TECHNICAL INSTRUCTIONS

NA100

AM BROADCAST TRANSMITTER
100 000 WATT

(THREE PRESET RF POWER LEVELS)

MONAURAL
(AM STEREO CAPABLE)

Original Issue ....01 April 1999

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ISO 9002 REGISTERED

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ISO 9001 REGISTERED

nautel
Simply the best engineered transmitters

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Original ....01 April 1999

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ARTIFICIAL RESPIRATION (MOUTH-TO-MOUTH)

(a) **START MOUTH-TO-MOUTH BREATHING IMMEDIATELY. SECONDS COUNT.** Do not wait to loosen clothing, warm the casualty, or apply stimulants.

(b) **ASSESS RESPONSIVENESS OF CASUALTY**. Do not jar casualty or cause further physical injury (**Figure 1)**

(c) **IF POSSIBLE, SEND A BYSTANDER TO GET MEDICAL HELP.** Do not leave casualty unattended (**Figure 2)**

(d) **CHECK CAROTID PULSE (Figure 3)**

(e) **LAY CASUALTY ON HIS/HER BACK** and place any available jacket or blanket under his/her shoulders.

(f) **TILT THE HEAD BACK AND LIFT THE CHIN** to open the airway (**Figure 4)**

(g) **PINCH CASUALTY'S NOSE AND EXHALE TWO SLOW BREATHS INTO CASUALTY (Figure 5)**

(h) **REMOVE YOUR MOUTH** and check for breathing **(Figure 6)**

(i) **CONTINUE GIVING ONE BREATH EVERY FIVE SECONDS** without interruption. If any air is retained in the stomach after exhalation by casualty, press gently on stomach to expel air.

(j) **IF CHEST DOES NOT RISE CHECK** for obstruction in casualty's mouth: clear foreign material using your finger, tissues, etc. Use chin lift and recommence mouth-to-mouth breathing.

(k) **WHILE MOUTH-TO-MOUTH BREATHING IS CONTINUED** have someone else:
- (a) Loosen casualty's clothing.
- (b) Keep the casualty warm.

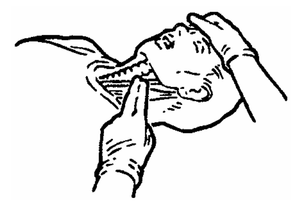
(l) **DON'T GIVE UP.** Continue without interruption until the casualty is revived, or until a doctor pronounces the casualty dead. Four hours or more may be required.

(m) **DO NOT PROVIDE ANYTHING ORALLY** while victim is unconscious.

1

2

3



4

5

6

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 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 that will flow through a victim's body. Very little current (as little as 10 milliamps) can result in severe shock or death.

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. Turn **OFF** the electrical source.
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 current 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.

TOXIC HAZARD WARNING

There are devices used in this equipment containing **BERYLLIUM OXIDE** ceramic, which is non-hazardous during normal device operation and under normal device failure conditions. These devices are specifically identified in the equipment manual's parts list(s).

DO NOT cut, crush or grind devices because the resulting dust may be **HAZARDOUS IF INHALED**. Unserviceable devices should be disposed of as harmful waste.

WARRANTY

Nautel 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.

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 sub-assembly which cannot be readily repaired in the field, the entire sub-assembly so damaged may be returned to Nautel for repair. The repairs will be made without charge to the Customer.

4. Where 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. Warranty replacement parts and repair, which are provided under items 2 or 3, shall be guaranteed for a period of ninety days from date of shipment or until the end of the original warranty period, whichever occurs later.

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

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

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

9. When requesting a warranty repair/replacement, please provide complete and accurate information. Observe the instructions regarding 'Equipment Being Returned to Nautel' on page two of this warranty and provide the information requested.

10. When ordering spare/replacement parts; please provide complete and accurate information. Refer to the parts list of this manual for ordering information. Provide as much of the information requested for 'Equipment Being Returned to Nautel' on page two of this warranty as is practical. The information identified by an asterisk is the minimum required.

FACTORY SUPPORT

TECHNICAL ASSISTANCE

Nautel's field service department provides telephone technical assistance on a 24 hour, seven days a week basis. Requests by other media (facsimile or telex) will be responded to the next working day if received after Nautel's normal working hours. Contact the appropriate field service centre from the following:

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
All other customers use:	Nautel Limited 10089 Peggy's Cove Road Hackett's Cove, Nova Scotia, Canada B3Z 3J4	
	Telephone	902-823-3900 (24 hours)
	Facsimile	902-823-3183
	E-Mail	nautel@fox.nstn.ca

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.

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 service instruction manual for additional ordering information.

The following information should accompany each request:

* Model of Equipment
* Serial number of Equipment
* 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

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SECTION 1
GENERAL INFORMATION

INTRODUCTION

1.1 The NA100 AM broadcast transmitter system is a totally solid state, medium wave, amplitude modulated, frequency agile broadcast transmitter system. The transmitter can easily be configured to operate at any frequency in the AM broadcast frequency band, into a nominal 50 ohm, unbalanced, transmission line. Remote control interfacing is a standard feature.

PURPOSE AND SCOPE OF MANUAL

1.2 This *Technical Instruction Manual* provides the information required to install, operate and maintain the transmitter system. Detailed information for modules/assemblies, which are normally removed from the transmitter for servicing, is not included. *Service Instruction Manual* appendices provide information for trouble shooting and maintaining bench-repairable modules/ assemblies used in the transmitter. Nautel also provides a service facility for repair of these modules/assemblies. See Warranty (Page 1).

1.2.1 FAMILY TREE: The family tree for this transmitter is depicted in figure 8-1. It identifies the major assemblies and shows their hierarchical assembly relationship. It also identifies the reference designation assigned to each assembly and where their parts list is located.

PURPOSE OF EQUIPMENT

1.3 The NA100 - 100 000 watt AM broadcast transmitter system is intended to be used in conventional AM broadcasting stations. Remote control facilities are incorporated to allow unattended operation at a transmitter site, remotely located from station studios.

MECHANICAL DESCRIPTION

1.4 The NA100 transmitter system's modules/ assemblies are housed in three cabinets. Figures MD-1 thru MD-39 provide assembly detail and identify the location of all electrical parts. The mechanical drawings are presented in order of the reference designation assigned to their assemblies. Refer to the list of drawings in page 10-1 to locate a specific illustration.

NOTE

Some modules/assemblies 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/assembly 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.

TECHNICAL SUMMARY

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

SPECIAL TOOLS AND TEST EQUIPMENT

1.6 Table 1-3 lists the special tools required. Table 1-2 - Test Equipment, lists the test equipment that is required to operate and maintain the NA100 transmitter system.

GLOSSARY OF TERMS

1.7 Table 1-4 - Glossary of Terms, provides a list of all unique terms, abbreviations and acronyms used in this publication.

Table 1-1 Technical Summary

Nautel Model Number	NA100
Configuration	
(1)	Sixteen RF power modules (two groups of eight)
RF Output Power	
(1)	Rated - 100 000 watts
(2)	Operating Range - 20 000 to 100 000 watts
(3)	Three preset levels, selected locally or remotely
RF Frequency Range (quickly field tuned to any frequency in the band)	531kHz to 1620kHz
RF Terminating Impedance	50 ohms, unbalanced
Audio Frequency Response	30Hz to 10,000Hz, +0.2dB, -0.8dB
Audio Frequency Distortion	Better than 1% (THD) at 95% modulation 30-10,000Hz Reduced antenna bandwidth may degrade specification
Audio Intermodulation Distortion	
(1)	1.0% or less, 60/7000Hz 1:1 ratio
(2)	1.0% or less, 60/7000Hz 4:1 ratio
(3)	SMPTE Standards at 85% modulation
Modulation Capability	140% positive peak modulation with 100% maximum average program modulation
Carrier Shift	0.5% or less
RF Harmonics	-80dB relative to carrier
Spurious Outputs	-80dB relative to carrier
Noise and Hum	65dB or more below 100% modulation Typically 70dB below 100% modulation
Frequency Stability	±4Hz over temperature range
Audio Input (600 ohms active balanced)	(adjustable from 0dBm to +12dBm) +10dBm nominal
Power Input	360-500V 50/60Hz three phase (customer specified)
Permissible Power Supply Variations	±10% voltage, ±5% frequency
Power Consumption	
0% modulation	Less Than 120.5kW
100% modulation	Less Than 180.7kW
Overall Efficiency	Better than 83% (85-88% typical) at 100kW
Metering	
(1)	Forward/reflected output power
(2)	DC input current/DC voltages

Table 1-1 Technical Summary (Continued)

Remote Control
(1) .... RF ON/OFF
(2) .... Selection of Exciter A or B Automatic Changeover
(3) .... Power Level Selection (HI, MED or LOW)
(4) .... Power Adjust (full range 0.1% resolution)
(5) .... Alarm Recall
(6) .... System Reset
(7) .... RF Inhibit

Remote Monitoring
(1) .... Forward Power level
(2) .... Reflected Power level
(3) .... RF Amplifier voltage
(4) .... Power Amplifier voltage
(5) .... B+ voltage
(6) .... RF ON/OFF status
(7) .... Exciter A or B status
(8) .... Power Level (HI/MED/LOW) status
(9) .... Remote/Local status
(10) .... RF Inhibit alarm
(11) .... Standby alarm
(12) .... Modulator Protection alarm
(13) .... External Interlock alarm
(14) .... Battery alarm
(15) .... Power Module alarm
(16) .... Transmitter Fault alarm
(17) .... Transmitter Interlock alarm
(18) .... Ac Line Phase alarm
(19) .... Power Supply Temperature alarm
(20) .... Power Supply alarm
(21) .... Power Supply Fans alarm
(22) .... Filter Temperature alarm
(23) .... Cutback alarm
(24) .... Filter alarm
(25) .... Reflected Power alarm

Environmental Limits
Temperature .... 0° - 50°C
(derate 3°C per 500m/2°C per 1000 ft above sea level)
Relative Humidity .... 0 - 95%
Altitude .... 0 - 13,000 feet (0 - 4000m)

Transmitter Dimensions
Height .... 73.5 inches (186.0 cm)
Width .... 148.0 inches (376 cm)
Depth .... 48.0 inches (122.0 cm)

Transmitter Weight

NOTE: Technical specifications established at 100 kW RF output power into a 50 ohm load.

Table 1-2 Test Equipment

NOMENCLATURE	PART, MODEL, OR TYPE NUMBER (EQUIVALENTS MAY BE USED)	APPLICATION
Dummy Load	50 ohms, 175 000 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 10MHz Fluke Model 1900A	measure carrier frequency
Oscilloscope	Tektronix Model T922	testing and maintenance
Modulation Monitor	50-ohm input impedance, -100% to +125% mod depth TFT Model 375	to set up audio level
Audio Signal Generator	10Hz to 10MHz, 600 ohms, 0 to +15dBm Hewlett Packard model 651B	simulates modulating audio input during testing and maintenance
Distortion Analyzer	20Hz to 20kHz Marconi Model TF231	measures audio distortion during testing and maintenance

Table 1-3 Special Tools

NOMENCLATURE	PART, MODEL, OR TYPE NUMBER (EQUIVALENTS MAY BE USED)	APPLICATION
Torque Wrench	Capable of torquing to five inch-pounds (0.565 Newton-Meters)	Installing power MOSFETS

Table 1-4 Glossary of Terms

TERM	DESCRIPTION
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.
PDM	Pulse duration modulation.
PWM	Pulse width modulation.

SECTION 2
INSTALLATION

PLANNING AND SITE PREPARATION

2.1 Transmitter sites for Nautel's NA100 - 100 000 watt AM broadcast transmitters should be prepared to receive the transmitter prior to its delivery and/or installation. The following must be taken into consideration when preparing new sites. They should be used as the evaluating criteria at existing sites. It is recommended that all requirements be incorporated to ensure optimum reliability and performance is obtained.

NOTE

Frequent reference is made to terminal boards on the remote interface PWB, which is located on the rear of the control/monitor panel. Refer to figure MD-5 as an aid in locating the remote interface PWB and then, if necessary, to figure MD-8 for its assembly detail.

2.1.1 TRANSMITTER ROOM REQUIREMENTS: The following transmitter room requirements must be addressed when the transmitter site is being finalized.

2.1.1.1 Transmitter Dimensions: Refer to figures MD-38 and MD-39 for dimensional information. These dimensions identify floor space requirements and will assist in determining cable lengths and routing.

2.1.1.2 Transmitter Clearances: It is recommended a clearance of at least four feet (1.3 meters) be maintained on all sides of the transmitter.

2.1.1.3 Air Flushing (see figure MD-39): Forced air ducting should be used to circulate cooling air. Air intake vents are provided at the top rear of the transmitter cabinets. The exhaust air is vented through air exhaust vents located at the top front of the transmitter cabinets. The cooling air must be filtered before entering the transmitter's air intake vents. A room/ventilation duct air exchange rate of 6000 CFM (10 200 m^3/hr) should achieve an acceptable intake/exhaust temperature rise. The transmitter can accept a maximum back pressure of 0.05 inches of water (12.5 Pa) total.

2.1.1.3.1 An optional method of drawing air into the transmitter, is to use its internal cooling fans as the motive power. When this option is requested; the rear, lower panels of the RF power module cabinet and the air intake ducts on the top of the transmitter are replaced with filter panels. The Internal fans will pull cooling air from the transmitter room through these filtered openings. The exhaust air should be ducted but must not have an air flow resistance that will create a back pressure exceeding 0.05 inches of water (12.5 Pa). This optional air flushing method is available only upon customer request.

2.1.1.3.2 Refer to figure MD-39 for the air intake/ exhaust vents provided. Note when the optional air flushing method is ordered, the transmitter's rear blocker panels will be removed and replaced by air filters.

2.1.1.4 Cooling: The transmitter room's ambient air temperature must not exceed 50°C. For air conditioning requirements, it can be assumed that 85% of the power being consumed, from the AC power source, is applied to the antenna system as the RF output and 15% is converted to waste heat.

NOTE

A simple method of determining waste heat being generated is to determine the average RF output power, and multiply this average RF output power (in watts) by 0.1765.

As an example: At 100 000 watts carrier power with 50% modulation, average power output is 112 500 watts. This represents an average long term output power based on typical processed program material. At 85% overall efficiency, waste heat generated is 19 856 watts.

2.1.1.5 Heating: The transmitter room must contain a heating system that will ensure its ambient air temperature does not go below 0°C.

2.1.1.6 Work Area: It is recommended that a suitable work area with an adequate table surface be provided adjacent to the transmitter to permit bench adjustment/repair of modules.

2.1.2 LIGHTNING PROTECTION: Extremely high voltage/current transients are produced when a lightning strike occurs. These transients, which are probably the most significant hazard to any solid state transmitter, may be passed to the transmitter through the wiring connecting it to its power source and its antenna system. It is imperative that all practical precautions be taken to protect the transmitter from this phenomenon. Refer to Nautel's ***Lightning Protection for Radio Transmitter Stations*** booklet for recommendations and for specific protection techniques. The following requirements are considered to be essential.

2.1.2.1 Station Reference Ground: The site must contain a station reference ground as defined in Nautel's ***Lightning Protection for Radio Transmitter Stations*** booklet. This ground must provide a continuous, low impedance path to the earth. The transmitter cabinet's designated reference ground point, the shield of the coaxial feed cable and the ground connection of the power source's surge protection devices must be connected directly to the station reference ground.

2.1.2.2 AC Power Source: All conductors from the AC power source should be protected by bi-directional surge protection devices that are connected between each conductor and the lightning/safety ground. A surge protector panel, that contains suitably rated varistors is available from Nautel for this purpose. In addition, the conductors should pass, as a group, through a ferrite toroid. The inductance formed by this toroid will be transparent to the AC voltages, but will present an impedance to transients originating in the power source. If used, the surge protector panel should be installed in close proximity to the station reference ground.

NOTE

The AC power source usually presents the lowest impedance path to ground potential for a lightning strike and will normally carry most of the lightning induced current away from the transmitter site.

When lightning hits the power source, a significant amount of induced current may flow towards the transmitter. In this instance, the objective is to route the current around the transmitter, instead of through it, to the best ground available.

2.1.2.3 Antenna Feed Cable: The shield of the antenna feed's coaxial cable should be connected directly to the station reference ground, where it enters the building. In addition, if practical, the centre conductor and the shield of the feed cable should pass through a ferrite toroid which is positioned between the shield ground, at the building entrance and the shield termination at the transmitter. This toroid will be transparent to the RF signal, but will present an impedance to transients originating in the antenna.

2.1.2.4 Antenna/RF Output Disconnect: A switching circuit that disconnects the antenna from the transmitter's RF output when the transmitter is turned off should be incorporated into the RF feed/ antenna design. This switching circuit will prevent lightning induced transients from entering the transmitter when its solid state devices are most susceptible to electrostatic failure.

2.1.2.5 Antenna Tower: The antenna tower is the most likely target for lightning strikes. It is imperative that it contain lightning protection devices, such as air-gap spark balls as the first line of defense against lightning strikes.

2.1.2.6 External Control/Monitor Wiring: All external/control wiring, that may be subjected to lightning induced transients, should be interfaced to the station reference ground by surge protection devices, where they enter the building. In addition, all conductors and their shields should pass through a ferrite toroid which is positioned between its surge protection device and the transmitter. This toroid will be transparent to control/monitor signals, but will present an impedance to lightning induced transients.

2.1.3 ELECTRICAL POWER: The transmitter is configured during manufacture to operate from one of a variety of 50/60Hz AC power sources. The option selected is specified by the purchaser. The preferred option is a three-phase, four-wire, wye connected, AC power source meeting all of the following requirements:

2.1.3.1 Nominal Voltage: The primary winding of the main AC power transformer contains taps to accommodate voltages that differ from the ideal voltage of the power source. These taps represent five percent increments and are selected during installation to provide the optimum nominal voltage for the transmitter.

2.1.3.2 Voltage Stability: The AC power source's nominal voltage must be stable to within plus or minus five percent under all loading conditions. The transmitter contains circuitry that maintains the RF output at the preset carrier level for voltage variations within this range.

2.1.3.3 Power Consumption: When a transmitter is operating at 100 000 watts with 70% modulation by a continuous sine wave, power consumption is 146.47 kilowatts. When operating at 100 000 watts and no modulation, power consumption is 117.65 kilowatts. Actual power consumption for a specific station will depend on the programming format and the level of audio processing. It is recommended that the AC power source have a twenty-five percent over-capacity to ensure adequate regulation.

2.1.3.4 External AC Switching: An AC input interlock switch is provided as the master on/off circuit between the AC power source and the transmitter. It is also part of a key controlled safety interlock system. It contains the master key which is not removable when the interlock switch is on (AC power is applied to the transmitter). Once the master key has been removed, the interlock switch cannot be set to its on position, ensuring AC power cannot be inadvertently applied to the transmitter. The AC input interlock switch should be located in close proximity to the transmitter.

2.1.4 ANTENNA SYSTEM: It is recommended that the antenna system meets (as a minimum) the standards specified in EIA Standard TR-101-A, paragraph 8(b) with a normal impedance of 50 ±j0 ohms at the carrier frequency. The transmitter will function while operating into a maximum VSWR of 1.5:1, or with sideband VSWR's of up to 2:1 when the carrier frequency impedance is 50 ±j0 ohms, but overall system performance will be degraded.

2.1.4.1 RF Feed Cable: The feed cable interconnecting the transmitter and the antenna system should be a suitably rated coaxial cable. Unless otherwise specified in contract documents, the transmitter's RF output device will accept a 6 1/8 inch EIA flange connector. The RF feed cable's transmitter end must be terminated by an appropriate mating connector.

2.1.5 EXTERNAL RF DRIVE SOURCE: There is provision for an external RF drive input, which can be used in place of the internal RF drive. The external RF generator must provide:

- Carrier frequency of ±5Hz or five parts per million (ppm) whichever is greater, when it is not being modulated.

- RF drive level of between 1.0 and 5.0 volts RMS (sine wave or square wave).

- 50-ohm impedance at the carrier frequency.

NOTE

If both exciters (A and B) are configured for an external RF drive, it is recommended the RF drive signal source be duplicated (main and standby). An automatic changeover circuit should be incorporated to activate and select the standby (reserve) source when the main source fails.

2.1.6 MODULATING AUDIO: Modulating audio must be applied from an external source. The transmitter does not have any audio processing capability, therefore, processing must be completed before the audio is applied, noting the audio may be processed to provide a higher percentage of positive modulation than negative modulation. Electrical inter-connection should be made using suitably rated twisted shielded pair(s) of conductors. The audio wiring is connected to TB1 on the remote interface PWB.

- Balanced 600 ohms.

- Output level between 0dBm and +12dBm (factory set to 10dBm) for 100% modulation.

2.1.7 SAFETY INTERLOCKS: There are three types of safety interlocks, one mechanical and two electrical. The mechanical interlock is a key controlled system that prevents opening of panels that provide access to areas with high voltages when AC power is being applied. One of the electrical interlocks is an external circuit that inhibits the RF output if any of its serially connected switches is opened. The second electrical interlock is an internal circuit that prevents the RF output from being enabled if a ground wand has not been returned to its retaining clips after use.

2.1.7.1 External Electrical Interlock: The external electrical interlock circuit is connected between TB1-6 (**UNREG +24V**) and TB1-4 (**EXT INTLK**) of the remote interface PWB. When it is safe to produce an RF output, the circuit must be intact and apply +24 VDC to TB1-4 (**EXT INTLK**). When it is not safe to produce an RF output (one or more of the external interlock switches have been activated), the circuit must provide an open circuit to TB1-4 (**EXT INTLK**). Any number of serial interlock switches may be installed, provided +24vdc is removed from TB1-4 if any interlock switch is activated.

NOTE

If external wiring is lengthy, unwanted transients may be induced on the 24 VDC source. If this occurs, a user supplied relay, with its energized/de-energized state controlled by the external interlock switches, should be installed in close proximity to the remote interface PWB. It should be connected as a fail-safe relay (energized when the interlock circuit is intact, de-energized when it is opened) with its normally open contacts interconnecting TB1-4 and TB1-6.

2.1.7.2 Internal Electrical Interlock: The internal electrical interlock is a protection circuit that prevents the RF output from being enabled when a ground wand is not properly stored in its retaining clips.

2.1.7.3 Mechanical Safety Interlock: The mechanical safety interlock system consists of locked panels in areas of the transmitter that contain or may be subjected to life threatening voltages. A key control system ensures a panel cannot be unlocked unless the AC power has been turned off and the antenna feed cable has been grounded. Conversely, it ensures AC power cannot be turned on unless all of the panels are closed and locked, their keys have been returned to a key transfer case and the ground has been removed from the antenna feed cable.

2.1.8 REMOTE CONTROL CIRCUITS: The on/off status, active (A/B) exciter, preset RF power level, power level adjustment, alarm recall and system reset can be controlled from a remote location, by switching circuits that comply with the following:

NOTE

External control circuits are interfaced to the transmitter circuits through opto couplers on the remote interface PWB. The opto couplers effectively buffer/isolate the external circuits and prevent any unwanted transients from affecting transmitter operation. They only have influence when **REMOTE** *control is selected at the transmitter.*

The remote interface PWB contains selection circuits that allow the user to select an internal or external DC power supply as the current source for the opto coupler associated with each controlled function. It also contains circuits that allow the user to choose positive logic (active state is +24 VDC) or negative logic (active state is a current-sink-to-ground) when the internal +24 VDC is the current source.

The switching circuit for each controlled function must be the equivalent of a normally open/held closed, spring-loaded (momentary) switch that has been configured as depicted in one of the three DC voltage source/logic level examples. Each function has positive and negative input terminals, on the remote interface PWB, to accommodate the selected input logic.

Internal VDC/Positive Logic: When transmitter's unregulated, +24 VDC is to be used as the current source for a control function's opto coupler and the control function's external switching circuit applies this voltage to the function's positive (+) input terminal, as its active (true) condition; the external switching circuit and remote interface PWB's remote selection circuitry must be configured as depicted in figure 2-1.

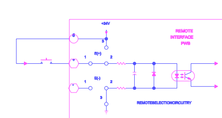


Figure 2-1 Internal VDC/Positive Logic Selected

Internal Vdc/Negative Logic: When the transmitter's internal, unregulated, +24 VDC is to be used as the current source for a control function's opto coupler and the control function's external switching circuit applies a current sink from the transmitter's ground to the function's negative (-) input terminal, as its active (true) condition; the external switching circuit and remote interface pwb's remote selection circuitry must be configured as depicted in figure 2-2.

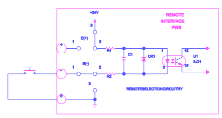


Figure 2-2 Internal Vdc/Negative Logic Selected

External Vdc/Negative or Positive Logic: When an external DC power supply (12 to 30 vdc) is to be used as the current source for a control function's opto coupler, the control function's external switching circuit and the remote interface pwb's remote selection circuitry must be configured as depicted in figure 2-3. The normally open/held closed switch may be located between the negative output of the DC power supply and the function's negative (-) input terminal or between the positive output of the DC power supply and the function's positive (+) input terminal.

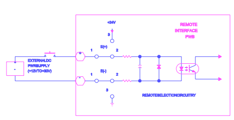


Figure 2-3 External Vdc/Either Logic Selected

2.1.8.1 On/Off Control: The remote on/off circuitry controls the on/off status of the RF power stage. It comprises an ***on*** circuit and an ***off*** circuit. Each must be configured as one of the three DC voltage source/logic level examples depicted in figures 2-1, 2-2 or 2-3. The ***on*** circuit connects to the RF **ON** terminals which are TB2-11(+) and TB2-12(-), the ***off*** circuit connects to the RF **OFF** terminals which are TB2-13(+) and TB2-14(-).

2.1.8.2 Preset Power Level Selection: The power level selection circuit selects one of three preset RF output power levels. It comprises three switching circuits (***high***, ***medium*** and ***low***). Each must be configured as one of the three DC voltage source/logic level examples depicted in figures 2-1, 2-2 or 2-3. The ***high*** circuit connects to the **HIGH** terminals which are TB2-5(+) and TB2-6(-), the ***medium*** circuit connects to the **MEDIUM** terminals which are TB2-7(+) and TB2-8(-) and the ***low*** circuit connects to the **LOW** terminals which are TB2-9(+) and TB2-10(-).

2.1.8.3 Power Level Adjust Select: The power level adjust circuit controls a dynamic circuit that slews the RF output level in an increasing or decreasing direction as long as the appropriate input is active. It comprises an ***increase*** and a ***decrease*** circuit. Each must be configured as one of the three DC voltage source/logic level examples depicted in figures 2-1, 2-2 or 2-3. The ***increase*** circuit connects to the **UP** terminals which are TB2-1(+) and TB2-2(-). The ***decrease*** circuit connects to the **DOWN** terminals which are TB2-3(+) and TB2-4(-).

2.1.8.4 Main Exciter Selection: The main exciter selection circuit selects which exciter will be enabled as the main exciter. It comprises an ***A*** and a ***B*** circuit. Each must be configured as one of three DC voltage source/logic level examples depicted in figures 2-1, 2-2 or 2-3. The ***A*** circuit connects to the **EXCITER A** terminals which are TB2-15(+) and TB2-16(-). The ***B*** circuit connects to the **EXCITER B** terminals which are TB2-17(+) and TB2-18(-).

2.1.8.5 Alarm Recall: The ***alarm recall*** circuit allows the user to reinstate an active remote alarm condition for any alarm(s) that caused the last RF shutback and is not currently being displayed or affecting the RF output. It must be configured as one of three DC voltage source/logic level examples depicted in figures 2-1, 2-2 or 2-3. The ***alarm recall*** circuit connects to the **ALARM RECALL** terminals which are TB2-19(+) and TB2-20(-).

2.1.8.6 System Alarm Reset: The remote system reset circuit resets all latched protection circuits. It must be configured as one of three DC voltage source/logic level examples depicted in figures 2-1, 2-2 or 2-3. The ***system reset*** circuit connects to the **SYSTEM RESET** terminals which are TB2-21(+) and TB2-22(-).

2.1.9 OTHER REMOTE CONTROLS: An RF inhibit control can be connected, at the user's discretion. This input will influence the transmitter's RF output regardless of the selected control location (**LOCAL** or **REMOTE**).

2.1.9.1 RF Inhibit Control: The external RF inhibit circuit causes the RF output to be inhibited (turned off) the instant an active condition is applied and maintains this state as long as the active condition exists. It must be configured as one of three DC voltage source/logic level examples depicted in figures 2-1, 2-2 or 2-3. The RF ***inhibit*** circuit connects to the RF **INHIBIT** terminals which are TB2-23(+) and TB2-24(-).

NOTE

The external RF inhibit input is intended to be used in conjunction with antenna switching circuitry, to ensure RF output current is not flowing during opening/closing of contacts in the transmitter's RF output feed cable. An active 'RF inhibit' condition must be applied prior to contact opening (disconnecting the RF load) and must be maintained until contact closure has occurred and an appropriate impedance has been connected to the transmitter's RF output. The RF output will be instantly restored to its original level when the active condition is removed.

2.1.10 RF PERFORMANCE MONITORING: The transmitter provides outputs to monitor RF performance. They include DC voltages which are representative of the forward power level, the reflected power level, the B+ DC voltage, RF drive amplifier's DC voltage and the voltage being applied to the RF amplifiers. In addition a true RF sample of the RF output's voltage waveform is available for external monitoring. These outputs are available on the remote interface PWB

2.1.10.1 RF Monitor Sample: A true sample of the RF output's voltage waveform, including its modulation envelope, is provided at a BNC connector (**EXT RF MONITOR**) on the remote interface pwb. The RF *monitor* output is intended to be applied to a station modulation monitor with a 50-ohm input impedance. It may also be monitored by an oscilloscope during maintenance procedures. The RF *monitor* output can be set to provide 5.0 volts RMS for each preset power level, provided they are preset to a level which is between 25 000 and 100 000 watts.

2.1.10.2 Forward Power Level: A buffered DC voltage that is representative of the forward power level is available on TB1-10 (**BFRD FWD PWR**) [TB1-9 (**GND**) is the return path]. This voltage is a non-linear (square law) function and will be 5.0 ± 1.0 VDC when the forward power is 100 kW.

2.1.10.3 Reflected Power Level: A buffered DC voltage that is representative of the reflected power level is available on TB1-8 (**BFRD REFLD PWR**) [TB1-7 (**GND**) is the return path]. This voltage is a non-linear (square law) function and will be 3.7 ± 0.5 VDC when the reflected power is 10 kW.

2.1.10.4 High Voltage B+ Volts: A buffered DC voltage that is directly proportional to the output of the B+ DC power supply is available on TB1-14 (**BFRD B+ V**). [TB1-13 (**GND**) is the return path]. This voltage will be 3.0 ± 0.5 VDC when B+ V is 312 vdc.

2.1.10.5 Power Amp Volts: A buffered DC voltage that is directly proportional to the DC voltage being applied to the RF amplifiers in the RF power modules is available on TB1-12 (**BFRD PA V**) [TB1-13 (**GND**) is the return path]. This voltage will be 2.5 ± 0.5 VDC when the DC voltage being applied to the RF amplifiers is 129 vdc.

2.1.10.6 RF Amp Volts: A buffered DC voltage that is directly proportional to the DC voltage being applied to the RF drive amplifier is available on TB1-11 (**BFRD RF AMP V**) [TB1-13 (**GND**) is the return path]. This voltage will be 3.25 ± 0.5 VDC when the DC voltage being applied to the RF drive amplifier is 65 VDC.

2.1.11 REMOTE ALARM INDICATIONS: Outputs that indicate stress thresholds for critical parameters have been exceeded are available, for external monitoring, on terminals of the remote interface PWB (see figure MD-8). Each alarm output contains a switching transistor that provides a negative logic output (a current-sink-to-ground when an alarm condition exists and an open collector during non-alarm periods). Each monitoring circuit must present an impedance, between the switching transistor and a positive DC voltage source (must not exceed +24 VDC), that will result in not more than 40 milliamperes flowing through the transistor when it is turned on.

If desired, +24 VDC is available for use by the remote monitoring circuits from TB1-6 (**UNREG +24V**) of the remote interface PWB.

If an external DC power source is used, it must not exceed +24 VDC and its return must be connected to TB1-7 (**GND**) on the remote interface PWB.

2.1.11.1 RF Inhibit Alarm: An alarm output that indicates the RF output is being inhibited, because an active external RF inhibit command is being applied to the **RF INHIBIT** terminals (TB2-23 or TB2-24), is available on TB3-12 (**RF INHIBIT**). A negative logic output (current-sink-to-ground) will be present for an alarm condition.

2.1.11.2 Internal Interlock Alarm: An alarm output that indicates the RF output is being inhibited, because one or more of the transmitter's ground wands are not properly stored in their retaining clips, is available on TB3-17 (**XMTR INTLK**). A negative logic output (current-sink-to-ground) will be present for an alarm condition.

2.1.11.3 External Interlock Alarm: An alarm output that indicates the RF output is being inhibited, because one or more of the external interlock switches has been opened, is available on TB3-13 (**EXT INTLK**). A negative logic output (current-sink-to-ground) will be present for an alarm condition.

2.1.11.4 AC Line Phase Alarm: An alarm output that indicates one line of the 3-phase AC power source has been lost, is available on TB3-18 (**AC LINE PHASE**). A negative logic output (current-sink-to-ground) will be present for an alarm condition.

2.1.11.5 Power Supply Fault Alarm: An alarm output that indicates the RF output has been inhibited, because the output of the B+ DC power supply is not within 15% of its optimum voltage (over or under) or excessive current is flowing through it (over-current), is available on TB3-20 (**PS ALARM**). A negative logic output (current-sink-to-ground) will be present for an alarm condition.

2.1.11.6 Power Supply Temp Alarm: An alarm output that indicates the RF output has been inhibited, because the sensed temperature in the transformer/ rectifier portion of the AC/DC power supply cabinet has exceeded 85°C, is available on TB3-19 (**PS TEMP**). A negative logic output (current-sink-to-ground) will be present for an alarm condition.

2.1.11.7 Filter Fault Alarm: An alarm output that indicates the RF output has been inhibited, because the RF current flowing to the RF combiner\ output filter has exceeded the maximum stress current threshold for the RF amplifiers, is available on TB3-24 (**FILTER ALARM**). A negative logic output (current-sink-to-ground) will be present for an alarm condition.

2.1.11.8 Filter Temperature Alarm: Not Used.

2.1.11.9 Reflected Power Alarm: An alarm output that indicates the RF output reflected power has exceeded 10kW, is available on TB3-25 (**REFLD PWR**). A negative logic output (current-sink-to-ground) will be present for an alarm condition.

2.1.11.10 Cutback Alarm: An alarm output that indicates the RF output has been inhibited; because the RF output has been automatically reduced (cutback), in an attempt to overcome recurring alarms (more than three in any five second period) that caused momentary RF shutbacks; is available on TB3-23 (**CUTBACK**). A negative logic output (current-sink-to-ground) will be present for an alarm condition.

2.1.11.11 Transmitter Fault Alarm: An alarm output that indicates one or more of the other alarms is/has been active, is available on TB3-16 (**XMTR FAULT**). A negative logic output (current-sink-to-ground) will be present for an alarm condition.

2.1.11.12 Power Module Alarm: An alarm output that indicates the RF output has been reduced, because one or more power blocks in one or more RF power modules have been turned off and are not contributing to the RF output, is available on TB3-15 (**PWR MODULE**). A negative logic output (current-sink-to-ground) will be present for an alarm condition.

2.1.11.13 Power Supply Fan Alarm: An alarm output that indicates a fan (one or more) that cools the AC/DC power supply cabinet has failed, is available on TB3-21 (**PS FAN**). A negative logic output (current-sink-to-ground) will be present for an alarm condition.

2.1.11.14 Battery Low Alarm: An alarm output that indicates the charge status of the batteries on the remote interface PWB has decayed to less than 4.3 VDC and they should be replaced, is available on TB3-14 (**BATTERY**). A negative logic output (current-sink-to-ground) will be present for an alarm condition.

2.1.11.15 Standby Exciter Alarm: An alarm output that indicates an automatic exciter changeover has occurred and the reserve (standby) exciter has been enabled as the pulse duration modulation (PDM)/RF drive source, is available on TB3-2 (**STBY**). A negative logic output (current-sink-to-ground) will be present for an alarm condition.

2.1.11.16 Modulation Protection Alarm: An alarm output that indicates the modulating audio's positive peaks are being limited; because their amplitude and/or low frequency duration would require RF currents that exceed the RF amplifier's stress current threshold, is available on TB3-1 (**MOD PROTECT**). A negative logic output (current-sink-to-ground) will be present for an alarm condition.

2.1.12 REMOTE STATUS INDICATIONS: Outputs that indicate the status of operator controlled circuits are available on terminals of the remote interface PWB (see figure MD-8) for external monitoring. Each status output contains a switching transistor that provides a negative logic output (a current-sink-to-ground when the status condition is true and an open collector when the status condition is false). Each monitoring circuit must present an impedance, between the switching transistor and a positive DC voltage source (must not exceed +24 VDC), that will result in not more than 40 milliamperes flowing through the transistor when it is turned on.

If desired, +24 VDC is available for use by the status monitoring circuits from TB1-6 (**UNREG +24V**) of the remote interface PWB.

If an external DC power source is used, it must not exceed +24 VDC and its return must be connected to TB1-7 (**GND**) on the remote interface PWB.

2.1.12.1 Local/Remote Control Status: There are two control status outputs to indicate whether local or remote control has been selected by the transmitter's **CONTROL** circuit. Only one of these outputs can be active at a time:

The local control status output is available on TB3-10 (**LOCAL**). A negative logic output (current-sink-to-ground) will be present when local control has been selected.

The remote control status output is available on TB3-11 (**RMT**). A negative logic output (current-sink-to-ground) will be present when remote control has been selected.

2.1.12.2 RF On/Off Status: There are two RF status outputs to indicate whether the RF power stage is turned on or if it is turned off. Only one of these outputs can be active at a time:

The RF on status output is available on TB3-6 (**RF ON**). A negative logic output (current-sink-to-ground) will be present when the RF power stage is enabled (turned on).

The RF off status output is available on TB3-5 (**RF OFF**). A negative logic output (current-sink-to-ground) will be present when the RF power stage is not enabled (turned off).

2.1.12.3 Exciter Status: There are two exciter status outputs to indicate which exciter (A or B) is enabled and providing the PDM (pulse width modulation) and RF drive. Only one of these outputs can be active at a time:

The exciter A status output is available on TB3-4 (**EXCITER A**). A negative logic output (current-sink-to-ground) will be present when exciter A is enabled and is the active exciter.

The exciter B status output is available on TB3-3 (**EXCITER B**). A negative logic output (current-sink-to-ground) will be present when exciter B is enabled and is the active exciter.

2.1.12.4 Power Level Status: There are three power level status outputs to indicate which of the three preset RF power levels (high, medium or low) have been selected. Only one of these outputs can be active at a time:

The high preset RF power level status output is available on TB3-7 (**HIGH**). A negative logic output (current-sink-to-ground) will be present when it has been selected.

The medium preset RF power level status output is available on TB3-8 (**MEDIUM**). A negative logic output (current-sink-to-ground) will be present when it has been selected.

The low preset RF power level status output is available on TB3-9 (**LOW**). A negative logic output (current-sink-to-ground) will be present when it has been selected.

2.1.13 PARTS SUPPLIED BY NAUTEL: The following parts/materials are supplied by or are available from Nautel.

2.1.13.1 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 manual, as the extent of disassembly is determined by the method of shipment. Detailed packing lists will be included with each transmitter shipment.

2.1.13.2 Surge Protector Panel: A surge protector panel, that is rated for the AC power source to be applied to the transmitter, may be provided by Nautel. The surge protector panel will help protect the transmitter against lightning induced voltage transients on the AC power source

2.1.13.3 Ancillary Parts: An ancillary parts kit is included. These parts are provided to ensure 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. They are not intended to be long term maintenance spares. Detailed information about these parts is not included in this manual. The packing list for the ancillary parts kit itemizes its contents.

2.1.14 PARTS REQUIRED BUT NOT SUPPLIED BY NAUTEL: Some parts and materials required to complete an installation are not supplied with the transmitter or are not provided by Nautel. The user must supply these parts. Each installation will dictate the parts required, and will normally include the following:

- A suitable 50-ohm RF feed cable that has been cut to the appropriate length and terminated, at the transmitter end, by a 6 1/8 inch EIA flange connector complete with an inner male connector (bullet).

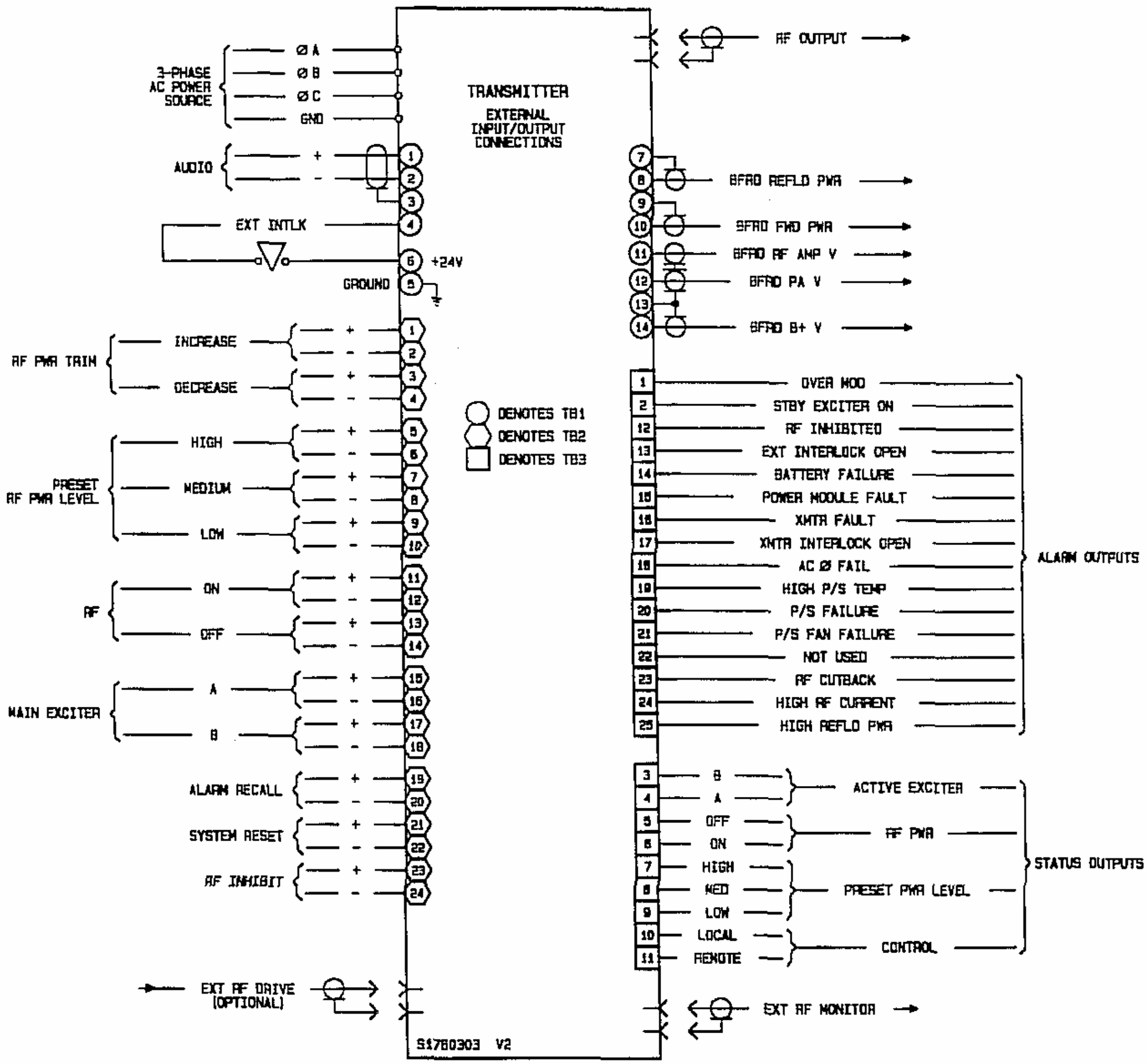
NOTE

The transmitter will contain a 6 1/8 inch EIA adapter plate (unless otherwise specified in contract documents) at the RF feed cable's connection point.

- If the diameter of the RF feed cable's inner male connector (bullet) is not 64mm (2.52 inches), an inner female (cup) connector with a flexible RF connecting strap that is a minimum of 30 centimetres (12 inches) long is required.

- All external control/monitor wiring and electrical power cables, including terminating devices, conduit and conduit clamps.

2.1.15 TEST EQUIPMENT AND SPECIAL TOOLS: The test equipment required to install and maintain the transmitter is listed in table 1-1 and the special tools are listed in table 1-2.



NOTES: REFER TO PARAGRAPH 2.1.8 FOR DETAILED INFORMATION REGARDING CONTROL INPUTS CONNECTED TO TB2. THIS INFORMATION INCLUDES DC VOLTAGE REQUIREMENTS/AVAILABILITY AND LOGIC OPTIONS.

REFER TO PARAGRAPHS 2.1.11 AND 2.1.12 FOR DETAILED INFORMATION REGARDING LOADING/TERMINATION LIMITATION OF ALARM AND STATUS OUTPUTS CONNECTED TO TB3.

Figure 2-4 External Input/Output Interface

NON-TECHNICAL PRE-COMMISSIONING

2.2 On delivery of the transmitter, the following non-technical procedures should be observed and completed.

NOTE

Non-technical procedures are defined as being those procedures that do not require technical knowledge of transmitter circuits or their operation to complete.

2.2.1 ACCEPTANCE OF SHIPMENT: All shipments should be inspected for transit damage prior to acceptance. Packing/shipping lists should be perused to determine contents of each crate.

CAUTION

Sufficient manpower or mechanical assistance should be available prior to attempted moving of transmitter assemblies or removal of them from their packing crates. A crate may weigh in excess of 800 kilograms (1800 pounds)

2.2.2 UNPACKING INSTRUCTIONS: The unpacking instructions are dictated by the method of packaging for shipment. Transmitters that are not shipped by electronic equipment moving specialists may be packed in wooden crates, with the number of crates determined by the extent of disassembly for shipment. Instructions accompany any crate that requires special unpacking information. Packing lists provide detailed listings of shipment contents and should be used as a checklist when unpacking.

NOTE

The transmitter will be partially disassembled for shipment. As a minimum, RF power modules, fan trays, power transformer and inductors will be removed. The extent of any additional disassembly will be dictated by the shipping method, site information provided by the user and the handling equipment of the mover.

(a) It is recommended the crates be positioned near the transmitter's final assembly location prior to unpacking. The following crated and uncrated weights of the major assemblies is provided to ensure personnel are aware of lifting requirements.

CRATE CONTENT	CRATED WEIGHT		UNCRATED WEIGHT	
	kg	LBS	kg	LBS
RF POWER MODULE CABINET (PRIMARY)	500	1100	340	750
RF POWER MODULE CABINET (SECONDARY)	580	1275	420	925
AC/DC POWER SUPPLY CABINET	750	1650	614	1350
AC INPUT INTERLOCK SWITCH	131	289	100	220
POWER TRANSFORMER	835	1838	727	1600
DUAL 3ø RECTIFIER	34	75	20	45

(b) For each crate, remove the panel labelled 'open this side', noting it is attached by cross recessed (philip) head screws.

(c) Remove any visible packing material, including braces, from the crate's interior.

(d) Remove the philip head screws securing the remaining panels to the base of the crate and carefully lift away the crate side/top panels.

(e) Carefully lift/slide the crate contents off the base of the crate and place them in their assigned positions.

2.2.3 CABINET PRE-POSITIONING (see figures MD-1 and MD-2 for positioning information and to figure MD-38 for dimensional information): Position the two halves of the RF power module cabinet and the AC/DC power supply cabinet in their final location, with their mating surfaces in close proximity.

CAUTION

Ensure wiring is not pinched between mating surfaces and any packing material that would be sandwiched between mating surfaces during assembly, is removed.

NOTE

It is assumed the final orientation and positioning of the transmitter has been pre-determined, based on the dimensional information provided with the pre-installation package.

(a) Ensure the AC/DC power supply cabinet's location will accommodate entry of AC power wiring from the AC input interlock switch.

(b) Ensure the RF power module cabinet's location will accommodate connection of the RF feed cable to the RF output connection.

(c) Ensure the cabinets' front edges are flush with a straight line representing the front of the transmitter.

2.2.4 DISASSEMBLY REQUIRED: Disassemble the cabinets and their assemblies to the extent necessary to bolt the cabinets together, install power transformer/chokes and interconnect the electrical wiring, as follows:

NOTE

Do not disassemble to a greater extent than is necessary to complete the following procedures. All hardware/parts removed during disassembly must be retained for reuse during reassembly.

