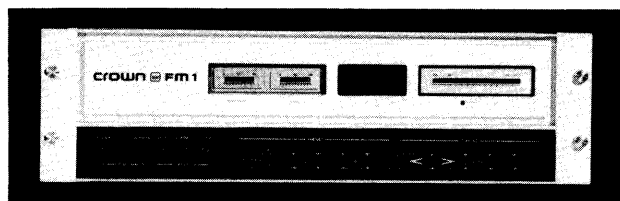


K 0869-6

CROWN

SERVICE MANUAL



FM1

STEREO TUNER

CROWN INTERNATIONAL, INC. 1718 W. MISHAWAKA RD. ELKHART, INDIANA 46517



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REVIEW SECTION

I. Introduction

This manual contains complete service information on the FM1. It is designed to be used in conjunction with the FM1 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 46517.

III. Specifications

Tuning Range: 88.1 to 107.9 MHz (U.S. Assigned Frequencies Only)

Antenna Inputs: 300 ohms balanced; 75 ohm unbalanced

Intermediate Frequency (IF): 10.7 MHz

Sensitivity: 10.8dBf IHF Usable

Quieting: .6 microvolt (75 ohm*) for 30dB mono quieting. 36dBf for 50dB stereo quieting. 10.8dBf for 50dB mono quieting

Signal to Noise Ratio: Mono 70dB below 100% modulation at 65dBf reference level. Stereo 65dB below standard stereo modulation at 65dBf reference level

Hum and Noise: 65dB below 100% modulation at 65dBf reference level. Minimum volume hum and noise is 90dB below reference

Total Harmonic Distortion: At 1000Hz 65dBf 100% modulation, mono .1% , stereo .09%

Capture Ratio: 2dB at 65dBf

Alternate Channel Selectivity: 75dB at 25dBf

Frequency Response: ±.5dB 30Hz to 15KHz

Stereo Separation: 45dB @1KHz
35dB @10KHz

Image Response Ratio: > 114dB

Spurious Response Ratio: > 114dB

IF Response Ratio: > 114dB both balanced and unbalanced

R.F. Intermodulation: 65dB

AM Suppression Ratio: > 73dB at 25dBf

Subcarrier Product Ratio: 65dB

SCA Rejection Ratio: 72dB

Connectors: 300 ohm Balanced Antenna Input - push button quick connect

75 ohm Unbalanced Input - F type

Composite - pin jack

Multipath - pin jack

Left Channel variable and fixed output - pin jack

Right Channel variable and fixed output - pin jack

Display: 7 segment red LED Frequency readout

Red LED Stereo indicator

20 LED Analog dial green dot display

10 LED Signal Strength green bar display

10 LED Multipath amber bar display

Power Requirements: 120V 50/60 Hz 10 watts; 100, 200, 220, 240VAC available

Size: 5¼"H (13.3cm), 15"D (38.1cm), 19"W (48.3cm)

Weight: 15.5 pounds (7kg)

Shipping Weight: 20 lbs (9kg)

*Voltage times approximately 2 for 300 ohm values

IV. Panel Configuration

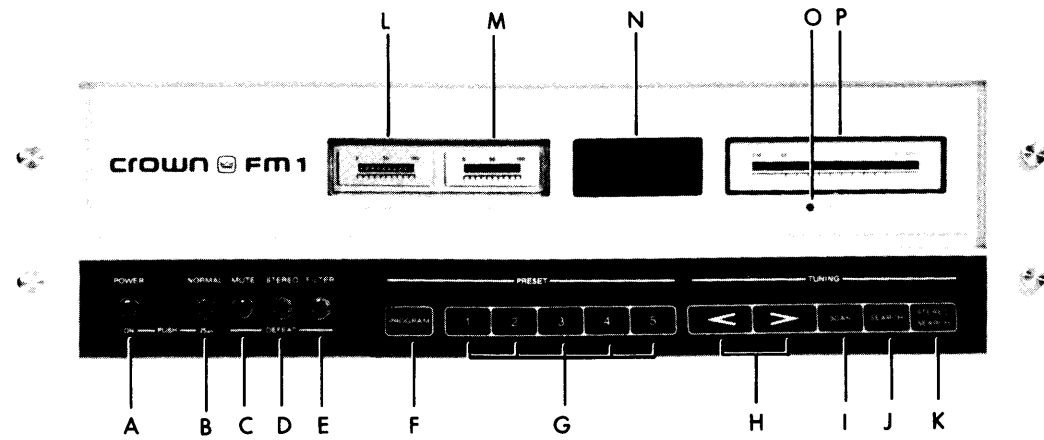


Fig. RVW.1 FM1 Front Panel

- | | |
|---------------------------------|------------------------------|
| A. POWER SWITCH | I. SCAN CONTROL |
| B. NORMAL/25 MICROSECOND SWITCH | J. SEARCH CONTROL |
| C. MUTE SWITCH | K. STEREO SEARCH CONTROL |
| D. STEREO SWITCH | L. MULTIPATH INDICATOR |
| E. FILTER SWITCH | M. SIGNAL STRENGTH INDICATOR |
| F. PROGRAM CONTROL | N. NUMERICAL READ-OUT |
| G. PRESET CONTROLS | O. STEREO INDICATOR |
| H. <> | P. LOG SCALE |



V. Performance Graphs

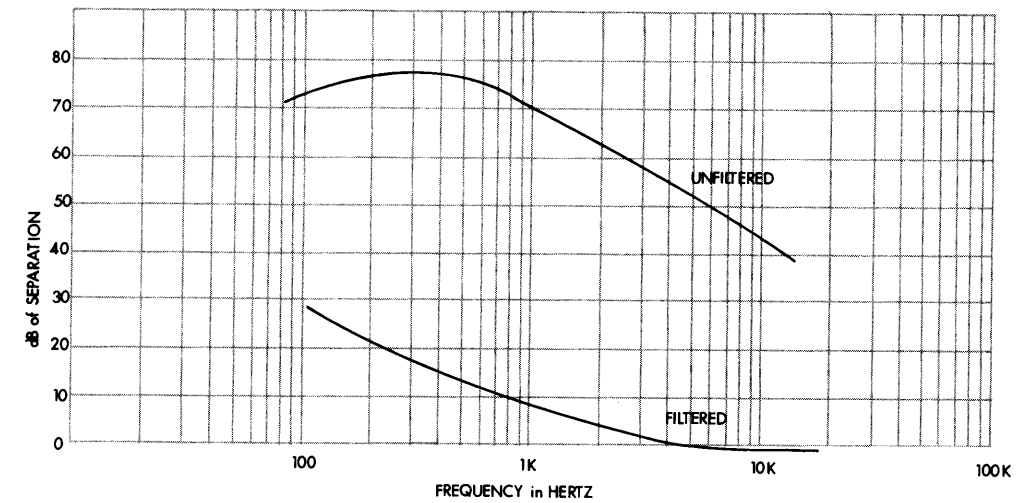


Fig. RVW.3 Stereo Separation Vs. Frequency

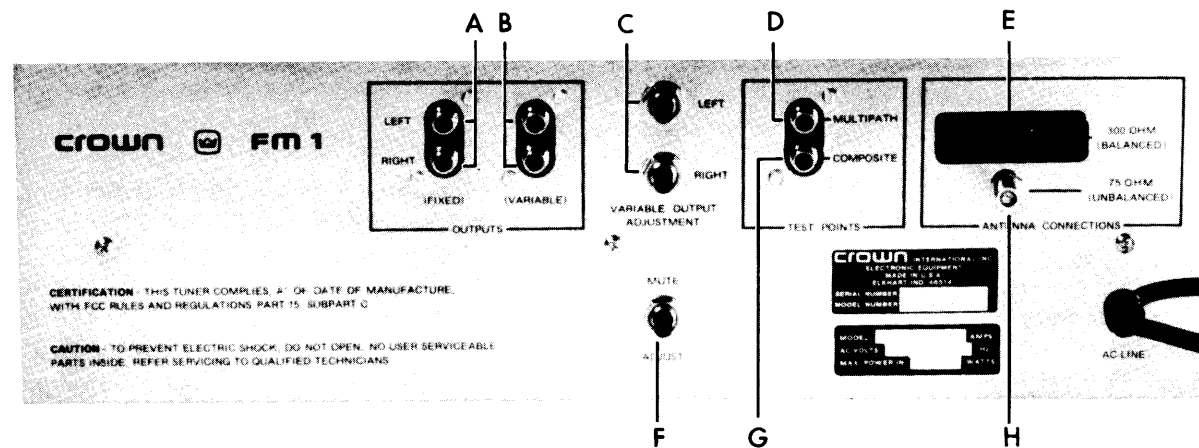


Fig. RVW.2 FM1 Back Panel

- | |
|--|
| A. FIXED LEVEL OUTPUT JACKS |
| B. VARIABLE LEVEL OUTPUT JACKS |
| C. VARIABLE OUTPUT ADJUSTMENT CONTROLS |
| D. MULTIPATH OUTPUT JACK (TEST POINT) |
| E. 300 OHM ANTENNA CONNECTOR |
| F. MUTE LEVEL ADJUST |
| G. COMPOSITE OUTPUT JACK (TEST POINT) |
| H. 75 OHM ANTENNA CONNECTOR |

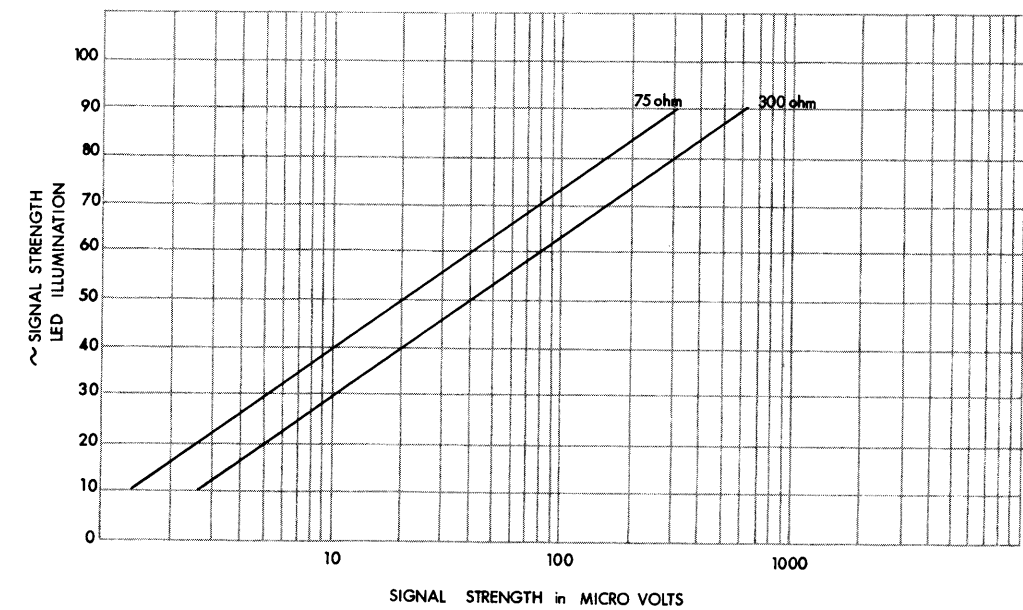


Fig. RVW.4 Signal Strength Display

SECTION 6

ILLUSTRATED PARTS LIST

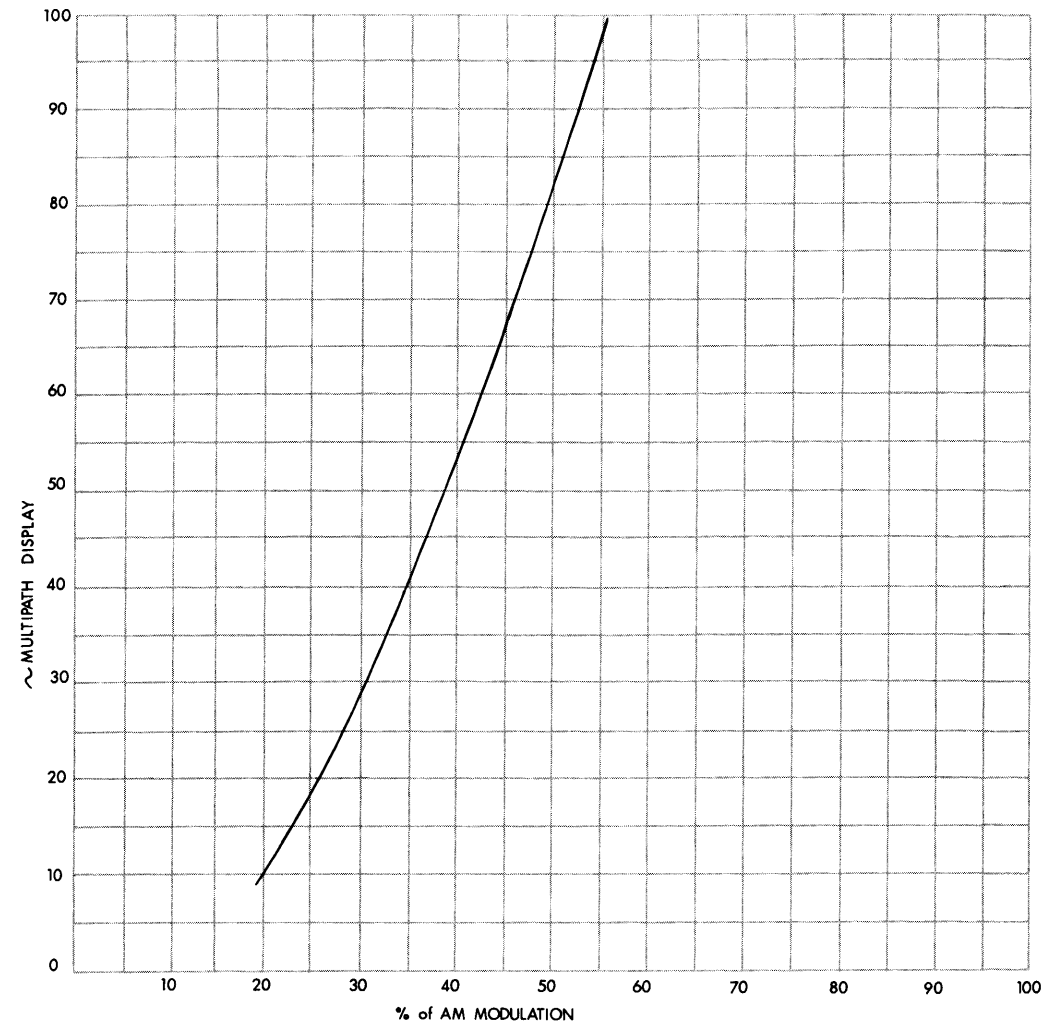


Fig. RVW.5 Multipath Display

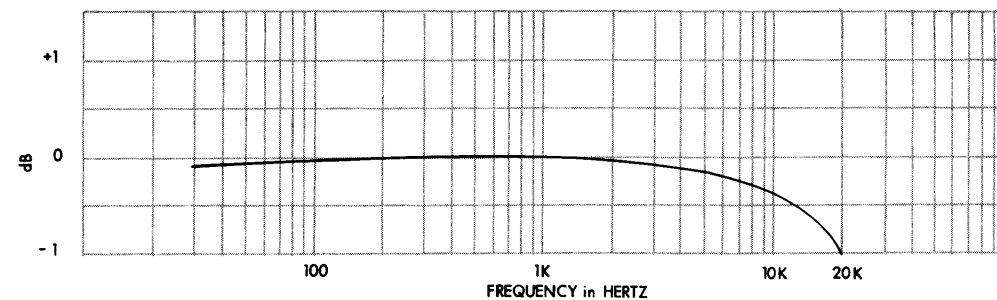


Fig. RVW.6 FM1 Frequency Response

6.1 General Information

Section 6 contains illustrations and parts lists for the FM1. 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 schematic designation next to the illustration. Both the index number and the schematic designation are included in the parts list in separate columns. The schematic 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. Schematic 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 FM1 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 unit 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

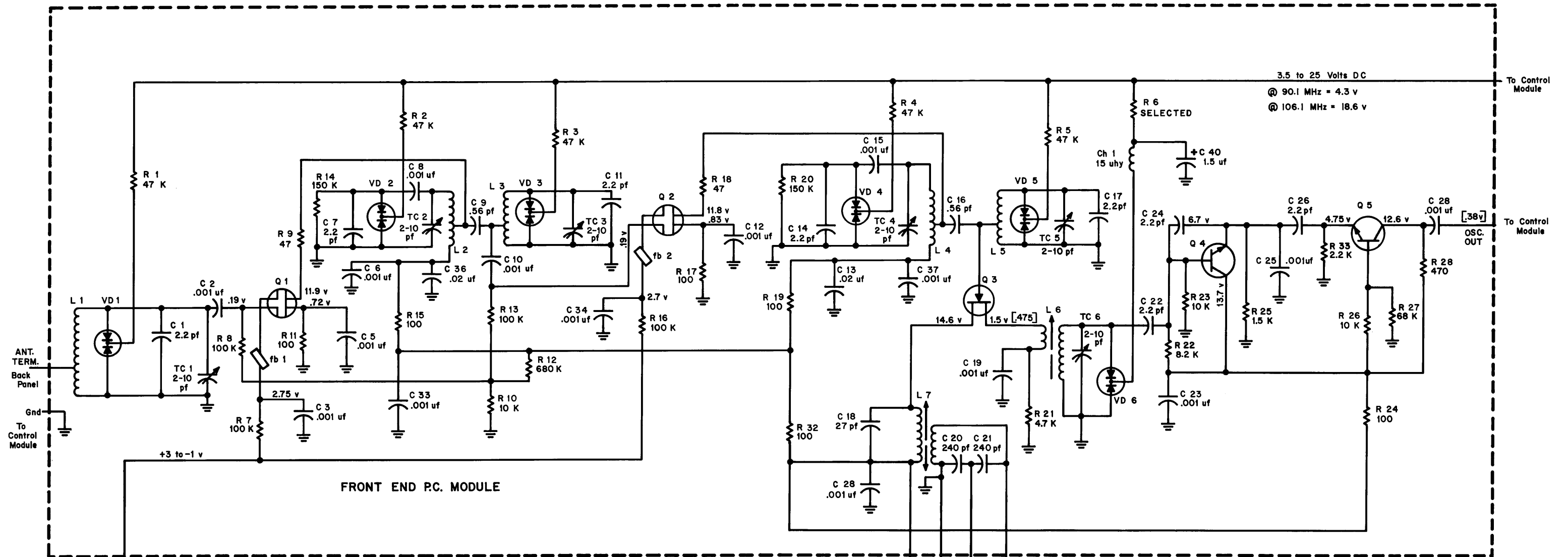
1. Shipment will be made by UPS or best method unless you specify a preferred method.
2. Shipments are made F.O.B. Elkhart, Indiana only.
3. Established Crown accounts will be freight prepaid and billed unless shipped by truck or air freight.
4. All others will be shipped freight collect.

