TECHNICAL INSTRUCTIONS

*AMPFET 5

5000WATT
AM BROADCAST TRANSMITTER

(THREE PRESET POWER LEVELS)

*AMPFET is a registered Trade Mark

nautel

LIST OF EFFECTIVE PAGES

The list of effective pages lists the status of all pages in this manual. Pages of the original issue are identified by a zero in the Change No. column. Pages subsequently changed are identified by the date of the change number. On a changed page, the text affected by the latest change is indicated by a vertical bar in the margin opposite the changed material.

Original . . . . 15 December 1986

Total number of printed sides in this manual is 215 as listed below:

PAGE	CHANGE No.	DATE	PAGE	CHANGE No.	DATE
Title	0	15 December 1986	1-11	0	15 December 1986
Title	-	Blank	1-12	0	15 December 1986
Effective (Page 1)	0	15 December 1986	2-1	0	15 December 1986
Effective (Page 2)	0	15 December 1986	2-2	0	15 December 1986
Effective (Page 3)	0	15 December 1986	2-3	0	15 December 1986
Effective (Page 4)	-	Blank	2-4	0	15 December 1986
Safety (Page 1)	0	15 December 1986	2-5	0	15 December 1986
Safety (Page 2)	0	15 December 1986	2-6	0	15 December 1986
Safety (Page 3)	0	15 December 1986	2-7	0	15 December 1986
Safety (Page 4)	-	Blank	2-8	0	15 December 1986
Warranty (Page 1)	0	15 December 1986	2-9	0	15 December 1986
Warranty (Page 2)	0	15 December 1986	2-10	-	Blank
Contents (Page 1)	0	15 December 1986	3-1	0	15 December 1986
Contents (Page 2)	0	15 December 1986	3-2	0	15 December 1986
Contents (Page 3)	0	15 December 1986	3-3	0	15 December 1986
Contents (Page 4)	0	15 December 1986	3-4	0	15 December 1986
Contents (Page 5)	0	15 December 1986	3-5	0	15 December 1986
Contents (Page 6)	0	15 December 1986	3-6	0	15 December 1986
Contents (Page 7)	0	15 December 1986	3-7	0	15 December 1986
Contents (Page 7)	0	15 December 1986	3-8	0	15 December 1986
Contents (Page 8)	0	15 December 1986	3-9	0	15 December 1986
Contents (Page 9)	0	15 December 1986	3-10	0	15 December 1986
Contents (Page 10)	-	Blank	3-11	0	15 December 1986
1-1	0	15 December 1986	3-12	0	15 December 1986
1-2	0	15 December 1986	3-13	0	15 December 1986
1-3	0	15 December 1986	3-14	0	15 December 1986
1-4	0	15 December 1986	3-15	0	15 December 1986
1-5	0	15 December 1986	3-16	0	15 December 1986
1-6	0	15 December 1986	3-17	0	15 December 1986
1-7	0	15 December 1986	3-18	0	15 December 1986
1-8	0	15 December 1986	3-19	0	15 December 1986
1-9	0	15 December 1986	3-20	0	15 December 1986
1-10	0	15 December 1986	3-21	0	15 December 1986

LIST OF EFFECTIVE PAGES (Continued)

PAGE	CHANGE No.	DATE	PAGE	CHANGE No.	DATE
3-22	0	15 December 1986	5-25	0	15 December 1986
3-23	0	15 December 1986	5-26	0	15 December 1986
3-24	0	15 December 1986	5-27	0	15 December 1986
3-25	0	15 December 1986	5-28	0	15 December 1986
3-26	0	15 December 1986	5-29	0	15 December 1986
3-27	0	15 December 1986	5-30	0	15 December 1986
3-28	-	Blank	5-31	0	15 December 1986
4-1	0	15 December 1986	5-32	0	15 December 1986
4-2	0	15 December 1986	5-33	0	15 December 1986
4-3	0	15 December 1986	5-34	0	15 December 1986
4-4	0	15 December 1986	5-35	0	15 December 1986
4-5	0	15 December 1986	5-36	0	15 December 1986
4-6	0	15 December 1986	5-37	0	15 December 1986
4-7	0	15 December 1986	5-38	0	15 December 1986
4-8	0	15 December 1986	5-39	0	15 December 1986
4-9	0	15 December 1986	5-40	0	15 December 1986
4-10	0	15 December 1986	5-41	0	15 December 1986
4-11	0	15 December 1986	5-42	0	15 December 1986
4-12	0	15 December 1986	5-43	0	15 December 1986
4-13	0	15 December 1986	5-44	0	15 December 1986
4-14	0	15 December 1986	5-45	0	15 December 1986
4-15	0	15 December 1986	5-46	-	Blank
4-16	0	15 December 1986	6-1	0	15 December 1986
4-17	0	15 December 1986	6-2	0	15 December 1986
4-18	0	15 December 1986	6-3	0	15 December 1986
5-1	0	15 December 1986	6-4	0	15 December 1986
5-2	0	15 December 1986	6-5	0	15 December 1986
5-3	0	15 December 1986	6-6	0	15 December 1986
5-4	0	15 December 1986	6-7	0	15 December 1986
5-5	0	15 December 1986	6-8	0	15 December 1986
5-6	0	15 December 1986	6-9	0	15 December 1986
5-7	0	15 December 1986	6-10	0	15 December 1986
5-8	0	15 December 1986	6-11	0	15 December 1986
5-9	0	15 December 1986	6-12	0	15 December 1986
5-10	0	15 December 1986	6-13	0	15 December 1986
5-11	0	15 December 1986	6-14	0	15 December 1986
5-12	0	15 December 1986	6-15	0	15 December 1986
5-13	0	15 December 1986	6-16	0	15 December 1986
5-14	0	15 December 1986	6-17	0	15 December 1986
5-15	0	15 December 1986	6-18	0	15 December 1986
5-16	0	15 December 1986	6-19	0	15 December 1986
5-17	0	15 December 1986	6-20	0	15 December 1986
5-18	0	15 December 1986	6-21	0	15 December 1986
5-19	0	15 December 1986	6-22	0	15 December 1986
5-20	0	15 December 1986	6-23	0	15 December 1986
5-21	0	15 December 1986	6-24	0	15 December 1986
5-22	0	15 December 1986	6-25	0	15 December 1986
5-23	0	15 December 1986	6-26	0	15 December 1986
5-24	0	15 December 1986	6-27	0	15 December 1986

LIST OF EFFECTIVE PAGES (Continued)

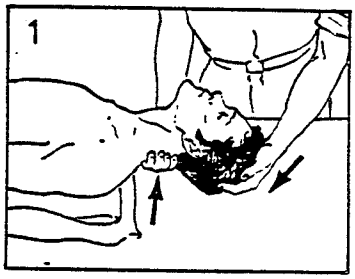
PAGE	CHANGE No.	DATE	PAGE	CHANGE No.	DATE
6-28	0	15 December 1986	FO-2	0	15 December 1986
6-29	0	15 December 1986	FO-3	0	15 December 1986
6-30	0	15 December 1986	FO-4	0	15 December 1986
6-31	0	15 December 1986	FO-5	0	15 December 1986
6-32	-	Blank	FO-6	0	15 December 1986
7-1	0	15 December 1986	FO-7	0	15 December 1986
7-2	0	15 December 1986	FO-8	0	15 December 1986
7-3	0	15 December 1986	FO-9	0	15 December 1986
7-4	0	15 December 1986	FO-10	0	15 December 1986
7-5	0	15 December 1986	FO-11	0	15 December 1986
7-6	0	15 December 1986	FO-12	0	15 December 1986
7-7	0	15 December 1986	FO-13	0	15 December 1986
7-8	0	15 December 1986	FO-14	0	15 December 1986
7-9	0	15 December 1986	FO-15	0	15 December 1986
7-10	0	15 December 1986	FO-16	0	15 December 1986
7-11	0	15 December 1986	FO-17	0	15 December 1986
7-12	0	15 December 1986	FO-18	0	15 December 1986
7-13	0	15 December 1986	FO-19	0	15 December 1986
7-14	0	15 December 1986	FO-20	0	15 December 1986
7-15	0	15 December 1986	FO-21	0	15 December 1986
7-16	0	15 December 1986	FO-22	0	15 December 1986
7-17	0	15 December 1986	FO-23	0	15 December 1986
7-18	0	15 December 1986	FO-24	0	15 December 1986
7-19	0	15 December 1986	FO-25	0	15 December 1986
7-20	0	15 December 1986	FO-26	0	15 December 1986
7-21	0	15 December 1986	FO-27	0	15 December 1986
7-22	0	15 December 1986	FO-28	0	15 December 1986
7-23	0	15 December 1986	FO-29	0	15 December 1986
7-24	-	Blank	FO-30	0	15 December 1986
FO-1	0	15 December 1986	FO-31	0	15 December 1986

ARTIFICIAL RESPIRATION (MOUTH TO MOUTH METHOD)

1. START MOUTH TO MOUTH BREATHING IMMEDIATELY, SECONDS COUNT. Do not wait to, loosen clothing, warm the casualty, or apply stimulants.

2. LAY CASUALTY ON HIS BACK and place any available jacket or blanket under his shoulders.

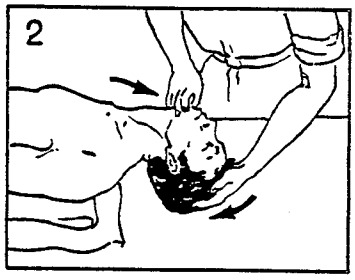
3. LIFT THE NECK. (Fig. 1)



4. MOVE FOREHEAD BACK as far as possible and open mouth by lifting jaw forward. (Fig. 2)

5. TAKE A DEEP BREATH and open your mouth widely.

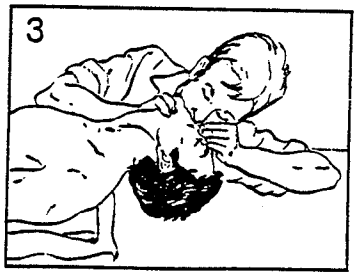
6. PINCH CASUALTY'S NOSE and blow into casualty until you see the chest rise. (Fig. 3)



7. REMOVE YOUR MOUTH and let casualty's chest deflate. (Fig. 4)

8. CONTINUE MOUTH-TO-MOUTH BREATHING without interruption at the rate of 10 to 12 breaths a minute. If any air retained in the stomach after exhalation by casualty, press gently on stomach to expel air.

9. IF CHEST DOES NOT RISE CHECK for obstruction in casualty's mouth: Clear foreign material by turning the head to one side and using finger, tissues, etc. Check neck extension and recommence mouth-to-mouth breathing.

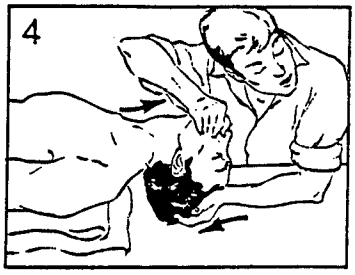


10. WHILE MOUTH-TO-MOUTH BREATHING IS CONTINUED have someone else:
    (a) Loosen casualty's clothing
    (b) Summon medical aid.
    (c) Keep the casualty warm.

11. DON'T GIVE UP. Continue without interruption until the casualty is revived, or until a doctor pronounces the casualty is dead. Four hours or more may be required.

12. DO NOT LEAVE CASUALTY when he revives. Be ready to resume artificial respiration if necessary.

13. DO NOT give liquids while victim is unconscious.



GENERAL RULES FOR TREATMENT FOR BURNS, BLEEDING, AND SHOCK

1. After casualty has revived, treat for injuries and shock.
2. Reassure casualty.
3. Try to make him comfortable.
4. Keep him reasonably warm but do not apply heat.
5. If thirsty, liquids may be given but no alcohol (no liquids should be given in cases of severe burns).
6. Treat burns or wounds. Infection danger in treating burns or wounds is very great so ensure hands are clean and do not handle affected areas more than necessary.
7. Do not apply salves, grease, etc. to burns.
8. Do not remove burned clothing which adheres to the skin or break blisters.
9. Cover the burn with a dry sterile dressing, piece of sheeting, etc.
10. Bandage lightly over blisters where care must be taken to cover and not to break.
11. If severe bleeding of wound, elevate affected area, except in the case of a fracture.
12. Expose wound, remove visible foreign bodies and apply pressure.
13. Apply dressing, pad and bandage.
14. For burns and bleeding, immobilize injured part using splints if necessary and keep patient in restful position during removal to hospital or expert medical attention.
15. In all cases, send for medical aid immediately.

ELECTRIC SHOCK - RESCUE METHODS

Electricity can damage the body in a number of ways. It may interfere with the proper functioning of the nervous system and the heart action, it can subject the body to extreme heat and can cause severe muscular contractions. The path that the current of electricity takes through the body is important. Currents which pass from hand to hand or from hand to foot may pass directly through the heart and upset its normal functioning. This threat to life is related to the amount of current or amperage which will flow through a victim's body. Very little current (as little as 10 milliamps) can result in severe shock.

Speed in the application of first aid measures is absolutely essential in cases of electrical injury. As soon as the victim is freed safely from the source of the electrical current, if breathing has stopped, artificial respiration should be commenced immediately. If the carotid pulse cannot be felt, external cardiac massage should be commenced simultaneously. Resuscitation should be continued until the patient is breathing on his own or until medical aid arrives. Survival rates can be quite high if cardio-pulmonary resuscitation is started within 3 to 4 minutes of the injury being received.

ACT AT ONCE - DELAY OR INDECISION MAY BE FATAL

1. Remove source or casualty from electrical contact.
2. Commence artificial respiration immediately.
3. Treat for burns, bleeding and shock.

REMOVING A CASUALTY FROM ELECTRICAL CONTACT

LOW VOLTAGE - 0 to 240 volts (household use)

Switch off the current, if possible and time permits. If the switch cannot be located immediately and the supply is through a flexible cord or cable, the currrent may be shut off by removing the plug or even breaking the cable or wrenching free. Never attempt to shut off current by cutting cord with a knife or scissors.

If the current cannot be shut off, the greatest care is necessary in removing the casualty. Household rubber gloves, rubber or plastic hose (if there is no water in them), a dry unpainted stick or a clean dry rope can be used to free victim.

HIGH VOLTAGE - 240 volts and up (industrial machines and power lines)

Do not touch any person or equipment in contact with a wire.

Use a dry unpainted pole, clean dry rope, dry rubber or plastic water hose to separate the casualty from the contact.

Keep as far away as possible.

Do not touch the casualty until he is free.

WARRANTY

Nautical Electronic Laboratories Limited/Nautel Maine Incorporated, hereinafter referred to as Nautel, guarantees all mechanical and electrical parts of the equipment for a period of thirteen months from date of shipment, provided the equipment has been installed, operated and maintained in accordance with Nautel's recommendations and the equipment has not been misused, neglected or modified. Nautel's liability is limited, at the absolute discretion of Nautel, to repairing or replacing the equipment that is found to the satisfaction of Nautel to have been defective.

1. A "Part Failure" shall be deemed to have occurred when the part has become defective, or does not have the characteristics required for the specified equipment performance:

   (a) When the equipment is operated within the design parameters, and

   (b) When the equipment is installed and adjusted according to Nautel's prescribed procedures as stated in the instruction manual.

2. Nautel shall provide replacements for all "Parts" at no cost to the Customer when they become defective during the warranty period, and upon the return of the defective part.

3. In the event that a "Part" fails during the warranty period and causes damage to a subassembly which cannot be readily repaired in the field, the entire subassembly so damaged may be returned to Nautel for repair. The repairs will be made without charge to the Customer.

4. Written authorization must be obtained before returning any equipment or goods for any reason. Equipment or goods returned under this warranty shall be delivered to Nautel's premises at the Purchaser's expense. Where no-charge warranty replacements or repair are provided under items 2 or 3, Nautel will pay that part of the shipping costs incurred in returning the part/assembly to the Customer.

5. Nautel will not assume responsibility for any charges incurred by other than Nautel employees.

6. Nautel shall have the privilege of investigating whether failures have been caused by factors beyond its control.

7. Nautel shall in no event be liable for any consequential damages arising from the use of this equipment.

8. This warranty is in lieu of all other express warranties of Nautel and Nautel does not assume, nor is any other person authorized to assume on Nautel's behalf, any other obligation or liability.

EQUIPMENT BEING RETURNED TO NAUTEL

All equipment being returned to Nautel and all requests for repairs or replacements should be marked 'field return' and addressed to the appropriate Nautel facility.

United States of America customers use:

Nautel Maine Incorporated
201 Target Industrial Circle
Bangor, Maine 04401

Telephone	207-947-8200 (24 hours)
Facsimile	207-947-3693
Telex	944466

All other customers use:

Nautical Electronic Laboratories Limited
Hackett's Cove, RR#1 Tantallon
Halifax County, Nova Scotia, Canada
B0J 3J0

Telephone	902-823-2233 (working hours)
	902-422-9641 (non-working hours)
Facsimile	902-823-3183
Telex	019-22552

Complete and accurate information regarding the equipment being returned will ensure prompt attention and will expedite the dispatch of replacements. Refer to the nameplate on the transmitter and/or the appropriate module/assembly to obtain name, type, part and serial number information. Refer to the parts list of this manual or the appropriate plug-in module service instruction manual for additional ordering information.

The following information should accompany each request:

Station name/call sign
* Model of Transmitter
* Serial number of Transmitter
Transmitted Frequency
* Name of Part/Assembly
Serial number of Part/Assembly
* Complete reference designation of Part/Assembly
* Nautel's part number of Part/Assembly
* OEM's part number of Part/Assembly
Number of hours in Use
Nature of defect
* Return shipping address

* Denotes minimum information required to order spare/replacement parts

CUSTOMER SERVICE NOTICE

A 'Technical Assistance' and 'Plug-in Module Exchange' service is available to AMPFET users. Direct all communications/requests to the appropriate Nautel facility (refer to top of this page).

AMPFET 5 (THREE PRESET POWER LEVELS)
5 KILOWATT AM BROADCAST TRANSMITTER

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF ILLUSTRATIONS

LIST OF TABLES

SECTION 1
GENERAL INFORMATION

INTRODUCTION

1.1 The AMPFET 5 AM broadcast transmitter is a 5,000 watt, totally solid state, transmitter which operates at one pretuned frequency, in the 535 kHz to 1705 kHz frequency range, into a nominal 50 ohm, unbalanced, transmission line. It may be operated as a monaural or an AM stereo transmitter. It has dual rf driver, modulator driver and low voltage power supply modules, as well as built-in modulator/power amplifier redundancy. The transmitter will operate continuously at 125 percent positive peak modulation and at 106 percent of full rated rf output power. Interfacing is provided to enable the transmitter to be remotely controlled and to permit remote monitoring of critical functions.

PURPOSE AND SCOPE OF MANUAL

1.2 This manual, which is referred to as the Basic Technical Instruction Manual, provides the information required to install, operate and maintain the subject transmitter. Detailed information for plug-in modules, which are normally removed from the transmitter for servicing, is not included in the Basic Technical Instruction Manual. Detailed information and bench servicing instructions are provided in individual Service Instruction Manuals. The Service Instruction Manuals for the plug in modules installed in the subject transmitter are supplied as appendices to the Basic Technical Instruction Manual.

PURPOSE OF EQUIPMENT

1.3 The AMPFET 5 transmitter is intended for use in a conventional AM broadcasting station. Remote control facilities are incorporated to allow unattended operation at a transmitter site remotely located from the station studios.

DESIGN CONSIDERATIONS/CHARACTERISTICS

1.4 The subject transmitter has been designed to meet the stringent requirements for state-of-the-art AM broadcast transmitters (see table 1-1). Additionally, two areas of special concern have been given full consideration in the design of the AMPFET series of transmitters. These are: (a) maintainability; (b) efficiency.

1.4.1 MAINTAINABILITY: The subject transmitter utilizes the modular assembly concept in design for ease of maintenance, maximum flexibility and built-in redundancy. Since a broadcast transmitter must operate continuously, it has been traditional to duplicate the entire system, with automatic or remote/manual switchover, to ensure continuing transmission in the event of a failure in the main transmitter. Nautel's AMPFET 5 broadcast transmitter incorporates a number of design innovations that virtually eliminate the need for a second transmitter system. Some of these are:

Table 1-1 Technical Summary

Nautel Model Number	AMPFET 5
Configuration	Four 1.25 kW power blocks Main/standby rf driver and main/standby mod driver
Rf Output Power	
(1)	Rated 5,000 watts (capable 5,500 watts)
(2)	Operating range 500 to 5,500 watts
(3)	Three preset levels, selected locally or remotely
RF Frequency Range (supplied to one frequency as ordered)	535 kHz to 1705 kHz
RF Terminating Impedance	50 ohms, unbalanced
Audio Frequency Response	50 Hz to 10,000 Hz within 1.0 dB
Audio Frequency Distortion	Better than 2% (THD) at 95% modulation 50-10,000 Hz Reduced antenna bandwidth may degrade specification
Audio Intermodulation Distortion	
(1)	1.0% or less, 60/7000 Hz 1:1 ratio
(2)	1.0% or less, 60/7000 Hz 4:1 ratio
(3)	SMPTE Standards at 85% modulation
AM Stereo (RF Phase Shift)	Less than 2° = 0.035 radians (1 radian = 57.29°) incidental phase at 1 kHz
Modulation Capability	125% positive peak modulation
Carrier Shift	Typically 1%, not exceeding 3%
RF Harmonics	-80 dB relative to carrier
Spurious Outputs	-80 dB relative to carrier
Noise and Hum	60 dB or more below 100% modulation (unweighted) Typically 70 dB below 100% modulation (weighted)
Frequency Stability	±5 Hz or ±5ppm whichever is greater
Audio Input	600/150 ohms (adjustable from -10 dBm to +12 dBm) +10 dBm nominal
Power Input	
North American Type:	198 - 242 volts, 3 phase 50/60 Hz, 4-wire
European Type:	385 - 465 volts, 3 phase 50/60 Hz, 4-wire
Permissible Power Supply Variations	±10% voltage, ±5% frequency
Power Consumption	
0% modulation	6.8 kW
100% modulation	10.0 kW
Overall Efficiency	74% typical

Table 1-1 Technical Summary (Continued)

Metering	(1)	Forward/reflected output power
	(2)	DC input current/voltage to modulators/PA's
	(3)	Test meter facility
Remote Control	(1)	Transmitter on/off
	(2)	One of three preset output power levels
	(3)	External interlock
	(4)	Rf output power trim
	(5)	Instantaneous rf power off/on
Remote Monitoring	(1)	Forward power level
	(2)	Reflected power level
	(3)	Rf Monitor output (station modulation monitor)
	(4)	Carrier (rf drive) frequency monitor
	(5)	Transmitter ON/OFF status
	(6)	Local/remote control status
	(7)	High/low rf power status
	(8)	Power trim control limit status
	(9)	Standby alarm
	(10)	PA failure alarm
	(11)	High VSWR alarm
	(12)	TX fault alarm
	(13)	Interlock open alarm
	(14)	(optional) Ac power fault alarm
Environmental Limits	Temperature	0 - 50°C
	Relative Humidity	0 - 95%
	Altitude	0 - 10,000 feet
Transmitter Cabinet Dimensions	Height	78 inches (198.0 cm)
	Width	26 inches (66.0 cm)
	Depth	25 inches (63.5 cm)
Weight		872 pounds (396 kg)

NOTE: Technical specifications established with transmitter operating at 5, 000 watts rf output power into a 50 ohm load.

1.4.1.1 The critical power amplifier (PA) sub-system is arranged in four 1.25 kilowatt power blocks, with each power block consisting of three pairs of interdependent PA modules. Each pair of PA modules has an rf drive splitting/failure-sensing circuit which senses if both PA modules are contributing equally to the transmitters rf output. If a significant imbalance is sensed, the affected pair of PA modules are automatically shut down. The rf outputs of the six PA modules in a 1.25 kilowatt power block are connected in series. A non-operational PA module (either failed or shutdown) appears as a short circuit at its output terminals. This feature maintains continuity of the 1.25 kilowatt power block's rf output circuit when one or more pairs of PA modules have been shut down. A reduction in rf output will occur (typically 0.8 dB for one pair of PA modules), but the transmitter will remain on the air.

1.4.1.2 Each modulator module provides the B- voltage, with superimposed modulating audio, for a 1.25 kilowatt power block (six PA modules). In the event of a failure in a modulator module, the six PA modules associated with the failed modulator module will be shut down. All The remaining 1.25 kilowatt power blocks will continue to function normally, however, the transmitter's rf output will be reduced by a nominal 2.5 dB.

1.4.1.3 The rf driver and modulator driver functions have been duplicated with automatic switchover in the event of a failure. This built-in redundancy provides 'standby' capability in this critical area of the transmitter.

1.4.2 EFFICIENCY: Overall efficiency of the AMPFET 5 transmitter is 74 percent from ac power input to rf power available at the antenna terminals. This has been achieved by the use of all solid-state devices throughout the transmitter, with all the devices in the power amplifier section of the transmitter operating in a switched mode. The 74 percent efficiency provides a significant reduction in operating costs and external cooling requirements when compared with conventional tube type transmitters.

MECHANICAL DESCRIPTION

1.5 The subject transmitter is housed in a single cabinet, see figure 1-1. The control/monitor panel, with full metering facilities, is mounted at the top of the transmitter cabinet with the rf output filter located directly behind. The front plug-in power amplifier modules, modulator modules, rf driver and modulator driver modules, rectifier/regulator modules and system monitoring modules are directly under the control panel. A hinged door covers these modules during normal operation while still providing full accessibility for module removal. Two removable back panels, which are not normally opened, carry the cooling air fans. The power transformer is located in the bottom of the transmitter cabinet. Remote control and monitoring wiring enters the transmitter cabinet through cable entry holes in the bottom/rear of the cabinet. Refer to figure FO-14 for illustrations that show the location of the assemblies and plug-in modules.

1.5.1 NAA11 RF POWER AMPLIFIER MODULES (see figure FO-23): NAA11 rf power amplifier modules are plug-in modules, which are intended to be removed from the transmitter for bench servicing when they require maintenance. There are twenty-four NAA11 rf power amplifier modules in an AMPFET 5 transmitter. They are installed in two rows (identified as row 2 and 3), with each row containing twelve modules. Refer to the NAA11 power amplifier Service Instruction Manual for additional information.

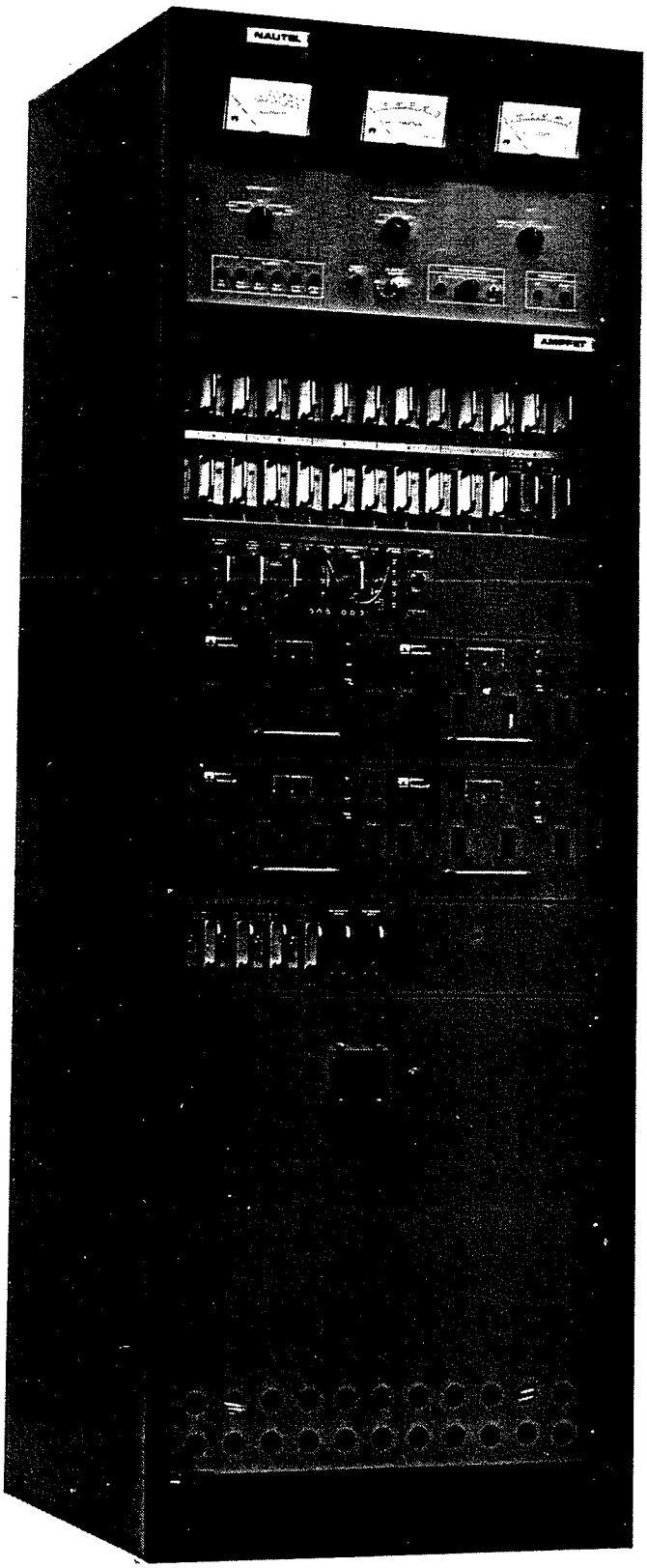


Figure 1-1 AMPFET 5 (3-Preset Power Levels) Transmitter

1.5.2 NAC21/4 CONTROL/MONITOR PANEL (see figures FO-15 and FO-16): The control/monitor panel is mounted at the top/front of the transmitter cabinet. It is fully visible at all times. Integral meters provide forward/reflected power readings and modulator input current/voltage readings. Status lamps show, at a glance, if the transmitter is operating and if it is being controlled remotely. Alarm lamps provide malfunction indications and identify the nature of the malfunction. One of the meters can be switched to a test position and used, in conjunction with test leads that plug into test jacks on the front of the driver unit, as a dc voltmeter for troubleshooting purposes.

1.5.3 NAE39/1 DRIVER UNIT (see figures FO-24 and FO-25): The driver unit is installed immediately below the second row of power amplifier modules. It contains five plug-in modules (two rf driver modules, two modulator driver modules and a system monitor module), an automatic level control (ALC)/ remote power control assembly, and a tuned rf drive filter assembly. It also contains a relay panel and an external connection interface panel. The relay panel contains relays that interface the remote control circuits or that are controlled by alarm/status circuits in the system monitor module. The interface panel contains two connectors that mate with connectors on the transmitter cabinet's wiring harness and two terminal boards that provide a connection point for the external control/monitor wiring.

1.5.4 RF DRIVER MODULES (see figures FO-24 and FO-25): The rf driver modules are plug-in modules, which are intended to be removed from the transmitter for bench servicing when they require maintenance. There are two rf driver modules in an AMPFET 5 transmitter. They are installed in positions A1 ('main') and A2 ('standby') of driver unit 4A1. In monaural applications, an NAPE12 rf driver module is installed in both 'main' and 'standby' positions. In AM stereo applications, or applications where an external rf carrier signal is applied, an NAPE20 stereo rf driver module is installed in the 'main' position and an NAPE12 rf driver is installed in the 'standby' position.

1.5.4.1 NAPE12 Monaural Rf Driver Module: The NAPE12 rf driver module utilizes a formed metal box as its chassis. An electrical connector and guide pin are mounted on the rear of the chassis. The front panel contains a calibration adjustment access hole, three test points and a handle to facilitate installation and removal. Refer to the NAPE12 rf driver module Service Instruction Manual for additional information.

1.5.4.2 NAPE20 Stereo Rf Driver Module: The NAPE20 stereo rf driver module utilizes a formed metal box as its chassis. Two electrical connectors and a guide pin are mounted on the rear of the chassis. The front panel contains three test points and a handle to facilitate installation and removal. Refer to the NAPE20 stereo rf driver module Service Instruction Manual for additional information.

1.5.5 MODULATOR DRIVER MODULES (see figures FO-24 and FO-25): The modulator driver modules are plug-in modules, which are intended to be removed from the transmitter for bench servicing when they require maintenance. There are two different modulator driver modules in an AMPFET 5 (3-preset power level) transmitter. An NAPE27/1 modulator driver is installed in position A4 ('main') of driver unit 4A1 and an NAPE19/1 modulator driver is installed in position A5 ('standby') of driver unit 4A1.

1.5.5.1 NAPE19/1 Modulator Driver Module: The NAPE19/1 modulator driver module utilizes a formed metal box as its chassis. The front panel contains a lamp, three test points, three calibration adjustment access holes and a handle to facilitate removal of the module. There are two electrical connectors and a centering guide pin on the rear face. All of the electrical components except the mating connectors, the front panel mounted lamp/test jacks and a fuse are mounted on a printed circuit board assembly. Refer to the NAPE19/1 rf driver module Service Instruction Manual for additional information.

1.5.5.2 NAPE27/1 Modulator Driver Module: The NAPE27/1 modulator driver module is essentially an NAPE19/1 modulator driver that has been modified for use with an NAPC18 ALC/remote power trim assembly. It utilizes a formed metal box as its chassis. The front panel contains a connector, a lamp, three test points, two calibration adjustment access holes and a handle to facilitate removal of the module. There are two electrical connectors and a centering guide pin on the rear face. All of the electrical components except the mating connectors, the front panel mounted lamp/test jacks and a fuse are mounted on a printed circuit board assembly. Refer to the NAPE27/1 rf driver module Service Instruction Manual for additional information.

1.5.6 NAPC18 ALC/REMOTE POWER TRIM ASSEMBLY (see figures FO-24 and FO-25): The NACP18 ALC/remote power trim assembly utilizes a formed metal box as its chassis. It is bolted to the chassis of rf driver unit 4A1. The front panel contains a connector, a lamp, three switches and five calibration adjustment access holes. All of the electrical components except the front panel mounted connector, lamp and switches are mounted on a printed circuit board assembly. A connector on the printed circuit board assembly provides interconnection with the transmitter's wiring harness. Refer to the NAPC18 ALC/remote power trim assembly Service Instruction Manual for additional information.

1.5.7 NAPC7 MONITOR MODULE (see figures FO-24 and FO-25): The NAPC7 monitor module is a plug-in module, which is intended to be removed from the transmitter for bench servicing when it requires maintenance. It is installed in position A3 of driver unit 4A1. The NAPC7 monitor module utilizes a formed metal box as its chassis. The front panel contains two calibration adjustment access holes and a handle to facilitate removal of the module. There are two electrical connectors and a centering guide pin on the rear of the chassis. All of the electrical components except the mating connectors are mounted on a printed circuit board assembly. Refer to the NAPC7 monitor module Service Instruction Manual for additional information.

1.5.8 NASM1 MODULATOR MODULES (see figure FO-27): NASM1 modulator modules are plug-in modules, which are intended to be removed from the transmitter for bench servicing when they require maintenance. There are eight NASM1 modulator modules in an AMPFET 5 transmitter. They are installed in four rows (identified as row 7, 8, 9 and 10), with each row containing two modules. The NASM1 modulator module utilizes a formed metal box as its chassis. Two heatsink sub-assemblies, which each contain a large reservoir capacitor, are mounted on the top of the chassis. Four ferrite inductors, a fuse holder and three circuit boards are mounted on the underside of the chassis. The front panel contains four lamps, a test jack, a ground terminal, four air flow slots and a handle to facilitate removal of the module. Two electrical connectors, with integral guide pins are mounted on the rear of the chassis for interconnection with the transmitter's wiring harness. Refer to the NASM1 modulator module Service Instruction Manual for additional information.

1.5.9 NAS13 RECTIFIER/REGULATOR MODULES (see figure FO-28): NAS13 rectifier/regulator modules are plug-in modules, which are intended to be removed from the transmitter for bench servicing when they require maintenance. There are eight NAS13 rectifier/regulator modules in an AMPFET 5 transmitter. They are installed in row 11 of the transmitter in positions A1, A2, A3, A4, A7, A8, A9 and A10. The NAS13 rectifier/regulator modules utilizes an extruded metal heat sink as its chassis. The heat dissipating components are mounted directly on the heat sink, while the remainder are mounted on two printed circuit boards. A front panel contains a lamp, a switch, a test point and a handle to facilitate removal of the module. An electrical connector is mounted on the rear of the chassis for interconnection with the transmitter's wiring harness. Refer to the NAS13 rectifier/regulator module Service Instruction Manual for additional information.

1.5.10 NAS14 LOW VOLTAGE POWER SUPPLY MODULES (see figure FO-28): NAS14 low voltage power supply modules are plug-in modules, which are intended to be removed from the transmitter for bench servicing when they require maintenance. There are two NAS14 low voltage power supply modules in an AMPFET 5 transmitter. They are installed in row 11 of the transmitter in positions A5 and A6. The NAS14 low voltage power supply module utilizes a formed metal box as its chassis. The front panel contains a lamp, two test points and a handle to facilitate removal of the module. There is one electrical connector and a centering guide pin on the rear of the chassis. All of the electrical components except the mating connector and storage capacitor are mounted on a metal terminal board assembly. Refer to the NAS14 low voltage power supply module service instruction manual for additional information.

1.5.11 HARMONIC FILTER ASSEMBLY (see figures FO-17, FO-18 and FO-19): The harmonic filter assembly is located behind the meter panel at the top of the cabinet. It contains all the high voltage capacitors and inductors that provide the rf filtering necessary to reduce all spurious and harmonic responses to the level specified by international and governmental regulatory agencies. An NAFP6/2 voltage probe, an NAF27 harmonic filter, an NAFP5/5 forward/reflected power probe and an NAFP15 modulation monitor probe are mounted on its top surface. An adjustable air, spark gap, which is also used as the connection point for the antenna systems rf feed cable, is also located on the top surface of the harmonic filter.

1.5.12 NAH24/1 RF COMBINER (see figure FO-20): The NAH24/1 rf combiner is mounted on the bottom rear of the NAF27 harmonic filter. It is a formed metal box that contains four ferrite cores, that are interwound to form a transformer, two terminal boards and an NAFP7 current probe printed circuit board.

1.5.13 NAFP7 CURRENT PROBE (see figure FO-20): The NAFP7 current probe is a printed circuit board assembly which is mounted on the NAH24/2 rf combiner.

1.5.14 NAFP5/5 FORWARD/REFLECTED POWER PROBE (see figure FO-21): The NAFP5/5 forward/reflected power probe is a formed metal box that contains an rf feed-thru, a printed circuit board and a terminal board. The rf feed-thru passes through the core of a transformer mounted on the printed circuit board.

1.5.15 NAFP15 MODULATION MONITOR PROBE (see figure FO-22): The NAFP15 modulation monitor probe is mounted on pillars on the top of the NAF27 harmonic filter assembly. It utilizes a formed metal box as its chassis. A fuse and three calibration adjusted potentiometers extend from one side of the chassis. An rf transformer is mounted on the underside of the chassis while the remaining components, including a connector, a terminal board and two transistors are mounted on the top of the chassis. Rf power level determined links are installed on the terminal board during initial installation and when assigned power levels are changed. Electrical interconnection with the transmitter cabinet's wiring harness is made through the connector.

1.5.16 AC POWER TRANSFORMER (see figure FO-30): The three-phase input power transformer is housed in the bottom of the transmitter cabinet. A three-section (three phase) ganged circuit breaker and a single circuit breaker are mounted on the inside of the cabinet's bottom/ front panel. The toggles for the circuit breakers are accessible from the outside. External power source wiring is connected directly to terminals on the power transformer. Transmitter connections to the stepped-down voltages on the transformer's secondary windings are made directly to terminals of the transformer for 3-phase voltages.

1.5.17 PA TEST PROBE NAX19: A power amplifier probe, to be used in conjunction with the power amplifier test jack to isolate faulty power amplifiers, is provided as an ancillary part.

1.5.18 MODULATOR DISCHARGE PROBE NAX20: A modulator discharge probe is normally mounted at the rear right-hand side of the cabinet.

TECHNICAL SUMMARY

1.6 Table 1-1 - Technical Summary, contains a detailed technical summary.

PLUG-IN MODULES

1.7 Table 1-2 - Bench Repairable Modules/Assemblies - AMPFET 5, lists the type and quantity of plug-in modules and assemblies intended to be removed from the subject transmitter and serviced on a work bench.

SPECIAL TOOLS AND TEST EQUIPMENT

1.8 Table 1-4 lists the special tools required. Table 1-3 - Test Equipment, lists the test equipment that is required to operate and maintain the AMPFET 5 transmitter.

GLOSSARY OF TERMS

1.9 Table 1-5 - Glossary of Terms, provides a list of all unique terms, abbreviations and acronyms used in this publication.

Table 1-2 Bench Repairable Modules/Assemblies - AMPFET 5

NAUTEL DESIGNATOR	DESCRIPTION	QUANTITY	
		MONAURAL	STEREO
NAA11	Power Amplifier Module	24	24
NAPC7	Monitor Module	1	1
NAPE12	RF Driver Module	2	1
NAPE20	Stereo RF Driver Module	0	1
NAPE19/1	Modulator Driver Module	1	1
NAPE27/1	Modulator Driver Module	1	1
NAPC18	ALC/Remote power Trim Assembly	1	1
NASM1	Modulator Module	4	4
NAS13	Rectifier/Regulator Module	4	4
NAS14	Low Voltage Power Supply Module	2	2

NOTE: Some modules may have an alpha suffix on their designator (A, B, C, etc.). The suffix is assigned alphabetically and indicates the module contains minor component or circuit variations. Since a change that merits an alpha suffix change will normally enhance the operation of the affected module or compliment the operation of an external circuit, it is not recommended that later versions be interchanged with earlier versions. All earlier versions can be replaced by later versions.

Table 1-3 - Test Equipment

NOMENCLATURE	PART, MODEL, OR TYPE NUMBER (EQUIVALENTS MAY BE USED)	APPLICATION
Dummy Load	50 ohms, 7,500 Watts (minimum) VSWR: 1.1	'off-air' testing
Digital Multimeter	3 1/2 digit, ac and dc volts (10M ohms input), ohms and amps, ±0.5% accuracy, Beckman 3010	testing and maintenance
Frequency Counter	5ppm up to 10 MHz Fluke Model 1900A	measure carrier frequency
Oscilloscope	15 MHz Tektronix Model T922	testing and maintenance
DC Ammeter	30 Amps dc YEW Type 3228	to calibrate current shunts
Modulation Monitor	-100% to +125% TFT Model 375	to set up audio level
Audio Signal Generator	10 Hz to 10 MHz, 600 ohms, 0 to +15 dBm Hewlett Packard model 651B	simulates modulating audio input during testing and maintenance
Distortion Analyzer	20 Hz to 20 kHz Marconi Model TF231A	measures audio distortion during testing and maintenance
Function Generator	sine, square and triangular waveform with dc offset Hewlett Packard model 3310A	signal source for module tests
15Vdc Power Supply	15 volts, 1 amp	dc supplies for module tests
24Vdc Power Supply	24 volts, 1 amp	dc supplies for module tests
0-100Vdc Power Supply	0-100 volts, 1/2 amp	dc supplies for module tests

Table 1-4 - Special Tools

NOMENCLATURE	PART, MODEL, OR TYPE NUMBER (EQUIVALENTS MAY BE USED)	APPLICATION
Dummy Power Amplifier	139-1020*	Temporary replacement of faulty power amplifier
Extractor Tool	139-8138*	Removal of power amplifier and rectifier/regulator modules.
Test Probe, Power Amplifier	NAX19 *	On-air testing of power amplifiers
Tuning Tool	HAG38*	Setting carrier frequency. Adjust output levels.
Tuning Tool	HAJ22 *	Adjust the regulated output voltage of the NAS13 rectifier/regulator modules

*Manufactured by, or available from, Nautel

Table 1-5 - Glossary of Terms

TERM	DESCRIPTION
AMPFET	NAUTEL's nomenclature for this fully solid-state series of broadcast transmitters.
Integral Modular Reserve IMR	Identical modules operating in an overall system design such that failure of individual modules results in a power reduction only and not a complete system shutdown.
Modular Redundancy	Identical modules operating in an overall system design such that failure of one module does not affect the output of the system.
PWM	Pulse width modulation.
Power Level Cutback Cycle	A cycle within the internal control of the system, which, when activated, results in the modulator drive being reduced to effectively zero until the fault has been removed following which the level returns to normal.

SECTION 2
THEORY OF OPERATION

GENERAL

2.1 The theory of operation for AMPFET 5 amplitude broadcast transmitters (AM) is presented in this section. The information is presented initially using block diagrams as the basis for the description. This information is then expanded and presented in more detail using the electrical schematics for reference. Detailed information for the plug-in modules/ assemblies that are normally removed from the transmitter for servicing is not provided in this manual. The information for each of these modules/assemblies will be found in individual service instruction manuals, which are appended to this manual.

TRANSMITTER OVERVIEW (see figure FO-1)

2.2 The subject transmitter has been specifically designed for use as a 5000 watt, AM broadcast transmitter. It can be configured to operate as a monaural AM transmitter or a stereo AM transmitter. It may be co-located with the station studios and controlled locally or it may be co-located with the station's antenna system and controlled remotely from the station studios. For technical performance details, refer to table 1-1, technical summary.

2.2.1 The 3-phase ac power source from the service entrance is applied to a power transformer. The resultant 3-phase, 55 volts rms, phase-to-phase ac voltage on one set of the power transformer's secondary windings is rectified and provides a nominal -72 volts dc as the B- voltage for the power amplifier stages. Another secondary winding provides a single-phase, 115 volt rms, ac voltage for the low dc voltage power supplies' power transformer and for the cooling air fans.

2.2.2 The studio audio, which is a balanced (600 ohm or 150 ohm) audio input, is applied to an audio transformer in the driver stage. Internal audio gain circuits can be adjusted for a 100% modulation envelope when the amplitude of the input audio is at a specific level between -10 dBm to +12 dBm. Adjustable limiters circuits are preset to limit the maximum positive modulation peaks to any desired level between 100 to 125 percent and to limit the maximum negative modulation valleys to any desired level between 95 and 100 percent.

2.2.3 The rf output stage of the transmitter is designed to operate into a 50 $\pm$j0 ohm load. Mismatches which cause a peak reflected power of up to 250 watts may be tolerated. This corresponds to an SWR of 1.25:1 where SWR is flat over the bandwidth of the system. In a more usual situation, where SWR at the carrier frequency is negligible, a 2:1 SWR at the extremities of the audio modulation sidebands may be tolerated. Where this SWR results entirely from the limited bandwidth of the antenna and its associated phasing/tuning circuits, it corresponds to an impedance of 50 $\pm$j35 ohms. Should the reactance at the maximum sideband exceed j35, it may be necessary to limit the bandwidth of the audio input signal. In the event of excessive SWR, the transmitter will automatically reduce its output power to a safe operating level.

2.2.4 An rf output sample, which is calibrated at -46 dB relative to the rf output level, when terminated by a 50 ohm load, is available through a BNC connector on the control/monitor panel. Dc voltages, which are proportional to the square of the sensed forward and reflected powers of the rf output, are provided for remote monitoring of the forward and reflected power levels. A modulation monitor probe provides a second rf output sample that is calibrated to maintain the sample at a constant amplitude, regardless of the preset output power level selected. This rf sample is intended to be applied to the station modulation monitor.

2.2.5 External generated inputs, which are 24 volt pulses that control bi-stable latching relays, are applied to the driver stage as the remote control for the on/off and preset power level selector functions.

2.2.6 An external interlock is provided as a safety circuit that will turn the transmitter off when personnel must work in areas that contain high rf voltages such as the antenna or its feed/matching network. Utilization of the external interlock feature is the responsibility of the station. The rear fan panels of the transmitter are interlocked internally. For details refer to section 3.

2.2.7 External alarm and status signals are provided for remote control functions.

POWER SUPPLY OVERVIEW

2.3 The power supply for the subject transmitter accepts the three phase ac power source from the service entrance and generates a single phase 115 volt ac for the cooling fans, a 55 volt ac phase-to-phase to the rf power block circuits and the +24 and +15 volt dc control voltages to the control/monitor panel.

5000 WATT DRIVER STAGE OVERVIEW (see figure FO-2)

2.4 The 5000 watt driver stage contains two rf driver modules (main and standby) with an associated rf drive switching circuit, two modulator driver modules (main and standby) with an associated modulator drive switching circuit, an automatic level control (ALC)/remote power trim assembly, a monitor module, an rf filter/tuning assembly, plus system control and monitor interface circuits.

2.4.1 The 'main' or 'standby' rf drive outputs from their respective modules are passed to the main/standby rf drive switching circuit. An rf switchover control signal from the system monitor determines which rf drive (main or standby) will be applied to the rf filter/tuning assembly. The outputs of the rf filter/tuning assembly are passed to the 1.25 kilowatt power blocks. An 'inhibit' control signal from the system monitor serves a dual function: it delays the application of the rf drive output until the 'B' minus voltage reaches the required level, and it instantaneously removes the rf drive output for a period of 50 milliseconds whenever a power amplifier fails or an auxiliary alarm (rf current cutback) occurs.

2.4.2 The 'main ' or 'standby' modulator driver module, selected by the modulator drive switchover signal from the system monitor, accepts the audio input from a balanced to unbalanced input transformer and generates the PWM drive signal for the modulators. High carrier level and audio level controls are accessible from the front of the module using a tuning tool. When operating in 'main' with the modulator driver module and ALC/remote power trim assembly, the associated transmitter is capable of operating at three power levels. Two low level adjustments are accessible on the front of the ALC/remote power trim assembly. When set in the ALC mode, the ALC/remote power trim assembly monitors the transmitter power output and maintains it at a preset carrier in the event of variations in ac power input voltage and/or antenna impedance variations. When set to the REMOTE mode, the transmitter output power may be trimmed through the remote control function. In the standby mode, the transmitter operates at two power levels with the low and high power adjustments accessible on the front of the modulator driver, using a small tuning tool. Power level cutback cycles result from an alarm cutback signal or from an excessive reflected power level. No output of the module is present until a logic level '1' (+15 volts dc) is applied to the modulator drive enable. When a failure occurs within the 'main' modulator driver module, a modulator driver alarm signal is applied which activates the modulator drive switchover through the system monitor module.

2.4.3 The system control circuit accepts the +24 volts and +15 volts from the control/monitor panel and distributes them throughout the system based upon the high/low power, transmitter on/off and internal and external interlock inputs, in the appropriate manner.

2.4.4 The power level cutback cycle shuts the transmitter output off, through the 'main' or 'standby' modulator driver module, while the fault condition is present. When the fault condition is removed, the transmitter returns to its normal operating level. In the case of a high reflected power, the transmitter will return to the point at which the reflected power reaches the operating threshold and then hold at that output level. For details of the rf driver (NAPE12 or NAPE 20), modulator driver (NAPE27/1 or NAPE19/1) and monitor (NAPC7) modules, refer to the appropriate service instruction manuals at the end of this publication.

2.4.5 The ALC/remote power trim assembly compares its associated transmitter's forward power sample with an ALC threshold voltage which is preset to a level corresponding to the operator's desired level of rf output. When a difference in these voltages is detected, the ALC/remote power trim assembly will vary its associated modulator driver's pulse width until the rf output sample is equal to the preset ALC threshold. If the ALC/remote power trim assembly is switched to remote power trim mode, the operator can remotely adjust the rf output power of the transmitter by grounding the appropriate terminals for increasing or decreasing power. Refer to the NAPC18 ALC/remote power trim assembly service instruction manual for detailed information.

5000 WATT RF POWER BLOCK OVERVIEW (see figure FO-3)

2.5 The 5000 watt rf power block comprises four identical 1.25 kilowatt rf power blocks referred to as blocks A, B, C, and D. Each block comprises a rectifier/regulator, a modulator and six power amplifiers with their associated fault detectors.

2.5.1 The 3-phase, 55 volt ac power from the input power transformer is rectified and regulated in the rectifier/regulator to provide a -72 volt dc which is applied to the modulator through a choke and current shunt resistor. In the modulator, the -72 volts dc is filtered by the energy storage capacitors and used as the energy source for the modulator. The output of the modulator is controlled by the pulse width modulation drive from either 'main' or 'standby' modulator driver module. Three identical but isolated outputs from the modulator are applied to three pairs of power amplifiers. These modulator outputs provide the dc supply voltage for the power amplifiers while the rf drive signal to these power amplifiers is applied through the associated fault detectors. If a fault is identified in a pair of power amplifiers, a signal is applied to the modulator which removes the modulator output from that pair of power amplifiers and sends a power amplifier failure signal to the system monitor module.

2.5.2 The four 1.25 kilowatt power blocks may be controlled independently by the switch located on the rectifier/regulators.

2.5.3 The outputs of the four 1.25 kilowatt power blocks are applied to the isolated primary winding of the combiner transformer. For details of the NASM1 modulator, NAS13 rectifier/regulator and NAA11 power amplifier modules, refer to appropriate service instruction manuals at the end of this publication. Refer to paragraph 2.7 for interconnection and circuit details.

5000 WATT COMBINER/FILTER/OUTPUT OVERVIEW (see figure FO-4)

2.6 The output circuitry of the subject transmitter comprises a 5000 watt combiner, a current probe, a harmonic filter, a voltage probe, a forward/reflected power probe, a modulation monitor probe and two spark gaps.

2.6.1 The outputs of the four 1.25 kilowatt power blocks 'A', 'B', 'C', and 'D' are combined in the 5000 watt combiner. The output current of power block 'A' is sensed to determine if excessive peak currents and/or excessive average power is being drawn from the transmitter. If such is the case, the 'rf current cutback' will activate circuits within the transmitter's system monitor module and initiate a transmitter shutdown cycle.

2.6.2 The output of the 5000 watt combiner, which is essentially a square wave, is filtered by the harmonic filter to reduce harmonic levels below -80 dB relative to the carrier. This output is monitored by a 5000 watt voltage probe and forward/reflected power probe to provide the rf monitor, forward power and reflected power signals. The modulation monitor probe provides a fixed level rf output for external monitoring.

2.6.3 The spark gap at the output of the transmitter provides protection from possible high voltage being applied to the transmitter from the antenna. For circuit details of the subject transmitter's output circuitry, refer to paragraph 2.10.

TRANSMITTER CABINET DETAILED CIRCUIT DESCRIPTION (see figures FO-5 and FO-6)

2.7 Figures FO-5 and FO-6 show point-to-point interconnecting information for the subject transmitter. FO-5 shows the transmitter less the 'B', 'C' and 'D', 1.25 kilowatt power blocks. FO-6 shows the wiring details for power block 'B' with a table showing the relationships between blocks 'B', 'C' and 'D' which are identical except for location and designations.

NOTE

Reference designations have been assigned in accordance with the intermixture of location numbering and unit numbering requirements of American National Standard ANSI Y32.16 to assist in locating assemblies/modules. The first number of the reference designation is the locator number. Refer to figure FO-12 to determine the locator number assigned to a specific area of the transmitter, and to the detailed mechanical drawings to determine unit numbers of assemblies and components. Figure 7-1 shows the family tree of the transmitter and identifies the reference designation, name and part number of the main assemblies/modules.

2.7.1 INTERNAL INTERLOCKS: Interlocks are located on the upper and lower fan panels which turn the transmitter off whenever these panels are removed. For servicing purposes, it is possible to mechanically override these interlocks.

2.7.2 -72 VOLT DC DISTRIBUTION: The outputs of rectifier/regulator 7A1 thru 7A4 are applied to their associated modulators through chokes L1 thru L4 and current shunts 5R1 thru 5R4 respectively. The input to the four current shunts is combined through isolating diodes CR1 thru CR4 to provide the -72 volts dc required in driver unit, NAE39/1.

2.7.3 RF DRIVER SPLITTER/FAULT DETECTOR (see figure FO-6): Rf drive splitter/PA fault detectors 2N1 thru 2N6 and 3N1 thru 3N6 are identical. 2N1 thru 2N3 and 2N4 thru 2N6 are associated with power blocks 'A' and 'B' respectively. 3N1 thru 3N3 and 3N4 thru 3N6 are associated with power blocks 'C' and 'D' respectively. The following general description of the function of an rf drive/PA fault detector is applicable to all twelve.

2.7.3.1 The rf drive is applied through capacitor C1 of the fault detector to a splitter current sensing circuit that provides two rf drive outputs. The rf drive outputs are applied to the rf drive inputs (pin 2) of a pair of power amplifiers (i.e., 2N4 rf output is applied to power amplifiers 2A7 and 2A8). If the load presented by one of the two power amplifiers is significantly different from the other, the current-sensing circuit in the fault detector will sense the resultant rf drive current difference and produce a positive voltage 'PA fault' signal at terminal 'B' of the fault detector.

2.7.3.2 The 'PA fault' signal from 2N4 thru 2N6 is applied through 5XA2P1-19, 5XA2P1-9 and 5XA2P1-5 respectively to a relay circuit in modulator '5A2'. The 'PA fault' signal from the remaining nine rf drive splitter/PA fault detectors is applied to their associated modulators. The relay circuit energizes a relay that removes the modulated negative dc voltage from the applicable pair of power amplifiers when a positive voltage 'PA fault' signal is applied.

2.7.4 DISCHARGE PROBE U1: A discharge probe is provided with the transmitter. This probe is used to discharge the energy storage capacitors of the modulator in 10 seconds rather than having to wait for the normal 10-minute discharge period.

AC POWER SUPPLY DETAILED DESCRIPTION (see figure FO-13)

2.8 The 3-phase ac power from the service entrance is connected at terminal board TB1. It is then applied to the primary winding taps of transformer T1 through main circuit breaker CB1. A set of secondary windings provides 3-phase, 55 volts ac for the rectifier/regulator modules. A separate 115 volt ac secondary winding provides power, through CB2, for the cooling fans and to transformer T2 for use by the low voltage power supplies.

2.8.1 The 115 volts ac from the ac power transformer is applied to the upper and lower fan panels and low voltage transformer T2. The 36 volt output of T2 is applied in parallel to two low voltage power supplies, 7A5 and 7A6. When the ac power from the service entrance is applied to the transmitter and circuit breakers CB1 and CB2 are on, +24 volts dc and +15 volts dc will be applied at the outputs of 7A5 and 7A6. The fans will be turned on.

2.8.2 The +24 volt and +15 volt isolated outputs of 7A5 and 7A6 are joined and applied to monitor panel 1A1 for distribution throughout the transmitter through TRANSMITTER CONTROL-Source switch 1A1S2. An unswitched +24 volts is applied to driver unit 4A1 for use by the external control circuits.

NAC21/4 CONTROL MONITOR PANEL DETAILED DESCRIPTION (see figure FO-7)

2.9 The NAC21/4 (1A1) control/monitor panel contains the TRANSMITTER CONTROL-MASTER switch S1, the TRANSMITTER CONTROL-Source switch S2, MODULATOR INPUT CURRENT switch S4 with associated meter M2, OUTPUT POWER switch S3 with associated meter M1, plus alarm indicators and status lamps for the subject transmitter.

2.9.1 LOCAL CONTROL SWITCHING: The '24 vdc' is applied to P2-5 and the '15 vdc' is applied to P2-6. Both low dc control voltages are passed to the contacts of TRANSMITTER CONTROL-Master switch S1. The '24 vdc' at P2-5 is also applied directly to POWER-READY lamp DS1, the lamp will turn on. When Master switch S1 is set to ON and TRANSMITTER CONTROL-Source switch set to LOCAL, the 24 volt dc and 15 volt dc control voltages will be applied through Master switch S1 and Source switch S2 to P1-10; 'local 24 vdc' and P1-8; 'local 15 vdc', 24 volts dc will be passed to POWER-ON lamp DS3. Lamp DS3 will turn on. The '15 vdc(A)' input at P1-7 will be passed through Source switch S2 to P1-1, 'local power control'. The '24 vdc(A)' input at P1-18 will be passed to alarm lamps DS4 thru DS8. The 'remote 24 vdc' and 'remote 15 vdc' at P1-11 and P1-9 will be applied to contacts of a relay within the 5000 watt rf driver assembly and will be inhibited.

2.9.2 REMOTE CONTROL SWITCHING: When TRANSMITTER CONTROL-Source switch is set to REMOTE, current will flow from ground, through Source switch S2 to REMOTE lamp DS2. Lamp DS2 will turn on. The 'local 24vdc' at P1-10 and the 'local 15 vdc' at P1-8 will be removed. The 'remote 24 vdc' at P1-11 and 'remote 15 vdc' at P1-9 will no longer be inhibited. The '15 vdc(A)' input at P1-7 will be applied through Source switch S2 and passed to P1-4, 'remote power control'.

2.9.2.1 TRANSMITTER CONTROL-Master Switch S1 and TRANSMITTER CONTROL-Source switch S2 are configures in such a way that Master switch S1 will override the 'remote-on' function, thus providing a convenient emergency 'off' feature. The 'local/remote status' output at P1-6 will be an open circuit when Source switch S2 is in REMOTE and short circuit to ground when Source switch S2 is set to LOCAL (S1 set to on).

2.9.3 ALARM INDICATIONS: The common terminal of the alarm indicators is connected to +24 vdc(A) through P1-18 . Alarm lamps, DS4 thru DS8, are turned on by their associated alarm control generated in the rf driver unit. INTERLOCK alarm lamp, DS9, is controlled by the interlock alarm signal on P1-17. PRESS-TO-TEST switch, S6, is provided to allow testing of the alarm indicators.

2.9.4 HIGH TEMPERATURE DETECTOR: Thermistor R3, used as a high temperature detector, is physically mounted on MODULATOR INPUT CURRENT switch S4 and is electrically connected to the rf driver unit through P1-3. Whenever the resistance of R3 falls below a nominal 350 ohms, the high temperature shutdown and alarm lamp will be activated.

2.9.5 RF MONITOR: A sample of the rf output of the subject transmitter is interfaced through the control/monitor panel and applied to connector J1 on the monitor's front panel.

2.9.6 OUTPUT POWER METER: OUTPUT POWER meter M1 is connected to the forward or reflected power output from NAFP5/5 power probe through OUTPUT POWER switch S3 and meter calibration assembly A1. Forward and reflected power outputs of NAFP5/5 power probe are applied to the rf driver unit through P1-2 and P1-5. R6 and C1 provide a simple filter network to decrease the sensitivity of SWR cutback at the sideband frequencies.

2.9.7 MODULATOR INPUT CURRENT METER: The MODULATOR INPUT CURRENT meter 1A1M2 indicates the input current to the modulators by measuring the voltage drop across current shunts 5R1, 5R2, 6R1 and 6R2. MODULATOR INPUT CURRENT switch S4 selects the desired input and applies it to meter M2 through calibration control A3R1.

2.9.8 TEST METER: TEST meter M3 is controlled by TEST switch S5. In the MODULATOR I/P VOLTS position, the meter measures the voltage on current shunts 5R1, 5R2, 6R1 and 6R2 through calibration control A2R2. In the TEST position, the meter is connected through A2R2 to test meter jacks 4A1TP3 and 4A1TP4 which may be used to assist in troubleshooting the transmitter. A set of test leads is supplied in the ancillary parts kit.

HARMONIC FILTER ASSEMBLY DETAILED CIRCUIT DESCRIPTION (see figure FO-8)

2.10 Harmonic filter assembly (1A2) comprises an NAH24/1 (1A2A1) combiner; NAFP7 (1A2A4) current probe; NAF27 harmonic filter; NAFP6/1 (1A2A2) voltage probe; NAFP5/5 (1A2A3) forward/reflected power probe; NAFP15 (1A2A5) modulation monitor probe; and two spark gaps (1A2E1 and 1A2E2).

2.10.1 NAH24/1 COMBINER: The input being applied to the output filter assembly is the 1.25 kilowatt rf power blocks 'A', 'B', 'C' and 'D' outputs which are applied to the magnetically isolated primaries of NAH24/1 combiner. The common secondary winding of combiner transformer A1T1 combines the power block outputs in a series configuration to drive the 50 ohm NAF27 harmonic filter.

2.10.2 NAFP7 CURRENT PROBE: Power block 'A' output is applied to NAH24/1 combiner through current probe A4T1. The output of T1 is detected and filtered by A4L1, R5 and C3. The dc voltage is compared to two fixed voltages of 3.7 volts and 5.7 volts by comparators U1B and U1A respectively. U1A acts as an instantaneous trip which provides an rf cutback signal whenever the voltage on C3 exceeds 5.7 volts. This occurs at 150 percent positive modulation when the transmitter is driving a 50 ohm load. The output of comparator U1B is applied through a low pass filter before it is sampled by another comparator U1D. When the input on U1D-11 exceeds the 3.2 volts established on U1D-10, an rf current cutback signal is generated. This corresponds to an average output level in excess of 8.5 kilowatts.

2.10.3 NAF27 HARMONIC FILTER: The NAF27 harmonic filter is pretuned at the factory to the carrier frequency using one of seven sets of capacitors (see table on FO-8) and by adjusting the taps on inductors L1, L2 and L3. Inductor L1 and capacitors C1 and C2 form a series-tuned circuit which is tuned to the carrier frequency in a manner to incorporate the leakage inductance of the power amplifier output transformers and the combiner transformer as part of inductor L1. Capacitors C3/C7 and inductor L2 form a quarter-wave section tuned to provide precisely 50 ohms at its input when the transmitter is operating into a 50 ohm load. Capacitor C4 is used to provide a notch at the third harmonic of the carrier frequency. Capacitors C5/C6 and inductor L3 form a second series tuned circuit at the output of the filter.

2.10.4 NAFP6/1 VOLTAGE PROBE: The NAFP6/1 voltage probe is a precision 100:1 (40 dB) voltage divider whose output is applied to the NAFP5/5 power probe where it is used as the voltage reference. A second output, isolated by resistors A2R1/A2R2, provides the signal to the rf monitor BNC J1 of the control monitor panel (-46 dB relative to output voltage when terminated in 50 ohms).

2.10.5 NAFP5/5 FORWARD/REFLECTED POWER PROBE: The NAFP5/5 power probe combines the output of the NAFP6/1 voltage probe and its own current probe T1 to provide dc voltage outputs on TB1-1 and TB1-4 which are proportional to the square of the forward and reflected power at the output of the transmitter.

2.10.6 NAFP15 MODULATION MONITOR PROBE: The NAFP15 modulation monitor probe provides a fixed level output for each of the transmitter's three power levels. In addition, an output is provided to indicate which low power level the transmitter is in. See NAFP15 modulation monitor service instruction manual for details.

2.10.7 SPARK GAP: Two spark gaps (one gas filled the other an adjustable air gap) are provided on the rf output of the transmitter to provide protection against excess voltage. Once one of the gaps fires, the short circuit on the output is transformed to an open circuit at the output of the power amplifiers by the quarter-wave section of the output filter. Adjustment of the air gap is described in section 3.

NAE39/1 5000 WATT RF DRIVER UNIT DETAILED DESCRIPTION (figures FO-10 thru FO-12)

2.11 The NAE39/1 5000 watt rf driver unit (4A1) comprises NAPE12 rf driver (4A1A1-standby), an NAPE20 rf driver (4A1A2-main), an NAPC18 ALC/remote power trim assembly (4A1A9), an NAPE27/1 modulator driver (4A1A4-main), an NAPE19/1 modulator driver (4A1A5-standby), NAPC7 system monitor (4A1A3), an inductor assembly (4A1A6) and an rf driver tuning assembly (4A1A7). The following circuit description covers the chassis-mounted components and assemblies. For details of plug-in modules/assemblies, refer to the appropriate module/assembly service instruction manual.

2.11.1 SYSTEM CONTROL: When the transmitter is operating in the local mode, '24 vdc(local)' is applied through J1-10 to the interlock relay coil and to interlock relay K2-10 while the '15 vdc(local)' is applied through J1-8 to interlock relay K2-11. Provided external interlock TB1-7 and TB1-8 is shorted and internal interlock control J2-5 is grounded, interlock relay K2, will be energized allowing +15 and +24 volts dc to provide the required low voltages to operate the transmitter. When K2 is not energized, interlock alarm lamp 1A1DS9 will be turned on through the 24 volts dc on J1-17 and a contact closure will be present between TB1-13/TB1-14.

