TECHNICAL MANUAL

for

GENERAL PURPOSE RADIO TRANSMITTER

MODEL SBTM-1KJC

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, CANADA

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IN1005

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NOTICE

FOREWORD

This instruction manual for SBTM-1KJC consists of the following Technical Manuals.

1 ea.	System Technical Manual for SBTM-1KJC
1 ea.	Technical Manual for PAL-1K9B2)
1 ea.	Technical Manual for MMXM-2
1 ea.	Technical Manual for APP-4A
1 ea,	Technical Manual for AX-198
1 ea.	Technical Manual for ATS-50-2A

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

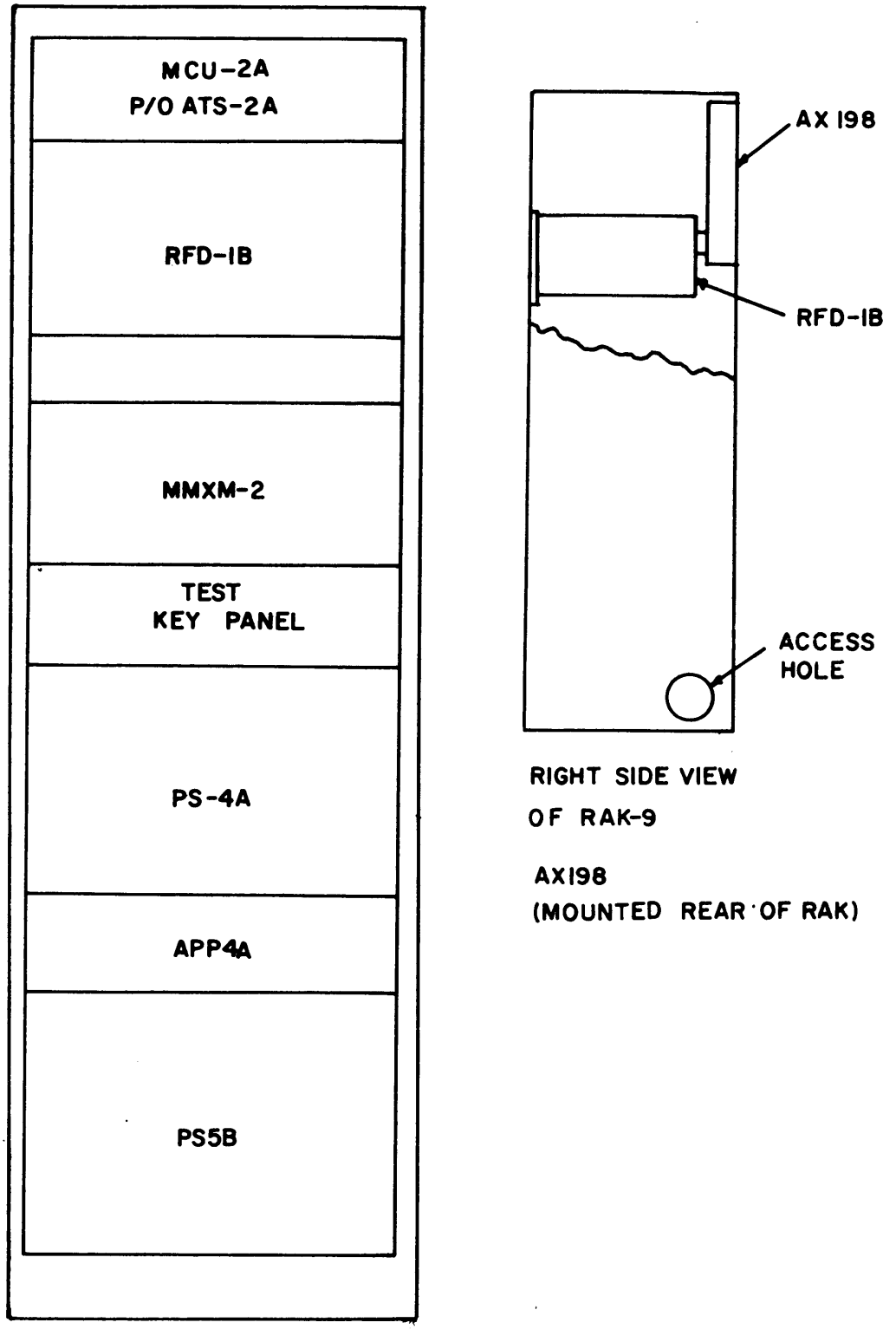


Figure 1-0. Front View, SBTM-1KJC General Purpose Transmitter

SECTION 1
GENERAL INFORMATION

1-1. FUNCTIONAL DESCRIPTION.

The 1 Kilowatt (PEP) Single Sideband Transmitter, model SBTM-1KJC is a General Purpose Unit. It provides continuously adjustable tuning in the frequency range of 2-29.9999 mc. The transmitter is capable of the following modes of operation:

CW (Telegraphy)
USB (Upper sideband) with suppressed or continously adjustable carrier.
AM (Amplitude Modulation)
FSK (Frequency Shift Keying)
FAX (Facsimile)

The exciter is a compact fully transistorized unit capable of producing about a 250 mw output in SSB operation, with about a 100 mw output produced in the CW mode of operation. It has a frequency range of 1.6-29.9999MHz with a 1 part in 10^8 per day frequency stability.

The Linear Power Amplifier provides a 1 Kilowatt output with a signal to distortion ratio better than 40 db. down, relative to the PEP output. A transmit-receive relay function is also provided allowing the transmitter to be cut off and the antenna switched to a receiver; when the transmitter is again energized the antenna is switched back to the transmitter output.

The transmitter also has additonal features that include (ALDC) Automatic Load and Drive Control), and full interlock protection for equipment and personnel safety.

1-2. MODULAR DESCRIPTION:

The SBTM-1KJC is a single rack transmitter system configuration consisting of eight modular units (refer to figure 1-1). The following paragraphs are a brief description of each module.

Refer to the individual Technical Manuals for a more detailed description of these units.

a. Antenna Tuning System, Model ATS-2A. - ATS-2A impedance matches the output of any 1000 watt transmitter with a nominal 50 ohms output impedance to a 35 foot Whip Antenna. Incorporated in the MCU-portion is a SWR indicator that displays both forward and Reflected power in the Antenna Circuit.

b. Transmit/Receive Switching Unit Model AX198. - The Transmit/Receive Switching unit is a relay switching network, enabling a transmitter and an associated receiver to operate from one common antenna.

c. Amplifier Unit Model RFD-1B.- RFD-1B, part of PAL-1KB2, amplifies the output of the MMXM-2 exciter up to 1-Kilowatt PEP.

d. Multimode Exciter Model MMXM-2. - MMXM-2 is a Synthesized exciter capable of producing Excitation to an associated Linear amplifier in the form of AM, CW, USB, FSK and FAX with a stability of 1 part in 10^8 per day.

e. Test Key panel Model AX5040. - AX5040 consists of a Test Key that is used to key the transmitter when the MMXM is set at CW Mode of operation.

f. Power Supply Model PS-4 - PS-4 is the Medium voltage power supply for RFD-1B.

g. Auxiliary Power Panel Model APP-4. - This unit functions as a distributor for line voltage to the modular units and also contains wiring connection for audio and keyer inputs.

h. High Voltage Power Supply, PS-5B.- This unit is the high voltage power supply of the RFD-1B.

1-3. PHYSICAL DESCRIPTION

The transmitter shown in figure 1-1, is contained in a single standard relay type rack measuring 71 1/2 inches high x 20 5/8 inches wide x 22 1/2 inches deep. This rack is base mounted with mounting holes in the base

for bolting the rack directly to the floor. Forced air cooling is provided by a blower mounted in the rack. The transmitter weighs approximately 700 pounds and is manufactured in accordance with MILITARY specifications wherever practicable. Seven of the eight modular units are front panel mounted. The AX198 is mounted in the upper rear portion of the rack. The RFD-1B, the MMXM-2 and the PS-4A are slide mounted providing ease of maintenance. The PS5B is not slide mounted, but it can be paritally pulled from the rack.

CAUTION

The PS5B is extremely heavy. Be sure to pull the drawer only PARTIALLY out. Pulling the drawer fully out could result in equipment and personnel damage, since no stops are provided on the rear portion of the drawer channels to keep it from dropping out of rack.

SECTION 2
INSTALLATION

2-1. UNPACKING AND HANDLING

The transmitter is shipped in boxes as shown by (figures 2-2 and 2-3). The box number is stenciled on the outside of each box and the contents are listed on the packing list. Inspect all boxes for possible damage when they arrive at the operating site. With respect to equipment damage for which the carrier is liable, the Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts.

Inspect the contents of each box for possible damage and inspect the packing material for parts that may have been shipped as loose items.

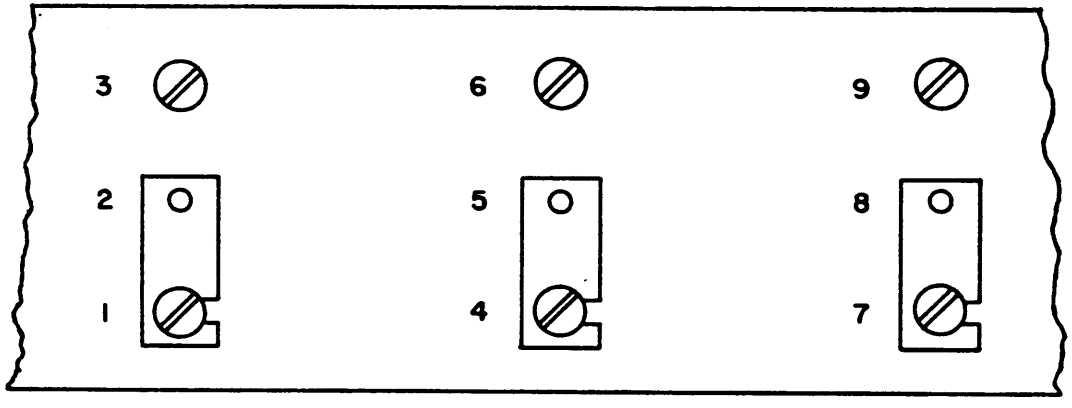
2-2. POWER REQUIREMENTS

All units of the transmitter leave the factory wired for 115-volt, 50/60 cycle, single phase line voltage unless ordered otherwise. Change may be made to 230-volt, 50/60 cycle, single phase operation by making minor wiring changes in modular units listed in Table 2-1 (also see Fig. 2-1). Consult the installation information and schematic diagrams provided in the individual modular-unit manuals for wiring-change information.

CAUTION

If 230 volt, 50/60 cycle operation is used, all line fuses except those in LV Power Supply PS-4 must be reduced to one half their rated current values to assure adequate circuit protection. Regulated and high voltage fuses remain the same with either line voltage.

Power consumption of the SBTM is approximately 3000 watts: power cabling of sufficient size to provide 30 amperes at 115 volts a-c, single phase, is adequate.



APP-4 BUS STRAP ARRANGEMENT

NOTES:

1. For 115VAC operation, connect terminals 1 and 2, 4 and 5, 7 and 8.

2. For 230VAC operation, connect terminals 2 and 3, 5 and 6, 8 and 9.

Figure I-2-1. 230V Line Voltage Modification Diagram, APP-4.

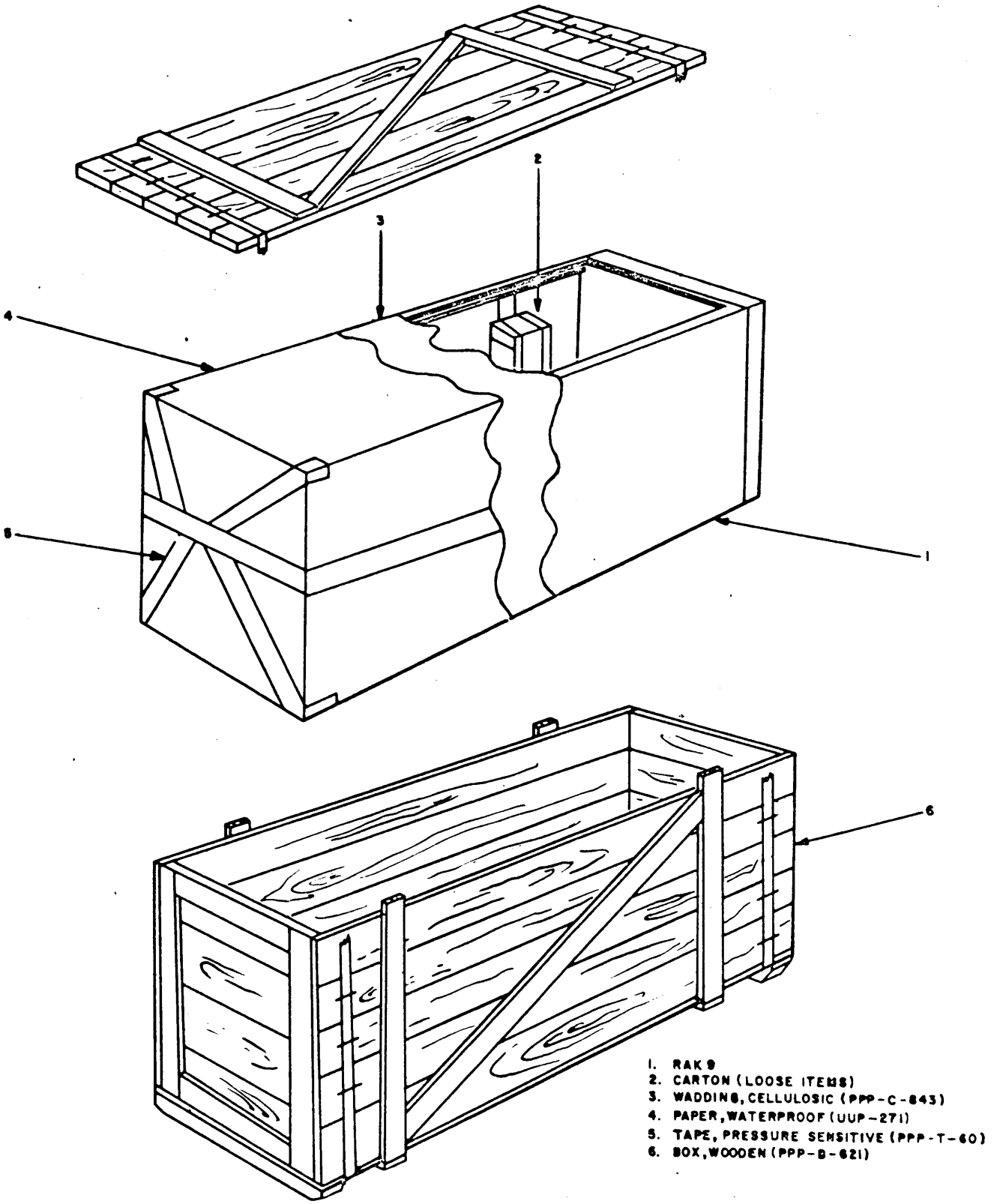
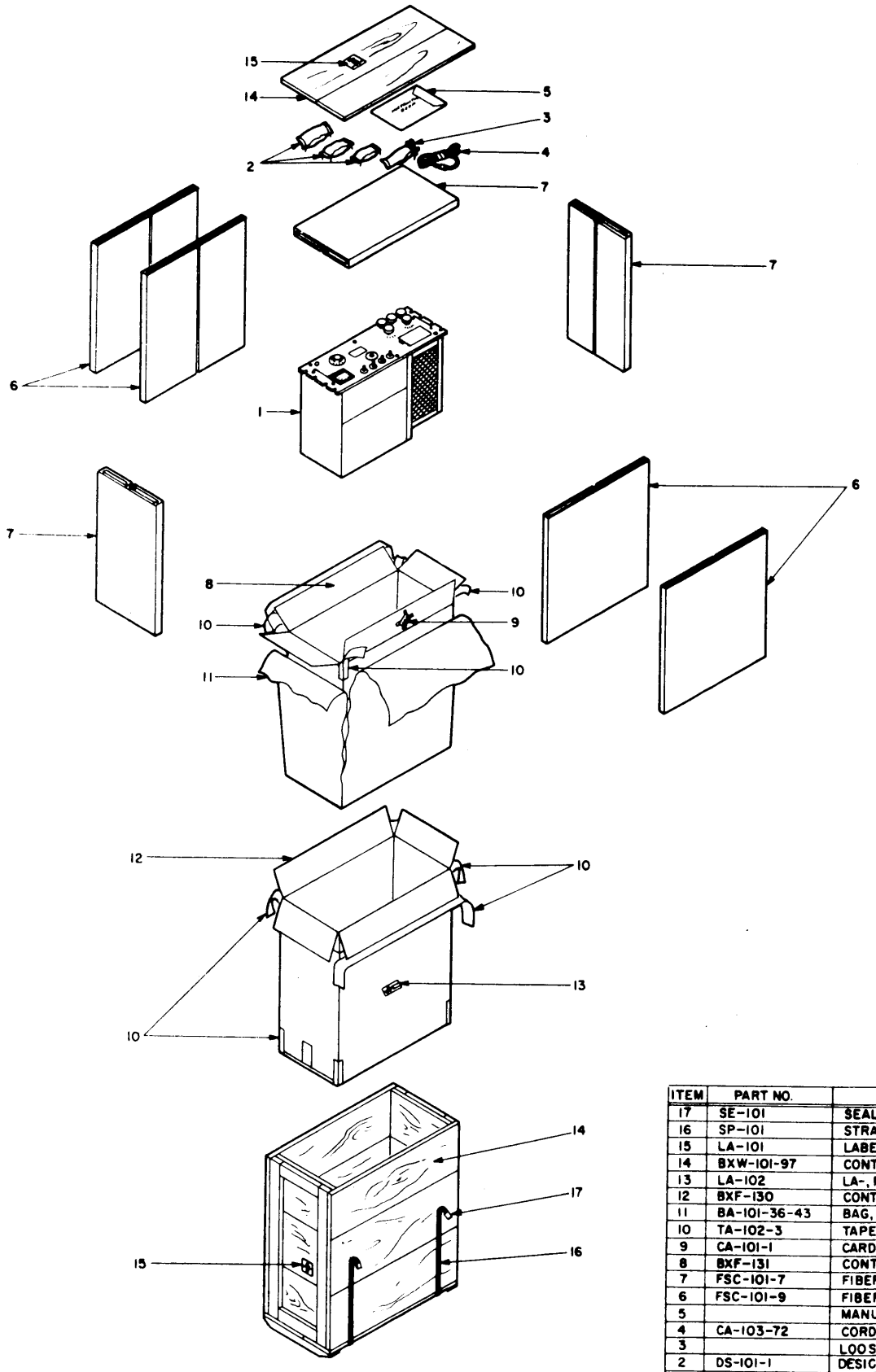