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.



FRONT END P.C. MODULE

FM1 Schematic Notes

General:

1. Circuit shown start with SN71172
2. All resistors are in ohms unless otherwise designated
3. All capacitors are in microfarads unless otherwise designated
4. Components are numbered as per following list:
 - A. Front End Module 1-99
 - B. I.F. Module 100-199
 - C. Meter Module 200-299
 - D. Multiplex Module 300 -399
 - E. Power Supply 400-499
 - F. Control Module 500-599
 - G. Display Module 600-699
 - H. Loop Filter Module 700-799
5. P refers to plug
J refers to jack

Front End Module: 1) fb denotes ferrite bead
2) VD denotes varactor diode

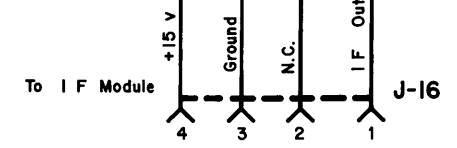
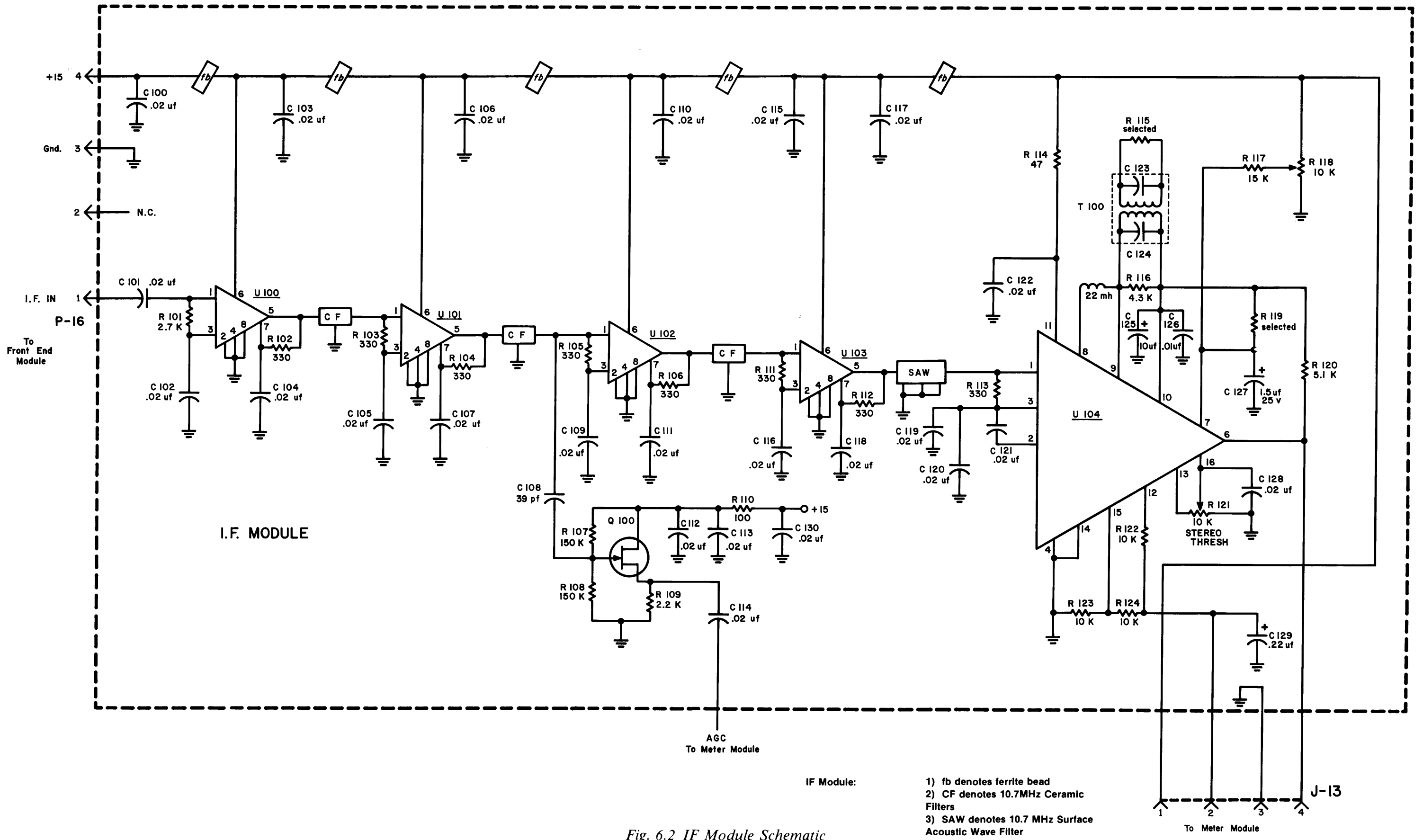


Fig. 6.1 Front End Module Schematic

Parts List: Front End Module Q42228J8

Schematic Designation	Description	Crown Part No.	Qty.
Resistors			
R1, R2, R3, R4, R5	47K ohm .25W 5%	C 2880-0	5
R8, R7, R13, R16	100K ohm .25W 5%	C 2883-4	4
R11, R15, R17 R19, R32, R24	100 ohm .25W 5%	C 2872-7	6
R14, R20	150K ohm .25W 5%	C 4216-5	2
R12	680K ohm .25W 5%	C 5167-9	1
R9, R18	47 ohm .25W 5%	C 1011-3	2
R21	4.7K ohm .25W 5%	C 3939-3	1
R22	8.2K ohm .25W 5%	C 2877-6	1
R23, R26, R10	10K ohm .25W 5%	C 2631-7	3
R25	1.5K ohm .25W 5%	C 2876-8	1
R33	2.2K ohm .25W 5%	C 2628-3	1
R28	470 ohm .25W 5%	C 2626-7	1
R27	6.8K ohm .25W 5%	C 5166-1	1
R6	Selected	--	1
Capacitors			
C1, C5, C14, C17, C26	2.2pF Disc	C 5190-1	5
TC1, TC2, TC3, TC4, TC5, TC6	2-10pF Ceramic Trimmer	C 5162-0	6
C2, C8, C3, C6, C5, C33, C10, C34, C12, C15, C37, C28, C19, C23, C25, C28	.001mF Ceramic Disc	C 2288-6	16
C9, C13	.56pF	C 5161-2	2
C18	.02mF 50V Ceramic Disc	C 5230-5	2
C18	27pF Mica	C 2342-1	1
C20, C21	240pF Disc	C 5196-8	2
C22	8.2pF Disc	C 5191-9	1
C40	1.5mF 25V	C 5183-6	1
Diodes			
VD1, VD2, VD3, VD4, VD5, VD6	Varactor Diode	C 5131-5	6
Transistors			
Q1, Q2	3N204 FET	C 5120-8	2
Q3	2N5485 FET	C 5123-2	1
Q4, Q5	2N5770 NPN	C 5135-6	2

Schematic Designation	Description	Crown Part No.	Qty.
Coils			
L1	CDTG-15(G) Coil	D 5129-8	1
L2, L3	CDTW-15(W) Coil	D 5127-2	2
L4, L5	CDTR-15(R) Coil	D 5130-6	2
L7	DDT150 Front End Coil	D 5126-4	1
L6	CDTY-15(Y) Coil	D 5128-0	1
CH1	15uH Choke	D 5121-5	1
Miscellaneous			
fb1, fb2	Ferrite Bead	C 5159-6	2
J16	MTS 156 9 Pin Connector	C 5147-1	1



I.F. MODULE

AGC
To Meter Module

IF Module:

- 1) fb denotes ferrite bead
- 2) CF denotes 10.7MHz Ceramic Filters
- 3) SAW denotes 10.7 MHz Surface Acoustic Wave Filter

Fig. 6.2 IF Module Schematic

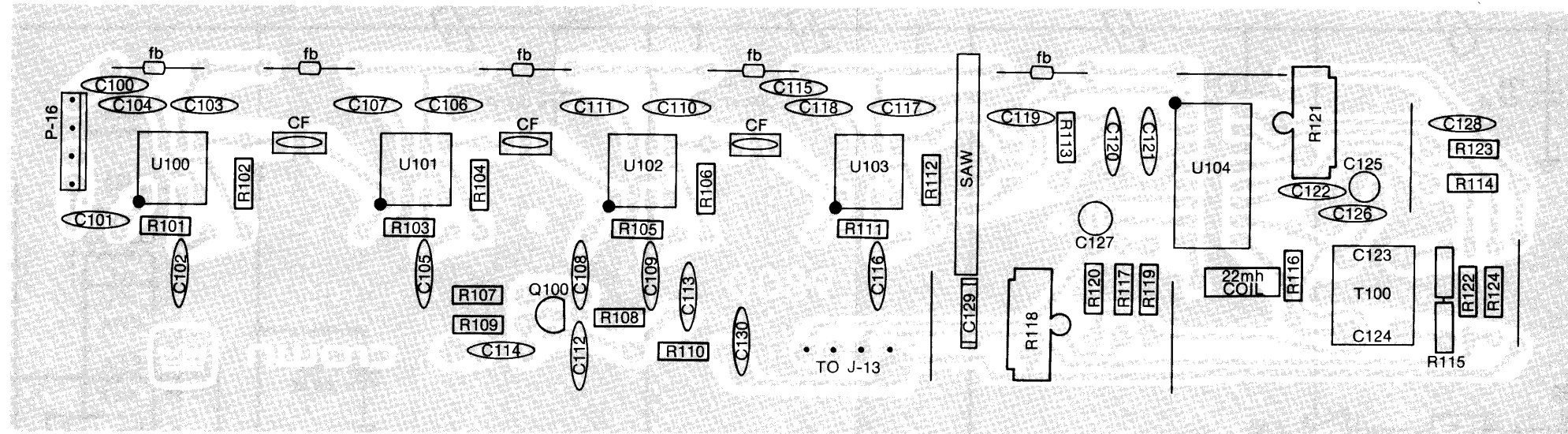


Fig. 6.3 IF Module Component Board Layout

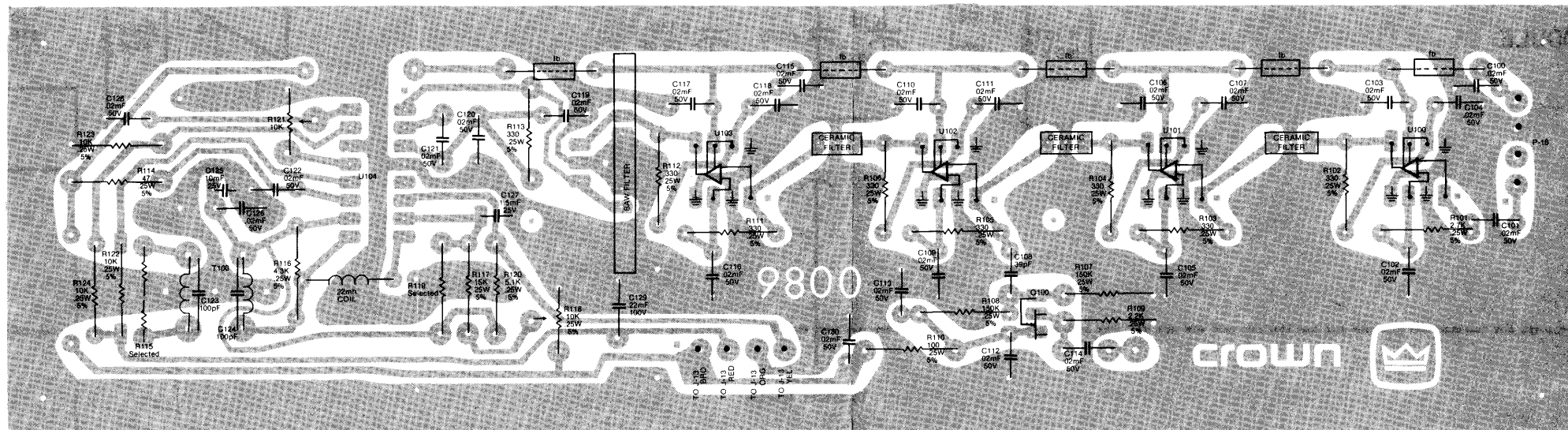


Fig. 6.4 IF Module Foil Board Layout

Parts List: I.F. Module Q42230J4

Schematic Designation	Description	Crown Part No.	Qty.
Resistors			
R118, R122, R123, R124	10K ohm .25W 5%	C 2631-7	4
R101	2.7K ohm .25W 5%	C 5168-7	1
R102, R103, R104, R105, R106, R111, R112, R113	330 ohm .25W 5%	C 5169-5	8
R107, R108	150K ohm .25W 5%	C 4216-5	2
R109	2.2K ohm .25W 5%	C 2628-3	1
R110	100 ohm .25W 5%	C 2872-7	1
R114	47 ohm .25W 5%	C 1011-3	1
R115	Selected	--	1
R117	15K ohm .25W 5%	C 2632-5	1
R119	Selected		1
R120	5.1K ohm .25W 5%	C 5163-8	1
R121, R118	10K ohm Vertical Pot	C 5210-7	2
R116	4.3K ohm .25W 5%	C 4855-0	1
Capacitors			
C100, C101, C102, C103, C104, C105, C106, C107, C109, C110, C111, C112, C113, C114, C115, C116, C117, C118, C119, C120, C121, C122, C126, C128			
C130	.02mF 50V Ceramic Disc	C 5230-5	25
C108	39pF Ceramic Disc	C 5227-1	1
C125	10mF 25V Tantalum	C 5208-1	1
C127	1.5mF 25V Tantalum	C 5183-6	1
C129	.22mF 100V Polycarb	C 4510-1	1
C123, C124	100pF Mica	C 3410-5	2
Integrated Circuits			
U100, U101, U102, U103	LM703 If Amp	C 5077-0	4
U104	CA3189 If Op Amp	C 4956-6	1
Transistors			
Q100	2N5485 FET	C 5123-2	1

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
Filters				
SAW	10.7MHz S.A.W. Filter	C 4953-3	1	
CF	10.7MHz Ceramic Filter	C 4954-1	3	
Miscellaneous				
	57-0180 Ferrite Bead	C 5159-6	5	
	8 Pin DIL IC Socket	C 3451-9	4	Sockets for U100-U103
	16 Pin DIL IC Socket	C 4508-5	1	Socket for U104
P-16	MTS156 4 Pin Header	C 5154-7	1	
	3 Pin Socket Strip	C 5295-8	3	CR Sockets
	22uH Choke	D 5122-3	1	
T100	Detector Coil	D 5125-6	1	
J-13	MT 156 4 Pin Connector	C 5147-1	1	