(a) With the exception of the door containing the control/monitor panel, remove front doors from the RF power module cabinet by releasing spring-loaded hinge pin of each door and carefully lifting away the door. Spring-loaded hinge pin is at top of door.

(b) Locate and remove a plastic bag which contains the attaching hardware to bolt cabinet sections together. It is secured to the outside cross braces in the right portion of the RF power module cabinet. It contains twelve sets of M8-20mm attaching hardware

(c) Open the door containing control/monitor panel, and secure it in its open position.

(d) Locate and remove a plastic bag containing five keys (removed from key transfer case for shipment), noting it is secured to the centre support rod in the RF power module cabinet primary side.

(e) Open the key-controlled access panels on the front of the RF combiner/output filter's right and left sides, by loosening the seven retaining screws for each door, unlocking the access lock (turn key clockwise) and swinging the doors open.

(f) Locate and remove a plastic bag which contains the attaching hardware to bolt the left and right sides of the RF combiner/output filter together. It is secured to L3 in left side of the RF combiner/output filter. It contains twenty sets of M5-12mm attaching hardware.

(g) Secure doors in their open positions, ensuring painted surfaces are not scratched and components of the exciter panel and/or control/ monitor panel are not damaged.

(h) At the bottom of RF combiner/output filter's right side (see figure MD-12), locate/remove:

- Lock mechanism (for the antenna ground switch) which contains two locks with a key latched in one of the locks.

- Three pieces of copper tubing, noting they are RF interconnecting straps identified as 'A' 'B' and 'C' in the RF combiner/output filter's assembly detail (see figures MD-11/MD-12).

(i) On the inside of the RF combiner/output filter's right side (see figure MD-12), at the antenna ground switch end, locate and remove the master key transfer case. It is a bar containing six locks. One of the locks contains a latched key, the remaining five locks do not have keys inserted [they were removed for shipping and were retrieved in step (d)].

(j) Locate and remove antenna ground switch handle, noting it is secured to the antenna ground switch inside the RF combiner/output filter. Retain the attaching hardware for reuse when the handle is properly installed.

(k) Open the key-controlled access panels on the rear of the RF power module cabinet, by loosening eleven retaining screws for each door and unlocking the access lock [use keys which were located/removed in step (d)].

(l) Open the key-controlled access panel on rear of AC/DC power supply cabinet, by removing eight retaining screws, unlocking the access lock [use a key which was located/removed in step (d)], and swinging the panel open. Note it pivots from the bottom. Disconnect its bonding ground strap and lift away the panel.

(m) Open the lower access panel on the front of the AC/DC power supply cabinet, by removing eight retaining screws; releasing the spring clips, which are located approximately one third down the panel; and swinging the panel open, noting it pivots from the bottom. Disconnect bonding ground strap and lift away the panel.

NOTE

Spring clips are located at the rear side of the panel. Access to the spring clips is achieved from the side of the cabinet

2.2.5 COMBINING CABINETS: Combine the cabinet sections, including the two halves of the RF combiner/output filter as follows:

(a) Obtain the two bags of attaching hardware which were removed during unpacking/ disassembly, noting:

One bag contains twelve sets of M8-20mm hardware (12 bolts, 24 flat washers and 12 nuts). Six sets attach the two halves of the RF power module cabinet. The other six sets attach the AC/DC power supply cabinet to the RF power module cabinet.

One bag contains twenty sets of M5-12mm hardware to combine the right and left sections of the RF combiner/output filter (20 bolts, 20 flat washers, 20 lock washers and 20 nuts).

NOTE

Do not tighten the cabinet attaching hardware until the twenty sets of attaching hardware for the RF combiner/output filter are installed and tightened.

(b) Combine the two halves of the RF power module cabinet by inserting the attaching hardware (M8-20mm) thru the elongated holes in the mating surfaces of the vertical members, noting three sets are used at the front and three at the rear (top, middle and bottom). Ensure a flat washer is installed between the bolt head and the chassis and between the nut and the chassis. Tighten to a snug fit only at this time.

(c) Combine the two halves of the RF combiner/ output filter using the 20 sets of M5-12mm attaching hardware, noting a flat washer and a lock washer should be located on the nut side with the lock washer against the nut.

(d) Combine the AC/DC power supply cabinet with the RF power module cabinet by installing the attaching hardware (M8-20mm) thru the elongated holes in the mating surfaces of their vertical members, noting three sets are used at the front and three at the rear (top, middle and bottom). Ensure a flat washer is installed between the bolt head and the chassis and between the nut and the chassis.

(e) Ensure the front and top mating surfaces of all cabinets are flush and then tighten the M8-20mm attaching hardware which was installed in steps (b) and (d).

(f) Locate and remove two plastic bags containing chassis bonding (ground) plates and their attaching hardware. They have been secured to the top of the capacitor trays in the rear of the secondary side of the RF power module cabinet.

(g) Bond the secondary back plate assembly (1A60) to the AC/DC power supply cabinet, using the angled plate (see figure MD-4 to locate 1A60). Secure using attaching hardware provided.

(h) Bond the primary and secondary back plates where the primary and secondary sides of the RF power module cabinet join using the remaining plate. Secure using attaching hardware provided.

2.2.6 REASSEMBLY OF ANTENNA GROUND SWITCH/KEY-LOCK SYSTEM: Install the handle on the antenna ground switch and reassemble its associated key locks as follows:

(a) Install the antenna ground switch lock mechanism on the mounting studs at inside end of the RF combiner/output filter. Secure using nuts and washers which were left on mounting studs.

NOTE

Ensure sliding portion of antenna ground switch is in **ON** *position before installing lock mechanism. Key insertion side must face the outside of the cabinet when it is properly installed.*

(b) Install handle on the sliding portion of the antenna ground switch, noting it uses the same mounting holes it was attached to for shipping, but it is located on the outside of the RF combiner/output filter. Use attaching hardware that secured handle for shipment.

(c) Install the master key transfer case on the outside end of the RF combiner/output filter, noting it uses the same mounting holes it was attached to for shipping. Use attaching hardware that secured transfer case for shipment.

2.2.7 REASSEMBLY OF RF COMBINER/ OUTPUT FILTER: Complete reassembly of the RF combiner/output filter by installing capacitor C30 and the interconnecting wiring/tubing which was disconnected for shipment, as follows:

NOTE

Variable capacitor C30 is pretuned for the assigned carrier frequency. Do not change its settings by turning its tuning shaft during installation.

(a) Obtain variable capacitor C30 from its shipping container. Remove the attaching hardware and attaching hardware for its RF connections, from the end plates.

(b) Locate capacitor mounting brackets and its tuning shaft, noting they are at the top/left of the RF combiner/output filter's right side (see figure MD-12). Loosen end collar on the tuning shaft, noting the collar has two set screws - one for the capacitor and one for the shaft.

(c) Remove tyraps which are securing a piece of copper tubing (RF jumper) to each of C30's mounting brackets.

(d) Install capacitor, labelled as C30, in its mounting brackets, using four sets of attaching hardware at front and rear.

NOTE

Both of C30's mounting brackets are insulated from the chassis by ceramic pillars.

(e) Position collar associated with capacitor C30 over its tuning shaft. Secure collar to the capacitor and the cabinet's tuning shaft by tightening the two set screws in the collar.

(f) Connect RF jumpers which were disconnected in step (c) to the appropriate end plates of C30; one on the front and one on the rear. Use remaining attaching hardware.

(g) Install RF interconnecting strap (copper tubing), as depicted for strap 'B' in figures MD-11 and MD-12.

- Connect L3 end to top of L3 (see figure MD-11) using attaching hardware left on L3.

- Connect other end to the RF output strap of 8-input RF combiner using attaching hardware left on output strap.

NOTE

The 8-input RF combiner's RF output strap is accessed thru a hole in the rear of the filter. Attaching hardware is installed from 8-input RF combiner side.

(h) Install RF interconnecting strap (copper tubing) as depicted for strap 'A' in figures MD-11 and MD-12.

- Connect C1-C17 end to the RF buss bar which interconnects C1 thru C17 as depicted in figure MD-11. Use attaching hardware left on buss bar.

- Connect L5/L6 end to L5 and L6 input taps, noting it joins the two inductors. L5 has an additional RF interconnecting strap which must be left attached.

(i) Install remaining RF interconnecting strap (copper tubing with three attached ribbon straps) as depicted for strap 'C' in figures MD-11 and MD-12.

- Connect strap 'C' to the appropriate tap of L1 thru L4, noting the tap selection is frequency dependent and the same tap must be selected on all four coils (see table 4-1 for tap selection).

- Connect three ribbon straps to the RF buss bar which interconnects C1 thru C17 as depicted in figure MD-11. Use attaching hardware left on buss bar.

2.2.8 REASSEMBLY OF 8-INPUT RF COMBINERS: Interconnect the RF buss bars of the 8-input RF combiners, as follows:

(a) Locate and remove a plastic bag which contains a small piece of copper tubing (RF interconnecting strap), and an angled aluminium bracket (ground shield), noting it is secured to a capacitor tray in the secondary side of the RF power cabinet. Remove/discard tyraps holding it in place.

- Install the RF interconnecting strap between the RF buss bars of the left and right 8-input RF combiners as depicted in figure MD-22. Use attaching hardware left on buss bars.

- Install the ground shield between the chassis of the left and right 8-input RF combiners as depicted in figure MD-22. Note it shields and protects the RF interconnecting strap.

2.2.9 REASSEMBLY OF AC/DC POWER SUPPLY CABINET: Install the dual 3ø rectifier (2A30 and the main power transformer (2T1) in the AC/DC power supply cabinet and then connect the electrical wiring that was disconnected for shipment as follows:

NOTE

The conductor terminating portion of the safety ground assembly, including its safety ground bolt are electrically isolated from the cabinet.

2.2.9.1 Safety/Inter-Cabinet Ground Wires: Connect the AC/DC power supply cabinet's ground wires to the identified ground points on the side of the RF power module cabinet's RF combiner/output filter as follows:

NOTE

An ILSCO terminal (referred to as 1A3E3) and three ground studs form the ground points for the AC/DC power supply cabinet's ground wires. The ground studs are located adjacent to each other on the upper side of the RF power module cabinet's RF combiner/ output filter. The ground studs, as well as the terminating location of 1A3E3, are depicted in figure MD-26.

(a) Locate two white 1AWG wires (two #327s). They are tyrapped together and terminated by an ILSCO termination (1A3E3) and should extend from the left, rear side of the transformer compartment to the vicinity of the antenna ground switch. Using hardware on the side panel, terminate 1A3E3 in the location depicted in figure MD-26.

(b) Locate five black 2AWG wires and four (two pairs) 20AWG wires. They are the safety grounds for the cabinet frame and its removable panel. They should be bundled at the top of the cabinet in the vicinity of the antenna ground switch on the RF power module cabinet's RF combiner/output filter.

(c) Install white 1AWG wire (#324) and black wires located in step (b) on the ground bolts adjacent to termination 1A3E3.

2.2.9.2 Dual 3ø Rectifier Installation: Install dual 3ø rectifier (2A3) and the current shunt resistor (2R7) in the AC/DC power supply cabinet as follows (see figures MD-25 and MD-26):

(a) Locate current shunt resistor 2R7, noting the resistor, its mounting bracket and a plastic bag containing the attaching hardware is bubble wrapped and secured in the rear, right (as viewed from the rear) side of the cabinet. Remove/discard packing material.

(b) Position the current shunt resistor and its mounting bracket where they will not interfere with the dual 3ø rectifier's installation.

(c) Locate the two phenolic mounts immediately below the horizontal cross brace at the rear of the cabinet, noting they support the dual 3ø rectifier when it is installed.

(d) Loosen but do not remove the retaining nut on the dual 3ø rectifier's restraining stud on the top/inside end of each phenolic mount.

(e) Remove and retain the screw, flat washer and lock washer from the top/outside end of each phenolic mount.

CAUTION

The dual 3ø rectifier weighs approximately 23 kilograms (50 pounds). It is supported and electrically isolated from the cabinet chassis by phenolic mounts. Prevent damage to the phenolic mounts during installation, by transferring the rectifier's weight slowly and smoothly.

(f) Carefully install dual 3ø rectifier by positioning its top angle bracket between the phenolic mounts. Ensure rectifiers angle bracket is on top of the phenolic mounts.

(g) Slide the dual 3ø rectifier in place until the rear slots on both sides of its angle bracket engage the restraining stud at the inside end of each phenolic mount and its front slots are positioned over the mounting holes on the outside end.

NOTE

Do not tighten attaching hardware until current shunt resistor has been installed in step (i).

(h) Retain the dual 3ø rectifier in place by installing a screw, flat washer and lock washer [removed and retained in step (e)] in the mounting hole at the outside end of each phenolic mount.

(i) Position the current shunt resistor (2R7) on the bolt (negative terminal) protruding from the dual 3ø rectifier ensuring the mounting bracket is positioned near its mounting holes on the cabinet's side panel. Verify the mounting hole used is on the wire 37 end.

(j) Loosely secure the current shunt resistor's mounting bracket to the cabinet's side panel using the attaching hardware (three screws, three flat washers and three lock washers) from the bag of attaching parts located in step (a).

(k) Secure the current shunt resistor (2R7) on the bolt (negative terminal) protruding from the dual 3ø rectifier using a flat washer, a lock washer and a hex nut from the bag of attaching parts located in step (a). Firmly tighten the nut.

(l) Firmly tighten the screws attaching the current shunt resistor's mounting bracket to the cabinet's side panel

(m) Firmly tighten the two nuts (inside end) and two screws (outside end) securing the dual 3ø rectifier to its phenolic mounts.

(n) Locate 20 AWG white wire (#106), noting it is tyrapped with the wiring for current shunt resistor 2R7. Solder wire #106 to terminal E9 of the dual 3ø rectifier.

2.2.9.3 Power Transformer Installation: Install the power transformer in the AC/DC power supply cabinet as follows.

NOTE

White 1AWG wires 9 thru 14 where left attached to the 'X' and 'Y' terminals of the transformer. Do not remove them unless they interfere with transformer installation.

(a) Locate the wiring that was disconnected from the power transformer, noting it will be bundled and tyrapped in the vicinity of the power transformer compartment. Remove the shipping tyraps and position the wiring where it cannot be damaged or interfere with transformer installation.

(b) Position the power transformer at the front of the AC/DC power supply cabinet, with its terminals facing the interior of the cabinet.

(c) Install the power transformer in the AC/DC power supply cabinet as detailed in the power transformer installation instructions (Nautel information sheet) packed with the transformer.

2.2.9.4 Connection of AC/DC Power Supply Cabinet Wiring: Reconnect wiring which was disconnected from transformer 2T1 and dual 3ø rectifier 2A3 during their removal as follows:

NOTE

Wire identification number is stamped on the wire insulation and is prefixed with an arrow. Read from direction of arrow.

If source/destination information is required, refer to table 9-6 - AC/DC power supply cabinet wiring list.

(a) Locate six white 1AWG wires (21 thru 26) noting they are located at bottom/rear of the transformer compartment. Using attaching hardware which was left on the terminals, connect the wires to the power transformer's 'H' terminals as tabulated below:

T1-H1	-	21 and 22
T1-H2	-	23 and 24
T1-H3	-	25 and 26

(b) Locate three white 12 AWG wires (31, 32 and 33). Route the unattached ends to the fuseholders on the power transformer and terminate as tabulated below:

#31	-	XF18-1
#32	-	XF19-1
#33	-	XF20-1

(c) Locate six white 1AWG wires (9, 10, 11, 12, 13 and 14) which were left attached to the power transformer's 'X' and 'Y' terminals. Route unattached ends of 9, 10 and 11 to the left side of dual 3ø rectifier 2A3 (as viewed from transmitter's rear). Route unattached ends of 12, 13 and 14 to the right side. Using attaching hardware which was left on the terminals, connect these wires to the dual 3ø rectifier's AC input terminals as tabulated below (see figure MD-31 as a guide to identify terminal numbers):

#9	-	2A3-1	#12	-	2A3-4
#10	-	2A3-2	#13	-	2A3-5
#11	-	2A3-3	#14	-	2A3-6

(d) Locate seven black 6AWG wires (122 thru 128), noting they are secured in the power supply cabinet. Route wires #122 thru 128 along the path of 1AWG wires #9 thru 12 to the vicinity of the power transformer's 'X' and 'Y' secondaries. Using attaching hardware which was left on the terminals, connect these wires to the power transformer as tabulated below:

#122	-	T1-X1	#125	-	T1-Y1
#123	-	T1-X2	#126	-	T1-Y2
#124	-	T1-X3	#127	-	T1-Y3
			#128	-	T1-Ground

(e) Locate four white 1AWG wires (27, 28, 29 and 30) which should be located directly under the dual 3ø rectifier.

- Connect wires 27/28 to the +V connection on the dual 3ø rectifier's left-hand heat sink (as viewed from transmitter's rear), noting it is identified as terminal 7 in figure MD-31. Use attaching hardware which was left on heat sink.

- Connect wires 29/30 to the +V connection on the dual 3ø rectifier's right-hand heat sink (viewed from transmitter's rear), noting it is identified as terminal 8 in figure MD-31. Use attaching hardware left on heat sink.

(f) Locate six grey 14AWG wires (91, 92, 93, 112, 113, 114) and one black 8AWG wire (96), noting they are bundled at the left rear of the transformer compartment.

(g) Connect wires 91, 92, 93, 96, 112, 113 and 114 to the 'Z' terminals of the power transformer as tabulated below, noting 'Z' terminals are screw lock devices:

T1-Z0: 96	T1-Z1: 91, 112
T1-Z2: 92, 113	T1-Z3: 93, 114

(h) Locate two grey 16AWG wires (7, 8), noting they are bundled near fuseholder XF8. Connect wires 7 and 8 to the secondary mounting holes of the power transformer's 'X1 and X2' terminals, as tabulated below. Use the attaching hardware left on terminals.

T1-X1: 7	T1-X2: 8

(i) Locate unattached end of 1AWG white wire (#324) which was connected to a ground stud on the side of the RF power module cabinet's RF combiner/output filter in paragraph 2.2.9.1 (c). Connect this wire to the power transformer's ground stud using the attaching hardware on the stud.

(j) Verify attaching hardware for wiring on terminals of power transformer 2T1 and dual 3ø rectifier 2A3 has been firmly tightened.

2.2.10 ROUTING AND CONNECTION OF INTER-CABINET WIRING: Route wiring of the inter-cabinet cableform, which was disconnected and stored in the primary side of the RF power module for shipping, to its final destination and then install the wiring as follows:

(a) Remove the dress panel, which covers the RF distribution PWB and wiring harness, from the lower front on each side of the RF power module cabinet, noting they are held in place by clips.

(b) In the primary and secondary sides of the RF power module cabinet, locate the portions of the cable harness which were disconnected and bundled for shipping. Remove the shipping tyraps and extend the cabling out the front of the associated cabinet.

(c) Locate and remove a plastic bag containing the attaching hardware for sixteen fan trays. It is secured to a power module support channel in the RF power module cabinet.

(d) Locate and remove a plastic bag containing the attaching hardware for sixteen RF power modules. It is secured to a power module support channel in the RF power module cabinet.

(e) Install sixteen fan trays in the RF power module cabinet (see figure MD-3), using attaching hardware retrieved in step (c).

(f) Locate the cable harness connector for each fan tray, from the cabling extended out the front of the cabinet. Refer to silk screen on the lower right panel of each side to identify connectors. Install the connector identified for each fan tray on the fan tray's mating connector. Ensure they are fully mated.

CAUTION

Ensure guide pins on the rear of RF power module have engaged the alignment holes in the back plate before final seating and mating of rear connectors.

(g) Carefully install sixteen RF power modules in the RF power module cabinet, using attaching hardware retrieved in step (d).

NOTE

Gently tighten spring-loaded screw on the bottom front of the RF power module and then secure the module using two white screws at the top front.

(h) Locate the cable harness connector for each RF power module, from the cabling extended out the front of the cabinet. Refer to silk screen on the lower right panel of each side to identify connectors. Install the connector identified for each RF power module on the RF power module's mating connector. Ensure connectors are fully mated.

(i) Locate eight coaxial cables (part of cable assembly 1W1) that are terminated by BNC connectors P17, P18, P19, P20, P21, P22, P23 and P24, noting they are in the cabling extending from the front of the primary side. Route them behind the cabinet's centre corner posts to the vicinity of the RF drive splitter (1A39) (see figure MD-3) and connect them to the appropriate mating connectors of the RF drive splitter. Refer to silk screen on the lower right panel of the RF power module cabinet's secondary side to identify mating connectors.

(j) Carefully route the remaining unterminated cabling, from the RF power module cabinet's primary side, behind the front centre posts of the primary and secondary sides, to the front, right corner post of the secondary side. Neatly dress the cabling along the floor of the cabinet, noting wire 183 and drop cables terminated by connectors P10, P11, P24 and P25 should stop in the vicinity of the RF drive PWB's and the secondary 50kW RF distribution PWB (see figure MD-3).

(k) Mate P10 to J1 of RF drive buffer PWB 1A37, noting P10 is a sub-miniature connector with 9 socket contacts.

(l) Mate P11 to J1 of RF drive buffer PWB 1A38, noting P11 is a sub-miniature connector with 9 socket contacts.

(m) Mate P24 to J3 of the secondary 50kW RF distribution PWB (1A40), noting P24 is a sub-miniature connector with 25 socket contacts.

(n) Mate P25 to J6 of the secondary 50kW RF distribution PWB (1A40), noting P25 is a sub-miniature connector with 15 socket contacts.

(o) Install wire 183 on one of the ground studs below the secondary 50kW RF distribution PWB (1A40), using attaching hardware left on the stud.

(p) Route remaining wires (133, 177, 178, 179, 184, 205) and cables (terminated by P12, P13, P14, P15 and P16) thru the grommeted cable channel at the bottom of the RF power module cabinet's front, right corner post, up the inside of the post and thru the cable access hole into AC/DC power supply cabinet.

NOTE

It will be necessary to remove the top three sets of the cable channel's attaching hardware and swivel the channel to insert the cables. Reposition the channel and replace its attaching hardware when the cable is routed thru the grommeted opening.

(q) Route wires (133, 178, 179 and 205) and cables terminated by P14 and P15 thru cable access hole in the side of the RF combiner/ output filter, to the inside of filter.

(r) Route wire 205 and connectors P14 and P15 to the forward/reflected power probe (1A3A2). On the forward/reflected power probe, mate; P14 to J1, P15 to J2 and wire 205's terminating lug to E1.

(s) Route wires 133, 178 and 179 across the lower front of the filter to the hinged side of the tuning control panel.

- Connect wire 133 to terminals of **IMPEDANCE** meter M1 [white conductor to M1-(+) and shield to M1-(-)].

- Connect wires 178/179 to the microswitch (1A3S2) under the tuning control panel's ground wand. Solder wire 178 to 1A3S2-3 and wire 179 to 1A3S2-4.

(t) Route the coaxial cable terminated by P16 along the external side of the RF combiner/ output filter and mate P16 with **RF SAMPLE** connector 1A3J2 on the side of the filter, noting P16 is a coaxial BNC connector.

(u) Route wires 177, 178, the second end of 184 and the cables terminated by P12 and P13 through the grommeted cable access hole in the centre dividing panel.

(v) Route wire 179 and cable terminated by P12 along the existing wiring harness to vicinity of power supply control/monitor PWB 2A1 (refer to figure MD-25 to locate the power supply control/monitor PWB). Mate P12 to J2 of the power supply control/ monitor PWB, noting P12 is a 'D' sub-miniature connector with 15 pin contacts.

(w) Route wire 179 along the panel containing the power supply control/monitor PWB (noting there are a number of tyrap anchors to accommodate securing the wire) and down the cabinet corner post to the vicinity of the cabinet's ground wand. Solder wire 179 to terminal 3 of the micro switch (2S2) under the ground wand, noting a ground wire is soldered to terminal 4.

(x) Route wire 184 and cable terminated by P13 to the vicinity of DC power supply 2A2 (see figure MD-25).

- Connect wire 184 to the exciter ground termination (E1) at the top of the DC power supply, using the attaching hardware that was left on E1.

- Mate P13 to J2 of the DC power supply (2A2), noting P13 is a 23/37 Amphenol connector with 14 pin contacts.

(y) Route wires 177 and 178 between the RF power cabinet and the AC/DC power supply cabinet to the vicinity of the ground wand on the rear door of the RF power module cabinet's secondary side. Solder wires to the micro switch (1S1) under the ground wand (177 to terminal 3 and 178 to terminal 4).

(z) Locate eight black, 8AWG wires (189 thru 196) that are bundled at the rear of the RF power module's secondary side and route them thru the rectangular cable access hole in the end of the RF power module cabinet, to the vicinity of B+ distribution PWBs (2A4/2A5) in the AC/DC power supply cabinet (see cross section A-A of figure MD-26). Using the attaching hardware left on the B+ distribution PWBs, connect (refer to figure MD-32 to locate the terminals on the B+ distribution PWB):

189 to 2A4-A	193 to 2A5-A
190 to 2A4-B	194 to 2A5-B
191 to 2A4-C	195 to 2A5-C
192 to 2A4-D	196 to 2A5-D

(aa) Locate eight black, 8AWG wires (197 thru 204) that are bundled at the rear of the RF power module cabinet's primary side and route them along the cable channel under the capacitor trays of the RF power module cabinet's secondary side; thru the rectangular cable access hole, in the end of the RF power module cabinet, to the vicinity of B+ distribution PWBs 2A6/2A7 in the AC/DC power supply cabinet (see cross section A-A of figure MD-26). Using the attaching hardware on the B+ distribution PWBs, connect:

197 to 2A6-A	201 to 2A7-A
198 to 2A6-B	202 to 2A7-B
199 to 2A6-C	203 to 2A7-C
200 to 2A6-D	204 to 2A7-D

(ab) Locate the cabling terminated by connector P30, noting it is secured in the primary (left-hand) side of the RF output filter compartment near arc detector PWB 1A3A4.

(ac) Route cable terminated by P30 along the bottom of the RF output filter to the vicinity of arc detector PWB 1A3A5, noting it is located on the secondary (right-hand) side of the RF output filter compartment (see figure MD-12).

(ad) Locate the cabling terminated by connector P28, noting it is secured in the primary (left-hand) side of the 8-input RF combiner near arc detector PWB 1A42A4.

(ae) Route cable terminated by P28 down through the primary side clearance hole in the 8-input RF combiner, along the underside of the 8-input combiner and up through the secondary side clearance hole in the 8-input RF combiner to the vicinity of arc detector PWB 1A41A4 (see figures MD-4/MD-22).

2.2.11 DRESSING OF WIRING/CABLES: When all wiring that was disconnected for shipping has been reconnected, complete the installation as follows:

(a) Obtain the tyraps which were provided as ancillary parts, noting there are different types and sizes.

NOTE

Cut off surplus length from tyraps after they have been tightened. Snugly tighten the tyraps, but do not over tighten them.

(b) Ensure all wiring and cables have been neatly dressed along their routing. Wiring should be bundled using appropriate size tyraps at frequent intervals, to maintain wire dressing.

(c) Check for tyrap anchors along the routing of installed wiring. When an anchor is located, neatly bundle wiring adjacent to it and secure the wiring to the anchor using an appropriate size tyrap.

(d) Check for installed, unused arrow-head tyraps along the routing of the installed wiring. When an arrow-head tyrap is located, neatly bundle the adjacent wiring and secure it using the tyrap.

2.2.12 INSTALLATION OF AC INPUT INTERLOCK SWITCH: If provided, install the Nautel AC input interlock switch on a wall in the immediate vicinity of the transmitter, noting it is a dedicated fused interface between the AC power service entrance and the transmitter's main power transformer.

2.2.13

CAUTION

The AC input interlock switch weighs approximately 100 kilograms (220 pounds). Ensure the wall has been reinforced to support this weight and that suitable lifting equipment is available.

NOTE

If an AC input interlock switch is not provided by Nautel, an equivalent switching circuit that has been modified to accommodate a key-lock safety system that requires the AC power for the transmitter to be turned off before the master key for the transmitter's safety interlocks can be removed. It must also prevent restoration of AC power until the master key is returned and inserted in the key-lock system.

2.2.13 INSTALLATION OF INTERLOCKED AC POWER WIRING: Install the AC power wiring between the AC input interlock switch and the transmitter's main power contactor as follows:

NOTE

The following procedures assume the AC power is supplied from a three-phase, four-wire, wye connected, 50/6Hz AC power source.

A dual, cable entry, knockout opening (is provided in the, rear, outside corner of the power supply cabinet's base, for cable entry from below floor cable ducts. If cable entry is to be made at any other place, an appropriately sized cable entry hole must be punched at the entry point. A 3.45mm (0.136 inch) pilot hole for a chassis punch is provided at the top, right of the cabinet (see figure MD-38) to accommodate top entry.

It is recommended that all AC power source wiring be installed in metal conduit and the conduit be rigidly attached to the interlock switch and cabinet entry/exit holes.

(a) Route the AC power source wires through the cable entry hole/opening on the side of the AC power switch box.

(b) Cut each conductor to the required length, noting the voltage carrying wires connect to the three switches at the top of the switch box, and the ground wire connects to a suitable lug on the Box itself.

(c) Route the wires connecting the AC power switch box and the main contactor in the AC/DC power supply cabinet.

(d) Run the ground wire from a suitable lug connected to the AC power source ground lug. Cut the ground wire to the correct length and connect the other end to the AC Ground of safety ground assembly 2A8.

(e) Run the three voltage carrying wires from the output of the three switches at the bottom of the Switch Box to the main contactor in the AC/DC power supply cabinet.

NOTE

Selection of the power transformer's primary winding taps is completed during the technical pre-commissioning procedures (paragraph 2.3)

2.2.14 INSTALLATION OF EXTERNAL CONTROL/MONITOR WIRING: Connect wiring originating from the audio source, remote control/ monitoring devices, and when used, the external RF drive source; to terminating points on the control cabinet's remote interface PWB, as follows:

NOTE

Monaural audio, remote control and remote monitor wiring, terminates on the remote interface PWB. Refer to figure MD-5 as an aid to locating the interface PWB and to its service instruction manual as an aid in locating the terminals.

(a) Route monaural audio, control and monitor wires, through the top of the control cabinet, to the vicinity of the remote interface PWB.

NOTE

Where practical, it is recommended all external wiring be installed in a metal conduit and the metal conduit be rigidly attached to the cabinet.

(b) Using figure 2-4 as a guide, determine the specific destination of each wire.

(c) The coaxial cable that terminates at J5 (**EXT RF MONITOR**) should be cut to length and terminated by a BNC coaxial connector.

(d) If the monaural audio input provides for greater than 100% positive modulation, connect positive input to TB1-1 and negative input to TB1-2 of the remote interface PWB.

NOTE

Connection of the audio cable's shield is dependent on the presence or absence of ground loops. In some installations, it may be necessary to connect the shield at one end only. In these cases, connect the end that provides the best results.

(e) Connect remaining control/monitor wiring to terminals of TB1, TB2 and TB3 on remote interface PWB as identified in figure 2-4. Ensure their securing screws are firmly tightened.

2.2.15 INSTALLATION OF RF FEED CABLE: Connect the RF feed cable to the transmitter's RF output connection point, noting the transmitter end must contain the appropriate termination (6 1/8 inch EIA flange connector unless otherwise specified in contract documents). The RF feed cable connection point is on top of the RF power module cabinet's secondary side (see figure MD-38 for location/dimensional information).

NOTE

The RF output should be applied to a dummy load during commissioning procedure's initial turn-on. If the RF feed cable is not connected to a switching circuit that permits antenna/dummy load selection, ensure the dummy load's RF feed cable is connected to the RF output connection until otherwise specified during the commissioning procedures.

The following instructions assume the RF feed cable's terminating device is a 6 1/8 inch EIA flange connector. If any other termination is used, the user is responsible for proper connection.

(a) Verify the RF feed cable has been cut to the required length and has been terminated by a 6 1/8 inch EIA flange connector.

(b) Verify the outside diameter of the 6 1/8 inch EIA male inner connector (bullet) is 64mm (2.52 inches).

NOTE

If the male inner (bullet) connector's outside diameter is not 64mm (2.52 inches), the mating female inner (cup) connector which is installed in the RF combiner /output filter must be replaced with one that has the correct inner diameter.

(c) Gain access to the interior of the RF combiner/ output filter, from the front of the transmitter, by opening its right hand door.

(d) Fasten the RF feed cable's 6 1/8 inch EIA fixed flange on the transmitter's RF output adapter plate using the twelve sets of attaching hardware that were left in the adapter plate.

NOTE

The adapter plate contains two shim plates to accommodate different thickness in the insulating material for the male inner connector. If necessary, one or both of these shims may be removed to ensure the male inner connector is snugly sandwiched between the EIA flange connector and the adapter plate.

(e) Mate the RF combiner/output filter's female inner (cup) connector with the RF feed cable's male inner (bullet) connector.

(f) Visually inspect interior of the RF combiner/ output filter and then close its access doors.

2.2.16 CONNECTION TO STATION REFERENCE GROUND SYSTEM: Connect a continuous, low-impedance conductor (0 AWG copper wire, two-inch copper strap or equivalent), as described in Nautel's 'Lightning Protection for Radio Transmitter Stations' booklet, between the station reference ground and the transmitter's reference ground bolt.

The transmitter's reference ground bolt is located at the bottom, rear of the AC/DC power supply cabinet (refer to figure MD-2 to locate it).

TECHNICAL PRE-COMMISSIONING

2.3 Prior to applying AC power and turning on the transmitter, some circuits must be customized to the station's power source and operating requirements. The following should be completed.

NOTE

Technical pre-commissioning procedures require technical decisions and customization of electrical circuits. They should be incorporated by the station engineer or a competent electronic technician.

Reference is made to bi-phase PDM driver and RF drive PWBs in the following procedures. These PWBs are on the exciter panel which is located behind the control/monitor panel. Refer to figure MD-9 to locate the specified PWB and then to the appropriate service instruction manual for its assembly detail.

WARNING

Ensure AC power source is switched off at the service entrance. If this precaution is not observed, voltages that may cause serious injury or death will be present on circuit breaker and transformer terminals.

2.3.1 SELECTING PWR TRANSFORMER'S PRIMARY WINDING TAPS: Select the appropriate primary winding taps of the main and low voltage power transformers, as follows:

NOTE

Access to the primary winding taps of power transformer 2T1 and 2T2 is from the rear of the AC/DC power supply cabinet (see figure MD-25).

(a) Determine fully loaded, mean, RMS, phase-to-phase voltage of the AC power source. Record this voltage for future reference.

2.3.1.1 Main Power Transformer Taps: Using the AC power source voltage recorded paragraph 2.3.1 (a), select and connect main power transformer 2T1's primary winding taps as follows:

(a) Verify power transformer 2T1 is rated for the voltage that will be applied from the AC power source by noting the voltage rating on its nameplate.

Table 2-1 2T1's Primary Winding Tap Selection

NOMINAL VOLTAGE (RMS, PHASE-TO-PHASE)		PRIMARY WINDING TAPS		
360-440	**414-506**	**H1**	**H2**	**H3**
331-350	403-425	A	A	A
351-370	426-448	B	B	B
371-390	449-471	C	C	C
391-410	472-494	D	D	D
411-430	495-517	E	E	E
431-450	-	F	F	F

(b)Enter the appropriate nominal AC voltage column of table 2-1 and determine which primary winding taps should be used.

(c) Connect the moveable wire from each of power transformer 2T1's input terminals (H1, H2 and H3) to the tap of its associated primary winding identified in step (b), noting the tap for all three primary windings must be the same (A, B, C, etc.).

2.3.1.2 Low Voltage Power Transformer Taps: Using the voltage recorded as the fully loaded, mean, RMS, phase-to-phase voltage of the AC power source in paragraph 2.3.1 (a), select and connect low voltage power transformer 2T2's primary winding taps as follows:

(a) Verify power transformer 2T2 is rated for the voltage that will be applied from the AC power source by noting the voltage rating on its nameplate.

(b) Enter the appropriate nominal AC voltage column of table 2-2 and determine which primary winding tap should be used.

(c) Connect wire 78 (grey, 16AWG) to the primary winding tap identified in step (b).

Table 2-2 2T2's Primary Winding Tap Selection

NOMINAL VOLTAGE (RMS, PHASE-TO-PHASE)		PRIMARY WINDING TAP (WIRE 78)
360-440	414-506	
331-350	403-425	H2
351-370	426-448	H3
371-390	449-471	H4
391-410	472-494	H5
411-430	495-517	H6
431-450	-	H7

2.3.2 RF DRIVE SOURCE: Connect or verify frequency synthesizer PWB's 1A2A2 and 1A2A5 are configured to operate from the desired RF drive source (external or internal), noting 1A2A2 is part of exciter 'A' and 1A2A5 is part of exciter 'B. The frequency synthesizer PWBs are mounted on the exciter panel which is located immediately behind the control/monitor panel. See figure MD-9 as an aid to locating the frequency synthesizer PWBs and then, if necessary, to the frequency synthesizer PWBs service instruction manual for its assembly detail.

NOTE

If an external RF drive is used, the consequence of a failure must be considered. If it is not duplicated and connected to changeover when a failure occurs, it is recommended one frequency synthesizer PWB be configured to operate from its internally generated RF drive. This will ensure continued operation in the event of an external RF drive failure.

(a) When a frequency synthesizer PWB is to be configured to operate from its internally generated RF drive, install or verify its shorting shunt post (MP1) is installed on 3-pin SIP header XMP1 and is shorting XMP1-2 to XMP1-3.

(b) When a frequency synthesizer PWB is to be configured to operate from an externally generated RF drive, install or verify its shorting shunt post (MP1) is installed on 3-pin SIP header XMP1 and is shorting XMP1-1 to XMP1-2.

Table 2-3 Low-Pass Filter Selector Switch Settings

HIGH FREQUENCY ROLLOFF (-1.0dB)	FILTER SELECTOR SWITCH SETTINGS	
	S1-1	S1-2
7.5kHz	OPEN	OPEN
10.5kHz	CLOSED	OPEN
13.5kHz	OPEN	CLOSED
16.0kHz	CLOSED	CLOSED

(c) Record the RF drive source selections for both frequency synthesizer PWBs (exciter 'A' and exciter 'B').

2.3.3 MODULATING AUDIO PASS BAND SELECTION: Set or verify the low-pass filter switches on both bi-phase PDM driver PWBs (1A2A3 and 1A2A6) have been set for the desired high frequency, -1.0dB roll-off; noting 1A2A3 is part of exciter 'A' and 1A2A6 is part of exciter 'B. The bi-phase PDM driver PWBs are mounted on the exciter panel which is located immediately behind the control/monitor panel. See figure MD-9 as an aid to locating them and if necessary, to the bi-phase PDM driver PWB service instruction manual for its assembly detail.

NOTE

The low-pass filter is a 3-pole Butterworth filter that can be altered towards a pseudo-Bessel response. It is factory set for -1.0dB roll-off at 16kHz (see table 2-3 for switch settings). This selection will be adequate for most installations.

The decision to select a lower roll-off frequency will be dictated by complex factors. They may include; an antenna with sideband limitations, square wave overshoot and processing the audio is subjected to. Nautel's field service department will provide advice and recommendations based on the installation.

(a) Enter table 2-3 for a tabulation of the high frequency roll off options and the low pass filter switch settings to obtain them.

(b) Record the frequency roll off selections for both bi-phase PDM driver PWBs (exciter 'A' and exciter 'B').

2.3.4 ƒc DEPENDENT SELECTIONS: The frequency synthesizer pwbs (1A2A2/1A2A5), the RF combiner/output filter (A3) and the 8-input RF combiners (1A41/1A42) contain switch settings, in-circuit capacitor selections and/or tuning coil tap selections which are carrier frequency (ƒc) dependent. Set or verify they have been set/selected for the assigned ƒc as follows:

NOTE

*The frequency dependent settings/selections have been preset to the carrier frequency identified in contract documents. They should not have to be changed unless a different carrier frequency is assigned. In this case refer to paragraph 4.11 - **Frequency Change Procedure.***

2.3.4.1 Frequency Synthesizer Switch Settings: Set or verify switches S1 thru S4 on both frequency synthesizer PWBs (1A2A2 and 1A2A5) are set for the assigned carrier frequency (ƒc), noting 1A2A2 is part of exciter 'A' and 1A2A5 is part of exciter 'B. The frequency synthesizer pwbs are mounted on the exciter panel which is located immediately behind the control/monitor panel. See figure MD-9 as an aid to locating the frequency synthesizer PWBs and if necessary, to the frequency synthesizer pwb's service instruction manual for its assembly detail.

NOTE

The selector switches are rotary BCD switches with the units digit representing 1kHz increments. S1 is the thousands digit, S2 is the hundreds digit, S3 is the tens digit and S4 is the ones digit. Refer to the frequency synthesizer PWBs assembly detail for a selection example.

2.3.4.2 RF Combiner/Output Filter Selections: Configure tuned circuits in the RF combiner/output filter that have frequency dependent variables as follows (refer to figures MD-11 and MD-12 as an aid to locating identified components):

(a) Enter table 4-1 with the assigned carrier frequency (ƒc). Determine which capacitors are in-circuit, which capacitors are out-of-circuit and which taps should be selected on tuning coils L1 thru L6 for the frequency band that contains ƒc.

(b) Gain access to the interior of the RF combiner/output filter, from the front of the transmitter, by opening its key-controlled access doors.

(c) Connect or verify the moveable conductor for each out-of-circuit ceramic plate capacitor identified in step (a) is connected to its mounting bracket (capacitor's input is shorted to its output).

(d) Connect or verify the moveable conductor for each in-circuit ceramic plate capacitor identified in step (a) is connected to its appropriate RF buss; noting:

- In-circuit capacitors between C1 thru C17 all connect to the same RF buss. Refer to figure MD-11 as an aid to locating the RF buss for these capacitors.
- In-circuit capacitors between C19 thru C23 all connect to a second RF buss. Refer to figure MD-12 as an aid to locating the RF buss for these capacitors.
- In-circuit capacitors between C24 thru C29 all connect to a third RF buss. Refer to figure MD-12 as an aid to locating the RF buss for these capacitors.

(e) Connect or verify the RF interconnecting strap identified as strap 'C' in figures MD-11 and MD-12 is connected to the tap of L1, L2, L3 and L4 identified in step (a). The same tap must be selected on each tuning coil.

(f) Connect or verify the RF interconnecting strap for L5 and L6 is connected to the taps identified in step (a) as depicted in figure MD-12. The same tap must be selected on each tuning coil.

2.3.4.3 8-Input RF Combiner Selections: Configure tuned circuits in 8-input RF combiners (A41 and A42) that have frequency dependent variables as follows (refer to figure MD-22 as an aid to locating identified components):

(a) Enter table 4-2 with the assigned carrier frequency (fc). Determine which capacitors are in-circuit, which capacitors are out-of-circuit and which taps should be selected on tuning coils L1 thru L4 for the frequency band that contains fc.

(b) Gain access to the interior of both 8-input RF combiners, from the rear of the transmitter.

NOTE

8-input RF combiners A41/A42 are identical except for the connection point for their interconnecting strap. On completion, the frequency dependent selections for both units should be identical.

(c) Connect or verify the moveable conductor for each out-of-circuit ceramic plate capacitor identified in step (a) is connected to its mounting bracket (capacitor's input is shorted to its output).

(d) Connect or verify the moveable conductor for each in-circuit ceramic plate capacitor identified in step (a) is connected to the RF buss as depicted in figure MD-22.

(e) Connect or verify cross connected straps of each four-coil assembly (in both 8-input RF combiners) are connected to the tap identified in step (a). The same tap must be selected on each tuning coil.

2.3.5 AIR SPARK GAP SETTING: Set or verify adjustable air spark gap 1A3E1 has been set to provide optimum lightning protection as follows:

NOTE

The transmitter site's altitude is a factor in determining the air spark gap. If this information has been provided, the adjustable air spark gap will be factory set to the appropriate gap.

(a) Obtain transmitter site's altitude in thousands of feet and then determine the air gap required using the following formula, noting:

Altitude is expressed in thousands of feet
Air gap is expressed in inches.

$$\text{Air Gap} = (0.001\,A^2) + 0.005\,A + 0.25$$

Example when altitude is 5000 feet

$$\begin{aligned}\text{Air Gap} &= (0.001 \text{ x } 5^2) + (0.005 \text{ x } 5) + 0.25\\ &= (0.001 \text{ x } 25) + 0.025 + 0.25\\ &= 0.025 + 0.025 + 0.25 = 0.3 \text{ inches}\end{aligned}$$

(b) Gain access to adjustable air spark gap 1A3E1 by opening the RF combiner/output filter's right hand access door (see figure MD-12 as an aid to locating the spark gap).

(c) Set or verify adjustable air spark gap 1A3E1 has been set for the air gap determined in step (a).

NOTE

If the air gap is not correct or measurement accuracy is suspect, it will be necessary to remove the spark gap assembly to make an accurate measurement and/or change the air gap.

2.3.6 LOAD RESISTANCE CHECK FOR B+ VOLTAGE POWER SUPPLY: Check for short circuits on the load of the B+ voltage power supply as follows:

(a) Remove all sixteen of the B+ fuses in the rear of the power supply (see figure MD-26 for the location of the B+ distribution PWBs).

(b) Measure the resistance from the hot side (side closest to front of cabinet) of each of the fuse holders to ground. This should be an open circuit.

(c) Measure resistance from fused side (nearest rear of cabinet) of each fuse holder to ground. Each resistance measurement should be a charging capacitor.

NOTE

Initially resistance reading will be low. It will increase towards infinity as the reservoir capacitors of each capacitor tray are charged from the multimeter's battery.

COMMISSIONING PROCEDURES

2.4 These procedures are in a step-by-step format. They will permit a person who is not familiar with the transmitter to perform the checks. They should be completed in sequence, as each procedure establishes settings and contains prerequisites for subsequent procedures.

NOTE

The transmitter was precisely calibrated and subjected to a burn-in during manufacture. It should not be necessary to change any adjustment, other than the ones specified. If the tests associated with a procedure indicate that the preset adjustments are not optimum, perform the appropriate adjustment procedure as detailed in section 5 prior to proceeding with additional tests.

The exciter assemblies are duplicated and are connected to form an active and a reserve exciter. The control/monitor panel's **EXCITER** *switch* **A/B** *setting determines which set is selected as the active exciter. Refer to the following listings to determine which PWB/assembly is selected for a specific* **EXCITER** *switch setting.*

Exciter A Selected

A - Frequency Synthesizer PWB 1A2A2
A - Bi-Phase PDM Driver PWB 1A2A3
A - DC Power Supply PWB........................ 1A2A4
A - RF Drive Buffer PWB.............................. 1A53
A - RF Drive Power Supply PWB 2A2A1

Exciter B Selected

B - Frequency Synthesizer PWB 1A2A5
B - Bi-Phase PDM Driver PWB 1A2A6
B - DC Power Supply PWB........................ 1A2A7
B - RF Drive Buffer PWB.............................. 1A54
B - RF Driver Power Supply PWB............. 2A2A2

2.4.1 PRECAUTIONS TO BE OBSERVED:

The NA100 transmitter contains many solid state devices which 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.

2.4.1.1 Preliminary Settings: Verify the transmitter is ready to turn on as follows:

(a) Verify the non-technical and technical pre-commissioning requirements of paragraphs 2.2 and 2.3 have been completed.

(b) Set the **TRANSMITTER ENABLE** circuit breaker (2CB1) to the **OFF** position, noting it is located inside the top/rear side of the AC/DC power supply cabinet (see figure MD-25).

(c) Terminate the transmitter's RF output into a precision 50 ohm dummy load which is rated at a minimum of 200kW

WARNING

If a jumper is placed between the UNREG +24V output (TB1-6) and the EXT INTLK input (TB1-4) on remote interface PWB 1A1A4, safety features provided by the external interlocks will be disabled. It is recommended that a fail safe method of alerting personnel to this fact be implemented. Voltages which are dangerous to life will be present on RF output stages and the antenna system if the transmitter is turned on.

(d) Close all external interlocks or temporarily connect a jumper wire between TB1-4 and TB1-6 of the remote interface PWB.

(e) Turn off the audio input at its source.

(f) Turn off transmitter's AC power source at the service entrance.

(g) Remove or verify the batteries have been removed from the remote interface PWB, noting it is located on the back of the control/ monitor panel (see figure MD-5).

(h) Set or verify the frequency selector switches (S1, S2, S3 and S4) on both of the exciter panel's frequency synthesizer PWBs have been set to produce the assigned carrier frequency. The exciter panel is located behind the control/ monitor panel. Refer to figure MD-9 as an aid in locating the frequency synthesizer PWBs.