2.11.1.1 When the transmitter is set to the remote mode, '24 vdc(remote)' and '15 vdc (remote)' on J1-11 and J1-9 is controlled through relay K7. Momentarily applying 24 volts dc between TB1-5(+) and TB1-1(-) latches relay K7 to the on position. Momentarily applying 24 volts dc between TB1-5(+) and TB1-2(-) latches relay K7 to the off position. Relay K7 will remain in the last selected position indefinitely. By connecting TB1-5 to the +24 volts dc on TB1-6, the input controls need be only a momentary contact closure between the appropriate control terminal and TB1-15 (ground).

2.11.1.2 When switched to LOCAL operation by TRANSMITTER CONTROL-Source switch 1A1S2, the high/low power selection is controlled by O/P LEVEL switch S1 which applies the local power control (15 volts dc) on J1-1 to modulator driver modules A4 and A5 at XA4P1-2 and at XA5P1-2 when switched to the LOW position. When 1A1S2 is in the REMOTE position, the remote power control (15 volts dc) on J1-4 is applied to XA4P1-2 and XA5P1-2 through remote level control latching relay K8. The remote operation of relay K8 is similar to that of relay K7 with the remote high power and low power inputs applied on TB1-3 and TB1-4. When the low output power has been selected, +15 volts is applied to the low power control at J2-17, a low power status signal is present on TB2-3 and LOW O/P LEVEL lamp DS1 will be turned on.

2.11.1.3 The low power option has two further options, LOW LEVEL '1' and LOW LEVEL '2'. These are controlled by in the NAPC18 ALC/remote power trim assembly. When the LL1/RMT/ LL2 front panel switch on the NAPC18 is in the RMT position, LOW LEVEL '1' may be selected by a momentary ground on TB2-7 and LOW LEVEL '2' by a momentary ground on TB2-8. When the LL1/RMT/LL2 is either in the LL1 or LL2 position, remote selection is not available.

2.11.1.4 The transmitter output power may be inhibited by a ground on TB2-10. This ground inhibits the 'mod drive enable' signal from the system monitor. When the ground is removed, the transmitter output power will be restored to the level selected. If 'automatic level control' (ALC) has been selected, the transmitter will step to the preset power level.

2.11.2 MAIN/STANDBY RF DRIVE SWITCHING: Switching between main and standby rf drivers A1 and A2 is achieved by relay K3 which is controlled by the rf drive standby alarm output of monitor module A3. Relay K3 switches +15 volts dc to the appropriate rf driver and applies the output of this module to inductor assembly A6 of the driver unit NAE39/1.

2.11.3 MAIN/STANDBY MODULATOR DRIVE SWITCHING: Switching between main and standby modulator drivers A4 and A5 is achieved by relay K9 which is controlled by the modulator drive standby alarm output of monitor module A3. Relay K9 switches +15 volts dc and audio input to the appropriate modulator driver and feeds the pulse width modulated output of this module to J2-3.

2.11.4 RF DRIVE FILTER: The rf drive filter comprises A6 and A7. The output of rf drive switchover at relay K3-11 and K3-12 is applied to TB1-1 of inductor assembly A6. The output of A6, at TB1-8, is applied to tuning assembly A7 from which it provides 12 isolated rf drive outputs to the power amplifier modules. A6 is basically a series-tuned circuit comprising capacitors A6C1/C4 and inductor L1. Inductor L1 is a tapped inductor with the appropriate

taps for the carrier frequency selected at the factory. Padding capacitor, C4, is a select-on-test capacitor to fine tune the circuit. Lamp A6DS1 is used as a tuning indicator when tuning inductor A7L1. Minimum brightness of lamp DS1 indicates minimum rf current and, hence, optimum tuning. Diodes CR2 and CR3 are back-to-back zener diodes used to clamp the rf drive to a level of less than 50 volts peak. Inductor A7L1 forms part of a parallel tuning circuit in conjunction with capacitors C1 thru C12 and the input capacity of the associated power amplifier modules. Diode CR1 and capacitor C3 provide the detected rf drive which is used in monitor module A3, to determine the acceptability of the rf drive. This dc voltage is also available at rf drive test point TP2 through resistor A6R1. The rf drive signal at the output of A6 is applied to rf drive test point TP1 through resistor R1 of the driver unit and to RF DRIVE lamp DS2 through resistor R2 of the driver unit NAE39/1.

2.11.5 SYSTEM MONITOR: The system monitor section of the rf driver unit comprises NAPC7 monitor module A3 and remote alarm relays K1, K4, K5 and K6. For details of the NAPC7 monitor module A3, refer to the NAPC7 service instruction manual.

2.11.5.1 Carrier Frequency Monitor: A sample of the rf drive waveform is applied to BNC connector 4A1J5 through a 1500 ohm resistor and provides a carrier frequency monitor point for permanent connection to a suitable frequency monitor. This will provide approximately one volt rms into a 50 ohm termination.

2.11.5.2 Alarm Relays: Tx fault relay (K6); VSWR relay (K5); power amplifier failure relay (K4); standby relay (K1) and remote alarm relays are activated by the appropriate alarm outputs of monitor module A3. When the alarms are active, contact closures are provided between the associated terminal on TB1 and the common status point TB1-14.

2.11.5.3 Remote RF Monitor Outputs: Dc voltages, which are proportional to the square of the forward and reflected output power respectively, are provided on BNC connectors J3 and J4. Full power output of 5000 watts corresponds to a nominal 9.5 volts dc. These outputs must not be terminated by a resistance of less than 100K ohms. Refer to the NAPC7 monitor module service instruction manual for circuit details.

2.11.6 AUDIO INPUT: The balanced audio input to the modulator driver modules (A4 and A5) is applied through TB1-16 and TB1-18 to transformer T1, through relay K9-2 or K9-6, to the appropriate modulator driver. Transformer T1 is normally wired for 600 ohm input impedance. The required modification to obtain a 150 ohm input impedance is shown in figure FO-9. The modulator driver module has an adjustable audio gain to allow full 100 percent modulation for input signal levels from -10 to +12 dBm. A limiter is incorporated in the modulator driver to prevent overdriving the transmitter. This limiter may be utilized as the final limiter in the audio feed by adjusting R64 and R62 for the desired negative and positive peak modulation levels (see the NAPE27/1 and/or NAPE19/1 modulator driver service instruction manual(s) for details). Normally, this limiter is effectively passed as part of the audio processing circuit by setting R64 fully counter- clockwise and R62 fully clockwise, which sets the peak modulation levels to effectively -110 percent and +135 percent. Under these conditions, the limiter is only activated when excessive audio levels are present and acts to protect the transmitter from being overdriven.

SECTION 3
INSTALLATION AND PREPARATION FOR USE

GENERAL

3.1 This section contains the information required to prepare the equipment site to receive the transmitter and the information required to unpack, install and prepare the transmitter for use.

TEST EQUIPMENT AND SPECIAL TOOLS

3.2 The test equipment required for initial installation is listed in table 1-3 and the special tools are listed in table 1-4.

SITE REQUIREMENTS

3.3 The transmitter should be installed in a building that provides a minimum clearance on all sides of at least four feet.

3.3.1 LIGHTNING/SAFETY GROUND: The transmitter site must contain a lightning/safety ground system to protect the transmitter from lightning-induced voltage transients. Refer to the Lightning Protection for Radio Transmitter Stations information booklet supplied with this manual.

3.3.2 ANTENNA SYSTEM: It is recommended that the antenna system used with the AMPFET transmitter meet (as a minimum) the standards laid down in EIA Standard TR-101-A, paragraph 8(b) with a normal impedance of 50 +j0 ohms at the carrier frequency. Although the transmitter will function while working into a maximum VSWR of 1.2:1 over the frequency band, or with sideband VSWR's of up to 2:1 when the carrier frequency impedance is 50 +j0 ohms, the overall system performance will be greatly degraded. It is essential that the antenna system include provision to protect the transmitter from lightning induced voltage transients. Refer to the Lightning Protection for Radio Transmitter Stations information booklet.

3.3.3 ELECTRICAL POWER: The AMPFET 5 transmitter requires a four-wire (plus ground), three-phase, ac power source rated at a minimum of 10 kVA. Provision must be made to protect the ac lines from lightning-induced voltage transients. Refer to the Lightning Protection for Radio Transmitter Stations information booklet supplied with this manual. The power supply delivered with the transmitter is determined by the voltage/frequency availability specified when the order was placed. The standard options are:

North American	Nominal 115/208 volts ac rms, 60 Hz, 3-phase. Phase-to-phase voltage must be maintained within five percent of a mean voltage between 198 and 242 volts ac rms.
European	Nominal 230/415 volts ac rms, 50 Hz, 3-phase. Phase-to-phase voltage must be maintained within five percent of a mean voltage between 385 and 465 volts ac rms.

3.3.4 ELECTRICAL POWER CABLING: The ac input power cable, from the service entrance, enters the cabinet through a cable entry hole in either side of the lower, rear panel. Refer to figure FO-14 for dimensional information to assist in locating rigid conduit and/or determining cable length.

3.3.5 RF OUTPUT CABLE: The rf output cable is normally attached directly to the spark gap assembly on the top of the transmitter as depicted in figure FO-17, unless an alternate connection method is specifically requested by the user.

3.3.6 CONTROL/MONITOR CABLING: Control and monitoring connections are made through an entry hole in the lower rear panel of the transmitter cabinet. Refer to figure FO-31 for dimensional information to assist in determining cable length. Optionally, control and monitor cables may be applied through an opening in the top of the transmitter.

3.3.7 TRANSMITTER CABINET ANCHORING: The transmitter cabinet has anchor bolt entry holes predrilled in its base to accommodate 12 mm (1/2 inch) anchor bolts. If the cabinet is to be anchored to the floor of the building, refer to figure FO-31 for dimensional information.

3.3.8 VENTILATION: The interior of the building must contain a ventilation system that will ensure the inside temperature does not exceed 50°C.

3.3.9 HEATING: The interior of the building must contain a heating system that will ensure the inside temperature does not go below 0°C.

3.3.10 WORK AREA: It is recommended that a suitable work area with an adequate table surface be provided adjacent to the transmitter to permit bench calibration/repair of modules.

EXTERNAL INPUT/OUTPUT CIRCUIT REQUIREMENTS (see figure 3-1)

3.4 The external input (rf carrier, audio and control) and output (status and alarm monitoring) circuits must comply with the following:

3.4.1 EXTERNAL RF SIGNAL SOURCE: An external rf signal must be provided when an NAPE20 stereo rf driver module is installed as the rf drive source. The NAPE20 stereo rf driver module will be installed for stereo operation and may be installed if the user feels the internally generated rf carrier signal is not sufficiently stable in monaural operation.

3.4.1.1 In stereo operation, the external rf signal source will normally be an AM stereo exciter. The AM stereo exciter must provide a 50-ohm, phase-modulated rf carrier signal, that contains the left minus right (L - R) channel information, at the assigned carrier frequency. The rf signal applied to the transmitter must be a sine wave that is between 1.0 and 3.0 volts rms.

3.4.1.2 In monaural operation, the external rf signal source will normally be obtained from an extremely stable rf signal generator. The rf signal source must provide a 50-ohm, rf signal that is precisely the assigned carrier frequency. The rf signal applied to the transmitter must be between 1.0 and 3.0 volts rms.

3.4.2 EXTERNAL AUDIO SOURCE: An external audio source must be provided. The preferred impedance of the audio source is 600 ohms, but an audio source that is 150 ohms may be used provided the primary windings of audio transformer 4A1T1, which are normally connected in series, are connected in parallel. The audio signal applied to the transmitter must be between -10 dBm and 12 dBm (10 dBm preferred). The audio signal may be processed to provide a higher percentage of positive modulation than negative modulation. Internal circuits in the rf driver modules will linearly attenuate the audio input if its amplitude would cause the positive or negative modulation percentages to exceed user determined limits. The user determined limits are between 95 to 100 percent negative modulation and 100 to 140 percent positive modulation.

3.4.2.1 In stereo operation, the external audio source will normally be the AM stereo exciter that provides the external phase-modulated rf carrier signal. The audio signal from the AM stereo exciter must contain the left plus right (L + R) channel information.

3.4.3 REMOTE CONTROL CIRCUITS: When the transmitter on/off status; the rf output off/on status, the trimming of the rf output level and the preset power level selection are to be controlled remotely, the following must be observed.

3.4.3.1 +24 volt dc must be applied to 4A1TB1-5 (control common) as the energizing voltage for bistable relays in the remotely controlled on/off and preset power selection circuits. +24 volts dc is available at 4A1TB1-6 for this purpose or it may be supplied from an external dc power source. The 24 volt dc return (ground), from 4A1TB1-15 or from the negative terminal of the external power source, must be connected to the contactor of the remote switching devices.

3.4.3.2 The remote on/off switching circuit should be a three position switch that has two spring-loaded momentary positions and a spring-return center-off position. Each momentary position should be normally open and close only when held in the spring-loaded position. One momentary position should be connected to the 'tx on' input (4A1TB1-1) and the other momentary position should be connected to the 'tx off' input (4A1TB1-2).

3.4.3.3 The power level selection switch circuit should be three, single pole, single throw, spring-loaded switches that are normally open when they are in their spring return position and closed only when they are held in their spring-loaded momentary position. There should be one switch for each of the 'high power' (4A1TB1-3), 'low level 1' (4A1TB2-7), and 'low level 2' (4A1TB2-8) inputs. The 'low power' (4A1TB1-4) input is not used in transmitters that have more than two preset power levels.

3.4.3.4 The rf output trim switching circuit should be a three position switch that has two spring-loaded momentary positions and a spring-return center-off position. Each momentary position should be normally open and close only when held in the spring-loaded position. One momentary position should be connected to the 'increase' input (4A1TB2-5) and the other momentary position should be connected to the 'decrease' input (4A1TB2-6).

3.4.3.5 The rf output instant off/instant on switching circuit is intended to be used in conjunction with rf output load switching circuits, when switching from an antenna to a dummy load or to another antenna. The rf output instant off/instant on switching circuit must apply a ground to 4A1TB2-10 immediately before any rf output load switching occurs; particularly any switching that will cause the transmitter to operate into an open circuit, and be an open circuit during normal operation.

3.4.4 EXTERNAL INTERLOCK CIRCUIT: The external interlock circuit must provide a low impedance (short circuit) between terminals 4A1TB1-7 and 4A1TB1-8 before the rf stages of the transmitter can be turned on. The user may install any number of serial interlock switches between terminals 7 and 8 of terminal board 4A1TB1, provided they apply an infinite impedance (open circuit) between these terminals when the transmitter is to be turned off (any interlock switch activated). The transmitter's 24 volt dc power source is present on the external interlock circuit. It is recommended that a user supplied relay be installed as the external interlock circuit when the interlock wiring is lengthy, with the energized/de-energized status of the relay determined by the external interlock switches. If a relay is used, it is recommended that it be installed as a fail-safe relay (energized when the transmitter's rf stages are to be enabled/de-energized when the transmitter's rf stages are to be inhibited).

3.4.5 EXTERNAL FORWARD POWER MONITORING CIRCUIT: A buffered dc voltage that is representative of the forward power level is provided at BNC coaxial connector 4A1J3. This voltage is a non-linear function of the forward power level and will be 9.5 ±0.5 volts dc at 5 000 Watts. An external panel meter that is accurate at all power levels would require a one microampere movement and have the same modified square law scale as OUTPUT POWER meter 1A1M1. It would have to be electrically connected the same as OUTPUT POWER meter 1A1M1 (see figure FO-7). If any other terminating device is used, it must have an input impedance of not less than 100K ohms.

3.4.6 EXTERNAL REFLECTED POWER MONITORING CIRCUIT: A buffered dc voltage that is representative of the reflected power level is provided at BNC coaxial connector 4A1J4. The output characteristics of the buffered reflected power circuit is identical to the circuit described for the bufferred forward power circuit (see paragraph 3.4.5).

3.4.7 EXTERNAL ALARM MONITORING CIRCUITS: The transmitter's alarm circuits provide normally open relay contacts that close when an alarm condition is sensed. The moving contact wiper of each set of relay contacts is connected to the same 'alarm common' point at 4A1TB1-14. The user must decide what potential is required to activate the alarm circuits and connect this potential to 4A1TB1-14.

3.4.7.1 Standby Alarm: A standby alarm relay provides an open circuit to 4A1TB1-9 when the main rf driver and mod driver modules are being used as the source for the transmitter's rf drive and mod drive signals. When a failure has been sensed in either of these modules, and the drive source has been transferred to the standby rf driver or mod driver module, a contact closure, will connect the 'alarm common' potential at 4A1TB1-14, to 4A1TB1-9 as the 'standby' alarm output. This contact closure will be maintained until the alarm circuits have been reset by turning off the transmitter and then turning it on.

3.4.7.2 PA Failure Alarm: A PA failure alarm relay provides an open circuit to 4A1TB1-10 when all of the power amplifiers are operating satisfactorily. When a power amplifier failure has been sensed and one or more pairs of power amplifiers has been turned off and are not contributing to the transmitter's rf output, a contact closure, will connect the 'alarm common' potential at 4A1TB1-14, to 4A1TB1-10 as the 'PA failure' alarm output. This contact closure will be maintained until the alarm circuits have been reset by turning off the transmitter and then turning it on.

3.4.7.3 SWR Alarm: An SWR alarm relay provides an open circuit to 4A1TB1-11 when the sensed reflected power is within the optimum stress limits of the rf power amplifier stages. When anything occurs that would cause the reflected power to exceed the optimum stress limits of the rf power amplifier stages, the transmitter's rf output will automatically be reduced to the level that will maintain the rf output current within the optimum stress limits, a contact closure will connect the 'alarm common' potential at 4A1TB1-14, to 4A1TB1-11 as the 'SWR alarm' output. This contact closure will be maintained for the period of time the excessive reflected power is sensed and will return to an open circuit when the reflected power returns to an acceptable level.

3.4.7.4 Tx Fault Alarm: A Tx fault alarm relay provides an open circuit to 4A1TB1-12 when the transmitter's rf carrier level exceeds the preset rf output fault threshold level. When the rf carrier level falls below this threshold level due to a malfunction or the transmitter being turned off for any reason (loss of ac power source, interlock open, etc.), a contact closure will connect the 'alarm common' potential at 4A1TB1-14, to 4A1TB1-11 as the 'Tx fault' alarm output. This contact closure will be maintained until the rf carrier level is restored to a level that exceeds the preset rf output fault threshold level. The Tx fault alarm relay is a fail-safe relay that is energized when the rf carrier level is acceptable and is de-energized when the rf carrier level is not acceptable.

3.4.7.5 Interlock Open Alarm: An interlock open alarm relay provides an open circuit to 4A1TB1-13 when the external interlock circuit is applying a short circuit between 4A1TB1-7 and 4A1TB1-8 and the internal interlock switches are being held closed. When the external interlock circuit is interrupted and removes the short circuit from between 4A1TB1-7 and 4A1TB1-8 or one of the internal interlock switches is opened, a contact closure will connect the 'alarm common' potential, from 4A1TB1-14, to 4A1TB1-13 as the 'interlock open' alarm output. The contact closure will be maintained until the interlock circuit's integrity is restored.

3.4.7.6 AC Alarm: The ac alarm feature is not normally installed. It is an option that requires the installation of an ac power monitor in the ac power supply. When it is installed, the ac alarm circuit provides an open circuit to 4A1TB2-2 when the ac power is acceptable. When the voltage of the ac power source is more than five percent above or below a predetermined nominal ac voltage, a contact closure will connect the 'alarm common' potential at 4A1TB1-14, to 4A1TB2-2 as the 'ac alarm' output. This contact closure will be maintained until the voltage of the ac power source is restored to a level that is within five percent of the predetermined value.

3.4.8 EXTERNAL STATUS MONITORING CIRCUITS: Outputs that may be used to identify or verify the status of remotely controlled functions are available on terminals of terminal board 4A1TB2.

3.4.8.1 Local/Remote Status: The local/remote status circuit is a set of switch contacts that provide an open circuit to 4A1TB2-1, as the local/remote status output, when the transmitter is turned on locally and remote control has been selected. When local control has been selected or the transmitter has been switched off locally, a contact closure will connect 4A1TB2-1 to ground potential as the local/remote status output.

3.4.8.2 Transmitter On Status: The transmitter on status circuit provides a 10K ohm resistance between 4A1TB2-4 and 4A1TB1-15 (ground) when the transmitter is turned off locally or turned off remotely when remote control has been selected. When the transmitter has been turned on, locally when local control has been selected or both locally and remotely when remote control has been selected, +15 volts dc will be applied to 4A1TB2-4 through a 1000 ohm resistor.

3.4.8.3 Low Power Status: The low power status circuit provides a 10K ohm resistance between 4A1TB2-3 and 4A1TB1-15 (ground) when the transmitter is operating in the high power mode. When the transmitter is operating in any of its low power modes, +15 volts dc will be applied to 4A1TB2-3 through a 1000 ohm resistor.

3.4.8.4 Level Control (ALC) Limit Status: The level control (ALC) limit status circuit contains a switching transistor that provides a current sink to ground to 4A1TB2-9 when the level control circuit has been driven to its maximum increase extreme or its maximum decrease extreme. It provides an open collector to 4A1TB2-9 when the level control circuit is operating anywhere between the two extremes. The dc voltage source for the ALC limit status monitoring circuit should not exceed 24 volts dc. The monitoring circuit must present an impedance between the switching transistor and the positive dc voltage source that will result in not more than 40 milliamperes flowing when the switching transistor is providing a current sink to ground.

3.4.9 EXTERNAL CARRIER FREQUENCY MONITOR CIRCUIT: An rf voltage sample of the rf drive is provided on BNC coaxial connector 4A1J5. This rf voltage is intended to be applied to a frequency counter/monitor that has a 50-ohm input, to provide a continuous check of the rf carrier frequency.

3.4.10 EXTERNAL RF OUTPUT MONITOR CIRCUIT: An rf voltage sample of the rf output is provided between terminals 1 and 2 of terminal board TB1 on modulation monitor probe 1A2A5. This rf voltage is intended to be applied to a 50-ohm load, such as a station modulation monitor, and is calibrated to provide the rms voltage required by the monitoring device (maximum of 5.0 volts rms). The rf voltage sample is set during calibration to provide the same rms voltage for all three preset rf output levels.

3.4.11 EXTERNAL LOW POWER CONTROL: The low power control circuit provides a means of controlling an external circuit when one, or both, of the low output power levels is selected. Switching transistors provide a current sink to ground, on J1-6 of modulation monitor probe 1A2A5, when the appropriate low power level(s) is selected and an open collector when other power levels are selected. User connected links determine which low power level(s) will apply a current sink to ground on J1-5. The voltage for the low power control circuit should not exceed 24 volts dc and its load must present an impedance, between the switching transistor and the dc voltage source, that will result in a current flow of not more than 100 milliamperes.

PARTS SUPPLIED BY NAUTEL

3.5 The following parts/materials are supplied by or are available from Nautel. Detailed information about these parts is not included in this instruction manual.

3.5.1 PARTS REMOVED DURING DISASSEMBLY FOR SHIPMENT: All the parts that were removed during disassembly for shipment and are required to reassemble the transmitter are provided. An itemized listing of the parts is not provided in this instruction manual, as the extent of disassembly is determined by the method of shipment. Detailed packing lists will be included with a transmitter shipment.

3.5.2 ANCILLARY PARTS: An ancillary parts kit is provided with each transmitter. These parts include spare fuses, some solid state devices and commonly used hardware/repair materials. The ancillary parts are not intended to be long term maintenance spares. They are provided to ensure the initial installation is not delayed because of a lost or damaged part and to allow the user to maintain the equipment until a comprehensive maintenance spares kit is obtained. An itemized listing of the ancillary parts kit contents is included in its packing list.

PARTS REQUIRED BUT NOT SUPPLIED BY NAUTEL

3.6 Some parts and materials required to complete an AMPFET 5 installation are not supplied with the transmitter or provided by Nautel. The user must supply these parts. Each installation will dictate the parts required, and will normally include the following:

(a) A suitable 50-ohm rf output coaxial cable is required.

(b) All external control/monitor wiring, including their associated terminating devices and conduit clamps must be provided by the user.

(c) All electrical power cables, including the cables interconnecting the service entrance panel and the transmitter; including conduit, terminating devices and conduit clamps must be provided by the user.

(d) A heavy gauge (#8 AWG minimum) insulated wire (approximately 10 feet long) is required.

3.6.1 NAX34 SURGE PROTECTOR PANEL: An optional NAX34 surge protector panel; that is rated for the ac power source to be applied to the transmitter, is available from Nautel. The surge protector panel will reduce the transmitter's susceptibility to lightning-induced voltage transients on the ac power source. It must be installed between the ac power service entrance and the transmitter's ac power supply. It must also be connected directly to the station reference ground, as defined in the Lightning Protection for Radio Transmitter Stations booklet.

UNPACKING

3.7 The transmitter, excluding spares, is packed in six wooden crates for shipment. A packing list on the outside of each crate provides a detailed listing of crate contents.

CAUTION

Sufficient manpower or mechanical assistance should be available prior to attempted removal of crate contents. All crates should be inspected for transit damage prior to shipment acceptance and/or uncrating.

3.7.1 TRANSMITTER CABINET CRATE: The transmitter cabinet is packed partially disassembled in a wooden crate that is 79 cm (31 inches) x 76 cm (30 inches) x 216 cm (85 inches). Shipping weight is approximately 234 kilograms (515 pounds). Open the crate and remove the transmitter cabinet as follows:

(a) Locate the crate in a clear area that will permit extraction of the transmitter cabinet without risk of damage to the unit or injury to personnel.

(b) Stand the crate upright as marked on the crate.

(c) Remove the panel identified as the front from the crate by carefully prying it open using a small pry bar or other suitable tool.

(d) Remove the four wooden brackets which are nailed to two sides of the crate and secure the transmitter in place.

(e) Remove the remaining crate panels by carefully prying them off using a small pry bar or other suitable tool.

(f) Carefully remove the transmitter cabinet.

3.7.2 AC POWER SUPPLY CRATE: The ac power supply is packed fully assembled in a wooden crate that is 46 cm (18 inches) x 53 cm (21 inches) x 56 cm (22 inches). Shipping weight is approximately 110 kilograms (242 pounds). Open the crate and remove its contents as follows:

(a) Locate the crate in a clear area that will permit extraction of the ac power supply without risk of damage to the unit or injury to personnel.

(b) Stand the crate upright as marked on the crate.

(c) Remove the top panel from the crate by carefully prying it open using a small pry bar or other suitable tool.

(d) Remove the two wooden brackets which are nailed to two sides of the crate and secure the ac power supply in place.

Table 3-1 Selecting Primary Winding Taps of Power Transformer

AC SUPPLY VOLTAGE (MEAN RMS - PHASE-TO-PHASE)		PRIMARY WINDING TAPS		
NORTH AMERICAN	EUROPEAN	H1	H2	H3
198-208	380-400	Ø1-A	Ø2-A	Ø3-A
209-219	401-415	Ø1-B	Ø2-B	Ø3-B
220-230	416-430	Ø1-C	Ø2-C	Ø3-C
231-242	431-460	Ø1-D	Ø2-D	Ø3-D
243-254	461-490	Ø1-E	Ø2-E	Ø3-E

(e) Gain access to the base of the ac power supply by removing the sides from the crate using a small pry bar or other suitable tool.

(f) Remove the four lag screws securing the cabinet legs to the shipping pallet. Carefully remove the ac power supply.

3.7.3 TRANSMITTER MODULE CRATES: The transmitter's modules are packed in the remaining four wooden packing crates. Unpack each crate as follows:

(a) Stand the crate upright as marked on the crate.

(b) Remove the top panel from the crate by carefully prying it open using a small pry bar or other suitable tool.

(c) Carefully remove and unwrap each module.

3.7.3.1 NASM1 Modulator Modules: The NASM1 modulator modules are packed in two wooden crates. Each crate contains 2 modules and is 64 cm (25 inches) x 56 cm (22 inches) x 28 cm (11 inches). Shipping weight for each crate is approximately 30.4 kg (67 pounds).

3.7.3.2 NAA11 Power Amplifier Modules: The NAA11 power amplifier (PA) modules are packed in one wooden crate. The crate contains 24 modules and is 51 cm (20 inches) x 91 cm (36 inches) x 36 cm (14 inches). Shipping weight for the crate is approximately 36.3 kg (80 pounds).

3.7.3.3 Remaining Modules and Ancillary Parts: The remaining plug-in modules and an ancillary parts kit are packed in one wooden crate. The crate's dimensions are 56 cm (22 inches) x 71 cm (28 inches) x 36 cm (14 inches) and its shipping weight is approximately 28 kg (62 pounds).

INSTALLATION PROCEDURES

3.8 The following procedures must be performed while installing the transmitter:

3.8.1 AC POWER SUPPLY INSTALLATION: Position the transmitter cabinet in its final position and install the ac power supply transformer as follows:

(a) Remove the lower panel from the front of the transmitter by removing six screws and six plastic cup washers.

(b) Remove the lower ventilation panel from the rear of the transmitter by removing six screws and six plastic cup washers.

(c) Position ac power transformer cabinet within six inches of front of the transmitter with the rear of the power transformer cabinet facing the transmitter cabinet.

(d) Using two four-foot lengths of 2" x 4", one on each side of the power transformer cabinet and passing through the transmitter cabinet, lift the power transformer cabinet into the transmitter cabinet.

(e) Place power transformer cabinet on the mounting bars over the four mounting holes.

(f) Secure power transformer cabinet to the mounting bars using the four 3/8-16 x 1 bolts; four plain and four split washers supplied in the ancillary parts kit.

(g) Gain access to interior of ac power transformer cabinet by removing its front panel.

(h) Determine the mean RMS voltage level between phases of the ac input power source.

(i) Refer to table 3-1 and determine which primary taps of the input power transformer should be interconnected for the mean RMS voltage of the input ac power source determined in step (h).

(j) Connect the wires from H1, H2 and H3 of the input power transformer, to the primary winding taps identified in step (i).

(k) Locate the three 10 AWG white wires originating from circuit breaker CB1. Route these wires through the upper left-hand knockout hole in the power transformer cabinet and connect to the appropriate terminals of power transformer T1 as follows:

CB1-A2	to	T1-H1
CB1-B2	to	T1-H2
CB1-C2	to	T1-H3

(l) Locate the three bundles of 14 AWG wires and two additional 18 AWG wires tied up in the lower part of the transmitter. Route these wire through the lower left-hand knockout hole in the power transformer cabinet and connect as follows:

Wires #144, 145, 150, 151, 156, 157, 162 and 163 to T1-X1.
Wires #146, 147, 152, 153, 158, 159, 164 and 165 to T1-X2.
Wires #148, 149, 154, 155, 160, 161, 166 and 167 to T1-X3.
Wire #174 to T1-Y1.

(m) Locate wire #136, route it through the upper right-hand knockout hole in the power transformer cabinet and connect to T1-Y2.

(n) Locate 10-AWG white wire originating from ground lug at bottom rear of transmitter cabinet. Route this cable through the most convenient knockout hole in the power transformer cabinet and connect to the ground lug of the power transformer.

(o) Visually inspect the interior and exterior of the power transformer cabinet for obvious damage, including damaged wiring and/or loose connections.

(p) Install the power transformer cabinet's front panel removed in step (g).

(q) Install and secure the front lower panel using six screws and six plastic cup washers removed in (a).

3.8.2 TRANSMITTER CABINET INSTALLATION: Finalize transmitter cabinet installation as follows:

3.8.2.1 Disassembly Required: Disassemble the transmitter cabinet to the extent necessary to gain access to its interior:

(a) Remove the upper panel from the rear of the transmitter by removing four screws and four plastic cup washers.

(b) Remove the upper fan panel from the rear of the transmitter by removing four screws and four plastic cup washers and then disconnecting fan power plug.

(c) Remove the lower fan panel from the rear of the transmitter by removing four screws and four plastic cup washers and then disconnecting fan power plug.

(d) Remove the four screws and four plastic cup washers securing the control/monitor panel and extend the top of the panel on its retaining chains while pivoting the bottom of the panel on the cabinet cross member.

(e) Remove the rear cover from the filter assembly (access from the rear of the cabinet) by removing 10 screws and 10 washers.

(f) Remove the front cover from the filter assembly (immediately behind the control/monitor panel) by removing 10 screws and 10 washers.

(g) Remove the front panel of the driver unit by removing four screws and four plastic cup washers.

(h) Remove the plexiglass panel that directs the air circulation over the power amplifiers by pushing and turning the four locking knobs.

(i) Remove the cover from the top of the transmitter by removing four screws and four washers.

(j) Remove the protective plastic cover from terminal board TB1.

(k) Remove the shorting straps from terminals of OUTPUT POWER meter 1A1M1, MODULATOR INPUT CURRENT meter 1A1M2 and TEST meter 1A1M3.

3.8.2.2 Filter Inspection: Inspect the filter for shipping damage as follows:

(a) Visually inspect the interior of the filter assembly for loose or damaged parts, paying particular attention to the ceramic pillars.

(b) Install the front cover of the filter assembly (immediately behind the control/monitor panel) using 10 screws and 10 washers removed in step (f) of paragraph 3.8.2.1.

(c) Install the rear cover of the filter assembly (rear of the cabinet) using 10 screws and 10 washers removed in step (e) of paragraph 3.8.2.1.

3.8.2.3 Ac Power Connections: Connect the interconnecting wiring between the transmitter and ac power service entrance as follows:

(a) Turn off or verify the input ac power is turned off at the service entrance.

(b) Insert the input ac power wiring through one of the cable entry holes on the lower rear panel of the transmitter cabinet, ensuring it passes through a cable clamp.

(c) Connect the input ac power wiring to the appropriate terminals of terminal board TB1 as tabulated below. (Refer to figure FO-13).

Line 1	-	directly to terminal 1 of terminal board TB1.
Line 2	-	directly to terminal 2 of terminal board TB1.
Line 3	-	directly to terminal 3 of terminal board TB1.
Neutral	-	directly to terminal 4 of terminal board TB1.
Ground	-	directly to ground lug at bottom, rear of transmitter cabinet.

(d) Install the protective plastic cover on terminal board TB1 removed in step (j) of paragraph 3.8.2.1.

3.8.2.4 External Control/Monitor Electrical Connections: Connect the wiring from the external control and monitoring circuits as follows (see figure 3-1):

NOTE

The forward power, reflected power, carrier frequency and external rf drive (when used) wires utilize coaxial cables and connect to BNC connectors on the rear of driver unit 4A1. The rf output sample from the modulation monitor probe utilizes a coaxial cable that connects to a terminal board on modulation monitor probe 1A2A5. The remaining wires connect to terminal board 4A1TB1 and 4A1TB2 on the rear of driver unit 4A1.

(a) Route the external control/monitor wires through one of the cable entry holes (see figure FO-14) in the lower, rear panel of the transmitter, ensuring they pass through a cable clamp.

(b) Using figure 3-1 as a guide to determine their final destinations, cut the wires to the required length.

(c) Remove approximately 0.5 inches of insulation from each of the wires that terminate at 4A1TB1 and 4A1TB2 and install a #6 screw, open terminal lug (HV09 in the ancillary parts kit) on the bared inductor.

NOTE

If the audio input provides 125% positive/100% negative modulation, the positive input must be connected to 4A1TB1-16 and the negative connected to 4A1TB1-18.

The shield of the audio input cable is normally grounded at one end only, to avoid ground loops. Select the most satisfactory connection.

(d) Connect the wires that terminate at 4A1TB1 and 4A1TB2 to their appropriate terminals (see figure 3-1).

(e) Route the rf output sample coaxial cable, from the station modulation monitor, to the top, rear of the cabinet and connect its center conductor to TB1-2 of modulation monitor probe 1A2A5 and its shield to TB1-1 (refer to figure FO-17).

(f) Install a BNC connector (not provided) on the end of each remaining coaxial cable.

(g) Connect coaxial cables to the appropriate BNC mating connectors (see figure 3-1).

(h) Install and secure the rear, upper panel using four screws and four plastic cup washers removed in step (a) of paragraph 3.8.2.1.

(i) Install and secure the rear, lower ventilation panel using six screws and six plastic cup washers removed in step (b) of paragraph 3.8.1.

(j) Tighten cable clamps on the rear, lower panel ensuring wiring is not cut or pinched.

(k) Return the control/monitor panel to its normal position, ensuring wiring or retaining chains are not pinched, and secure using the four screws and four plastic cup washers removed in step (d) of paragraph 3.8.2.1.

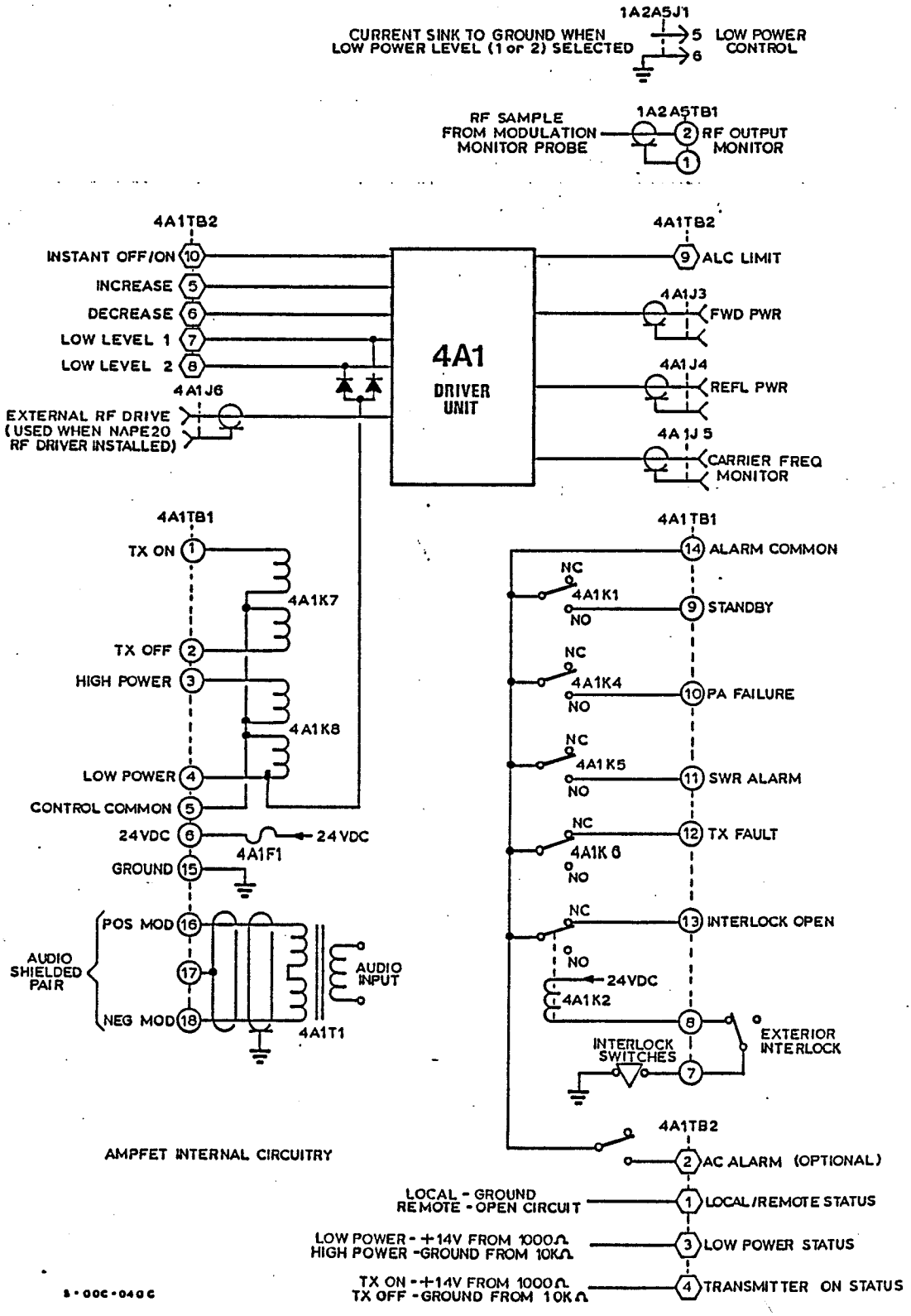


Figure 3-1 External Input/Output Interface

3.8.2.5 Rf Output Cable Connection: Route the rf output coaxial cable to the top, rear of the cabinet and connect its center conductor to spark gap assembly 1A2E1 and its shield to the ground terminal as depicted in figure FO-17.

NOTE

If an rf output coaxial connector has been installed, as the result of a specific customer request, connect the rf output coaxial cable directly to the rf output coaxial connector on the cabinet's top cover.

3.8.2.6 Lightning/Safety Ground Connection: Connect a continuous, heavy gauge copper strap or one-inch copper braid between the transmitter's safety ground stud and the station lightning/safety ground system. The lightning/safety ground may enter the bottom of the cabinet, near the control/monitor cable entry hole, through any opening that is convenient.

NOTE

The transmitter's safety ground stud is a 0.25 inch bolt; located in the bottom, rear, right-hand corner (when viewed from the rear) of the cabinet; that has a braided strap connected between it and the transmitter's main, ground buss.

3.8.3 TRANSMITTER MODULE INSTALLATION: Install the plug-in modules in the transmitter cabinet as follows:

NOTE

It is assumed the transmitter's plug-in modules have been pretested and are serviceable in the following procedures. New modules from the factory have been calibrated and burned-in. All other modules must be calibrated/tested in accordance with the instructions in section 5 or instructions provided in the appropriate service instruction manuals.

(a) Visually inspect rows 2 and 3; power amplifier mounting assemblies, for loose or damaged parts paying particular attention to the mating connectors.

(b) Install twelve NAA11 power amplifier modules (2A1, 2A2, 2A3, 2A4, 2A5, 2A6, 2A7, 2A8, 2A9, 2A10, 2A11 and 2A12) in row 2 as depicted in figure FO-23.

(c) Install twelve NAA11 power amplifier modules (3A1, 3A2, 3A3, 3A4, 3A5, 3A6, 3A7, 3A8, 3A9, 3A10, 3A11 and 3A12) in row 3 as depicted in figure FO-23.

(d) Visually inspect row 4, driver unit assembly, for loose or damaged parts paying particular attention to the mating connectors.

(e) In monaural transmitters, install an two NAPE12 rf driver modules (4A1A1 and 4A1A2) in row 4 as depicted in figure FO-24.

(f) In stereo transmitters, install an NAPE20 stereo rf driver module as 4A1A1 and an NAPE12 rf driver module as 4A1A2 in row 4 as depicted in figure FO-24.

(g) Install one NAPC7 monitor module (4A1A3) in row 4 as depicted in figure FO-24.

(h) Install one NAPE27/1 modulator driver module (4A1A4) in row 4 and interconnect to NAPC18 as depicted in figure FO-24.

(i) Install one NAPE19/1 modulator driver module (4A1A5) in row 4 as depicted in figure FO-24.

(j) Visually inspect rows 5 and 6; modulator mounting assemblies, for loose or damaged parts paying particular attention to the mating connectors.

(k) Install two NASM1 modulator modules (5A1/5A2) in row 5 as depicted in figure FO-27.

(l) Install two NASM1 modulator modules (6A1/6A2) in row 6 as depicted in figure FO-27.

(m) Visually inspect row 7, low voltage power supply mounting assembly, for loose or damaged parts paying particular attention to the mating connectors.

(n) Install four NAS13 rectifier/regulator modules (7A1, 7A2, 7A3 and 7A4) in row 7 as depicted in figure FO-28.

(o) Install two NAS14 low voltage power supply modules (7A5 and 7A6) in row 7 as depicted in figure FO-28.

(p) Visually inspect the rear of the transmitter for obvious damage paying particular attention to the mating connectors for power amplifier modules installed in rows 2 and 3, modulator modules installed in rows 5 and 6 and rectifier/regulator modules installed in row 7. Ensure large ground pins have not been pushed out of their sockets by the force of inserting the mating connector.

NOTE

The ground pins (center row of connector) in module mating connectors are removable and may be released by the force of installing a module. Reinsert any pin that has been released by pushing on rear of pin, using a pair of pliers, taking care not to damage wiring or rear of connector.

(q) Install and secure the upper fan panel using six screws and six plastic cup washers removed in step (b) of paragraph 3.8.2.1. Ensure fan connector is properly connected prior to securing.

(r) Install and secure the lower fan panel using four screws and four plastic cup washers removed in step (c) of paragraph 3.8.2.1. Ensure fan connector is properly connected prior to securing.

(s) Install and secure the driver unit's front panel using four screws and four plastic cup washers removed in step (g) of paragraph 3.8.2.1.

(t) Install and secure the plexiglass panel that directs the air circulation over the power amplifiers using four self-contained locking knobs.

3.8.4 SPARK GAP SETTING: Set the adjustable spark gap as follows:

NOTE:
The spark gap setting is dependent on the rf output power and the altitude of the transmitter site. The spark gap is preset at the factory if the station's power level and site altitude are known.

(a) Refer to figure 3-2 to determine the spark gap for the altitude of the transmitter site.

(b) Measure the distance between spark gap ball and spark gap plate (see figure FO-17).

(c) The spark gap measurement in step (b) should be distance determined an step (a).

(d) If necessary, loosen locking nut on spark gap, adjust position of spark gap ball and then tighten locking nut.

(e) Install and secure the top cover of the transmitter using four screws and four washers removed in step (i) of paragraph 3.8.2.1.

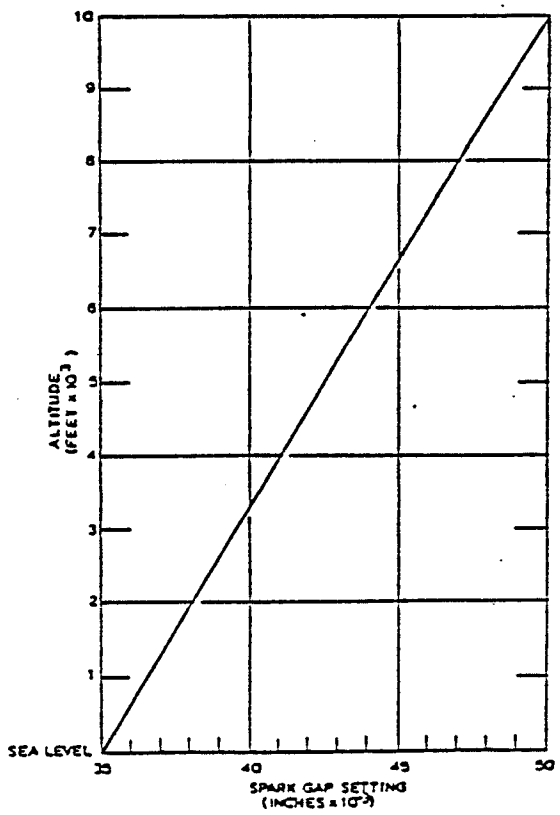


Figure 3-2
Determination of Spark Gap Setting

3.8.5 SELECTING MODULATION MONITOR PROBE'S LOW POWER LINKS: If used, determine which links must be connected, to produce the external low power control as follows (refer to paragraph 3.4.11 for a description of the external low power control circuits and to figure FO-22 to locate the link terminals):

(a) If a low power control output is required when low level 1 is selected, connect a link between terminal 4 (LL1) and terminal 3 (LP) on modulation monitor probe 1A2A5.

(b) If a low power control output is required when low level 2 is selected, connect a link between terminal 2 (LL2) and terminal 3 (LP) on modulation monitor probe 1A2A5.

(c) If a low power control output is required when low level 1 and when low level 2 is selected, connect a link between terminal 4 (LL1), terminal 3 (LP) and terminal 2 (LL2) on modulation monitor probe 1A2A5.

3.8.6 SELECTION OF MODULATION MONITOR PROBE AUTOTRANSFORMER TAPS: Determine the tap selections of autotransformer 1A2A5T1 that will provide the same rms voltage, for each preset rf output power level, at the amplitude required by the station modulation monitor to be used, as follows: For example of calculations, refer to example shown after procedural steps at the end of this paragraph.

(a) Determine the transmitter's assigned rf carrier output for high, low 1 and low 2 operating levels.

(b) Determine input voltage required by station modulation monitor to be used, in rms volts.

(c) Calculate the rms voltage of the rf input being applied to modulation monitor probe 1A2A5's autotransformer (T1), using the following formula:

$$V_{in} = \sqrt{P \times R_L}$$

where: P = rf output level in Watts [determined in step (a)]

R_L = rf output terminating impedance (50 ohms)

V_{in} = rf input voltage (rms volts)

(d) Calculate the reduction, in dB, to produce the rms voltage required by the station modulation monitor to be used, using the following formula:

$$X\ dB = 20 \log \left(\frac{V_{out}}{V_{in}} \right)$$

where: V_{out} = required output voltage of modulation monitor probe in rms volts

V_{in} = rf input voltage to modulation monitor probe in rms volts

X dB = reduction required in dB

(e) Calculate and record the dB reduction for the assigned high level rf output as specified in steps (c) and (d).

(f) Enter table 3-2 with the dB reduction recorded in step (e) and determine which terminal of modulation monitor probe 1A2A5's terminal board (TB1) will provide the reduction required during high level operation.

(g) Connect a jumper wire between 1A2A5TB1-3 (HIGH) and the terminal of 1A2A5TB1 identified in step (e).

(h) Calculate and record the dB reduction for the assigned low level 1 rf output as specified in steps (c) and (d).

(i) Enter table 3-2 with the dB reduction recorded in step (h) and determine which terminal of modulation monitor probe 1A2A5's terminal board (TB1) will provide the reduction required during low 1 level operation.

(j) Connect a jumper wire between 1A2A5TB1-7 (LOW 1) and the terminal of 1A2A5TB1 identified in step (i).

Table 3-2 Autotransformer 1A2A5T1 Tap Selection

CALCULATED POWER REDUCTION (dB)	TERMINAL OF 1A2A5T1
-46	4
-41	5
-37	6
-35	8
-33	9
-31.5	10
-30.5	11

(k) Calculate and record the dB reduction for the assigned low level 2 rf output as specified in steps (c) and (d).

(l) Enter table 3-2 with the dB reduction recorded in step (k) and determine which terminal of modulation monitor probe 1A2A5's terminal board (TB1) will provide the reduction required during low 2 level operation.

(m) Connect a jumper wire between 1A2A5TB1-7 (LOW 1) and the terminal of 1A2A5TB1 identified in step (l).

EXAMPLE OF TAP SELECTION FOR TYPICAL TRANSMITTER

Assigned high level rf output = 5 000 Watts
Assigned low 1 level rf output = 2 500 Watts
Assigned low 2 level rf output = 500 Watts
Voltage required by station modulation monitor = 5.0 volts rms.

High Level Operation step (e) $\sqrt{5{,}000 \times 50} = 500$ volts rms

$$20 \log \left(\frac{5.0}{500}\right) = -40 \text{ dB}$$

step (f) Connect 1A2A5TB1-1 (HIGH) to 1A2A5TB1-6

Low Level Operation 1 step (h) $\sqrt{2{,}500 \times 50} = 353$ volts rms

$$20 \log \left(\frac{5.0}{353}\right) = -37 \text{ dB}$$

step (i) Connect 1A2A5TB1-7 (LOW) to 1A2A5TB1-8

Low Level 2 Operation step (k) $\sqrt{500 \times 50} = 158$ volts rms

$$20 \log \left(\frac{5.0}{158}\right) = -30 \text{ dB}$$

step (l) Connect 1A2A5TB1-7 (LOW) to 1A2A5TB1-11

INITIAL START-UP

3.9 The following information contains step-by-step start-up procedures for the subject transmitter. It is recommended the instructions be followed sequentially, as presented.

NOTE

The transmitter was precisely calibrated at the factory and subjected to a minimum burn-in period of seven days. There should not be any need for adjustment of calibration controls at initial turn-on. If the following tests reveal that tuning or calibration is not optimum, perform the appropriate calibration procedure as detailed in section 5 prior to proceeding with additional tests.

3.9.1 PRECAUTIONS TO BE OBSERVED: The AMPFET 5 transmitter contains many solid state devices that may be damaged if they are subjected to excessive heat or high voltage transients. Every effort must be taken to ensure the circuits are not overdriven and they are not disconnected from their loads while turned on. The precautionary information included in the operating instructions of section four should be read and fully understood prior to applying power and must be observed during operation.

3.9.2 PRESTART-UP CHECKS: Prior to applying power to the transmitter, observe the following:

(a) Visually inspect the transmitter and it's power supply for obvious defects such as; damaged insulation, broken wires, wrong connections and/or loose connections.

(b) Verify all assemblies/modules are installed and mating connectors are fully engaged.

(c) Verify the external control and monitoring wiring is connected as detailed in paragraph 3.8.2.4.

(d) Verify all panels are installed and securely tightened, paying particular attention to the front and rear panels on output filter assembly 1A2.

(e) Verify the fan panels are installed and their electrical connectors are connected.

(f) Verify the transmitter rf output is terminated into a 50 ohm resistive dummy load that is rated at a minimum of 7500 watts.

(g) Verify the voltage of the input power source is within 5% of the voltage used as the mean RMS voltage when selecting the primary winding taps of the ac power supply's power transformer (refer to paragraph 3.8.1).

(h) Verify the power source is rated at a minimum of 10,000 volt amperes.

3.9.3 INITIAL TURN-ON: Apply power and turn-on the transmitter as follows:

(a) Verify all switches are set as tabulated for Initial Setting in table 4-1.

(b) Set or verify the modulating audio input signal is set to zero (turned off).

(c) Turn on input ac power source at the service entrance.

(d) Turn on High Power circuit breaker CB1 by placing its toggle in the up position.

(e) Set Control circuit breaker CB2 to its ON position.

(f) Low voltage power supply lamps 7A5DS1 and 7A6DS1, and POWER READY lamp 1A1DS1 shall turn on; all other lamps shall be off.

(g) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(h) POWER ON lamp 1A1DS3 shall turn on. No alarm lamps shall turn on.

(i) Set or ensure the transmitter is set in its high power mode of operation by setting O/P LEVEL switch 4A1S1 to its HIGH position.

(j) LOW O/P LEVEL lamp 4A1DS1 shall be off.

3.9.4 LOW VOLTAGE CHECKS: Verify the low voltage power supplies are functioning normally as follows:

(a) Connect a dc voltmeter between TP1(+) of power supply 7A5 and the ground connection on the panel to the right of ALC/power trim assembly 4A1A9.

(b) Voltmeter indication shall be between 22.0 and 26.0 volts dc.

(c) Connect a dc voltmeter between TP2(+) of power supply 7A5 and the ground connection on the panel to the right of ALC/power trim assembly 4A1A9.

(d) Voltmeter indication shall be between 14.5 and 15.5 volts dc.

(e) Connect a dc voltmeter between TP1(+) of power supply 7A6 and the ground connection on the panel to the right of ALC/power trim assembly 4A1A9.

(f) Voltmeter indication shall be between 22.0 and 26.0 volts dc.

(g) Connect a dc voltmeter between TP2(+) of power supply 7A6 and the ground connection on the panel to the right of ALC/power trim assembly 4A1A9.

(h) Voltmeter indication shall be between 14.5 and 15.5 volts dc.

3.9.5 MODULATOR RAMP CHECK: Check the modulator ramp prior to enabling any of the power blocks as follows:

(a) Connect an oscilloscope between TP1 of 'main' modulator driver 4A1A4 and the ground connection on the panel to the right of ALC/power trim assembly 4A1A9.

(b) Oscilloscope indication should be a sawtooth waveform that is approximately 3.0 volts peak-to-peak at a frequency of 70 kHz. The highest excursion of the waveform should be approximately 7.0 volts above ground.

(c) Connect an oscilloscope between TP2 of 'main' modulator driver 4A1A4 and the ground connection on the panel to the right of ALC/power trim assembly 4A1A9.

(d) Oscilloscope indication should be a dc control reference line that is not more than 1.5 1.25 volts below the peak level measured in step (b).

(e) Adjust 'main' modulator driver 4A1A4's HIGH-CARR LEVEL potentiometer (R16) for a dc control reference voltage trace on the oscilloscope that is 1.0 volts below the sawtooth waveform peak measured in step (b) (this is the dc control reference voltage that will normally result in an rf output of approximately 2.5 kilowatts).

(f) Disconnect the NAPC18/NAPE27 interconnecting cable from connector J1 of 'main' modulator driver 4A1A4 and then remove the NAPE27/1 modulator driver module from position 4A1A4.

(g) Remove NAPE19/1 modulator driver module from position 4A1A5 and install it in the 'main' modulator driver module's position (4A1A4).

NOTE

It is necessary to test both modulator drivers in position 4A1A4 at this stage since the 'main'/'standby' changeover function is not enabled until at least one rectifier/regulator is turned on.

(h) Repeat steps (a) thru (e) for the modulator driver now installed in position 4A1A4.

(i) Remove NAPE19/1 modulator driver module from position 4A1A4 and install it in the 'standby' modulator driver module's position (4A1A5).

(j) Install NAPE27/1 modulator driver previously tested/adjusted, as detailed in steps (a) thru (e), in the 'main' modulator driver module's position (4A1A4) and then connect NAPC18/NAPE27 interconnecting cable to J1 of 'main' modulator driver 4A1A4.

3.9.6 ENABLING POWER BLOCKS: Enable the power blocks' sequentially and verify each one is operating satisfactorily before proceeding to the next as follows:

CAUTION

When all four power blocks are turned on and the modulator dc control reference voltage has been preset as detailed in paragraph 3.9.5, the high level rf output should be approximately 2.5 kilowatts. No further adjustment of the dc control reference level should be made until all power blocks are enabled. Monitor the modulator input current of all enabled power blocks each time an additional block is turned on. The modulator input current for each power block shall be less than 12.0 amperes and the readings shall be within 10 percent of one another.

NOTE

If the phase-to-phase voltage of the ac power source is low, the indicator lamp of any or all rectifier/regulators may not turn on or may turn off when additional power blocks are enabled.

3.9.6.1 Enabling Power Block 'A': Enable power block 'A' and verify it is operating satisfactorily as follows:

(a) Set OUTPUT POWER switch 1A1S3 to FWD - HIGH.

(b) Set MODULATOR INPUT CURRENT switch 1A1S4 to '1'.

(c) Set TEST switch 1A1S5 to MODULATOR I/P VOLTS.

(d) Set rectifier/regulator 7A1's on/off switch (S1) to on (toggle up).

(e) Modulator 5A1's 'B-' lamp (DS1) shall turn on slowly and shall be at full brilliance in a nominal 10 seconds.

(f) Rectifier/regulator 7A1's indicator lamp (DS1) should turn on, indicating the -72 volt output is being regulated.

(g) RF DRIVE lamp 4A1DS1 shall turn on, indicating the rf carrier is being generated by the 'main' rf driver and it is being applied to the power amplifiers.

(h) Modulator 5A1's PA DRIVE lamps, 'A' (DS2), 'B' (DS3) and 'C' (DS4) shall not turn on.

(i) All other alarm lamps shall remain off.

(j) OUTPUT POWER meter 1A1M1 shall indicate less than 500 watts.

(k) MODULATOR INPUT CURRENT meter 1A1M2 shall indicate less than 5.0 amperes.

(l) TEST meter 1A1M3 indication shall be between -71.0 and -72.0 volts dc.

3.9.6.2 Enabling Power Block 'B': Enable power block 'B' and verify it is operating satisfactorily as follows:

(a) Verify OUTPUT POWER switch 1A1S3 is set to FWD - HIGH.

(b) Verify TEST switch 1A1S5 is set to MODULATOR I/P VOLTS.

(c) Set MODULATOR INPUT CURRENT switch 1A1S4 to '2'.

(d) Set rectifier/regulator 7A2's on/off switch (S1) to on (toggle up).

(e) Modulator 5A2's 'B-' lamp (DS1) shall turn on slowly and shall be at full brilliance in a nominal 10 seconds.

(f) Rectifier/regulator 7A2's indicator lamp (DS1) should turn on, indicating the -72 volt output is being regulated.

(g) Modulator 5A2's PA DRIVE lamps, 'A' (DS2), 'B' (DS3) and 'C' (DS4) shall not turn on.

(h) All other alarm lamps shall remain off.

(i) OUTPUT POWER meter 1A1M1 shall indicate less than 700 watts.

(j) MODULATOR INPUT CURRENT meter 1A1M2 shall indicate less than 7.0 amperes.

(k) Sequentially set MODULATOR INPUT CURRENT switch 1A1S4 to positions '1' thru '2' and simultaneously observe indications on MODULATOR INPUT CURRENT meter 1A1M2 and TEST meter 1A1M3.

(l) MODULATOR INPUT CURRENT meter 1A1M2 indication, for each switch setting of MODULATOR INPUT CURRENT switch 1A1S4, should be less than 7.0 amperes and shall be within 10% of any other indication.

(m) TEST meter 1A1M3 indication, for each switch setting of MODULATOR INPUT CURRENT switch 1A1S4, shall be between -71.0 and -72.0 volts dc.

3.9.6.3 Enabling Power Block 'C': Enable power block 'C' and verify it is operating satisfactorily as follows:

(a) Verify OUTPUT POWER switch 1A1S3 is set to FWD - HIGH.

(b) Verify TEST switch 1A1S5 is set to MODULATOR I/P VOLTS.

(c) Set MODULATOR INPUT CURRENT switch 1A1S4 to '3'.

(d) Set rectifier/regulator 7A3's on/off switch (S1) to on (toggle up).

(e) Modulator 6A1's 'B-' lamp (DS1) shall turn on slowly, but shall be at full brilliance in a nominal 10 seconds.

(f) Rectifier/regulator 7A3's indicator lamp (DS1) should turn on, indicating the -72 volt output is being regulated.

(g) Modulator 6A1's PA DRIVE lamps, 'A' (DS2), 'B' (DS3) and 'C' (DS4) shall not turn on.

(h) All other alarm lamps shall remain off.

(i) OUTPUT POWER meter 1A1M1 shall indicate less than 1500 watts.

(j) MODULATOR INPUT CURRENT meter 1A1M2 shall indicate less than 9.0 amperes.

(k) Sequentially set MODULATOR INPUT CURRENT switch 1A1S4 to positions '1' thru '3' and simultaneously observe indications on MODULATOR INPUT CURRENT meter 1A1M2 and TEST meter 1A1M3.

(l) MODULATOR INPUT CURRENT meter 1A1M2 indication, for each switch setting of MODULATOR INPUT CURRENT switch 1A1S4, should be less than 9.0 amperes and shall be within 10% of any other indication.

(m) TEST meter 1A1M3 indication, for each switch setting of MODULATOR INPUT CURRENT switch 1A1S4, shall be between -71.0 and -72.0 volts dc.

3.9.6.4 Enabling Power Block 'D': Enable power block 'D' and verify it is operating satisfactorily as follows:

(a) Verify OUTPUT POWER switch 1A1S3 is set to FWD - HIGH.

(b) Verify TEST switch 1A1S5 is set to MODULATOR I/P VOLTS.

(c) Set MODULATOR INPUT CURRENT switch 1A1S4 to '4'.

(d) Set rectifier/regulator 7A4's on/off switch (S1) to on (toggle up).

(e) Modulator 6A2's 'B-' lamp (DS1) shall turn on slowly, but shall be at full brilliance in a nominal 10 seconds.

(f) Rectifier/regulator 7A4's indicator lamp (DS1) should turn on, indicating the -72 volt output is being regulated.

(g) Modulator 6A2's PA DRIVE lamps, 'A' (DS2), 'B' (DS3) and 'C' (DS4) shall not turn on.

(h) All other alarm lamps shall remain off.

(i) OUTPUT POWER meter 1A1M1 shall indicate less than 2700 watts.

(j) MODULATOR INPUT CURRENT meter 1A1M2 shall indicate less than 12 amperes.

(k) Sequentially set MODULATOR INPUT CURRENT switch 1A1S4 to positions '1' thru '4' and simultaneously observe indications on MODULATOR INPUT CURRENT meter 1A1M2 and TEST meter 1A1M3.

(l) MODULATOR INPUT CURRENT meter 1A1M2 indication, for each switch setting of MODULATOR INPUT CURRENT switch 1A1S4, should be less than 12 amperes and shall be within 10% of any other indication.

(m) TEST meter 1A1M3 indication, for each switch setting of MODULATOR INPUT CURRENT switch 1A1S4, shall be between -71.0 and -72.0 volts dc.

3.9.7 CARRIER FREQUENCY CHECK: Check the frequency of the rf carrier oscillators using a frequency counter as follows:

(a) Connect a frequency counter between TP1 of 'main' rf driver 4A1A1 and the ground connection on the panel to the right of ALC/power trim assembly 4A1A9.

(b) Measure and record the frequency indication on the frequency meter.

(c) Measurement obtained in step (b) should be the carrier frequency of the transmitter, plus/minus 5.0 Hz.

(d) If necessary (NAPE12 only), adjust FREQ variable capacitor C4 of 'main' rf driver 4A1A1 until the precise carrier frequency is obtained.

(e) Disengage 'main' rf driver 4A1A1 from its mating connector.

(f) RF DRIVE ALARM lamp 1A1DS6 shall turn on to indicate 'main' rf driver 4A1A1 has failed and 'standby' rf driver 4A1A2 is enabled.

(g) Connect a frequency counter between TP1 of 'standby' rf driver 4A1A2 and the ground connection on the panel to the right of ALC/power trim assembly 4A1A9.

(h) Measure and record the frequency indication on the frequency meter.

(i) Measurement obtained in step (h) should be the carrier frequency of the transmitter, plus/minus 5.0 Hz.

(j) If necessary (NAPE 12 only), adjust FREQ variable capacitor C4 of 'standby' rf driver 4A1A2 until the precise carrier frequency is obtained.

(k) Install 'main' rf driver 4A1A1, ensuring it is fully engaged with its mating connector.

(l) Momentarily set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF and then return it to ON.

(m) RF DRIVE ALARM lamp 1A1DS6 shall turn off indicating rf driver 4A1A1 has been enabled as the 'main' rf drive.

3.9.8 RF OUTPUT CHECKS: Set the rf output to the preset levels and check rf output related indications as follows:

NOTE

There are three preset power levels available when an NAPE27/1 modulator driver is installed in the 'main' modulator driver position (4A1A4). There are only two preset power levels available when an NAPE19/1 modulator driver is installed in this position.

(a) Set or verify OUTPUT POWER switch 1A1S3 is set to FWD - HIGH.

(b) Adjust 'main' modulator driver 4A1A4's HIGH - CARR LEVEL potentiometer (R16) for an indication of 2.5 kilowatts on OUTPUT POWER meter 1A1M1.

(c) Set OUTPUT POWER switch 1A1S3 to REFL - LOW.

(d) OUTPUT POWER meter 1A1M1's reflected power indication shall be less than 50 watts.

(e) Set or verify TEST switch 1A1S5 is set to MODULATOR I/P VOLTS.

(f) Simultaneously observe and record MODULATOR INPUT CURRENT meter 1A1M2 and TEST meter 1A1M3 indications while sequentially setting MODULATOR INPUT CURRENT switch 1A1S4 to positions '1' thru '4'.

(g) Modulator input current readings recorded in step (f) should be approximately 11 amperes at each setting of MODULATOR INPUT CURRENT switch 1A1S4 and each reading shall be within 10% of any other reading.

(h) TEST meter 1A1M3 readings recorded in step (f) shall be between -71.0 and -72.0 volts dc at each setting of MODULATOR INPUT CURRENT switch 1A1S4.

(i) Set OUTPUT POWER switch 1A1S3 to FWD - HIGH.

(j) Adjust 'main' modulator driver 4A1A4's HIGH - CARR LEVEL potentiometer (R16) for the highest assigned rf carrier output power level (maximum of 5.5 kilowatts), as displayed on OUTPUT POWER meter 1A1M1. Record this output as the assigned 'high level' rf output.

(k) Set OUTPUT POWER switch 1A1S3 to REFL - LOW and record reflected power indication on OUTPUT POWER meter 1A1M1.

(l) Reflected power reading recorded in step (k) shall be less than 100 watts.

(m) Simultaneously observe and record MODULATOR INPUT CURRENT meter 1A1M2 and TEST meter 1A1M3 indications while sequentially setting MODULATOR INPUT CURRENT switch 1A1S4 to positions '1' thru '4'.

(n) All modulator input current readings recorded in step (m) shall be within 5% of any other reading.

(o) TEST meter 1A1M3 readings recorded in step (m) shall be between -71.0 and -72.0 volts dc at each setting of MODULATOR INPUT CURRENT switch 1A1S4.