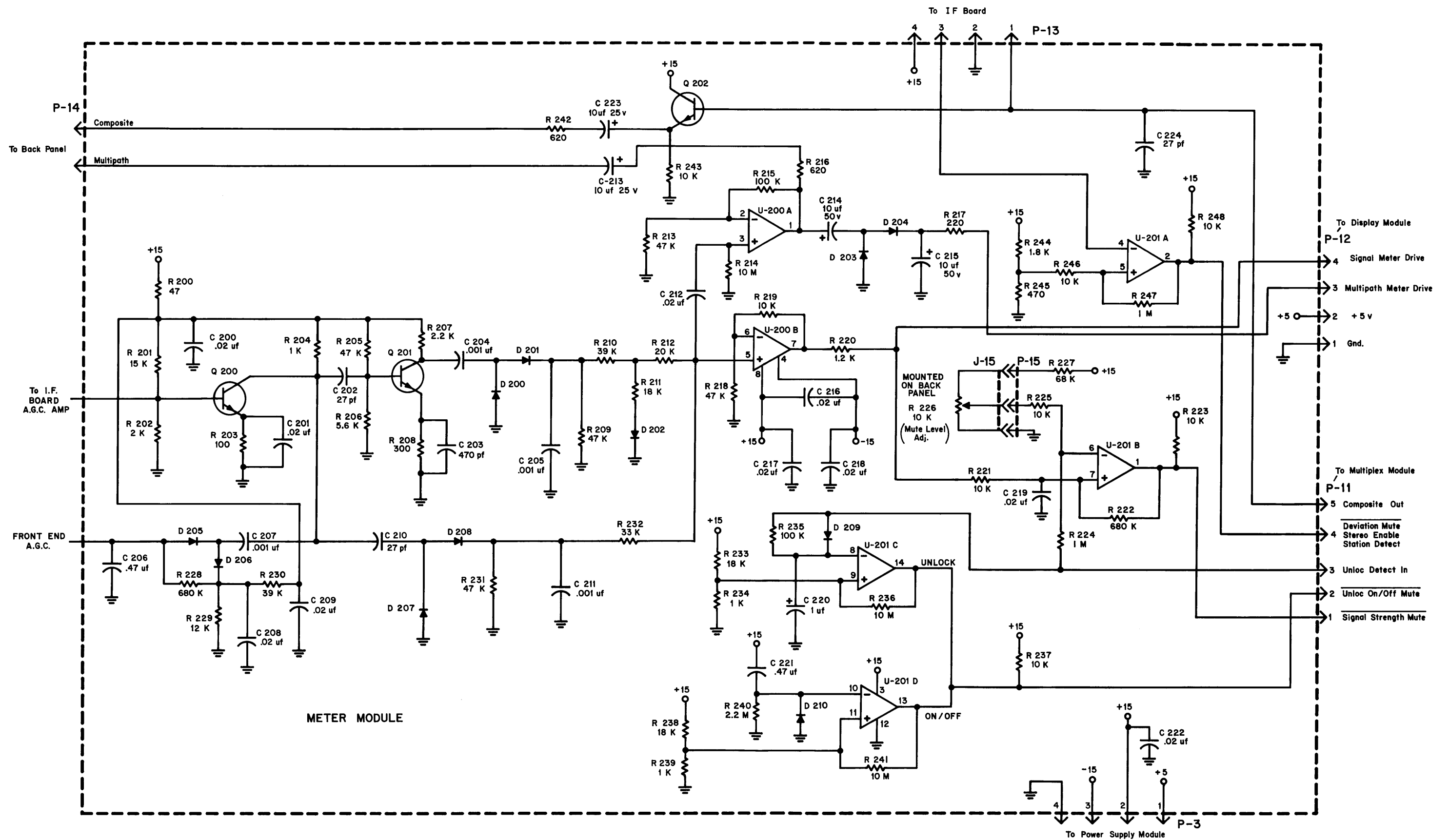


Fig. 6.5 Meter Module Schematic

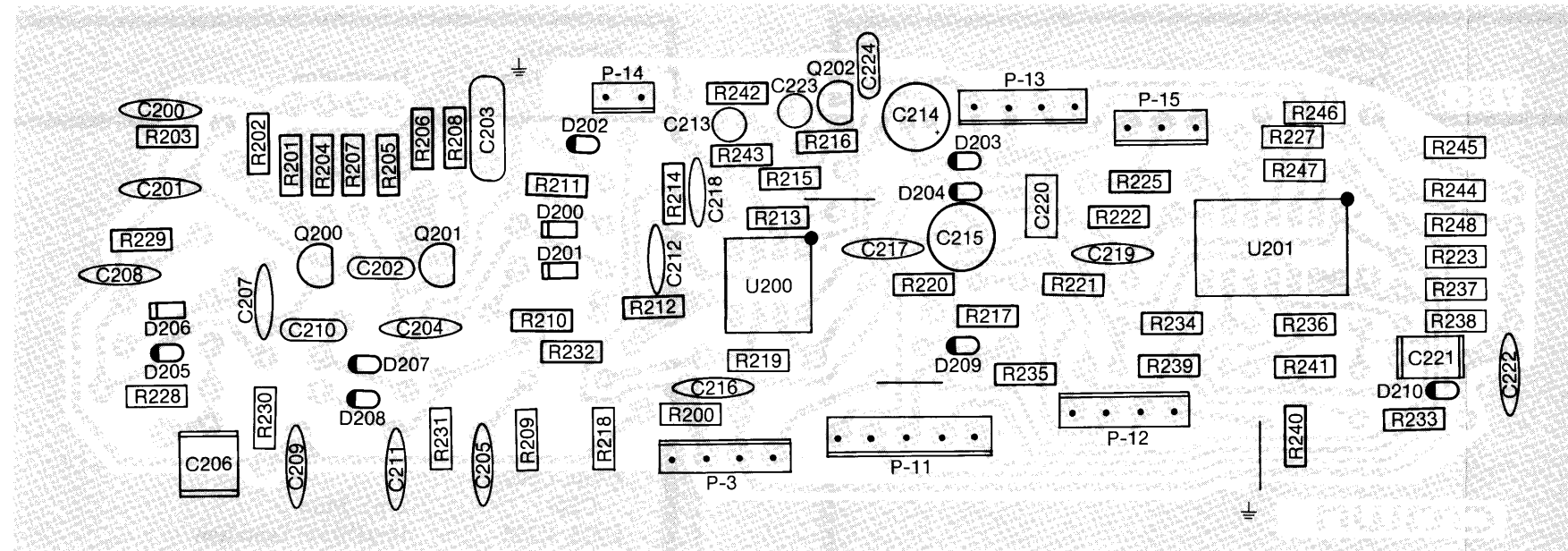


Fig. 6.6 Meter Module Component Board Layout

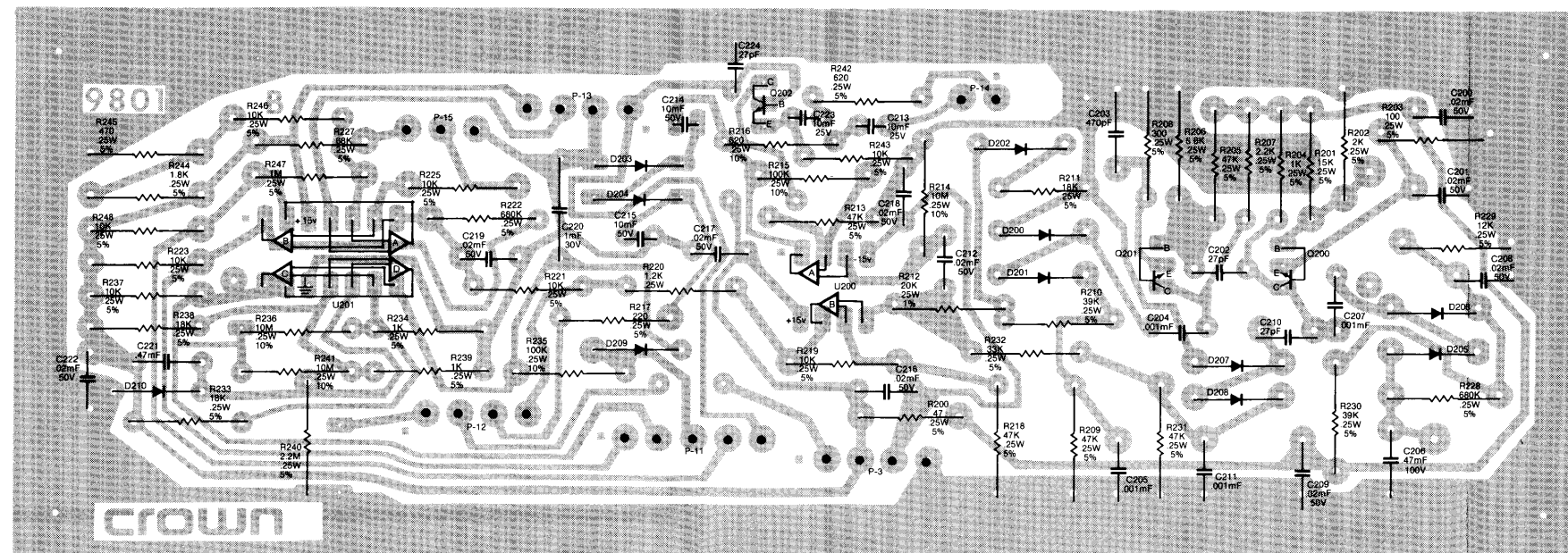


Fig. 6.7 Meter Module Foil Board Layout

Parts List: Meter Module Q42231J2

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
Resistors				
R200	47 ohm .25W 5%	C 1011-3	1	
R201	15K ohm .25W 5%	C 2632-5	1	
R202	2K ohm .25W 5%	C 3804-9	1	
R203	100 ohm .25W 5%	C 2872-7	1	
R204, R234, R239	1K ohm .25W 5%	C 2627-5	3	
R205, R209, R213, R218, R231	47K ohm .25W 5%	C 2880-0	5	
R219, R221, R223, R243, R225, R237, R246, R248	10K ohm .25W 5%	C 2631-7	8	
R206	5.6K ohm .25W 5%	C 3220-8	1	
R207	2.2K ohm .25W 5%	C 2628-3	1	
R208	300 ohm .25W 5%	C 3801-5	1	
R210, R230	39K ohm .25W 5%	C 2879-2	2	
R211, R233, R238	18K ohm .25W 5%	C 2633-3	3	
R212	20K ohm .25W 1%	C 4861-8	1	
R214, R236, R241	10M ohm .25W 10%	C 3221-6	3	
R215, R235	100K ohm .25W 5%	C 2883-4	2	
R216, R242	620 ohm .25W 5%	C 3872-6	2	
R217	220 ohm .25W 5%	C 5047-3	1	
R220	1.2K ohm .25W	C 2875-0	1	
R222, R228	680K ohm .25W 5%	C 5167-9	2	
R224, R247	1M ohm .25W 5%	C 3198-6	2	
R226	10K ohm Variable	D 5141-3	1	Mute Level Adjust
R227	68K ohm .25W 5%	C 3620-9	1	
R229	12K ohm .25W 5%	C 2878-4	1	
R232	33K ohm .25W 5%	C 4346-0	1	
R240	2.2M ohm .25W 5%	C 5170-3	1	
R244	1.8K ohm .25W 5%	C 3807-2	1	
R245	470 ohm .25W 5%	C 2626-7	1	
Integrated Circuits				
U200	TL072 CP Op Amp	C 5070-5	1	
U201	LM 339 Voltcomparator	C 4345-2	1	

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
Capacitors				
C200, C201, C208, C209, C212, C216, C217, C218, C219, C222	.02mF 50V Ceramic Disc	C 5230-5	10	
C203	470pF Mica	C 2511-1	1	
C204, C205, C207, C211	.001mF Ceramic Disc	C 2288-6	4	
C206, C221	.47mF 100V	C 4119-1	2	
C210, C202, C224	27pF Mica	C 2342-1	3	
C213, C223	10mF 25V Tantalum	C 5208-1	2	
C214, C215	10mF 50V Vertical	C 3728-0	2	
C220	1mF 30V Tantalum	C 1750-6	1	
Diodes				
D200, D201, D206	1N270	C 3447-7	3	
D202, D203, D204, D205, D207, D208 D209, D210	1N4148	C 3181-2	8	
Transistors				
Q200, Q201	TIS 86 NPN	C 5078-8	2	
Q202	SEL TZ-81 NPN	D 2962-5	1	
Miscellaneous				
	14 Pin DIL IC Socket	C 3450-1	1	Socket for U201
	8 Pin DIL IC Socket	C 3451-9	1	Socket for U200
P-14	MTS156 2 Pin Header	C 5152-1	1	
P-15	MTS156 3 Pin Header	C 5153-9	1	
P-12, P-13, P-3	MTS156 4 Pin Header	C 5154-7	3	
P-11	MTS156 5 Pin Header	C 5155-4	1	

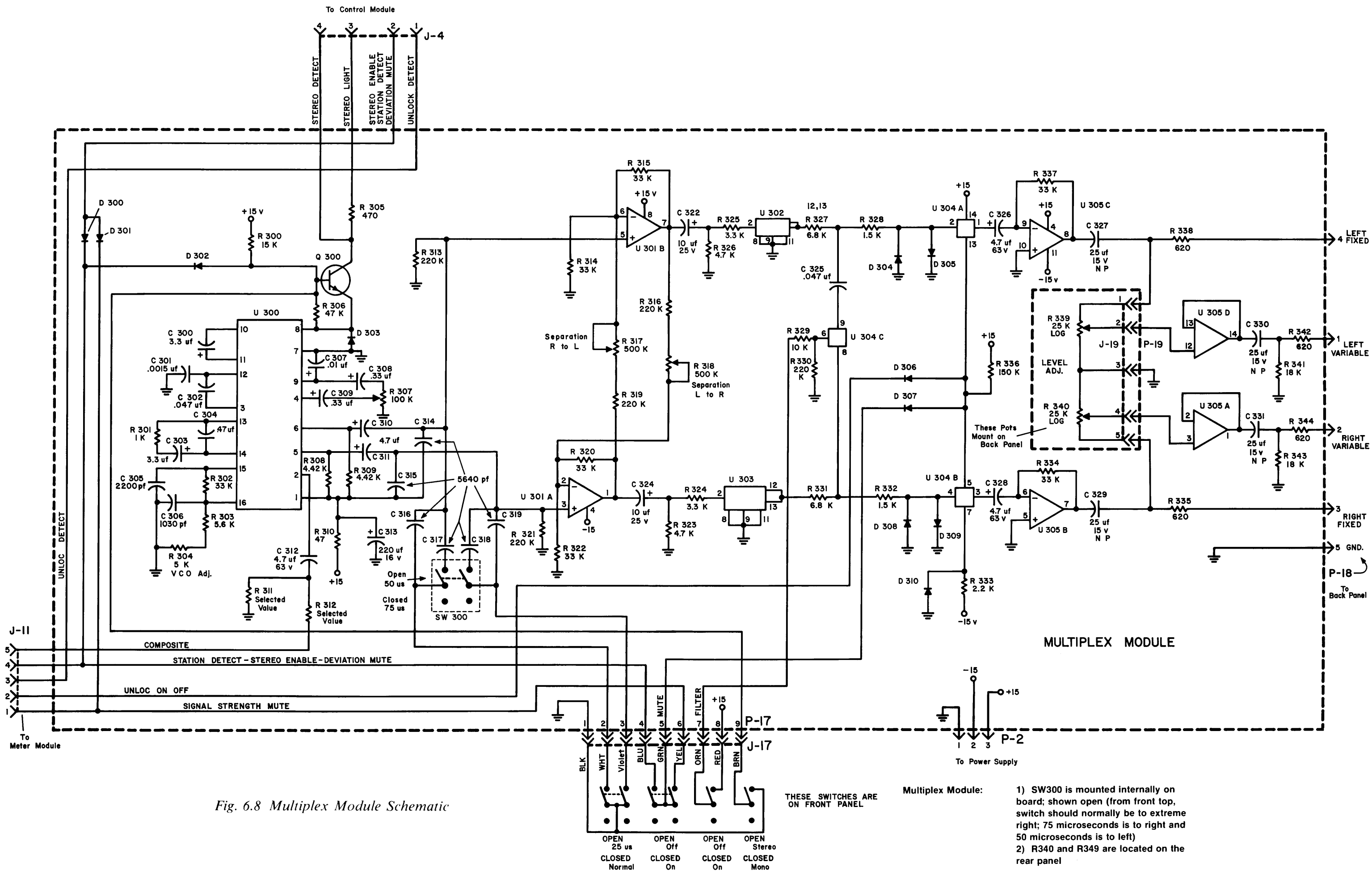


Fig. 6.8 Multiplex Module Schematic

THESE SWITCHES ARE ON FRONT PANEL

Multiplex Module:

- 1) SW300 is mounted internally on board; shown open (from front top, switch should normally be to extreme right; 75 microseconds is to right and 50 microseconds is to left)
- 2) R340 and R349 are located on the rear panel

OPEN 25 us OPEN Off OPEN Off OPEN Stereo
 CLOSED Normal CLOSED On CLOSED On CLOSED Mono

LEFT
FIXED

LEFT
TABLE

RIGHT
TABLE

RIGHT
FIXED

GND.