2.4.1.2 Resistance Checks: Verify none of the DC power supplies are shorted to ground:

(a) Measure phase-to-phase resistance (øA-øB, øB-øC and øC-øA) where the AC power source wiring connects to the terminals of the full power contactor (2K1).

- Resistance reading should be an open circuit for each of the phase combinations.

(b) Measure power transformer 2T1's primary winding continuity/impedance for each phase. Measure phase-to-phase resistance (øA-øB, øB-øC and øC-øA) where the AC power source wiring connects to the terminals of the full power contactor (2K1), while pressing and holding the white test/indicator button on top of the charge contactor (2K2).

- Resistance reading should be a nominal ten ohms for each of the combinations.

(c) Measure the resistance between the input side of B+ distribution pwb's 2A4, 2A5 (aluminum bar) and ground. Meter reading should indicate capacitors charging.

(d) Repeat step (c) measuring resistance between input to 2A6, 2A7 and ground.

(e) Remove connector plugged into E4 of RF drive power supply A (2A2A1). Measure the resistance from E4 to ground. Meter reading should indicate capacitor charging. Reconnect E4.

(f) Measure resistance between 2A9R32 and ground. Meter reading should indicate capacitor charging.

(g) Measure the resistance between RT1 (right hand side) of DC power supply A (1A2A4) and ground. Meter reading should indicate capacitors charging.

(h) Measure the resistance between RT2 (right hand side) of DC power supply A (1A2A4) and ground. Meter reading should indicate capacitors charging.

(i) Measure the resistance between RT3 (right hand side) of DC power supply A (1A2A4) and ground. Meter reading should indicate capacitors charging.

(j) Measure the resistance between RT4 (left hand side) of DC power supply A (1A2A4) and ground. Meter reading should indicate capacitors charging.

(k) Measure the resistance between TP2 on DC power supply A (1A2A4) and ground. Meter reading should indicate capacitors charging.

(l) Measure the resistance between TP3 on DC power supply A (1A2A4) and ground. Meter reading should indicate capacitors charging.

(m) Measure the resistance between TP4 on DC power supply A (1A2A4) and ground. Meter reading should indicate capacitors charging.

(n) Measure the resistance between TP5 on DC power supply A (1A2A4) and ground. Meter reading should indicate capacitors charging.

2.4.1.3 Disabling of Power Modules: Disable the power modules (1A4 thru 1A19) by removing the connector plugged into J1 of each power module (1W1P1 thru 1W1P8, 1W2P1 thru 1W2P8).

2.4.1.4 Initial Turn On: Apply power to the transmitter and observe the alarm and status indicators as follows:

(a) Verify the requirements of paragraphs 2.4.1.2 and 2.4.1.3 have been completed.

(b) Ensure all panels are in place and all interlocked doors are closed and all the keys are in the transfer box.

(c) Set the **TRANSMITTER ENABLE** circuit breaker (2CB1) to **ON**.

(d) Turn on the AC power at the source. The charge contactor (2K2) should immediately pick up and about one second later the full power contactor should pick up. Turn off the audible alarm. Press **AUDIBLE ALARM MUTE** switch on the control/monitor panel. The RF **OFF,**

EXCITER A, **LOCAL CONTROL** and **LOW POWER** status LEDs on the control panel should all be on. The **BATTERY LOW** and **XMTR FAULT** alarm LEDs on the control panel should both be red as well as the alarm LEDs on the front of each of the power modules.

(e) Install three AA type batteries into BT1 on the remote interface PWB (1A1A4). The **BATTERY LOW** and **XMTR FAULT** alarm LEDs should both turn green.

2.4.1.5 B+ Voltage Check (no load)**:** Verify the no-load B+ voltage is satisfactory as follows:

(a) Verify meters are turn on (**METER ON/OFF** on control panel). Set **VOLTMETER SELECT** to **B+**. The meter should display 350 ±20 volts.

NOTE

If voltage in step (a) is not within specified limits, the most probable cause is power transformer 2T1's primary winding tap selection. Refer to paragraph 2.3.1 for information on transformer tap selection.

2.4.1.6 Low Voltage Power Supply Checks: Verify the low DC voltages are within tolerance as follows:

(a) Set the **VOLTMETER SELECT** to **+24V**. The meter should display 26 ±2 volts.

(b) Set the **VOLTMETER SELECT** to **+15V**. The meter should display 15 ±0.5 volts.

(c) Set the **VOLTMETER SELECT** to **+5V**. The meter should display 5.2 ±0.3

(d) Set the **VOLTMETER SELECT** to **-5V**. The meter should display 5.0 ±0.3 volts.

(e) Set the **VOLTMETER SELECT** to **-15V**. The meter should display 15 ±0.5 volts.

(f) Select exciter B by pressing **EXCITER B** switch on the control panel. Repeat steps (b), (c), (d) and (e).

(g) Select exciter A.

(h) Select **HIGH POWER**. Press the ∧ **POWER** and ∨ **POWER** switches at the same time (resets all power levels to zero).

2.4.1.7 RF Drive Checks: Verify the RF drive frequency and level are satisfactory as follows:

NOTE

The level of the DC voltage being applied to the RF drive amplifier and therefore the RF drive amplitude is a function of its frequency (fc).

(a) Calculate the RF drive power supply's output voltage for the assigned carrier frequency as follows:

fc is expressed in MHz

$$V_{RF\ Drive} = 74 - 8\ f_c$$

Example when fc is 576kHz

$$V_{RF\ Drive} = 74 - 8\ (0.576) = 74 - 4.608$$

$$= 69.392 \text{ volts}$$

(b) Turn on the transmitter. Press/release the control/monitor panel's **RF ON** switch and verify exciter 'A' is the active exciter.

(c) Select the RF drive power supply's output voltage as the input to the control/monitor panel's **DC VOLTS** meter, noting the 0-80 scale is to be read. Press/release the associated **METER SELECT** switch until **RF AMP VOLT** LED turns on.

(d) The RF drive voltage calculated in step (a) should be displayed on the **DC VOLTS** meter.

(e) If necessary, adjust RF drive power supply PWB 2A2A1's **VOLTAGE CONTROL** potentiometer to obtain the RF drive voltage in step (a). Connect a digital multimeter between TP2 and TP1 (ground) to monitor the RF drive voltage while performing the adjustment.

(f) Using an oscilloscope, monitor the RF drive at the right hand side of C9 on RF drive buffer PWB 1A37 (see figure MD-3 as an aid to locate the RF drive buffer PWB). Oscilloscope display should be a nominal square wave at the carrier frequency with a peak-to-peak voltage of about 33 volts.

(g) Disconnect BNC connector P8 from J12 of the exciter interface PWB. The exciter should automatically switch over to the standby exciter. Reconnect P8.

(h) Repeats steps (d) thru (g) for exciter B. Substitute 2A2A2 for 2A2A1 and 1A38 for 1A37.

2.4.1.8 Bi-Phase PDM Driver Checks: Verify the bi-phase PDM drivers are operating properly as follows:

(a) Calculate pulse duration modulation (PDM) frequency (f_{PDM}) for the assigned carrier frequency (fc) as follows:

fc and f_{PDM} are both expressed in kHz

$$\ddot{u}_{PDM} = \frac{\ddot{u}_C}{\text{integer}\left[\dfrac{\text{integer}\ \dfrac{\ddot{u}_C}{10}}{6.4}\right]}$$

Example when fc is 576kHz

$$\ddot{u}_{PDM} = \frac{576}{\text{integer}\left[\dfrac{\text{integer}\ \dfrac{576}{10}}{6.4}\right]} = \frac{576}{\text{integer}\left[\dfrac{57}{6.4}\right]}$$

$$= \frac{576}{8} = 72\text{ kHz}$$

(b) Using an oscilloscope, monitor the PDM 1 signal at TB2-10 and TB2-11 of primary 50kW distribution1A36 and PDM 2 signal at TB2-12 and TB2-13 of the same PWB.

(c) Both PDM signals should be at zero volts.

(d) Press and hold the control/monitor panel's ∧ **POWER** for one second. Oscilloscope display should be a 0 to 15 volt rectangular waveform. Both PDM signals should be identical but 180 degrees out-of-phase.

(e) Using a frequency counter, measure the frequency of the PDM 1 and PDM 2 signals. Measured frequency should agree with f_{PDM} calculated in step (a).

(f) Set RF power level command to maximum. Press and hold the control/monitor panel's ∧ **POWER** switch while monitoring the oscilloscope display. The duty cycle of the PDM waveform should increase to about 45% and then switch to zero percent.

NOTE

A protection circuit turns off (shuts back) the RF power and effectively sets the RF power level command to zero if a duty cycle of more than 45% is detected.

(g) Reset the protection circuitry. Reset RF power level command to zero watts. Simultaneously press ∧ **POWER** and ∨ **POWER** switches and then press the **SYSTEM RESET** switch.

(h) Set RF power level command for a PDM waveform duty cycle of 40% using the control/monitor panel's ∧ **POWER** switch.

(i) Set RF power level command to minimum. Press and hold the control/monitor panel's ∨ **POWER** switch while monitoring the oscilloscope display. The PDM waveform's duty cycle should decrease to zero percent.

(j) Repeats steps (b) thru (i) for the PDM drive from secondary 50kW distribution PWB 1A40. Substitute 1A40 for 1A36.

(k) Select exciter 'A' as the active exciter. Press/release the control/monitor panel's **EXCITER A** switch.

(l) Repeats steps (c) thru (j) for exciter 'A'

2.4.1.9 Gate Bias Drive Checks: Verify gate bias drive signals are within tolerance as follows:

(a) Monitor the gate bias drive at TB2-14 and TB2-15 on the primary 50kW distribution PWB with an oscilloscope. Oscilloscope should display a 0 to 20 volt square wave with a 50% duty cycle and the same frequency as the bi-phase PDM drive signals.

(b) Check the gate bias drive signals on the other 50kW distribution PWB (1A40). The signals should be the same as 1A36.

2.4.1.10 Initial Turn On of RF Power Modules: Turn on the power modules as follows:

(a) Preset the RF output power level command for zero watts. Simultaneously press ∧ **POWER** and ∨ **POWER** switches.

(b) Mate connector 1W1P1 with J1 of RF power module 1A4. A relay at rear of the transmitter (1A59K8) should be heard to drop out (turn off).

(c) **POWER MODULE** and **XMTR FAULT** alarm LEDs of the control panel should both turn red.

(d) Press/release **ALARM RESET** switch on the front of RF power module (1A4). The **RF DRIVE FAIL** and **POWER MOD FAIL** alarm LEDs could stay red but all other alarms should turn off.

(e) Sequentially connect the appropriate mating connector with J1 of the remaining RF power modules, listening for their associated relays to drop out as they are connected. Reset the alarm circuits for each RF power module by pressing/releasing its **ALARM RESET** switch before going on to the next. Refer to the RF power section schematics (figures SD-6 and SD-7) for a table of connectors and relays associated with each RF power module.

(f) Once all the RF power modules are plugged in, set the exciter interface PWBs **TUNE** switch to its **TUNE** position. Press/release its **TUNE RESET** switch and note its **TUNE** LED should turn on. The RF drive tuning motor in each RF power module may be heard if tuning was required. The **RF DRIVE FAIL** and **POWER MOD FAIL** alarm LEDs on all RF power modules should turn off.

(g) After approximately fifteen seconds the **TUNE** LED should turn off and there should be no alarm LEDs left on in the power modules.

(h) Set the exciter interface PWB's **TUNE** switch to its **NORM** position.

(i) Measure the DC voltage at 1A9R32-3 and verify it is between 51.25 and 51.75 VDC. If necessary, adjust 3-ø SCR power supply 2A9's **OUTPUT VOLTS** potentiometer for a reading of between 51.25 and 51.75 VDC.

(j) Select forward power to be displayed on the control/monitor panel's **RF KILOWATTS** meter, noting the upper scale is to be read. Press/release **METER SELECT** switch until **FORWARD PWR** LED turns on.

(k) Slowly increase the RF output to 10kW using the control/monitor panel's ∧ **POWER** switch. Using a dual beam oscilloscope, monitor the RF voltage sample out and RF current sample out at J10 and J11 of the primary 50kW distribution PWB (1A36). Use two 50 ohm coaxial cables of the same length. Ensure the voltage waveform leads the current waveform by between 55 and 120 ns.

(l) Slowly increase the RF output to 50kW using the control/monitor panel's ∧ **POWER** switch. Verify the RF power being applied to the dummy load is 50kW.

2.4.1.11 SWR Protection Check: Verify that the SWR protection circuits are operating as follows:

(a) Set the RF output power level command for zero watts. Simultaneously press ∧ **POWER** and ∨ **POWER** switches.

(b) Turn off the transmitter's RF power stages. Press/release the control/monitor panel's **RF OFF** switch.

(c) Turn off the transmitter's AC power source.

(d) Open circuit the transmitter's RF output, noting this may be accomplished by gaining access to the interior of the RF combiner/output filter and disconnecting the EIA inner female (cup) connector from the EIA inner male (bullet) connector.

CAUTION

Ensure the EIA inner female connector is positioned where it will not permit arcing of the RF output when the RF power stage is enabled in the following tests.

(e) Turn on the AC power source to the transmitter and turn on the transmitter. Press/release the control/monitor panel's **RF ON** switch.

NOTE

When the transmitter is operating into an open circuit, the reflected power level will equal the forward power level.

(f) Select reflected power to be displayed on the control/monitor panel's **RF KILOWATTS** meter, noting the lower scale is to be read. Press/release **METER SELECT** switch until **REFLD PWR** LED turns on.

CAUTION

Discontinue increasing the RF output if the required result does not occur before the reflected power reading on the RF KILOWATTS meter reading exceeds 20kW in the following tests.

(g) Slowly increase the RF output, using the control/monitor panel's ∧ **POWER** switch, until the **VSWR** status LED switches from green to red. The reflected power reading should be a nominal 10kW.

(h) Continue to slowly increase the RF output, using the control/monitor panel's ∧ **POWER** switch, until the **SHUTBACK** status LED switches from green to red. The reflected power reading should be a nominal 16kW.

(i) The reflected power reading shall fall to zero and then be exponentially restored to the RF shutback threshold. This cycle shall be repeated.

(j) After three shutback cycles the **CUTBACK** status LED shall switch from green to red.

(k) The reflected power reading shall be maintained at a nominal 16kW, noting one or more additional shutback cycles may occur before this happens.

(l) Set the RF output power level command for zero watts. Simultaneously press ∧ **POWER** and ∨ **POWER** switches.

(m) Turn off the transmitter's RF power stages. Press/release the control/monitor panel's **RF OFF** switch.

(n) Turn off the transmitter's AC power source.

(o) Restore the integrity of the transmitter's RF output load by connecting a 50-ohm load to its RF output.

2.4.1.12 External Interlock Shutback: Verify the transmitter's RF output power is shutback (turned off) when the external interlock is open.

(a) Turn on the transmitter's RF power stages. Press/release the control/monitor panel's **RF ON** switch.

(b) Select forward power to be displayed on the control/monitor panel's **RF KILOWATTS** meter, noting the upper scale is to be read. Press/release **METER SELECT** switch until **FORWARD PWR** LED turns on.

(c) Set the RF output, using the control/monitor panel's ∧ **POWER** switch, for a forward power reading of 100kW.

(d) Open an external interlock.

(e) The forward power reading shall immediately fall to zero watts. The **EXTERNAL INTLK** and **XMTR FAULT** alarm LEDs should switch from green to red, indicating an external interlock is open and the RF output has been inhibited.

(f) Close the external interlock.

(g) The forward power reading shall be restored to 100kW. The **EXTERNAL INTLK** and **XMTR FAULT** alarm LEDs shall switch from red to green, indicating the external interlock is intact and an RF output is being produced.

2.4.2 FINAL SET-UP: If required, perform a proof of performance and then set up preset power levels and audio level for desired envelope.

SECTION 3
CONTROLS AND INDICATORS

GENERAL

3.1 The following section is intended to familiarize operators and maintainers with the various controls and indicators contained in the transmitter.

CONTROL/MONITOR PANEL CONTROLS AND INDICATORS

3.2 Table 3-1 identifies controls and/or indicators on the control/monitor panel. The table identifies the panel marking, or when there is no marking, the nomenclature used in text, the reference designation assigned to each item and a description of each control/indicator's purpose/function. Refer to figure MD-1 for the location of the control/monitor panel. Refer to figure MD-5 for the location of and reference designations for the system controller PWB (1A1A3), the 8-input meter switch/monitor PWB (1A1A2), the 2-input meter switch/monitor PWB (1A1A1) and the remote interface PWB (1A1A4).

NOTE

Alarms on the control/monitor front panel are bi-colour lamps. When red is displayed, the associated alarm has been tripped. Otherwise, the alarm will glow green.

EXCITER PANEL

3.3 Table 3-2 identifies controls and/or indicators on the exciter panel. The table identifies the panel marking, or when there is no marking, the nomenclature used in text, the reference designation assigned to each item and a description of each control/indicator's purpose/function. Refer to figure MD-3 for the location of the exciter panel. Refer to figure MD-9 for the location of and reference designations for the exciter interface PWB (1A2A1), the frequency synthesizer PWBs (1A2A2, 1A2A5), the bi-phase PDM driver PWBs (1A2A3, 1A2A6) and the DC power supply PWBs (1A2A4, 1A2A7).

50kW DISTRIBUTION PWBs

3.4 Table 3-3 identifies controls and/or indicators on the primary 50kW distribution PWB (1A36). The table identifies the panel marking, or when there is no marking, the nomenclature used in text, the reference designation assigned to each item and a description of each control/indicator's purpose/ function. Refer to figure MD-3 for the location of the primary 50kW distribution PWB.

CAPACITOR TRAYS

3.5 Table 3-4 identifies controls and/or indicators on the capacitor trays (1A43 thru 1A58). The table identifies the panel marking, or when there is no marking, the nomenclature used in text, the reference designation assigned to each item and a description of each control/indicator's purpose/ function. Refer to figure MD-4 for the location of the capacitor trays.

RF POWER STAGE

3.6 Table 3-5 identifies controls and/or indicators in the output filter (1A3) and the 8-input RF combiners (1A41 and 1A42). The table identifies the panel marking, or when there is no marking, the nomenclature used in text, the reference designation assigned to each item and a description of each control/indicator's purpose/ function. Refer to figure MD-3 for the location of the output filter and to figure MD-4 for the location of the 8-input combiners.

POWER SUPPLY CABINET

3.7 Table 3-6 identifies controls and/or indicators in the power supply cabinet. The table identifies the panel marking, or when there is no marking, the nomenclature used in text, the reference designation assigned to each item and a description of each control/indicator's purpose/ function. Refer to figure MD-1 for the location of the power supply cabinet. Refer to figure MD-25 and MD-26 for the location of controls and indicators in the power supply cabinet.

B+ DISTRIBUTION PWBs

3.8 Table 3-7 identifies controls and/or indicators on the B+ distribution PWBs (2A4 thru 2A7). The table identifies the panel marking, or when there is no marking, the nomenclature used in text, the reference designation assigned to each item and a description of each control/indicator's purpose/ function. Refer to figure MD-26 for the location of the B+ distribution PWBs in the power supply cabinet. Refer to figure MD-32 for the location of controls and indicators on the B+ distribution PWBs.

DC POWER SUPPLY

3.9 Table 3-8 identifies controls and/or indicators on the DC power supply (2A2). The table identifies the panel marking, or when there is no marking, the nomenclature used in text, the reference designation assigned to each item and a description of each control/indicator's purpose/function. Refer to figure MD-25 for the location of the DC power supply in the power supply cabinet. Refer to figure MD-28 for the location of controls and indicators on the DC power supply. Refer to figure MD-30 for the location of controls and indicators on the RF drive DC power supply.

3-PHASE SCR POWER SUPPLY

3.10 Table 3-9 identifies controls and/or indicators on the 3ø SCR power supply (2A9). The table indicates panel marking, the nomenclature used in text, the reference designation assigned to each item and a description of each control/indicator's purpose/function. Refer to figure MD-25 for the location of the 3ø SCR power supply in the power supply cabinet. Refer to figures MD-35 and MD-36 for the location of controls and indicators on the 3ø SCR power supply.

Table 3-1 Control/Monitor Panel Controls and Indicators

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
1A1A1DS3	MD-5	**FORWARD PWR**	When turned on, indicates **RF KILOWATTS** power meter (1A1M3) is displaying total forward output power.
1A1A1DS7	MD-5	**REFLD PWR**	When turned on, indicates **RF KILOWATTS** power meter (1A1M3) is displaying total reflected output power.
1A1A2DS1	MD-5	**HIGH VOLTAGE B+**	Turned on when **DC VOLTS** meter (1A1M2) is displaying B+ voltage.
1A1A2DS2	MD-5	**POWER AMP VOLT**	Turned on when **DC VOLTS** meter (1A1M2) is displaying input DC voltage to the RF amplifiers in the power modules.
1A1A2DS3	MD-5	**RF AMP VOLT**	Turned on when **DC VOLTS** meter (1A1M2) is displaying RF drive DC supply voltage (2A2A1, 2A2A2).
1A1A2DS4	MD-5	**24 VDC**	Turned on when **DC VOLTS** meter (1A1M2) is displaying +24 VDC supply voltage.
1A1A2DS5	MD-5	**15 VDC**	Turned on when **DC VOLTS** meter (1A1M2) is displaying +15 VDC supply voltage.
1A1A2DS6	MD-5	**5 VDC**	Turned on when **DC VOLTS** meter (1A1M2) is displaying +5 VDC supply voltage.
1A1A2DS7	MD-5	**-5 VDC**	Turned on when **DC VOLTS** meter (1A1M2) is displaying -5 VDC supply voltage.
1A1A2DS8	MD-5	**-15 VDC**	Turned on when **DC VOLTS** meter (1A1M2) is displaying -15 VDC supply voltage.
1A1A1S1	MD-5	**Power METER SELECT**	Selects which of **FORWARD PWR** or **REFLD PWR** is displayed on **RF KILOWATTS** power meter (1A1M3).
1A1A2S1	MD-5	**Volt METER SELECT**	Selects one of **HIGH VOLTAGE B+**, **POWER AMP VOLT**, **RF AMP VOLT**, **24 VDC**, **15 VDC**, **5 VDC**, **-5VDC**, or **-15 VDC** is displayed on **DC VOLTS** meter (1A1M2).
1A1A3DS1	MD-5	**XMTR INTLK**	Glows green when all grounding wands are secured in place. When one or more wands are removed from their mounts, alarm turns red.
1A1A3DS2	MD-5	**XMTR FAULT**	Glows green when transmitter is operating with no faults detected. Turns red when a fault is registered (when any other alarm comes on).
1A1A3DS3	MD-5	**POWER MODULES**	Glows green when all power modules are operating properly. Turns red when any number of power modules experience a power module fault (RF, temperature, modulator, RF amp).

Table 3-1 Control/Monitor Panel Controls and Indicators (Continued)

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
1A1A3DS4	MD-5	**FAN FAILURE**	Glows green when the power supply cooling fans are operating. Turns red if any of the power supply cooling fans fails.
1A1A3DS5	MD-5	**RF INHIBIT**	Red alarm indicates that remote RF inhibit has been activated.
1A1A3DS6	MD-5	**SHUTBACK**	Glows green if transmitter detects no faults that force the shutback condition. Glows red when transmitter is shutback.
1A1A3DS7	MD-5	**CUTBACK**	Glows green when transmitter is operating at full power level set by the operator. Turns red when transmitter cuts back the output power level. Reset to original output power by pressing either ∧ **POWER** or ∨ **POWER**.
1A1A3DS8	MD-5	**STANDBY**	Glows green when selected main exciter is operating. Turns red if main exciter has failed and the standby exciter is in operation.
1A1A3DS9	MD-5	**BATTERY LOW**	Glows green when the battery backup voltage is acceptable; glows red when batteries need to be replaced.
1A1A3DS10	MD-5	**MODULATOR PROTECTION**	Glows green under normal operation. Turns red if modulator protection function engages.
1A1A3DS11	MD-5	**HIGH TEMP**	A red alarm indicates that the temperature sensors in the power supply have sensed a temperature which exceeds safe operating temperature or the charge/ discharge time, determined by the power supply monitor PWB, has been exceeded.
1A1A3DS12	MD-5	**AC LINE VOLTAGE**	Displays red if any phase (A, B or C) is outside of the safe operating range.
1A1A3DS14	MD-5	**COMBINER ARC**	Displays red if an arc is detected in the RF combiner/ output filter or the 8-input RF combiner.
1A1A3DS15	MD-5	**EXT INTLK**	Glows green when external interlock is short circuit. Glows red if external interlock is open circuit.
1A1A3DS16	MD-5	**OVER VOLT**	Displays red if the B+ voltage rises above a nominal fifteen percent threshold.
1A1A3DS17	MD-5	**UNDER VOLT**	Displays red if the B+ voltage falls below a nominal fifteen percent threshold.
1A1A3DS18	MD-5	**OVER CURRENT**	A red alarm indicates that the B+ current out of the B+ power supply has exceeded the maximum operational current.

Table 3-1 Control/Monitor Panel Controls and Indicators (Continued)

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
1A1A3DS21	MD-5	**COMBINER INPUT CURRENT**	Displays green when RF current into the combiner is within safe operating levels. Red when RF current into combiner exceeds the power module's stress current threshold.
1A1A3DS22	MD-5	**RF DRIVE**	Glows green when the output of the RF drive power supply is above 56V; turns red if it falls below 56V.
1A1A3DS23	MD-5	**LOW VOLTAGE**	Displays red if the +5V, -5V, +15V and/or -15V DC supplies are out of tolerance.
1A1A3DS24	MD-5	**MODULATOR DRIVER**	Glows red when there is a discrepancy between output of the modulator driver and expected output based on gain control setting.
1A1A3DS25	MD-5	**OSCILLATOR DRIVER**	Glows red when RF buffer output is missing or incorrect.
1A1A3DS26	MD-5	**VSWR**	Glows green when VSWR is less than 1.35:1. Otherwise, displays red.
1A1A3E1	MD-7	**SOLID FLASHING**	Selects solid red or flashing red alarms on control/ monitor panel. Alarms are solid red when link is between pin 1 and pin 2. Alarms are flashing red when link is between pin 2 and pin 3.
1A1A3R157	MD-7	**PA VOLTS SAMPLE**	Calibrates pa volts reading on the **DC VOLTS** meter (1A1M2 - see figure MD-5).
1A1A3R160	MD-7	**B+ SAMPLE**	Calibrates B+ reading on the **DC VOLTS** meter (1A1M2 - see figure MD-5).
1A1A3R189	MD-7	**VOLTMETER CAL**	Calibrates **DC VOLTS** meter (1A1M2 - see figure MD-5) for **24 VDC**, **15 VDC**, **5 VDC**, **-5 VDC**, and **-15 VDC** ranges.
1A1A3R192	MD-7	**POWER METER CAL**	Calibrates reading on **RF KILOWATTS** meter (1A1M3 - see figure MD-5).
1A1A3R193	MD-7	**CURRENT METER CAL**	Calibrates reading on **DC CURRENT** meter (1A1M1 - see figure MD-5).
1A1A3S1	MD-5	∧ **POWER**	Increases RF output power in one thousand (1000) increments. Momentarily pressing ∧ **POWER** increases output power by one increment. If ∧ **POWER** is held pressed, RF output power will ramp up after ¼ second delay (rate of increase slows near full power level). Output power stays at level observed when released. Only affects power level of currently selected power mode **(HIGH, MED, LOW)**. Output power level cannot be made greater than level set in next higher output power mode. Lamp is turned on while ∧ **POWER** switch is depressed.

Table 3-1 Control/Monitor Panel Controls and Indicators (Continued)

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
1A1A3S2	MD-5	∨ **POWER**	Decreases RF output power in one thousand (1000) increments. Momentarily pressing ∨ **POWER** decreases output power by one increment. If ∨ **POWER** is held pressed, RF output power will ramp down after ¼ second delay. Output power stays at level observed when released. Affects power level of currently selected power mode **(HIGH, MED, LOW)**, and power level of lower modes when RF output power level of current mode is decreased below level set in lower modes. Lamp is turned on while ∨ **POWER** switch is depressed. **NOTE** *Press* ∧ **POWER** *and* ∨ **POWER** *switches simultaneously to instantly reduce RF output power of selected power mode to 0W.*
1A1A3S3	MD-5	**HIGH POWER**	Sets RF output power to level most recently set for high power mode (one of three predefined levels). Lamp is turned on when high power mode is selected.
1A1A3S4	MD-5	**MED POWER**	Sets RF output power to level most recently set for medium power mode (one of three predefined levels). RF output power level cannot be made greater than level set in high power mode. Lamp is turned on when medium power mode is selected.
1A1A3S5	MD-5	**LOW POWER**	Sets RF output power to level most recently set for low power mode (one of three predefined levels). RF output power level cannot be made greater than level set in medium power mode. Lamp is turned on when low power mode is selected.
1A1A3S6	MD-5	**EXCITER A**	Selects exciter A as main exciter, and exciter B as standby exciter. Lamp is turned on when exciter A is operating.
1A1A3S7	MD-5	**EXCITER B**	Selects exciter B as main exciter, and exciter A as standby exciter. Lamp is turned on when exciter B is operating.
1A1A3S8	MD-5	**RF ON**	Enables the RF output power stage of the transmitter. Lamp is turned on when the RF output power stage is operating.
1A1A3S9	MD-5	**RF OFF**	Disables the RF output power stage of the transmitter. Lamp is turned on when the RF output power stage is not operating.

Table 3-1 Control/Monitor Panel Controls and Indicators (Continued)

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
1A1A3S10	MD-5	SYSTEM RESET	Resets all latched protection circuits to their unlatched state when actuated. Any influence the latched protection circuit had on the RF output will be discontinued. This action does not disable the protection circuit and it will continue to respond to any out-of-tolerance condition to the parameter it is monitoring. Lamp is turned on while **SYSTEM RESET** is depressed.
1A1A3S11	MD-5	**LED TEST**	Turns on all lamps on the control panel when pressed and held. Indicator lamps return to their previous states when the switch is released.
1A1A3S12	MD-5	**LOCAL**	Selects local control mode, enabling all switches on the transmitter's front panel. Lamp is turned on when in local control mode.
1A1A3S13	MD-5	**REMOTE**	Selects remote control mode, disabling all switches on the transmitter's front panel, except, **MUTE**, **ALARM RECALL**, **METER ON/OFF**, **LOCAL**, and **RF OFF**. All other functions are controlled remotely. Lamp is turned on when in remote control mode.
1A1A3S14	MD-5	**MUTE**	Enables and disables the audible alarm. Has no effect on other alarms. Lamp is turned on when **AUDIBLE ALARM** is muted.
1A1A3S15	MD-5	**ALARM RECALL**	Displays the last alarm that forced the transmitter to take corrective/protective action. Lamp is turned on while **ALARM RECALL** is depressed.
1A1A3S16	MD-5	**METER ON/OFF**	Enables and disables the power, voltage and current meters on the control panel. Lamp is turned on when the meters are enabled.
1A1A3S17	MD-5	**ALARM MEMORY RESET**	Resets all alarms stored in memory, such that **ALARM RECALL** switch does not turn on any alarm indicators.
1A1A4BT1	MD-8	**BT1**	Supplies 4.5vdc to control/monitor PWB as battery backup during periods of AC power loss, to preserve operational settings and alarm status. Transmitter will resume operation as it was before AC power loss when AC power is restored.
1A1A4R16	MD-8	**HIGH**	Adjusts level of RF output at J5 (**EXT RF MONITOR**) when **HIGH POWER** is selected on the front panel.
1A1A4R17	MD-8	**MEDIUM**	Adjusts level of RF output at J5 (**EXT RF MONITOR**) when **MED POWER** is selected on the front panel.

Table 3-1 Control/Monitor Panel Controls and Indicators (Continued)

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
1A1A4R18	MD-8	**LOW**	Adjusts level of RF output at J5 (**EXT RF MONITOR**) when **LOW POWER** is selected on the front panel.
1A1M2	MD-5	DC VOLTS	Displays B+ DC voltage on top 0-400V scale when **HIGH VOLTAGE B+** lamp is turned on. Displays power amplifier DC input voltage on middle 0-200V scale when **POWER AMP VOLT** lamp is turned on. Displays RF drive DC supply voltage on bottom 0-80V scale when **RF AMP VOLT** lamp is turned on. Displays 24 volt DC supply voltage on 0-400 V scale, where markings are divided by 10, when **24 VDC** lamp is turned on. Displays 15 volt DC supply voltage on 0-200 V scale, where markings are divided by 10, when **15 VDC** lamp is turned on. Displays 5 volt DC supply voltage on 0-80 V scale, where markings are divided by 10, when **5 VDC** lamp is turned on. Displays -5 volt DC supply voltage on 0-80 V scale, where markings are divided by 10 and polarity of markings is reversed, when **-5 VDC** lamp is turned on. Displays -15 volt DC supply voltage on 0-200 V scale, where markings are divided by 10, and polarity of markings is reversed, when **-15 VDC** lamp is turned on.
1A1M3	MD-5	**RF KILOWATTS**	Displays total forward output power on upper scale when **FORWARD PWR** lamp is turned on. Displays total reflected output power on lower scale when **REFLD PWR** lamp is turned on.

Table 3-2 Exciter Panel Controls and Indicators

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
1A2A1DS2	MD-10	**TUNE**	Indicates automatic RF drive tuning circuits in RF power modules are enabled and RF drive protection circuits are disabled when turned on.
1A2A1R9	MD-10	**Ext RF Drive**	Adjusted for symmetry of externally applied RF drive waveform when ext fc is a sine wave. Used only when the RF drive source is an external RF generator.
1A2A1S1	MD-10	**TUNE RESET**	Initiates tuning of RF power modules. Resets frequency synthesizer PWB for new frequency. Press the **TUNE RESET** after the **TUNE/NORM** switch (1A2A1S2) is set to **TUNE**.
1A2A1S2	MD-10	**TUNE/NORM**	When set to **TUNE**, enables RF power module tuning mode (see **TUNE RESET** (1A2A1S1) above). When set to **NORM**, enables normal operating mode of the transmitter.
1A2♦C49	MD-10	**FREQ TRIM**	Adjusted to set frequency synthesizer PWB's crystal oscillator to precisely the assigned RF carrier frequency.
1A2♦MP1	MD-10	**RF Drive Source**	Bi-position selector circuit that allows the user to configure the frequency synthesizer PWB to use either the output of an integral crystal controlled oscillator or an external RF generator as the RF drive source. Refer to paragraph 2.3.2 for selection information. The integral crystal controlled oscillator is selected as the RF drive source when shorting shunt post MP1 is installed between pins 2 and 3 of its 3-pin header. An external RF generator is selected as the RF drive source when shorting shunt post MP1 is installed between between pins 1 and 2 of its 3-pin header.
1A2♦R40	MD-10	**SLICER BIAS**	Adjusted to obtain an RF oscillator drive waveform that is a symmetrical square wave.
1A2♥R31	MD-10	**AUDIO GAIN**	Adjusted, when bi-phase PDM driver PWB is enabled (the associated exciter is the active exciter). Adjusted for 100% modulation when the modulating audio is between 0dBm and +12dBm and its amplitude is the level that is expected to produce 100% modulation.
1A2♥R51	MD-10	**GAIN TRIM**	Adjusted, when bi-phase PDM driver PWB is enabled (the associated exciter is the active exciter). Compensates for tolerance differences between exciter 'A' and exciter 'B' of dual exciter transmitters. One or both must be adjusted to set the PDM pulse train to produce identical RF output levels when either exciter is selected.

Table 3-2 Exciter Panel Controls and Indicators (Continued)

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
1A2♥S1	MD-10	**Audio Filter**	Binary selector switch that selects one of four frequencies (7.5kHz, 10.5kHz, 13.5kHz or 16.0kHz) as the modulating audio's 1.0dbm roll-off point.
1A2♣DS1	MD-10	15VDC	Indicates the DC power supply PWB's +15 VDC power supply is enabled (when its associated exciter is the active exciter) and providing a regulated +15 VDC output when turned on.
1A2♣DS2	MD-10	**5VDC**	Indicates the DC power supply PWB's +5 VDC power supply is enabled (when its associated exciter is the active exciter) and providing a regulated +5 VDC output when turned on.
1A2♣DS3	MD-10	**-15VDC**	Indicates the DC power supply PWBs –15 VDC power supply is enabled (when its associated exciter is the active exciter) and providing a regulated –15 VDC output when turned on.
1A2♣DS4	MD-10	**-5VDC**	Indicates the DC power supply's –5 VDC power supply is enabled (when the associated exciter is the active exciter) and providing a regulated –5 VDC output when turned on.

NOTE

1A2♦ - Denotes two identical frequency synthesizer PWBs are installed. One for exciter 'A' (1A2A2) and one for exciter 'B' (1A2A5). Refer to the frequency synthesizer PWB's service instruction manual for its electrical schematic and assembly detail.

1A2♥ - Denotes two identical bi-phase PDM driver PWBs are installed. One for exciter 'A' (1A2A3) and one for exciter 'B' (1A2A6). Refer to the bi-phase PDM driver PWB's service instruction manual for its electrical schematic and assembly detail.

1A2♣ - Denotes two identical DC power supply PWBs are installed. One for exciter 'A' (1A2A4) and one for exciter 'B' (1A2A7). Refer to the DC power supply PWB's service instruction manual for its electrical schematic and assembly detail.

Table 3-3 50kW Distribution PWB Controls and Indicators

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
1A36F1	MD-18	**F1**	Fuses +48V being applied to power module under test using power module test cable (176-5710) at 5.0 amperes.
1A36F2	MD-18	**F2**	Fuses RF drive volts to power module under test using power module test cable (176-5710) at 3.0 amperes.
1A36R44	MD-18	**IMPD METER**	Calibrates **IMPEDANCE** meter (1A3A1M1) on the tuning control panel.
1A36R71	MD-18	**RF Current Threshold**	Adjusted, during frequency change procedure, to set the threshold of the RF current detection circuitry.
1A36S1	MD-18	**START**	When pressed and held, tunes a power module being tested using the power module test cable (176-5710).
1A40R71	MD-21	**RF Current Threshold**	Adjusted, during frequency change procedure, to set the threshold of the RF current detection circuitry.

Table 3-4 Capacitor Tray Indicators

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
1A43DS1	MD-24	**B+ ON**	Turned on when B+(P) voltage is present at input to power module 1A19.
1A44DS1	MD-24	**B+ ON**	Turned on when B+(O) voltage is present at input to power module 1A18.
1A45DS1	MD-24	**B+ ON**	Turned on when B+(N) voltage is present at input to power module 1A17.
1A46DS1	MD-24	**B+ ON**	Turned on when B+(M) voltage is present at input to power module 1A16.
1A47DS1	MD-24	**B+ ON**	Turned on when B+(L) voltage is present at input to power module 1A15.
1A48DS1	MD-24	**B+ ON**	Turned on when B+(K) voltage is present at input to power module 1A14.
1A49DS1	MD-24	**B+ ON**	Turned on when B+(J) voltage is present at input to power module 1A13.
1A50DS1	MD-24	**B+ ON**	Turned on when B+(I) voltage is present at input to power module 1A12.
1A51DS1	MD-24	**B+ ON**	Turned on when B+(H) voltage is present at input to power module 1A11.
1A52DS1	MD-24	**B+ ON**	Turned on when B+(G) voltage is present at input to power module 1A10.
1A53DS1	MD-24	**B+ ON**	Turned on when B+(F) voltage is present at input to power module 1A9.
1A54DS1	MD-24	**B+ ON**	Turned on when B+(E) voltage is present at input to power module 1A8.
1A55DS1	MD-24	**B+ ON**	Turned on when B+(D) voltage is present at input to power module 1A7.
1A56DS1	MD-24	**B+ ON**	Turned on when B+(C) voltage is present at input to power module 1A6.
1A57DS1	MD-24	**B+ ON**	Turned on when B+(B) voltage is present at input to power module 1A5.
1A58DS1	MD-24	**B+ ON**	Turned on when B+(A) voltage is present at input to power module 1A4.

Table 3-5 RF Power Stage Controls and Indicators

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
1A3A1M1	MD-13	**IMPEDANCE**	Used in tuning the output filter. Needle is at centre scale when filter is tuned for optimum input impedance.
1A3S1		**INTERLOCK**	Opens internal interlock circuit when ground wand in left side of RF combiner/final filter is not properly stored in its holder.
1A3S2		**INTERLOCK**	Opens internal interlock circuit when ground wand in right side of RF combiner/final filter is not properly stored in its holder.
1A3S3	MD-1 MD-12	**ANTENNA GROUND SWITCH**	Grounds output of transmitter during maintenance. Must be closed before any **KEY CONTROLLED ACCESS** locks on the transmitter can be opened.
1A3C30	MD-12 MD-13	**PHASE ADJUST**	Used to adjust series capacitance of the output filter.
1A3A2A1S1	MD-12 MD-14		Used to adjust load on the current transformer used in the forward/reflected power probe. Forward/reflected power readings will be accurate when properly set.
1A3A3P1 thru 1A3A3P6	MD-12 MD-15	**Fine Tuning Capacitor Jumpers**	Jumpers which determine the value of shunt capacitance used to fine tune the RF combiner/output filter. Refer to frequency change procedure in section 4.
1A3A4DS1	MD-11	**ARC DET O/P Filter - LHS**	Turned off during normal operation. Turned on (amber) when an arc is detected in the left-hand side of the RF combiner/output filter (1A3). Lamp is reset by temporarily resetting the transmitter's AC power source.
1A3A4E1	MD-11	**Sensitivity O/P Filter - LHS**	Selects sensitivity of associated arc detector PWB. Low sensitivity selected when link is between pins 1 and 2. High sensitivity when link is between pins 2 and 3.
1A3A5DS1	MD-12	**ARC DET O/P Filter - RHS**	Turned off during normal operation. Turned on (amber) when an arc is detected in the right-hand compartment of the RF combiner/output filter (1A3). Lamp is reset by temporarily resetting the transmitter's AC power source.
1A3A5E1	MD-12	**Sensitivity O/P Filter - RHS**	Selects sensitivity of associated arc detector PWB. Low sensitivity selected when link is between pins 1 and 2. High sensitivity when link is between pins 2 and 3.
1A41A4DS1	MD-22	**ARC DET RF Combiner - RH**	Turned off during normal operation. Turned on (amber) when an arc is detected in the right-hand 8-input RF combiner (1A41). Lamp is reset by temporarily resetting the transmitter's AC power source.

Table 3-5 RF Power Stage Controls and Indicators (Continued)

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
1A41A4E1	MD-22	**Sensitivity RF Combiner - RH**	Selects sensitivity of associated arc detector PWB Low sensitivity selected when link is between pins 1 and 2. High sensitivity when link is between pins 2 and 3.
1A42A4DS1	MD-22	**ARC DET RF Combiner - LH**	Turned off during normal operation. Turned on (amber) when an arc is detected in the left-hand 8-input RF combiner (1A42). Lamp is reset by temporarily resetting the transmitter's AC power source.
1A42A4E1	MD-22	**Sensitivity RF Combiner - LH**	Selects sensitivity of associated arc detector PWB. Low sensitivity selected when link is between pins 1 and 2. High sensitivity when link is between pins 2 and 3.

Table 3-6 Power Supply Cabinet Controls and Indicators

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
2M1	MD-25	ELAPSED TIME	Displays total time in hours (red least significant digit is tenths of hours) that the transmitter's RF power stage has been operating. Does not register time during which transmitter is on and RF power stage is off (**RF OFF** indicator is turned on).
2CB1	MD-25	**TRANSMITTER ENABLE**	Removes AC power from transmitter when **EMERGENCY ON/OFF** switch is pressed by de-energizing the main contactor (2K1). Does not remove AC power from input to the main contactor. Must be in **ON** position for transmitter to operate. Cannot be set to **ON** position until **EMERGENCY ON/OFF** switch (2S1) is pulled out.
2S1	MD-25	**EMERGENCY ON/OFF**	When pushed in, shuts down the transmitter by tripping **TRANSMITTER ENABLE** circuit breaker (2CB1). AC power is not removed from the input to the main contactor. Must be pulled out for transmitter to operate.
2F1	MD-26	**F1**	Fuses primary of 2T2 at 8 amperes.
2F2	MD-26	**55 VAC (A)**	Fuses **55 VAC (A)** to 3ø SCR power supply (2A9) at 30 amperes.
2F3	MD-26	**55 VAC (B)**	Fuses **55 VAC (B)** to 3ø SCR power supply (2A9) at 30 amperes.
2F4	MD-26	**55 VAC (C)**	Fuses **55 VAC (C)** to 3ø SCR power supply (2A9) at 30 amperes.
2F5	MD-26	**55 VAC (A)**	Fuses **55 VAC (A)** to 3ø SCR power supply (2A9) and to power supply control/monitor PWB (2A1) at 30 amperes.
2F6	MD-26	**55 VAC (B)**	Fuses **55 VAC (B)** to 3ø SCR power supply (2A9) and to power supply control/monitor PWB (2A1) at 30 amperes.
2F7	MD-26	**55 VAC (C)**	Fuses **55 VAC (C)** to 3ø SCR power supply (2A9) and to power supply control/monitor PWB (2A1) at 30 amperes.
2F8	MD-26	**233 VAC (A)**	Fuses **233 VAC (A)** to power supply control/monitor PWB (2A1) at 10 amperes.
2F9	MD-26	**233 VAC (B)**	Fuses **233 VAC (B)** to main contactor 2K1 at 10 amperes.

Table 3-7 B+ Distribution PWB Controls and Indicators

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
2A4DS1	MD-26 MD-32	**P**	When turned on, indicates that B+(P) to capacitor tray 1A43 and power module 1A19 is on via fuse 2A4F1.
2A4DS2	MD-26 MD-32	**O**	When turned on, indicates that B+(O) to capacitor tray 1A44 and power module 1A18 is on via fuse 2A4F2.
2A4DS3	MD-26 MD-32	**N**	When turned on, indicates that B+(N) to capacitor tray 1A45 and power module 1A17 is on via fuse 2A4F3.
2A4DS4	MD-26 MD-32	**M**	When turned on, indicates that B+(M) to capacitor tray 1A46 and power module 1A16 is on via fuse 2A4F4.
2A4F1	MD-26 MD-32	**B+(P)**	Fuses B+(P) to capacitor tray 1A43 and power module 1A19 at 40 amperes.
2A4F2	MD-26 MD-32	**B+(O)**	Fuses B+(O) to capacitor tray 1A44 and power module 1A18 at 40 amperes.
2A4F3	MD-26 MD-32	**B+(N)**	Fuses B+(N) to capacitor tray 1A45 and power module 1A17 at 40 amperes.
2A4F4	MD-26 MD-32	**B+(M)**	Fuses B+(M) capacitor tray 1A46 and power module 1A16 at 40 amperes.
2A5DS1	MD-26 MD-32	**L**	When turned on, indicates that B+(L) to capacitor tray 1A47 and power module 1A15 is on via fuse 2A5F1.
2A5DS2	MD-26 MD-32	**K**	When turned on, indicates that B+(K) to capacitor tray 1A48 and power module 1A14 is on via fuse 2A5F2.
2A5DS3	MD-26 MD-32	**J**	When turned on, indicates that B+(J) to capacitor tray 1A49 and power module 1A13 is on via fuse 2A5F3.
2A5DS4	MD-26 MD-32	**I**	When turned on, indicates that B+(I) to capacitor tray 1A50 and power module 1A12 is on via fuse 2A5F4.
2A5F1	MD-26 MD-32	**B+(L)**	Fuses B+(L) to capacitor tray 1A47 and power module 1A15 at 40 amperes.
2A5F2	MD-26 MD-32	**B+(K)**	Fuses B+(K) to capacitor tray 1A48 and power module 1A14 at 40 amperes.
2A5F3	MD-26 MD-32	**B+(J)**	Fuses B+(J) to capacitor tray 1A49 and power module 1A13 at 40 amperes.
2A5F4	MD-26 MD-32	**B+(I)**	Fuses B+(I) to capacitor tray 1A50 and power module 1A12 at 40 amperes.