(p) Plot the assigned 'high level' rf output reading recorded in step (j) and each of the modulator input current readings recorded in step (m) on the graph shown in figure 4-1. The intersection points must be below the 'Maximum - Carrier Only' line.

(q) Set the transmitter to its 'low level 1' mode of operation by setting Low Level Select switch 4A1A9S1 to LL1 and then setting O/P LEVEL switch 4A1S1 to LOW.

(r) LOW O/P LEVEL lamp 4A1DS1 shall turn on.

(s) Set or verify OUTPUT POWER switch 1A1S3 is set to FWD - HIGH.

(t) Adjust ALC/power trim assembly 4A1A9's O/P - LL1 potentiometer (R44) for an assigned rf power level, as displayed on OUTPUT POWER meter 1A1M1, that is less than the assigned 'high level' rf output recorded in step (j). Record this output as the assigned 'low level 1' rf output.

(u) Set the transmitter to its 'low level 2' mode of operation by setting Low Level Select switch 4A1A9S1 to LL2. (Verify O/P LEVEL switch 4A1S1 is set to LOW.)

(v) Adjust ALC/power trim assembly 4A1A9's O/P - LL2 potentiometer (R46) for an assigned rf power level, as displayed on OUTPUT POWER meter 1A1M1, that is less than the assigned 'high level' rf output recorded in step (j). Record this output as the assigned 'low level 2' rf output.

(w) Set the transmitter to its 'high level' mode of operation by setting O/P LEVEL switch 4A1S1 to HIGH.

(x) Disengage 'main' modulator driver 4A1A4 from its mating connector.

(y) MOD DRIVE ALARM lamp 1A1DS7 shall turn on to indicate 'main' modulation driver 4A1A4 has failed and 'standby' modulation driver 4A1A5 is enabled.

(z) Adjust 'standby' modulator driver 4A1A5's HIGH - CARR LEVEL potentiometer (R16) for the assigned 'high level' rf output [see step (j)], as displayed on OUTPUT POWER meter 1A1M1.

(aa) Set the transmitter to its low power mode of operation by setting O/P LEVEL switch 4A1S1 to its LOW position.

(ab) Adjust 'standby' modulator driver 4A1A5's LOW - CARR LEVEL potentiometer (R2) for one of the two assigned 'low level' rf outputs [see steps (t) and (v)], as displayed on OUTPUT POWER meter 1A1M1.

NOTE

There is only one preset low power setting available when standby modulator driver 4A1A5 is being used as the mod drive source. The user must decide which of the two preset low power levels is acceptable if the transmitter switches to standby when a power level other than the assigned 'high level' rf output is to be produced.

(ac) Set the transmitter to its high power mode of operation by setting O/P LEVEL switch 4A1S1 to its HIGH position.

(ad) Turn transmitter off by setting TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(ae) Install 'main' modulator driver 4A1A4, ensuring its mating connector is fully engaged.

(af) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(ag) MOD DRIVE ALARM lamp 1A1DS7 shall not turn on, indicating modulator driver 4A1A4 has been restored as the modulator drive source.

(ah) OUTPUT POWER meter 1A1M1's indication shall be the assigned 'high level' rf output (maximum of 5.5 kilowatts).

MINIMUM PERFORMANCE TESTS

3.10 Carry out the minimum performance tests detailed in paragraph 5.5.

SECTION 4
OPERATING INSTRUCTIONS

GENERAL

4.1 This section provides the information required to operate the AMPFET 5 AM broadcast transmitter. Normally, the transmitter will not be attended during use. The following instructions are primarily intended for persons involved in testing or maintenance of the equipment.

EMERGENCY SHUTDOWN PROCEDURE

4.2 There are no special precautions to be taken if an emergency shutdown is required. Switch off the transmitter by placing TRANSMITTER CONTROL - Master switch 1A1S1 on the control/monitor panel (figure FO-15) to its OFF position; or switch off circuit breaker CB1 on the ac power supply unit; or switch off the ac power source at the service entrance.

CONTROLS AND INDICATORS

4.3 The following paragraphs identify modules or major areas of the transmitter that contain controls and indicators and reference tables that identify illustrations that depict their location/markings and describe their purpose/function. The paragraphs and their referenced tables are keyed to the row/unit number that has been assigned as the prefix for the reference designation numbers. Controls and indicators that are not monitored or adjusted when installed in the transmitter are not included in this portion of the manual. Refer to the appropriate module service instruction manual for information regarding controls and indicators that are only monitored/adjusted during bench testing/servicing.

4.3.1 ROW 1 - NAC21/4 CONTROL/MONITOR PANEL CONTROLS AND INDICATORS: Table 4-2 references illustrations that depict the controls and indicators on the NAC21/4 control/monitor panel. The table is keyed to the reference numbers assigned to the controls and indicators and explains their function.

4.3.2 ROW 1 - HARMONIC FILTER ASSEMBLY CONTROLS AND INDICATORS: Table 4-3 references illustrations that depict the controls and indicators on the harmonic filter assembly. The table is keyed to the reference numbers assigned to the controls and indicators and explains their function.

4.3.3 ROW 2 AND 3 - POWER AMPLIFIER CONTROLS AND INDICATORS: Table 4-4 references an illustration that depicts the controls and indicators on the power amplifiers in rows 2 and 3. The table is keyed to the reference numbers assigned to the controls and indicators and explains their function.

4.3.4 ROW 4 - NAE39/1 DRIVER UNIT CONTROLS AND INDICATORS: Table 4-5 references illustrations that depict the controls and indicators on the NAE39/1 driver unit in row 4. The table is keyed to the reference numbers assigned to the controls and indicators and explains their function.

4.3.5 ROW 5 AND 6 - NASM1 MODULATOR UNIT CONTROLS AND INDICATORS: Table 4-6 references an illustration that depicts the controls and indicators on the NASM1 modulator units in rows 5 and 6. The table is keyed to the reference numbers assigned to the controls and indicators and explains their function.

4.3.6 ROW 7 - LOW VOLTAGE POWER SUPPLY CONTROLS AND INDICATORS: Table 4-7 references an illustration that depicts the controls and indicators on the NAS13 rectifier/regulators (-72 volts dc) and NAS14 low voltage power supplies (+15 and +24 volts dc) in row 7. The table is keyed to the reference numbers assigned to the controls and indicators and explains their functions.

4.3.7 ROW 8 - POWER SUPPLY CONTROLS AND INDICATORS: Table 4-8 references an illustration that depicts the controls and indicators on the power supply. The table is keyed to the reference numbers assigned to the controls and indicators and explains their function.

4.3.8 FAN PANEL CONTROLS AND INDICATORS: Table 4-9 references an illustration that depicts the controls and indicators on the fan panels. The table is keyed to the reference numbers assigned to the controls and indicators and explains their function.

PRESTART-UP CHECKS

4.4 Prior to applying input power to the transmitter, observe the following:

(a) Verify all assemblies/modules are installed and mating connectors are fully engaged.

(b) Verify the ac power supply and the external input/output wiring is connected as detailed in paragraphs 3.8.2.3 thru 3.8.2.6.

(c) Visually inspect the internal electrical wiring for defects such as; damaged insulation, broken wires, wrong connections and/or loose connections.

(d) Verify all panels are installed and securely tightened, paying particular attention to the front and rear panels on output filter assembly 1A2.

(e) Verify the fan panels are installed and their electrical connectors are connected.

(f) Verify the requirements of section 3 have been completed.

(g) Verify the transmitter rf output is terminated into a 50 ohm load - an antenna that is interfaced by an appropriate matching system for normal operation, or a 50 ohm resistive dummy that is rated at 7500 watts for calibration and testing procedures.

(h) Verify the appropriate primary winding taps of the ac power supply's power transformer have been selected to match the voltage of the input power source (refer to paragraph 3.6.1).

(i) Verify the power source has a minimum rating of 10,000 volt amperes.

TURNING ON TRANSMITTER

4.5 Turn on the transmitter as described in paragraph 3.7 for initial startup and after repairs that may have affected the calibration. At other times, set the switches to the positions tabulated for calibration setting in table 4-1 initially and then to the settings tabulated for operational setting.

Table 4-1 Preliminary Switch Settings

PANEL MARKING/ NOMENCLATURE USED IN TEXT	REF DES	INITIAL SETTING	CALIBRATION SETTING	OPERATING SETTING
TRANSMITTER CONTROL - Master	1A1S1	OFF	ON	ON
TRANSMITTER CONTROL - Source	1A1S2	LOCAL	LOCAL	REMOTE
OUTPUT POWER	1A1S3	OFF	FWD-HIGH	OFF
MODULATOR INPUT CURRENT	1A1S4	OFF	1	OFF
TEST	1A1S5	OFF	MODULATOR I/P VOLTS	OFF
O/P LEVEL	4A1S1	HIGH	HIGH	HIGH
Low Power Select	4A1A9S1	RMT	RMT	RMT
Level Control Source	4A1A9S2	ALC	ALC	As Required
Power Trim Control	4A1A9S3	PRESET	PRESET	ALC
Rectifier/Regulator on/off	7A1S1	Down (off)	Up (on)	Up (on)
Rectifier/Regulator on/off	7A2S1	Down (off)	Up (on)	Up (on)
Rectifier/Regulator on/off	7A3S1	Down (off)	Up (on)	Up (on)
Rectifier/Regulator on/off	7A4S1	Down (off)	Up (on)	Up (on)
High Power	CB1	Down (off)	Up (on)	Up (on)

RESETTING TRANSMITTER

4.6 Transmitters that have transferred to the standby configuration or that have 'shutdown' or that show an alarm condition may be reset by momentarily switching the transmitter 'off' and then 'on'. This action may be taken locally by using TRANSMITTER CONTROL - Master switch 1A1S1 or remotely by using the remote 'off' and remote 'on' controls. Transmitters that have been reset will always go to the 'main' configuration with no alarms and remain there until an alarm condition occurs.

OPERATING PRECAUTIONS

4.7 The AMPFET 5 transmitter contains many solid state devices that may be damaged if they are subjected to excessive heat or high voltage transients. Every effort must be taken to ensure the circuits are not overdriven and they are not disconnected from their loads while turned on. The following should be routinely observed.

4.7.1 The transmitter must transmit into a 50-ohm load (antenna or resistive dummy load). Do not permit the load to be open circuited, by switching or disconnection, when the transmitter is turned on. Turn off the transmitter prior to changing or removing the load. It is not recommended that the transmitter be turned on and operated into an open circuit.

4.7.2 The modulator input current of any power block, as indicated on MODULATOR INPUT CURRENT meter 1A1M2, must not exceed prescribed maximums. It is recommended that the modulator input current for all power blocks be routinely monitored whenever the carrier or modulation levels are changed. Figure 4-1 provides a graph that depicts the maximum modulator input current for the full rf carrier forward power output range; when there is no modulation, when the modulation source is normal station programming, and when the modulation source is a continuous sine wave from an audio signal generator. The one exception is when a power block is operating with one or more defective power amplifiers. Verify these maximums are not exceeded whenever a rectifier/regulator is turned on, when the high or low carrier level is varied, when the modulation level is varied and when the rf output loading changes.

4.7.3 Turn off the transmitter prior to removing or installing a power amplifier. Opening of the power amplifier's output circuit when rf current is flowing will cause arcing that may result in destruction of solid state devices and/or cause damage to the mating connectors.

4.7.4 The transmitter will not operate with any power amplifiers removed. If sufficient serviceable power amplifier modules are not available, the transmitter may be operated with a dummy PA module or a defective power amplifier(s) installed. If the transmitter must be operated with defective power amplifiers, ensure they are installed in pairs, in locations that share the same rf drive/PA fault detector circuit (2A1/2A2, 2A3/2A4, 2A5/2A6, etc.).

4.7.5 Do not increase the output to compensate for the loss of a power amplifier(s). Refer to table 6-2 for the maximum power that can be generated if one or more power amplifiers has failed. If operation must be maintained when more than one power amplifier has failed, reduce the power loss by observing the instructions in paragraph 4.7.4.

4.7.6 Do not remove a modulator if its associated rectifier/regulator is turned on (5A1/7A1, 5A2/7A2, 6A1/7A3, 6A2/7A4) or if its storage capacitors are not discharged to less than 10 volts as indicated on TEST meter 1A1M3. Opening of the modulator's output circuit when current is flowing will cause arcing that may result in destruction of solid state devices and/or cause damage to the mating connectors.

4.7.7 Do not remove a rectifier/regulator if it is turned on. Opening of the rectifier/regulator's output circuit when current is flowing will cause arcing that may result in destruction of solid state devices and/or cause damage to the mating connectors.

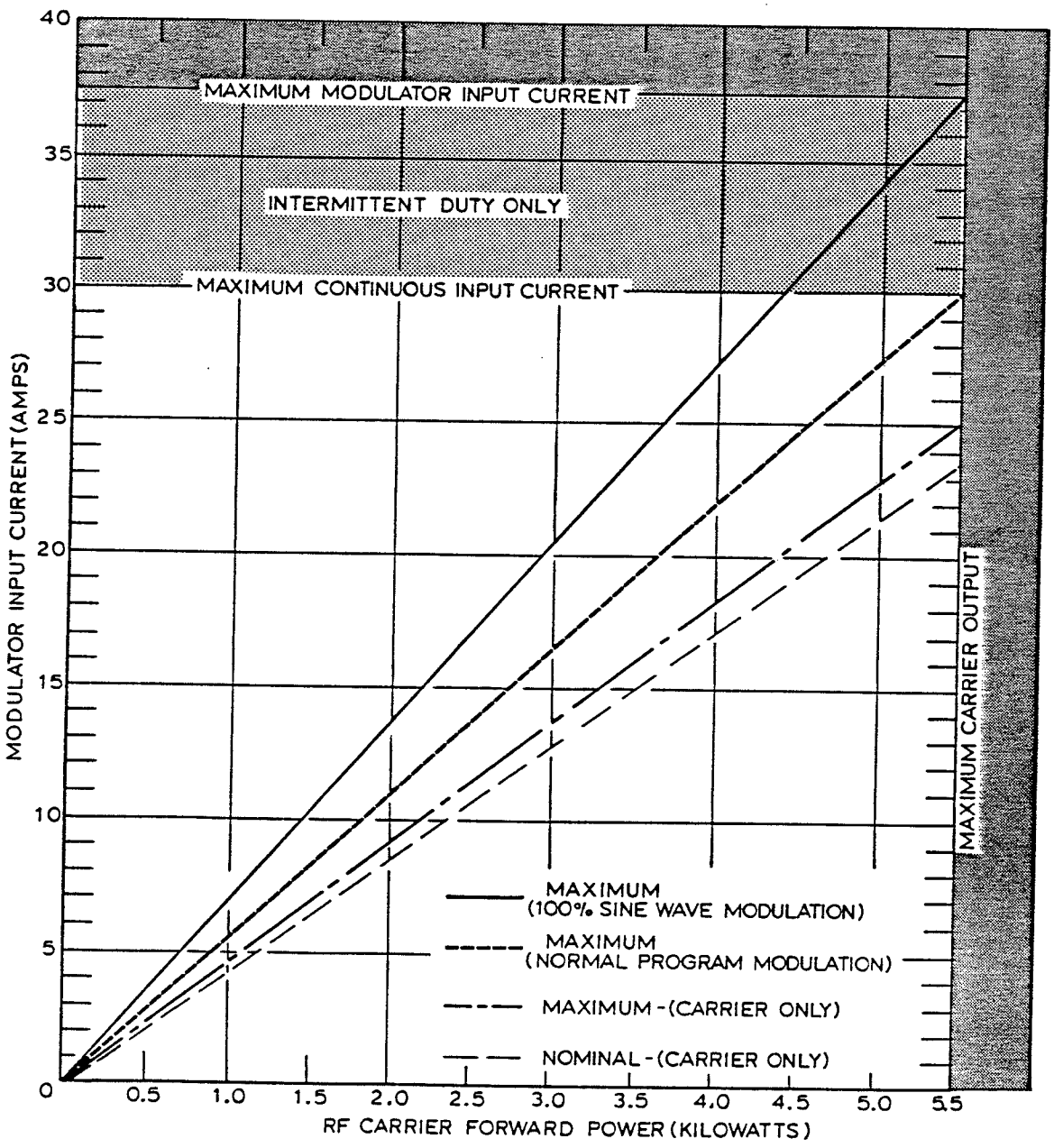


Figure 4-1 Modulator Input Current Versus RF Carrier Forward Power

MODULATION LEVELS

4.8 The modulation criteria is detailed in paragraph 5.5.9. The modulation level can be adjusted for 100% modulation when the input modulating audio is between +10 dBm and +12 dBm at 600 ohms. If any adjustment in the audio input level is required, refer to the procedures outlined in paragraph 5.5.9. Under normal modulation conditions, the modulator input currents should not exceed the levels indicated in figure 4-1. Actual level of modulator input currents will vary between the nominal level for carrier only, and the maximum level for normal modulation depending upon the degree of signal processing/compression used in the station's audio system, and the program material.

REMOTE OPERATION

4.9 The AMPFET 5 transmitter will normally be operated by remote control from the station studios. TRANSMITTER CONTROL - Source switch 1A1S2 must be set to REMOTE and TRANSMITTER CONTROL - Master switch 1A1S1 must be set to ON before the remote control circuits will have any influence on transmitter operation.

4.9.1 Remote control operating details must be established by the station engineering personnel, as details of the operating procedure will depend upon the remote control system used in conjunction with the transmitter. Refer to paragraph 3.4 for remote control and monitoring circuit criteria.

READING OUTPUT POWER METER 1A1M1

4.10 OUTPUT POWER meter 1A1M1 has two scales. The upper scale should be read when OUTPUT POWER switch 1A1S1 is set to HIGH (FWD or REFL). The lower scale should be read when OUTPUT POWER switch 1A1S1 is set to LOW (FWD or REFL). Always select the appropriate HIGH setting and verify the meter indication is less than the maximum reading on the lower scale (1750 watts) and then switch to the appropriate LOW setting, to obtain more accurate readings, when the parameter being measured is less than 1750 watts. Set OUTPUT POWER switch to OFF or HIGH after any LOW reading has been obtained.

4.10.1 Both scales of OUTPUT POWER meter 1A1M1 are square law scales. The resulting non-linearity makes it difficult to read below 500 watts on the upper scale or below 125 watts on the lower scale. Any indication that is less than sixty percent of the 125 watt scale mark is less than 50 watts.

Table 4-2 Row 1 - NAC21/4 Control/Monitor Panel Controls and Indicators

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
1A1DS1	FO-15	POWER STATUS - READY	Indicates ac voltage from the service entrance is being applied to the transmitter and the low voltage power supplies are operational when ON.
1A1DS2	FO-15	TRANSMITTER CONTROL - REMOTE	Indicates transmitter's MASTER CONTROL switch is ON and the on/off and high/low power selections are being controlled remotely when on.
1A1DS3	FO-15	POWER STATUS - ON	Indicates the transmitter is enabled when on.
1A1DS4	FO-15	PA FAIL ALARM	Indicates a power amplifier failure has been sensed when on.
1A1DS5	FO-15	HIGH VSWR ALARM	Indicates a high VSWR has been detected when on.
1A1DS6	FO-15	RF DRIVE ALARM	Indicates an abnormal rf drive has been detected and the standby rf driver is selected as the rf drive source when on.
1A1DS7	FO-15	MOD DRIVE ALARM	Indicates the standby modulation driver is enabled as the modulator drive source when on.
1A1DS8	FO-15	HIGH TEMP ALARM	Indicates a high temperature (more than 80 C) has been sensed when on.
1A1DS9	FO-15	INTERLOCK ALARM	Indicates a fan panel interlock switch is open or the external interlock is open when on.
1A1J1	FO-15	RF OUTPUT MONITOR	Provides a BNC coaxial connection for external 50 ohm monitoring of the rf output, attenuated 46 dB.
1A1M1	FO-15	OUTPUT POWER	Provides indication of forward or reflected power, as selected by OUTPUT POWER switch.
1A1M2	FO-15	MODULATOR INPUT CURRENT	Provides indication of selected modulator's input current being drawn from associated -72 volt dc rectifier/regulator.
1A1M3	FO-15	TEST	Provides indication of the B- voltage (-72 volts dc) to the modulator selected by MODULATOR INPUT CURRENT switch when MODULATOR I/P VOLTS is selected. Provides a 0-100 volt voltmeter when used in conjunction with test leads connected to 4A1TP3(+) and 4A1TP4(-) and TEST is selected.

Table 4-2 Row 1 - NAC21/4 Control/Monitor Panel Controls and Indicators (Continued)

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
1A1S1	FO-15	TRANSMITTER CONTROL - Master	Applies dc voltages to low level driver stages of the transmitter when set to ON.
1A1S2	FO-15	TRANSMITTER CONTROL - Source	Transfers transmitter on/off and high/low power control to a remote location when REMOTE is selected.
1A1S3	FO-15	OUTPUT POWER	Selects forward power, OFF, or reflected power inputs to OUTPUT POWER meter M1.
1A1S4	FO-15	MODULATOR INPUT CURRENT	Applies the voltage dropped across the current shunt resistor associated with the selected modulator; 1-(5A1), 2-(5A2), 3-(6A1) and 4-(6A2))to MODULATOR INPUT CURRENT meter M2 and applies the input voltage of the selected modulator to TEST switch S5.
1A1S5	FO-15	TEST	Applies the input voltage of the modulator selected by MODULATOR INPUT CURRENT switch S4 to TEST meter M3 when MODULATOR I/P VOLTS is selected and connects the driver unit's test leads to permit TEST meter M3 to be used as a voltmeter when TEST is selected.
1A1S6	FO-15	PRESS-TO-TEST	Momentary switch that applies voltages to test alarm lamps when pressed.
1A1A1R2	FO-16	1A1A1R2	Potentiometer to provide precise calibration of OUTPUT POWER meter M1's indication when FWD-HIGH is selected.
1A1A1R5	FO-16	1A1A1R5	Potentiometer to provide precise calibration of OUTPUT POWER meter M1's indication when FWD-LOW is selected.
1A1A2R2	FO-16	1A1A2R2	Potentiometer to provide precise calibration of TEST meter M3's indication.
1A1A3R2	FO-16	1A1A3R2	Potentiometer to provide precise calibration of MODULATOR INPUT CURRENT meter M2's indication.

Table 4-3 Row 1 - Harmonic Filter Assembly Controls and Indicators

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
1A2E1	FO-17	SPARK GAP	Provides connection for rf output coaxial cable and is adjusted to limit voltage at transmitter output caused by lightning or other static electric charges.
1A2A5F1	FO-19	1/4 AMP Fuse	Fuses rf sample provided as the 'monitor output' at 1/4 ampere.
1A2A5R1	FO-19	LO LEVEL 1	Potentiometer to set 'monitor output' to the rms voltage required by the station modulation monitor when power level 1 is selected.
1A2A5R2	FO-19	LO LEVEL 2	Potentiometer to set 'monitor output' to the rms voltage required by the station modulation monitor when power level 2 is selected.
1A2A5R3	FO-19	HIGH PWR	Potentiometer to set 'monitor output' to the rms voltage required by the station modulation monitor when high power level is selected.

Table 4-4 Row 2 and 3 - Power Amplifier Controls and Indicators

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
TP1	FO-23	Test Point TP1	Test point to permit isolation of a defective power amplifier by using the power amplifier comparator test set to compare its input rf drive to the input rf drive of a serviceable power amplifier.

NOTE:

Reference designation shown must be prefixed with the designation of the associated power amplifier:

2A1 thru 2A12 for power amplifiers in row 2
3A1 thru 3A12 for power amplifiers in row 3

Table 4-5 Row 4 - NAE39/1 Driver Unit Controls and Indicators

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
DS1	FO-24	O/P LEVEL - LOW	Indicates operation in low level output mode when on.
DS2	FO-24	RF DRIVE	Indicates rf drive is being generated by the active rf driver and is being applied to the rf driver tuning stage when on.
F1	FO-24	Remote 24V	Fuses 24 volt dc voltage provided for external control use.
J3	FO-24	Buffered Fwd Pwr	Provides a dc signal that is proportional to the square of the forward output power.
J4	FO-24	Buffered Refl Pwr	Provides a dc signal that is proportional to the square of the reflected output power.
J5	FO-24	Carrier Frequency Monitor	Provides a sample of the rf drive frequency.
J6	FO-24	External RF Input	Measurement
S1	FO-24	O/P LEVEL	Provides local selection of high or low power output.
TP1	FO-24	RF DRIVE - TP1	Test point to monitor rf drive waveform.
TP2	FO-24	RF DRIVE - TP2	Test point to monitor rf drive level.
TP3	FO-24	TEST METER (red)	Jack to accommodate positive test lead when using TEST meter 1A1M3 as a voltmeter.
TP4	FO-24	TEST METER (violet)	Jack to accommodate negative test lead when using TEST meter 1A1M3 as a voltmeter.
TP5	FO-24	TP5 (Black)	Ground to be used in conjunction with test points TP1 thru TP4.
A1TP1	FO-24	TP1 (white)	'Main' rf carrier frequency test point.
A1TP2	FO-24	TP2 (violet)	'Main' rf drive -72 volt dc test point.
A1TP3	FO-24	TP3 (red)	'Main' rf drive +15 volt dc test point.
A1A2C4	FO-24	FREQ	Provides fine frequency adjustment of 'main' rf carrier frequency.
A2TP1	FO-24	TP1 (white)	'Standby' rf carrier frequency test point.

Table 4-5 Row 4 - NAE39/1 Driver Unit Controls and Indicators (Continued)

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
A2TP2	FO-24	TP2 (violet)	'Standby' rf drive -72 volt dc test point.
A2TP3	FO-24	TP3 (red)	'Standby' rf drive +15 volt dc test point.
A2A2C4	FO-24	FREQ	Provides fine frequency adjustment of 'standby' rf carrier frequency (NAPE12 only).
A3A1R15	FO-24	POWER - LOW	Provides adjustment of the 'tx fault alarm' in low level operation.
A3A1R22	FO-24	POWER - HIGH	Provides adjustment of the 'tx fault alarm' in high level operation.
A4DS1	FO-24	LIMIT	Indicates limiter in 'main' modulator driver module is activated.
A4TP1	FO-24	TP1 (white)	Monitor 'Main' modulator driver 70 kHz ramp.
A4TP2	FO-24	TP2 (white)	Monitor 'Main' modulator driver audio control signal.
A4TP3	FO-24	TP3 (white)	Monitor 'Main' modulator driver output PWM signal.
A4A1R8	FO-24	AUDIO LEVEL	Provides adjustment to set 'main' modulator driver modulation level (audio gain).
A4A1R16	FO-24	HIGH CARRIER LEVEL	Provides adjustment to set 'main' rf output level when high output level is selected.
A5DS1	FO-24	LIMIT	Indicates limiter in 'standby' modulator driver module is activated.
A5TP1	FO-24	TP1 (white)	Monitor 'standby' modulator driver 70 kHz ramp.
A5TP2	FO-24	TP2 (white)	Monitor 'standby' modulator driver audio control signal.
A5TP3	FO-24	TP3 (white)	Monitor 'standby' modulator driver output PWM signal.
A5A1R8	FO-24	AUDIO LEVEL	Provides adjustment to set 'standby' modulator driver modulation level (audio gain).
A5A1R16	FO-24	CARR LEVEL - HIGH	Provides adjustment to set 'standby' rf output level when high output level is selected.

Table 4-5 Row 4 - NAE39/1 Driver Unit Controls and Indicators (Continued)

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
A5A1R25	FO-24	CARR LEVEL - LOW	Provides adjustment to set 'standby' rf output level when low output level is selected.
A6DS1	FO-24	DS1	Tuning indicator for rf drive filter, tuned for minimum brightness.
A6TB1	FO-24	TB1	Provides selection of taps for series tuning of rf drive filter.
A7L1	FO-25	Driver Tuning Coil	Provides fine tuning of rf drive tank circuit for Power blocks 'A' thru 'D'.
A9DS1	FO-24	ALC	Indicates rf carrier level is being maintained at the assigned power level when turned on.
A9A1R13	FO-24	ALC HIGH	Potentiometer to set the threshold level for the automatic level control circuit when high power is selected.
A9A1R14	FO-24	ALC LL1	Potentiometer to set the threshold level for the automatic level control circuit when low power level 1 is selected.
A9A1R15	FO-24	ALC LL2	Potentiometer to set the threshold level for the automatic level control circuit when low power level 2 is selected.
A9A1R44	FO-24	O/P LL1	Potentiometer to set the rf output to the assigned level when low power level 1 is selected.
A9A1R46	FO-24	O/P LL2	Potentiometer to set the rf output to the assigned level when low power level 2 is selected.
A9S1	FO-24	Low Power Select	Determines the source of the low power level choice when transmitter is operating in a low power mode. Rf output will be the assigned low level 1 when LL1 selected, the assigned low level 2 when LL2 is selected or the last remote low power command when RMT is selected.
A9S2	FO-24	Level Control Source	Determines the source of the power level control when Power Trim Source switch A9S3 is set to ALC. Selects the remote power trim circuit when set to RMT. Selects the automatic level control circuit when set to ALC.

Table 4-5 Row 4 - NAE39/1 Driver Unit Controls and Indicators (Continued)

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
A9S3	FO-24	Power Trim Control	Determines whether the power level control circuit can influence the rf output or if it will be set to a fixed reference level. The power level control circuit is enabled when set to ALC. The power level control circuit is set to a fixed reference near the center of its operating range for calibration purposes when set to PRESET.

NOTE:

Reference designations shown must be prefixed with 4A1

Table 4-6 Rows 5 and 6 - NASM1 Modulator Unit Controls and Indicators

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
DS1	FO-27	B-	Indicates -72 volts dc operating voltage for associated power block is present when full on and indicates presence of (-) voltage stored in reservoir capacitors when other than full on.
DS2	FO-27	PA DRIVE - A	Indicates one of the pair of associated power amplifiers has failed and the modulator's 'A' output has been removed from them when on.
DS3	FO-27	PA DRIVE - B	Indicates one of the pair of associated power amplifiers has failed and the modulator's 'B' output has been removed from them when on.
DS4	FO-27	PA DRIVE - C	Indicates one of the pair of associated power amplifiers has failed and the modulator's 'C' output has been removed from them when on.
TP1	FO-27	O/P	Test point to measure output voltage of modulator.

NOTE:

Reference designation shown must be completed by prefixing with the designation of the associated modulator:

5A1 and 5A2 for modulators in row 5
6A1 and 6A2 for modulators in row 6

Refer to table 6-1 to determine the power block associated with a specific modulator and to determine the reference designations of the associated rectifier/regulator and power amplifiers.

Table 4-7 Row 7 - DC Power Supply Controls and Indicators

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
7A*DS1	FO-28	DS1	Indicates associated power block's -72 volts dc is being produced and is being actively regulated by the regulator.
7A*S1	FO-28	S1	Enables associated power block's -72 volt dc power supply and regulator when turned on (toggle up).
7A*TP1	FO-28	TP1	Test point for rectifier/regulator's -72 volt dc output for associated power block.
7A5DS1	FO-28	DS1	Indicates +15 volts dc is being produced by low voltage power supply 7A5 when on.
7A5TP1	FO-28	TP1	+24 volt dc test point for low voltage power supply 7A5.
7A5TP2	FO-28	TP2	+15 volt dc test point for low voltage power supply 7A5.
7A6DS1	FO-28	DS1	Indicates +15 volts dc is being produced by low voltage power supply 7A6 when on.
7A6TP1	FO-28	TP1	+24 volt dc test point for low voltage power supply 7A6.
7A6TP2	FO-28	TP2	+15 volt dc test point for low voltage power supply 7A6.

NOTE: 7A* denotes reference designation shown must be completed by inserting the designation of the appropriate rectifier/regulator module (7A1, 7A2, 7A3, 7A4).

Refer to table 6-1 to determine the power block associated with a specific rectifier/regulator and the reference designations of its modulator and power amplifiers.

Table 4-8 Power Supply Controls and Indicators

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
CB1	FO-14	HIGH POWER	Main circuit breaker for 3-phase ac power to rectifier/regulator.
CB2	FO-14	CONTROL	Circuit breaker for single-phase ac used to provide low level power for control and driver circuitry.

Table 4-9 Fan Panel Controls and Indicators

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
F1	-	F1	Fuses input to fan B1 at 1/2 ampere.
F2	-	F2	Fuses input to fan B2 at 1/2 ampere.
F3	-	F3	Fuses input to fan B3 at 1/2 ampere.
F4	-	F4	Fuses input to fan B4 at 1/2 ampere.
F5	-	F5	Fuses input to fan B5 at 1/2 ampere.
F6	-	F6	Fuses input to fan B6 at 1/2 ampere.
F7	-	F7	Fuses input to fan B7 at 1/2 ampere.
F8	-	F8	Fuses input to fan B8 at 1/2 ampere.

SECTION 5
TESTING AND CALIBRATION

GENERAL

5.1 This section contains an on-air test procedure, a detailed step-by-step minimum performance test procedure and final calibration procedures for the fully assembled transmitter. Since many of the operating parameters, the audio interfacing equipment and the antenna system are dictated by each individual station, it is necessary that personnel performing these procedures be familiar with the technical details of the transmitter, the associated equipment and the operational requirements of the station.

NOTE

Plug-in modules are serviced independent of the transmitter on a work bench. Testing and calibration instructions for these modules are not included in this section. They are located in the appropriate module service instruction manual.

OPERATION OF EQUIPMENT

5.2 Operating procedures for the transmitter are provided in section 4. Detailed control and indicator information is presented in tables 4-2 thru 4-9.

CAUTION

It is essential that the operating precautions detailed in paragraph 4.7 be read, fully understood and observed prior to operation.

The following tests and required results are predicated on all of the power amplifiers and modulators being serviceable and contributing to the rf output. If not, the specified limits for modulator input current per kilowatt of rf carrier forward power will be invalid.

5.2.1 SETTING OF OUTPUT POWER SWITCH: OUTPUT POWER switch 1A1S3 selects the upper or lower scale of OUTPUT POWER meter 1A1M1. The upper scale is read when HIGH (FWD or REFL) is selected and the lower scale is read when LOW (FWD or REFL) is selected. Always select the appropriate HIGH setting and verify the meter indication is less than the maximum reading on the lower scale (1750 watts) and then switch to the appropriate LOW setting to obtain more accurate readings when the parameter being measured is less than 1750 watts. Set OUTPUT POWER switch to OFF or HIGH after any LOW reading has been obtained.

5.2.2 REFERENCE TO RF OUTPUT: The unmodulated rf carrier output level (rf output) should not exceed 5500 watts. Since adjustment of the remote power trim circuit can normally cause the rf output to be increased by a nominal eighteen percent, precautions must be observed to prevent the rf output from exceeding 5500 watts when maximum rf output has been commanded by the remote power trim circuit. There are two separate rf output power level calibration adjustments for each preset power level. One is adjusted when the level control circuit is set for a preset gain and the other is adjusted when the automatic level control is enabled. When all assigned/permitted rf output levels are 5000 watts or less, both adjustments are set to provide the 'assigned' rf output. When an assigned/permitted rf output is greater than 5000 watts, the preset adjustment must not exceed 5000 watts. This output is referred to as the 'preset' output in the following procedures. The automatic level control adjustment is set to provide the 'assigned' rf output and is referred to as the 'assigned' rf output in the following procedures.

5.2.3 READING OUTPUT POWER METER 1A1M1: OUTPUT POWER meter 1A1M1 has square law scales. The resulting non-linearity makes it difficult to read below 125 watts. Any indication that is less than sixty percent of the 125 watt scale mark is less than 50 watts.

TEST EQUIPMENT

5.3 The test equipment required for testing and calibration is listed in table 1-3.

ON-AIR FUNCTIONAL TEST

5.4 The on-air functional test is a quick and reliable method of determining the operating status of the transmitter without disrupting its operation or station programming.

5.4.1 INITIAL CONTROL SETTINGS: Set the controls to perform an on-air functional test with the transmitter being controlled locally as follows:

(a) Set or verify the switches are set as tabulated for 'Operating Setting' in table 4-1.

(b) Set OUTPUT POWER switch 1A1S3 to FWD-HIGH.

(c) Set TEST switch 1A1S5 to MODULATOR I/P VOLTS.

(d) Set MODULATOR INPUT CURRENT switch 1A1S4 to 1.

(e) Set O/P LEVEL switch 4A1S1 to HIGH.

(f) Set ALC/remote power trim assy 4A1A9's Level Control Source switch (S2) to ALC.

5.4.2 RF OUTPUT LEVELS: Check rf output forward/reflected power levels as follows:

(a) Set TRANSMITTER CONTROL - Source switch 1A1S2 to LOCAL.

(b) POWER READY lamp (1A1DS1), POWER ON lamp (1A1DS3), RF DRIVE lamp (4A1DS2), B- lamps (5A1DS1, 5A2DS1, 6A1DS1 and 6A2DS1), rectifier/regulator lamps (7A1DS1, 7A2DS1, 7A3DS1 and 7A4DS1), low voltage power supply lamps (7A5DS1 and 7A6DS1) shall be on.

NOTE

One or more ALARM and/or modulator/power amplifier fault lamps will turn on when an abnormal condition is sensed. A turned on warning lamp does not necessarily mean the transmitter is off the air or that normal programming must be interrupted to correct the defect. Normal operation is maintained with the main rf driver module and/or the main modulator driver module disabled or removed. The integral modular reserve (IMR) feature allows operation at a reduced power level if a power amplifier or modulator module is disabled.

(c) ALARM lamps - INTERLOCK (1A1DS9), PA FAIL (1A1DS4), HIGH VSWR (1A1DS5), RF DRIVE (1A1DS6), MOD DRIVE (1A1DS7) and HIGH TEMP (1A1DS8) should be off.

(d) All modulator PA DRIVE lamps (A, B and C) should be off.

(e) REMOTE lamp 1A1DS2 and LOW O/P LEVEL lamp 4A1DS1 shall be off.

(f) All cooling air fans shall be operating.

(g) ALC/remote power trim assembly 4A1A9's ALC lamp (DS1) should be on.

(h) Record OUTPUT POWER meter 1A1M1's forward power indication.

(i) Forward power reading obtained in step (h) should be the 'assigned high level' rf output (maximum of 5500 watts) and should be within 5% of the reading recorded as the 'assigned high level (main)' rf output during last calibration.

(j) Set OUTPUT POWER switch 1A1S3 to REFL-HIGH.

(k) Record OUTPUT POWER meter 1A1M1's reflected power indication.

(l) Reflected power reading recorded in step (k) should be less than 100 watts.

(m) Record MODULATOR INPUT CURRENT meter 1A1M2 and TEST meter 1A1M3 indications for each setting of MODULATOR INPUT CURRENT switch 1A1S4.

(n) Plot forward power reading recorded in step (h) and modulator input current reading recorded in step (m) on the graph shown in figure 4-1. Intersection must be below 'Maximum - Carrier Only' line when there is no modulation and must be below the appropriate 'Maximum - with Modulation' line when the carrier is being modulated. Each modulator input current reading should be within 5% of any other reading.

(o) All TEST readings recorded in step (m) should be between -70.0 and -73.0 volts dc.

(p) Set OUTPUT POWER switch 1A1S3 to FWD-HIGH.

(q) Set O/P LEVEL switch 4A1S1 to LOW.

(r) LOW O/P LEVEL lamp 4A1DS1 shall turn on.

(s) Set ALC/remote power trim assembly 4A1A9's Power Select switch (S1) to LL1.

(t) ALC/remote power trim assembly 4A1A9's ALC lamp (DS1) should be on.

(u) Record OUTPUT POWER meter 1A1M1's forward power indication.

(v) Forward power reading obtained in step (u) should be the 'assigned low level 1' rf output and should be within 5% of the reading recorded as the 'assigned low level 1 (main)' rf output during last calibration.

(w) Set ALC/remote power trim assy 4A1A9's Low Power Select switch (S1) to LL2.

(x) ALC/remote power trim assy 4A1A9's ALC lamp (DS1) should be on.

(y) Record OUTPUT POWER meter 1A1M1's forward power indication.

(z) Forward power reading obtained in step (y) should be the 'assigned low level 2' rf output and should be within 5% of the reading recorded as the 'assigned low level 2 (main)' rf output during last calibration.

(aa) Set O/P LEVEL switch 4A1S1 to HIGH.

5.4.3 CARRIER FREQUENCY ACCURACY: Measure the rf carrier frequency as follows:

(a) Connect a frequency counter between 'main' rf driver 4A1A1's carrier frequency test jack (TP1) and GND test jack 4A1TP5.

(b) Measure and record the frequency indication on the frequency meter.

(c) Measurement obtained in step (b) should be the carrier frequency of the transmitter, plus/minus 5.0 Hz or 5 parts per million (ppm) whichever is greater.

5.4.4 MODULATION LEVELS AND QUALITY: Monitor the transmitted signal by using a suitable station modulation monitor and verify the modulation levels are at the desired level and the detected audio is of satisfactory quality.

MINIMUM PERFORMANCE TEST

5.5 The minimum performance test is an off-air test that verifies operating parameters are within design limits. The rf output is applied to a precision, 50-ohm, resistive, dummy load for these tests. Personnel who are not intimately familiar with the transmitter circuits should follow the step-by-step instructions in the order presented, since prerequisites for some procedures are established in preceding steps. A minimum performance test should be performed and the results recorded, for comparison with past and future minimum performance tests, on completion of calibration procedures and as a routine part of a scheduled maintenance program.

5.5.1 PRELIMINARY REQUIREMENTS: Prepare the transmitter for a minimum performance test as follows:

(a) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(b) Disconnect the antenna system and connect a precision, 50 ohm, resistive dummy load that is rated at a minimum of 7500 watts; to the rf output.

(c) Verify that all panels are installed and securely fastened.

(d) Set the modulating audio input to zero (turned off).

(e) Verify the voltage of the ac power source is within 5% of the voltage used as the mean RMS voltage level during initial installation (see paragraph 3.6.1).

(f) Set switches as tabulated for 'calibration setting' in table 4-1.

(g) POWER READY lamp (1A1DS1), POWER ON lamp (1A1DS3), RF DRIVE lamp (4A1DS2), B- lamps (5A1DS1, 5A2DS1, 6A1DS1 and 6A2DS1), rectifier/regulator lamps (7A1DS1, 7A2DS1, 7A3DS1 and 7A4DS1), low voltage power supply lamps (7A5DS1 and 7A6DS1) shall be on.

(h) ALARM lamps - INTERLOCK (1A1DS9), PA FAIL (1A1DS4), HIGH VSWR (1A1DS5), RF DRIVE (1A1DS6), MOD DRIVE (1A1DS7) and HIGH TEMP (1A1DS8) should be off.

(i) All modulator PA DRIVE lamps (A, B and C) should be off.

(j) REMOTE lamp 1A1DS2 and LOW O/P LEVEL lamp 4A1DS1 shall be off.

(k) All cooling air fans shall be operating.

5.5.2 LOW VOLTAGE MEASUREMENT: Measure the outputs of the low voltage power supplies as follows:

(a) Connect a digital multimeter between power supply 7A5's 24 vdc test jack (TP1)(+) and GND test jack 4A1TP5.

(b) Digital multimeter indication shall be between 22.0 and 26.0 volts dc.

(c) Connect a digital multimeter between power supply 7A5's 15 vdc test jack (TP2)(+) and GND test jack 4A1TP5.

(d) Digital multimeter indication shall be between 14.5 and 15.5 volts dc.

(e) Connect a digital multimeter between power supply 7A6's 24 vdc test jack (TP1)(+) and GND test jack 4A1TP5.

(f) Digital multimeter indication shall be between 22.0 and 26.0 volts dc.

(g) Connect a digital multimeter between power supply 7A6's 15 vdc test jack (TP2)(+) and GND test jack 4A1TP5.

(h) Digital multimeter indication shall be between 14.5 and 15.5 volts dc.

5.5.3 RF DRIVE TESTS: Check the frequency and level of the rf drive as follows:

(a) Connect a frequency counter between 'main' rf driver 4A1A1's carrier frequency test jack (TP1) and GND test jack 4A1TP5.

(b) Measure and record the frequency indication on the frequency meter.

(c) Frequency recorded in step (b) shall be the assigned carrier frequency plus/minus 5.0 Hz or 5 parts per million (ppm) whichever is greater.

(d) Connect digital multimeter between RF DRIVE test jack 4A1TP2(+) and 4A1TP5 (gnd).

(e) Digital multimeter indication should be greater than 39.0 volts dc.

(f) RF DRIVE lamp 4A1DS2 should be on.

(g) Disengage 'main' rf driver 4A1A1 from its mating connector.

(h) RF DRIVE ALARM lamp 1A1DS6 shall turn on and an external 'standby alarm' condition shall be generated, to indicate 'standby' rf driver 4A1A2 is enabled.

(i) Connect frequency counter between 'standby' rf driver 4A1A2's carrier frequency test jack (TP1) and GND test jack 4A1TP5.

(j) Repeat steps (b) thru (f) for 'standby' rf driver 4A1A2.

(k) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(l) Install 'main' rf driver 4A1A1, ensuring it is fully engaged with its mating connector.

(m) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

5.5.4 FORWARD AND REFLECTED POWER/MODULATOR CURRENT LEVELS: Measure the forward and reflected power and modulator input current levels as follows:

(a) Verify switches are set as tabulated for 'calibration setting' in table 4-1 and lamp status is as detailed in para 5.5.1.

(b) Record OUTPUT POWER meter 1A1M1's forward power indication as 'preset high level' rf output.

(c) Forward power reading recorded in step (b) should be within 5% of reading recorded for 'preset high level' rf output during last calibration.

(d) Set OUTPUT POWER switch 1A1S3 to REFL-LOW.

(e) Record OUTPUT POWER meter 1A1M1's forward power indication.

(f) Reflected power reading recorded in step (e) should be nominally zero watts when impedance of the dummy load is precisely 50 ohms.

(g) Record MODULATOR INPUT CURRENT meter 1A1M2 and TEST meter 1A1M3 indications for each setting of MODULATOR INPUT CURRENT switch 1A1S4.

(h) Plot 'preset high level' rf output reading recorded in step (b) and modulator input current readings recorded in step (h) on the graph shown in figure 4-1. The intersection point must be below the line representing the maximum current level.

(i) All 'modulator input current' readings recorded in step (g) should be within 5% of any other reading.

(j) All 'test' readings recorded in step (g) should be between -70.0 and -73.0 volts dc.

(k) Set O/P LEVEL switch 4A1S1 to LOW.

(l) LOW O/P LEVEL lamp 4A1DS1 shall turn on.

(m) Set ALC/remote power trim assy 4A1A9's Low Power Select switch (S1) to LL1.

(n) Set OUTPUT POWER switch 1A1S3 to FWD-HIGH.

(o) Record OUTPUT POWER meter 1A1M1's forward power indication as 'preset low level 1' rf output .

(p) Reading recorded in step (o) should be within 5% of reading recorded for 'preset low level 1' rf output during last calibration.

(q) Set ALC/remote power trim assy 4A1A9's Low Power Select switch (S1) to LL2.

(r) Record OUTPUT POWER meter 1A1M1's forward power indication as 'preset low level 2' rf output.

(s) 'Preset low level 2' rf output reading recorded in step (r) should be within 5% of reading recorded for 'preset low level 2' rf output during last calibration.

(t) Set O/P LEVEL switch 4A1S1 to HIGH.

(u) LOW O/P LEVEL lamp 4A1DS1 shall turn off.

(v) Disengage 'main' modulator driver 4A1A4 from its mating connector.

(w) MOD DRIVE ALARM lamp 1A1DS7 shall turn on and a 'standby alarm' condition shall be generated, to indicate 'standby' modulator driver 4A1A5 is enabled and providing the mod drive for the modulators.

(x) Record OUTPUT POWER meter 1A1M1's forward power indication as 'standby high level' rf output.

(y) Reading recorded in step (x) should be within 5% of the reading recorded for 'standby high level' rf output during last calibration.

(z) Set O/P LEVEL switch 4A1S1 to LOW.

NOTE

Only one preset low power level is available when 'standby' modulator driver 4A1A5 is providing the mod drive for the modulators. The user decided, during last calibration, which of the two assigned low power levels will be produced. The setting of Low Power Select switch 4A1A9S1 will have no influence.

(aa) LOW O/P LEVEL lamp 4A1DS1 shall turn on.

(ab) Record OUTPUT POWER meter 1A1M1's forward power indication as the 'standby low level' rf output.

(ac) Reading recorded in step (ab) should be within 5% of the reading recorded for 'standby low level' rf output during last calibration.

(ad) Set O/P LEVEL switch 4A1S1 to HIGH.

(ae) LOW O/P LEVEL lamp 4A1DS1 shall turn off.

(af) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(ag) Install modulator driver 4A1A4, ensuring it is fully engaged with its mating connector.

(ah) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(ai) The external 'standby alarm' condition shall be removed and MOD DRIVE ALARM lamp 1A1DS7 shall turn off, indicating modulator driver 4A1A4 has been restored as the 'main' modulator drive.

5.5.5 MODULATOR RAMP OPERATION: Check modulator ramp operation as follows:

(a) Verify switches are set as tabulated for 'calibration setting' in table 4-1 and OUTPUT POWER meter 1A1M1's forward power indication is the 'preset high level' rf output.

(b) Connect oscilloscope between 'main' mod driver 4A1A4's linear ramp generator test jack (TP1) and GND test jack 4A1TP5.

(c) Oscilloscope indication should be a 70 ±1 kHz symmetrical ramp waveform of approximately 3.0 volts peak-to-peak with a peak voltage of approximately 7.0 volts.

(d) Connect oscilloscope between 'main' mod driver 4A1A4's carrier reference level test jack (TP2) and GND test jack 4A1TP5.

(e) Oscilloscope indication should be a dc control reference line that is within the limits of the ramp waveform observed in step (c).

(f) Connect oscilloscope between 'main' mod driver 4A1A4's mod drive test jack (TP3) and GND test jack 4A1TP5.

(g) Oscilloscope indication should be a rectangular waveform at 70 kHz, switching between zero and 13.5 volts.

(h) Disengage 'main' modulator driver 4A1A4 from its mating connector.

(i) MOD DRIVE ALARM lamp 1A1DS7 shall turn on and a 'standby alarm' condition shall be generated, to indicate 'standby' modulator driver 4A1A5 is enabled.

(j) Connect oscilloscope between 'standby' mod driver 4A1A5's linear ramp generator test jack (TP1) and GND test jack 4A1TP5.

(k) Oscilloscope indication should be a 70 ±1 kHz symmetrical ramp waveform of approximately 3.0 volts peak-to-peak with a peak voltage of approximately 7.0 volts.

(l) Connect oscilloscope between 'standby' mod driver 4A1A5's carrier reference level test jack (TP2) and GND test jack 4A1TP5.

(m) Oscilloscope indication should be a dc control reference line that is within the limits of the ramp waveform observed in step (k).

(n) Connect oscilloscope between 'standby' mod driver 4A1A5's mod drive test jack (TP3) and GND test jack 4A1TP5.

(o) Oscilloscope indication should be a rectangular waveform at 70 kHz, switching between zero and 13.5 volts.

(p) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(q) Install modulator driver 4A1A4, ensuring its mating connector is fully engaged.

(r) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(s) External 'standby alarm' condition shall be removed and MOD DRIVE ALARM lamp 1A1DS7 shall turn off.

5.5.6 TX FAULT ALARM THRESHOLD LEVEL: Verify the tx fault alarm threshold has been set to the desired level and is functioning correctly as follows:

NOTE

There is only one low power tx fault alarm threshold level available. The user must decide which of the two preset low power levels will be used as the reference level during calibration.

(a) Verify switches are set as tabulated for 'calibration setting' in table 4-1, lamp status is as detailed in paragraph 5.5.1 and OUTPUT POWER meter 1A1M1's forward power indication is the 'preset high level' rf output.

(b) Record OUTPUT POWER meter 1A1M1's forward power indication.

(c) Determine the rf output recorded as the 'high power' tx fault alarm threshold during last calibration.

(d) Simultaneously monitor OUTPUT POWER meter 1A1M1 and the external 'Tx Fault alarm' condition, while decreasing the rf output, by slowly adjusting 'main' modulator driver 4A1A4's potentiometer (R16) counter clockwise, until an external 'Tx Fault alarm' condition just occurs.

(e) External 'Tx Fault alarm' condition shall occur as OUTPUT POWER meter 1A1M1's forward power indication passes through 'high power' tx fault alarm threshold determined in step (c).

NOTE

The 'high power' tx fault alarm threshold is set to 20 percent below the assigned high power level at the factory. If it has been subsequently reset, the new threshold should have been recorded as the 'high power' tx fault alarm threshold.

(f) Adjust 'main modulator driver 4A1A4's potentiometer (R16) for an rf output of the 'preset high level' rf output recorded in step (b), as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

(g) The external 'Tx Fault alarm' condition shall be removed.

(h) Set O/P LEVEL switch 4A1S1 to LOW.

(i) LOW O/P LEVEL lamp 4A1DS1 shall turn on.

(j) Set ALC/remote power trim assy 4A1A9's Low Power Select switch (S1) to the low power setting (LL1 or LL2) used as the reference during the last calibration.

(k) Record OUTPUT POWER meter 1A1M1's forward power indication.

(l) Forward power reading recorded in step (k) shall be the 'preset low level' rf output for the low power level selected in step (j).

(m) Determine the rf output recorded as the 'low power' tx fault alarm threshold during last calibration.

(n) Simultaneously monitor OUTPUT POWER meter 1A1M1's forward power indication and external 'Tx Fault alarm' condition while decreasing rf output by slowly adjusting ALC/remote power trim assy 4A1A9's appropriate O/P (LL1 or LL2) potentiometer counter clockwise until an external 'Tx Fault alarm' condition just occurs.

(o) External 'Tx Fault alarm' condition shall occur as OUTPUT POWER meter 1A1M1's forward power indication passes through 'low power' tx fault alarm threshold determined in step (n).

(p) Adjust ALC/remote power trim assy 4A1A9's appropriate O/P (LL1 or LL2) potentiometer for an rf output of the 'preset low level' rf output recorded in step (l), as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

(q) The external 'Tx Fault alarm' condition shall be removed.

5.5.7 RF SHUTBACK FUNCTION: Verify the rf output power is shutback as the sensed reflected power approaches 250 watts, as follows:

WARNING

RF voltages that are dangerous to life are present on exposed terminals when the top cover is removed from the transmitter. The SWR alarm testing procedure requires that the top cover be removed and two wires adjacent to the rf output connection must be interchanged. Do not work in the vicinity of the rf output when the transmitter is turned on.

(a) Verify switches are set as tabulated for 'calibration setting' in table 4-1, lamp status is as detailed in para 5.5.1 and OUTPUT POWER meter 1A1M1's forward power indication is the 'preset high level' rf output.

(b) Set O/P LEVEL switch 4A1S1 to LOW.

(c) LOW O/P LEVEL lamp 4A1DS1 shall be on.

(d) Set ALC/remote power trim assy 4A1A9's Low Power Select switch (S1) to LL1

(e) Record OUTPUT POWER meter 1A1M1's forward power indication.

(f) Forward power reading recorded in step (e) shall be the 'preset low level 1' rf output.

(g) Set ALC/remote power trim assy 4A1A9's O/P LL1 potentiometer (R44) fully counter clockwise.

NOTE

An external 'tx fault alarm' condition will be generated. This condition should be ignored.

(h) OUTPUT POWER meter 1A1M1's forward power indication shall be less than 100 watts.

(i) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(j) Gain access to terminal board TB1 of FWDS/REFL power probe 1A2A3 by removing the top cover from the transmitter cabinet.

(k) Interchange the center conductor of coaxial cable #46 (forward power) and the center conductor coaxial cable #47 (reflected power) on TB1-1 and TB1-4 of FWD/REFL power probe 1A2A3.

(l) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(m) OUTPUT POWER meter 1A1M1's forward power indication shall be a nominal zero watts.

(n) Set OUTPUT POWER switch 1A1S3 to REFL-LOW.

(o) OUTPUT POWER meter 1A1M1's forward power indication shall be less than 100 watts.

(p) Simultaneously monitor OUTPUT POWER meter 1A1M1's forward power indication and HIGH VSWR - ALARM lamp 1A1DS5, while increasing rf output by slowly adjusting ALC/remote power trim assy 4A1A9's O/P LL1 potentiometer (R44) clockwise, until HIGH VSWR - ALARM lamp 1A1DS5 just turns on.

(q) OUTPUT POWER meter 1A1M1's forward power indication shall be less than 250 watts (nominally 200 watts).

(r) An external 'SWR alarm' condition shall be generated.

(s) The rf output shall not increase after HIGH VSWR - ALARM lamp 1A1DS5 has turned on, with further clockwise adjustment of ALC/remote power trim assy 4A1A9's O/P LL1 potentiometer (R44).

(t) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(u) Restore forward power and reflected power coaxial cables interchanged in step (k) to their original positions. Ensure the center conductor of coaxial cable #46 (forward power) is connected to 1A2A3TB1-1 and the center conductor of coaxial cable #47 (reflected power) is connected to 1A2A3TB1-4.

(v) Install the transmitter cabinet's top cover, using the four screws and four washers removed in step (j).

(w) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(x) The external 'SWR alarm' condition shall be removed and HIGH VSWR - ALARM lamp 1A1DS5 shall be off.

(y) Adjust ALC/remote power trim assy 4A1A9's O/P LL1 potentiometer (R44) for an rf output of the 'preset low level 1' rf output recorded in step (e), as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

(z) 'External 'tx fault alarm' condition shall be removed.

(aa) Set O/P LEVEL switch 4A1S1 to HIGH and OUTPUT POWER switch 1A1S3 to FWD-LOW.

5.5.8 REMOTE CONTROL FUNCTIONS: Check the remote control circuits as follows:

5.5.8.1 External Control Prerequisites: The following prerequisites are applicable to paragraphs 5.5.8.2 thru 5.5.8.5.

(a) Verify the remote control circuits meets the requirements of para 3.4.3.

(b) Verify switches are set as tabulated for 'calibration setting' in table 4-1, lamp status is as detailed in para 5.5.1 and OUTPUT POWER meter 1A1M1's forward power indication is the 'preset high level' rf output.

(c) Record OUTPUT POWER meter 1A1M1's forward power indication.

(d) Set ALC/remote power trim assy 4A1A9's Level Control Source switch (S2) to RMT.

(e) Have remote 'High Pwr' switch momentarily set to its spring-loaded 'on' position.

(f) Have remote 'On/Off' switch momentarily set to its spring-loaded 'on' position.

(g) Set TRANSMITTER CONTROL - Source switch 1A1S2 to REMOTE.

(h) REMOTE lamp 1A1DS2 shall turn on.

(i) An external 'remote' condition shall be produced.

(j) OUTPUT POWER meter 1A1M1's forward power indication shall be the 'preset high level' rf output recorded in step (c).

5.5.8.2 On/off Control: Verify the transmitter's on/off status can be controlled remotely as follows:

(a) Have remote 'On/Off' switch momentarily set to its spring-loaded 'Off' position.

(b) OUTPUT POWER meter 1A1M1's forward power indication shall go to zero and all lamps, except for POWER READY lamp 1A1DS1, REMOTE lamp 1A1DS2 and the 'B-' lamp on each modulator (5A1, 5A2, 6A1 and 6A2), shall turn off.

(c) The intensity of the 'B-' lamp on each modulator (5A1, 5A2, 6A1 and 6A2) will slowly decay as the -72 vdc storage capacitors discharge.

(d) Have remote 'On/Off' switch momentarily set to its spring-loaded 'On' position.

(e) The transmitter shall turn on and be restored to the status observed prior to starting step (a).

5.5.8.3 Instant Off/Instant On Control: Verify the rf output can be turned off instantly and then instantly restored to its original level by the remote instant off/on circuit, as follows:

(a) Connect an oscilloscope to RF OUTPUT MONITOR connector 1A1J1, using a suitable coaxial cable and note amplitude of oscilloscope's rf carrier waveform.

(b) Simultaneously monitor oscilloscope waveform and connect a ground to 4A1TB2-10.

(c) Amplitude of oscilloscope waveform shall instantly collapse to near zero, indicating the rf output has turned off.

(d) OUTPUT POWER meter 1A1M1's forward power indication shall go to zero and an external 'tx fault alarm' condition shall be generated.

(e) Simultaneously monitor the oscilloscope and remove the ground from 4A1TB2-10.

(f) Oscilloscope waveform trace shall return to the original amplitude noted in step (a) instantly, indicating the rf output has been restored to the original level.

(g) OUTPUT POWER meter 1A1M1's forward power indication shall be the 'preset high level' rf output and the external tx fault alarm condition shall be removed.

(h) Disconnect oscilloscope from RF OUTPUT MONITOR connector 1A1J1.

5.5.8.4 Remote Power Level Selection: Verify preset rf output power levels can be selected remotely as follows:

(a) Have remote 'Low pwr 2' switch momentarily set to its spring-loaded 'On' position.

(b) LOW O/P LEVEL lamp 4A1DS1 shall turn on.

(c) OUTPUT POWER meter 1A1M1's forward power indication shall be the 'preset low level 2' rf output.

(d) All ALARM lamps shall be off.

NOTE
An external tx fault alarm may be generated if the 'low level 2' rf output is less than the the low power tx fault alarm threshold.

(e) Have remote 'High Pwr' switch momentarily set to its spring-loaded 'On' position.

(f) LOW O/P LEVEL lamp 4A1DS1 shall turn off.

(g) OUTPUT POWER meter 1A1M1's forward power indication shall be the 'preset high level' rf output.

(h) Have remote 'Low pwr 1' switch momentarily set to its spring-loaded 'On' position.

(i) LOW O/P LEVEL lamp 4A1DS1 shall remain on.

(j) OUTPUT POWER meter 1A1M1's forward power indication shall be the 'preset low level 1' rf output.

(k) All alarm lamps shall be off.

5.5.8.5 Remote Power Trim Control: Verify rf output power level can be trimmed (increased and decreased) remotely as follows:

(a) Set ALC/remote power trim assy 4A1A9's Power Trim Control switch (S3) to ALC.

(b) OUTPUT POWER meter 1A1M1's forward power indication shall be the 'preset high level' rf output.

(c) Have remote Rf Output Trim switch held in its spring-loaded 'increase' position until the requirements of step (d) have been attained.

(d) Rf output indication on OUTPUT POWER meter 1A1M1 shall increase in nominal one percent increments, at the rate of one increment per second, until the maximum power trim correction has been achieved (ten increments).

(e) OUTPUT POWER meter 1A1M1's forward power indication should be approximately eighteen percent more than the 'preset high level' rf output observed in step (b) but should not be more than 5500 watts.

(f) An external 'Level Control (ALC) Limit' status output shall be produced.

(g) Have remote Rf Output Trim switch held in its spring-loaded 'decrease' position until the requirements of step (h) have been attained.

(h) Rf output, as indicated by OUTPUT POWER meter 1A1M1's forward power indication, shall decrease in nominal one percent increments, at the rate of one per second, until the power trim correction has been attained (fifteen increments).

(i) OUTPUT POWER meter 1A1M1's forward power indication should be approximately nine percent less than the 'preset high level' rf output observed in step (b).

(j) The external 'Level Control (ALC) Limit' status output shall be removed while the level control circuit is incrementing and shall be present when the level control has attained its minimum level.

(k) The 'assigned high level' rf output shall have been produced at one increment of the remote power trim operating range.

(l) Set ALC/remote power trim assy 4A1A9's Power Trim control switch (S3) to PRESET.

(m) Set TRANSMITTER CONTROL - Source switch 1A1S2 to LOCAL.

(n) OUTPUT POWER meter 1A1M1's forward power indication shall be the 'preset high level' rf output.

5.5.9 LOCAL/REMOTE ALARMS AND REMOTE STATUS MONITORING: Check the local alarm indications and the remote alarm/status monitoring circuits as follows:

NOTE

Provision is made to remotely monitor the status of critical functions. The monitoring circuits requirements are described in paragraph 3.4. Since Nautel does not control the design for the monitoring circuits, the following checks will only refer to a specific alarm/status condition.

'Interlock alarm' and 'Tx Fault alarm' will be present when transmitter is turned off since their relays are energized during normal operation.

5.5.9.1 External Monitoring Prerequisites: The following prerequisites are applicable to 5.5.9.2 thru 5.5.9.10.

(a) Verify the remote alarm and status monitoring circuits meet the requirements of para 3.4.7 and 3.4.8.

(b) Verify switches are set as tabulated for 'calibration setting' in table 4-1, lamp status is as detailed in para 5.5.1 and OUTPUT POWER meter 1A1M1's forward power indication is the 'preset high level' rf output.

5.5.9.2 Local and Remote Interlock Alarms: Verify an interlock alarm condition is generated whenever the interlock circuit is interrupted as follows:

CAUTION

The interlock switches behind the fan panels can be bypassed by moving their push rods to their fully extended and locked position. This feature is provided for servicing and the transmitter must not be operated for more than 10 minutes with a fan panel removed. Non reversible damage may result if overheating occurs.

(a) Open or cause the interlock circuit to be opened by removing one or both of the fan panels (upper or lower) on the rear of the transmitter cabinet or by opening any external switch or relay in the interlock circuit.

(b) An external 'interlock alarm' condition shall be generated.

(c) INTERLOCK ALARM lamp 1A1DS9 shall turn on.

(d) OUTPUT POWER meter 1A1M1 and MODULATOR INPUT CURRENT meter 1A1M2 indications shall go to zero indicating the transmitter has turned off.

(e) The 'B-' lamp on each modulator (5A1, 5A2, 6A1 and 6A2) will remain on. Their intensity will slowly decay as the -72 vdc storage capacitors discharge.

(f) Close the interlock circuit by replacing fan panels removed in step (a) or by closing any external switch or relay contacts that were opened in step (a).

(g) The transmitter shall turn on and OUTPUT POWER meter 1A1M1's forward power indication shall return to the 'assigned high level' rf output.

(h) The external 'interlock alarm' condition shall be removed and INTERLOCK ALARM lamp 1A1DS9 shall turn off.

5.5.9.3 Local and Remote PA Failure Alarms: Verify a PA failure alarm condition is generated whenever a power amplifier fails as follows:

(a) Remove the plexiglass panel that directs the air circulation over the power amplifiers by pulling and releasing the four locking knobs.

CAUTION

Do not operate the transmitter for extended periods of time with the plexiglass panel removed from the front of the power amplifiers. Overheating that may cause damage to solid state devices may result. The length of time is determined by the rf output level and should not exceed 10 minutes when the rf output level is 5000 watts.

(b) Simulate a fault by momentarily connecting a 47 ohm resistor between chassis ground and TP1 of power amplifier 2A1.

(c) PA FAIL lamp 1A1DS4 and the 'A' fault lamp (DS1) on modulator 5A1 shall turn on and an external 'PA Fail alarm' condition shall be generated.

(d) OUTPUT POWER meter 1A1M1's forward power indication shall decrease by approximately 0.76 dB.

Table 5-1 Identifying Power Amplifiers Associated With Modulator Fault Lamps

BASIC REF DES	ASSOCIATED MODULATOR AND FAULT INDICATOR LAMP	
	ROW 2's PAs	ROW 3's PAs
A1/A2	'A' 5A1(DS2)	'A' 6A1(DS2)
A3/A4	'B' 5A1(DS3)	'B' 6A1(DS3)
A5/A6	'C' 5A1(DS4)	'C' 6A1(DS4)
A7/A8	'A' 5A2(DS2)	'A' 6A2(DS2)
A9/A10	'B' 5A2(DS3)	'B' 6A2(DS3)
A11/A12	'C' 5A2(DS4)	'C' 6A2(DS4)

(e) Momentarily set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF and then set it to ON.

(f) The transmitter shall turn on and OUTPUT POWER meter 1A1M1's forward power indication shall return to the 'assigned high level' rf output.

(g) PA FAIL lamp 1A1DS4 and 'A' fault lamp (DS1) on modulator 5A1 shall turn off and the external 'PA Fail alarm' condition shall be removed.

(h) Verify the operation of all power amplifier fault detection circuits by repeating steps (b) thru (g) for each remaining pair of power amplifiers, substituting the appropriate modulator fault lamp as identified in table 5-1.

