Foil Layout

Parts List: Main Board

Schematic Designation	Description	Qty.	Crown Part No.	Other Information
	Capacitors			
C1	.22mf 100V filmatic	1	C 3218-2	
C2, C3, C7	4.7mf 63V vertical	3	C 4253-8	
C4, C8, C9	.01mf Ceramic disc	3	C 1751-4	Power Supply
C5, C6	1000mf 40V axial	2	C 4303-1	Power Supply
C100, C200, C101, C201, C103, C203	.068mf 100V polycarb	6	C 4813-9	
C102, C202, C106, C206, C109, C209	220mf 16V vertical	6	C 3796-7	
C104, C204, C107, C207, C117, C217, C120, C220, C123, C223	4.7mf 35V tantalum	10	C 4019-3	
C105, C205	20pf ceramic	2	C 3535-9	
C108, C208, C119, C219	.001 ceramic disc	4	C 2288-6	
C110, C210, C125, C225	10pf mica	4	C 2821-4	
C111, C211, C113, C213, C116, C216, C118, C218, C121, C221, C122, C222	.1mf 200V filmatic	12	C 2938-6	
C112, C212	200pf mica	2	C 3411-3	
C114, C214	.47mf 100V 5 polycarb	2	C 4119-1	
C115, C215	27pf mica	2	C 2342-1	
C124, C224	.047mf 200V 5 mylar	2	C 3978-1	
	Diodes			
D1, D100, D200 D101, D201	1N961B 10V zener	5	C 3549-0	
D2, D3, D4, D5, D7, D8, D9, D10	1N4004 diode	8	C 2851-1	
D6	MV5153 amber LED	1	C 4342-9	Power On Indicator
D102, D202, D103, D203, D104, D204, D105, D205, D106, D206, D107, D207, D108, D208, D109, D209, D110, D210	1N4148 diode	18	C 3181-2	
LED100, LED200	MV5053 red LED	2	C 4341-1	

Schematic Designation	Description	Qty.	Crown Part No.	Other Information
	Integrated Circuits			
IC1	78MGT2C positive regulator	1	C 4296-7	
IC2	79MGT2C negative regulator	1	C 4297-5	
IC100, IC200, IC101, IC201, IC102, IC202	NE5534AN Op Amp	6	C 4475-7	
IC103A,B,C,D, IC203A,B,C,D	LM339N voltage comparator	2	C 4345-2	
	Transistors			
Q1	SEL 2N3859A NPN	1	D 2961-7	
Q100, Q200	PN4250A PNP	2	C 3786-8	
FET1	2N5459 N-channel JFET	1	C 3053-3	
	Resistors			
R1	12K ohm .25W 5%	1	C 2878-4	
R2, R120, R220, R122, R222	3.9K ohm .25W 5%	5	C 2630-9	
R3	100M ohm .25W 5%	1	C 4206-6	
R4	2.7 ohm .5W 10%	1	C 2857-8	Power supply
R5, R6	Resistor trimmer network 1	2	D 4445-9	Power Supply
R11, R124, R224	1.5K ohm .5W 5%	3	C 1076-6	R11 - Power Supply
R100, R200	82K ohm .25W 1%	2	C 4994-7	
R101, R201	51K ohm .25W 1%	2	C 4814-7	
R104, R204	604 ohm .5W 1%	2	C 3109-3	
R105, R205	5.6K ohm .25W 5%	2	C 3220-8	
R106, R206, R107, R207, R111, R211, R112, R212	360K ohm .25W 5%	8	C 4223-1	
R108, R208	10M ohm .25W 10%	2	C 3221-6	
R109, R209	470 ohm .25W 5%	2	C 2626-7	
R110, R210	5.1M ohm .25W 5%	2	C 4126-6	
R113, R213, R131, R231	75 ohm .25W 5%	4	C 3798-3	
R114, R214, R115, R215	348K ohm .25W 1%	4	C 4816-2	
R116, R216	2.4M ohm .25W 5%	2	C 4600-0	
R117, R217, R119, R219	47K ohm .25W 5%	4	C 2880-0	
R118, R218	33K ohm .25W 5%	2	C 4346-0	
R121, R221	3M ohm .25W 5%	2	C 4489-8	
R123, R223	10K ohm .25W 5%	2	C 2631-7	
R125, R225, R126, R226, R127, R227, R128, R228, R129, R229, R130, R230	200K ohm .25W 1%	12	C 4995-4	
R132, R232	20K ohm .25W 1%	2	C 4861-8	

Schematic Designation	Description	Qty.	Crown Part No.	Other Information
	Miscellaneous			
	MOD 4 Pin Housing	1	C 5011-9	
	MOD 5 Hi Pressure Receptacle	3	C 5014-3	
	SL-1 Voltage Regulator Heat Sink	2	F 9655-6	
Mute Relay	5K ohm DPST NC reed relay	1	C 3496-4	
SW1A,B, SW2A,B, SW3A,B	9 station DPDT pushbutton switch	1	D 4811-2	Tape Monitor, Low Filter

