NAVSHIPS 900,613

INSTRUCTION BOOK

for

FREQUENCY SHIFT RECEIVER CONVERTER EQUIPMENT NAVY MODEL FRA

RCA VICTOR DIVISION, RADIO CORPORATION OF AMERICA
Camden, New Jersey

NAVY DEPARTMENT **BUREAU OF SHIPS**

Contract N5sr 7266 *Approved 8 January 1946*

LIST OF EFFECTIVE PAGES

PAGE NUMBERS	CHANGE IN EFFECT	PAGE NUMBERS	CHANGE IN EFFECT
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ADDRESS NAVY DEPARTMENT,
BUREAU OF SHIPS

Section 993-100
REFER TO FILE NO.

NAVY DEPARTMENT
BUREAU OF SHIPS
WASHINGTON 25, D. C.

4 December 1945

To: All Activities concerned with the Installation, Operation and Maintenance of the Subject Equipment.

Subj: Instruction Book for Frequency Shift Receiver Converter Equipment, Navy Model FRA (NAVSHIPS 900,613).

1. NAVSHIPS 900,613 is the instruction book for the subject equipment and is in effect upon receipt.

2. When superseded by a later edition, this publication shall be destroyed.

3. Extracts from this publication may be made to facilitate the preparation of other Navy instruction books and handbooks.

4. Copies of this publication may be obtained from the nearest Electronics Officer.

E. L. COCHRANE
Chief of Bureau

FROM BUREAU OF SHIPS, NAVY DEPARTMENT, WASHINGTON 25, D. C.

RECORD OF CORRECTIONS MADE

CHANGE NO.	DATE	SIGNATURE OF OFFICER MAKING CORRECTION

E R R A T A

Page 2-3 Fig. 2-5, Discriminator.
Add Capacitor C120, 20 mmf. plate to plate of V104.

Page 3-1 Add Para. 1 - h as follows:
h - Remove equipment from case as described in Section 3. Para 4-a-b. Remove coupling kit components and connecting plugs and cables which are packed in cardboard containers. Remove 4 bolts holding wooden mounting skids from chassis mounting tray and discard skids and bolts.

Page 7-11-12 Fig. 7-5 Schematic Diagram.
J203 should be shown as a closed circuit jack.
Add Capacitor C120, 20 mmf. plate to plate of V104.

Page 7-13-14 Fig. 7-6 Voltage and Resistance Chart.
Socket X103. Valves shown for Pin #5 should be for Pin #8
" " " " #8 " " " " #5

Socket X210 Pin #1 should read Pin #6
" #2 " " " #7
" #3 " " " #8
" #4 " " " #1
" #5 " " " #2
" #6 " " " #3
" #7 " " " #4
" #8 " " " #5

Page 7-15-16 Fig. 7-7 Wiring Diagram I.F. Chassis.
Add Capacitor C120 from Pin #5 to Pin #3 of X104

Page 8-5 Item 15, Resistor, R108, Tolerance should be ± 10%.
JAN type no. should be RC10BE151K.
Mfr's. designation should be RC10BE151K.
Contractor's part no. should be 722302-52.

Page 8-12 Item 49, Wrench, H202. This wrench is not supplied in spares but is included with equipment.

ADD Item 104 used in I.F. chassis. CAPACITOR: fixed, ceramic, 20 mmf. ± 10% uninsulated, temperature compensating -750 parts/M/°C dimensions .460" x .240" dia. two pigtail terminal leads.
Capacitor, tuning T104.
JAN type no. CC30UJ200K.
Manufacturer's part no. CC30UJ200K.
Contractor's part no. 722423-417
Symbol designation, C120.
Total no. per equipment, 1.
Quantity, Equip. -1, Tender -1, Stock -1.

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GUARANTEE

The Contractor guarantees that at the time of delivery thereof the articles provided for under this contract will be free from any defects in material or workmanship and will conform to the requirements of this contract. Except as to vacuum tubes, batteries, rubber and material normally consumed in operation, the equipment, including all spare parts, is guaranteed for a period of one (1) year from the date of its delivery to and acceptance by the Government, with the understanding that all items found to be defective as to material, workmanship or manufacture will be repaired or replaced, f.o.b. any point within the continental limits of the United States designated by the Government, without delay and at no expense to the Government; provided, that such guarantee shall not obligate the Contractor to repair or replace any such defective items unless the defect appears within the aforementioned period and the Contractor is notified thereof in writing within a reasonable time and unless the defect is not the result of normal expected shelf life deterioration. This guarantee shall then continue as to corrected or replacing articles or, if only parts of such articles are corrected or replaced, to such corrected or replacing parts, until one year after the date of redelivery.

INSTALLATION RECORD

Contract: N5sr 7266 Dated: 12 June 1945

Serial number of equipment _____

Date of Acceptance by the Navy _____

Date of delivery to contract destination _____

Date of completion of installation _____

Date placed in Service _____

Blank spaces in this table shall be filled in at the time of installation. Operating personnel shall also mark the "Date placed in Service" on the date of acceptance plate located below the model nameplate on the equipment, using suitable methods and care to avoid damaging the equipment.

REPORT OF FAILURE

Report of failure of any part of this equipment during its service life shall be made to the Bureau of Ships using form Navships (NBS) 383 (revised) in accordance with current instructions. The report shall cover all details of the failure and give the date of installation of the equipment. For procedure in reporting failures see Chapter 67 of the "Bureau of Ships Manual" or superseding instructions.

ORDERING PARTS

All requests or requisitions for replacement material should include the following data:

1. Navy stock number or, when ordering from a Marine Corps or Army Signal Corps Depot, the Signal Corps stock number.
2. Name and short description of part.

If the appropriate stock number is not available, the following shall be specified:

1. Equipment model or type designations, circuit symbol and item number.
2. Name of part and complete description.
3. Manufacturer's designation.
4. Contractor's drawing and part number.
5. JAN or Navy type number.

SAFETY

THE ATTENTION OF OFFICERS AND OPERATING PERSONNEL IS DIRECTED TO CHAPTER 67 OF BUREAU OF SHIPS MANUAL OR SUPERSEDING INSTRUCTIONS ON THE SUBJECT OF "RADIO SAFETY PRECAUTIONS TO BE OBSERVED".

This equipment employs voltages which are dangerous and may be fatal if contacted by operating personnel. Extreme caution should be exercised when working with the equipment.

RESUSCITATION

AN APPROVED POSTER ILLUSTRATING THE RULES FOR RESUSCITATION BY THE PRONE PRESSURE METHOD SHALL BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR OR SONAR ENCLOSURE. POSTERS MAY BE OBTAINED UPON REQUEST TO THE BUREAU OF MEDICINE AND SURGERY.

Frequency Shift Receiver Converting Equipment, Navy Model FRA

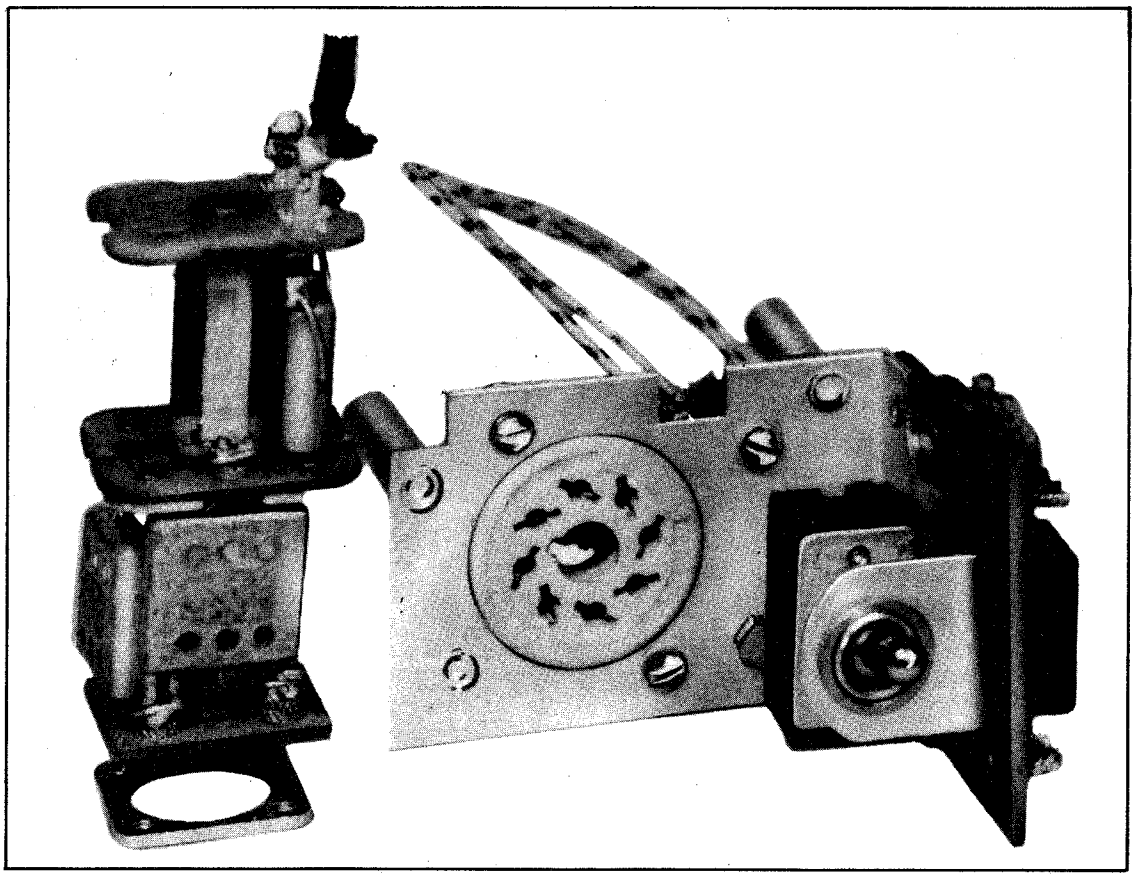
SECTION 1
GENERAL DESCRIPTION

1. PURPOSE

The Navy Model FRA Frequency Shift Receiver Converter Equipment has been designed to permit the reception of frequency shift telegraph signals on receivers such as the Navy Model RBB/RBC or other similar types. It is capable of converting these signals as received by the receivers into polar or neutral d.c. signals suitable for the operation of teleprinters or other suitable recording devices. Keyed tone output is also supplied when required. Frequency shift transmission differs from "on-off" keying insomuch as in the former the transition from "mark" to "space" pulses is achieved by shifting the carrier a small amount in frequency, instead of turning it on and off as in the latter. This shift in frequency may be of any magnitude from 100 (±50) cycles to 1000 (±500) cycles although at present 850 (±425) cycles is the most commonly used. When the higher values of shift are used (above 500 cycles) 200 cycles phase modulation up to 1 radian is sometimes superimposed on the regular frequency shift signal.

2. GENERAL OPERATION

The general operation of the Model FRA Converter is as follows. The I.F. signal from the receiver is fed through a coupling adapter to the converter, where it is amplified, limited by a locked oscillator used as a limiter and detected in a discriminator. The audio pulses thus obtained are passed through locking circuits which amplify them to the point where they are suitable for the operation of teleprinters and similar recording devices. Tone output is also obtained simultaneously with the d.c. output. Features of this Converter are a very high degree of limiting due to the locked oscillator, variable selectivity provided by the type of coupling to the locked oscillator, freedom from drift troubles due to the absence of direct coupled stages following the discriminator, operation at various degrees of shift and keying speeds and removable I.F. chassis to facilitate changing to a new I.F. frequency when using different type receivers.



Coupling Kit Navy Type CRV-10563

3. COUPLING KIT

The Coupling Kit type CRV-10563 is intended to adapt any RBB/RBC series of Radio Receiving Equipment for use with an FRA Frequency Shift Receiver Converter. When installed in a Model RBB/RBC Radio Receiver as described in this book, the coupling kit provides a means for feeding signals to the Model FRA Frequency Shift Converter. The kit has been designed for field installation. The Coupling Kit consists of two sub-assemblies, a cathode follower assembly, and a low pass filter unit, together with the necessary mounting accessories and cables. When properly installed, the circuits are such as to prevent interaction between the receiver and the converter and to minimize interference from local transmitters. The low pass filter is designed to pass the receiver intermediate frequency (400 k.c., ± 100 k.c.) with minimum attenuation.

4. QUICK REFERENCE DATA

a. Nomenclature ---------- Navy Model FRA
b. Contract No. and Date------ N5sr 7266, 12 June 1945
c. Contractor---------- RCA Victor Division
Radio Corporation of America
Camden, N.J., U.S.A.
d. Cognizant Naval
Inspector----- Resident Inspector of Naval Material
Front and Cooper Streets
Camden, N.J., U.S.A.
e. Number of packages in Complete Shipment------ two
f. Total Cubical Contents Crated---------- 18.1 cu. ft.
Uncrated---------- 6.4 cu. ft.
g. Total Weight Crated---------- 335 lbs.
Uncrated---------- 175 lbs.
h. Intermediate Frequency---------- 400 kc.
i. Polar Direct Current Output-------- 25 milliamperes
j. Neutral Direct Current Output------ 60 milliamperes
k. Direct Current Load Impedance---- 130 to 1800 ohms
l. Tone Output (1000 cycles)---------- 24 milliwatts
m. Tone Output Impedance---------- 600 ohms
n. Power Supply------ 110, 115, 120 volts 60 cycle A.C. single phase
o. Power Input---------- 135 watts
p. Squelch Circuit Characteristics------ With no carrier applied for a period of 200 milliseconds the output shall revert to "mark" output.

5. EQUIPMENT SUPPLIED

a. OVERALL DIMENSIONS.

QUANTITY PER EQUIP.	NAME OF UNIT	NAVY TYPE DESIGNATION	HEIGHT Inches	LENGTH Inches	WIDTH Inches	VOLUME (Cu. Ft.)	WEIGHT (pounds)
1	Frequency Shift Converter	CRV-35122	11¾	19¾	18¼	2.45	98
1	Coupling Kit consisting of						
	Cathode Follower Assembly	CRV-10563	4	3	2	.014	0.3
	Low Pass Filter Unit		3½	1⅜	1⅜	.004	0.25
	Miscellaneous Accessories		—	—	—	—	0.45
1	A.C. Power Plug	CRV-49125	1¾	3¼	1¾	.004	0.35
1	Output Plug	AN 3106-14S-5P	1	2¼	1	.001	0.15

b. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

QUANTITY PER EQUIPMENT	NAME OF UNIT	NAVY DESIGNATION	REQUIRED CHARACTERISTICS
As Required	Radio Receiving Equipment	RBB or RBC	400 kilocycle I.F. Frequency

c. SHIPPING DATA.

SHIPPING BOX NO.	NAME AND DESIGNATION OF CONTENTS	OVERALL DIMENSIONS			VOLUME (cu. ft.)	HEIGHT (lbs.)
		Height	Width	Length		
1	Frequency Shift Receiver Converter Navy Model FRA	18½	24¾	26½	7.02	155
2	Equipment Spare Parts Box	22½	25	31	10.09	180

6. TUBE COMPLEMENT

NAME OF UNIT	6H6	6J5	6SA7	6SG7	6SJ7	6L6GA	6AB7	5Y3GT/G	VR75/043	VR150/ODE	TOTAL
I.F. Chassis	1		1	1	1						4
Main Chassis		1			5	2		3	1	4	16
Coupling Kit							1				1
Total	1	1	1	1	6	2	1	3	1	4	21

SECTION II
THEORY OF OPERATION

1. I. F. AMPLIFIER

The intermediate frequency signal from the receiver is obtained from the Coupling Kit Navy type CRV-10563 which is fully described in paragraph 11 of this section. This signal is fed into the converter through J204 to the primary of T101 which is matched to the output impedance of the coupling adaptor. This signal is stepped up through T101 and applied to the grid of V101 which functions as a straight I.F. amplifier. This tube operates with fixed bias supplied by cathode resistor R101 and screen voltage supplied through R102.

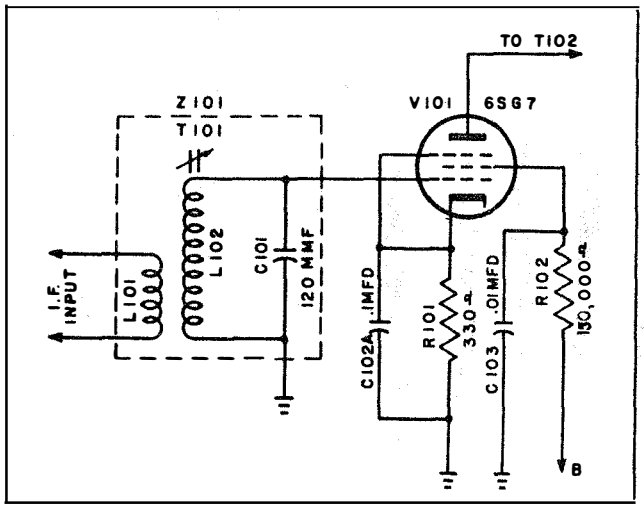


Fig. 2-2 I. F. Amplifier

2. LIMITER

T102 is a single tuned coil which supplies the plate load for the I.F. amplifier. The signal is coupled to the grid of the limiter V102 through C105. This tube limits by virtue of the fact that R104 in series with the grid self-biases the tube beyond cut-off, limiting the negative swing, and the positive swing is limited by saturation occurring due to the low screen voltage applied through R106.

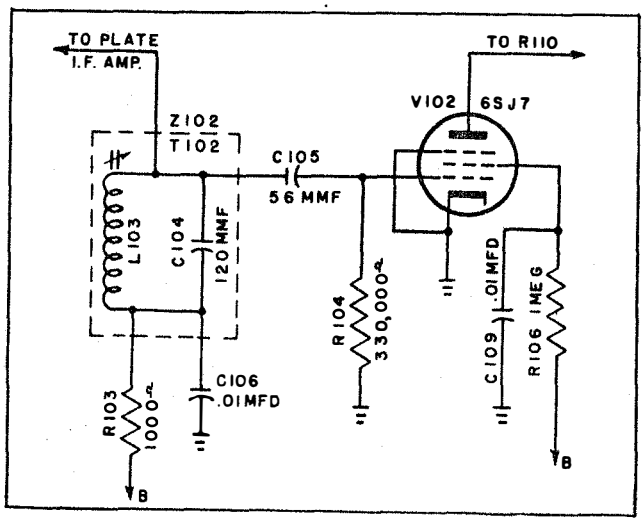


Fig. 2-3 Limiter

3. LOCKED OSCILLATOR

The plate of the limiter V102 is fed through the filter resistor R107 and the plate load resistors R109 and R110 in series. The No. 1 grid of the locked oscillator V103 is connected through C110 to the junction of the voltage divider R109 and R110. These two resistors comprise the plate load of the limiter and consequently due to the limiting action have a constant I.F. Voltage developed across them. Only a portion of the output voltage of V102 can be applied to the grid of the succeeding stage, the actual amount being selected by the selectivity switch S101, which shunts R108 across R109 in the narrow position, thus reducing the amount of I.F. voltage applied to the No. 1 grid of V103. This controls the selectivity of the system for the following reason. The range over which a locked oscillator will synchronize with the incoming signal is determined by the characteristics of the oscillator and the magnitude of the applied signal. Consequently, since the characteristics of the oscillator are constant, the lock-in range is controlled only by the magnitude of the signal applied to the No. 1 grid. Furthermore, since the output of the limiter is constant regardless of signal strength, tapping down on the plate load of the limiter to obtain different input signals to V103 through C110 effectively controls the selectivity since any signal outside the lock-in range of the oscillator produces no output. The normal screen grid of the 6SA7 is used as the oscillator plate which is electron coupled to the plate of the tube from whence the output is derived.

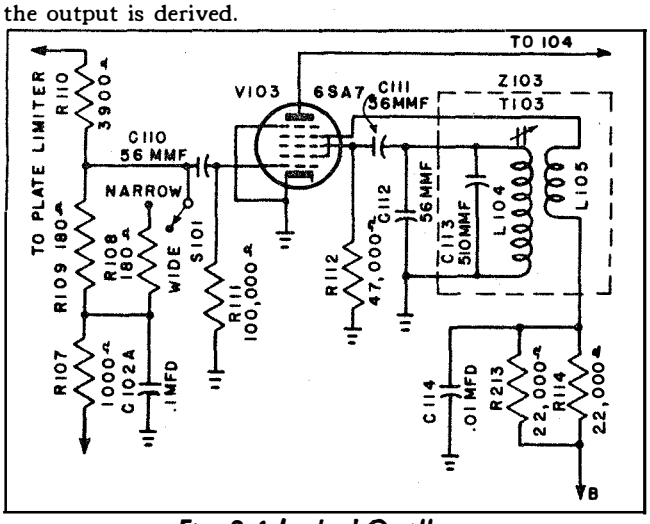


Fig. 2-4 Locked Oscillator

4. DISCRIMINATOR

The output of the locked oscillator is fed to T104 which is the discriminator transformer. The two diode sections of the 6H6 Tube V104 operate as shunt rectifiers causing the rectified voltage of each diode to appear across R116 and R117 respectively. The D.C. path between R116 and R117 is completed through L107. Due to the connections and phase relationships existing in T104 D.C. voltages are developed across R116 and R117 which are equal and opposite when the applied signal is at the resonance point of the transformer and consequently the D.C. output voltage across C119 is zero. When the signal shifts from the centre of resonance of the transformer these two voltages

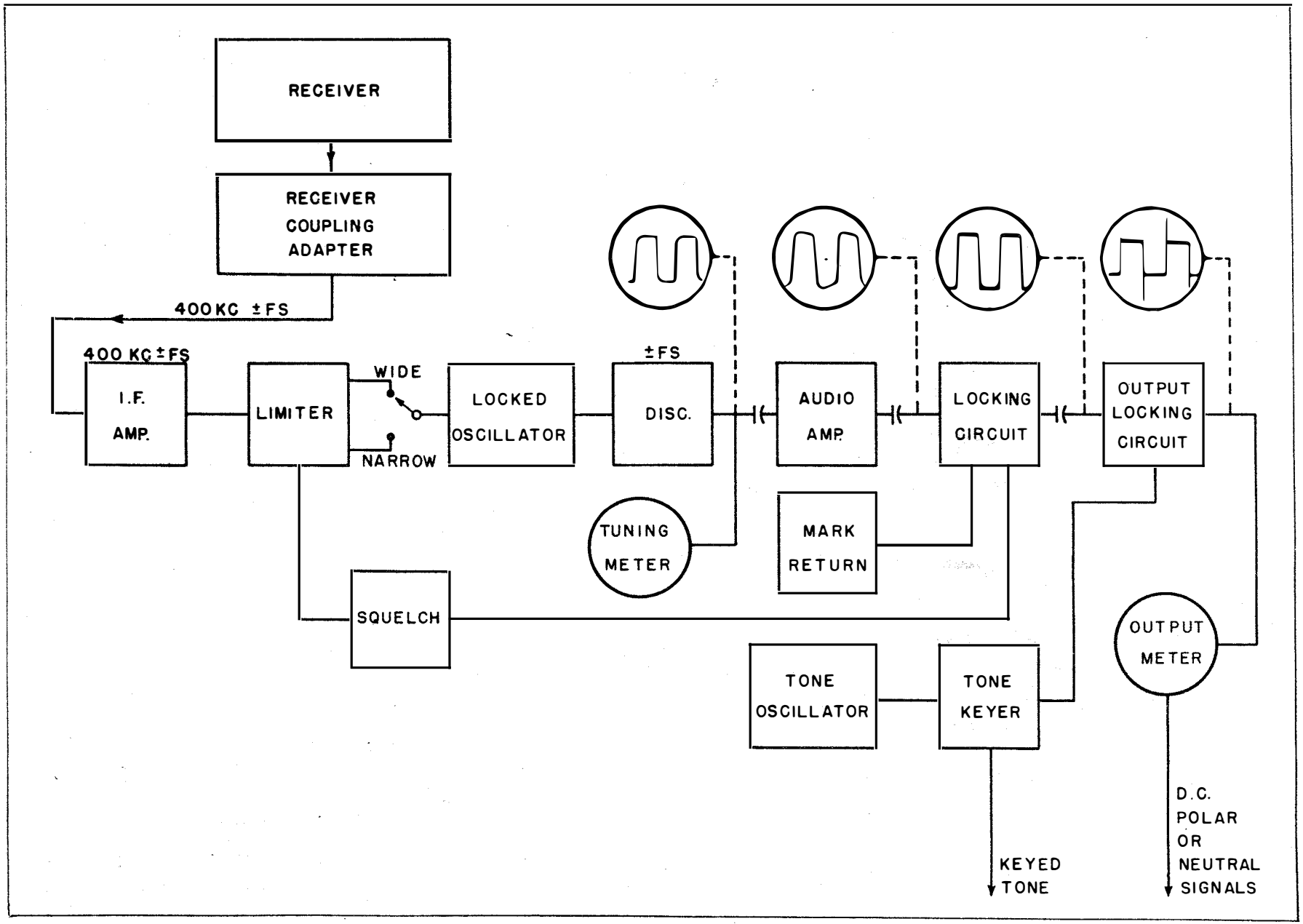


Fig. 2-1 Functional Block Diagram

change in magnitude and the difference voltage appears across C119. Thus the frequency variations of the signal are changed to amplitude variations which exactly correspond to the rate and amount of frequency shift of the original signal. S102 is a reversing switch which reverses the sense or polarity of the output signal with respect to ground as required. A tuning meter M202 connected in series with R201 serves as a high resistance voltmeter to indicate when the signal is centered about zero on the discriminator curve.

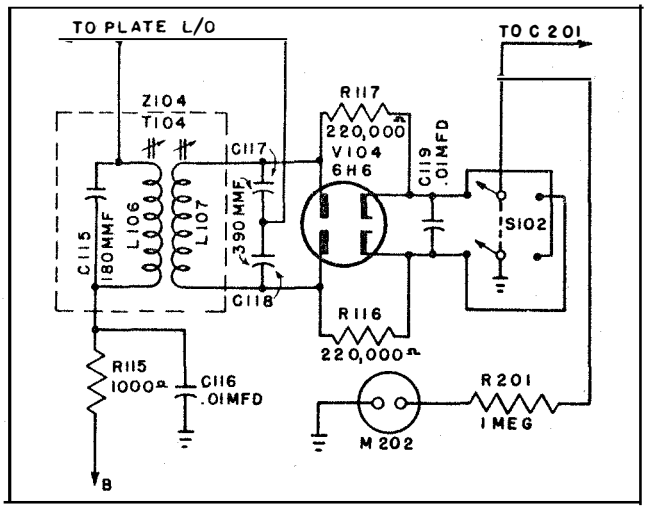


Fig. 2-5 Discriminator

5. AUDIO AMPLIFIER

The signal, pulsating at audio frequency, is fed to the audio amplifier V201. It is coupled through C201 which isolates the D.C. and also has an important bearing on the operation of the system, since it allows the signal to drift up and down the linear part of the discriminator curve without destroying the sense or polarity of the signal. Thus the amount of drift that can be tolerated is limited only by the I.F. selectivity of the system. A low pass filter consisting of L201 and C202-3-4 is connected in the plate circuit of this tube with a switch S201 to switch it in and out of the circuit as required. The filter removes the high frequency noise components from the signal. The cut-off frequency of this filter is approx. 200 cycles, consequently it is desirable to cut it out of the circuit when it is desired to receive high speed signals greater than about 250 words per minute.