Table 3-7 B+ Distribution PWB Controls and Indicators (Continued)

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
2A6DS1	MD-26 MD-32	**H**	When turned on, indicates that B+(H) to capacitor tray 1A51 and power module 1A11 is on via fuse 2A6F1.
2A6DS2	MD-26 MD-32	**G**	When turned on, indicates that B+(G) to capacitor tray 1A52 and power module 1A10 is on via fuse 2A6F2.
2A6DS3	MD-26 MD-32	**F**	When turned on, indicates that B+(F) to capacitor tray 1A53 and power module 1A9 is on via fuse 2A6F3.
2A6DS4	MD-26 MD-32	**E**	When turned on, indicates that B+(E) to capacitor tray 1A54 and power module 1A8 is on via fuse 2A6F4.
2A6F1	MD-26 MD-32	**B+(H)**	Fuses B+(H) to capacitor tray 1A51 and power module 1A11 at 40 amperes.
2A6F2	MD-26 MD-32	**B+(G)**	Fuses B+(G) to capacitor tray 1A52 and power module 1A10 at 40 amperes.
2A6F3	MD-26 MD-32	**B+(F)**	Fuses B+(F) to capacitor tray 1A53 and power module 1A9 at 40 amperes.
2A6F4	MD-26 MD-32	**B+(E)**	Fuses B+(E) to capacitor tray 1A54 and power module 1A8 at 40 amperes.
2A7DS1	MD-26 MD-32	**D**	When turned on, indicates that B+(D) to capacitor tray 1A55 and power module 1A7 is on via fuse 2A7F1.
2A7DS2	MD-26 MD-32	**C**	When turned on, indicates that B+(C) to capacitor tray 1A56 and power module 1A6 is on via fuse 2A7F2.
2A7DS3	MD-26 MD-32	**B**	When turned on, indicates that B+(B) to capacitor tray 1A57 and power module 1A5 is on via fuse 2A7F3.
2A7DS4	MD-26 MD-32	**A**	When turned on, indicates that B+(A) to capacitor tray 1A58 and power module 1A4 is on via fuse 2A7F4.
2A7F1	MD-26 MD-32	**B+(D)**	Fuses B+(D) to capacitor tray 1A55 and power module 1A7 at 40 amperes.
2A7F2	MD-26 MD-32	**B+(C)**	Fuses B+(C) to capacitor tray 1A56 and power module 1A6 at 40 amperes.
2A7F3	MD-26 MD-32	**B+(B)**	Fuses B+(B) to capacitor tray 1A57 and power module 1A5 at 40 amperes.
2A7F4	MD-26 MD-32	**B+(A)**	Fuses B+(A) to capacitor tray 1A58 and power module 1A4 at 40 amperes.

Table 3-8 DC Power Supply Controls and Indicators

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
2A2F8	MD-28	**RF PWR SUPPLY (A)**	Fuses +48V to RF power supply A (2A2A1) at 30 amperes.
2A2F7	MD-28	**RF PWR SUPPLY (B)**	Fuses +48V to RF power supply B (2A2A2) at 30 amperes.
2A2F6	MD-28	**BUFFER**	Fuses +48V to RF buffer PWBs (1A37 and 1A38) at 4 amperes.
2A2F5	MD-28	**FANS**	Fuses +48V to all cooling fans at 30 amperes.
2A2F4	MD-28	**-18V**	Fuses -18V to exciter interface PWB (1A2A1) at 2 amperes.
2A2F3	MD-28	**24V**	Fuses +24V to power supply control/monitor PWB (2A1) and exciter interface PWB (1A2A1) at 20 amperes.
2A2F2	MD-28	**-8V**	Fuses -8V to exciter interface PWB (1A2A1) at 5 amperes.
2A2F1	MD-28	**8V**	Fuses +8V to exciter interface PWB (1A2A1) and power supply control/monitor PWB (2A1) at 5 amperes.
2A2A1DS1	MD-30	**15 VDC**	When turned on, indicates **RF DRIVE POWER SUPPLY** (A) is operating.
2A2A1R3	MD-30	**VOLTAGE CONTROL**	Adjusts output voltage of **RF DRIVE POWER SUPPLY** (A).
2A2A2DS1	MD-30	**15 VDC**	When turned on, indicates **RF DRIVE POWER SUPPLY** (B) is operating.
2A2A2R3	MD-30	**VOLTAGE CONTROL**	Adjusts output voltage of **RF DRIVE POWER SUPPLY** (B).

Table 3-9 3-Phase SCR Power Supply Controls and Indicators

REF DES	FIG NO.	PANEL MARKING/ NOMENCLATURE USED IN TEXT	FUNCTION
2A9R9	MD-36	**OUTPUT VOLTS**	Adjusts output voltage of 48V DC power supply.

SECTION 4
OPERATING INSTRUCTIONS

GENERAL

4.1 The following instructions are primarily intended for persons involved in testing or maintenance of the equipment.

4.1.1 PRECAUTIONS TO BE OBSERVED: The NA100 transmitter contains many solid state devices which 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.

CONTROLS AND INDICATORS

4.2 It is highly recommended that the operator be familiar with the transmitter's controls and indicators described in section 3 before proceeding with the transmitter commissioning.

EMERGENCY SHUTDOWN PROCEDURE

4.3 There are no special precautions to be taken if an emergency shutdown is required, but the type of shutdown will be dictated by the reason for the shutdown. There are two types of shutdown. The first turns off the RF output by inhibiting the power output stages. The second turns off the RF output and disables all of the internal power supplies by disconnecting the ac power source.

4.3.1 TURN OFF RF OUTPUT: When the cause of the emergency shutdown is external to the transmitter or is in the RF output portion of the transmitter, the following will turn off the RF power produced by the power modules:

WARNING

The following will not remove the ac power source voltage from the transmitter or inhibit any of the internal low voltage DC supplies or the B+ power supply. If the reason for the shutdown requires all voltages to be turned off, proceed directly to paragraph 4.3.2.

- If in local or remote control, press and release **RF OFF** on the transmitter's control/monitor panel.
- If in remote control, press and release **RF OFF** at the remote control site.
- If in local or remote control, select **RF INHIBIT** at the remote control site.
- Open any external interlock switch.

4.3.2 COMPLETE SHUTDOWN: When the cause of the emergency shutdown dictates the need for a complete shutdown of the transmitter, the following will shut down the transmitter completely:

- Switch off the ac power source at the service entrance.

WARNING

The following will not remove the AC power source voltage at the transmitter input. If the reason for the shutdown requires AC power to be removed at the transmitter input, the power must be turned off at the service entrance.

- Press the **EMERGENCY ON/OFF** switch on the front panel of the power supply cabinet.

PRE-STARTUP 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 external input/output wiring is connected as detailed in section 2.

(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/covers are installed and their attaching hardware is firmly secured.

(e) 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 load that is rated at 200,000 watts for adjustment and testing procedures.

(f) Verify appropriate primary winding taps of the power transformer have been selected to match the voltage of the input power source (refer to paragraph 2.3.1).

(g) Verify appropriate primary winding taps of transformer 2T2 have been selected to match the voltage of the input power (refer to paragraph 2.3.1.2).

KEY CONTROLLED ACCESS SYSTEM

4.5 The NA100 transmitter is equipped with a key controlled access system to help ensure operator safety. Access panels throughout the transmitter must be closed and locked before ac power to the transmitter can be turned on. Similarly, ac power must be turned off and the antenna grounded before any of the access panels can be opened.

4.5.1 COMPONENTS OF KEY CONTROLLED ACCESS SYSTEM: There are four (4) components in this system:

(a) **Service Entrance Switch** requires **SERVICE ENTRANCE KEY** to be turned on. Will not release **SERVICE ENTRANCE KEY** while turned on.

(b) **Antenna Ground Switch** requires **SERVICE ENTRANCE KEY** to ground antenna. Cannot be opened without **TRANSFER CASE KEY**.

(c) **Transfer Case** requires **TRANSFER CASE KEY** to release access lock keys. Will not release **TRANSFER CASE KEY** until all access lock keys are in the transfer case.

(d) **Access Lock Keys (5)** required to open access panels throughout the transmitter. Access panels must be closed and locked to release access lock keys.

4.5.2 OPENING ACCESS PANELS: Follow these steps to gain access to the inside of the transmitter:

(a) Turn off ac power at the service entrance panel. Turn **SERVICE ENTRANCE KEY** counter clockwise to release it.

(b) Insert **SERVICE ENTRANCE KEY** into antenna ground switch lock labelled **SERVICE ENTRANCE KEY** and turn clockwise.

(c) Close **ANTENNA GROUND SWITCH** by pushing it towards the rear of the transmitter. Turn **TRANSFER CASE KEY** counter clockwise and remove from lock.

(d) Insert **TRANSFER CASE KEY** into transfer case and turn it clockwise. The five access lock keys will be released.

(e) Remove one access lock key (or more, if required) from transfer case and insert it into the access lock on the access panel. Turn clockwise to unlock the access panel.

4.5.3 APPLYING AC POWER TO TRANSMITTER: Follow these steps to close the transmitter and apply AC power:

(a) Close all access panels. To release the access lock key in each panel, turn it counter clockwise and remove it from the lock.

(b) Insert all five (5) access lock keys into transfer case. Turn **TRANSFER CASE KEY** counter clockwise and remove from transfer case.

(c) Insert **TRANSFER CASE KEY** into **ANTENNA GROUND SWITCH** lock labelled **TRANSFER CASE KEY** and turn clockwise. Open the **ANTENNA GROUND SWITCH** by pulling it towards the front of the transmitter.

(d) Turn **SERVICE ENTRANCE KEY** counter clockwise and remove from **ANTENNA GROUND SWITCH** lock.

(e) Insert **SERVICE ENTRANCE KEY** into AC power switch and turn clockwise. Close switch.

ELECTROSTATIC PROTECTION

4.6 The transmitter's assemblies contain semiconductor devices that are susceptible to damage from electrostatic discharge. Prior to removing an assembly from the transmitter and while servicing an assembly, the following precautions must be observed:

NOTE

Electrostatic energy is produced when two insulating materials are rubbed together. A person wearing rubber-soled shoes, walking across a nylon carpet or a waxed floor, can generate an extremely large electrostatic charge. This effect is magnified during periods of low humidity.

Components such as integrated circuits, field-effect transistors, thyristors and Schottky diodes may be damaged by this high voltage unless adequate precautions are taken.

4.6.1 DISCHARGING OF PERSONNEL: Maintainers should be electrically discharged by a suitable ground system (anti-static mats, grounding straps) during removal of an assembly from the transmitter and while handling the assembly for maintenance procedures.

4.6.2 HANDLING/STORAGE: The assembly should be placed in an anti-static bag when it is not installed in a host transmitter or when it is not being subjected to maintenance procedures. Electronic components should be stored in anti-static materials.

4.6.3 TOOLS/TEST EQUIPMENT: Testing and maintenance equipment, including soldering and unsoldering tools, should be suitable for contact with static sensitive semiconductor devices.

4.6.4 STRESS CURRENT PROTECTION: Every precaution should be taken to ensure the static sensitive semiconductor devices are protected from unnecessary stress current. This is achieved by ensuring:

- Current is not flowing when an electrical connection is to be broken.
- Voltages are not present on external control/ monitoring circuits when they are to be connected.

REMOTE OPERATION

4.7 The transmitter's on/off status, power level selection and its active exciter selection can be controlled remotely. When **REMOTE** control is selected, these functions are controlled from a remote location. When **LOCAL** control is selected, the remote controls have no influence. The remote alarm/status monitoring is independent of and is not affected by the *local/remote* selection.

EXCITER CONFIGURATION

4.8 The exciter assemblies are duplicated and are connected to form an active and a reserve exciter. The control/monitor panel's **EXCITER A/EXCITER B** switches determine which set is selected as the active exciter. Refer to the following listings to determine which PWB/assembly is selected for a specific **EXCITER** switch setting.

Exciter A Selected

A - DC Power Supply 1A2A4
A - Frequency Synthesizer PWB..................... 1A2A2
A - Modulator Driver PWB 1A2A3
A - RF Drive Buffer... 1A37
A - RF Drive Power Supply 2A2A1

Exciter B Selected

B - DC Power Supply 1A2A7
B - Frequency Synthesizer PWB..................... 1A2A5
B - Modulator Driver PWB 1A2A6
B - RF Drive Buffer... 1A38
B - RF Drive Power Supply............................ 2A2A2

TURN-ON EXPECTATIONS

4.9 Following is the sequence of events that should occur when AC power is first applied to the transmitter.

NOTE

It is assumed that the transmitter was not operating before ac power was removed from the transmitter. If AC power was removed while the transmitter was operating, the same sequence of events will occur, with the exception that normal operation will resume automatically when AC power is restored.

(a) Charge contactor (2K2) energizes.

(b) B+ voltage charges to approximately 250V (as read on the **DC VOLTS** meter on the control/ monitor panel), in approximately one second.

(c) Power contactor (2K1) energizes. B+ voltage jumps to approximately 340V as read on the **DC VOLTS** meter on the control/ monitor panel.

(d) All alarm indicators on the control/monitor panel are green and sixteen **POWER MODULE** LEDs on the rear of the power supply cabinet are turned on.

ROUTINE OPERATION

4.10 Operators of the NA100 transmitter may wish to perform routine tasks, as outlined in this section.

4.10.1 CHANGING EXCITERS: The operator may change from exciter A to exciter B and from exciter B to exciter A at any time, as follows:

(a) Press and release **EXCITER A** switch on the control/monitor panel to activate exciter A.

(b) Press and release **EXCITER B** switch on the control/monitor panel to activate exciter B.

4.10.2 SETTING RF OUTPUT POWER LEVEL: Increase and decrease output power as follows:

NOTE

Ensure **RF KILOWATTS** *meter is indicating output* **FORWARD PWR**.

*Output power level of any preset level (***HIGH, MED, LOW***) cannot be made greater than the output power level of the next higher preset. For example,* **MED** *output power level cannot be made greater than* **HIGH** *output power level.*

4.10.2.1 Increase Output Power: To increase output power, press and hold ∧ **POWER** until **RF KILOWATTS** meter indicates level desired.

4.10.2.2 Decrease Output Power: To decrease output power, press and hold ∨ **POWER** until **RF KILOWATTS** meter indicates level desired.

NOTE

Press and release ∧ **POWER** *and* ∨ **POWER** *simultaneously to instantaneously reduce RF output power to 0 kW.*

4.10.3 ADJUST AUDIO LEVEL: The **AUDIO GAIN** potentiometer on the bi-phase PDM PWBs controls amplitude of the audio signal input to the transmitter. Turn clockwise to increase audio gain (and modulation depth). Turn counter clockwise to decrease audio gain (and modulation depth).

4.10.4 LOCAL/REMOTE OPERATION: Select either *local* or *remote* operation of the transmitter as follows:

4.10.4.1 Local Operation: Press and release **LOCAL** on the control/monitor panel to enable *local* operation of the transmitter. The transmitter will not respond to *remote* commands.

4.10.4.2 Remote Operation: Press and release **REMOTE** on the control/monitor panel to enable *remote* operation of the transmitter. The transmitter will respond to some *local* commands.

NOTE

See table 3-1 for a description of local commands that can be actuated while in remote mode.

4.10.5 CONTROL/MONITOR PANEL METER CONTROL: Turn control/monitor panel meters on and off as follows:

NOTE

The control/monitor panel's **METER ON/OFF CONTROL** *switch controls the operating status of the* **RF KILOWATTS**, **DC CURRENT** *and* **DC VOLTS** *meters. When it is illuminated, the meters are turned on (enabled). When it is not illuminated, the meters are turned off (disabled).*

(a) To enable (turn on) the meters on the control/monitor panel, press and release the **METER ON/OFF CONTROL** switch until it is illuminated. The meters should display the appropriate readings for selected parameters.

(b) To disable (turn off) the meters on the control/ monitor panel, press and release the **METER ON/OFF CONTROL** switch until it is not illuminated. The meters should all display zero readings.

4.10.6 AUDIBLE ALARM CONTROL: Control the on/off status of the audible alarm as follows:

NOTE

The control/monitor panel's **AUDIBLE ALARM - MUTE** *switch controls the audible alarm's status. When it is not illuminated, the alarm is enabled. When it is illuminated, the alarm is disabled.*

(a) To enable (turn on) the audible alarm, press and release the **AUDIBLE ALARM - MUTE** switch until it is not illuminated. An audible alarm will sound whenever the **XMTR FAULT ALARM** LED is red.

(b) To disable (turn off) the audible alarm, press and release the **AUDIBLE ALARM - MUTE** switch until it is illuminated.

4.10.7 LED TEST: Verify the LED's on the control/monitor panel, including the ones in the switches are functional, by pressing and holding the control/monitor panel's **LED TEST CONTROL** switch for the duration of the test. All of the bi-colour LEDs (**STATUS** indicators) will toggle between red and green. All of the amber LEDs will turn on.

NOTE

The LEDs may be tested at any time without affecting transmitter operation.

4.10.8 ALARM INDICATION RECALL: To recall the alarm indications that were present when the most recent RF shutback cycle was initiated and therefore assist in identifying the out-of-tolerance condition that caused the RF shutback, press and hold the control/monitor panel's **ALARM RECALL** switch and note which **STATUS** LEDs switch from green to red. Release the switch to return to the current alarm status indications.

4.10.9 RESETTING LATCHED PROTECTION CIRCUITS/ALARMS: All latched protection circuits, except the three alarms described in paragraphs 4.10.9.1 thru 4.10.9.3, may be reset by pressing/releasing the control/monitor panel's **SYSTEM RESET** switch. If the function being monitored by a reset protection is still abnormal, the protection circuit will instantly return to its latched failure state. If the function is not abnormal, it may be because sufficient time has elapsed to cool down the overheated area or because it was a spurious transient that activated the protection circuit. Alarms stored in memory may be reset by pressing/releasing the control/ monitor panel's **ALARM MEMORY RESET** switch.

NOTE

Before pressing the **ALARM MEMORY RESET**, *press the* **ALARM RECALL** *switch to view any stored alarms. Alarm information is lost when alarm memory reset is activated.*

4.10.9.1 Modulator Protection Alarm: Occurs when modulation depth is great enough that damage to modulators in power modules may occur. Decrease audio input or adjust **AUDIO GAIN** control on bi-phase PDM driver PWB to decrease modulation depth.

4.10.9.2 Cutback Alarm: Occurs when output power level is of sufficient amplitude to damage the transmitter. Reset **CUTBACK** alarm by pressing and releasing either ∧ **POWER** or ∨ **POWER**.

4.10.9.3 Standby Alarm: Occurs when *standby* exciter is operating. Reset **STANDBY** alarm by pressing and releasing either **EXCITER A** or **EXCITER B**.

FREQUENCY CHANGE PROCEDURE

4.11 The NA100 transmitter will operate at any carrier frequency between 531kHz and 1610kHz in one kHz steps. This procedure will prepare the transmitter for operation at a new carrier frequency.

NOTE

During the frequency change procedure, it is recommended that the transmitter's RF output be connected to a 50 ohm resistive dummy load, rated for a minimum of 200 000 watts.

(a) Reduce the transmitter output power to zero by pressing ^ **POWER** and v **POWER** simultaneously. Press **RF OFF**.

(b) Disconnect ac power from the transmitter at the service entrance.

(c) Open the locked access panels of the RF combiner/output filter. See paragraph 4.5.2 for detailed instructions.

NOTE

Refer to figure MD-12 to locate the RF output filter's staircase capacitor assembly (1A3A3) and to figure MD-37 for its assembly detail.

(d) Initially set the RF output filter (1A3) fine tuning capacitors (A3C1 thru A3C5) for minimum capacitance. Mate floating connectors A3P1 thru A3P6 with A3J1 thru A3J6 respectively (refer to table 4-3).

(e) Enter tables 4-1/4-2 with the new and old carrier frequencies.

- If both fall in the same frequency band, the in-circuit/out-of circuit capacitor selections and the coil tap settings for both 8-input RF combiners (1A59/1A60) and the RF combiner/output filter (1A3) will not require changes. Close and lock the RF combiner/output filter's access panels. Ensure all panel securing screws are firmly tightened and return keys to master transfer case. Proceed to paragraph 4.11.3.

- If both do not fall in the same frequency band, the in-circuit/out-of circuit capacitor selections and the coil tap settings for both 8-input RF combiners (1A59/1A60) and the RF combiner/ output filter (1A3) will require changes. Complete all of the remaining requirements of this paragraph.

CAUTION

All RF carrying leads associated with in-circuit RF power ceramic plate capacitors must be dressed a minimum of 12 millimetres (0.5 inches) from objects at ground potential.

Acorn nuts must be used on all RF buss and coil tap studs (including those which are not used).

Failure to observe these precautions may result in arcing and damage to the transmitter.

Use extreme care when removing/installing attaching hardware. It is recommended a piece of cloth or cardboard be placed in the bottom of the units. This will ensure inadvertently dropped washers/nuts do not fall through the bottom of the units. All washers/nuts which are dropped must be retrieved. Remove cloth/cardboard on completion.

NOTE

The studs on the RF buss bars, capacitor mounting plates and coil taps are metric. Use M5 replacement nuts and washers.

4.11.1 L/C SELECTION IN RF COMBINER/ OUTPUT FILTER: Configure the RF combiner/ output filter's capacitor/inductance for the assigned carrier frequency as follows:

(a) Enter table 4-1 and determine which capacitors are in-circuit, which capacitors are out-of-circuit and which coil taps should be used for the frequency band that contains the new carrier frequency.

(b) Using figures MD-11 and MD-12 to assist in identifying the tabulated capacitors and inductors, reconfigure the RF combiner/output filter as follows:

- Install the lead (twisted pair) associated with each in-circuit capacitor on the nearest stud of the appropriate ***RF buss for in-circuit capacitors***. Secure it using a flat washer, a split washer and an acorn nut. Ensure nuts are firmly tightened.
- Install the lead (twisted pair) for each out-of-circuit capacitor on the stud of the associated capacitor mounting plate. Secure it using a flat washer, a split washer and a nut which is/was left on the stud. Ensure nuts are firmly tightened.
- Install RF interconnecting strap identified as 'C' in figures MD-11 and MD-12 on the stud for the tabulated tap of L1 thru L4. Secure the strap using a flat washer, a split washer and an acorn nut which were on the stud. Replace flat washer, split washer and acorn nut on the stud of the previously used coil tap. Ensure nuts are firmly tightened.
- Install L5/L6 RF interconnecting strap between the stud for the tabulated tap of L5 and the stud for the same tap of L6. Secure the strap using a flat washer, a split washer and an acorn nut which were on the stud. Replace flat washer, split washer and acorn nut on the stud of the previously used taps. Ensure nuts are firmly tightened.

CAUTION

If a ceramic plate capacitor is not securely fastened to its mounting plate or the lug of its interconnecting lead is loose, refer to paragraph 7.10 for special torquing instructions. Improper tightening may result in irreparable damage to the capacitor.

(c) Perform a complete visual inspection of the RF combiner/output filter's interior, paying particular attention to lead dressing and security of capacitor mounting and lead connections. Ensure there are no conductive foreign particles inside the filter.

(d) Close and lock the RF combiner/output filter's access panels. Ensure all panel securing screws are firmly tightened.

(e) Return keys to the master key transfer case.

4.11.2 L/C SELECTION IN 8-INPUT RF COMBINERS: Configure or verify the capacitor/ inductance for both 8-input RF combiners is configured for the assigned carrier frequency as follows:

(a) Open locked access panels of both 8-input RF combiners. See paragraph 4.5.2 for detailed instructions.

(b) Enter table 4-2 and determine which capacitors are in-circuit, which capacitors are out-of-circuit and which coil taps should be used for the frequency band that contains the new carrier frequency.

(c) Using figure MD-22 to assist in identifying the tabulated capacitors and inductor taps, reconfigure both 8-input RF combiners:

- Install the lead (twisted pair) associated with each in-circuit capacitor on the nearest stud of the ***RF buss***. Secure it using a flat washer, a split washer and an acorn nut. Ensure nuts are firmly tightened.
- Install the lead (twisted pair) for each out-of-circuit capacitor on the stud of the associated capacitor mounting plate. Secure it using a flat washer, a split washer and a nut which is/was left on the stud. Ensure nuts are firmly tightened.
- Install crossed RF interconnecting straps of four coil assemblies A1 and A2 for both 8-input RF combiners on the studs for the tabulated tap of L1 thru L4. Secure the strap using a flat washer, a split washer and an acorn nut on each stud. Replace flat washer, split washer and acorn nut on the stud of the previously used taps. Ensure nuts are firmly tightened.

CAUTION

If a ceramic plate capacitor is not securely fastened to its mounting plate or the lug of its interconnecting lead is loose, refer to paragraph 7.10 for special torquing instructions. Improper tightening may result in irreparable damage to the capacitor.

(d) Perform a complete visual inspection of the interior of both 8-input RF combiners, paying particular attention to lead dressing and security of capacitor mounting and lead connections. Ensure there are no conductive foreign particles inside the filter.

(e) Close and lock the access panels for both 8-input RF combiners. Ensure all panel securing screws are firmly tightened.

(f) Return keys to the master key transfer case.

4.11.3 fc CHANGE on FREQ SYNTHESIZER PWBS: Set the frequency selector switches (S1 thru S4) on both of the exciter panel's frequency synthesizer PWBs (1A2A2 and 1A2A5) for the new carrier frequency, noting they select the four most significant digits when fc is expressed in kHz. S4, which is the least significant switch, represents 1.0kHz increments.

NOTE

Refer to the assembly detail drawing in the frequency synthesizer PWB's service instruction manual to identify the switches, noting S1 selects the thousands digit, S2 selects the hundreds digit, S3 selects the tens digit and S4 selects the units digit.

4.11.4 RF DRIVE AMPLITUDE/TUNING: Set the RF drive amplitude by setting the frequency dependent output voltage of the RF drive power supplies (2A2A1 and 2A2A2) and then activate the automatic RF drive tuning in the RF power modules as follows:

(a) Disable oscillator alarm circuit by grounding the right side of R127 on the right hand side of system controller PWB 1A1A3.

(b) Turn on the AC power at the service entrance and verify the transmitter's **EMERGENCY ON/OFF** switch is set to its **ON** position.

(c) Select exciter A. Press and release the control/monitor panel's **EXCITER A** switch.

(d) Disable the RF drive fault detection circuits by setting the exciter interface PWB's **TUNE** switch to **TUNE**, noting the exciter interface PWB (1A2A1) is located on the exciter panel.

(e) Turn on the RF power stages. Press/release the control/monitor panel's **RF ON** switch.

(f) Press the **TUNE RESET** switch on the exciter interface PWB. The tune alarm on the exciter interface PWB should come on and stay on for about twenty seconds. If there are any RF drive fail alarms turned on in the power modules, press the **TUNE RESET** switch a second time.

(g) Monitor RF drive by connecting an oscilloscope probe at C37 (left hand side) of RF drive control PWB (A1) in one RF power module. Oscilloscope waveform should have a 50 percent duty cycle. If necessary adjust the active frequency synthesizer PWB's (1A2A2 for exciter A and 1A2A5 for exciter B) **SLICER BIAS** potentiometer to obtain 50 percent duty cycle.

NOTE

If the **OSCILLATOR DRIVER** *alarm on the control/monitor panel turns red during slicer bias adjustment, some adjustment of the RF drive alarm threshold may be necessary. Refer to step (l).*

(h) Calculate the RF drive power supply's output voltage for the assigned carrier frequency as follows:

fc is expressed in MHz

$$V_{RF\ Drive} = 74 - 8\ f_c$$

Example when fc is 576kHz

$$V_{RF\ Drive} = 74 - 8\ (0.576) = 74 - 4.608$$

$$= 69.392 \text{ volts}$$

(i) Select the RF drive power supply's output voltage as the input to the control/monitor panel's **DC VOLTS** meter, noting the 0-80 scale is to be read. Press/release the associated **METER SELECT** switch until **RF AMP VOLT** LED turns on.

(j) The RF drive voltage calculated in step (h) should be displayed on the **DC VOLTS** meter.

(k) If necessary, adjust active RF drive power supply PWB's (2A2A1 for exciter A and 2A2A2 for exciter B) **VOLTAGE CONTROL** potentiometer (R3) to obtain the calculated RF drive voltage. Connect a digital multimeter between TP2 and TP1 (ground) of the active RF drive power supply PWB to monitor the RF drive voltage while performing the adjustment.

(l) Using an oscilloscope, monitor the RF drive at TP2 on active RF drive buffer PWB (1A37 for exciter A and 1A38 for exciter B) (see figure MD-3 as an aid to locate the RF drive buffer PWBs). Oscilloscope display should be a nominal square wave at the carrier frequency with a peak-to-peak voltage of about 33 volts.

(m) Measure the voltage at 1A37U1-7 using a voltmeter. Monitor the voltage at 1A37U1-5 and adjust 1A37R13 to get a voltage equal to the voltage measured at 1A37U1-7 plus 0.9 volts.

(n) Select exciter B. Press and release the control/monitor panel's **EXCITER B** switch.

(o) Repeats steps (g) thru (m) for exciter B.

(p) Initiate automatic tuning of the RF power modules' RF drive circuits. Press and release the exciter interface PWB's **TUNE RESET** switch.

(q) The exciter interface PWB's **TUNE** LED should turn on for approximately fifteen seconds and then turn off, indicating automatic tuning of the RF drive circuits has been completed.

(r) Remove the ground on the right side of R127 on the system controller PWB which was added in step (a).

(s) Enable the RF drive fault detection circuits. Set the exciter interface PWB's **TUNE** switch to **NORM**.

4.11.5 RF COMBINER/OUTPUT FILTER FINE TUNING: Complete the tuning of the RF combiner/output filter tuning as follows:

WARNING

Fine tuning of the RF combiner/output filter requires access (often repeated access) to the staircase capacitor assembly (A3) within the compartment. Before attempting any adjustment of A3's capacitance value, ensure the key-interlocked access panel is removed as detailed in paragraph 4.5.2. Upon completion of each adjustment, close and lock the access panel, secure all panel screws and return keys to the master transfer case. Failure to do so may result in the presence of potentially lethal voltages during adjustment.

(a) Select forward power to be displayed on the control/monitor panel's **RF KILOWATTS** meter, noting the upper scale is to be read. Press/release **METER SELECT** switch until **FORWARD PWR** LED turns on.

(b) Using a dual beam oscilloscope, monitor the RF voltage sample out and RF current sample out at J10 and J11 of the primary 50kW distribution PWB (1A36). Use two 50 ohm coaxial cables of the same length.

WARNING

If the voltage waveform monitored in step (b) leads the current waveform by less than 55 ns, transmitter damage may occur.

(c) Initially adjust series tuning capacitor 1A3C30 fully counter clockwise. Increase output power to 10kW and adjust C30 until the voltage waveform leads the current waveform by between 55 and 120 ns. Typically, the voltage waveform lead time increases as the carrier frequency decreases.

(d) If the phase difference cannot be reduced to within the range specified in step (c):

- Turn off the RF power stages (press/release the control/monitor panel's **RF OFF** switch.

- Disconnect ac power from the transmitter at the service entrance.
- Increase the capacitance of the staircase capacitor assembly (1A3A3) by 200 pF. Enter table 4-3 with desired capacitance value and mate floating connectors 1A3A3P1 thru 1A3A3P6 with the appropriate fixed J# connectors (refer to figure MD-37 for assembly detail).
- Reconnect ac power to the transmitter and press **RF ON**. Repeat steps (c) and (d) as necessary.

(e) Increase the output power to 50kW. The tuning control panel's **IMPEDANCE** meter should read near zero (between +2 and -2). If not, adjust C30 until the meter reads zero.

(f) If the **IMPEDANCE** meter cannot be set to near zero:

- Turn off the RF power stages (press/release the control/monitor panel's **RF OFF** switch.
- Disconnect ac power from the transmitter at the service entrance.
- Adjust the capacitance of the staircase capacitor assembly (1A3A3) by 100 pF. Enter table 4-3 with desired capacitance value and mate floating connectors 1A3A3P1 thru 1A3A3P6 with the appropriate fixed J# connectors (refer to figure MD-37 for assembly detail).
- Reconnect ac power to the transmitter and press **RF ON**. Repeat steps (e) and (f) as necessary.

(g) Verify the voltage waveform still leads the current waveform by between 55 and 120 ns.

(h) Select the **POWER AMPLIFIER VOLT** setting for the voltage meter (A1M2). The PA voltage should be 93 ± 2V.

(i) Increase the RF output to 100kW using the control/monitor panel's ∧ **POWER** switch.

(j) If necessary, re-adjust the RF combiner/output filter's variable capacitor (C30) for a zero reading on the **IMPEDANCE** meter and between 55 and 120 ns delay.

(k) Measure RF output power using a precision external measuring device (e.g., RF current probe).

(l) The forward power measurement in step (k) should be the same as the reading on the transmitter's **RF KILOWATTS** meter.

(m) If necessary, adjust system controller PWB's **POWER METER CAL** potentiometer for an **RF KILOWATTS** meter reading that is the same as the reading obtained in step (g), noting the system controller PWB (1A1A2) is located on the back of the control/monitor panel.

(n) Select the **POWER AMPLIFIER VOLT** setting for the voltage meter (A1M2). The PA voltage should be 131.5 ± 2V.

(o) Measure frequency response and distortion. The frequency response should roll off to approximately -0.8dB at 10kHz. If distortion is high at 5000Hz, slowly adjust the frequency synthesizer PWB's **SLICER BIAS** potentiometer to minimize distortion.

4.11.6 FREQUENCY BAND SELECTION ON 50KW DISTRIBUTION PWBS: Configure frequency dependent portion of 50kW distribution PWBs (1A36 and 1A40) as follows:

(a) While the transmitter is operating at 100 kW, connect a digital multimeter (set to measure dc volts) between TP6 (+) of 50kW primary distribution PWB 1A36 and ground.

(b) Adjust potentiometer R71 until the digital multimeter reads 5.5 V.

(c) Repeat steps (a) and (b) for 50 kW secondary distribution PWB 1A40.

(d) Apply typical (sample) programming to audio input. If the **COMBINER INPUT CURRENT** lamp turns red (alarm), slowly decrease the voltage at TP6 (on both PWBs) until the lamp turns green (no alarm). Do not adjust R71 for a TP6 reading of less than 5.2V.

Table 4-1 *fc* Dependent Selections for 100kW RF Combiner/Output Filter (1A3)

REF DES	VALUE (pF)	FREQUENCY BAND (KHz)														
		530 - 570	571 - 620	621 - 660	661 - 710	711 - 770	771 - 830	831 - 890	891 - 950	951 - 1021	1021 - 1110	1111 - 1190	1191 - 1290	1291 - 1390	1391 - 1490	1491 - 1610
C1	1600	◆	◆	◆	-	-	-	-	-	-	-	-	-	-	-	-
C2	1000	◆	◆	◆	◆	◆	◆	◆	◆	◆	-	-	-	-	-	-
C3	1000	◆	◆	◆	◆	◆	◆	◆	◆	◆	-	◆	-	-	-	-
C4	1000	◆	◆	◆	◆	◆	◆	◆	◆	◆	-	◆	◆	-	-	-
C5	500	◆	◆	-	◆	◆	◆	◆	-	-	◆	◆	-	-	-	-
C6	500	◆	◆	-	◆	-	◆	◆	-	-	◆	◆	◆	◆	-	-
C7	500	◆	◆	-	◆	-	◆	-	-	-	◆	◆	◆	◆	◆	◆
C8	500	◆	-	-	-	-	◆	-	-	-	◆	◆	◆	◆	◆	◆
C9	500	◆	-	-	-	-	◆	-	-	-	◆	◆	◆	◆	◆	-
C10	500	◆	-	-	-	-	-	-	-	-	◆	◆	◆	◆	◆	◆
C11	500	◆	-	-	-	-	-	-	-	-	◆	◆	◆	◆	◆	◆
C12	500	-	-	-	-	-	-	-	-	-	◆	◆	◆	◆	◆	◆
C13	500	-	-	-	-	-	-	-	-	-	-	-	◆	◆	-	-
C14	1000	◆	◆	◆	◆	◆	◆	◆	◆	◆	-	-	-	-	-	-
C15	1000	◆	◆	◆	◆	◆	◆	◆	◆	◆	-	-	-	-	-	-
C16	1000	◆	◆	◆	◆	◆	◆	◆	◆	-	-	-	-	-	-	-
C17	1600	◆	◆	◆	-	-	-	-	-	-	-	-	-	-	-	-
C19	400	◆	◆	◆	◆	◆	◆	◆	-	-	-	-	-	-	-	-
C20	200	◆	◆	-	-	-	-	-	◆	◆	◆	◆	◆	◆	◆	◆
C21	100	◆	-	◆	-	-	◆	-	◆	◆	-	◆	◆	-	-	-
C22	50	-	-	◆	◆	-	-	-	◆	-	◆	-	-	◆	-	-
C23	25	◆	◆	-	-	-	-	◆	◆	◆	◆	-	-	◆	◆	-
C24	2000	◆	◆	◆	◆	◆	◆	◆	◆	-	-	◆	-	-	-	-
C25	2000	◆	◆	◆	◆	◆	◆	◆	◆	-	-	◆	◆	-	-	-
C26	1000	◆	◆	-	◆	-	-	◆	-	◆	◆	-	◆	◆	◆	◆
C27	500	-	◆	◆	-	◆	-	-	-	◆	-	◆	-	-	◆	◆
C28	2000	◆	◆	◆	-	-	◆	-	-	-	-	-	-	-	-	-
C29	1600	◆	-	-	-	-	-	-	-	◆	◆	-	-	◆	-	-
L1	TAP	A	A	A	A	A	B	B	B	B	B	C	C	C	C	C
L2	TAP	A	A	A	A	A	B	B	B	B	B	C	C	C	C	C
L3	TAP	A	A	A	A	A	B	B	B	B	B	C	C	C	C	C
L4	TAP	A	A	A	A	A	B	B	B	B	B	C	C	C	C	C
L5	TAP	A	A	A	A	A	B	B	B	B	B	C	C	C	C	C
L6	TAP	A	A	A	A	A	B	B	B	B	B	C	C	C	C	C

◆ DENOTES CAPACITOR IN-CIRCUIT - DENOTES CAPACITOR NOT IN-CIRCUIT

Table 4-2 *f*c Dependent Selections for 8-Input RF Combiners (1A41/1A42)

REF DES	VALUE (pF)	FREQUENCY BAND (KHz)														
		530 - 570	571 - 620	621 - 660	661 - 710	711 - 770	771 - 830	831 - 890	891 - 950	951 - 1020	1021 - 1110	1111 - 1190	1191 - 1290	1291 - 1390	1391 - 1490	1491 - 1610
C1	2000	♦	♦	♦	-	-	♦	-	-	-	-	-	-	-	-	-
C2	2000	♦	♦	♦	♦	-	♦	♦	-	-	-	-	-	-	-	-
C3	2000	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	-	-
C4	2000	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	-	-
C5	2000	♦	♦	♦	♦	♦	♦	♦	♦	♦	-	♦	♦	♦	-	-
C6	1600	♦	♦	♦	♦	♦	-	♦	♦	♦	-	♦	-	-	♦	-
C7	1600	♦	♦	-	-	-	-	-	♦	-	-	-	-	-	♦	♦
C8	1600	♦	♦	-	-	-	-	-	-	-	-	-	-	-	♦	♦
C9	1000	♦	-	-	-	-	-	-	-	-	♦	-	♦	♦	♦	♦
C10	500	♦	♦	-	♦	-	♦	♦	-	-	♦	♦	♦	♦	-	♦
C11	1000	♦	-	-	-	-	-	-	♦	-	-	-	-	-	♦	♦
C12	1600	♦	-	-	-	-	-	-	♦	-	-	-	-	-	♦	♦
C13	1600	-	♦	♦	-	♦	-	♦	♦	♦	-	♦	-	-	♦	♦
C14	2000	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	-	-	-
C15	2000	♦	♦	♦	♦	♦	♦	♦	-	♦	♦	♦	♦	♦	-	-
C16	2000	♦	♦	♦	♦	♦	♦	♦	-	-	♦	♦	♦	♦	-	-
C17	2000	♦	♦	♦	♦	-	♦	-	-	-	-	-	-	-	-	-
C18	2000	♦	-	-	-	-	♦	-	-	-	-	-	-	-	-	-
A1L1	TAP	A	A	A	A	A	B	B	B	B	B	C	C	C	C	C
A1L2	TAP	A	A	A	A	A	B	B	B	B	B	C	C	C	C	C
A1L3	TAP	A	A	A	A	A	B	B	B	B	B	C	C	C	C	C
A1L4	TAP	A	A	A	A	A	B	B	B	B	B	C	C	C	C	C
A2L1	TAP	A	A	A	A	A	B	B	B	B	B	C	C	C	C	C
A2L2	TAP	A	A	A	A	A	B	B	B	B	B	C	C	C	C	C
A2L3	TAP	A	A	A	A	A	B	B	B	B	B	C	C	C	C	C
A2L4	TAP	A	A	A	A	A	B	B	B	B	B	C	C	C	C	C

♦ DENOTES CAPACITOR IN-CIRCUIT - DENOTES CAPACITOR NOT IN-CIRCUIT

Table 4-3 Staircase Capacitor Assembly Terminations Versus Capacitance Value

CAPACITANCE VALUE (pF)	STAIRCASE ASSEMBLY (1A3A3) FLOATING CONNECTOR					
	P1	P2	P3	P4	P5	P6
0	J1	J2	J3	J4	J5	J6
100	J7	J2	J3	J4	J5	J6
200	J1	J8	J3	J4	J5	J6
300	J7	J8	J3	J4	J5	J6
400	J1	J8	J9	J4	J5	J6
500	J7	J8	J9	J4	J5	J6
600	J1	J2	J3	J10	J5	J6
700	J7	J2	J3	J10	J5	J6
800	J1	J8	J3	J10	J5	J6
900	J7	J8	J3	J10	J5	J6
1000	J1	J8	J9	J10	J5	J6
1100	J7	J8	J9	J10	J5	J6
1200	J1	J2	J3	J4	J11	J12
1300	J7	J2	J3	J4	J11	J12
1400	J1	J8	J3	J4	J11	J12
1500	J7	J8	J3	J4	J11	J12
1600	J1	J8	J9	J4	J11	J12
1700	J7	J8	J9	J4	J11	J12
1800	J1	J2	J3	J10	J11	J12
1900	J7	J2	J3	J10	J11	J12
2000	J1	J8	J3	J10	J11	J12
2100	J7	J8	J3	J10	J11	J12
2200	J1	J8	J9	J10	J11	J12
2300	J7	J8	J9	J10	J11	J12

SECTION 5
SYSTEM LEVEL TROUBLE SHOOTING

GENERAL

5.1 This section contains scheduled and corrective maintenance information for the subject transmitter. Fault symptoms should be analyzed to determine the corrective action required. Normally a recalibration will resolve the apparent problem. Trouble shooting information (see paragraph 5.9) is presented based on the front panel alarm indication. For quick reference to an offending alarm's trouble shooting procedure or repair procedure, refer to the table below:

PROCEDURE **PARAGRAPH**

Troubleshooting:

Repair:

CAUTION

The NA100 transmitter contains many solid state devices that may be damaged if subjected to excessive heat or high voltage transients. Every effort must be taken to ensure circuits are not overdriven or disconnected from their loads while turned on.

SCHEDULED MAINTENANCE

5.2 Scheduled maintenance consists of performing a visual inspection of the transmitter at scheduled intervals. Recommended minimum time between scheduled maintenance visits is three months. Local operating and environmental conditions may dictate more frequent visit and in remote sites, less frequent visits may be acceptable. Experience and system reliability will determine the most practical schedule for a specific installation.

CORRECTIVE MAINTENANCE

5.3 Corrective maintenance procedures consist of identifying and correcting defects or deficiencies that arise during operation of the transmitter. Local/ remote alarm signals will be generated when a malfunction occurs. If the alarm condition was caused by a malfunction in the RF power stage, the transmitter will maintain operation 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 three different levels with a different technical competence level required for each.

5.3.1 ON-AIR TROUBLE SHOOTING: On-air trouble shooting can be performed from a remote location or locally at the transmitter site.

5.3.1.1 Remote Trouble Shooting: Remote on-air trouble shooting consists of monitoring the transmitter's radiated signal using an on-air monitor and observing status of remote fault alarm indicators. Information obtained from these sources should enable an operator to decide if response may be deferred to a more convenient time, if immediate corrective action must be taken and/or whether the standby transmitter must be enabled (if one is available). It is recommended that the significance of remote indications and the appropriate responses be incorporated into a station's standard operating procedures. Refer to paragraph 5.9 to determine the remedial action required for a given fault.

5.3.1.2 Local Trouble Shooting: Local on-air trouble shooting consists of monitoring the transmitter's integral meters and fault alarm indicators. Analysis of their status will normally identify the type of fault and in most cases will determine what corrective action must be taken. Refer to paragraph 5.9 to determine the remedial action required for a given fault.

5.3.1.2.1 The power amplifier stage contains an integral modular reserve (IMR) feature. This feature permits the transmitter to operate at a reduced RF output level when a malfunction occurs in one of its power modules. Station operating procedures will dictate if reduced RF output level is acceptable. When reduced, RF output level can be tolerated, replacement of the defective RF power module may be deferred to a more convenient time. A defective module may be removed from the transmitter for servicing, while the transmitter is operating at reduced RF output level, provided removal instructions detailed in paragraph 5.7.1 are met. Refer to paragraph 5.7 for power module removal/ replacement instructions.

5.3.2 OFF-AIR TROUBLE SHOOTING: Off-air trouble shooting must be performed when replacement of a defective RF power amplifier module or routine on-air calibration adjustments will not restore operation. It is recommended the output be connected to a precision 50-ohm resistive dummy load (rated at a minimum of 200 kW) for off-air trouble shooting procedures. If an appropriate dummy load is not available, trouble shooting for a majority of faults can be performed with RF power stage turned off. The transmitter may remain connected to its antenna system for these procedures. It is recommended RF output level be reduced to a minimal value when RF output is connected to the antenna system and it is necessary to trouble shoot faults in the power amplifier stage.

ELECTROSTATIC PROTECTION

5.4 The transmitter's assemblies contain semiconductor devices that are susceptible to damage from electrostatic discharge. Prior to removing an assembly from the transmitter, and while servicing an assembly, the following precautions must be observed:

NOTE

Electrostatic energy is produced when two insulating materials are rubbed together. A person wearing rubber-soled shoes, walking across a nylon carpet or a waxed floor, can generate an extremely large electrostatic charge. This effect is magnified during periods of low humidity. Components such as integrated circuits, field-effect transistors, thyristors and Schottky diodes may be damaged by this high voltage unless adequate precautions are taken.

5.4.1 DISCHARGING OF PERSONNEL: Maintainers should be electrically discharged by a suitable grounding system (anti-static mats, ground straps) during removal of an assembly from the transmitter and while handling the assembly for maintenance procedures.

5.4.2 HANDLING/STORAGE: The assembly should be placed in an anti-static bag when not installed in a host transmitter or when not being subjected to maintenance procedures. Electronic components should be stored in anti-static materials.

5.4.3 TOOLS/TEST EQUIPMENT: Testing and maintenance equipment, including soldering and unsoldering tools, should be suitable for contact with static sensitive semiconductor devices.

5.4.4 STRESS CURRENT PROTECTION: Every precaution should be taken to ensure the static sensitive semiconductor devices are protected from unnecessary stress current. This is achieved by ensuring:

- electrical connections are not broken while current is flowing in the circuit.

- voltages are not present on external control/ monitoring circuits when they are connected.

OPERATION WITH DEFECTIVE OR MISSING RF POWER MODULE

5.5 It is permissible to operate the transmitter with a defective or missing RF power module, provided the following precautions/ procedures are observed:

5.5.1 If an RF power module has one or more defective RF amplifiers, as indicated by the power module front panel's **RF AMP** alarm lamps, but is still contributing to the transmitter's RF output, it may be left on. A reduction in carrier level is the only consequence. The power module will shut down when two or more alarms are registered.

CAUTION

Do not attempt to compensate for any RF power reduction caused by RF amplifier assembly failures by adjusting RF power level controls.

5.5.2 An RF power module must be inhibited prior to its removal from the transmitter. Follow the instructions detailed in paragraph 5.7 to inhibit a module that must be removed with the transmitter on-air. At all other times, turn off the transmitter by pressing the **RF OFF** switch and then switching off the AC power source. This is accomplished by turning off the AC power at the service entrance panel.

RF POWER MODULE FAULT ISOLATION

5.6 Determine if an RF power module is defective and then determine which section of the RF power module caused an alarm condition to be generated, as follows:

NOTE

A defective RF power module can be removed for repair, without turning off the transmitter as described in paragraph 5.7. The transmitter can be operated at a reduced output power level with a module removed.

(a) Set the control/monitor panel's **FORWARD/ REFLECTED POWER** switch to **FORWARD PWR** and read **FORWARD/REFLECTED POWER** meter indication.

(b) If meter reading in step (a) is below normal operating level, and the **CUTBACK ALARM** is not on, at least one power module is not operating. Proceed to step (d).

(c) If meter reading in step (a) is the normal operating level, the alarm is probably false. Press **ALARM RECALL** switch to check if any other alarms are registered that may have triggered the power module fail alarm. Press and release **SYSTEM RESET**. Reset latched alarm indication by pressing the **ALARM MEMORY RESET** switch.