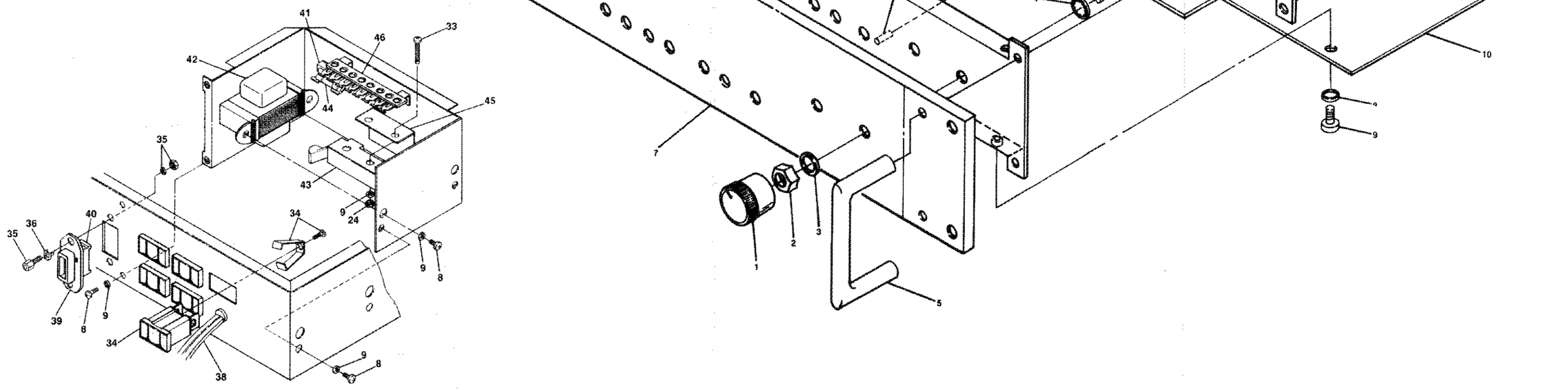


Fig. 6.5 SL-1 Main Assembly

Parts List: Main Assembly

Index No.	Schematic Designation	Description	Qty.	Crown Part No.	Comments
1		1 in. ~~Aluminum~~ Knob Black	2	D 4820-3	SL-1 only
1		1 in. ~~Satin~~ Knob Silver	2	D 5331-0	SL-1S only
2		.375 Bright Nut	2	C 1288N7	
3		.375 Bright Washer	2	C 2189-6	
4		.375 Internal Starwasher	2	C 2188-8	
5		Round Component Handle	2	D 4818-7	SL-1 only
5		Round Component Handle (Silver)	2	D 5329-4	SL-1S only
6		Sub Front Panel	1	F 9806-5	
7		Front Panel (Black)	1	F 9811J4	SL-1 only
7		Front Panel (Silver)	1	F 9888J2	SL-1 only
8		R6 32 .18 Machine Screw	24	C 2008-8	Cover, miscellaneous mounting, and transformer mounting screws
9		#6 Internal Star Lockwasher	28	C 5594-4	For miscellaneous #6 screws
10		Bottom Cover	1	F 9812-3	
11		Top Cover	1	F 9929-5	
12		Chassis	1	F 9807-3	
13		S8 32 .75 Machine Screw	4	C 5024-2	Handle screws
14		#2 Internal Star Lockwasher	4	C 3912-0	Regulator mounting washers
15		4 Way Phono Jackplate	5	C 4790-9	
16		Black Pushbuttons	8	D 4819-5	SL-1 only
16		Silver Pushbuttons	8	D 4074-7	SL-1S only
18		B4H .50 Self Tapping Screw	10	C 4895-6	
19		4-40 x .4375 Standoff	4	C 5022-6	
20		Power Switch Rod	1	F 9810-7	
21		Brass Spacers	2	D 5025-8	
22		1 Station Plunger	1	D 4808-1	
23		4-40 x .375 Screws	4	C 5328-7	Pushbutton switch mounting screws
24		6-32 Hex Nut	2	C 1889-2	Microswitch nuts
25		R6 32 .75 Machine Screw	2	C 2135-9	
26		R3 48 .25 Machine Screw	2	C 1975-9	
27		#8 Internal Starwashers	4	C 1951-0	Handle washers
28		#3 Internal Starwasher	2	C 1825-6	
29		#4 Internal Starwasher	4	C 1824-9	Pushbutton washers
30		2-56 Hex Nut	4	C 1817-3	
31		R 2-56x.25 Machine Screw	4	C 1919-7	Regulator mounting screws
32		SL-1 Partition Panel	1	F 9809-9	
33		R632 1.00 Machine Screw	2	C 2138-3	Microswitch screws
34		AC Receptacle	5	C 2432-0	
35		Champ Screw Mounting Kit	1	C 4587-9	
36		Champ Connector Washer	2	C 4766-9	
37		Mod 3 Hi Press Receptacle	6	C 5340-2	Not shown
38		Power Cord (AC)	1	C 5020-0	
39		Champ Receptacle	1	C 4582-0	
40		Champ Strain Relief	2	C 4586-1	
41		Fuse Block	1	C 3776-9	
42	T1	18VDC Regulator, 20MA Transformer	1	D 4349-3	
43		SPDT 25A Microswitch	1	C 3222-4	On/Off
44	F1	MDL .125A Fuse	1	C 3905-4	
45		Microswitch Bracket	1	F 9808-1	
46		Terminal Strip	1	D 4985-4	

SECTION 7
MAINTENANCE

7.1 Introduction

Section 7 contains technical information required to effectively and efficiently service and repair the Crown SL-1 preamplifier. Included are disassembly and reassembly procedures, required test equipment lists, checkout procedures, basic troubleshooting tips and a soldering technique review.

THIS INFORMATION IS INTENDED FOR USE BY AN EXPERIENCED TECHNICIAN ONLY!

Use this information in conjunction with the Instruction Manual, schematic/board layout diagrams, parts lists and exploded view drawings (the latter located in Section 6 of this manual).

7.2 Required Test Equipment

Many of the service and repair problems with the SL-1 can be performed with a limited amount of test equipment. However, in order to return the unit to its "factory new" specifications, the following list of required test equipment is recommended. The "Requirements" column provides information to allow intelligent selection of substitutes if the "Suggested Supplier and Model" is not available or is considered impractical to obtain.

EQUIPMENT	REQUIREMENTS	APPLICATION	SUGGESTED MODEL
Oscilloscope	Capable of displaying a 10MHz signal	Monitoring output during service and testing	Telequipment D54A or equivalent
Volt-ohmmeter (VOM)	Low-voltage resistance probe (100mv range). High-voltage resistance probe (1.5V range)	Check resistance values (low voltage probe). check semi-conductor junctions for opens or shorts (high voltage probe) Check DC voltages	Triplett 601 or equivalent
Freq. Counter		For accurate general monitoring	Heath SM118A
Signal Generator	Sine/Square wave available; flat frequency response. THD. .1% maximum	Provide test signals for service and checkout	Wavetek 130-Series or equivalent
Circuit Breaker	15 ampere rating	In AC line to unit; protects circuitry from overload if power supply has shorted	
AC Line Voltage Monitor	Peak reading meter (displays rms equivalent to a sinusoidal peak from any wave form)	Monitor Line voltage	Available from CROWN

EQUIPMENT	REQUIREMENTS	APPLICATION	SUGGESTED MODEL
Phase Meter			
AC Voltmeter	100mv low range, flat frequency response to 100KHz	Set output level for testing; check noise level	Hewlett-Packard 400F or equivalent
Filter	20-20KHz bandpass, low noise 20Hz-20KHz	Between preamplifier and voltmeter in noise test	Information available from CROWN
Intermodulation Distortion Analyzer	Residual (.002% or lower)	Check IM distortion	Information available from Crown

especially obnoxious when measuring distortion. An IM analyzer for example has its input and output terminals tied to a common ground. Such a test should use an ungrounded output return with the output lead wrapped around a well-shielded and grounded input cable (See Section 7.9 for additional information).