Figure 2-2. Rack, Preparation for Shipment



ITEM	PART NO.	DESCRIPTION
17	SE-101	SEALS, STRAPPING
16	SP-101	STRAPPING, STEEL
15	LA-101	LABEL, FRAGILE
14	BXW-101-97	CONTAINER, SHIPPING
13	LA-102	LA-, METHOD II
12	BXF-130	CONTAINER, OUTER
11	BA-101-36-43	BAG, BARRIER
10	TA-102-3	TAPE, PRESSURE SENSITIVE
9	CA-101-1	CARD, HUMIDITY INDICATOR
8	BXF-131	CONTAINER
7	FSC-101-7	FIBERBOARD SHEET, CREASED
6	FSC-101-9	FIBERBOARD SHEET, CREASED
5		MANUALS, INSTRUCTION
4	CA-103-72	CORD, LINE
3		LOOSE ITEMS
2	DS-101-1	DESICCANT, 16 UNIT
1		MODULAR UNIT

Figure 2-3. Modular Units, Preparation for Shipment Typical

TABLE 2-1. WIRING CHANGES, 115-VS 230-VOLT LINE SUPPLY

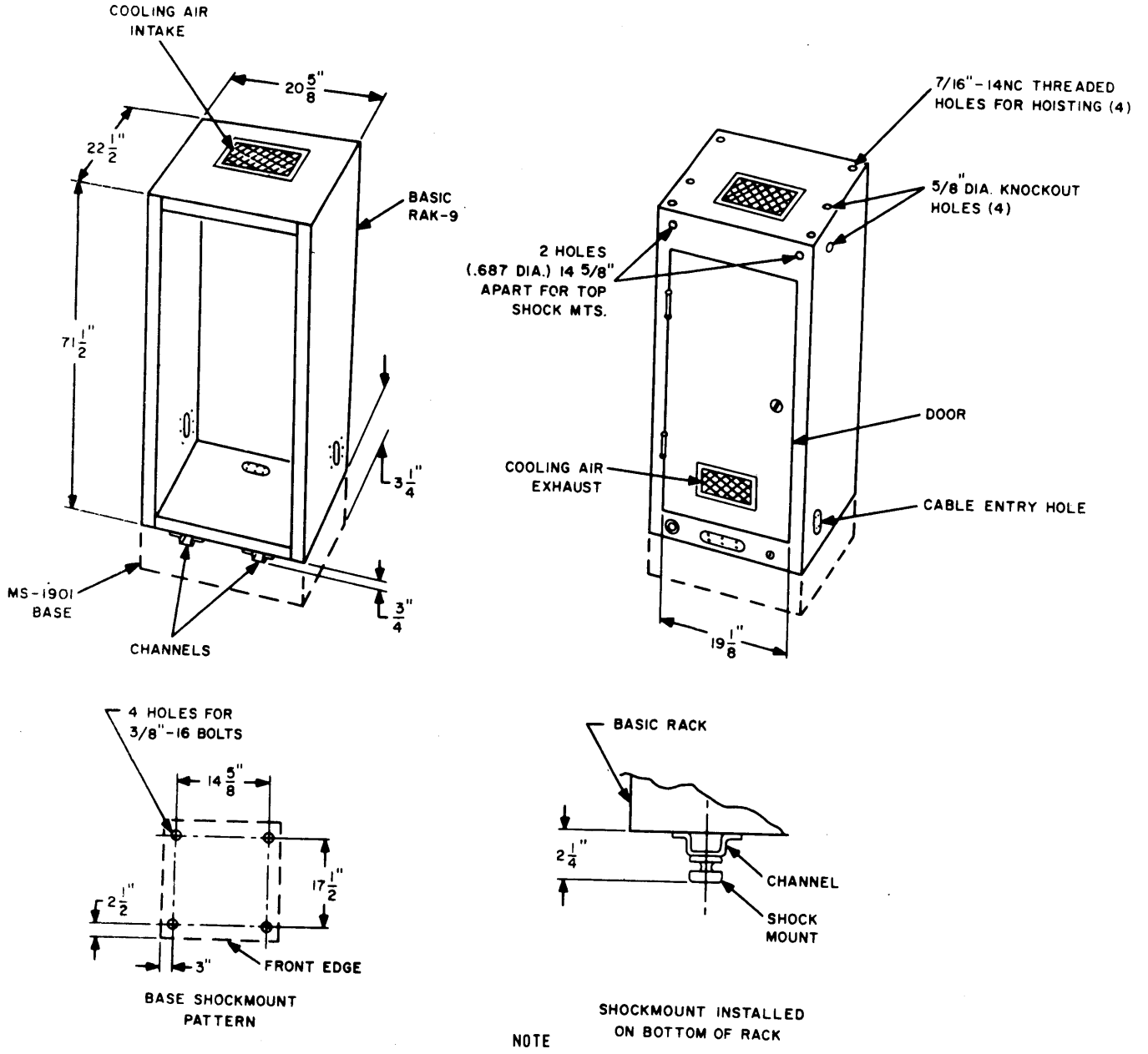
MODULAR	WIRING CHANGE MADE AT:	MANUAL REFERENCE
LV Power Supply PS-4 *	Circuit Breaker CB301 Transformer T301	PAL-1K(B2) PAL-1K(B2)
HV Power Supply PS-5B*	Transformer T401	PAL-1K(B2)
Exciter Unit MMXM-2	Transformer T301	MMXM-2
Auxiliary Power Panel APP-4A	Circuit Breaker CB501	APP-4A

* Do not replace fuses in these units.

2-3. INSTALLATION

a. LOCATION OF TRANSMITTER - Before attempting to install the transmitter ensure that adequate power (paragraph 2-2) is available at the selected site or location. Refer to outline dimensional drawing figure 2-4 when choosing the operating location. The room (or van) in which the transmitter is located must have a ceiling height of at least 7 feet. Adequate ventilation must be provided; operation of the transmitter in a poorily ventilated room will cause the surrounding temperature to become too high. Also, a clearance of about two feet at the rear of the rack is needed for opening the door.

After unpacking and inspecting the cabinet, place it in its operating location. It is advisable to do this while modular units are not installed because the added weight of the assembled transmitter will make movement more difficult. The four holes in the top of the rack and the four eyebolts included as loose parts in the shipment are for moving the rack with a crane hoist. Holes in the base are for rigid-mounting or shock mounting the rack to the floor. Holes along the top of the rear wall are for the top shock mounts. Use these holes as a template for drilling holes in the shelter or van.



NOTE

The shock mounts shipped with a particular SBT are determined by the weight applied to each shockmount and the size shown above is correct for installation of all various shock mounts used.

Figure 2-4. Outline Dimensional and Installation Drawing

NOTE

When equipment is to be shockmounted, a shockmounting kit and separate installation instructions are supplied.

b. INSTALLATION OF MODULAR UNITS - Refer to figures (1-1 and 2-5 for information regarding cabinet location of all modular units.)

The following modular units are slide mounted, RFD 1B, MMXM, and the PS-4. To install any slide-mounted unit in its compartment, refer to figure 2-6 and proceed as follows:

1. Untape or unstrap cable assemblies and all other components secured to the rack frame for shipment.

2. Pull center section of associated compartment track out until it locks in an extended position.

3. Position slide mechanisms of modular unit in tracks, and ease modular unit forward into rack until release buttons engage hole in track.

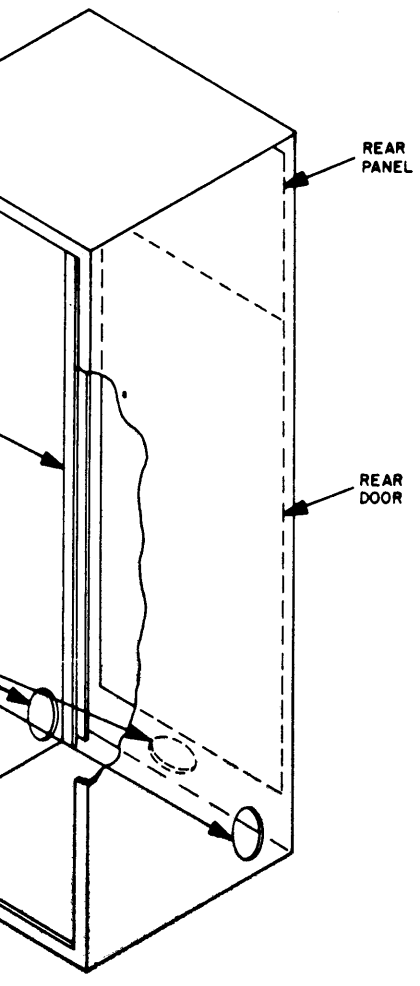
4. Start at the bottom and proceed up to prevent the rack from tipping over.

5. Make the necessary cable and electrical connections as described in paragraph 2-3c. To prevent the cables extending from Amplifier RFD and LV Power Supply PS-4 from snagging, utilize the reel-mounted springs located inside the rack.

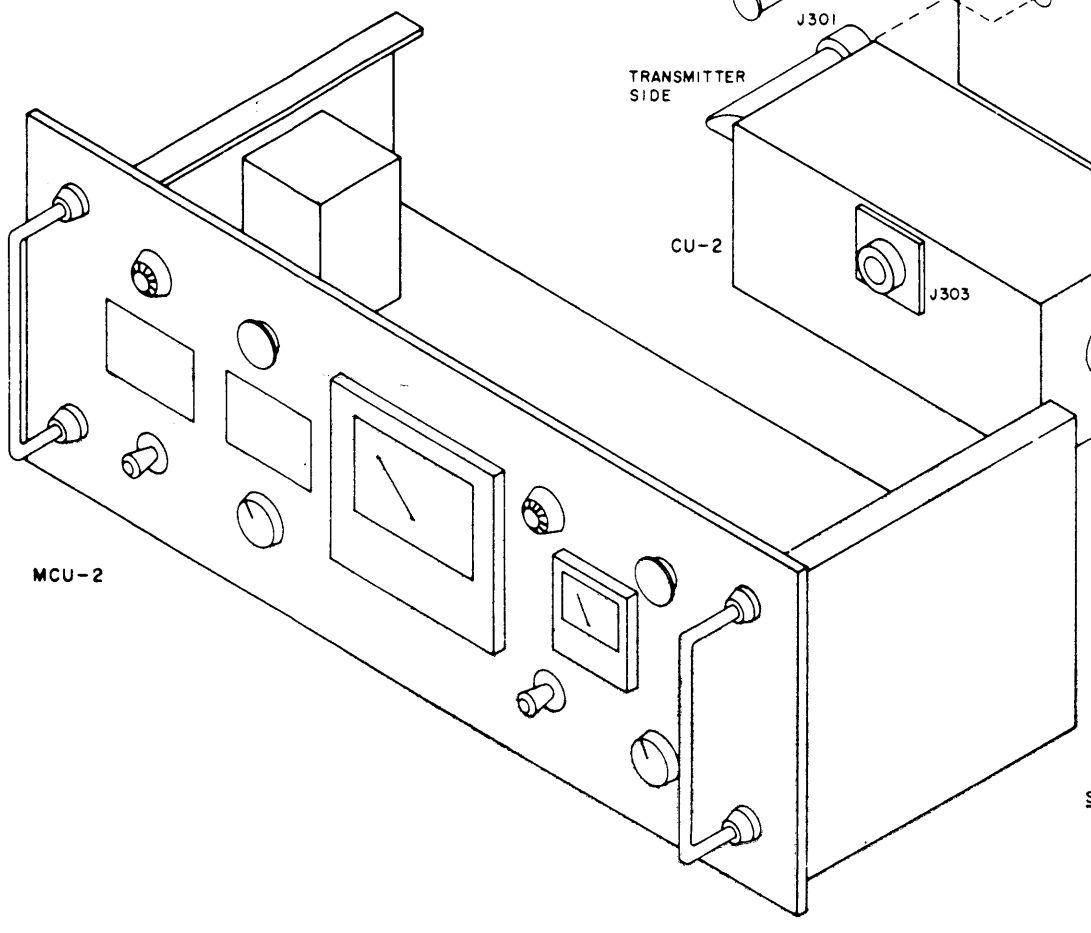
6. Depress release buttons and slide modular unit completely into compartment.

7. Secure front panel of modular unit to the rack with screws.

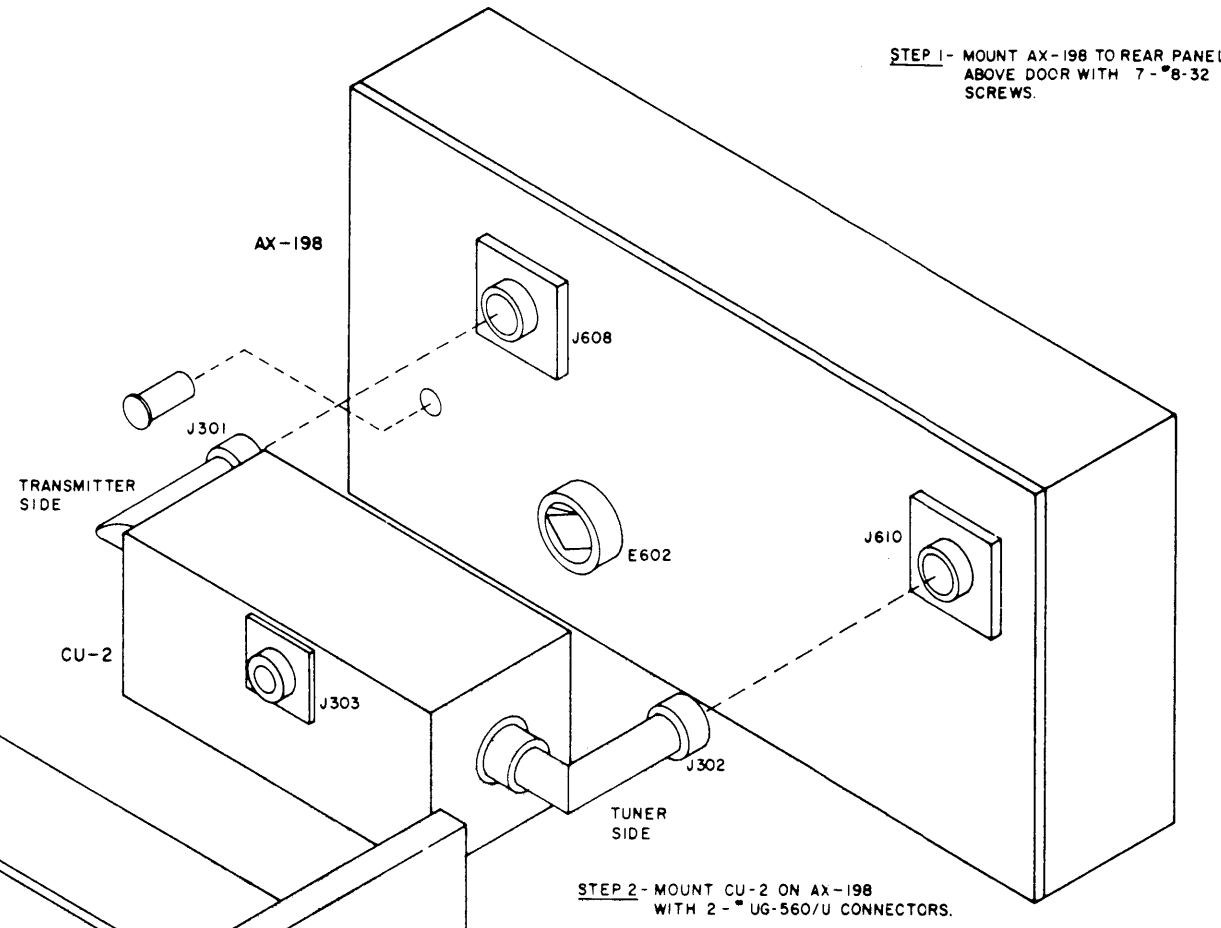
c. INTERCONNECTION OF MODULAR UNITS.- Figure 2-7 illustrates the cabling and wiring interconnection between the various modular units contained in the transmitter. Refer to figure 2-7 and connect modular units as indicated.



