ANTENNA FILTER RA6397A

TECHNICAL MANUAL

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RCI 84212

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FIGURE 1-1 ANTENNA FILTER UNIT

CHAPTER 1

INTRODUCTION

1-1 Scope

This part of the manual describes Antenna Filter Assembly, RA6397 and provides instructions for maintenance, direct and general support. Instructions are provided for the operator and repairman for installation, preventive maintenance, and replacement of parts. Due to simplicity of the circuit's functioning, a short function description is included. Also included are instructions appropriate to the various categories of maintenance for testing, aligning and repairing equipment, and replacing maintenance parts.

1-2 Description and Use

a. Antenna Filter Assembly RA6397 is designed for use with radio receiver RA6217 where manual antenna tuning is either impractical or undesirable. The sub-paragraphs below, with reference to main assembly schematic (DWG. G02057) provide a brief yet comprehensive circuit description.

b. The Antenna Filter Assembly consists of 21 separate filters (modules A102 through A122), 19 filters are approximately 1MHz in bandwidth and cover the range 1-20 MHz. The remaining two filters (A121-A122) are each approximately 5 MHz in bandwidth and cover the range 20-30 MHz.

c. Input signals from the Antenna pass into J102, W102 through closed relay contacts, the selected Filter Modules (A102-A122) and out W101, J101 to the Receiver.

d. Relay contacts are normally open at the input and output of each module. The selected module relays close when the proper selection control voltage is applied from the receiver to J201. Negative reference voltage is applied to one of pins H through T. Even number relays K102-142 are inputs, and odd numbers K101-141 are outputs.

e. Diodes CR140 and odd numbers CR101-139 are induction suppressors that provide a current path when selection voltage is removed. CR141-150 and even numbers CR102-138 insure activation of only the filter module selected.

f. Capacitors C101-106 are RF bypass filters.

g. Line filters C201, L201, C202 through C225, C226 are used to suppress noise that would enter on the control lines.

1-3. Technical Characteristics

Frequency range	1-30MHz, in 1 MHz intervals to 20MHz, and 5MHz intervals to 30 MHz
Input/Output Impedance	75 ohms nominal
Insertion loss (measured at center frequency	3dB nominal
Passband ripple	±1.0 dB Nominal
Shape factor -3 dB to -30 dB	1:2 or better
Switching	a. by reed relay at input/output of each filter. b. by application of a negative 12-16 volts DC supply voltage to one of three control lines (A,B, or C) and a ground connection to one of ten control lines (H through T). I.,O and Q are not used
Power required	12 volts DC, approximately 22 mA
Environmental conditions	a. Operating: 0 to 55°C b. Storage: 40 to 70° C
Dimensions	19" side by 1 3/4" high by 16" deep
Weight	8 pounds approximately

1-4 Module Selection and Frequencies

The following is not supplied as part of the RA6397 but is required for operation:

a. Receiver RA6217

b. Selection Control voltages applied to J201 are selected by a thirty position switch on the Receiver: Selection logic is shown in Table 1-1.

FILTER SELECTION LOGIC TABLE 1-1

MHZ	J201 TERMINALS													FILTER MODULES
	A	B	C	H	J	K	L	M	N	P	R	S	T	
1	-				x									A102
2	-					x								A103
3	-						x							A104
4	-							x						A105
5	-								x					A106
6	-									x				A107
7	-										x			A108
8	-											x		A109
9	-												x	A110
10		-		x										A111
11		-			x									A112
12		-				x								A113
13		-					x							A114
14		-						x						A115
15		-							x					A116
16		-								x				A117
17		-									x			A118
18		-										x		A119
19		-											x	A120
20			-	x										A121
21			-		x									A121
22			-			x								A121
23			-				x							A121
24			-					x						A121
25			-						x					1222
26			-							x				A122
27			-								x			A122
28			-									x		A122
29			-										x	A122

Module selection logic key

MHz (frequency)	Receiver dial reading
Terminal	pins J201
Filter Modules	activated module
-	-DC volts applied
x	Ground applied