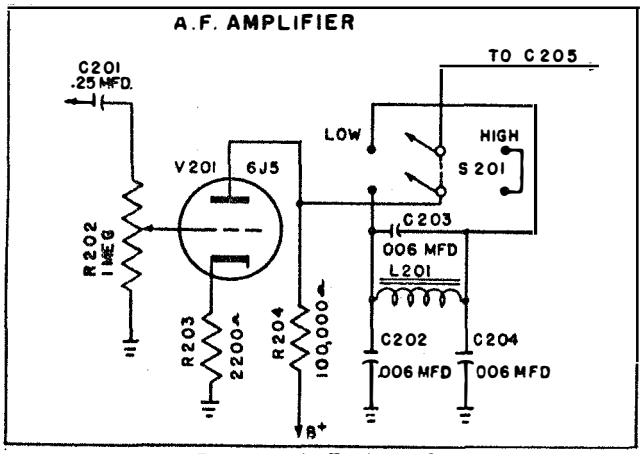


Fig. 2-6 A. F. Amplifier

6. FIRST LOCKING CIRCUIT

In order to make it possible to hold long "mark" or "space" pulses until a pulse of the opposite polarity is received, such as might be the case in facsimile or similar services, a locking circuit is introduced at this point. This consists of two 6SJ7 tubes V202 and V203 which function as follows. Each tube has its screen grid cross connected to the plate of the opposite tube. Therefore if the driven tube V202 is caused to conduct by a positive pulse applied to its grid through C205 the plate current through its plate load resistor R207 will reduce the plate voltage to a low value. This low voltage being also applied to the screen grid of the other tube V203 is sufficient to cut off its plate current, the cut off bias being supplied by the common cathode resistor R208. At the same time lack of plate current in this tube V203 causes a high screen voltage on the first tube V202 which maintains it in a conducting condition. If now a negative pulse is applied to the grid of the driven tube V202 sufficient to momentarily cut it off, the opposite occurs causing the second tube to conduct and leaving the first tube in a non-conducting state until another positive pulse is received.

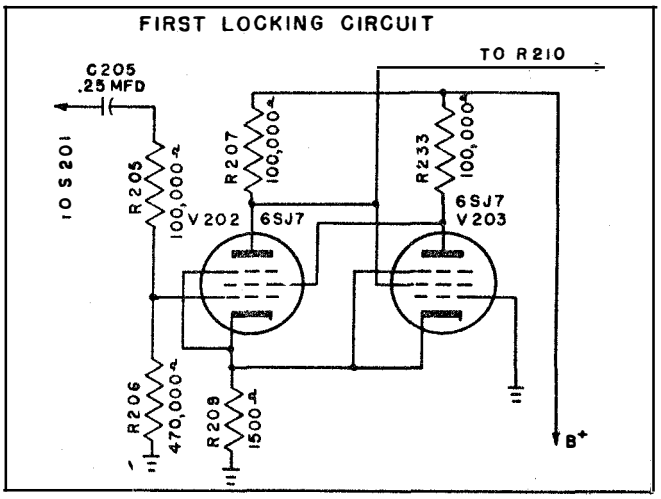


Fig. 2-7 First Locking Circuit

7. POWER LOCKING STAGE

The signal from the first locking stage is capacity coupled through C208 to the output power locking stage which can be switched to provide either polar or neutral D.C. signals. This consists of two 6L6GA tubes V206 and V207 each with a separate power supply connected to operate in the following manner.

a. POLAR CONNECTION. When connected for polar operation, the plate current of the driven tube V206 returns through the load and cathode bias resistor R213 of the second tube V207. Similarly the plate current for tube V207 returns through the load and cathode resistor R211 of the first tube V206. Assuming that tube V206 is conducting, causing current to flow through the load—in one direction—and through the cathode resistor R213. The voltage drop across R213 is applied to the grid of V207 through the grid resistor R214 and is sufficient to cut off its plate current. If now a negative pulse is applied to the grid of V206 sufficient to cut this tube off momentarily, the bias disappears on the grid of V207 causing it to become conducting. This results in current flow in the opposite direction in the load, and the voltage drop across R211 is sufficient when applied to the grid of V206 to

maintain this tube in a non-conductng condition, where it remains until another positive pulse reverses the process. Current through the load is adjusted by shunting the D.C. Output Control Rheostat R212 across the load. Resistor R232 is connected in series with the load when the load is small and chiefly inductive, as is the case when a teleprinter or similar device is connected to the load terminals through a short line. This is desirable since an inductive load without any series resistance to damp it causes some distortion in the output waveshape.

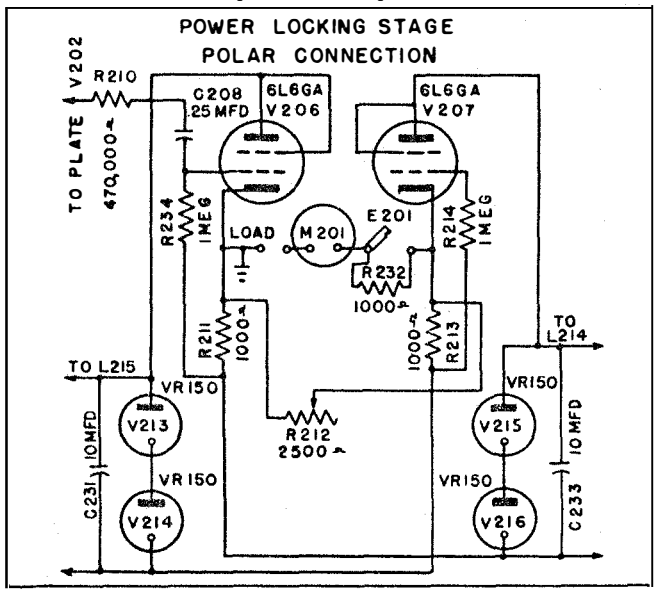


Fig. 2-8 Power Locking Stage. Polar Connection

b. NEUTRAL CONNECTION. When connected for neutral operation the circuit is switched to give the connections shown in Fig. 2-9. The action is similar except that in this case the load is removed from its previous position between the cathodes of V206 and V207 and substituted for the cathode bias resistor R213 of V207. Both cathodes are now connected together and the control rheostat R212 placed in series with the load instead of shunting it as in polar operation.

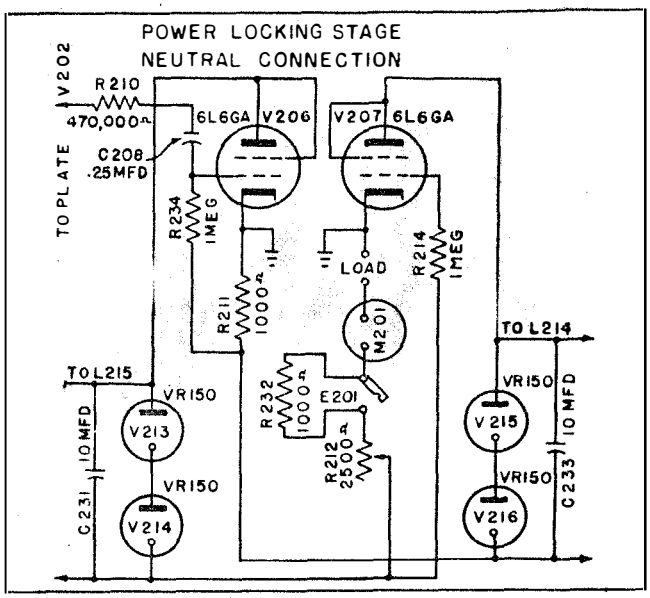


Fig. 2-9 Power Locking stage. Neutral Connection

8. TONE OSCILLATOR AND KEYER

The 1000 cycle tone oscillator consists of a 6SJ7 tube V208 connected as a phase shift oscillator. The resistors R225, R226 and R227 together with capacitators C211, C212 and C213 form a three mesh resistance-capacity phase shifting network connected between the plate and grid of V208. This network is proportioned to give 180° total phase shift from plate to grid at the frequency of oscillation 1000 cycles, which causes the tube to oscillate at this frequency. The output of the oscillator is fed to the grid of the tone keyer tube V209 through the Tone Output Control R229. The output of this tube is transformer coupled to the output terminals through T201. This tube is keyed on and off by keying the suppressor grid with a high negative voltage sufficient to cut the tube off. This keying voltage is obtained from the cathode bias resistor R211 of the power locking stage. Since this voltage varies between zero and about —70 volts tube V209 is alternately rendered conducting and non-conducting in synchronism with the signal.

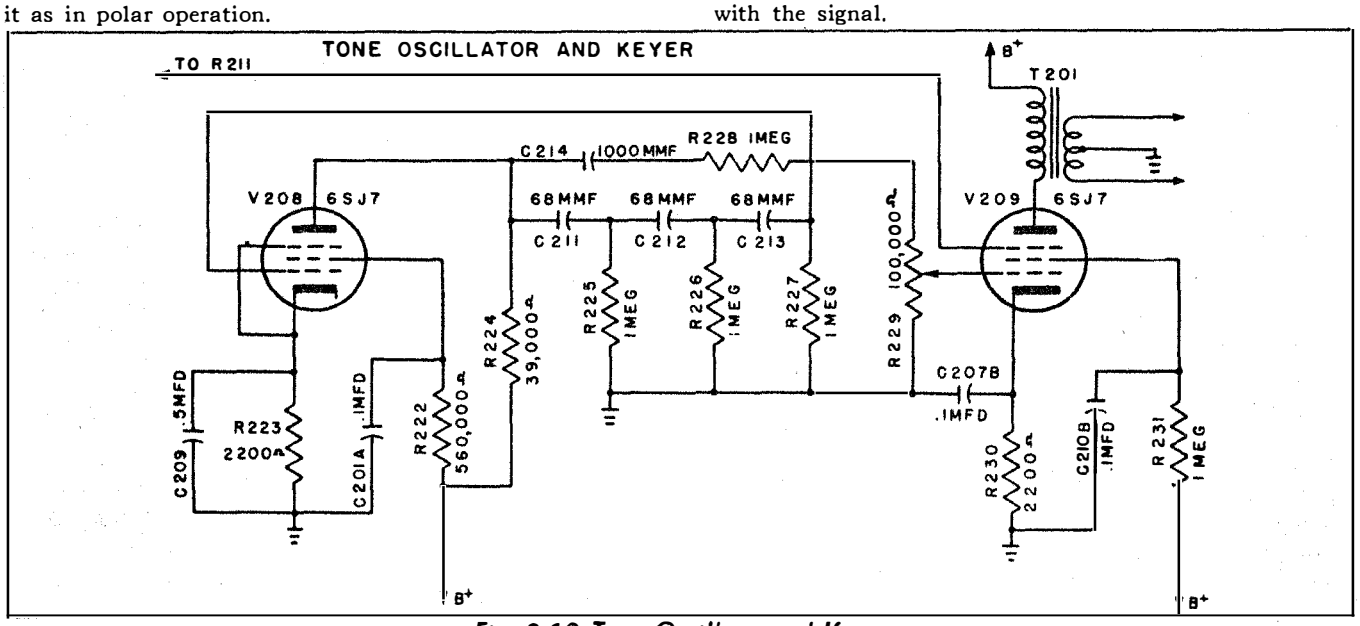


Fig. 2-10 Tone Oscillator and Keyer

9. MARK RETURN CIRCUIT

A "mark return" circuit employing a VR75 tube V204 is provided for use on teletype operation. The purpose of this circuit is to prevent the output from remaining on "space" for a period longer than 200 milliseconds, which might occur if a noise burst caused the locking circuit to flip to "space" when normally standing-by on "mark". This consists of a resistance capacity filter R208 and C207A having a time constant of 200 milliseconds connected from the plate of one of the first locking circuit tubes V203 to ground. This tube is the one that is non-conducting on "space" and therefore has a high voltage in this condition. The VR75 tube is connected across C207A and this point is also connected to the grid of the other locking tube V202 through capacitor C206. In operation, if the locking circuit remains on "space" for a sufficient time for C207A to charge up through R208 to a value high enough to break down the VR75, which is about 105 volts, the voltage across the VR75 immediately drops to 75 volts. This surge is applied to the control grid of the first locking circuit tube V202 through capacitor C206 which flips the circuit back to "mark". A switch S202 is provided to disable this circuit when it is not required.

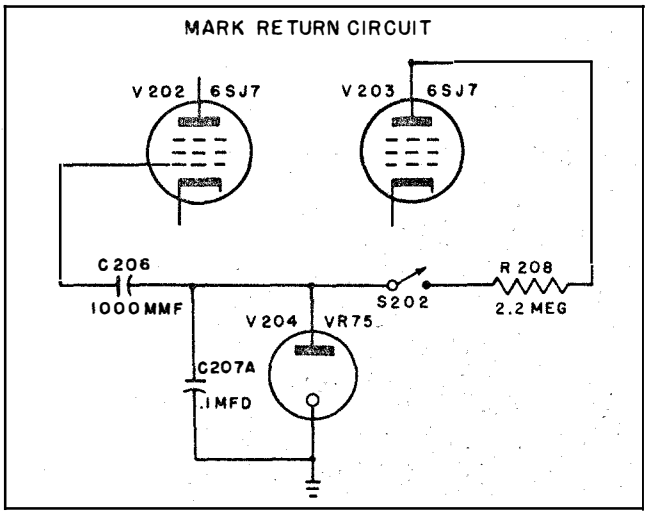
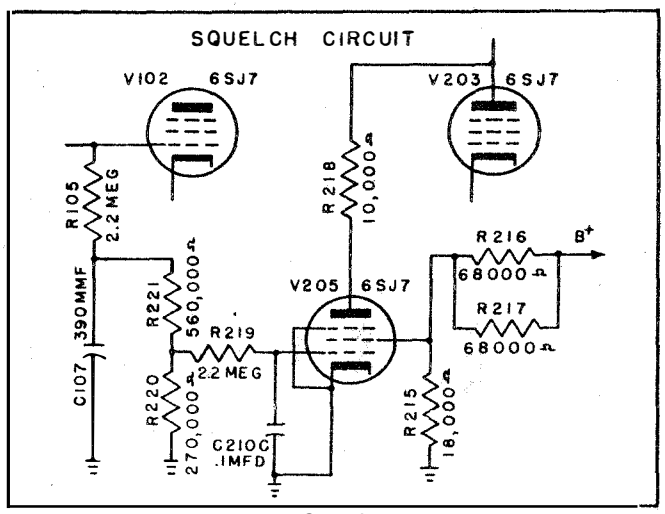


Fig. 2-11 Mark Return Circuit

10. SQUELCH CIRCUIT

A form of squelch circuit is provided so that signals below any predetermined level will not operate the Converter. This consists of a 6SJ7 tube V205 with its control grid connected to the grid of the limiter V102 through an R.F. filter R105 and C107, a voltage divider R220 and R221 and a resistance capacity filter R219 and C210C which has a time constant of 200 milliseconds. The noise level is adjusted by means of the gain control on the receiver so that the negative voltage developed by the limiter and appearing on the squelch tube grid is just sufficient to allow this tube to conduct. Any larger signal will then produce a more negative voltage and drive the squelch tube past cut-off. This tube is operated with a fixed screen voltage and the plate is connected to the plate of the locking tube V203 which is conducting on "mark". Thus if the squelch tube is rendered conducting by reason of the low signal level, the plate current of V205 flowing through the load resistor R233 and V203 will hold the first locking circuit on "mark" and no output will be obtained from the Converter.



F.g. 2-12 Squelch Circuit

11. COUPLING KIT, NAVY TYPE 10563

The Coupling Kit components provide the means for connecting a high impedance scurce to a low impedance load. The signal voltage is coupled from the plate of the last I.F. tube V303 of the RBB/RBC equipment by means of capacitor C501. The output voltage appears across the cathode resistor R501. The grid circuit of V101 adds a small amount of capacity across the last I.F. tube V303 plate circuit. This capacity must be compensated for by adjusting the primary core of the I.F. transformer T305 in the IF-AF unit of the RBB/RBC receivers. Since the impedance across resistor R501 is low, a low impedance line is coupled across the cathode resistor R501 by means of capacitor C502. A completely shielded, two-section, low pass filter is inserted in series with the low impedance line and the output plug J501. The coil and capacitor assembly L501, L502, C504, C505, C506 comprises the filter. This filter passes frequencies below 550 kilocycles with very little attenuation, while those frequencies higher than 550 kilocycles are rapidly attenuated. The cathode follower tube V501 prevents loading or inter-action in the plate circuit of the last I.F. tube V303. The ground system is not completed until the shield spring around J501 contacts the shield cabinet. Should the receiver be operated outside the shield cabinet with the Coupling Kit, it will be necessary to complete the ground system by connecting the shield of J501 to the RBB/RBC receiver chassis. The filter output is connected to the Frequency Shift Converter by means of a coaxial cable which is furnished with the equipment.

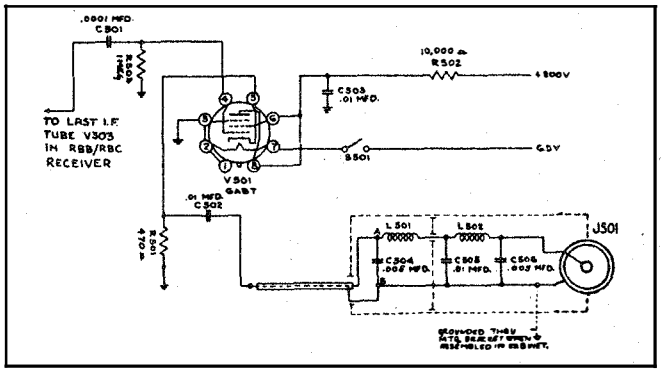


Fig. 2-13 Coupling Kit, Navy Type CRV 10563

SECTION III
INSTALLATIONS AND INITIAL ADJUSTMENTS

1. UNPACKING

In order to ensure the safe unpacking of this equipment the following method should be used.

a. Remove screws from lid.

b. Pry lid up to break Permalac Seal.

c. Lift fold of liner bag from center upright, slit with knife, and open bag.

d. Remove top pad and excelsior packing from top, sides and ends.

e. Lift carton out of case, break seal on top of master carton, turn carton gently upside down to slide inner carton out.

f. Reverse carton enclosed in barrier, slit end of barrier bag, pull carton out of bag.

g. Break seal of carton, remove top pad, Silica Gel, Instruction Books and Cables. Remove back and front pads, lift unit out of carton.

2. LOCATION

The Model FRA Converter is designed to be mounted on the top of an operating table, using the shock mounts supplied on the chassis mounting tray. (See Figs. 3-1 and 3-2). The installation drawings show the units mounted with front panels flush with the edge of the operating table shelf. The location of the Converter may be varied to suit particular installation requirements, but a clearance of at least five inches should be provided from the rear of the Converter to the bulkhead or nearest obstruction in order to permit removal of cables and provide movement clearances in cases of severe shock.

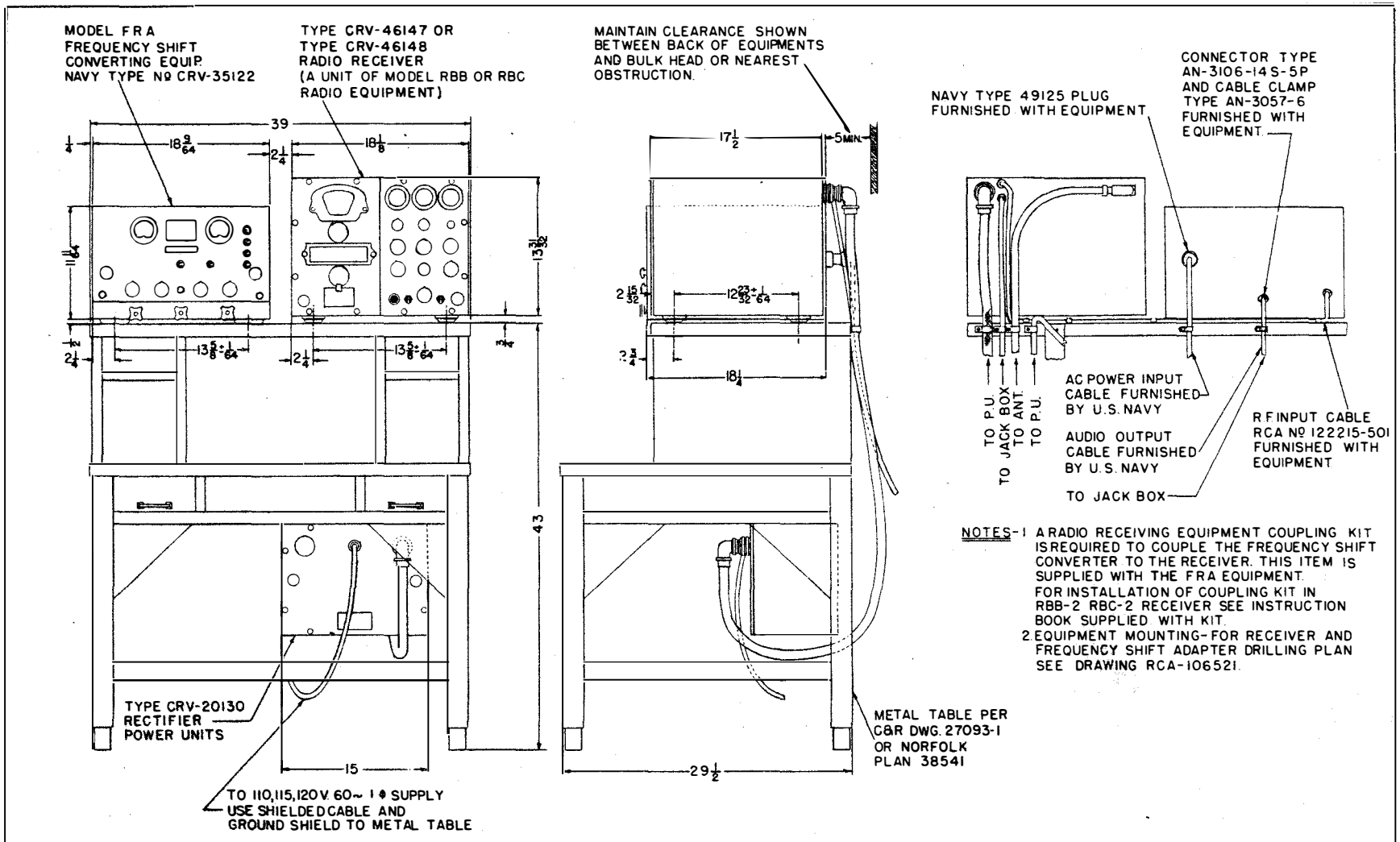


Fig. 3-1 Installation with RBB/RBC Receivers

3. POSITION

The Converter should preferably be mounted adjacent to the receiver with which it is to be used. This will allow short interconnecting cable lengths and simplify operation, since it is necessary to operate controls on both receiver and converter simultaneously. Special care should be taken in installing the set-up to see that all units are well grounded. The teleprinter and its connecting cables should be isolated as far as practical from the receiver antenna input leads, since the steep wavefronts radiated by the teleprinter cables can readily cause severe interference in the receiver.

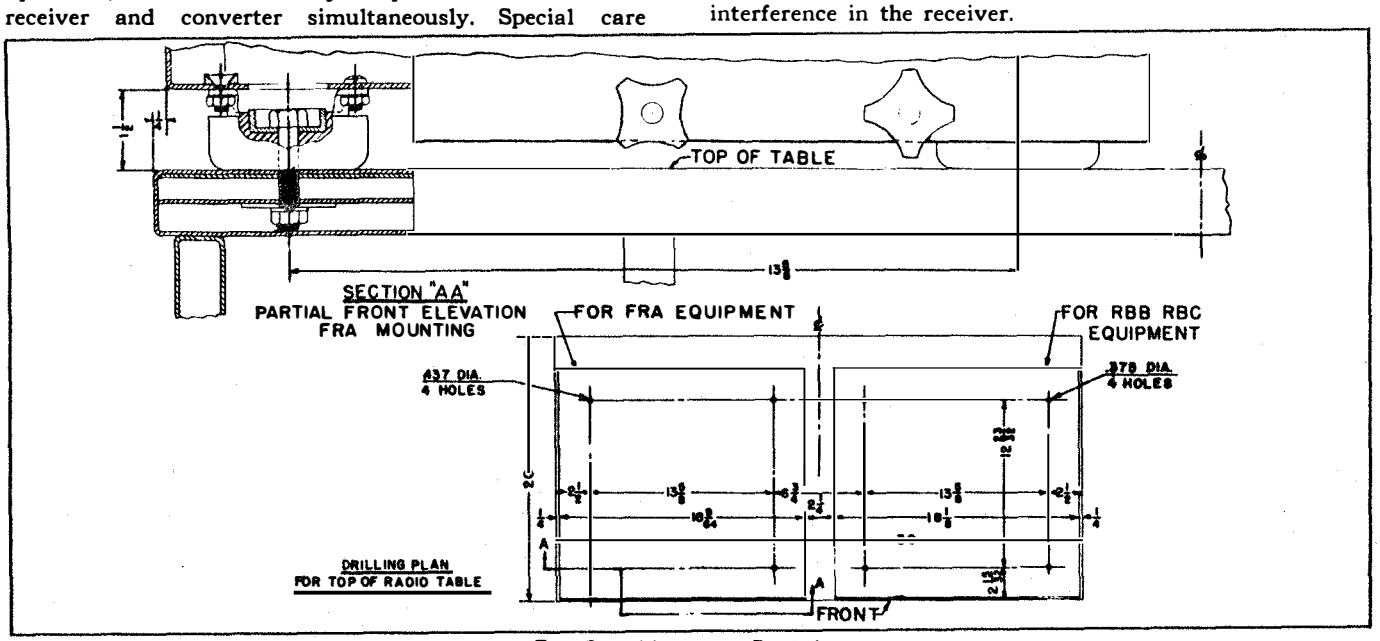


Fig. 3-2 Mounting Details

4. MOUNTING

In order to mount the equipment on the table proceed as follows:

a. Remove the chassis from the chassis mounting tray by disengaging the three chassis mounting bolts located at the bottom of the front panel. These bolts are of the captive type and remain in the front panel when the chassis is withdrawn.

b. Withdraw the chassis using the round pull knobs provided on the front panel and note that the chassis strikes a pair of stops when partially withdrawn. Release these stops by turning the knobs marked CATCH in the direction indicated by the arrows. In case the Converter has been previously installed it is necessary to remove the cables from the receptacles at the rear of the unit before completely withdrawing the chassis.

c. Drill the operating table, using the layout dimensions shown in Fig. 3-2.

d. Bolt the mounting tray to the operating table as shown in Fig. 3-2, using hardware supplied with each Model FRA equipment. Four each of the following are provided:

3/16 — 16 x 2¼ bolt
1/16 x 1¾ o.d. washer
⅜ lockwasher
⅜ — 16 nut

e. Determine the approximate resistance of the load to be connected to the D.C. output. This will consist of the resistance of the teleprinter relay coil plus the resistance of the cable connecting the teleprinter to the converter. If this resistance is less than approximately 1000 ohms open the link or terminal board E201 on the rear of the chassis. If this resistance is greater than 1000 ohms this link should remain closed.

f. Measure the power line input voltage and set the Line Voltage Switch S205 A-B on the rear of the chassis to the tap which most nearly corresponds to the measured value.

g. Replace the chassis in the cabinet. It is necessary to turn the CATCH knobs when inserting the chassis into the cabinet in the same manner as when withdrawing it. Care should be taken that three mounting bolts are turned up tight so that the springs in the rear chassis locating pins are compressed as far as possible.

5. INSTALLATION OF COUPLING KIT, NAVY TYPE CRV 10563

Installation of the Coupling Kit shall be made in the following manner:

a. REMOVAL OF RBB/RBC CHASSIS FROM CABINET.

(1) Disconnect the antenna, audio output, and interconnecting cable plugs from their receptacles at the rear of the radio receiver.

(2) Loosen the twelve panel thumbscrews by turning them approximately six turns. These screws are of the captive type and do not release entirely.

(3) Take hold of the two round knobs located on the front of the receiver and pull the chassis out part way until the stops strike. These stops may be released by pressing on the stop arms through the holes on each side of the chassis near the bottom.

(4) Pull the chassis completely out and set it on a level surface.

b. REMOVAL OF AUDIO FILTER COIL AND CONNECTOR ASSEMBLY.

Remove from the receiver the audio filter coil L304A-B and connector assembly J302 in the following manner. (See Fig. 3-3).