NOTE

Each PA fault detection circuit monitors two power amplifiers. It is only necessary to simulate a fault on one of the pair, as identified in table 5-1, to verify the fault detector is operating properly.

(i) Install the plexiglass panel removed in step (b) and secure using four self-contained locking knobs.

5.5.9.4 Remote Tx Fault Alarm: The external 'Tx fault alarm' function was tested while the rf alarm level was being checked. See paragraph 5.5.6.

5.5.9.5 Remote Standby Alarm: The external 'standby alarm' condition was tested during the testing of the 'standby' rf driver and the 'standby' modulator driver. See paragraphs 5.5.3 and 5.5.5.

5.5.9.6 Local RF Drive Alarm: The RF DRIVE alarm circuit was tested during the testing of the 'standby' rf driver. See paragraph 5.5.3.

5.5.9.7 Local Mod Drive Alarm: The MOD DRIVE alarm' circuit was tested during the testing of the 'standby' modulator driver. See paragraph 5.5.5.

5.5.9.8 Local and Remote SWR Alarm: The VSWR ALARM circuit and external 'SWR alarm' condition were tested during the testing of the shutback function. See paragraph 5.5.7.

5.5.9.9 Remote AC Power Alarm: The external ac power alarm feature is only available when an option that monitors the ac power is installed. Refer to the documentation supporting this option to determine when an external 'low ac power' condition will be produced.

5.5.9.10 Local High Temperature Alarm: It is not practical to check the high temperature alarm circuit during a functional test. HIGH TEMP ALARM lamp 1A1DS8 will turn on when a thermistor in control/monitor panel 1A1 senses a temperature in access of 70 C.

5.5.10 REMOTE FORWARD/REFLECTED POWER LEVEL MONITORING: Check the buffered dc voltage outputs, which are provided for remote monitoring of the forward power level and reflected power level, as follows:

(a) Verify the remote forward power level and reflected power level monitoring circuits meet the requirements of paragraphs 3.4.5 and 3.4.6.

(b) Verify switches are set as tabulated for 'calibration setting' in table 4-1, lamp status is as detailed in paragraph 5.5.1 and OUTPUT POWER meter 1A1M1's forward power indication is the 'preset high level' rf output.

(c) Record OUTPUT POWER meter 1A1M1's forward power indication.

(d) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(e) Remove the upper fan panel from the rear of the transmitter.

(f) Connect a digital multimeter to connector 4A1J3 using a suitable coaxial cable.

(g) Pull interlock switch S1's actuating plunger out to its override position.

(h) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(i) Adjust 'main' modulator driver 4A1A4's potentiometer (R16) for an rf output of 5000 watts, as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

(j) Record dc voltage indication on digital multimeter connected to 4A1J3.

(k) Digital multimeter reading recorded in step (j) should be 9.5 $\pm$0.5 volts dc.

(l) Adjust 'main' modulator driver 4A1A4's potentiometer (R16) for an rf output of the 'preset high level' rf output recorded in step (c), as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

(m) Record dc voltage indication on digital multimeter connected to 4A1J3.

(n) Digital multimeter reading recorded in step (m) should be within five percent of dc voltage recorded for 'preset high level' forward power during last calibration.

(o) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(p) Connect digital multimeter to connector 4A1J4 using a suitable coaxial cable.

(q) Terminate rf output into an open circuit by disconnecting the 50-ohm dummy load.

(r) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(s) FWD and REFL - PWR readings on OUTPUT POWER meter 1A1M1 should be equal (approximately 200 watts).

(t) Record indication on digital multimeter connected to 4A1J4.

(u) Digital multimeter reading recorded in step (t) should be 2.63 $\pm$ 0.26 volts dc.

NOTE:
SWR threshold level is set to 2.63 volts dc during manufacture. If the SWR threshold has been altered to overcome antenna bandwidth problems, the new SWR threshold voltage must be determined and used in step (t).

(v) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(w) Disconnect the digital multimeter and connect the remote forward and reflected power output coaxial cables to 4A1J3 (forward) and 4A1J4 (reflected).

(x) Install upper fan panel, removed in step (e).

5.5.11 MODULATION LEVELS: Verify the modulation levels and response are within acceptable limits as follows:

CAUTION

Continuous modulation levels of more than 60% should be avoided when the audio input signal is a sine/square wave. Overheating may occur if the transmitter is operated at 5000 watts and the modulation level is a continuous 100% for more than ten minutes.

5.5.11.1 Modulation Level Prerequisites: The following prerequisites are applicable to 5.5.11.2 thru 5.5.11.7.

(a) Verify switches are set as tabulated for 'calibration setting' in table 4-1, lamp status is as detailed in paragraph 5.5.1 and OUTPUT POWER meter 1A1M1's forward power indication is the 'preset high level' rf output.

(b) Record OUTPUT POWER meter 1A1M1's forward power indication.

(c) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(d) Connect an audio signal generator with an output impedance of 600 ohms between terminals 16 and 18 of terminal board 4A1TB1, as the transmitter's source of modulation audio, in lieu of the normal station modulating audio.

(e) Connect a modulation monitor to RF OUTPUT MONITOR connector 1A1J1.

(f) Connect a distortion analyzer with a nominal 25 kHz bandwidth to the demodulated audio output of the modulation monitor.

(g) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(h) Record OUTPUT POWER meter 1A1M1's forward power indication.

5.5.11.2 Modulation Control: Verify the modulation level can be adjusted for 100% modulation when the 600 ohm audio input signal is from -10 dBm to +10 dBm as follows:

(a) Set the audio signal generator's frequency to 1000 Hz.

(b) Adjust audio signal generator's output level for 100% modulation as indicated on the modulation monitor's modulation percentage indicator.

NOTE

The internal limiter, in both modulator drivers, is normally set with R64 fully counter clockwise and R62 fully clockwise. This results in limiting at audio levels that would produce modulation depths of -110 percent and +135 percent at 2500 watt outputs. The following assumes R64 and R62 are set as indicated above. If the limiting has been adjusted to some lesser level, this must be taken into account in the following procedures. See the appropriate modulator driver service instruction manual for details relating to limiter controls.

(c) Record the audio signal generator's output level.

NOTE

Audio signal generator output level recorded in step (c) represents the normal station programming signal level to obtain 100% modulation.

(d) Set audio signal generator's output level to -10 dBm.

(e) Set 'main' mod driver 4A1A4's AUDIO LEVEL potentiometer (A1R8) fully clockwise.

(f) Adjust the audio signal generator's output level for 100% modulation as indicated on the modulation monitor's modulation percentage indicator.

(g) The audio signal generator's output level shall be less than -10 dBm.

(h) Set 'main' mod driver 4A1A4's AUDIO LEVEL potentiometer (A1R8) fully counter clockwise.

(i) Adjust the audio signal generator's output level for 100% modulation as indicated on the modulation monitor's modulation percentage indicator.

(j) The audio signal generator's output level shall be greater than +10 dBm.

(k) Set the audio signal generator's output to the level recorded in step (c).

(l) Adjust 'main' mod driver 4A1A4's AUDIO LEVEL potentiometer (A1R8) for 100% modulation, as indicated on monitoring monitor's modulation percentage indicator.

(m) Disengage 'main' modulator driver 4A1A4 from its mating connector. Verify MOD DRIVE ALARM lamp 1A1DS7 has turned on.

(n) Repeat steps (b) thru (l), substituting 'standby' modulator driver 4A1A5 where 'main' modulator driver 4A1A4 is specified.

(o) Install modulator driver 4A1A4, ensuring its connectors are fully mated and then reset the transmitter by momentarily setting TRANSMITTER CONTROL - Master switch 1A1S1 to OFF and then returning it to ON.

5.5.11.3 Audio Frequency Response: Check modulation audio frequency response as follows:

(a) Set audio signal generator's frequency to 1000 Hz.

(b) Adjust audio signal generator's output for 25% modulation as indicated on modulation monitor's modulation percentage indicator or demodulated audio level indicator.

(c) Record the audio signal generator's output level.

(d) Repeat steps (b) and (c) with the audio signal generator's frequency set to 50 Hz, 100 Hz, 400 Hz, 5000 Hz and 7500 Hz.

(e) The results recorded as the signal generator's output for the frequencies specified in steps (a) and (d) shall be within 1.0 dB.

(f) Repeat steps (a) thru (e) with the modulation level set to 50% in step (b).

(g) Repeat steps (a) thru (e) with the modulation level set to 85% in step (b).

(h) Repeat steps (a) thru (e) with the modulation level set to 95% in step (b).

5.5.11.4 Signal-To-Noise Ratio: Check the combined noise and hum to signal ratio as follows:

NOTE
When RF OUTPUT MONITOR connector 1A1J1 is used as the output voltage monitor point, hum and noise introduced by the monitor ground loops may result in measured levels higher than those actually present. It may be necessary to utilize a current probe with an isolated ground as a signal source for this measurement.

(a) Set the audio signal generator's frequency to 400 Hz.

(b) Adjust the audio signal generator's output level for 100% modulation.

(c) Record the signal level on the distortion analyzer's signal level indicator.

(d) Set the audio signal generator's output level to zero.

(e) Record combined noise and hum level on distortion analyzer's signal level indicator.

(f) The combined noise and hum level recorded in step (e) shall be a minimum of 60 dB below the signal level recorded in step (c).

5.5.11.5 Audio Distortion: Check the demodulated audio for distortion as follows:

(a) Set the audio signal generator's frequency to 1000 Hz.

(b) Adjust the audio signal generator's output level for 25% modulation.

(c) Measure the audio distortion level using the distortion analyzer.

(d) The distortion measured in step (c) shall not exceed two percent.

(e) Repeat steps (b) thru (d) with the audio signal generator's frequency set to 50 Hz, 100 Hz, 400 Hz, 5000 Hz and 7500 Hz in step (a).

(f) Repeat steps (a) thru (d) with the audio signal generator's output level set for 50%, 85% and 95% modulation in step (b).

(g) Repeat steps (a) thru (d) with the audio signal generator's output level set for 85% modulation in step (b).

(h) Repeat steps (a) thru (d) with the audio signal generator's output level set for 95% modulation in step (b).

(i) If the distortion in step (h) is greater than two percent when the modulating audio is 50 Hz, calibrate the hum balance circuit in the associated modulator driver module as detailed in paragraph 5.6.12.

5.5.11.6 Carrier Shift: Check the carrier shift with 400 Hz modulation as follows:

(a) Set the audio signal generator's frequency to 400 Hz.

(b) Set the audio signal generator's output level to zero (0% modulation).

(c) Measure and record the carrier level indication on the modulation monitor.

(d) Adjust the audio signal generator's output level for 95% modulation.

(e) Measure and record the carrier level indication on the modulation monitor.

(f) Measurement recorded in step (e) shall not vary from the measurement recorded in step (c) by more than three percent.

5.5.11.7 Completion of Modulation Tests: On completion of the modulation level tests restore the transmitter to an operational status as follows:

(a) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(b) Disconnect the audio signal generator and reconnect the normal station modulating audio source.

(c) Disconnect the modulation monitor from RF MONITOR jack 1A1J1.

(d) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

5.5.12 RADIATED HARMONICS/SPURIOUS OUTPUT LEVEL: Measure radiated harmonics and spurious output levels as follows:

5.5.12.1 Radiated Harmonic/Spurious Output Prerequisites: The following prerequisites are applicable to 5.5.12.2 thru 5.5.12.3.

(a) Verify switches are set as tabulated for 'calibration setting' in table 4-1, lamp status is as detailed in para 5.5.1 and OUTPUT POWER meter 1A1M1's forward power indication is the 'preset high level' rf output.

(b) Set the modulating audio input to zero (turned off).

CAUTION

2.5 volts rms is present on RF OUTPUT MONITOR connector 1A1J1 when terminated by a 50-ohm load and the unmodulated rf output is 5000 watts. This voltage may damage some spectrum analyzers. If necessary, reduce the output voltage by using a suitable attenuator that has a 50-ohm input impedance.

(c) Connect a spectrum analyzer to RF OUTPUT MONITOR connector 1A1J1 using a suitable coaxial cable.

5.5.12.2 Within 75 kHz of Carrier Frequency: Measure the 70 kHz sideband, which is caused by the 70 kHz pulse width modulation frequency, and other spurious outputs within 75 kHz of the carrier frequency as follows:

(a) Perform spectrum analysis of rf output within 75 kHz of the rf carrier frequency.

(b) The 70 kHz sideband and spurious outputs other than normal sideband noise shall be a minimum of 60 dB below the fundamental rf carrier frequency.

NOTE

Modulators 5A1, 5A2, 6A1 and 6A2 contain 70 kHz notch filters to reduce the 70 kHz sideband. If 70 kHz sidebands are not acceptable, remove the modulators and check 70 kHz notch filter calibration as described in the NASM1 modulator module service instruction manual.

5.5.12.3 More Than 75 kHz From Carrier Frequency: Measure the radiated harmonics and spurious outputs that are more than 75 kHz from the carrier frequency as follows:

NOTE

When RF OUTPUT MONITOR connector 1A1J1 is used as the monitor point, hum and noise introduced by ground loops may result in measured levels that are higher than those actually present. It may be necessary to utilize a current probe with an isolated ground as a signal source for this measurement.

Notching of the fundamental carrier frequency may be necessary due to limitations of the spectrum analyzer in use.

(a) Perform spectrum analysis of rf output more than 75 kHz from rf carrier frequency.

(b) All harmonics and spurious outputs more than 75 kHz from the rf carrier frequency shall be a minimum of 80 dB below the fundamental rf carrier frequency.

CALIBRATION PROCEDURES

5.6 Calibration consists of adjusting variable electrical components to bring the operating parameters of a fully assembled transmitter into required or desired limits.

NOTE

Modulator drivers 4A1A4 and 4A1A5 contain circuits that must be calibrated on a work bench. Calibration instructions for these circuits are in the appropriate modulator driver service instruction manual.

The following procedures are presented in a logical sequence to accommodate a complete transmitter recalibration. The procedures may also be performed independently to correct an out-of-tolerance condition discovered during a minimum performance test. It is recommended a complete minimum performance test be completed after completion of any calibration procedures.

5.6.1 PRE-CALIBRATION REQUIREMENTS: Prepare for calibration as follows:

(a) Turn transmitter off. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(b) Disconnect or verify the antenna system is disconnected and connect a precision, 50 ohm, resistive dummy load rated at a minimum of 10,000 watts, to the rf output using a suitable coaxial cable. Dummy load must have provision to measure/indicate the rf power being applied to it, with an accuracy of ±2%.

(c) Verify that all panels are installed and securely fastened.

(d) Set the modulating audio input to zero (turned off).

(e) Set all switches as tabulated for 'Initial Setting' in table 4-1.

5.6.1.1 AC Voltage Checks: Check the ac voltages as follows:

WARNING

Terminals containing ac voltages that may be dangerous to life are exposed when the lower front panel is removed. Use extreme caution when making voltage measurements.

(a) Gain access to transformer T1's secondary winding taps by removing six screws and six plastic cup washers securing lower front panel (panel containing HIGH POWER circuit breaker CB1) and carefully extend the panel.

(b) Set HIGH POWER circuit breaker CB1 to its 'on' position.

(c) Measure phase-to-phase ac voltages across terminals H1, H2 and H3 of power transformer T1.

(d) Voltage measurements obtained in step (c) must be within five percent of the voltage used as the mean rms voltage level used to determine T1's primary winding taps during initial installation (see paragraph 3.8.1).

(e) If the requirements of step (d) are not met, it may be necessary to change the primary tap selection of transformer T1. Refer to paragraph 3.8.1.

NOTE

If the ac power source voltage is low, the output voltage on transformer T1's 55 volt ac rms phase-to-phase secondary windings will not provide -72 volts dc and the transmitter's rf carrier level will increase and/or decrease with line voltage fluctuations. If the ac power source voltage is high, the input/output power efficiency will be reduced and excessive heat will be dissipated by the transmitter.

(f) Measure phase-to-phase, rms, ac voltages between terminals X1, X2 and X3 of power transformer T1.

(g) Voltage measurements obtained in step (f) must be 55 (-0/+10) volts ac rms.

(h) Measure ac voltage between terminals Y1 and Y2 of power transformer T1.

(i) Voltage measurement obtained in step (h) must be 115 (-5/+10) volts ac rms.

(j) Set HIGH POWER circuit breaker CB1 to its 'off' position.

(k) Replace lower front panel removed in step (a).

5.6.1.2 15/24 Volt DC Power Supply Checks: Check the regulated 15 volt dc and unregulated 24 volt dc power supplies in low voltage power supply modules 7A5 and 7A6 as follows:

(a) Set switches as tabulated for 'Calibration Setting' in table 4-1.

(b) Connect a digital multimeter between power supply 7A5's 24 vdc test jack (TP1)(+) and GND test jack 4A1TP5.

(c) Digital multimeter indication shall be between 22.0 and 26.0 volts dc.

(d) Connect a digital multimeter between power supply 7A5's 15 vdc test jack (TP2)(+) and GND test jack 4A1TP5.

(e) Digital multimeter indication shall be between 14.5 and 15.5 volts dc.

(f) If requirements of steps (c) and/or (e) are not met, remove low voltage power supply 7A5 and service using NAS14 low voltage power supply service instruction manual.

(g) Connect a digital multimeter between power supply 7A6's 24 vdc test jack (TP1)(+) and GND test jack 4A1TP5.

(h) Digital multimeter indication shall be between 22.0 and 26.0 volts dc.

(i) Connect a digital multimeter between power supply 7A6's 15 vdc test jack (TP2)(+) and GND test jack 4A1TP5.

(j) Digital multimeter indication shall be between 14.5 and 15.5 volts dc.

(k) If requirements of steps (h) and/or (j) are not met, remove low voltage power supply 7A6 and service using NAS14 low voltage power supply service instruction manual.

5.6.2 -72 VOLT DC CALIBRATION: Calibrate the -72 volt dc regulator as follows:

NOTE

-72 vdc outputs of all rectifier/regulators are matched during calibration to ensure all modulator input voltages are balanced. Before attempting adjustment of the -72 volt dc outputs, ensure requirements of paragraph 5.6.1.1 are being met. It is possible to adjust -72 Vdc Regulator potentiometer A1R4 from the front of rectifier/regulator modules 7A1, 7A2, 7A3 and 7A4, using HAJ22 tuning tool, while they are installed in the transmitter. Refer to NAS13 rectifier/regulator service instruction manual for details of the module. If it is necessary to adjust the -72 volt dc outputs while the transmitter is operating into an antenna, care must be taken to ensure they do not vary by more than ±3.0 volts.

(a) Verify requirements of paragraph 5.6.1.1 are being met.

(b) Verify switches are set as tabulated for 'calibration setting' in table 4-1, lamp status is as detailed in paragraph 5.5.1 and OUTPUT POWER meter 1A1M1's forward power indication is the 'preset high level' rf output.

(c) Regulator lamp on front of each rectifier/regulator (7A1, 7A2, 7A3 and 7A4) should be on.

(d) Connect a digital multimeter between rectifier/regulator 7A1's -72 vdc test jack (TP1) (-) and GND test jack 4A1TP5.

(e) Voltage indications on TEST meter 1A1M3 and the digital multimeter shall be identical.

(f) If requirements of step (e) are not met, calibrate TEST meter 1A1M3 as described in paragraph 5.6.9.

(g) Adjust -72 Vdc Regulator potentiometer 7A1A1R4, using HAJ22 tuning tool, for a digital multimeter indication of -72.0 volts dc.

(h) Set MODULATOR INPUT CURRENT switch 1A1S4 to '2'.

(i) Repeat steps (d) and (g) for regulator 7A2, substituting 7A2 for 7A1.

(j) Set MODULATOR INPUT CURRENT switch 1A1S4 to '3'.

(k) Repeat steps (d) and (g) for regulator 7A3, substituting 7A3 for 7A1.

(l) Set MODULATOR INPUT CURRENT switch 1A1S4 to '4'.

(m) Repeat steps (d) and (g) for regulator 7A4, substituting 7A4 for 7A1.

5.6.3 CARRIER FREQUENCY CALIBRATION: Set the rf drive frequency and therefore the transmitter's rf carrier frequency to the assigned carrier frequency as follows:

(a) Verify switches are set as tabulated for 'calibration setting' in table 4-1, lamp status is as detailed in paragraph 5.5.1 and OUTPUT POWER meter 1A1M1's forward power indication is the 'preset high level' rf output.

(b) Connect a frequency counter between 'main' rf driver 4A1A1's carrier frequency test jack (TP1) and GND test jack 4A1TP5.

NOTE:

NAPE20 stereo rf drivers do not contain a frequency adjustment. The accuracy of the carrier frequency is dependent on the external frequency source when an NAPE20 stereo rf driver is installed as the 'main' rf driver (4A1A1).

(c) Adjust 'main' rf driver 4A1A1's FREQ variable capacitor (C4) (NAPE12 only) for the precise assigned carrier frequency, as indicated on the frequency meter.

(d) Disengage 'main' rf driver 4A1A1 from its mating connector.

(e) RF DRIVE ALARM lamp 1A1DS6 shall turn on, to indicate 'standby' rf driver 4A1A2 is enabled as the rf drive source for the power amplifiers.

(f) Connect a frequency counter between 'standby' rf driver 4A1A2's carrier frequency test jack (TP1) and GND test jack 4A1TP5.

(g) Adjust standby' rf driver 4A1A2's FREQ variable capacitor (C4) for precisely the assigned carrier frequency, as indicated on the frequency meter.

(h) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(i) Install 'main' rf driver 4A1A1, ensuring it is fully engaged with its mating connector.

(j) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(k) RF DRIVE ALARM lamp shall turn off, indicating rf driver 4A1A1 has been restored as the 'main' rf drive.

5.6.4 RF DRIVE TUNING CALIBRATION: Calibrate the rf drive tuned circuits as follows:

(a) Verify switches, except TRANSMITTER CONTROL - Master switch 1A1S1, are set as tabulated for 'calibration setting' in table 4-1.

(b) Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(c) Gain access to rf driver tuning assembly 4A1A7's adjustment knob by removing the front cover from driver unit 4A1.

WARNING

High voltages are present on rf drive tuning assembly 4A1A7 when rf drive is being applied. Do not loosen adjustment locking nut with power on.

(d) Loosen rf driver tuning assembly 4A1A7's tuning adjustment locking wing nut (see figure FO-25).

(e) Set the modulating audio input to zero (turned off).

(f) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(g) Adjust rf driver tuning coil 4A1A7L1's tuning knob for minimum brilliance on RF Driver Output lamp DS1 on inductor assembly 4A1A6 (see figures FO-24 and FO-25).

(h) RF DRIVE lamp 4A1DS2 should be on.

(i) Connect a digital multimeter between RF DRIVE test jack 4A1TP2(+) and GND test jack 4A1TP5.

(j) Digital multimeter indication should be greater than 37 volts dc.

(k) Disengage 'main' rf driver 4A1A1 from its mating connector.

(l) RF DRIVE ALARM lamp 1A1DS6 shall turn on, to indicate 'standby' rf driver 4A1A2 is enabled as the rf drive source for the power amplifiers.

(m) Inductor assembly 4A1A6's Rf Driver Output lamp (DS1) should remain at the same brilliance as observed in step (g).

(n) RF DRIVE lamp 4A1DS2 should remain on.

(o) Digital multimeter indication should be greater than 37 volts dc.

(p) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

CAUTION

High voltages are present on rf drive tuning assembly 4A1A7 when rf drive is being applied. Do not tighten adjustment locking nut with power on.

(q) Tighten rf driver tuning assembly 4A1A7's tuning adjustment locking wing nut (see figure FO-25).

(r) Install driver unit 4A1's front cover, using four screws and four plastic cup washers removed in step (c).

(s) Install 'main' rf driver 4A1A1, ensuring it is fully engaged with its mating connector.

(t) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(u) RF DRIVE ALARM lamp shall turn off, indicating rf driver 4A1A1 has been restored as the 'main' rf drive.

(v) Verify lamp status is as detailed in paragraph 5.5.1 and OUTPUT POWER meter 1A1M1's forward power indication is the 'preset high level' rf output.

(w) Restore the modulating audio input to the desired level.

5.6.5 PRESET CARRIER LEVEL CALIBRATION: Adjust the preset rf outputs to their assigned carrier levels as follows:

5.6.5.1 Prerequisites for Preset Carrier Level Calibration: The following prerequisites must be completed before attempting to calibrate a preset carrier level.

(a) Verify requirements of paragraphs 5.6.1 thru 5.6.4 are completed and are being met.

(b) Verify switches are set as tabulated for 'calibration setting' in table 4-1, lamp status is as detailed in paragraph 5.5.1 and OUTPUT POWER meter 1A1M1's forward power indication is not greater than 5500 watts.

(c) Adjust 'main' modulator driver 4A1A4's potentiometer (R16) for an rf output of 5500 watts, as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

(d) Set OUTPUT POWER switch 1A1S3 to REFL-LOW.

(e) OUTPUT POWER meter 1A1M1's reflected power indication should be near zero watts.

(f) Record MODULATOR INPUT CURRENT meter 1A1M2 and TEST meter 1A1M3 indications for each setting of MODULATOR INPUT CURRENT switch 1A1S4.

(g) Plot 5500 watts forward power, established in step (c) and modulator input current readings recorded in step (d) on the graph shown in figure 4-1. The intersection point must be below the 'Maximum - Carrier Only' line.

(h) All 'modulator input current' readings recorded in step (d) should be within 5% of any other reading.

(i) All 'test' readings recorded in step (d) should be between -70.0 and -73.0 volts dc.

(j) Set OUTPUT POWER switch 1A1S3 to FWD-HIGH.

(k) Determine the carrier levels that have been assigned to the subject transmitter, noting that a maximum of three preset levels can be accommodated.

5.6.5.2 High Power Calibration - Main Modulator Driver 4A1A4: Calibrate the carrier level to be produced as the transmitter's 'high power' output, when 'main' modulator driver 4A1A4 is the mod drive source, as follows:

(a) Determine the highest carrier level, from the three preset assigned carrier levels determined in step (k) of paragraph 5.6.5.1.

(b) Verify carrier level calibration prerequisites of para 5.6.5.1 have been completed.

(c) If the carrier level determined in step (a) is more than 5000 watts, adjust 'main' modulator driver 4A1A4's potentiometer (R16) for 5000 watts rf output, as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

(d) If the carrier level determined in step (a) is less than 5000 watts, adjust 'main' modulator driver 4A1A4's potentiometer (R16) for an rf output of the highest assigned carrier level, as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

(e) Record OUTPUT POWER meter 1A1M1's forward power indication, obtained in step (c) or (d), as the 'preset high level' rf output.

(f) Set ALC/remote pwr trim assembly 4A1A9's Power Trim Control switch (S3) to ALC.

NOTE

OUTPUT POWER meter 1A1M1's forward power indication may increment to a new level, at the rate of one increment per second.

(g) Rf output shall stabilize, within ten seconds, to a level that is within plus 18 percent/minus 10 percent of the 'preset high level' rf output recorded in step (e).

(h) Slowly adjust ALC/remote power trim assembly 4A1A9's ALC HIGH potentiometer (R13) for an rf output of the carrier level determined in step (a), as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

NOTE

Allow sufficient time for the rf output to stabilize while adjusting ALC HIGH potentiometer 4A1A9R13. The rf output will change in nominal 1.8 percent increments, at the rate of one increment per second. ALC lamp 4A1A9DS1 shall turn off when the rf output is being incremented and shall turn on when the rf output has stabilized.

(i) Record OUTPUT POWER meter 1A1M1's forward power indication obtained in step (h), when ALC lamp 4A1A9DS1 is on, as the 'assigned high level' rf output.

(j) Set ALC/remote pwr trim assy 4A1A9's Power Trim Control switch (S3) to PRESET.

(k) OUTPUT POWER meter 1A1M1's forward power indication shall be the 'preset high level' rf output recorded in step (e).

CAUTION

Adjustment of potentiometer 4A1A4R16 will affect the 'preset low level 1' and 'preset low level 2' rf outputs. If potentiometer 4A1A4R16 setting is changed, it will be necessary to recalibrate the 'low power 1' output as detailed in paragraph 5.6.5.3 and the 'low power 2' output as detailed in paragraph 5.6.5.4.

5.6.5.3 Low Power 1 Calibration - Main Modulator Driver 4A1A4: Calibrate the carrier level to be produced as the transmitter's rf output when 'low power 2' is selected and 'main' modulator driver 4A1A4 is the mod drive source, as follows:

(a) Determine the carrier level to be produced when 'low power 1' is selected, from the three preset assigned carrier levels determined in step (k) of paragraph 5.6.5.1.

NOTE

The carrier level to be produced for low power 1 can be higher or lower than the carrier level to be produced for low power 2. Both must be less than the 'preset high level' rf output established in para 5.6.5.2.

(b) Verify the high power calibration requirements of paragraph 5.6.5.2 have been completed and the 'preset high level' rf output has been set to its final value.

(c) Set O/P LEVEL switch 4A1S1 to LOW.

(d) LOW O/P LEVEL lamp 4A1DS1 shall turn on.

(e) Set ALC/remote power trim assembly 4A1A9's Low Power Select switch S1 to LL1.

(f) Adjust ALC/remote power trim assembly 4A1A9's O/P LL1 potentiometer (R44) for an rf output of the carrier level determined in step (a), as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

(g) Record OUTPUT POWER meter 1A1M1's forward power indication obtained in step (f) as the 'preset low level 1' rf output.

(h) Set ALC/remote power trim assembly 4A1A9's Power Trim Control switch (S3) to ALC.

NOTE

OUTPUT POWER meter 1A1M1's forward power indication may increment to a new level, at the rate of one increment per one second.

(i) Rf output shall stabilize, within ten seconds, to a level that is within plus 18 percent/minus 10 percent of the 'preset low level 1' rf output recorded in step (g).

(j) Slowly adjust ALC/remote power trim assembly 4A1A9's ALC LL1 potentiometer (R14) for an rf output of the rf carrier level determined in step (a), as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

NOTE

Allow sufficient time for the rf output to stabilize while adjusting ALC LL1 potentiometer 4A1A9R14. The rf output will change in nominal 1.8 percent increments, at the rate of one increment per second. ALC lamp 4A1A9DS1 shall turn off when the rf output is being incremented and shall turn on when the rf output has stabilized.

(k) Record OUTPUT POWER meter 1A1M1's forward power indication obtained in step (j), when ALC lamp 4A1A9DS1 is on, as the 'assigned low level 1' rf output.

(l) Set ALC/remote power trim assy 4A1A9's Power Trim Control switch (S3) to PRESET.

(m) OUTPUT POWER meter 1A1M1's forward power indication shall be the 'preset low level 1' rf output recorded in step (g).

5.6.5.4 Low Power 2 Calibration - Main Modulator Driver 4A1A4: Calibrate the carrier level to be produced as the transmitter's rf output when 'low power 2' is selected and 'main' modulator driver 4A1A4 is the mod drive source, as follows:

(a) Determine the carrier level to be produced when 'low power 2' is selected, from the three preset assigned carrier levels determined in step (k) of paragraph 5.6.5.1.

NOTE

The carrier level to be produced when low power 2 is selected can be higher or lower than the carrier level to be produced when low power 1 is selected. Both must be less than the 'preset high level' rf output established in paragraph 5.6.5.2.

(b) Verify the high power calibration requirements of para 5.6.5.2 have been completed.

(c) Set or verify O/P LEVEL switch 4A1S1 is set to LOW.

(d) LOW O/P LEVEL lamp 4A1DS1 shall be on.

(e) Set ALC/remote power trim assembly 4A1A9's Low Power Select switch S1 to LL2.

(f) Adjust ALC/remote power trim assembly 4A1A9's O/P LL2 potentiometer (R46) for an rf output of the carrier level determined in step (a), as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

(g) Record OUTPUT POWER meter 1A1M1's forward power indication obtained in step (f) as the 'preset low level 2' rf output.

(h) Set ALC/remote power trim assembly 4A1A9's Power Trim Control switch (S3) to ALC.

NOTE

Rf output, as indicated by OUTPUT POWER meter 1A1M1's forward power indication may increment to a new level, at one second intervals.

(i) Rf output shall stabilize, within ten seconds, to a level that is within plus 18 percent/minus 10 percent of the 'preset low level 1' rf output recorded in step (g).

(j) Slowly adjust ALC/remote power trim assembly 4A1A9's ALC LL2 potentiometer (R15) for an rf output of the rf carrier level determined in step (a), as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

NOTE

Allow sufficient time for the rf output to stabilize while adjusting ALC LL2 potentiometer 4A1A9R15. The rf output will change in nominal 1.8 percent increments, at the rate of one increment per second. ALC lamp 4A1A9DS1 shall turn off when the rf output is being incremented and shall turn on when the rf output has stabilized.

(k) Record OUTPUT POWER meter 1A1M1's forward power indication obtained in step (j), when ALC lamp 4A1A9DS1 is on, as the 'assigned low level 2' rf output.

(l) Set Power Trim Control switch 4A1A9S3 to PRESET.

(m) OUTPUT POWER meter 1A1M1's forward power indication shall be the 'preset low level 2' rf output recorded in step (g).

(n) Set O/P LEVEL switch 4A1S1 to HIGH.

(o) LOW O/P LEVEL lamp 4A1DS1 shall turn off.

(p) OUTPUT POWER meter 1A1M1's forward power indication shall be the 'preset high level' rf output recorded in step (e) of paragraph 5.6.5.2.

5.6.5.5 High Power Calibration - Standby Modulator Driver 4A1A5: Calibrate the carrier level to be produced as the transmitter's 'high power' output, when 'standby' modulator driver 4A1A5 is the mod drive source, as follows:

(a) Determine the highest carrier level, from the three preset assigned carrier levels determined in step (k) of paragraph 5.6.5.1.

(b) Verify carrier level calibration prerequisites of para 5.6.5.1 have been completed.

(c) Set or verify O/P LEVEL switch 4A1S1 is set to HIGH.

(d) Disengage 'main' modulator driver 4A1A4 from its mating connector.

(e) MOD DRIVE ALARM lamp 1A1DS7 shall turn on, indicating 'standby' modulator driver 4A1A5 is enabled as the mod drive source for the modulators.

(f) Adjust 'standby' modulator driver 4A1A5's potentiometer (R16) for an rf output of the carrier level determined in step (a), as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

(g) Record OUTPUT POWER meter 1A1M1's forward power indication as the 'standby high level' rf output.

CAUTION

Adjustment of potentiometer 4A1A5R16 will affect the 'standby assigned low level' rf output. If potentiometer 4A1A5R16 setting is changed, it will be necessary to recalibrate the 'standby low power' output as detailed in paragraph 5.6.5.6.

5.6.5.6 Low Power Calibration - Standby Modulator Driver 4A1A5: Calibrate the carrier level to be produced as the transmitter's 'standby low power' output, when 'standby' modulator driver 4A1A5 is the mod drive source, as follows:

(a) Determine which of the two lower power carrier levels is to produced, from the three preset assigned carrier levels determined in step (k) of paragraph 5.6.5.1, when low power is selected and a failure in 'main' modulator driver 4A1A4 causes a transfer to 'standby' modulator driver 4A1A5.

NOTE

There is only one preset low power level available when 'standby' modulator driver 4A1A5 is the mod drive source. The user must decide which of the two low power levels will be produced as the 'standby low level' rf output.

(b) Verify the standby high power calibration requirements of paragraph 5.6.5.2 have been completed and the 'standby high level' rf output has been set to its final value.

(c) Disengage or verify 'main' modulator driver 4A1A4 has been disengaged from its mating connector.

(d) MOD DRIVE ALARM lamp 1A1DS7 shall be on, indicating 'standby' modulator driver 4A1A5 is enabled as the mod drive source for the modulators.

(e) Set O/P LEVEL switch 4A1S1 to LOW.

(f) LOW O/P LEVEL lamp 4A1DS1 shall turn on.

(g) Adjust 'standby' modulator driver 4A1A5's CARR LEVEL-LOW potentiometer (R25) for an rf output of the carrier level determined in step (a), as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

(h) Record OUTPUT POWER meter 1A1M1's forward power indication as the 'standby low level' rf output.

(i) Set O/P LEVEL switch 4A1S1 to HIGH.

(j) LOW O/P LEVEL lamp 4A1DS1 shall turn off.

(k) OUTPUT POWER meter 1A1M1's forward power indication shall be the 'standby high level' rf output recorded in step (g) of paragraph 5.6.5.5.

(l) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(m) Install modulator driver 4A1A4, ensuring it is fully engaged with its mating connector.

(n) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(o) The external 'standby alarm' condition shall be removed and MOD DRIVE ALARM lamp 1A1DS7 shall turn off, indicating modulator driver 4A1A4 has been restored as the 'main' modulator drive.

(p) OUTPUT POWER meter 1A1M1's forward power indication should be the 'preset high level' rf output recorded in step (e) of paragraph 5.6.5.2.

(q) Restore the modulating audio input to the desired level.

5.6.6 MODULATION LEVEL CALIBRATION: The AUDIO LEVEL control on the front of each modulator driver ('main' and 'standby') is adjusted in conjunction with the station audio source to provide the desired modulation levels. 100% modulation may be obtained provided the input audio level is from -10 dBm to +12 dBm.

NOTE

The figures quoted for the input audio level are valid only when the impedance of the signal source is 600 ohms.

If modulation envelope is not acceptable, remove the offending modulator driver and calibrate on a work bench using the appropriate modulator driver module service instruction manual.

5.6.7 TX FAULT ALARM THRESHOLD CALIBRATION: Adjust the tx fault alarm threshold to the desired level as follows:

NOTE

There is only one low power tx fault alarm threshold level available. The user must decide which of the two preset low power levels will be used as the reference level.

(a) Verify calibration requirements of paragraphs 5.6.1 thru 5.6.5 have been completed and their requirements are being met.

(b) Verify switches are set as tabulated for 'calibration setting' in table 4-1, lamp status is as detailed in paragraph 5.5.1 and OUTPUT POWER meter 1A1M1's forward power indication is the 'preset high level' rf output.

(c) Set monitor module 4A1A3's HIGH POWER-TX FAULT THRESHOLD potentiometer (R22) fully clockwise.

(d) An external 'Tx Fault Alarm' condition shall not be generated.

(e) Determine the rf output level to be used as the high power tx fault alarm reference threshold.

(f) Adjust 'main' modulator driver 4A1A4's potentiometer (R16) for the high power tx fault alarm threshold rf output, determined in step (e), as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

(g) Adjust monitor module 4A1A3's HIGH POWER-TX FAULT THRESHOLD potentiometer (R22) counter clockwise, until an external 'Tx Fault Alarm' condition is generated.

NOTE

The high power tx fault alarm threshold is set, at the factory, to generate a 'Tx Fault Alarm' condition when the rf output falls below 4000 watts (approximately 1 dB down from 5000 watts).

(h) Adjust monitor module 4A1A3's HIGH POWER-TX FAULT THRESHOLD potentiometer (R22) clockwise, until external 'Tx Fault Alarm' condition just turns off.

(i) Adjust 'main' modulator driver 4A1A4's potentiometer (R16) for the 'preset high level' rf output observed in step (b), as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

(j) Simultaneously monitor OUTPUT POWER meter 1A1M1's forward power indication and the external 'Tx Fault alarm' condition, while decreasing the rf output by slowly adjusting potentiometer 4A1A4R16 counter clockwise, until an external 'Tx Fault alarm' condition just occurs.

(k) External 'Tx Fault alarm' condition shall occur as OUTPUT POWER meter 1A1M1's forward power indication passes through 'high power' tx fault alarm threshold determined in step (e).

(l) Repeat steps (f) thru (k) until the requirements of step (k) are met.

(m) Adjust 'main' modulator driver 4A1A4's potentiometer (R16) for the 'preset high level' rf output observed in step (b), as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

(n) The external 'Tx Fault alarm' condition shall be removed.

(o) Determine the rf output level to be used as the low power tx fault alarm reference threshold.

(p) Set monitor module 4A1A3's HIGH POWER-TX FAULT THRESHOLD potentiometer (R15) fully clockwise.

(q) Set ALC/remote power trim assembly 4A1A9's Low Power Select switch (S1) to the low power setting (LL1 or LL2) which will produce an rf output that is higher than the low power tx fault reference threshold determined in step (o).

(r) Set O/P LEVEL switch 4A1S1 to LOW.

(s) LOW O/P LEVEL lamp 4A1DS1 shall turn on.

(t) OUTPUT POWER meter 1A1M1's forward power indication shall be the 'preset low level' rf output for the low power output (LL1 or LL2) selected.

(u) An external 'Tx Fault Alarm' condition shall not be generated.

(v) Adjust ALC/remote power trim assembly 4A1A9's appropriate O/P (LL1 or LL2) potentiometer for the low power tx fault alarm threshold rf output, determined in step (o), as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

(w) Adjust monitor module 4A1A3's LOW POWER-TX FAULT THRESHOLD potentiometer (R15) counter clockwise, until an external 'Tx Fault Alarm' condition is generated.

(x) Adjust monitor module 4A1A3's LOW POWER-TX FAULT THRESHOLD potentiometer (R15) clockwise, until external 'Tx Fault Alarm' condition just turns off.

(y) Adjust ALC/remote power trim assembly 4A1A9's appropriate O/P (LL1 or LL2) potentiometer for the 'preset low level' rf output observed in step (t), as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

(z) Simultaneously monitor OUTPUT POWER meter 1A1M1's forward power indication and external 'Tx Fault alarm' condition while decreasing rf output by slowly adjusting ALC/remote power trim assembly 4A1A9's appropriate O/P (LL1 or LL2) potentiometer counter clockwise, until a 'Tx Fault alarm' condition just occurs.

(aa) External 'Tx Fault alarm' condition shall occur as OUTPUT POWER meter 1A1M1's forward power indication passes through 'low power' tx fault alarm threshold determined in step (o).

(ab) Repeat steps (v) thru (z) until the requirements of step (aa) are met.

(ac) Adjust ALC/remote power trim assembly 4A1A9's appropriate O/P (LL1 or LL2) potentiometer for the 'preset low level' rf output observed in step (t), as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

(ad) The external 'Tx Fault alarm' condition shall be removed.

(ae) Set ALC/remote power trim assembly 4A1A9's Low Power Select switch (S1) to RMT.

(af) Set O/P LEVEL switch 4A1S1 to HIGH.

(ag) LOW O/P LEVEL lamp 4A1DS1 shall turn off.

(ah) OUTPUT POWER meter 1A1M1's forward power indication shall be the 'preset high level' rf output observed in step (b).

5.6.8 OUTPUT POWER METER 1A1M1 CALIBRATION: Calibrate OUTPUT POWER meter 1A1M1 as follows:

(a) Verify all switches, except TRANSMITTER CONTROL - Master switch 1A1S1, are set as tabulated for 'calibration setting' in table 4-1.

(b) Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(c) Gain access to rear of control/monitor panel 1A1 by removing four screws and four plastic cup washers securing it to the cabinet. Extend the panel top on its retaining chains while pivoting the panel bottom on the cabinet cross member.

(d) Set the modulating audio input to zero (turned off).

(e) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(f) Adjust 'main' modulator driver 4A1A4's potentiometer (R16) for 1250 watts rf output, as indicated on the dummy load's power indicator.

(g) Set OUTPUT POWER switch 1A1S3 to FWD-LOW.

(h) Adjust potentiometer R5, on meter calibration printed circuit board 1A1A1, for a forward power indication on OUTPUT POWER meter 1A1M1's lower scale that is precisely 1250 watts.

(i) Set OUTPUT POWER switch 1A1S3 to FWD-HIGH.

(j) Adjust 'main' modulator driver 4A1A4's potentiometer (R16) for 5000 watts rf output, as indicated on the dummy load's power indicator.

(k) Adjust potentiometer R2, on meter calibration printed circuit board 1A1A1, for a forward power indication on OUTPUT POWER meter 1A1M1's upper scale that is precisely 5000 watts.

(l) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(m) Return control/monitor panel 1A1 to its normal position, ensuring wiring or retaining chains are not pinched, and secure using four screws and four plastic cup washers.

(n) Calibrate the preset carrier levels as detailed in paragraph 5.6.5.

5.6.9 MODULATOR INPUT CURRENT METER 1A1M2 CALIBRATION: Calibrate MODULATOR INPUT CURRENT meter 1A1M2 as follows:

CAUTION

Each current shunt resistor has a voltage, with a high current capacity (from large storage capacitors), on it for up to ten minutes after the transmitter or its associated rectifier/regulator is turned off. Contact with a conductive object during this time will cause arcing which may result in irreparable damage. A discharge probe (at the rear, right-hand side of the cabinet) is provided to safely discharge storage capacitors and reduce the waiting time.

NOTE

The current shunt resistors were precisely calibrated during manufacture. If their settings have not been disturbed, there are no alarm lamps on and the modulator input current readings all appear to be high or low, the most likely problem is the MODULATOR INPUT CURRENT meter circuit.

(a) Verify all switches, except TRANSMITTER CONTROL - Master switch 1A1S1, are set as tabulated for 'calibration setting' in table 4-1.

(b) Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(c) Set the modulating audio input to zero (turned off).

(d) Gain access to rear of control/monitor panel 1A1 by removing four screws and four plastic cup washers securing it to the cabinet. Extend the panel top on its retaining chains while pivoting the panel bottom on the cabinet cross member.

(e) Gain access to the current shunt resistors, located at the rear of their associated modulators, by removing the lower fan panel.

(f) Reset the interlock circuit by placing the lower fan panel interlock switch's actuating plunger to its extended position.

CAUTION

The positioning of the nuts on the current shunt resistors is critical to calibration. Do not disturb the setting of any nut other than the top castle nut when connecting the ammeter.

(g) Connect an ammeter between terminal 1 of current shunt resistor 5R1 and its associated choke (L1) as depicted in figure 5-1.

(h) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(i) OUTPUT POWER meter 1A1M1's forward power indication should be the 'preset high level' rf output.

(j) Adjust 'main' modulator driver 4A1A4's potentiometer (R16) for a convenient reading on the ammeter connected in step (g).

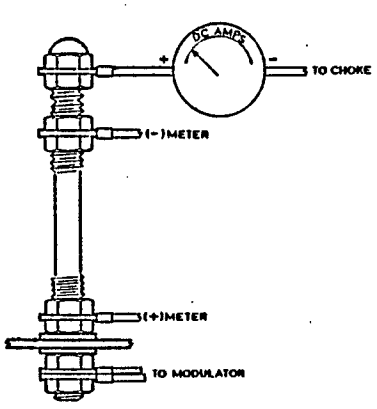


Figure 5-1 Current Shunt Resistor

Test Connections

(k) Adjust potentiometer R2, on meter calibration printed circuit board 1A1A3, until MODULATOR INPUT CURRENT meter 1A1M2's indication is precisely the same as the ammeter reading obtained in step (j).

NOTE

If potentiometer R2's limits are reached before calibration is achieved, set potentiometer R2 to the center of its adjustment range and then calibrate the current shunt resistor(s) as described in para 5.6.11.

(l) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(m) Return control/monitor panel 1A1 to its normal position, ensuring wiring or retaining chains are not pinched, and secure using hardware removed in step (b).

(n) Disconnect the ammeter and connect the wire from choke L1 to the top of current shunt resistor 5R1, ensuring the position of all nuts is retained while securely tightening the top castle nut.

(o) Install the lower fan panel removed in step (e).

(p) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(q) MODULATOR INPUT CURRENT meter 1A1M2 indication shall be the same as the reading obtained in step (k).

(r) Calibrate the preset carrier levels as detailed in para 5.6.5.

5.6.10 TEST METER 1A1M3 CALIBRATION: Calibrate TEST meter 1A1M3 as follows:

(a) Verify all switches, except TRANSMITTER CONTROL - Master switch 1A1S1, are set as tabulated for 'calibration setting' in table 4-1.

(b) Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(c) Gain access to rear of control/monitor panel 1A1 by removing four screws and four plastic cup washers securing it to the cabinet. Extend the panel top on its retaining chains while pivoting the panel bottom on the cabinet cross member.

(d) Connect a digital multimeter's test leads between rectifier/regulator 7A1's -72 vdc test jack (TP1) (-) and GND test jack 4A1TP5.

(e) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(f) When the -72 volt dc output of rectifier/regulator 7A1 has stabilized (approximately 20 seconds) record the dc voltage indication on the digital multimeter.

(g) Adjust potentiometer, R2 on meter calibration printed circuit board 1A1A2, for a TEST meter 1A1M3 indication that is the same as the digital multimeter reading recorded in step (f).

(h) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(i) Return control/monitor panel 1A1 to its normal position, ensuring wiring or retaining chains are not pinched, and secure using the four screws and four plastic cup washers removed in step (c).

5.6.11 MODULATOR INPUT CURRENT SHUNT RESISTOR CALIBRATION: Calibrate modulator input current shunt resistors as follows:

CAUTION

Each current shunt resistor has a voltage, with a high current capacity (from large storage capacitors), on it for up to ten minutes after the transmitter or its associated rectifier/regulator is turned off. Accidental contact with a conductive object during this time will cause arcing which may result in irreparable damage to the equipment. A modulator discharge probe (located on the rear, right-hand side of the cabinet) is provided to safely discharge the storage capacitors and reduce the waiting time.

NOTE

The current shunt resistors provide a reference voltage for monitoring purposes. If a current shunt resistor is out of calibration, the rf output of the transmitter will not be affected but the MODULATOR INPUT CURRENT indication for that power block will be inaccurate. If their are no alarm lamps on, the majority of MODULATOR INPUT CURRENT indications are normal, and the replacement of the modulator associated with an incorrect indication by a known serviceable modulator does not correct the problem, it may be assumed the current shunt resistor is out of calibration. Normal operation of the transmitter may be maintained until it is convenient to calibrate the affected current shunt resistor(s).

(a) Verify all switches, except TRANSMITTER CONTROL - Master switch 1A1S1, are set as tabulated for 'calibration setting' in table 4-1.

(b) Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(c) Set the modulating audio input to zero (turned off).

(d) Gain access to the current shunt resistors, located at the rear of their associated modulators, by removing the lower fan panel.

(e) Reset the interlock circuit by placing the lower fan panel interlock switch's actuating plunger to its extended position.

CAUTION

The positioning of the nuts on the current shunt resistors is critical to calibration. Do not disturb the setting of any nut other than the top castle nut when connecting the ammeter.

(f) Connect an ammeter between terminal 1 of the current shunt resistor to be calibrated and its associated choke (L1) as depicted in figure 5-1.

(g) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(h) OUTPUT POWER meter 1A1M1's forward power indication should be the 'preset high level' rf output.

(i) Set MODULATOR INPUT CURRENT switch 1A1S4 to the appropriate position (determined by the shunt resistor being monitored by the ammeter).

(j) Adjust 'main' modulator driver 4A1A4's potentiometer (R16) for a reading of 20 amperes on the ammeter connected in step (f).

(k) MODULATOR INPUT CURRENT meter 1A1M2 indication should be within 2% of the ammeter reading obtained in step (j).

(l) If MODULATOR INPUT CURRENT meter 1A1M2 indication obtained in step (k) is within tolerance, the associated current shunt resistor is within calibration limits.

(m) If MODULATOR INPUT CURRENT meter 1A1M2 indication obtained in step (k) is not within tolerance, turn off transmitter by setting TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(n) Loosen the nuts associated with terminal 2 of the associated current shunt resistor and adjust the nuts to position terminal 2 closer or further from terminal 3 as required, noting that increasing the separation will increase the indication on MODULATOR INPUT CURRENT meter 1A1M2.

(o) Tighten nuts loosened in step (n), ensuring positioning of terminal 2 does not change.

(p) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(q) Repeat steps (j) thru (p) until the requirement of step (k) is met.

(r) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(s) Disconnect ammeter and restore current shunt resistor's circuit to its original status, ensuring position of all nuts is retained while securely tightening the top castle nut.

(t) Repeat steps (f) thru (s) for the remaining suspect current shunt resistors.

(u) Install the lower fan panel removed in step (d).

(v) If necessary, return control/monitor panel 1A1 to its normal position, ensuring wiring or retaining chains are not pinched, and secure using the four screws and four plastic cup washers removed during disassembly.

(w) Calibrate the preset carrier levels as detailed in paragraph 5.6.5.

5.6.12 AUDIO DISTORTION CALIBRATION: Optimize the audio distortion by calibrating the hum balance circuit in 'main' modulator driver 4A1A4 and/or 'standby' modulator driver 4A1A5, as follows:

CAUTION

Continuous modulation levels of more than 60% should be avoided when the audio input signal is a sine/square wave. Overheating may occur if the transmitter is operated at 5000 watts and the modulation level is a continuous 100% for more than ten minutes.

(a) Verify all switches, except TRANSMITTER CONTROL - Master switch 1A1S1, are set as tabulated for 'calibration setting' in table 4-1.

(b) Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(c) Connect an audio signal generator with an output impedance of 600 ohms between terminals 16 and 18 of terminal board 4A1TB1, as the transmitter's source of modulation audio, in lieu of the normal station modulating audio.

(d) Connect a modulation monitor to RF OUTPUT MONITOR connector 1A1J1.

NOTE

If a modulation monitor is not available, refer to table 1-2 as an aid in selecting alternative measuring equipment.

(e) Connect a distortion analyzer with a nominal 25 kHz bandwidth to the demodulated audio output of the modulation monitor.

(f) Gain access to the interior of 'main' modulator driver module 4A1A4 by extending it using modulator drive module extender P/N 139-8229. Connect J1 of modulator driver module 4A1A4 to J1 of ALC/remote power trim assembly using extender interconnecting cable assembly provided.

(g) Set 'main' modulator driver module 4A1A4's hum balance potentiometer (A1R9) fully counterclockwise.

CAUTION

If hum balance potentiometer 4A1A4A1R9 is not set fully counterclockwise initially, the transmitter's rf output may oscillate and cause the rf output to be shut back.

(h) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(i) OUTPUT POWER meter 1A1M1's forward power indication should be the 'preset high level' rf output.

(j) Set the frequency of the the audio signal generator's output to 50 Hz.

(k) Adjust the audio signal generator's output level to obtain a 95 percent modulation envelope on the rf carrier output.

CAUTION

Discontinue adjusting hum balance potentiometer 4A1A4A1R9 when an audio distortion level of two percent has been obtained. An attempt to improve the distortion level beyond this point may result in audio instability with a high modulation depth and a low modulating audio frequency.

(l) Simultaneously measure the audio distortion level, using a distortion analyzer, and slowly adjust 'main' modulator driver 4A1A4's hum balance potentiometer (A1R9) clockwise until an audio distortion level of two percent is obtained.

(m) Perform the signal-to-noise ratio and audio distortion tests specified in paragraphs 5.5.11.3 and 5.5.11.4.

(n) Install 'main' modulator driver module 4A1A4 in driver unit 4A1, ensuring its mating connectors are fully engaged. Connect J1 of modulator driver module 4A1A4 to J1 of ALC/remote power trim assembly using original interconnecting cable assembly.

(o) If audio distortion is not optimum when standby modulator driver is enabled and producing the mod drive for the modulators, disengage 'main' modulator driver 4A1A4 from its mating connector, using the extraction tool provided.

(p) MOD DRIVE ALARM lamp 1A1DS7 shall turn on, indicating 'standby' modulator driver 4A1A5 is enabled and providing the mod drive for the modulators.

(q) Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(r) Gain access to the interior of 'standby' modulator driver module 4A1A5 by extending it using modulator drive module extender P/N 139-8229.

(s) Set 'standby' modulator driver module 4A1A5's hum balance potentiometer (A1R9) fully counterclockwise.

CAUTION

If hum balance potentiometer is not set fully counterclockwise initially, the rf output may oscillate and cause the rf output to be shut back.

(t) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(u) OUTPUT POWER meter 1A1M1's forward power indication should be the 'standby high level' rf output.

(v) Set the frequency of the the audio signal generator's output to 50 Hz.

(w) Adjust the audio signal generator's output level to obtain a 95 percent modulation envelope on the rf carrier output.

CAUTION

Discontinue adjusting hum balance potentiometer A1R9 when an audio distortion level of two percent has been obtained. An attempt to improve distortion level beyond this point may result in audio instability during high modulation depths and low modulating audio frequencies.

(x) Simultaneously measure the audio distortion level, using a distortion analyzer, and slowly adjust 'standby' modulator driver 4A1A5's hum balance potentiometer (A1R9) clockwise until an audio distortion level of two percent is obtained.

(y) Perform the signal-to-noise ratio and audio distortion tests specified in paragraphs 5.5.11.3 and 5.5.11.4.

(z) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(aa) Install modulator driver 4A1A4, ensuring its mating connector is fully engaged.

(ab) Install 'standby' modulator driver module 4A1A5 in driver unit 4A1, ensuring its mating connector is fully engaged.

(ac) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(ad) The external 'standby alarm' condition shall be removed and MOD DRIVE ALARM lamp 1A1DS7 shall turn off, indicating modulator driver 4A1A4 has been restored as the 'main' modulator drive.

5.6.13 MODULATION MONITOR OUTPUT CALIBRATION: Calibrate the modulation monitor output of modulation monitor probe 1A2A5 as follows:

WARNING

High voltages that may cause serious injury or death are present on the transmitter's harmonic filter when the transmitter is turned on. Use extreme caution when making adjustments to potentiometers R1, R2 and R3 on modulation monitor probe 1A2A5 .

(a) Verify all switches, except TRANSMITTER CONTROL - Master switch 1A1S1, are set as tabulated for 'calibration setting' in table 4-1.

(b) Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(c) Set the modulating audio input to zero (turned off).

(d) Verify autotransformer tap selection has been completed (see paragraph 3.8.6.).

(e) Determine the input voltage required by the station modulation monitor to be used, in rms volts.

(f) Set modulation monitor probe 1A2A5's potentiometers (R1, R2 and R3) fully counter clockwise.

(g) Connect a 50-ohm load (input of station modulation monitor) to the output of modulation monitor probe 1A2A5 (between 1A2A5TB1-2 and 1A2A5TB-1) using a suitable coaxial cable.

(h) Connect an rf voltmeter across the 50-ohm load connected in step (g).

(i) Set 'main' modulator driver 4A1A4's potentiometer (R16) fully counter clockwise (minimum rf output).

(j) Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(k) OUTPUT POWER meter 1A1M1's forward power indication should be less than 100 watts.

(l) Monitor rf voltmeter connected in step (h) and slowly adjust 'main' modulator driver 4A1A4's potentiometer (R16) for the assigned 'high level' rf output, as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

CAUTION

Discontinue adjusting potentiometer 4A1A4R16 if rf voltmeter's rms voltage indication reaches the input voltage required by the station modulation monitor before the desired rf output level is obtained. Turn transmitter off. Change high level autotransformer tap setting, as described in paragraph 3.8.6, to the tap that will provide the next higher reduction in dBs and then repeat steps (i) thru (l).

(m) Rf voltmeter's rms voltage indication should be less than the required station modulation monitor input voltage determined in step (e).

(n) Adjust modulation monitor probe 1A2A5's HIGH POWER potentiometer (R3) for an rf voltmeter indication that is precisely the rms voltage required as the station modulation monitor's input voltage.

NOTE

If the requirements of step (n) cannot be achieved, turn transmitter off. Change high level autotransformer tap setting, as described in paragraph 3.8.6, to the tap that will provide the next lower reduction in dBs and then repeat steps (i) thru (n).

(o) Set O/P LEVEL switch 4A1S1 to LOW.

(p) Set ALC/remote power trim assy 4A1A9's Low Power Select switch (S1) to LL1.

(q) LOW O/P LEVEL lamp 4A1DS1 shall turn on and OUTPUT POWER meter 1A1M1's forward power indication should be the assigned 'low level 1' rf output.

(r) Set ALC/remote power trim assy 4A1A9's O/P LL1 potentiometer (R44) fully counter clockwise.

NOTE

An external 'tx fault alarm' condition will be generated. This condition should be ignored.

(s) OUTPUT POWER meter 1A1M1's forward power indication shall be less than 100 watts.

(t) Monitor rf voltmeter connected in step (h) and slowly adjust ALC/remote power trim assy 4A1A9's O/P LL1 potentiometer (R44) for the assigned 'low level 1' rf output, as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

CAUTION

Discontinue adjusting O/P LL1 potentiometer 4A1A9R44 if rf voltmeter's rms voltage indication reaches the input voltage required by the station modulation monitor before the desired rf output level is obtained. Turn transmitter off. Change low level 1 autotransformer tap setting, as described in paragraph 3.8.6, to the tap that will provide the next higher reduction in dBs and then repeat steps (r) thru (t).

(u) Rf voltmeter's rms voltage indication should be less than the required station modulation monitor input voltage determined in step (e).

(v) Adjust modulation monitor probe 1A2A5's LO LEVEL 1 potentiometer (R2) for an rf voltmeter indication that is precisely the rms voltage required as the station modulation monitor's input voltage.

NOTE

If the requirements of step (v) cannot be achieved, turn transmitter off. Change low level 1 autotransformer tap setting, as described in paragraph 3.8.6, to the tap that will provide the next lower reduction in dBs and then repeat steps (r) thru (v).

(w) Set ALC/remote power trim assy 4A1A9's Low Power Select switch (S1) to LL2.

(x) OUTPUT POWER meter 1A1M1's forward power indication should be the assigned 'low level 2' rf output.

(y) Set ALC/remote power trim assy 4A1A9's O/P LL2 potentiometer (R46) fully counter clockwise.

NOTE

An external 'tx fault alarm' condition will be generated. This condition should be ignored.

(z) OUTPUT POWER meter 1A1M1's forward power indication shall be less than 100 watts.

(aa) Monitor rf voltmeter connected in step (h) and slowly adjust ALC/remote power trim assy 4A1A9's O/P LL2 potentiometer (R46) for the assigned 'low level 2' rf output, as indicated by OUTPUT POWER meter 1A1M1's forward power indication.

CAUTION

Discontinue adjusting O/P LL2 potentiometer 4A1A9R46 if rf voltmeter's rms voltage indication reaches the input voltage required by the station modulation monitor before the desired rf output level is obtained. Turn transmitter off. Change low level 2 autotransformer tap setting, as described in paragraph 3.8.6, to the tap that will provide the next higher reduction in dBs and then repeat steps (y) thru (aa).

(ab) Rf voltmeter's rms voltage indication should be less than the required station modulation monitor input voltage determined in step (e).

(ac) Adjust modulation monitor probe 1A2A5's LO LEVEL 2 potentiometer (R1) for an rf voltmeter indication that is precisely the rms voltage required as the station modulation monitor's input voltage.

NOTE

If the requirements of step (ac) cannot be achieved, turn transmitter off. Change low level 2 autotransformer tap setting, as described in paragraph 3.8.6, to the tap that will provide the next lower reduction in dBs and then repeat steps (y) thru (ac).

If the lowest tap setting has already been selected, set modulation monitor probe 1A2A5's LO LEVEL 2 potentiometer (R1) fully clockwise and record rf voltmeter's rms voltage indication. If the station modulation monitor can be adjusted to operate from this voltage, record the voltage as the input rms voltage required by the station modulation monitor in step (e) and repeat steps (n) and (v).

SECTION 6
MAINTENANCE

GENERAL

6.1 This section contains scheduled and corrective maintenance information for the subject transmitter. Fault symptoms should be analyzed to determine the corrective action required. Normally, faults will be isolated to a plug-in module, which is then removed from the transmitter and repaired on a work bench independent of the transmitter. Replacement of the defective module with a serviceable module will restore the transmitter to an operational status. In any event, the most practical way to isolate a fault is to perform a minimum performance test in conjunction with troubleshooting procedures. This section contains wiring information for each hard wired assembly and references illustrations in the foldout section that depict the mechanical assembly of the transmitter components, and provide information regarding the location, marking of all controls and indicators.

ELECTRICAL SCHEMATICS/LOGIC DIAGRAMS

6.2 An electrical schematic for each electrical assembly in the AMPFET 5 AM broadcast transmitter is provided.

6.2.1 COMPONENT VALUES: Unless otherwise specified on the schematic:

- All resistor values are shown in ohms (K = 1 000 and M = 1 000 000).
- All capacitor values are shown in microfarads (uF).
- Unidentified diodes are part number 1N4938.

6.2.2 GRAPHIC SYMBOLS: The graphic symbols used on the electrical schematics are in accordance with American National Standard ANSI Y32.2-1975 - Graphic Symbols for Electrical and Electronic Diagrams.

6.2.3 LOGIC SYMBOLS: The logic symbols used on electrical schematics and logic diagrams are in accordance with American National Standard ANSI Y32.14-1975 - Graphic Symbols for Logic Diagrams.

6.2.4 REFERENCE DESIGNATIONS: Reference designations have been assigned to all electrical parts and mechanical parts that are referenced in this manual in accordance with American National Standard ANSI Y32.16-1975 - Reference Designations for Electrical and Electronic Parts and Equipments. Each electrical symbol has been identified with its basic reference designation. To obtain the full reference designation for a specific part, this basic identifier must be prefixed with the reference designation assigned to all higher assemblies.

WIRING INFORMATION

6.3 Point-to-point wiring information is provided in tables 6-3 thru 6-6. Refer to the appropriate service instruction manual for wiring information of plug-in modules.

6.3.1 AMPFET 5 CABINET WIRING: Table 6-3 provides a tabular wiring list for the AMPFET 5 transmitter cabinet.

6.3.2 FAN PANEL WIRING: Table 6-4 provides a tabular wiring list for the upper and lower fan panels.

6.3.3 CONTROL/MONITOR PANEL NAC21/4 WIRING: Table 6-5 provides a tabular wiring list for the NAC21/4 control/monitor panel.

6.3.4 DRIVER UNIT NAE39/1 WIRING: Table 6-6 provides a tabular wiring list for the NAE39/1 rf driver unit.

6.3.5 MODULATION MONITOR PROBE NAFP15 WIRING: Table 6-7 provides a tabular wiring list for the NAFP15 modulation monitor probe.

MECHANICAL DRAWINGS

6.4 Mechanical drawings that depict the location of electrical components and show assembly outline detail are provided in the foldout section. The assembly illustrations are presented in the order of their assigned reference designations.

6.4.1 AMPFET 5 TRANSMITTER CABINET: Assembly detail of the AMPFET 5 transmitter cabinet is depicted in figure FO-14.

6.4.2 1A1 - CONTROL/MONITOR PANEL NAC21/4: Assembly detail of the NAC21/4 control/monitor panel is depicted in figures FO-15 and FO-16.

6.4.3 1A2 - HARMONIC FILTER ASSEMBLY: Assembly detail of the harmonic filter assembly is depicted in figures FO-17, FO-18 and FO-19.

6.4.3.1 1A2A1 - 5000 Watt Combiner NAH24/1: Assembly detail of the NAH24/1 5000 watt combiner is depicted in figure FO-20.

6.4.3.2 1A2A2 - 5000 Watt RF Voltage Probe NAFP6/1: Assembly detail of the NAFP6/1 5000 watt rf voltage probe is depicted in figures FO-17, FO-18 and FO-19.

6.4.3.3 1A2A3 - 5000 Watt Forward/Reflected Power Probe NAFP5/5: Assembly detail of the NAFP5/5 5000 watt forward/reflected power probe is depicted in figure FO-21.

6.4.3.4 1A2A4 - Current Probe NAFP7: Assembly detail of the NAFP7 current probe is depicted in figure FO-20.

6.4.3.5 1A2A5 - Modulation Monitor Probe NAFP15: Assembly detail of the NAFP15 Modulation Monitor Probe is depicted in figure FO-22.

6.4.4 2A1 thru 2A12 and 3A1 thru 3A12 - POWER AMPLIFIER MODULES NAA11: Installation and location information for the NAA11 power amplifier modules is depicted in figure FO-23. Refer to the NAA11 service instruction manual for assembly detail of a power amplifier module.

6.4.5 4A1 - 5000 WATT RF DRIVER UNIT NAE39/1: Assembly detail of the NAE39/1 5000 watt rf Driver unit is depicted in figures FO-24 and FO-25.

6.4.5.1 4A1A1/A2 - RF Driver Modules: Installation and location information for the rf driver modules is depicted in figures FO-24 and FO-25. Note that 4A1A1 is an NAPE12 rf driver module in monaural transmitters and is an NAPE20 stereo rf driver module in stereo transmitters or transmitters that utilize an externally generated rf carrier signal. 4A1A2 is an NAPE12 rf driver module in monaural and stereo transmitters. Refer to the NAPE12 and/or NAPE20 service instruction manual for assembly detail of the rf driver modules.