7.3 Soldering Techniques

Note: Proper continuity between internal components of any electronic device is the key to its successful operation. Therefore, a brief review of the following discussion on soldering techniques may be in order. Because most service work involves component part(s) replacement, hand-soldering with the use of a soldering iron will be the only method covered, even though many exist.

The difference between success and failure in service repair is often determined by the thermal characteristics of an iron and how well it matches the job at hand. One would not use a large flat-head screwdriver to work on a delicate Swiss watch. Likewise, the proper size iron and tip should be used when soldering delicate electronic parts in position.

Iron wattage classification is actually not a very good method of choosing an iron. The reason for this is because of the possible inefficiency of heat transfer to the tip internally. A large wattage iron (125W) may, in effect produce lower tip temperatures than another iron smaller in wattage. Likewise, tip size and shape does not necessarily work in proportion to temperature. Therefore, it is impractical to compare soldering irons by their wattage but more feasible to refer to them by their maximum tip temperature.

Usually, the skilled service technician can pick the right iron and tip for the job from experience or recommendation. In most cases, the miniature or small electrical soldering iron will work well with delicate semiconductor devices (Fig. 7.1). When the proper size iron is used (usually around 700° F. tip temperature), a joint is almost instantly heated (approx. 500-550°) and application of iron and solder melting is simultaneous.

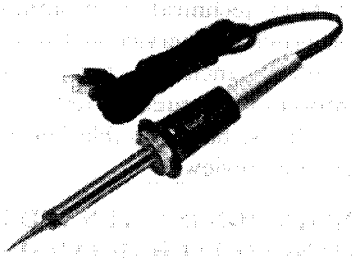
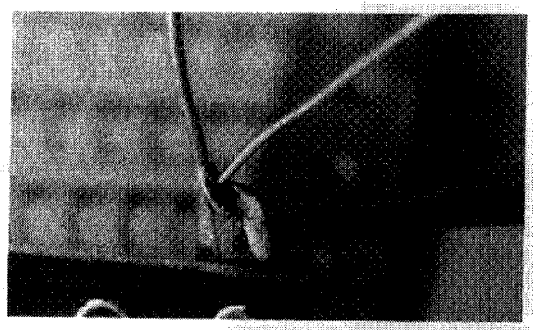


Fig. 7.1 Miniature Soldering Iron

When clean metal is exposed to air a chemical reaction takes place known as oxidation. When heat is applied to metal, oxidation is speeded up and creates a non-metallic film that prevents solder from touching the base metal. By applying a small amount of solder to a hot iron tip, a desirable process known as tinning occurs. The main reason for tinning an iron is to help prevent it from oxidation as well as to aid in heat transfer. Tinning should be performed prior to each use as well as after long idling times.

To help prevent oxidation or remove existing oxidation while soldering, a natural rosin flux core solder should be used. Not only does flux aid in cleaning, but acts as a catalyst in that it helps speed up the joint formation without actually entering itself, into the bond. Never use an acid flux except to clean a highly oxidized tip that will not tin correctly. Crown recommends 63% tin/37% lead composition with a rosin flux core of 2.5% (melting temperature is approx. 361°F.).

Fig. 7.2 shows the correct and incorrect method of applying rosin flux core solder to a joint. Never apply solder to the iron tip directly and allow solder to run onto the joint (flux is burned away and does not clean the joints). Always apply heat to the connection and allow the joint to melt the solder, not the iron. This insures proper wetting and flow of the solder.



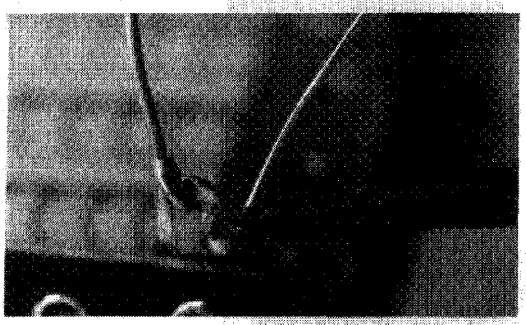


Fig. 7.2 Correct and Incorrect Solder Application

One of the main advantages of using solder to make connections is that it is one of the few joining methods responsive to visual examination. This permits 100% inspection, while other methods require sampling and lengthy electrical tests. With proper inspection of materials used, soldering is the most reliable, time-proved, and versatile form of electrical joining offering the benefits of economy, dependability and speed.

A good solder joint will have the following recognizable features:

a) Proper wetting - mixing of molecules to form a singular, shiny bond of metal
b) Proper flow - feathering out of solder
c) Proper contour - outline of wire under solder
d) Proper fillet - solder filling in holes and crevices.

Because visual inspection is an important part of recognizing a good solder joint, the following examples have been provided to help with familiarization.

Problem: Unsoldered wire.

Characteristics: Properly assembled junction of wire, but without any solder.

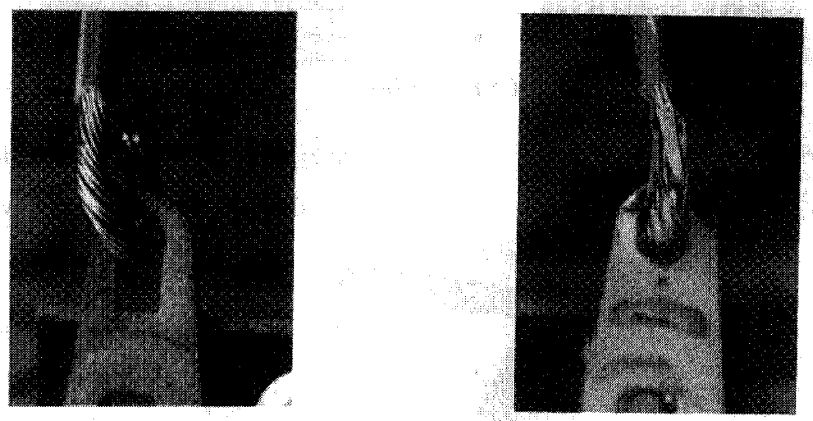


Fig. 7.3 Unsoldered Wire

Cause: Solder not applied.