Panel

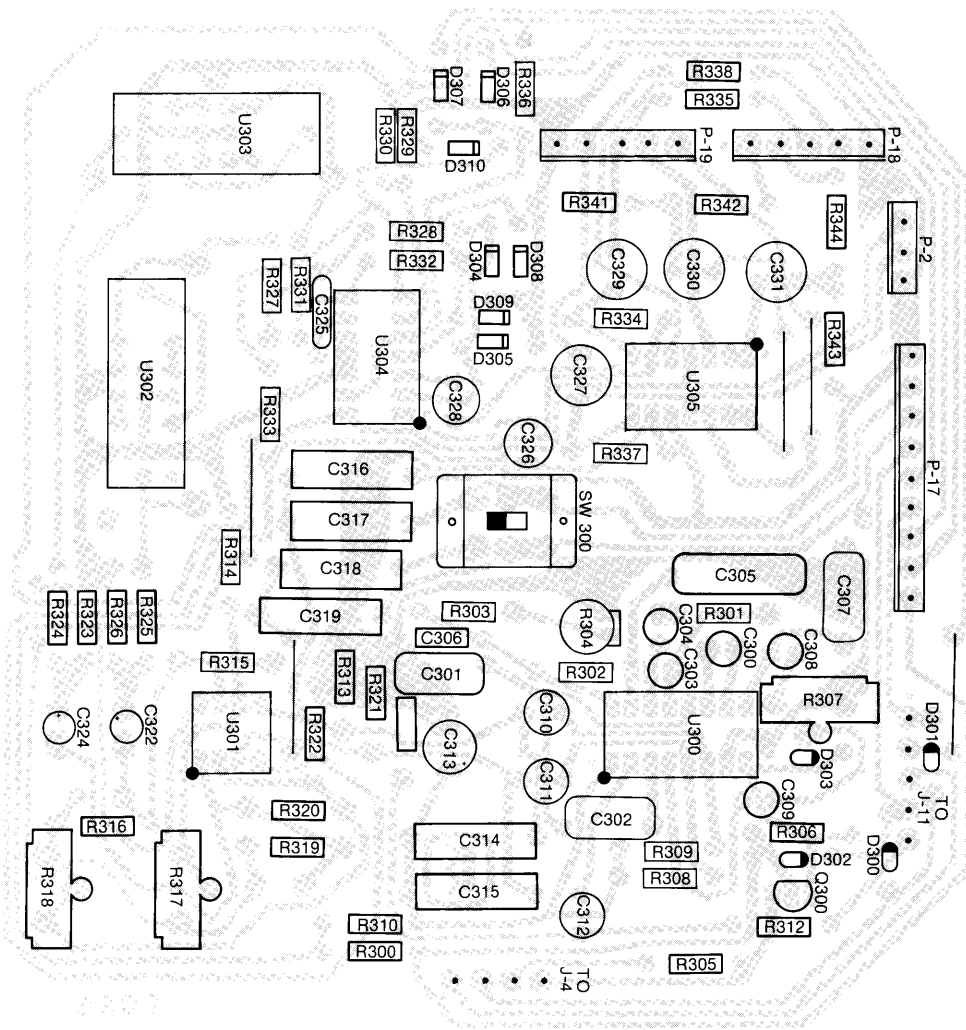


Fig.6.9 Multiplex Module Component Board
Layout

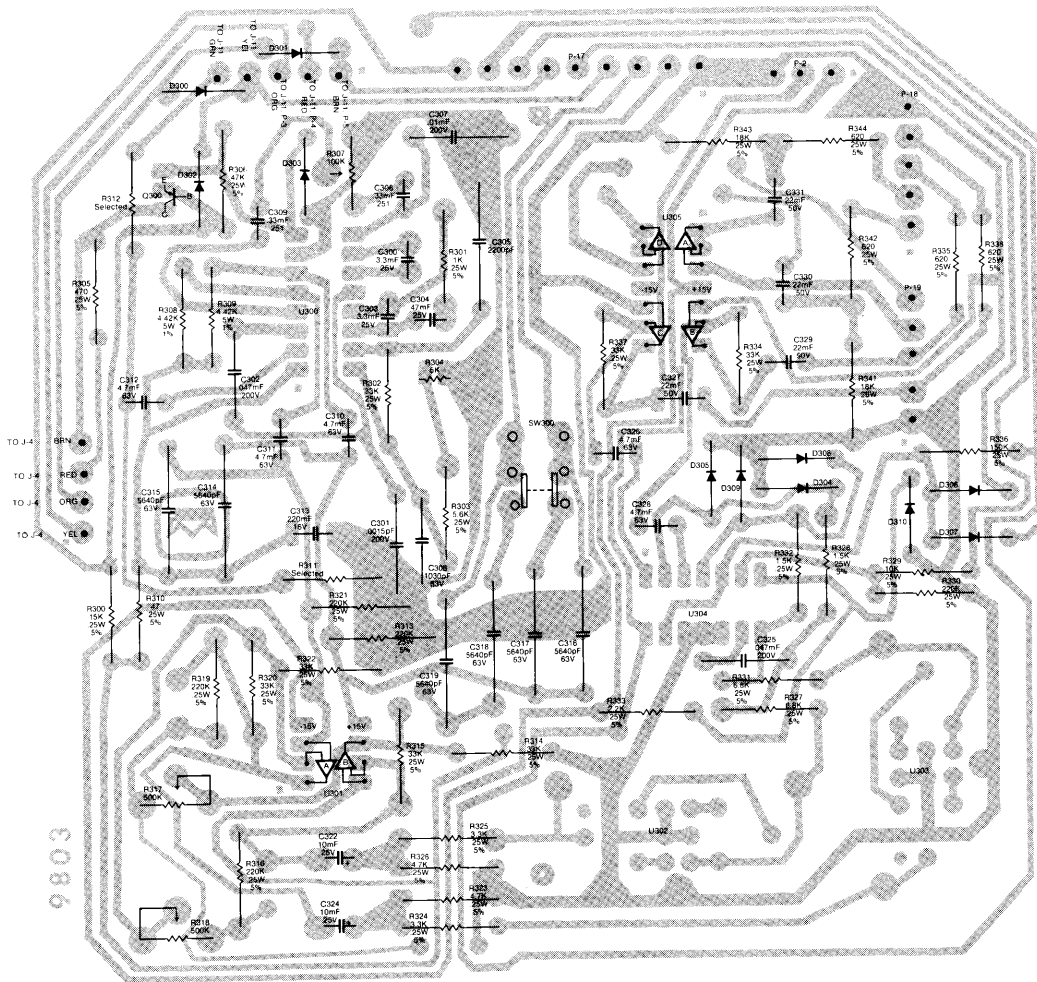


Fig. 6.10 Multiplex Module Foil Board Layout

Parts List: Multiplex Module Q42227J0

Schematic Designation	Description	Crown Part No.	Qty.
Resistors			
R300	15K ohm .25W 5%	C 2632-5	1
R301	1K ohm .25W 5%	C 2627-5	1
R302, R314, R315, R320, R322, R334, R337	33K ohm .25W 5%	C 4346-0	7
R303	5.6K ohm .25W 5%	C 3220-8	1
R304	5K ohm Helipot Trim	C 3670-4	1
R305	470 ohm .25W 5%	C 2626-7	1
R306	47K ohm .25W 5%	C 2880-0	1
R307	100K ohm Vertical White Pot	C 1713-4	1
R308, R309	4.42K ohm .5W 1%	C 3120-0	2
R310	47 ohm .25W 5%	C 1011-3	1
R311	Selected		1
R329	10K ohm .25W 5%	C 2631-7	1
R312	Selected		1
R313, R316, R319, R321, R330	220K ohm .25W 5%	C 4219-9	5
R317, R318	500K ohm Vertical Trim Pot	C 5209-9	2
R323, R326	4.7K ohm .25W 5%	C 3939-3	2
R324, R325	3.3K ohm .25W 5%	C 2629-1	2
R327, R331	6.8K ohm .25W 5%	C 5166-1	2
R328, R332	1.5K ohm .25W 5%	C 2876-8	2
R333	2.2K ohm .25W 5%	C 2628-3	1
R335, R338, R342, R344	620 ohm .25W 5%	C 3876-6	4
R336	150Kohm .25W 5%	C 4216-5	1
R339, R340	25K ohm		
R343, R341	18K ohm .25W 5%	C 2633-3	2
Capacitors			
C300, C303	3.3mF 25V	C 5180-2	2
C301	.0015mF 200V Filmatic	C 3089-7	1
C302, C325	.047mF 200V Mylar	C 3978-1	2
C304	.47mF 25V	C 5181-0	1
C305	2200pF	C 3141-6	1
C306	1030pF 63V	D 4464-0	1
C307	.01mF 200V Filmatic	C 3161-4	1
C308, C309	.33mF 251 Tantalum	C 5184-4	2
C310, C311, C326, C328, C313	4.7mF 63V Vertical	C 4253-8	5
C312	220mF 16V Vertical	C 3796-7	1
C314, C315, C316, C317, C318, C319	5640pF 63V	D 4466-5	6
C322, C324	10mF 25V Tantalum	C 5208-1	2
C323	22pF		
C327, C329, C330, C331	22mF 50V N-P	C 5311-3	4

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
Diodes				
D300, D301, D302, D303, D304, D305, D306, D307, D308, D309, D310	1N4148	C 3181-2	11	
Transistors				
Q300	Sel 2N3859A NPN	D 2961-7	1	
Integrated Circuits				
U300	HA11223 Demod.	C 4955-8	1	
U301	TL072 Op Amp	C 5070-5	1	
U302, U303	Multiplex Filter	C 5059-8	2	
U304	MCI4016 Quad Switch	C 4834-5	2	
U305	TL074 Quad Op Amp	C 4696-8	1	
Miscellaneous				
	14 Pin DIL IC Socket	C 3450-1	2	Sockets for U304, U305
	8 Pin DIL IC Socket	C 3451-9	1	Socket for U301
	PC Receptacles	C 3519-3	2	Used with R312
SW300	DPDT Slide SW	C 5080-4	1	
P2	3 Pin Header	C 5153-9	1	
P19, P18	5 Pin Header	C 5155-4	2	
P17	9 Pin Header	C 5158-8	1	
J4	MTS 156 4 Pin Connector	C 5147-1	1	
J11	MTS 156 5 Pin Connector	C 5148-9	1	
J17	MTS 156 9 Pin Connector	C 5158-8	1	

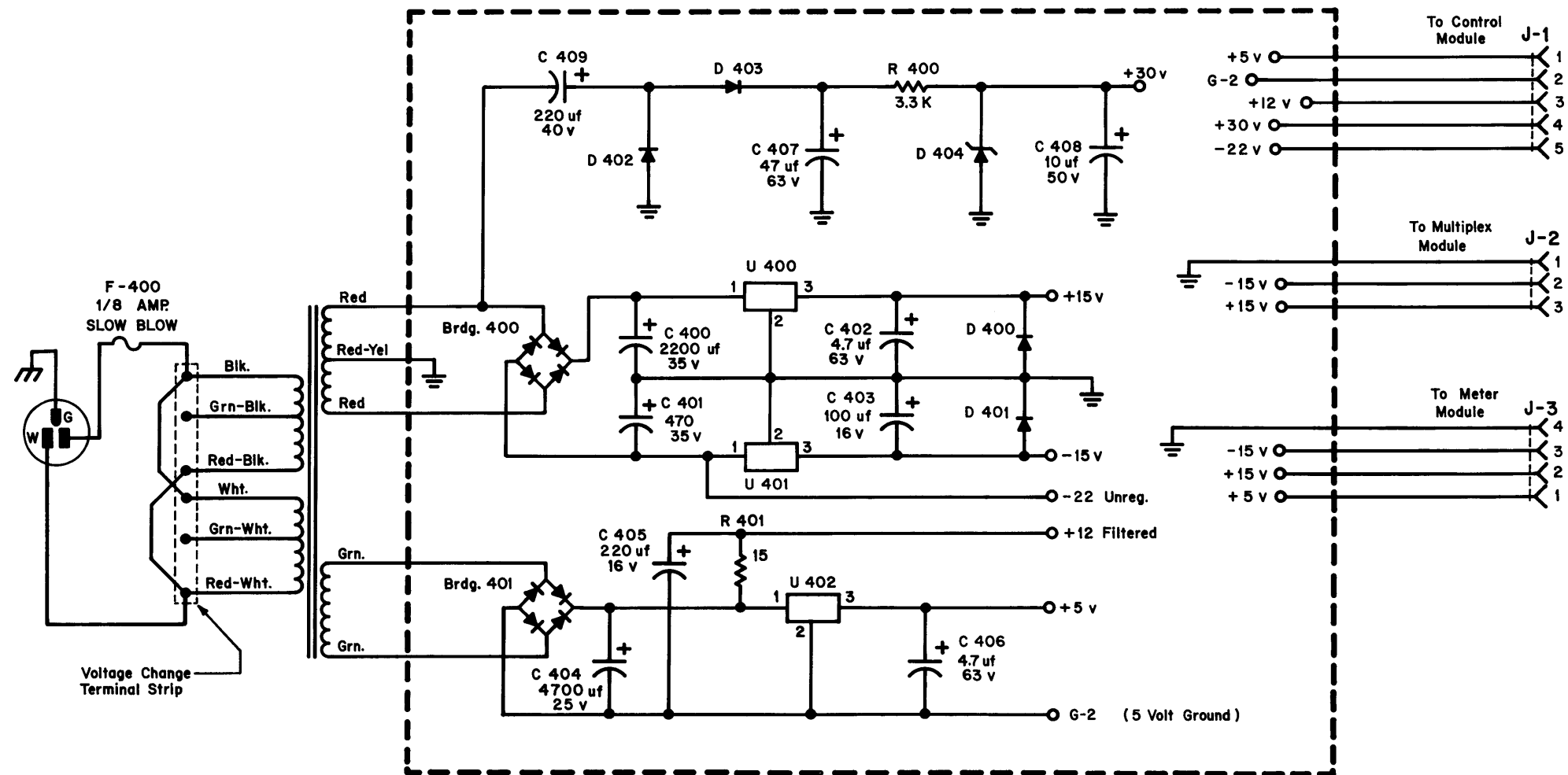


Fig. 6.11 Power Supply Module Schematic

Parts List: Power Supply Q42232J0

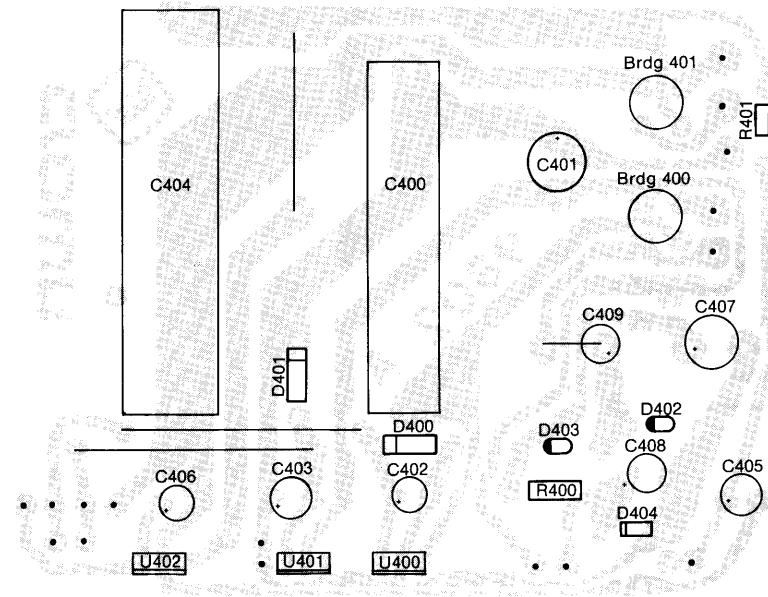


Fig. 6.12 Power Supply Module Component Board Layout

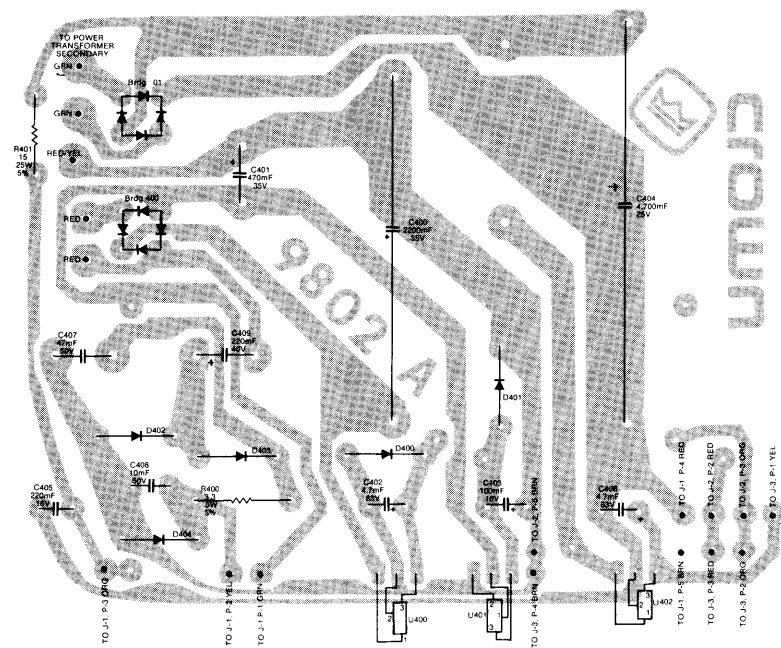


Fig. 6.13 Power Supply Module Foil Board Layout

Schematic Designation	Description	Crown Part No.	Qty.
Resistors			
R400	3.3K ohm .5W 5%	C 1051-9	1
R401	15 ohm .25W 5%	C 3614-2	1
Capacitors			
C400	2200mF 35V	C 5202-4	1
C401	470mF 35V Vertical	C 4477-3	1
C402, C406	4.7mF 63V Vertical	C 4253-8	2
C403	100mF 16V Vertical	C 3729-8	1
C404	4,700mF 25V	C 5201-6	1
C405	220mF 16V Vertical	C 3796-7	1
C407	47mF 50V Vertical	C 5219-8	1
C408	10mF 50V Vertical	C 3728-0	1
C409	220mF 40V	C 4147-2	1
Diodes			
D400, D401	1N4148	C 3181-2	2
D402, D403	1N4004	C 2851-1	2
D404	1N4751A 30V Zener	C 5081-2	1
Brdg. 400, 401	1.5A Bridge	C 5066-3	2
Integrated Circuits			
U400	MC7815CT +15V Regulator	C 5095-2	1
U401	MC7915CT -15V Regulator	C 5096-0	1
U402	MC7805CT +5V Regulator	C 5094-5	1
Miscellaneous			
J1	MTS 156 5 Pin Connector	C 5148-9	1
J2	MTS 156 3 Pin Connector	C 5146-3	1
J3	MTS 156 4 Pin Connector	C 5147-1	1