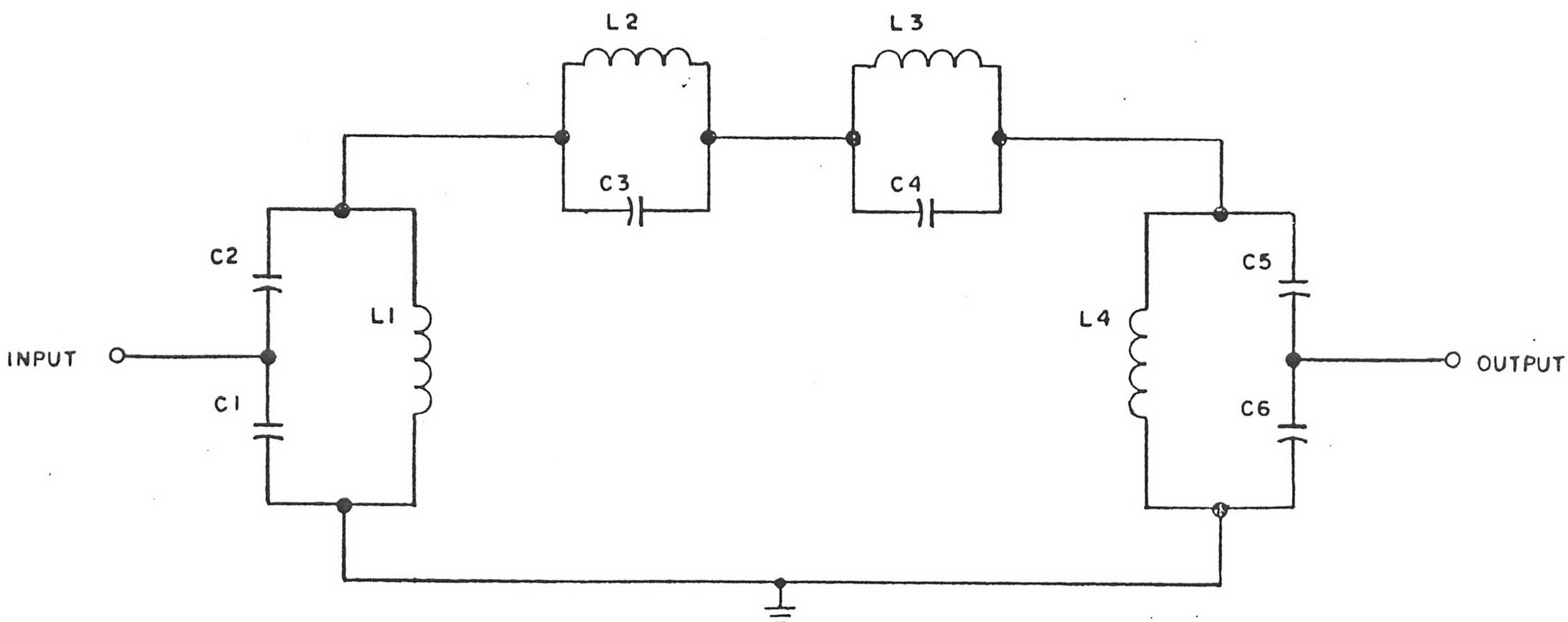
C. Filter Modules A102-A122 are similar except that component value on respective modules differ according to the module's assigned frequency. Module circuits are designed for interactions that give flat passband response with 30 dB attenuation outside the passband. Filters C4, L3, andC3, L2 are tuned above and below the passband center to establish passband end limits. The input and output circuits are tuned to the mean center frequency of the passband. The input (C1, L1) and output C5, C6, L4) circuit values on each module are matched to maintain an input/output impedance of 75 ohms. See fig. 1-2 and Table 1-2.

TABLE 1-2. MODULE COMPONENT VALUES (Ref. Figure 1-2)

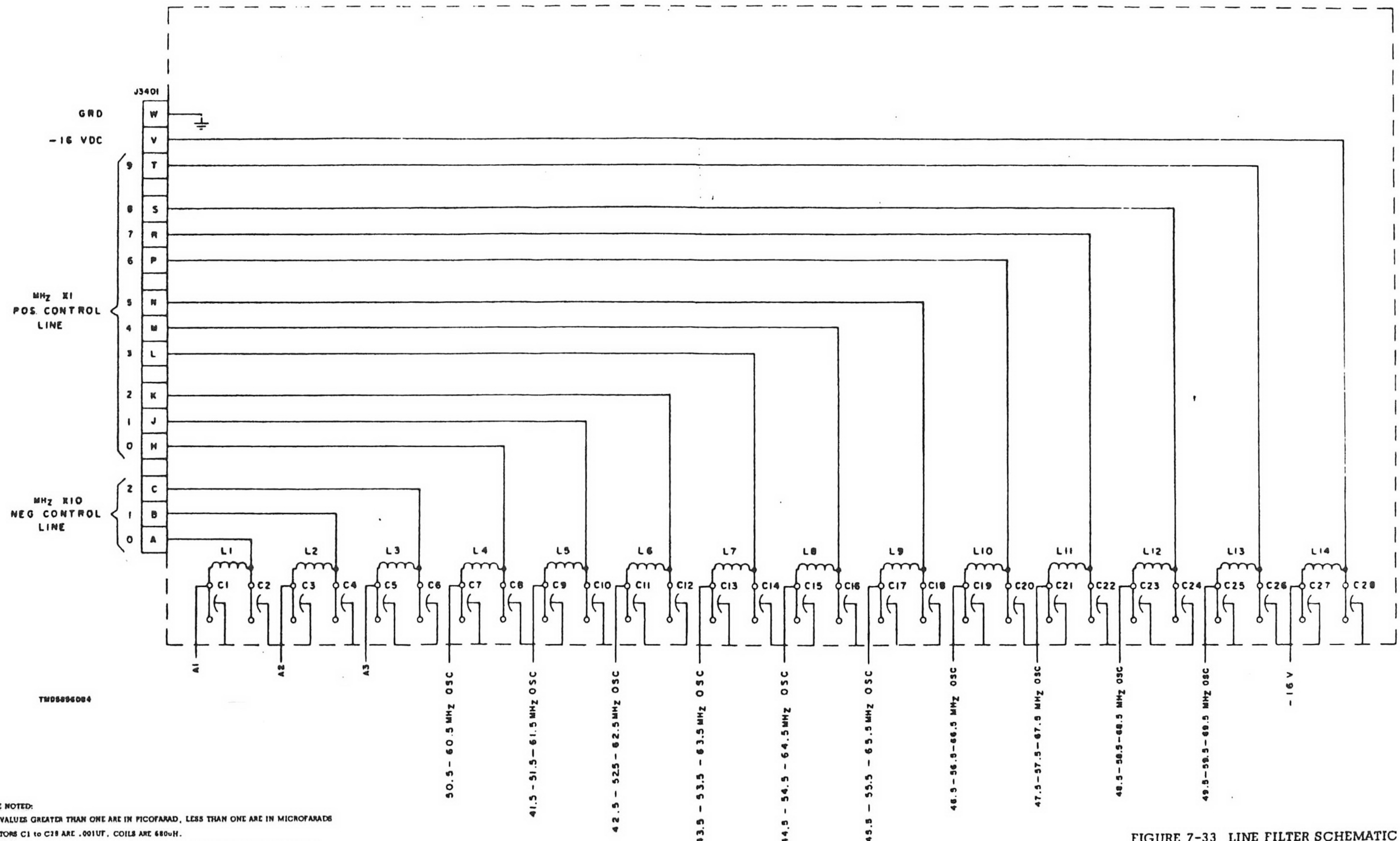
MODULE NUMBER	FREQUENCY MHz	CAPACITORS, PF C 1	C 2	C 3	C 4	C 5	C 6	COILS, UH L 1	L 2	L 3	L 4
A-102	1 - 2	1300	910	390	75	910	1300	22.	120.	33	22
A-103	2 - 3	910	390	120	47	390	910	15.	100.	33	15
A-104	3 - 4	910	390	100	50	390	910	10.	47.	22	10
A-105	4 - 5	910	390	91	56	390	910	4.7	33.	15	4.7
A-106	5 - 6	910	390	91	51	390	910	3.3	15.	10.	3.3
A-107	6 - 7	910	390	82	56	390	910	2.2	10.	6.8	2.2
A-108	7 - 8	910	390	62	56	390	910	1.5	10.	6.8	1.5
A-109	8 - 9	910	390	75	56	390	910	1.5	6.8	4.7	1.5
A-110	9 - 10	910	390	75	56	390	910	1.0	4.7	3.3	1.0
A-111	10 - 11	910	390	75	56	390	910	.68	4.7	3.3	.68
A-112	11 - 12	910	390	75	62	390	910	.68	3.3	2.2	.68
A-113	12 - 13	910	390	75	62	390	910	.68	3.3	2.2	.68
A-114	13 - 14	910	390	75	62	390	910	.47	2.2	2.2	.47
A-115	14 - 15	910	390	75	62	390	910	.47	2.2	1.5	.47
A-116	15 - 16	910	390	75	62	390	910	.47	2.2	1.5	.47
A-117	16 - 17	910	390	75	62	390	910	.33	1.5	1.0	.33
A-118	17 - 18	910	390	68	62	390	910	.33	1.5	1.0	.33
A-119	18 - 19	910	390	75	62	390	910	.33	1.5	1.0	.33
A-120	19 - 20	910	390	68	56	390	910	.27	1.0	1.0	.27
A-121	20 - 25	200	82	20	12	82	200	1.0	4.7	2.2	1.0
A-122	25 - 30	200	82	18	12	82	200	.47	2.2	1.5	.47