6.4.5.2 4A1A3 - Monitor Module NAPC7: Installation and location information for the NAPC7 monitor module is depicted in figures FO-24 and FO-25. Refer to the NAPC7 service instruction manual for assembly detail of the monitor module.

6.4.5.3 4A1A4/A5 - Modulator Driver Modules NAPE27/1 and NAPE19/1: Installation and location information for the NAPE27/1 and NAPE19/1 modulator driver modules is depicted in figures FO-21 and FO-22. Note that 4A1A4 is an NAPE27/1 modulator driver module and 4A1A5 is an NAPE19/1 modulator driver module. Refer to the NAPE27/1 and/or NAPE19/1 service instruction manuals for assembly detail of the modulator driver modules.

6.4.5.4 4A1A6 - Inductor Assembly: Installation and location information for the inductor assembly is depicted in figures FO-24 and FO-25. Figure FO-26 depicts its assembly detail.

6.4.5.5 4A1A7 - RF Driver Tuning Assembly: Installation and location information for the rf driver tuning assembly is depicted in figures FO-24 and FO-25. Figure FO-26 depicts its assembly detail.

6.4.5.6 4A1A9 - ALC/Remote Power Trim Assembly NAPC18: Installation and location information for the NAPC18 ALC/Remote Power Trim Assembly is depicted in figures FO-24 and FO-25. Refer to the NAPC18 service instruction manual for assembly detail of the ALC/Remote Power Trim Assembly.

6.4.6 5A1/5A2-6A1/6A2 - MODULATOR MODULES NASM1: Installation and location information for the NASM1 modulator modules is depicted in figure FO-27. Refer to the NASM1 service instruction manual for assembly detail of a modulator module.

6.4.7 7A1/A2/A3/A4 - RECTIFIER/REGULATOR MODULE NAS13: Installation and location information for the NAS13 rectifier/regulator modules is depicted in figure FO-28. Refer to the NAS13 rectifier/regulator service instruction manual for assembly detail of a rectifier/regulator module.

6.4.8 7A5/A6 - LOW VOLTAGE SUPPLY MODULE NAS14: Installation and location information for the NAS14 low voltage supply modules is depicted in figure FO-28. Refer to the NAS14 service instruction manual for assembly detail of a low voltage supply module.

SCHEDULED MAINTENANCE

6.5 Scheduled maintenance consists of performing a visual inspection of the transmitter in conjunction with a minimum performance test procedure (see paragraph 5.5) at scheduled intervals. The recommended minimum time between scheduled maintenance visits is three months. Local operating and environmental conditions may dictate more frequent visits and in the case of remote sites, less frequent visits may be acceptable. Experience and system reliability will determine the most practical schedule for a specific installation.

CORRECTIVE MAINTENANCE

6.6 Corrective maintenance procedures consist of identifying and correcting defects or deficiencies that arise during operation and/or calibration and testing of the AMPFET 5 transmitter. Local and remote alarm signals will be generated when a defect occurs, but normally the built-in redundancy and integral modular reserve (IMR) features will permit the transmitter to maintain normal operation or to operate at a reduced rf output level. The nature of the fault and station policy will dictate whether immediate maintenance response is necessary. Fault analysis and rectification may be conducted from four different levels with a different technical competence level required for each.

6.6.1 REMOTE ON-AIR TROUBLESHOOTING: Remote on-air troubleshooting consists of monitoring the transmitter's radiated signal using an on-air monitor and observing the state of remote status/fault alarm indicators. Normally the nature of a malfunction can be determined by analyzing the status of these indicators. Some fault indications are caused by induced transients that trigger standby switchover or power amplifier shutdown circuits. When a 'standby' and/or a 'PA Failure' alarm indication occurrs, verify a real fault exists by momentarily turning off the transmitter. If the fault indication does not recur when the transmitter is turned on, it may be assumed the original alarm condition was a transient induced false alarm.

6.6.2 LOCAL ON-AIR TROUBLESHOOTING: Local on-air troubleshooting consists of monitoring the transmitter's integral meters and fault alarm indicators, analyzing the readings and indications obtained and determining whether the replacement of a plug-in module will restore the transmitter to fully operational status or if the standby transmitter must be enabled and off-air troubleshooting procedures initiated. Built-in rf drive and modulator drive redundancy features permit the transmitter to transfer to a back-up module when a primary module fails. Under these circumstances, the defective module may be removed for bench servicing without affecting operation or interrupting station programming. The integral modular reserve (IMR) feature allows the transmitter to function at a reduced rf output level while faults are present in the power amplifier stages. When such a condition occurs, replacement of a faulty module with a spare, or removal of that module to allow bench testing and repair may be carried out at a convenient time in the program format provided the rf output level is above the station minimum. Maximum off-air time requirement for replacement of a plug-in module is less than 30 seconds.

6.6.3 OFF-AIR TROUBLESHOOTING: Off-air troubleshooting must be performed when replacement of a plug-in module will not correct a fault. The transmitter must be taken off the air and connected to a precision, 50-ohm, resistive dummy load for off-air troubleshooting procedures. If the nature of the malfunction is not readily apparent, perform a minimum performance test as described in paragraph 5.5 as the first step in off-air trouble shooting.

CAUTION

Discharge or ensure -72 volts on modulator storage capacitors are discharged to a safe level (less than 10 volts) prior to using conductive tools or materials in the vicinity of the current shunt resistors. A discharge probe, for this purpose, is located on the rear, inside of the cabinet. It should be used when the lower fan panel is removed and the current shunt resistors have been exposed. Discharge the capacitors by placing the discharge probe's tip on the castle nut of each current shunt resistor. It may take up to ten seconds to fully discharge a capacitor.

NOTE

The low level driver stages may be tested independently from the rf power stages by removing relays K1, K2 and K3 from any one modulator and then switching on the rectifier/regulator associated with that modulator. Ensure the remaining rectifier/regulators are turned off. This technique provides -72 volts dc for the low level stages but does not enable the rf power blocks. While operating under these conditions, the rear panels may be removed from the transmitter.

6.6.4 PLUG-IN MODULE TROUBLESHOOTING: Detailed information for the plug-in modules is not included in this manual. Refer to the appropriate service instruction manual for troubleshooting information for a specific plug-in module.

Table 6-1 Power Block/Plug-in Module Relationship

POWER BLOCK	MODULATOR	RECTIFIER/ REGULATOR MODULE	POWER AMPLIFIERS		
			PAIR 'A'	PAIR 'B'	PAIR 'C'
A	5A1	7A1	2A1/2A2	2A3/2A4	2A5/2A6
B	5A2	7A2	2A7/2A8	2A9/2A10	2A11/2A12
C	6A1	7A3	3A1/3A2	3A3/3A4	3A5/3A6
D	6A2	7A4	3A7/3A8	3A9/3A10	3A11/3A12

POWER AMPLIFIER FAULT ISOLATION PROCEDURES

6.7 Isolate defective power amplifiers while the transmitter is on the air, using the NAX19 test probe provided with the transmitter, as follows:

NOTE

The original indication of a defective power amplifier is the presence of a PA FAIL alarm and one or more modulator PA DRIVE - 'A', 'B' or'C' alarm lamps turning on. Refer to table 6-1 to determine which pair(s) of power amplifiers are associated with the alarm lamps that are turned on and which rectifier/regulator must be switched off to remove a specific power amplifier.

(a) Remove the plexiglass panel that directs the air circulation over the power amplifiers by pulling and releasing the four locking knobs.

(b) Determine which pair of power amplifiers are affected by observing which modulator PA DRIVE lamps are turned on and referring to table 6-1.

(c) Insert NAX19 test probe's white test lead into test jack (TP1) of power amplifier, from a non-suspect pair.

(d) Insert NAX19 test probe's test plug into the test jack (TP1) of one of the pair of suspect power amplifiers and observe the LED indication on the test probe.

(e) If the NAX19 test probe's LED turns on, the power amplifier is defective.

(f) Repeat steps (d) and (e) for the remaining power amplifier of the suspect pair.

(g) Replace any defective power amplifiers as described in paragraph 6.8.1.

PLUG-IN MODULE REMOVAL/REPLACEMENT PROCEDURES

6.8 Observe the following instructions during removal/replacement of plug-in modules:

CAUTION

Irreparable damage to solid state devices and mating connectors may result if the removal/replacement procedures are not observed.

Table 6-2 PA Failures Versus RF Output

DISABLED POWER AMPLIFIERS	POWER REDUCTION RELATIVE TO 5000W	NOMINAL RF CARRIER OUTPUT
One Pair	-0.76 dB	4200 watts
Two Pairs	-1.60 dB	3500 watts
Three Pairs or One Power Block	-2.5 dB	2800 watts

6.8.1 NAA11 POWER AMPLIFIER MODULE REMOVAL/REPLACEMENT: Observe the following procedures when removing or replacing an NAA11 power amplifier module.

CAUTION

Turn off transmitter before removing a power amplifier module.

(a) Remove the plexiglass panel that directs the air circulation over the power amplifiers by pulling and releasing the four locking knobs.

(b) Determine which power amplifier is to be removed (refer to paragraph 6.7).

(c) Obtain a serviceable NAA11 power amplifier or a dummy power amplifier and have it available for installation.

(d) Turn off transmitter. Sett TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

CAUTION

The rf output is disabled and the transmitter is off-the-air when any power amplifier is removed. Do not remove a power amplifier unless a serviceable power amplifier or a dummy power amplifier is available to replace it. The transmitter will operate at a reduced power level (see table 6-2) with defective or dummy power amplifiers installed. If more than one power amplifier is defective, and spares are not available, reduce number of disabled power amplifiers by combining them as pairs.

(e) Remove all defective NAA11 power amplifiers defective identified in step (b), using extractor tool (139-8138) provided.

(f) Install a serviceable NAA11 power amplifier module or a dummy power amplifier in each of the locations vacated by a defective power amplifier in step (e). Ensure mating connectors are fully engaged.

(g) Replace plexiglass panel removed in step (a), ensuring snap fasteners are engaged.

(h) Turn on transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to ON.

(i) Repair defective power amplifier(s) as described in the NAA11 power amplifier service instruction manual.

6.8.2 'MAIN' RF DRIVER (NAPE20 or NAPE12) MODULE REMOVAL/REPLACEMENT: Observe the following procedures when removing or replacing 'main' rf driver 4A1A1:

NOTE

"Main' rf driver 4A1A1 of AM stereo transmitters must be an NAPE20 stereo rf driver module.

Standby rf driver 4A1A2 will be enabled and provide the rf drive for the power amplifier stages when rf driver 4A1A1 is removed.

It is not necessary to turn off the transmitter to remove 'main' rf driver 4A1A1.

(a) Disengage 'main' rf driver 4A1A1 from its mating connectors using extractor tool (139-8138) and then carefully remove the module from driver unit 4A1.

(b) Repair defective rf driver module as described in the appropriate (NAPE12 monaural rf driver or NAPE20 stereo rf driver) service instruction manual.

(c) At the earliest convenience, install a serviceable rf driver module (NAPE20 for stereo transmitters or NAPE12 for monaural transmitters) in position A1 of driver unit 4A1. Ensure mating connectors are fully engaged.

(d) Reset the transmitter's main/standby changeover circuits by momentarily setting TRANSMITTER CONTROL - Master switch 1A1S1 to OFF and then to ON.

(e) Calibrate the carrier frequency and check the rf drive level as described in paragraphs 5.6.3 and 5.6.4.

6.8.3 'STANDBY' RF DRIVER (NAPE12) MODULE REMOVAL/REPLACEMENT: Observe the following procedures when removing or replacing 'standby' rf driver 4A1A2:

NOTE

'Main' rf driver 4A1A1 provides the rf drive for the power amplifier stages during normal operation. The only consequence of removing 'standby' rf driver 4A1A2 is the loss of the standby feature in the event of a failure in rf driver 4A1A1.

It is not necessary to turn off the transmitter to remove 'standby' rf driver 4A1A2.

(a) Disengage NAPE12 rf driver module 4A1A2 from its mating connectors using extractor tool (139-8138) and then carefully remove the module from driver unit 4A1.

(b) Repair defective NAPE12 rf driver module removed in step (a) as described in the NAPE12 rf driver service instruction manual.

(c) At the earliest convenience, install a serviceable NAPE12 rf driver module in position A2 of driver unit 4A1. Ensure mating connectors are fully engaged.

(d) Calibrate the carrier frequency and check the rf drive level as described in paragraphs 5.6.3 and 5.6.4.

6.8.4 NAPE27/1 MODULATOR DRIVER MODULE REMOVAL/REPLACEMENT: Observe the following procedures when removing or replacing an NAPE27/1 modulator driver module:

NOTE

Standby modulator driver 4A1A5 will be enabled and provide the mod drive when NAPE27/1 modulator driver 4A1A4 is removed.

It is not necessary to turn off the transmitter to remove NAPE27/1 modulator driver 4A1A4.

(a) Disconnect connector P2 of cable assembly W1 from connector J1 of NAPE27/1 modulator driver 4A1A4.

(b) Disengage NAPE27/1 modulator driver 4A1A4 from its mating connectors and then carefully remove the module from driver unit 4A1.

(c) Repair defective NAPE27/1 modulator driver removed in step (b) as described in the NAPE27/1 modulator driver module service instruction manual.

(d) At the earliest convenience, install a serviceable NAPE27/1 modulator driver module in position A4 of driver unit 4A1. Ensure mating connectors are fully engaged.

(e) Mate connector P2 of cable assembly W1 with connector J1 of NAPE27/1 modulator driver 4A1A4. Ensure connector W1P1 is mated with J1 of NAPC18 ALC/remote power trim assembly 4A1A9.

(f) Reset the main/standby changeover circuits by momentarily setting TRANSMITTER CONTROL - Master switch 1A1S1 to OFF and then to ON.

(g) Calibrate preset carrier levels and modulation level as described in paragraphs 5.6.5 and 5.6.6.

6.8.5 NAPE19/1 MODULATOR DRIVER MODULE REMOVAL/REPLACEMENT: Observe the following procedures when removing or replacing the NAPE19/1 modulator driver module:

NOTE

Modulator driver 4A1A4 provides the mod drive during normal operation. The only consequence of removing modulator driver 4A1A5 is the loss of the standby feature in the event of a failure in modulator driver 4A1A4.

It is not necessary to turn off the transmitter to remove NAPE19/1 modulator driver 4A1A5.

(a) Disengage NAPE19/1 modulator driver 4A1A5 from its mating connectors and then carefully remove the module from driver unit 4A1.

(b) Repair defective NAPE19/1 modulator removed in step (a) as described in the NAPE19/1 modulator driver service instruction manual.

(c) At the earliest convenience, install a serviceable NAPE19/1 modulator driver module in position A5 of driver unit 4A1. Ensure mating connectors are fully engaged.

(d) Calibrate the 'standby' preset carrier levels and the modulation level as described in paragraphs 5.6.5 and 5.6.6.

6.8.6 NAPC7 MONITOR MODULE REMOVAL/REPLACEMENT: Observe the following procedures when removing or replacing an NAPC7 monitor module:

NOTE

The transmitter will turn off when the NAPC7 monitor module is removed and may not be turned on while the monitor module is not installed. It is recommended that the transmitter be turned off prior to removal of the monitor module.

(a) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(b) Disengage NAPC7 monitor 4A1A3 from its mating connectors and then carefully remove the module from driver unit 4A1.

(c) Obtain a serviceable NAPC7 monitor module or repair the NAPC7 monitor module removed in step (b) as described in the NAPC7 monitor service instruction manual.

(d) Install a serviceable NAPC7 monitor module in position A3 of driver unit 4A1, ensuring its mating connectors are fully engaged.

(e) Calibrate the tx fault alarm thresholds as described in paragraphs 5.6.7 and then perform a minimum performance test as described in paragraph 5.5.

6.8.7 NASM1 MODULATOR MODULE REMOVAL/REPLACEMENT: Observe the following procedures when removing or replacing an NASM1 modulator module. These procedures may be carried out while the transmitter is operating provided the associated NAS13 rectifier/regulator has been turned off and the -72 volt dc power supply has decayed or been discharged to less than -10 volts dc. Refer to table 6-1 to determine the associated rectifier/regulator.

CAUTION

Large storage capacitors in each modulator module store sufficient energy to cause a damaging current arc if they are accidentally short circuited. Do not remove a modulator until its charge voltage, as indicated on TEST meter 1A1M3, is less than -10 volts dc.

(a) Determine which NASM1 modulator module is to be removed (5A1, 5A2, 5A3 or 5A4).

(b) Refer to table 6-1 to determine which NAS13 rectifier/regulator (7A1, 7A2, 7A3 or 7A4) is associated with the NASM1 modulator module to be removed.

(c) Switch off the NAS13 rectifier/regulator associated with the NASM1 modulator module to be removed.

(d) Observe 'B-' lamp, on the NASM1 modulator module to be removed and its modulator input voltage, as indicated on TEST meter 1A1M3.

(e) When the 'B-' lamp turns off and the modulator input voltage indicated on TEST meter 1A1M3 is less than -10 volts dc, pre-release the NASM1 modulator module to be removed by grasping its handles with both hands and pulling with a firm, steady pressure until the mating connectors are disengaged.

(f) Complete removal of the NASM1 modulator module by holding the handle with one hand and taking the weight, from underneath or by holding a suitable chassis mounted component with the other hand.

(g) Obtain a serviceable NASM1 modulator module or repair the NASM1 modulator module removed in step (f), as described in the NASM1 modulator module service instruction manual.

NOTE

The transmitter will remain operational with a power block disabled by the removal of an NASM1 modulator module , but the rf output will be decreased by approximately 2.5 dB (rf output will decrease to approximately 2800 watts if original power level was 5000 watts).

(h) Verify the NAS13 rectifier/regulator associated with the NASM1 modulator module to be installed is turned off.

(i) Install a serviceable NASM1 modulator module, ensuring the mating connectors are fully engaged after installation.

(h) Switch on the NAS13 rectifier/regulator associated with the modulator module installed in step (g) and perform an on-air functional test as described in para 5.4.

6.8.8 NAS13 RECTIFIER/REGULATOR REMOVAL/REPLACEMENT: Observe the following procedures when removing or replacing an NAS13 rectifier/regulator. These procedures may be carried out while the transmitter is operating provided the NAS13 rectifier/regulator to be removed has been turned off.

CAUTION

Exercise extreme care to avoid shorting active circuits in adjacent modules when removing or installing an NAS13 rectifier/regulator.

(a) Determine which NAS13 rectifier/regulator module is to be removed.

(b) Switch off the NAS13 rectifier/regulator module identified in step (a).

(c) Remove the NAS13 rectifier/regulator module, switched off in step (b), using the extractor tool provided as an ancillary part.

NOTE

The transmitter will remain operational with a power block disabled by the removal of an NAS13 rectifier/regulator module, but the rf output will be decreased by approximately 2.5 dB (rf output will decrease to approximately 2800 watts if original power level was 5000 watts).

(d) Obtain a serviceable NAS13 rectifier/regulator module or repair the NAS13 rectifier/regulator module removed in step (c) as described in the NAS13 rectifier/regulator service instruction manual.

(e) Install a serviceable NAS13 rectifier/regulator module, ensuring the rectifier/regulator to be installed is turned off prior to installation and the mating connectors are fully engaged after installation.

(f) Switch on the rectifier/regulator module installed in step (e) and perform an on-air functional test as described in paragraph 5.4.

6.8.9 NAS14 LOW VOLTAGE POWER SUPPLY MODULE REMOVAL/REPLACEMENT: Observe the following procedures when removing or replacing an NAS14 low voltage power supply module. These procedures may be carried out while the transmitter is operating provided one serviceable NAS14 low voltage power supply module is installed at all times.

(a) Determine the NAS14 low voltage power supply module to be removed (7A5 or 7A6).

(b) Remove the NAS14 low voltage power supply module identified in step (a).

(c) Obtain a serviceable NAS14 low voltage power supply module or repair the low voltage power supply module removed in step (b) as described in the NAS14 low voltage power supply service instruction manual.

(d) Install A serviceable NAS14 low voltage power supply module, ensuring mating connectors are fully engaged.

(e) Perform a 15/24 volt dc power supply check as described in paragraph 5.6.1.2.

REMOVAL/REPLACEMENT OF NAPC18 ALC/REMOTE POWER TRIM ASSEMBLY

6.9 Observe the following procedures during removal and installation of NAPC18 ALC/remote power trim assembly 4A1A9.

NOTE
When NAPC18 ALC/remote power trim assembly 4A1A9 has been removed, it is possible to operate the transmitter using 'standby' modulator driver 4A1A5 as the mod drive source for the modulators.

(a) Turn off transmitter. Set TRANSMITTER CONTROL - Master switch 1A1S1 to OFF.

(b) Disconnect connector P1, of cable assembly W1, from connector J1 of NAPC18 ALC/remote power trim assembly 4A1A9.

(c) Gain access to NAPC18 ALC/remote power trim assembly 4A1A9's attaching hardware by:

- removing 'standby' NAPE19/1 modulator driver 4A1A5 as described in para 6.8.5.
- removing 'main' NAPE27/1 modulator driver 4A1A4 as described in para 6.8.4.
- removing NASM1 modulator 5A2 as described in para 6.8.7.

(d) Disconnect MTA closed end housing 4A1P1 from MTA header assembly A1J1 of NAPC18 ALC/remote power trim assembly 4A1A9.

(e) Remove NAPC18 ALC/remote power trim assembly 4A1A9, by removing two nuts, two washers and two screws securing the assembly to driver unit 4A1 and then carefully extracting the assembly.

NOTE
Two spacers, which are secured by the screws removed in step (e), are located between the NAPC18 ALC/remote power trim assembly and driver unit 4A1's chassis.

(f) Obtain a serviceable NAPC18 ALC/remote power trim assembly or repair the assembly removed in step (e) as described in the NAPC18 ALC/remote power trim assembly service instruction manual.

NOTE

If it is necessary to restore the transmitter to an operative state before a serviceable NAPC18 ALC/remote power trim assembly can be obtained, install NASM1 modulator removed in step (c) in position 5A2 and 'NAPE19/1 modulator driver removed in step (c) in position A5 of driver unit 4A1. Ensure terminals of MTA closed end housing 4A1P1, disconnected in step (d), are not shorted.

(g) Install a serviceable NAPC18 ALC/remote power trim assembly in position A9 of driver unit 4A1, using two screws, two washers and two nuts, removed in step (c). Ensure two spacers are located between NAPC18 ALC/remote power trim assembly and the chassis of driver unit 4A1 and they are being held in place by the securing screws.

(h) Connect MTA closed end housing 4A1P1 to MTA header assembly A1J1 of NAPC18 ALC/remote power trim assembly 4A1A9.

(i) Install NASM1 modulator module removed in step (c) in position 5A2, as described in paragraph 6.8.7.

(j) Install NAPE19/1 modulator driver removed in step (c) in position A5 of driver unit 4A1, as described in paragraph 6.8.5.

(k) Install NAPE27/1 modulator driver removed in step (c) in position A4 of driver unit 4A1, as described in paragraph 6.8.4.

(l) Install cable assembly W1, ensuring W1P2 is mated with J1 of NAPE27/1 modulator driver 4A1A4 and W1P1 is mated with J1 of NAPC18 ALC/remote power trim assembly 4A1A9.

(m) Calibrate carrier levels and modulation level as described in paragraphs 5.6.5 and 5.6.6.

Table 6-3 Wiring List - AMPFET 5 (3-Preset Power Levels) Cabinet

SOURCE	DESTINATION	CODE		SIZE	REMARKS
7XA3-5	7XA2-5	1	Red	18	
7XA2-5	7XA1-5	2	Red	18	
7XA3-5	7XA4-5	3	Red	18	
7XA1-5	6XA1P1-11	4	Red	18	
6XA1P1-11	6XA2P1-11	5	Red	18	
6XA2P1-11	5XA1P1-11	6	Red	18	
5XA1P1-11	5XA2P1-11	7	Red	18	
5XA2P1-11	P4-7	8	Red	18	
6XA2P1-4	6XA1P1-4	9	Orange	20	
6XA1P1-4	5XA2P1-4	10	Orange	20	
5XA2P1-4	5XA1P1-4	11	Orange	20	
5XA1P1-4	P4-12	12	Orange	20	
7XA5-3	7XA6-3	13	Orange	20	
7XA5-3	P3-5	14	Orange	20	
P3-5	P4-11	15	Orange	20	
7XA5-4	7XA6-4	16	Red	18	
7XA6-4	P3-6	17	Red	18	
7XA6-6	7XA5-6	18	Black	18	
-	-	19	Not Used		
-	-	20	Not Used		
7XA5-1	7XA6-1	21	Grey	18	
7XA6-1	TB2-1	22	Grey	18	
7XA5-2	7XA6-2	23	Grey	18	
7XA6-2	TB2-2	24	Grey	18	
7XA1-6	7XA2-6	25	Black	18	
7XA2-6	7XA3-6	26	Black	18	
7XA3-6	7XA4-6	27	Black	18	
7XA4-6	7XA5-5	28	Black	18	
7XA5-5	7XA6-5	29	Black	18	
7XA6-5	P4-10	30	Black	18	
S2-C	S1-C	31	White	22	
S1-NO	P4-5	32	White	22	
7XA1-1	8L1-1	33	White	14	
7XA1-2	8L1-1	34	White	14	
7XA1-3	8L1-1	35	White	14	
7XA1-4	8L1-1	36	White	14	
7XA2-1	8L2-1	37	White	14	
7XA2-2	8L2-1	38	White	14	
7XA2-3	8L2-1	39	White	14	
7XA2-4	8L2-1	40	White	14	
7XA3-1	8L3-1	41	White	14	
7XA3-2	8L3-1	42	White	14	
7XA3-3	8L3-1	43	White	14	
7XA3-4	8L3-1	44	White	14	
7XA4-1	8L4-1	45	White	14	
7XA4-2	8L4-1	46	White	14	
7XA4-3	8L4-1	47	White	14	
7XA4-4	8L4-1	48	White	14	
-	-	49	Not Used		
-	-	50	Not Used		
-	-	51	Not Used		

Table 6-3 Wiring List - AMPFET 5 (3-Preset Power Levels) Cabinet (Continued)

SOURCE	DESTINATION	CODE		SIZE	REMARKS
-	-	52	Not Used		
-	-	53	Not Used		
-	-	54	Not Used		
-	-	55	Not Used		
-	-	56	Not Used		
-	-	57	Not Used		
-	-	58	Not Used		
-	-	59	Not Used		
-	-	60	Not Used		
-	-	61	Not Used		
-	-	62	Not Used		
-	-	63	Not Used		
-	-	64	Not Used		
5XA1P2-3	2XA1-3	65	White	14	
5XA1P2-4	2XA2-3	66	White	14	
5XA1P2-5	2XA3-3	67	White	14	
5XA1P2-6	2XA4-3	68	White	14	
5XA1P2-7	2XA5-3	69	White	14	
5XA1P2-8	2XA6-3	70	White	14	
5XA2P2-3	2XA7-3	71	White	14	
5XA2P2-4	2XA8-3	72	White	14	
5XA2P2-5	2XA9-3	73	White	14	
5XA2P2-6	2XA10-3	74	White	14	
5XA2P2-7	2XA11-3	75	White	14	
5XA2P2-8	2XA12-3	76	White	14	
6XA1P2-3	3XA1-3	77	White	14	
6XA1P2-4	3XA2-3	78	White	14	
6XA1P2-5	3XA3-3	79	White	14	
6XA1P2-6	3XA4-3	80	White	14	
6XA1P2-7	3XA5-3	81	White	14	
6XA1P2-8	3XA6-3	82	White	14	
6XA2P2-3	3XA7-3	83	White	14	
6XA2P2-4	3XA8-3	84	White	14	
6XA2P2-5	3XA9-3	85	White	14	
6XA2P2-6	3XA10-3	86	White	14	
6XA2P2-7	3XA11-3	87	White	14	
6XA2P2-8	3XA12-3	88	White	14	
5R1-3	P3-17	89	White	22	
5R1-2	P3-18	90	White	22	
5R2-3	P3-15	91	White	22	
5R2-2	P3-16	92	White	22	
6R1-3	P3-13	93	White	22	
6R1-2	P3-14	94	White	22	
6R2-3	P3-11	95	White	22	
6R2-2	P3-12	96	White	22	
* 5XA1P1-6	P4-3	97	Core	RG188A/U	Coaxial cable
5XA1P1-8	P4-4	-	Shield		
* 5XA2P1-6	5XA1P1-6	98	Core	RG188A/U	Coaxial cable
5XA2P1-8	5XA1P1-8	-	Shield		
* 6XA1P1-6	5XA2P1-6	99	Core	RG188A/U	Coaxial cable
6XA1P1-8	5XA2P1-8	-	Shield		

Table 6-3 Wiring List - AMPFET 5 (3-Preset Power Levels) Cabinet (Continued)

SOURCE	DESTINATION	CODE		SIZE	REMARKS
* 6XA2P1-6	6XA1P1-6	100	Core	RG188A/U	Coaxial cable
6XA2P1-8	6XA1P1-8	-	Shield		
-	-	101	Not Used		
-	-	102	Not Used		
-	-	103	Not Used		
-	-	104	Not Used		
-	-	105	Not Used		
-	-	106	Not Used		
-	-	107	Not Used		
-	-	108	Not Used		
@ 5XA1P1-10	2N1-B	109	Black	22	
@ 5XA1P1-9	2N2-B	110	White	22	3-conductor
@ 5XA1P1-5	2N3-B	111	Red	22	shielded cable
5XA1P1-12	Ground	-	Shield		
@ 5XA2P1-10	2N4-B	112	Black	22	
@ 5XA2P1-9	2N5-B	113	White	22	3-conductor
@ 5XA2P1-5	2N6-B	114	Red	22	shielded cable
5XA2P1-12	Ground	-	Shield		
@ 6XA1P1-10	3N1-B	115	Black	22	
@ 6XA1P1-9	3N2-B	116	White	22	3-conductors
@ 6XA1P1-5	3N3-B	117	Red	22	shielded cable
6XA1P1-12	Ground	-	Shield		
@ 6XA2P1-10	3N4-B	118	Black	22	
@ 6XA2P1-9	3N5-B	119	White	22	3-conductors
@ 6XA2P1-5	3N6-B	120	Red	22	shielded cable
6XA2P1-12	Ground	-	Shield		
2N1-A	4A1A7-1	121	White	16	1-conductor
Ground	Ground	-	Shield		shielded cable
2N2-A	4A1A7-2	122	White	16	1-conductor
Ground	Ground	-	Shield		shielded cable
2N3-A	4A1A7-3	123	White	16	1-conductor
Ground	Ground	-	Shield		shielded cable
2N4-A	4A1A7-4	124	White	16	1-conductor
Ground	Ground	-	Shield		shielded cable
2N5-A	4A1A7-5	125	White	16	1-conductor
Ground	Ground	-	Shield		shielded cable
2N6-A	4A1A7-6	126	White	16	1-conductor
Ground	Ground	-	Shield		shielded cable
3N1-A	4A1A7-7	127	White	16	1-conductor
Ground	Ground	-	Shield		shielded cable
3N2-A	4A1A7-8	128	White	16	1-conductor
Ground	Ground	-	Shield		shielded cable
3N3-A	4A1A7-9	129	White	16	1-conductor
Ground	Ground	-	Shield		shielded cable
3N4-A	4A1A7-10	130	White	16	1-conductor
Ground	Ground	-	Shield		shielded cable
3N5-A	4A1A7-11	131	White	16	1-conductor
Ground	Ground	-	Shield		shielded cable
3N6-A	4A1A7-12	132	White	16	1-conductor
Ground	Ground	-	Shield		shielded cable
-	-	133	Not Used		

Table 6-3 Wiring List - AMPFET 5 (3-Preset Power Levels) Cabinet (Continued)

SOURCE	DESTINATION	CODE		SIZE	REMARKS
-	-	134	Not Used		
-	-	135	Not Used		
T1-Y2	TB2-3	136	Grey	18	
Ground	P3-10	137	Black	18	
-	-	138	Not Used		
P4-14	CR1-Anode	139	Blue	20	
CR1-Cathode	8L1-2	140	Blue	20	
CR2-Cathode	8L2-2	141	Blue	20	
CR3-Cathode	8L3-2	142	Blue	20	
CR4-Cathode	8L4-2	143	Blue	20	
7XA4-7	T1-X1	144	Grey	14	
7XA4-8	T1-X1	145	Grey	14	
7XA4-9	T1-X2	146	Grey	14	
7XA4-10	T1-X2	147	Grey	14	
7XA4-11	T1-X3	148	Grey	14	
7XA4-12	T1-X3	149	Grey	14	
7XA3-7	T1-X1	150	Grey	14	
7XA3-8	T1-X1	151	Grey	14	
7XA3-9	T1-X2	152	Grey	14	
7XA3-10	T1-X2	153	Grey	14	
7XA3-11	T1-X3	154	Grey	14	
7XA3-12	T1-X3	155	Grey	14	
7XA2-7	T1-X1	156	Grey	14	
7XA2-8	T1-X1	157	Grey	14	
7XA2-9	T1-X2	158	Grey	14	
7XA2-10	T1-X2	159	Grey	14	
7XA2-11	T1-X3	160	Grey	14	
7XA2-12	T1-X3	161	Grey	14	
7XA1-7	T1-X1	162	Grey	14	
7XA1-8	T1-X1	163	Grey	14	
7XA1-9	T1-X2	164	Grey	14	
7XA1-10	T1-X2	165	Grey	14	
7XA1-11	T1-X3	166	Grey	14	
7XA1-12	T1-X3	167	Grey	14	
TB2-4	7XA6P1-6	168	Black	18	
@ 1A2A4-1	P4-7	169	Red	22	3 conductors
@ Not terminated	P4-17	170	Black	22	shielded cable
@ 1A2A4-3	P4-15	171	White	22	
1A2A4-2	P4-18	-	Shield		
P3-1	P4-13	172	White	22	
P3-2	P4-16	173	White	22	
T1-Y1	CB2-1	174	Grey	18	
CB2-2	TB2-5	175	Grey	18	
TB2-5	J1-2	176	Grey	18	
TB2-3	J1-1	177	Grey	18	
TB2-5	J2-2	178	Grey	18	
TB2-3	J2-1	179	Grey	18	
-	-	180	Not used		
-	-	181	Not used		
-	-	182	Not used		
-	-	183	Not used		

Table 6-3 Wiring List - AMPFET 5 (3-Preset Power Levels) Cabinet (Continued)

SOURCE	DESTINATION	CODE		SIZE	REMARKS
-	-	184	Not used		
-	-	185	Not used		
-	-	186	Not used		
-	-	187	Not used		
-	-	188	Not used		
-	-	189	Not used		
P4-8	P5-3	190	White	22	
P4-9	P5-4	191	White	22	
P4-6	P5-1	192	Orange	22	
P4-10	P5-2	193	Black	22	
S2-NO	Ground	-	Black	22	
5XA1P2-9	5R1-4	-	White	14	
5XA1P2-10	5R1-4	-	White	14	
5XA1P2-11	5R1-4	-	White	14	
5XA1P2-12	5R1-4	-	White	14	
5XA2P2-9	5R2-4	-	White	14	
5XA2P2-10	5R2-4	-	White	14	
5XA2P2-11	5R2-4	-	White	14	
5XA2P2-12	5R2-4	-	White	14	
6XA1P2-9	6R1-4	-	White	14	
6XA1P2-10	6R1-4	-	White	14	
6XA1P2-11	6R1-4	-	White	14	
6XA1P2-12	6R1-4	-	White	14	
6XA2P2-9	6R2-4	-	White	14	
6XA2P2-10	6R2-4	-	White	14	
6XA2P2-11	6R2-4	-	White	14	
6XA2P2-12	6R2-4	-	White	14	
7XA1-13	Ground	-	Black	14	
7XA1-14	Ground	-	Black	14	
7XA1-15	Ground	-	Black	14	
7XA1-16	Ground	-	Black	14	
7XA2-13	Ground	-	Black	14	
7XA2-14	Ground	-	Black	14	
7XA2-15	Ground	-	Black	14	
7XA2-16	Ground	-	Black	14	
7XA3-13	Ground	-	Black	14	
7XA3-14	Ground	-	Black	14	
7XA3-15	Ground	-	Black	14	
7XA3-16	Ground	-	Black	14	
7XA4-13	Ground	-	Black	14	
7XA4-14	Ground	-	Black	14	
7XA4-15	Ground	-	Black	14	
7XA4-16	Ground	-	Black	14	
5XA1P1-1	Ground	-	Black	14	
5XA1P1-12	Ground	-	Black	14	
5XA1P2-1	Ground	-	Black	14	
5XA2P1-1	Ground	-	Black	14	
5XA2P1-12	Ground	-	Black	14	
5XA2P2-1	Ground	-	Black	14	
6XA1P1-1	Ground	-	Black	14	
6XA1P1-12	Ground	-	Black	14	

Table 6-3 Wiring List - AMPFET 5 (3-Preset Power Levels) Cabinet (Continued)

SOURCE	DESTINATION	CODE	SIZE	REMARKS
6XA1P2-1	Ground	- Black	14	
6XA2P1-1	Ground	- Black	14	
6XA2P1-12	Ground	- Black	14	
6XA2P2-1	Ground	- Black	14	
5R1-1	8L1-2	- White	10	
5R2-1	8L2-2	- White	10	
6R1-1	8L3-2	- White	10	
6R2-1	8L4-2	- White	10	
2XA3-7	1A2A1TB1-4	Via Core on A4	14	Teflon
2XA4-8	1A2A1TB2-1	- White	14	Teflon
2XA9-7	1A2A1TB1-2	- White	14	Teflon
2XA10-8	1A2A1TB2-3	- White	14	Teflon
# 2XA1-5	2XA1-6	Tinned Copper	10	
# 2XA1-6	2XA2-5	Tinned Copper	10	
# 2XA2-5	2XA2-6	Tinned Copper	10	
# 2XA2-6	2XA3-5	Tinned Copper	10	
# 2XA3-5	2XA3-6	Tinned Copper	10	
# 2XA3-6	2XA4-5	Tinned Copper	10	
# 2XA4-5	2XA4-6	Tinned Copper	10	
# 2XA4-6	2XA5-5	Tinned Copper	10	
# 2XA5-5	2XA5-6	Tinned Copper	10	
# 2XA5-6	2XA6-5	Tinned Copper	10	
# 2XA6-5	2XA6-6	Tinned Copper	10	
# 2XA6-6	2XA7-5	Tinned Copper	10	
# 2XA7-5	2XA7-6	Tinned Copper	10	
# 2XA7-6	2XA8-5	Tinned Copper	10	
# 2XA8-5	2XA8-6	Tinned Copper	10	
# 2XA8-6	2XA9-5	Tinned Copper	10	
# 2XA9-5	2XA9-6	Tinned Copper	10	
# 2XA9-6	2XA10-5	Tinned Copper	10	
# 2XA10-5	2XA10-6	Tinned Copper	10	
# 2XA10-6	2XA11-5	Tinned Copper	10	
# 2XA11-5	2XA11-6	Tinned Copper	10	
# 2XA11-6	2XA12-5	Tinned Copper	10	
2XA1-7	2XA2-8	Tinned Copper	14	
2XA2-7	2XA3-8	Tinned Copper	14	
2XA4-7	2XA5-8	Tinned Copper	14	
2XA5-7	2XA6-8	Tinned Copper	14	
2XA7-7	2XA8-8	Tinned Copper	14	
2XA8-7	2XA9-8	Tinned Copper	14	
2XA10-7	2XA11-8	Tinned Copper	14	
2XA11-7	2XA12-8	Tinned Copper	14	
2XA1-3	2XA1-4	Tinned Copper	14	
2XA2-3	2XA2-4	Tinned Copper	14	
2XA3-3	2XA3-4	Tinned Copper	14	
2XA4-3	2XA4-4	Tinned Copper	14	
2XA5-3	2XA5-4	Tinned Copper	14	
2XA6-3	2XA6-4	Tinned Copper	14	
2XA7-3	2XA7-4	Tinned Copper	14	

# Denotes connection made by a continuous length of wire

Table 6-3 Wiring List - AMPFET 5 (3-Preset Power Levels) Cabinet (Continued)

SOURCE	DESTINATION	CODE	SIZE	REMARKS
2XA8-3	2XA8-4	Tinned Copper	14	
2XA9-3	2XA9-4	Tinned Copper	14	
2XA10-3	2XA10-4	Tinned Copper	14	
2XA11-3	2XA11-4	Tinned Copper	14	
2XA12-3	2XA12-4	Tinned Copper	14	
2XA1-1	Ground	- Black	22	
2XA2-1	Ground	- Black	22	
2XA3-1	Ground	- Black	22	
2XA4-1	Ground	- Black	22	
2XA5-1	Ground	- Black	22	
2XA6-1	Ground	- Black	22	
2XA7-1	Ground	- Black	22	
2XA8-1	Ground	- Black	22	
2XA9-1	Ground	- Black	22	
2XA10-1	Ground	- Black	22	
2XA11-1	Ground	- Black	22	
2XA12-1	Ground	- Black	22	
2XA1-8	Gnd near 2XA3-2XA4	Tinned Copper	14	
2XA6-7	Gnd near 2XA3-2XA4	Tinned Copper	14	
2XA7-8	Gnd near 2XA9-2XA10	Tinned Copper	14	
2XA12-7	Gnd near 2XA9-2XA10	Tinned Copper	14	
2N1-A	2XA2-2	CCG04 Capacitor	0.01uF 100V	2N1C1
2N2-A	2XA4-2	CCG04 Capacitor	0.01uF 100V	2N2C1
2N3-A	2XA6-2	CCG04 Capacitor	0.01uF 100V	2N3C1
2N4-A	2XA8-2	CCG04 Capacitor	0.01uF 100V	2N4C1
2N5-A	2XA10-2	CCG04 Capacitor	0.01uF 100V	2N5C1
2N6-A	2XA12-2	CCG04 Capacitor	0.01uF 100V	2N6C1
2N1T1-1	2XA2-2	- -		
2N1T1-2	2N1-A	- -		
2N1T1-3	2N1-A	- -		
2N1T1-4	2XA1-2	- -		
2N1T1-5	Ground	- -		
2N1T1-6	2N1CR1-Anode	- -		
2N2T1-1	2XA4-2	- -		
2N2T1-2	2N2-A	- -		
2N2T1-3	2N2-A	- -		
2N2T1-4	2XA3-2	- -		
2N2T1-5	Ground	- -		
2N2T1-6	2N2CR1-Anode	- -		
2N3T1-1	2XA6-2	- -		
2N3T1-2	2N3-A	- -		
2N3T1-3	2N3-A	- -		
2N3T1-4	2XA5-2	- -		
2N3T1-5	Ground	- -		
2N3T1-6	2N3CR1-Anode	- -		
2N4T1-1	2XA8-2	- -		
2N4T1-2	2N4-A	- -		
2N4T1-3	2N4-A	- -		
2N4T1-4	2XA7-2	- -		
2N4T1-5	Ground	- -		
2N4T1-6	2N4CR1-Anode	- -		

Table 6-3 Wiring List - AMPFET 5 (3-Preset Power Levels) Cabinet (Continued)

	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	2N5T1-1	2XA10-2	-	-		
	2N5T1-2	2N5-A	-	-		
	2N5T1-3	2N5-A	-	-		
	2N5T1-4	2XA9-2	-	-		
	2N5T1-5	Ground	-	-		
	2N5T1-6	2N5CR1 Anode	-	-		
	2N6T1-1	2XA12-2	-	-		
	2N6T1-2	2N6-A	-	-		
	2N6T1-3	2N6-A	-	-		
	2N6T1-4	2XA11-2	-	-		
	2N6T1-5	Ground	-	-		
	2N6T1-6	2N6CR1 Anode	-	-		
	Ground	Jct 2XA2-5/2XA3-6	-	White	10	
	Ground	Jct 2XA4-5/2XA5-6	-	White	10	
	Ground	Jct 2XA8-5/2XA9-6	-	White	10	
	Ground	Jct 2XA10-5/2XA11-6	-	White	10	
	3XA3-7	1A2A1TB1-3	-	White	14	Teflon
	3XA4-8	1A2A1TB2-2	-	White	14	Teflon
	3XA9-7	1A2A1TB1-1	-	White	14	Teflon
	3XA10-8	1A2A1TB2-4	-	White	14	Teflon
#	3XA1-5	3XA1-6	Tinned Copper		10	
#	3XA1-6	3XA2-5	Tinned Copper		10	
#	3XA2-5	3XA2-6	Tinned Copper		10	
#	3XA2-6	3XA3-5	Tinned Copper		10	
#	3XA3-5	3XA3-6	Tinned Copper		10	
#	3XA3-6	3XA4-5	Tinned Copper		10	
#	3XA4-5	3XA4-6	Tinned Copper		10	
#	3XA4-6	3XA5-5	Tinned Copper		10	
#	3XA5-5	3XA5-6	Tinned Copper		10	
#	3XA5-6	3XA6-5	Tinned Copper		10	
#	3XA6-5	3XA6-6	Tinned Copper		10	
#	3XA6-6	3XA7-5	Tinned Copper		10	
#	3XA7-5	3XA7-6	Tinned Copper		10	
#	3XA7-6	3XA8-5	Tinned Copper		10	
#	3XA8-5	3XA8-6	Tinned Copper		10	
#	3XA8-6	3XA9-5	Tinned Copper		10	
#	3XA9-5	3XA9-6	Tinned Copper		10	
#	3XA9-6	3XA10-5	Tinned Copper		10	
#	3XA10-5	3XA10-6	Tinned Copper		10	
#	3XA10-6	3XA11-5	Tinned Copper		10	
#	3XA11-5	3XA11-6	Tinned Copper		10	
#	3XA11-6	3XA12-0	Tinned Copper		10	
	3XA1-7	3XA2-8	Tinned Copper		14	
	3XA2-7	3XA3-8	Tinned Copper		14	
	3XA4-7	3XA5-8	Tinned Copper		14	
	3XA5-7	3XA6-8	Tinned Copper		14	
	3XA7-7	3XA8-8	Tinned Copper		14	
	3XA8-7	3XA9-8	Tinned Copper		14	
	3XA10-7	3XA11-8	Tinned Copper		14	

# Denotes connection made by a continuous length of wire

Table 6-3 Wiring List - AMPFET 5 (3-Preset Power Levels) Cabinet (Continued)

SOURCE	DESTINATION	CODE	SIZE	REMARKS
3XA11-7	3XA12-8	Tinned Copper	14	
3XA1-3	3XA1-4	Tinned Copper	14	
3XA2-3	3XA2-4	Tinned Copper	14	
3XA3-3	3XA3-4	Tinned Copper	14	
3XA4-3	3XA4-4	Tinned Copper	14	
3XA5-3	3XA5-4	Tinned Copper	14	
3XA6-3	3XA6-4	Tinned Copper	14	
3XA7-3	3XA7-4	Tinned Copper	14	
3XA8-3	3XA8-4	Tinned Copper	14	
3XA9-3	3XA9-4	Tinned Copper	14	
3XA10-3	3XA10-4	Tinned Copper	14	
3XA11-3	3XA11-4	Tinned Copper	14	
3XA12-3	3XA12-4	Tinned Copper	14	
3XA1-1	Ground	- Black	22	
3XA2-1	Ground	- Black	22	
3XA3-1	Ground	- Black	22	
3XA4-1	Ground	- Black	22	
3XA5-1	Ground	- Black	22	
3XA6-1	Ground	- Black	22	
3XA7-1	Ground	- Black	22	
3XA8-1	Ground	- Black	22	
3XA9-1	Ground	- Black	22	
3XA10-1	Ground	- Black	22	
3XA11-1	Ground	- Black	22	
3XA12-1	Ground	- Black	22	
3XA1-8	Gnd near 3XA3-3XA4	Tinned Copper	14	
3XA6-7	Gnd near 3XA3-3XA4	Tinned Copper	14	
3XA7-8	Gnd near 3XA9-3XA10	Tinned Copper	14	
3XA12-7	Gnd near 3XA9-3XA10	Tinned Copper	14	
3N1-A	3XA2-2	CCG04 Capacitor	0.01uF 100V	N1C1
3N2-A	3XA4-2	CCG04 Capacitor	0.01uF 100V	N2C1
3N3-A	3XA6-2	CCG04 Capacitor	0.01uF 100V	N3C1
3N4-A	3XA8-2	CCG04 Capacitor	0.01uF 100V	N4C1
3N5-A	3XA10-2	CCG04 Capacitor	0.01uF 100V	N5C1
3N6-A	3XA12-2	CCG04 Capacitor	0.01uF 100V	N6C1
3N1T1-1	3XA2-2	- -		
3N1T1-2	3N1-A	- -		
3N1T1-3	3N1-A	- -		
3N1T1-4	3XA1-2	- -		
3N1T1-5	Ground	- -		
3N1T1-6	3N1CR1-Anode	- -		
3N2T1-1	3XA4-2	- -		
3N2T1-2	3N2-A	- -		
3N2T1-3	3N2-A	- -		
3N2T1-4	3XA3-2	- -		
3N2T1-5	Ground	- -		
3N2T1-6	3N2CR1-Anode	- -		
3N3T1-1	3XA6-2	- -		
3N3T1-2	3N3-A	- -		
3N3T1-3	3N3-A	- -		
3N3T1-4	3XA5-2	- -		

Table 6-3 Wiring List - AMPFET 5 (3-Preset Power Levels) Cabinet (Continued)

SOURCE	DESTINATION	CODE	SIZE	REMARKS
3N3T1-5	Ground	- -		
3N3T1-6	3N3CR1-Anode	- -		
3N4T1-1	3XA8-2	- -		
3N4T1-2	3N4-A	- -		
3N4T1-3	3N4-A	- -		
3N4T1-4	3XA7-2	- -		
3N4T1-5	Ground	- -		
3N4T1-6	3N4CR1-Anode	- -		
3N5T1-1	3XA10-2	- -		
3N5T1-2	3N5-A	- -		
3N5T1-3	3N5-A	- -		
3N5T1-4	3XA9-2	- -		
3N5T1-5	Ground	- -		
3N5T1-6	3N5CR1-Anode	- -		
3N6T1-1	3XA12-2	- -		
3N6T1-2	3N6-A	- -		
3N6T1-3	3N6-A	- -		
3N6T1-4	3XA11-2	- -		
3N6T1-5	Ground	- -		
3N6T1-6	3N6CR1 Anode	- -		
Ground	Jct 3XA2-5/3XA3-6	- White	10	
Ground	Jct 3XA4-5/3XA5-6	- White	10	
Ground	Jct 3XA8-5/3XA9-6	- White	10	
Ground	Jct 3XA10-5/3XA11-6	- White	10	
TB1-1	CB1A-1	- White	10	
TB1-2	CB1B-1	- White	10	
TB1-3	CB1C-1	- White	10	
CB1A-2	T1-H1	- White	10	
CB1B-2	T1-H2	- White	10	
CB1C-2	T1-H3	- White	10	
Tx Gnd Stud	Tx Cabinet	Heavy Braid	-	Double Braid
Tx Gnd Stud	T1-Gnd Lug	- White	10	
T2-Blk/Brn	TB2-3	Lead of T2	-	
T2-Wht/Org	TB2-5	Lead of T2	-	
T2-Grn	TB2-1	Lead of T2	-	
T2-Grn/Yel	TB2-4	Lead of T2	-	
T2-Grn	TB2-2	Lead of T2	-	
U1-White	R1-Top	Lead of U1	-	
U1-Black	R1-Bottom	Lead of U1	-	
R1-Bottom	Ground	- Black	18	
CR1-Anode	CR2-Anode	Tinned Copper	20	

* Denotes passes through a ferrite toroid (2 turns) at source end.

@ Denotes all three insulated conductors of 3-conductor, shielded cable pass through a ferrite toroid (2 turns) at source end.

Table 6-4 Wiring List - Fan Panel

SOURCE	DESTINATION	CODE	SIZE	REMARKS
P1-1	B1-L1	- Grey	18	
B1-L1	B2-L1	- Grey	18	
B2-L1	B3-L1	- Grey	18	
B3-L1	B4-L1	- Grey	18	
P1-2	XF1-Center	- Grey	18	
XF1-Center	XF2-Center	- Grey	18	
XF2-Center	XF3-Center	- Grey	18	
XF3-Center	XF4-Center	- Grey	18	
XF1-Side	B1-L2	- Grey	18	
XF2-Side	B2-L2	- Grey	18	
XF3-Side	B3-L2	- Grey	18	
XF4-Side	B4-L2	- Grey	18	
P2-1	B5-L1	- Grey	18	
B5-L1	B6-L1	- Grey	18	
B6-L1	B7-L1	- Grey	18	
B7-L1	B8-L1	- Grey	18	
P2-2	XF5-Center	- Grey	18	
XF5-Center	XF6-Center	- Grey	18	
XF6-Center	XF7-Center	- Grey	18	
XF7-Center	XF8-Center	- Grey	18	
XF5-Side	B5-L2	- Grey	18	
XF6-Side	B6-L2	- Grey	18	
XF7-Side	B7-L2	- Grey	18	
XF8-Side	B8-L2	- Grey	18	

Table 6-5 Wiring List - NAC21/4 Control/Monitor Panel

SOURCE	DESTINATION	CODE		SIZE	REMARKS
S3-5	Ground	RD05	Resistor	6800 ohm	R1
S3-8	Ground	RD05	Resistor	6800 ohm	R2
S4-12	Ground	RX01	Thermistor	2K ohm @ 20°C	R3
S5-1	S5-12	RAP13	Resistor	10K ohm	R4
XDS9-Cathode	Ground	RAP10	Resistor	1800 ohm	R5
XDS1-Cathode	Ground	RAP10	Resistor	1800 ohm	R6
XDS3-Cathode	Ground	RAP10	Resistor	1800 ohm	R7
S3-2	Ground	RD09	Resistor	15K ohm	R8
S2B-1	S2B-4	RAP10	Resistor	1800 ohm	R9
S2A-2	P1-1	1	Red	20	
S2A-1	P1-4	2	Red	20	
S1-9	XDS1-Anode	3	Orange	22	
XDS2-Anode	XDS1-Anode	4	Orange	22	
S1-5	S2B-W2	5	Orange	22	
S3-W2	A4-11	6	Core	RG188A/U	Coaxial cable
Ground at S3	-	-	Shield		
P2-8	Ground	7	Black	20	
P2-6	S1-11	8	Red	16	
-	-	9	Not Used		
P2-5	S1-9	10	Orange	22	
P2-18	S4-8	11	White	22	
P2-17	S4-2	12	White	22	
P2-16	S4-9	13	White	22	
P2-15	S4-3	14	White	22	
P2-14	S4-10	15	White	22	
P2-13	S4-4	16	White	22	
P2-12	S4-11	17	White	22	
P2-11	S4-5	18	White	22	
-	-	19	Not Used		
-	-	thru			
-	-	26	Not Used		
S5-12	S4-W1	27	White	22	
S4-W2	A3-B(M2)	28	White	22	
S4-W1	A3-A(M2)	29	White	22	
S5-W2	A2-A(M3)	30	White	22	
S5-W1	A2-B(M3)	31	White	22	
S3-9	A1-A(M1)	32	White	22	
S3-10	A1-B(M1)	33	White	22	
P1-8	S2A-8	34	Red	16	
P1-9	S2A-7	35	Red	16	
P1-10	S2B-8	36	Orange	22	
XDS3-Anode	P1-10	37	Orange	22	
P1-11	S2B-7	38	Orange	22	
XDS2-Cathode	S2B-4	39	White	22	
XDS4-Cathode	P1-12	40	White	22	
XDS5-Cathode	P1-13	41	White	22	
XDS6-Cathode	P1-14	42	White	22	
XDS7-Cathode	P1-15	43	White	22	
XDS8-Cathode	P1-16	44	White	22	
XDS9-Anode	P1-17	45	White	22	

Table 6-5 Wiring List - NAC21/4 Control/Monitor Panel (Continued)

SOURCE	DESTINATION	CODE	SIZE	REMARKS
P1-2	A4-23	46 Core	RG188A/U	Coaxial cable
-	A4-12	- Shield		
P1-5	S3-W1	47 Core	RG188A/U	Coaxial cable
-	Ground	- Shield		
J1-Center	1A2A3TB1-3	48 Core	RG188A/U	Coaxial cable
Ground near J1	Ground near TB1	- Shield		
S3-W1	1A2A3TB1-1	49 Core	RG188A/U	Coaxial cable
Ground	Ground near TB1	- Shield		
S3-W2	1A2A3TB1-4	50 Core	RG188A/U	Coaxial cable
Ground	Ground near TB1	- Shield		
P1-18	A4-1	51 Orange	22	
S5-9	P2-1	52 White	22	
S5-3	P2-2	53 White	22	
P1-3	S4-12	54 Core	RG188A/U	Coaxial cable
-	Ground at S4	- Shield		
P1-6	S2B-2	55 White	22	
P1-7	S2A-W1	56 Red	22	
S1-7	S2A-W2	57 Red	16	
S1-8	S2B-2	58 White	22	
A4-10	S6-1	59 White	22	
P2-5	S6-2	60 Orange	22	
S6-4	XDS9-Anode	61 White	22	
S6-3	Ground	- Black	22	
S5-2	S5-8	Tinned Copper	24	
S4-1	S4-7	Tinned Copper	24	
S5-7	Ground	Tinned Copper	24	
A1-C(M1-)	Ground	- Black	22	
S2B-W1	Ground	- Black	22	
XDS4-Anode	A4-13	- White	22	
XDS5-Anode	A4-14	- White	22	
XDS6-Anode	A4-15	- White	22	
XDS7-Anode	A4-16	- White	22	
XDS8-Anode	A4-17	- White	22	
S3-4	S3-3	Tinned Copper	24	
S3-7	S3-8	Tinned Copper	24	
S3-2	S3-9	Tinned Copper	24	
S3-4	S3-5	Tinned Copper	24	
S3-6	S3-7	Tinned Copper	24	
S3-1	S3-10	Tinned Copper	24	
S1-4	Ground	Tinned Copper	24	
XDS4-Cathode	A4-22	- White	22	
XDS5-Cathode	A4-21	- White	22	
XDS6-Cathode	A4-20	- White	22	
XDS7-Cathode	A4-19	- White	22	
XDS8-Cathode	A4-18	- White	22	
A4-1	Ground	- Black	22	
S2A-W2	S2A-7	Tinned Copper	24	
S2B-W2	S2B-7	Tinned Copper	24	

Table 6-6 Wiring List - NAE39/1 Driver Unit

SOURCE	DESTINATION	CODE		SIZE	REMARKS
XK8-5	Ground	CCG07	Capacitor	0.1uF 100V	C1
TT-6	TT-7	CCG04	Capacitor	0.01uF 100V	C2
TB2-4	Ground	CCG07	Capacitor	0.1uF 100V	C3
TB2-3	Ground	CCG07	Capacitor	0.1uF 100V	C4
TB1-1	Ground	CCG07	Capacitor	0.1uF 100V	C5
TB1-2	Ground	CCG07	Capacitor	0.1uF 100V	C6
TB1-3	Ground	CCG07	Capacitor	0.1uF 100V	C7
TB1-4	Ground	CCG07	Capacitor	0.1uF 100V	C8
TB1-5	Ground	CCG07	Capacitor	0.1uF 100V	C9
TB1-6	Ground	CCG07	Capacitor	0.1uF 100V	C10
TB1-8	Ground	CCG07	Capacitor	0.1uF 100V	C11
TB1-9	Ground	CCG07	Capacitor	0.1uF 100V	C12
TB1-10	Ground	CCG07	Capacitor	0.1uF 100V	C13
TB1-11	Ground	CCG07	Capacitor	0.1uF 100V	C14
TB1-12	Ground	CCG07	Capacitor	0.1uF 100V	C15
TB1-13	Ground	CCG07	Capacitor	0.1uF 100V	C16
TB1-14	Ground	CCG07	Capacitor	0.1uF 100V	C17
TB2-2	Ground	CCG07	Capacitor	0.1uF 100V	C18
TB2-1	Ground	CCG07	Capacitor	0.1uF 100V	C19
XA5P2-3	Ground	CCG04	Capacitor	0.01uF 100V	C20
TB2-10	Ground	CCG07	Capacitor	0.1uF 100V	C21
XK7-14 (Cathode)	XK7-13 (Anode)	QAP29	Diode	1N4938	CR1
XK7-12 (Cathode)	XK7-9 (Anode)	QAP29	Diode	1N4938	CR2
XK8-12 (Cathode)	XK8-9 (Anode)	QAP29	Diode	1N4938	CR3
XK8-14 (Cathode)	XK8-13 (Anode)	QAP29	Diode	1N4938	CR4
XK3-13 (Cathode)	XK3-14 (Anode)	QAP29	Diode	1N4938	CR5
XK2-14 (Cathode)	XK2-13 (Anode)	QAP29	Diode	1N4938	CR6
XK9-13 (Cathode)	XK9-14 (Anode)	QAP29	Diode	1N4938	CR7
XK5-14 (Cathode)	XK5-13 (Anode)	QAP29	Diode	1N4938	CR8
XK4-14 (Cathode)	XK4-13 (Anode)	QAP29	Diode	1N4938	CR9
XK1-3 (Cathode)	XK1-1 (Anode)	QAP29	Diode	1N4938	CR10
XK1-2 (Cathode)	XK1-1 (Anode)	QAP29	Diode	1N4938	CR12
XK1-14 (Cathode)	XK1-13 (Anode)	QAP29	Diode	1N4938	CR13
XK6-13 (Cathode)	XK6-14 (Anode)	QAP29	Diode	1N4938	CR14
TT-8 (Cathode)	TT-7 (Anode)	QAP29	Diode	1N4938	CR15
TT-8 (Cathode)	TT-2 (Anode)	QAP29	Diode	1N4938	CR16
TT-9 (Cathode)	TT-3 (Anode)	QAP29	Diode	1N4938	CR17
TT-10 (Cathode)	TT-5 (Anode)	QAP29	Diode	1N4938	CR18
XK1-3 (Cathode)	XK1-7 (Anode)	QAP29	Diode	1N4938	CR19
XK1-2 (Cathode)	XK1-6 (Anode)	QAP29	Diode	1N4938	CR20
TT-17 (Cathode)	TT-18 (Anode)	QAP29	Diode	1N4938	CR21
TT-16 (Cathode)	TT-18 (Anode)	QAP29	Diode	1N4938	CR22
TT-13	TP1	RAP11	Resistor	3300 ohms	R1
TT-12	TT-13	RI42	Resistor	2700 ohms	R2
TT-14	J5-Center	RI39	Resistor	1500 ohms	R3
TT-1	TT-6	RAP13	Resistor	10K ohms	R4
TT-7	Ground	RAP13	Resistor	10K ohms	R5
TT-3	TT-15	RAP09	Resistor	1000 ohms	R6
TT-9	Ground	RAP13	Resistor	10K ohms	R7
TT-4	TT-5	RAP09	Resistor	1000 ohms	R8
TT-11	XDS1-Anode	RC38	Resistor	1200 ohms	R9

Table 6-6 Wiring List - NAE39/1 Driver Unit (Continued)

SOURCE	DESTINATION	CODE		SIZE	REMARKS
TT-10	Ground	RAP13	Resistor	10K ohms	R10
XA3P1-12	XA4P1-1	RAP11	Resistor	3300 ohms	R11
XA1P1-1	XA2P1-1	1	White	22	
XA2P1-1	XA3P1-7	2	White	22	
XK7-5	TT15	3	Red	22	
XA1P1-5	XA2P1-5	4	Blue	22	
XA2P1-5	XA3P1-1	5	Blue	22	
XA3P1-8	XA4P1-4	6	White	22	
TT9	TB2-4	7	White	22	
XA4P1-4	XA5P1-4	8	White	22	
XK2-13	TT-1	9	White	22	
XA4P1-2	XA5P1-2	10	White	22	
TT10	TB2-3	11	White	22	
K1-12	J2-2	12	White	22	
J1-18	J2-6	13	Orange	22	
XK1-14	XK4-14	14	Orange	22	
XK4-14	XK5-14	15	Orange	22	
XK5-14	XK2-6	16	Orange	22	
XK1-12	XK4-12	17	White	22	
XK4-12	XK5-12	18	White	22	
XK5-12	XK6-12	19	White	22	
-	-	20	Not Used		
-	-	21	Not Used		
XK2-10	XK7-8	22	Orange	22	
XK2-11	XK7-5	23	Red	22	
XK2-6	J1-18	24	Orange	22	
XK3-13	XK9-13	25	Orange	22	
XK3-10	XK9-9	26	Red	22	
XA1P1-3	XK3-4	27	Core	RG58A/U	Coaxial cable
XA1P1-4	Gnd near XK3	-	Shield		
XA1P1-6	XK3-2	28	Red	22	
XA2P1-3	XK3-8	29	Core	RG58A/U	Coaxial cable
XA2P1-4	Gnd near XK1	-	Shield		
XA2P1-6	XK3-6	30	Red	22	
XA3P2-11	XK3-13	31	Orange	22	
XA4P1-5	XK9-1	32	Red	22	
XA5P1-5	XK9-5	33	Red	22	
XA4P2-1	XK9-2	34	Core	RG188A/U	Coaxial cable
XA4P2-2	Gnd near XK9	-	Shield		
J2-1	TB2-2	35	White	22	
XA3P2-10	XA4P1-2	36	White	22	
XA4P2-5	XK9-4	37	Core	RG188A/U	Coaxial cable
XA4P2-6	Gnd near XK9	-	Shield		
XA5P2-1	XK9-6	38	Core	RG188A/U	Coaxial cable
XA5P2-2	Gnd near XK9	-	Shield		
XA5P2-5	XK9-8	39	Core	RG188A/U	Coaxial cable
XA5P2-6	Gnd near XK9	-	Shield		
-	-	40	Not Used		
J2-3	XK9-12	41	Core	RG188A/U	Coaxial cable
J2-4	Gnd near XK9	-	Shield		
XK9-13	XK2-6	42	Orange	22	

Table 6-6 Wiring List - NAE39/1 Driver Unit (Continued)

SOURCE	DESTINATION	CODE		SIZE	REMARKS
XA5P1-2	XK8-5	43	White	22	
XK9-9	XK2-7	44	Red	22	
XA3P2-2	XK9-14	45	White	22	
XK9-14	XK1-3	46	White	22	
XA3P1-6	XK3-14	47	White	22	
XK3-14	XK1-2	48	White	22	
XK9-10	T1-5	49	White	22	
XA4P2-4	XA3P1-4	50	White	22	
TB2-10	XA5P1-1	51	White	22	
XA3P1-1	J2-14	52	Blue	22	
-	-	53	Not Used		
XK2-4	TB1-13	54	White	22	
XK8-5	J2-17	55	White	22	
XK7-8	J1-10	56	Orange	22	
XK7-11	J1-11	57	Orange	22	
XK7-10	J1-9	58	Red	22	
XK7-5	J1-8	59	Red	22	
XK1-6	J1-14	60	White	22	
XK1-7	J1-15	61	White	22	
XA3P2-5	XK4-13	62	White	22	
XK4-13	J1-12	63	White	22	
XA3P2-3	XK5-13	64	White	22	
XK5-13	J1-13	65	White	22	
XA4P1-2	TT-11	66	White	22	
XK2-13	TB1-8	67	White	22	
XA3P2-7	J1-2	68	Core	RG188A/U	Coaxial cable
XA3P2-8	-	-	Shield		
XA3P2-4	J2-12	69	Orange	22	
TB1-7	J2-5	70	White	22	
XK8-10	J1-4	71	White	22	
TB1-1	XK7-13	72	White	22	
TB1-2	XK7-9	73	White	22	
TB1-3	XK8-9	74	White	22	
TB1-4	XK8-13	75	White	22	
J1-6	TB2-1	76	White	22	
J1-7	XA3P2-12	77	Red	22	
XF1-center	J2-11	78	Orange	22	
TB1-14	XK6-12	79	White	22	
TB1-9	XK1-8	80	White	22	
TB1-10	XK4-8	81	White	22	
TB1-11	XK5-8	82	White	22	
TB1-12	XK6-4	83	White	22	
TB1-16	T1-1	84	White	22	2-conductor
TB1-17	Gnd near T1	85	Shield		shielded cable
TB1-18	T1-4	86	Black	22	
XA3P1-3	J1-16	87	White	22	
XA3P1-9	J4 Center	88	Core	RG188A/U	Coaxial cable
XA3P1-10	Gnd near J4	-	Shield		
XK3-12	A6-1	89	Core	RG58A/U	Coaxial cable
Gnd near XK3	A6-Gnd	-	Shield		

Table 6-6 Wiring List - NAE39/1 Driver Unit (Continued)

SOURCE	DESTINATION	CODE		SIZE	REMARKS
XA3P2-6	A6-2	90	Core	RG188A/U	Coaxial cable
Gnd near XA3P2	A6-Gnd	-	Shield		
XF1-side	TB1-6	91	Orange	22	
XK8-5	TT-4	92	White	22	
XA3P1-11	J3 Center	93	White	RG188A/U	Coaxial cable
XA3P1-10	Gnd near J3	-	Shield		
TB1-5	XK8-14	94	White	22	
Gnd near XK3	J2-10	95	Black	22	
XA3P2-9	J1-5	96	Core	RG188A/U	Coaxial cable
XA3P2-8	-	-	Shield		
XK2-7	J2-7	97	Red	22	
XK2-2	J1-17	98	White	22	
XK2-12	XK1-12	99	White	22	
XK6-13	XK5-14	100	Orange	22	
TT-14	A6CR2 Anode	101	Core	RG188A/U	Coaxial cable
Gnd at J5	A6CR3 Anode	-	Shield		
TT-13	Jct A7C9/C10	102	White	22	
TP2	A6-3	103	White	22	
J2-15	TT-2	104	White	22	
S1-2	J1-1	105	White	22	
XA3P2-12	XK9-9	106	Red	22	
-	-	107	Not Used		
TT-8	XA3P2-1	108	White	22	
-	-	109	Not Used		
J2-13	TP-3 Red	110	White	22	
J2-16	TP-4 Violet	111	White	22	
-	-	112	Not Used		
J1-3	XA3P1-2	113	White	22	
XK8-14	XK7-14	114	White	22	
-	-	115	Not Used		
XA3P2-10	S1-1	116	White	22	
-	-	117	Not Used		
-	-	118	Not Used		
-	-	119	Not Used		
XK6-14	XA3P1-5	120	White	22	
-	-	121	Not Used		
-	-	122	Not Used		
J6-Center	XA2P2-2	123	Core	RG188A/U	Coaxial cable
Gnd Near J6	XA2P2-1	-	Shield		
XA2P2-2	XA1P2-2	124	Core	RG188A/U	Coaxial cable
XA2P2-1	XA1P2-1	-	Shield		
XA3P1-1	XA4P1-3	125	Blue	22	
XA4P1-3	XA5P1-3	126	Blue	22	
-	-	127	Not Used		
-	-	128	Not Used		
P1-12	TB2-9	129	White	22	
XA3P2-10	P1-7	130	White	22	
XA3P2-9	P1-4	131	White	22	
TB2-5	P1-5	132	White	22	
TB2-6	P1-1	133	White	22	
TB2-7	P1-6	134	White	22	

Table 6-6 Wiring List - NAE39/1 Driver Unit (Continued)

SOURCE	DESTINATION	CODE	SIZE	REMARKS
TB2-8	P1-8	135 White	22	
J2-8	P1-2	136 White	22	
J2-9	P1-3	137 White	22	
XK7-12	P1-9	138 White	22	
XA4P1-6	P1-10	139 Black	22	
J2-7	P1-11	140 Red	22	
TB2-7	TT16	141 White	22	
TB2-8	TT17	142 White	22	
TT18	XK8-13	143 White	22	
T1-6	T1-7	Tinned Copper	20	
T1-8	T1-9	Tinned Copper	20	
T1-9	Gnd	- Black	22	
XK7-12	XK7-14	Tinned Copper	20	
XK8-12	XK8-14	Tinned Copper	20	
XA1P1-2	XA2P1-2	- Black	22	
XK1-1	XK1-13	- White	22	
J2-18	Ground	- Black	22	
XA5P2-3	XA4P2-3	- White	22	
XA4P2-3	XA3P2-7	- White	22	
XA5P1-6	Gnd	- Black	22	
TB1-15	Gnd	- Black	22	
XK2-10	XK2-14	- Orange	22	
TP5	Gnd	- Black	22	
XA4P1-1	XA5P1-1	- White	22	
T1-2	T1-3	- Tinned Copper	24	
XA4P1-6	XA5P1-6	- Black	22	
XA4P1-6	XA3P1-10	- Black	22	
XA3P1-10	XA2P1-2	- Black	22	
XK3-3	XK3-4	- Tinned Copper	20	
XK3-7	XK3-8	- Tinned Copper	20	
XK3-11	XK3-12	- Tinned Copper	20	
TT-12	XDS2-Anode	- White	22	
XDS1-Cathode	Ground	- Black	22	
XDS2-Cathode	Ground	- Black	22	
A6CR2-Anode	Jct A7C9/C10	- Teflon	16	

Table 6-7 Wiring List - NAFP15 Modulation Monitor Probe

SOURCE	DESTINATION	CODE		SIZE	REMARKS
J1-1	J1-2	CCG04	Capacitor	0.01uF	C1
Q1-E	Q1-B	CCG04	Capacitor	0.01uF	C2
Ground	Q2-B	CCG04	Capacitor	0.01uF	C3
XK1-13 Cathode	XK1-14 Anode	QAP29	Diode	1N4938	CR1
XK2-13 Cathode	XK2-14 Anode	QAP29	Diode	1N4938	CR2
XK1-14 Anode	XK1-10 Cathode	QAP29	Diode	1N4938	CR3
XK2-14 Anode	XK2-10 Cathode	QAP29	Diode	1N4938	CR4
Q1-C Cathode	TT4 Anode	QAP29	Diode	1N4938	CR5
Q2-C Cathode	TT2 Anode	QAP29	Diode	1N4938	CR6
Q1-B	TT-5	RAP13	Resistor	10K ohms	R4
Q1-E	Q1-B	RAP11	Resistor	3.3K ohms	R5
Q2-B	TT-1	RAP13	Resistor	10K ohms	R6
Ground	Q2-B	RAP11	Resistor	3.3K ohms	R7
* J1-1	XK1-13	-	Red	22	
R1-1	TB1-12	1	White	22	
R2-1	TB1-7	2	White	22	
R3-1	TB1-3	3	White	22	
R1-3	XK1-1	4	White	22	
R2-3	XK1-8	5	White	22	
R3-3	XK1-4	6	White	22	
XK1-9	XK2-8	7	White	22	
XK1-12	XK2-4	8	White	22	
XK2-12	XF1-Centre	9	White	22	
XF1-Side	TB1-2	10	White	22	
TT1	J1-4	11	White	22	
TT5	J1-3	12	White	22	
Q2-C	XK2-10	13	White	22	
Q1-C	XK1-10	14	White	22	
TT3	J1-5	15	White	22	
XK1-13	XK2-13	16	Red	22	
TB1-3	TB1-5	-	White	22	
TB1-7	TB1-9	-	White	22	
TB1-12	TB1-10	-	White	22	
J1-6	Ground	-	Black	22	
Q1-E	Ground	Tinned Copper		22	
Q2-E	Ground	Tinned Copper		22	
TB1-1	Ground	Tinned Copper		22	
J1-2	Ground	Tinned Copper		22	
R1-1	R1-2	Tinned Copper		22	
R2-1	R2-2	Tinned Copper		22	
R3-1	R3-2	Tinned Copper		22	

* Denotes passes through a ferrite toroid (2 turns) at source end.