RAK-9 RACK

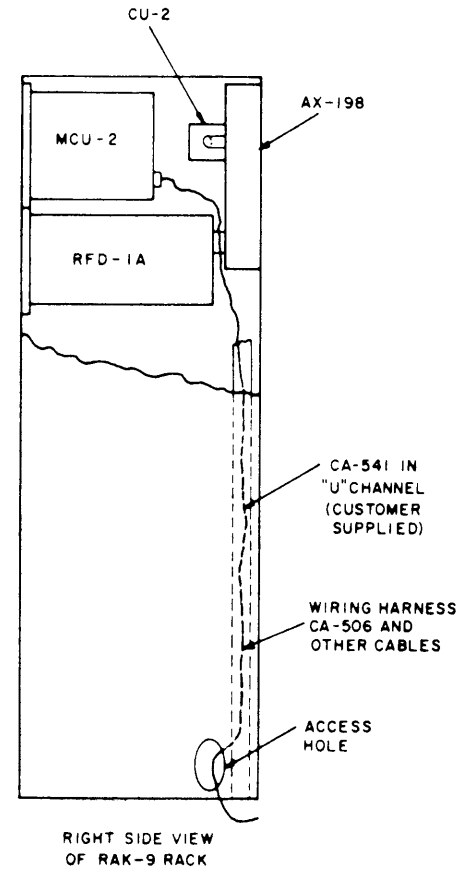


STEP 3 - MOUNT MCU-2 ON FRONT P/O FRAME WITH 4 - #10-32 SCREWS. (MCU-2 HAS NO DRAWER SLIDES)



STEP 2 - MOUNT CU-2 ON AX-198 WITH 2 - # UG-560/U CONNECTORS.

STEP 1 - MOUNT AX-198 TO REAR PANEL ABOVE DOOR WITH 7 - #8-32 SCREWS.



RIGHT SIDE VIEW OF RAK-9 RACK

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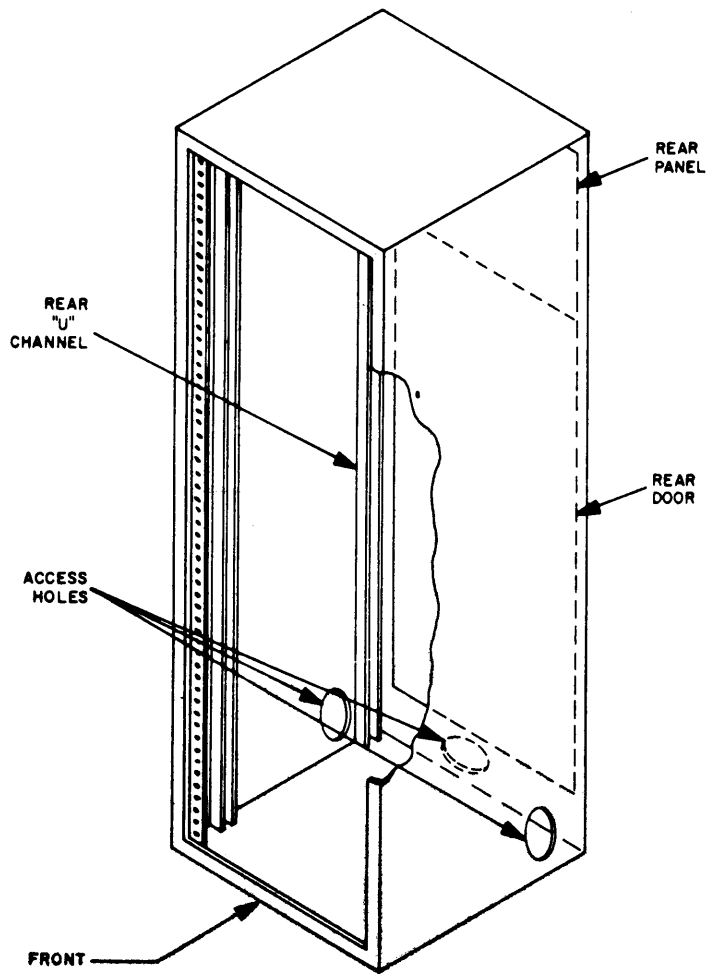
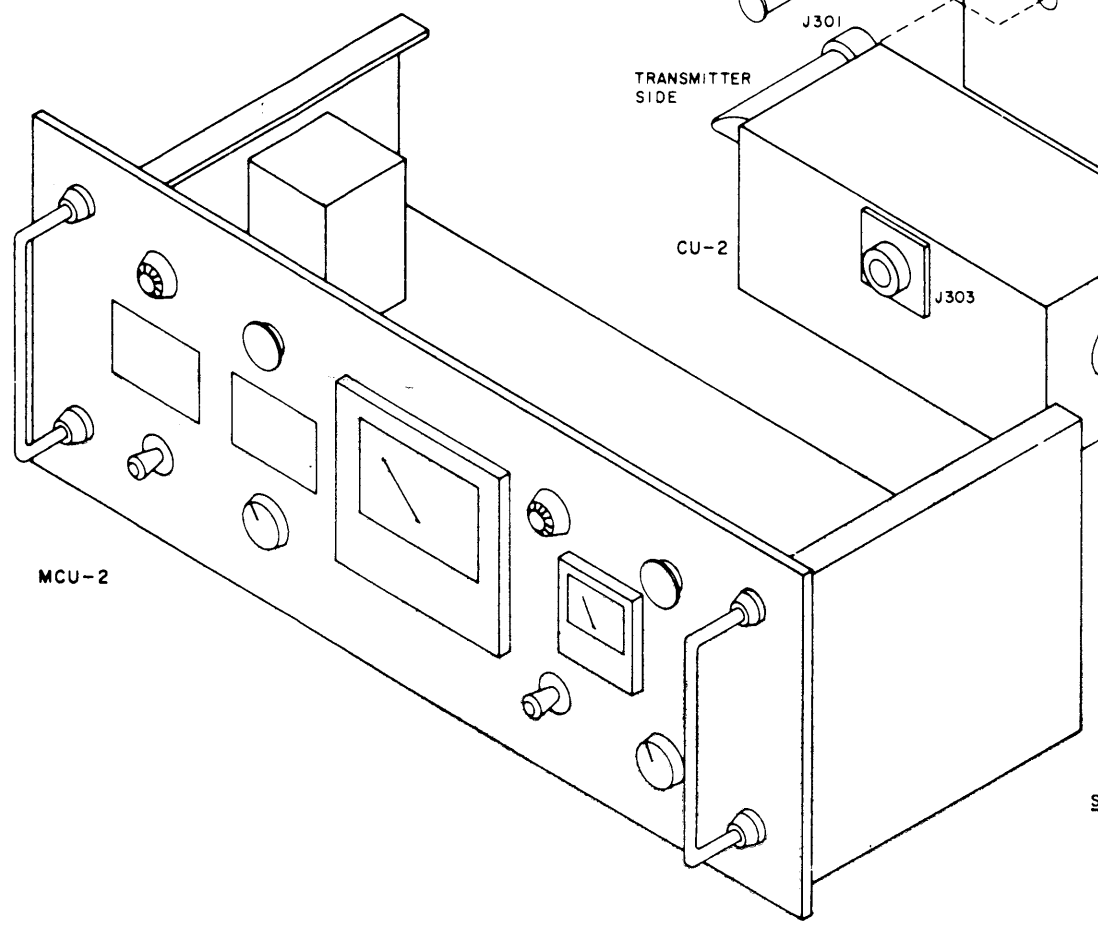
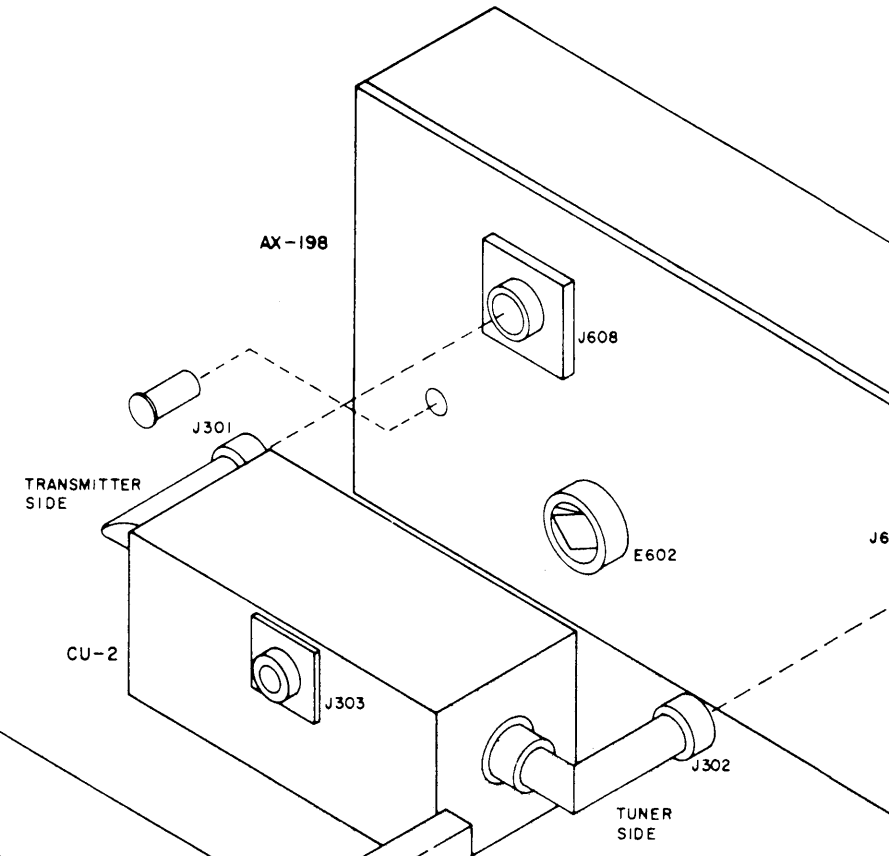
Figure 2-5. Installation of AX198 Assembly



STANDARD RAK-9 RACK





STEP 2 - MOUNT CU-2 ON AX-198 WITH 2 - UG-560/U CONN

STEP 3 - MOUNT MCU-2 ON FRONT P/O FRAME WITH 4 - 10-32 SCREWS. (MCU-2 HAS NO DRAWER SLIDES)

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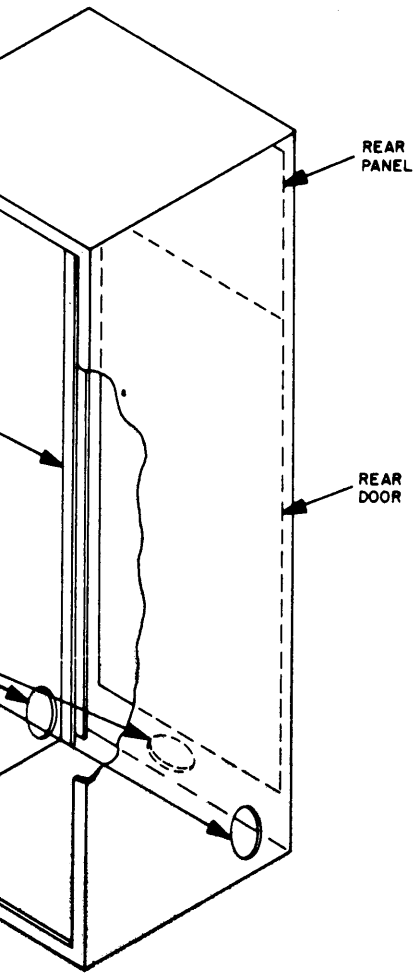
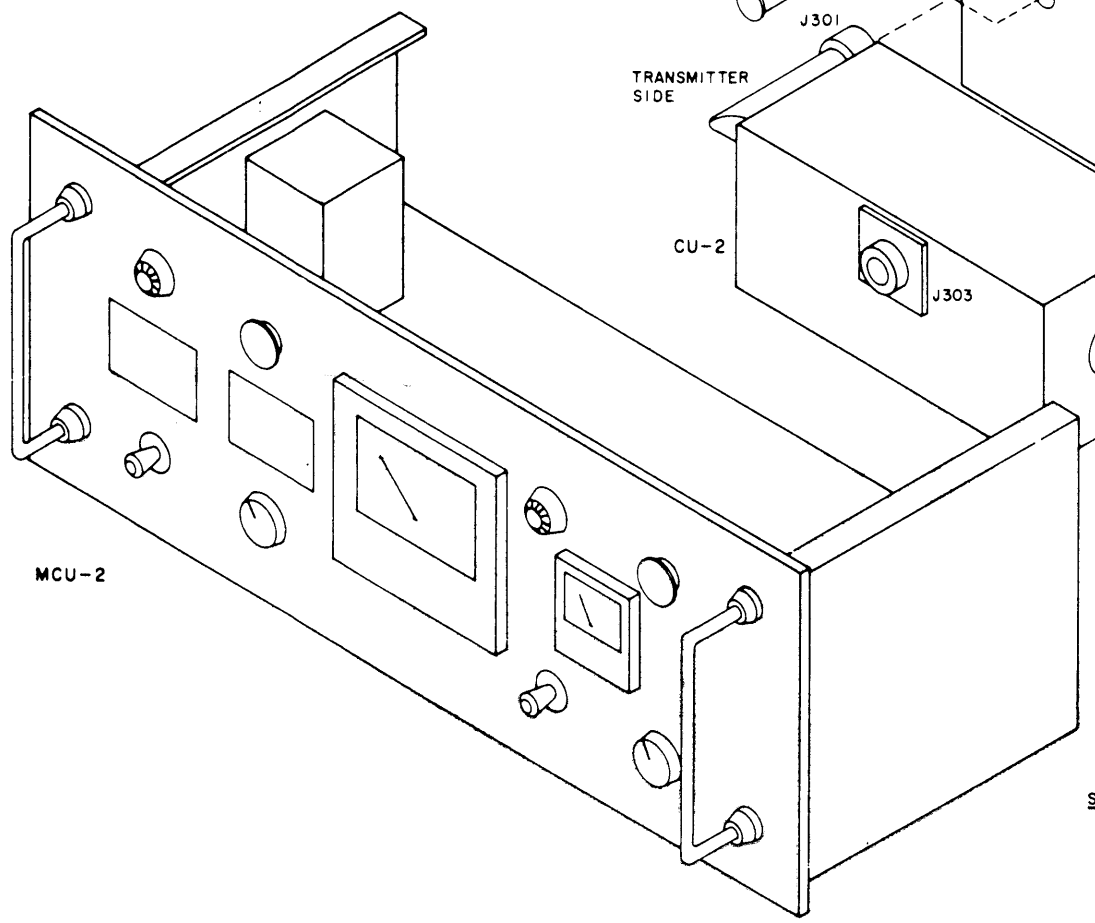
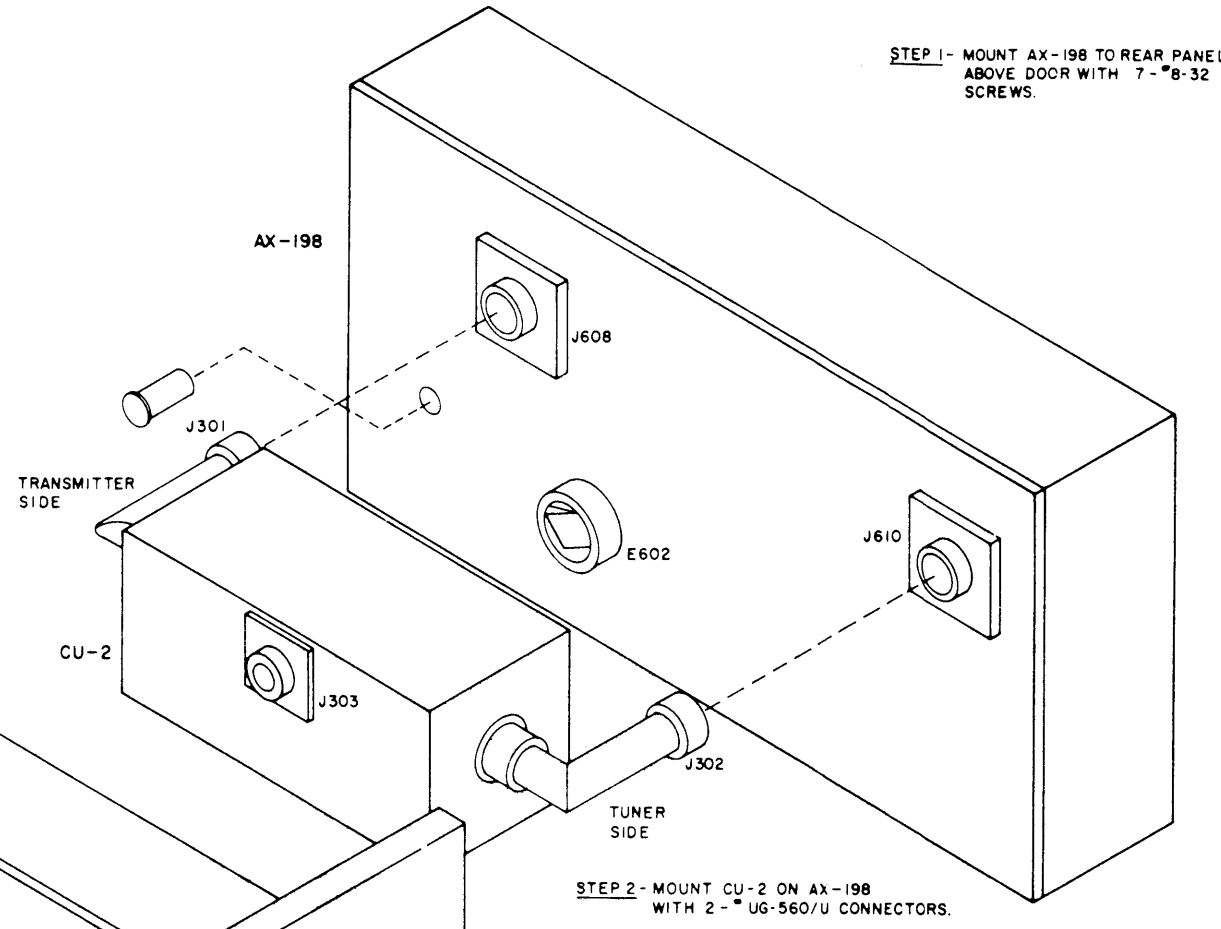