All capacitors are fixed mica,
values in pf, 2 percent

All coils are values in UH



ANTENNA FILTER MODULE, SCHEMATIC
FIGURE 1-2



UNLESS OTHERWISE NOTED:

1. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARAD, LESS THAN ONE ARE IN MICROFARADS
2. ALL CAPACITORS C1 to C28 ARE .001UF. COILS ARE 680uH.
3. COMPONENT-PART REFERENCE DESIGNATIONS ARE ABBREVIATED: COMBINE COMPONENT PART DESIGNATION WITH SERIES NO. (3400). EXAMPLE: L1 IS L3401: C12 IS C3412: ETC.

FIGURE 7-33 LINE FILTER SCHEMATIC
(SERIES 3400)

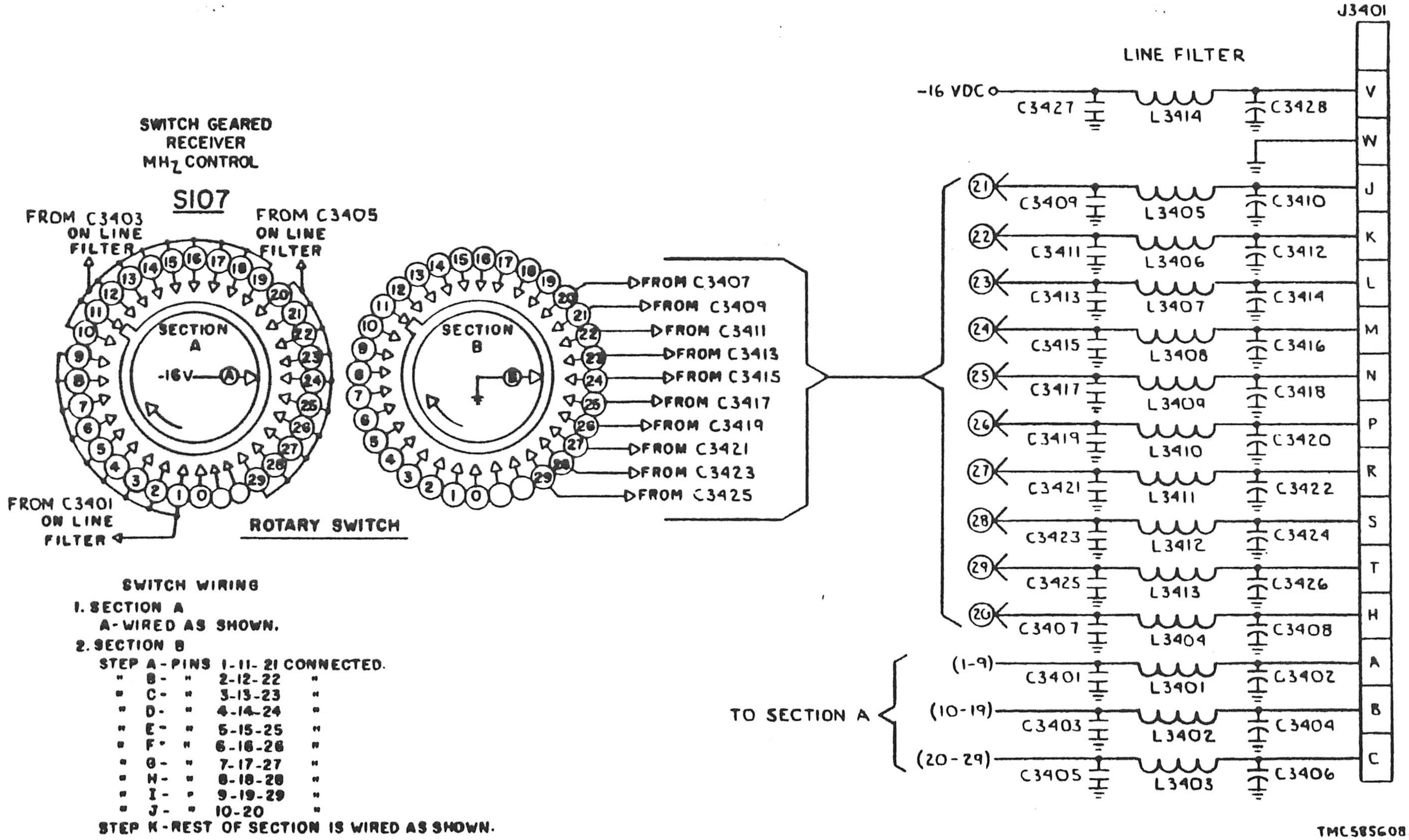


FIGURE 7-32 ANTENNA FILTER CONTROL DIAGRAM

CHAPTER 2

INSTALLATION

2.1. Unpacking and Checking Equipment

Unpacking the equipment, a careful examination should be made for any signs of damage. Mounting holes are provided in the front panel for mounting the unit either in a standard 19" rack or suitable cabinet. Adequate ventilation must be provided to prevent the operating temperature exceeding 55°C. All power and RF connections are on the rear panel of the equipment.

2.2. Mounting Requirements

The RA6397 is normally used as part of a system. Instruction for installing the antenna filter unit for fixed and mobile use are listed in a and b below.

a. Fixed Installation: To install the antenna filter unit in a standard rack, remove one of the blank panels from the rack or cabinet and install the antenna filter unit. Secure the front panel of antenna filter unit to the rack or cabinet with bolts removed from the blank panel. Insert bolts in the elongated holes along vertical edges of antenna filter unit front panel, and secure bolts in place.

b. Mobile Installation: When antenna filter unit is installed in a cabinet or rack for mobile operation, the cabinet must be securely bolted to vehicle body. Allow enough room for access to back panel connections and for removal of antenna filter unit for servicing.

2-3. Cable Connections

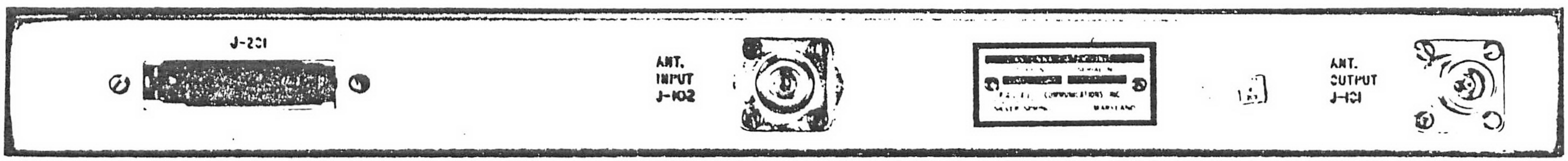
General: Cable connections that are necessary for normal use of the antenna filter unit are listed in (A) through (C) below. All connectors are mounted on the rear panel.

(A) Antenna input:
Connect cable plug from antenna to antenna input Jack (J-102).

(B) Antenna output:
Connect signal cable from receiver to antenna filter unit (J-101).

(C) 20 position connector assembly:
Mate selection control cable connector (P-201) with receiver mate (J-3401).

RA6397A



ANTENNA FILTER UNIT, REAR PANEL
FIGURE 2-1

CHAPTER 3

OPERATOR'S MAINTENANCE INSTRUCTIONS

3-1. Scope of Operator's Maintenance

The following is a list of maintenance duties normally performed by the operator of RA6397. These procedures do not require special tools or equipment.

a. Preventive maintenance (para 3-2)

b. Cleaning (para 3-3)

c. Operator's preventive maintenance checks and services (para 3-4)

3-2 Preventive Maintenance

The Antenna Filter Unit normally requires cleaning and visual checks (for burnt or corroded components) to ensure an indefinite service-life. This low maintenance requirement is primarily due to the absence of moving parts and the use of extremely low voltages. There are no external controls therefore alignment becomes necessary only when parts are replaced. Periodic checks should be made to ensure that selection of the correct Filter Module and proper outputs are available. Chapter 4 outlines test procedures to check proper input and outputs; table 1-1 illustrates the correct filter selection sequences.

3-3. Cleaning

a. Remove dust and other loose dirt from the exterior surface and front panel with clean cloth. Dampen cloth with water and mild soap to make cleaning more effective.

b. Remove grease, fungus, and ground-in dirt with a cloth dampened (not wet) with cleaning compound.

c. Remove dust and other dirt from plugs and sockets with a soft bristle brush.

WARNING - Prolonged breathing of cleaning compound is dangerous; make certain that adequate ventilation is provided. Cleaning compound is flammable; do not use near a flame. Avoid contact with skin; wash off any that spills on the skin.

3-4. Operator's Preventive Maintenace Checks and Services

Sequence No.	Item to be inspected	Procedures	References
1	Exterior surface	Clean antenna filter unit panel, and cables	Para 3-3
2	Mounting	Tighten loose nuts or bolts. Replace missing hardware as required.	
3	Intercabling and connectors	Check all interconnecting cables and connectors for cracks and breaks	Para 2-3

CHAPTER 4

TEST AND ALIGNMENT PROCEDURES

4-1 General

Under normal conditions, the Antenna filter Unit RA6397 will maintain the factory alignment over a long period of time, consequently, any other causes of trouble should be eliminated before realignment is undertaken. If realignment becomes necessary only minor adjustments should be necessary.

4-2 Test Equipment Required

The test equipments required to align and test the Filter Unit are listed in the chart below.