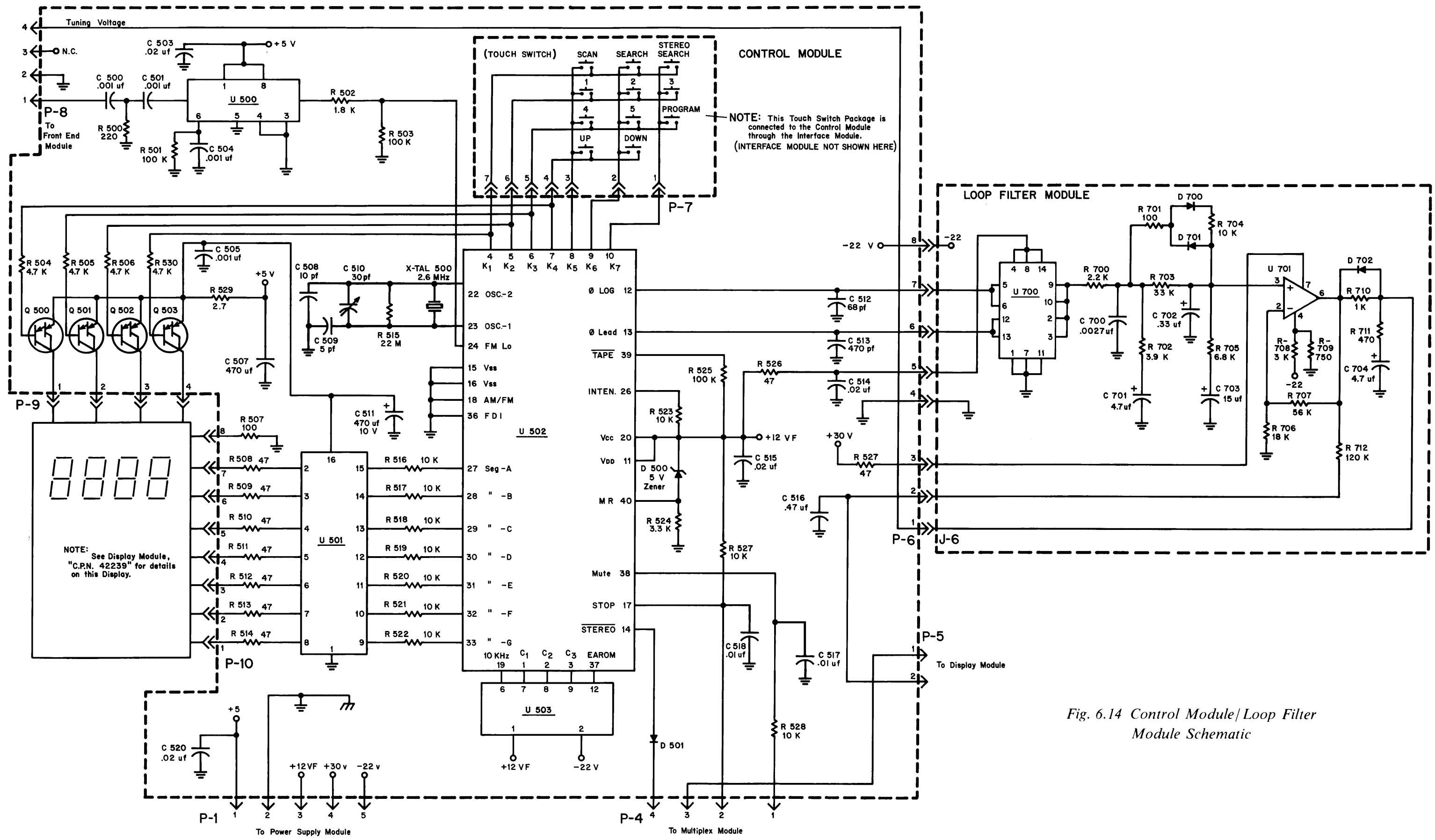


Fig. 6.14 Control Module/Loop Filter Module Schematic

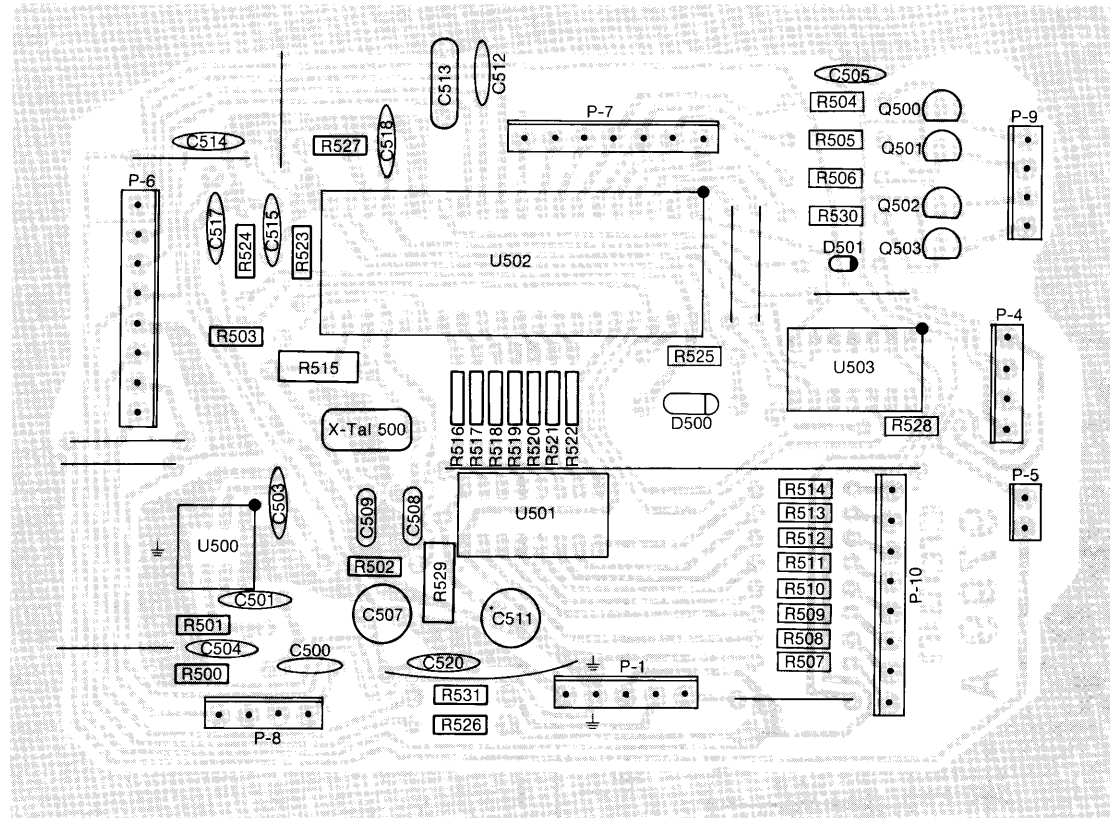


Fig. 6.15 Control Module Component Board Layout

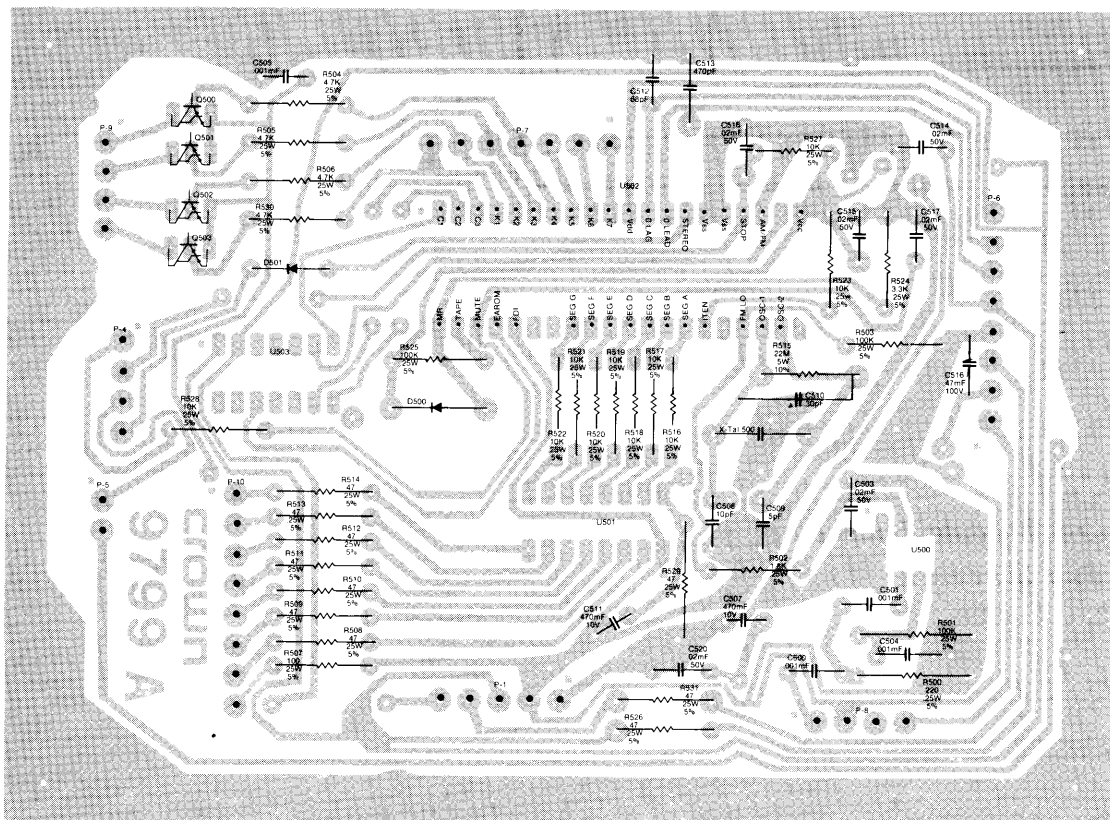


Fig. 6.16 Control Module Foil Board Layout

Parts List: Control Module Q42225J4

Schematic Designation	Description	Crown Part No.	Qty.
Resistors			
R500	220 ohm .25W 5%	C 5047-3	1
R501, R503, R525, R502	100K ohm .25W 5%	C 2883-4	3
R502	1.8K ohm .25W 5%	C 3807-2	1
R504, R505, R506, R530	4.7K ohm .25W 5%	C 3939-3	4
R529	2.7 ohm .5W 5%	C 2857-8	1
R508, R509, R510, R511, R512, R513, R514, R526, R531	47 ohm .25W 5%	C 1011-3	9
R507	100 ohm .25W 5%	C 2872-7	1
R516, R517, R518, R519, R520, R521, R522, R523, R527, R528	10K ohm .25W 5%	C 2631-7	10
R524	3.3K ohm .25W 5%	C 2629-1	1
R515	22M ohm .5W 10%	C 3052-5	1
Capacitors			
C500, C501, C504, C505	.001uF Ceramic Disc	C 2288-6	4
C503, C517, C518, C514, C515, C520	.02mF 50V Ceramic Disc	C 5230-5	6
C513	470pF Mica	C 2511-1	1
C508	10pF Mica	C 2821-4	1
C509	5pF Mica	C 2820-6	1
C510	30pF Trimmer	C 5058-0	1
C511, C507	470mF 10V Vertical	C 5239-6	2
C512	68pF Disc	C 5194-3	1
C516	.47mF 100V Polycarb	C 4119-1	1

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
Diodes				
D501	1N4148	C 3181-2	1	
D500	1N4733A 5V Zener	C 5082-0	1	
Transistors				
Q500, Q501, Q502, Q503	D39C1 Darlington	C 5124-0	4	
Integrated Circuits				
U500	SP8629 150mHz/100	C 4962-4	1	
U501	SN75497 Driver	C 4966-5	1	
U502	AY-3-8115-2 Control	C 4952-5	1	
U503	ER1400 Memory	C 4951-7	1	
Miscellaneous				
	15 Gauge Braided Cable	B 4785-0		
	Loop Mod Connector	F 9874-3		
	14 Pin DIL Socket	C 3450-1	1	Socket for U503
	8 Pin DIL Socket	C 3451-9	1	Socket for U500
	16 Pin DIL Socket	C 4508-5	1	Socket for U501
	40 Pin DIL Socket	C 5076-2	1	Socket for U502
X-Tal 500	2.6MHz Crystal	C 5068-9	1	
P-5	2 Pin Header	C 5152-1	1	
P-8, P-4, P-9	4 Pin Header	C 5154-7	3	
P-1	5 Pin Header	C 5155-4	1	
P-7	7 Pin Header	C 5156-2	1	
P-10	8 Pin Header	C 5157-0	1	
P-6	Midway 8 Pin PC Header	C 5172-9	1	

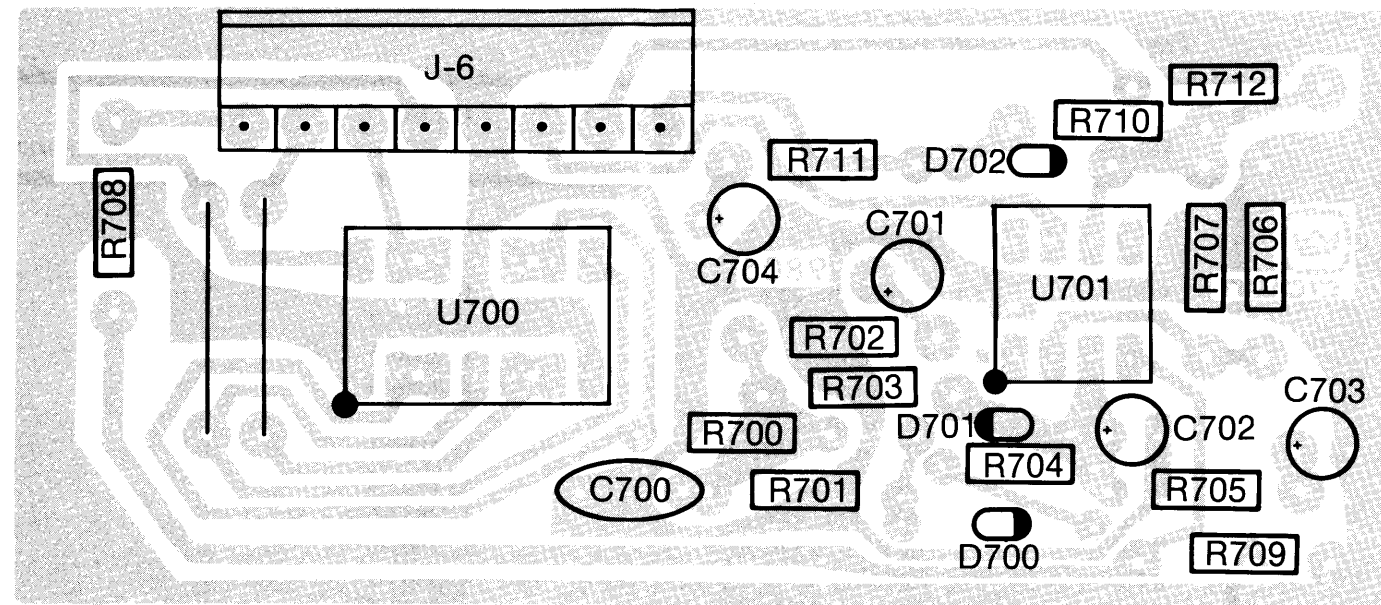


Fig. 6.17 Loop Filter Module Component Board Layout

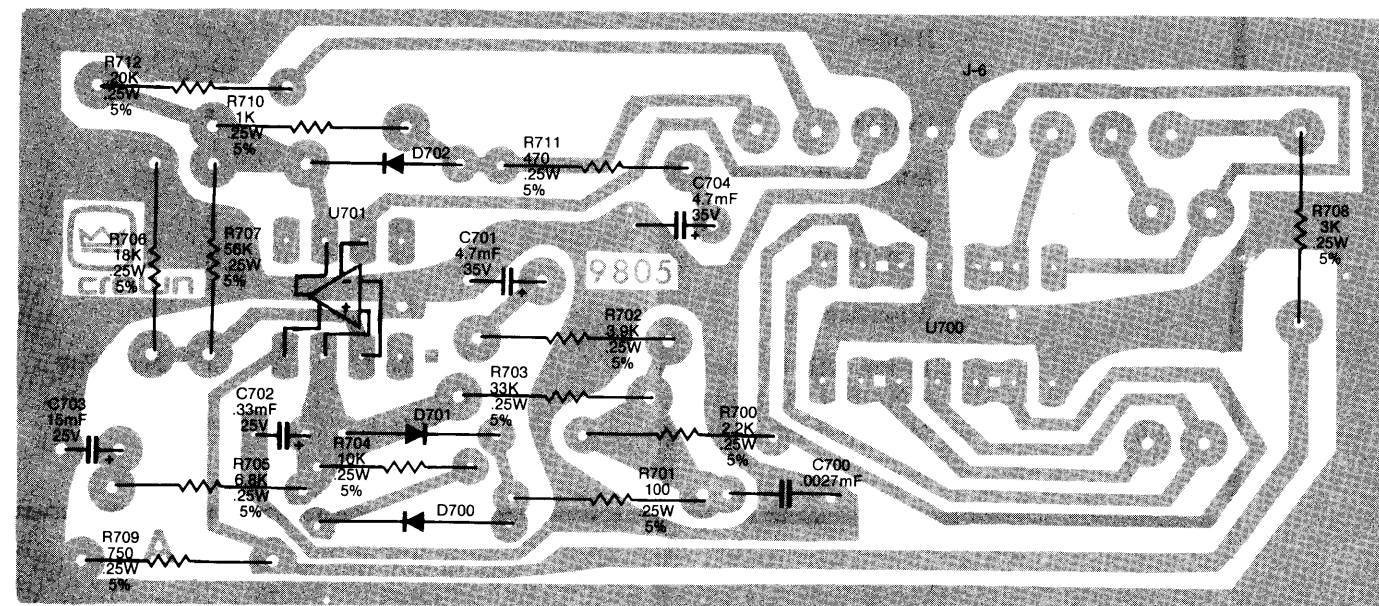
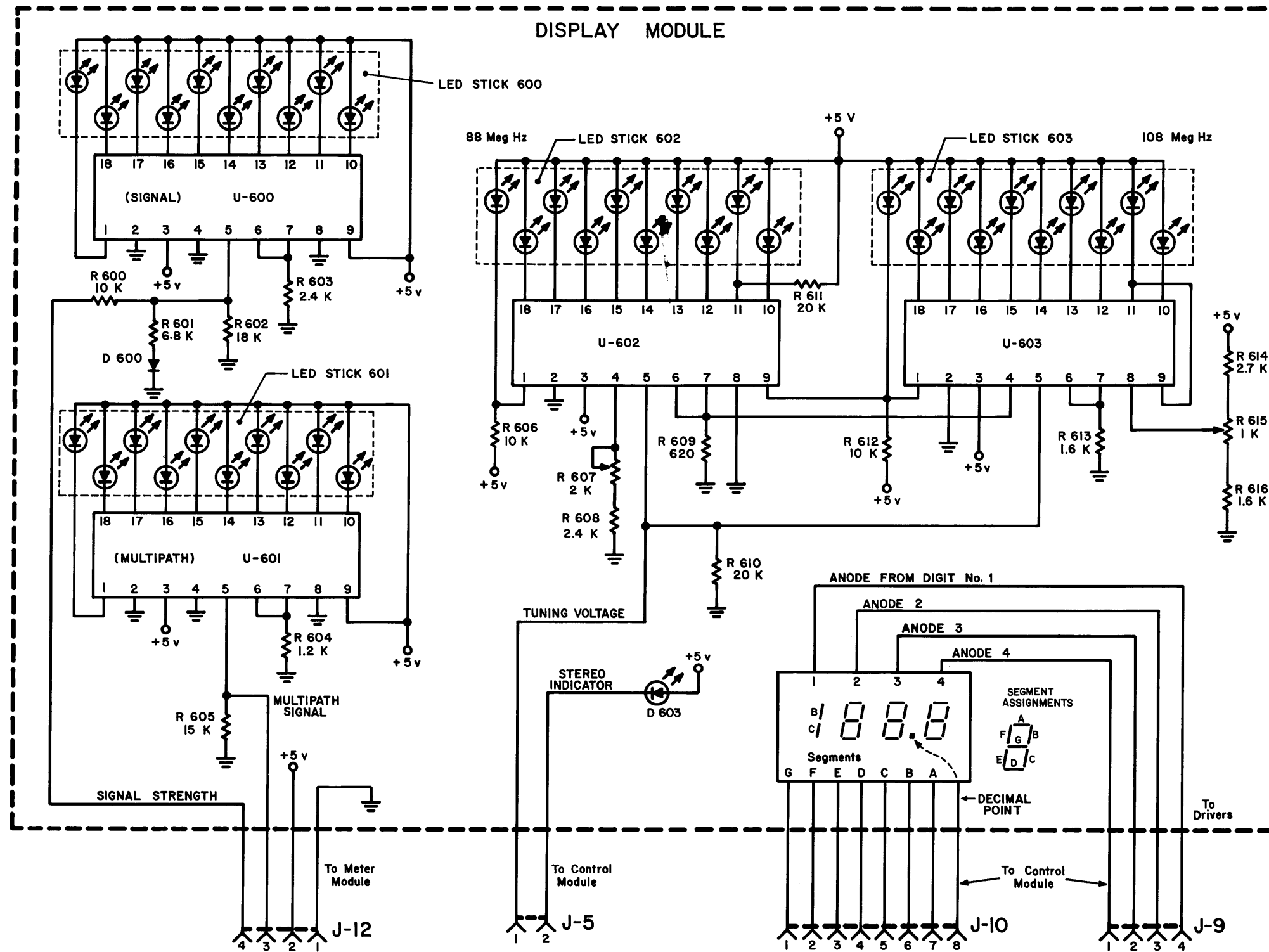