SECTION 7
PARTS LIST

INTRODUCTION

7.1 This section contains a complete listing of all electrical and mechanical parts that have been assigned a reference designation and form a part of the subject transmitter. Detailed parts of identified plug-in modules, which are normally removed from the transmitter for servicing, are not listed in the reference designation index and are not included in the parts per unit index. Refer to the service instruction manual for a specific plug-in module/assembly for detailed parts information of these assemblies.

FAMILY TREE

7.2 Figure 7-1 depicts the family tree for an AMPFET 5 AM broadcast transmitter.

SUBSTITUTION OF PARTS

7.3 Each part assigned a reference designation index has been identified by a Nautel in-house number and by the original equipment manufacturer's part number to assist the user in obtaining replacement parts. Nautel reserves the right to substitute an equivalent or higher quality part during manufacture or when filling replacement part orders, where its use will not degrade circuit operation or reliability.

MANUFACTURER'S INDEX

7.4 Table 7-1 provides a cross reference from the original equipment manufacturers (OEM) codes to the manufacturer's name and address. The listing is sorted alpha/numerically by the manufacturers' codes. The OEM code listed for parts that are manufactured by Nautel or to a Nautel control drawing, is for Nautical Electronic Laboratories Limited of Canada (OEM code 37338). United States of America customers should refer all orders for replacement parts to Nautel Maine Incorporated (OEM code 57655).

REFERENCE DESIGNATION INDEX

7.5 Table 7-2 provides a parts listing for the subject transmitter, in alpha/ numeric order of its reference designations. The reference designation index is divided into four columns as an aid to locating specific information. Refer to paragraph 7.7 for an explanation of column contents.

PARTS PER UNIT INDEX

7.6 Table 7-3 provides a listing of the total number of each part that is in the subject transmitter, in alpha/numeric order of the Nautel part number. The parts per unit index is divided into five columns as an aid to locating specific information, including a column that identifies the original equipment manufacturer for each part. Refer to paragraph 7.7 for an explanation of column contents.

COLUMN CONTENT EXPLANATION

7.7 The following paragraphs provide an explanation of the purpose and contents of each column in the reference designation and parts per unit indexes.

7.7.1 REF DES COLUMN: The first column in the reference designation index contains the full reference designation, in accordance with American National Standard Specification ANSI Y32.16, assigned to a specific part. The reference designation index is sorted and listed alpha/numerically according to the reference designation in this column. There is no Ref Des column in the parts per unit index.

7.7.2 NAME OF PART AND DESCRIPTION COLUMN: The second column of the reference designation and the parts per unit indexes contains the name and descriptive information for each part. The key word or noun is presented first, followed by the adjective identifiers.

7.7.3 NAUTEL'S PART NO. COLUMN: The third column of the reference designation index and the first column of the parts per unit index contains the Nautel in-house part number assigned to each part. This number is a Nautel inventory management aid that allows a single number to represent two or more different manufacturers part numbers for interchangeable parts. The parts per unit index is sorted and listed alpha/numerically according to the part number in this column.

7.7.4 JAN, MIL OR MFR PART NO. COLUMN: The fourth column of the reference designation index and the third column of the parts per unit index contains an original equipment manufacturer's part number for a part. A single part number is listed for each part, even though there may be more than one known manufacturer. The listed number is Nautel's usual or preferred choice. A JAN or MIL number has been assigned as the manufacturer's part number, where practical, to assist the user in finding a suitable replacement part. The use of this number does not restrict Nautel from selecting and using commercial equivalents, where their use will not degrade circuit operation or reliability, during manufacture.

7.7.5 OEM CODE COLUMN: The fourth column of the parts per unit index contains a five digit coded group as the original equipment manufacturer's (OEM) identifier. The code is based on and was extracted from Cataloging Handbook H4-2 - Federal Supply Code for Manufacturers (United States and Canada). Manufacturers that were not listed in the H4 catalog at the time this listing was compiled have been assigned a five letter code. The five letter code is assigned arbitrarily and has no other significance. The manufacturers identified for parts that have JAN or MIL part numbers are Nautel's normal supply source for that part. There is no OEM Code column in the reference designation index.

7.7.6 TOTAL IDENT PARTS COLUMN: The fifth column of the parts per unit index contains a number that represents the total quantity of that specific part listed in the reference designation index for the subject transmitter. This quantity does not include the detailed parts of the identified plug-in modules or the detailed parts of optional or external assemblies which may be provided with the transmitter. There is no Total Ident Parts column in the reference designation index.

Table 7-1 Manufacturers' Code to Address Index

00213 Nytronics Incorporated,
Nytronics Components Group,
Orange Street,
Darlington, South Carolina 29532

00779 AMP Incorporated,
PO Box 3608,
Harrisburg, Pennsylvania 17105

00853 Sangamo Weston Incorporated,
Sangamo Capacitor Division,
PO Box 128,
Route 3,
Sangamo Road,
Pickens, South Carolina 29671

01121 Allen-Bradley Company,
1201 South 2nd Street,
Milwaukee, Wisconsin 53204

01295 Texas Instruments Incorporated,
US Semiconductor Group,
PO Box 225012, M/S 49,
13500 North Central Expressway,
Dallas, Texas 75265

02111 Spectrol Electronics Corporation,
17070 East Gale Avenue,
City of Industry, California 91745

02114 Ferroxcube Corporation,
Mt. Marion Road,
PO Box 359
Saugerties, NY 12447

02660 Bunker Ramo Corporation,
Amphenol Connector Division,
2801 South 25th Avenue,
Broadview, Illinois 60153

04713 Motorola Incorporated,
Semiconductor Products Group,
5005 East McDowell Road,
Phoenix, Arizona 85008

07355 Airpax Electronics Inc.,
Controls Division,
6801 W. Sunrise Blvd.,
Ft. Lauderdale, Florida 33313

08372 Cutler-Hammer Canada Limited,
45 Progress Avenue,
Scarsborough, Ontario, Canada,
M1P 2T6
USA customers see OEM code 68592

09482 Amp of Canada Ltd.,
20 Esna Park Drive,
Markham, Ontario
L3R 1E1
USA customers see OEM code 00779

12969 Unitrode Corporation,
580 Pleasant Street,
Watertown, Massachusetts 02172

13150 Vernitron Electronic Components,
Beau Products Division,
PO Box 10,
Laconia, New Hampshire 03246

14604 Elmwood Sensors Inc.,
1655 Elmwood Ave.,
Cranston, RI 02907

14655 Cornell Dubilier Electronics Division,
Federal Pacific Electric Company,
150 Avenue L,
Newark, New Jersey 07101

15513 Data Display Products,
P O Box 91072,
5428 West 104th St.,
Los Angeles, Ca 90009

33062 Ferronics Incorporated,
60 North Lincoln Road,
East Rochester, New York 14445

34361 Brunswick Corp.,
Circle Seal Controls Technetics Div.,
1111 W. Brookhurst Street,
PO Box 3666,
Anaheim, California 92803

35005 Dale Electronics Canada Limited,
18 Howden Road,
Scarborough, Ontario
USA customers use OEM code 91637

Table 7-1 Manufacturers' Code to Address Index (Continued)

35104 Bach Simpson Limited,
1255 Brydges Street
London, Ontario, Canada
N6A 4G7
USA customers use OEM code 16902

37338 Nautical Electronic Laboratories Ltd,
Hackett's Cove, Halifax County,
Nova Scotia, Canada,
B0J 3J0
USA customers use OEM code 57655

37903 Siemens Electric Ltd.,
7300 Trans Canada Highway,
Pointe Clare, Quebec,
H9R 1O7
USA customers use OEM code 60076

44655 Ohmite Manufacturing Co.,
3601 West Howard Street,
Skokie, Illinois 60076

50434 Hewlett Packard Company,
Optoelectronics Division,
640 Page Mill Road,
Palo Alto, California 94304

54590 RCA Corporation,
Dist. and Special Products,
Bldg 206-2,
Cherry Hill Offices,
Camden, New Jersey 08101

55292 Wilbrecht Electronic Inc.,
LEDCO Division,
240 Plato Boulevard,
St. Paul, Minnesota 55107

56289 Sprague Electric Company,
Distributors' Division,
87 Marshall Street,
North Adams, Massachusetts 01247

57655 Nautel Maine Inc.,
201 Target Industrial Circle;
Bangor, Maine 04401

71279 Cambridge Thermionic Corp.,
445 Concord Avenue,
Cambridge, Massachusetts 02238

71400 Bussman Manufacturing Division,
McGraw-Edison Company,
502 Earth City Plaza,
Earth City, Missouri 63045

71785 TRW Incorporated,
TRW Cinch Connectors,
1501 Morse Avenue,
Elk Grove Village, Illinois 60007

72982 Erie Technological Products Inc,
644 West 12th Street,
Erie, Pennsylvania 16512

73168 Fenwall Incorporated,
Walter Kidde & Company Inc.,
400 Main Street,
Ashland, Massachusetts 01721

73631 Curtis Industries Inc.,
8000 West Tower Avenue
Milwaukee, Wi 53223

73831 Hammond Manufacturing Co. Ltd.,
394 Edinburgh Road North,
Guelph, Ontario
N1H 1E5

73899 JFD Electronics Components Corp.,
112 Mott Street
Oceanside, New York 11572

73949 Guardian Electric Manufacturing Co.,
1550 West Carroll Avenue,
Chicago, Illinois 60607

75042 TRW Electronic Components,
IRC Fixed Resistor Division,
401 North Broad Street,
Philadelphia, Pennsylvania 19108

75915 Littlefuse Incorporated,
800 East Northwest Highway,
Des Plaines, Illinois 60016

77342 AMF Incorporated,
Potter and Brumfield Division,
200 Richland Creek Drive,
Princeton, Indiana 47670

Table 7-1 Manufacturers' Code to Address Index (Continued)

80207 Unimax Switch Corp.,
A Unimax Group Subsidiary,
Ives Road,
Wallingford, Connecticut 06492

80294 Bourns Incorporated,
Instrument Division,
6135 Magnolia Avenue,
Riverside, California 92506

81483 International Rectifier,
9220 Sunset Boulevard,
PO Box 2321,
Terminal Annex,
Los Angeles, Ca 90054

82877 Rotron Inc.,
7-9 Hasbrouk Lane,
Woodstock, New York 12498

83003 VARO Incorporated,
PO Box 401426,
2203 Walnut Street,
Garland, Texas 75040

89473 General Electric Distributing Corp.,
1 River Road,
Schenactady, New York 12305

91506 Augat Incorporated,
PO Box 779,
633 Perry Avenue,
Attleboro, Massachusetts 02703

91929 Honeywell Inc
Micro Switch Division
11 West Spring Street
Freeport, Illinois 61032

95146 Alco Electronic Products Inc
PO Box 1340
Lawrence, Ma 01842

99942 Centralab Electronics Division,
Centralab Semiconductor,
P O Box 591
5757 North Green Bay Road,
Milwaukee, Wisconsin 53201

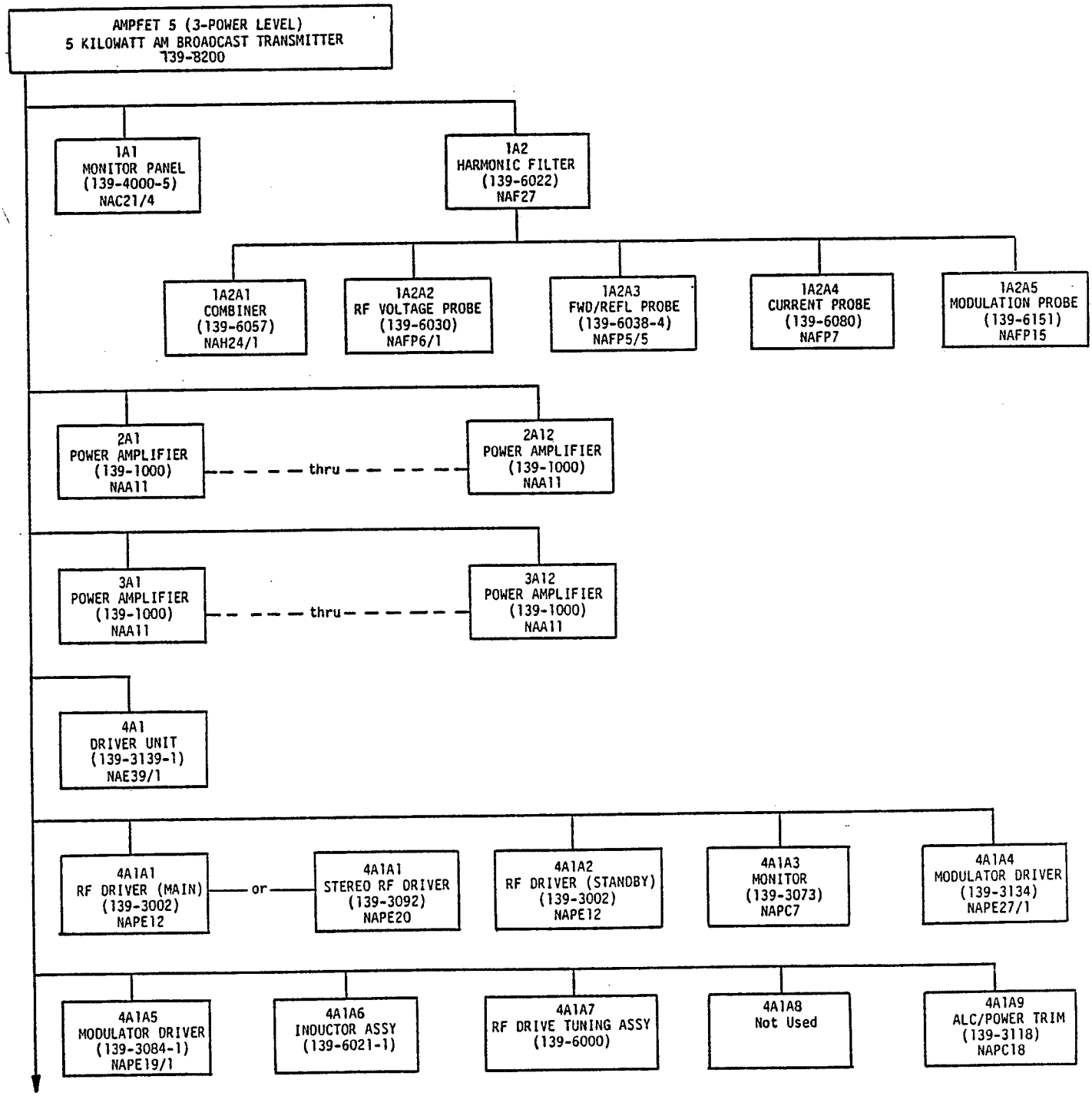


Figure 7-1 AMPFET 5 (Three Preset Power Levels) Family Tree (Sheet 1 of 2)

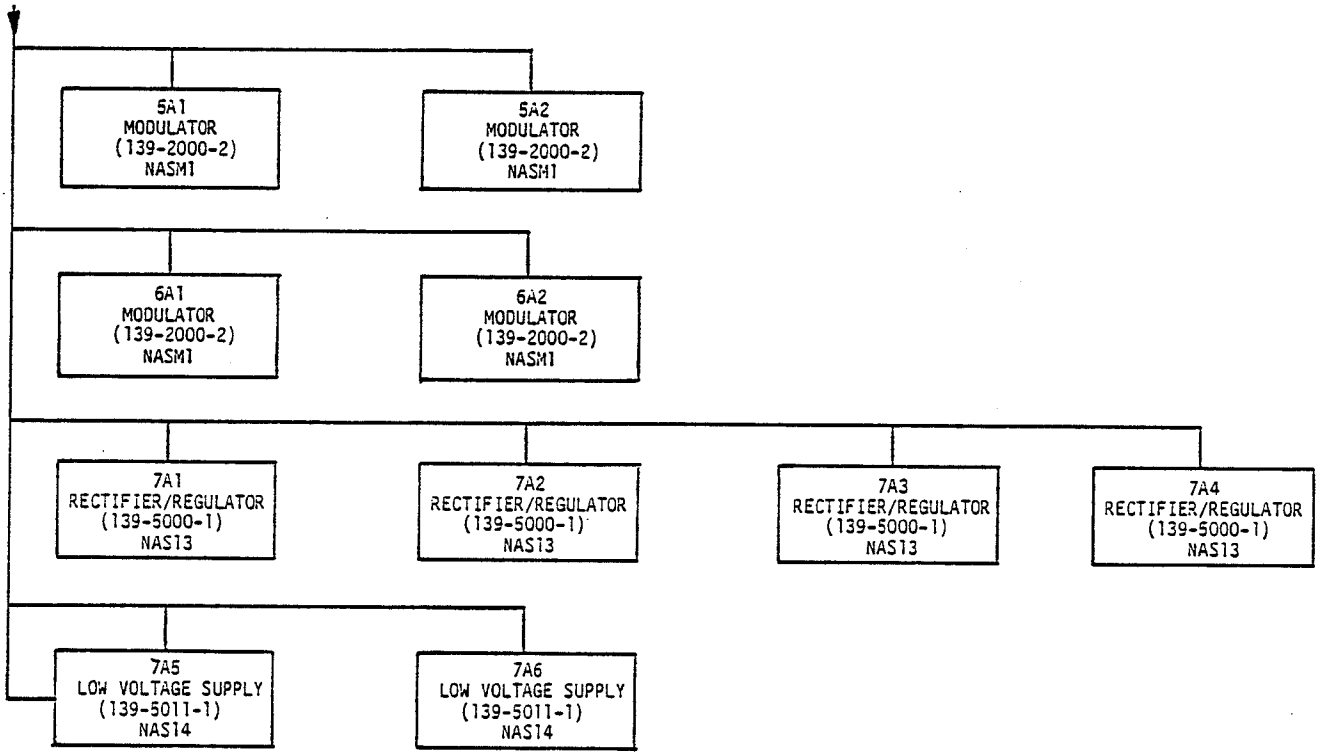


Figure 7-1 AMPFET 5 (Three Preset Power Levels) Family Tree (Sheet 2 of 2)

Table 7-2 Reference Designation Index

REF DES	NAME OF PART AND DESCRIPTION	NAUTEL's PART NO.	JAN, MIL OR MFR PART NO.
-	Transmitter, AM Broadcast, 5 kW	AMPFET 5	139-8200-
1A1	Control/Monitor Panel Assembly, 5kW	NAC21/4	139-4000-5
1A1A1	FWD/REFL Meter PCB Assembly	139-4028-2	139-4028-2
1A1A1R1	Resistor, Film, 15K ohms, 2% 1/2W	RD09	RL20S153G
1A1A1R2	Resistor, Variable, 1000 ohms, 1/2W	RW07	63P102
1A1A1R3	Resistor, Film, 5600 ohms, 2% 1/2W	RAP12	RL20S562G
1A1A1R4	Resistor, Selected at Final Test	-	RL20S---G
1A1A1R5	Resistor, Variable, 1000 ohms, 1/2W	RW07	63P102
1A1A2	Test Meter PCB Assembly	139-4028	139-4028
1A1A2CR1	Diode, General Purpose, Small Signal	QAP29	1N4938
1A1A2R1	Resistor, Film, 82K ohms, 2% 1/2W	RD18	RL20S823G
1A1A2R2	Resistor, Variable, 10K ohms, 1/2W	RW08	63P103T000
1A1A2R3	Resistor, Film, 3300 ohms, 2% 1/2W	RAP11	RL20S332G
1A1A3	Current Meter PCB Assembly	139-4028-1	139-4028-1
1A1A3R1	Not Used		
1A1A3R2	Resistor, Variable, 100 ohms, 1/2W	RW24	63P101T000
1A1A4	Terminal Board Assembly	139-4045	139-4045
1A1A4C1	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
1A1A4CR1	Diode, General Purpose, Small Signal	QAP29	1N4938
1A1A4CR2	Diode, General Purpose, Small Signal	QAP29	1N4938
1A1A4CR3	Diode, General Purpose, Small Signal	QAP29	1N4938
1A1A4CR4	Diode, General Purpose, Small Signal	QAP29	1N4938
1A1A4CR5	Diode, General Purpose, Small Signal	QAP29	1N4938
1A1A4R1	Resistor, Film, 1800 ohms, 2% 1/2W	RAP10	RL20S182G
1A1A4R2	Resistor, Film, 1800 ohms, 2% 1/2W	RAP10	RL20S182G
1A1A4R3	Resistor, Film, 1800 ohms, 2% 1/2W	RAP10	RL20S182G
1A1A4R4	Resistor, Film, 1800 ohms, 2% 1/2W	RAP10	RL20S182G
1A1A4R5	Resistor, Film, 1800 ohms, 2% 1/2W	RAP10	RL20S182G
1A1A4R6	Resistor, Film, 1000 ohms, 2% 1/2W	RAP09	RL20S102G
1A1DS1	Diode, Light Emitting, Amber	QK14	5082-4592
1A1DS2	Diode, Light Emitting, Amber	QK14	5082-4592
1A1DS3	Diode, Light Emitting, Green	QK12	5082-4992
1A1DS4	Diode, Light Emitting, Red	QK13	5082-4693
1A1DS5	Diode, Light Emitting, Red	QK13	5082-4693
1A1DS6	Diode, Light Emitting, Red	QK13	5082-4693
1A1DS7	Diode, Light Emitting, Red	QK13	5082-4693
1A1DS8	Diode, Light Emitting, Red	QK13	5082-4693
1A1DS9	Diode, Light Emitting, Red	QK13	5082-4693
1A1J1	Connector, RF Coaxial, BNC, Bulkhead	JDP26	UG1094/U
1A1M1	Meter, Output Power	MB32	139-4010-1
1A1M2	Meter, Modulator Input Current	MB36	139-4014
1A1M3	Meter, Test	MB34	139-4011
1A1P1	Connector, Plug, 18-pin	J024	P-3318-CCT
1A1P2	Connector, Plug, 18-pin	J024	P-3318-CCT
1A1R1	Resistor, Film, 6800 ohms, 2% 1/2W	RD05	RL20S682G
1A1R2	Resistor, Film, 6800 ohms, 2% 1/2W	RD05	RL20S682G
1A1R3	Thermistor, 2000 ohms @ 25°C	RX01	PB32D1

Table 7-2 Reference Designation Index (Continued)

REF DES	NAME OF PART AND DESCRIPTION	NAUTEL's PART NO.	JAN, MIL OR MFR PART NO.
1A1R4	Resistor, Film, 10K ohms, 2% 1/2W	RAP13	RL20S103G
1A1R5	Resistor, Film, 1800 ohms, 2% 1/2W	RAP10	RL20S182G
1A1R6	Resistor, Film, 1800 ohms, 2% 1/2W	RAP10	RL20S182G
1A1R7	Resistor, Film, 1800 ohms, 2% 1/2W	RAP10	RL20S182G
1A1R8	Resistor, Film, 15K ohms, 2% 1/2W	RD09	RL20S153G
1A1R9	Resistor, Film, 1800 ohms, 2% 1/2W	RAP10	RL20S182G
1A1S1	Switch, Toggle, 4PDT	SA23	SF4GCY191
1A1S2	Switch, Rotary, Shorting	SC16	PA2010
1A1S3	Switch, Rotary, Shorting	SC29	T202
1A1S4	Switch, Rotary, Non-shorting	SA32	T206
1A1S5	Switch, Rotary, Non-shorting	SA32	T206
1A1S6	Switch, 2PDT, PB, Momentary	SCP41	8N2011
1A1XDS1	Socket, LED	QK25	PS-200-B
1A1XDS2	Socket, LED	QK25	PS-200-B
1A1XDS3	Socket, LED	QK25	PS-200-B
1A1XDS4	Socket, LED	QK25	PS-200-B
1A1XDS5	Socket, LED	QK25	PS-200-B
1A1XDS6	Socket, LED	QK25	PS-200-B
1A1XDS7	Socket, LED	QK25	PS-200-B
1A1XDS8	Socket, LED	QK25	PS-200-B
1A1XDS9	Socket, LED	QK25	PS-200-B
A 1A2	Harmonic Filter (520kHz-620kHz)	NAF27/1	139-6022-1
B 1A2	Harmonic Filter (620kHz-743kHz)	NAF27/2	139-6022-2
C 1A2	Harmonic Filter (743kHz-887kHz)	NAF27/3	139-6022-3
D 1A2	Harmonic Filter (887kHz-1067kHz)	NAF27/4	139-6022-4
E 1A2	Harmonic Filter (1067kHz-1306kHz)	NAF27/5	139-6022-5
F 1A2	Harmonic Filter (1306kHz-1599kHz)	NAF27/6	139-6022-6
G 1A2	Harmonic Filter (1599kHz-1955kHz)	NAF27/7	139-6022-7
1A2A1	Combiner, 5 kW	NAH24/1	139-6057
1A2A1T1	Transformer	-	Not Procurable
1A2A1TB1	Terminal Block, Barrier, 4-terminal	JB33	4-142
1A2A1TB2	Terminal Block, Barrier, 4-terminal	JB33	4-142
1A2A2	RF Voltage Probe, 5kW	NAFP6/1	139-6030
1A2A2R1	Resistor, Film, 100 ohms, 2% 1/2W	RAP05	RL20S101G
1A2A2R2	Resistor, Film, 100 ohms, 2% 1/2W	RAP05	RL20S101G
1A2A2T1	Transformer	139-6031	139-6031
1A2A3	FWD/REFL Power Probe	NAFP5/5	139-6038-4
1A2A3A1	FWD/REFL Power Probe PCB Assembly	139-6065-4	139-6065-4
1A2A3A1C1	Capacitor, Mica, 2700pF 2%, 500V	CB42	CM06FD272G03
1A2A3A1C2	Capacitor, Mica, 2700pF 2%, 500V	CB42	CM06FD272G03
1A2A3A1C3	Capacitor, Mica, 470pF 2%, 500V	CB33	CD15FD471G03
1A2A3A1C4	Capacitor, Mica, 470pF 2%, 500V	CB33	CD15FD471G03
1A2A3A1CR1	Diode, Hot Carrier	QK09	1N6263
1A2A3A1CR2	Diode, Hot Carrier	QK09	1N6263
1A2A3A1L1	Inductor, Moulded, Shielded, 10000uH	LAP41	SWD10000
1A2A3A1L2	Inductor, Moulded, Shielded, 10000uH	LAP41	SWD10000

Table 7-2 Reference Designation Index (Continued)

REF DES	NAME OF PART AND DESCRIPTION	NAUTEL's PART NO.	JAN, MIL OR MFR PART NO.
1A2A3A1R1	Resistor, Film, 150 ohms, 2% 1/2W	RC27	RL20S151G
1A2A3A1R2	Resistor, Film, 150 ohms, 2% 1/2W	RC27	RL20S151G
1A2A3A1R3	Resistor, Film, 150 ohms, 2% 1/2W	RC27	RL20S151G
1A2A3A1R4	Resistor, Film, 150 ohms, 2% 1/2W	RC27	RL20S151G
1A2A3A1R5	Resistor, Film, 150 ohms, 2% 1/2W	RC27	RL20S151G
1A2A3A1R6	Resistor, Film, 150 ohms, 2% 1/2W	RC27	RL20S151G
1A2A3A1R7	Resistor, Film, 1800 ohms, 2% 1/2W	RAP10	RL20S182G
1A2A3A1R8	Resistor, Film, 1800 ohms, 2% 1/2W	RAP10	RL20S182G
1A2A3A1T1	Transformer Assembly	139-6046	139-6046
1A2A3TB1	Terminal Block, Barrier, 4-terminal	JB11	4-140Y
1A2A4	Current Probe PCB Assembly	NAFP7	139-6080
1A2A4C1	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
1A2A4C2	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
1A2A4C3	Capacitor, Ceramic, 0.01uF 10%, 100V	CCG04	CKR05BX103KL
1A2A4C4	Capacitor, Tantalum 1.0uF 10%, 50V	CCP24	CSR13G105KM
1A2A4C5	Capacitor, Tantalum 1.0uF 10%, 50V	CCP24	CSR13G105KM
1A2A4C6	Capacitor, Tantalum 1.0uF 10%, 50V	CCP24	CSR13G105KM
1A2A4C7	Capacitor, Ceramic, 0.01uF 10%, 100V	CCG04	CKR05BX103KL
1A2A4C8	Capacitor, Ceramic, 0.01uF 10%, 100V	CCG04	CKR05BX103KL
1A2A4C9	Capacitor, Ceramic, 0.01uF 10%, 100V	CCG04	CKR05BX103KL
1A2A4C10	Capacitor, Ceramic, 0.01uF 10%, 100V	CCG04	CKR05BX103KL
1A2A4CR1	Diode, General Purpose, Small Signal	QAP29	1N4938
1A2A4CR2	Diode, General Purpose, Small Signal	QAP29	1N4938
1A2A4CR3	Diode, General Purpose, Small Signal	QAP29	1N4938
1A2A4CR4	Diode, General Purpose, Small Signal	QAP29	1N4938
1A2A4CR5	Diode, General Purpose, Small Signal	QAP29	1N4938
1A2A4CR6	Diode, General Purpose, Small Signal	QAP29	1N4938
1A2A4L1	Inductor, Moulded, Shielded, 100uH	LAP35	SWD100
1A2A4L2	Ferrite, Toroid	LY09	11-122-B
1A2A4R1	Resistor, Film, 33 ohms, 2%, 1/2W	RAP03	RL20S330G
1A2A4R2	Resistor, Film, 33 ohms, 2%, 1/2W	RAP03	RL20S330G
1A2A4R3	Resistor, Film, 33 ohms, 2%, 1/2W	RAP03	RL20S330G
1A2A4R4	Resistor, Film, 33 ohms, 2%, 1/2W	RAP03	RL20S330G
1A2A4R5	Resistor, Film, 1000 ohms, 2%, 1/2W	RAP09	RL20S102G
1A2A4R6	Resistor, Film, 82K ohms, 2%, 1/2W	RD18	RL20S823G
1A2A4R7	Resistor, Film, 18K ohms, 2%, 1/2W	RAP14	RL20S183G
1A2A4R8	Resistor, Film, 33K ohms, 2%, 1/2W	RAP15	RL20S333G
1A2A4R9	Resistor, Film, 5600 ohms, 2%, 1/2W	RAP12	RL20S562G
1A2A4R10	Resistor, Film, 5600 ohms, 2%, 1/2W	RAP12	RL20S562G
1A2A4R11	Resistor, Film, 5600 ohms, 2%, 1/2W	RAP12	RL20S562G
1A2A4R12	Resistor, Film, 5600 ohms, 2%, 1/2W	RAP12	RL20S562G
1A2A4R13	Resistor, Film, 5600 ohms, 2%, 1/2W	RAP12	RL20S562G
1A2A4R14	Resistor, Film, 100K ohms, 2%, 1/2W	RAP17	RL20S104G
1A2A4R15	Resistor, Film, 100K ohms, 2%, 1/2W	RAP17	RL20S104G
1A2A4R16	Resistor, Film, 27K ohms, 2% 1/2W	RD12	RL20S273G
1A2A4R17	Resistor, Film, 5600 ohms, 2%, 1/2W	RAP12	RL20S562G

Table 7-2 Reference Designation Index (Continued)

REF DES	NAME OF PART AND DESCRIPTION	NAUTEL's PART NO.	JAN, MIL OR MFR PART NO.
1A2A4T1	Transformer	139-6082	139-6082
1A2A4U1	IC, Comparator, Quad	UL02	MC3302L
1A2A4XU1	Socket, Integrated Circuit, 14-pin	UC02	640-357-1
1A2A5	Modulation Monitor Probe	NAFP15	139-651
1A2A5C1	Capacitor, Ceramic, 0.01uF 10%, 100V	CCG04	CKR05BX103KL
1A2A5C2	Capacitor, Ceramic, 0.01uF 10%, 100V	CCG04	CKR05BX103KL
1A2A5C3	Capacitor, Ceramic, 0.01uF 10%, 100V	CCG04	CKR05BX103KL
1A2A5CR1	Diode, General Purpose, Small Signal	QAP29	1N4938
1A2A5CR2	Diode, General Purpose, Small Signal	QAP29	1N4938
1A2A5CR3	Diode, General Purpose, Small Signal	QAP29	1N4938
1A2A5CR4	Diode, General Purpose, Small Signal	QAP29	1N4938
1A2A5CR5	Diode, General Purpose, Small Signal	QAP29	1N4938
1A2A5CR6	Diode, General Purpose, Small Signal	QAP29	1N4938
1A2A5F1	Fuse, 0.25A, 250V, Type 3AG	FC06	312.250
1A2A5J1	Connector, Plug, 6-pin	JD09	P-3306-AB
1A2A5K1	Relay, 24Vdc Coil	KAP05	1315-4C-24D
1A2A5K2	Relay, 24Vdc Coil	KAP05	1315-4C-24D
1A2A5L1	Ferrite, Toroid	LY09	11-122-B
1A2A5Q1	Transistor, NPN, Darlington	QA06	2N6295
1A2A5Q2	Transistor, NPN, Darlington	QA06	2N6295
1A2A5R1	Resistor, Variable, 100 ohms, 2W	RV15	RV4LAYSA101A
1A2A5R2	Resistor, Variable, 100 ohms, 2W	RV15	RV4LAYSA101A
1A2A5R3	Resistor, Variable, 100 ohms, 2W	RV15	RV4LAYSA101A
1A2A5R4	Resistor, Film, 10K ohms, 2% 1/2W	RAP13	RL20S103G
1A2A5R5	Resistor, Film, 3300 ohms, 2% 1/2W	RAP11	RL20S332G
1A2A5R6	Resistor, Film, 10K ohms, 2% 1/2W	RAP13	RL20S103G
1A2A5R7	Resistor, Film, 3300 ohms, 2% 1/2W	RAP11	RL20S332G
1A2A5T1	Transformer	139-6099	139-6099
1A2A5TB1	Terminal Block, Barrier, 12-terminal	JB14	12-140Y
1A2A5XF1	Fuseholder, Panel, Type 3AG Fuse	BAP30	342012A
1A2A5XK1	Socket, Relay	KA19	1310-1ST
1A2A5XK2	Socket, Relay	KA19	1310-1ST
A 1A2C1	Capacitor, Mica, 5600pF 5%, 4000V	CYP15	291-60B-562-J02
B 1A2C1	Capacitor, Mica, 4700pF 5%, 6000V	CYP14	291-60B-472-J02
C 1A2C1	Capacitor, Mica, 3900pF 5%, 6000V	CYP13	291-60B-392-J02
D 1A2C1	Capacitor, Mica, 3300pF 5%, 6000V	CYP12	291-60B-332-J02
E 1A2C1	Capacitor, Mica, 2700pF 5%, 6000V	CYP11	291-60B-272-J02
F 1A2C1	Capacitor, Mica, 2200pF 5%, 6000V	CYP10	291-6-B-222-J02
G 1A2C1	Capacitor, Mica, 1800pF 5%, 6000V	CYP09	291-60B-182-J02
A 1A2C2	Capacitor, Mica, 5600pF 5%, 4000V	CYP15	291-60B-562-J02
B 1A2C2	Capacitor, Mica, 4700pF 5%, 6000V	CYP14	291-60B-472-J02
C 1A2C2	Capacitor, Mica, 3900pF 5%, 6000V	CYP13	291-60B-392-J02
D 1A2C2	Capacitor, Mica, 3300pF 5%, 6000V	CYP12	291-60B-332-J02
E 1A2C2	Capacitor, Mica, 2700pF 5%, 6000V	CYP11	291-60B-272-J02
F 1A2C2	Capacitor, Mica, 2200pF 5%, 6000V	CYP10	291-6-B-222-J02
G 1A2C2	Capacitor, Mica, 1800pF 5%, 6000V	CYP09	291-60B-182-J02

Table 7-2 Reference Designation Index (Continued)

REF DES	NAME OF PART AND DESCRIPTION	NAUTEL's PART NO.	JAN, MIL OR MFR PART NO.
A 1A2C3	Capacitor, Mica, 5600pF 5%, 4000V	CYP15	291-60B-562-J02
B 1A2C3	Capacitor, Mica, 4700pF 5%, 6000V	CYP14	291-60B-472-J02
C 1A2C3	Capacitor, Mica, 3900pF 5%, 6000V	CYP13	291-60B-392-J02
D 1A2C3	Capacitor, Mica, 3300pF 5%, 6000V	CYP12	291-60B-332-J02
E 1A2C3	Capacitor, Mica, 2700pF 5%, 6000V	CYP11	291-60B-272-J02
F 1A2C3	Capacitor, Mica, 2200pF 5%, 6000V	CYP10	291-6-B-222-J02
G 1A2C3	Capacitor, Mica, 1800pF 5%, 6000V	CYP09	291-60B-182-J02
A 1A2C4	Capacitor, Mica, 680pF 5%, 5000V	CYP37	272-50B-681-J01
B 1A2C4	Capacitor, Mica, 560pF 5%, 5000V	CYP36	272-50B-561-J01
C 1A2C4	Capacitor, Mica, 470pF 5%, 5000V	CYP35	272-50B-471-J01
D 1A2C4	Capacitor, Mica, 390pF 5%, 5000V	CYP34	272-50B-391-J01
E 1A2C4	Capacitor, Mica, 330pF 5%, 5000V	CYP33	272-50B-331-J01
F 1A2C4	Capacitor, Mica, 270pF 5%, 5000V	CYP32	272-50B-271-J01
G 1A2C4	Capacitor, Mica, 220pF 5%, 5000V	CYP31	272-50B-221-J01
A 1A2C5	Capacitor, Mica, 5600pF 5%, 4000V	CYP15	291-60B-562-J02
B 1A2C5	Capacitor, Mica, 4700pF 5%, 6000V	CYP14	291-60B-472-J02
C 1A2C5	Capacitor, Mica, 3900pF 5%, 6000V	CYP13	291-60B-392-J02
D 1A2C5	Capacitor, Mica, 3300pF 5%, 6000V	CYP12	291-60B-332-J02
E 1A2C5	Capacitor, Mica, 2700pF 5%, 6000V	CYP11	291-60B-272-J02
F 1A2C5	Capacitor, Mica, 2200pF 5%, 6000V	CYP10	291-6-B-222-J02
G 1A2C5	Capacitor, Mica, 1800pF 5%, 6000V	CYP09	291-60B-182-J02
A 1A2C6	Capacitor, Mica, 5600pF 5%, 4000V	CYP15	291-60B-562-J02
B 1A2C6	Capacitor, Mica, 4700pF 5%, 6000V	CYP14	291-60B-472-J02
C 1A2C6	Capacitor, Mica, 3900pF 5%, 6000V	CYP13	291-60B-392-J02
D 1A2C6	Capacitor, Mica, 3300pF 5%, 6000V	CYP12	291-60B-332-J02
E 1A2C6	Capacitor, Mica, 2700pF 5%, 6000V	CYP11	291-60B-272-J02
F 1A2C6	Capacitor, Mica, 2200pF 5%, 6000V	CYP10	291-6-B-222-J02
G 1A2C6	Capacitor, Mica, 1800pF 5%, 6000V	CYP09	291-60B-182-J02
A 1A2C7	Capacitor, Mica, 5600pF 5%, 4000V	CYP15	291-60B-562-J02
B 1A2C7	Capacitor, Mica, 4700pF 5%, 6000V	CYP14	291-60B-472-J02
C 1A2C7	Capacitor, Mica, 3900pF 5%, 6000V	CYP13	291-60B-392-J02
D 1A2C7	Capacitor, Mica, 3300pF 5%, 6000V	CYP12	291-60B-332-J02
E 1A2C7	Capacitor, Mica, 2700pF 5%, 6000V	CYP11	291-60B-272-J02
F 1A2C7	Capacitor, Mica, 2200pF 5%, 6000V	CYP10	291-6-B-222-J02
G 1A2C7	Capacitor, Mica, 1800pF 5%, 6000V	CYP09	291-60B-182-J02
1A2E1	Spark Gap Assembly	139-6053	139-6053
1A2E2	Surge Arrester, 2800Vdc 10%	UC29	LA9 B1B
1A2L1	Inductor	139-6047	139-6047
1A2L2	Inductor	139-6049	139-6049
1A2L3	Inductor	139-6047	139-6047
# 2A1	Power Amplifier Module	NAA11	139-1000
# 2A2	Power Amplifier Module	NAA11	139-1000
# 2A3	Power Amplifier Module	NAA11	139-1000
# 2A4	Power Amplifier Module	NAA11	139-1000
# 2A5	Power Amplifier Module	NAA11	139-1000
# 2A6	Power Amplifier Module	NAA11	139-1000

Table 7-2 Reference Designation Index (Continued)

REF DES	NAME OF PART AND DESCRIPTION	NAUTEL's PART NO.	JAN, MIL OR MFR PART NO.
# 2A7	Power Amplifier Module	NAA11	139-1000
# 2A8	Power Amplifier Module	NAA11	139-1000
# 2A9	Power Amplifier Module	NAA11	139-1000
# 2A10	Power Amplifier Module	NAA11	139-1000
# 2A11	Power Amplifier Module	NAA11	139-1000
# 2A12	Power Amplifier Module	NAA11	139-1000
2N1C1	Capacitor, Ceramic, 0.01uF 10%, 100V	CCG04	CKR05BX103KL
2N1C2	Capacitor, Ceramic, 0.01uF 10%, 100V	CCG04	CKR05BX103KL
2N1CR1	Diode, General Purpose, Small Signal	QAP29	1N4938
2N1R1	Resistor, Film, 1000 ohms, 2% 1/2W	RAP09	RL20S102G
2N1T1	Transformer	139-8019	139-8019
2N2	Same as 2N1		
2N3	Same as 2N1		
2N4	Same as 2N1		
2N5	Same as 2N1		
2N6	Same as 2N1		
2XA1	Connector, Socket, 8-pin	JP15	S3-5408-LAB
2XA2	Connector, Socket, 8-pin	JP15	S3-5408-LAB
2XA3	Connector, Socket, 8-pin	JP15	S3-5408-LAB
2XA4	Connector, Socket, 8-pin	JP15	S3-5408-LAB
2XA5	Connector, Socket, 8-pin	JP15	S3-5408-LAB
2XA6	Connector, Socket, 8-pin	JP15	S3-5408-LAB
2XA7	Connector, Socket, 8-pin	JP15	S3-5408-LAB
2XA8	Connector, Socket, 8-pin	JP15	S3-5408-LAB
2XA9	Connector, Socket, 8-pin	JP15	S3-5408-LAB
2XA10	Connector, Socket, 8-pin	JP15	S3-5408-LAB
2XA11	Connector, Socket, 8-pin	JP15	S3-5408-LAB
2XA12	Connector, Socket, 8-pin	JP15	S3-5408-LAB
# 3A1	Power Amplifier Module	NAA11	139-1000
# 3A2	Power Amplifier Module	NAA11	139-1000
# 3A3	Power Amplifier Module	NAA11	139-1000
# 3A4	Power Amplifier Module	NAA11	139-1000
# 3A5	Power Amplifier Module	NAA11	139-1000
# 3A6	Power Amplifier Module	NAA11	139-1000
# 3A7	Power Amplifier Module	NAA11	139-1000
# 3A8	Power Amplifier Module	NAA11	139-1000
# 3A9	Power Amplifier Module	NAA11	139-1000
# 3A10	Power Amplifier Module	NAA11	139-1000
# 3A11	Power Amplifier Module	NAA11	139-1000
# 3A12	Power Amplifier Module	NAA11	139-1000
3N1C1	Capacitor, Ceramic, 0.01uF 10%, 100V	CCG04	CKR05BX103KL
3N1C2	Capacitor, Ceramic, 0.01uF 10%, 100V	CCG04	CKR05BX103KL
3N1CR1	Diode, General Purpose, Small Signal	QAP29	1N4938
3N1R1	Resistor, Film, 1000 ohms, 2% 1/2W	RAP09	RL20S102G
3N1T1	Transformer	139-8019	139-8019
3N2	Same as 3N1		

Table 7-2 Reference Designation Index (Continued)

REF DES	NAME OF PART AND DESCRIPTION	NAUTEL's PART NO.	JAN, MIL OR MFR PART NO.
3N3	Same as 3N1		
3N4	Same as 3N1		
3N5	Same as 3N1		
3N6	Same as 3N1		
3XA1	Connector, Socket, 8-pin	JP15	S3-5408-LAB
3XA2	Connector, Socket, 8-pin	JP15	S3-5408-LAB
3XA3	Connector, Socket, 8-pin	JP15	S3-5408-LAB
3XA4	Connector, Socket, 8-pin	JP15	S3-5408-LAB
3XA5	Connector, Socket, 8-pin	JP15	S3-5408-LAB
3XA6	Connector, Socket, 8-pin	JP15	S3-5408-LAB
3XA7	Connector, Socket, 8-pin	JP15	S3-5408-LAB
3XA8	Connector, Socket, 8-pin	JP15	S3-5408-LAB
3XA9	Connector, Socket, 8-pin	JP15	S3-5408-LAB
3XA10	Connector, Socket, 8-pin	JP15	S3-5408-LAB
3XA11	Connector, Socket, 8-pin	JP15	S3-5408-LAB
3XA12	Connector, Socket, 8-pin	JP15	S3-5408-LAB
4A1	Driver Unit, 5 kW	NAE39/1	139-3139-1
$ # 4A1A1	RF Driver Module	NAPE12	139-3002
% # 4A1A1	Stereo RF Driver Module	NAPE20	139-3092
# 4A1A2	RF Driver Module	NAPE12	139-3002
# 4A1A3	Monitor Module	NAPC7	139-3026-1
# 4A1A4	Modulator Driver	NAPE27/1	139-3134
# 4A1A5	Modulator Driver Module	NAPE19/1	139-3084-1
4A1A6	Inductor Assembly, 5 kW	139-6021	139-6021
4A1A6C1	Capacitor, Mica, 3900pF 5%, 500V	CCC36	D205C392J0
4A1A6C2	Capacitor, Mica, 33pF 2%, 500V	CB19	CM05ED330G03
4A1A6C3	Capacitor, Ceramic, 0.01uF 10%, 100V	CCG04	CKR05BX103KL
4A1A6C4	Capacitor, Selected at Final Test		
4A1A6CR1	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1A6CR2	Diode, Zener, 47V, 10W, 5%	QK07	1N2995B
4A1A6CR3	Diode, Zener, 47V, 10W, 5%	QK07	1N2995B
4A1A6L1-A	Inductor	139-6008	139-6008
4A1A6L1-B	Inductor	139-6008-1	139-6008-1
4A1A6L1-C	Inductor	139-6008	139-6008
4A1A6L1-D	Inductor	139-6008-1	139-6008-1
4A1A6R1	Resistor, Film, 3300 ohms, 2% 1/2W	RAP11	RL20S332G
4A1A6TB1	Terminal Block, Barrier, 8-terminal	JB23	8-140Y
4A1A7	RF Drive Tuning Assembly	139-6000	139-6000
4A1A7C1	Capacitor, Plastic, 0.01uF 10%, 200V	CCD09	WPP2S1
4A1A7C2	Capacitor, Plastic, 0.01uF 10%, 200V	CCD09	WPP2S1
4A1A7C3	Capacitor, Plastic, 0.01uF 10%, 200V	CCD09	WPP2S1
4A1A7C4	Capacitor, Plastic, 0.01uF 10%, 200V	CCD09	WPP2S1
4A1A7C5	Capacitor, Plastic, 0.01uF 10%, 200V	CCD09	WPP2S1
4A1A7C6	Capacitor, Plastic, 0.01uF 10%, 200V	CCD09	WPP2S1
4A1A7C7	Capacitor, Plastic, 0.01uF 10%, 200V	CCD09	WPP2S1
4A1A7C8	Capacitor, Plastic, 0.01uF 10%, 200V	CCD09	WPP2S1

Table 7-2 Reference Designation Index (Continued)

REF DES	NAME OF PART AND DESCRIPTION	NAUTEL's PART NO.	JAN, MIL OR MFR PART NO.
4A1A7C9	Capacitor, Plastic, 0.01uF 10%, 200V	CCD09	WPP2S1
4A1A7C10	Capacitor, Plastic, 0.01uF 10%, 200V	CCD09	WPP2S1
4A1A7C11	Capacitor, Plastic, 0.01uF 10%, 200V	CCD09	WPP2S1
4A1A7C12	Capacitor, Plastic, 0.01uF 10%, 200V	CCD09	WPP2S1
4A1A7DS1	Lamp Assembly, Amber Lens, 18V	BAP08	300-1-HM631
4A1A8	Not Used		
# 4A1A9	ALC/Remote Power Trim Assembly	NAPC18	139-3118
4A1C1	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1C2	Capacitor, Ceramic, 0.01uF 10%, 100V	CCG04	CKR05BX103KL
4A1C3	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1C4	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1C5	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1C6	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1C7	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1C8	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1C9	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1C10	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1C11	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1C12	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1C13	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1C14	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1C15	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1C16	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1C17	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1C18	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1C19	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1C20	Capacitor, Ceramic, 0.01uF 10%, 100V	CCG04	CKR05BX103KL
4A1C21	Capacitor, Ceramic, 0.1uF 10%, 100V	CCG07	CKR06BX104KL
4A1CR1	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR2	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR3	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR4	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR5	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR6	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR7	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR8	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR9	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR10	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR11	Not Used		
4A1CR12	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR13	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR14	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR15	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR16	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR17	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR18	Diode, General Purpose, Small Signal	QAP29	1N4938

Table 7-2 Reference Designation Index (Continued)

REF DES	NAME OF PART AND DESCRIPTION	NAUTEL's PART NO.	JAN, MIL OR MFR PART NO.
4A1CR19	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR20	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR21	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1CR22	Diode, General Purpose, Small Signal	QAP29	1N4938
4A1DS1	Diode, Light Emitting, Amber	QK14	5082-4592
4A1DS2	Diode, Light Emitting, Amber	QK14	5082-4592
4A1F1	Fuse, 0.25A, 250V, Slo-Blo, Type 3AB	FB11	323.250
4A1J1	Connector, Socket, 18-pin	JO25	S-3318-AB
4A1J2	Connector, Plug, 18-pin	JD13	P-3318-AB
4A1J3	Connector, RF Coaxial, BNC, Bulkhead	JDP26	UG1094/U
4A1J4	Connector, RF Coaxial, BNC, Bulkhead	JDP26	UG1094/U
4A1J5	Connector, RF Coaxial, BNC, Bulkhead	JDP26	UG1094/U
4A1J6	Connector, RF Coaxial, BNC, Bulkhead	JDP26	UG1094/U
4A1K1	Relay, 24Vdc Coil	KAP05	1315-4C-24D
4A1K2	Relay, 24Vdc Coil	KAP05	1315-4C-24D
4A1K3	Relay, 24Vdc Coil	KAP05	1315-4C-24D
4A1K4	Relay, 24Vdc Coil	KAP05	1315-4C-24D
4A1K5	Relay, 24Vdc Coil	KAP05	1315-4C-24D
4A1K6	Relay, 24Vdc Coil	KAP05	1315-4C-24D
4A1K7	Relay, Latching, 24Vdc Coil	KAP03	MY2K-UA-DC24
4A1K8	Relay, Latching, 24Vdc Coil	KAP03	MY2K-UA-DC24
4A1K9	Relay, 24Vdc Coil	KAP05	1315-4C-24D
4A1L1	Ferrite, Toroid, Coated	LX13	11-762-B
4A1P1	MTA, Closed End Housing, 12-pin, 22 AWG	JU03	1-640433-2
4A1R1	Resistor, Film, 3300 ohms, 2% 1/2W	RAP11	RL20S332G
4A1R2	Resistor, Comp, 2700 ohms, 5% 2W	RI42	RC42GF272J
4A1R3	Resistor, Comp, 1500 ohms, 5% 2W	RI39	RC42GF152J
4A1R4	Resistor, Film, 10K ohms, 2% 1/2W	RAP13	RL20S103G
4A1R5	Resistor, Film, 10K ohms, 2% 1/2W	RAP13	RL20S103G
4A1R6	Resistor, Film, 1000 ohms, 2% 1/2W	RAP09	RL20S102G
4A1R7	Resistor, Film, 10K ohms, 2% 1/2W	RAP13	RL20S103G
4A1R8	Resistor, Film, 1000 ohms, 2% 1/2W	RAP09	RL20S102G
4A1R9	Resistor, Film, 1200 ohms, 2% 1/2W	RC38	RL20S122G
4A1R10	Resistor, Film, 10K ohms, 2% 1/2W	RAP13	RL20S103G
4A1R11	Resistor, Film, 3300 ohms, 2% 1/2W	RAP11	RL20S332G
4A1S1	Switch, Toggle, 1PDT	SA26	MSTE-106D
4A1T1	Transformer, Audio	TC18	850G
4A1TB1	Terminal Block, Barrier, 18-terminal	JR32	CFT-18
4A1TB2	Terminal Block, Barrier, 10-terminal	JR30	CFT-10
4A1TP1	Jack, Tip, White, Teflon	JO21	450-4355-1-0319
4A1TP2	Jack, Tip, White, Teflon	JO21	450-4355-1-0319
4A1TP3	Jack, Tip, Red, Teflon	JO19	450-4355-1-0312
4A1TP4	Jack, Tip, Violet, Teflon	JO20	450-4355-1-0317
4A1TP5	Jack, Tip, Black, Teflon	JO18	450-4355-1-0310
4A1W1	Cable Assembly	139-3116	139-3116
4A1W1P1	Connector, 7-pin, Hood, Cable Clamp	JO02	126-195
4A1W1P2	Connector, 7-pin, Hood, Cable Clamp	JO02	126-195

Table 7-2 Reference Designation Index (Continued)

REF DES	NAME OF PART AND DESCRIPTION	NAUTEL's PART NO.	JAN, MIL OR MFR PART NO.
4A1XA1P1	Connector, Socket, 6-pin	JD24	S-3306-AB
4A1XA1P2	Connector, Socket, 2-pin	JD20	S-3302-AB
4A1XA2P1	Connector, Socket, 6-pin	JD24	S-3306-AB
4A1XA2P2	Connector, Socket, 2-pin	JD20	S-3302-AB
4A1XA3P1	Connector, Socket, 12-pin	J006	S-3312-AB
4A1XA3P2	Connector, Socket, 12-pin	J006	S-3312-AB
4A1XA4P1	Connector, Socket, 6-pin	JD24	S-3306-AB
4A1XA4P2	Connector, Socket, 6-pin	JD24	S-3306-AB
4A1XA5P1	Connector, Socket, 6-pin	JD24	S-3306-AB
4A1XA5P2	Connector, Socket, 6-pin	JD24	S-3306-AB
4A1XDS1	Socket, LED	QK25	PS-200-B
4A1XDS2	Socket, LED	QK25	PS-200-B
4A1XF1	Fuseholder, Panel, Type 3AG Fuse	BAP30	342012A
4A1XK1	Socket, Relay	KA19	1310-1ST
4A1XK2	Socket, Relay	KA19	1310-1ST
4A1XK3	Socket, Relay	KA19	1310-1ST
4A1XK4	Socket, Relay	KA19	1310-1ST
4A1XK5	Socket, Relay	KA19	1310-1ST
4A1XK6	Socket, Relay	KA19	1310-1ST
4A1XK7	Socket, Relay	KAP04	PY14
4A1XK8	Socket, Relay	KAP04	PY14
4A1XK9	Socket, Relay	KA19	1310-1ST
# 5A1	Modulator Module	NASM1	139-2000-2
# 5A2	Modulator Module	NASM1	139-2000-2
5L1	Ferrite, Toroid, Coated	LX13	11-762-B
5L2	Ferrite, Toroid, Coated	LX13	11-762-B
5L3	Ferrite, Toroid, Coated	LX13	11-762-B
5L4	Ferrite, Toroid, Coated	LX13	11-762-B
5XA1P1	Connector, Socket, 11-pin	J013	S3G-5411-SB
5XA1P2	Connector, Socket, 11-pin	J013	S3G-5411-SB
5XA2P1	Connector, Socket, 11-pin	J013	S3G-5411-SB
5XA2P2	Connector, Socket, 11-pin	J013	S3G-5411-SB
# 6A1	Modulator Module	NASM1	139-2000-2
# 6A2	Modulator Module	NASM1	139-2000-2
6L1	Ferrite, Toroid, Coated	LX13	11-762-B
6L2	Ferrite, Toroid, Coated	LX13	11-762-B
6L3	Ferrite, Toroid, Coated	LX13	11-762-B
6L4	Ferrite, Toroid, Coated	LX13	11-762-B
6XA1P1	Connector, Socket, 11-pin	J013	S3G-5411-SB
6XA1P2	Connector, Socket, 11-pin	J013	S3G-5411-SB
6XA2P1	Connector, Socket, 11-pin	J013	S3G-5411-SB
6XA2P2	Connector, Socket, 11-pin	J013	S3G-5411-SB
# 7A1	Rectifier/Regulator Module	NAS13	139-5000-1
# 7A2	Rectifier/Regulator Module	NAS13	139-5000-1
# 7A3	Rectifier/Regulator Module	NAS13	139-5000-1
# 7A4	Rectifier/Regulator Module	NAS13	139-5000-1
# 7A5	Low Voltage Supply Module	NAS14	139-5011-1
# 7A6	Low Voltage Supply Module	NAS14	139-5011-1

Table 7-2 Reference Designation Index (Continued)

REF DES	NAME OF PART AND DESCRIPTION	NAUTEL's PART NO.	JAN, MIL OR MFR PART NO.
7XA1	Connector, Socket, 16-pin	J011	S3-5416-SB
7XA2	Connector, Socket, 16-pin	J011	S3-5416-SB
7XA3	Connector, Socket, 16-pin	J011	S3-5416-SB
7XA4	Connector, Socket, 16-pin	J011	S3-5416-SB
7XA5	Connector, Socket, 6-pin	JD24	S-3306-AB
7XA6	Connector, Socket, 6-pin	JD24	S-3306-AB
B1	Fan, 115V, 50/60Hz, Muffin XL	ZA06	MX2B3-028422
B2	Fan, 115V, 50/60Hz, Muffin XL	ZA06	MX2B3-028422
B3	Fan, 115V, 50/60Hz, Muffin XL	ZA06	MX2B3-028422
B4	Fan, 115V, 50/60Hz, Muffin XL	ZA06	MX2B3-028422
B5	Fan, 115V, 50/60Hz, Muffin XL	ZA06	MX2B3-028422
B6	Fan, 115V, 50/60Hz, Muffin XL	ZA06	MX2B3-028422
B7	Fan, 115V, 50/60Hz, Muffin XL	ZA06	MX2B3-028422
B8	Fan, 115V, 50/60Hz, Muffin XL	ZA06	MX2B3-028422
* CB1	Circuit Breaker, 3-pole 50A 240Vac	SB05	209-3-1-62F-4-9-50
@ CB1	Circuit Breaker, 3-pole 25A 240Vac	SB07	209-3-1-62F-4-9-25
CB2	Circuit Breaker, SP, Therm, 5A 250Vac	SCP25	W23X1A1G-5
CR1	Diode, Power Rectifier, 3A	QG31	1N5624
CR2	Diode, Power Rectifier, 3A	QG31	1N5624
CR3	Diode, Power Rectifier, 3A	QG31	1N5624
CR4	Diode, Power Rectifier, 3A	QG31	1N5624
F1	Fuse, Slow-Blo, 1/2A, 250V	FA05	313.500
F2	Fuse, Slow-Blo, 1/2A, 250V	FA05	313.500
F3	Fuse, Slow-Blo, 1/2A, 250V	FA05	313.500
F4	Fuse, Slow-Blo, 1/2A, 250V	FA05	313.500
F5	Fuse, Slow-Blo, 1/2A, 250V	FA05	313.500
F6	Fuse, Slow-Blo, 1/2A, 250V	FA05	313.500
F7	Fuse, Slow-Blo, 1/2A, 250V	FA05	313.500
F8	Fuse, Slow-Blo, 1/2A, 250V	FA05	313.500
J1	Connector, Socket, 2-pin	JD20	S-3302-AB
J2	Connector, Socket, 2-pin	JD20	S-3302-AB
L1	Inductor, Choke, 2.5mH	TB19	195-E30
L2	Inductor, Choke, 2.5mH	TB19	195-E30
L3	Inductor, Choke, 2.5mH	TB19	195-E30
L4	Inductor, Choke, 2.5mH	TB19	195-E30
L5	Ferrite, Toroid, Coated	LX13	11-762-B
P1	Connector, 2-pin, Cable Clamp	J014	P-3302-CCT
P2	Connector, 2-pin, Cable Clamp	J014	P-3302-CCT
P3	Connector, Socket, 18-pin	JD33	S-3318-CCT
P4	Connector, Socket, 18-pin	JD33	S-3318-CCT
P5	Connector, Socket, 6-pin	JDP42	S-3306-CCT
R1	Resistor, Wirewound, 12.5 ohms, 5% 120W	RQ07	NHL120-12.5 Ohms-5%
S1	Switch, Interlock	SC15	11TL6-4
S2	Switch, Interlock	SC15	11TL6-4
* T1	Transformer, 208V, 3-phase, 60 Hz	TC19	139-7007/4
@ T1	Transformer, 415V, 3-phase, 50 Hz	TC21	139-7007-6
T2	Transformer	139-7008	139-7008

Table 7-2 Reference Designation Index (Continued)

REF DES	NAME OF PART AND DESCRIPTION	NAUTEL's PART NO.	JAN, MIL OR MFR PART NO.
TB1	Terminal Block, Barrier, 4-terminal	JP18	4-152
TB2	Terminal Block, Barrier, 8-terminal	JB23	8-140Y
U1	Discharge Probe	139-8144	139-8144
XF1	Fuseholder, Panel, Type 3AG Fuse	BAP30	342012A
XF2	Fuseholder, Panel, Type 3AG Fuse	BAP30	342012A
XF3	Fuseholder, Panel, Type 3AG Fuse	BAP30	342012A
XF4	Fuseholder, Panel, Type 3AG Fuse	BAP30	342012A
XF5	Fuseholder, Panel, Type 3AG Fuse	BAP30	342012A
XF6	Fuseholder, Panel, Type 3AG Fuse	BAP30	342012A
XF7	Fuseholder, Panel, Type 3AG Fuse	BAP30	342012A
XF8	Fuseholder, Panel, Type 3AG Fuse	BAP30	342012A

\# Denotes parts for this assembly not included in this index. Refer to appropriate module service instruction manual for breakdown.