(d) Open the front cabinet doors on primary and secondary power cabinets, and record which power module(s) are showing a fault. Also record what the indicated fault is.

(e) Try to reset the power module by pressing **RESET** on its front panel. If the power module successfully resets, alarm may have been false. If alarm does not reset, continue to step (f).

NOTE

*An **RF AMP** alarm lamp cannot be reset.*

(f) The following power module alarms indicate that the problem is internal to the power module:

- Modulator fail (**MOD**)
- RF amplifier fail (**RF AMP**)
- Temperature fail (**TEMP**)

If **RF FAIL** alarm is turned on, the fault is in either the power module or the connections to the power module. If it is suspected the problem may not be in the power module, exchange the module with another one that is currently operating normally, by following the procedure for power module removal/ installation outlined in paragraph 5.7. If the power module in question still shows an alarm, the problem is in the power module.

(g) If the problem seems to be localized to the power module, refer to paragraph 5.6.1 to test the RF power module using the transmitter's built-in power module testing capability.

5.6.1 RF POWER MODULE TROUBLE SHOOTING: Refer to trouble shooting information in the power module's documentation.

REPLACEMENT OF RF POWER MODULE

5.7 Following are the procedures for removing and reinstalling an RF power module.

CAUTION

RF power modules contain 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 circuits are not overdriven and they are not disconnected from their loads while turned on.

5.7.1 RF POWER MODULE REMOVAL: Remove a defective RF power module as follows:

(a) Verify requirements of paragraph 5.4 have been completed and are being met.

(b) Press **POWER MODULE INHIBIT** on the front panel of the power module.

(c) Ensure that **TEMP** alarm and **PWR MODULE FAIL** alarm on the power module are both turned on.

(d) Remove connector from J1 of the power module. You should hear a relay in the rear of the transmitter pick up (turn on).

(e) Loosen the screw at bottom front of the power module (the connector must be removed from J1 to allow access to the screw).

(f) Remove two screws at top front of the power module.

(g) Carefully pull the power module forward. Lift it out of the transmitter.

NOTE

The power modules are heavy (approximately 25kg). Use caution when lifting them into or out of the transmitter.

NOTE

If an operational RF power module is available, it may be installed in the transmitter while the power module is being serviced. Refer to paragraph 5.7.2 for information on installing a power module.

5.7.2 RF POWER MODULE INSTALLATION: The procedure to install a power module in the transmitter follows:

(a) Verify requirements of paragraph 5.4 have been completed and are being met.

(b) Lift the power module into the transmitter.

(c) Ensure the module is pushed firmly in place. Several alarms will turn on (**PWR MODULE FAIL, RF FAIL** and all **MOD** alarms).

(d) Gently tighten the spring-loaded screw located at bottom front of the power module. Do not overtighten this screw, it needs only to be finger-tight.

(e) Fasten top front of the power module to the transmitter with two screws. Tighten firmly.

(f) Mate connector to J1 of the power module. You should hear the relay in the rear of the transmitter drop out (turn off).

(g) Press **RESET** on front of the power module.

PWB REPLACEMENT/ADJUSTMENT

5.8 Install and adjust replacement printed wiring boards as follows:

5.8.1 SYSTEM CONTROLLER PWB (1A1A3) REPLACEMENT/ADJUSTMENT: Replace the system controller PWB and configure the replacement PWB for operation as follows (see figure MD-5 for location of system controller PWB 1A1A3):

(a) Record front panel DC current meter's reading and forward power level reading. Record reading for **POWER AMP VOLT** on the front panel dc voltmeter. Press the control panel's RF **OFF** switch. Record the front panel meter readings for **HIGH VOLTAGE B+** and **15 VDC**.

(b) Turn off AC main power at the service entrance.

(c) Remove remote interface PWB (1A1A4) as follows:

- Remove and retain three batteries on the remote interface PWB.

CAUTION

The batteries should not be reinstalled until the AC power has been reapplied to the transmitter. The system controller PWB has default settings that will come on when the AC power is first applied to the transmitter such as RF off, exciter A, etc.

- Remove and retain one nut at each end of metal bracket holding the bottom of PWB to the control panel. Do not remove hardware that secures the PWB to the metal bracket.

- Remove and retain five screws at top of the PWB
- Carefully pull remote interface PWB away from the panel and down from the system controller PWB. The connectors will separate more easily if gently pried with a screwdriver.

(d) Remove and retain hardware on the meter switch/monitor PWBs (1A1A1 and 1A1A2). Lift these two PWBs away from the front panel and the system controller PWB. Leave them hanging on the wires connecting them to the meters.

(e) Pull three connectors off of the system controller PWB's right side.

(f) Remove and retain sixteen pieces of hardware holding PWB in place.

(g) Carefully pull PWB away from the front panel. Several switches and LEDs on the underside of the PWB will be pulled free of the control panel.

(h) Install the new system controller PWB (1A1A3) by reversing the above procedure, using the hardware removed in each step. Be careful to line up the switches and LEDs with the holes in the control panel while setting the board in place.

(i) ***ENSURE AC POWER IS SWITCHED OFF*** and attach a suitable current probe to the output of the transmitter.

NOTE

It may be necessary to press **ALARM MEMORY RESET** *to clear any false alarms caused by the latching alarm circuitry on the replacement PWB.*

It may not be necessary to make any adjustments to the new system controller PWB If the PWB was shipped as a spare with your transmitter, it has been factory calibrated for your transmitter and needs no adjustment. If the PWB was not supplied as a spare, follow the adjustment procedure below. A calibrated PWB has red stickers placed over potentiometers that have been preset at the factory.

(j) Turn on AC power at the service entrance. ***BEFORE*** pressing **RF ON**, press and release ∨ **POWER** and ∧ **POWER** simultaneously with **HIGH** power mode selected.

(k) Select **15 VDC** range on the voltmeter. Adjust **VOLT METER CAL** potentiometer on the system controller PWB (1A1A3R189) for the value recorded in step (a).

(l) Adjust **B+ SAMPLE** potentiometer 1A1A3R160 for **HIGH VOLTAGE B+** reading recorded in step (a).

(m) Press **RF ON**. Increase power until current probe indicates that output power is the same as recorded in step (a). Adjust **PA VOLTS SAMPLE** potentiometer 1A1A3R157 for **POWER AMP VOLT** reading recorded in step (a).

(n) Adjust **CURRENT METER CAL** potentiometer 1A1A3R193 for dc current reading recorded in step (a).

(o) Adjust **POWER METER CAL** potentiometer 1A1A3R192 for forward power reading recorded in step (a).

NOTE

Ensure that three 1.5 VDC batteries are installed in the remote interface PWB's battery holder (XBT1) in order to provide battery back-up of key status signals during interruption of AC power.

5.8.2 50kW DISTRIBUTION PWB (1A36, 1A40) REPLACEMENT/ADJUSTMENT: Install a replacement 50kW distribution PWB as follows (see figure MD-3 for location of 50kW distribution PWB's 1A36 and 1A40):

(a) If replacing 1A36, record the readings on the **IMPEDANCE** meter on the **TUNING CONTROL PANEL** in the secondary power cabinet.

(b) Press the control/monitor panel's **RF OFF** switch and turn off AC main power at the service entrance.

(c) Remove the dress panel on lower front of the power cabinet. Disconnect all connectors plugged into the 50kW distribution PWB.

(d) Remove and retain eight screws holding the PWB in place. Remove the PWB.

(e) Install the new 50kW distribution PWB using eight screws removed in step (d). Reconnect all connectors removed in step (c).

(f) Turn on AC power at the service entrance.

(g) Press the control/monitor panel's **RF ON** switch.

(h) If 1A36 has been replaced, adjust **IMPD METER** potentiometer (1A36R44) until **IMPEDANCE** meter reads the value recorded in step (a).

(i) Adjust potentiometer R71 (1A36 or 1A40) as detailed in paragraph 4.11.6.

NOTE

It may be necessary to press **ALARM MEMORY RESET** *to clear any alarms caused by the status of alarm latching circuitry on the PWB.*

5.8.3 EXCITER INTERFACE PWB (1A2A1) REPLACEMENT: Replace the exciter interface PWB as follows (see figure MD-3 for location of exciter panel and figure MD-9 for location of exciter interface PWB):

(a) Press the control panel's **RF OFF** switch. Turn off AC power at service entrance.

(b) Open front doors of the primary power cabinet.

(c) Remove and retain mounting hardware for two bi-phase PDM driver PWB's (1A2A3 and 1A2A6) on the exciter assembly. Remove these two PWB's.

(d) Remove and retain mounting hardware for the exciter interface PWB (1A2A1). Pull the board away from the four remaining boards. It may be helpful to gently pry the connectors loose with a screwdriver.

(e) Install the new exciter interface PWB by reversing the steps above.

(f) Turn on AC power at the service entrance. Press **RF ON** on the front panel of the transmitter.

5.8.4 POWER SUPPLY CONTROL/ MONITOR PWBS REPLACEMENT: Replace either of the power supply control or monitor PWBs (2A1 or 2A10) as follows (see figure MD-25 for location of power supply PWB):

(a) Press **RF OFF** on the control panel of the transmitter. Turn AC power off at the service entrance.

(b) Open lower rear panel of the power supply cabinet by removing and retaining six screws and by releasing the safety interlock with one key from the transfer key case. It may also be necessary to remove the grounding strap fastened to the lower left corner of the panel.

NOTE

To release a safety interlock key from the transfer case, turn off the service entrance. Use the key from the service entrance to release the antenna ground switch. Use the key from the antenna ground switch to release the keys in the transfer case, located just below the antenna ground switch.

(c) Disconnect all connectors from the associated power supply PWB (2A1 or 2A10).

(d) Remove and retain mounting screws (six for 2A1; four for 2A10) and remove the board from the power supply.

(e) Install the new PWB using screws removed in step (d). Reconnect the connectors.

(f) Install power supply rear panel using six screws from step (b) and by locking the safety interlock.

(g) Reverse the procedure outlined in step (b) to re-establish the safety interlock system.

(h) Turn on main AC power. Press **RF ON** on the control panel of the transmitter.

5.8.5 ARC DETECTOR PWB REPLACEMENT: Replace an arc detector PWB, noting there are two located in the RF combiner/ output filter (1A3) and one in each of the 8-input RF combiners (1A41 and 1A42), as follows (see figures MD-11, MD-12 or MD-21 to locate the appropriate arc detector PWB):

(a) Press RF **OFF** on the control panel of the transmitter. Turn AC power off at the service entrance.

(b) Open the locked access panels of the appropriate compartment (RF combiner/output filter or 8-input RF combiner) to access the arc detector PWB to be replaced. See paragraph 4.5.2 for detailed instructions.

(c) Disconnect the connector from the associated arc detector PWB.

(d) Remove and retain four mounting screws and remove the PWB from the compartment.

(e) Install the new PWB using screws removed in step (d). Reconnect the connector.

(f) Reverse the procedure performed in step (b) to re-establish the safety interlock system.

(g) Turn on main AC power. Press **RF ON** on the control panel of the transmitter.

TROUBLE SHOOTING FRONT PANEL ALARMS

5.9 Trouble shooting front panel alarms assumes that the transmitter has been operating normally before the fault condition occurred. An alarm glows red when tripped (or flashes red, depending on the setting of jumper E1 on the system controller PWB). Information is keyed to red front panel alarms.

NOTE

Before undertaking any trouble shooting, press **ALARM RECALL** *to see if any other alarm has been registered. Then press* **SYSTEM RESET** *to try to clear the alarm(s). If the alarm(s) clear, it may have been false. If not, trouble shooting is necessary.*
Pressing **ALARM MEMORY RESET** *will clear the latched status of all stored alarms. Ensure all latched alarms have been noted/recorded before resetting.*
If one or more power modules indicate alarms on their front panels, try resetting the power modules by pressing the **RESET** *switch on its front panel. If the alarm does not clear, trouble shooting is necessary.*

5.9.1 XMTR FAULT ALARM: The **XMTR FAULT** alarm indicates that a fault condition has occurred. If no alarms are red, press **ALARM RECALL** to check the status of other alarms. If no other alarms turn red when **ALARM RECALL** is pressed, suspect the system control PWB's alarm circuitry (see figures SD-8 thru SD-11).

5.9.2 EXTERNAL INTERLOCK ALARM: An **EXTERNAL INTERLOCK** alarm indicates that the external interlock is open. It will force a shutback condition. +24V (UNREG) is applied from TB1-6 on the remote interface PWB (1A1A4), through the external interlock system and returned to 1A1A4TB1-4. Check for +24 VDC at 1A1A4TB1-6 and 1A1A4TB1-4. If 1A1A4TB1-6 has 24 VDC and 1A1A4TB1-4 does not, there is an open in the external interlock system. If both points have 24 VDC present, suspect the circuitry on the remote interface PWB (U10 - see figure SD-12) or the circuitry on the system controller PWB (U23, U24 - see figures SD-8 thru SD-11). If 1A1A4TB1-6 does not have 24 VDC, begin trouble shooting from J5-12 of the system controller PWB.

5.9.3 XMTR INTERLOCK ALARM: An **XMTR INTERLOCK** alarm indicates that at least one of the ground wands is not in place. Turn off the transmitter and check that all wands are secured and that the switches in the cradles are being closed when the wand is in place. Check for continuity from CR44 (anode) on the system controller PWB to ground (with the transmitter off). If this path is approximately 100 ohms, suspect the monitoring circuits on the system controller PWB (see figures SD-8 thru SD-11).

5.9.4 AC LINE VOLTAGE ALARM: An **AC LINE VOLTAGE** alarm indicates that one of the three AC input phases has exceeded a predetermined threshold. It can be caused by phase failure, faulty wiring, or a fault on the power supply control/ monitor PWB or the system controller PWB. Trouble shoot an **AC LINE VOLTAGE** alarm as follows:

(a) Determine if any incoming phase voltage is significantly higher/lower than the other two.

(b) If one phase is more than 15 percent higher or lower than the others, the alarm is a legitimate **AC** phase failure.

(c) If the phase voltages are not significantly different, measure the dc voltage at R88 of the system controller PWB. If 0V, suspect the alarm circuitry on the system controller PWB (1A1A3) (see figures SD-8 thru SD-11).

(d) If 5V, suspect the detection circuitry on the power supply control/monitor PWB (see figure SD-21).

5.9.5 POWER SUPPLY OVERVOLT ALARM: The **OVERVOLT** alarm indicates that B+ DC voltage connected to the power modules has risen approximately 15 percent higher than normal operating level. The alarm may be caused by high AC input voltage, use of improper primary taps on the power transformer, a fault in the power supply or its wiring, a defect in the power supply control/ monitor PWB detection circuit or a defect in the system controller PWB alarm circuit. Trouble shoot the power supply **OVERVOLT** alarm as follows:

(a) Check B+ voltage on transmitter's **DC VOLTS** meter. If it is higher than approximately 350V, continue to step (b). If it is lower than approximately 350V, go to step (e).

(b) Verify the AC power source voltage is within normal parameters.

(c) Verify selected power transformer primary taps are appropriate for your three phase voltage supply. If not, move the wires to the appropriate taps on the transformer.

(d) If results of steps (a), (b) and (c) are satisfactory, suspect the power supply itself (see figure SD-5).

(e) Measure the dc voltage at R92 on the system controller PWB (1A1A3). If 0V, suspect the alarm circuitry of the system controller PWB (see figures SD-8 thru SD-11).

(f) If 5V, suspect overvolt detector circuit on the power supply control/monitor PWB (2A1 - see figure SD-21).

5.9.6 POWER SUPPLY UNDER VOLT ALARM: An **UNDER VOLT** alarm indicates that B+ voltage has fallen below the acceptable 15 percent threshold level. It may be caused by low AC input voltage, use of improper primary taps on the power transformer, a fault in the power supply or its wiring, a defect in the power supply control/monitor PWB detection circuit or a defect in the system controller PWB alarm circuit. Trouble shoot the **UNDER VOLT** alarm as follows:

NOTE

If the **UNDER VOLT** *and the AC* **LINE VOLTAGE** *alarms are on, a brown-out may have occurred.*

(a) Check the B+ voltage on the transmitter's **DC VOLTS** meter. If it is lower then approximately 270V, continue to step (b). If it is higher than approximately 270V, go to step (e).

(b) Verify that the voltage on the AC power lines is within normal parameters.

(c) Verify that primary taps being used on the power transformer are appropriate for your three phase voltage supply. If not, move the wires to the appropriate taps on the transformer.

(d) If steps (a), (b) and (c) are satisfied, suspect the power supply itself (see figure SD-5).

(e) Measure the DC voltage at R93 on the system controller PWB (1A1A3). If 0V, suspect the alarm circuity of the system controller PWB (see figures SD-8 thru SD-11).

(f) If 5V, suspect detector circuit on the power supply control/monitor PWB (see figure SD-21).

5.9.7 POWER SUPPLY OVER CURRENT ALARM: The **OVER CURRENT** alarm indicates that dc current drawn from the B+ power supply has risen above normal operating threshold level. It may be caused by a fault in the transmitter or wiring that is drawing excessive current, overdriving the system (too much output power and/or modulation), a fault in the power supply control/monitor PWB detection circuits or a fault in the system controller PWB alarm circuits. Trouble shoot an **OVER CURRENT** alarm as follows:

NOTE

An **OVER CURRENT** *alarm shuts down the entire high voltage supply by releasing the charge contactor (2K2) which in turn releases the main contactor (2K1). The* **OVER CURRENT** *alarm will be latched on and the only way to reset this alarm is to turn off the AC power at its source.*

(a) Press the **RF OFF** on the control panel. Turn off the AC power at its source and open the power supply cabinet (rear lower section).

(b) Verify that current shunt (2R7) is securely fastened in place and that the wires are fastened correctly.

(c) Measure resistance between the B+ buss bar and ground; reading should indicate a charging capacitor. If so, perform a visual inspection of the B+ wiring to ensure there is no insulation breaking down with high volts. If there is a short circuit, find the short circuit and repair.

(d) Close the power supply and turn on the AC power. If the transmitter trips off on an **OVER CURRENT** alarm, measure the voltage on the right side of R16 on the primary 50kW distribution PWB (1A36). If there is voltage at this point, it would indicate a failure either in the detector circuit or in the monitor circuit. If the voltage is zero, the problem could be a failure in the overcurrent detector comparator (U3 on the power supply control PWB) or on the *P/S over current* line.

(e) If the transmitter turns on and the power comes up as usual the cause of the alarm was most likely caused by overmodulation.

5.9.8 POWER SUPPLY FAN FAIL ALARM: The **FAN FAILURE** alarm indicates that at least one of the power supply fan tray's cooling fans is not operating or is running too slowly. A pulse train, representative of each fan's speed, is monitored by a fan monitor circuit in the power supply control/ monitor PWB. If one or more of fan has failed, a local and remote **FAN FAILURE** alarm will be generated. The alarm may be caused by a failed fan, a slowly running fan, a fault in the wiring connecting the fans to the power supply control/monitor PWB, a fault in the power supply control/monitor PWB detection circuitry, a fault in the dual regulated +48 VDC power supply or a fault in the system controller PWB alarm circuits. Trouble shoot a **FAN FAILURE** alarm as follows:

(a) If none of the transmitter fans are running, measure DC voltage at 2TB1-5. If less than +48 VDC, suspect the dual regulated +48 VDC power supply (see figure SD-24).

(b) Open upper rear doors of the AC/DC power supply cabinet (this may be done while the transmitter is running) and visually inspect the fans. If one or more is not running properly, check its wiring connections. If the wiring is satisfactory, replace fan in question.

(c) If all fans are running normally, use an oscilloscope to monitor the pulse train on 2TB1-1, 2TB1-2, 2TB1-7, 2TB1-8 and 2TB1-9. It should be a square wave varying between +5V and 0V. If any pulse train is incorrect, replace the fan in question.

(d) If all pulse trains in step (c) are correct, measure dc voltage at CR47 (anode) of the system controller PWB (1A1A3). If approximately 0V, suspect the alarm circuitry of the system controller PWB (see figures SD-8 thru SD-11).

(e) If the voltage measured in (d) is approximately 5V, suspect the detection circuitry on the power supply control/monitor PWB (2A1) (see figure SD-21).

5.9.9 POWER SUPPLY HIGH TEMP ALARM: A **HIGH TEMP** alarm indicates that either the charge resistors (2R1 thru 2R6) or the discharge resistor (2R8) is getting too hot (excessive charge/discharge time period). A high temperature alarm may result from a failure of the discharge control circuitry or the overtemperature sensing circuitry on the power supply control/monitor PWB, a fault in the temperature-sensing thermistors inside the charge/discharge resistors, a fault in the charge contactor's contacts, a fault in the system controller PWB alarm circuitry or a fault in the power supply monitor PWB. Under normal circumstances, these resistors conduct current for a short-period of time and do not get hot enough to trigger an alarm. Trouble shoot a **HIGH TEMP** alarm as follows:

CAUTION

Use caution when touching these resistors because they can get extremely hot.

(a) If the transmitter shutdown (main contactor shut off) when the fault occurred, proceed to step (b). If the main contactor did not shut off, the alarm is probably false. Press **SYSTEM RESET** to try to clear the fault.

(b) Shut off AC power to the transmitter at the AC power switch box. Open the lower rear door of the power supply cabinet. Determine which (if any) resistors (2R1 thru 2R6 and 2R8) are causing the alarm.

(c) If any charge resistors are hot, suspect a wiring fault between the main contactor and the charge contactor.

(d) If the discharge resistor is hot, suspect a fault in the discharge circuitry on the power supply control/monitor PWB (Q3 may be short).

(e) If no resistors are hot and the main contactor did not shut off, suspect the alarm circuitry on the system controller PWB. If no resistors are hot and the main contactor did shut off, suspect the detection circuitry on the power supply control/ monitor PWB (2A1) or the power supply monitor PWB (2A10).

5.9.10 RF DRIVE POWER SUPPLY ALARM: The **RF DRIVE** alarm indicates that the output of at least one RF drive power supply has fallen below 56 VDC. The alarm could result from a fault in the RF drive power supply, a fault in the dual regulated +48 VDC power supply, a faulty detection circuitry on the RF drive power supply or a fault in the alarm circuitry on the system controller PWB. Trouble shoot an **RF DRIVE** alarm as follows:

(a) Measure dc voltage at E8 of the dual regulated +48 VDC power supply. If it is less 48 volts, suspect the dual regulated +48 VDC power supply (see figure SD-24).

(b) Ensure that the RF drive power supply in question is on. Measure DC voltage at the power supply output at TP2. If it has fallen below approximately 56 volts, try adjusting R3 of the RF drive power supply. If the voltage is still below 56V, suspect the RF drive power supply (see figure SD-23).

(c) If the voltage at TP2 is greater than 56V (see voltage setting in paragraph 4.11.4), measure DC voltage at Q3 (collector) of the RF drive power supply. If 0V, suspect the alarm circuitry on the system controller PWB (see figures SD-8 thru SD-11).

(d) If the voltage measured in (c) is approximately 5V, suspect the detection circuitry on the RF drive power supply (see figure SD-23).

5.9.11 LOW BATTERY ALARM: A **LOW BATTERY** alarm indicates that the voltage provided by the battery backup system is low. The fault may be caused by weak batteries or a fault in the detection or alarm circuitry on the system controller PWB.

Replace batteries on the remote interface PWB. If alarm remains, suspect the system controller PWB (see figures SD-8 thru SD-11).

5.9.12 POWER SUPPLY LOW VOLTAGE ALARM: A **LOW VOLTAGE** alarm indicates that at least one of the exciter's low voltage dc power supplies (+5, +15, -5V, -15V) has failed. The alarm may be caused by a failure of the power supply, a fault in the detection circuitry on the exciter interface PWB or a fault in the alarm circuitry on the system controller PWB. Trouble shoot the **LOW VOLTAGE** alarm as follows:

(a) On the exciter interface PWB (1A2A1), measure the following:
- +5V on R13 left side
- +15V on R14 left side
- -5V on R15 left side
- -15V on R16 left side

If any of these are incorrect, suspect a problem in the low voltage power supply (1A2A4, 1A2A7). Refer to the appropriate service instruction manual.

(b) If voltages in step (a) are correct, measure DC voltage at CR15 (cathode) on the exciter interface PWB. If approximately 0V, suspect the alarm circuitry on the system controller PWB (see figures SD-8 thru SD-11).

(c) If the voltage measured in step (b) is approximately 5V, suspect the detection circuitry on the exciter interface PWB (see figures SD-13 and SD-14).

5.9.13 OSCILLATOR DRIVER ALARM: The **OSCILLATOR DRIVER** alarm indicates that at least one of the RF buffers is not operating properly. The alarm could result from a failure in the RF buffer, in the detection circuit on the RF buffer PWB (1A38, 1A39), a failure on the frequency synthesizer PWB (1A2A2) 1A2A5) or in the alarm circuitry on the system controller PWB. Trouble shoot an **OSCILLATOR DRIVER** alarm as follows:

(a) Measure DC voltage at L1 of the RF drive buffer PWB. If it is less than 48 volts, suspect the dual regulated +48Vdc power supply (see figure SD-24).

(b) Use an oscilloscope to look at the signal at E1 of the RF buffer PWB. The signal should approximate a square wave of approximately 30Vp-p. If signal is present, go to step (e).

(c) If no signal is present, check R1 of the RF buffer PWB for a 15Vp-p square wave at the carrier frequency. If present and there is +48 VDC at L1, +24 VDC at CR5 (cathode) and a nominal +0.2 VDC at Q6 (collector), suspect the RF buffer PWB (see figure SD-18).

(d) If no signal is present at R1, check R59 of the frequency synthesizer PWB (1A2A2, 1A2A5) for a 15Vp-p square wave. If no signal is present, suspect the frequency synthesizer PWB (see frequency synthesizer manual).

(e) Measure dc voltage at Q8 (collector) on the RF buffer PWB. If approximately 0V, suspect the alarm circuitry on the system controller PWB. If approximately 5V, suspect the detection circuitry (U1, Q8 and associated components) on the RF buffer PWB (see figure SD-18).

5.9.14 MODULATOR DRIVER ALARM: A **MODULATOR DRIVER** alarm indicates that a fault exists in the bi-phase PDM drive signals. It may be caused by a fault on the bi-phase PDM driver PWB (1A2A3, 1A2A6), a fault in the detection circuitry on the exciter interface PWB (1A2A1), a fault on the 50kW distribution PWBs (1A36, A140) or a fault in the alarm circuitry on the system controller PWB. Trouble shoot a **MODULATOR DRIVER** alarm as follows:

(a) If the transmitter successfully switched to the standby exciter, suspect the main exciter's bi-phase PDM driver PWB. See the instruction manual for the bi-phase PDM driver PWB.

(b) Use an oscilloscope to view the signals at TB2-10 and TB2-12 on the 50kW distribution PWBs (1A36 and 1A40). The signals should be a PDM pulse train, 0 to +15 volts, 180 degrees out of phase with each other, with equal duty cycle. If signals are incorrect, go to paragraph (e).

(c) If signals in step (b) are correct, use a multimeter to measure the signals at TP3, TP4 and CR30-anode (with respect to ground) of the exciter interface PWB. The signal measured at TP3 and TP4 should be between 5.1 volts and the DC level measured at CR30-anode.

(d) If signals in step (c) are correct, measure DC voltage at U1-14 on the exciter interface PWB. If approximately 0V, suspect the alarm circuitry on the system controller PWB (see figures SD-8 thru SD-11). If approximately 5V, suspect the detection circuitry on the exciter interface PWB (see figures SD-13 and SD-14).

(e) Use an oscilloscope to view the signals at TP16 and TP17 of the bi-phase PDM driver PWB (1A2A3, 1A2A6). If the signals are not as described in paragraph (b), suspect the bi-phase PDM driver PWB (see bi-phase PDM driver PWB manual).

5.9.15 MODULATOR PROTECTION ALARM: A **MODULATOR PROTECTION** alarm may occur from overdriving the transmitter (high output power, high modulation depth or a very low modulating frequency), a fault in the alarm circuitry on the system controller PWB or a fault in the monitor/detection circuitry of the bi-phase PDM driver. Trouble shoot a **MODULATOR PROTECTION** alarm as follows:

(a) Examine the operating conditions under which the alarm occurred. **MODULATOR PROTECTION** will be initiated when the transmitter is running at high output power, with high modulation depth (i.e., 95 percent and above) or at low modulating frequency (i.e., 30Hz and below). If these conditions were present at the time of the alarm, adjust the modulating signal, the level of modulation and/or the output power. If the alarm persists, go to paragraph (b).

(b) Use an oscilloscope to view TP3 on the bi-phase PDM PWB. If the audio is clipped (as in figure 7-5), suspect the bi-phase PDM PWB (see bi-phase PDM PWB manual).

(c) If the waveform in step (b) is not clipped, measure DC voltage at the drain of Q1 on the exciter interface PWB (1A2A1). If the voltage is switching between +5 and 0V, suspect either the exciter interface PWB (see figures SD-13 and SD-14) or Q2 on the bi-phase PDM PWB (see bi-phase PDM PWB manual).

5.9.16 RF INHIBIT ALARM: An **RF INHIBIT** alarm indicates that an external RF inhibit command has been issued. The alarm could be caused by a short circuit in the external wiring path to the remote controller, a fault in the switching circuitry on the remote interface PWB or a fault in the alarm circuitry on the system controller PWB. Trouble shoot an **RF INHIBIT** alarm as follows:

(a) Check that the jumper settings for E23 and E24 on the remote interface PWB are appropriate for the remote control system being used.

(b) Ensure that the remote RF inhibit command is not activated.

(c) Measure DC voltage at R45 on the remote interface PWB. If it is approximately 4.5 VDC, suspect the switching circuit on the remote interface PWB (see figure SD-12). If it is near 0 VDC, suspect the alarm circuitry on the system controller PWB (see figures SD-8 thru SD-11).

5.9.17 STANDBY ALARM: A **STANDBY** alarm indicates that the standby exciter is operating and that the transmitter has switched from main exciter to standby exciter. The **STANDBY** alarm may be caused by a fault in the transmitter that forced a changeover or a fault in the system controller PWB's microprocessor or alarm circuit. Trouble shoot the **STANDBY** alarm as follows:

(a) Verify that the standby exciter is operating. If the main exciter is operating and the **STANDBY** alarm is red, suspect a problem in the alarm circuit on the system controller PWB (see figures SD-8 thru SD-11).

(b) If the standby exciter is operating, switch back to the main exciter to verify that the transmitter switches back to the standby exciter. If the transmitter switches back to the **STANDBY** exciter, press and hold **ALARM RECALL** on the control panel. A red alarm indicates a problem somewhere in the transmitter that forced the changeover. Faults likely to cause a changeover are:

- **OSCILLATOR DRIVER**
- **MODULATOR DRIVER**
- **LOW VOLTAGE**
- **RF DRIVE**

Refer to the appropriate paragraph in this section for information on trouble shooting these alarms.

(c) If the transmitter does not change back to the standby exciter when the main exciter is selected, suspect that the switch-over was a false alarm most likely caused by a transient.

(d) If no alarms occur (lamps glow red) when **ALARM RECALL** switch is pressed and the standby exciter is operating, suspect a problem on the system controller PWB (see figures SD-8 thru SD-11).

5.9.18 POWER MODULES ALARM: A **POWER MODULES** alarm indicates that at least one of the power modules is registering an alarm.

(a) Open the front doors on the primary and secondary power cabinets to see if any power modules are showing alarms.

(b) If no power modules are showing alarms, press **SYSTEM RESET** on the control panel to try to clear the alarm. If the alarm persists, there may be a problem in the alarm circuit on the system controller PWB (see figures SD-8 thru SD-11) or a problem with the alarm circuits in a power module (see RF power module manual). If the alarm extinguishes, it may have been false.

(c) If one or more power modules are showing an alarm, refer to the power module manual for trouble shooting information.

5.9.19 CUTBACK ALARM: A **CUTBACK** alarm indicates that several shutback alarms have occurred. A **CUTBACK** alarm may be triggered by a fault in the transmitter, large VSWR, or a fault in the alarm circuitry of the system controller PWB. Trouble shoot a **CUTBACK** alarm as follows:

(a) Read the output power level on the **RF KILOWATTS** meter on the transmitter's control panel. If the output power is not less than the preset operating level, the **CUTBACK** alarm may be false. Suspect the alarm circuitry on the system controller PWB (see figures SD-8 thru SD-11).

(b) Press and release the ∧ **POWER** switch on front panel to restore the preset power level. If the fault persists, the output power will automatically cutback again. Observe the front panel and note which alarm is forcing shutback. Refer to the appropriate trouble shooting paragraph in this section.

(c) If the output power does not cutback, the fault no longer exists. Press **ALARM RECALL**. The fault that caused cutback will turn red. Refer to the appropriate paragraph in this section for trouble shooting information, if necessary.

5.9.20 SHUTBACK ALARM: A **SHUTBACK** alarm indicates that the output power of the transmitter has been reduced to zero. **SHUTBACK** alarm may be caused by a fault in the transmitter, large VSWR or a fault in the alarm circuitry of the system controller PWB.

NOTE

A **SHUTBACK** *alarm will always be accompanied by another alarm, with one exception. If output power gain control is set too high by the operator (approximately 8.5 VDC at TP4 on the system control /monitor PWB), the transmitter will shutback with only the* **SHUTBACK** *alarm indication. To reset this fault, press and hold* ∨ **POWER** *for three (3) seconds, then press* **SYSTEM RESET**.

Alarms that accompany **SHUTBACK** are **OSCILLATOR DRIVER, MODULATOR DRIVER, RF INHIBIT, COMBINER INPUT, OVER VOLT, UNDER VOLT, OVER CURRENT, HIGH TEMP, RF DRIVE, LOW VOLTAGE, XMTR INTLK, EXTERNAL INTLK, COMBINER ARC** and **VSWR** (second level; see paragraph 5.9.22).

(a) Read the control panel's output power meter. If the output power is zero, go to step (b). If output power is not reduced, suspect a fault in the detection/alarm circuitry on the system controller PWB (see figures SD-8 thru SD-11).

(b) If another alarm is red, refer to the appropriate paragraph in this handbook for trouble shooting information. If no alarm is registered in addition to the shutback alarm, suspect either a fault on the system controller PWB or that the output power gain control is set too high.

5.9.21 COMBINER INPUT CURRENT ALARM: A **COMBINER INPUT CURRENT** alarm indicates that too much RF current is flowing for too long in the combiner assemblies in the rear of the transmitter. A **COMBINER INPUT CURRENT** alarm may be caused by a fault in the transmitter that causes too much current to flow in the output combiner, overdriving the transmitter, a fault in the detection circuitry on the 50kW distribution PWBs (1A36, 1A40), a fault in the alarm circuitry on the system controller PWB or a fault in the resistor network assemblies (1A41A3, 1A42A3). Trouble shoot a **COMBINER INPUT CURRENT** alarm as follows:

(a) Investigate the operating conditions at the time of the alarm. The alarm will trip when the transmitter is being driven too hard (i.e., output power too high).

(b) If the transmitter is not being overdriven, try to clear the alarm by pressing **SYSTEM RESET**. If the alarm clears, it may have been false.

(c) Measure DC voltage at TP12 on the 50kW distribution PWBs. If it is approximately 0V, suspect the alarm circuitry on the system controller PWB (see figures SD-8 thru SD-11).

(d) If approximately 5V, measure dc voltage at TP6 on the 50kW distribution PWB. If it is less than 5.2V, suspect the RF current detector circuit on the 50kW distribution PWB (see figures SD-16 and SD-17).

(e) If the voltage at TP6 is greater than 5.2V and transmitter is not being overmodulated, suspect the transformer or resistor network in the RF combiner (1A41, 1A42).

5.9.22 VSWR ALARM: A **VSWR** alarm indicates that the reflected power is higher than normal. The **VSWR** alarm trips in two stages. The **VSWR** lamp will turn red when the reflected power is equal to 10kW (the peak reflected power to have a VSWR of 1.35:1 at full rated power 100% modulation) as a warning to the operator. No protective action is taken by the transmitter. When the reflected power reaches a level of 16kW (the peak reflected power to have a VSWR of 1.5:1 at full rated power, 100% modulation), the transmitter will shutback, preventing damage.

A **VSWR** alarm can be caused by excessive reflected power, a fault in the forward/reflected power probe (1A3A2) or a fault in the alarm circuitry on the system controller PWB. Trouble shoot a **VSWR** alarm as follows:

(a) Read the forward and reflected power from the power meter on the transmitter's control panel. If the forward power has been reduced and the reflected power increased, there may be a matching problem between antenna and transmitter.

(b) Perform a visual inspection of the antenna feed line and antenna and correct any obvious problems that can cause excessive reflected power.

(c) If there are no obvious problems between transmitter and antenna, measure dc voltage on R117 (right side) on the system controller PWB. If greater than three volts, suspect an actual VSWR condition or a fault in the forward/reflected power probe (see figure SD-15). If less than three volts, suspect the detection/alarm circuitry on the system controller PWB (see figures SD-8 thru SD-11).

NOTE

The power probe has eight DIP switches (accessed through the front of the power supply) that need to be adjusted for the most accurate reading on the power meter. These switches are factory set and should not require any adjustment.

5.9.23 COMBINER ARC ALARM: A **COMBINER ARC** alarm indicates that an arc has been detected in the RF combiner/output filter or in the 8-input RF combiner. A **COMBINER ARC** alarm may also be caused by a fault in the detection circuitry on one of the arc detector PWBs (1A3A4, 1A3A5, 1A41A4 or 1A42A4) or a fault in the alarm circuitry on the system controller PWB. Trouble shoot a **COMBINER ARC** alarm as follows:

(a) Attempt to reset the **COMBINER ARC** alarm by turning off, then on, the AC input voltage.

(b) If the alarm reoccurs upon resetting, it is probable that an arc has occurred in either the RF combiner/output filter or the 8-input RF combiner.

(c) Gain access to the RF combiner/output filter and 8-input RF combiner by opening key interlocked doors/panels.

(d) Perform a visual inspection of the assemblies and correct any obvious problems that can cause arcing.

(e) Restore all keyed interlocks and return the transmitter to operation. Set the transmitter's RF output to zero watts.

(f) If the **COMBINER ARC** alarm still occurs, suspect a fault with the detection circuitry on one of the four arc detector PWBs or a fault with the alarm detection circuitry on the system controller PWB.

SECTION 6
THEORY OF OPERATION

GENERAL

6.1 The theory of operation for the NA100 - 100kW AM broadcast transmitter is presented in this section. Unique circuits are explained.

NA100 SYSTEM OVERVIEW

6.2 See to figure SD-1. The transmitter circuitry is subdivided into four functional blocks: exciter stage, RF power stage, control/monitor function and AC/DC power supply.

The exciter stage accepts audio, output gain control, exciter selection, RF drive control and PDM inhibit controls from the control/monitor function. Low level DC voltages are applied to the exciter stage from the AC/DC power supply. Samples of PA and B+ voltages and a power module fault alarm is applied to the exciter stage from the RF power stage. The exciter can accept signals from an optional dynamic carrier control interface. RF drive, gate bias and PDM signals are applied to the RF power stage from the exciter stage as well as regulated low level DC voltages and power module control signals. Low level voltages and control/status signals are also applied to the control/monitor function and AC/DC power supply.

The RF power stage accepts drive, control and DC voltages from the exciter stage. It also receives B+ supplies, fan supplies, RF drive supplies and a +24V supply from the AC/DC power supply. Reset and fan control inputs to the RF power stage originate in the control/monitor function. RF power monitoring and power module status information is applied to the control/monitor function. Final RF output to the antenna system is provided by the RF power stage.

The control/monitor function accepts critical signal samples, status and alarm signals from the exciter stage, RF power stage and AC/DC power supply. Based on the values of these inputs the control/ monitor function will output the appropriate control signals to the exciter stage, RF power stage and AC/DC power supply to ensure proper operation and protection of the transmitter system.

EXCITER STAGE

6.3 See figure SD-2. The exciter stage contains two independent driver units *A* and *B* which can be selected automatically or by local or remote control. Each exciter generates its own regulated DC supply voltages, synthesized RF frequency source, and PDM signal. Each unit has control circuitry to provide RF drive and modulator drive signals to the RF power stage. The exciter stage consists of an exciter interface PWB , frequency synthesizer PWB *A* and *B*, bi-phase PDM driver PWB *A* and *B*, DC power supply *A* and *B*, RF drive buffer PWB *A* and *B* and RF drive splitter.

6.3.1 EXCITER INTERFACE PWB : See figures SD-2, SD-13 and SD-14. The exciter interface PWB provides signal distribution and physical interconnection for DC power supply *A* and *B*, frequency synthesizer PWB *A* and *B* and bi-phase PDM driver PWB *A* and *B*.

6.3.1.1 Control/Status Signal Distribution: Various control and status signals are routed through the exciter interface PWB between subassemblies within the exciter stage, the control/monitor function, the RF power stage, the AC/DC power supply and the optional dynamic carrier control unit.

6.3.1.2 DDS Reset: The **RESET** switch, S1, provides a +5V *reset dds (A)* and *reset dds (B)* signal to frequency synthesizer PWB s *A* and *B* of the exciter stage. If the carrier frequency selected at the frequency synthesizer PWB has been changed prior to the reset request and after initial turn on, the new carrier frequency will be output after the synthesizer reset sequence has completed.

6.3.1.3 RF Power Module Tune: As part of the carrier frequency change procedure, RF power modules *A* thru *P* must be auto tuned, thru circuitry within the power modules, to new operating carrier frequency. **TUNE** switch S2 is set to **TUNE** position during this portion of the tuning procedure. When S2 is set to the **TUNE** position, a ground is applied from S2/A thru the *tune selected (A)* and *tune selected (B)* outputs to the frequency synthesizer PWB s to indicate that the auto tuning sequence is in progress.

A ground is also applied from S2/C to the f_{PDM} output to RF power modules *A* thru *P*, in the RF power stage, to ensure the transmitter's RF output is inhibited during the auto tuning sequence. S2/B provides +5V to allow the **TUNE** LED to be turned on to indicate the status of the auto tuning sequence and to apply a +5V *tune RF drive* signal to RF power modules *A* thru *P* to activate the auto tuning sequence. The *tune RF drive* output will be applied to RF power modules *A* thru *P* and the **TUNE** LED will be turned on as long as the *tune RF drive (A)* or *tune RF drive (B)* input from frequency synthesizer PWB *A* or *B* is applied to U1/B. After the auto tuning sequence is completed and the **TUNE** LED turns off, the **TUNE** switch may be returned to the **NORMAL** position.

6.3.1.4 Low Voltage Supply Detector: Comparators U3/A and U3/B monitor the +5V, +15V, -5V and -15V regulated supply voltages against a fixed reference voltage to detect a high or low supply voltage condition. If all supplies are within allowable tolerances, the output of U3/A and U3/B is at ground potential. If one or more supply voltages increase or decrease, such that they are no longer at an acceptable level, the associated comparator's output will switch to high impedance (open circuit). A +8V *lv p/s fail* alarm signal will be applied to the system controller PWB in the control/monitor function.

6.3.1.5 Audio Input Selector: Relays K4, K5 and K6 select the signal path for audio input to the transmitter. If an optional dynamic carrier control unit (DCCU) is installed in the transmitter, an *enable DCC* signal (current sink to ground) will be applied to energize relays K4, K5 and K6. The *audio (+), audio (-)* and *gain cont* inputs will be applied to the DCCU for processing. After processing by the DCCU, the signals are routed thru the exciter interface PWB as the *audio (+) (from DCC), audio (-) (from DCC)* and *gain cont (DCC)* inputs. The audio signals are routed thru relays K4, K5 and K6 to relay K3 for application to the selected bi-phase PDM driver PWB of the exciter stage. The *gain cont (A)* and *gain cont (B)* outputs are applied simultaneously to both bi-phase PDM driver PWB s.

6.3.1.6 PDM Monitor: A sample of each phase of the PDM drive signal from bi-phase PDM driver PWB s *A* and *B* is applied as the *PDM 1 (A), PDM 1 (B), PDM 2 (A)* and *PDM 2 (B)* inputs. Each drive phase is converted to a DC voltage proportional to the PDM pulse duration and compared against a fixed +5.1V reference. Should either drive phase fail and provide a continuous DC voltage which exceeds the +5.1V threshold, output of the associated comparator will switch from its normally high impedance state to a current sink to ground and apply a *PDM fault* alarm to the system controller PWB of the control/ monitor function. The DC voltage proportional to the PDM pulse duration is also compared against a sample of the DC gain control voltage to determine if the PDM pulse duration is in correct proportion to the applied gain control voltage.

6.3.1.7 Low Voltage Distribution: Relay K2 determines which of the exciter stage's DC power supplies receives the unregulated DC supply voltages from the AC/DC power supply. Relay K1 determines which of the DC power supplies the common regulated DC supplies (+5V, -5V, +15V and -15V). Relay K3 determines to which bi-phase PDM driver PWB the audio signal is applied. Relay K7 determines which bi-phase PDM driver PWB supplies the f_{PDM} signal applied to RF power modules *A* thru *P* of the RF power stage. Relays K1, K2, K3 and K7 are controlled by the *exciter B select* input from the system controller PWB in the control/monitor function.

6.3.2 FREQUENCY SYNTHESIZER PWB : See figure SD-2.

6.3.2.1 Frequency synthesizer PWB *A* and *B* accepts regulated DC supply voltages as well as digital control/status and analog inputs from the exciter interface PWB to generate the desired RF carrier frequency for the transmitter. The frequency synthesizer is a microprocessor-controlled synthesizer which uses direct digital synthesis (DDS) techniques to generate the required RF carrier frequency. Rotary DIP switches allow for the selection of any frequency in the broadcast band.

6.3.2.2 The *reset DDS (A/B)* input provides a reset signal to the synthesizer when **RESET** switch (S1) on the exciter interface PWB is momentarily pressed. This reset signal will cause the synthesizer to reset to initial, turn-on conditions. The *serial in (A/B)* input allows for an optional, external serial input to the microprocessor controlling the synthesizer. The *ext f_C (A/B)* input allows for the application of an optional external RF frequency source. The *tune* *selected (A/B)* input provides an indication to the synthesizer controller that **TUNE** switch (S2) on the exciter interface PWB is set to the **TUNE** position and an RF power module RF drive input auto-tune sequence is required.

The output of synthesizer *A*, *RF osc (A)*, is applied to RF buffer PWB *A* thru the exciter interface PWB . The output of synthesizer *B*, *RF osc (B)*, is applied to RF buffer PWB *B* thru the exciter interface PWB . The *high band (A/B)* output is applied to the RF power stage, thru the exciter interface PWB , to indicate to power modules *A* thru *P* that the synthesizer frequency output is in the upper half of its operating range. The *tune RF drive (A/B)* output is applied to the RF power and control/monitor stages, thru the exciter interface PWB , to initiate the operation of the RF drive auto-tune circuitry in the RF power modules during a frequency change procedure. The *DDS inhibit (A/B)* output is applied to the associated bi-phase PDM driver PWB as the *PDM inhibit (A/B)* input thru the exciter interface PWB . This signal inhibits the bi-phase PDM drive signals while the auto-tune circuitry in the RF power modules is activated. The *2*f_{PDM} *(A/B)* output is applied to the associated bi-phase PDM driver PWB thru the exciter interface PWB and is used to drive the PDM ramp integrator circuit on the bi-phase PDM driver PWB .

Refer to the frequency synthesizer PWB service instruction manual for detailed information.

6.3.3 BI-PHASE PDM DRIVER PWB : See figure SD-2. The bi-phase PDM driver PWB accepts regulated DC supply voltages as well as B+ sample, digital control/status and analog inputs from the exciter interface PWB to generate the required bi-phase PDM drive signals for the modulator assemblies in RF power modules *A* thru *P*. These PDM drive signals determine the transmitter output power level as well as the output modulation level. The bi-phase PDM drive signals are generated using pulse duration modulation (PDM) techniques.

The *audio (+) (A/B)* and *audio (-) (A/B)* inputs contain the analog program material from the external audio source. This audio information is converted to the bi-phase PDM drive signals required by the modulator assemblies in the RF power modules. The *gain cont (A/B)* input is applied from the system controller PWB , 1A1A3, in the control/monitor function. This variable, DC gain control voltage is used by the bi-phase PDM circuitry to determine the output power of the transmitter. A sample of the B+ supply voltage applied to the RF power stage is input at *B+ sample (A/B)*. This voltage sample is used as an input to the carrier level control circuit which is designed to hold the transmitter output power constant with variations in the unregulated B+ supply. A *reset PDM (A/B)* input is applied from the system controller PWB (1A1A3) to inhibit the bi-phase PDM drive during a system reset sequence.