EQUIPMENT		COMMON NAME
Hewlett Packard	HP120B	Oscilloscope
Telonic	SM2000	Sweep Generator
Jerrold Model 5100 (or equal)		Log. Amplifier
75 ohm Matching Pad		75 ohm Matching Pad
22 ohm Matching Pad		22 ohm Matching Pad

4-3 Control Set Up

a. Sweep Generator
   (1) Power Switch --On
   (2) RF Attenuators to OdB
   (3) Markers -- 1-MHz
   (4) Sweep to correspond with C.R.O.
   (5) RF Function - sweep, sweep rate - to line
   (6) Monitor - RF 1

b. Oscilloscope

(1) Power Switch - On
(2) Horizontal -- Vernier to 1 volt/cm
(3) Vertical -- Vernier to 10mv/cm

c. Logarithmic Amplifier

(1) Expand -- OFF
(2) Meter - ON - set to midscale
(3) Range - Linear

d. Receiver, RA6217E (R1555)

(1) Power - ON
(2) Set receiver to required frequency

4-4. Test Procedure

To perform test procedure, set equipment up as shown in fig. 4-1.

(1) Connect Receiver to Filter Unit J201.

(2) Connect 75 ohm matching pad to Rf 1 output on sweep generator.

(3) Connect 75 ohm co-axial cable from 75 ohm matching pad to J102 on Filter Unit.

(4) Connect 22 ohm matching resistor on Log. Amp. input.

(5) Connect 75 ohm co-axial cable from 22 ohm matching resistor on Log. Amp. to Filter Unit J101.

(6) Connect 75 ohm cable from video output on Log. Amp. to marker adder input on sweep generator.

(7) Connect marker adder output jack of sweep generator to vertical input of oscilloscope.

(8) Connect horizontal output from sweep generator to horizontal input of oscilloscope.

(9) Set Receiver to 1-MHz.

(10) Switch 1MHz marker on sweep generator to On, adjust sweep generator variable marker to 1.5 MHz. A trace should be apparent on scope with markers every 1-MHz. Adjust marker level output for a convenient level.

(11) Adjust sweep control in conjunction with sweep width so the 1-MHz, 1.5 MHz, and 2 MHz markers occupy approxi-