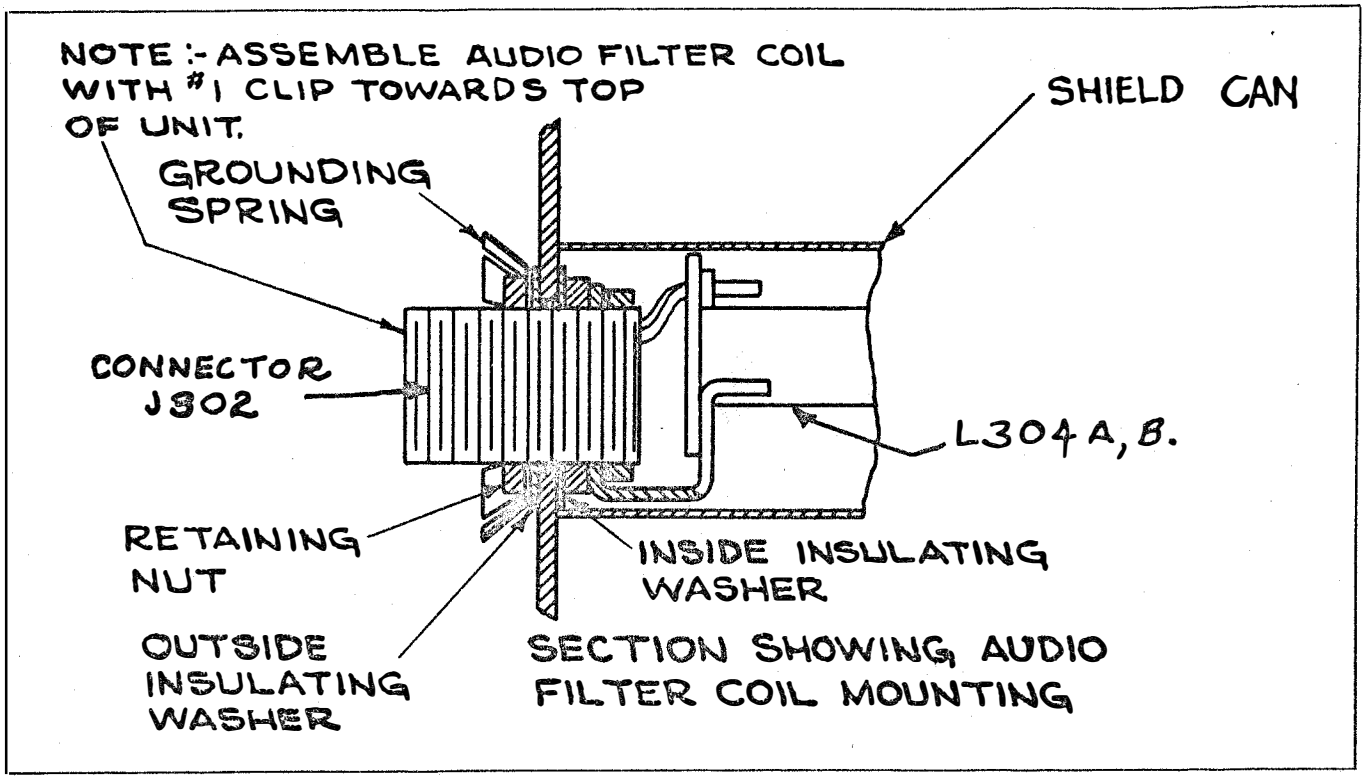


Fig. 3-3 Audio Filter Coil Mounting, Side View

(1) Remove the retaining nut.
(2) Remove the grounding spring.
(3) Remove the outside insulating washer.
(4) Remove shield can screws and brackets.
(5) Remove the audio filter coil, connector assembly, and inside insulating washer.

NOTE: It is not necessary to unsolder any wires.

c. CHASSIS DRILLING. (See Fig. 3-4)

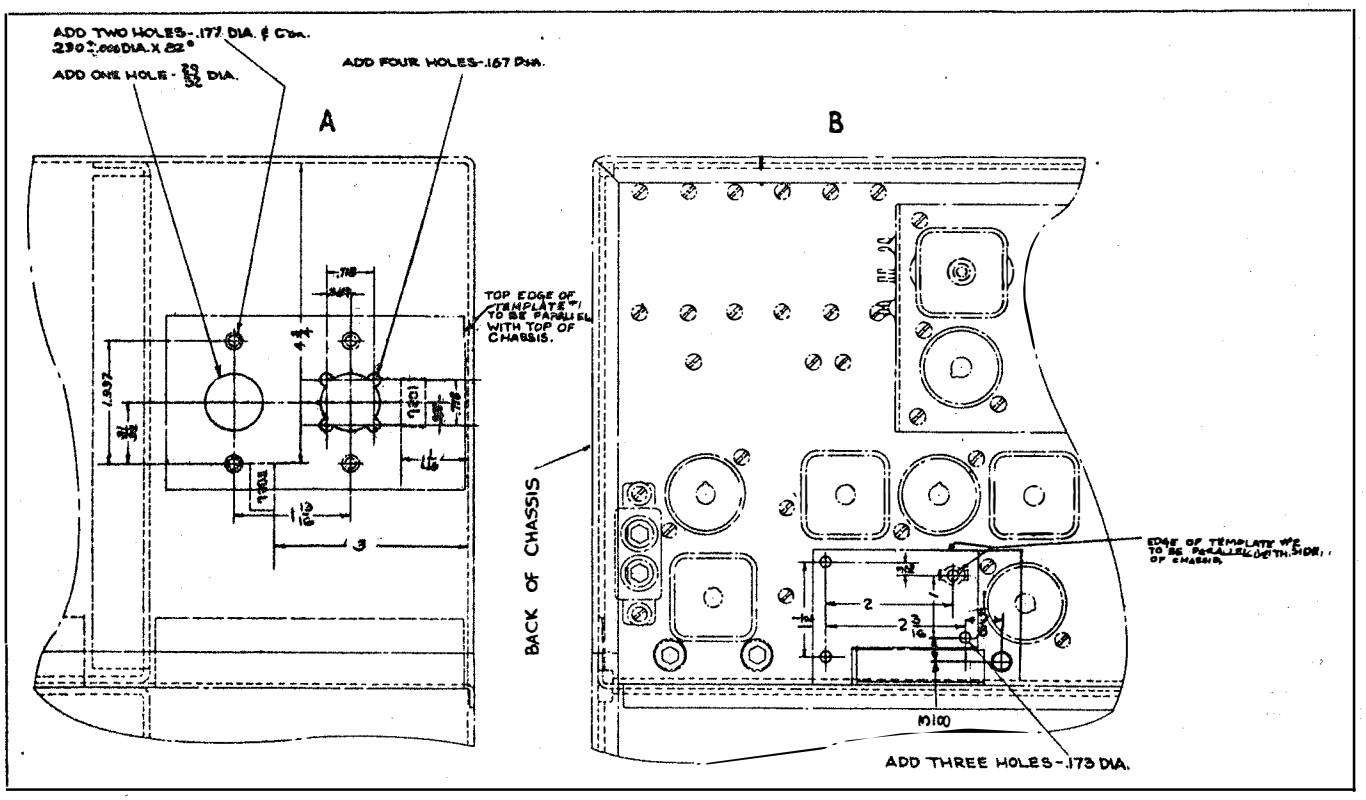


Fig. 3-4 Coupling Kit. Receiver Chassis Drilling

(1) Cut out template No. 1 with a razor or some sharp instrument. Hold the template in place against the rear of the RBB or RBC radio receiver chassis with scotch tape or friction tape. (See Fig. 3-4A).

(2) Mark off the position of the seven additional holes by means of a centerpunch.

(3) Drill the four 0.1875" (3/16") holes in the back of the chassis frame as shown in Fig. 3-4A.

NOTE: Drill pilot holes before drilling the finished (correct size) holes.

(4) Cut out template No. 2. Remove the ground terminal and drill the three O.173" and one 0.25" diameter holes. See Fig. 3-4B.

d. CABINET DRILLING.

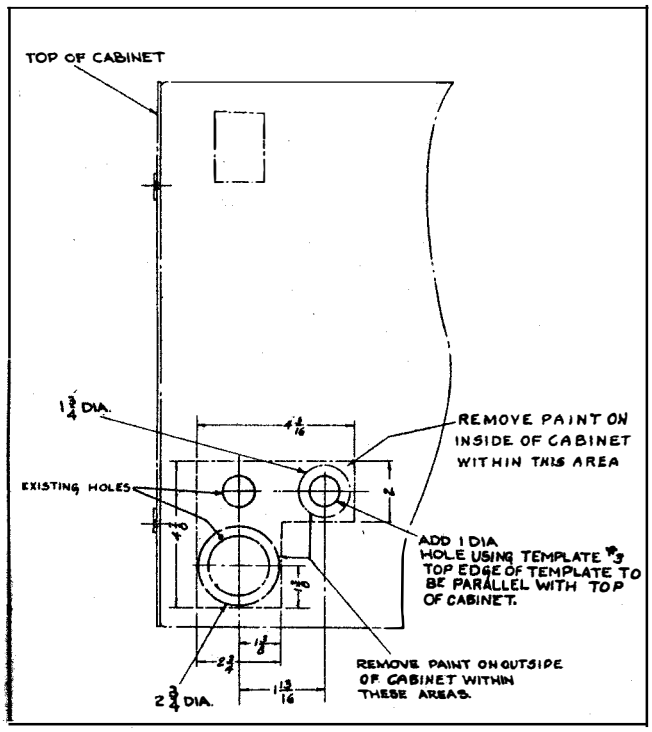


Fig. 3-5 Coupling Kit. Receiver Cabinet Drilling

(1) Cut out templates No. 3. See Fig. 3-5.

(2) Drill the additional 1" diameter hole.

(3) Remove the paint from the cabinet within the area shown on Fig. 3-5.

e. AUDIO FILTER MOUNTING.

Remount the audio filter coil L304A-B and connector assembly J302 in their new position as shown in Fig. 3-3. Use the same mounting hardware (Brackets, nuts, etc.) as were used for the original mounting.

f. LOW PASS FILTER UNIT MOUNTING. (See Fig. 3-6).

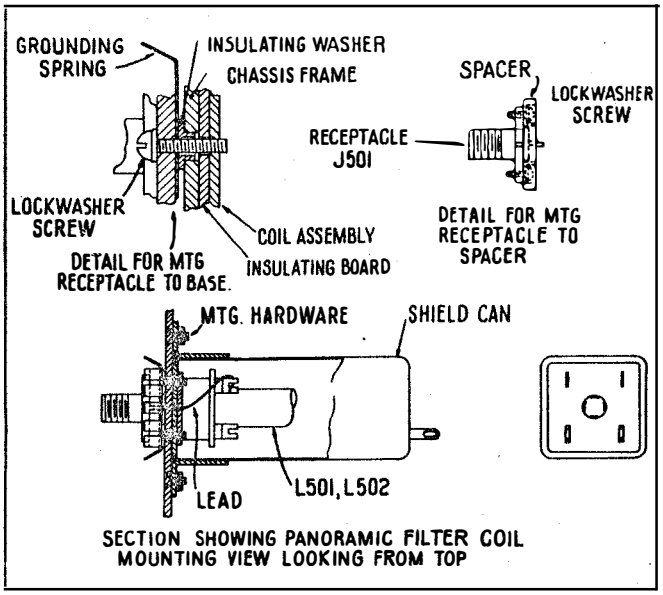


Fig. 3-6 Low Pass Filter Unit Mounting

(1) Assemble receptacle J501 to the spacer H501 as shown in Fig. 3-6 using four screws H502 and lockwashers H503 supplied with the kit.

(2) Connect lead "D" on the receptacle as shown in Fig. 3-6. Assemble the four insulating washers, H504 grounding spring, H505 receptacle and spacer assembly, insulating board, H506 coil assembly and four screws H507 and lockwashers H508 as shown in Fig. 3-6.

(3) Place the shield can over the above assembly.

(4) Fasten the shield can to the chassis frame using two screws, H510 two lockwashers H509 and two nuts H511 supplied.

(5) Place the shield can cover in position after feeding the cable "C" through the side hole.

(6) Place the decalcomanias in position as shown in Fig. 3-4A.

g. CATHODE FOLLOWER ASSEMBLY MOUNTING. (See Figs. 3-7 and 3-8).

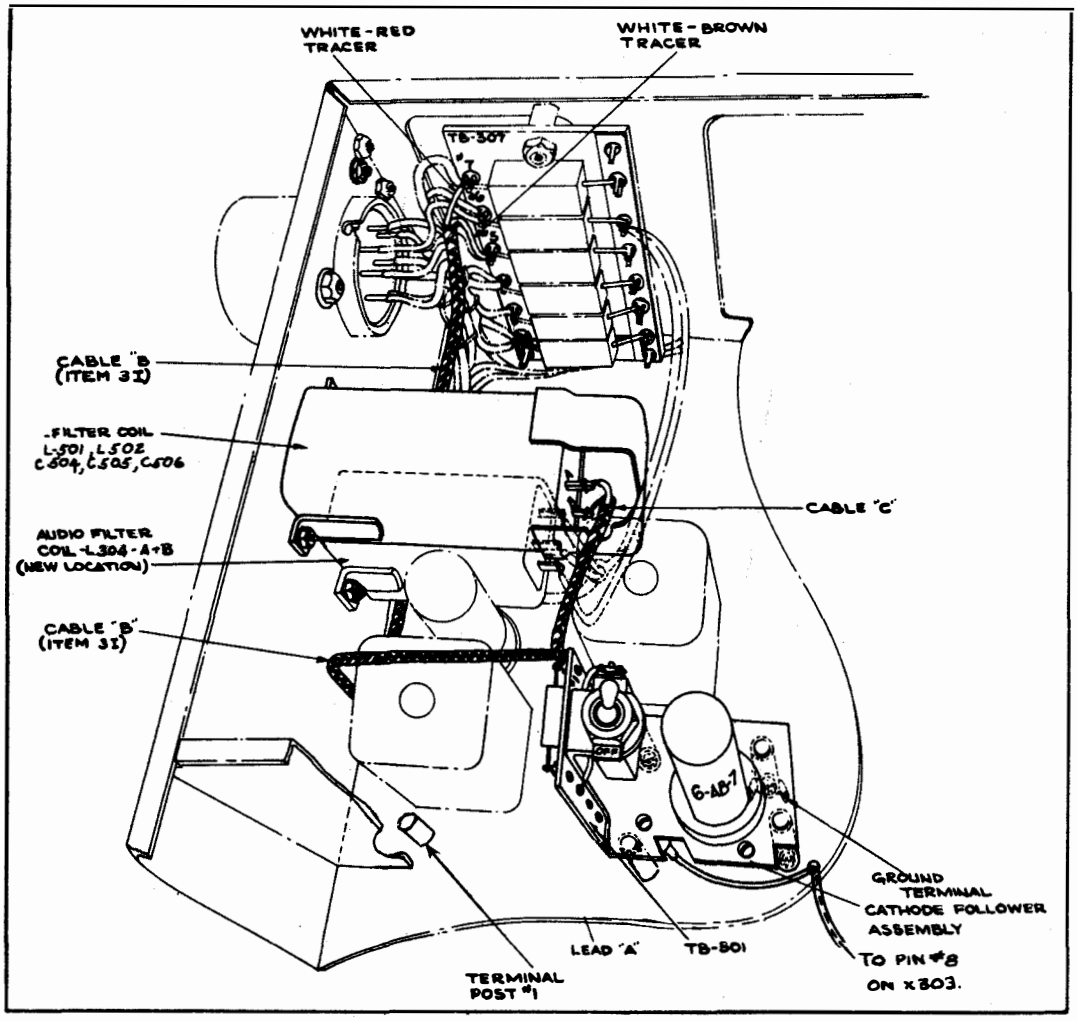


Fig. 3-7 Installation of Coupling Kit Components

(1) Mount the cathode follower assembly in position as shown in Fig. 3-7.

(2) Fasten this assembly to the chassis by means of four screws H512 and lockwashers H509. Be sure to put the ground terminal in place as shown in Fig. 3-7.

h. WIRING. (See Figs. 3-7 and 3-9).

(1) Connect lead "A" to pin No. 8 on socket X303 of receiver. (See RBB/RBC Instruction Book, Connection Diagram).

(2) Connect cable "B" to TB307. The white lead with red tracer is connected to terminal No. 7 and the white lead with brown tracer is connected to terminal No. 5.

(3) Connect cable "C" to TB501, terminal No. 1, located on the cathode follower assembly.

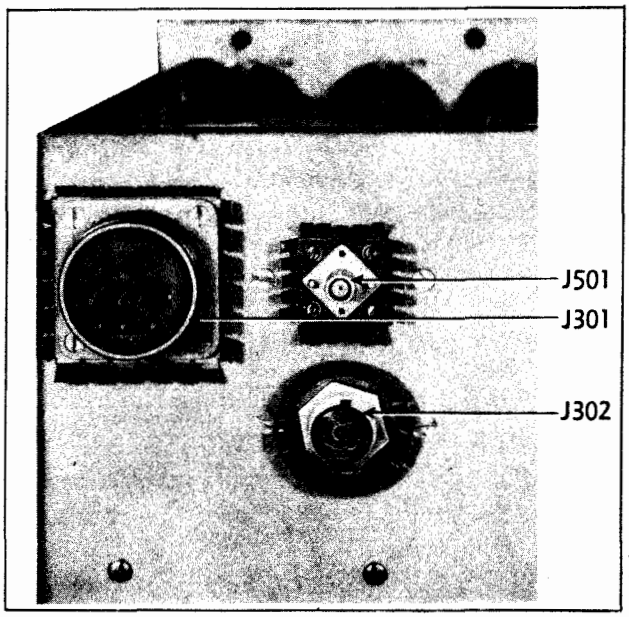


Fig. 3-8 Model RBB/RBC Receiver (Rear View Showing J301, J302, J501)

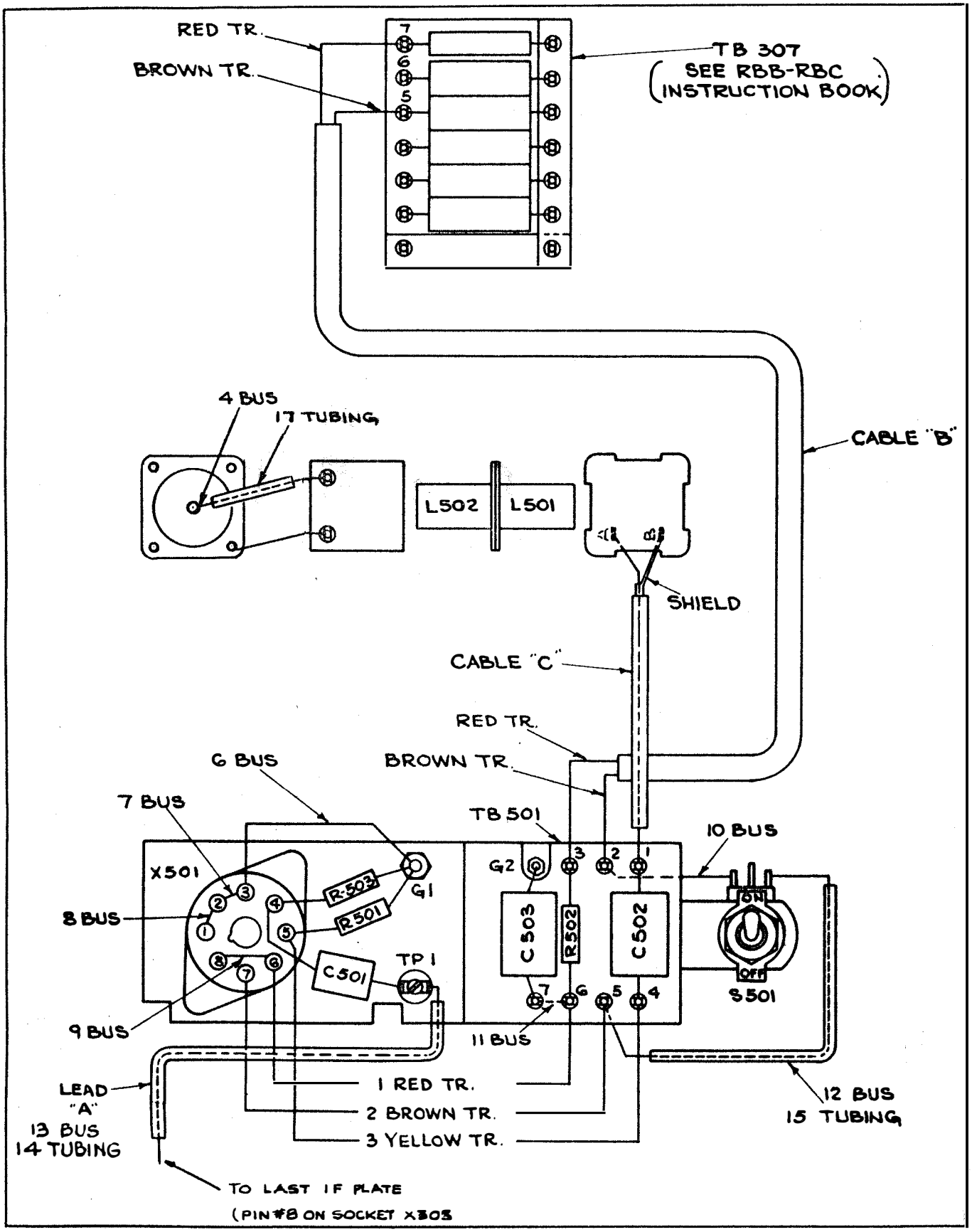


Fig. 3-9 Interconnection of Coupling Kit Components

6. CONNECTIONS

Before connecting up the Converter it is necessary to make up two cables, one for the A.C. power, and the other for the D.C. and tone outputs. The assembly of these is shown in the exploded diagrams, Fig. 3-11.

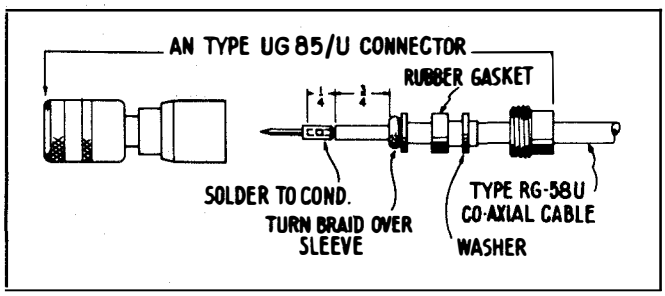


Fig. 3-10 Assembly of AN UG 85/U Connector

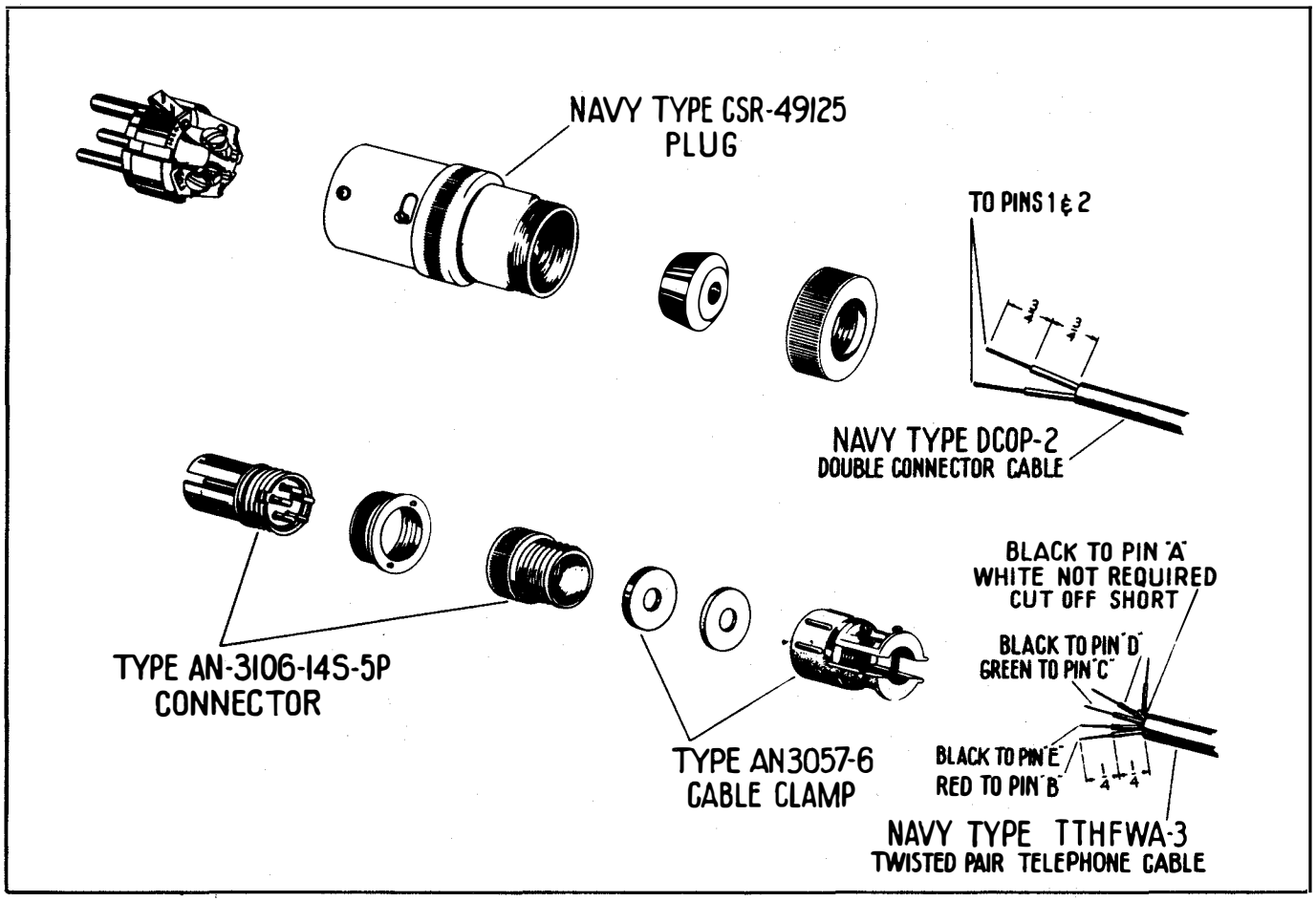


Fig. 3-11 Exploded View of Cable Plug Assembly

a. A.C. POWER INPUT CONNECTOR. Connect a cable consisting of a twisted pair NAVY Type DCOP-2 to the AC Plug Navy type CRV 49125 supplied with the Converter. Connect the wires to terminals No. 1 and No. 2. The cable should run to a grounded junction box near the equipment table.

b. DC AND TONE OUTPUT CONNECTOR. Connect a six conductor armored cable Navy type TTHFWA-3 to the five point connector type AN-3106-14-5P supplied with the Converter. Disassemble the plug as shown in Fig. 3-11 and insert the cable through the clamping rings and solder to the plug according to the following chart.

D.C. AND TONE OUTPUT CONNECTIONS

PIN	A	B	C	D	E
CONNECTION	Ground	D.C. Output Low Side	Tone Output	Tone Output	D.C Output High Side

c. Connect the Coaxial Cable Assembly RCA Type 122215-501 from the connector outlet on the Receiver Coupling Adapter to J204 on the rear apron of the Converter chassis.

d. Connect the A.C. Power input Plug to J201 on the rear of the Converter chassis.

e. Connect the D.C. and Tone Output Plug to J203 on the rear of the Converter chassis.

7. I.F. FREQUENCY

The Model FRA Converter is shipped from the contractor with a 400 kilocycle I.F. chassis installed and is aligned accurately at the factory to this frequency. This is the I.F. frequency of the RBB and RBC receivers and is the frequency at which it is expected the converter will be most commonly used.

8. INITIAL ADJUSTMENTS

Assuming a Teleprinter or similar device has been connected to the D.C. output leads, the initial adjustments should be made as follows.

a. Energize the equipment by turning the switch marked POWER to its ON position.

b. The D.C. OUTPUT control should be near its minimum position when the equipment is turned on for the first time. After the tubes warm up, turn the D.C. OUTPUT control in the direction marked INCREASE until the required current is shown on the OUTPUT meter on the front panel.