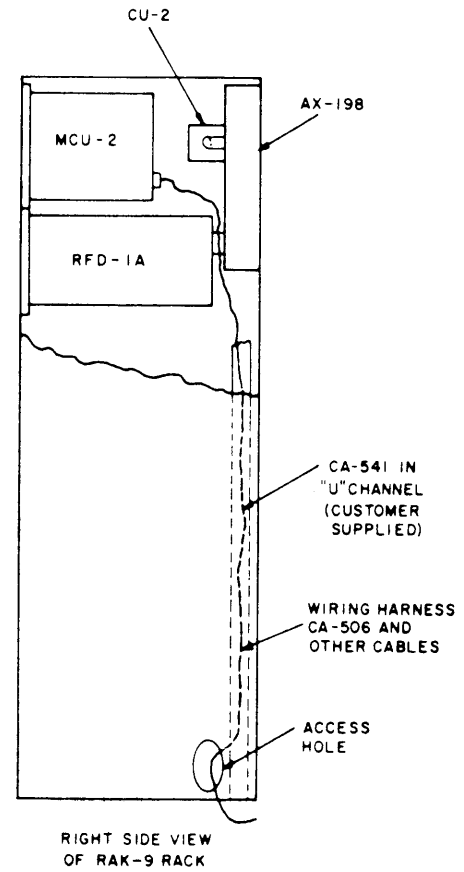


STEP 3 - MOUNT MCU-2 ON FRONT P/O FRAME WITH 4 - #10-32 SCREWS. (MCU-2 HAS NO DRAWER SLIDES)



STEP 2 - MOUNT CU-2 ON AX-198 WITH 2 - # UG-560/U CONNECTORS.

STEP 1 - MOUNT AX-198 TO REAR PANEL ABOVE DOOR WITH 7 - #8-32 SCREWS.



RIGHT SIDE VIEW OF RAK-9 RACK

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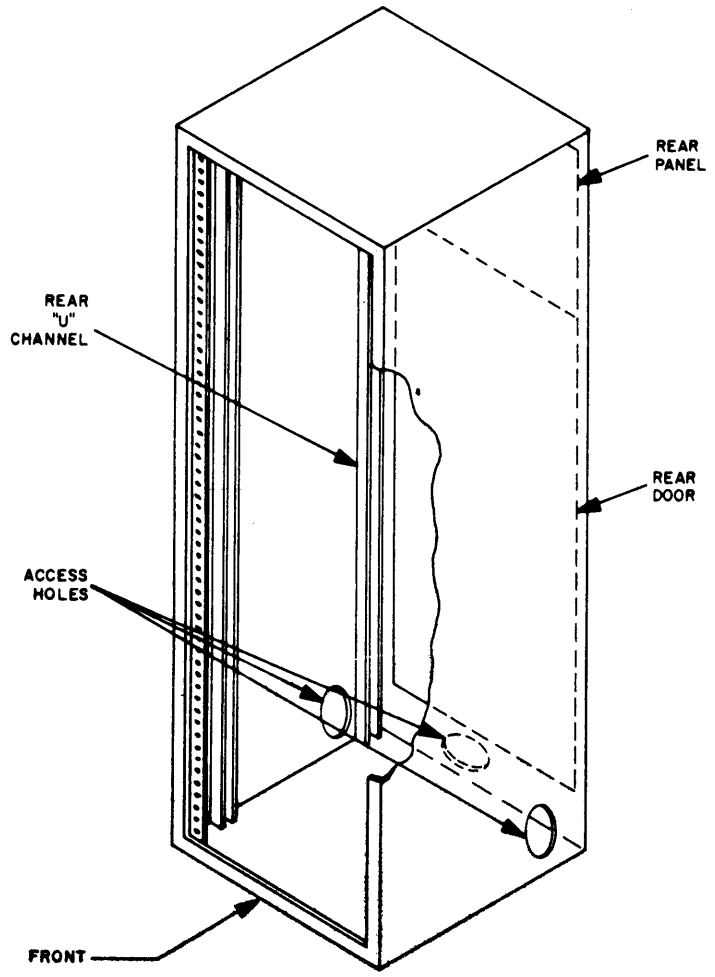
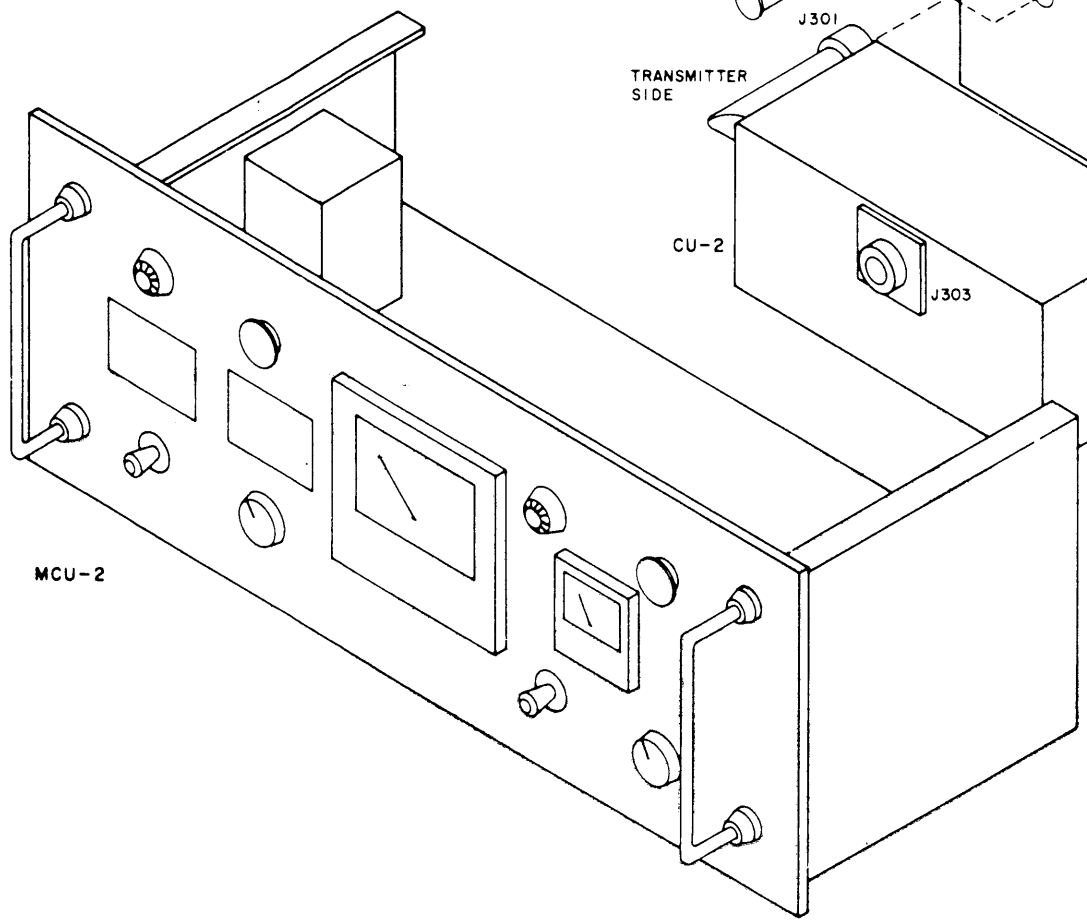
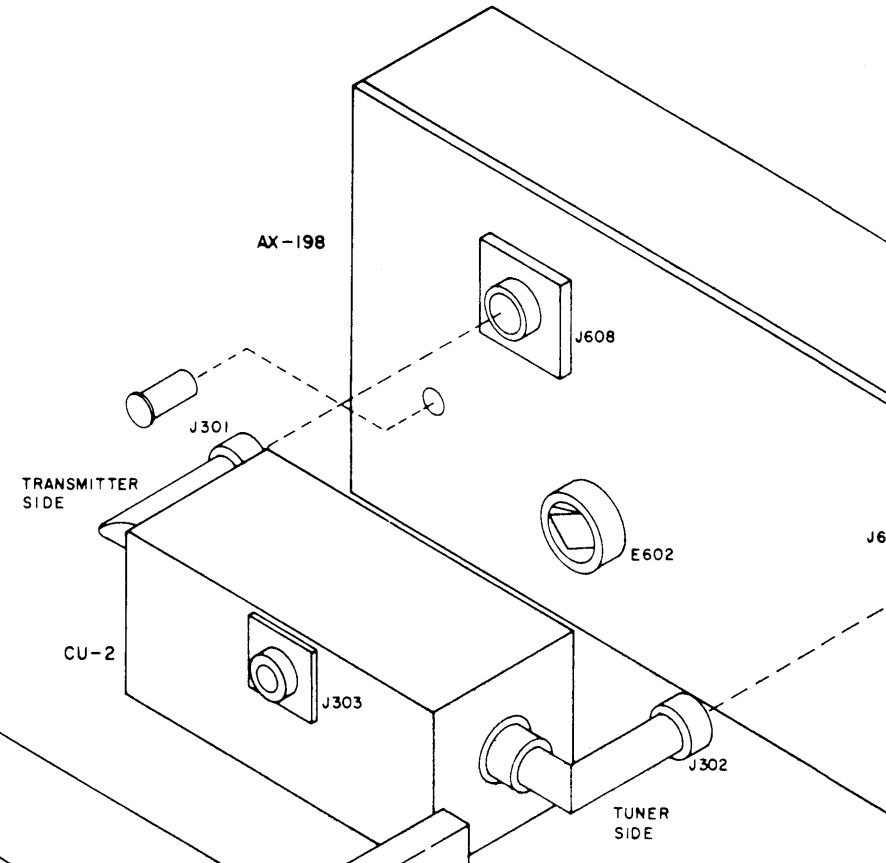
Figure 2-5. Installation of AX198 Assembly



STANDARD RAK-9 RACK





STEP 2 - MOUNT CU-2 ON AX-198 WITH 2 - ⁸ UG-560/U CONN

STEP 3 - MOUNT MCU-2 ON FRONT P/O FRAME WITH 4 - ⁸ 10-32 SCREWS.
(MCU-2 HAS NO DRAWER SLIDES)

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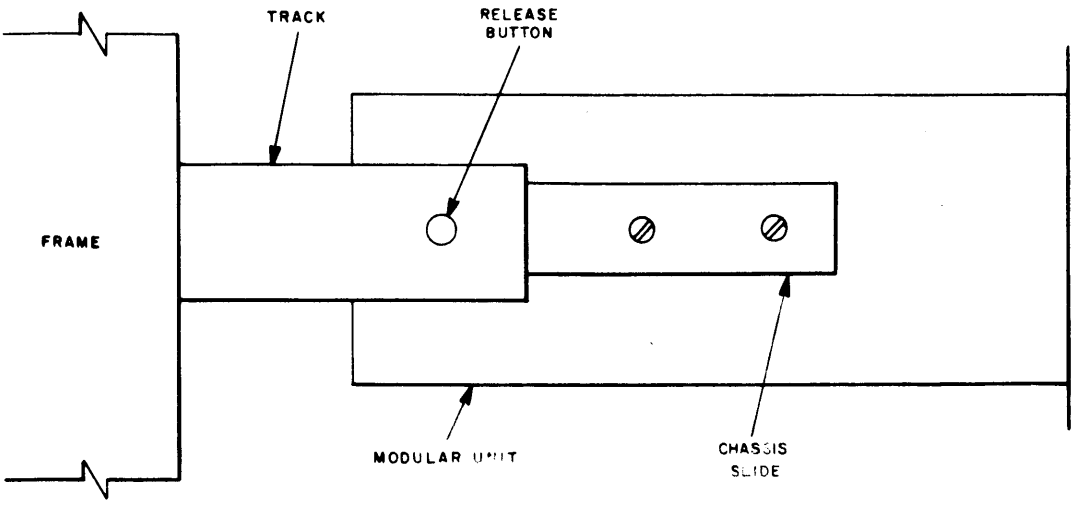
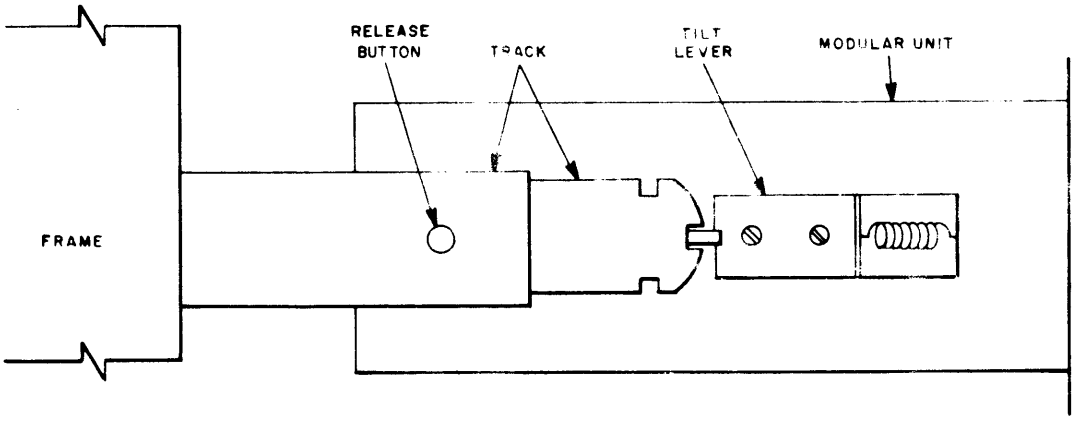


A NON-TILTING SLIDE MECHANISM



B TILTING SLIDE MECHANISM

Figure 2-6 Slide-Mounting Details

d. INITIAL ADJUSTMENTS - The SET has been factory tested and adjusted before disassembly for crating. No initial adjustments of chassis mounted variable components are necessary before operation.

e. CONNECTION OF EXTERNAL EQUIPMENT

(1) GENERAL. - Auxiliary Power Panel APP is a standard modular unit present in all SBTM transmitters. Besides functioning as a distributor for line voltage, the APP provides two terminal blocks to facilitate connection of external equipment to transmitter. Except for the MIKE and Key connection on Exciter Unit MMXM, all external connections may be made at terminal blocks E501 and E502 located at the rear of Auxiliary Power Panel APP. Figure 2-7 and the following paragraphs illustrate the possible external connections to SBTM-1KJC. Schematic diagrams in the individual modular-unit manuals should be used as an aid for tracing wiring.

2. REGULATE 115VAC - Terminals 3 and 4 are available for an extension source of the regulate 115VAC used in the PS-4 unit.

3. EXTERNAL INTERLOCKS - Terminals 5, 6, 7 and 8 are provided for connection of additonal safety interlock/s external to the SBT transmitter. Such additional interlock/s will be in series with the SBTM interlocks and form another link in the interlock circuit. When these terminals are not used in this way, the jumpers remain in place.

4. PUSH-TO-TALK SYSTEM SYSTEM - Terminals 9 and 10 are provided for a push-to-talk button attachment. A push-to-talk system may be used in lieu of circuits available in the MMXM.

5. AUDIO INPUT

SBTM operates only on the upper sideband thus only one channel input is required. Channel 1 terminals 13, 14 and 15 are wired directly to the channel 1 input of the MMXM. Figure 2-7 illustrates connections for either balanced or unbalanced input.

7. KEY LINE - Terminals 21 and 22 of terminal block E502 are provided for the attachment of a keying device in CW mode of transmission.