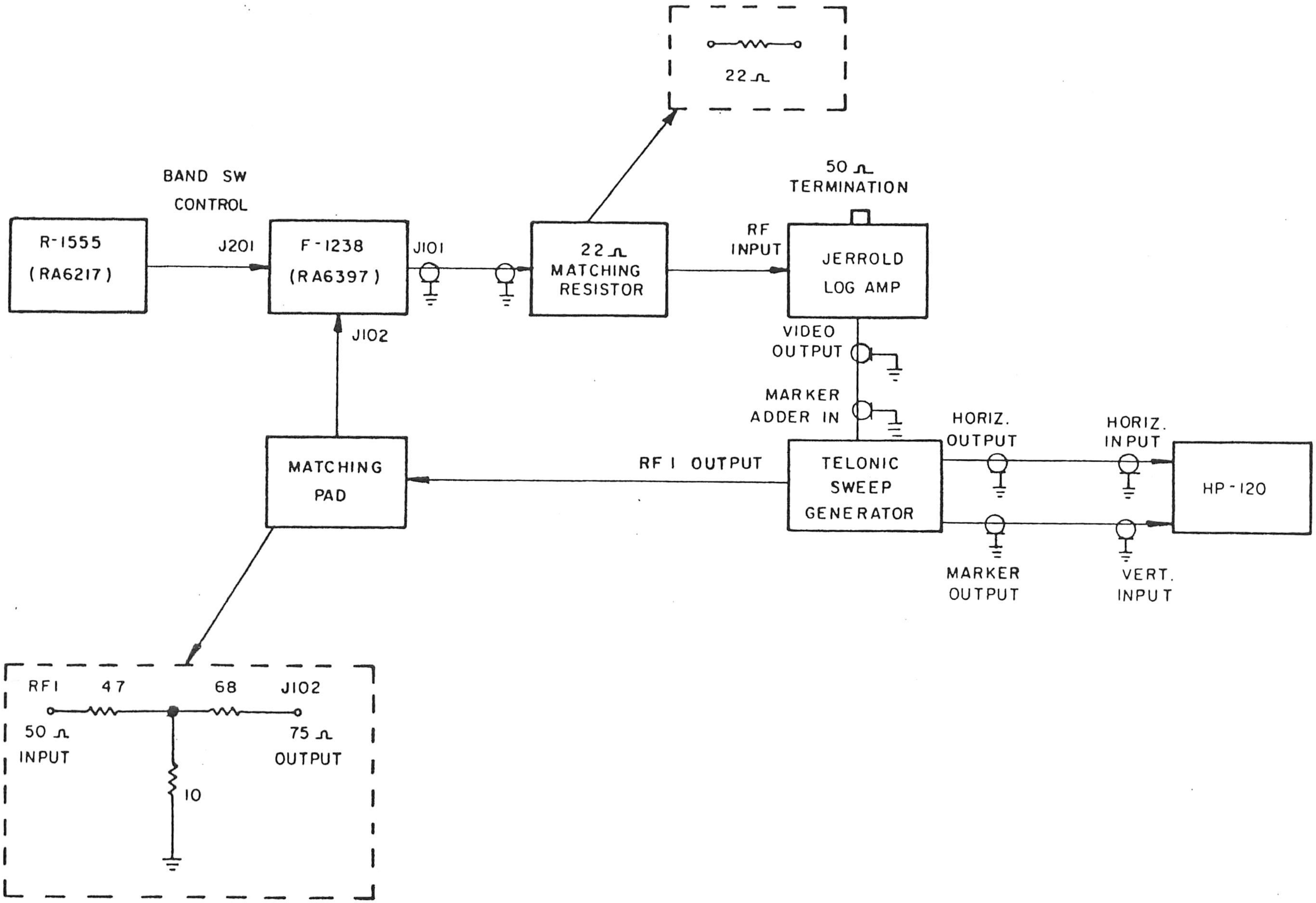


FIG.4-1 TEST BLOCK DIAGRAM

TEST BLOCK DIAGRAM
DWG NO. CO3911

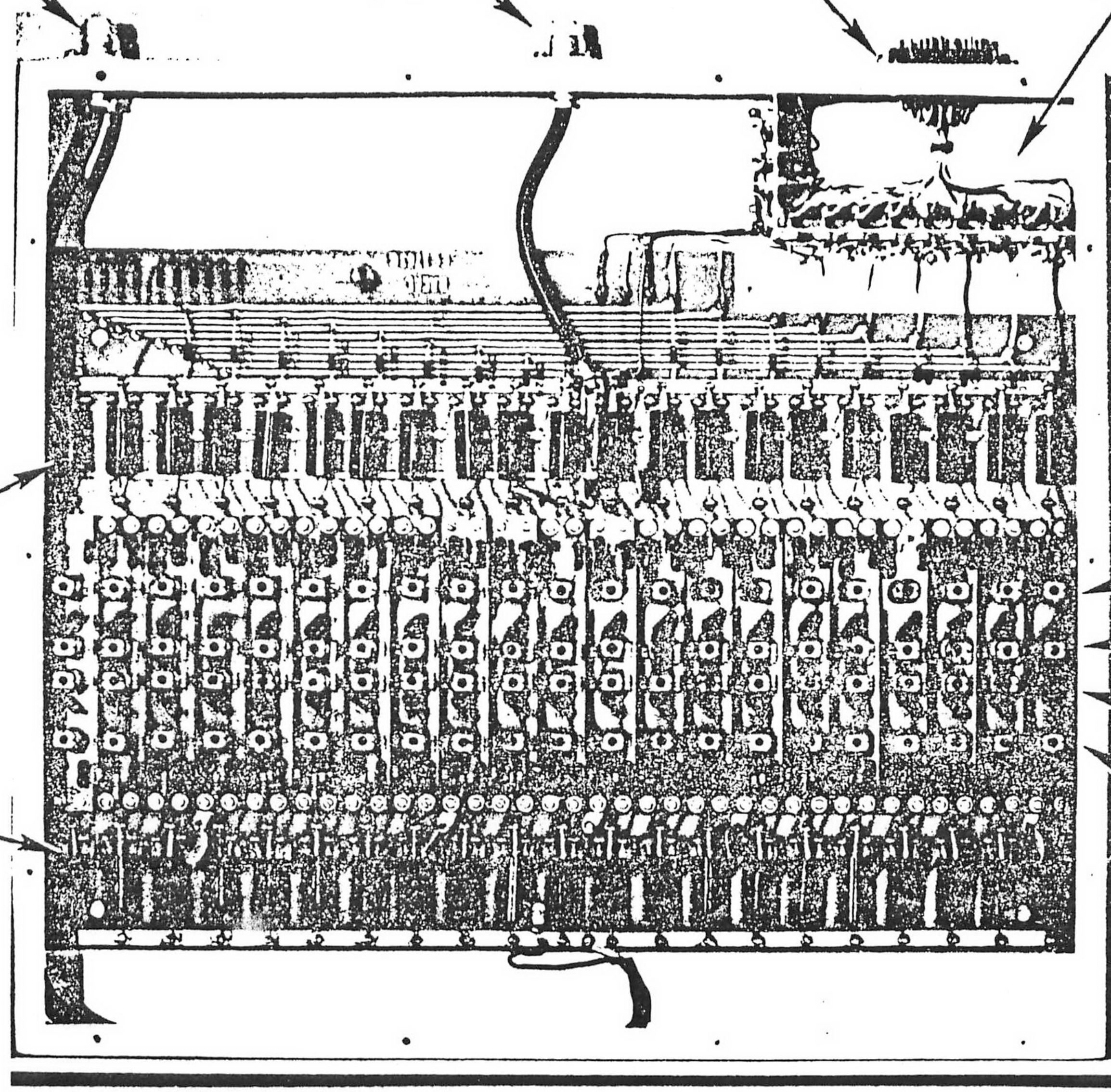


FIGURE 4-2 ANTENNA FILTER ALIGNMENT PARTS LOCATION

mately one-third of the face of the oscilloscope centered at 1.5 MHz.

(12) Adjust the amplitude control of Log. Amp. for convenient level of deflection on oscilloscope.

4-5. Alignment Procedures

(1) Adjust coils L1 and L4 for maximum at center frequency.

(2) Adjust coil L2 for maximum at lower pass-band frequency.

(3) Adjust coil L3 for maximum at upper pass-band frequency.

(4) Using vertical gain control, adjust trace for ten lines of deflection on oscilloscope. Check attenuator setting on sweep generator. Also check where minimum point of passband occurs on oscilloscope. Increasing the attenuator in 1dB steps, set maximum point of passband at minimum point previously noted. The difference in attenuator readings is the ripple of filter. This value shall be less than 2.5dB within the filter passband.

(5) Adjust level of attenuator so that trace occupies 7 lines of scope deflection. Check attenuator setting of sweep generator. Disconnect cable from antenna input J102 on Filter Unit and connect to 22 ohm resistor at log. amplifier. Increase attenuator in dB steps until trace returns to reference (7 lines of oscilloscope deflection). The difference in attenuator readings is the insertion loss of the filter. This value shall be less than 4.5dB for frequencies below 15 MHz and 3dB above 20 MHz. For frequencies between 15 and 20 MHz shall be less than 6dB.

4-6. Measurement of 30 dB Bandwidth

(1) Connect equipment as shown in Figure 4-1.

(2) Set output of sweep generator for 10 lines of deflection with Log amplifier on 30 dB Log. range.

(3) Increase attenuation 30 dB and note level displayed on oscilloscope.

(4) Return attenuator to original setting.