Fig. 6.18 Loop Filter Module Foil Board Layout

Parts List: Loop Filter Module Q42226J2

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
Resistors				
R700	2.2K ohm .25W 5%	C 2628-3	1	
R701	100 ohm .25W 5%	C 2872-7	1	
R702	3.9K ohm .25W 5%	C 2630-9	1	
R703	33K ohm .25W 5%	C 4346-0	1	
R704	10K ohm .25W 5%	C 2631-7	1	
R705	6.8K ohm .25W 5%	C 5166-1	1	
R706	18K ohm .25W 5%	C 2633-3	1	
R707	56K ohm .25W 5%	C 2882-6	1	
R708	3K ohm .25W 5%	C 3805-6	1	
R709	750 ohm .25W 5%	C 3803-1	1	
R710	1K ohm .25W 5%	C 2627-5	1	
R711	470 ohm .25W 5%	C 2626-7	1	
R712	.20K ohm .25W 5%	C 4214-0	1	
Capacitors				
C700	.0027mF Disc	C 5189-3	1	
C701, C704	4.7mF 35V Tantalum	C 4019-3	2	
C702	.33mF 25V Tantalum	C 5184-4	1	
C703	15mF 25V Tantalum	C 5182-8	1	
Diodes				
D700, D701, D702	IN4148	C 3181-2	3	
Integrated Circuits				
U700	MC14016 Quad Switch	C 4834-5	1	
U701	TL071CP Bifet Op Amp	C 5069-7	1	
Miscellaneous				
	14 Pin DIL IC Socket	C 3450-1	1	For U700
	8 Pin DIL IC Socket	C 3451-9	1	For U701
J-6	Midway 8 Pin Housing	C 5171-1	1	



Display Module:

1) R607 and R615 are mounted horizontally for ease of adjustment

Fig. 6.19 Display Module Schematic

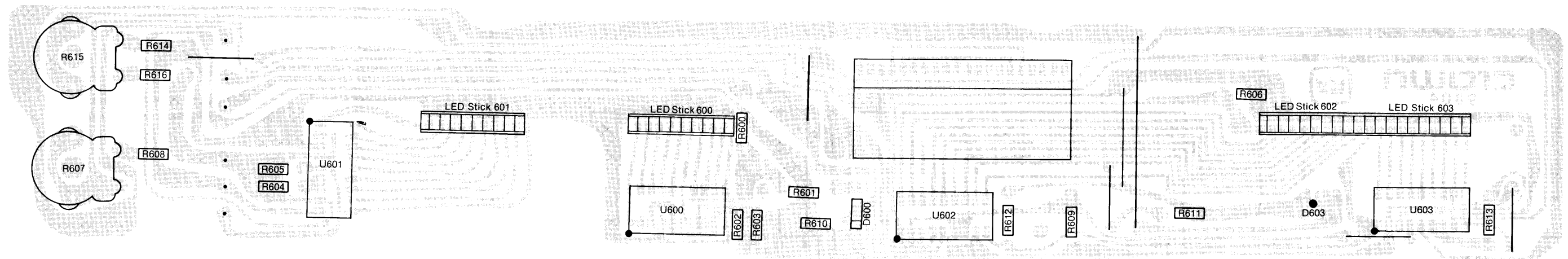


Fig. 6.20 Display Module Component Board Layout

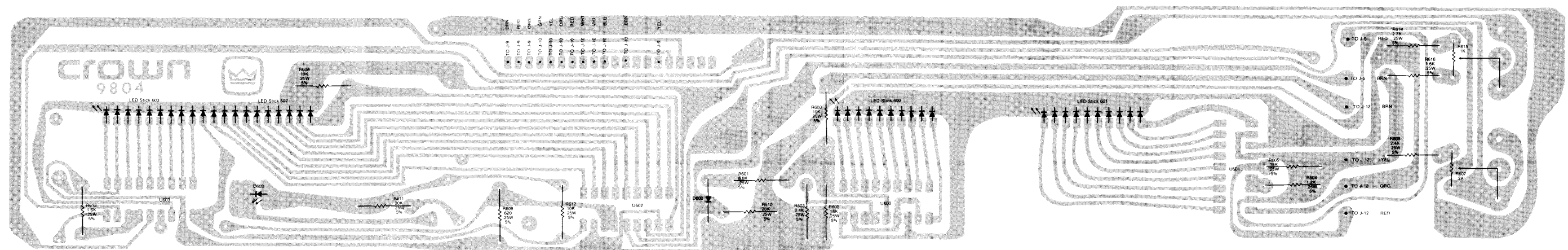


Fig. 6.21 Display Module Foil Board Layout

Parts List: Display Module Q42239J5

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
Resistors				
R600, R606, R612	10K ohm .25W 5%	C 2631-7	3	
R601	6.8K ohm .25W 5%	C 5166-1	1	
R602	18K ohm .25W 5%	C 2633-3	1	
R603, R608	2.4K ohm .25W 5%	C 3616-7	2	
R604	1.2K ohm .25W 5%	C 2875-0	1	
R605	15K ohm .25W 5%	C 2632-5	1	
R607	2K ohm Red	C 2067-4	1	
R609	620 ohm .25W 5%	C 3872-6	1	
R610, R611	20K ohm .25W 5%	C 5046-5	2	
R613, R616	1.6K ohm .25W 5%	C 3873-4	2	
R614	2.7K ohm .25W 5%	C 5168-7	1	
R615	1K ohm Black Pot	C 1711-8	1	
Diodes				
D600	IN4148	C 3181-2	1	
D603	TIL209A Mini Red LED	C 4978-0	1	Stereo indicator
LED Stick 600, 602, 603	10 Element Green LED	C 4977-2	3	
LED Stick 601	10 Element Yellow LED	C 4976-4	1	Multipath
	TIL835 3.5 Digit 7 Seg	C 5097-8	1	Frequency read-out
Integrated Circuits				
U600, U601, U602, U603	LM 3914N Dot Display Driver	C 4924-4	4	
Miscellaneous				
	10 Pin Socket Strip	C 5203-2	4	
	20 Pin Socket Strip	C 5204-0	2	
	18 Pin DIL IC Socket	C 5118-2	4	
J-5	MTS 156 2 Pin Connector	C 5145-5	1	
J-9, J-12	MTS 156 4 Pin Connector	C 5147-1	2	
J-10	MTS 156 8 Pin Connector	C 5150-5	1	

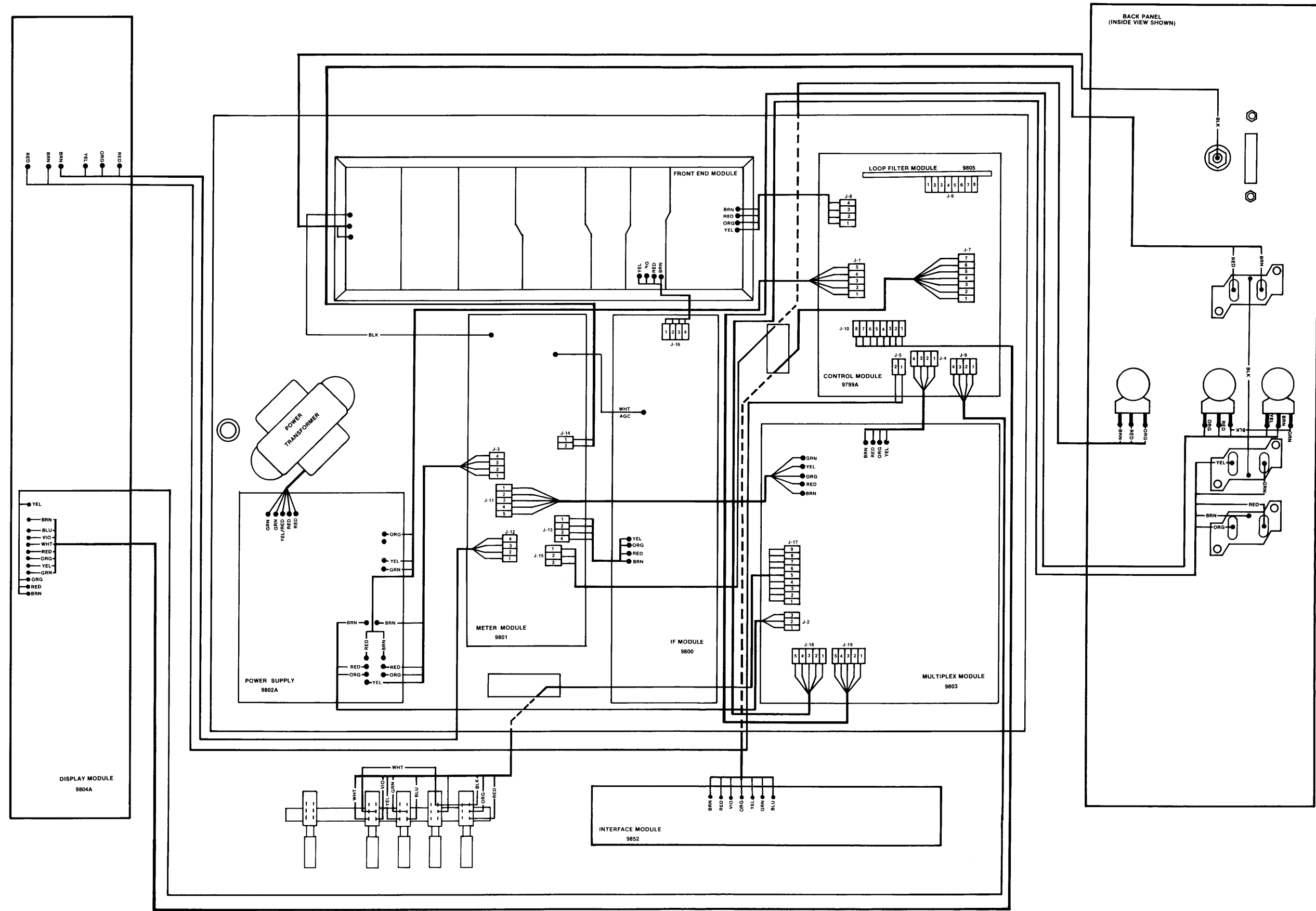


Fig. 6.22 Interconnect Wiring Diagram

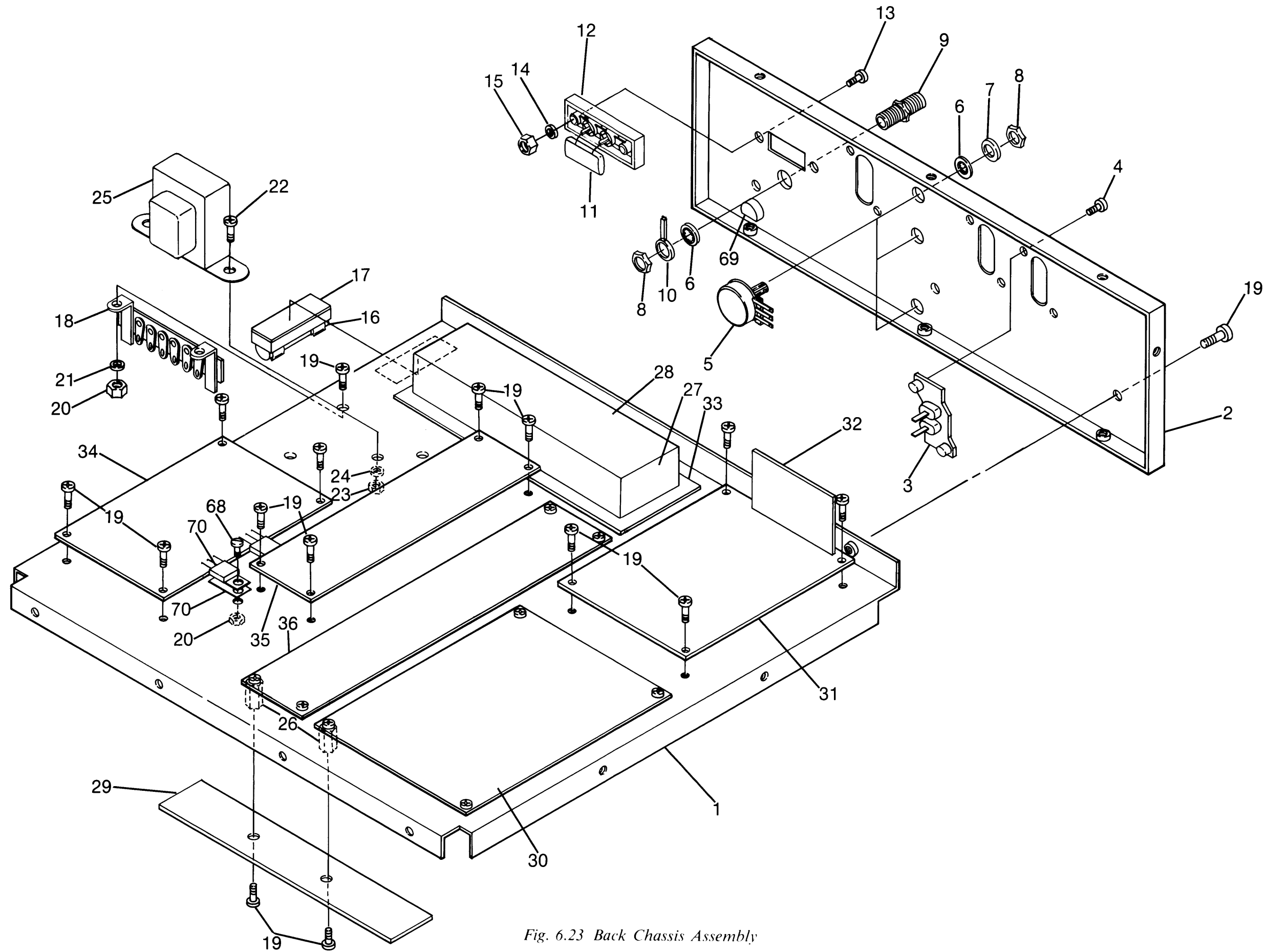


Fig. 6.23 Back Chassis Assembly

Parts List: Back Chassis Assembly

Index No.	Schematic Designation	Description	Crown Part No.	Qty.	Other Information
1		FM1 Chassis	M20126-5	1	
2		FM1 Back Panel	M20127-3	1	
3		2 way Phone Jackplate	C 4933-5	3	
4		B 4H .37 Self-tapping Screw	C 4895-6	6	
5	R339, R340	25K ohm CW Log	D 5142-1	2	Level adjust
5	R226	10K ohm CW Log	D 5141-3	1	Mute Level
6		.375 Internal Star Lockwasher	C 2188-8	4	
7		.625x.375x.030 Brightwasher	C 2189-6	3	
8		.375 Bright Nut	C 1288N7	4	
9		Chassis Mount Female Connector	C 5207-3	1	
10		Solder Lug .375 Hole	D 2828-8	1	
11		300/75 ohm Balun Coil	D 5205-6	1	
12		2 way Wirelock Connector	D 5224-7	1	
13		R6 32 .37 BS Machine Screw	C 2134B8	2	
14		#6 Internal Starwasher Black	C 1823-1	2	
15		6-32 Hex Nut	C 1889-2	2	
16	F400	MOL .25A 1 Fuse	C 1758-9	1	
17		3823-1 Fuse Block	C 3776-9	1	
18		Terminal Strip	D 3503-6	1	
19		R6 32 .25 Machine Screw	C 1954-4	31	
20		6-32 Hex Nut	C 1889-2	4	
21		#6 Internal Starwasher Black	C 1823-1	2	
22		T8 32 .37 Machine Screw	C 2155-7	2	
23		8-32 Hex Nut	C 1986-6	2	
24		#8 Internal Star Lockwasher	C 1951-0	2	
25		FM1 Power Transformer	H42288-3	1	
26		6-32 Hex Spacer	D 3251-2	2	
27		Front End Shield	M42504-7	1	
28		Front End Shield Top	F 9867-7	1	
29		FM1 Interface Module	M42229-1	1	
30		Multiplex Module	Q42227J0	1	
31		Control Module	Q42225J4	1	
32		Loop Filter Module	Q42226J2	1	
33		Front End Module	Q42228J8	1	
34		Power Supply Module	Q42232J0	1	
35		Meter Module	Q42231J2	1	
36		IF Module	Q42230J4	1	
68		R6 32 .37 AN Machine Screw	C 2620-0	2	
69		Power Cord	H42247-9	1	
70		MC7805CT +5V	C 5094-5	1	