8. RECIEVER MUTING - Terminals 23, 24 and 25 are provided for a receiver muting feature. The purpose of this feature is to automatically disable the receiver when the transmitter is sending and enable it when the transmitter is in OFF or STANDBY condition.

f. FAX AND FSK TERMINALS - Terminals 27 through 32 of E502 are FAX and FSK. FSK connections are accomplished at terminals 27 (minus) and 29 (plus) GAX connections are accomplished at Terminals 31 and 32.

g. ANTENNA - RF receptacle J609 on AX-198 RF Output Chassis and mating plug P606 are provided for the antenna connection. J609 is an adapter with a nominal impedance of 50-ohms, adapting a UHF type of connection on the inside of the chassis to a QDS type on the outside. P606 is a QDS type plug with a nominal impedance of 50-ohms. Use RG-8U or RG-10U cable running to antenna connection.

h. TRANSMITTER/RECEIVER ANTENNA - RF receptacle J606 on AX-198 RF Output Chassis and mating plug P624 are provided for connecting the transmitting antenna to a receiver input, thus making the transmitting antenna double for a receiving antenna. The antenna relay (K601) circuitry switches the antenna from transmitter to receiver system and back. When the transmitter is sending the antenna is connected to the transmitter and disconnected from the receiver. When the transmitter is not sending, the antenna is disconnected from the transmitter and connected to the receiver.

i. MIKE/KEY - The MIKE jack MMXM front panel is for the connection of a 50,000-ohm high impedance crystal or dynamic microphone. The Key jack on MMXM front panel is for the connection of a telegraph key (key connection are also located on the APP-4A and a test key is provided on the front Test Key Panel).

j. EXTERNAL ALDC - When ALDC switch located at the rear of RFD-1B amplifier is placed in INT position, the output of the amplifier acts on its own input stage to effect ALDC (automatic load and drive control). When ALDC switch is placed in EXT position, the ALDC signal is, instead, routed to the MMXM to control the exciter output level. The latter position (EXT) is preferable, when the RFD-1B is used in the SBT, since it is more effective in preventing overdrive conditions in the RFD.

Within the MMXM an internal ALDC circuit is continously functioning. ALDC output from the RFD is applied to and combined with this internal ALDC.

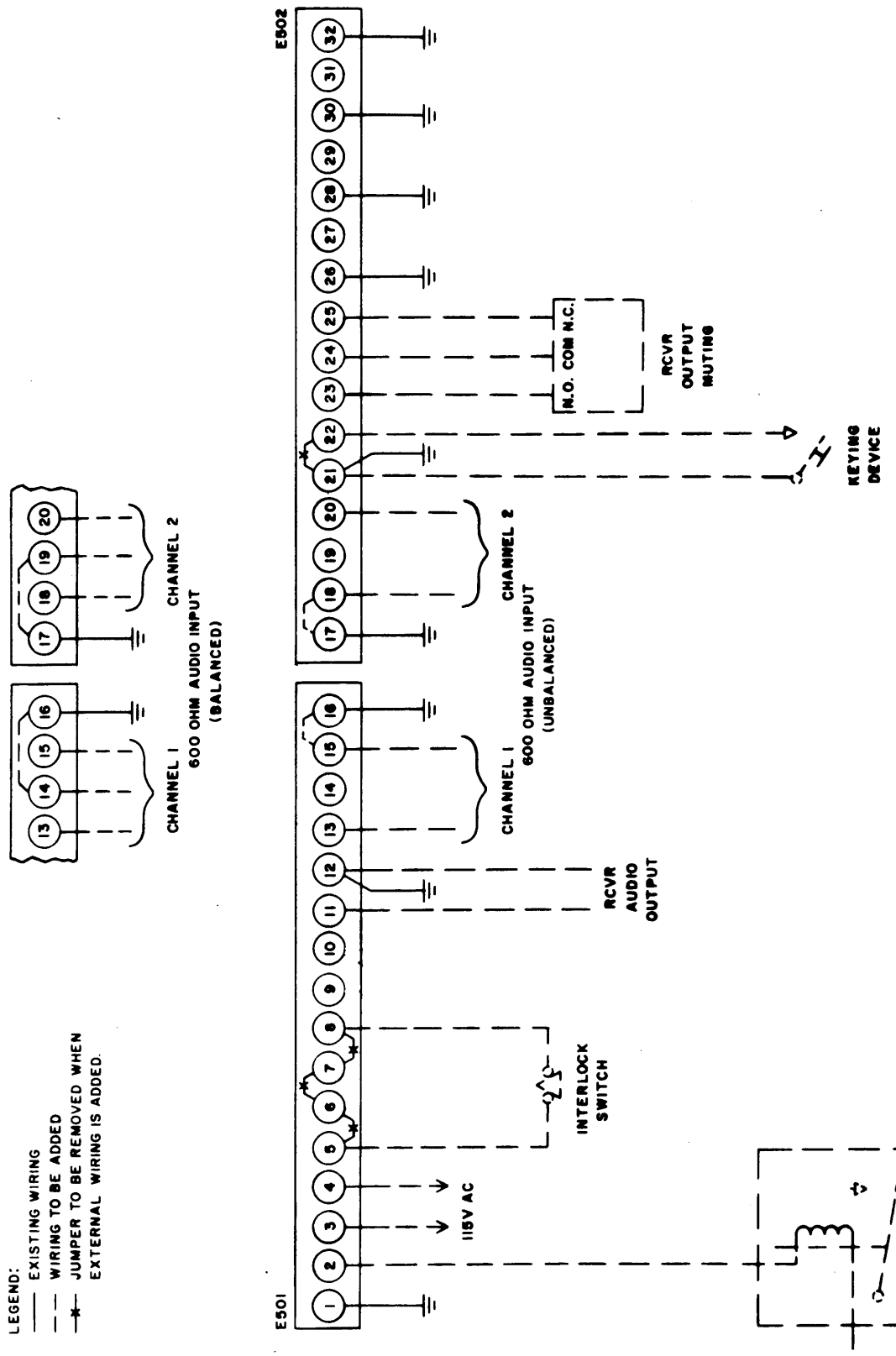


Figure 2-7. Connection Diagram, External Equipment to SBTM-1KJC

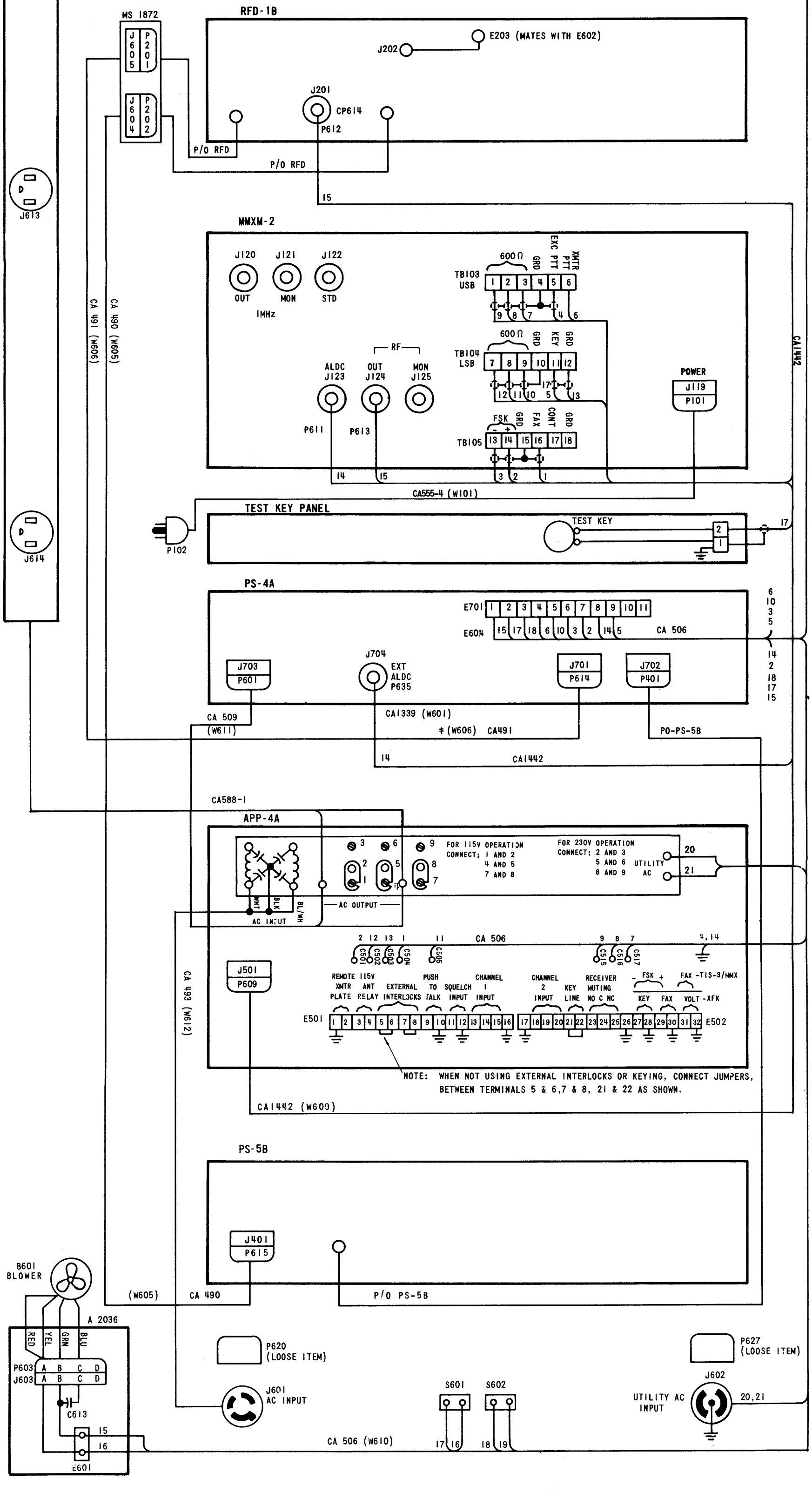
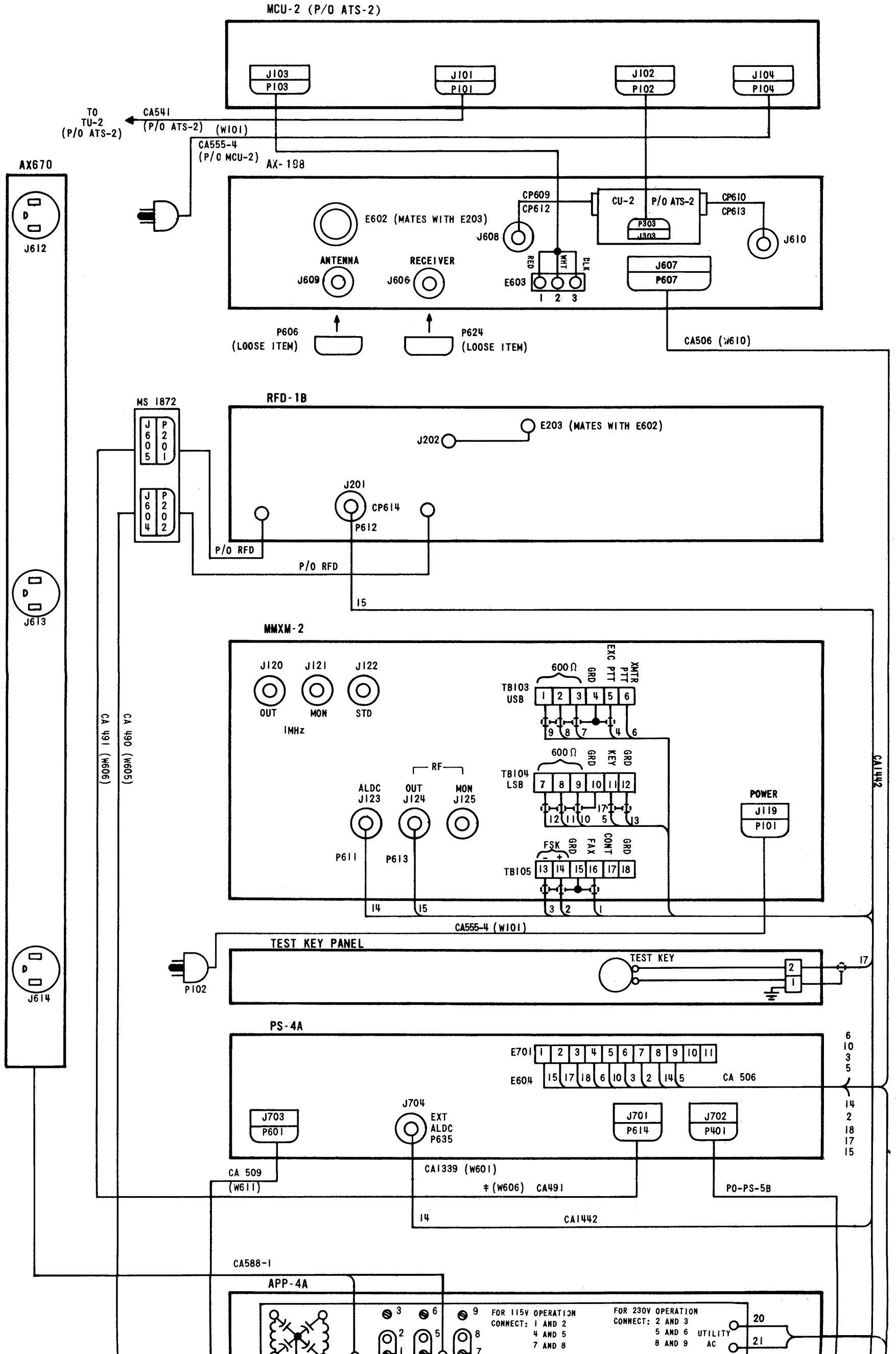


Figure 2-8. Interconnection and Cabling Diagram, General Purpose Transmitter, SBTM-1KJC


MCU-2 (P/O ATS-2)
J103
P103
J101
P101
J102
P102
J104
P104
TO
TU-2
(P/O ATS-2)
CA541
(P/O ATS-2)
(W101)
CA555-4
(P/O MCU-2)
AX-198
AX670
D
J612
E602 (MATES WITH E203)
CP609
CP612
CU-2
P/O ATS-2
P303
J303
CP610
CP613
J608
J610
ANTENNA
J609
RECEIVER
J606
RED
WHT
BLK
E603
1 2 3
J607
P607
P606
(LOOSE ITEM)
P624
(LOOSE ITEM)
CA506 (W610)
MS 1872
J605
P201
J604
P202
RFD-1B
E203 (MATES WITH E602)
J202
J201
CP614
P612
P/O RFD
P/O RFD
15
D
J613
MMXM-2
J120
J121
J122
OUT
MON
STD
1MHz
600Ω
GRD
EXC PTT
XMTR PTT
TB103
USB
1 2 3 4 5 6
9 8 7 4 6
600Ω
GRD
KEY
GRD
TB104
LSB
7 8 9 10 11 12
12 11 10 5 13
RF
ALDC
J123
OUT
J124
MON
J125
P611
P613
POWER
J119
P101
FSK
GRD
FAX
CONT
GRD
TB105
13 14 15 16 17 18
3 2 1
14
15
CA555-4 (W101)
CA1442
TEST KEY PANEL
P102
TEST KEY
2
1
17
PS-4A
E701
1 2 3 4 5 6 7 8 9 10 11
E604
15 17 18 6 10 3 2 14 5
CA 506
6
10
3
5
J704
EXT
ALDC
P635
J703
P601
J701
P614
J702
P401
14
2
18
17
15
CA 509
(W611)
CA1339 (W601)
‡ (W606) CA491
PO-PS-5B
14
CA1442
CA588-1
APP-4A
FOR 115V OPERATION
CONNECT: 1 AND 2
4 AND 5
7 AND 8
FOR 230V OPERATION
CONNECT: 2 AND 3
5 AND 6
8 AND 9
UTILITY
AC
20
21
J614
CA 1916 (W605)
CA 1906 (W605)
CA1442

SECTION 3
OPERATOR'S SECTION

3-1 GENERAL

The following paragraphs discuss the stand by, and output operating procedures of the SBTM-1KJC transmitter system (refer to figure 3-1). Before operating any of the controls on the transmitter it is recommended that the operator first familiarize himself with the controls and indicators of each unit. They are explained in the accompanying modular manuals.

3-2 STANDBY OPERATION

EXCITER

CONTROL	POSITION
1) EXCITER switch (34)	ON
2) STANDBY switch (35)	STANDBY
3) RF OUTPUT control (25)	fully CCW

NOTE

For maximum stability the MMXM requires a 24 hour warm up period.

AUXILIARY POWER PANEL

1) MAIN POWER circiut breaker (50)	ON

MONITOR CONTROL UNIT

1) POWER switch (8)	OFF

LINEAR POWER AMPLIFIER (PAL-1K)

1) FINAL VOLTAGES switch (44)	OFF
2) TRANSMITTER VOLTAGES switch (46)	STANDBY
3) PA PLATE, SCRN, and CONTR GRID over load circuit breakers (41) (42).	ON
4) MAIN POWER circuit breaker (47)	ON
5) PA FIL PRI meter adust knob (40)	Meter should read 115 volts.