Remedy: Correct amount of solder applied properly.

Problem: External strands.

Characteristics: One or more strands of wire outside terminal. This defect most common when cup-type terminals are utilized.

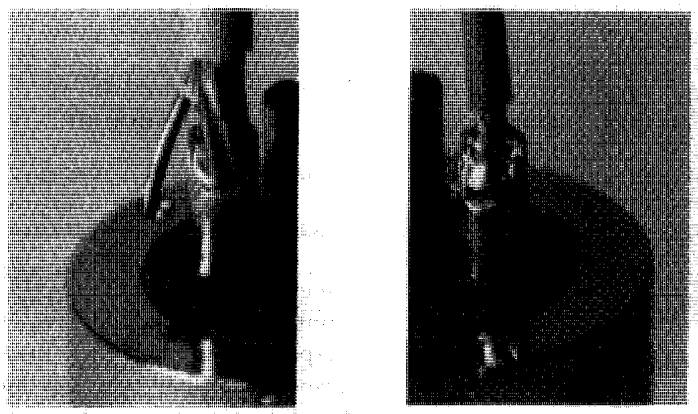


Fig. 7.4 External Strands

Cause: Poor assembly operation, too large diameter wire used.

Remedy: Correct diameter wire tinned prior to insertion.

Problem: Cut strands.

Characteristics: Several strands of wire cut or broken and usually not soldered to terminal.

Fig. 7.5 Cut Strands

Cause: Improper wire stripping; wire flexed or bent excessively during or after assembly.

Remedy: Use wire strippers similar to the one shown in Fig. 7.6. Care must be taken to avoid nicking or cutting.

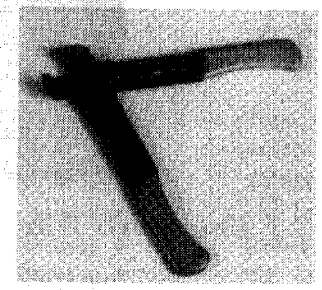


Fig. 7.6 Wire Strippers

Problem: Disturbed joint.

Characteristics: Rough appearance with questionable adhesion.

Fig. 7.7 Disturbed Joint

Cause: Movement of wire/joint during cool-off stage.

Remedy: Use of holding vice or similar tool to help prevent movement.

Problem: Cold solder joint.

Characteristics: Joint with dull, frosty appearance; often has poor adhesion as well as imperfect shaping.

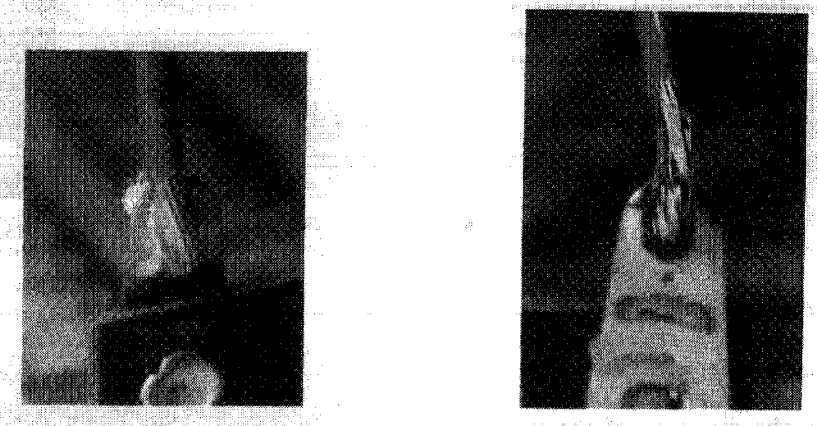


Fig. 7.8 Cold Solder Joint

Cause: Too much heat applied (flux is boiled off before oxide removal action takes place).

Remedy: Correct matching of iron/tip to specific job. Correct solder flux combination is also important.

Problem: Rosin joint.

Characteristics: Joint is separated by a thin coat of flux producing high resistance to current.

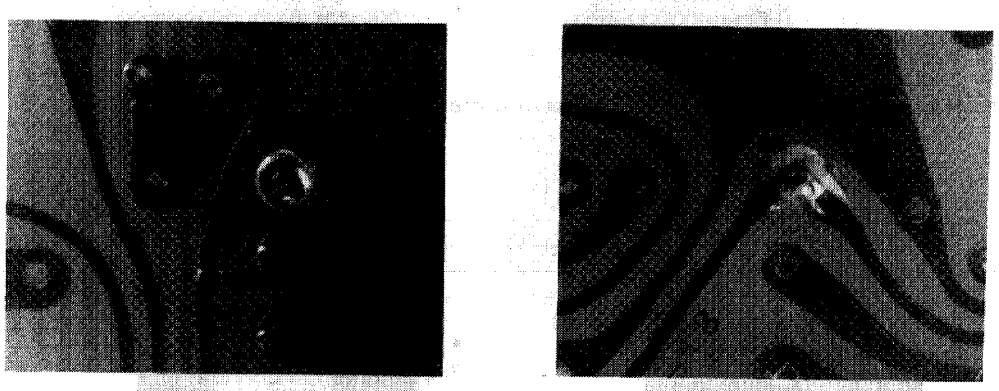


Fig. 7.9 Rosin Joint

Cause: Solder applied previous to terminal reaching minimum temperature (solder melting point).

Remedy: Apply correct amount of heat; remove only after good wetting and fillet is achieved.

When soldering individual component parts to printed circuit boards, several procedures may be followed. The following procedure complies to U.S. Government standards and may be altered to suit a specific situtation.

1. Components leads should be bent to exact spacing of mounting holes in PC board (Fig. 7.10). This allows leads to enter PC board at right angles and relieves stress.

Fig. 7.10 Component Lead Spacing

2. Leads should be bent down tight to pad.

3. Leads should be bent in the direction of the run connected to the pad and clipped at a length approximately ⅛" (Fig. 7.11).