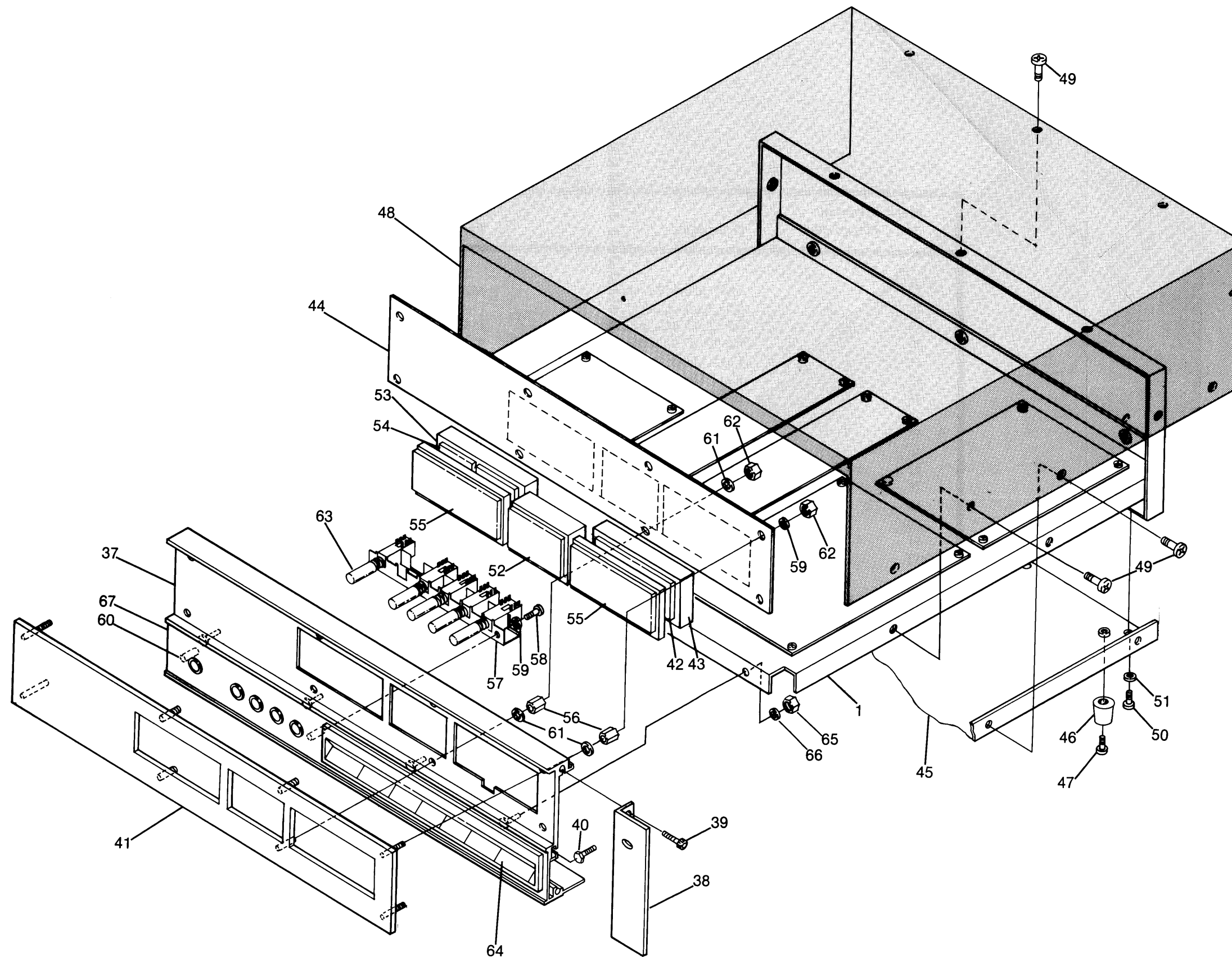


Fig. 6.24 Front Chassis Assembly

Parts List: Front Chassis Assembly

Index No.	Schematic Designation	Description	Crown Part No.	Qty.	Other Information
37		FM1 Front Panel	M20128-1	1	
38		5.25 Rack Ear	D 4802-1	2	
39		S6 32 .75 Machine Screw	C 1858-7	4	
40		X6 32 .37 Machine Screw	C 3322-2	4	
41		FM1 Meter Panel	M20156-2	1	
42		Band Display Overlay	D 5110-8	1	
43		Band Display Bezel	D 5074-6	1	
44		Display Module	Q42239J5	1	
45		Bottom Cover	M20129-9	1	
46		Feet	C 2945-1	4	
47		R6 32 .75 Machine Screw	C 2135-9	4	
48		Top Cover	F 9854-5	1	
49		SW 6P .37 Self-tapping Screw	C 4329-6	15	
50		R6 32 .25 Machine Screw	C 1954-4	6	Bottom Cover
51		#6 Internal Star Washer	C 1823-1	6	Bottom cover
52		Display Lens	D 4988-8	1	
53		Signal Display Bezel	D 5075-3	1	
54		Signal Display Overlay	D 5109-0	2	
55		Meter Lens	D 4989-6	2	
56		4-40 Hex Spacers	C 5475-6	8	
57		6 Station DPDT Pushbutton Switch	D 5144-7	1	
58		S 4-40 .25 Machine Screw	C 4334-6	2	
59		#4 Internal Star Washer	C 1824-9	7	
60		.35 RND Pushbutton Switch Collar	D 4108-3	2	
61		.375x1.41x.031 Fiber Washer	C 1296-0	9	
62		4-40 Hex Nut	C 1938-7	8	
63		Black Pushbuttons	D 4572-0	5	
64		Touch Switch Assembly	M42286-1	1	
65		6-32 Hex Nut	C 1889-2	4	
66		#6 Internal Starwasher	C 1823-1	4	
67		Front Panel Overlay	D 5111-6	1	



SECTION 7 MAINTENANCE

7.1 Introduction

Section 7 contains technical information required to effectively and efficiently service and repair the Crown FM1. 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

Because of the complex circuitry utilized in the FM1, special alignment procedures and expensive equipment are necessary. In fact, in order to even perform minimal checkout procedures, a test bench, 100% enclosed in a screen wire room to protect the unit from outside Radio Frequency Interference, must be incorporated. For this reason, Crown recommends **limited** checkout (See Section 7.7) with standard test bench equipment as listed below. The "Requirements" column provides information to allow intelligent selection of substitutes of 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 semiconductor junctions for opens or shorts (high voltage probe) Check DC voltages	Triplet 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

Problem: External strands.

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

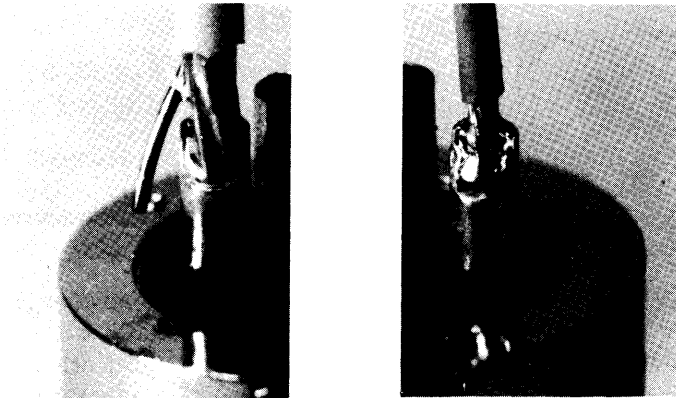


Fig. 7.4 External Strands

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.

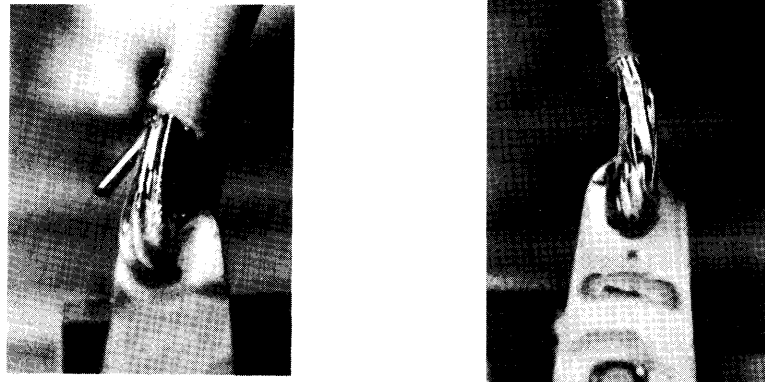


Fig. 7.5 Cut Strands

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.

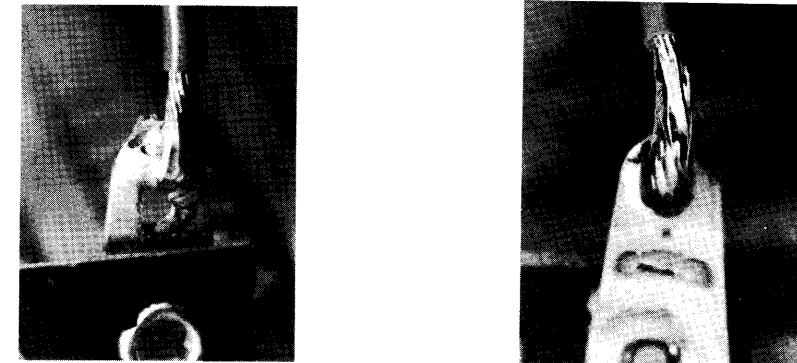


Fig. 7.7 Disturbed Joint

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.

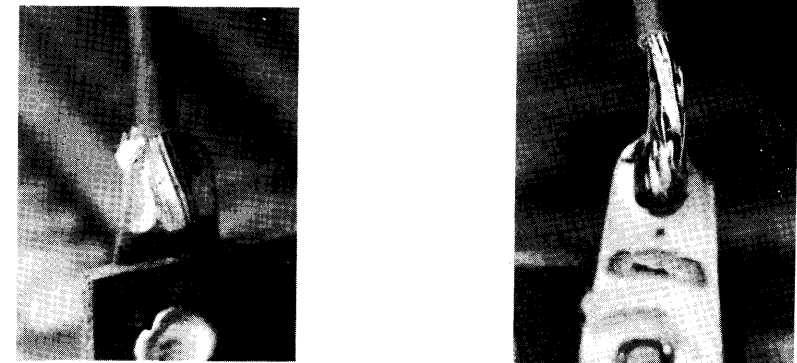


Fig. 7.8 Cold Solder Joint

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.

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 Procedures

The extent of disassembly required will depend upon the amount of inspection, service, testing, adjustment and repair to be performed. The FM1 has been specially designed for ease of disassembly. In addition, because of the circuit complexity it will be (in most cases) more effective to replace a complete module (if that certain module is replaceable) rather than spend large amounts of time and effort locating specific faulty components (should replacement of socketed components not resolve the problem). In fact, Crown encourages this procedure when applicable.

Note: Because of the complex test equipment used in aligning the FM1, certain repairs/adjustments are not recommended in field servicing. **Always** observe warnings listed throughout this section pertaining to specific "do's and don'ts".

Illustrations referred to in parenthesis are located in the parts list (Section 6) of this manual. Also, an interconnect wiring diagram is supplied in Fig. 6.22 for aid in re-connecting cables and connectors.

A. Cover Removal

A fairly complete visual inspection can be performed by removing the top (48) and bottom (45) covers. To remove these parts proceed as follows:

1. Remove the fifteen phillips head mounting screws (49) that secure the top cover. Gently lift cover and remove.

2. Remove the six phillips head mounting screws (50) that secure the bottom cover. As with the top cover, the bottom cover can be now easily removed.

B. Front-end Module Removal

This module should not, under any circumstances, be removed or adjusted!! Refer to factory service.

C. I.F. Module Removal

This module should not, under any circumstances, be removed or adjusted!! Refer to factory service.

D. Meter Module Removal

1. Unsolder the AGC wire from the point indicated on the Meter Module Foil board layout (Fig. 6.7).
2. Disconnect the six plug connectors and note their location for future reconnection (See Fig. 6.22).
3. Remove four phillips head board mount screws (19) located in each corner.

E. Multiplex Module Removal

This module should not under any circumstances, be removed or adjusted!! Refer to factory service.

F. Power Supply Module Removal

1. Unsolder the five power transformer leads from the points indicated on the Power Supply Foil Board Layout (Fig. 6.13).
2. Disconnect the three plugs from the Control Multiplex and Meter Module which attach from the power Supply Module.
3. Remove the two screws (68) and nuts (20) from the regulators.
4. Remove the four phillips head board mount screws (19) from each corner.

G. Control Module Removal

1. Unsolder braided wire from the point indicated on the Control Module Foil Board Layout.
 2. Disconnect the eight connectors and note their location for future reconnection (See Fig. 22).
 3. Remove the four phillips head board mount screw (19) from each corner.
- Note:** After re-inserting the Control Module, several voltage adjustments must be made. See Section 7.7 for further details.

H. Display Module Removal

1. Disconnect the four plugs from the Control and Meter Module which attach from the Display Module. Note their location for future reconnection.
2. Remove the eight board mount nuts/washers (62).
3. Gently remove board.



I. Loop Filter Module Removal

1. The Loop Filter Module connects via J6, an eight pin plug-type connector, to the Control Module (P6). To remove the Loop Filter Module, apply pressure to the lower section of P6 and gently pull upward until the board is released.

J. Power Transformer Removal

1. Disconnect all wires leading from the power transformer to the Power Supply Module and the voltage terminal strip. Note their location for future reconnection.
2. Remove the two large phillips head mounting screws (22) and respective hardware (23, 24).
3. The transformer is now free and can be lifted out easily.

K. Pushbutton Switch Assembly Removal

1. Disconnect the 9 pin connector plug (17) from the Multiplex Module which is attached to the Switch Assembly.
2. Unsolder power switch wires from the fuse block and voltage terminal strip.
3. Remove the two allen-socket mounting screws (58) from each end of the assembly.

L. Touch Button Switch Assembly Replacement (64)

1. Disconnect each of the three mylar cable strips from their connections on the interface board (29). To do this, grasp both sides of the cable and gently pull outward, away from the connector.
2. Next, push firmly on the cable, toward the front panel enough to "push away" the touch switch assembly strip from the touch assembly casing.
3. Replacement is the opposite of above.

M. Rear Panel Component Removal

1. All component parts located on the rear panel can be replaced with relatively little effort (see exploded view drawing, Section 6). Should questions arise, contact the Crown Technical Service Department.

N. Component Parts Replacement

As previously mentioned, the FM1 is designed for easy access to all component parts. However, parts located on the Front End Module, I.F. Module and Multiplex module should not be changed due to the possibility of mis-aligning the unit's critical stages (certain IC chips may be excluded; see troubleshooting chart Section 7.8). On the remaining boards, standard circuit board repair procedures should be followed.

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

In order to complete a thorough checkout of the FM1, complex and costly test equipment is necessary. For this reason, electrical checkout should be limited to checking power supply voltages (see schematic 6.11) and to following the troubleshooting hints located in Section 7.8.

Several adjustments are necessary when specific boards are replaced:

1. Control Module replacement requires that with a frequency counter connected to the last I.F. stage (pin 5 of U103), C510 on the Control Module should be adjusted until 10.7MHz is registered.

Note: The station reference must be accurate for this adjustment to be meaningful.