(5) Tune variable marker to level noted in step (3) on both sides of trace and note frequency. Difference in frequency is 30 dB B.W. The bandwidth shall be less than 2.7MHz in the 1-20MHz range and 12.0 MHz in the 20-30 MHz range.

4-7. Measurement of Ultimate Attenuation

(1) Set equipment up as shown in Fig. 4-1, adjust attenuator on sweep generator for 10 lines of deflection.

(2) Set Log. amplifier on 30 dB Log. range, note maximum point of rebound on trace.

(3) Increase attenuator until trace falls to reference noted in Step (2). The difference in attenuator settings from Steps (1) and (3) plus insertion loss previously measured is the ultimate attenuation of the filter. This attenuation should be greater than 30 dB.

CHAPTER 5

SHIPMENT AND LIMITED STORAGE

5-1 Introduction

This chapter contains information and procedures for preparation of the Antenna Filter Unit, for shipment and limited storage. Included in this chapter is the packing diagram. (Fig. 5-1)

5-2 Shipment

a. Position and tape corrugated blocks at the corners of the Antenna Filter Unit.

b. Coil and tape the electrical cord to the rear of the panel unit.

c. Insert and seal unit in dust cover.

d. Place rubberized cushions in rear of inner corrugated carton.

e. Insert and seal unit in corrugated carton.

f. Place rubberized cushion in bottom of outer corrugated carton.

g. Place unit container in outer corrugated carton.

h. Insert rubberized cushion spacers around corrugated carton.

i. Seal outer corrugated carton.

5-3 Limited Storage

a. Follow procedure outlined in paragraph 5-2, Steps a. through 3.