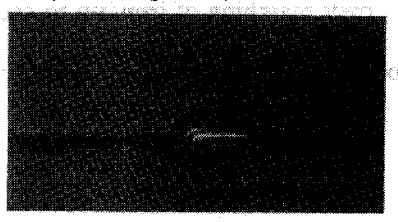


Fig. 7.11 Component Lead Bending

4. Components should be held tight to the PC board while clinching leads on other side (Fig. 7.12) and soldered accordingly. Fig. 7.13 shows acceptable solder joints.

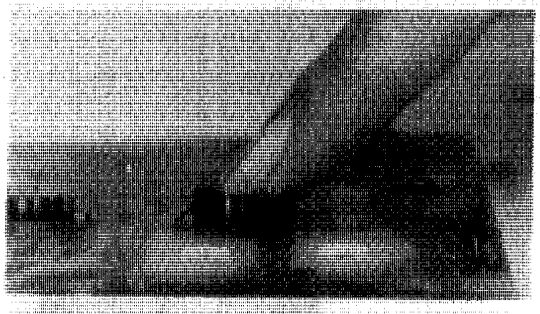


Fig. 7.12 Correct Pressure Applied

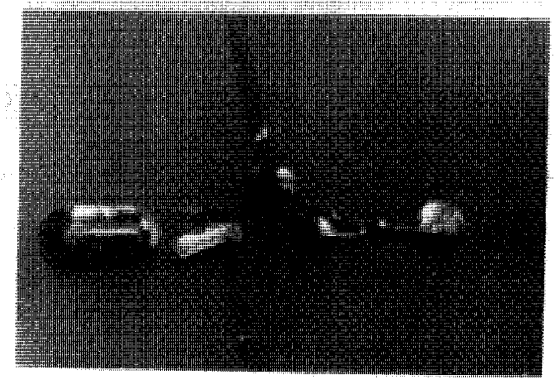


Fig. 7.13 Acceptable Solder Joints

When soldering to lugs (as on potentiometers), the mechanical wire wrap should be a J hook with correct insulation clearance as shown in Fig. 7.14.

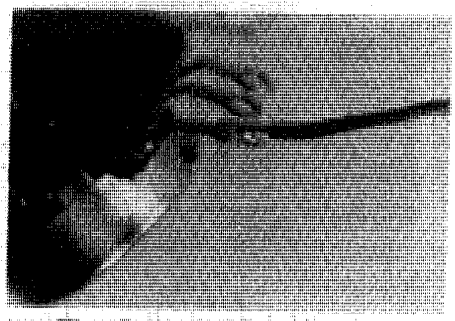


Fig. 7.14 Soldering to a Lug

Turret terminals also utilize the "J" hook (Fig. 7.15). Concentrate on good heat transfer to the terminal first, then the wire. If two wires are to be soldered, be sure of good solder flow to all three.

Fig. 7.15 Turret Terminal

Desoldering

In order to replace a component part, it is often necessary to remove the old part by means of desoldering. Several methods are available, the most common being the braided bare copper method. This wire braid is placed on the lead(s) of the component to be removed with the iron placed on top of the braided wire. This allows the solder to heat up while simultaneously adhering to the braid. When the braided wire is removed, the joint should be clean. (See Fig. 7.16)

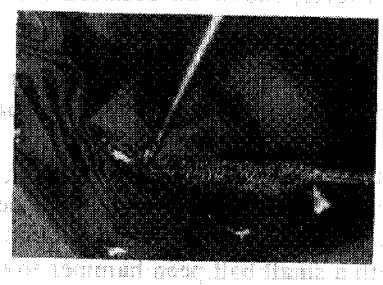


Fig. 7.16 Wire Braid Desoldering

Next, use points of small diagonals to lift ends of component lead wires and remove the part. This procedure is applicable to both PC board desoldering as well as terminal and lug desoldering.

Note: Be sure that lifting of the component lead does not also lift the copper foil pad from the board. Occasionally a small amount of iron will be helpful.

Soldering is one of the most reliable methods of joining electronic component parts and assemblies. When properly used, it can be one of the most helpful tools in service repair work.

7.4 Basic Troubleshooting

As is well known, time is an important factor in providing efficient service repair. Therefore, several time-saving troubleshooting steps are listed below. These hints may or may not already be implemented in your service work. If not, you may wish to experiment with them in order to help improve your efficiency. After all, time is money!

A. Establishing Problems

User complaints about defective operation may not always be clear or simple. Furthermore, the trouble the user has experienced may be due to the system and not the unit itself. If possible, talk to the user about this problem. This will usually be simpler than trying to understand written complaints. A first hand account of the problem can help in:

1) Getting the problem to re-occur on the service bench.
2) Getting an understanding of the probable cause. Some troubles will be obvious upon visual inspection. When the trouble (or its symptoms) is not so obvious ask:
   a) Exactly what was the problem; how was it noticable?
   b) How was the unit being used?
   c) Has the system as a whole been carefully examined for possible external problems?
   d) How long had the unit been operating when the problem occurred? Was it heat related?

If the user is unavailable or unable to explain the trouble the next step is a thorough visual inspection.

B. Visual Inspection

A good visual inspection may often save hours of tedious troubleshooting. Make a habit of proceeding in an orderly manner to insure that no vital part of the

following procedure is omitted. The visual inspection can be performed in 10 to 15 minutes. It is recommended both as a preventive maintenance procedure and also for its value in determining cause of malfunction.

1) Check that all external screws are tight and that none are missing.
2) Check all fuses/circuit breakers.
3) Check for smooth and proper operation of switches, etc.
4) Inspect line cord for possible damage to cap, jacket and conductors.
5) Remove protective covers as outlined in disassembly instruction (Section 7.5).
6) Check that all attaching parts for internal circuits are tight and that none are missing.
7) Inspect all wiring for charred insulation, or discoloration as evidence of previous overheating.
8) Check that all electrical connections are secure. This includes wire terminals, screw and stud type terminals, and all soldered connections.
9) Check for obvious destruction of internal structural parts. Distortion in any of these parts could mean that the unit has been dropped or subjected to severe shock.

7.5 Disassembly for Inspection, Service, Testing, Adjustment and Repair

The extent of disassembly required will depend upon the extent of inspection, service, testing, adjustment and repair to be performed. Illustrations referred to in parenthesis are located in the parts list (Section 6) of this manual.