MONITOR CONTROL UNIT

CONTROL	POSITION
1) POWER switch (8)	ON
2) METER switch (10)	RES
3) METER (11)	Read resistance switch position indication on meter.
4) TUNE OPERATE switch (7)	TUNE

3-3 OPERATING PROCEDURE

NOTE

Allow a 15 minute warm up period before any tuning is performed.

CAUTION

Before tuning transmitter make sure either a Dummy Load or an antenna is connected to the output.

1. Set EXCITER switch (34) at ON.

2. Set POWER switch (35) at ON.

3. Set EXCITER switch (34) at ON when using either the USB or LSB 600 ohm line control (31) or (36)

Set EXCITER switch at PTT when using a mike in front panel MIKE jack (32).

4. Set MODE switch (51) at AM.

5. Select the desired operating frequency with the FREQUENCY SELECTION switch (37).

6. Turn Meter switch (26) to the USB position.

7. Adjust the MIKE or LINE control (36) of sideband selected, to desired level as indicated by MONITOR (27).

8. Turn Meter switch (26) to the LSB position.

9. Adjust the MIKE or LINE control (36) to desired level as indicated by MONITOR (27). (If LSB function is incorporated in the exciter unit, MMXM.)

NOTE

DO NOT EXCEED RED REGION ON MONITOR (27). When mike input is used adjust level so as not to exceed red region with highest input from microphone.

10. Turn METER switch (26) to the RF POSITION and adjust RF output control (25) for the desired level of RF output indicated on monitor (27).

NOTE

Turn RF OUTPUT control (25) fully CCW before selecting different modes of operation.

CAUTION

Turn RF OUTPUT control (25) fully CCW before performing next steps of operation.

11. TRANSMITTER VOLTAGES switch (45) to ON, Indicator should light. (46).

12. Turn the MULTIMETER switch (13) to 1st AMPL PLATE.

13. Increase MMXM OUTPUT (25) until a usable reading is obtained on MULTIMETER (14).

14. Rotate 1st AMPL TUNING (18) to maximize reading on MULTIMETER (14).

15. Reduce MMXM OUTPUT to bring approximately 1/4 scale reading on MULTIMETER (14).

16. Turn the MULTIMETER switch (13) to the PA Eg position.

17. Rotate the PA GRID TUNING switch (17) to maximize reading on MULTIMETER (14).

18. Turn MMXM OUTPUT (25) fully CCW.

19. Turn PA TUNING switch (21) for desired output frequency. (see tuning chart).

20. Turn PA LOADING switch (24) for desired output frequency (see tuning chart).

21. Turn PA LOADING switch (22) for desired output frequency (see tuning chart).

22. Turn FINAL VOLTAGES switch (44) to ON, indicator (43) should light.

23. Increase MMXM output until PA PLATE CURRENT meter (15) indicates 300 ma.

24. Adjust PA TUNING switch (21) observing the PA PLATE CURRENT meter (15) for a dip.

25. Increase PA LOADING switch (22) until the plate current rises.

26. Readjust MMXM OUTPUT until PA PLATE CURRENT meter (15) indicates 300mma.

27. Adjust PA TUNING switch (21) observing the PA PLATE CURRENT meter (15) for a dip.

28. Repeat PA TUNING (21) and PA LOADING (22) adjustments until correct output is read on the MULTIMETER (14).

29. Turn MMXM OUTPUT (25) fully CCW momentarily.

30. Turn the MCU-2 (MONITOR CONTROL UNIT) POWER switch (8) to X1 position and refer to chart for ATS-2 system. Slowly increase MMXM OUTPUT (25) until MCU-2 gives a good indication of forward watts and reflected power. (Reading should not exceed 100 watts output). If a satisfactory voltage standing wave ratio is indicated, turn POWER switch (8) to X10.

31. If the reflected watts indication is not sufficiently low operate the REACTANCE switch (9).

32. Place TUNE-OPERATE switch (7) in OPERATE.

33. Increase MMXM OUTPUT (25) for desired output power. Check that the MCU-2 still indicates a satisfactory voltage standing wave ratio.

NOTE

Under one tone output condition the MCU-2 VSWR meter will read full or 1000 watt output under two tone output condition meter will read 70% less than full rated output.

34. Adjust ALDC control (52) until OUTPUT reading on VSWR meter (2) starts to decrease.

35. The SBTM-1KJC is now fully tuned and loaded on carrier. The following instructions provide other modes of transmission.

3-4 CW OPERATION

1. Place MODE switch (51) on MMXM to CW (keyline must be closed with external keying device).

2. Test switch (38) on TEST KEY PANEL should be in the neutral position.

3. Remove jumper from terminals 21 and 22 on E502 of APP-4.

4. Follow normal tuning procedure outlined in paragraph 3-3.

3-5 PTT OPERATION

1. Turn TRANSMITTER VOLTAGE switch (45) to STANDBY.

2. Set EXCITER switch (34) to PTT.

3. Set MODE switch (51) in either AM, USB, or ISB.

4. Set METER switch (26) to appropriate position. (refer to MMXM manual).

5. Set USB switch (36) to MIKE control.

6. Insert mike in front panel of MMXM or externally wire through terminals

9 and 10 of E501 on APP-4.

7. Follow normal tuning procedure outlined in paragraph 3-3. With the exception of step 11.

NOTE

When PTT is activated, transmitter voltages are energized.

3-6 FSK OPERATION

1. Place Mode switch (51) on MMXM to FSK.
2. Externally wire FSK input to appropriate terminals on APP-4.
3. Follow normal tuning procedure outlined in paragraph 3-3.

3-7 FAX

1. Place MODE switch (51) on MMXM to FAX.
2. Externally wire FAX input to appropriate terminals on APP-4.
3. Follow normal tuning procedure outlined in paragraph 3-3.

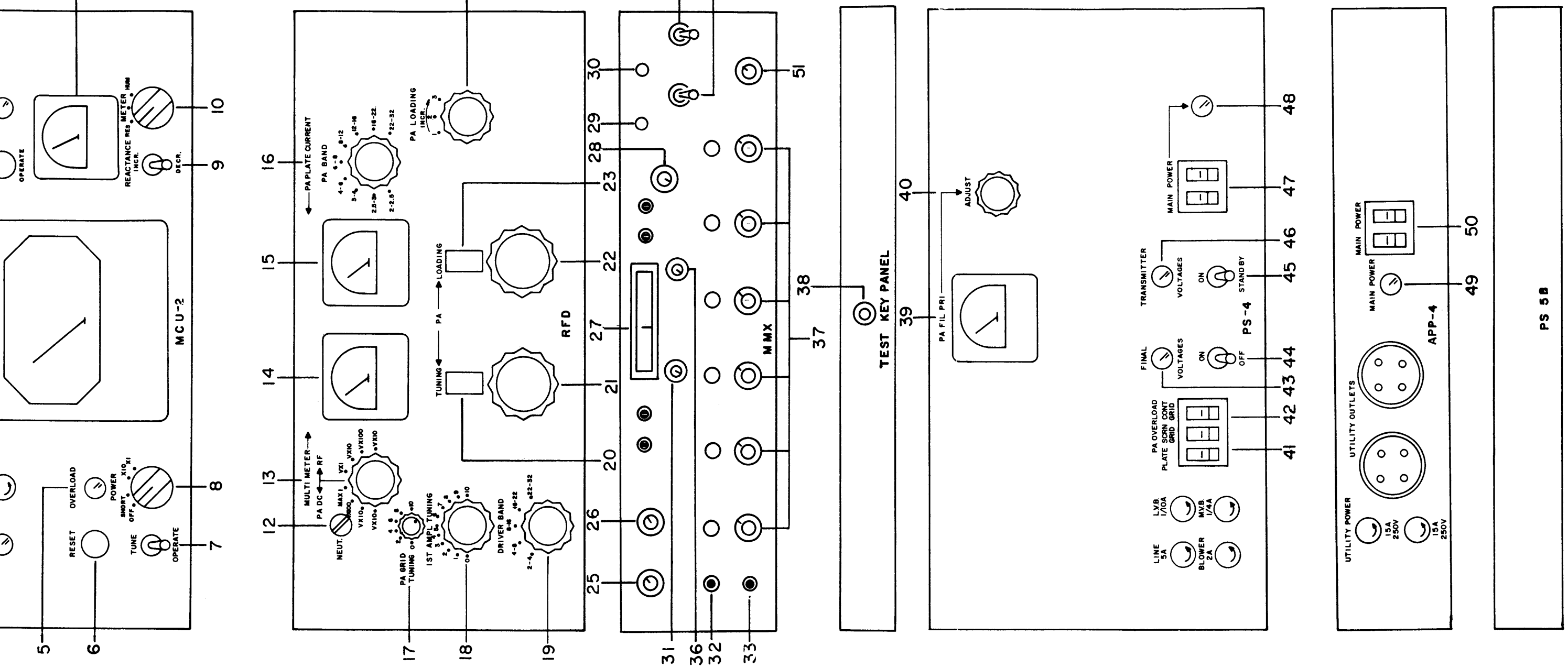


Figure 3-1. Controls and Indicators

011681005

1
2
3
4
POWER
2A
RESISTANCE
STOP
OPERATE
5
RESET
OVERLOAD
6
POWER
SHORT
OFF
X10
X1
TUNE
OPERATE
MCU-2
REACTANCE
INCR.
RES
METER
HUM
DECR.
11
7
8
9
10
12
13
14
15
16
MULTI METER
PA DC
RF
PA PLATE CURRENT
PA BAND
NEUT.
MAX
VX1
VX10
VX100
VX1000
4-6
6-8
8-12
3-4
12-16
2.5-3
16-22
2-2.5
22-32
17
PA GRID TUNING
0
10
PA LOADING
INCR.
1ST AMPL TUNING
18
TUNING
PA
LOADING
24
DRIVER BAND
2-4
19
RFD
25
26
20
21
27
22
23
28
29
30
31
36
32
33
34
35
MMX
51
37
38
TEST KEY PANEL
39
40
PA FIL PRI
ADJUST

SECTION 4
PRINCIPLES OF OPERATION

4-1 INTRODUCTION

Figure 4-1 is a functional block diagram of the SBTM-1KJC transmitter, showing the main interrelationships of the APP-4A, MMXM, PAL-1KB2, AX5040, AX198 and ATS-2A. For a complete functional block diagram and schematic diagram of each unit, refer to the individual manual for the unit.

4-2 a) BLOCK DIAGRAM DESCRIPTION (Refer to figure 4-1).

The Auxiliary Power Panel APP-4A is a distribution panel providing interconnection between internal and external transmitter circuitry. The APP-4A distributes the primary ac input power to the PS4 ., and to Jacks J614 and J612 which provide primary ac power to the MMXM-2 and MCU-2. The APP-4A also has two ac utility outlets. The Push-to-talk, keying, FAX, and FSK inputs are applied through the APP-4.

The audio input signals enter the APP-4A at E501 and E502, they are then coupled to terminal boards TB103, TB104, and TB105 of the multimode exciter MMXM-2. The MMXM-2 provides an r-f output signal in the range of 2-29.9999 MHz at a 250 mw level for single sideband modes of operation. In the CW mode of operation a 100 mw output signal is provided. When the MMXM-2 is in the CW mode, a circuit test may be performed by using switch S1001 on the test key panel.

The output signal from the MMXM-2 is passed through the Test Key Panel and applied to jack J201 of the linear power amplifier RFD-1B. The signal is then passed through three stages of amplification in the RFD, producing a 1 kilowatt (PEP) peak envelope power output signal at E203. The 1 kilowatt signal is coupled to terminal E602 of the Transmit/Receive unit, AX198, where it passes through one set of contacts on relay K601. The signal is then coupled from jack J608 to the Directional Coupler unit CU-2. In the Directional Coupler a portion of the signal

is rectified and applied to the metering circuits of the VSWR unit MCU-2. The major portion of the signal passes through the coupler, through jack J610, to antenna output jack J609, where it is applied to the antenna matching device, TU-2. The signal is then applied to the antenna.

b. AUTOMATIC LOAD AND DRIVE CONTROL

When switch S209 in the RFD is turned to the external position, the ALDC signal is fed out of the RFD to the PS4 where it is coupled back to the MMXM2.

c. TRANSMITTER/RECEIVER (T/R) ANTENNA SYSTEM - If suitable connections are made to a receiver (refer to figures 2-7 and 4-2) at terminals 23 through 25 of E502 in APP-4 and J606 on AX-198, a T/R antenna system may be had. In this system, the receiver and transmitter share the same antenna. K601 relay action, controlled by the TRANSMITTER VOLTAGES switch, serves to switch the antenna between receiver and transmitter. A receiver muting action is also possible in which case the receiver is muted while the antenna is connected to the transmitter.

In order to make SBTM adaptable to an external antenna system and receiver muting system relay K601 is inserted in the circuitry. When TRANSMITTER VOLTAGES switch (S703) is closed, relay K703 is energized providing a path for the +500 VDC source in the PS-4, completing a circuit to ground through E701 terminal 9, P607 and J607 pin F, K601 relay coil, normally closed contacts of K602 relay, P607 and J607 pin E and TRANSMITTER VOLTAGES switch (S702). This energizes K601 relay, closing a set of contacts and thereby connecting the output of RFD amplifier to the antenna. Another set of contacts on K601 also close, providing the -200VDC source for the interlock circuit a path to ground through normally closed contacts of K602 and P607 and J607 pin G. The resulting current through K703 coil energized this relay and the RFD receives its medium plate voltages. The next step in operating the transmitter is to close the FINAL VOLTAGES switch, in order to supply the RFD amplifier with high voltage. This action also supplies a-c current to the coil of K603 relay. The resulting energization of this relay cause the -200VDC source and the +500VDC source to switch paths to ground. From this point on, it becomes possible to obtain on-off control of the transmitter