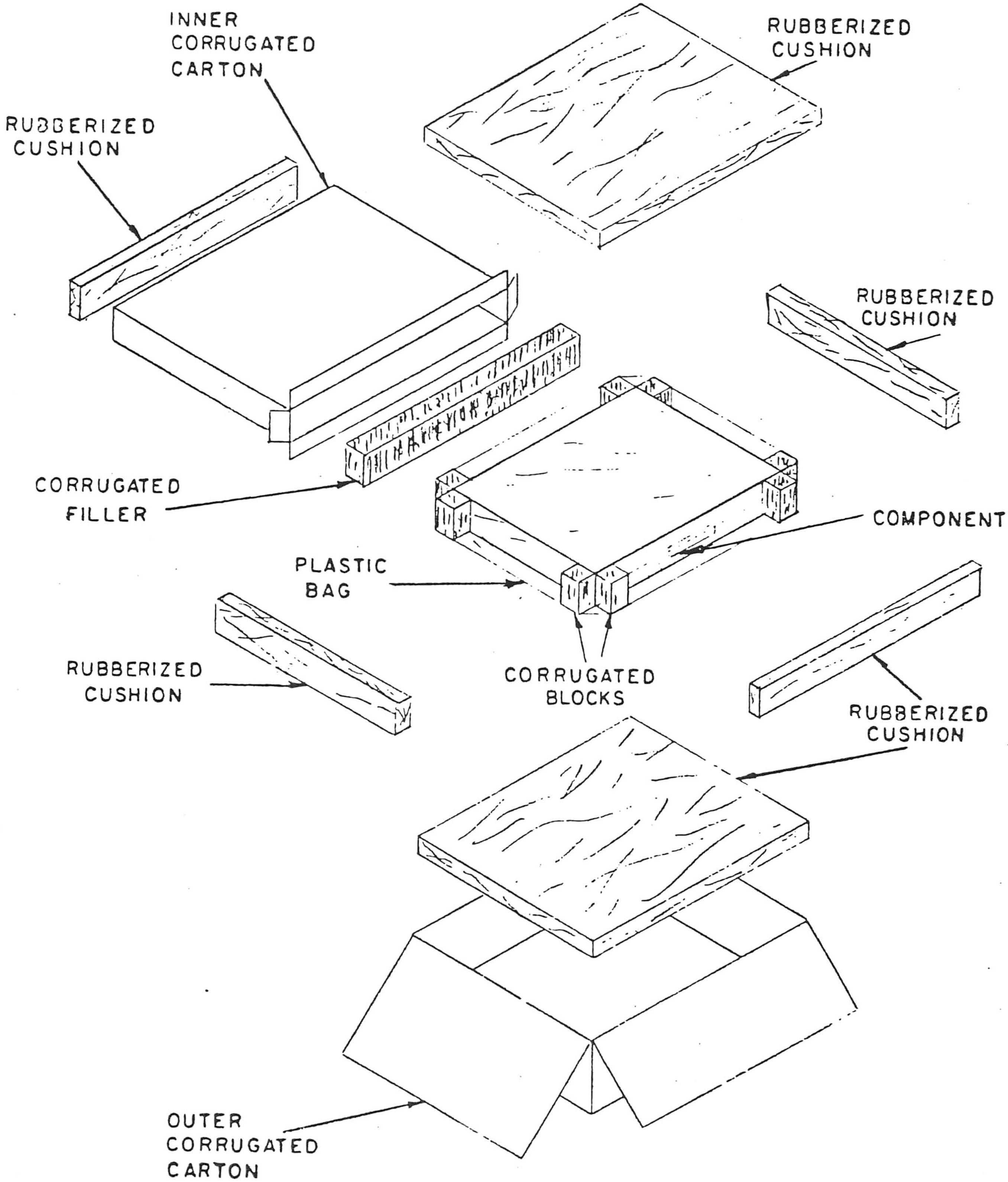


FIGURE 5-1 PACKAGING DIAGRAM

CHAPTER 6

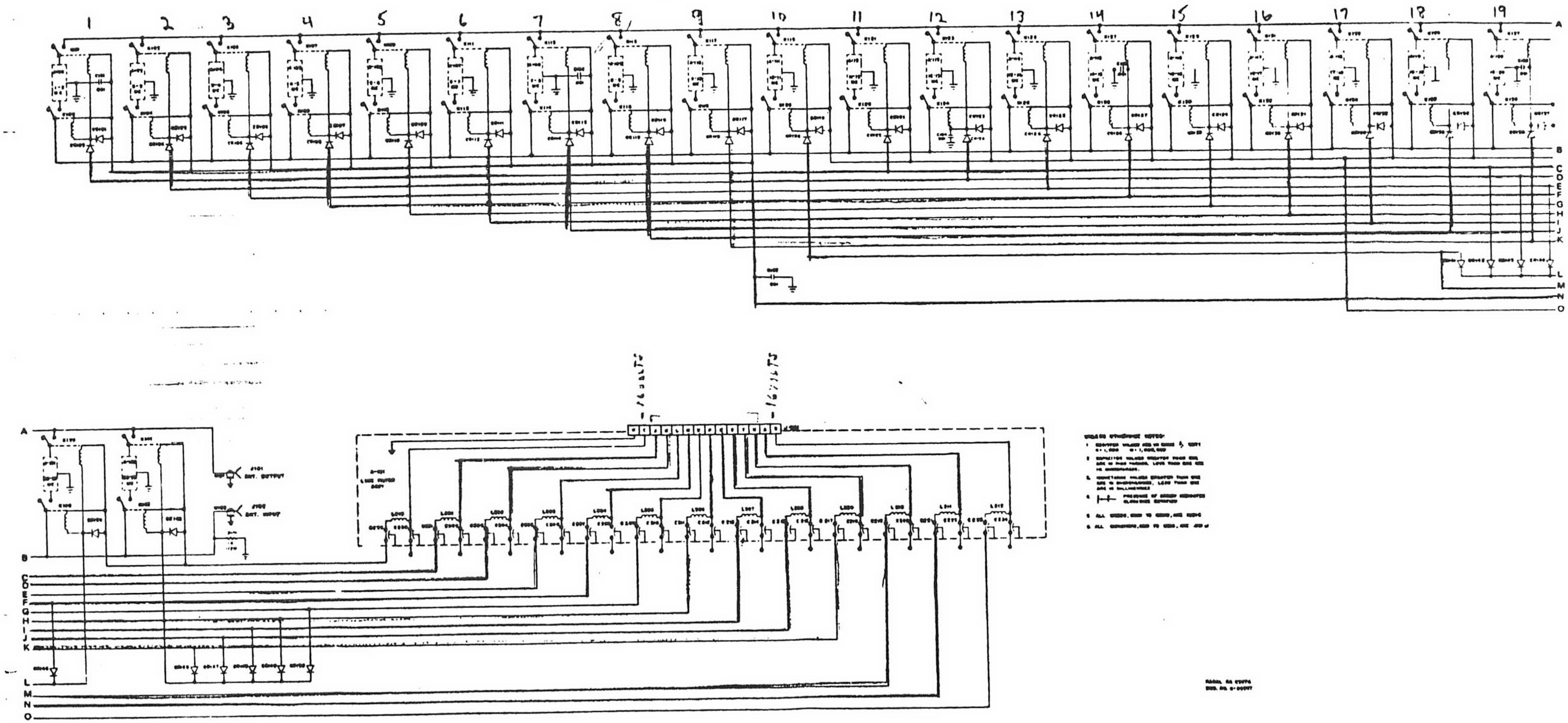
PARTS LIST

(Ref. Sch. GO 2057)

Ckt Ref.	Description	Value	Tol %	Rating	Mfr. Part No. and/o Mil Type Desig.
Main Chassis Assembly					
R101	Resistor, carbon	1K	10%	1/2	RC20GF102K RCI 1132
C101 thru C106	Capacitor, Ceramic	.001 uf	10%		Centralab, CE-10: RCI 21712
K101 thru K142	Relay, Reed				Dunco MRR-1A RCI 51802
CR101 thru CR150	Diode				IN916 RCI 35514
J101	Connector, coax, UG-593A/U, W101				60011
J102	Same as J101				
J201	Connector, 20-pin				A02900-2
A-101 Line Filter Assembly					
C-201 thru C-226	Capacitor feed-thru	1000 pf		500 VDC	Allen Bradley FAS5C-102W RCI 26402
L-201 thru L-213	Coil, choke	1mH		680 mA	Miller #9220.20 RCI 43011
A102 thru A122	Filter Board Assembly				RCI, A01822 thru RCI, A01842
W101	Cable Assy, RF, 75-ohm				D10580-45
W102	Cable Assy, RF, 75-ohm				D10580-44