A. Cover Removal

A fairly complete visual inspection can be performed by removing the top (11) and bottom (10) covers. To remove these parts, proceed as follows:

1. Remove the nine phillips head (8) mounting screws and star washers (9) that secure top cover (10). Remove cover.
2. Remove the nine phillips head (8,9) mounting screws and star washers that secure bottom cover (10). Remove cover.

B. Main Board Removal

The SL-1 has been specially designed for ease of service. Every component part is in fingers reach for fast and effective replacement. This means it should never be necessary to replace the Main Board unless damage was done beyond repair (severed, burnt, etc.) to the board itself. If this occurs, proceed as follows:

1. Refer to the component side board layout, Fig. 6.3.
2. Disconnect all cables and wire which connect to/from the board via interlock plugs or push-on pins. Note their location on the board layout for future reconnection.
3. Remove front panel knobs (1) and associated hardware.
4. Remove the 4 (two each side) phillips handle mount screws (13). This will free the handles, front panel and will also expose the aluminum frame.
5. Remove the aluminum front panel by unscrewing the four push-button mount screws (23) located on the inner side of the panel. It may be helpful to use an "L" angle screwdriver as shown in Fig. 7.17 Also remove on/off switch screws from bottom of Main Board.

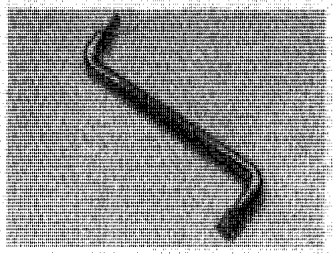


Fig. 7.17 "L" Angle Screwdriver

6. Remove the two phillips head Main Board mount screws (25) and related hardware located next to the Power supply housing.
7. The only remaining source of support for the Main Board is the rear panel input jack brackets. They can be disconnected from the rear frame by removing the ten hex mounting screws (two per bracket).

C. Component Parts Replacements

As previously mentioned, the SL-1 is designed for easy access to all component parts. This means any part located on the Main Board may be replaced through standard circuit board repair procedures.

Most power supply components (excluding the voltage terminal strip) may be replaced with simple screw, and then part removal. Should any questions arise as to the above mentioned procedures, contact the Crown Technical Service Department at the location as indicated on the title page at the beginning of this manual.

D. Front Panel LED Replacement

Because of the extremely high reliability factor of the light emitting diodes used in the SL-1, replacement is unlikely. However, should an occasion arise for such a procedure, proceed as follows:

1. Remove the wires connected to the rear of the LED by gently pulling the connector away from the front panel.
2. With the handle-end of a ¼" nut driver, apply pressure to the LED from the front panel side. It may be necessary to gently strike the socket-end of the nut driver with a small ball peen hammer to ensure sufficient removal pressure on the LED (See Fig. 7.18).

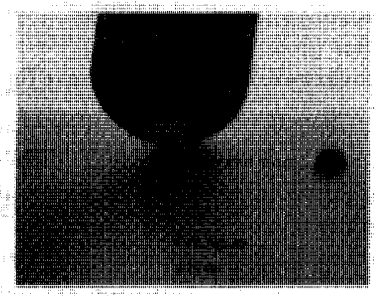


Fig. 7.18 LED Removal

3. To replace, apply 1 drop of Eastmon 910 cyanacrolete to the edge of the substitute LED (Fig.7.19) during insertion. Apply small amount of pressure from the back side until cyanacrolete has set (about 10 seconds). **Note:** Be careful not to use excessive amounts of cyanacrolete.

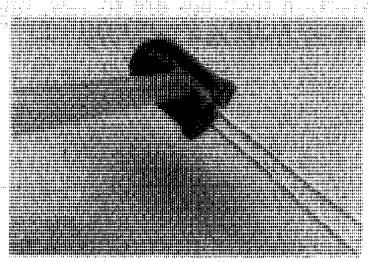


Fig. 7.19 Cyanacrolete Application

4. Clip lead-in wires from LED to approximately ¼". Re-connect supply wires making sure polarity is correct. If in doubt, observe the small flat edge located to one side of the lead-in wires on the LED (Fig.7.20). That is the cathode or the **black** wire side.

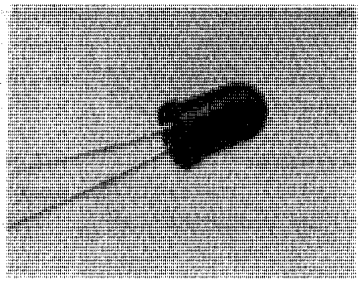


Fig. 7.20 Cathode Lead of LED

7.6 Reassembly

Reassembly is essentially the reverse of disassembly. If in doubt about types and sizes of attaching parts, refer to the appropriate illustration in Section 6.

7.7 Electrical Checkout and Adjustment Procedures

The following chart outlines an orderly checkout and adjustment procedure for the SL-1. The test equipment required to perform th various procedures is listed in Section 7.2.

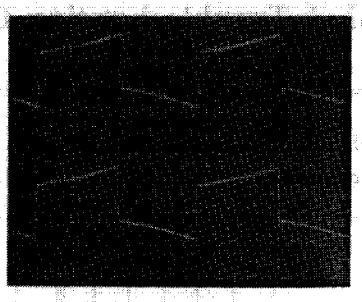


Fig. 7.21 Lo Filter Waveform

SL-1 Checkout and Adjustment

	Type of Test/Adjustment	Input Signals Characteristics	Comments
1.	Power Supply	None	a. Adjust RN1 for +18V at supply output. b. Adjust RN2 for -18V at supply output.
2.	Tracking-Volume Control	1KHz sine wave into auxiliary one	a. Set volume at 0 (cw), other controls at normal. b. Increase output from signal generator until output from "main output" is +10dB on audio voltmeter (2.5 volts). This is the reference level. c. Check tracking and level at each 2dB step; +.4dB tracking error is acceptable between channels. +0.1 tracking error is acceptable between channels. +0.1dB is the maximum level error between channels.