7.8 FM1 Troubleshooting Hints

The key to effective troubleshooting in the FM1 is circuit familiarity. For this reason it is highly recommended Section 7.9 be studied before attempting any type of repair. The following hints refer to FM1 schematic/board diagrams located in Section 6 of this manual

Symptom	Possible Defect
Unit appears dead (Fuse F400 OK)	<ol style="list-style-type: none"> 1. Defective 5V bridge rectifier, Brdg. 401 2. Power transformer defective
Memory function inoperative; display erratic; program function fails; unit powers-up out-of-band	<ol style="list-style-type: none"> 1. Defective EAROM chip, U503
Digital control function inoperative; will not seek or scan properly	<ol style="list-style-type: none"> 1. Defective controller IC, U502 2. Defective touch switch package (see S. bulletin FM171000-7170031880)
Tuned frequency will not lock	<ol style="list-style-type: none"> 1. Defective detector stage; REFER TO FACTORY SERVICE
Station cannot be received or is highly distorted	<ol style="list-style-type: none"> 1. Defective IF amplifier stage; U100, U101, U102, U103 2. Any one of the .02 capacitors on IF module defective
Log scale meter does not track properly	<ol style="list-style-type: none"> 1. Defective controller IC, U502 2. Defective display module IC; U602, U603
Signal strength meter not responding correctly; station appears weak	<ol style="list-style-type: none"> 1. Signal strength meter driver defective; U600 2. DC amplifier U200B defective 3. IF amplifier IC's U100 or U101 defective 4. Q100 defective 5. Q200, Q201 defective
Multipath meter not responding correctly	<ol style="list-style-type: none"> 1. Multipath meter driver defective; U601 2. AC amplifier U200A defective 3. IF amplifier IC's U100, U101 defective 4. Q100 defective 5. Q200, Q201 defective
Frequency display problem	<ol style="list-style-type: none"> 1. Controller IC defective, U502 2. Defective segment driver, U501 3. Defective digit drivers; Q500, Q501, Q502, Q503 4. Defective LED display chip
Mute function problem	<ol style="list-style-type: none"> 1. U304A, U304B defective 2. D304, D305, D308, D309 open or shorted 3. Mute comparator IC defective; U201B 4. U201C, U201D defective

Note: do not replace the following IC chips: U300, U104



7.9 Detailed Circuit Theory

The following discussion refers to schematic diagrams MI-279A through MI-286A as well as the composite fold-out schematic located at the rear of this manual. The block diagram in Fig. 7.17 should also be used as additional aid in understanding the FM1 circuit trace-through.

A. Front End Stage

An external antenna connected (75 or 300 ohm cable) to the FM1 is responsible for supplying a signal path to the Front End Stage. This stage consists of six tuned circuits, two RF amplifiers, a mixer, local oscillator and buffer.

L-1 is the first tuned circuit which passes the signal to the initial RF amplifier (Q1). Q1 (as well as the second RF amplifier Q2) is a dual gate MOS-FET. Here the signal is amplified and propagated into a double-tuned network (L2 and L3). The purpose of using a double-tuned circuit is to provide increased selectivity and to eliminate any possible "second harmonics" that may have been produced as a result of RF amplification. This means that the input to the second RF amplifier (Q2) is essentially the same as the original input signal band, but amplified helping to reduce any subsequent noise contributions. After passing through the second RF amplifier, the signal is once again fed to another double-tuned circuit (L5 and L6) and then on to the mixer.

The mixer (Q3) is an N-channel Junction FET. Its purpose is to mix the "RF amplified" incoming signal with a signal which stems from the local oscillator (L8 and associated circuitry). This produces a sum and difference or "beat" signal between the two signals. Here it is desired that the resultant frequency be 10.7MHz (higher than the incoming signal) in order for it to be accepted (rather than rejected) by the upcoming IF Stages. It is interesting to note here that the local oscillator, as well as all of the tuned stages, are tuned by double varicaps (VD6, etc.). This provides a higher Q and thus, better selectivity and less signal loss.

Following the local oscillator is a buffer stage (Q4, Q5, etc.). It is inserted in between the local oscillator and the prescaler which is located on the Control Module. As any buffer, its purpose is to isolate. In this situation it minimizes any possible interaction between the oscillator and prescaler (harmonics, spurious signals, etc.).

Attached to the second RF amplifier, is the AGC line from the IF stage. For the moment simply take note that it is connected here. Its operation will be described shortly.

B. The IF Amplifier/Meter Module Stages

The IF stage is made up of four IF amplifiers, various filters and a high gain limiter/detector.

After receiving the signal from a double tuned 10.7MHz transformer on the front end (L7), the first IF amplifier (U100) amplifies the signal and passes it on to the first ceramic filter. At this point, any frequencies that are not 10.7MHz are removed from the signal. This occurs at each of the amplifier/filter combinations that follow (U101, U102, U103) including and up to the Surface Acoustic Wave filter. The SAW filter acts as the final IF filter and is incorporated here because of its extremely low distortion characteristics.

For the moment, refer back to the second ceramic filter which succeeds U101. Note that here, a portion of the 10.7MHz signal is buffered through Q100 and associated circuitry (on block diagram: IF AGC Buffer) and then detoured to the Meter Module where AGC and Signal Meter Drive circuitry co-exist. Here the signal is passed through the first AGC amp (Q200) and after, splits into two areas: one part to the second AGC amplifier (Q201) and another to the AGC signal detector circuitry (D205, D206, etc.) for the front end. This point is the AGC connection mentioned earlier which feeds the dual gate MOS FET (Q2) on the front end stage. Also occurring at this time, Q201 begins to saturate and is no longer able to produce higher levels of dc signal information at its output detector (D200 and D201), and therefore must call upon an additional detector (D207 and D208) to mix the overflow information (through R232) with the original from Q201. Together, these two detectors (D200/D201 and D207/D208) increase the dynamic range of the Signal Meter drive circuitry (DC amp U200B) which would otherwise, saturate the signal strength LED display and render it useless.

Returning once again to the IF Module, note that just as a portion of the 10.7MHz signal was fed to the meter module, likewise a portion is fed through the SAW filter to U104. This 16 pin chip serves several purposes, as indicated by the block diagram. Besides being a high gain limiter amp, it is also a quad detector, level detector (for Mute Threshold) and a deviation detector.

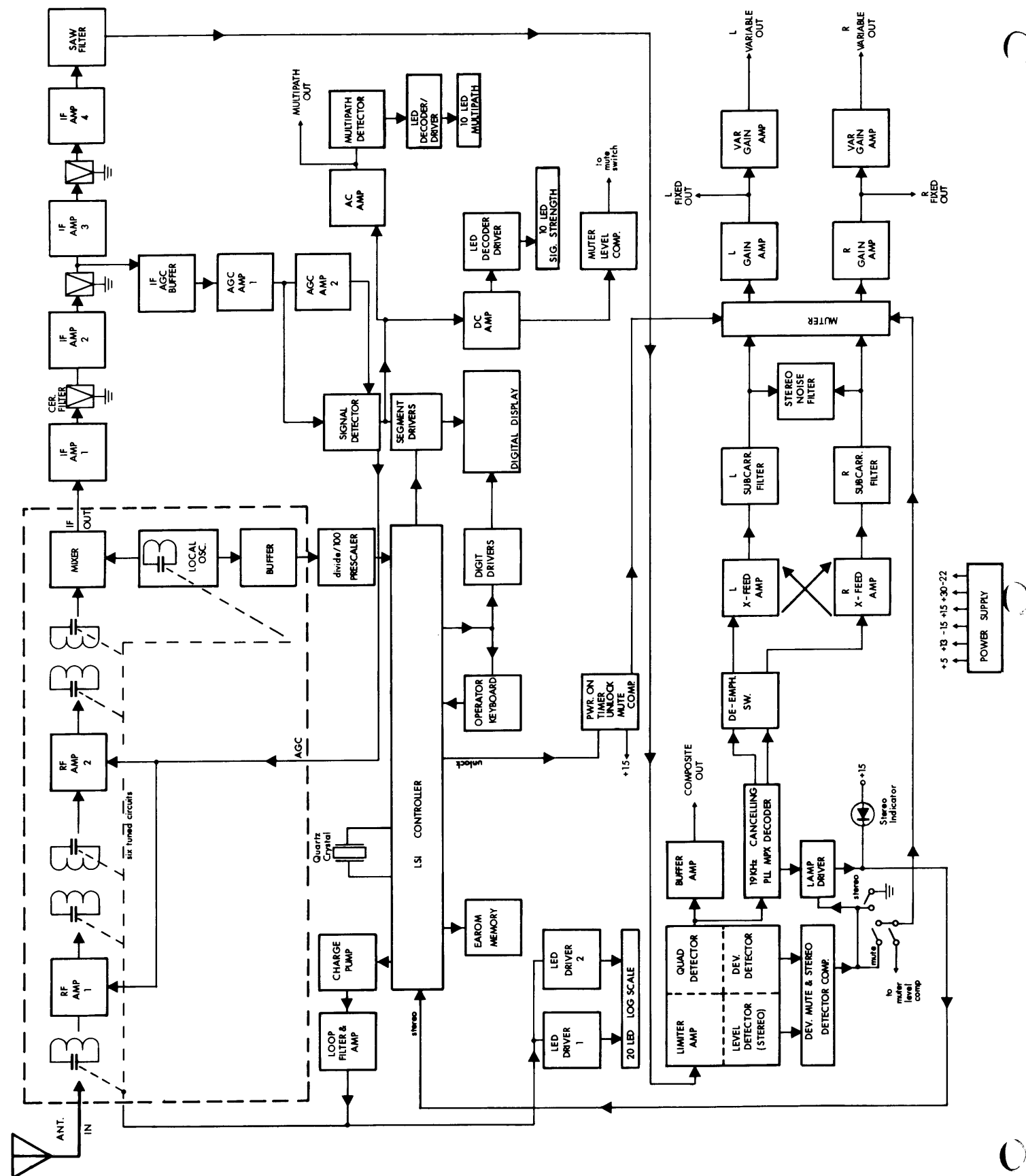


Fig. 7.17 FM1 Block Diagram

As a quadrature detector, U104 detects the change in phase of the signal across the double-tuned network, T100. This process helps insure improved linearity of the detector itself. At the output (pin 6), the signal is sent to a buffer amp (Q202 on Meter Module) for use with the Composite Test Point jack located on the rear panel of the unit. In addition, this same signal is fed to the 19KHz cancelling Phase Lock Loop MPX Decoder chip (U300 on the Multiplex Module) via U-201A, the Deviation, Mute and Stereo Detector comparator chip.

The combination hook-up of using the composite test point and multipath test point to an oscilloscope, allows the technician to observe the instantaneous frequency (Composite) vs the fluctuating signal strength (Multipath). As shown on the Meter Module schematic, multipath signal derivation is from U200A, R216, C213, etc. which is, for practical discussion, an AC amplifier. Also at the output of U200A, Multipath Meter signal drive is obtained, but not before being rectified into a DC voltage by detector D203/D204/C215.

U201B is the Mute Level Comparator that compares the level of DC signal information from U200B (DC Amplifier) to that which is selected by the rear panel Mute Level adjust control (R225). This circuit is sensitive with signals up to 1 millivolt. Also connected with the mute circuitry are U201C and U201D. U201C is a timing circuit which provides a short delay (or extends the mute interval) after a station is locked to ensure that all noise has dissipated before the audio may be heard. U201D also provides a delay. However with this circuit the mute level is extended for about 3 seconds upon turn-on of the unit.

C. The Controller Stage

The Controller stage is the "heart" of the FM1. Here all tuning commands are accepted and carried out. In addition, all other stages continuously report back to this stage (either directly or indirectly) for sophisticated monitoring capability.

The Prescaler (U500) was mentioned briefly in the discussion of the RF Stage, simply because of its connection directly (through a buffer) to the local oscillator. Because the frequency from the oscillator is too high for the Controller (U502) to accept, it is necessary to divide the signal down to a lower frequency. This is accomplished through the Prescaler which divides the signal by 100.

After the signal leaves the Prescaler, it is fed directly to the Controller Chip (pin 24). The Controller has the task of performing many duties, often simultaneously. The following paragraphs explain each of the functions as clearly as possible.

Pins 4 through 10 of U502 are seven control lines whereby signal commands are accepted from the front panel touch switches. K1 through K4 are outputs and K5 through K7 are inputs. An internal clock (pins 22 and 23) regulated by an external 2.6MHz crystal (X-TAL 500), continuously scans K1 through K4. These lines send out "enable" drive signals for the touch switches. At the same time, these identical lines are connected to the four digit drivers (Q500-Q503). They are enabled at the same time as K1 through K4 and thus utilize the same scanning approach, awaiting "enable" information from the controller chip.

For example, when K1 is signal "low" a Scan, Search or Stereo Search signal is received if the respective button is touched. If Scan is touched, the input K5 will go low in addition to K1. Likewise if Search or Stereo Search is touched K6 and K7 will go signal "low" respectively. Through the processing of these two input to output signals, the Control chip can calculate which button was touched, if any and at the same moment, supply drive for the proper digit section.

Pin 40 is the MR or Master Reset line. When the unit is turned on initially, the MR line will go logic high and automatically reset itself. In other words, the chip will execute a routine that will read a particular location in the Memory EAROM chip (U503). This location stores the last station frequency tuned, previous to turn-off. The next procedure, is then to identify that proper frequency and tune that frequency.

U502 identifies and tunes the proper frequency by making a comparison between the output of the Prescaler (pin 24) and its own internal reference. In order for proper frequency identification and for the mute function to be released (audio signal available), the proper frequency and phase relationship between these two signals, must be met. Should the phase signal be different, the Controller chip's internal phase detector will send out a pair of correction signals. One is a phase lead signal (pin 13) and the other is a phase lag (pin 12). These two signals are then sent on to U700 (LOOP FILTER MODULE). U700 is known as a charge pump (or electronic switch). Its function is to either pump "up" or "down" and thus regulate the frequency (as voltage) that is being tuned.

Notice that this tuning voltage (U701, pin 6) is fed to the front end module through J6 pin 1 to each of the six tuned circuits. This is how each section is kept on the proper tuning frequency.

Pins 27 through 33 (A-G) supply the display data necessary to illuminate the proper frequency readout on the display chip. U501 is the display chip segment driver. Fig. 7.18 shows segment breakdown.

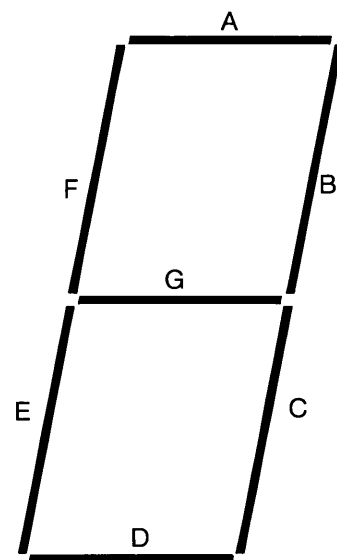


Fig. 7.18 Segment Breakdown

D. Display Module Stage

Signal LED Stick 600 and Multipath LED Stick 601 are connected so as to produce a bar display. This is achieved by wiring pin 9 of both U-600 and U-601 (decoder chips) to +5 volts. R603 and R604 serve as current limiting resistors determining how much current (and thus brightness) is delivered to the LED array. R600, R601, D601, and R602 make up a timing circuit which serves to slow down the meter response upon large input signals and thus prevents premature display saturation.

The twenty LED array (LED Stick 602 and 603) is driven as a dot display for an 88MHz-108MHz Log Scale display. R607 and R615 are voltage adjustments for both the bottom and top of the scale respectively. In addition, U602 and U603 are drivers for each of the upper and lower LED Stick array.

E. Multiplex Stage

On the Multiplex Module, U300 is the Stereo Multiplex Decoder chip and is of the phase-lock-loop pilot cancelling type. In order to decode a stereo signal, a 19KHz pilot must be transmitted with the signal as a phase reference.

This phase reference is then used to phase lock oscillator which produces a timing signal used in decoding a stereo signal. In addition, this same reference signal is used to produce a signal that is "counter-phased" to the 19KHz pilot itself. This is done so that later in the decoder chip, it can remix the pilot signal and cancel the 19KHz signal that would otherwise be produced at the FM1 audio output. This however, produces the need for filters at the output of the decoder chip (U300). U302 and U303 are these subcarrier filters and serve to reduce the unwanted frequencies which do appear at the output of U300.

Previous to this stage are the left and right channel cross-feed amplifiers U301A and U301B. They incorporate the circuitry that provide separation correction that could otherwise cause severe cross-talk problems.

U304C is an FET transmission gate switch used as a Stereo Noise Filter.

U304A and U304B are also FET transmission gate switches, but in this case used as Muters. D304, D305, D308 and D309 are used to prevent large signals from appearing across the FET's when they are open (muted). If these signals did appear, muting would not occur.

Gain amplifiers U305C and U305B are succeeded by voltage followers U305D and U305C. They are used to provide adjustable output levels accessible from the rear panel. However, standard fixed output jacks are also available as seen at the output lines of U305C and B.

7.10 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 chart/explanation as well as a world-wide voltage map is provided.

The FM1 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 cutters. Follow the drawing below.

1. Remove the bottom cover (see Section 7.5A).
2. With the unit top side down and the front panel toward you, locate the terminal strip on the right hand side.
3. Make the appropriate change in jumpers for the desired operating voltage. See Fig. 7.19.
4. Replace the 1/8 amp fuse with a 1/16 amp fuse for all connectors 200V and above.
5. Change the line cord tag to read the correct voltage.

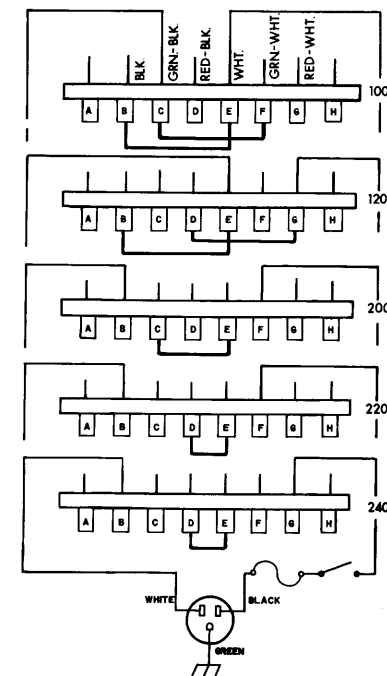


Fig. 7.19 Voltage Conversion Chart