Twenty-one filter modules (A102 through A122) have the same configuration. Only component values change, thus a single breakdown is provided for these modules with a table showing individual component values. All capacitors are CMO types and the inductors are manufactured by Nytronics under VIV part numbers. (Ref. Figure 1-2)

Ckt. Ref.	Description	Value	Tol %	Rating	Mfr. Part No. and/ or Mil Type Desig.
A102	Filter Board Assembly (1-2 Mc/s)				RCI, A01822
C1	Capacitor, Mica	1300 pf	2%	300 V	CMO 6F132G03 RCI 22132
C2	Capacitor, Mica	910 pf	2%	300 V	CMO 6F911G03 RCI 22122
C3	Capacitor, Mica	390 pf	2%	300 V	CMO 5F391G03 RCI 22105
C4	Capacitor, Mica	75 pf	2%	300 V	CMO 5E750G03 RCI 22125
C5	Capacitor, Mica	910 pf	2%	300 V	CMO 6F911G03 RCI 22122
C6	Capacitor, Mica	1300 pf	2%	300 V	CMO 6F132G03 RCI 22132
L1	Inductor	22 uH			Nytronics VIV RCI 47015
L2	Inductor	120 uH			Nytronics VIV RCI 47038
L3	Inductor	33 uH			Nytronics VIV RCI 47016
L4	Inductor	22 uH			Nytronics VIV RCI 47015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