Since this meter is in series with the output load no reading will be shown on the meter unless a load is connected to the D.C. output receptacle. The Teleprinter must be connected to the output terminals in such polarity that "mark" condition is obtained when the OUTPUT meter is deflected to the right of zero.

c. Turn the POLAR-NEUTRAL switch to either its Polar or Neutral position depending on the requirements of the load connected to the D.C. output terminals.

d. Correct operation of the I.F. circuits is checked by tuning in a signal as described in Section 4, Paragraph 4. If the tuning is normal as described in the section referred to it can be assumed that connections to the receiver have been correctly made.

e. Set the THRESHOLD control as described in Section 4, Paragraph 5. The teleprinter should now start to print, if all operations have been carried out correctly.

f. If the teleprinter does not print an intelligent message, turn the OUTPUT REVERSAL switch to its opposite position. However, this switch *must not* be used to correct the condition which would occur if the teleprinter were not connected in the correct polarity as described in Paragraph 7 *b* of this section. Since this would render the SQUELCH and MARK-RETURN circuits inoperative.

g. If the D.C. output does not key when a signal is being received, make sure the GAIN control on the receiver is set high enough that the SQUELCH circuit is not making the Converter inoperative. The proper adjustment for this is described in Section 4 - Paragraph 9.

h. Turn the MARK-RETURN switch to its ON position and with the receiver tuned a steady carrier turn the OUTPUT REVERSAL switch to its opposite position. The output should flip to space when the switch is reversed, and then flip back to "mark" after about a 200 millisecond delay.

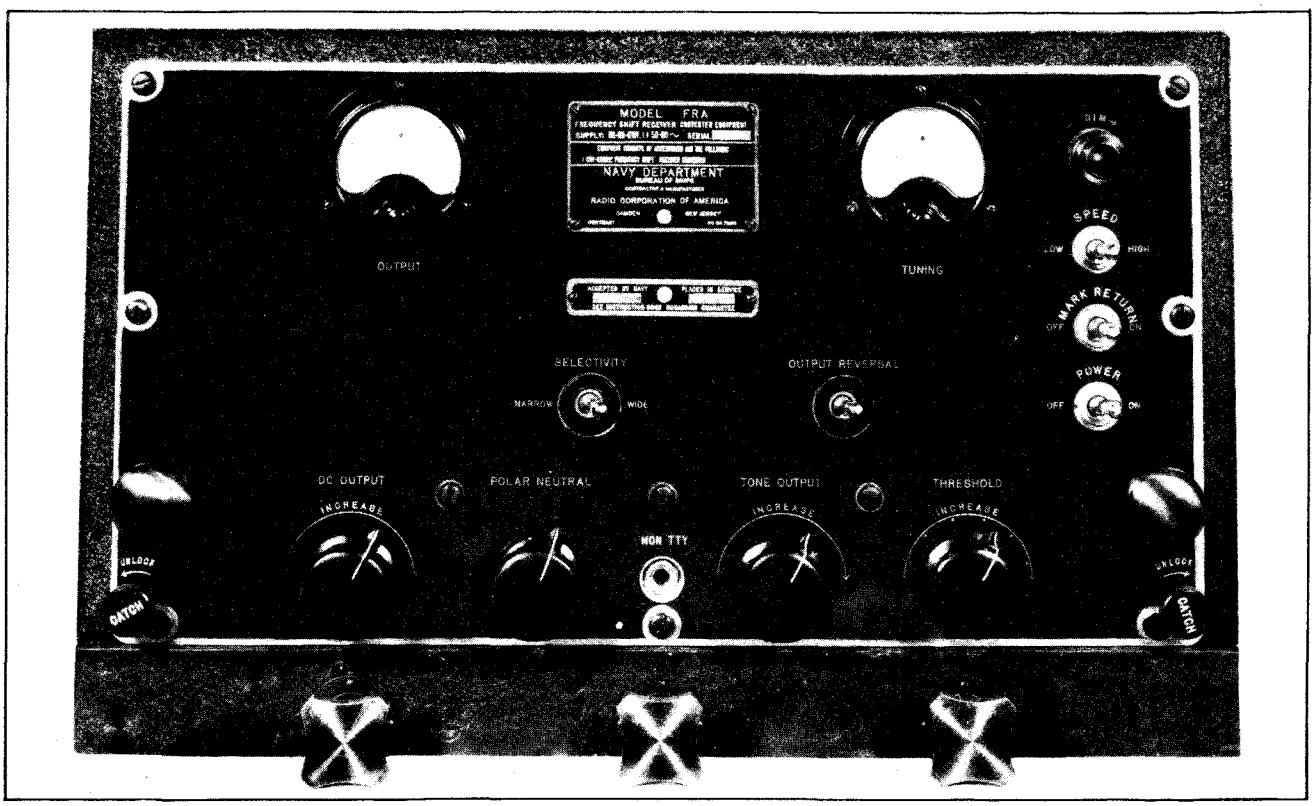


Fig. 4-1 Frequency Shift Converter, Navy Type CRV-35122 Front Panel

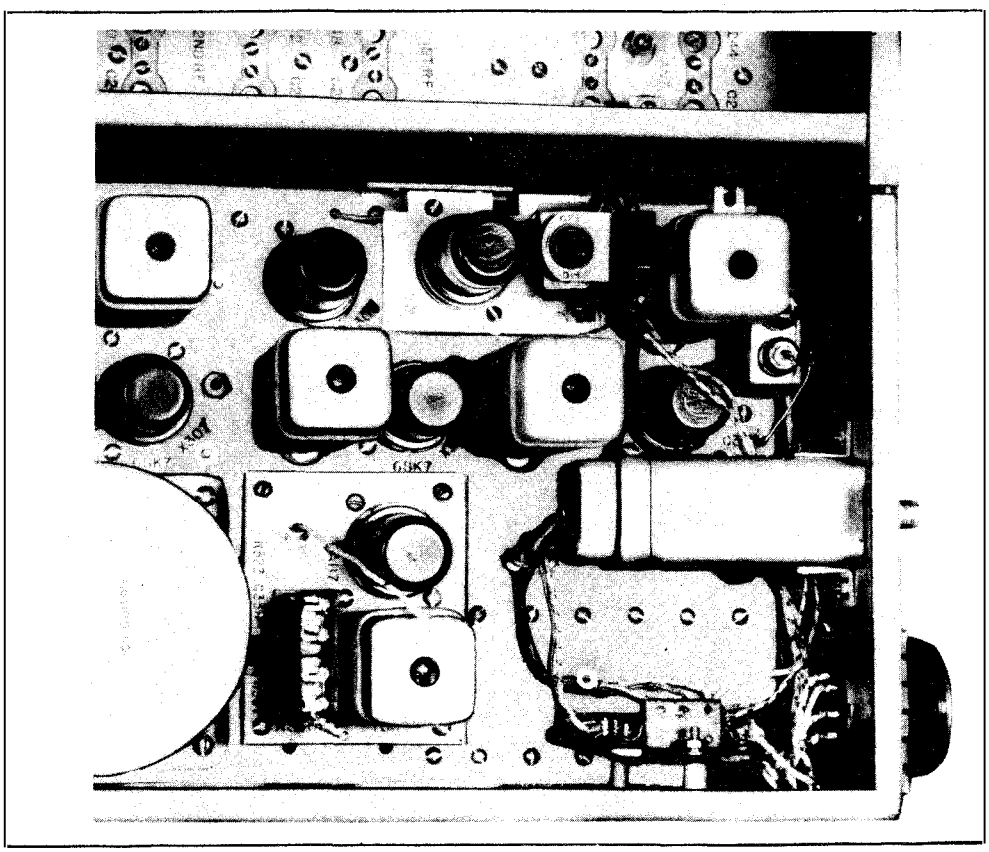


Fig. 4-2 Model RBB/RBC Receiver (Showing Cathode Follower Assembly and Low Pass Filter Unit)

SECTION IV
OPERATION

1. OPERATION OF CONTROLS

The controls are shown in Fig. 4-1 and 4-2 and are operated in the following manner.

a. COUPLING KIT, NAVY TYPE CRV-10563

In order to couple the signal from the receiver to the converter, throw the switch S501 to the ON position (see Fig. 4-2). Since the switch is inside the receiver unit (i.e. mounted on the chassis), it is necessary that the switch be operated before the receiver is replaced in the cabinet. The switch S501 is in series with the filament circuit of V501 and should be in the "OFF" position only when the extra power to operate the coupler components cannot be spared or when the coupling unit is not in use. Such a condition possibly can arise when operating two receivers from a single power supply and on low line voltage.

b. FREQUENCY SHIFT RECEIVER CONVERTER, NAVY TYPE CRV-35122

STEP 1. Power is turned on to start the equipment by turning the switch marked POWER to its ON position.

STEP 2. Turn the POLAR-NEUTRAL switch either its POLAR or NEUTRAL position, depending on the requirements of the load connected to the D.C. output terminals.

STEP 3. The D.C. OUTPUT control should be near its minimum position when the equipment is turned on for the first time. After the tubes warm up, turn the control in the direction marked INCREASE until the required current is shown on the OUTPUT meter.

STEP 4. Tune a signal in roughly on the receiver. It is important to establish the fact that the signal is correct, i.e. not diplex, multiplex, or "scrambled". This is best done with the receiver Mode of Operation switch set at its CW position. When a signal has been located the receiver Mode of Operation switch is set to its MOD position, (which removes the BFO), and the signal accurately tuned in by means of the TUNING meter on the panel of the Converter. Set the SELECTIVITY switch at its WIDE position for this operation. Correct tuning as indicated on the meter is obtained as follows. As the signal is approached by slowly turning the receiver dial the TUNING meter should suddenly indicate to one side of zero, then as the dial is further turned in the same direction the TUNING meter should pass through zero and swing over to the other side to approximately the same amount. The correct setting is at the point where the meter passes through zero between the two swings, and the receiver dial should be set at this point. If the transmitter is keying, the average value of the swings should be zero, however, if the transmitter is standing by on "mark" when the signal is tuned in, the TUNING meter should be set slightly off centre in the "mark" direction which is to the *right* of zero.

STEP 5. Set the THRESHOLD control by starting from the minimum position and slowly turning the control in the direction marked INCREASE until the output circuit just begins to key as shown on the OUTPUT meter. The control should be advanced approximately 90° past this point, which with a normal 850 cycle shift signal will be about 5 to 6 dots from the minimum position.

STEP 6. The OUTPUT REVERSAL switch is used to reverse the output of the discriminator. This should be switched to the right when receiving normal signals in which the "mark" frequency is the higher. If for some reason the transmitter is sending "mark" and "space" signals reversed from normal, as is indicated by the TUNING meter resting to the left for "mark", this switch should be thrown to the left.

STEP 7. Set the SPEED switch to its LOW position for normal teletype signals. This switch should be set to its HIGH position when receiving high speed signals of greater than about 250 words per minute.

STEP 8. Set the MARK RETURN switch to ON position for normal teleprinter operation. In some cases, such as black and white facsimile, it may be required to hold a long "space" in which case the switch is set to its OFF position, which disables the mark return circuit.

STEP 9. The SQUELCH circuit does not require a panel control but is caused to operate in the following manner. With no signal tuned in on the receiver the gain control of the receiver should be retarded until the noise output of the receiver to the converter is just low enough that the squelch circuit operates to hold the output to "mark". This setting of the GAIN control is used when the signal is tuned in, and any carrier that is appreciably above the noise level will render the squelch inoperative. Under some conditions where a high noise level is present it may be desirable to advance the gain control while searching for a signal, but in such cases the GAIN control should be turned back to its proper squelch setting after the signal is properly tuned in.

SECTION V
OPERATOR'S MAINTENANCE

1. PERIODICAL CHECKS

Make the following checks at the periods indicated in the table below.

WHAT TO CHECK	PERIOD	HOW TO CHECK	PRECAUTIONS
Tuning	½ hour	Indication on TUNING meter as described in Section 4, para. 4.	
Output	1 hour	Read current on OUTPUT meter for Mark and Space current.	Current to be set for correct value for Recorder in use, e.g. 60 ma. for neutral teletype.
Squelch	1 hour	Check setting of receiver gain control as described in Section 4, para. 9.	

2. SYMPTOMS OF FUSE FAILURE

WARNING

NEVER REPLACE A FUSE WITH ONE OF A HIGHER RATING UNLESS CONTINUED OPERATION OF THE EQUIPMENT IS MORE IMPORTANT THAN PROBABLE DAMAGE. IF A FUSE BURNS OUT IMMEDIATELY AFTER REPLACEMENT, DO NOT REPLACE A SECOND TIME UNTIL THE CAUSE OF THE TROUBLE HAS BEEN LOCATED.

If the pilot light does not light and no output is shown on the OUTPUT meter, check and replace if necessary F201 or F202 located at the right hand top rear of the chassis. These fuses are in the main supply line to the equipment and remove power from all parts of the Converter. Two spare fuses are mounted in clips adjacent to the fuse holders and should be used as replacements.

NOTE: Always keep two good fuses in the spare fuse clips for emergency use.

3. TUBE LOCATION

Location of tubes and fuses are shown in Fig. 5-1. Any inoperative tubes should be immediately replaced by the operator.

4. VISUAL INSPECTION

Periodic visual inspection should be made of all external connections to the Converter to ascertain that they are tightly fitted and in good general condition.

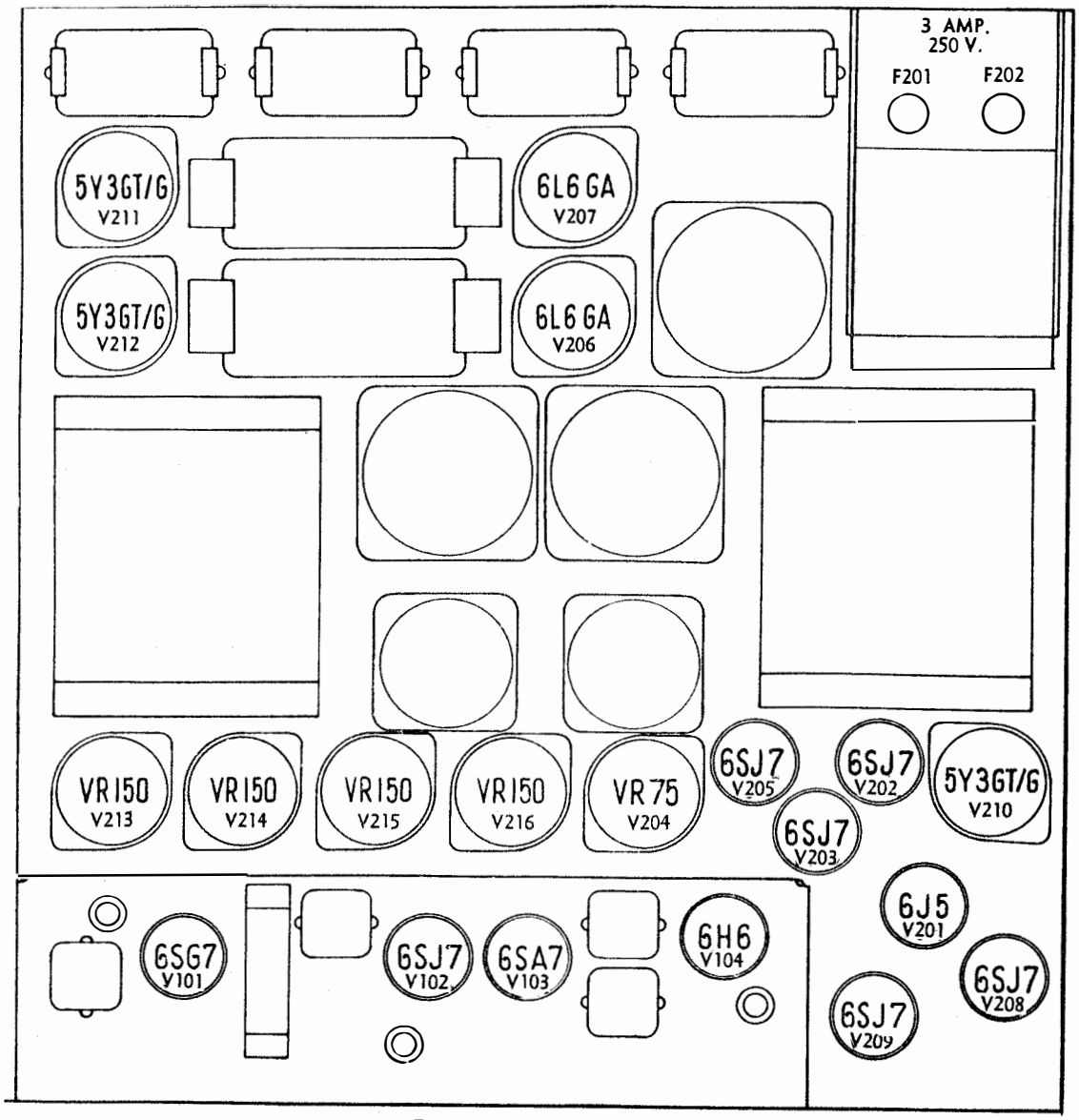


Fig. 5-1 Tube Layout

SECTION VI
PREVENTIVE MAINTENANCE

NOTE.

The attention of Maintenance Personnel is invited to the requirements of Chapter 67 of the "Bureau of Ships Manual" of the latest issue.

1. MONTHLY CHECKS

Monthly checks should be made as follows.

a. Check all tubes on a reliable tube checker. Replace any tubes that read low or doubtful. See section 7, paragraph 4.

b. Check all socket voltages as given in Fig. 7-6. If any voltages depart appreciably from the values shown in the diagram, further investigation should be made into the cause of this condition by a technician.

2. LUBRICATION

This equipment requires no lubrication.

SECTION VII
CORRECTIVE MAINTENANCE

1. LOCALIZATION OF DEFECTIVE UNIT

In Case of non-operation of the equipment, the source of the trouble should be localized before changing any adjustments other than panel controls, and before distributing the internal wiring or mounting of components.

The first step in servicing any equipment is to locate the defective part by a series of tests or checks. Before checking electrically, visually inspect the RBB/RBC receiver, the frequency shift converter and the converter coupling components for loose connections, broken leads and short circuits. If all connections appear to be normal, proceed with the following checks in the order given.

The trouble can be roughly localized by observing the panel meters and pilot light. If the pilot lamp does not light it is an indication that either it is burned out, the a.c. supply has failed, a blown fuse or a defective line voltage switch S205. However, the pilot is connected to the set power transformer T202 and does not indicate that power is being supplied to the d.c. output power transformer T203, which might not be receiving power due to a defective section S205B of the line voltage switch.

A quick check can be made by noting if the TUNING meter is operating normally. If this is not the case the trouble is either in the I.F. unit, coupling kit, or no signal is being supplied from the receiver. If normal operation of the TUNING meter is obtained but the OUTPUT meter does not show any keying, it is an indication that the trouble is in the A.F. system.

2. I.F. UNIT

If the trouble has been localized to the I.F. unit by the foregoing observations, before removing the I.F. unit, measure the voltage developed on the grid of the limiter tube V102 by inserting the prod of a D.C. vacuum tube voltmeter, such as the RCA Junior Voltohmyst, through the hole in the main chassis under the limiter tube. The grid resistor R104 of the limiter tube is connected to the terminal directly below this hole and the voltage developed can be conveniently measured at this point. If it does not measure greater than about 30 volts negative with respect to ground it indicates that little or no signal is being supplied to the limiter and a careful check should be made of the I.F. input cable, plugs, etc. as well as the coupling kit in the receiver and the receiver itself. See paragraph 3 of this section.

If substantially greater than —30 volts is measured on the limiter grid but the TUNING meter does not operate or indicates tuning with much less than normal swing, it is a probable indication that the locked-oscillator V103 is not oscillating. Weak indication by the TUNING meter probably means that the oscillator tube V103 is acting as an amplifier only.

Either of the above indications of trouble may occur if the I.F. unit is badly out of alignment. In any case the alignment should be checked as described below before proceeding further. If this procedure does not result in clearing up the trouble, reference should be made to the Trouble Shooting Chart for the I.F. unit Fig. 7-2 and proceed as indicated on this chart.

a. ALIGNMENT—Complete I.F. Alignment is most easily accomplished with the I.F. chassis removed from the main chassis, although all adjustments are accessible with the I.F. chassis installed. With the I.F. chassis removed it is necessary to connect leads supplying plate and filament power to the I.F. chassis which are connected to the RED and BROWN terminals respectively at one end of the I.F. chassis. Care must be taken that a good ground connection exists between the main chassis, or other source of plate and filament power, and the I.F. chassis.

Equipment required for alignment consists of a signal generator and a high impedance D.C. vacuum tube voltmeter, such as the RCA Junior Voltohmyst.

STEP 1. Set the signal generator to the frequency required, 400KC.

STEP 2. Connect the output of the signal generator to the input terminal board of the I.F. chassis.

STEP 3. Connect the tube voltmeter lead to the grid of the limiter tube V102.

STEP 4. Peak the secondary of T101 for maximum negative indication on the meter by turning the screw stud projecting from the top of T101. The input level from the signal generator should be high for this operation, otherwise it may not be possible to discern a readable deflection of the voltmeter.

STEP 5. With all connections as before, peak T102 for maximum negative indication on the voltmeter by turning the screw stud on the top of T102.

STEP 6. Remove the tube voltmeter prod from the limiter grid and connect it to Pin #3 (or #5) of the discriminator tube V104.

STEP 7. Stop oscillation of the locked oscillator by grounding Pin #8 of the locked oscillator tube V103.

STEP 8. Peak the primary of the discriminator transformer T104 for maximum negative indication on the voltmeter by turning the screw stud on the bottom of T104.

STEP 9. Connect the tube voltmeter to the GREEN terminal of the output terminal board.

STEP 10. Align the secondary of T104 to the center of the discriminator curve by turning the screw stud at the top of T104. As resonance is approached the voltmeter reading should gradually build up a positive or negative value, depending on from which side resonance is being approached, then as the screw is further turned in the same direction the meter should reverse and quickly go through zero and up to an approximately equal value of the opposite polarity. The adjusting screw should be backed up until the zero indication between the two peaks is reached and then left at this point.

STEP 11. Remove the input signal from the generator.

STEP 12. Remove the ground from Pin #8 of V103, allowing the oscillator to resume oscillations.

STEP 13. Adjust the oscillator frequency by turning the screw stud at the top of the oscillator transformer T103. This will give an indication on the tube voltmeter similar to that obtained when aligning the secondary of the discriminator transformer T104 and the adjustment should be made in the same manner.

STEP 14. Reconnect the signal generator to the input terminals.

STEP 15. Vary the frequency of the input signal and note on the meter whether or not the oscillator swings

FAILURE REPORTS

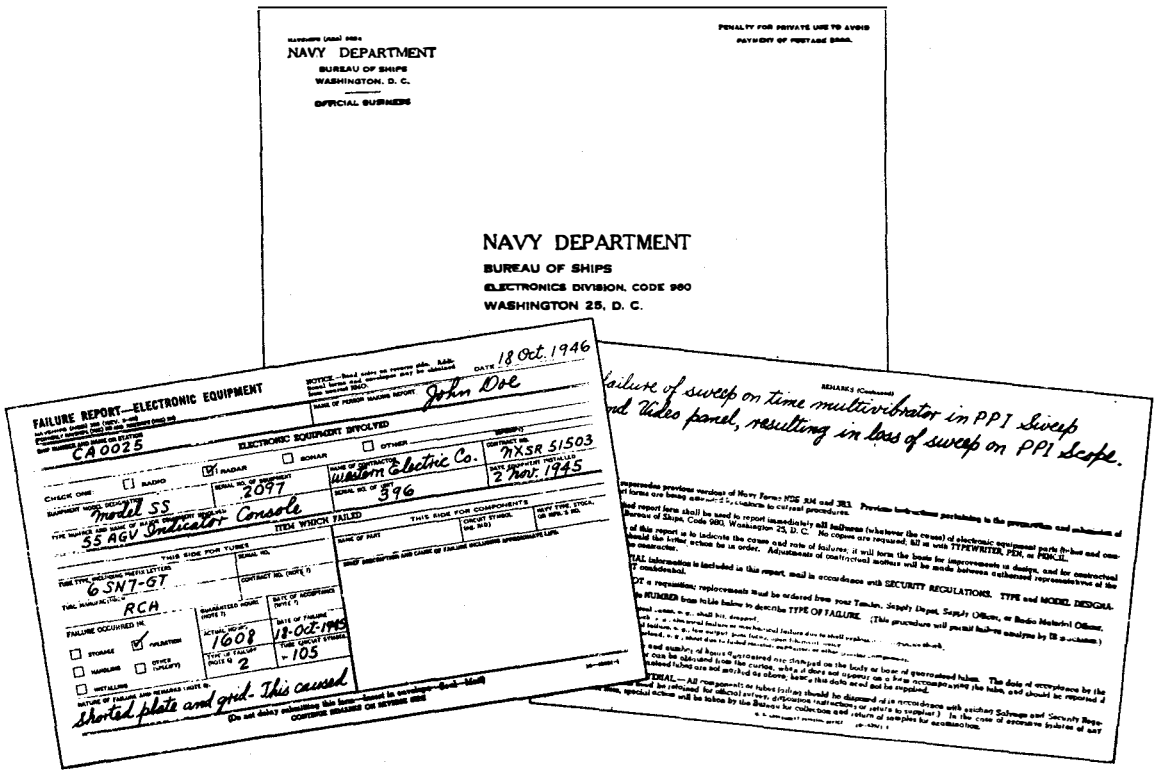
A FAILURE REPORT must be filled out for the failure of any part of the equipment whether caused by defective or worn parts, improper operation, or external influences. It should be made on Failure Report, form NBS-383, which has been designed to simplify this requirement. The card must be filled out and forwarded to BUSHIPS in the franked envelope which is provided. Full instructions are to be found on each card.

Use great care in filling the card out to make certain it carries adequate information. For example, under "Circuit Symbol" use the proper circuit identification taken from the schematic drawings, such as T-803, in the case of a transformer, or R-207, for a resistor. Do not substitute brevity for clarity. Use the back of the card to completely describe the cause of failure and attach an extra piece of paper if necessary.

The purpose of this report is to inform BUSHIPS of the cause and rate of failures. The information is used by the Bureau in the design of future equipment and in the maintenance of adequate supplies to keep the present equipment going. The cards you send in, together with those from hundreds of other ships, furnish a store of information permitting the Bureau to keep in touch with the performance of the equipment of your ship and all other ships of the Navy.

This report is not a requisition. You must request the replacement of parts through your Officer-in-Charge in the usual manner.

Make certain you have a supply of Failure Report cards and envelopes on board. They may be obtained from any Electronics Officer.



Sample Failure Report Cards Properly Filled In

both sides of centre frequency before dropping out of lock. Removing the signal generator input signal should cause the meter to indicate at centre showing that the free oscillation frequency is the centre frequency of the I.F. Signal.

3. COUPLING KIT

With the receiver operating, measure the voltages to ground from the socket contacts of X501 with the cathode follower tube V501 operating. If the defective part has not been located, measure the resistance to ground (with the receiver off). Values to be expected are shown in Fig. 7-6. If the defective part is not located in the coupling components, measure the voltage and resistance in the receiver. See RBB/RBC instruction book for normal values.

Operation of the cathode follower and low pass filter components may be checked by means of a signal generator capable of delivering one volt at 400 k.c. and a vucuum tube voltmeter. To make this check, proceed as follows.

STEP 1. Using the signal generator apply one volt at 400 k.c. to the grid terminal #4 of the cathode follower tube V501.

STEP 2. Using the vacuum tube voltmeter measure the output voltage from terminal to grounding spring of J501. Normal operation is indicated by an output of 0.15 volt.

4. A.F. SYSTEM

If the I.F. unit performs normally but the OUTPUT Meter does not show any keying, refer to the Trouble Shooting Chart for the Main Chassis Fig. 7-3 and proceed as outlined to trace through the circuit stage by stage.

Oscillograph patterns that should be obtained at the output of each stage in the A.F. system are shown on the Block Diagram Fig. 7-1 and should be viewed on an oscilloscope having a pass band of at least 5 to 10,000 cycles.