	Type of Test/Adjustment	Input Signals Characteristics	Comments
	Balance Control	1KHz sine wave into auxiliary one	a. Set Volume at 0 (fully cw). b. Rotate Balance control left and right of center. Maximum change should be 1dB between channels.
3.	Lo Filter	100Hz .5V sq. wave into auxiliary one	a. Set Volume control to 20; observe scope. b. Activate low filter (depress pushbutton). c. Output signal should look like the waveform in Fig. 7.21. d. Leave Lo filter out.
4.	Slew Response	10KHz .5V sq. wave	a. Set Volume control to 0 (fully cw). b. Decrease and then increase control while simultaneously observing scope. c. Watch for aberrations of sq. wave at full output.
5.	High Level Noise	None	a. Set Volume control fully ccw. b. Record reading in dB. c. Noise should be below -98dB.
6.	Listening	None	a. Activate and listen carefully to the Volume control, Balance Control and all pushbutton switches at the main output through an amplified system. b. Be sure no pops or thumps are present during this time.
7.	IM Distortion	60Hz-7KHz signal summed in 4:1 ratio	a. Because the distortion readings are so low, only the residual of the analyzer itself can be tested (see specifications).

7.8 SL-1 Troubleshooting Chart

Symptom	Possible Cause	Solution
1. Unit does not turn on (as indicated by pilot light)	1.a. Blown Fuse, F1 b. Switch lever mis-adjusted c. Faulty on/off switch d. Faulty transformer	1.a. Replace fuse, seek cause b. Bend lever into correct position c. Replace switch d. Replace transformer
2. Unit has power, but passes no audio signal in both channels	2.a. Mute Relay, defective b. Q1, FET 1 open, shorted or leaky c. D1, D2 defective	2.a. Replace Relay b. Replace Q1, FET1 c. Replace D1, D2
3. Unit turns on, however no muting delay of audio (audio on instantly)	3.a. Mute Relay defective b. C1 open or shorted c. Note suggestions in #2	3.a. Replace Mute Relay b. Replace C1 c. See solutions in #2
4. Power supply exhibiting improper output voltage	4.a. A regulator transistor slipped out of tolerance or faulty b. C2, C3 defective c. Regulator controls are misadjusted	4.a. Replace regulators IC-1, IC-2 b. Replace filter caps C2, C3 c. Adjust RN1, RN2 for correct output
5. Mute Relay buzzes	5.a. Power connector from transformer to Main Board reversed	5.a. Reverse connector

Symptom	Possible Cause	Solution
6. Intermittent loss of one or more channels during Volume control rotation	6.a. Cracked or faulty ceramic Volume switch plates	6.a. Replace plate/entire control
7. Intermittent loss of one or more channels during Balance Control rotation	7.a. Cracked or faulty ceramic Balance switch plates	7.a. Replace plate/entire control
8. Definite loss of one channel	8.a. Defective gain integrated circuit	8.a. Replace IC100/200
9. High IM distortion	9.a. Power Supply problem b. Faulty Balance Control c. Faulty Balance IC chip	9.a. Seek cause; replace b. Replace Balance control c. Replace IC102/IC202
10. High Signal/Noise	10.a. Ground buss wires beneath front pushbutton bracket or Balance control extending too far upward	10.a. Press ground buss wire flat against Main board
11. Pop or thump when rotating Volume Control	11.a. C104/C204 shorted or leaky	11.a. Replace C104, C204
12. Low Filter inoperative	12.a. Low filter circuitry has defective component i.e.... IC100/IC200, etc.	12.a. Seek faulty device; replace 12.a. Seek faulty device; replace
13. Overload indicator erratic in operation	13.a. Defective IC103/IC203 b. Diode 110/210 open	13.a. Replace IC103/IC203 b. Replace D110/D210

7.9 Voltage Conversion

Often Crown products are purchased in one country and later moved to another, requiring an AC mains conversion. For this reason, the following explanation/chart as well as a world-wide voltage map is provided in Fig. 7.23.

The SL-1 power supply may be connected for any of five voltages. Converting from one to another can be accomplished with a soldering iron and a pair of wire strippers.

1. Remove the top cover.
2. With the unit right side up, and the front panel toward the rear, locate the terminal strip in the rear left-hand corner.
3. Make the appropriate change in jumpers for the desired operating voltages (Fig. 7.22).
4. Replace the 1/8 amp line fuse with a 1/16 amp fuse, for all connections 200V and above.
5. Change the line cord tag to read the correct voltage.

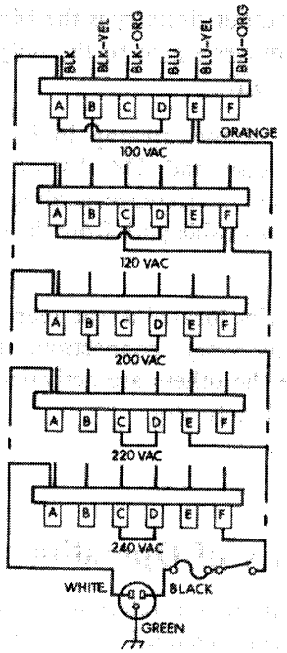


Fig. 7.22 Voltage Conversion Jumpers

7.10 Block Diagram Explanation

The following explanation pertains to the block diagram in Fig. 7.24.

The SL-1 circuitry is designed to add or "color" as little as possible to the input signal. This configuration is more commonly known as the "straight wire" approach. As shown in the diagram, any alteration to the main signal is done manually via front panel pushbuttons. This includes mainly the volume and balance functions as well as the Low filter.

After the signal enters the back panel input pin jacks, input selection is made by front panel pushbuttons. Beyond this point, tape monitor function is available if so desired. Note that any input signal will be fed directly to the tape outputs without any interruption.

The Low cut filter has an 18dB per octave slope, down 3dB at 33Hz. Its op amp design reduces any signal distortion whether it is active in the circuit or not. At this stage, no additional gain is added (unity gain).

Volume may be increased by rotating the step level control located in the following stage. An additional gain of up to 20dB is possible, depending upon the position of the control. Before and after this stage, connections to the Overload circuitry are made. As before, this circuitry does relatively little to the signal itself.

The final stage before the signal reaches the output circuitry is the unity gain step Balance stage. Here the signal may be fed more predominantly to one side or the other if so desired.

Included in the output circuitry is the Mute relay which automatically removes signal to the output jacks upon turn-on and turn-off.

By isolating the phono preamp in its own package, extremely low noise and IM distortion figures are possible. Also, RF interference is almost non existent because of the short cable path from the turntable to the phono preamp.