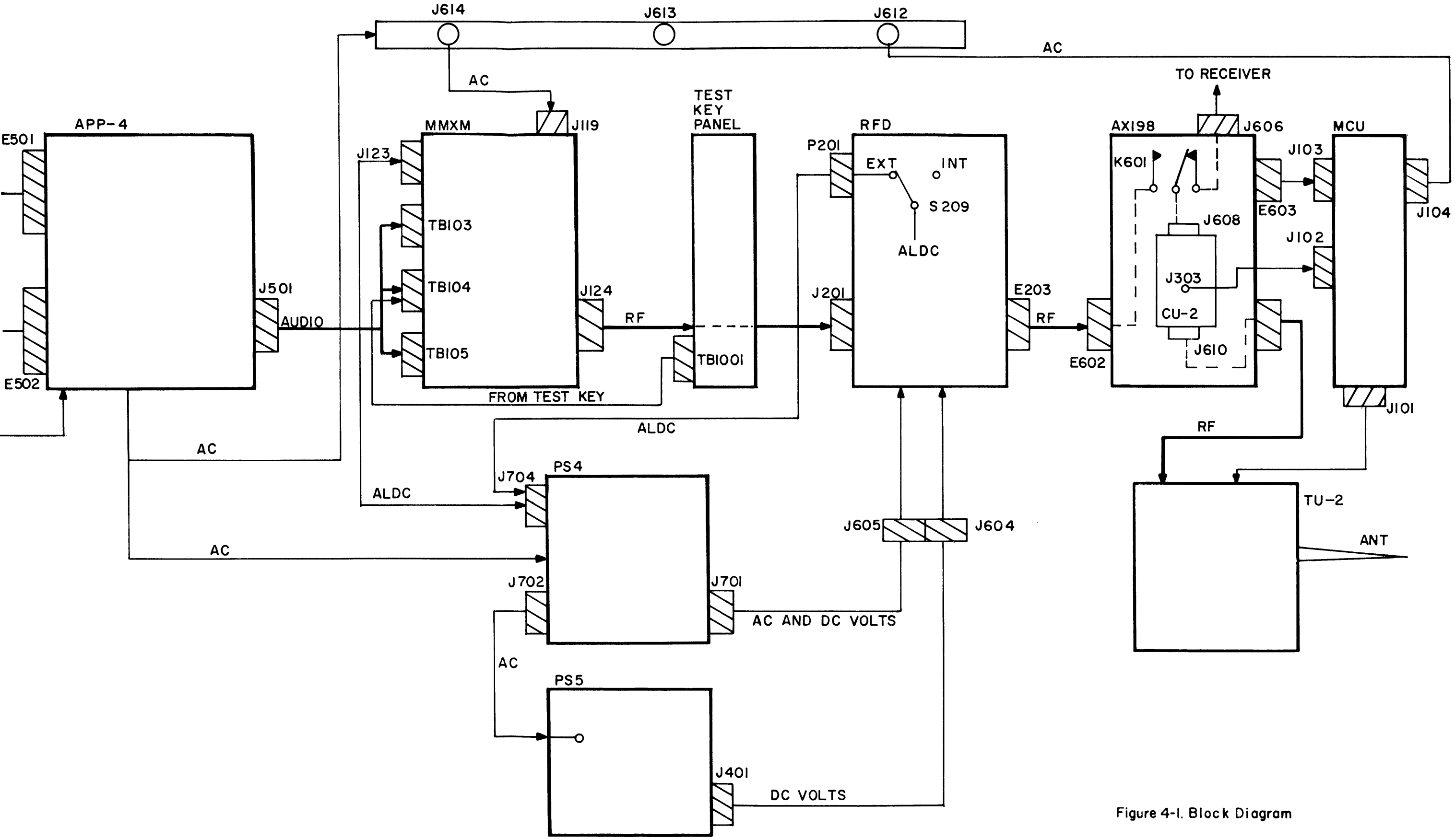
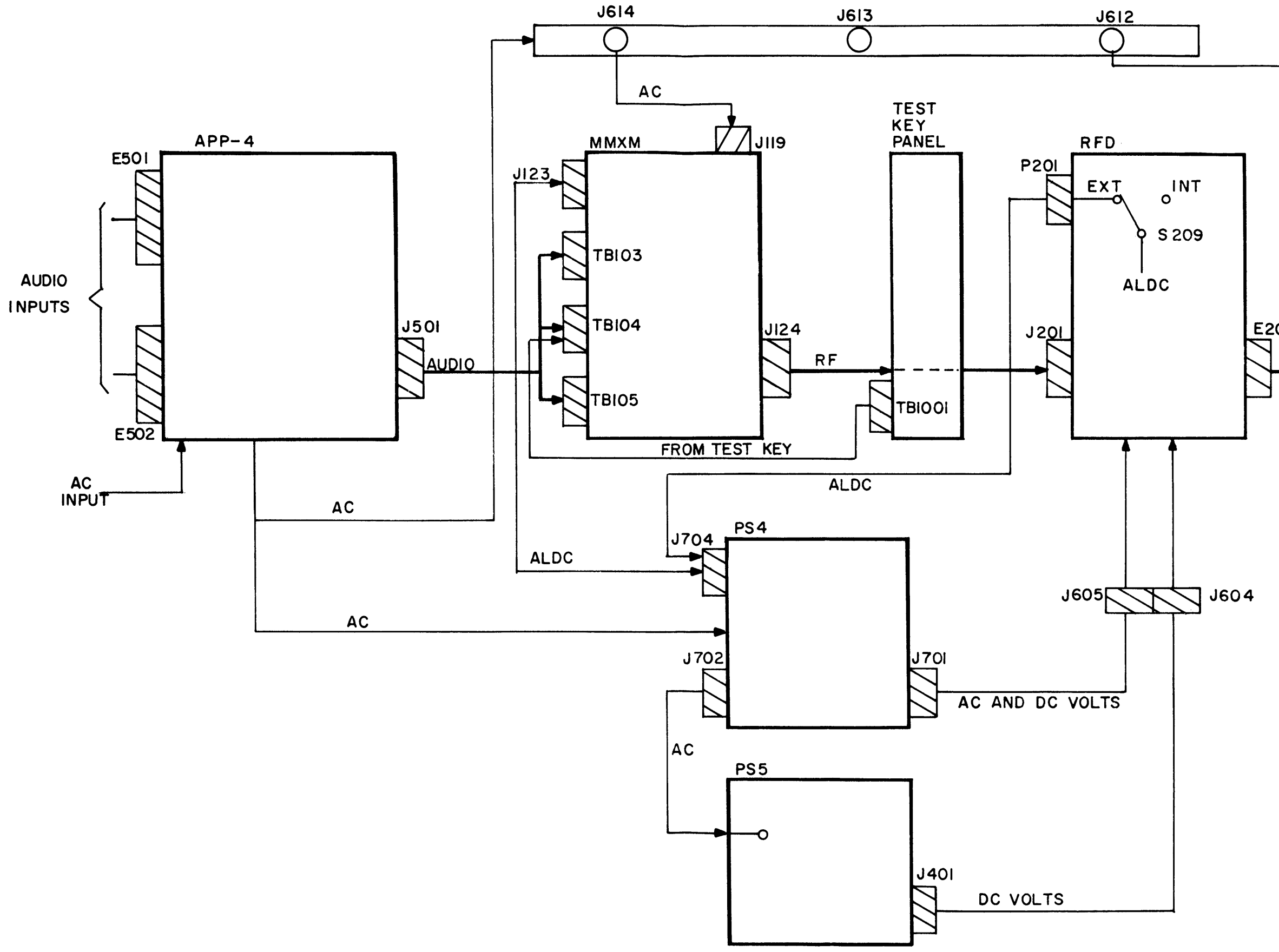


Figure 4-1. Block Diagram


J614
J613
J612
AC
APP-4
E501
AUDIO
INPUTS
E502
J501
AUDIO
AC
INPUT
AC
ALDC
MMXM
J119
J123
TBI03
TBI04
TBI05
J124
RF
FROM TEST KEY
TEST
KEY
PANEL
TBI001
ALDC
RFD
P201
EXT
INT
S 209
ALDC
J201
E20
PS4
J704
J702
J701
AC AND DC VOLTS
J605
J604
AC
PS5
J401
DC VOLTS

by manipulation of the TRANSMITTER VOLTAGES switch (S702) as long as FINAL VOLTAGES switch control has the additional feature of switching a common antenna over to a receiver when the transmitter is in STANDBY. When TRANSMITTER VOLTAGES switch is returned to STANDBY, relays K703, K602 and K601 become de-energized in that sequence; when switch is returned to ON position relays K601, K703 and K602 become energized in that sequence. The sequences prevent the antenna from becoming disconnected at an instant when the high plate voltages are still applied to the RFD-1B amplifier.

c. INTERLOCK SYSTEM - (Refer to figure 4-3: Interlock Diagram) A complete safety interlock system is provided through-out the transmitter. The purpose of the interlock system is to prevent the transmitter from operating when any one of a series of dangerous conditions exist. Essentially, a negative voltage (-200VDC), originated in the PS-4 unit, completes a ciruit through a series of interlocks when TRANSMITTER VOLTAGES switch is closed. The completion of this circuit sends current through K703 relay coil. Energization of K703 furnishes +500VDC supply to RFD-1B driver tube plate and +250VDC to RFD-1B 1st amplifier tube plate. The subsequent manual closing of FINAL VOLTAGES switch sends +500VDC to PA tube screen in RFD-1B and line voltage to PS-5B High Voltage Power Supply which, in turn, supplies +3000VDC to RFD-1B PA tube plate. The SBTM interlock system is the same as the PAL-1K (B2) interlock system with an additional link running through the APP-4 and AX-198 units. The complete series of links capable of opening the interlock circuit are summarized in table 4-1.

TABLE 4-1. INTERLOCK CIRCUIT COMPONENTS

UNIT	INTERLOCK OR CIRCUIT BREAKER	CLOSED
PS-4	PA OVERLOAD CONT GRID circuit breaker CB702	when no overload condition exists in the RFD-1B PA grid circuit
PS-4	PA OVERLOAD SCRN GRID circuit breaker CB703	when no overload condition exists in the RFD-1B screen grid circuit
PS-4	PA OVERLOAD PLATE circuit breaker CB704	When no overload condition exists in the RFD-1B PA plate circuit
RFD-1B	Air switch interlock S206	When blower motor B201 is operating normally
RFD-1B	Band switch S205	When PA BAND switch S202 is properly set in a detent
RFD-1B	Top cover interlock S207	When top cover of the RFD-1B is secured in position
RFD-1B	Bottom cover interlock S208	When the bottom cover of the RFD-1B is secured in position
PS-5B	Top cover interlock S403	When the top cover of PS-5B is secured in position
PS-5B	Door interlock S402	When PS-5B is secured in the rack
RAK-9()	Door interlock S602	When rear door of rack is closed
B601	Door interlock S601	When rear door of rack is closed
AX-198	Push-button interlock S603	When RFD-1B is secured in rack
AX-198	Switch interlock S604	When antenna cable is connected to AX-198 at J609
MCU-2	Overload Relay K103	When no SWR overload condition exists in the antenna circuit

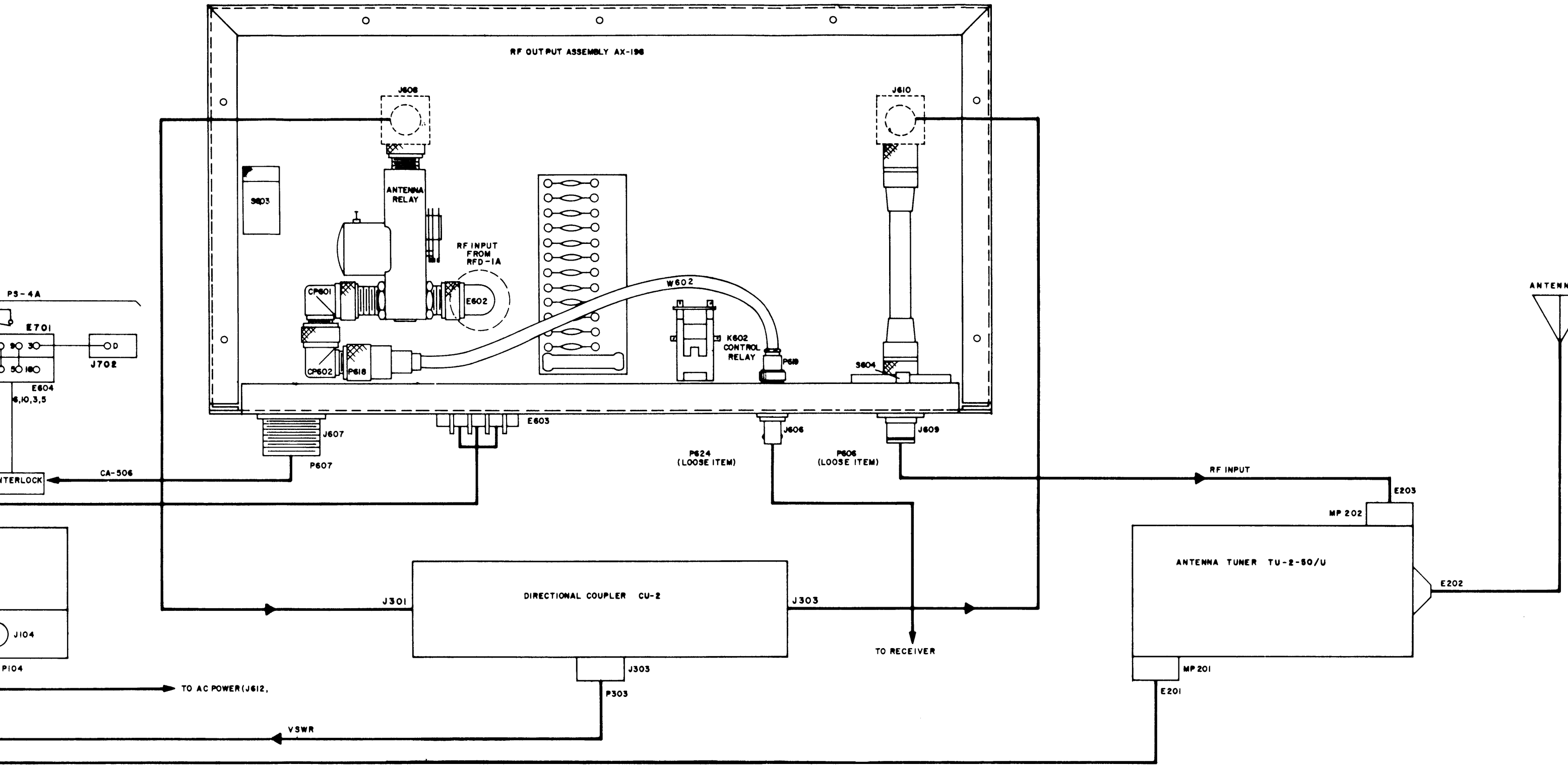


Figure 4-2. Parital Wiring Diagram Showing Interconnections of AX-198 Assembly and Closely Associate Units