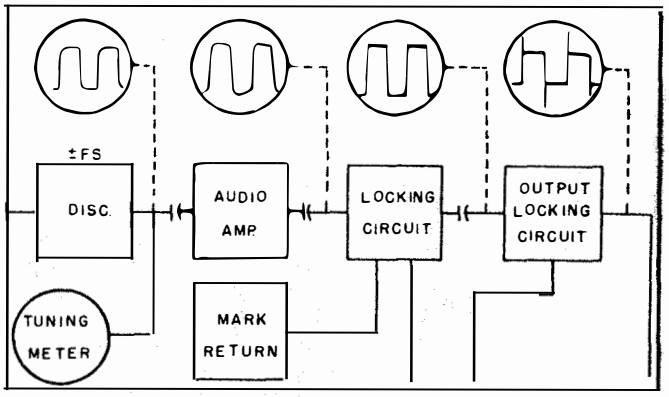


Fig. 7-1 Block Diagram of A F. System

A word of caution regarding the squelch circuit. This circuit consisting of tube V205 and its associated components functions to render the first locking circuit inoperative unless sufficient bias is applied to its grid to cut the tube off. This requires a minimum of —3 volts and at least this much voltage must be present on this grid to allow the locking circuits to operate. If any doubt exists regarding this a quick check can be made by removing the squelch tube V205 and checking the operation of the circuit.

5. VACUUM TUBES

Vacuum tubes should be discarded if they fail to give satisfactory readings on a reliable tube checker. This will prevent future trouble caused by partially worn out tubes remaining in the equipment when their useful life is nearly expended.

	TUBE TYPE								
CHARACTERISTIC	6SG7	6SJ7	6SA7	6H6	6J5	6L6GA	5Y3GT/G	0D3/VR150	0A3/VR75
Heater Volts	6.3	6.3	6.3	6.3	6.3	6.3	5.0		
Heater Amperes	0.3	0.3	0.3	0.3	0.3	0.9	2.0		
Plate Volts	250	250	250		250	250			
Screen Volts	125	100	100			250			
Grid Volts	-2.5	-3.0	0		-8.0	-14			
Plate M.A.	9.2	3.0	3.5		10	72			
Screen M.A.	3.4	0.8	8.5			5			
Plate Resistance	0.9 Meg.	1.0 Meg.	1.0 Meg.		7700	23000			
Transconductance Micrombos	4000	1650	450		2600	6000			
A.C. Volts per plate R-M-S				117			350 Max.		
D.C. Output MA				8 Max.			125 Max.		
D.C. Starting Volts (approx.)								160	100
D.C. Operating Volts (approx.)								150	75
D.C. Operating Current								5-40	5-40

NOTE

All tubes of a given type supplied with the equipment shall be consumed prior to employment of tubes from general stock.

NOTE

A wrench to remove the set screw from the knobs and catch parts is supplied in a spring clip on the side brace of the chassis.

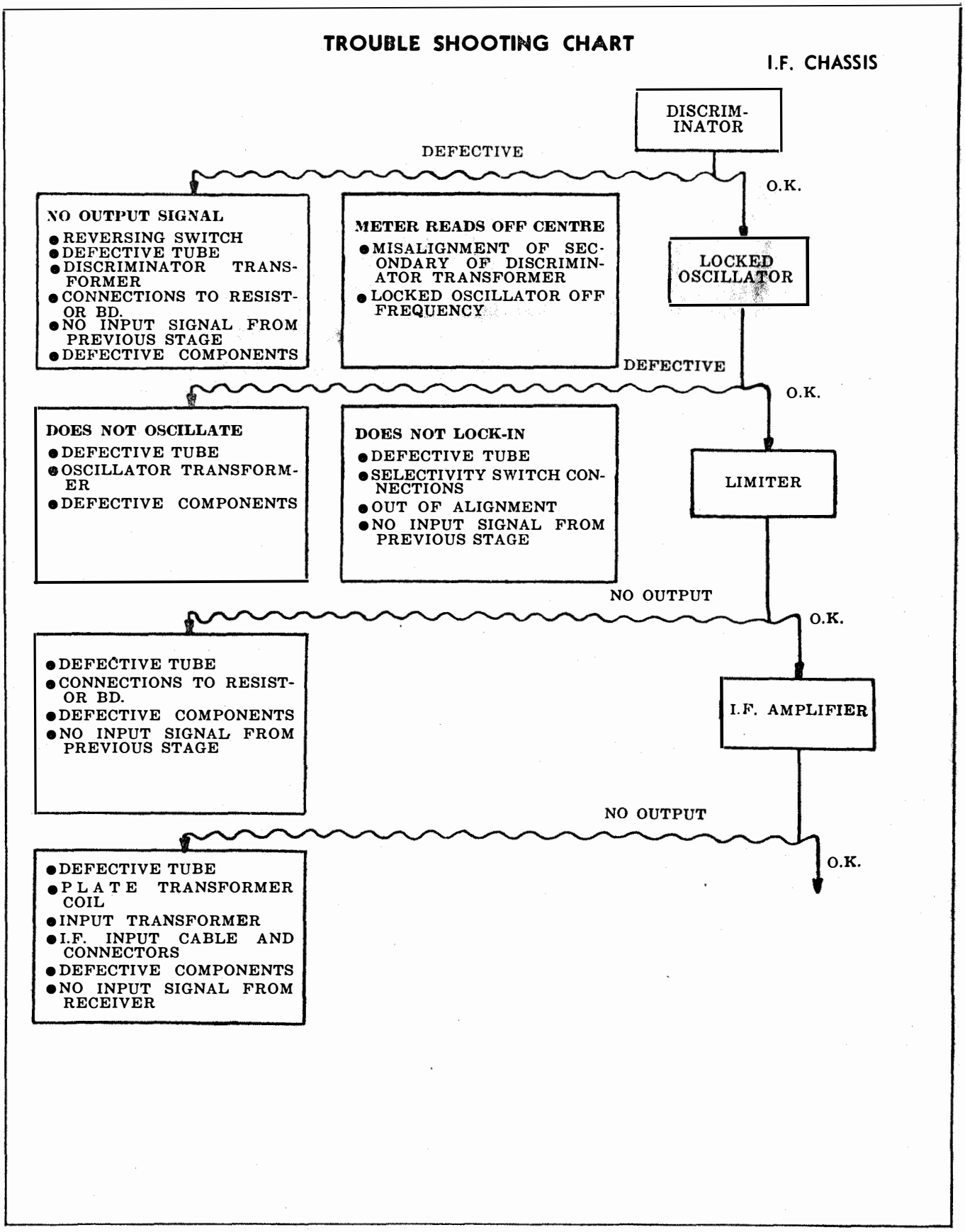


Fig. 7-2 Trouble Shooting Chart I.F. Chassis

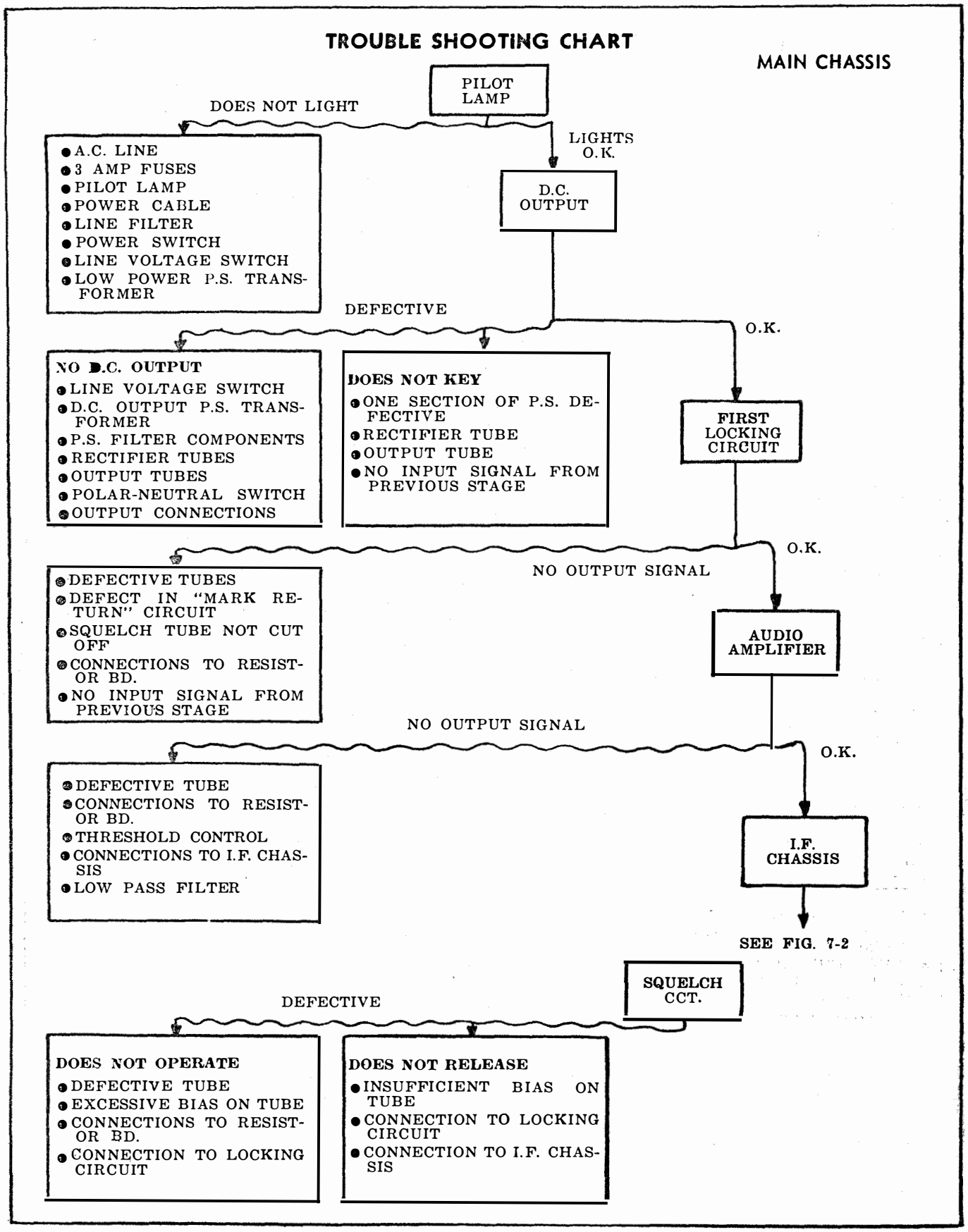


Fig. 7-3 Trouble Shooting Chart Main Chassis

COIL WINDING DATA

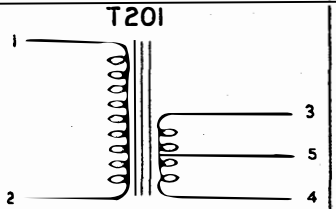
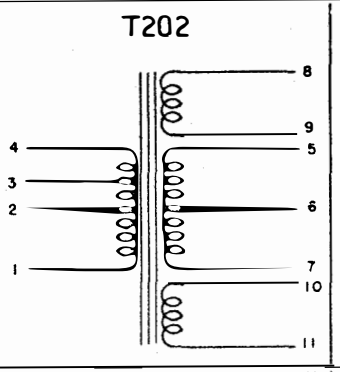
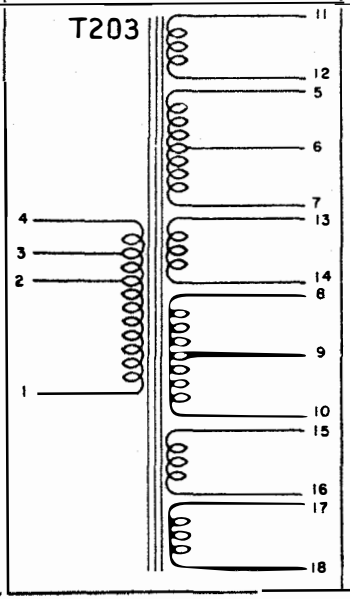
SYMBOL	RCA DWG. NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	D.C. RESISTANCE IN OHMS	IMPEDANCE RATIO	HI-POT A.C. VOLTS	REMARKS
T201	121368-1	T201 	Primary 1-2	No. 38 E	4000	700	166 to 1	1500	Impedance at 3V. 60c and 001 amp D.C. is 5000 ohms min.
			Secondary 3-4 C.T.-5	No. 30 E	310	11		500	Secondary centre-tapped.
T202	121385-1	T202 	Primary 1-2-3-4	No. 23 E	407 tap at 390, 372	2.1		2000	
			Secondary 5-7 C.T.-6	No. 32 E	2090 tap at 1045	250		2500	
			Secondary 10-11	No. 18 E	18	0.18		2500	
			Secondary 8-9	No. 18 E	22½	0.2		1000	
T203	121347-1	T203 	Primary 1-2-3-4	No. 21 E	318 tap at 304, 290	1.7		1500	
			Secondary 5-7 C.T.-6	No. 33 E	1680 tap at 840	280		2500	
			Secondary 8-10 C.T.-9	No. 33 E	1680 tap at 840	280		2500	
			Secondary 11-12	No. 18 E	14	0.15		2500	
			Secondary 13-14	No. 18 E	14	0.15		2500	
			Secondary 15-16	No. 21 E	18	0.5		1000	
			Secondary 17-18	No. 21 E	18	0.5		1000	

Fig. 7-4 Coil Winding Data (Sheet 1 of 4 Sheets)

COIL WINDING DATA

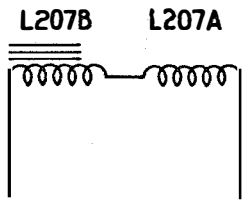
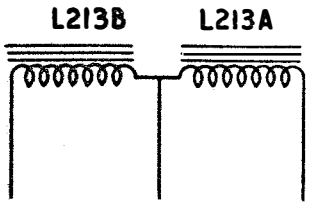
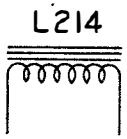
SYMBOL	RCA DWG. NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	D.C. RESISTANCE IN OHMS	IMPEDANCE RATIO	HI-POT A.C. VOLTS	REMARKS
L207A L207B	121369-501		1st Section 2nd Section	No. 22 ES No. 22 ES	40 50 per Section	0.85 total			Single layer close wound. Each section Universal wound 2 crosses per turn.
L208A L208B	121369-501								Same as L207A L207B
L209A L209B	121369-501								Same as L207A L207B
L210A L210B	121369-501								Same as L207A L207B
L213A L213B	121344-1		Single	No. 38 E	4560	1150		2000	Impedance at 3V 60c and .020 amps D C. is 13000 ohms min. Two identical reactors in can.
L214	121346-1		Single	No. 34 E	3440	375		2000	Impedance at 3V 60c and .090 amps D.C. is 5000 ohms min.
L215	121346-1								Same as L214

Fig. 7-4 Coil Winding Data (Sheet 2 of 4 Sheets)

COIL WINDING DATA

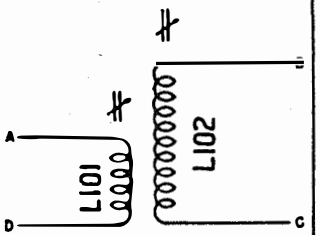
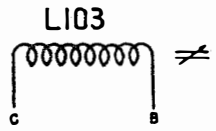
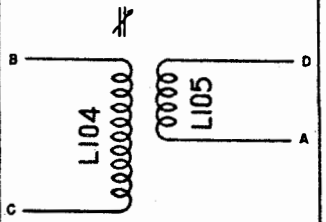
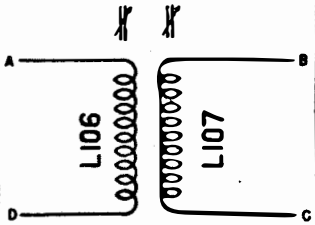
SYMBOL	RCA DWG. NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	D.C. RESISTANCE IN OHMS	IMPEDANCE RATIO	HI-POT A.C. VOLTS	REMARKS
T101	122209-501		Primary A-D	3 strand .0028 Litz.	15	0.85			Wind between 1st and second pies of secondary.
			Secondary B-C	3 strand .0028 Litz.	90 per Section	17.5			4 sections Universal wound 4 crosses per turn.
T102	122209-502		Single B-C	3 strand .0028 Litz.	90 per Section	17.5			4 sections Universal wound 4 crosses per turn.
T103	122210-501		Primary B-C	7 strand .0028 Litz.	125	3.1			Cumulative wound 250 turns per inch.
			Secondary A-D	No. 38 E	85	6.2			Single layer close wound 200 turns per inch.
T104	122209-503		Primary A-D	3 strand .0028 Litz.	75	14			4 sections Universal wound 4 crosses per turn.
			Secondary	3 strand .0028 Litz.	75	14			4 sections Universal wound 4 crosses per turn.

Fig. 7-4 Coil Winding Data (Sheet 3 of 4 Sheets)

COIL WINDING DATA

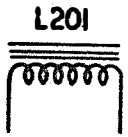
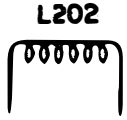
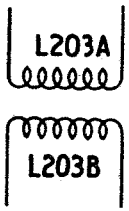
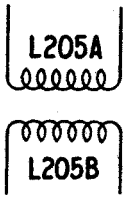
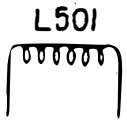
SYMBOL	RCA DWG. NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	D.C. RESISTANCE IN OHMS	IMPEDANCE RATIO	HI-POT A.C. VOLTS	REMARKS
L201	121345-1		Single	No. 36 E	3200	400		1500	Impedance at 3V 60 cycle A.C. and 0 D.C. amps 25000-35000 ohms.
L202	121744-503		Single	No. 28 ES	25	0.28			
L203A L203B	121744-502		Bifilar	No. 28 ES	25 per Section	0.29			
L205A L205B	121744-501		Bifilar	No. 28 ES	30 per Section	0.31			
L501	890737-3		Single	No. 30 E	55	0.9			Inductance 22 MH at 1000 cycles.
L502									Same as L501

Fig. 7-4 Coil Winding Data (Sheet 4 of 4 Sheets)