The *PDM 1 (A/B)* and *PDM 2 (A/B)* PDM drive outputs are applied to the modulators in RF power modules *A* thru *P*. A f_{PDM} *(A/B)* signal at a frequency equal to that of the PDM ramp is applied to RF power modules *A* thru *P* to develop a supply which is used for switching the field effect transistor (FET) devices. The *overmod (A/B)* alarm is applied to the system controller PWB , 1A1A3, in the control/monitor function. When active, this alarm indicates that the bi-phase PDM drive has exceeded the safe maximum allowable pulse duration.

Refer to the bi-phase driver PWB service instruction manual for detailed information.

6.3.4 DC POWER SUPPLY PWB : See figure SD-2. The DC power supply PWB accepts unregulated DC voltages from the AC/DC power supply and provides regulated +15V, +5V, -15V and -5V supplies for the exciter stage and the remaining functional blocks of the transmitter. Positive temperature coefficient (PTC) devices are installed in series with all supply inputs to provide a high impedance should excessive currents be drawn from any supply. The regulated DC voltages are generated by monolithic voltage regulator devices whose output voltage is determined by a resistor divider at the output of the device. Thyristors Q1 thru Q4 provide over voltage protection by clamping to ground the input (output) of the associated regulator should its output voltage exceed the allowable limit. Clamping trigger thresholds are determined by zener diodes CR5 thru CR8.

Refer to the DC power supply PWB service instruction manual for detailed information.

6.3.5 RF BUFFER PWB : See figures SD-2 and SD-18. The RF carrier frequency generated by frequency synthesizer A, *RF osc (A)*, is applied thru exciter interface PWB to the f_C input of RF buffer PWB *A*. Voltage supplies *+15V* and *+24V* are also applied from the exciter interface PWB . The RF carrier frequency generated by frequency synthesizer *B*, *RF osc (B)*, is applied thru exciter interface PWB to the f_C input of RF buffer PWB *B*. Voltage supplies *+15V* and *+24V* are also applied from the exciter interface PWB . A *+48V buffer* supply is applied to both *A* and *B* RF buffer PWB s from the AC/DC power supply. An *RF drive on* signal is applied to both *A* and *B* RF buffer PWB s to enable the output of the selected exciter's RF buffer when the transmitter RF output is enabled. The f_C signal (50/50 duty cycle, 0-15V square wave at the selected carrier frequency) is applied to the bases of transistors Q1 and Q2. Q1 and Q2 form a push-pull buffer which drives the primary of transformer T1. The secondary of T1 drives the gates of field effect transistors Q3 and Q4 to produce a higher voltage RF drive (f_C) signal. The FETs switch the 30V supply created by Zener diode CR3, resistor R8 and transistors Q5 and Q7. Relay K1 is energized by the application of an *RF drive on* signal to enable the output of the selected RF buffer PWB . A sample of the RF drive output is applied to resistor R9 and on to comparators U1/A and U1/B. These comparators with their associated components form a circuit which monitors the level and the duty cycle of the RF drive. Comparator U1/C monitors the level of the 30 volts which is connected to the last buffer stage. During normal operation the output of the comparators is an open collector, Q8 is turned on and a current sink to ground exists at the *low RF drive* output. If a failure occurs in the buffer, transistor Q8 will turn off and cause the *low RF drive* output to switch to an open circuit (high impedance). This alarm signal is applied to the exciter interface PWB .

6.3.6 RF DRIVE SPLITTER: See figure SD-2. The RF output from each RF buffer PWB , *A* and *B*, is applied to the E1 and E2 inputs on the RF drive splitter, 1A39. The splitter assembly provides a parallel distribution buss for the RF drive signal to RF power modules *A* thru *P* in the RF power stage.

RF POWER STAGE

6.4 See figures SD-3, SD-6 and SD-7. The RF power stage is comprised of 50kW RF power section 1, 50kW RF power section 2 and the frequency agile 100kW RF combiner/output filter, (1A3). Each 50KW RF power section accepts RF drive, bi-phase PDM drive, gate bias drive, regulated DC voltages and low level control signals from the exciter stage as well as supply voltages from the AC/DC power supply and low level control signals from the control/ monitor function. The RF output from each 50kW RF power section, *RF 1* and *RF 2*, is applied to the 100kW RF combiner/output filter, which combines and filters the two 50kW inputs to provide a common 100kW output (*RF out* at 1A3J1). The filter may be set up to operate at any frequency in the broadcast band by selecting the appropriate capacitor combinations and inductor taps for the required frequency. Probes in the output filter provide forward power, reflected power and RF sample signals to the control/monitor function for protection and metering purposes. Grounding wands are provided to ensure safety during transmitter maintenance. Removal of a grounding wand from its mounting clip automatically opens the associated interlock switch.

50kW RF power section 1 contains the 50kW primary distribution PWB , RF power modules *A* thru *H*, fan trays *A* thru *H*, capacitor trays *A* thru *H*, the primary backplate assembly (1A59) and 8-input RF combiner (1A42). 50kW RF power section 2 contains the 50kW secondary distribution PWB , RF power modules *I* thru *P*, fan trays *I* thru *P*, capacitor trays *I* thru *P*, the secondary backplate assembly (1A60) and 8-input RF combiner (1A41).

6.4.1 50KW PRIMARY DISTRIBUTION PWB : See figures SD-6, SD-16 and SD-17. The 50kW primary distribution PWB is located in 50kW RF power section 1 and provides control for RF power modules *A* thru *H*.

6.4.1.1 Drive Buffers: Transistors Q1, Q2, Q8 and Q9 increase the voltage level of the f_{PDM} signal from the selected bi-phase PDM driver PWB in the exciter stage to RF power modules *A* thru *H*. Comparators U1/C and U1/D with their associated components form a circuit which monitors the amplitude and duty cycle of the buffered *GATE BIAS DRIVES*. Transistors Q3, Q4, Q10 and Q11 buffer the *PDM1* signal from the selected bi-phase PDM driver PWB in the exciter stage to RF power modules *A* thru *H*. Transistors Q5, Q6, Q12 and Q13 buffer the *PDM2* signal from the selected bi-phase PDM driver PWB in the exciter stage to RF power modules *A* thru *H*.

6.4.1.2 Fan Control: The *fans on* signal from the system controller PWB in the control/monitor function turns on transistor Q7 which grounds the *inh RF dr fail* signal to RF power modules *A* thru *H*. The *tune RF drive* and *high band* control signals from the exciter stage and the *reset pm* signal from the control/monitor function are applied to RF power modules *A* thru *H*.

6.4.1.3 Load Impedance Measurement: The load impedance measurement circuit applies a DC voltage to **IMPEDANCE** meter 1A3A1M1, to indicate the magnitude of the impedance of the input of the output combiner filter. An RC4200AN multiplier/divider integrated circuit is used to generate the required signal. For this application the RC4200AN device has been configured such that the following relationship between the device inputs and out exists: I3 = (I1 x I2)/I4, where I1 thru I4 are current signals. The output, I3, is directly proportional to inputs I1 and I2 and inversely proportional to input I4. A sample of the pa supply voltage *pa volts* from RF power modules *A* thru *H*, a voltage sample proportional to the DC current consumption from the AC/DC power supply and a DC voltage proportional to the pulse duration of phase 1 of the PDM signal (*PDM 1*) are applied to the I1, I4 and I2 inputs of U5. The I3 output of U5 will, therefore, be directly proportional to the product of the PA supply voltage and the PDM pulse duration and inversely proportional to the DC current consumption. **IMPEDANCE METER** potentiometer, R44, allows calibration of the **IMPEDANCE METER** reading when the output filter is terminated with a 50 ohm resistive load.

6.4.1.4 RF Current Detector: An RF voltage signal *RF current sample* directly proportional to the RF output current of 50kW RF power section 1 from resistor network assembly 1A42A3 is monitored for an overcurrent condition. Resistor R70 and potentiometer R71, in parallel with resistor R20, establish the level of this voltage. The voltage is half-wave rectified by CR6 to provide a DC voltage proportional to the RF current. Operational amplifier U3/A is configured as a differential amplifier. Operational amplifier U3/B is configured as an integrator accumulator. The output of this accumulator is determined by the transmitter's RF output characteristics which include: carrier level, amplitude of the modulation envelope and frequency of the modulating audio. The gain of the accumulator is inversely proportional to the frequency of the modulating audio, therefore, changes in U3/B's output will be greater at low frequencies than at high frequencies of equal amplitude signals. Under normal operating conditions the output of accumulator U3/B will be near +5V causing the *RF over current* output to the control/monitor function to be inactive (ground). Should an unacceptably high RF stress current be detected and be of sufficient amplitude or duration to reduce output of U3/B, a *RF over current* signal (+5V) will be applied to the system controller PWB of the control/monitor function indicating the over current condition.

Comparator U1/B monitors the *RF current sample* so that if RF current reaches a level greater than the current required for 100kW with 140 percent modulation, a *rf over current* signal (+5V) will be applied to the system controller PWB of the control/monitor function indicating the over current condition.

Comparator U1/A compares a sample of the forward power to a sample of the PA volts so that if the forward power is lower than what the Pa volts indicates it should be a *RF over current* signal (+5V) will be applied to the system controller PWV of the control/monitor function indicating the over current condition.

6.4.1.5 Power Supply Distribution: DC supply voltages +24V, *RF drive volts*, +15V, -5V, +5V, and -15V are applied to RF power modules *A* thru *H*. PTC devices RT1 thru RT6 provide over current protection and switch to a high impedance (open circuit) state if excessive current is detected.

6.4.1.6 Fan Supply: The +48V fan supply from the AC/DC power supply is applied to fan trays 1A20 thru 1A27 of 50kW RF power section 1.

6.4.1.7 Power Module Alarms: Power module fault alarm signals *pm fault (A)* thru *pm fault (H)* are OR'ed together thru diodes CR12 thru CR19 to provide a common *power module fault* alarm signal which is then applied to the exciter stage and control/ monitor function.

6.4.1.8 Test Outputs: Various supply voltages, control and drive signals required to test an RF power module that has been removed for servicing are provided at connector J4. See section 7 for module-to-transmitter interconnection instructions and to the RF power module's instruction manual for a detailed description of the test procedure.

6.4.1.9 Power Module Inhibit: Power module interlock signals *pm intlk (A)* thru *pm intlk (H)* are applied to the gates of field effect transistors Q17 thru Q24 from power modules *A* thru *H*. Outputs *pm disabled (A)* thru *pm disabled (H)* are applied as the on/off control for relays 1A59K1 thru 1A59K8 of the primary backplate assembly 1A59, in RF power section 1. When a *pm intlk* input is active, the associated FET will turn on and energize the appropriate relay (1A59K1 thru 1A59K8). Relays 1A59K1 thru 1A59K8 short the *RF 1* and *RF 2* outputs of RF power modules *A* thru *H*, respectively, so that any module may be removed for servicing without disturbing the input impedance of the 8-input RF combiner (1A42) while the transmitter is operating (on-air). When the transmitter is turned off (**RF OFF**), +15 volts is applied to the gate of field effect transmitter Q25 which activates relays 1A59K1 thru 1A59K8.

6.4.2 50KW SECONDARY DISTRIBUTION PWB : See figures SD-7, SD-19 and SD-20. The 50kW secondary distribution PWB is located in 50kW RF power section 2 and provides control for RF power modules *I* thru *P*.

6.4.2.1 Drive Buffers: Transistors Q1, Q2, Q8 and Q9 increase the voltage level of the f_{PDM} signal from the selected bi-phase PDM driver PWB in the exciter stage to RF power modules *I* thru *P*. Comparators U1/C and U1/D with their associated components form a circuit which monitors the amplitude and duty cycle of the buffered *GATE BIAS DRIVES*. Transistors Q3, Q4, Q10 and Q11 buffer the *PDM1* signal from the selected bi-phase PDM driver PWB in the exciter stage to RF power modules *I* thru *P*. Transistors Q5, Q6, Q12 and Q13 buffer the *PDM2* signal from the selected bi-phase PDM driver PWB in the exciter stage to RF power modules *I* thru *P*.

6.4.2.2 Fan Control: The *fans on* signal from the system controller PWB in the control monitor function turns on transistor Q7 which provides a current sink to ground to the *inh RF dr fail* signal to RF power modules *I* thru *P*. The *tune RF drive (I-P)* and *high band* control signals from the exciter stage and the *reset pm* signal from the control/monitor function are applied to RF power modules *I* thru *P*.

6.4.2.3 RF Current Detector: An RF voltage signal *RF current sample* directly proportional to the RF output current of 50kW RF power section 2 from resistor network assembly 1A41A3 is monitored for an over current condition. Resistor R70 and potentiometer R71, in parallel with resistor R20, establish the level of this voltage. This voltage is half-wave rectified by CR6 to provide a DC voltage that is proportional to the RF current. Operational amplifier U3/A is configured as a differential amplifier. Operational amplifier U3/B is configured as an integrator accumulator. The output of this accumulator is determined by the transmitter's RF output characteristics which include: carrier level, amplitude of the modulation envelope and the frequency of the modulating audio. The gain of the accumulator is inversely proportional to the frequency of the modulating audio, therefore, changes in U3/B's output will be greater at low frequencies than they will be at high frequencies of equal amplitude signals. Under normal operating conditions the output of accumulator U3/B will be near +5V causing the *RF over current* output to the control/monitor function to be inactive (ground). Should an unacceptably high RF stress current be detected and be of sufficient amplitude or duration to reduce output of U3/B, a *RF over current* signal (+5V) will be applied to the system controller PWB of the control/monitor function indicating the over current condition.

Comparator U1/B monitors the *RF current sample* so that if the RF current reaches a level greater than the current required for 100kW with 140 percent modulation, a *RF over current* signal (+5V) will be applied to the system controller PWB of the control/ monitor function indicating the over current condition.

6.4.2.4 Power Supply Distribution: DC supply voltages +24V, *RF drive volts*, +15V, -5V, +5V, -15V and are applied to RF power modules *I* thru *P*. Positive temperature coefficient (PTC) devices RT1 thru RT6 provide over current protection and switch to a high impedance (open circuit) state if excessive current is detected.

6.4.2.5 Fan Supply: The +48V fan supply from the AC/DC power supply is applied to fan trays 1A28 thru 1A35 of 50kW RF power section 2.

6.4.2.6 Power Module Alarms: Power module fault alarm signals *pm fault (I)* thru *pm fault (P)* are OR'ed together through diodes CR12 thru CR19 to provide a common *pm fault* alarm signal which is then applied to the exciter stage and control/monitor function.

6.4.2.7 Power Module Inhibit: Power module interlock signals *pm intlk (I)* thru *pm intlk (P)* are applied to the gates of field effect transistors Q17 thru Q24 from power modules *I* thru *P*. Outputs *pm disabled (I)* thru *pm disabled (P)* are applied as the on/off control for relays 1A60K1 thru 1A60K8 of the secondary backplate assembly 1A60, in RF power section 2. When a *pm intlk* input is active, the associated FET will turn on and energize the appropriate relay (1A60K1 thru 1A60K8). Relays 1A60K1 thru 1A60K8 short the *rRF1* and *RF 2* outputs of RF power modules *I* thru *P*, respectively, so that any module may be removed for servicing without disturbing the input impedance of the 8-input RF combiner (1A41) while the transmitter is operating (on-air). When the transmitter is turned off (**RF OFF**), +15 volts is applied to the gate of field effect transmitter Q25 which activates relays 1A60K1 thru 1A60K8.

6.4.3 RF POWER MODULES A THRU P: See figures SD-6 and SD-7. Each of the transmitter's sixteen identical RF power modules, *A* thru *P* provide up to 6250 watts of RF carrier output power and contain eight power amplifier and four modulator assemblies. At any carrier power or modulation level, these subsystems all contribute equally to the final combined output of the transmitter. Each of the RF power modules receives a B+ voltage supply from the AC/DC power supply, RF drive from the exciter stage and bi-phase mod drive, gate bias drive, regulated DC voltages, fan supply/control and other low level control signals from the 50kW primary and secondary distribution PWB s. Samples of the B+ voltage applied to each RF power module, within 50kW RF power section 1, are connected in parallel thru positive temperature coefficient (PTC) devices and applied to the 50kW primary distribution PWB for monitoring purposes. The RF output of each RF power module is applied to the corresponding input on the associated 8-input RF combiner. The 50kW RF outputs of the two 8-input combiners (*RF 1* and *RF 2*) are applied to the 100kW RF combiner/output filter for final combining and filtering. Refer to the RF power module service instruction manual for detailed information.

6.4.4 FAN TRAYS A THRU P: See figures SD-6 and SD-7. Fan trays *A* thru *P* provide forced air cooling for RF power modules *A* thru *P*. The controlled +48V fan supply is provided by the primary and secondary 50kW distribution PWB s.

6.4.5 CAPACITOR TRAYS A THRU P: See figures SD-6 and SD-7. Capacitor trays *A* thru *P* contain the B+ voltage reservoir capacitors required for RF power modules *A* thru *P*. An LED mounted on the capacitor tray indicates the charge status of the capacitors.

6.4.6 PRIMARY AND SECONDARY BACKPLATE ASSEMBLIES: See figures SD-6 and SD-7. The primary and secondary backplate assemblies contain RF power module combining transformers 1A59T1 thru 1A59T8 and 1A60T1 thru 1A60T8 as well as RF power module output inhibit relays 1A59K1 thru 1A59K8 and 1A60K1 thru 1A60K8. The RF combining transformers combine the two RF outputs from each RF power module *RF 1 (A/P)* and *RF 2 (A/P)* to produce a common RF output for each RF power module *A* thru *P*. The RF power module inhibit relays provide a means to ground the inputs to the associated RF combining transformers should one or more RF power modules be removed from the transmitter.

The primary backplate assy (1A59) also contains thermistors 1A59RT1 thru 1A59RT8 which provide a *B+ Sample* to be used by the exciter. Capacitor Divider Assy (1A59A1) provides an *RF voltage sample* to the 50kW distribution PWB (Primary) which is use for fine tuning the output combiner filter. Resistor 1A59R11 provides the *high voltage* required by the UV detector on each of the four arc detector PWB smn.

6.4.7 8- INPUT RF COMBINERS: See figures SD-6 and SD-7. The 8-input RF combiners, 1A41 and 1A42, provide RF combining for each of the two 50kW RF power sections (1 and 2). Each 8-input RF combiner accepts the RF output from eight RF power modules *RF (A)* thru *RF (H)* and *RF (I)* thru *RF (P)* to produce a common 50kW RF output (*RF 1* and *RF 2*) from the corresponding 50kW RF power section. The two 50kW outputs from 50kW RF power sections 1 and 2 are then applied to the 100kW RF combiner/ output filter for final combining and filtering. Each 8-input combiner also contains an arc detector PWB (A4) which acts to protect the transmitter against high voltage arcing.

6.4.7.1 4-Coil Assy: See figures SD-6 and SD-7. Each of the 4-coil assemblies, 1A41A1, 1A41A2, 1A42A1 and 1A42A2, contains tapped coils which allows the assemblies to be set up for operation at any frequency in the broadcast band. The output of each assembly contains a transformer (T1) which provides a sample of the RF output current from the assembly.

6.4.7.2 Resistor Network Assy: See figures SD-6 and SD-7. The RF output current samples from each pair of 4-coil assemblies are applied to the resistor network assembly, 1A41A3 and 1A42A3. These samples are combined and a composite RF current sample signal is applied to each of the 50kW primary and secondary distribution PWB s for monitoring and protection purposes.

6.4.8 100KW RF COMBINER/OUTPUT FILTER (FREQ AGILE): See figure SD-15. The 100kW RF combiner/output filter (1A3), contains a frequency agile RF power combining stage, output filter, tuning control panel (1A3A1), forward/ reflected power probe (1A3A2) and arc detector PWB s (1A3A4 and 1A3A5). *RF 1* and *RF 2* inputs (50kW each) are applied to inductors L1 thru L4 from the RF power stage for combining to a total of 100kW of RF output power. Combinations of capacitors C1 thru C17 may be selected to set up the filter to operate at any frequency in the broadcast band. Capacitors 1A3A3C1 thru 1A3A3C5 provide a means to fine tune the magnitude portion of the input impedance of the filter. Capacitors C19 thru C23 and tapped inductors L5 and L6 form a third harmonic notch which is set based on the required operating carrier frequency. The secondary of transformer T1 of the forward/reflected power probe 1A3A2, provides a sample of the RF output current. Combinations of capacitors C24 thru C29 may be selected to set up the filter to operate at any frequency in the broadcast band. Capacitor C30 provides a means to fine tune to the phase angle portion of the impedance of the filter. Some interaction exists between the magnitude and phase angle fine tuning adjustments. It is important to note this when any adjustments are made to the filter fine tuning.

A surge arrestor (E2) and spark gap (E1) are provided as added protection against a lightning strike or other transient at the transmitter output. As an integral part of the transmitter's keyed mechanical interlock system, a maintenance safety switch (S3) is provided to ground the transmitter output before access to the interior of the output filter assembly is possible. Inductor L7 functions as a static discharge choke for the antenna system as well as provides a sample of the RF output on an auxiliary winding to J2 *RF sample*. This RF output sample is applied to the control/monitor function for external use. Grounding wands are provided to allow for the grounding of specific portions of the filter circuitry during maintenance procedures.

Two arc detector PWB s (A4 and A5) are provided to protect the transmitter against high voltage arcing in the RF output filter compartment.

6.4.8.1 Tuning Control Panel: See figure SD-15. *Load impedance* signal is applied to the tuning control panel from the 50kW primary distribution PWB in 50kW RF power section 1. This signal drives the **IMPEDANCE** meter (1A3A1M1) to give an indication of the output filter fine tuning as adjusted by capacitors 1A3A3C1 thru 1A3A3C5 (*impedance adjust*) and 1A3C30 (*phase adjust*).

6.4.8.2 Forward/Reflected Power Probe: See figure SD-15. The forward/reflected power probe provides a voltage proportional to the forward and reflected power present at the transmitter output. The *fwd pwr* and *refld pwr* signals are applied to the system controller PFWB (1A1A3) of the control/ monitor function to drive metering and protection circuitry.

A voltage proportional to the current level of the RF output is coupled to the centre-tapped secondary winding of the forward/reflected power probe's current transformer (T1). A voltage, proportional to the RF output's voltage level, is applied to the centre tap of T1 from capacitive voltage divider C1, A1C1 and A1C2. When the output of the transmitter is terminated into a 50 ohm resistive load, the voltages (current and voltage) across one half of T1's secondary winding will be in phase and of equal amplitude. The voltages across the other half of T1's secondary winding will be of equal amplitude and phase shifted 180 degrees. The in-phase voltages are summed, limited by A1CR1 and half-wave rectified by A1CR3. The RF component of the resultant signal is filtered by A1R17 and A1C6 and a DC voltage that is proportional to the RF output level is applied to J1 as the *fwd pwr* sample. The out-of-phase voltages are summed, limited by A1CR2 and half-wave rectified by A1CR4. The RF component of any resultant signal is filtered by A1R18 and A1C7 and a **DC** voltage that is proportional to the reflected power level is applied to J2 as the *refld pwr* sample. Switches A1S1-1 thru A1S1-8 allow the probe to be set up for use at any frequency in the broadcast band.

CONTROL/MONITOR FUNCTION

6.5 See figure SD-4. The control/monitor function is comprised of the pwr meter control PWB , voltmeter control PWB , system controller PWB and remote interface PWB . These PWB assemblies are located on the transmitter's control/monitor panel, 1A1 and provide local and remote operational control and status monitoring as well as the external interface for the transmitter system.

6.5.1 SYSTEM CONTROLLER PWB : See figures SD-4, SD-8, SD-9, SD-10 and SD-11. The system controller PWB controls the active exciter stage circuitry, bi-phase PDM drive and RF power stage of the transmitter. Its primary functions are:

- Produces a DC voltage as the *gain cont* output that ultimately determines the transmitter's RF carrier level. This voltage is used as the reference voltage for a variable pulse duration modulation (PDM) generator.
- Monitors critical parameters and causes the *gain cont* voltage to be turned off (shutback) or reduced (cutback) when defined fault threshold limits are exceeded.
- Identifies the out-of-tolerance parameter, when the carrier level is shutback/cutback by providing a visual indication for local monitoring or an electrical status output for remote monitoring.
- Selects which exciter *A* or *B* will provide the RF drive and variable pulse duration bi-phase PDM drive to the RF power stage of the transmitter.
- Determines the on/off status of the transmitter's RF power stage.

NOTE

Detailed descriptions are limited to complex or non-obvious circuits.

6.5.1.1 Operator Local/Remote Controls: The on/off status of the transmitter's RF power stage, RF power level selection, active exciter selection and displaying or resetting of latched alarm indicators can be controlled using integral (local) switches or switches that are external to the transmitter at a remote location. There is also provision for external switching circuits to increase or decrease the transmitter's RF output and to instantly inhibit (shutback) the RF output.

6.5.1.1.1 Microcontroller: An 87C752 single-chip microcontroller (U1) is used to provide the necessary automatic control signals and monitoring for on/off status, preset RF power level selection, active exciter selection and RF power level for the transmitter.

6.5.1.1.2 Local/Remote Selection: The RF on/off status, power level selection and active exciter selection are determined by microcontroller U1. The setting of the transmitter's control relay K1 determines whether the local switches or remote input signals control the microcontroller input ports.

6.5.1.1.2.1 Local Control: When the transmitter's **LOCAL** switch is pressed, bistable relay K1 will switch to its local position. A current sink to ground will be applied to local switches from the *COM1* line. The local switches will be enabled and the remote inputs will have no influence.

NOTE

RF OFF *switch S9 is connected directly to control common. It is in-circuit regardless of local or remote control selection. This feature permits the RF power stage to be turned off locally in an emergency.*

6.5.1.1.2.2 Remote Control: When the transmitter's **REMOTE** switch is pressed, bistable relay K1 will switch to its remote position. A current sink to ground will be applied to the remote control switching circuits from the *remote common* output to the remote interface PWB . The remote switching circuits will be enabled and the local control switches, except for the **RF OFF** switch, will have no influence.

6.5.1.1.3 RF On/Off: Microcontroller U1 controls the logic 1 (+5 VDC) *RF drive/fans on* output to enable the exciter stage (RF buffer PWB s), RF power stage (cooling fans) and AC/DC power supply (cooling fans) and the logic 0 (ground) *RF pwr on* status output to the remote interface PWB .

6.5.1.1.3.1 RF On Selected: When **RF ON** is selected, a ground potential is applied to microcontroller U1 as the *RF on* input. The microcontroller will process the input signal and apply a logic 1 to inverters U5/E and U5/F. The inverters convert the signal to a current sink to ground for the following circuits:

- **RF ON** indicator (part of S8) thru CR15 indicating the RF power stage is enabled;
- *RF drive/fans on* output thru U5/F and Q1 to control transmitter's RF power section and to the *RF pwr on* output thru U5/E to the remote interface PWB ;
- programmable control logic integrated circuit U4 as an *RF cont* signal.

6.5.1.1.3.2 RF Off Selected: When **RF OFF** is selected, a ground potential is applied to microcontroller U1 as the *RF off* input. The microcontroller will process the input signal and apply a logic 0 thru CR16 to the **RF OFF** indicator (part of S9) to indicate the RF power stage is disabled and to inverters U5/E and U5/F. U5/E and U5/F convert the signal to a logic 1 potential for the following circuits:

- *RF drive/fans on* output thru U5/F and Q1 to control transmitter's RF power section and to the *RF pwr on* output thru U5/E to the remote interface PWB .
- programmable control logic integrated circuit U4 as an *RF cont* signal.

6.5.1.1.4 Power Level Selection: Microcontroller U1 provides a read/write function to monitor the status of the *high pwr*, *medium pwr* and *low pwr* select input lines. Whenever a ground potential input is detected by the microcontroller on one of these lines, the PDM gain control output (U1-8) is adjusted to produce the correct RF output power corresponding to that power level. The microcontroller also writes a current sink to ground back to the corresponding *high pwr*, *medium pwr* and *low pwr* line to turn on the appropriate status indicator lamp located on either switch S3, S4 or S5.

6.5.1.1.5 RF Power Increase/Decrease: Microcontroller U1 provides a read/write function to monitor the status of the *increase* and *decrease* lines. Whenever a ground potential on one of these lines is detected by the microcontroller, the PDM gain control output (U1-8) is adjusted either up or down to achieve the desired power level. The microcontroller also writes a current sink to ground back to the corresponding *increase* or *decrease* line to turn on the appropriate status indicator lamp located in either switch S1 or S2.

NOTE

Momentarily pressing and releasing the **Increase POWER** *or* **Decrease POWER** *switch will cause a small change in power level. Pressing and holding the switch will, after a brief pause, cause the RF power level to change more rapidly.*

6.5.1.1.5.1 Transmitter Output Power Clear Selected: When the transmitter's **Increase POWER** (S1) and **Decrease POWER** (S2) switches are simultaneously pressed, a ground potential is applied to both the *increase* and the *decrease* inputs. The PDM gain control for the currently selected preset rf power level and all lower presets will be set to zero.

6.5.1.1.6 Exciter A/B Selection: Microcontroller U1 provides a read/write function to monitor the status of the exciter select input lines. Whenever a ground potential *exciter A* input is recognized by the microcontroller, U1-25 switches to a logic 1 causing the *exciter B* output line to switch to a ground potential thru U5/C. The current sink to ground on the *exciter B* line is applied to the *exciter A* indicator (part of S6) thru CR13.

6.5.1.1.6.1 Exciter B Selection: Whenever a ground potential *exciter B* input is recognized by the microcontroller, U1-25 switches to a logic 0 causing the *exciter B* output line to switch to a logic 1 thru U5/C. The current sink to ground at U1-25 is applied to the *exciter B* indicator (part of S7) thru CR14.

6.5.1.1.6.2 Auto Exciter Transfer: The automatic exciter transfer function selects the standby exciter under some fault conditions.

6.5.1.1.6.2.1 Whenever one of the exciter alarms is present, a *select stby* input is applied to the microcontroller. The microcontroller toggles the *exciter B* output line and a logic 1 *standby selected* output is applied to the control logic circuitry. The following exciter functions are monitored:

- *RF drive fail* (**OSCILLATOR DRIVER** alarm)
- *PDM fault* (**MODULATOR DRIVER** alarm)
- *lv p/s fail* (**LOW VOLTAGE** alarm)
- *RF dr p/s fail* (**RF DRIVE** alarm)

6.5.1.2 Level Detectors and Indicators: The system controller PWB monitors critical parameters of the transmitter and provides an LED status display. The system controller also provides a gain control voltage which ultimately determines the transmitter's RF output power.

6.5.1.2.1 Carrier Reference Filter: The carrier reference filter comprises U2/B and associated components to form a Bessel filter with a nominal 5Hz cutoff frequency. The microcontroller produces a variable pulse duration 120Hz signal as the PDM gain control output. The gain control filter is provided to remove all switching components from the *gain cont* line.

6.5.1.2.2 Gain Control Fault Detector: The gain control fault detector comprises U30/C and associated components. A sample of the PDM gain control signal is applied to gain control fault detector integrated circuit U30/C. If the gain control voltage sample rises above 2.5 VDC. a +5 VDC *xmtr fault* signal is generated which will set the output power to zero.

6.5.1.2.3 Reset: A reset pulse is applied to U1-9 from U6-4 when power is first applied to the system controller PWB to reset the microcontroller to initial start up conditions.

6.5.1.2.4 Control Logic: The control logic circuitry comprises U4 and associated circuitry. U4 is a programmable generic array logic integrated circuit which is programmed to provide the equivalent logic circuitry of several discrete gates.

6.5.1.2.5 System Reset: A system reset is initiated by pressing the **SYSTEM RESET** switch S10 or from an external input. When a system reset is initiated, a 5ms reset pulse will be applied to the transmitter's RF power stage, DC power control and exciter.

6.5.1.2.6 Alarm Memory Reset: An alarm memory reset is initiated by pressing the **ALARM MEMORY RESET** switch S17. When an alarm memory reset is initiated, all alarms latched by U23 and U32 will be reset.

6.5.1.2.7 LED Test: An LED test circuit is provided to test all LED indicators. When **LED TEST** switch S11 is pressed, the output of the 3Hz clock will be applied to the *led com* line causing all bi-colour LEDs to flash green and red. **LED TEST** switch S11 also applies a current sink to ground to *led test* line thru Q9 to turn on all LED indicators in the control panel switches.

6.5.1.2.8 Battery Detector: The low battery detector comprises U30/A and associated components. If the battery voltage falls below 4.37 VDC, the output of U30/A will switch to high impedance. A +5 VDC signal will be applied to the battery status display circuitry.

6.5.1.2.9 Real Time Status Display: The real time status display indicators glow green under normal conditions. Under fault conditions they will glow red continuously if a shorting link is installed at E1-1 and E1-2 (*solid*). If flashing alarm indicators are desired, a shorting link is installed at E1-2 and E1-3 (*flashing*).

6.5.1.2.9.1 RF Internal Interlock: If the *xmtr intlk intact* signal at J7-6 is not a current sink to ground (i.e., at least one ground wand is not secured in place), the output of U27/C will switch to +8 VDC, turning on the red **XMTR INTLK** LED. A +8 VDC signal is also applied to J3-10 as the remote *xmtr intlk open* output.

6.5.1.2.9.2 RF Power Module: Whenever the transmitter provides a +5 VDC *pm fault* signal at J7-8, the output of U18/B will switch to +8 VDC, turning on the red **POWER MODULES** LED. A +8 VDC signal is also applied to J3-21 as the remote *pm fault* alarm output.

6.5.1.2.9.3 Power Supply Fan Fail: Whenever the transmitter provides a +5 VDC *p/s fan fail* signal at J7-5, the output of U18/C will switch to +8 VDC, turning on the red **FAN FAILURE** LED. A +8 VDC signal is also applied to J3-11 as the remote *p/s fan fail* output.

6.5.1.2.9.4 RF Inhibit: Whenever a +5 VDC *RF inhibit (ext)* signal is applied at J3-25, the output of U18/D will switch to +8 VDC, turning on the red **RF INHIBIT** LED. A +8 VDC signal is also applied to J5-2 as the remote *PDM inhibit* output.

6.5.1.2.9.5 RF Power Shutback: Whenever any alarm function has been activated that requires the output power to be shutback, the control logic circuit provides a +5 VDC *shutback* signal. The output of U19/A will switch to +8 VDC, turning on the red **SHUTBACK** LED.

6.5.1.2.9.6 RF Power Cutback: Whenever any alarm function that forces shutback has been activated more than three times in three seconds, the transmitter RF output will be placed in a cutback mode. The microcontroller provides a +5 VDC *cutback* signal. The output of U19/B will switch to +8 VDC, turning on the red **CUTBACK** LED. A +8 VDC signal is also applied to J5-4 as the remote *cutback* alarm output.

6.5.1.2.9.7 Standby Exciter: Whenever an automatic exciter changeover has occurred, the microcontroller provides a +5 VDC *stby selected* signal. The output of U19/C will switch to +8 VDC, turning on the red **STANDBY** LED. A +8 VDC signal is also applied to J5-8 as the remote *stby selected* alarm output.

6.5.1.2.9.8 Battery: Whenever a low battery voltage is detected, a +5 VDC signal is provided at U19-12. The output of U19/D will switch to +8 VDC, turning on the red **BATTERY LOW** LED. A +8 VDC signal is also applied to J3-23 as the remote *bat fail* alarm output.

6.5.1.2.9.9 Modulator Detector: Whenever the transmitter provides a current-sink-to-ground *over mod* alarm signal at J7-10, the output of U20/A will switch to +8 VDC, turning on the red **MODULATOR PROTECTION** LED. A +8 VDC signal is also applied to J5-1 as the remote *over mod* alarm output.

6.5.1.2.10 Latched Status Display: The latched status display indicators glow green under normal conditions. Under fault conditions they will glow red continuously if a shorting link is installed at *E1-1* and *E1-2* (*solid*). If flashing alarm indicators are desired, a shorting link is installed at *E1-2* and *E1-3* (*flashing*). Tri-state D flip-flops U23 and U32 provide a latching ability for these alarms. With the exception of the AC line voltage alarm, all latching alarm functions initiate a *xmtr fault* signal to shutback transmitter's RF output while the alarm is present. Whenever a *shutback* occurs, the control logic circuitry provides a +5 VDC alarm latching *clk* output to store the alarm status at that time. The alarm status information is stored in U23 and U32 and an output is not provided until **ALARM RECALL** switch is pressed. The alarm status information is stored until it is cleared by an **ALARM MEMORY RESET** application or is replaced by another latched alarm status.

6.5.1.2.10.1 AC Phase Fail: Whenever the transmitter provides a +5 VDC AC *ø a fail*, *AC ø b fail*, or *AC ø c fail* signal at J6-2, J6-16 or J6-17, the output of U20/D will switch to +8 VDC, turning on the red **AC LINE VOLTAGE** LED. A common +8 VDC signal is applied to J4-24 as the remote *AC ø fail* alarm output.

6.5.1.2.10.2 Power Supply Temperature: Whenever the transmitter provides a +5 VDC *p/s over temp* signal at J6-1, the output of U20/C will switch to +8 VDC, turning on the red **HIGH TEMP** LED. A +8 VDC signal is also applied to J4-13 as the remote *p/s over temp* alarm output.

6.5.1.2.10.3 RF External Interlock: Whenever the transmitter provides a +5 VDC *ext intlk intact* signal at J4-2, the output of U24/C will switch to +8 VDC, turning on the red **EXTERNAL INTLK** LED. A +8 VDC signal is also applied to J4-6 as the remote *ext intlk open* alarm output.

6.5.1.2.10.4 Power Supply Over Voltage: Whenever a +5 VDC *p/s over volts* signal is applied to J6-3, the output of U24/D will switch to +8 VDC, turning on the red **OVER VOLT** LED. A +8 VDC signal is also applied to J4-7 in conjunction with the under voltage and over current alarms as the remote *p/s fail* alarm output.

6.5.1.2.10.5 Power Supply Under Voltage: Whenever the transmitter provides a +5 VDC *p/s under volts* signal at J6-4, the output of U25/A will switch to +8 VDC, turning on the red **UNDER VOLT** LED. A +8 VDC signal is also applied to J4-7 in conjunction with the over voltage and over current alarms as the remote *p/s fail* alarm output.

6.5.1.2.10.6 Power Supply Over Current: Whenever the transmitter provides a +5 VDC *p/s over current* signal at J6-14, U25/B's output will switch to +8 VDC, turning on the red **OVER CURRENT** LED. A +8 VDC signal is also applied to J4-7 in conjunction with the over voltage and under voltage alarms as the remote *p/s fail* alarm output.

6.5.1.2.10.7 Output Network RF Current: Whenever the transmitter provides a +5 VDC *RF over current* signal at J6-6, the output of U26/A will switch to +8 VDC, turning on the red **COMBINER INPUT CURRENT** LED. A +5 VDC signal is applied thru CR117 to the *VSWR fault* input (pin 14) of U4, forcing a more immediate shutback of the RF output than achieved by the *XMTR fault* line. A +8 VDC signal is also applied to J4-14 as the remote *filter fault* alarm output.

6.5.1.2.10.8 RF Drive Amp Power Supply: Whenever the transmitter provides a +5 VDC *RF dr p/s fail* signal at J6-11, U26/B's output will switch to +8 VDC, turning on the red **RF DRIVE** LED.

6.5.1.2.10.9 Regulated Voltages: Whenever the transmitter provides a +5 VDC *lv p/s fail* signal at J6-10, the output of U26/C will switch to +8 VDC, turning on the red **LOW VOLTAGE** LED.

6.5.1.2.10.10 Bi-phase PDM Drive: Whenever the transmitter provides a +5 VDC *PDM fault* signal at J6-9, the output of U26/D will switch to +8 VDC turning on the red **MODULATOR DRIVER** LED.

6.5.1.2.10.11 RF Drive: Whenever the transmitter provides a +5 VDC *RF drive fail* signal at J6-8, the output of U27/A will switch to +8 VDC, turning on the red **OSCILLATOR DRIVER** LED.

6.5.1.2.10.12 VSWR: Whenever the transmitter provides a *rfld pwr* signal at J7-12 greater than +3.1 VDC, the output of U30/D will provide +5 VDC to the VSWR status display circuit turning on the red **VSWR** LED. A +8 VDC signal is also applied to J4-25 as the remote *high refld pwr* alarm output. Whenever the transmitter provides a *rfld pwr* signal at J7-12 greater than +4.2 VDC, U30/B will provide +5 VDC thru CR128 to the *VSWR fault* input (pin 14) of U4, forcing a more immediate shutback of the RF output than achieved by the *XMTR fault* line.

6.5.1.2.10.13 Combiner Arc: Whenever the transmitter provides a +5 VDC *combiner arc* signal at J6-13, the output of U24/B will switch to +8 VDC, turning on the red **COMBINER ARC** LED.

6.5.1.2.11 Meter Control: The on/off status, scale selection and signal buffering for the transmitter's status meter displays is included in the system control PWB .

6.5.1.2.11.1 Meter Scale Encoder: Dual binary encoder U11 accepts *volt meter sel* and *pwr meter sel* signals and provides control signals for the selection of volt meter scale, pwr meter scale and volt meter display control circuits. Each time a meter scale select clock pulse is received, the appropriate Q output will increment.

6.5.1.2.11.2 Volt Meter Scale Select: Multiplexer U8 switches the appropriate voltage to the transmitter's voltmeter for a given scale selection. The binary coded *A, B* and *C* control inputs on U8 are encoded by meter scale encoder U11 to ensure the correct *X#* input is selected. **PA VOLTS SAMPLE** (R157) and **B+ SAMPLE** (R160) potentiometers are provided for individual calibration of the associated voltmeter parameter. **VOLT METER CAL** potentiometer R189 is provided for common mode calibration of the voltmeter's low level DC voltages.

6.5.1.2.11.3 Volt Meter Display Control: Demultiplexer U12 provides the appropriate meter scale selected signal to J2 to turn on the required meter scale indicating LED.

6.5.1.2.11.4 Power Meter Scale Select: Multiplexer U9 switches the appropriate power voltage sample to the transmitter's power meter for a given scale selection. The *A* input toggles the *X0* and *X1* inputs to the *X* output. **POWER METER CAL** potentiometer R192 is provided for calibration of the power meter.

6.5.1.2.11.5 Power Meter Display Control: The *fwd pwr* and *refld pwr* outputs of U4 toggle with the change in state of the *pwr sel* input. These outputs control the required meter scale indicating LED.

6.5.1.2.11.6 Meter On/Off Select: Each time **METER ON/OFF** switch S16 is pressed, a clock pulse is applied to U10. The outputs, which are applied to the scale select and display control circuits, toggle with each clock pulse. When the meters are switched on, a logic 0 is applied to the scale select circuits and a logic 1 is applied to the display control circuit to turn on the devices.

6.5.2 PWR METER CONTROL PWB : See figure SD-4. The **FORWARD PWR** or **REFLD PWR** LED on pwr meter control PWB indicates which parameter, *fwd pwr* or *refld pwr*, is being displayed on **RF KILOWATTS** meter. The **METER SELECT** switch applies a *pwr meter select* signal to the system controller PWB to select desired power parameter for display.

6.5.3 VOLT METER CONTROL PWB : See figure SD-4. LEDs on the voltmeter control PWB indicate which supply voltage (*B+, PA volts, RF drive amp, +24V, +15V, +5V, -5V* or *-15V*) is being displayed on **DC VOLTS** meter 1A1M2. The **METER SELECT** switch applies a *voltmeter select* signal to the system controller PWB to select the desired voltage parameter for display.

6.5.4 REMOTE INTERFACE PWB : See figures SD-4 and SD-12. The remote interface PWB buffers all external transmitter remote control inputs and transmitter remote status/alarm outputs. Opto-couplers are provided to allow the control inputs to be configured to operate from a voltage source, a current sink to ground or a floating control input. See section 2.1.8, remote control circuits, for a detailed description of how to configure each control input for the desired input signal type.

Analog voltages proportional to the B+ supply voltage, pa supply voltage, RF amplifier supply voltage, forward power and reflected power are available for external monitoring. An unregulated +24V supply output thru a positive temperature co-efficient (PTC) is also provided for external use. A sample of the RF output of the transmitter is applied to the *RF monitor* output. The magnitude of this sample may be set by potentiometers R16, R17 or R18 depending on which preset output power level is selected.

The external interlock is completed by applying a +24V signal to the *ext intlk intact* input at TB1-4.

The transmitter's output power level may be selected remotely using the *high preset pwr*, *medium preset pwr* or *low preset pwr* inputs. The output power level may be adjusted by using the *increase* or *decrease* inputs. The transmitter's RF output is enabled/ disabled using the *RF on* and *RF off* inputs. The operational exciter is selected using the *exciter A/B* inputs. Transmitter alarms may be recalled remotely using the *alarm recall* input. The transmitter system may be reset remotely using the *system reset* input. The RF output of the transmitter may be inhibited remotely using the *RF inhibit* input.

External audio is applied to *audio (+)* and *audio (-)* inputs (TB1-1 and TB1-2).

Various internally generated alarm/status indications are available for remote monitoring purposes. These outputs are provided by open-collector drivers and are all active low (current sink to ground = alarm or active status). Alarms and status indications include: high power level selected, external RF inhibit active, RF output power cutback active, over modulation alarm, standby (exciter) alarm, medium power level selected, filter (RF over current) alarm, low power level selected, loss of AC phase alarm, power supply over temperature alarm, external interlock open alarm, RF on/off status, power supply over voltage (B+) alarm, low battery alarm, power supply fan failure alarm, exciter A/B status, reflected power alarm, power module alarm, transmitter fault alarm, internal interlock open alarm and local/remote control status.

AC/DC POWER SUPPLY

6.6 See figure SD-5. The AC power input from the external AC power source is applied thru the AC power switch box (3) to the a AC/DC power supply cabinet (2). The DC input is used to create B+ supplies (A thru P) which are applied to RF power modules *A* thru *P*. Supply voltages +48V (fans), +24V, -18V, +8V and -8V are developed for use by the exciter, control/monitor and RF power stages. The DC supply voltages for RF drive buffer PWB s *A* and *B* are created as well as the regulated DC supply voltage for the RF drive amplifiers in the RF power stage. Power supply control/monitor PWB (2A1) provides control and monitoring of all power supply functions. Power supply status is applied to the control/monitor function.

The AC source voltage is applied to power transformer T1 thru full power contactor K1, charge power contactor K2 and charging resistors R1 thru R6. When AC power is first applied thru AC power switch box (3), contactor K2 is energized by the *energize B+ charge relay* control signal from the power supply control/monitor PWB . The 3-phase AC supply voltage is applied thru K2 and charging resistors R1 thru R6 to T1. The wye (Y1/Y2/Y3) and delta (X1/X2/X3) secondary outputs of T1 are applied to dual 3ø rectifier 2A3. MOV assembly 2A11 contains metal-oxide varistors which provide line transient (overvoltage) protection of the X/Y secondary outputs. The outputs of the rectifier are applied thru choke L1 to B+ distribution PWB s 2A7 and 2A6 and thru choke L2 to B+ distribution PWB s 2A5 and 2A4. The *B+ (A)* thru *B+ (P)* supply voltage outputs from distribution PWB s are applied to capacitor trays 1A43 thru 1A58 in the RF power stage to charge the reservoir capacitors for RF power modules *A* thru *P*. When the B+ supply has charged to a sufficient level, as indicated by the B+ sample at the *discharge B+* input (2A1E1) of the power supply control/monitor PWB , contactor K1 is energized by the *energize full pwr relay* output from the power supply control/monitor PWB . Contactor K1's energizing voltage (nominal 209 VAC) is provided by step-down transformer assembly 2A12. Contactor K1 shorts out charge resistors R1 thru R6 and applies the 3-phase **DC** directly to transformer T1. A *charge completed* signal is applied to the control/monitor function once the capacitors have charged. The temperature of each pair of charge resistors is detected by thermistors RT1, RT2 and RT3 and applied to power supply control/monitor PWB . The output of DC current shunt R7 (+)/(-) is applied to the power supply control/monitor PWB for over current monitoring and to develop a DC voltage proportional to the DC current consumption of the B+ supply. This voltage is applied to the control/monitor function for a DC current indication on a transmitter front panel meter.

When the 3-phase AC supply voltage is removed from the transmitter, contactors K1 and K2 de-energize and the power supply control/monitor PWB applies a current sink to ground at the junction of resistors 2R8 and 2R10 to discharge the B+ supply. Resistor 2R10 is grounded thru K2 to complete the discharge sequence.

The Z1/Z2/Z3 secondary output of T1 is applied thru dual regulated +48V power supply 2A9 to DC power supply 2A2 to create a +48 supply for the transmitter's DC cooling fans, RF drive buffer PWB s, and RF drive amplifiers. A sample of this 3-phase secondary is also applied to the power supply control/monitor PWB for loss-of-phase monitoring.