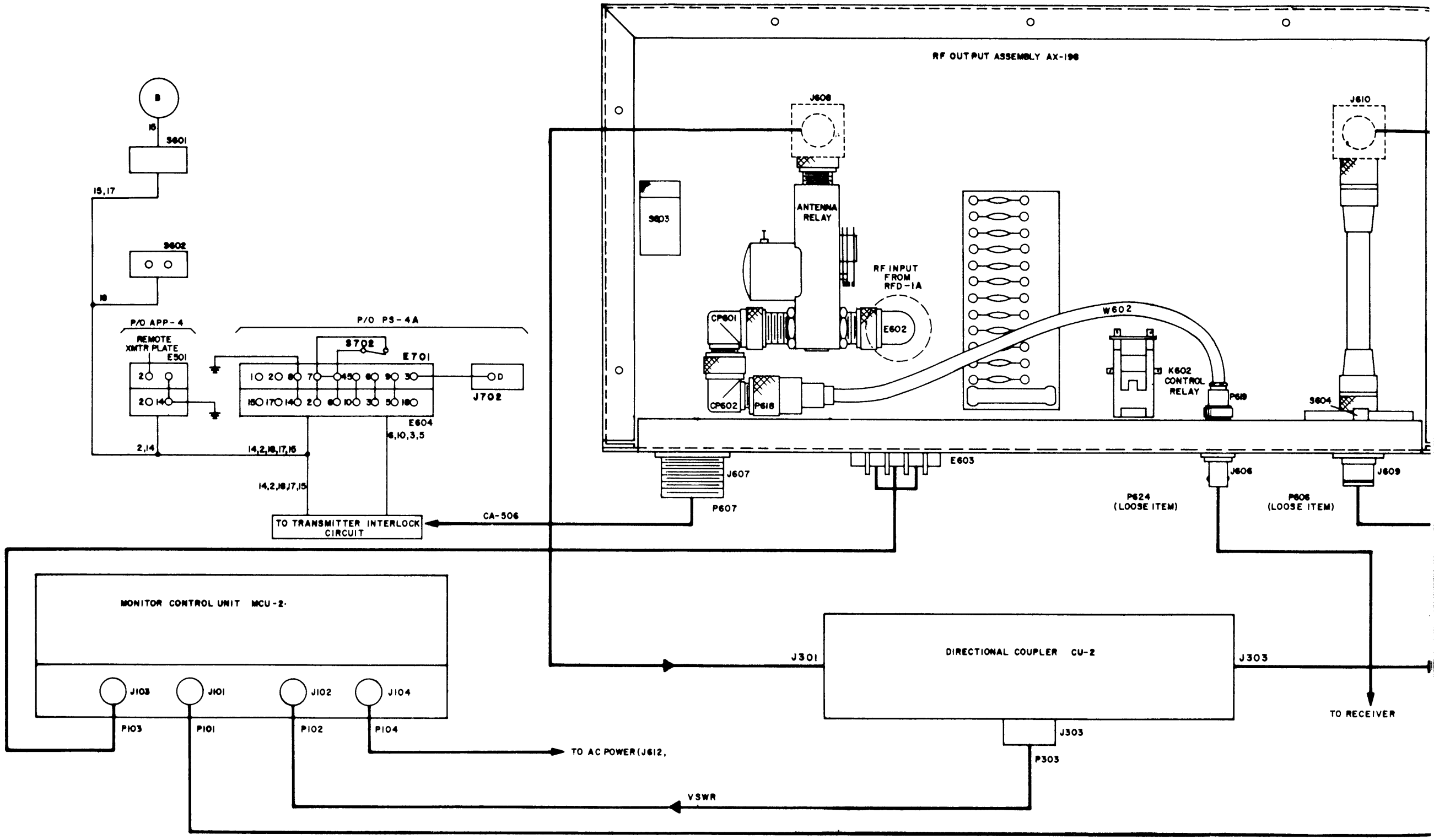


Figure 4-2. Parital Wiring Diagram Showing Interconnections of AX-198 Assembl

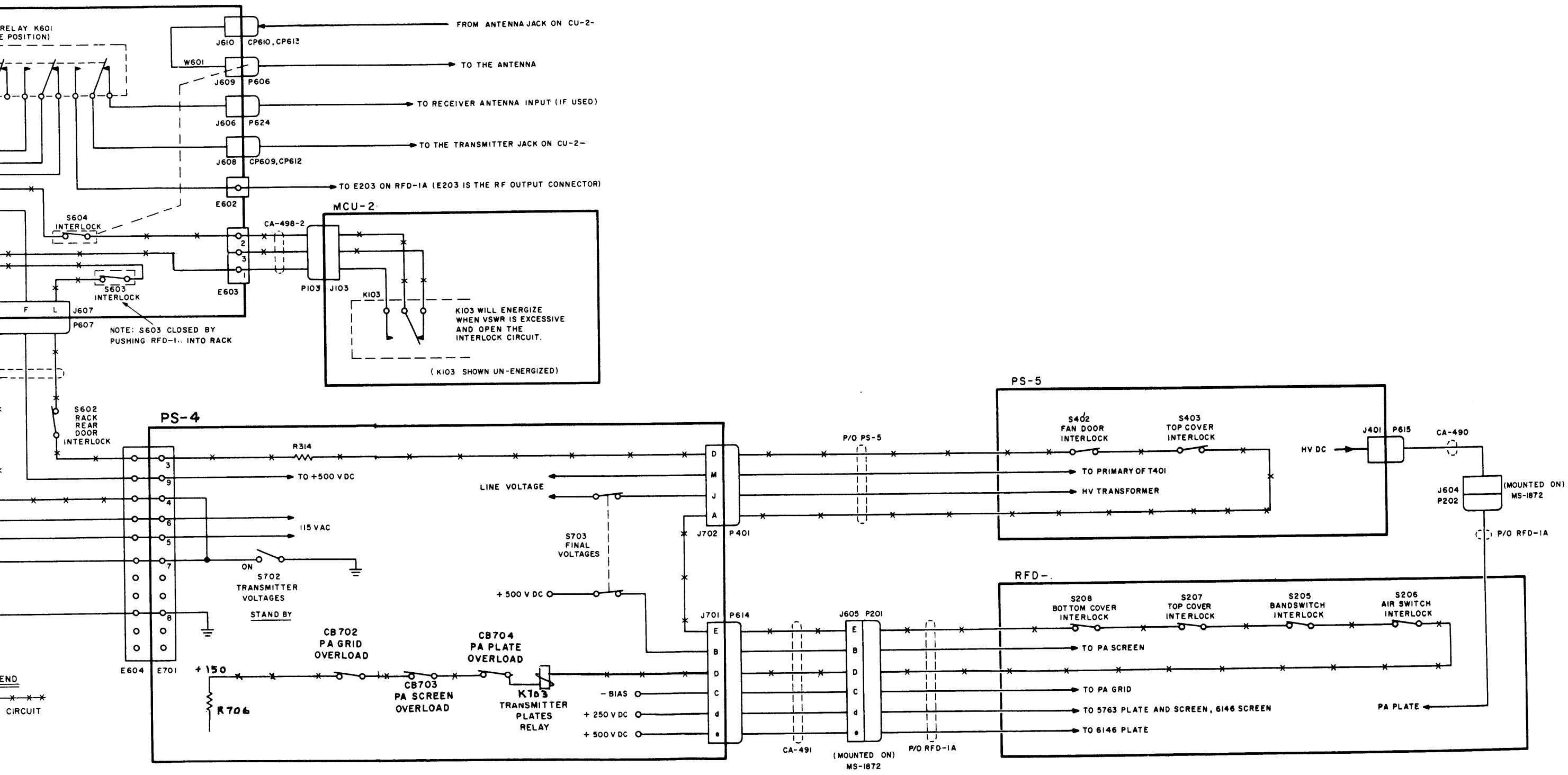
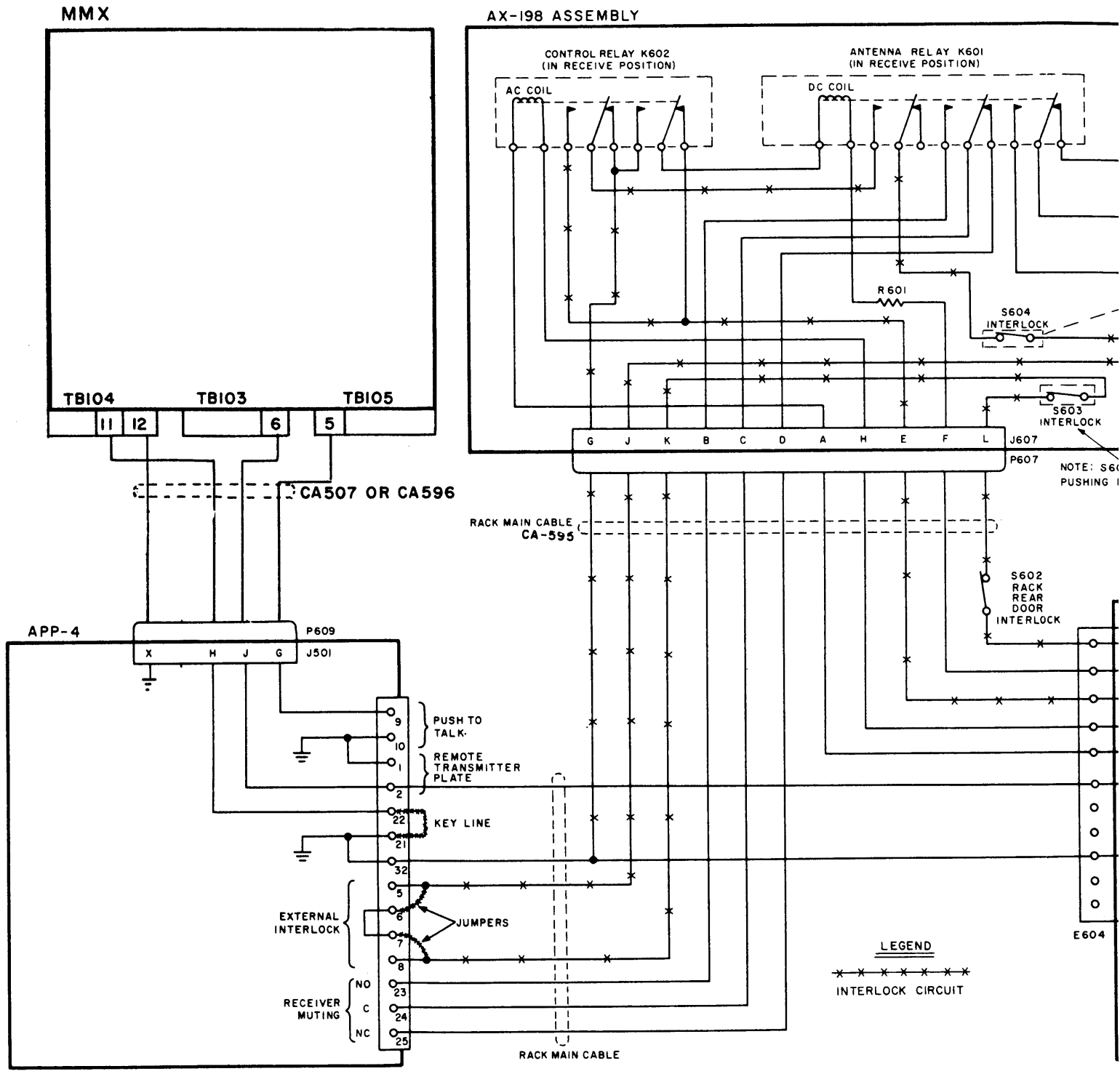


Figure 4-3. Interlock Diagram


MMX
TB104
TB103
TB105
11
12
6
5
CA507 OR CA596
APP-4
P609
X
H
J
G
J501
9
10
1
2
22
21
32
5
6
7
8
PUSH TO TALK
REMOTE TRANSMITTER PLATE
KEY LINE
EXTERNAL INTERLOCK
JUMPERS
RECEIVER MUTING
NO
C
NC
23
24
25
AX-198 ASSEMBLY
CONTROL RELAY K602 (IN RECEIVE POSITION)
AC COIL
ANTENNA RELAY K601 (IN RECEIVE POSITION)
DC COIL
R601
S604 INTERLOCK
S603 INTERLOCK
G
J
K
B
C
D
A
H
E
F
L
J607
P607
NOTE: S6
PUSHING
RACK MAIN CABLE CA-595
S602 RACK REAR DOOR INTERLOCK
E604
RACK MAIN CABLE
LEGEND
INTERLOCK CIRCUIT

01168100

SECTION 5
MAINTENANCE

5-1. PREVENTIVE MAINTENANCE

In order to prevent equipment failure due to dust, dirt or other destructive elements, it is suggested that a schedule of preventive maintenance be set up and adhered to.

At periodic intervals, the equipment should be removed from its mounting for cleaning and inspection. The wiring and all components should be inspected for dirt, dust, corrosion, grease or other harmful conditions. Remove dust with a soft brush or vacuum cleaner. Remove dirt or grease with any suitable cleaning solvent. Use of carbon tetrachloride should be avoided due to its highly toxic effects. Trichlorethylene or methyl chloroform may be used, providing the necessary precautions are observed.

> When using toxic solvents, make certain that adequate ventilation exists. Avoid prolonged or repeated breathing of the vapor. Avoid prolonged or repeated contact with skin. Flammable solvents shall not be used on energized equipment or near any equipment from which a spark may be received. Smoking, "hot work", etc. is prohibited in the immediate area.

> When using trichlorethylene, avoid contact with painted surfaces, due to its paint removing effects.

5-2. TROUBLESHOOTING

Often it is unnecessary to follow a lengthy and orderly course of trouble-shooting in order to localize and isolate the faulty part. When a piece of equipment has been working satisfactorily and suddenly fails, the cause of failure may be apparent either because of circumstances occurring at the time of failure or because of symptoms analogous to past failures. Ascertain that

all tubes and fuses are in proper working order; also that equipment receives proper supply voltages. Many times this will eliminate further investigation. Sometimes excessive vibration will cause failure; for example with soldered joints or when components normally isolated from others are shaken together. Such failures are more difficult to locate.

If trouble occurs during operation of the SBT, some general rules may be followed that will sometimes give a quick clue in determining which major unit (PAL-1K, MMXM or ATS-2A) is at fault. In many cases the faulty unit may be evident from referring to tuning and control function tables in the individual manuals. If the various lights and indicators have responded correctly as described in the operation section up to a certain step and do not respond in that step, the faulty unit may be pointed out in this way.

Besides this, other generalizations may be stated as listed below:

TROUBLE	CHECK
SBT output frequency is off or unstable	MMXM 1 MC Standard
SBT output power cannot be brought up to desired level	RFD PA tube
SBT has distorted output	RFD amplifier tubes or ALDC improperly set
SBT is inoperative	Interlock system*

*NOTE

Failure of the operator to check all the interlocks, particularly the one at the antenna output connector J606, is the most common cause of trouble in this transmitter. The mating plug, P606, shipped with the transmitter must be used to make up the antenna cable. This plug has the necessary flange on it to close S604 interlock switch in the AX-198 unit.

5-3. REPAIR AND REPLACEMENT

Repair and replacement of parts is an aftermath of troubleshooting as discussed in paragraphs 5-1 and 5-2. With the exception of those cases when components suddenly fail for no apparent reason or under extenuating circumstances, an intelligent program of preventive maintenance should produce minimum equipment down-time.

After a defective part has been localized and isolated by the troubleshooting techniques presented in the various manuals, replacement generally presents no major problem particularly in the case of failure of non-complex electrical and mechanical components.

SECTION 6
PARTS LIST

6-1. INTRODUCTION

The parts list presented in this section is a cross-reference list of parts identified by a reference designation and TMC part number. In most cases, parts appearing on schematic diagrams are assigned reference designations in accordance with MIL-STD-16. Wherever practicable, the reference designation is marked on the equipment, close to the part it identifies. In most cases, mechanical and electro-mechanical parts have TMC part numbers stamped on them.

To expedite delivery when ordering any part, specify the following:

a. Reference symbol.

b. Description as indicated in parts list.

c. TMC part number.

d. Model and serial numbers of the equipment containing the part being replaced; this can be obtained from the equipment nameplate.

For replacement parts not covered by warranty (refer to warranty sheet in front of manual), address all purchase orders to:

The Technical Materiel Corporation
Attention: Sales Department
700 Fenimore Road
Mamaroneck, New York

PARTS LIST

for

RACK EQUIPMENT ELECTRICAL, RAK-9J1

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
B601	FAN, AXIAL: 115 VAC, 50/60 Hz, single phase, power rating 35 watts; 450 cfm free delivery at 60 Hz.	BL101
C613	CAPACITOR, FIXED, PAPER DIELECTRIC: 2 uf, ±10%; 600 WVDC. Part of W610.	CP53B1EF205KI
CP609	CONNECTOR, ADAPTER, ELECTRICAL: RF-BNC	UG212*/U
CP610	Same as CP609.	
CP611	NOT USED.	
CP612	CONNECTOR, ADAPTER, ELECTRICAL: RF	SA103
CP613	Same as CP612.	
E601	TERMINAL BOARD, BARRIER: two 6-32 thd. x 1/4" long binder head machine screws; black bakelite body. Part of W610.	TM102-2
E604	TERMINAL BOARD, FANNING: 11 terminals, angle type; left end feed. Part of W610.	TM105-11AL
J601	CONNECTOR, RECEPTACLE, ELECTRICAL: 3 male contacts; polarized; current rating 30 amps at 250 VAC/DC; twist lock type. Part of W612.	JJ297-1
J602	CONNECTOR, RECEPTACLE, ELECTRICAL: AC; 2 prong contact.	JJ100
J603	CONNECTOR, RECEPTACLE, ELECTRICAL: female. Part of W610.	MS3102A14S2S
J604	CONNECTOR, RECEPTACLE, ELECTRICAL: female. Part of W605.	MS3102A18-16S
J605	CONNECTOR, RECEPTACLE, ELECTRICAL: female. Part of W606.	MS3102A32-7S
J612	CONNECTOR, RECEPTACLE, ELECTRICAL: 3 wire; current rating 15 amps at 250 V; black plastic insulation.	JJ337
J613	Same as J612.	
J614	Same as J612.	

PARTS LIST

for

RACK EQUIPMENT ELECTRICAL, RAK-9J1

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
MP601	FILTER, AIR CONDITIONING: replaceable item; aluminum mesh, steel frame; 10-1/8" x 9-7/8" x 1/2".	AD103-9
MP602	FILTER, AIR CONDITIONING: replaceable item; aluminum mesh, steel frame; 16-7/8" x 7-5/8" x 1/2".	AD103-5
P101	CONNECTOR, PLUG, ELECTRICAL: male. Part of W101.	MS3106B20-27P
P102	CONNECTOR, PLUG, ELECTRICAL: female. Part of W101.	MS3106B20-27S
P401	NOT USED.	
P402	NOT USED.	
P600	NOT USED.	
P601	CONNECTOR, PLUG, ELECTRICAL: female; 3 wire contact; current rating 20 amps at 250 VAC/DC or 10 amps at 600 VAC; polarized. Part of W611.	PL134NG
P602	NOT USED.	
P603	CONNECTOR, PLUG, ELECTRICAL: male. Part of W610.	MS3108A14S2P
P604	NOT USED.	
P605	NOT USED.	
P606	CONNECTOR, PLUG, ELECTRICAL: 1 male contact, teflon dielectric; maximum peak operating voltage 5000 volts, nominal impedance 50 ohms; series QDS with switch plate. (Supplied as loose item)	PL150
P607	CONNECTOR, PLUG, ELECTRICAL: female. Part of W610.	MS3106B20-27S
P608	NOT USED.	
P609	CONNECTOR, PLUG, ELECTRICAL: male. Part of W609.	MS3106B28-11P
P610	NOT USED.	
P611 thru P613	CONNECTOR, PLUG, ELECTRICAL: Part of W609.	PL244-1
P614	CONNECTOR, PLUG, ELECTRICAL: male. Part of W606.	MS3106B32-7P
P615	CONNECTOR, PLUG, ELECTRICAL: male. Part of W605.	MS3106B18-16P

PARTS LIST

for

RACK EQUIPMENT ELECTRICAL, RAK-9J1

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
P616 thru P619	NOT USED.	
P620	CONNECTOR, PLUG, ELECTRICAL: AC; 3 prong, female. (Supplied as loose item)	PL190NG
P621 thru P623	NOT USED.	
P624	CONNECTOR, PLUG, ELECTRICAL: 1 male contact; maximum operating voltage 500 volts, nominal impedance 50 ohms; silver plated.	UG260*/U
P625	NOT USED.	
P626	NOT USED.	
P627	CONNECTOR, PLUG, ELECTRICAL: 2 female contacts, rated for 10 amps at 250 volts; polarized; twist lock; midget size; brown bakelite. (Supplied as loose item)	PL176
P628 thru P634	NOT USED.	
P635	Same as P611. Part of W609.	
P636	NOT USED.	
S601	SWITCH, PUSH-PULL: SPDT; 15 amps at 120/250 VAC, .2 amps at 250 WVDC. Part of W610.	SW230
S602	Same as S601. Part of W610.	
W101	CABLE ASSEMBLY, ELECTRICAL: power; consists of 2 connectors, P101, P102.	CA346-3-9
W601	NOT USED.	
W603	NOT USED.	
W604	NOT USED.	
W605	LEAD, ELECTRICAL: hi-voltage; consists of 2 connectors, J604, P615.	CA490

PARTS LIST

for

RACK EQUIPMENT ELECTRICAL, RAK-9J1

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
W606	CABLE ASSEMBLY, ELECTRICAL: special purpose; consists of 2 connectors, J605, P614.	CA491
W607	NOT USED.	
W608	NOT USED.	
W609	CABLE ASSEMBLY, ELECTRICAL: special purpose; consists of 3 terminal boards, and 5 connectors, P609, P611, P612, P613, P635.	CA1442
W610	WIRING HARNESS, BRANCHED: consists of 1 capacitor, C613, 2 terminal boards, E601, E604, 3 connectors, J603, P603, P607 and 2 switches, S601, S602.	CA506
W611	CABLE ASSEMBLY, ELECTRICAL: power; consists of 1 connector, P601.	CA509
W612	CABLE ASSEMBLY, ELECTRICAL: power; consists of 1 connector, J601.	CA493