Fig. 7-5 Schematic Diagram

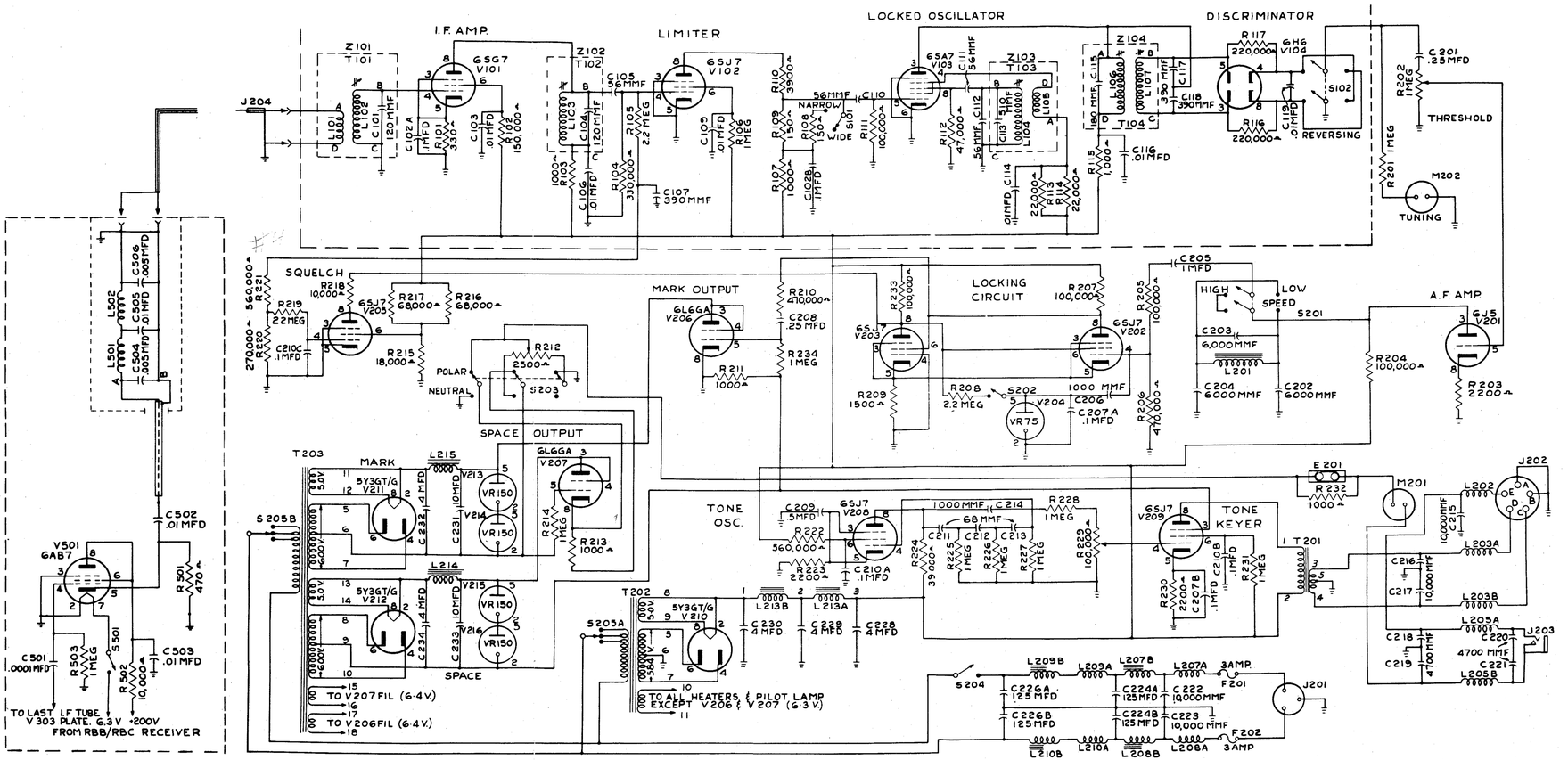


Fig. 7-5 Schematic Diagram

Fig. 7-6 Voltage and Resistance Chart

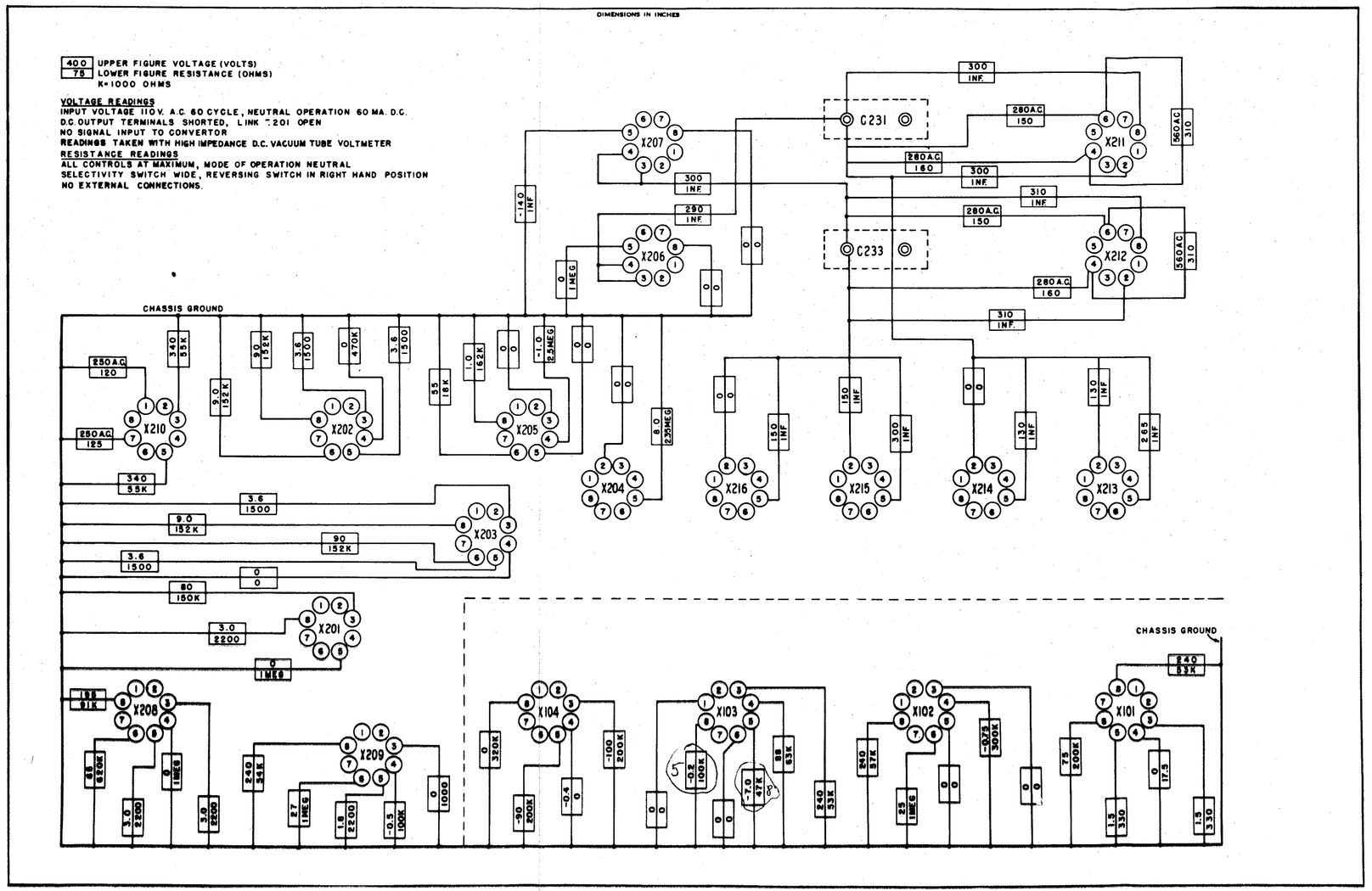


Fig. 7-6 Voltage and Resistance Chart

Fig. 7-7 Wiring Diagram I. F. Chassis

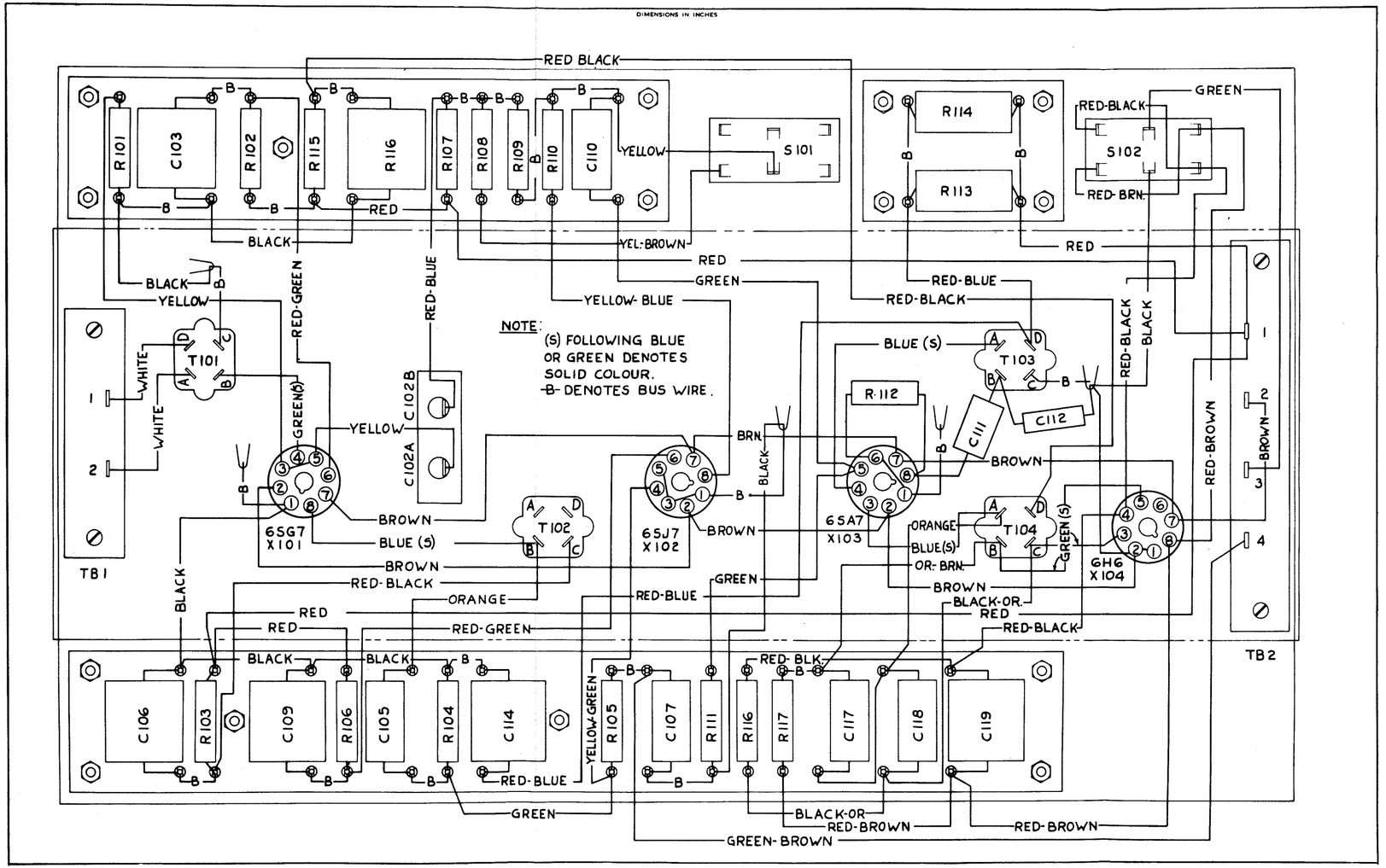


Fig. 7-7 Wiring Diagram I. F. Chassis

Fig. 7-8 Wiring Diagram Main Chassis

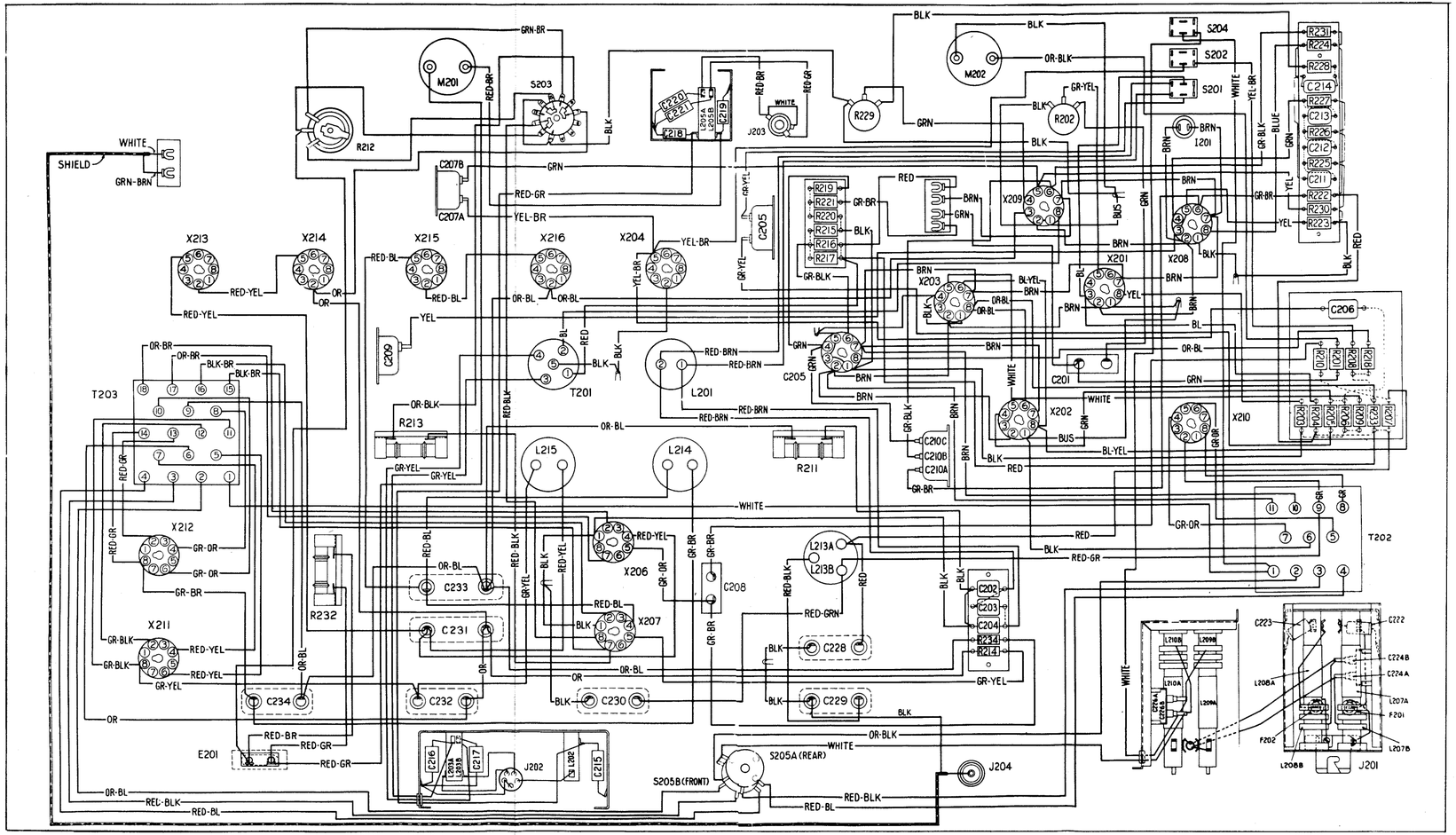


Fig. 7-8 Wiring Diagram Main Chassis

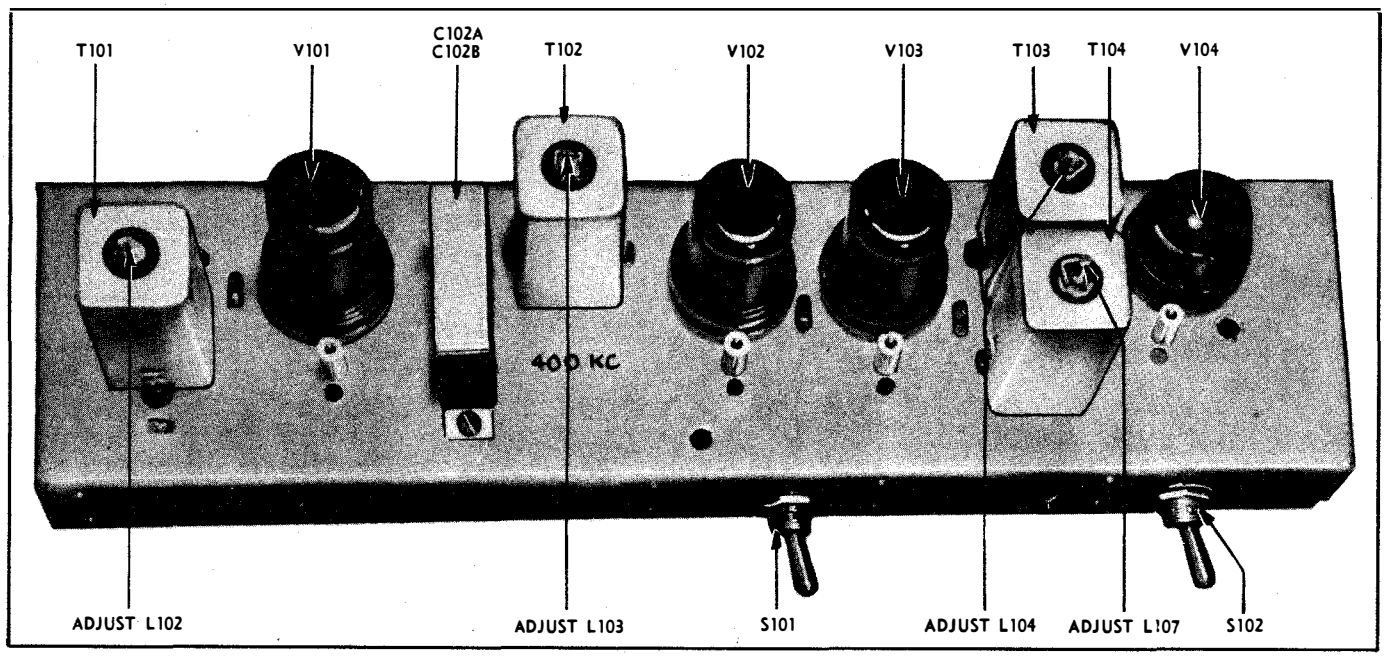


Fig. 7-9 I.F. Chassis Top View

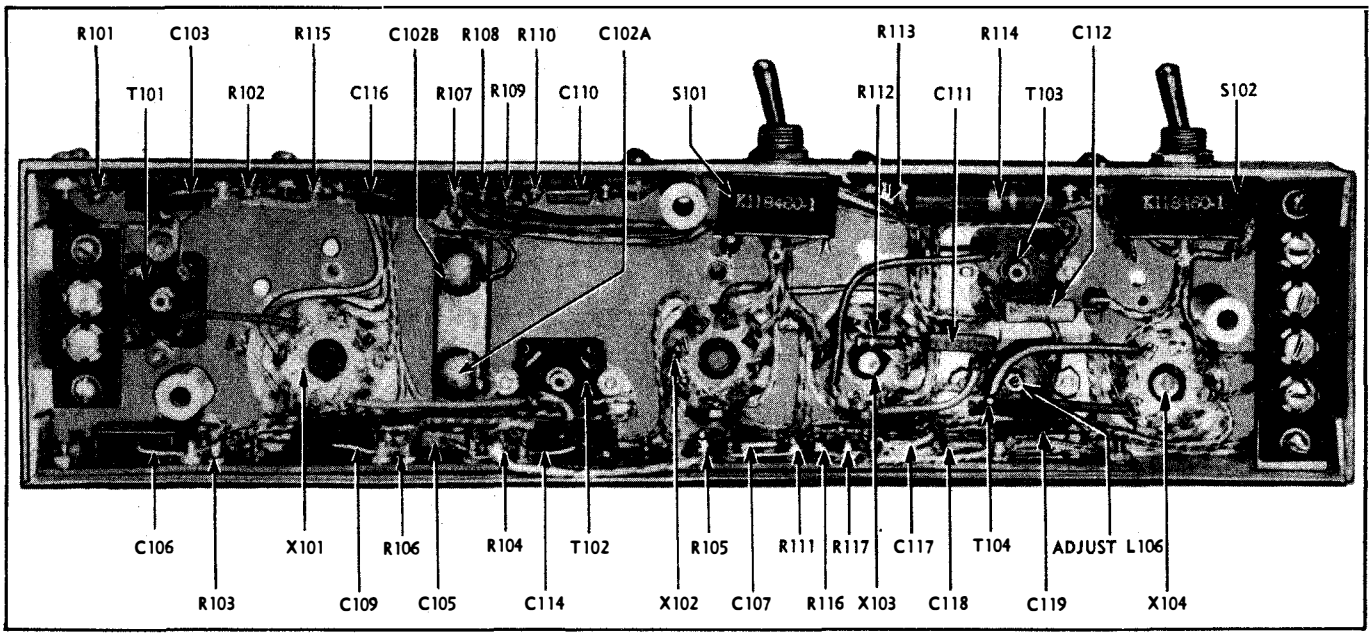


Fig. 7-10 I.F. Chassis Bottom View

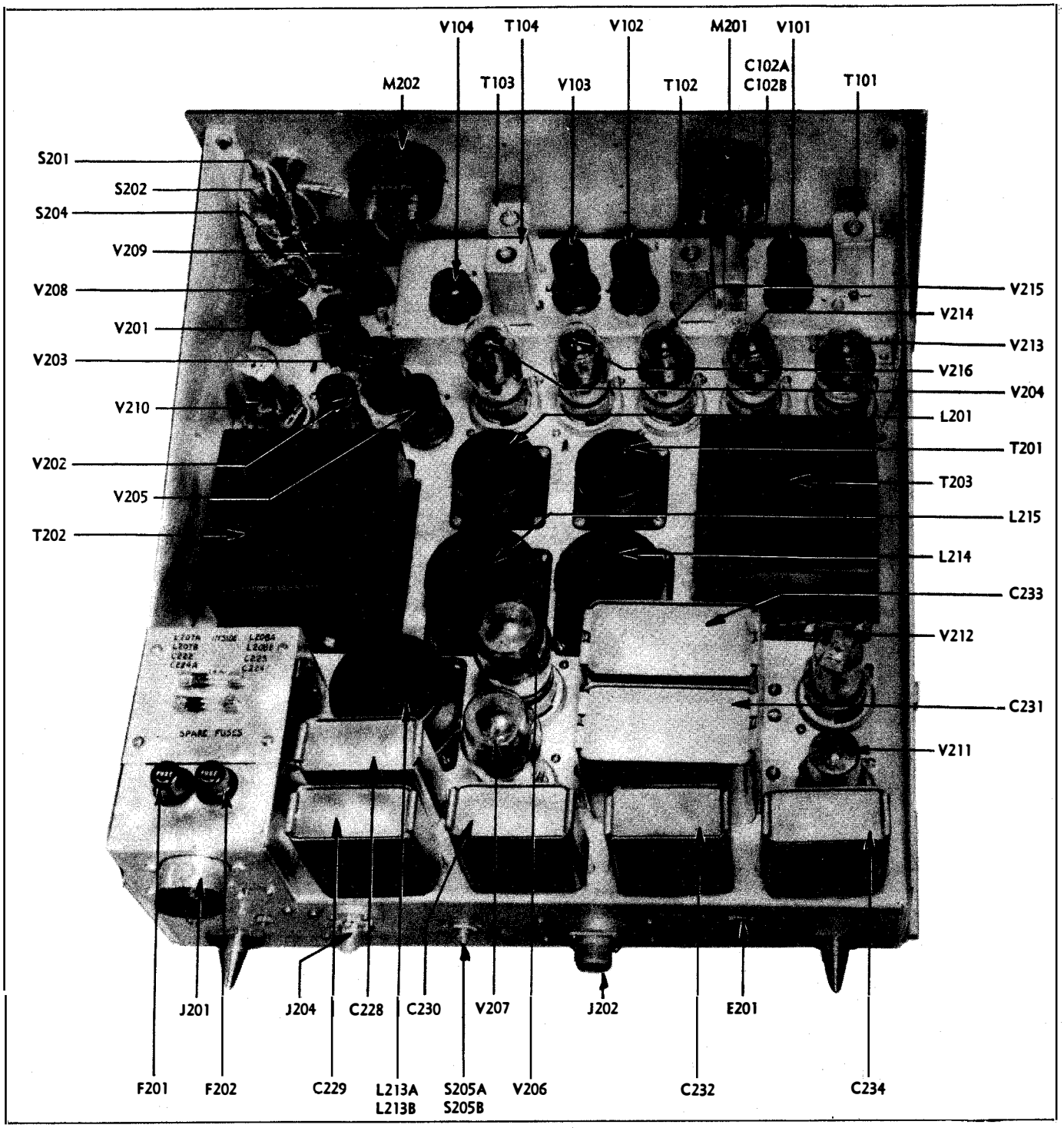


Fig. 7-11 Main Chassis Top View

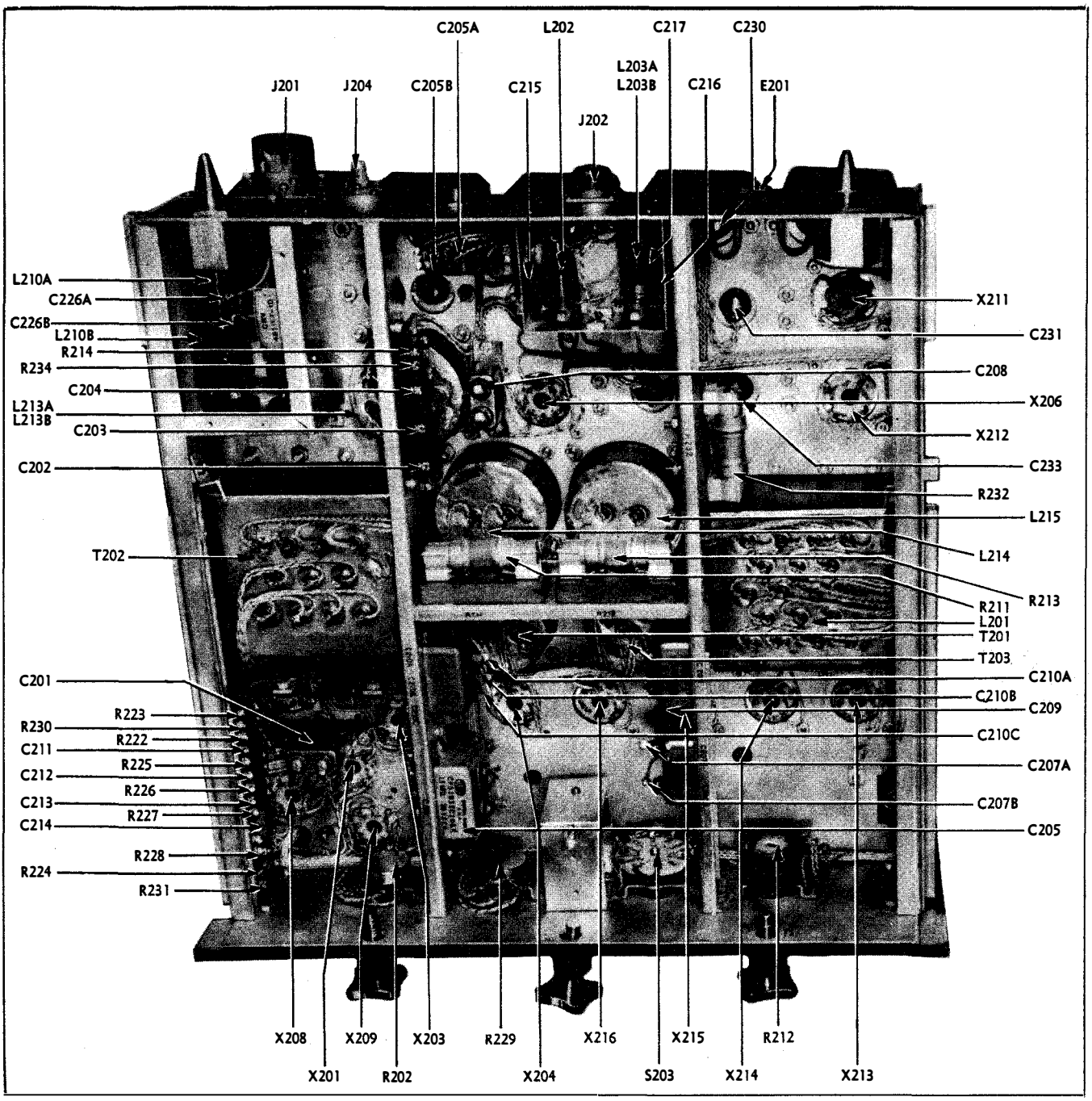


Fig. 7-12 Main Chassis Bottom View

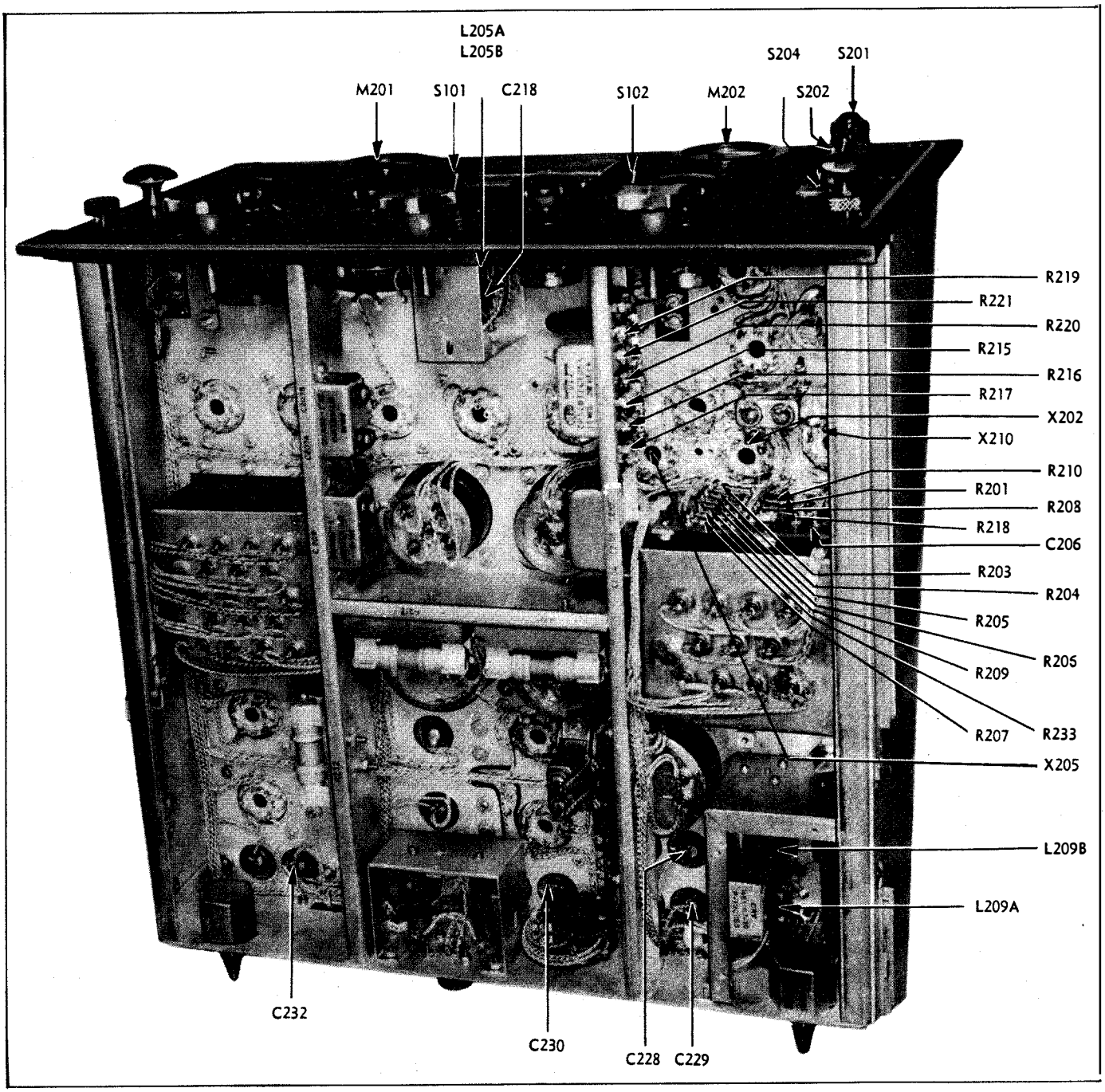


Fig. 7-13 Main Chassis Bottom View

TABLE 8-1
LIST OF MAJOR UNITS
FREQUENCY SHIFT RECEIVER CONVERTING EQUIPMENT NAVY MODEL FRA

SYMBOL GROUP	QUANTITY	NAME OF UNIT	NAVY TYPE DESIGNATION
	1	Frequency Shift Receiver Converter Consisting of -	CRV-35122
101 - 199		I.F. Assembly 400 K.C.	
201 - 299		Main Chassis Assembly	
301 - 499		Unassigned	
501 - 599	1	Coupling Kit - Consisting of	CRV-10563
		Cathode Follower Assembly	
		Low Pass Filter Unit	
		Coaxial Cable	
		Miscellaneous Accessories	
	1	A.C. Power Plug	CRV-49125
	1	Output Plug	AN-3106-14-5P

TABLE 8-2

COMBINED PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR NAVY MODEL FRA FREQUENCY SHIFT RECEIVER CONVERTER EQUIPMENT

PARTS: I.F. CHASSIS ASSEMBLY 400 KC

Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS: Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
C101	Capacitor: fixed, mica, 120 mmf. ± 5%,500 v. d.c. working characteristic C, part of Z-101, max.dimensions 51/64"x15/32"x 7/32", two pigtail terminal leads.	Capacitor, I.F. Tuning T101	CM20C121J	CM20C121J	722004-525	C101,C104	2	1	1	1	1	2	1	2
C102A	Capacitor: fixed, paper, dual, .1 x .1mf., 400 v working, mineral oil impregnated and filled, two mounting holes spaced 2-1/8", dimensions 41/64" x 2-7/16" x 1-1/2", overall height 2-1/4".	Capacitor, Cathode By-pass V101	CP69B3EE 104MK	CP69B3EE 104MK	121706-1	C102	1	2	1	1	1	2	1	3
C102B	Part of C102	Capacitor, Plate Filter V102												
C103	Capacitor: moulded,fixed,paper .01mf., 400 v working, dimensions 53/64" x 53/64" x 11/32", two pigtail terminal leads.	Capacitor, Screen By-pass V101	CN35A 103	CN35A 103	121704-2	C103,C106 C109,C114 C116,C119	6	3	1	3	1	9	1	15
C104	Same as C101	Capacitor,Tuning T102												
C105	Capacitor: fixed, mica, 56 mmf. ± 10%, 500 v d.c. working, characteristic A, max. dimensions 51/64" x 15/32" x 7/32", two pigtail terminal leads.	Capacitor, Grid Coupling V102	CM20A560K	CM20A560K	722000-567	C105,C110, C111	3	4	1	1	1	3	1	4
C106	Same as C103	Capacitor,Plate Decoupling V101												
C107	Capacitor: fixed, mica, 390 mmf. ±5%, 500 v d.c. working, characteristic C, max. dimensions 51/64" x 15/32" x 7/32", two pigtail terminal leads.	Capacitor, RF Filter	CM20C 391J	CM20C 391J	722004-537	C107,C117, C118	3	5	1	1	1	2	1	3
C108	Not used													
C109	Same as C103	Capacitor, Screen By-pass V102												
C110	Same as C105	Capacitor,Grid Coupling V103												

PARTS: I.F. CHASSIS ASSEMBLY 400 KC.

Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
C111	Same as C105	Capacitor, Oscillator Coupling V103												
C112	Capacitor: fixed, ceramic, 56 mmf. ± 5% uninsulated, temperature compensating - 750 parts/M/°C dimensions .460" x .240" diam., two pigtail terminal leads.	Capacitor, Tuning T103	CC30UJ560J	CC30UJ560J	722422-428	C112	1	6	1	1	1	1	1	1
C113	Capacitor: fixed, mica, 510 mmf. ± 5% 500 v d.c. working, characteristic D, dimensions 51/64" x 15/32" x 7/32", two pigtail terminal leads.	Capacitor, Tuning T103	CM20D511J	CM20D511J	722006-540	C113	1	7	1	1	1	1	1	1
C114	Same as C103	Capacitor, Decoupling V103												
C115	Capacitor: fixed, mica, 180 mmf. ±5% 500 v d.c. working, characteristic C, maximum dimensions 51/64" x 15/32" x 7/32", two pigtail terminal leads.	Capacitor, Tuning T104	CM20C181J	CM20C181J	722004-529	C115	1	8		1		1		1
C116	Same as C103	Capacitor Plate Decoupling V103												
C117	Same as C107	Capacitor, Tuning T104												
C118	Same as C107	Capacitor, Tuning T104												
C119	Same as C103	Capacitor, Filter V104												
L101	Inductance: R.F., part of Z101.	Inductance, Primary T101		CRV 121389-6	121389-6									
L102	Inductance: R.F., part of Z101, four sections spacing 1/32" between pies, overall coil length 11/32", coil located 7/16" from top of coil form, treated after assembly with Cumar.	Inductance, Secondary T101		CRV 121389-5	121389-5									
L103	Inductance: R.F., part of Z102, same as L102.	Inductance, Primary T102												
L104	Inductance: R.F., part of Z103, located 7/16" from top end of bakelite coil form, coil length 1/2", treated with Cumar after assembly.	Inductance, Primary T103		CRV 121393-3	121393-3									

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Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
L105	Inductance: R.F., part of Z103, start located 1/32" from finish of L104, treated after assembly with Cumar.	Inductance, Secondary T103		CRV 121393-4	121393-4									
L106	Inductance: R.F., part of Z104, four sections, spacing 1/32" between pies, overall length 11/32", located 1-5/32" from top of coil form, treated after assembly with Cumar.	Inductance, Primary T104		CRV 121389-7	121389-7									
L107	Inductance: R.F., part of Z104, same as L106, located 9/16" from top of coil form, treated after assembly with Cumar.	Inductance, Secondary T104		CRV 121389-7	121389-7									
R101	Resistor: fixed, composition, 330 ohms ± 20%, 1/4 watt insulated, .406" max. length, .170" max. diam., two axial leads 1-1/2" long.	Resistor, Cathode Bias V101	RC10BE331M	RC10BE331M	722302-10	R101	1	9	1	1	1	3	1	5
R102	Resistor: fixed, composition, 150,000 ohms ± 20%, 1/4 watt insulated, .406" max.length, .170" max. diam., two axial leads 1-1/2" long.	Resistor, Screen Dropping V101	RC10BE154M	RC10BE154M	722302-26	R102	1	10	1	1	1	3	1	5
R103	Resistor: fixed, composition 1000 ohms ± 20%, 1/4 watt insulated, .406" max.length, .170" max.diam., two axial leads 1-1/2" long.	Resistor, Plate Decoupling V101	RC10BE102M	RC10BE102M	722302-13	R103,R107, R115	3	11	1	2	1	9	1	15
R104	Resistor: fixed, composition, 330,000 ohms ± 20%, 1/4 Watt insulated, .406" max.length, .170" max.diam., two axial leads 1-1/2" long.	Resistor, Grid Leak V102	RC10BE334M	RC10BE334M	722302-28	R104	1	12	1	1	1	3	1	5
R105	Resistor: fixed, composition, 2.2 megohms ± 10%, 1/4 watt insulated, .406" max.length, .170" max.diam., two axial leads 1-1/2" long.	Resistor, R.F.Filter	RC10BE225K	RC10BE225K	722302-102	R105,R219	2	13	1	1	1	6	1	10
R106	Resistor: fixed, composition, 1.0 megohms ± 20%, 1/4 watt insulated, .406" max.length, .170" max.diam., two axial leads 1-1/2" long.	Resistor, Screen Dropping V102	RC10BE105M	RC10BE105M	722302-31	R106,R201, R214,R228, R231,R234	6	14	1	3	1	18	1	30

PARTS: I.F. CHASSIS ASSEMBLY 400 KC.

Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS Equip Box. No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
R107	Same as R103	Resistor, Plate Decoupling V102												
P108	Resistor: fixed, composition, 150 ohms ± 5%, 1/4 watt insulated, .406" max. length, .170" max.diam., two axial leads 1-1/2" long.	Resistor, Plate load V102	RC10BE151J	RC10BE151J	722302-139	R108,R109	2	15	1	1	1	6	1	10
R109	Same as R108	Resistor, Plate Load V102												
R110	Resistor: fixed, composition, 3900 ohms ± 10%, 1/4 watt insulated, .406" max.length, .170" max.diam., two axial leads 1-1/2" long.	Resistor, Plate Load V102	RC10BE392K	RC10BE392K	722302-69	R110	1	16	1	1	1	3	1	5
R111	Resistor: fixed, composition, 100,000 ohms, ± 20%, 1/4 watt insulated, .406" max.length, .170" max.diam., two axial leads 1-1/2" long.	Resistor, Grid Leak V103	RC10BE104M	RC10BE104M	722302-25	R111,R205, R207,R233	4	17	1	3	1	15	1	25
R112	Resistor: fixed, composition, 47000 ohms, ± 20%, 1/4 watt insulated, .406" max.length, .170" max.diam., two axial leads 1-1/2" long	Resistor, Osc. Grid Leak V103	RC10BE473M	RC10BE473M	722302-23	R112	1	18	1	1	1	6	1	10
R113	Resistor: fixed, composition, 22,000 ohms ± 10%, 2 watt, insulated small, 1.41" max. length, .405" max.diam., two axial leads 1-1/2" long.	Resistor, Screen Dropping V103	RC40BE233K	RC40BE223K	722352-78	R113,R114	2	19	1	1	1	6	1	10
R114	Same as R113	Resistor, Screen Dropping V103												
R115	Same as R103	Resistor, Plate Decoupling V103												
R116	Resistor: fixed, composition, 220,000 ohms ± 10%, 1/4 watt, insulated .406" max.length, .170" max.diam., two axial leads 1-1/2" long.	Resistor, Discrimator Load V104	RC10BE224K	RC10BE224K	722302-90	R116,R117	2	20	1	1	1	6	1	10
R117	Same as R116	Resistor,Discriminator Load V104												

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Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
S101	Switch: toggle D.P.D.T., 3 amp., 250 v. d.c., 6 amp., 125 v. d. c., 1-9/32" max.length, 23/32" max. width, 31/32" high for body and terminals, 15/32" - 32 NS-2 mounting shoulder, 15/32" long, supplies with two mtg. nuts, toggle 11/16" long, six terminals.	Switch, Selectivity	ST 22N	CAE ST 22N	121370-1	S101,S102 S201,S202 S204	5	21	1	2	1	3	1	6
S102	Same as S101	Switch, Output Reversing												
T101	Transformer assembly: Z101 assembly consisting of L101, L102,C101 and bakelite coil form enclosed in an aluminum shield can, coil form provided with terminal board at bottom, plain board at top, L101 connects to terminals A and D, L102,C101 connect to terminals B and C on bottom terminal board, L102 is slug tuned through top of assembly, assembly mounts to I.F. chassis by two spade bolts spaced 1-1/16", can dimensions 1-3/8" long, 1" square, terminals extend 7/16" beyond can edge.	Transformer, I.F. Input	CRV 471777	CRV 122209-501	122209-501	T101	1	22	1	1	1	2	1	3
T102	Transformer assembly: Z102 assembly consists of L103,C104 and bakelite coil form enclosed in an aluminum shield can, coil form provided with terminal board at bottom, plain board at top, coil and capacitor connect to terminals B and C on terminal board, coil is slug tuned through top of assembly, assembly mounts to I.F. chassis by two spade bolts spaced 1-1/16", can dimensions 1-3/8" long, 1" square, terminals extend 7/16" beyond can edge.	Transformer, Tuned Plate Coil V101	CRV 471778	CRV 122209-502	122209-502	T102	1	23	1	1	1	2	1	3

PARTS: I.F. CHASSIS ASSEMBLY 400 KC

Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
T103	Transformer assembly: Z103 assembly consists of L104,L105, C113 and bakelite coil form enclosed in an aluminum shield can, coil form provided with terminal board at bottom,plain board at top,L-104,C-113 connect to terminals B and C,L-105 connects to terminals A and D, L-104 is slug tuned through top of assembly,assembly mounts to I.F. chassis by two spade bolts spaced 1-1/16",can dimensions 1-3/8" long, 1" square,terminals extend 7/16"beyond can edge.	Transformer,Oscillator	CRV 471773	CRV 122210-501	122210-501	T103	1	24		0	1	1	1	1
T104	Transformer assembly: Z104 assembly consists of L106,L107, C117 and bakelite coil form enclosed in an aluminum shield can, coil form provided with terminal board at bottom,plain board at top, L-106,C-117 connect to terminals A and D,L-107 connects to terminals B and C, coils are slug tuned through top and bottom of assembly, assembly mounts to I.F.chassis by two spade bolts spaced 1-1/16", can dimensions 1-3/8" long, 1" square, terminals extend 7/16" beyond can edge.	Transformer, Discriminator	CRV 471779	CRV 122209-503	122209-503	T104	1	25	1	1	1	2	1	3
V101	Tube: electron JAN 6SG7	Tube, I.F.Amplifier		CRC		V101	1	26	1	2	1	3		0
V102	Tube: electron JAN 6SJ7	Tube, Limiter		CRC		V102,V202 V203,V205 V208,V209	6	27	1	12	1	18		0
V103	Tube: electron JAN 6SA7	Tube,Locked Oscillator		CRC		V103	1	28	1	2	1	3		0
V104	Tube: electron JAN 6H6	Tube, Discriminator		CRC		V104	1	29	1	2	1	3		0
X101	Socket: tube, eight contacts, with #4 retaining ring for 1/16" thick chassis, contacts phosphor bronze, silver plated, sockets ceramic steatite base material, sockets impregnated high melting point wax,51/64" thick - 1-1/4" diam. overall	Socket, for V101	CPH49373	CPH SS-8M	856956-6	X101,X102, X103,X104, X201,X202, X203,X204, X205,X206, X207,X208, X209,X210, X211,X212, X213,X214 X215,X216	20	30	1	10	1	10	1	20

PARTS: I.F. CHASSIS ASSEMBLY 400 KC

Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS: Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
X102	Same as X101	Socket, for V102												
X103	Same as X101	Socket, for V103												
X104	Same as X101	Socket, for V104												
		MAIN CHASSIS												
A201	Shockmount: metal parts heavy cadmium plate, dynamic stiffness, axial 3800 pounds per inch, radial 3600 pounds per inch, 3" square, 1-1/2"thick, four mounting holes 2-1/2" centres, 3/8" diameter axial hole.	Shockmount, Chassis Mounting		L.N.Barry Co. C-2045	121373-7	A201,A202, A203,A204	4	31	1	1	1	4	1	4
A202	Same as A201	Shockmount, Chassis Mounting												
A203	Same as A201	Shockmount, Chassis Mounting												
A204	Same as A201	Shockmount, Chassis Mounting												
C201	Capacitor: fixed, paper, .25 mf. 400 v d.c., mineral oil impregnated and filled, two terminal solder lugs spaced 5/8", body 1-5/8" high,1-5/16" long, 49/64" wide, two mounting holes spaced 3-7/8" centres	Capacitor, Audio Coupling V201	CP63B1EE 254MK	CP63B1EE 254MK	121354-1	C201,C208	2	32	1	1	1	3	1	5
C202	Capacitor: moulded, fixed, paper, 6000 mmf. 400 v. working, dimensions 53/64" x 53/64" x 11/32", two pigtail terminal leads 1-1/4" long.	Capacitor, Audio Filter	CN35 A602	CN35A602	121704-1	C202,C203, C204	3	33	1	2	1	5	1	8
C203	Same as C202	Capacitor, Audio Filter												
C204	Same as C202	Capacitor, Audio Filter												
C205	Capacitor: fixed, paper, 1.0 mf. 400 v. working, mineral oil impregnated and filled, two terminal solder lugs spaced 1", body 1" high, 2" long, 1-3/4" wide, two mounting holes spaced 2-3/8" centres.	Capacitor, Audio Coupling V202	CP51B1EE 105 PL	CP51B1EE 105PL	121397-1	C205	1	34	1	1	1	2	1	3

PARTS: MAIN CHASSIS

Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS: Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
C206	Capacitor: fixed, mica, 1000 mmf. ± 20% 500 v d.c. working, max.dimensions,1-1/16" long, 15/32" wide, 7/32" thick, two pigtail leads 1-1/8" min.	Capacitor, Mark Return Coupling	CM25A102M	CM25A102M	722007-547	C206,C214	2	35	1	1	1	2	1	2
207A	Capacitor: fixed, paper, dual, .1X .1mf. 400v working, mineral oil impregnated and filled,two terminal solder lugs spaced 1", body 3/4" high, 1-13/16" long, 1" wide, two mounting holes spaced 2-1/8" centres.	Capacitor,Filter for V204	CP51B3EE 104PL	CP51B3EE 104PL	121398-1	C207	1	36	1	1	1	2	1	3
C207B	Part of C207	Capacitor, Cathode By-pass V209												
C208	Same as C201	Capacitor, Audio Coupling V206												
C209	Capacitor: fixed, paper, .5 mf. 200v working, mineral oil impregnated and filled, one terminal lug, body 1-13/16" long,1" wide, 7/8" high, two mounting holes spaced 2-1/8" centres.	Capacitor, Cathode By-pass V208	CP51B2EC 504PL	CP51B2EC 504PL	121399-1	C209	1	37	1	1	1	2	1	3
C210A	Capacitor: fixed, paper, triple .1 X .1 X .1 mf. 400v working, mineral oil impregnated and filled, three terminal lugs, body 1-13/16" long, 1" wide,7/8" high, two mounting holes spaced 2-1/8" centres.	Capacitor, Screen By-pass V208	CP51B5EE 104PL	CP51B5EE 104PL	121740-1	C210	1	38	1	1	1	2	1	3
C210B	Part of C210	Capacitor,Screen By-pass V209												
C210C	Part of C210	Capacitor, Filter for V205												
C211	Capacitor: fixed, mica, 68 mmf. ± 5%, 51/64" x 15/32" x 7/32" max. dimensions two pigtail terminal leads 1-1/8" long.	Capacitor, Feed-back	CM20A680J	CM20A680J	121705-1	C211,C212, C213	3	39	1	1	1	2	1	3
C212	Same as C211	Capacitor, Feedback V208												
C213	Same as C211	Capacitor, Feedback V208												
C214	Same as C206	Capacitor,Oscillator Coupling to V209												

PARTS: MAIN CHASSIS

Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
C215	Capacitor: fixed, mica, 10000 mmf. ±5%, 300v d.c. max. working volts, characteristic B, maximum dimensions 41/64" x 11/32" x 1-1/32", two pigtail leads 1-3/8" min.length.	Capacitor, D.C.Output Filter to J202	CM40B103J	CM40B103J	722036-513	C215,C216 C217,C222 C223	5	40	1	1	1	2	1	2
C216	Same as C215	Capacitor, Tone Output Filter												
C217	Same as C215	Capacitor, Tone Output Filter												
C218	Capacitor: fixed, mica, 4700 mmf. ±10% 500v d.c. max.working volts,characteristic B, max. dimensions 53/64" x 53/64" x 11/32", two pigtail leads 1-1/8" min. length.	Capacitor, D.C. Output Filter to J203	CM35B472K	CM35B472K	722026-555	C218,C219 C220,C221 C504,C506	6	41	1	2	1	4	1	6
C219	Same as C218	Capacitor, D.C. Output Filter to J203												
C220	Same as C218	Capacitor, D.C. Output Filter to J203												
C221	Same as C218	Capacitor, D.C. Output Filter to J203												
C222	Same as C215	Capacitor, Power Line Filter												
C223	Same as C215	Capacitor, Power Line Filter												
C224A	Capacitor: fixed, paper, dual .125 x .125 mf. ± 10% 400v d.c. working volts, 1-1/16" high, 1-11/32" wide, 23/32" deep, two solder terminal lugs spaced 5/8", lugs and insulators extend 15/16" beyond top of capacitor.	Capacitor, Power Line Filter	481167	CRV 720555-55	720555-55	C224,C226	2	42	1	1	1	3	1	5
C224B	Part of C224	Capacitor, Power Line Filter												
C225	Not used.													
C226A	Same as C224A	Capacitor, Power Line Filter												
C226B	Part of C226	Capacitor, Power Line Filter.												

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Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
C227	Not used.													
C228	Capacitor: fixed, paper, 4 mf. 600v d.c. max. working volts, mineral oil impregnated and filled, two terminal solder lugs spaced 1-1/8", 3-7/8" high, 2-1/2" wide, 1-3/16" deep supplied with two mounting brackets CP 70 S B4 mounting spade bolts on brackets spaced 2-1/8" centres.	Capacitor, B Supply Filter	CP70B1EE 405PL	CP70B1EE 405PL	110906-1	C228,C229, C230,C232, C234	5	43	1	3	1	8	1	13
C229	Same as C228	Capacitor, B Supply Filter												
C230	Same as C228	Capacitor, B Supply Filter												
C231	Capacitor: fixed, paper, 10 mf. 600v d.c. max.working volts, mineral oil impregnated and filled, two terminal solder lugs spaced 2-3/16", 4" high, 3-3/4" wide, 1-3/4" deep, supplied with two mounting brackets CP07FD3, mounting holes on brackets spaced 4-3/8" centres.	Capacitor, B Supply Filter	CP70B1EE 106V	CP70B1EE 106V	122201-1	C231,C233	2	44	1	1	1	3	1	5
C232	Same as C228	Capacitor, B Supply Filter												
C233	Same as C231	Capacitor, B Supply Filter												
C234	Same as C228	Capacitor, B Supply Filter												
E201	Holder: fuse removable post type. Overall size 11/16" dia. x 1-1/2" long. Two solder lug terminals.	Holder, for F201		CFA HKM	119281-1	E201	1	45	1	1	1	1	1	2
E202	Holder: pilot light, red lens, bayonet socket, adjustable iris type, mounting threads 11/16" x 27, overall length 2-1/2", max. diam. 13/16".	Holder, for Pilot Lamp		Dial Light Co. DTR-88T1	119604-1	E202	1	46	1	1	1	1	1	1

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F201	Fuse: cartridge, glass body, special anti-vibration construction marked with current rating and voltage RCA Spec. 119407 Type 3AG., 3 amp. 250 volt, 1-1/4" long, 1/4" diam.	Fuse, Power Line	CLF-28032-3	CLF	121388-1	F201,F202	2	47	1	20	1	40	1	100
F202	Same as F201	Fuse, Power Line												
H201	Screw: machine, set screw socket type (Hex), cup point, 1/8" #8-32 cadmium plated,hex. faces .0786" apart.	Screw, for Knobs		Allen Mfg. Co.	843365-11	H201	12	48		0		0	1	6
H202	Wrench: short series, steel, for #8 screw, hex. faces .0771" apart, length 1-31/32", bend over 45/64".	Wrench, for set screws in Knobs.		Allen Mfg. Co.	828505-12	H202	1	49	1	1		0		0
H203	Tool: hand, socket retainer ring, for "SS" Steatite sockets for small No.4 rings, two separate parts, handle and spring assembly 5" long, max. diam. 1-3/8", cup 1-1/2" long, tapered from max. diam. of 1-5/32".	Tool, to Mount Sockets		CPH51-3	121762-1	H203	1	50	1	1		0		0
I201	Lamp: incandescent, bayonet type circuit volts 12-16, bulb symbol T-3-1/4, min. bay, max.overall length 1-3/16" filament C-2.	Lamp, Pilot Lamp		CG	849546-1	I201	1	51	1	2	1	4	1	6
J201	Connector: male, 3-pole EVER-LOK plug,grounded, steel housing cadmium plated, moulded bakelite interior, shakeproof lockwashers furnished on terminal screws, silver plated contact pins, 3-1/8" long 1-3/4" max. diam.	Connector, Power Line Input Cable	-49125	Russel & Stoll Co.	864221-1	J201	1	52	1	1	1	1	1	2
J202	Connector: female, 5 contact type, threaded 7/8" - 20 thds., four mounting holes spaced 29/32" centres, overall dimensions excluding terminal solder lugs 1-3/16" x 1-3/16" x 3/4" min. diam.	Connector, D.C. and Tone Output	AN.3102 14S-5S	CPH AN-3102-14S-5S	121381-1	J202	1	53	1	1	1	1	1	2

PARTS: MAIN CHASSIS

Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
J203	Jack: telephone, short frame, shorting type, non-ferrous, nickel plated, 29/32" x 7/8" x 1.245" overall, threaded 3/8" - 32 N.E.F. Thds. for mounting, nut supplied, 3/8" - 32 hex.nut 3/32" thick x .500" across flats, brass, black nickel finish.	Jack, Monitor D.C. Output	CRA-491622	CRA 1J - 109	122217-1	J203	1	54	1	1	1	1	1	2
J204	Connector: socket, female, single contact, threaded 3/8" - 32 Thd., four mounting holes 1/2" centres, .687" x .687" x .725" long excluding single contact solder terminal, supplied with four R.H. brass machine screws #3-56 x 1/4" lg.	Connector, I.F. Input	UG-87/U	Ucinite Co. UG-87/U	121756-1	J204	1	55	1	1	1	2	1	4
J205	Connector: male contact, 5-pin, threaded 3/4" - 20 Thds. on end away from pins, 1-11/32" long overall, 1-1/16" max.diam., 17/32" insertion.	Connector, D.C. and Tone Cable		CPH #AN 3106-14S-5P	121381-2	J205	1	56	1	1	1	1	1	2
J206	Connector: female contact, 3-pole receptacle, contact socket silver plated, moulded bakelite body, shakeproof lockwashers furnished on terminal screws, 1-9/16" x 2-1/4" x 1-3/8" max. dimensions, two mounting holes 1-13/16" centres.	Connector, Power Line Socket	-49126	Russel & Stoll Co. EVER-LOK	864222-1	J206	1	57	1	1	1	1	1	2
L201	Coil: radio, A.F., completely hermetically sealed, core & coil vacuum impregnated and can oil filled, 5/8" stack of 5/8" standard laminations, part 26 GA silicon and part mumetal, has two terminals #1 and #2, at 3v 60 cy. min. impedance 25000 ohms, 2-5/16" x 2-5/16" x 2-5/8" overall dimensions, case diameter 2", finished black.	Coil, Audio Filter	CBDR-471772	CBDR 121345-1	121345-1	L201	1	58	1	1	1	2	1	3
L202	Coil: radio, R.F., assembly treated with Cumar, start and finish leads soldered to solder lug terminals provided, coil form 2-1/8" long, .562" o.d., .437" I.D.	Coil, D.C. Output Filter to J202	CRV-471776	CRV 121744-503	121744-503	L202	1	59	1	1	1	2	1	3

PARTS: MAIN CHASSIS

Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
L203A	Coil: radio, R.F., assembly treated with Cumar, four solder terminal lugs, each start and each finish lead soldered to separate terminal, coil form 2-1/8" long, .562" O.D. .437" I.D.	Coil, Tone Output Filter to J202	CRV-471774	CRV 121744-501	121744-501	L203	1	60	1	1	1	2	1	3
L203B	Part of L203A	Coil Tone Output Filter to J202												
L204	Not used.													
L205A	Coil: radio, R.F., assembly treated with Cumar, four solder terminal lugs provided, both start and both finish leads soldered to separate terminals, coil form 2-1/8" long, .562" O.D. .437" I.D.	Coil, D.C. Output Filter	CRV-471775	CRV 121744-502	121744-502	L205	1	61	1	1	1	2	1	3
L205B	Part of L205A	Coil, D.C. Output Filter to J203												
L206	Not used.													
L207A	Coil: radio, R.F., consists of three pie sections in series with no break, pie windings are slug tuned from top of assembly, bakelite plug and brass insert in coil tube 4-1/2" long .625" I.D., 3/4" O.D., treated with Cumar, inductance of three pies 0.61 millihenries.	Coil, Power Line Filter	CRV-471771	CRV 121369-501	121369-501	L207,L208, L209,L210	4	62	1	4	1	8	1	12
L207B	Part of L207A	Coil, Power Line Filter												
L208A	Same as L207A	Coil, Power Line Filter												
L208B	Part of L208A	Coil, Power Line Filter												
L209A	Same as L207A	Coil, Power Line Filter												
L209B	Part of L209A	Coil, Power Line Filter												
L210A	Same as L207A	Coil, Power Line Filter												

PARTS: MAIN CHASSIS

Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
L210B	Part of L210A	Coil, Power Line Filter												
L211	Not used.													
L212	Not used.													
L213A	Coil: radio A.F., completely hermetically sealed, core and coil vacuum impregnated and can oil filled, 1-1/4" stack of 1/2" laminations, .002" gap, 3 glass feed through terminals, start of one coil and finish of other connect to #2 terminal, total winding between terminals #1 and #3, overall dimensions 2-13/16 x 2-13/16 x 3-1/8" high, can diameter 2-1/2".	Coil, B Supply Filter	CBDR-303892	CBDR 121344-1	121344-1	L213	1	63	1	1	1	2	1	3
L213B	Part of L213	Coil, B Supply Filter												
L214	Coil: radio, A.F., completely hermetically sealed, core and coil vacuum impregnated and can oil filled, core 1-1/4" stack of 3/4" standard laminations, .006 gap, two glass feed through terminals on bottom, overall dimensions 2-13/16" x 2-13/16" x 3-1/8" high, can diameter 2-1/2".	Coil, B Supply Filter	CBDR-303891	CBDR 121346-1	121346-1	L214,L215	2	64	1	2	1	4	1	6
L215	Same as L214	Coil, B Supply Filter												
M201	Meter: milliammeter, zero centre 75 milA full scale deflection either side of zero, ± 5% accuracy full scale deflection, zero adjuster, tropicalized, damping factor less than 2.5, supplied with mounting screws, nuts, and lockwasher, 2.695" max. diameter, 2.125" overall depth, three mtg. holes on a 1.22" radius spaced at 120°.	Meter, D.C. Output	CDJ-22647	CDJ 110908-1	110908-1	M201	1	65		0		0	1	1

PARTS: MAIN CHASSIS

Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS Equip Box. No.	Equip Quan.	Tender Box. No.	Tender Quan.	Stock Box. No.	Stock Quan.
M202	Meter: micrometer, zero centre, 25 mA full scale deflection either side of zero, accuracy ±5% full scale deflection, zero adjuster, tropicalized, damping factor not less than 2, supplied with mounting screws, nuts and lockwashers, 2.695" max. diameter 2.125" overall depth, three mounting holes on a 1.22" radius spaced at 120°.	Meter, Tuning Meter	CDJ-22648	CDJ 110907-1	110907-1	M202	1	66		0		0	1	1
R201	Same as R106	Resistor, Tuning Meter Multiplier												
R202	Resistor: carbon, variable, potentiometer, 1 megohm ±20%, linear, shaft corrosion resisting steel or brass, nickel plated, mounting bushing to be corrosion resisting steel, nickel copper alloy or brass, nickel plated contact arm insulated from shaft and case, overall dimensions, shaft 1-1/4", body 9/16" x 1-1/4" diameter, three solder terminal lugs.	Resistor, Threshold Control	CIR-635244-20	CIR 121386-1	121386-1	R202	1	67	1	1	1	3	1	5
R203	Resistor: composition, fixed, 2200 ohms, ±20%, 1/4 watt insulated, .406" max.length, .170" max.diam., two axial leads 1-1/2" long.	Resistor, Cathode Bias V201	RC10BE222M	RC10BE222M	722302-15	R203,R223, R230	3	68	1	2	1	9	1	15
R204	Same as R111	Resistor, Plate Load V201												
R205	Same as R111	Resistor, Grid Decoupling V202												
R206	Resistor: composition, fixed, 470000 ohms ±20%, 1/4 watt insulated .406" max.length, .170" max.diam., two axial leads 1-1/2" long.	Resistor, Grid Leak V202	RC10BE474M	RC10BE474M	722302-29	R206,R210	2	69	1	1	1	6	1	10
R207	Same as R111	Resistor, Plate Load V202												

PARTS: MAIN CHASSIS

Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
R208	Resistor: fixed, composition, 2.2 Megohms, ±20%, 1/4 watt, insulated, .406" max.length, .170" max.diam., two axial leads 1-1/2" long.	Resistor, Mark Return Coupling to V204	RC10BE225M	RC10BE225M	722302-33	R208	1	70	1	1	1	3	1	5
R209	Resistor: fixed, composition, 1500 ohms, ±5%, 1/4 watt insulated, .406" max.length, .170" max.diam., two axial leads 1-1/2" long.	Resistor, Cathode Bias V202,V203	RC10BE152J	RC10BE152J	722302-163	R209	1	71	1	1	1	3	1	5
R210	Same as R206	Resistor, Grid Decoupling V206												
R211	Resistor: wire wound, fixed, 1000 ohms ±5%, power type, grade 1, class 1, overall length 2-3/8", 9/16" terminal diameter, both ends.	Resistor, Cathode Bias V206	RW16F102	RW16F102	722461-41	R211,R213 R232	3	72	1	1	1	6	1	10
R212	Resistor: wire wound, variable, potentiometer, 2500 ohms, +15% - 10%, power type, 25 watt, flat on shaft when control is in mid position, shaft 1-1/4" long, body 1.41" long, 1.68" diam. three solder terminal lugs.	Resistor, D.C. Output Control	RP101FG 252LK	RP101FG 252LK	121372-1	R212	1	73	1	1	1	3	1	5
R213	Same as R211	Resistor, Cathode Bias V207												
R214	Same as R106	Resistor, Grid Leak V207												
R215	Resistor: fixed, composition, 18000 ohms, ±10%, 1/2 watt insulated, .655" max.length, .249" max.diam., two axial leads 1-1/2" long.	Resistor, Screen V205	RC21BE183K	RC21BE183K	722322-77	R215	1	74	1	1	1	3	1	5
R216	Resistor: fixed, composition, 68000 ohms, ±10%, 1/2 watt insulated, .655" max.length, .249" max.diam., two axial leads 1-1/2" long.	Resistor, Screen Dropping V205	RC21BE683K	RC21BE683K	722322-84	R216,R217	2	75	1	1	1	6	1	10
R217	Same as R216	Resistor, Screen Dropping V205												