The status of each DC fan in the power supply cabinet (2B1 thru 2B5) is monitored by the power supply control/monitor PWB *fan monitor 1* thru *fan monitor 5* and, should a fan failure occur, a *p/s fan fail* alarm is applied to the control/monitor function.

AC phase A and B inputs are applied thru *transmitter enable* circuit breaker CB1 to transformer T2 which is used to create low level **DC** supply voltage inputs to DC power supply 2A2. **EMERGENCY TRANSMITTER SHUT-OFF** switch 2S1 is located on the front panel of the power supply cabinet and is used to trip circuit breaker CB1, and therefore shut down the transmitter, should an emergency occur.

ELAPSED TIME meter 2M1 indicates time that RF output stage of the transmitter has been enabled.

6.6.1 POWER SUPPLY CONTROL/ MONITOR PWB : See figure SD-21. The power supply control/monitor PWB 2A1 provides monitoring for cooling fans in the power supply cabinet, B+ current consumption, temperature of B+ charge resistors, B+ discharge status, presence of AC phases and B+ voltage level. Status and alarm signals are generated and output to the control/monitor function. Control signals are generated to enable the charge contactor, power supply cooling fans and main AC contactor.

6.6.1.1 Charge/Discharge Resistor Temperature: Temperatures of the charge/ discharge resistors in the AC/DC power supply are monitored at inputs *p/s temp 1* thru *p/s temp 4*. These inputs are ORed together thru diodes and applied to comparator U3-10. The input at U3-10 is tied high thru resistor R21. When a high temperature condition or an excessive charge/discharge period (*p/s temp 1* input) occurs on one of the *p/s temp* inputs (current sink to ground), the voltage at U3-10 will fall below the threshold voltage at U3-11 causing U3-13's output to switch from current sink to ground to high impedance. Transistor Q4 will be turned on, thru CR23, removing the gate drive to FET Q10. When Q10 turns off, charge power contactor 2K2 will be de-energized causing the AC supply to full power contactor 2K1 to be removed which removes AC supply to power transformer 2T1. The *p/s over temp* signal is also activated and applied to system controller PWB in the control/monitor function.

6.6.1.2 DC Current Monitor: A fixed gain, differential amplifier creates a DC voltage proportional to the DC current consumption of the transmitter from the *current shunt (+)* and *current shunt (-)* inputs. This voltage level (U3-9) is compared with a reference threshold (U3-8) to detect an over current condition. If an over current condition exists, U3-14 switches from current sink to ground to high impedance. Transistor Q4 will be turned on, thru CR24, removing the gate drive to FET Q10. When Q10 turns off, charge power contactor 2K2 will be de-energized causing the DC supply to full power contactor 2K1 to be removed which removes DC supply to power transformer 2T1. The *DC current sample* output is applied to **CURRENT METER** 1A1M1 to provide an indication of DC current consumption. The *p/s over current* signal is also activated and applied to the system controller PWB in the control/ monitor function.

6.6.1.3 Fan Control/Monitor: The *fans on (p/s)* input from the system controller PWB in the control/ monitor function turns on transistor Q23 of the 3ø SCR power supply (2A9), turning on the 3ø SCR power supply. Each DC cooling fan contains a tachometer circuit which provides an output to indicate the fan is operating. These fan status signals are applied to the *fan monitor 1* thru *fan monitor 5* inputs. The signals are combined such that failure of one or more of the fans will cause transistor Q2 to turn off and activate the *p/s fan fail* alarm applied to the system controller PWB .

6.6.1.4 Charge/Discharge Control: When AC power is first applied to the AC/DC power supply, charge power contactor 2K2 is energized, a ground signal is applied to the discharge control input turning off Q3 and Q9. Reservoir capacitors in the RF power stage begin to charge to B+ supply voltage. This charge voltage is sampled at the *discharge B+ (A)* input, attenuated and compared (U3-4) against a fixed reference threshold (U3-5) to determine at which point in the charge cycle full power contactor 2K1 will be energized. Once the fixed reference threshold has been exceeded by the charge sample voltage, the output of U3-2 switches to current sink to ground. Opto-isolated triac U6 will turn on and apply AC supply to turn on triac Q7. The *energize full pwr relay* output provides the DC supply to turn on full power contactor 2K1 which shorts out the AC/DC power supply's charging resistors and applies the DC supply to transformer 2T1. FET Q8 will turn off and a *charge completed* status signal will be applied to the system controller PWB in the control/ monitor function.

When AC power is removed from the AC/DC power supply, contactors 2K1 and 2K2 de-energize and the ground applied at the *charge B+* input is removed. FET Q9 turns on and grounds the B+ charge sample voltage at U3-4. Insulated gate bipolar transistor (IGBT) Q3 turns on and grounds the B+ *discharge A* input to discharge the B+ supply reservoir capacitors.

6.6.1.5 AC Phase Monitor: A sample of the Z1/Z2/Z3 low voltage secondary of power transformer 2T1 is applied to the *55 VAC (A/B/C)* inputs to detect an AC supply phase loss. A DC voltage proportional to the level of the *55 VAC (A)* sampled AC phase voltage is applied to comparators U5-10/U2-4. This DC voltage is attenuated and applied to the input of comparators U5-9/U5-5. This technique is repeated for the *55 VAC (B)* and *55 VAC (C)* sampled AC phase voltages. When an AC supply phase is lost, the outputs of the comparator pair associated with the alarm output of the lost phase switches from current sink to ground to high impedance. The corresponding alarm output (*AC ø A fail*, *AC ø B fail* or *AC ø C fail*) is applied to the system controller PWB in the control/monitor function.

6.6.1.6 B+ Over/Under Voltage Detector: A sample of the B+ supply voltage is compared against fixed reference thresholds to detect an over or under B+ supply voltage condition. A *p/s under volts* or *p/s over volts* alarm signal is applied to the system controller PWB in the control/monitor function should an under or over B+ supply voltage condition occur.

6.6.2 DC POWER SUPPLY: See figure SD-22. DC power supply 2A2 provides low level DC voltages for the exciter and control/monitor stages as well as the +48V fan supply, +48V RF buffer supply and supply voltage for the RF drive amplifiers. A *7.8 VAC* supply is applied to full wave bridge rectifier U1 and its associated components to develop a *+8V* and *-8V* supply. A *20 VAC* supply is applied to full wave bridge rectifier U2 and its associated components to develop a *+24V* supply. A *15 VAC* supply is applied to full wave bridge rectifier U3 and associated components to develop a *-18V* supply.

A *+48v (fans)* supply from the 3ø SCR power supply (2A9) is applied thru choke L1 to smoothing capacitor C5 to develop a +48V supply for the **DC** cooling fans used throughout the transmitter and the rf drive buffer. A *+48v (RF dr amp)* supply from the 3ø SCR power supply (2A9) is applied thru choke L2 to smoothing capacitor C6 to develop a +48V supply for the two RF drive power supply PWB assemblies (A1/A2) and the RF drive PWB s in the exciter stage. The *+15V (a)* input from **EXCITER A** enables the output of RF drive power supply PWB assembly A1 when **EXCITER A** is selected and functioning normally. The *+15V (b)* input from **EXCITER B** enables the output of RF drive power supply PWB assembly A2 when **EXCITER B** is selected and functioning normally. *RF dr volts ref (a)* input from **EXCITER A** and *RF dr volts ref (b)* input from **EXCITER B** provide an optional external control for the output voltage of RF drive power supply PWB assembly A1 and A2. The output voltages of A1 (E4) and A2 (E4) are connected in parallel to provide a common *RF dr volts* output at J2-9/10 to the RF drive amplifiers. Each RF drive power supply PWB assembly provides an alarm output should it fail during normal transmitter operation. These alarm outputs (P1-5 and P2-5) are connected in parallel to provide a common *RF dr p/s fail* alarm to the control/monitor stage of the transmitter. This alarm signal is normally a current sink to ground and switches to an open circuit condition should a failure occur in the operating RF drive power supply PWB assembly (A1 or A2).

6.6.2.1 RF Drive Power Supply: See figure SD-23. The RF drive power supplies, 2A2A1 and 2A2A2, are boost type switching power supplies which provide a regulated DC supply voltage to the RF drive amplifiers in transmitter. A 48V supply is applied to the drain of switching FETs Q1 and Q2 thru inductor L2. The gates of Q1 and Q2 are driven with square wave pulses from U1 thru push-pull buffer stage Q4/Q5. U1 is a fixed-frequency, pulse width modulation control circuit, incorporating the functions required for the control of a switching power supply. The device contains an internal sawtooth oscillator which is set to a nominal frequency of 100kHz by external components R6 and C6. The output pulse width modulated control pulses to the gate of FETs Q1 and Q2 are generated by the comparison of this sawtooth waveform with a feed-back voltage sample from the junction of U2-cathode/ C8(+)/ C12(+)/L5-2 and the bias voltage created by **VOLTAGE CONTROL** potentiometer R3. The resultant variable pulse width, 100kHz square wave at U1-8 (*e*) is applied to the gate of FETs Q1 and Q2 (thru Q4/Q5) and turns them on and off with the appropriate pulses to maintain the desired set DC output voltage. Inductor L5 and capacitors C9 and C10 provide filtering of the DC output voltage. Diode pair U3 provides output isolation for the circuit so that it may be connected in parallel with another identical assembly. A sample of the DC output voltage level is applied thru zener diode CR1 to the base of transistor Q3 which provides an alarm signal should the RF drive power supply fail. The *RF dr p/s fail* alarm output is normally at ground potential and switches to an open circuit condition should a failure occur in the RF drive power supply.

6.6.3 DUAL 3-ø RECTIFIER: See figure SD-5. Dual 3ø rectifier 2A3 uses 12-pulse AC rectification to generate two B+ supply voltage outputs to inductors 2L1 and 2L2. The Delta (X) and Wye (Y) secondaries of transformer 2T1 are applied to the rectifier assembly.

6.6.4 B+ DISTRIBUTION PWB : See figure SD-5. The B+ distribution PWB s, 2A4 thru 2A7, provide fusing and status information for the B+ supplies to the RF power stage. A separate fuse and indicator LED (indicates charge on RF power module reservoir capacitors) is provided for the supply to each RF power module in the RF power stage. B+ distribution PWB s 2A7 and 2A6 supply B+ to RF power modules *A* thru *H* and PWB s 2A5 and 2A4 supply B+ to RF power modules *I* thru *P*.

6.6.5 POWER SUPPLY MONITOR PWB : The power supply monitor PWB (2A10) acts to protect the charge/discharge resistors from prolonged periods of excessive power dissipation by turning off the transmitter's AC source voltage. In each case (charge and discharge), the voltage across one or more of the power resistors is monitored. If either voltage exists for a longer period of time than allowed by the power supply monitor PWB s detection circuitry, a current-sink-to-ground will be generated as a fault signal (P6-1) and applied to the power supply control PWB . This initiates transmitter protection by inhibiting the AC power source. Refer to the power supply monitor PWB instruction manual for detailed information.

6.6.6 SAFETY GROUND ASSEMBLY: See figure SD-5. The safety ground assembly, 2A8, provides an isolated, low impedance path to the station reference ground for the AC supply ground connection and the RF output coaxial cable ground (shield). This grounding technique ensures that unwanted signals appearing on the AC or coaxial grounds (e.g., lightning strike) are provided with a well defined, low impedance path to the station reference ground and do not use the transmitter cabinet as the ground return.

6.6.7 POWER SUPPLY FAN TRAY: See figure SD-5. The power supply fan tray contains five DC cooling fans used to cool rectifier assembly 2A3. *+48v (fans p/s)* is applied from the DC power supply (2A2) when the fan supply output of the 3ø SCR power supply (2A9) has been enabled. Each fan provides a status indication *fan monitor 1* thru *fan monitor 5* to the power supply control/monitor PWB . If one or more of the DC cooling fans fail, an alarm is generated by the power supply control/monitor PWB and applied to the control/monitor function.

6.6.8 DUAL REGULATED +48 VDC POWER SUPPLY: See figures SD-5 and SD-24. The dual regulated +48 VDC power supply (2A9) provides a regulated DC supply voltage, with current limiting, for the transmitter's cooling fans as well as a regulated DC supply voltage for RF drive power supplies A and B in DC power supply 2A2. A control input is provided to inhibit the output of the cooling fan supply.

6.6.8.1 Zero Crossover Detector: The Z1/Z2/ Z3 3ø secondary output of AC transformer 2T1 (*55 VAC (a), 55 VAC (b), 55 VAC (c)*) is applied thru fuses F2/F3/F4 to input of control ramp generator circuitry at E1, E2 and E3. Field effect transistors Q2, Q3 and Q4 and associated circuitry comprise the zero crossover detector. Each phase is applied to a back-to-back diode (CR1, CR2 or CR3) which limits the peak-to-peak voltage to 20V. This 20V peak-to-peak signal is approximately a squarewave and is used to turn on and off the associated FET (Q2, Q3 or Q4). Each FET will alternately provide a ground or an open circuit to its associated ramp generator circuit as it is turned on and off by the square wave which is synchronized to the zero crossing of the input phase.

6.6.8.2 Ramp Generator: Resistors R15, R16 and R17 and capacitors C4, C5 and C6, in conjunction with the output of the three zero crossing detectors, form three identical ramp generators. Each ramp generator consists of an R/C integrator that provides a triangular waveform whose origin is synchronized to the zero crossing of the applied input phase. The ramp output is clamped to ground when the zero crossover detector's output is ground and charges toward +24V when the zero crossover detector's output is open circuit. The long R/C time constant ensures the ramp is relatively linear. The ramp is applied as an input to U1/A, U1/B, U1/D, U2/A, U2/B and U2/D.

6.6.8.3 Fan Supply Control Voltage Generator: Operational amplifier U2/C, configured as a differential amplifier, compares the difference between the fan supply output voltage (*+48v ref (fans)*) and an adjustable threshold voltage from **OUTPUT VOLTS** potentiometer R9 and produces a control voltage that varies in inverse proportion to changes of the fan supply voltage *+48v ref (fans)*. During set up the **OUTPUT VOLTS** potentiometer is adjusted to produce a control voltage that will result in the thyristors of the 3 phase fan supply circuit being turned on for the period of time required to restore and maintain the *+48v (fans)* supply output at the required voltage.

When the DC supply is initially applied to cooling fans in transmitter, a high in-rush current results. Current shunt R32 is used to detect if a current of more than 18 amperes is being drawn from fan supply. If 18 amperes is drawn thru the shunt, a voltage sufficient to turn on transistor Q1 is developed. When Q1 switches on, the fan supply control voltage output from U2/C is pulled toward +24V to inhibit the output of U1/A, U1/B and U1/D and turn off the fan supply thyristors. The voltage across the shunt will drop until Q1 turns off and allows the fan supply to function normally. This cycle repeats to limit the fan supply output current to a maximum of 18 amperes until fans have reached full speed at a steady state current draw of approximately 13.5 amperes.

The *fans on (p/s)* control input is applied from the system controller PWB (control/monitor function) thru the power supply control/monitor PWB and is used to turn the fan supply on and off. When Q23 is turned off +24V is applied, thru CR6, to the fan supply control voltage output from U2/C to inhibit the output of U1/A, U1/B and U1/D, and turn off the fan supply thyristors. When Q23 is turned on, the +24V inhibit is removed and the fan supply thyristor turn on is controlled by the fan supply control voltage level from U2/C.

6.6.8.4 RF Drive Amplifier Control Voltage Generator: Operational amplifier U1/C, configured as a differential amplifier, compares the difference between a sample of the RF drive amplifier supply output voltage (*RF dr volts sample*) and an adjustable threshold voltage from **OUTPUT VOLTS** potentiometer R9, and produces a control voltage that varies in inverse proportion to changes of the RF drive amplifier supply sample voltage (*RF dr volts sample*). During set up, the **OUTPUT VOLTS** potentiometer is adjusted to produce a control voltage that will result in the thyristors of the 3 phase RF drive amplifier supply circuit being turned on for the period of time required to restore and maintain the *+48v (RF dr amp)* supply output at the required voltage.

6.6.8.5 Thyristor On/Off Switch: There are two sets of three identical thyristor on/off switches, one for the fan supply and one for the RF drive amplifier supply. Each switch controls the turn on (gate/anode) voltage of a thyristor (Q17 thru Q22). Each thyristor on/off switch functions as in the following example: when the ramp voltage applied to U1/B is less positive than the fan supply control voltage applied from U2/C, the output of U1/B will be at ground potential. Transistors Q5, Q11 and, therefore, Q17 will be turned off. When the ramp voltage goes more positive than the fan supply control voltage, the output of U1,B will switch to +24V and turn on transistors Q5 and Q11. When Q11 turns on, and since the input phase voltage is synchronous with the phase voltage applied to the anode of Q17, a positive voltage will be applied to the gate of thyristor Q17 and turn it on for the balance of the positive half cycle on Q17's anode.

AC INPUT INTERLOCK SWITCH

6.7 System of keyed mechanical interlocks is provided to ensure that the AC supply voltage is turned off at the source and the RF output to the antenna system is grounded before access is allowed to any area of the transmitter which might contain potentially lethal voltages.

SECTION 7
COMPONENT LEVEL TROUBLE SHOOTING

TROUBLE SHOOTING REFERENCE DATA

7.1 The information provided in this section is intended to assist an experienced electronic technician in fault diagnosis and isolation. Tables of typical voltages as well as typical waveforms are provided for referenced assemblies.

NOTE

The voltage and waveforms provided in this section are intended to represent the nominal level only. Component tolerances and carrier frequency may cause slight differences in the measured and tabulated data. For voltage levels dependent on the level of another parameter, that parameter's level has been noted next to the test voltage in the Test Voltage/ Waveform column.

All measurements/waveforms recorded with transmitter output power set to 100kW unless otherwise specified.

SYSTEM CONTROL PWB

7.2 Table 7-1 provides typical test voltages and references to waveforms for the system control PWB (1A1A3).

EXCITER INTERFACE PWB

7.3 Table 7-2 provides typical test voltages for the exciter interface PWB (1A2A1).

DC POWER SUPPLY

7.4 Table 7-3 provides typical test voltages for an exciter dc power supply PWB (1A2A4/1A2A7) when it is installed in a transmitter and its associated exciter is the active exciter. If a test voltage is not within tolerance or a required waveform is abnormal, remove the offending PWB and repair it on a suitable work bench using the maintenance instructions in its service instruction manual.

FREQUENCY SYNTHESIZER PWB

7.5 Table 7-4 provides typical test voltages and references to waveforms for a frequency synthesizer PWB (1A2A2/1A2A5) when it is installed in a transmitter and its associated exciter is the active exciter. If a test voltage is not within tolerance or a required waveform is abnormal, remove the offending PWB and repair it on a suitable work bench using the maintenance instructions in its service instruction manual.

BI-PHASE PDM DRIVER PWB

7.6 Table 7-5 provides typical test voltages and references to waveforms for a bi-phase PDM driver PWB (1A3A3/1A3A6) when it is installed in a transmitter and its associated exciter is the active exciter. If a test voltage is not within tolerance or a required waveform is abnormal, remove the offending PWB and repair it on a suitable work bench using the maintenance instructions in its service instruction manual.

50kW DISTRIBUTION PWB

7.7 Table 7-6 provides typical test voltages and references to waveforms for the 50kW distribution PWBs (1A36, 1A40).

NOTE

It is necessary to remove the lower front dress panel from the RF power module cabinet before trouble shooting data in table 7-6 can be verified.

3-PHASE SCR POWER SUPPLY

7.8 Table 7-7 provides typical test voltages and references to waveforms for the 3-phase SCR power supply (2A9).

POWER MODULES

7.9 Trouble shooting procedures for the RF power module are contained in its service instruction manual.

7.9.1 REMOVAL OF RF POWER MODULE: Remove a suspect RF power module from its mounting tray as described in paragraph 5.7.1.

7.9.2 PREPARATION FOR TESTING: Connect the suspect RF power module to the transmitter's test circuit as detailed in paragraph C6.1 of the RF power module's service instruction manual, observing the following for NA100 transmitters:

NOTE

The preparation for use and maintenance instructions in the RF power module's service instruction manual must be read and understood before connecting an RF power module to the transmitter's test circuit.

(a) Connect P1 of the test cable to J4 of the 50kW primary distribution PWB (1A36). Refer to figure MD-3 as an aid to locating the 50kW primary distribution PWB.

(b) Connect P2 of the test cable to J17 of the RF drive splitter (1A39). Refer to figure MD-3 as an aid to locating the RF drive splitter.

(c) Connect P3 of the test cable to J1 of the RF power module to be tested, noting J1 is located below the module's front panel.

(d) Connect P4 of the test cable to J2 of the RF power module to be tested, noting J2 is located on the module's rear panel.

7.9.3 TESTING/REPAIR OF RF POWER MODULE: Test and repair suspect RF power modules as described in the preparation for use and maintenance instructions sections of the RF power module's service instruction manual.

7.9.4 INSTALLING REPAIRED RF POWER MODULES: Install serviceable RF power modules as described in paragraph 5.7.2.

NOTE

When the RF power module to be installed has manual RF drive tuning, verify it has been tuned to the carrier frequency as described in the preparation for use section of the RF power module's service instruction manual, prior to installing it in the transmitter

RF POWER CAPACITOR REPLACEMENT

7.10 The ceramic plate capacitors in the 8-input combiners and the RF combiner/output filter can be damaged if precautions are not taken during their removal/installation or when an interconnecting lead is removed/installed on a capacitor plate's lead termination nut. Refer to figure 7-20 for the proper methods and torquing information.

Table 7-1 Test Voltages/Waveforms for System Controller PWB

LOCATION	DESCRIPTION	TEST VOLTAGE/WAVEFORM
TP1	Watchdog Timer	3-5 VDC
TP2	Gain Control Level PDM	See figure 7-1
TP3	Ground Reference	Ground
TP4	Gain Control Level	7-8 VDC
TP5	Ground Reference	Ground
TP6	Volt Meter Output	0-5 VDC
TP7	Power Meter Output	3-3.5 VDC

Table 7-2 Test Voltages for Exciter Interface PWB

LOCATION	DESCRIPTION	TEST VOLTAGE/WAVEFORM
TP1	Ground Reference	Ground
TP2	Not Used	-
TP3	PDM 1	3 ± 0.5 VDC
TP4	PDM 2	3 ± 0.5 VDC
TP5	LVPS Detector Input	1.3 ± 0.2 VDC
TP6	LVPS Detector Threshold	1.0 ± 0.1 VDC
TP7	Not Used	-
TP8	Gain Control	7 ± 0.5 VDC
TP9	Ground Reference	Ground

Table 7-3 Test Voltages for DC Power Supply PWB

LOCATION	DESCRIPTION	TEST VOLTAGE/WAVEFORM
TP1	Ground Reference	Ground
TP2	15 VDC	15 ± 0.2 VDC
TP3	5 VDC	5.2 ± 0.2 VDC
TP4	-15 VDC	-15 ± 0.2 VDC
TP5	-5 VDC	-5 ± 0.2 VDC

Table 7-4 Test Voltages/Waveforms for Frequency Synthesizer PWB

LOCATION	DESCRIPTION	TEST VOLTAGE/WAVEFORM
TP1	18.735MHz Clock	18.735MHz ± 10Hz (5V logic)
TP2	Not Used	-
TP3	Ground Reference	Ground
TP4	Ground Reference	Ground
TP5	$2f_{PDM}$	See figure 7-2

Table 7-5 Test Voltages/Waveforms for Bi-Phase PDM Driver PWB

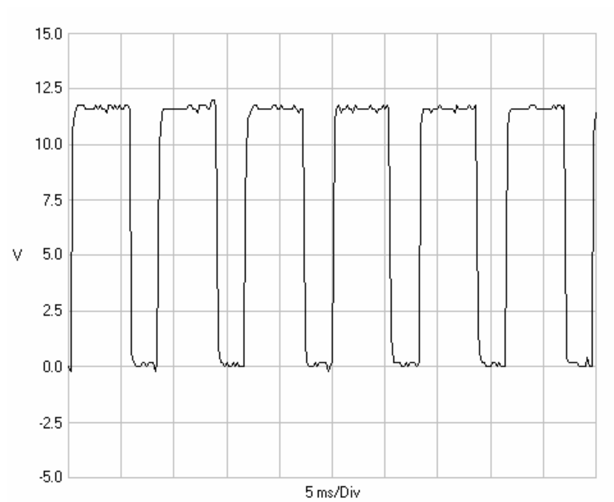
LOCATION	DESCRIPTION	TEST VOLTAGE/WAVEFORM
TP1	Filtered PDM for Modulator Protection	See figure 7-3
TP2	Modulator Protection	See figure 7-4
TP3	Audio Input with Modulator Protection	See figure 7-5
TP4	Ground Reference	Ground
TP5	Ground Reference	Ground
TP6	Buffered Gain Control	7 ± 1 VDC
TP7	Audio Plus DC	See figure 7-6
TP8	Buffered B+ Sample	7 ± 1 VDC
TP9	Carrier Ref Level	See figure 7-7
TP10	Ramp	See figure 7-8
TP11	Ramp Level	1.8 VDC
TP12	Ground Reference	Ground
TP13	Ground Reference	Ground
TP14	Adjusted Carrier Ref Level	See figure 7-9
TP15	Inverted Adjusted Carrier Ref Level	See figure 7-10
TP16	PDM 1	See figure 7-11
TP17	PDM 2	See figure 7-12

Table 7-6 Test Voltages/Waveforms for 50kW Distribution PWB

LOCATION	DESCRIPTION	TEST VOLTAGE/WAVEFORM
TP1	Gate Bias Drive (f_{PDM})	See figure 7-13
TP2	PDM 1	See figure 7-14
TP3	PDM 2	See figure 7-15
TP4	Ground Reference	Ground
TP5	Ground Reference	Ground
TP6	RF Current Sample	5.4 VDC
TP7	RF Current Reference	6.1 VDC
TP8	Buffered DC Current Sample	4.7 VDC
TP9	Buffered PA Volts Sample	4.9 VDC
TP10	RF Overcurrent Detector	24.5 VDC
TP11	Load Impedance (Meter)	6.7 VDC
TP12	RF Overcurrent Fault	0 VDC
TP13	Gate Bias Drive (TEST)	See figure 7-13

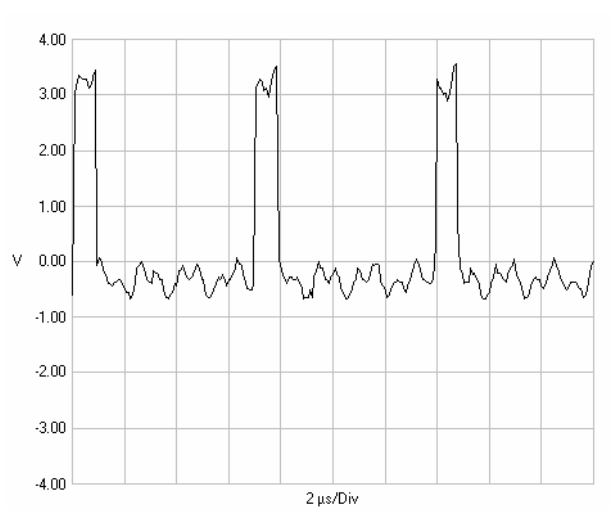
Table 7-7 Test Voltages/Waveforms for 3 Phase SCR Power Supply

LOCATION	DESCRIPTION	TEST VOLTAGE/WAVEFORM
TP1	Output Volts Threshold	8.5 VDC
TP2	AC Phase 1	See figure 7-16
TP5	Ramp 1	See figure 7-17
TP8	Control Volts (Fans)	4.25 VDC
TP9	Not Used	-
TP10	Control Volts (RF Dr Amp)	4.4 VDC
TP11	Ground Reference	Ground
TP12	SCR Gate Drive (Fans)	See figure 7-18
TP15	SCR Gate Drive (RF Dr Amp)	See figure 7-19



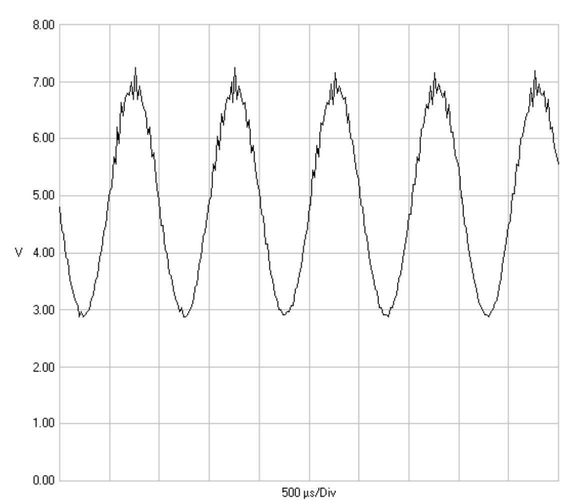
Output Power = 100kW

Figure 7-1 Gain Control PDM



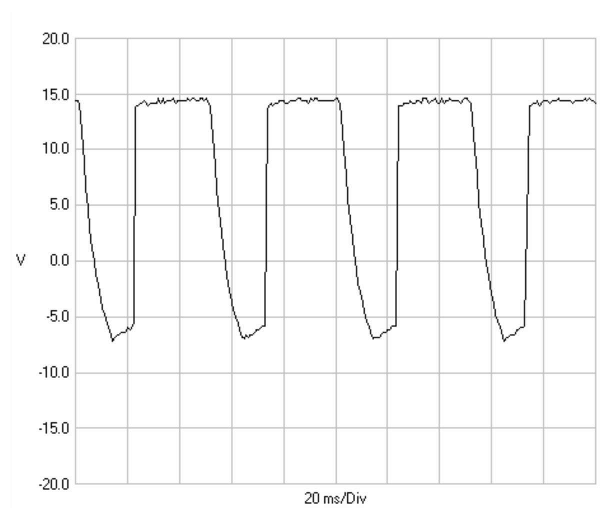
f_C = 576kHz, $2f_{PDM}$ = 144kHz

Figure 7-2 $2f_{PDM}$ on Frequency Synthesizer PWB



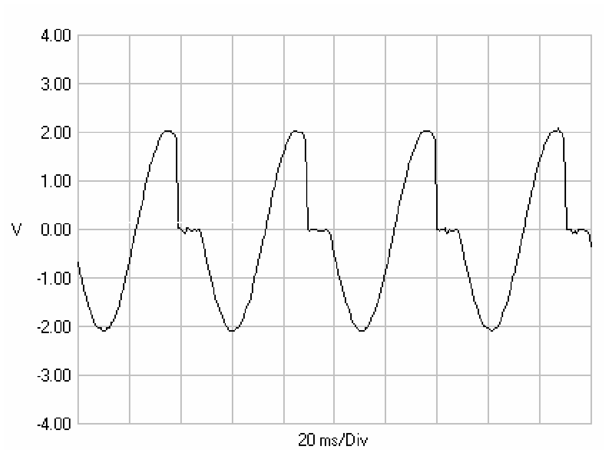
f_{MOD} = 1000Hz, Mod Depth = 95%
Output Power = 100kW

Figure 7-3 Filtered PDM for Modulator Protection



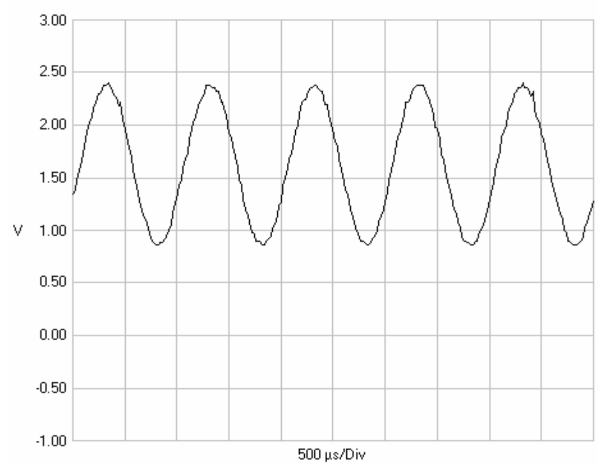
f_{MOD} = 20Hz, Mod Depth = 95%
Output Power = 100kW

Figure 7-4 Modulator Protection



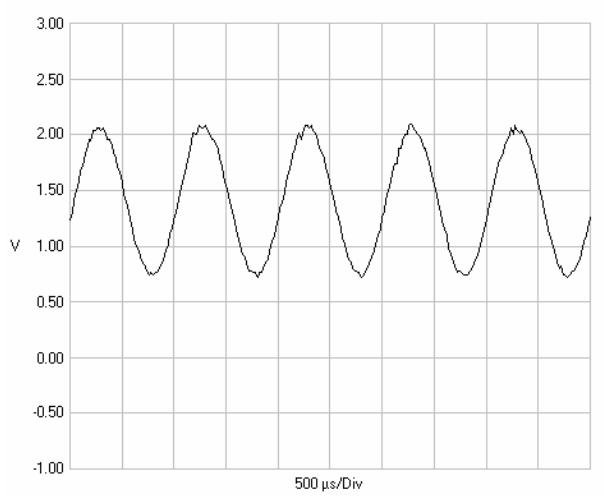
f_{MOD} = 20Hz, Mod Depth = 95%
Output Power = 100kW

Figure 7-5 Audio with Modulator Protection



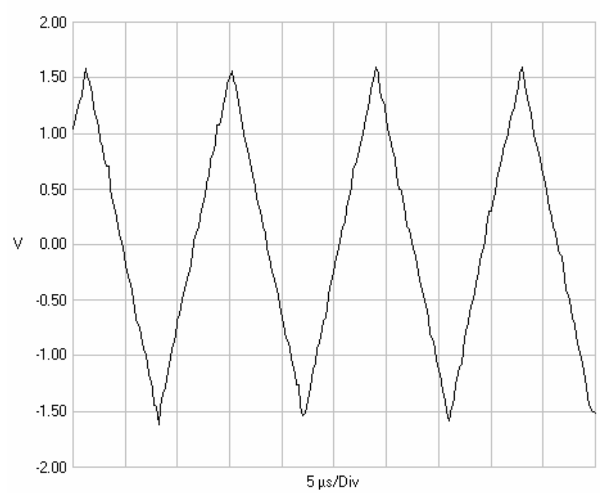
f_{MOD} = 1000Hz, Mod Depth = 50%
Output Power = 100kW

Figure 7-7 Carrier Ref Level



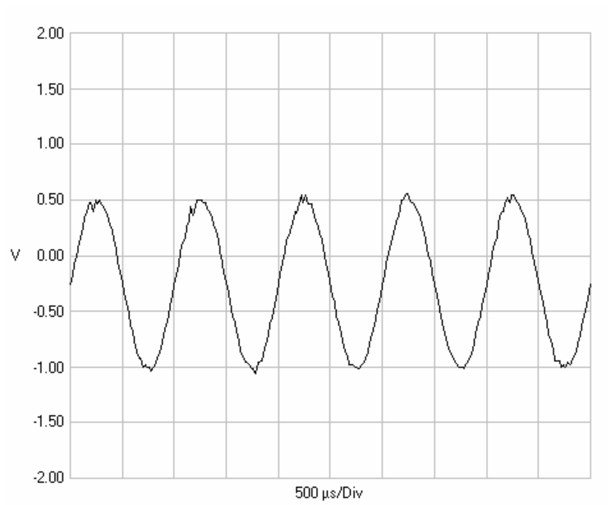
f_{MOD} = 1000Hz, Mod Depth = 50%
Output Power = 100kW

Figure 7-6 Audio plus DC



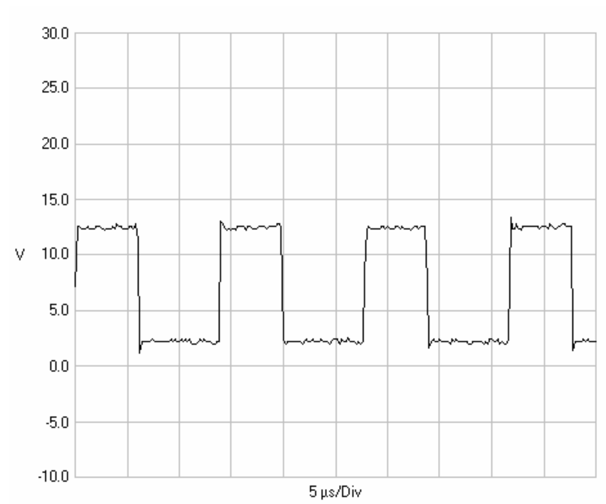
f_C = 576 kHz, f_{RAMP} = 72kHz

Figure 7-8 PDM Ramp



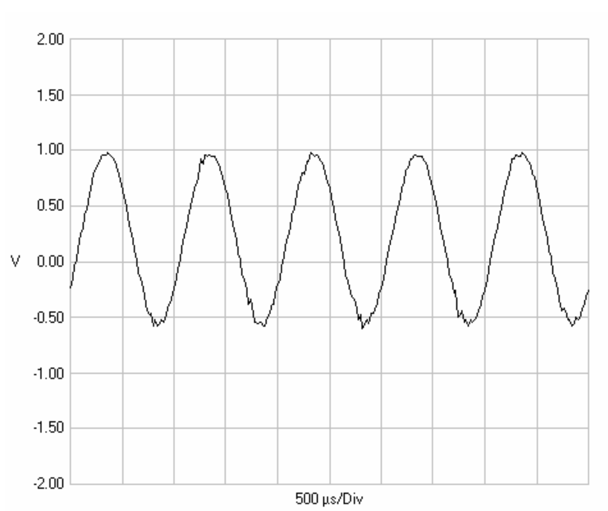
f_{MOD} = 1000Hz, Mod Depth = 50%
Output Power = 100kW

Figure 7-9 Adjusted Carrier Ref Level



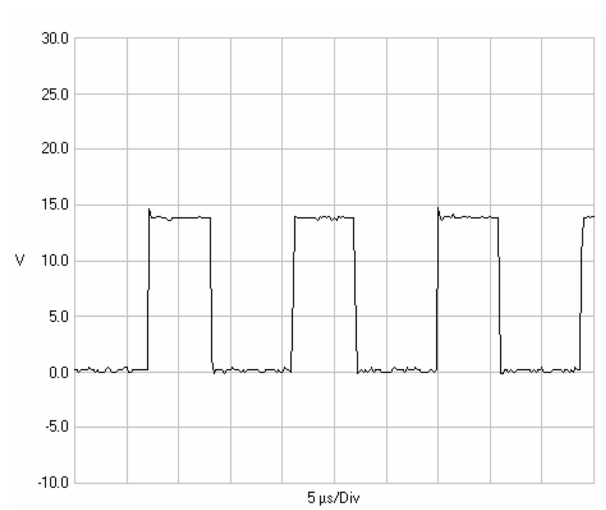
f_C = 576kHz, f_{PDM} = 72kHz,
Output Power = 100kW, No Modulation

Figure 7-11 PDM 1 (Bi-Phase PDM Driver PWB)



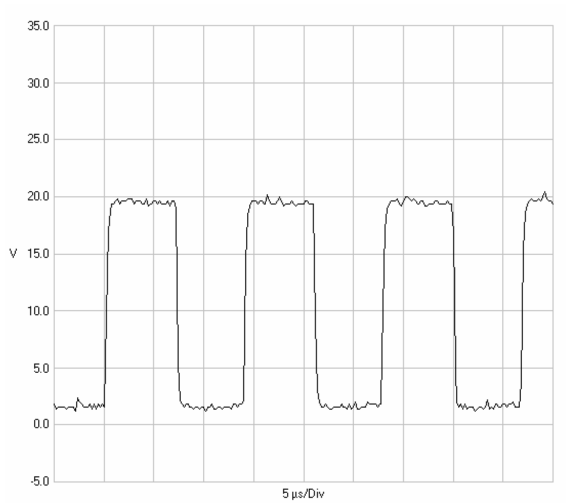
f_{MOD} = 1000Hz, Mod Depth = 50%
Output Power = 100kW

Figure 7-10 Inverted Adjusted Carrier Ref Level



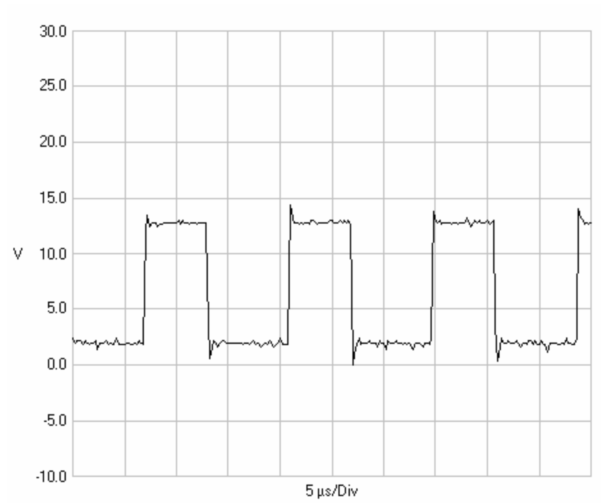
f_C = 576kHz, f_{PDM} = 72kHz,
Output Power = 100kW, No Modulation

Figure 7-12 PDM 2 (Bi-Phase PDM Driver PWB)



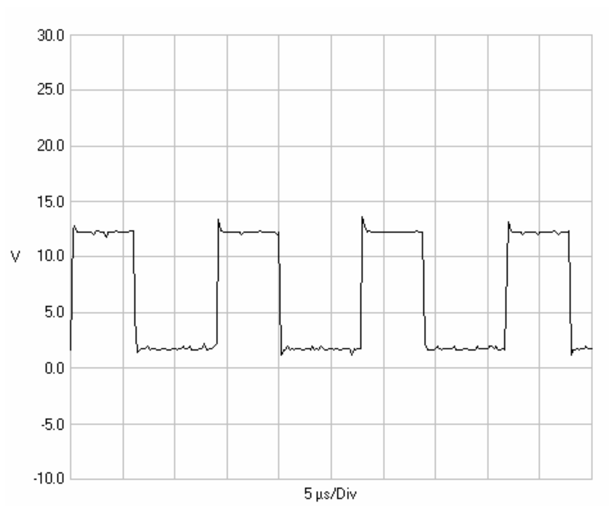
f_C = 576kHz, f_{PDM} = 72kHz

Figure 7-13 Gate Bias Drive (Primary)



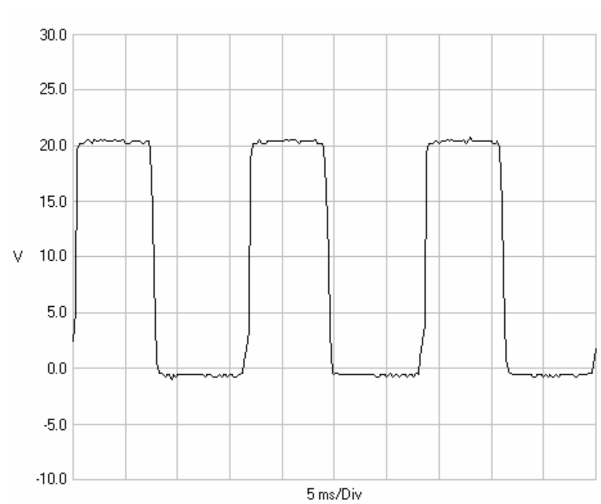
f_C = 576kHz, f_{PDM} = 72kHz,
Output Power = 100kW, No Modulation

Figure 7-15 PDM 2 (Primary Distribution PWB)



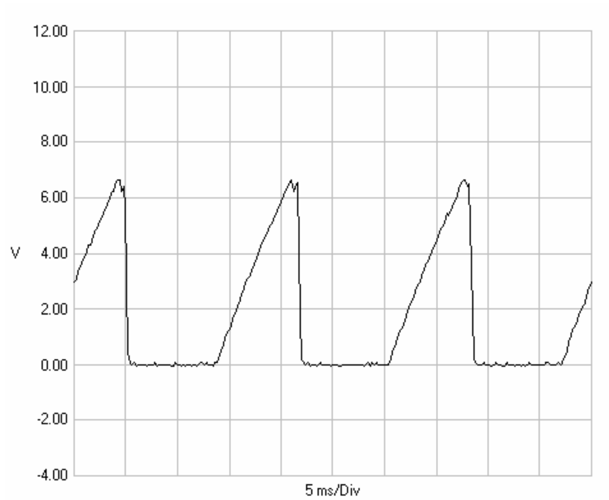
f_C = 576 kHz, f_{PDM} = 72 kHz,
Output Power = 100kW, No Modulation

Figure 7-14 PDM 1 (Primary Distribution PWB)



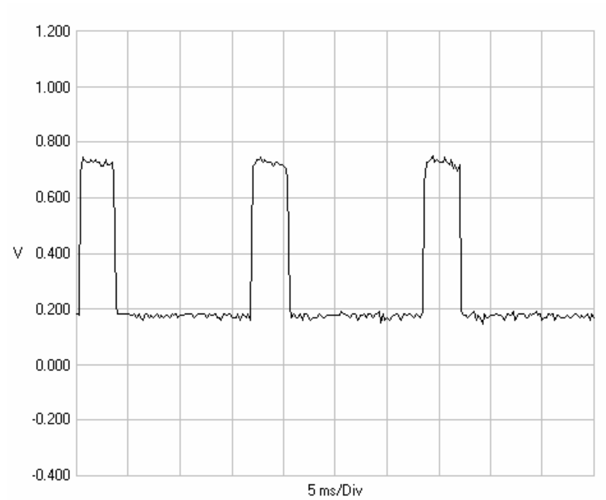
Output Power = 100kW, No Modulation

Figure 7-16 AC Phase 1



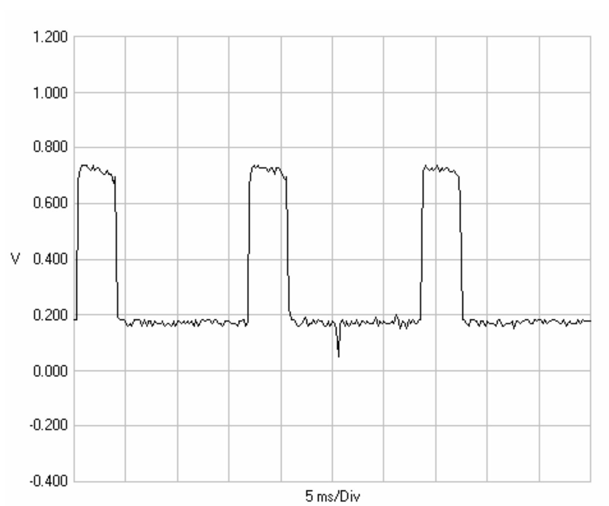
Output Power = 100kW, No Modulation

Figure 7-17 Ramp 1



Output Power = 100kW, No Modulation

Figure 7-19 SCR Gate Drive (RF Dr Amp)



Output Power = 100kW, No Modulation

Figure 7-18 SCR Gate Drive (Fans)

An rf Power ceramic plate capacitor can be damaged if a torque in excess of 4.0 newton metres is applied between either of its lead termination nuts and its ceramic body.

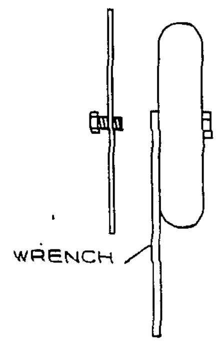
Thin walled wrenches must be used on the termination nuts, due to their width.

ATTACHED BY A BOLT

When a bolt is being threaded into or removed from a capacitor plate termination nut, the termination nut must be held and prevented from turning by a wrench as depicted in example A. This technique will ensure the applied torque is restricted to threads of bolt and termination nut.

Do not prevent the capacitor from turning by physically holding its body or using the termination nut on its opposite side. Either of these techniques will transfer applied torque to the capacitor's ceramic body.

A

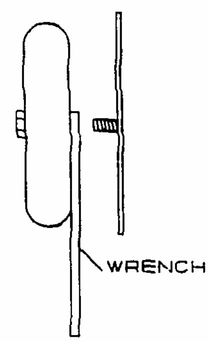


ATTACHED TO A FIXED STUD

When a capacitor is being installed on or removed from a fixed stud, the capacitor must be turned by applying torque to the plate termination nut on the stud side as depicted in example B. This technique will ensure the applied torque is restricted to threads of the stud and termination nut.

Do not turn the capacitor by physically holding its body or using the termination nut on the opposite side. Either of these techniques will transfer the applied torque to the capacitor's ceramic body.

B



DUAL CAPACITOR INSTALLATION

When two capacitors are installed on a common threaded stock, such as when they are on located on either side of a mounting bracket, two thin walled wrenches are required. See example C.

One capacitor must be prevented from turning as described in the ***Attached by a Bolt*** procedure of this figure, the other must be turned and the tightening torque applied as described by the ***Attached to a Fixed Stud*** procedure of this figure.