$ Monaural transmitters only
% Stereo transmitters only

* Denotes used on North American style 208 volt, 3-phase 60 Hz power supply.
@ Denotes used on European style 415 volt, 3-phase 50 Hz power supply.

A Denotes used only when transmitter frequency is 520 kHz-620 kHz
B Denotes used only when transmitter frequency is 620 kHz-743 kHz
C Denotes used only when transmitter frequency is 743 kHz-887 kHz
D Denotes used only when transmitter frequency is 887 kHz-1067 kHz
E Denotes used only when transmitter frequency is 1067 kHz-1306 kHz
F Denotes used only when transmitter frequency is 1306 kHz-1599 kHz
G Denotes used only when transmitter frequency is 1599 kHz-1955 kHz

Table 7-3 Parts Per Unit Index

NAUTEL'S PART NO.	NAME OF PART AND DESCRIPTION	JAN, MIL OR MFR PART NO.	(OEM) MFR CODE	TOTAL IDENT PARTS	
AMPFET 5	Transmitter, AM Broadcast, 5 kW	139-8200-	37338	-	
139-3116	Cable Assembly	139-3116	37338	1	
139-4028	Test Meter PCB Assembly	139-4028	37338	1	
139-4028-1	Current Meter PCB Assembly	139-4028-1	37338	1	
139-4028-2	FWD/REFL Meter PCB Assembly	139-4028-2	37338	1	
139-4045	Terminal Board Assembly	139-4045	37338	1	
139-6000	RF Drive Tuning Assembly	139-6000	37338	1	
139-6008	Inductor	139-6008	37338	2	
139-6008-1	Inductor	139-6008-1	37338	2	
139-6021	Inductor Assembly, 5 kW	139-6021	37338	1	
139-6031	Transformer	139-6031	37338	1	
139-6046	Transformer Assembly	139-6046	37338	1	
139-6047	Inductor	139-6047	37338	2	
139-6049	Inductor	139-6049	37338	1	
139-6053	Spark Gap Assembly	139-6053	37338	1	
139-6065-4	FWD/REFL Power Probe PCB Assembly	139-6065-4	37338	1	
139-6082	Transformer	139-6082	37338	1	
139-6099	Transformer	139-6099	37338	1	
139-7008	Transformer	139-7008	37338	1	
139-8019	Transformer	139-8019	37338	2	
139-8144	Discharge Probe	139-8144	37338	1	
BAP08	Lamp Assembly, Amber Lens, 18V	300-1-HM631	55292	1	
BAP30	Fuseholder, Panel, Type 3AG Fuse	342012A	75915	10	
CB19	Capacitor, Mica, 33pF 2%, 500V	CM05ED330G03	14655	1	
CB33	Capacitor, Mica, 470pF 2%, 500V	CD15FD471G03	14655	2	
CB42	Capacitor, Mica, 2700pF 2%, 500V	CM06FD272G03	14655	2	
CCC36	Capacitor, Mica, 3900pF 5%, 500V	D205C392J0	00853	1	
CCD09	Capacitor, Plastic, 0.01uF 10%, 200V	WPP2S1	14655	12	
CCG04	Capacitor, Ceramic, 0.01uF 10%, 100V	CKR05BX103KL	56289	15	
CCG07	Capacitor, Ceramic, 0.1uF 10%, 100V	CKR06BX104KL	56289	21	
CCP24	Capacitor, Tantalum 1.0uF 10%, 50V	CSR13G105KM	56289	3	
CYP09	Capacitor, Mica, 1800pF 5%, 6000V	291-60B-182-J02	00853	6	G
CYP10	Capacitor, Mica, 2200pF 5%, 6000V	291-6-B-222-J02	00853	6	F
CYP11	Capacitor, Mica, 2700pF 5%, 6000V	291-60B-272-J02	00853	6	E
CYP12	Capacitor, Mica, 3300pF 5%, 6000V	291-60B-332-J02	00853	6	D
CYP13	Capacitor, Mica, 3900pF 5%, 6000V	291-60B-392-J02	00853	6	C
CYP14	Capacitor, Mica, 4700pF 5%, 6000V	291-60B-472-J02	00853	6	B
CYP15	Capacitor, Mica, 5600pF 5%, 4000V	291-60B-562-J02	00853	6	A
CYP31	Capacitor, Mica, 220pF 5%, 5000V	272-50B-221-J01	00853	1	G
CYP32	Capacitor, Mica, 270pF 5%, 5000V	272-50B-271-J01	00853	1	F
CYP33	Capacitor, Mica, 330pF 5%, 5000V	272-50B-331-J01	00853	1	E
CYP34	Capacitor, Mica, 390pF 5%, 5000V	272-50B-391-J01	00853	1	D
CYP35	Capacitor, Mica, 470pF 5%, 5000V	272-50B-471-J01	00853	1	C
CYP36	Capacitor, Mica, 560pF 5%, 5000V	272-50B-561-J01	00853	1	B
CYP37	Capacitor, Mica, 680pF 5%, 5000V	272-50B-681-J01	00853	1	A
FA05	Fuse, Slow-Blo, 1/2A, 250V	313.500	75915	8	
FB11	Fuse, 0.25A, 250V, Slo-Blo, Type 3AB	323.250	75915	1	
FC06	Fuse, 0.25A, 250V, Type 3AG	312.250	75915	1	

Table 7-3 Parts Per Unit Index (Continued)

NAUTEL'S PART NO.	NAME OF PART AND DESCRIPTION	JAN, MIL OR MFR PART NO.	(OEM) MFR CODE	TOTAL IDENT PARTS	
JB11	Terminal Block, Barrier, 4-terminal	4-140Y	71785	1	
JB14	Terminal Block, Barrier, 12-terminal	12-140Y	71785	1	
JB23	Terminal Block, Barrier, 8-terminal	8-140Y	71785	2	
JB33	Terminal Block, Barrier, 4-terminal	4-142	71785	2	
JD09	Connector, Plug, 6-pin	P-3306-AB	13150	1	
JD13	Connector, Plug, 18-pin	P-3318-AB	13150	1	
JD20	Connector, Socket, 2-pin	S-3302-AB	13150	4	
JD24	Connector, Socket, 6-pin	S-3306-AB	13150	8	
JD33	Connector, Socket, 18-pin	S-3318-CCT	13150	2	
JDP26	Connector, RF Coaxial, BNC, Bulkhead	UG1094/U	02660	4	
JDP42	Connector, Socket, 6-pin	S-3306-CCT	13150	1	
J002	Connector, 7-pin, Hood, Cable Clamp	126-195	02660	2	
J006	Connector, Socket, 12-pin	S-3312-AB	13150	2	
J011	Connector, Socket, 16-pin	S3-5416-SB	13150	4	
J013	Connector, Socket, 11-pin	S3G-5411-SB	13150	8	
J014	Connector, 2-pin, Cable Clamp	P-3302-CCT	13150	2	
J018	Jack, Tip, Black, Teflon	450-4355-1-0310	71279	1	
J019	Jack, Tip, Red, Teflon	450-4355-1-0312	71279	1	
J020	Jack, Tip, Violet, Teflon	450-4355-1-0317	71279	1	
J021	Jack, Tip, White, Teflon	450-4355-1-0319	71279	2	
J024	Connector, Plug, 18-pin	P-3318-CCT	13150	2	
J025	Connector, Socket, 18-pin	S-3318-AB	13150	1	
JP15	Connector, Socket, 8-pin	S3-5408-LAB	13150	24	
JP18	Terminal Block, Barrier, 4-terminal	4-152	71785	1	
JR30	Terminal Block, Barrier, 10-terminal	CFT-10	73631	1	
JR32	Terminal Block, Barrier, 18-terminal	CFT-18	73631	1	
JU03	MTA, Closed End Housing, 12-pin, 22 AWG	1-640433-2	09482	1	
KA19	Socket, Relay	1310-1ST	73949	9	
KAP03	Relay, Latching, 24Vdc Coil	MY2K-UA-DC24	34361	2	
KAP04	Socket, Relay	PY14	34361	2	
KAP05	Relay, 24Vdc Coil	1315-4C-24D	73949	9	
LAP35	Inductor, Moulded, Shielded, 100uH	SWD100	00213	1	
LAP41	Inductor, Moulded, Shielded, 10000uH	SWD10000	00213	2	
LX13	Ferrite, Toroid, Coated	11-762-B	33062	10	
LY09	Ferrite, Toroid	11-122-B	33062	2	
MB32	Meter, Output Power	139-4010-1	37338	1	
MB34	Meter, Test	139-4011	37338	1	
MB36	Meter, Modulator Input Current	139-4014	37338	1	
NAA11	Power Amplifier Module	139-1000	37338	24	#
NAC21/4	Monitor Panel Assembly, 5kW	139-4000-5	37338	1	
NAE39/1	Driver Unit, 5 kW	139-3007-1	37338	1	
NAF27/1	Harmonic Filter (520kHz-620kHz)	139-6022-1	37338	1	A
NAF27/2	Harmonic Filter (620kHz-743kHz)	139-6022-2	37338	1	B
NAF27/3	Harmonic Filter (743kHz-887kHz)	139-6022-3	37338	1	C
NAF27/4	Harmonic Filter (887kHz-1067kHz)	139-6022-4	37338	1	D
NAF27/5	Harmonic Filter (1067kHz-1306kHz)	139-6022-5	37338	1	E
NAF27/6	Harmonic Filter (1306kHz-1599kHz)	139-6022-6	37338	1	F
NAF27/7	Harmonic Filter (1599kHz-1955kHz)	139-6022-7	37338	1	G

Table 7-3 Parts Per Unit Index (Continued)

NAUTEL'S PART NO.	NAME OF PART AND DESCRIPTION	JAN, MIL OR MFR PART NO.	(OEM) MFR CODE	TOTAL IDENT PARTS	
NAFP5/5	FWD/REFL Power Probe	139-6038-4	37338	1	
NAFP6/1	RF Voltage Probe, 5kW	139-6030	37338	1	
NAFP7	Current Probe PCB Assembly	139-6080	37338	1	
NAFP15	Modulation Monitor Probe	139-6151	37338	1	
NAH24/1	Combiner, 5 kW	139-6057	37338	1	
NAPC7	Monitor Module	139-3026-1	37338	1	#
NAPC18	ALC/Remote Power Trim Assembly	139-3118	37338	1	#
NAPE12	RF Driver Module	139-3002	37338	1	# $
NAPE12	RF Driver Module	139-3002	37338	1	#
NAPE19/1	Modulator Driver Module	139-3084-1	37338	1	#
NAPE20	Stereo RF Driver Module	139-3092	37338	1	# %
NAPE27/1	Modulator Driver Module	139-3084-1	37338	1	#
NAS13	Rectifier/Regulator Module	139-5000-1	37338	4	#
NAS14	Low Voltage Supply Module	139-5011-1	37338	2	#
NASM1	Modulator Module	139-2000-2	37338	4	#
QA06	Transistor, NPN, Darlington	2N6295	04713	2	
QAP29	Diode, General Purpose, Small Signal	1N4938	01295	40	
QG31	Diode, Power Rectifier, 3A	1N5624	89473	4	
QK07	Diode, Zener, 47V, 10W, 5%	1N2995B	04713	2	
QK09	Diode, Hot Carrier	1N6263	50434	2	
QK12	Diode, Light Emitting, Green	5082-4992	50434	1	
QK13	Diode, Light Emitting, Red	5082-4693	50434	6	
QK14	Diode, Light Emitting, Amber	5082-4592	50434	4	
QK25	Socket, LED	PS-200-B	15513	11	
RAP03	Resistor, Film, 33 ohms, 2%, 1/2W	RL20S330G	35005	4	
RAP05	Resistor, Film, 100 ohms, 2% 1/2W	RL20S101G	35005	2	
RAP09	Resistor, Film, 1000 ohms, 2% 1/2W	RL20S102G	35005	6	
RAP10	Resistor, Film, 1800 ohms, 2% 1/2W	RL20S182G	35005	11	
RAP11	Resistor, Film, 3300 ohms, 2% 1/2W	RL20S332G	35005	5	
RAP12	Resistor, Film, 5600 ohms, 2% 1/2W	RL20S562G	35005	7	
RAP13	Resistor, Film, 10K ohms, 2% 1/2W	RL20S103G	35005	7	
RAP14	Resistor, Film, 18K ohms, 2%, 1/2W	RL20S183G	35005	1	
RAP15	Resistor, Film, 33K ohms, 2%, 1/2W	RL20S333G	35005	1	
RAP17	Resistor, Film, 100K ohms, 2%, 1/2W	RL20S104G	35005	2	
RC27	Resistor, Film, 150 ohms, 2% 1/2W	RL20S151G	35005	6	
RC38	Resistor, Film, 1200 ohms, 2% 1/2W	RL20S122G	35005	1	
RD05	Resistor, Film, 6800 ohms, 2% 1/2W	RL20S682G	35005	2	
RD09	Resistor, Film, 15K ohms, 2% 1/2W	RL20S153G	35005	2	
RD12	Resistor, Film, 27K ohms, 2% 1/2W	RL20S273G	35005	1	
RD18	Resistor, Film, 82K ohms, 2% 1/2W	RL20S823G	35005	2	
RI39	Resistor, Comp, 1500 ohms, 5% 2W	RC42GF152J	01121	1	
RI42	Resistor, Comp, 2700 ohms, 5% 2W	RC42GF272J	01121	1	
RQ07	Resistor, Wirewound, 12.5 ohms, 5% 120W	NHL120-12.5 Ohms-5%	35005	1	
RV15	Resistor, Variable, 100 ohms, 2W	RV4LAYSA101A	44655	3	
RW07	Resistor, Variable, 1000 ohms, 1/2W	63P102	02111	2	
RW08	Resistor, Variable, 10K ohms, 1/2W	63P103T000	02111	1	
RW24	Resistor, Variable, 100 ohms, 1/2W	63P101T000	02111	1	
RX01	Thermistor, 2000 ohms @ 25°C	PB32D1	73168	1	

Table 7-3 Parts Per Unit Index (Continued)

NAUTEL'S PART NO.	NAME OF PART AND DESCRIPTION	JAN, MIL OR MFR PART NO.	(OEM) MFR CODE	TOTAL IDENT PARTS	
SA23	Switch, Toggle, 4PDT	SF4GCY191	08372	1	
SA26	Switch, Toggle, 1PDT	MSTE-106D	95146	1	
SA32	Switch, Rotary, Non-shorting	T206	75042	2	
SB05	Circuit Breaker, 3-pole 50A 240Vac	209-3-1-62F-4-9-50	07355	1	*
SB07	Circuit Breaker, 3-pole 25A 240Vac	209-3-1-62F-4-9-25	07355	1	@
SC15	Switch, Interlock	11TL6-4	80207	2	
SC16	Switch, Rotary, Shorting	PA2010	99942	1	
SC29	Switch, Rotary, Shorting	T202	75042	1	
SCP25	Circuit Breaker, SP, Therm, 5A 250Vac	W23X1A1G-5	77342	1	
SCP41	Switch, 2PDT, PB, Momentary	8N2011	91929	1	
TB19	Inductor, Choke, 2.5mH	195-E30	73831	4	
TC18	Transformer, Audio	850G	73831	1	
TC19	Transformer, 208V, 3-phase, 60 Hz	139-7007/4	37338	1	*
TC21	Transformer, 415V, 3-phase, 50 Hz	139-7007-6	37338	1	@
UC02	Socket, Integrated Circuit, 14-pin	640-357-1	00779	1	
UC29	Surge Arrester, 2800Vdc 10%	LA9 B1B	35005	1	
UL02	IC, Comparator, Quad	MC3302L	04713	1	
ZA06	Fan, 115V, 50/60Hz, Muffin XL	MX2B3-028422	82877	8	

\# Denotes parts for this assembly not included in this index. Refer to appropriate module service instruction manual for breakdown.

$ Monaural transmitters only
% Stereo transmitters only

* Denotes used on North American style 208 volt, 3-phase 60 Hz power supply.
@ Denotes used on European style 415 volt, 3-phase 50 Hz power supply.

A Denotes used only when transmitter frequency is 520 kHz-620 kHz
B Denotes used only when transmitter frequency is 620 kHz-743 kHz
C Denotes used only when transmitter frequency is 743 kHz-887 kHz
D Denotes used only when transmitter frequency is 887 kHz-1067 kHz
E Denotes used only when transmitter frequency is 1067 kHz-1306 kHz
F Denotes used only when transmitter frequency is 1306 kHz-1599 kHz
G Denotes used only when transmitter frequency is 1599 kHz-1955 kHz

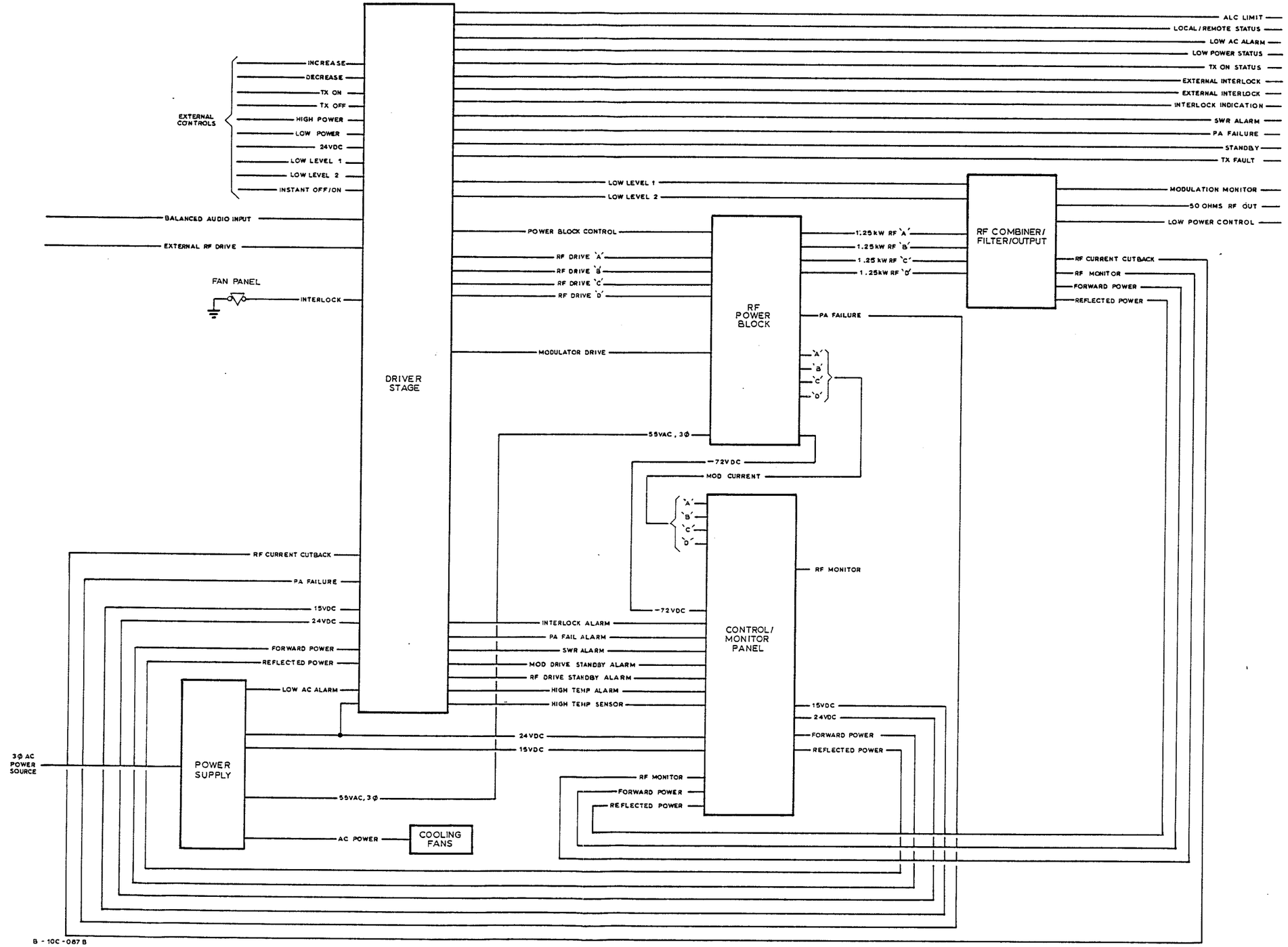


Figure FO-1 Block Diagram - AMPFET 5 System

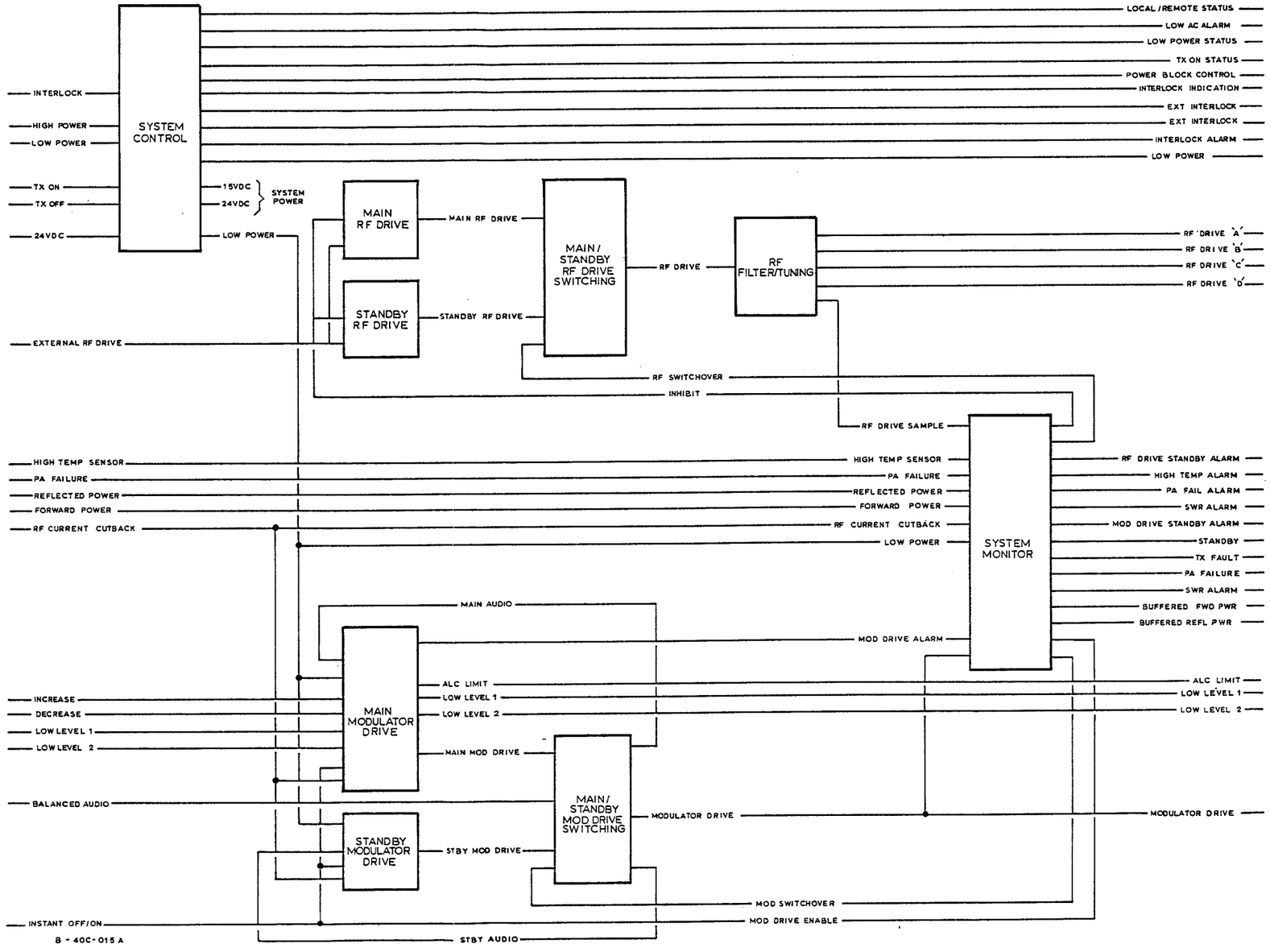


Figure FO-2 Block Diagram - 5000 Watt Driver Stage

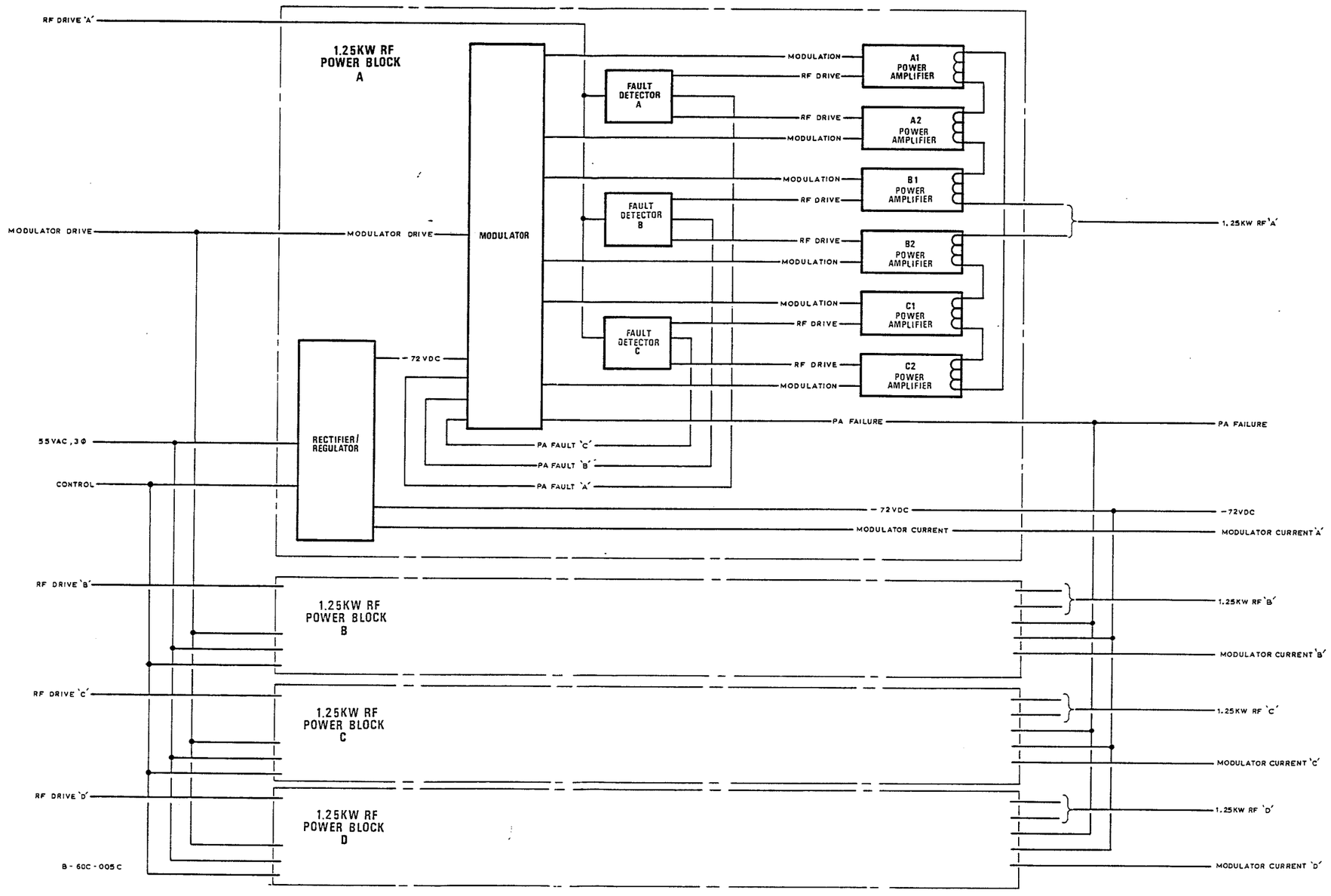


Figure FO-3 Block Diagram - 5000 Watt RF Power Block

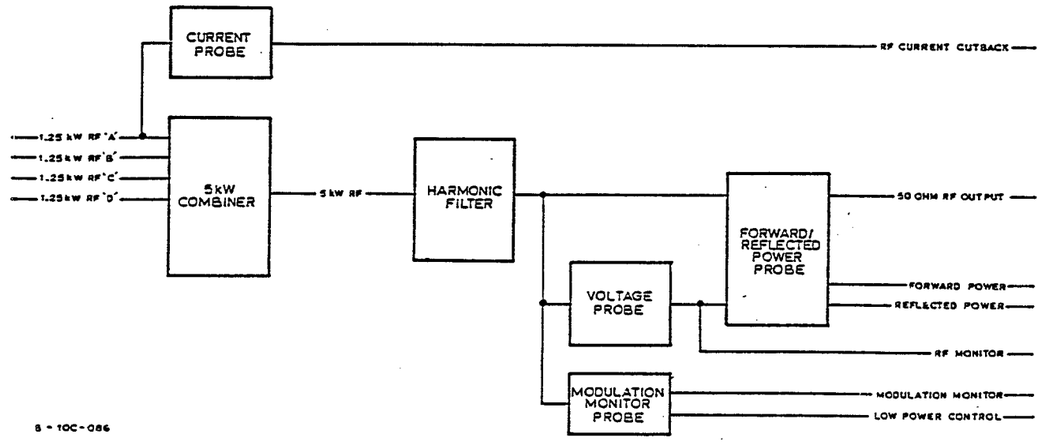


Figure FO-4 Block Diagram - 5000 Watt Combiner/Filter/Output

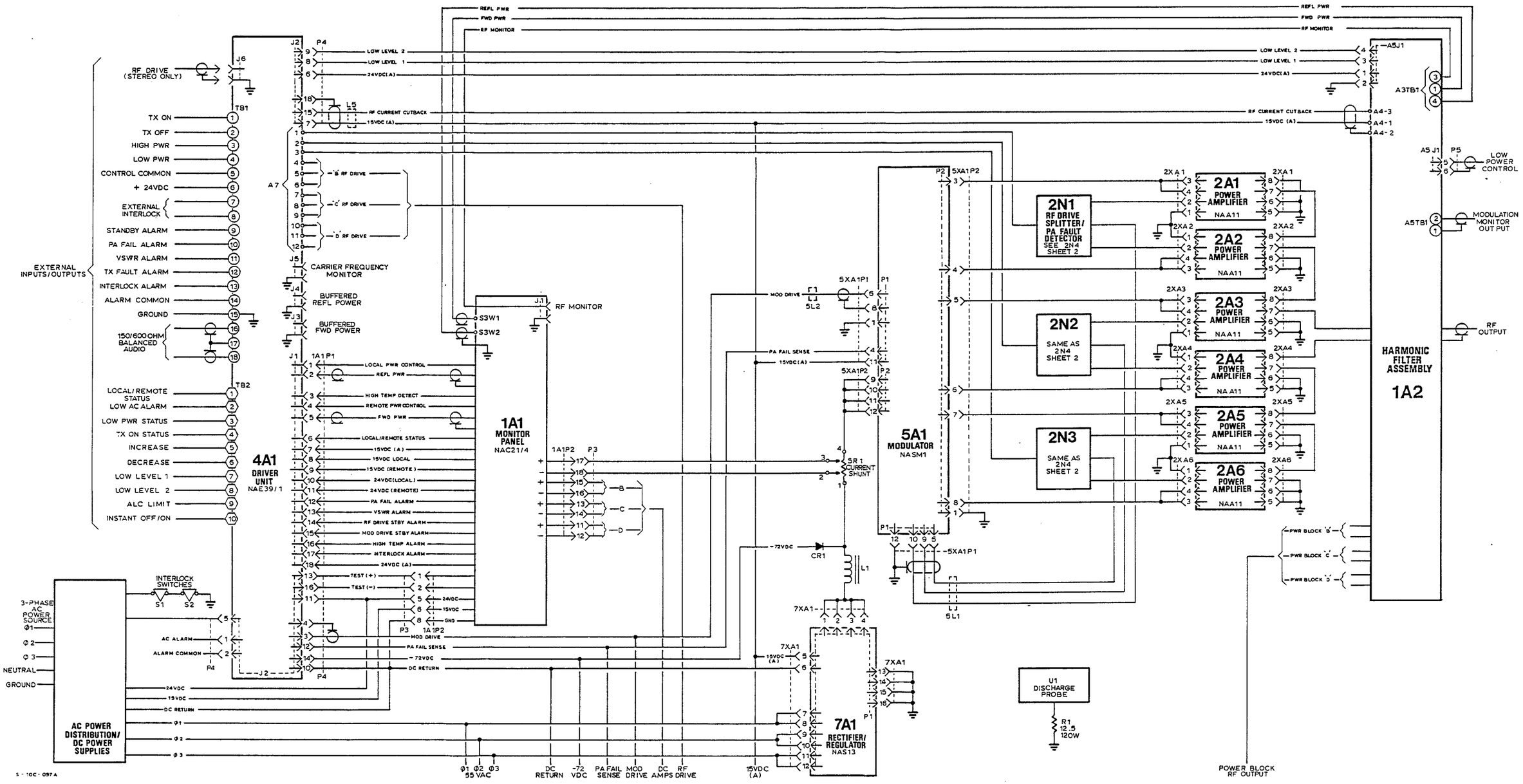
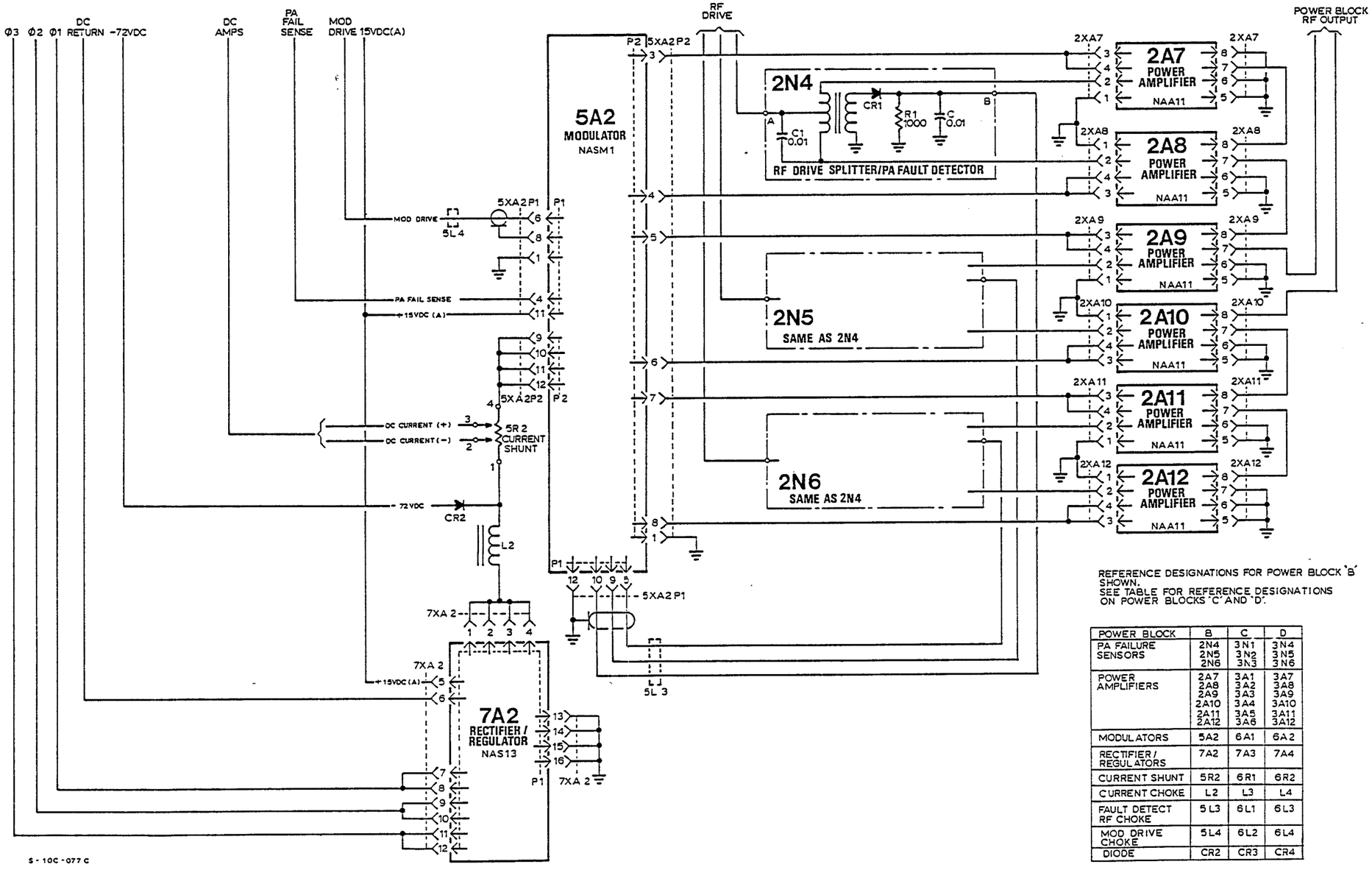


Figure FO-5 Electrical Schematic - AMPFET 5 Transmitter (Sheet 1 of 2)



REFERENCE DESIGNATIONS FOR POWER BLOCK 'B' SHOWN.
SEE TABLE FOR REFERENCE DESIGNATIONS ON POWER BLOCKS 'C' AND 'D'.

POWER BLOCK	B	C	D
PA FAILURE SENSORS	2N4 2N5 2N6	3N1 3N2 3N3	3N4 3N5 3N6
POWER AMPLIFIERS	2A7 2A8 2A9 2A10 2A11 2A12	3A1 3A2 3A3 3A4 3A5 3A6	3A7 3A8 3A9 3A10 3A11 3A12
MODULATORS	5A2	6A1	6A2
RECTIFIER / REGULATORS	7A2	7A3	7A4
CURRENT SHUNT	5R2	6R1	6R2
CURRENT CHOKE	L2	L3	L4
FAULT DETECT RF CHOKE	5L3	6L1	6L3
MOD DRIVE CHOKE	5L4	6L2	6L4
DIODE	CR2	CR3	CR4

Figure FO-6 Electrical Schematic - AMPFET 5 Transmitter (Sheet 2 of 2)

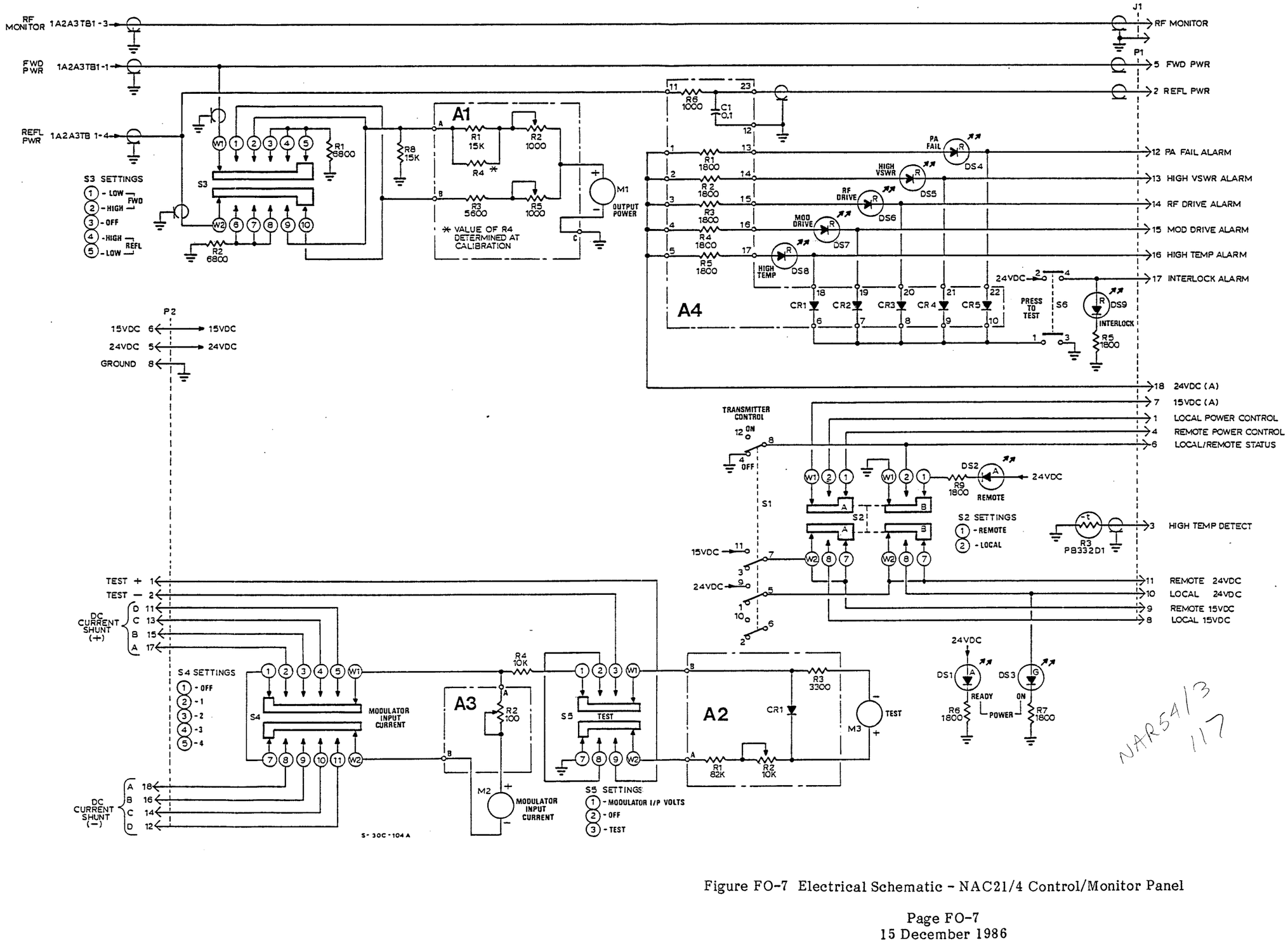
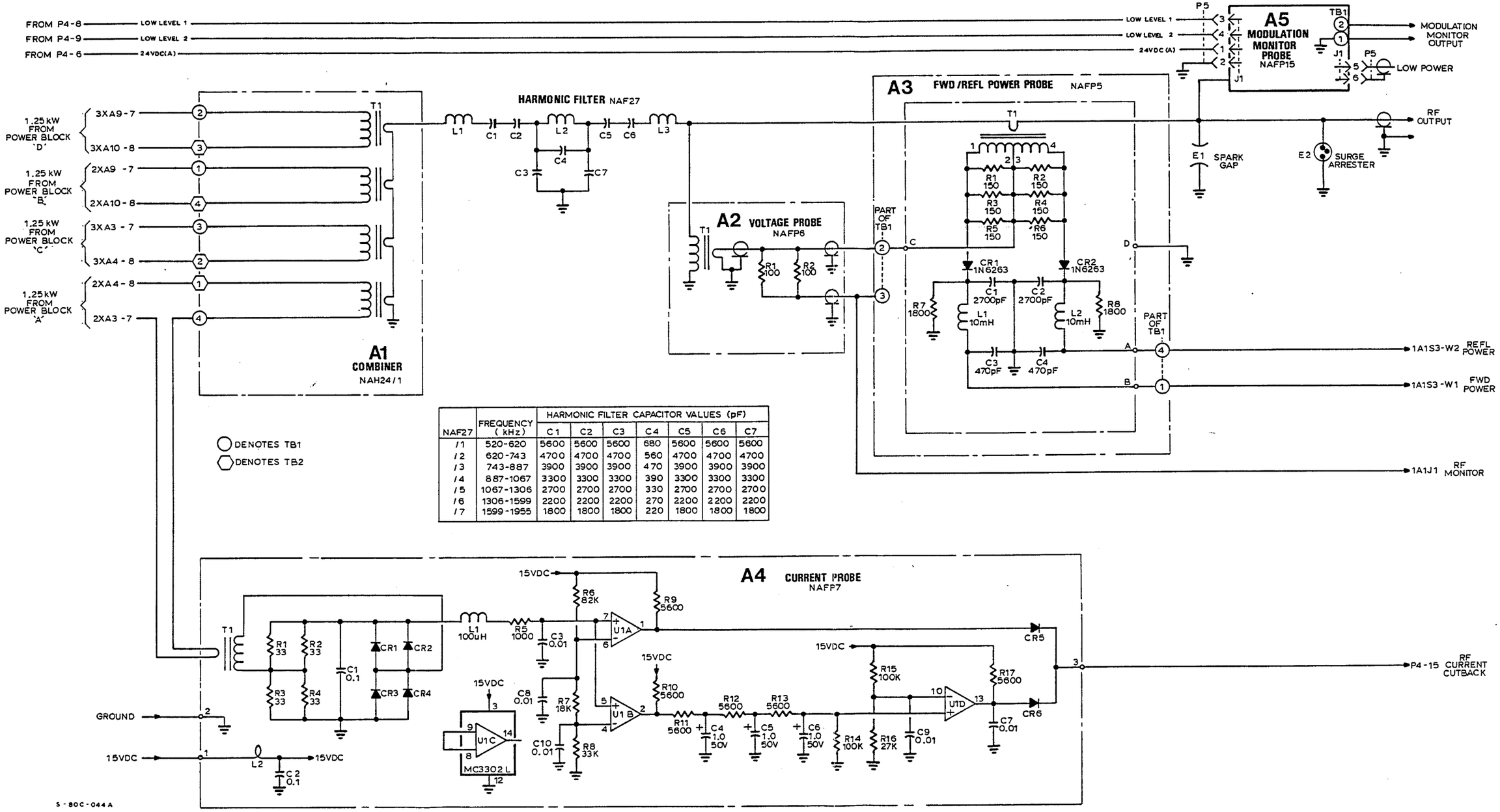


Figure FO-7 Electrical Schematic - NAC21/4 Control/Monitor Panel



NAF27	FREQUENCY (kHz)	HARMONIC FILTER CAPACITOR VALUES (pF)						
		C1	C2	C3	C4	C5	C6	C7
/1	520-620	5600	5600	5600	680	5600	5600	5600
/2	620-743	4700	4700	4700	560	4700	4700	4700
/3	743-887	3900	3900	3900	470	3900	3900	3900
/4	887-1067	3300	3300	3300	390	3300	3300	3300
/5	1067-1306	2700	2700	2700	330	2700	2700	2700
/6	1306-1599	2200	2200	2200	270	2200	2200	2200
/7	1599-1955	1800	1800	1800	220	1800	1800	1800

Figure FO-8 Electrical Schematic - Harmonic Filter Assembly

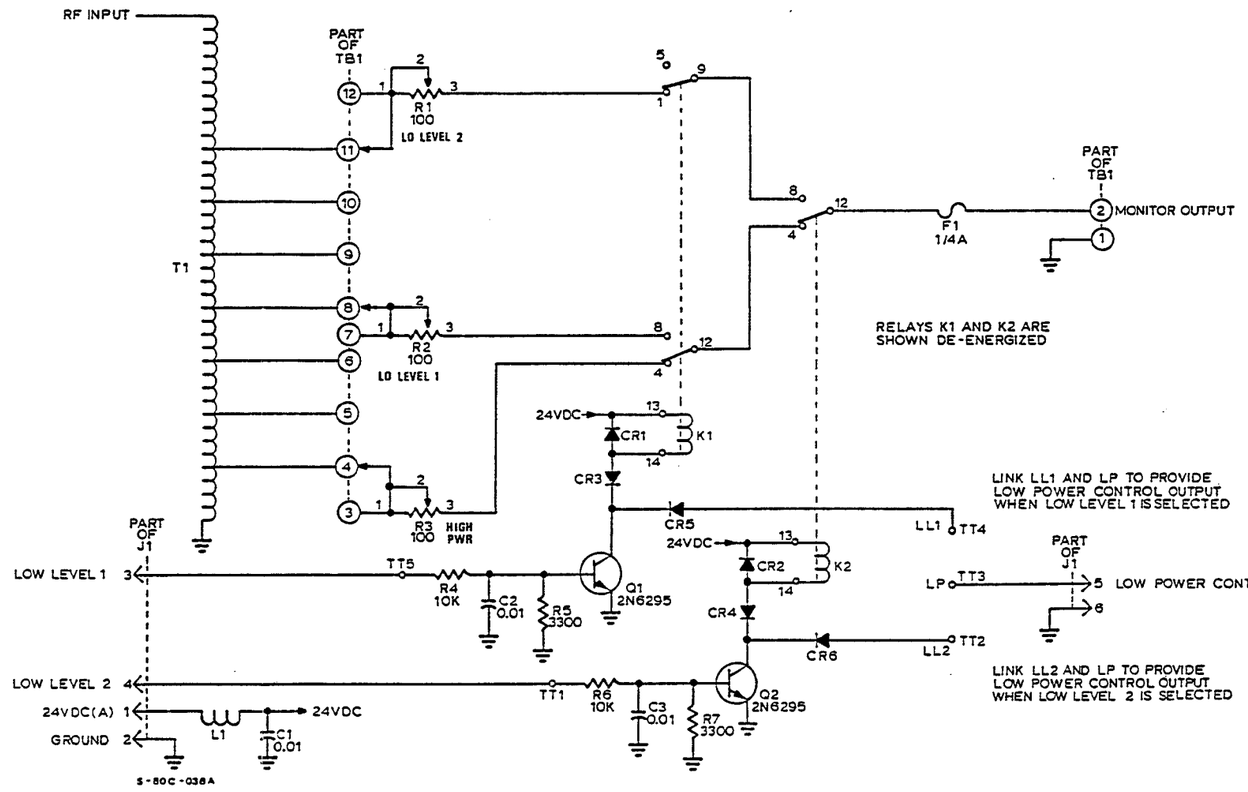


Figure FO-9 Electrical Schematic - NAFP15 Modulation Monitor Probe

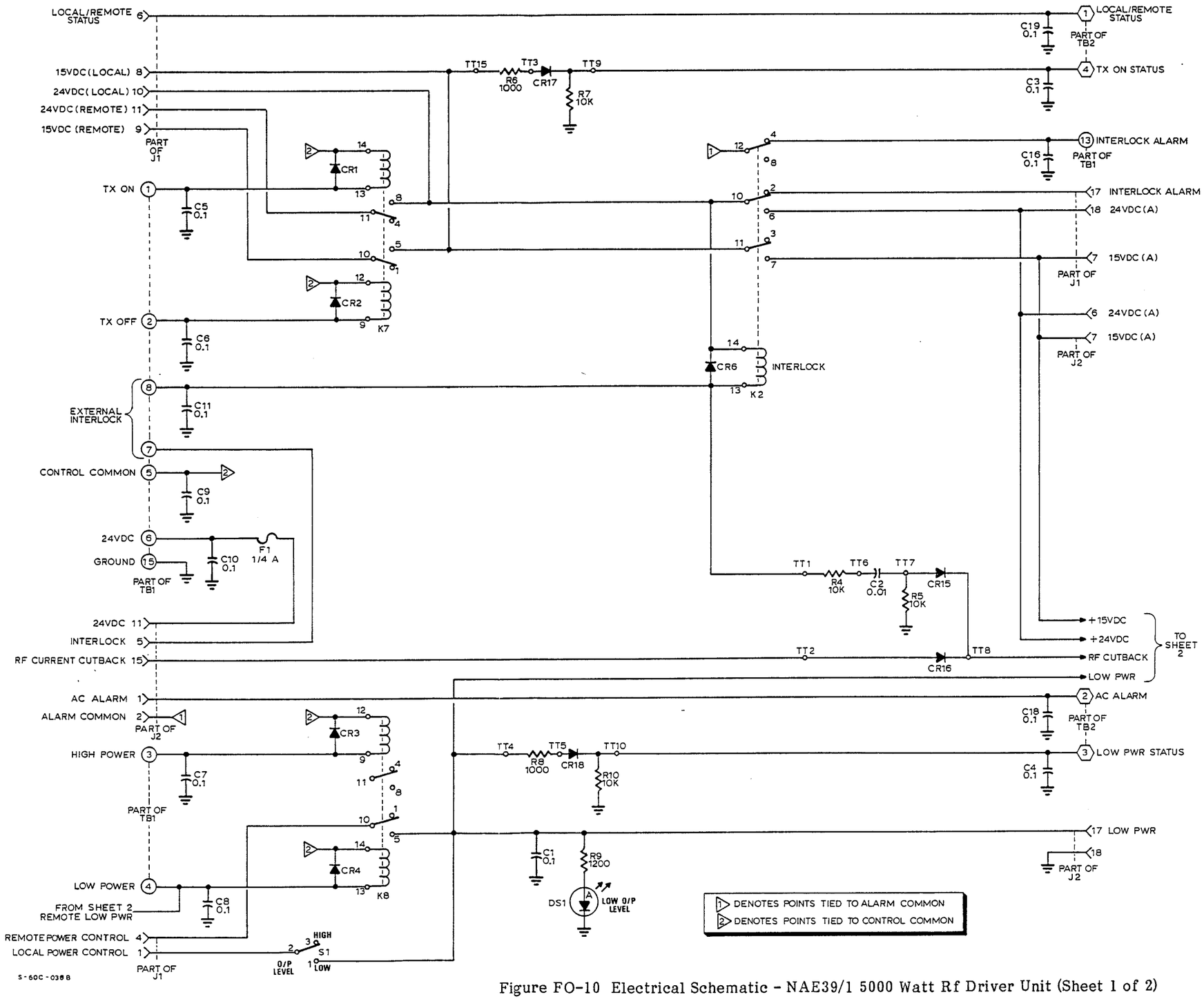


Figure FO-10 Electrical Schematic - NAE39/1 5000 Watt Rf Driver Unit (Sheet 1 of 2)

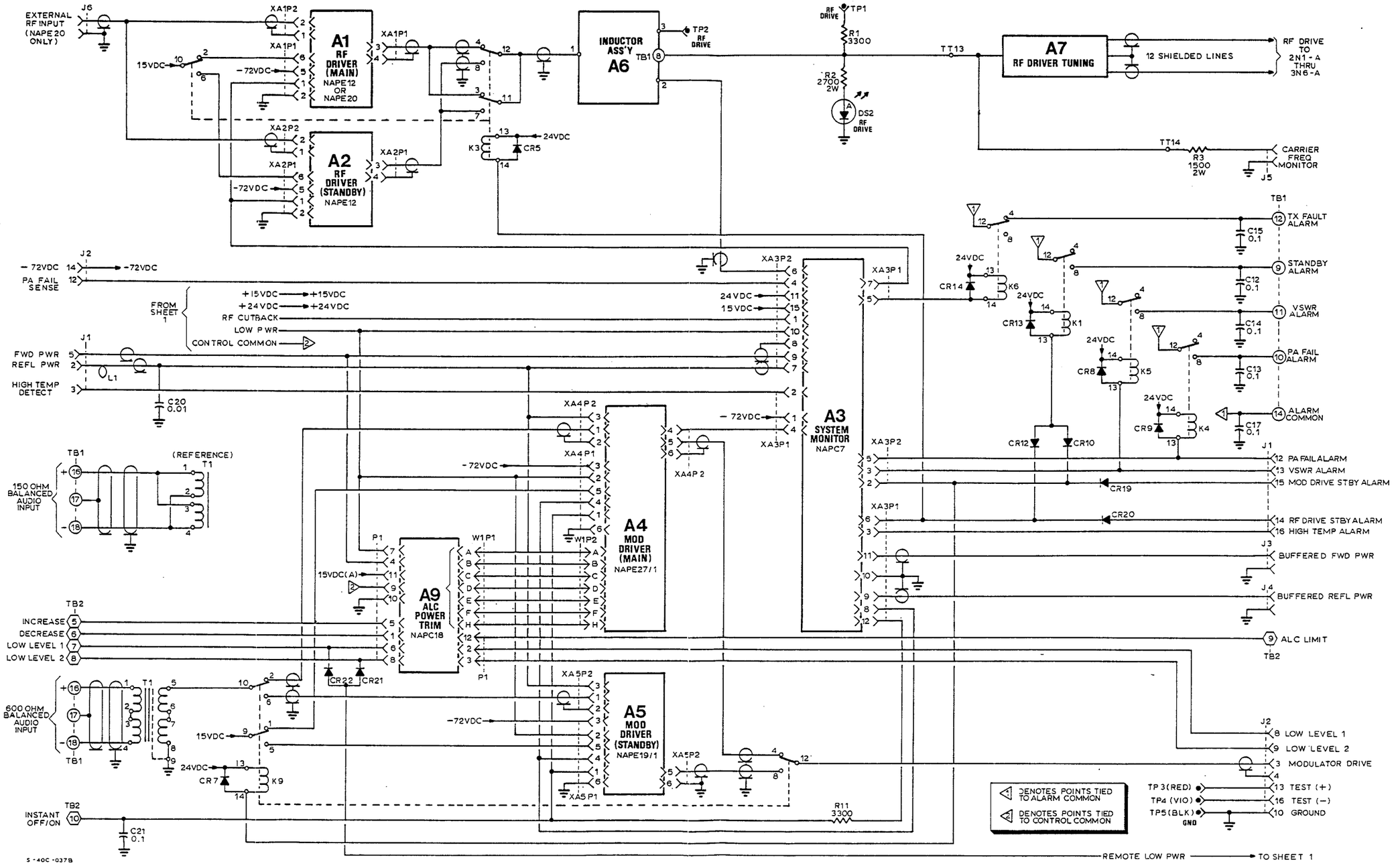


Figure FO-11 Electrical Schematic - NAE39/1 5000 Watt Rf Driver Unit (Sheet 2 of 2)

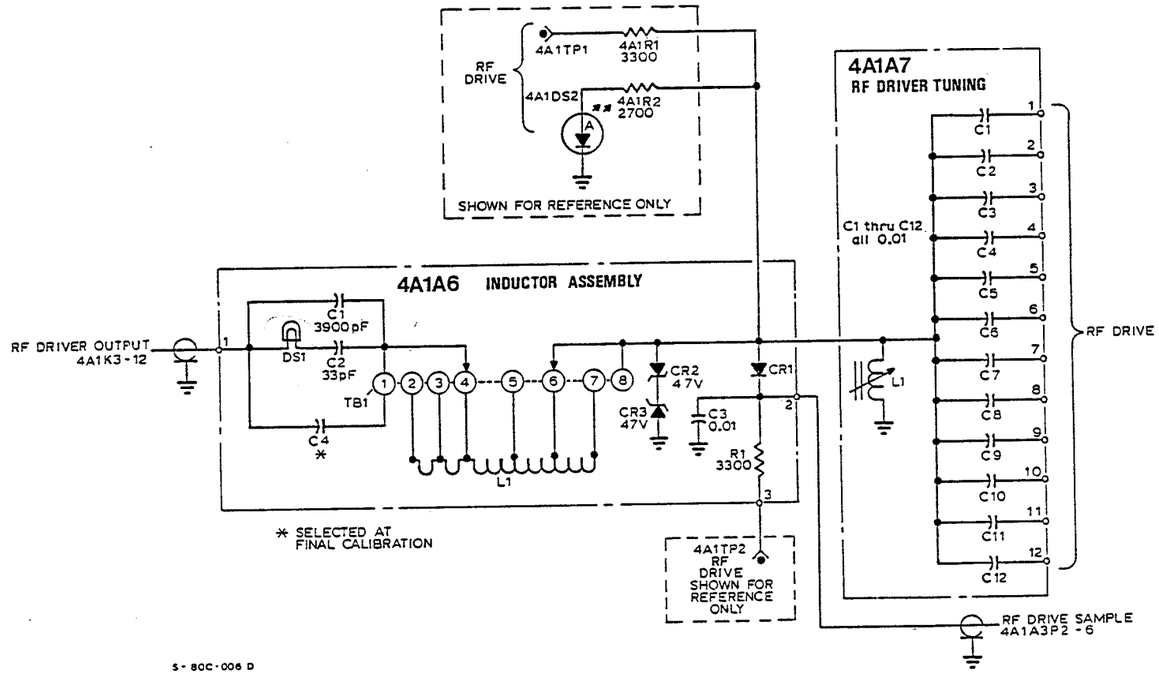


Figure FO-12 Electrical Schematic - RF Driver Filter

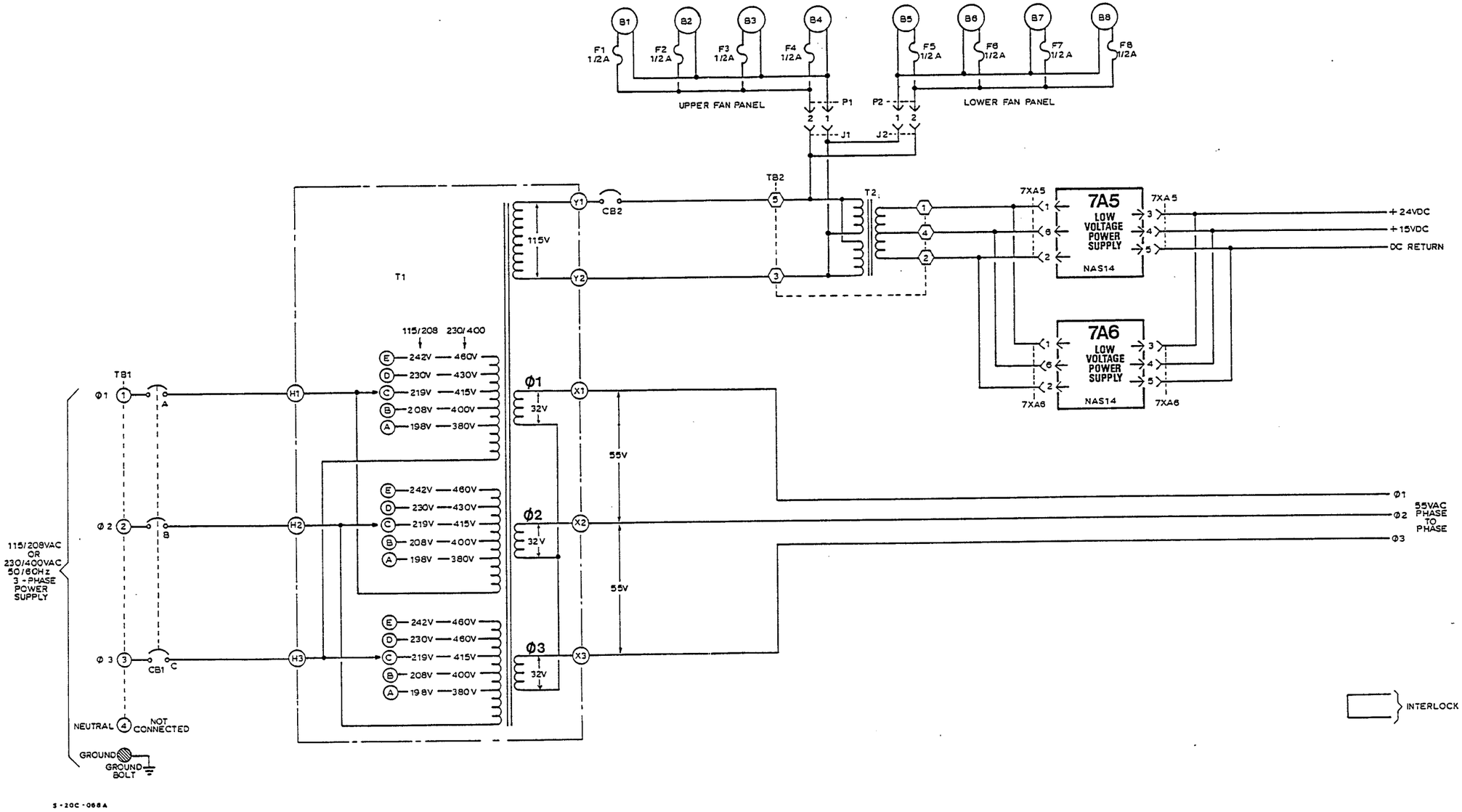
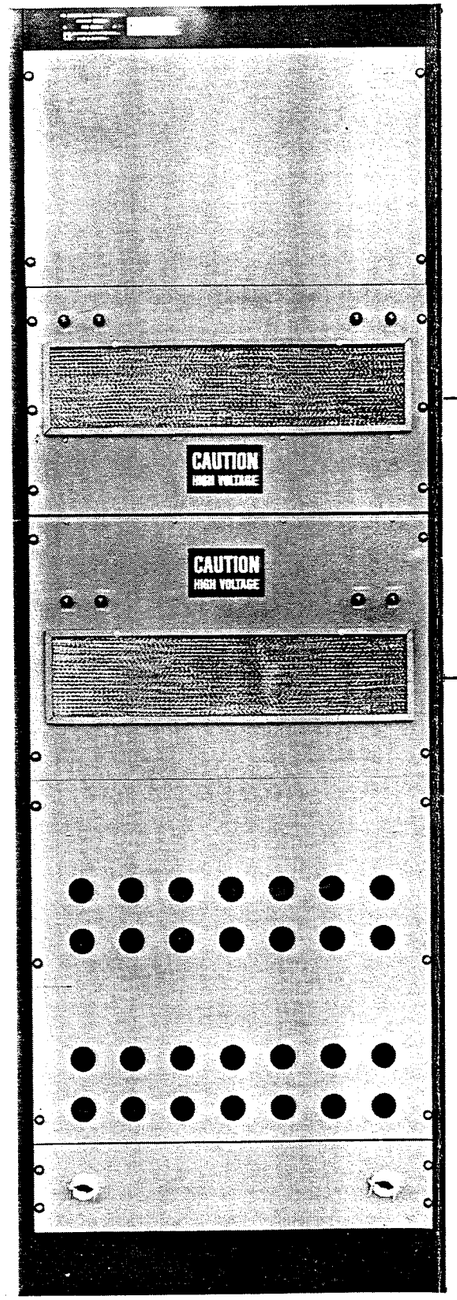
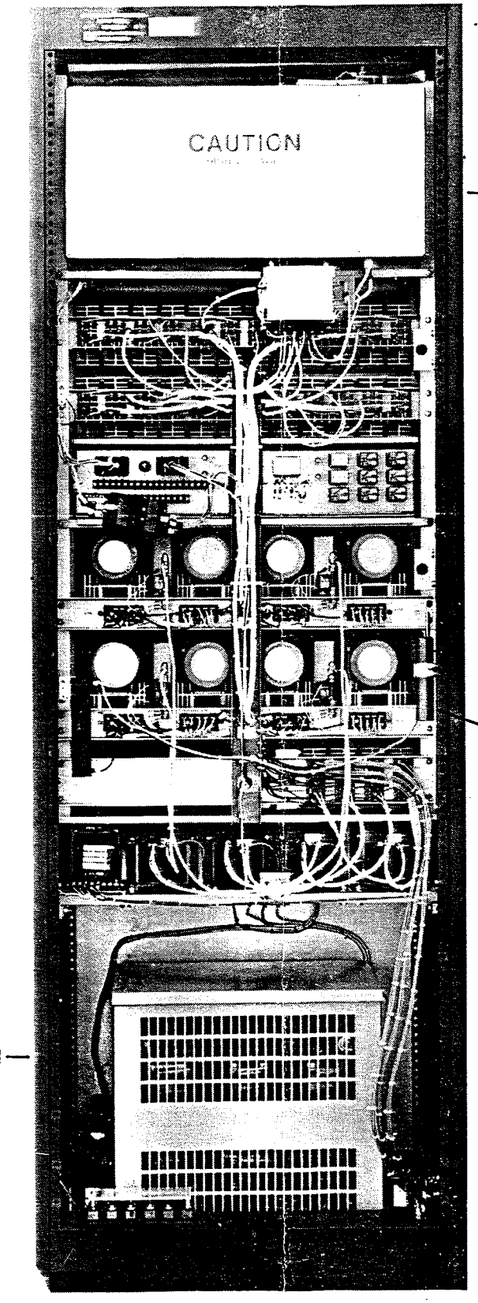


Figure FO-13 Electrical Schematic - AC Power Supply



Upper Fan Panel

Lower Fan Panel



ROW 1
NAC21/4 Control/Monitor Panel
and
NAF27 Harmonic Filter

ROW 2
12 - NAA11 Power Amplifiers
for Power Blocks A and B

ROW 3
12 - NAA11 Power Amplifiers
for Power Blocks C and D

ROW 4
NAE39/1 RF Driver Unit
(see figure FO-24)

ROW 5
2 - NASM1A Modulator Modules
for Power Blocks A and B

ROW 6
2 - NASM1A MODULATOR MODULES
for Power Blocks C and D

Discharge Probe

ROW 7
DC POWER SUPPLIES
(see figure FO-28)

AC Power Supply

Power Transformer T1

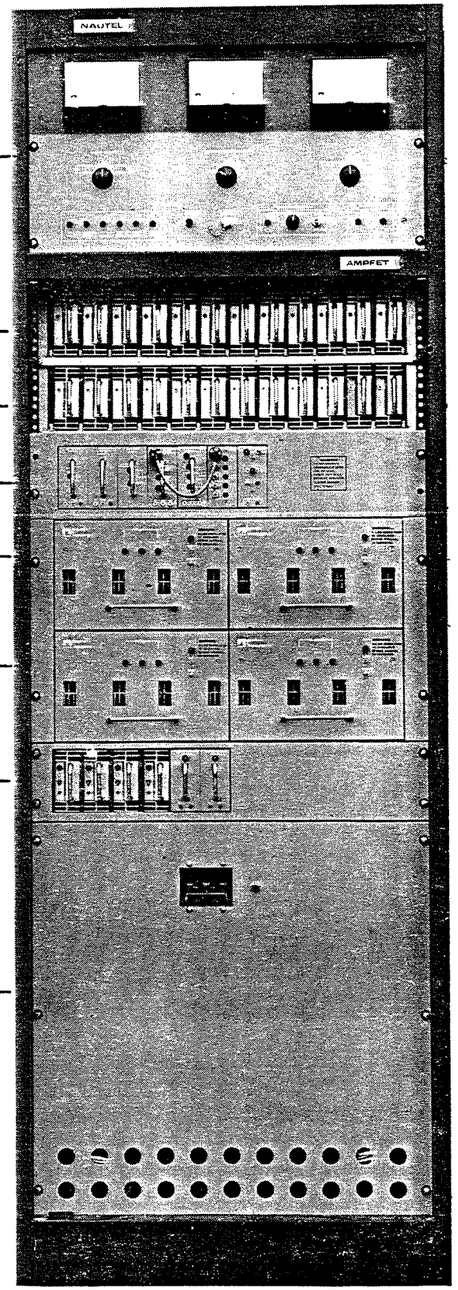


Figure FO-14 Assembly Detail - AMPFET 5 Transmitter, Front and Rear Views

see graph pg 4-5

@ 5kW
NO mod (max) = 23 A.
Normal mod (max) = 27.5 A.
100% sin mod (max) = 34 A.