PARTS: MAIN CHASSIS

Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
R218	Resistor, composition fixed, 10000 ohms, ±10%, 1/2 watt insulated, .655" max.length, .249" max.diam., two axial leads 1-1/2" long.	Resistor, Plate V205	RC21BE103K	RC21BE103K	722322-74	R218	1	76	1	1	1	3	1	5
R219	Same as R105	Resistor,Grid Filter V205												
R220	Resistor: composition, fixed 270000 ohms, ±10%, 1/2 watt, insulated, .655" max.length, .249" max. diam., two axial leads 1-1/2" long.	Resistor, Voltage Divider for Grid V205	RC21BE274K	RC21BE274K	722322-91	R220	1	77	1	1	1	3	1	5
R221	Resistor: composition, fixed 56000 ohms ±10%, 1/4 watt insulated .406" max.length, .170" max.diam., two axial leads 1-1/2" long.	Resistor, Voltage Divider for Grid V205	RC10BE564K	RC10BE564K	722302-95	R221,R222	2	78	1	1	1	6	1	10
R222	Same as R221	Resistor, Screen Supply to V208												
R223	Same as R203	Resistor, Cathode Bias V208												
R224	Resistor: composition, fixed, 39000 ohms, ±10%, 1/4 watt, insulated, .406" max.length, .170" max.diam., two axial leads 1-1/2" long.	Resistor, Plate Load V208	RC10BE393K	RC10BE393K	722302-81	R224	1	79	1	1	1	3	1	5
R225	Resistor: composition, fixed, 1 megohm, ±5%, 1/4 watt, insulated .406" max.length, .170" max.diam., two axial leads 1-1/2"long.	Resistor, Feedback Circuit V208	RC10BE105J	RC10BE105J	722302-231	R225,R226, R227	3	80	1	2	1	9	1	15
R226	Same as R225	Resistor, Feedback Circuit V208												
R227	Same as R225	Resistor, Feedback Circuit V208												
R228	Same as R106	Resistor, Voltage Divider to Grid V209												

PARTS: MAIN CHASSIS

Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
R229	Resistor: carbon, variable, potentiometer, 100000 ohms, ±20%, linear, shaft corrosion resisting steel, or brass, nickel plated, mounting bushing to be corrosion resisting steel, nickel-copper alloy, or brass, nickel plated, contact arm to be insulated from shaft and case, overall dimensions, shaft 1-1/4", body 9/16"x1-1/4" diameter, three terminal solder lugs.	Resistor, Tone Output Control	CIR-631270-20	CIR 121386-2	121386-2	R229	1	81	1	1	1	3	1	5
R230	Same as R203	Resistor, Cathode Bias V209												
R231	Same as R106	Resistor, Screen Supply V209												
R232	Same as R211	Resistor, Series Resistor D.C. Output												
R233	Same as R111	Resistor, Plate Load V203												
R234	Same as R106	Resistor, Grid Leak V206												
S201	Same as S101	Switch, Speed, Hi-Lo												
S202	Same as S101	Switch, Mark Return												
S203	Wafer and Contact Assembly: for rotary switch #122207-1 2-position, contacts and terminals spring silver, three rotor blades have shorting type teeth coin silver, ceramic parts have low loss steatite, impregnated with Cerese AA wax, wafer contacts #1,7,10 make contact on three rotor blades in both positions of switch, wafer contacts #2,8,11, make contact in extreme counter-clockwise position when viewed from front end of chassis, wafer contacts #3,9,12,make contact in other position of switch.	Wafer and Contact Assembly, for Polar Neutral Switch		COC 122207-2	122207-2	S203	1	82	1	1	1	1	1	1
S204	Same as S101	Switch, Power Switch												

PARTS: MAIN CHASSIS

Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
S205A	Switch: rotary, 2-pole, 3-position, no off positions, supplied with two hexagonal mounting nuts, one shakeproof lockwasher and one locking ring, contact and terminal lugs silver plated, contact rating 3 Amp.125v AC, 1-61/64"xl-23/32" max. diam., screwdriver slot for switch rotation .057" wide, .057" deep at end of shaft, when in mid position slot to be parallel to keying on locking ring and on 23/64" centres.	Switch, Line Voltage		CAE #7272	121755-1	S205	1	83	1	1	1	1	1	1
S205B	Part of S205	Switch, Line Voltage												
T201	Transformer: A.F., completely hermetically sealed, core and coil vacuum impregnated and can oil filled, core 5/8"x5/8" interleaved, primary 100000 ohms, secondary 600 ohms, ±5% five glass fed through terminals, #1,2 primary, #3,4 secondary, centre tap #5, 2-5/16"x2-5/16"x 2-5/8", can diameter 2".	Transformer, Tone Output	CBDR-303888	CBDR 121368-1	121368-1	T201	1	84	1	1	1	2	1	3
T202	Transformer: power, completely hermetically sealed, core and coil vacuum impregnated and can oil filled, core 1-1/2" stack of 1-1/4" standard laminations, primary tapped for operation from 110,115,120 volts 50/60 cy., eleven glass feed through terminals, #10,11, 6.3v, #8,9 5v, #5,6, 7, 584 volts, #6 centre tap, primary, #1,2, 110v, #1,3, 115v, #1,4, 120v, 5-3/32"x4-1/4"x5-1/4" max. dimensions.	Transformer, Set Power Supply	CBDR-303889	CBDR 121385-1	121385-1	T202	1	85	1	1	1	2	1	3

PARTS: MAIN CHASSIS

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T203	Transformer: power, completely hermetically sealed, core and coil vacuum impregnated and can oil filled, core 1-1/2"x1-1/2", primary tapped for operation from 110,115,120 volts 50/60 cy., eighteen glass feed through terminals, six secondary windings, #5,6,7 terminals 600v,#6 centre tap, #8,9,10 600v, #9 centre tap, #11,12 5v, #13,14 5v, #15,16, 6.4v, #17,18, 6.4v, primary #1,2, 110v, #1,3, 115v, #1,4, 120v, finish #430 black, 5-3/32"x4-1/4"x5-1/4" max. dimensions.	Transformer, D.C.Output Power Supply	CBDR-303890	CBDR 121347-1	121347-1	T203	1	86	1	1	1	2	1	3
V201	Tube, electron, JAN 6J5	Tube, A.F.Amplifier		CRC		V201	1	87	1	2	1	3		0
V202	Same as V102	Tube, Locking Circuit												
V203	Same as V102	Tube, Locking Circuit												
V204	Tube: electron, JAN VR-75	Tube, Mark Return Circuit		CRC		V204	1	88	1	2	1	3		0
V205	Same as V102	Tube, Squelch Circuit												
V206	Tube: electron, JAN 6L6GA	Tube, D.C. Output		CRC		V206,V207	2	89	1	4	1	6		0
V207	Same as V206	Tube, D.C. Output												
V208	Same as V102	Tube, Tone Oscillator												
V209	Same as V102	Tube, Tone Keyer												
V210	Tube: electron, JAN 5Y3GT/G	Tube, Rectifier		CRC		V210,V211, V212	3	90	1	6	1	9		0
V211	Same as V210	Tube, Rectifier												
V212	Same as V210	Tube, Rectifier												
V213	Tube, electron, JAN VR-150	Tube, Voltage Regulator		CRC		V213,V214, V215,V216	4	91	1	8	1	12		0
V214	Same as V213	Tube, Voltage Regulator												
V215	Same as V213	Tube, Voltage Regulator												
V216	Same as V213	Tube, Voltage Regulator												

PARTS: MAIN CHASSIS

Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
X201	Same as X101	Socket, for V201												
X202	Same as X101	Socket, for V202												
X203	Same as X101	Socket, for V203												
X204	Same as X101	Socket, for V204												
X205	Same as X101	Socket, for V205												
X206	Same as X101	Socket, for V206												
X207	Same as X101	Socket, for V207												
X208	Same as X101	Socket, for V208												
X209	Same as X101	Socket, for V209												
X210	Same as X101	Socket, for V210												
X211	Same as X101	Socket, for V211												
X212	Same as X101	Socket, for V212												
X213	Same as X101	Socket, for V213												
X214	Same as X101	Socket, for V214												
X215	Same as X101	Socket, for V215												
X216	Same as X101	Socket, for V216												
X217	Clamp Assembly: tube, consists of clamp, brace and plate, cup and gronnet, tube socket mounted to clamp assembly which is then mounted to chassis by two mounting holes spaced 2-3/16" provided in cup assembly, clamp 1-3/8" in diameter.	Clamp, for V206		CRV 121737-501	121737-501	X217,X218	2	92	1	1	1	1	1	1
X218	Same as X217	Clamp, for V207												
X219	Clamp Assembly: tube, consists of clamp, brace and plate, cup and gronnet, tube socket mounted to clamp assembly which is then mounted to chassis by two mounting holes, spaced 2-3/16", provided in cup on assembly, clamp 1-5/32" in diameter.	Clamp, for V213		CRV 121737-502	121737-502	X219,X220 X221,X222, X223	5	93	1	2	1	2	1	3
X220	Same as X219	Clamp, for V214												

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X221	Same as X219	Clamp, for V215												
X222	Same as X219	Clamp, for V216												
X223	Same as X219	Clamp, for V204												
X224	Clamp Assembly: tube, consists of clamp, brace and plate cup and grommet, tube socket mounted to clamp assembly which is then mounted to chassis by two mounting holes, spaced 2-3/16", provided in cup on assembly, clamp 1-5/32" in diameter.	Clamp, for V210		CRV 888502-501	888502-501	X224,X225 X226	3	94	1	2	1	2	1	3
X225	Same as X224	Clamp, for V211												
X226	Same as X224	Clamp, for V212												
		COUPLING KIT												
C501	Capacitor: fixed, mica, 100 mmf, ±10% 500v DC, working volts, 51/64"x15/32"x7/32" max.dimensions, two pigtail leads 1-1/8" min.length.	Capacitor, Input Coupling	CM20B101K	CM20B101K	722001-573	C501	1	95	1	1	1	1	1	1
C502	Capacitor: fixed, mica, 10000 mmf. ±10% 300v d.c., max.working volts, max.dimensions after waxing 53/64"x53/64"x11/32",two pigtail leads 1-1/8" min. length.	Capacitor, R.F. Bypass Plate V301	CM35B103K	CM35B103K	722026-563	C502,C503 C505	3	96	1	2	1	4	1	6
C503	Same as C502	Capacitor, Filter Input Coupling												
C504	Same as C218	Capacitor, Filter Tuning												
C505	Same as C502	Capacitor, Filter Tuning												
C506	Same as C218	Capacitor, Filter Tuning												
R501	Resistor: fixed, composition, 470 ohms, ±10%, 1/2 watt,large, insulated, BE characteristic, .655" max.length, .249" max. diam., two axial leads 1-1/2" long.	Resistor, Cathode Grid Bias	RC21BE471K	RC21BE471K	722322-58	R501	1	97	1	1	1	3	1	5

PARTS: COUPLING KIT

Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
R502	Resistor: fixed, composition, 10000 ohms ± 20%, 1/4 watt, insulated, .406" max.length, .170" max.diam., two axial leads 1-1/2" long.	Resistor, Decoupling	RC10BE103M	RC10BE103M	722302-19	R502	1	98	1	1	1	6	1	10
R503	Resistor: fixed, composition, 1.0 MEGOHM, ±10%, 1/2 watt, insulated, .655" max.length, .249" max.diam., two axial leads 1-1/2" long.	Resistor, Grid	RC21BE105K	RC21BE105K	722322-98	R503	1	99	1	1	1	3	1	5
V501	Tube: electron JAN 6AB7	Tube, Cathode Follower		CRC		V501	1	100	1	2	1	3		0
W501	Cable Assembly: R.F. consists of 4 feet Army-Navy Type RG-58/U cable and two Army-Navy Type UG-85/U connectors.	Cable Assembly, R.F. Input Connector		CPH Cable RG58/U Plug UG85/U	122215-501	W501	1	101	1	1	1	1	1	2
X501	Socket Assembly: tube, consists of socket-octal(steatite) retaining spring, and adapter plate, as per US Navy drawing RE49AA 313A, spacer washer not furnished, contacts heavily silver plated, terminal ends hot tin dipped for soldering, retaining spring to be steel, copper and nickel plated, mounting holes spaced 1-5/8".	Socket Assembly, for V501	49373	CPH 421395-505	421395-505	X501	1	102	1	1	1	1	1	1
Z501	Coil Assembly: consists of two coils L501 and L502, inductance 22 microhenries ± 10% at 1000 cycles; also includes capacitors, C-505,C-504,C-506 and three terminal boards, assembly is unshielded and has mounting bracket at bottom, four tapped mounting holes centres spaced 3/4" in bracket, overall dimensions 3-1/8"x1-3/8"x1-3/8" shielded lead connects to terminals A and B at top, shield goes to B.	Coil Assembly, Low Pass Filter, R.F.	CRV-53476	CRV 122220-501	122220-501	Z501	1	103	1	1	1	2	3	3
H501	Spacer	Mounting receptacle J501		CRV-121783-1	121783-1	H501	1							
H502	Screws, 3-56 thread,1/4" long	Mounting J501 to H501				H502	4							
H503	Lockwasher, #3, split type	Used under H502			121722-1	H503	4							

PARTS: COUPLING KIT

Symbol Design	Name of Part and Description	Function	Aws.Jan.or Navy Type Desig.	Mfr. and Mfr's Desig.	Contractor's Dwg. and Part No.	All Symbol Designations Involved	Total No. Per Equip.	Item No.	SPARE PARTS: Equip Box No.	Equip Quan.	Tender Box No.	Tender Quan.	Stock Box No.	Stock Quan.
H504	Insulating washer	Used under grounding spring H505		CRV-865390-8	865390-8	H504	4							
H505	Grounding spring	To ground receptacle J501		CRV-890709-1	890709-1	H505	1							
H506	Insulating board	To insulate low pass filter coil mounting		CRV-890710-1	890710-1	H506	1							
H507	Screws, 4-40 thread, 7/16" long binder head, brass	To mount spacer H501 to chassis			82287-57	H507	4							
H508	Lockwasher, #4, split type	Used under H507			59048-31	H508	4							
H509	Lockwasher, #6, split type	Used under H511 & H512			59048-31	H509	6							
H510	Screws, 6-32 thread, 3/8" long, flat head, brass	To mount low pass filter shield can			57466-59	H510	2							
H511	Nuts, 6-32 thread, brass	Used on H510			57435-54	H511	2							
H512	Screws, 6-32 thread, 3/8" long, round head, brass	To mount cathode follower assembly			57456-59	H512	4							

TABLE 8-3
CROSS REFERENCE PARTS LIST

By JAN or AWS DESIGNATION

JAN or AWS DESIGNATION	KEY SYMBOL
CC30UJ560J	C112
CM20C121J	C101
CM20A560K	C105
CM20C391J	C107
CM20D511J	C113
CM20C181J	C115
CM25A102M	C206
CM20A680J	C211
CM40B103J	C215
CM35B472K	C218
CM20B101K	C501
CM35B103K	C502
CN35A103	C103
CN35A602	C202
CP69B3EE104MK	C102
CP63B1EE254MK	C201
CP51B1EE105PL	C205
CP51B3EE104PL	C207
CP51B2EC504PL	C209
CP51B5EE104PL	C210
CP70B1EE405PL	C228
CP70B1EE106V	C231
RC10BE331M	R101
RC10BE154M	R102
RC10BE102M	R103
RC10BE334M	R104
RC10BE225K	R105
RC10BE105M	R106
RC10BE151J	R108
RC10BE392K	R110
RC10BE104M	R111
RC10BE473M	R112
RC40BE223K	R113
RC10BE224K	R116
RC10BE222M	R203
RC10BE474M	R206
RC10BE225M	R208
RC10BE152J	R209
RC21BE183K	R215
RC21BE683K	R216
RC21BE103K	R218
RC21BE274K	R220
RC10BE564K	R221
RC10BE393K	R224
RC10BE105J	R225
RC21BE471K	R501
RC10BE103M	R502
RC21BE105K	R503
RE13A488	C224
RE13A317F	S203
RE49AA313A	X501
RP101FG252LK	R212
RW16F102	R211

By NAVY TYPE NUMBER

NAVY TYPE NUMBER	KEY SYMBOL
22647	M-201
22648	M-202
28032-3	F201
49125	J201
49126	J206
49373	X-101,X-501
53476	Z-501
303888	T-201
303889	T-202
303890	T-203
303891	L-214
303892	L-213A
471771	L-207A
471772	L-201
471773	T-103
471774	L-203A
471775	L-205A
471776	L-202
471777	T-101
471778	T-102
471779	T-104
481167	C-224
491622	J-203
631270-20	R-229
635244-20	R-202

By ARMY-NAVY TYPE NUMBERS

ARMY-NAVY TYPE NUMBER	KEY SYMBOL
3102	J202
UG87/U	J204
ST22N	S101

By ITEM NUMBERS

ITEM NUMBER	KEY SYMBOL
1	C101
2	C102
3	C103
4	C105
5	C107
6	C112
7	C113
8	C115
9	R101
10	R102
11	R103

By ITEM NUMBERS

ITEM NUMBER	KEY SYMBOL
12	R104
13	R105
14	R106
15	R108
16	R110
17	R111
18	R112
19	R113
20	R116
21	S101
22	T101
23	T102
24	T103
25	T104
26	V101
27	V102
28	V103
29	V104
30	X101
31	A201
32	C201
33	C202
34	C205
35	C206
36	C207
37	C209
38	C210
39	C211
40	C215
41	C218
42	C224
43	C228
44	C231
45	E201
46	E202
47	F201
48	H201
49	H202
50	H203
51	I201
52	J201
53	J202
54	J203
55	J204
56	J205
57	J206
58	L201
59	L202
60	L203
61	L205
62	L207
63	L213
64	L214

By ITEM NUMBERS

ITEM NUMBER	KEY SYMBOL
65	M201
66	M202
67	R202
68	R203
69	R206
70	R208
71	R209
72	R211
73	R212
74	R215
75	R216
76	R218
77	R220
78	R221
79	R224
80	R225
81	R229
82	S203
83	S205
84	T201
85	T202
86	T203
87	V201
88	V204
89	V206
90	V210
91	V213
92	X217
93	X219
94	X224
95	C501
96	C502
97	R501
98	R502
99	R503
100	V501
101	W501
102	X501
103	Z501

TABLE 8-4
APPLICABLE COLOR CODES

RESISTOR AND CAPACITOR CODES

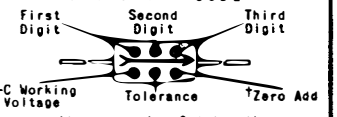
MICA CAPACITOR CODING

Values of capacitance and tolerance are coded identically on both R.M.A. 6 dot and A.W.S. coded capacitors. Only the coding of the sixth (lower left) dot differs between the two.

R.M.A. CODE

R.M.A. coded capacitors have 3 or 6 dots located as shown below.

6 DOT COLOR CODE



On capacitors bearing 6 dots, the upper 3 dots become the first 3 figures. When the number of zeros determined by the "Zero Add" (lower right) dot is added, the capacitance in micromicrofarads (mmfd) is obtained. The other two dots show the percentage tolerance and the voltage rating.

EXAMPLE:

Brown, Red, Green / Green, Silver, Brown
- 125 + 0 = 1250 mmfd capacitance
- 10% tolerance
- 500 v d-c working voltage

3 DOT COLOR CODE

On capacitors bearing 3 dots, the first 2 dots become the first two figures. When the number of zeros determined by the "Zero Add" (third) dot is added, the capacitance in micromicrofarads (mmfd) is obtained. All 3 dot capacitors are rated at 500 v d-c working voltage.

EXAMPLE:

Red, Green, Brown
- 25 + 0 - 250 mmfd capacitance
- (inferred tolerance) 500 v d-c working voltage

A.W.S. CODE

A.W.S. coded capacitors may have a coded "Type Designation" or 6 colored dots as shown below.

TYPE DESIGNATION

CM 20 A 050 M

Component — Case — Characteristic — Capacitance — Tolerance

COMPONENT: All mica capacitors are identified by "CM".

*CASE: Identifies external shape and dimensions.

*CHARACTERISTIC: Identifies temperature coefficient and "Q".

CAPACITANCE: The first 2 digits are the first 2 figures of the capacitance, in mmfd. The third determines the number of zeros to add. If more than 3 digits are used, all except the last are figures of capacitance. The last determines the number of zeros to add.

TOLERANCE:

Designation	Tolerance
G	±2%
J	±5%
K	±10%
M	±20%

EXAMPLE: The above type designation identifies the capacitance as 5 mmfd and the tolerance as 20 per cent.

*For specific information see publication C75.3 – 1942 of the American Standards Association.

6 DOT COLOR CODE

EXAMPLE:

Black	Orange	Orange
Black	Silver	Red

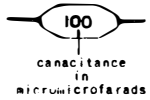
033 + 00 = 3300 mmfd capacitance
10% tolerance
"A" characteristic

R.C.A. CODE

for mica capacitors of the shape shown below

The capacitance in micromicrofarads (mmfd) is stamped on the case. The color of the numbers shows the tolerance, as follows:

Green . . .	2.5%	Blue	1C%
Black	5%	Yellow . . .	20%
	Red . . .	30%	



capacitance in micromicrofarads

† *When the "ZERO ADD" color is GOLD, multiply the preceeding digits by 0.1 for capacitance in mmfd; when the "ZERO ADD" color is SILVER, multiply by 0.01*

COLOR IDENTIFICATION FOR MICA CAPACITORS

COLOR	DIGITS and ZERO ADD	TOLERANCE R.M.A.	TOLERANCE A.W.S.	TOLERANCE R.C.A. mica	D-C VOLTAGE (R.M.A.)	CHARACTERISTIC (A.W.S.)
BLACK	0			5%		A
BROWN	1	1%			100	B
RED	2	2%	2% (G)		200	C
ORANGE	3	3%			300	D
YELLOW	4	4%		20%	400	E
GREEN	5	5%		2½%	500	F
BLUE	6	6%		10%	600	G
VIOLET	7	7%			700	
GRAY	8	8%			800	
WHITE	9	9%			900	
GOLD	†	5%	5% (J)		1000	
SILVER	†	10%	10% (K)		2000	
NO COLOR		20%	20% (M)		500	

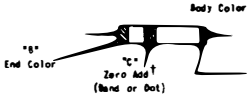
†When the "ZERO ADD" color is GOLD, multiply the number obtained from "A" and "B" by 0.1 to get capacitance in mmfd; when it is SILVER; multiply the number by 0.01.

RESISTOR CODING

(Composition and Low Power Wire Wound Resistors)

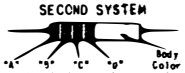
THE R.M.A. CODING AND A.W.S. CODING FOR THESE RESISTORS ARE IDENTICAL

FIRST SYSTEM



Tolerance may not be given; in which case there will be no "D" band.

SECOND SYSTEM



The body color indicates the type of resistor, and is coded as follows:

BODY COLOR	TYPE
Black	Composition, non-insulated
Any Color but Black	Composition, insulated
Chocolate Brown	Wire wound, insulated

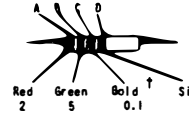
TO FIND RESISTANCE IN OHMS FROM COLOR CODING:

Obtain the digits identified by the colors of "A", "B", and "C" from the following table:

COLOR	Digit or Zero Add	COLOR	Digit or Zero Add	Tolerance
Black	0	Violet	7	
Brown	1	Gray	8	
Red	2	White	9	
Orange	3	Gold	†	5%
Yellow	4	Silver	†	10%
Green	5	No Color		20%
Blue	6			

† When the "ZERO ADD" color is GOLD, multiply the number obtained from "A" and "B" by 0.1 to get resistance in ohms; when it is SILVER; multiply the number by 0.01.

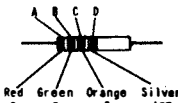
EXAMPLE



A B x C = 25 x 0.1 = 2.5
Resistance is 2.5 ohms
Tolerance: 10 per cent

EXAMPLE

The first two digits "A" and "B" become the first two numbers of the resistance. The ZERO ADD digit, "C", gives the number of zeros to add after the first two numbers. (If the ZERO ADD color is GOLD or SILVER, it becomes a multiplier. See note †)



A B + C zeros =
25 + 3 zeros = 25,000
Resistance is 25,000 ohms
Tolerance: 10 per cent

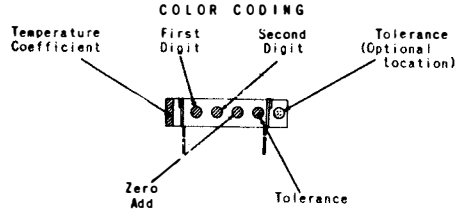
RCA CERAMIC CAPACITOR CODING

COLOR IDENTIFICATION

COLOR	DIGIT	ZERO ADD	TOLERANCE Note 1	TOLERANCE Note 2	TEMP. COEFFICIENT [MMFD/MMFD/°C.]
BLACK	0	0			0
BROWN	1	1	5%	0.5 mmfd	-0.30×10^{-4}
RED	2	2			-0.80×10^{-4}
ORANGE	3	3	2½%		-1.5×10^{-4}
YELLOW	4	4			-2.2×10^{-4}
GREEN	5	5	5%	0.5 mmfd	-3.3×10^{-4}
BLUE	6	6			-4.7×10^{-4}
VIOLET	7	7			-7.5×10^{-4}
GRAY	8		2½%	0.25 mmfd	
WHITE	9		10%	1.0 mmfd	

Note 1 – This column applies to capacitances GREATER than 10 mmfd.
Note 2 – This column applies to capacitances LESS than 10 mmfd.

COLOR CODING



The d-c working voltage of this type is 500 volts.

EXAMPLE:

4 Brown Dots, Red End Color
- 11 + 0 = 110 mmfd capacitance
- ±5% tolerance
- -0.80×10^{-4} mmfd/mmfd/°C. temperature coefficient
- inferred: 500 volt rating

TABLE 8-5
LIST OF MANUFACTURERS
FREQUENCY SHIFT RECEIVER CONVERTING EQUIPMENT NAVY MODEL FRA

Mfr. Prefix	N A M E	A D D R E S S
CRV	Radio Corporation of America	Camden, N.J.
CAE	Cutler Hammer Inc.	1333 W. St. Paul Ave. Milwaukee, Wis.
CPH	American Phenolic Corp.	1250 W. Van Buren St. Chicago, Ill.
	L.N. Barry Co.	489 Main St. Cambridge, Mass.
CFA	Bussman Mfg. Co.	2538 W. University St. St. Louis, Mo.
	Dial Light Co.	900 Broadway, New York, N.Y.
CLF	Littlefuse Laboratories, Inc.	4765 Ravenswood Ave. Chicago, Ill.
	Allen Mfg. Co.	Hartford, Conn.
CG	General Electric Co.	Schenectady, N.Y.
CRA	Utah Radio Products Co.	812 Orleans St. Chicago, Ill.
	Ucinite Co.	Newtonville, Mass.
	Russel & Stoll Co.	125 Barclay St., New York, N.Y.
CBDR	Hammond Manufacturing Co.	Guelph, Ont., Canada.
CDJ	Dejur Amsco Corp.	Shelton, Conn.
CIR	International Resistance Corp.	401 N. Broad St. Philadelphia, Pa.
COC	Oak Mfg. Co.	1200 N. Clybourne Ave., Chicago, Ill.