Five AC receptacles located at the rear of the unit, are available for accessory connection. One is active constantly while the others are activated only through front panel switch activator.

7.11 Theory of Operation

The following discussion refers to schematics M1-271a and M1-271b. Only channel 1 is used as reference for simplicity.

The SL-1 remote preamplifier phono module provides the 30 to 50dB of gain necessary to bring phono cartridge output levels up to typical preamp input line levels.

The SL-1 itself does not have a large amount of gain, and will in fact often function as a signal attenuator. Its primary function is selection from any various input and output signal paths. The signal from any input to the Tape Output does not pass through a single amplifier stage. The Main Output signal flows through only three operational amplifiers. In reducing the number of amplifier stages, potential sources of noise and distortion are eliminated.

After entering the SL-1 input jacks (either from the SL-1PM or another source) it travels through the tape monitor buss to the impedance converter or buffer stage, IC100. As well as impedance conversion, this stage acts in conjunction with C100, C101, C103 and R201 to form a Sallen-Key 3 pole bi pass filter (or Low Filter).

Coupling Capacitors are used around the op amps and Volume control to help eliminate any DC noise and insure smooth changes in level. Also, there are two identical resistors with each op amp; one in the feedback loop between the op amp output and its inverting input (R115, R106, R107), and the other between the non-inverting input and ground (R111, R211, R114). They help minimize any DC offset in the amplifiers output. Bypass capacitors (C117, C120) short the AC current from the op amp's non-inverting input to ground, thus preventing the DC offset-eliminating resistors (as mentioned above) from contributing excess noise to the amplifier.

Next through coupling capacitor C102, the signal travels to the level control stage. The volume control itself (R102) is a dual-ganged precision switch, one side per channel. Each side is wired into the feedback loop of the "main gain" op amp (IC101/IC201). As the volume setting is decreased, the gain of the op amp is lowered, reducing the signal level at the amplifier output. This configuration assures that the noise level drops as the volume is lowered, maintaining the full signal-to-noise ratio at all times, in contrast to other circuit configurations with attenuators that come before fixed gain op amps. The SL-1 Volume control circuitry also insures that full headroom is maintained at all settings, unlike circuits where attenuators are placed after fixed gain op amps.

The Balance control circuitry (IC102 and related components) is similar to the Volume control circuitry, with the exception that the left and right channels are at maximum level when the control (R103) is centered. At this point one channel or the other is attenuated as the control is moved off center. The same advantages are obtained; full headroom at all settings, and a noise floor that decreases with decreasing gain.

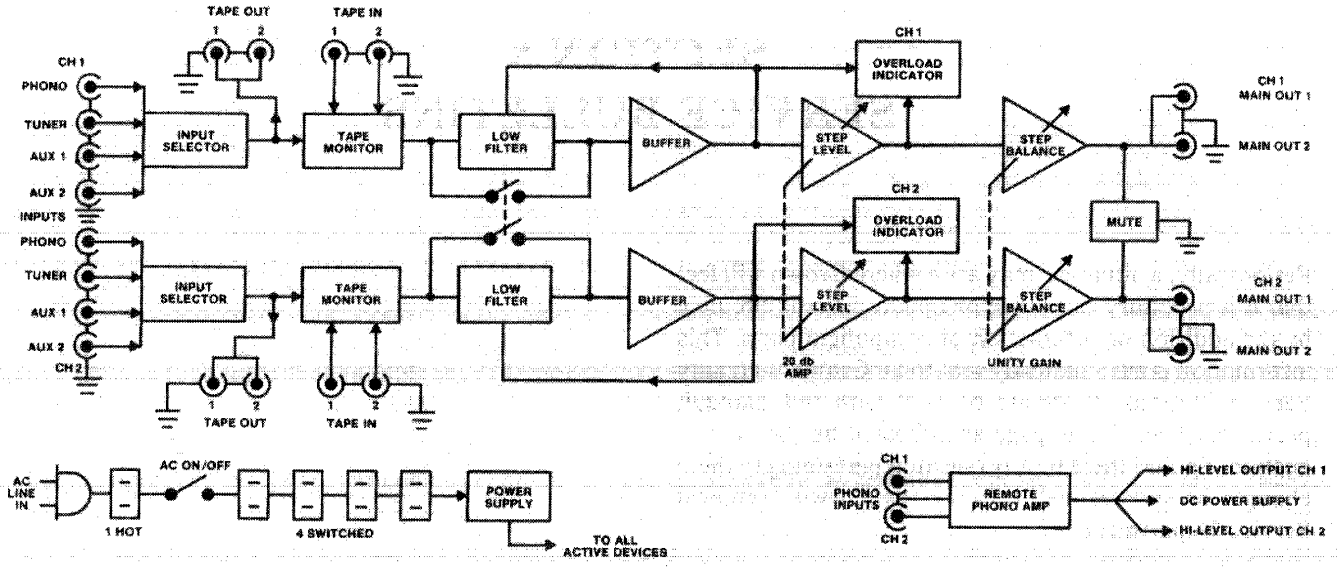


Fig. 7.24 SL-1 Block Diagram

A separate peak level sensing circuit is provided for each channel. It continuously monitors the positive and negative peak levels at each of two circuit points; after the Low Filter (OVLD 1 and 3) and after the Volume control (OVLD 2 and 4). As long as the level is above a set threshold (chosen to be a point at which overload occurs), the Overload light (LED100) is energized. An RC circuit (C124, R123, Q100, R124) insures that the LED will remain on long enough to be visible even if the overload is momentary. The input of the peak level sensor is considerably higher in impedance than the circuit it measures, so it has no discernable effect on the audio signal.

A normally closed relay is connected between the Main output signal line and audio ground so that when the relay coil is not energized, the outputs are inactive. As soon as the power is removed, the relay closes and the outputs are muted to reduce any possiblity that turn-off transients could be sent through the amplifier and speakers. On initial turn-on of the unit, the relay is not activated immediately. Instead, a delay circuit (consisting of R1, R2, R3, D1, D2, C1, Q1 and FET1) blocks power to the relay coil for approximately seven seconds. This provides a safe period during which the SL-1 power supply and audio circuitry can stabilize. The same relay thereby prevents turn-on transients from also reaching the speakers.