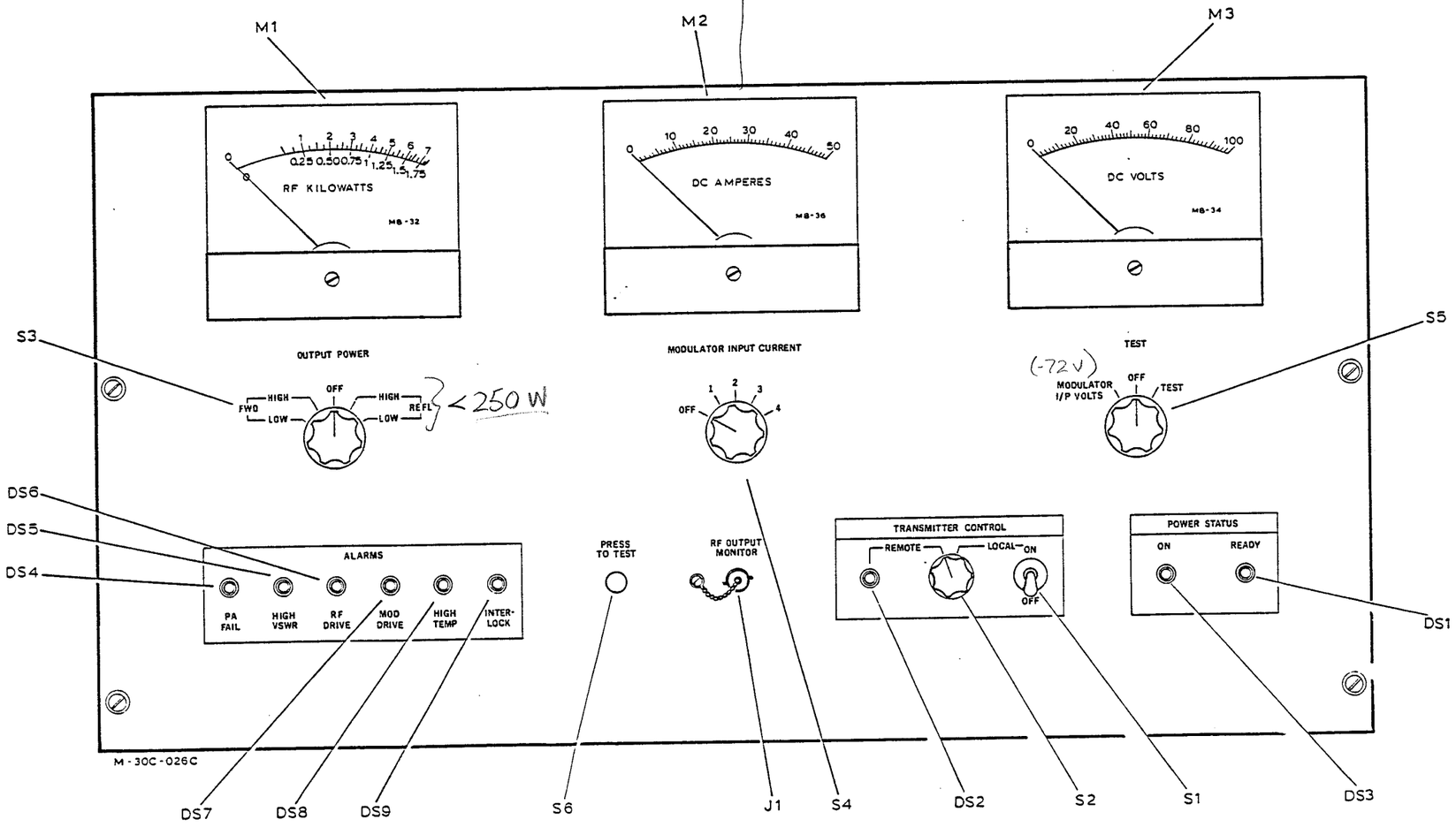


Figure FO-15 Assembly Detail - NAC21/4 Control/Monitor Panel, Front View

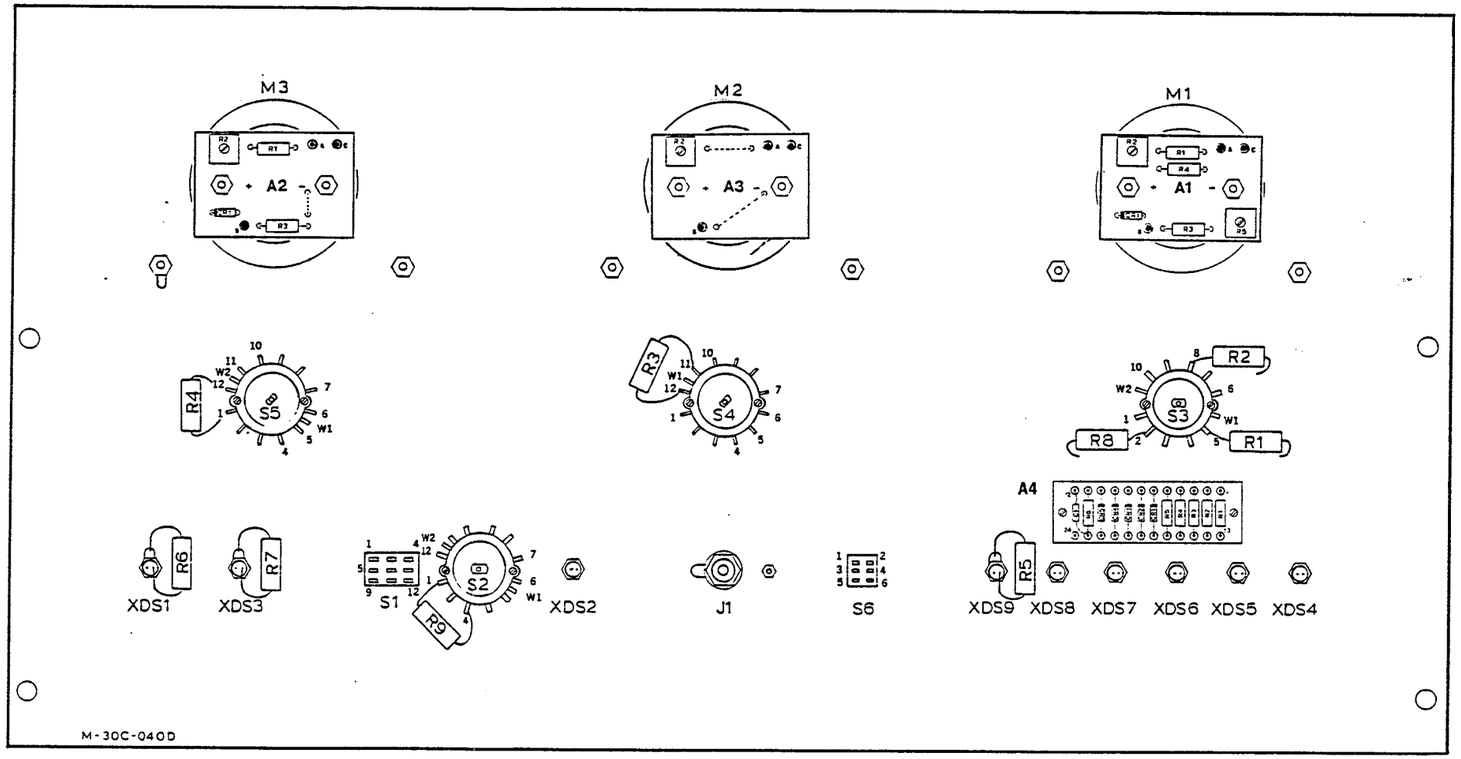


Figure FO-16 Assembly Detail - NAC21/4 Control/Monitor Panel, Rear View

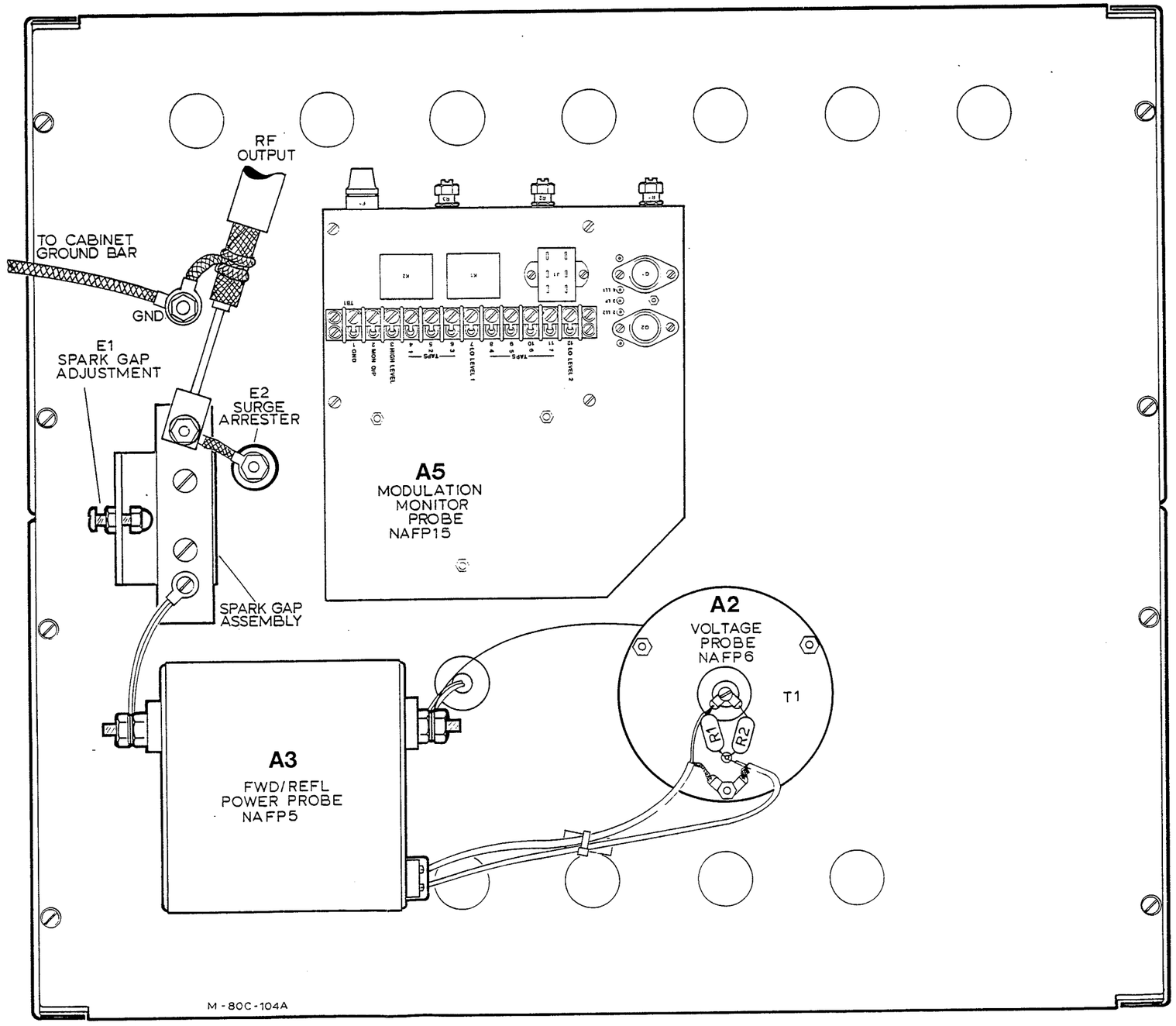


Figure FO-17 Assembly Detail - Harmonic Filter Assembly, Top View

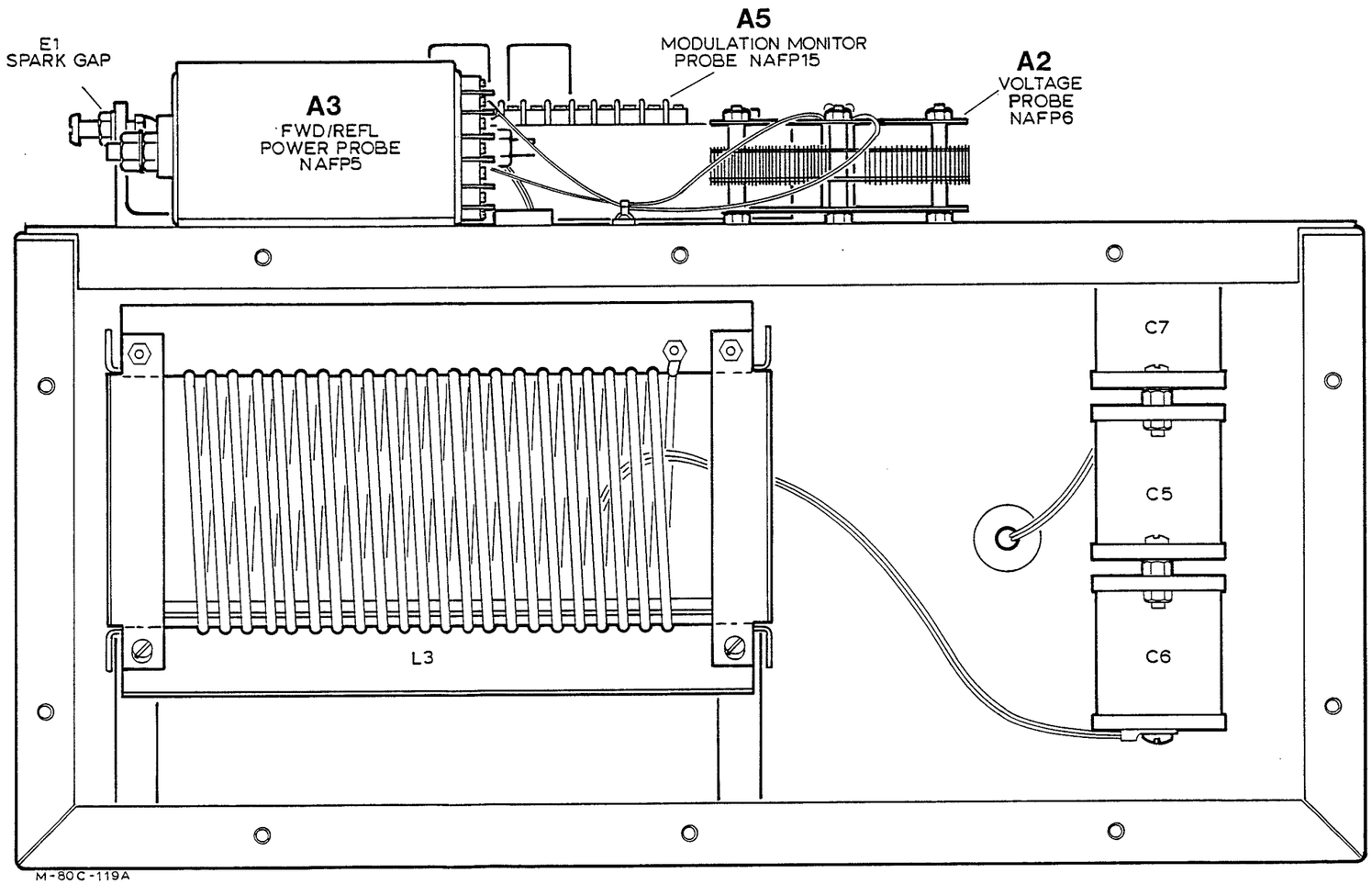


Figure FO-18 Assembly Detail - Harmonic Filter Assembly, Front View

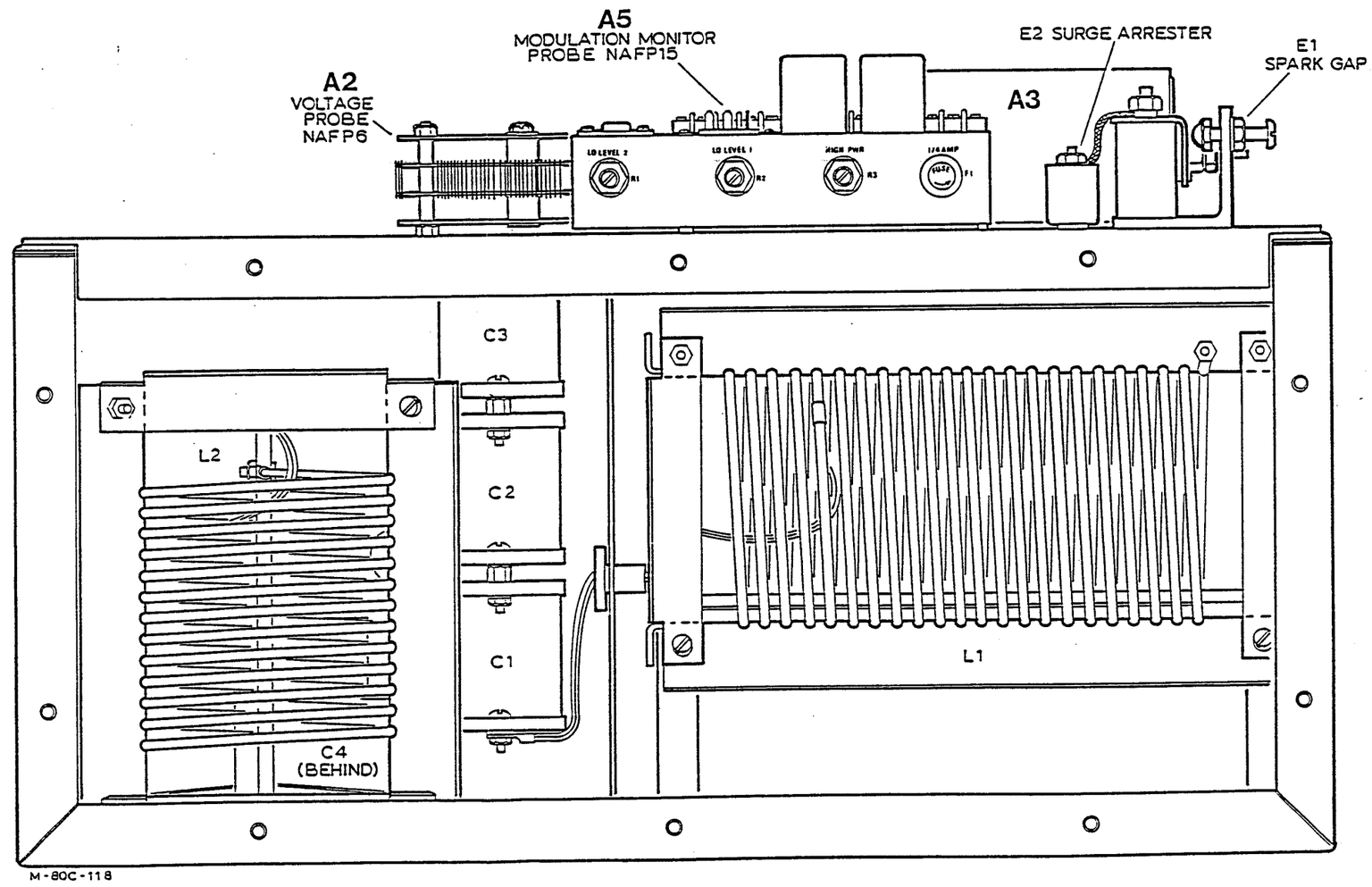
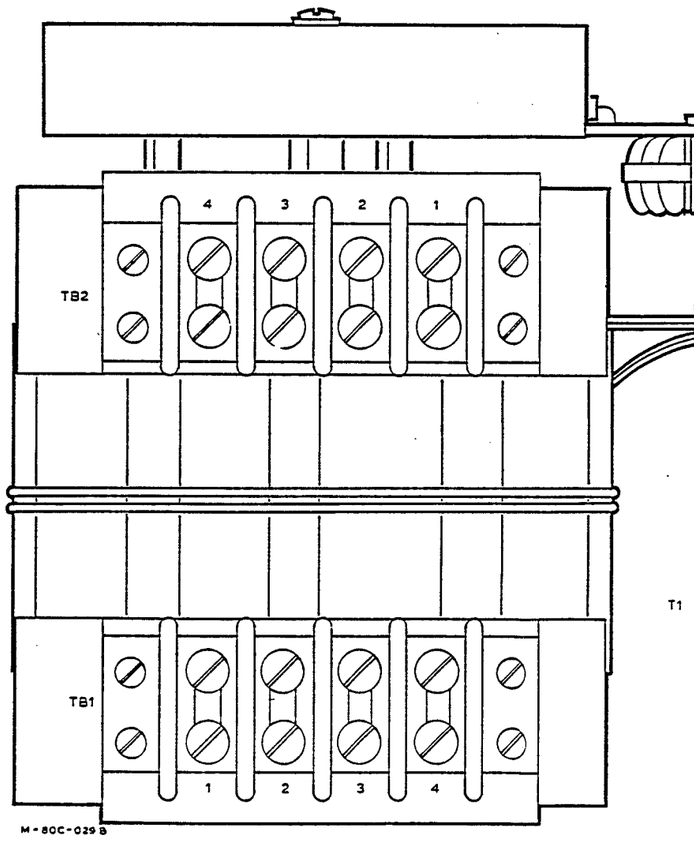


Figure FO-19 Assembly Detail - Harmonic Filter Assembly, Rear View



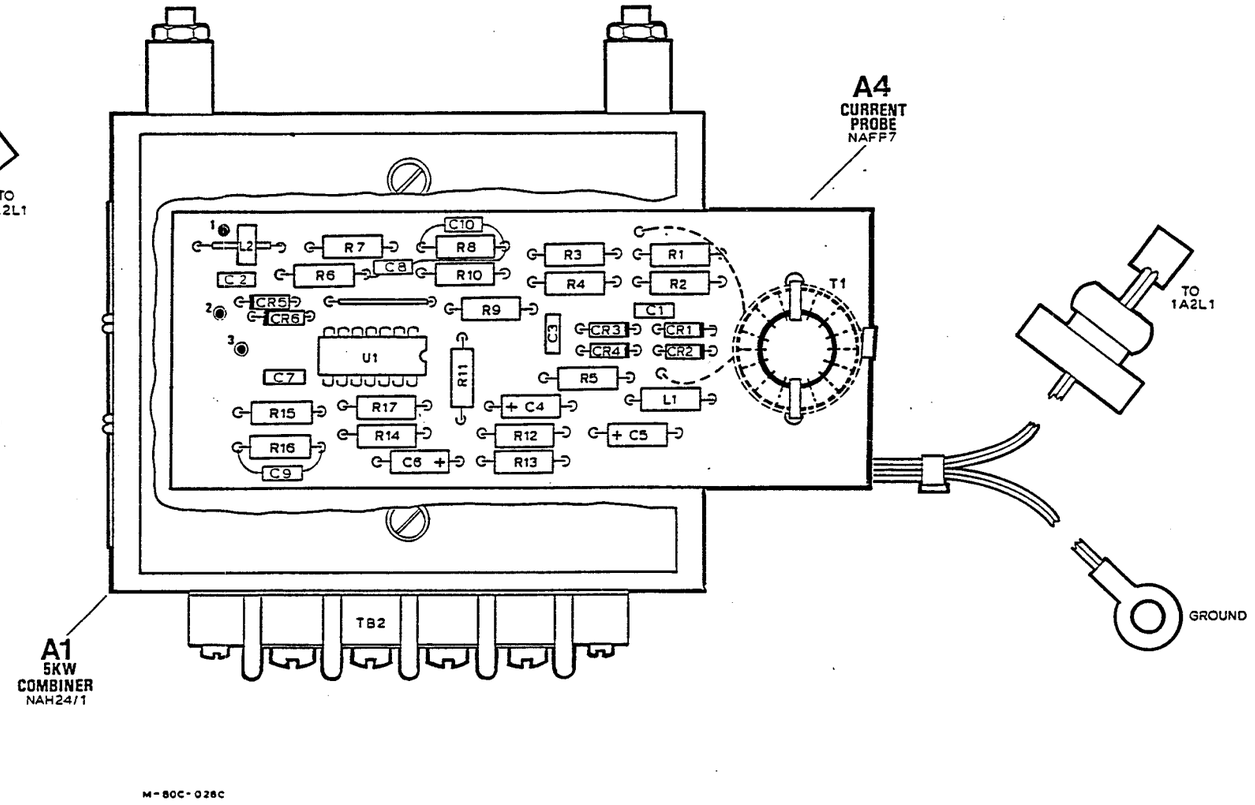


Figure FO-20 Assembly Detail - NAH24/1 5000 Watt Combiner/NAFP7 Current Probe

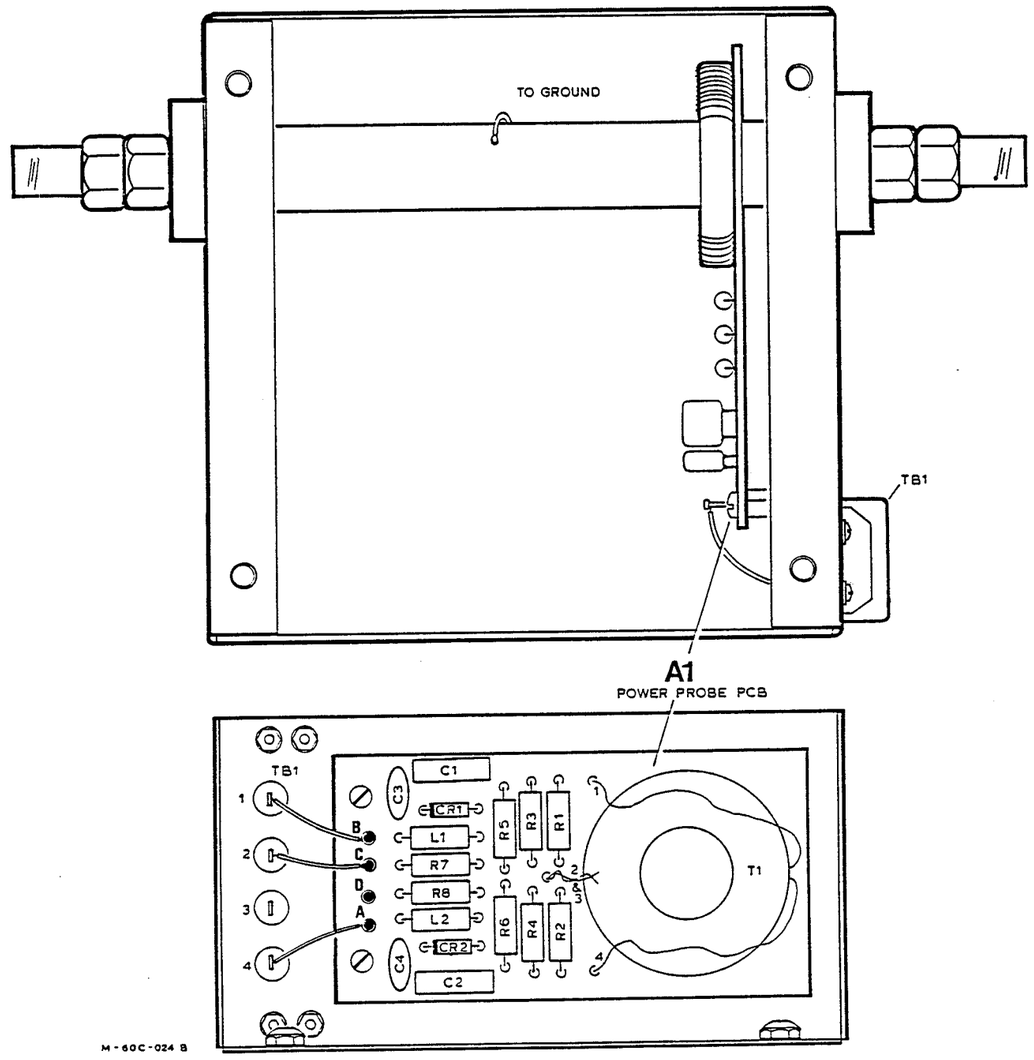
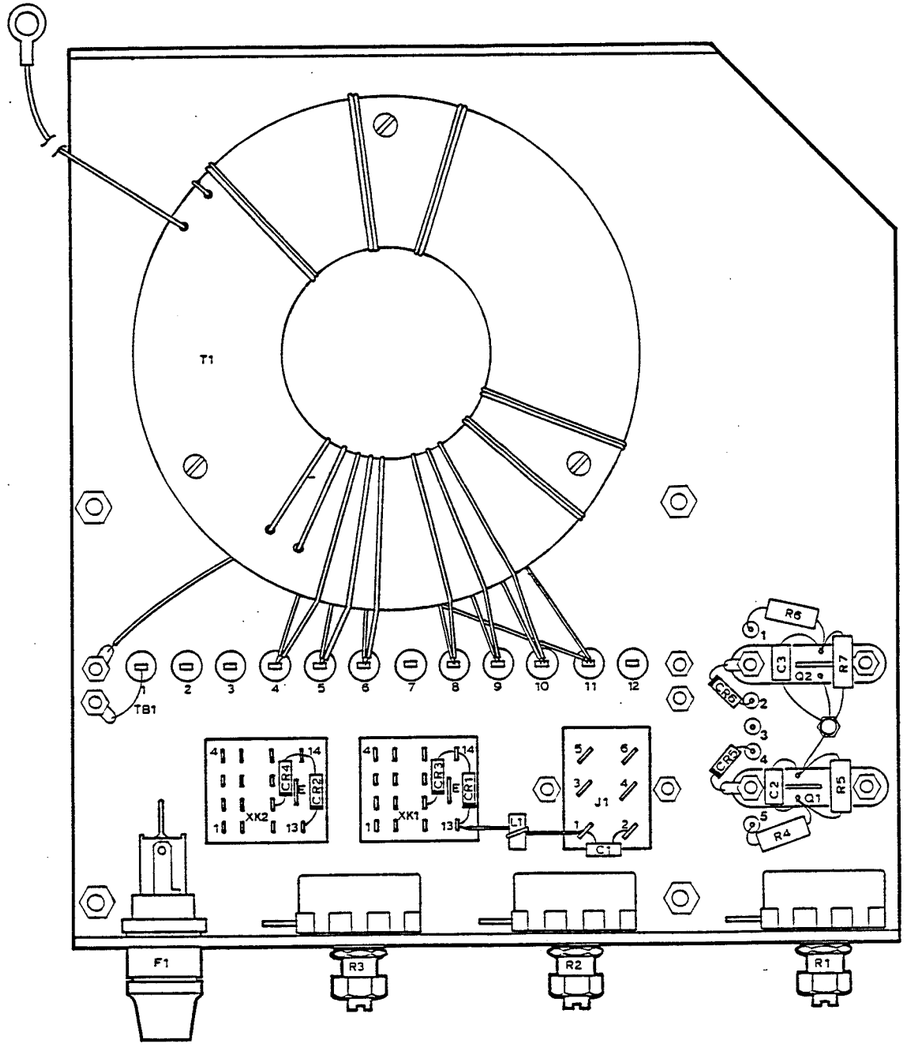


Figure FO-21 Assembly Detail - NAFP5/5 5000 Watt Forward/Reflected Power Probe



M-30C-133

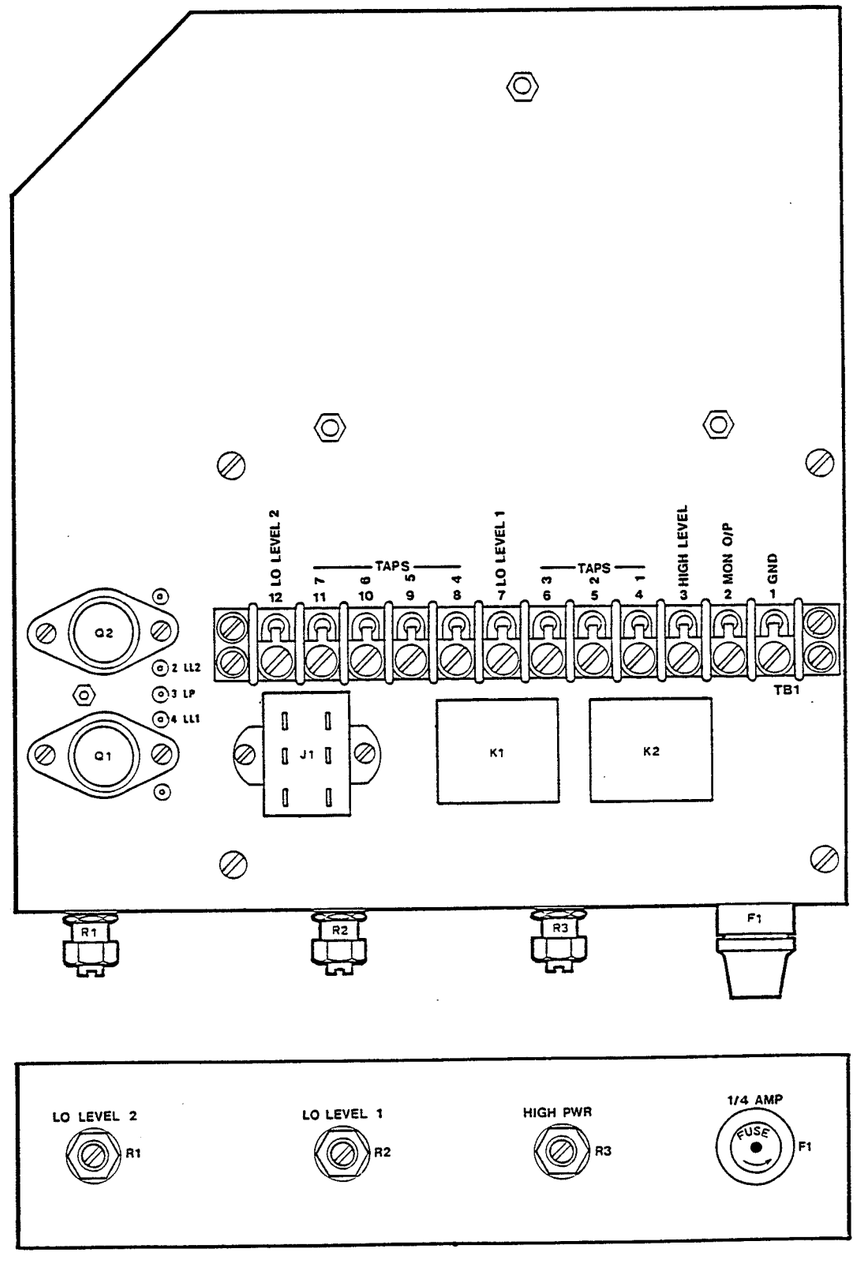
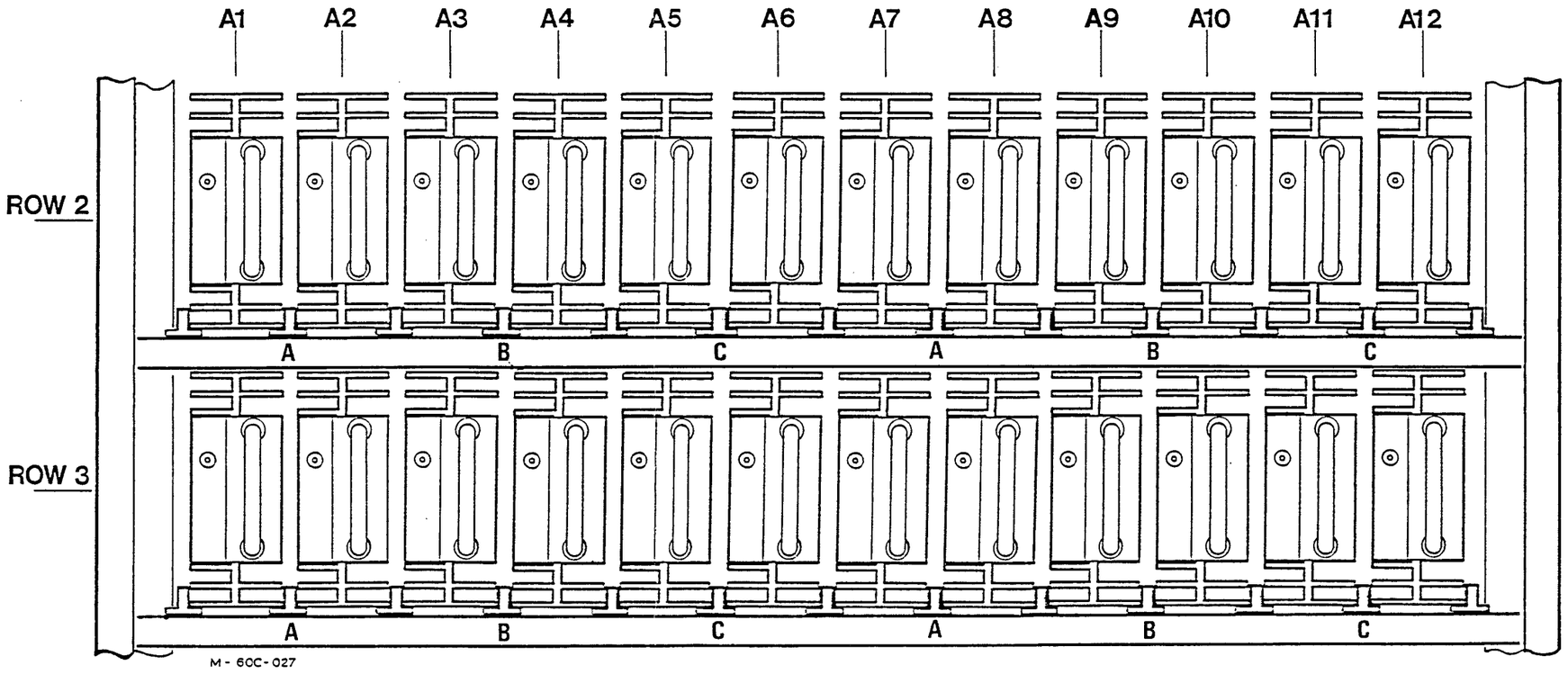


Figure FO-22 Assembly Detail - NAFP15 Modulation Monitor Probe



NOTE: Prefix Power Amplifier's 'A' number with its 'row' number to obtain complete reference designation.

Figure FO-23 Assembly Detail - Rows 2 and 3 (Location of Power Amplifiers)

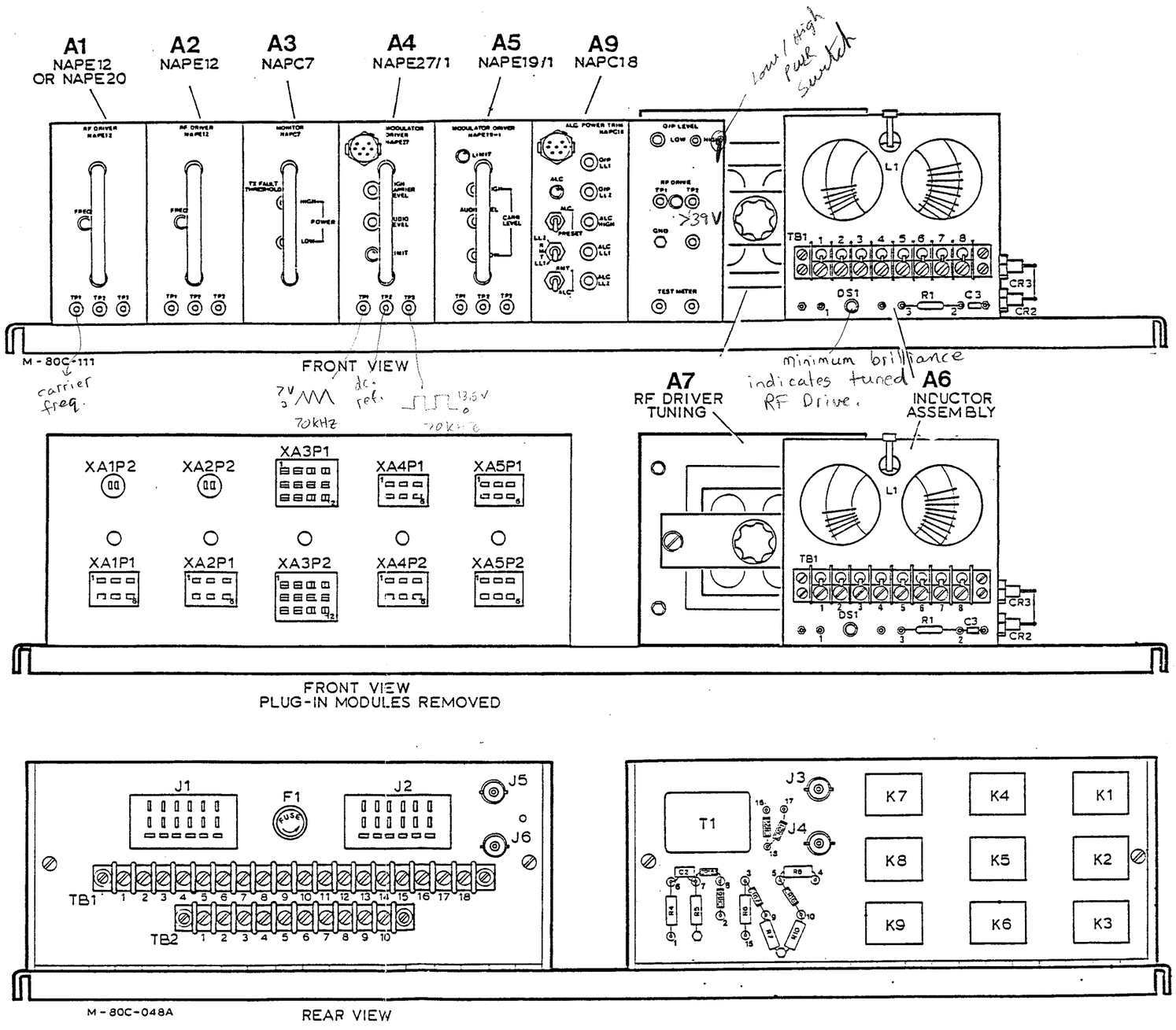


Figure FO-24 Assembly Detail - NAE39/1 5000 Watt Rf Driver Unit, Front View

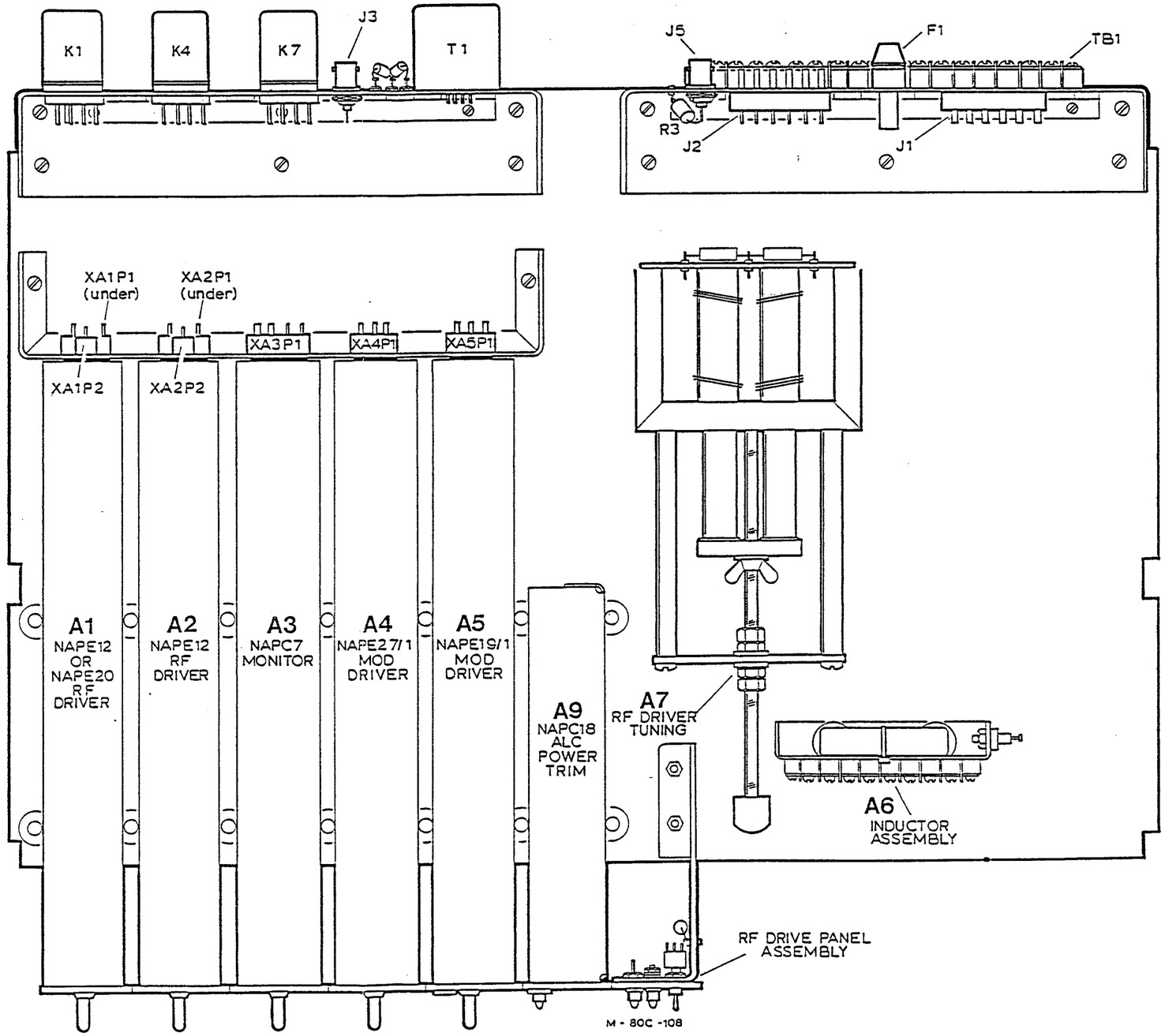
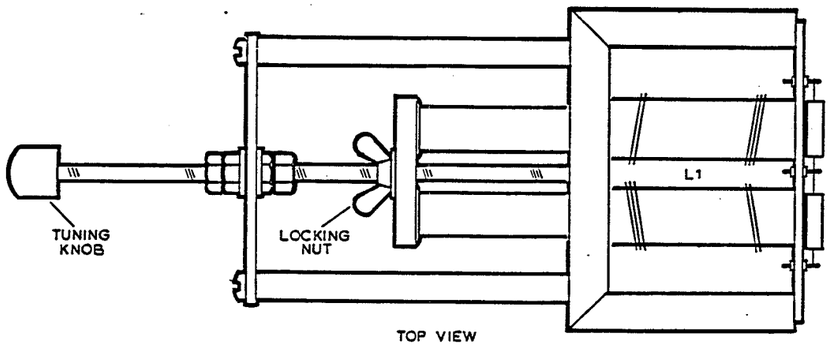
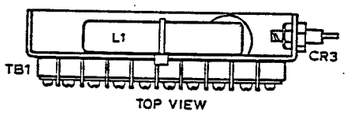
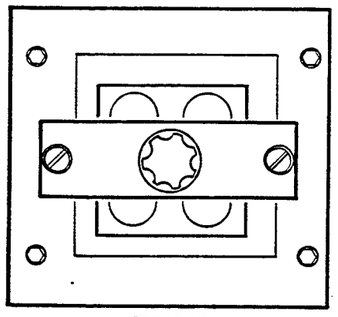
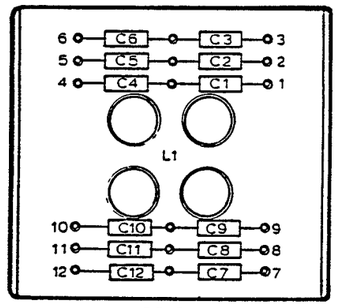


Figure FO-25 Assembly Detail - NAE39/1 5000 Watt Rf Driver Unit, Top View

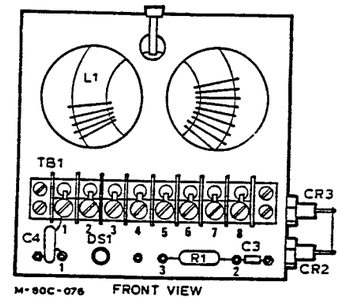


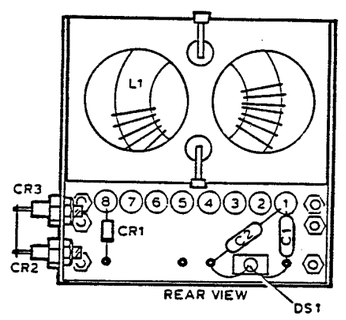






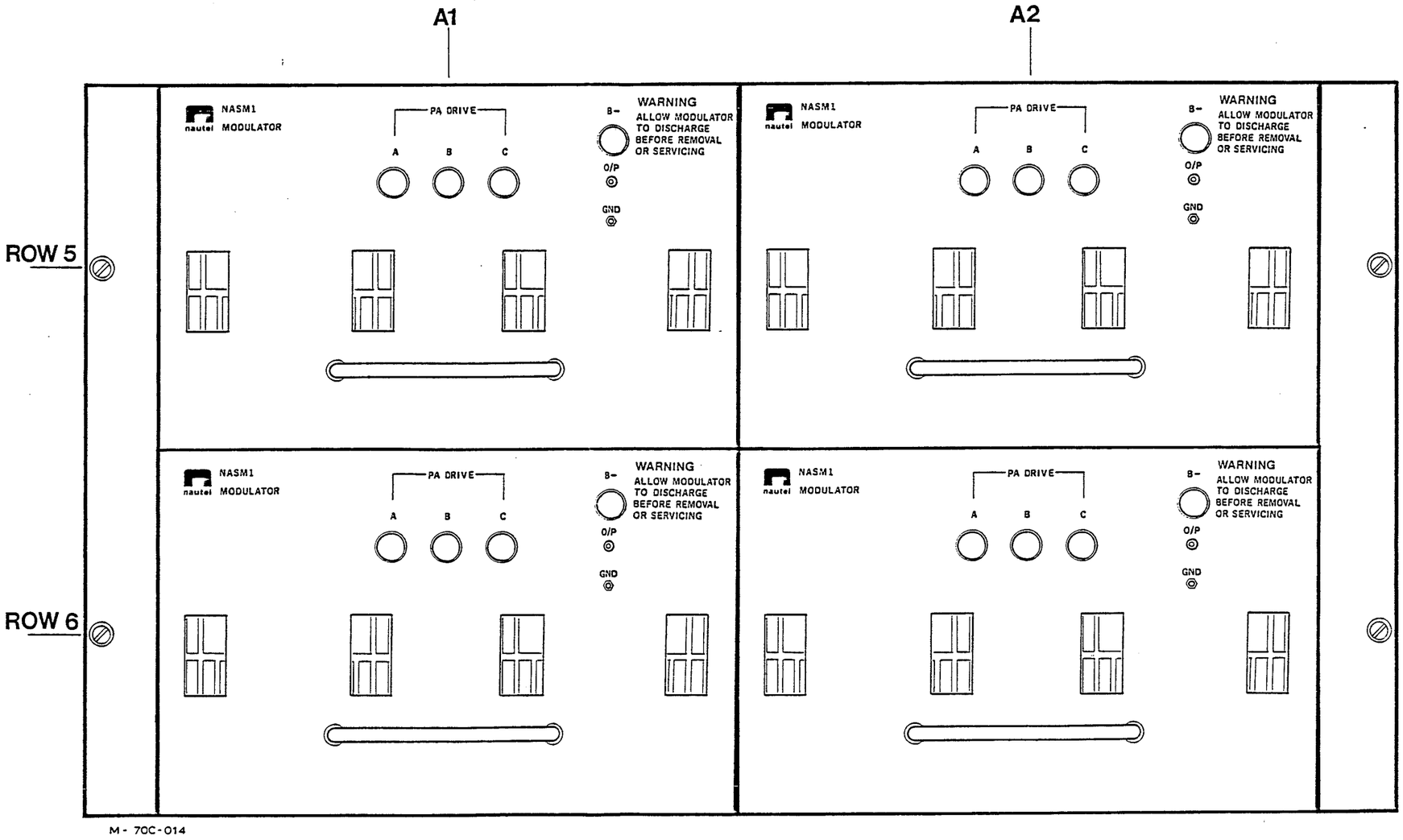
RF Drive Tuning Assembly (P/N 139-6000)





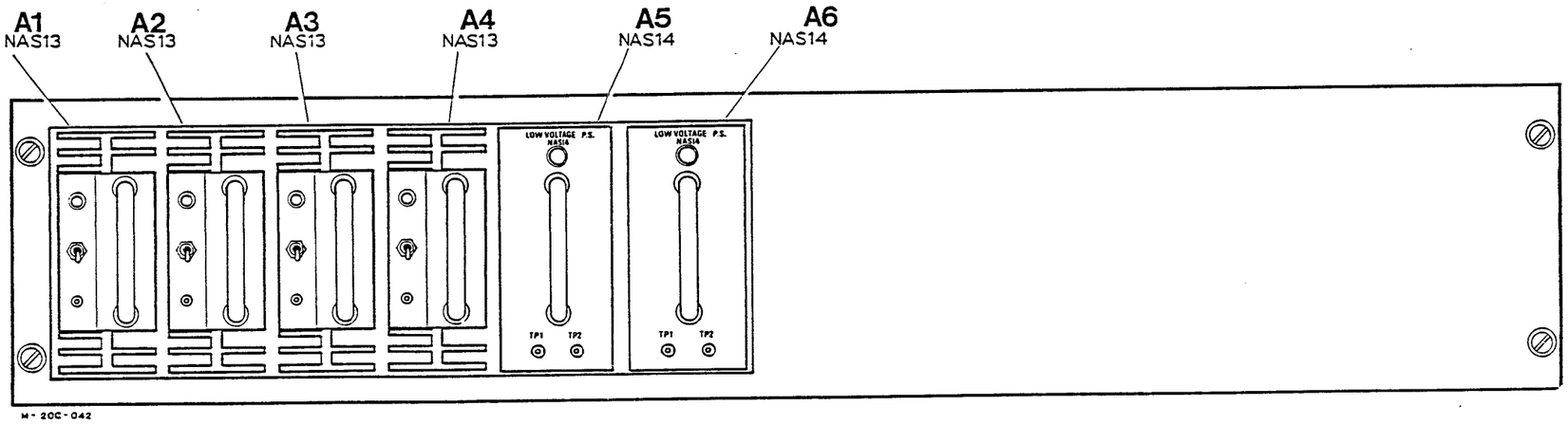
5 kW Inductor Assembly (P/N 139-6021)

Figure FO-26 Assembly Detail - RF Drive Tuning and 5000 Watt Inductor Assemblies



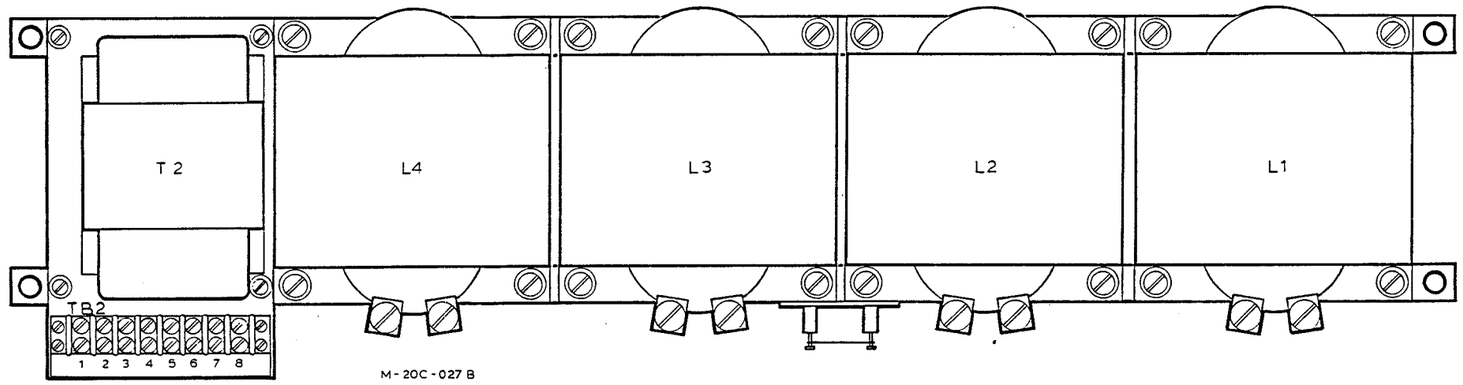
NOTE: Prefix Modulator's 'A' number with its 'row' number to obtain complete reference designation.

Figure FO-27 Assembly Detail - Rows 5 and 6 (Location of Modulators)



NOTE: Prefix 'A' numbers with '7' to obtain reference designation.

Figure FO-28 Assembly Detail - Row 7 (Location of Low Voltage Power Supplies)



5 kW Diode Assembly

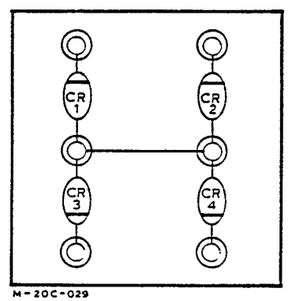


Figure FO-29 Assembly Detail - 5000 Watt Choke Assembly, Top View

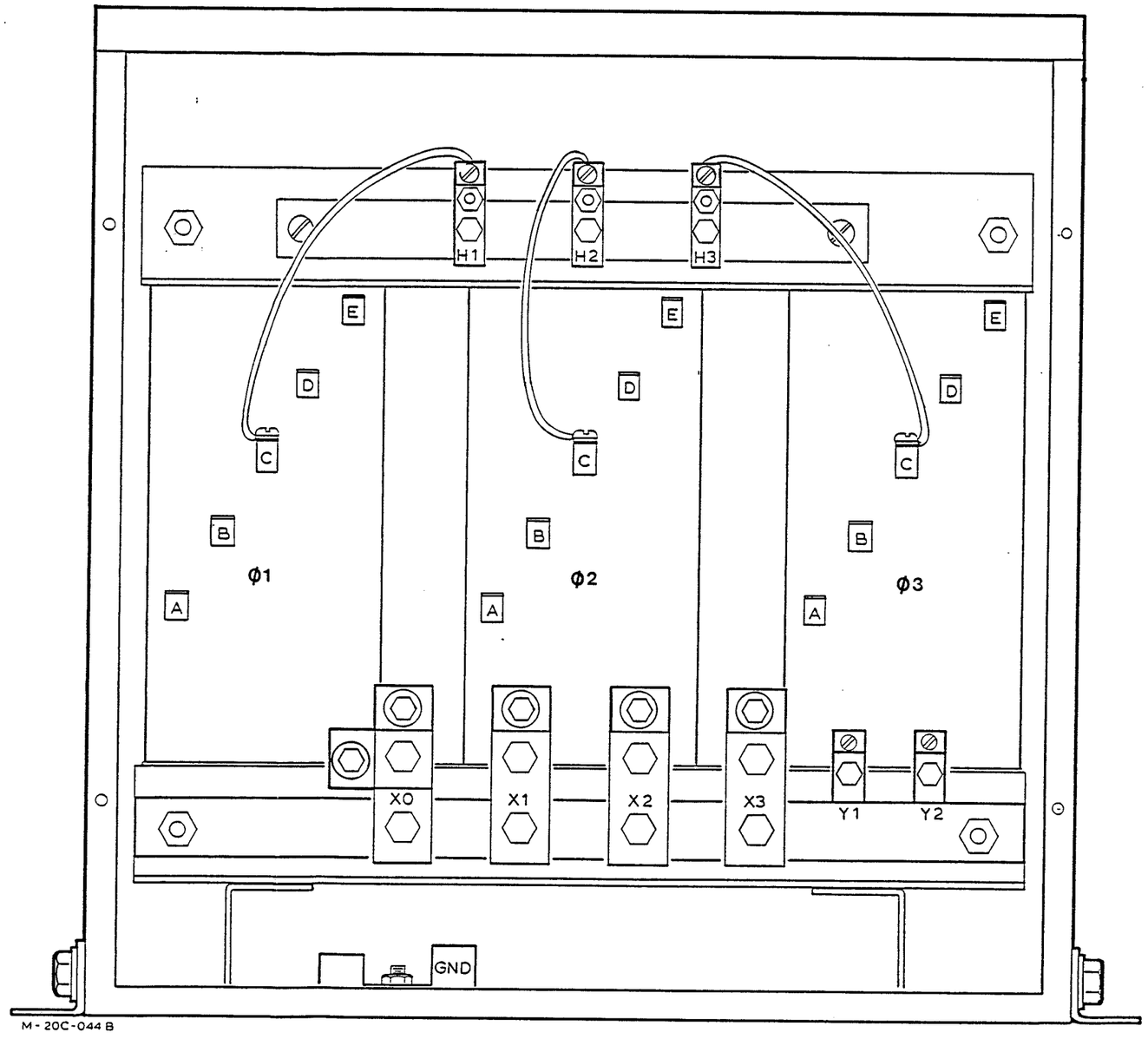
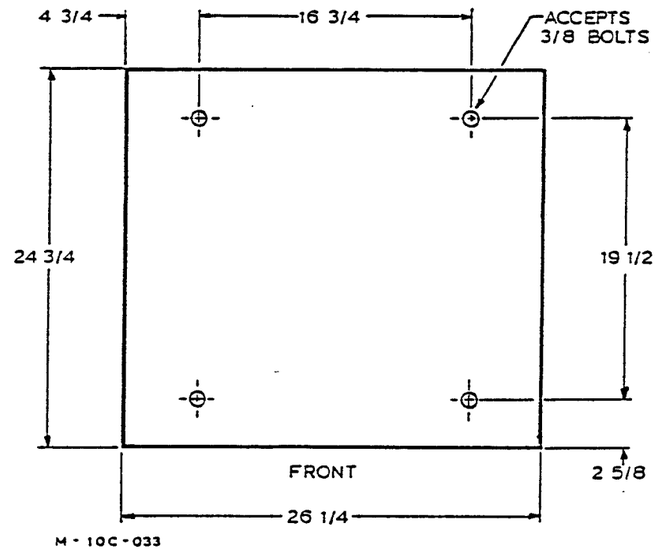
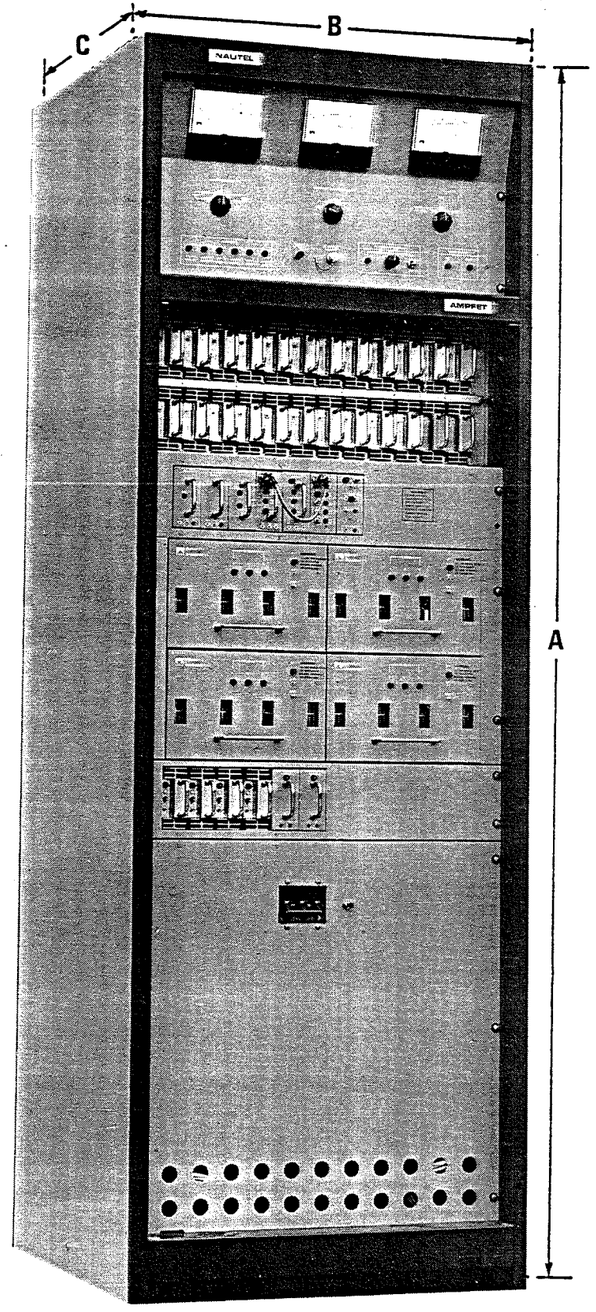


Figure FO-30 Assembly Detail - Ac Power Transformer



Anchor Bolt Hole Locations
(Cabinet Base)



A = 198 cm (78 inches)

B = 66 cm (26 inches)

C = 63.5 cm (25 inches)

Figure FO-31 AMPFET 5 Transmitter Cabinet Dimensions