C

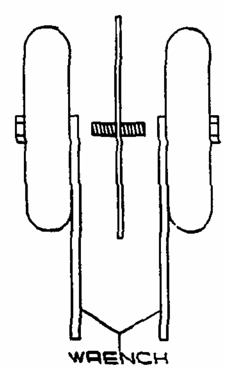


Figure 7-20 Installation/Torquing Instructions for RF Power Ceramic Plate Capacitors

SECTION 8
PARTS LIST

INTRODUCTION

8.1 This section contains reference designation indexes which provide descriptive and provisioning information for all electrical and mechanical parts that have been assigned a reference designation and form a part of the subject equipment.

FAMILY TREE

8.2 Figure 8-1 depicts the family tree for the subject equipment. It is based on the descending order of the reference designation hierarchy and identifies all assemblies that have been assigned a Nautel configuration control number.

MANUFACTURER'S INDEX

8.3 Table 8-1 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.

HOW TO LOCATE INFORMATION FOR A SPECIFIC PART

8.4 To locate the information for a specific part, the user must know the reference designation assigned to the part. In addition, the user must know the Nautel configuration control number assigned to the assembly that contains the part or the full reference designation, which includes the reference designation of all higher assemblies.

8.4.1 WHEN NAUTEL CONFIGURATION CONTROL NUMBER IS KNOWN: Locate the information for a part when the Nautel configuration control number is known, as follows:

Refer to the table of contents (list of tables), for this manual and identify which table is the reference designation index for that assembly.

Locate the part's reference designation in the identified table.

8.4.2 WHEN REF DES IS KNOWN: Locate the information for a part when the full reference designation is known, as follows:

Enter the family tree depicted in figure 8-1 with the full reference designation.

Follow the family tree branches to the block that represents the lowest level assembly assigned a Nautel configuration control number. Delete the reference designation and then go to the table specified in the block with the balance of the reference designation.

Locate the part's reference designation in the specified table.

REFERENCE DESIGNATION INDEXES

8.5 Individual reference designation indexes are provided for all assemblies that have been assigned a Nautel configuration control number. To obtain the full reference designation for a specific part, the tabulated designation must be prefixed with the reference designation of the assembly that contains the part and the reference designation of all higher level assemblies. Notes at the end of each table identify possible higher level assemblies. The reference designation indexes are divided into columns to aid in locating specific information.

COLUMN CONTENT EXPLANATION

8.6 The following paragraphs provide an explanation of the purpose and contents of each column in the reference designation indexes.

8.6.1 USE CODE COLUMN: This column contains a symbol/letter code which is part of a configuration control management system. When there is more than one variation of an assembly, each variation will be assigned a code in this column and the parts that are unique to a variation will be assigned the same code. Parts that are common to all variations will not have an entry in this column. Notes at the end of each table explain the code's significance.

8.6.2 REF DES COLUMN: The ref des column contains the reference designation for a specific part. These designations are assigned in accordance with the requirements of American National Standard Specification ANSI Y32.16. Each reference designation index is sorted and listed alpha/numerically according to the reference designations in this column.

8.6.3 NAME OF PART AND DESCRIPTION COLUMN: This column contains the name and descriptive information for each part. The key word or noun is presented first, followed by the adjective identifiers.

8.6.4 NAUTEL'S PART NO. COLUMN: This column contains the Nautel part number assigned to each part. This number is Nautel's drawing number for Nautel manufactured parts, Nautel's configuration control number for assemblies that are under configuration control management or Nautel's inventory management number for purchased parts.

8.6.5 JAN/MIL/OEM PART NO. COLUMN: This column 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/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.

8.6.6 X/Y GRID COLUMN: Ref Des Indexes for printed wiring boards with a high parts density have an X/Y grid column. This column contains an alpha/numeric grouping that is keyed to an X/Y grid on the item's assembly detail drawing. This information is provided as an aid to locating parts on printed wiring boards.

8.6.7 OEM CODE COLUMN: This column contains a five digit coded group as the original equipment manufacturer's (OEM) identifier. The code was extracted from Cataloging Handbook H4/H8 - Commercial and Government Entity (Cage) Code. Manufacturers that were not listed in the catalog when this listing was compiled have been assigned a unique five letter code. This 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.

NOTE

OEM code 37338 is listed for parts manufactured by Nautel or to a Nautel control drawing. United States of America customers should refer all replacement part orders to Nautel Maine Incorporated (OEM code 57655).

Table 8-1 Manufacturers' Code to Address Index

0CVK3	Allegro Microsystems Incorporated 115 Northeast Cutoff PO Box 2036 Worchester, Massachussets 01613
0D1M6	NMB Technologies Inc 9730 Independence Avenue Chatsworth, California
0GP12	Radial Incorporated 150 Long Beach Blvd, Stratford, Connecticut 06497
0LUA4	Browning-Ferris Industries Inc 1080 Airport Road Fall River, Massachussets 02720
00779	AMP Incorporated, 2800 Fulling Mill, P O Box 3608, Harrisburg, Pennsylvania 17105
01295	Texas Instruments Incorporated, US Semiconductor Group, PO Box 225012, 13500 North Central Expressway, Dallas, Texas 75265
02660	Bunker Ramo Corporation, Amphenol Connector Division, 2801 South 25th Avenue, Broadview, Illinois 60153
04426	Illinois Tool Works, Licon Division, 6615 West Irving Park Road, Chicago, Illinois 60634
04713	Motorola Incorporated, Semiconductor Products Group, 5005 East McDowell Road, Phoenix, Arizona 85008
06090	Raychem Corporation, 300 Constitution Drive, Menlo Park, California 94025-1111
07355	Airpax Electronics Incorporated, Controls Division, 6801 W Sunrise Boulevard, Fort Lauderdale, Florida 33313
09353	C & K Components Incorporated 15 Riverdale Avenue Newton, Massachusetts 02158
09482	AMP of Canada Limited, 20 Esna Park Drive, Markham, Ontario, Canada L3R 1E1 USA customers use - 00779
09675	Raytheon Canada Limited, 400 Phillips Street, PO Box 1619, Waterloo, Ontario, Canada N2J 4K6
09710	Square D Canada Electrical Equipment Incorporated 6675 Rexwood Road Mississauga, Ontario, Canada L4V 1V1
1BH13	Fenwal Electronics Incorporated 63 Fountain Street, Framingham, Massachusetts 01701
1C498	Westcode Semiconductors 1485 Triole Street, Ottawa, Ontario, Canada K1B 3S4
1C532	EEV Canada Limited, 67 Westmore Drive, Rexdale, Ontario, Canada M9V 3Y6
1EM90	Lumex Opto\Components Inc 292 Hellem Road Paletine, Il 60067-6955
13150	Vernitron Electronic Components, Beau Products Division, PO Box 10, Laconia, New Hampshire 03246
14655	Cornell Dubilier Electronics Division, Federal Pacific Electric Company, 150 Avenue L, Newark, New Jersey 07101
17856	Siliconix Incorporated, 2201 Laurelwood Road, Santa Clara, California 95054
21574	Gould Shawmut 88 Horner Avenue Toronto, Ontario, Canada MHZ 5Y3
27014	National Semiconductor Corp, 2900 Semiconductor Drive, Santa Clara, California 95051

Table 8-1 Manufacturers' Code to Address Index (Continued)

27194	TECCOR Electronics Incorporated, 1801 Hurd Drive, Irving, Texas 75038-4385
31019	Allegro Microsystems Inc 3900 Welsh Road Willow Grove, PA
33062	Ferronics Incorporated, 60 North Lincoln Road, East Rochester, New York 14445
34361	Omron Electronics Incorporated, 432 Toyama Road, Sunnyvale, California 94086
35005	Dale Electronics Canada Limited, 18 Howden Road, Scarborough, Ontario, Canada M1R 3E6 USA customers use - 91637
35104	Bach-Simpson Limited, 1255 Brydges Street, London, Ontario, Canada N5W 2C2
37338	Nautel Limited 10089 Peggy's Cove Road Hackett's Cove, Nova Scotia, Canada B3Z 3J4 USA customers use - 57655
37833	Telemecanique Canada Ltd 580 Lepine Avenue Dorval, Quebec, Canada M9P 1H8
37903	Siemens Electric Limited, 7300 Trans-Canada Highway, Pointe Claire, Quebec, Canada H9R 1C7 USA Customer's Use: 66842
4G927	RayChem Corporation, PolySwitch Products, 300 Constitution Drive, Mento Park, California 94025
44655	Ohmite Manufacturing Company, 3601 West Howard Street, Skokie, Illinois 60076
45496	Digital Systems 1850 Centennial Park Drive Suite 300 Reston, Virginia 22091
46897	Phillips Manufacturing Company, 7334 North Clark Street, Chicago, Illinois 60626
50088	SGS-Thomson Micro Electronics Inc 1310 Electronics Drive Carrolton, Texas 75006-6905
50434	Hewlett Packard Company, 640 Page Mill Road, Palo Alto, California 94304
51182	Diodes Incorporated Lynn, Massachussetts
56289	Sprague Electric Company, 87 Marshall Street, North Adams, Massachusetts 01247
57062	Biomation Corporation 19050 Pruneridge Avenue Cupertino, California 95014
57655	Nautel Maine Incorporated, 201 Target Industrial Circle Bangor, Maine 04401
59124	KOA Speer Electronics Incorporated, Bolivar Drive, PO Box 547, Bradford, Pennsylvania 16701
59474	Jeffers Electronics Incorporated, Grand Plaza, 945 Grand Avenue, PO Box 730, Nogales, Arizona 85621
61529	Aromat Corporation, 250 Sheffield Street, Mountainside, New Jersey 07092
62643	United Chemicon Incorporated 9806 Higgins Street Rosemont, Illinois, 60018
63426	MKK Switches of America Incorporated, 7850 East Gelding Drive, Scottsdale, Arizona 85260

Table 8-1 Manufacturers' Code to Address Index (Continued)

63590	STI Technology Division of Premier Industrial Corp 4801 North Ravens Wood Avenue Chicago, Il 68640-4496
65249	Memory Protection Devices Inc., 320 Broad Hollow Road, Farmingdale, New York 11735
66675	Lattice Semiconductor Corporation 5555 NE Moore Court Hillsborough, Oregon 97124
66842	Siemens Energy & Automation I-T-E Circuit Protection Division 811 N. Main Street Bellefontaine, Ohio 43311
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
73831	Hammond Mfg Company Limited, 394 Edinburgh Road North, Guelph, Ontario, Canada N1H 1E5
73949	Guardian Electric Mfg Company, 1550 W 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
80294	Bourns Incorporated, Instrument Division, 6135 Magnolia Avenue, Riverside, California 92506
81073	Grayhill Incorporated, PO Box 10373, 561 Hillgrove Avenue, Louisiana Grange, Illinois 60525
81483	International Rectifier, 9220 Sunset Boulevard, PO Box 2321, Terminal Annex, Los Angeles, California 90069
90201	P R Mallory and Company Inc, Mallory Capacitor Division, PO Box 372, 4760 Kentucky Avenue, Indianapolis, Indiana 46206
91637	Dale Electronics Incorporated, 2064 12th Avenue, Columbus, Nebraska 68601
91833	Keystone Electronics Corporation, 49 Bleeker Street, New York, New York 10012
95146	Alco Electronic Products Inc, PO Box 1348, Lawrence, Massachusetts 08142
96095	AVX Ceramics, Division of AVX Corporation, Seneca Avenue, Olean, New York 14760
DRALO	Draloric Electronic GMBH Postfach 1180 Geheimrat-Rosenthal-Strause 100 D-8672 SELB Germany
RALTR	Raltron Electronics, 2315 NW 107th Avenue, Miami, Florida 33172

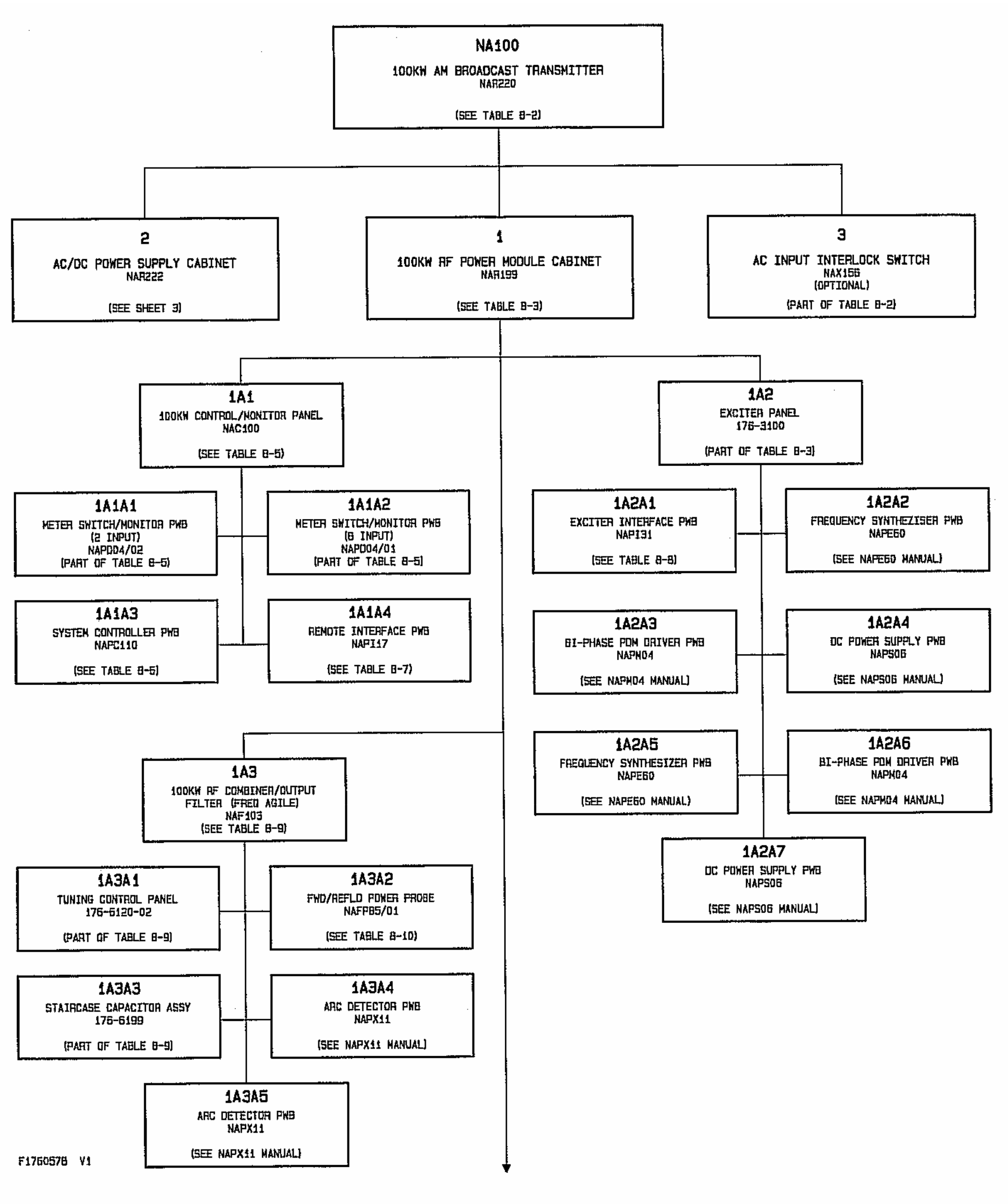


Figure 8-1 Family Tree - NA100 100kW AM Broadcast Transmitter (Sheet 1 of 3)

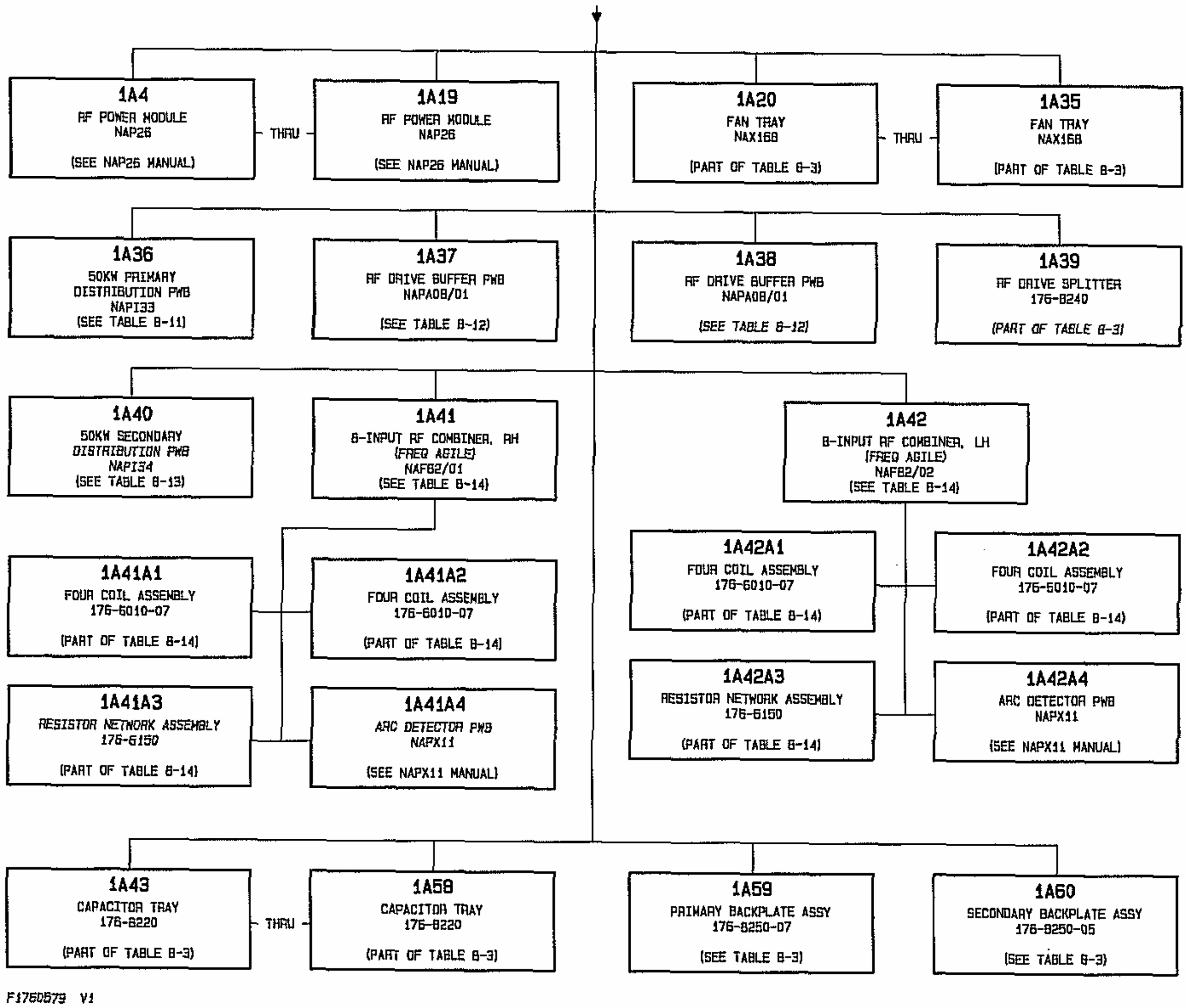


Figure 8-1 Family Tree - NA100 100kW AM Broadcast Transmitter (Sheet 2 of 3)

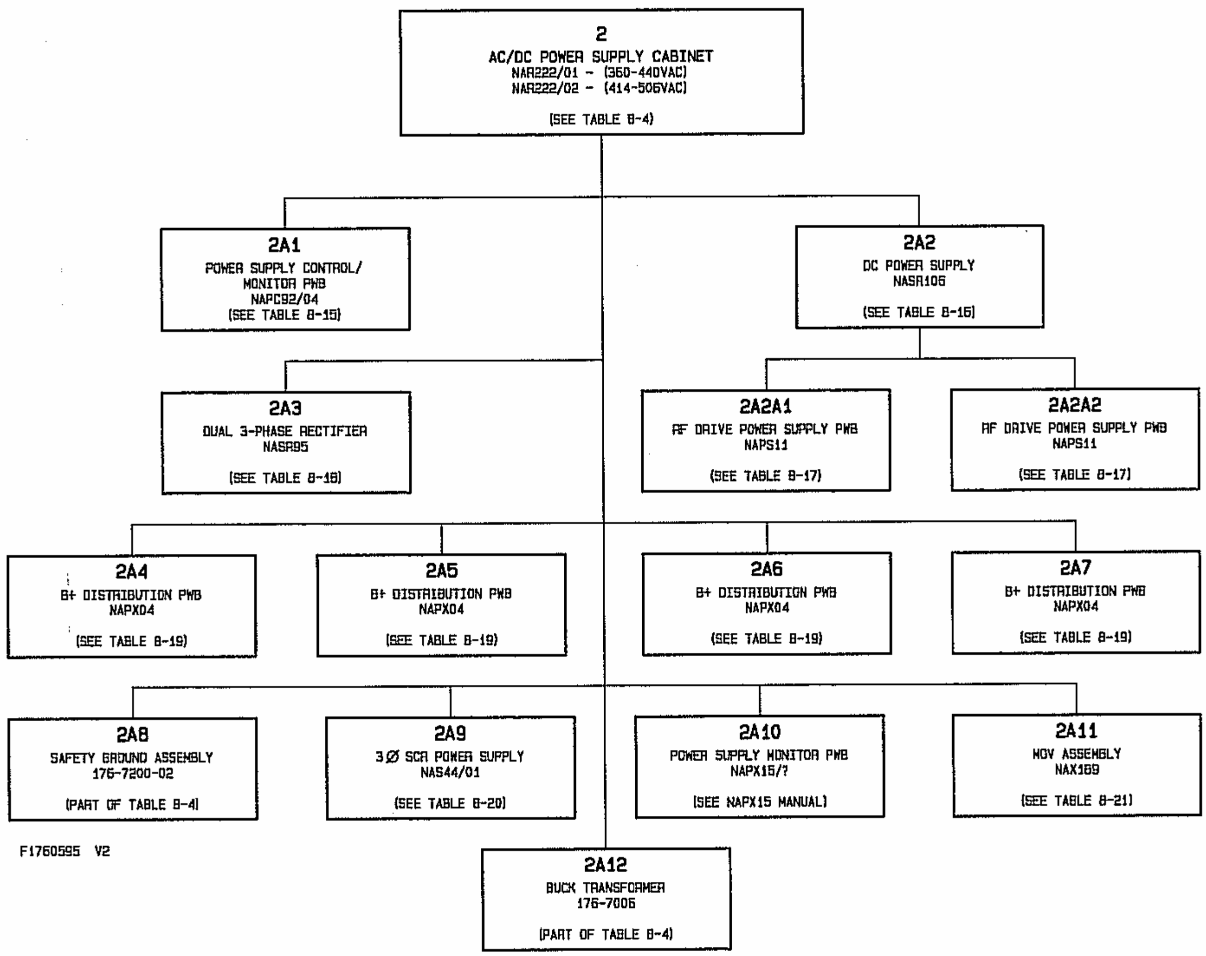


Figure 8-1 Family Tree - NA100 100kW AM Broadcast Transmitter (Sheet 3 of 3)

Table 8-2 Ref Des Index - NA100 100kW AM Broadcast Transmitter

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
♠	-	100kW AM Broadcast Transmitter	NA100	176-8650-0?	37338
	1	RF Power Module Cabinet, 100kW	NAR199	See Table 8-3	37338
	2	AC/DC Power Supply Cabinet	NAR222/?	See Table 8-4	37338
♣	3	Switch, Interlock, AC Input, 400A	NAX156	176-5060-00	37338
	3F1	Fuse, One time, 400A, 600 VAC, Type NRS	FD05	NRS400A	57062
	3F2	Fuse, One time, 400A, 600 VAC, Type NRS	FD05	NRS400A	57062
	3F3	Fuse, One time, 400A, 600 VAC, Type NRS	FD05	NRS400A	57062
	P1	Connector, 'D' Sub-Min, 25 Pin-Contacts	176-5102-01	176-5102-01	37338
	P2	Connector, 'D' Sub-Min, 25 Socket-Contacts	176-5102	176-5102	37338
	P3	Connector, 'D' Sub-Min, 15 Socket-Contacts	176-5101	176-5101	37338
	P4	Connector, Coaxial, BNC, 50Ω, Crimp	JDP24	225395-7	09482
	P5	Connector, 'D' Sub-Min, 25 Socket-Contacts	176-5102	176-5102	37338
	P6	Connector, 'D' Sub-Min, 25 Socket-Contacts	176-5102	176-5102	37338
	P7	Connector, 'D' Sub-Min, 25 Pin-Contacts	176-5102-01	176-5102-01	37338
	P8	Connector, Coaxial, BNC, 50Ω, Crimp	JDP24	225395-7	09482
	P9	Connector, Coaxial, BNC, 50Ω, Crimp	JDP24	225395-7	09482
	P10	Connector, 'D' Sub-Min, 9 Socket-Contacts	176-5100	176-5100	37338
	P11	Connector, 'D' Sub-Min, 9 Socket-Contacts	176-5100	176-5100	37338
	P12	Connector, 'D' Sub-Min, 15 Pin-Contacts	176-5101-01	176-5101-01	37338
	P13	Connector, Size 23-37, 16 Pin-Contacts	182-5014	182-5014	37338
	P14	Connector, Coaxial, BNC, 50Ω, Clamp	JDP25	69475	02660
	P15	Connector, Coaxial, BNC, 50Ω, Crimp	JDP24	225395-7	09482
	P16	Connector, Coaxial, BNC, 50Ω, Crimp	JDP24	225395-7	09482
	P17	Connector, Coaxial, BNC, 50Ω, Crimp	JF33	31-4320	02660
	P18	Connector, Coaxial, BNC, 50Ω, Crimp	JF33	31-4320	02660
	P19	Connector, Coaxial, BNC, 50Ω, Crimp	JF33	31-4320	02660
	P20	Connector, Coaxial, BNC, 50Ω, Clamp	JDP25	69475	02660
	P21	Connector, 'D' Sub-Min, 25 Socket-Contacts	176-5102	176-5102	37338
	P22	Connector, 'D' Sub-Min, 15 Socket-Contacts	176-5101	176-5101	37338
	P23	Connector, Coaxial, BNC, 50Ω, Crimp	JF33	31-4320	02660
	P24	Connector, 'D' Sub-Min, 25 Socket-Contacts	176-5102	176-5102	37338
	P25	Connector, 'D' Sub-Min, 15 Socket-Contacts	176-5101	176-5101	37338
	P26	Connector, Coaxial, BNC, 50Ω, Crimp	JF33	31-4320	02660
	P27	Connector, 'D' Sub-Min, 9 Socket-Contacts	176-5100	176-5100	37338
	P28	Connector, 'D' Sub-Min, 9 Socket-Contacts	176-5100	176-5100	37338
	P29	Connector, 'D' Sub-Min, 9 Socket-Contacts	176-5100	176-5100	37338
	P30	Connector, 'D' Sub-Min, 9 Socket-Contacts	176-5100	176-5100	37338

USE CODE EXPLANATION:

♣ - Denotes item is optional.

♠ - Denotes cooling method determines final variation.

176-8650-09 Externally Ducted Input and Output
176-8650-10 Room Air Input/Room Air Exhaust
176-8650-11 Room Air Input/Externally Ducted Output

Table 8-3 Ref Des Index - NAR199 100kW RF Power Module Cabinet

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	1	RF Power Module Cabinet, 100kW	NAR199D	176-8200-04	37338
	1A1	Control/Monitor Panel, 100kW	NAC100	See Table 8-5	37338
	1A2	Exciter Panel	176-3100	176-3100	37338
	1A2A1	Exciter Interface PWB	NAPI31	See Table 8-8	37338
	1A2A2	Frequency Synthesizer PWB	NAPE60/01	See NAPE60 Manual	37338
	1A2A3	Bi-Phase PDM Driver	NAPM04	See NAPM04 Manual	37338
	1A2A4	Dc Power Supply PWB	NAPS06	See NAPS06 Manual	37338
	1A2A5	Frequency Synthesizer PWB	NAPE60/01	See NAPE60 Manual	37338
	1A2A6	Bi-Phase PDM Driver	NAPM04	See NAPM04 Manual	37338
	1A2A7	Dc Power Supply PWB	NAPS06	See NAPS06 Manual	37338
	1A3	RF Combiner/Output Filter, 100kW, Freq Agile	NAF103	See Table 8-9	37338
	1A4	RF Power Module	NAP26/01	See NAP26 Manual	37338
	1A5	RF Power Module	NAP26/01	See NAP26 Manual	37338
	1A6	RF Power Module	NAP26/01	See NAP26 Manual	37338
	1A7	RF Power Module	NAP26/01	See NAP26 Manual	37338
	1A8	RF Power Module	NAP26/01	See NAP26 Manual	37338
	1A9	RF Power Module	NAP26/01	See NAP26 Manual	37338
	1A10	RF Power Module	NAP26/01	See NAP26 Manual	37338
	1A11	RF Power Module	NAP26/01	See NAP26 Manual	37338
	1A12	RF Power Module	NAP26/01	See NAP26 Manual	37338
	1A13	RF Power Module	NAP26/01	See NAP26 Manual	37338
	1A14	RF Power Module	NAP26/01	See NAP26 Manual	37338
	1A15	RF Power Module	NAP26/01	See NAP26 Manual	37338
	1A16	RF Power Module	NAP26/01	See NAP26 Manual	37338
	1A17	RF Power Module	NAP26/01	See NAP26 Manual	37338
	1A18	RF Power Module	NAP26/01	See NAP26 Manual	37338
	1A19	RF Power Module	NAP26/01	See NAP26 Manual	37338
	1A20	Fan Tray	NAX168	176-8070-03	37338
	1A20B1	Fan, Brushless, 48 VDC, 240CFM	176-8076	176-8076	37338
	1A20B2	Fan, Brushless, 48 VDC, 240CFM	176-8076	176-8076	37338
	1A20F1	Fuse, 2A, 125V, Slow, Dual Element	FB39	MDL2	71400
	1A20J1	Connector, Size 11-4, 2 Pin-Contacts	JQ28	206061-1	09482
	1A20XF1	Fuseholder, Single Fuse	159-3037-08	159-3037-08	37338
	1A21	Same as 1A20			
	1A22	Same as 1A20			
	1A23	Same as 1A20			
	1A24	Same as 1A20			
	1A25	Same as 1A20			
	1A26	Same as 1A20			
	1A27	Same as 1A20			
	1A28	Same as 1A20			
	1A29	Same as 1A20			
	1A30	Same as 1A20			
	1A31	Same as 1A20			
	1A32	Same as 1A20			
	1A33	Same as 1A20			
	1A34	Same as 1A20			

Table 8-3 Ref Des Index - NAR199 100kW RF Power Module Cabinet (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	1A35	Same as 1A20			
	1A36	50kW Distribution PWB, Primary	NAPI33	See Table 8-11	37338
	1A37	RF Drive Buffer PWB	NAPA08/01	See Table 8-12	37338
	1A38	RF Drive Buffer PWB	NAPA08/01	See Table 8-12	37338
	1A39	RF Drive Splitter	176-8240	176-8240	37338
	1A39J1	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	02660
	1A39J2	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	02660
	1A39J3	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	02660
	1A39J4	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	02660
	1A39J5	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	02660
	1A39J6	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	02660
	1A39J7	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	02660
	1A39J8	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	02660
	1A39J9	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	02660
	1A39J10	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	02660
	1A39J11	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	02660
	1A39J12	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	02660
	1A39J13	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	02660
	1A39J14	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	02660
	1A39J15	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	02660
	1A39J16	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	02660
	1A39J17	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	02660
	1A40	50kW Distribution PWB, Secondary	NAPI34	See Table 8-13	37338
	1A41	RF Combiner, 8-input, Frequency Agile, RH	NAF82/01	See Table 8-14	37338
	1A42	RF Combiner, 8-input, Frequency Agile, LH	NAF82/02	See Table 8-14	37338
	1A43	Capacitor Tray	176-8220	176-8220	37338
	1A43C1	Capacitor, Electrolytic, 6800uF, 450 VDC	CE04	36DA682F45ODJ2T	62643
	1A43C2	Capacitor, Electrolytic, 6800uF, 450 VDC	CE04	36DA682F45ODJ2T	62643
	1A43DS1	Diode, Light Emitting, Red, 8.6mm Lg	QM18	SSL-LX5093ID	1EM90
	1A43R1	Resistor, Metal Film, 82K Ohms, 5% 2W	RBP37	GS-3, 82K Ohms	75042
	1A44	Same as 1A43			
	1A45	Same as 1A43			
	1A46	Same as 1A43			
	1A47	Same as 1A43			
	1A48	Same as 1A43			
	1A49	Same as 1A43			
	1A50	Same as 1A43			
	1A51	Same as 1A43			
	1A52	Same as 1A43			
	1A53	Same as 1A43			
	1A54	Same as 1A43			
	1A56	Same as 1A43			
	1A57	Same as 1A43			
	1A58	Same as 1A43			
	1A59	Back Plate Assembly	176-8250-07	176-8250-06	37338
	1A59A1	Capacitor Divider Assembly	176-8253	176-8253	37338
	1A59A1C1	Capacitor, Mica, Dipped, 47pF, 1000V	CS17	CDV18EF470J03	14655

Table 8-3 Ref Des Index - NAR199 100kW RF Power Module Cabinet (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	1A59A1C2	Capacitor, Mica, Dipped, 47pF, 1000V	CS17	CDV18EF470J03	14655
	1A59A1C3	Capacitor, Mica, Dipped, 47pF, 1000V	CS17	CDV18EF470J03	14655
	1A59A1C4	Capacitor, Mica, Dipped, 1500pF 2% 500V	CB39	CM06FD152G03	14655
	1A59A1R1	Resistor, Metal Film, 68 Ohms, 5% 2W	RBP06	GS-3, 68 Ohms	75042
	A59C1	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	56289
	A59C2	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	56289
	A59C3	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	56289
	A59C4	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	56289
	A59C5	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	56289
	A59C6	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	56289
	A59C7	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	56289
	A59C8	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	56289
	1A59J1	Connector, Panel, 8 Socket-Contacts, Gold	176-5110-02	176-5110-02	37338
	1A59J2	Connector, Panel, 8 Socket-Contacts, Gold	176-5110-02	176-5110-02	37338
	1A59J3	Connector, Panel, 8 Socket-Contacts, Go1ld	176-5110-02	176-5110-02	37338
	1A59J4	Connector, Panel, 8 Socket-Contacts, Gold	176-5110-02	176-5110-02	37338
	1A59J5	Connector, Panel, 8 Socket-Contacts, Gold	176-5110-02	176-5110-02	37338
	1A59J6	Connector, Panel, 8 Socket-Contacts, Gold	176-5110-02	176-5110-02	37338
	1A59J7	Connector, Panel, 8 Socket-Contacts, Gold	176-5110-02	176-5110-02	37338
	1A59J8	Connector, Panel, 8 Socket-Contacts, Gold	176-5110-02	176-5110-02	37338
	1A59J9	Connector, Panel, 8 Socket-Contacts, Gold	JT01	S3-5408-SB-04	13150
	1A59J10	Connector, Panel, 8 Socket-Contacts, Gold	JT01	S3-5408-SB-04	13150
	1A59J11	Connector, Panel, 8 Socket-Contacts, Gold	JT01	S3-5408-SB-04	13150
	1A59J12	Connector, Panel, 8 Socket-Contacts, Gold	JT01	S3-5408-SB-04	13150
	1A59J13	Connector, Panel, 8 Socket-Contacts, Gold	JT01	S3-5408-SB-04	13150
	1A59J14	Connector, Panel, 8 Socket-Contacts, Gold	JT01	S3-5408-SB-04	13150
	1A59J15	Connector, Panel, 8 Socket-Contacts, Gold	JT01	S3-5408-SB-04	13150
	1A59J16	Connector, Panel, 8 Socket-Contacts, Gold	JT01	S3-5408-SB-04	13150
	1A59K1	Relay, 24 VDC Coil, 2 Form X Contacts, 20A	KC31	VC20-2A-DC24V	61529
	1A59K2	Relay, 24 VDC Coil, 2 Form X Contacts, 20A	KC31	VC20-2A-DC24V	61529
	1A59K3	Relay, 24 VDC Coil, 2 Form X Contacts, 20A	KC31	VC20-2A-DC24V	61529
	1A59K4	Relay, 24 VDD Coil, 2 Form X Contacts, 20A	KC31	VC20-2A-DC24V	61529
	1A59K5	Relay, 24 VDC Coil, 2 Form X Contacts, 20A	KC31	VC20-2A-DC24V	61529
	1A59K6	Relay, 24 VDC Coil, 2 Form X Contacts, 20A	KC31	VC20-2A-DC24V	61529
	1A59K7	Relay, 24 VDC Coil, 2 Form X Contacts, 20A	KC31	VC20-2A-DC24V	61529
	1A59K8	Relay, 24VDC Coil, 2 Form X Contacts, 20A	KC31	VC20-2A-DC24V	61529
	1A59R1	Resistor, Metal Film, 560 Ohms, 5% 2W	RT14	GS-3, 560 Ohms	75042
	1A59R2	Resistor, Metal Film, 560 Ohms, 5% 2W	RT14	GS-3, 560 Ohms	75042
	1A59R3	Resistor, Metal Film, 560 Ohms, 5% 2W	RT14	GS-3, 560 Ohms	75042
	1A59R4	Resistor, Metal Film, 560 Ohms, 5% 2W	RT14	GS-3, 560 Ohms	75042
	1A59R5	Resistor, Metal Film, 560 Ohms, 5% 2W	RT14	GS-3, 560 Ohms	75042
	1A59R6	Resistor, Metal Film, 560 Ohms, 5% 2W	RT14	GS-3, 560 Ohms	75042
	1A59R7	Resistor, Metal Film, 560 Ohms, 5% 2W	RT14	GS-3, 560 Ohms	75042
	1A59R8	Resistor, Metal Film, 560 Ohms, 5% 2W	RT14	GS-3, 560 Ohms	75042
	1A59R9	Resistor, Wirewound, 33K Ohms, 1% 5W	RN13	RS5-33K Ohms-1%	35005
	1A59R10	Resistor, Metal Film, 1800 Ohms, 2% 1/2W	RAP10	RL20S182G	35005
	1A59R11	Resistor, Metal Film, 390K Ohms, 2% 1/2W	RD26	RL20S394G	35005
	1A59RT1	Thermistor, PTC, 9.0Ω, 600V, Trip @ 0.375A	RX18	TR600-150	4G927

Table 8-3 Ref Des Index - NAR199 100kW RF Power Module Cabinet (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	1A59RT2	Thermistor, PTC, 9.0Ω, 600V, Trip @ 0.375A	RX18	TR600-150	4G927
	1A59RT3	Thermistor, PTC, 9.0Ω, 600V, Trip @ 0.375A	RX18	TR600-150	4G927
	1A59RT4	Thermistor, PTC, 9.0Ω, 600V, Trip @ 0.375A	RX18	TR600-150	4G927
	1A59RT5	Thermistor, PTC, 9.0Ω, 600V, Trip @ 0.375A	RX18	TR600-150	4G927
	1A59RT6	Thermistor, PTC, 9.0Ω, 600V, Trip @ 0.375A	RX18	TR600-150	4G927
	1A59RT7	Thermistor, PTC, 9.0Ω, 600V, Trip @ 0.375A	RX18	TR600-150	4G927
	1A59RT8	Thermistor, PTC, 9.0Ω, 600V, Trip @ 0.375A	RX18	TR600-150	4G927
	1A59T1	Transformer, RF	176-8060	176-8060	37338
	1A59T2	Transformer, RF	176-8060	176-8060	37338
	1A59T3	Transformer, RF	176-8060	176-8060	37338
	1A59T4	Transformer, RF	176-8060	176-8060	37338
	1A59T5	Transformer, RF	176-8060	176-8060	37338
	1A59T6	Transformer, RF	176-8060	176-8060	37338
	1A59T7	Transformer, RF	176-8060	176-8060	37338
	1A59T8	Transformer, RF	176-8060	176-8060	37338
	1A60	Back Plate Assembly	176-8250-05	176-8250-05	37338
	A60C1	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	56289
	A60C2	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	56289
	A60C3	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	56289
	A60C4	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	56289
	A60C5	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	56289
	A60C6	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	56289
	A60C7	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	56289
	A60C8	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	56289
	1A60J1	Connector, Panel, 8 Socket-Contacts, Gold	176-5110-02	176-5110-02	37338
	1A60J2	Connector, Panel, 8 Socket-Contacts, Gold	176-5110-02	176-5110-02	37338
	1A60J3	Connector, Panel, 8 Socket-Contacts, Gold	176-5110-02	176-5110-02	37338
	1A60J4	Connector, Panel, 8 Socket-Contacts, Gold	176-5110-02	176-5110-02	37338
	1A60J5	Connector, Panel, 8 Socket-Contacts, Gold	176-5110-02	176-5110-02	37338
	1A60J6	Connector, Panel, 8 Socket-Contacts, Gold	176-5110-02	176-5110-02	37338
	1A60J7	Connector, Panel, 8 Socket-Contacts, Gold	176-5110-02	176-5110-02	37338
	1A60J8	Connector, Panel, 8 Socket-Contacts, Gold	176-5110-02	176-5110-02	37338
	1A60J9	Connector, Panel, 8 Socket-Contacts, Gold	JT01	S3-5408-SB-04	13150
	1A60J10	Connector, Panel, 8 Socket-Contacts, Gold	JT01	S3-5408-SB-04	13150
	1A60J11	Connector, Panel, 8 Socket-Contacts, Gold	JT01	S3-5408-SB-04	13150
	1A60J12	Connector, Panel, 8 Socket-Contacts, Gold	JT01	S3-5408-SB-04	13150
	1A60J13	Connector, Panel, 8 Socket-Contacts, Gold	JT01	S3-5408-SB-04	13150
	1A60J14	Connector, Panel, 8 Socket-Contacts, Gold	JT01	S3-5408-SB-04	13150
	1A60J15	Connector, Panel, 8 Socket-Contacts, Gold	JT01	S3-5408-SB-04	13150
	1A60J16	Connector, Panel, 8 Socket-Contacts, Gold	JT01	S3-5408-SB-04	13150
	1A60K1	Relay, 24 VDC Coil, 2 Form X Contacts, 20A	KC31	VC20-2A-DC24V	61529
	1A60K2	Relay, 24 VDC Coil, 2 Form X Contacts, 20A	KC31	VC20-2A-DC24V	61529
	1A60K3	Relay, 24 VDC Coil, 2 Form X Contacts, 20A	KC31	VC20-2A-DC24V	61529
	1A60K4	Relay, 24 VDC Coil, 2 Form X Contacts, 20A	KC31	VC20-2A-DC24V	61529
	1A60K5	Relay, 24 VDC Coil, 2 Form X Contacts, 20A	KC31	VC20-2A-DC24V	61529
	1A60K6	Relay, 24 VDC Coil, 2 Form X Contacts, 20A	KC31	VC20-2A-DC24V	61529
	1A60K7	Relay, 24 VDC Coil, 2 Form X Contacts, 20A	KC31	VC20-2A-DC24V	61529

Table 8-3 Ref Des Index - NAR199 100kW RF Power Module Cabinet (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	1A60K8	Relay, 24 VDC Coil, 2 Form X Contacts, 20A	KC31	VC20-2A-DC24V	61529
	1A60R1	Resistor, Metal Film, 560 Ohms, 5%, 2W	RT14	GS-3, 560 Ohms	75042
	1A60R2	Resistor, Metal Film, 560 Ohms, 5%, 2W	RT14	GS-3, 560 Ohms	75042
	1A60R3	Resistor, Metal Film, 560 Ohms, 5%, 2W	RT14	GS-3, 560 Ohms	75042
	1A60R4	Resistor, Metal Film, 560 Ohms, 5%, 2W	RT14	GS-3, 560 Ohms	75042
	1A60R5	Resistor, Metal Film, 560 Ohms, 5%, 2W	RT14	GS-3, 560 Ohms	75042
	1A60R6	Resistor, Metal Film, 560 Ohms, 5%, 2W	RT14	GS-3, 560 Ohms	75042
	1A60R7	Resistor, Metal Film, 560 Ohms, 5%, 2W	RT14	GS-3, 560 Ohms	75042
	1A60R8	Resistor, Metal Film, 560 Ohms, 5%, 2W	RT14	GS-3, 560 Ohms	75042
	1A60T1	Transformer, RF	176-8060	176-8060	37338
	1A60T2	Transformer, RF	176-8060	176-8060	37338
	1A60T3	Transformer, RF	176-8060	176-8060	37338
	1A60T4	Transformer, RF	176-8060	176-8060	37338
	1A60T5	Transformer, RF	176-8060	176-8060	37338
	1A60T6	Transformer, RF	176-8060	176-8060	37338
	1A60T7	Transformer, RF	176-8060	176-8060	37338
	1A60T8	Transformer, RF	176-8060	176-8060	37338
	1MP1	Wand, Ground	176-6130	176-6130	37338
	1MP2	Wand, Ground	176-6130	176-6130	37338
	1S1	Switch, Micro, 1PST	SC01	16-188051	04426
	1S2	Switch, Micro, 1PST	SC01	16-188051	04426
	1W1	Cableform, 50kW Distribution	176-8304-02	176-8304-02	37338
	1W1P1	Connector, Size 17-28, 28 Socket-Contacts	176-5103-01	176-5103-01	37338
	1W1P2	Connector, Size 17-28, 28 Socket-Contacts	176-5103-01	176-5103-01	37338
	1W1P3	Connector, Size 17-28, 28 Socket-Contacts	176-5103-01	176-5103-01	37338
	1W1P4	Connector, Size 17-28, 28 Socket-Contacts	176-5103-01	176-5103-01	37338
	1W1P5	Connector, Size 17-28, 28 Socket-Contacts	176-5103-01	176-5103-01	37338
	1W1P6	Connector, Size 17-28, 28 Socket-Contacts	176-5103-01	176-5103-01	37338
	1W1P7	Connector, Size 17-28, 28 Socket-Contacts	176-5103-01	176-5103-01	37338
	1W1P8	Connector, Size 17-28, 28 Socket-Contacts	176-5103-01	176-5103-01	37338
	1W1P9	Connector, Size 11-4, 2 Socket-Contacts	182-5010	182-5010	37338
	1W1P10	Connector, Size 11-4, 2 Socket-Contacts	182-5010	182-5010	37338
	1W1P11	Connector, Size 11-4, 2 Socket-Contacts	182-5010	182-5010	37338
	1W1P12	Connector, Size 11-4, 2 Socket-Contacts	182-5010	182-5010	37338
	1W1P13	Connector, Size 11-4, 2 Socket-Contacts	182-5010	182-5010	37338
	1W1P14	Connector, Size 11-4, 2 Socket-Contacts	182-5010	182-5010	37338
	1W1P15	Connector, Size 11-4, 2 Socket-Contacts	182-5010	182-5010	37338
	1W1P16	Connector, Size 11-4, 2 Socket-Contacts	182-5010	182-5010	37338
	1W1P17	Connector, Coaxial, BNC, 50Ω, Crimp	JDP24	225395-7	09482
	1W1P18	Connector, Coaxial, BNC, 50Ω, Crimp	JDP24	225395-7	09482
	1W1P19	Connector, Coaxial, BNC, 50Ω, Crimp	JDP24	225395-7	09482
	1W1P20	Connector, Coaxial, BNC, 50Ω, Crimp	JDP24	225395-7	09482
	1W1P21	Connector, Coaxial, BNC, 50Ω, Crimp	JDP24	225395-7	09482
	1W1P22	Connector, Coaxial, BNC, 50Ω, Crimp	JDP24	225395-7	09482
	1W1P23	Connector, Coaxial, BNC, 50Ω, Crimp	JDP24	225395-7	09482
	1W1P24	Connector, Coaxial, BNC, 50Ω, Crimp	JDP24	225395-7	09482
	1W1P25	Connector, 'D' Sub-Min, 25 Pin-Contacts	176-5102-01	176-5102-01	37338

Table 8-3 Ref Des Index - NAR199 100kW RF Power Module Cabinet (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	1W1P26	Connector, 'D' Sub-Min, 15 Pin-Contacts	176-5101-01	176-5101-01	37338
	1W1XTB1	Fanning Strip, 15 Pin, Left	JT17	15-160A-L	71785
	1W1XTB2	Fanning Strip, 15 Pin, Left	JT17	15-160A-L	71785
	1W2	Same as 1W1			

NOTE: Duplicated reference designations indicate an option exists for that item. Refer to description to determine which item/variation is required for a specific installation.

Table 8-4 Ref Des Index - NAR222 AC/DC Power Supply Cabinet

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
♦	2	AC/DC Power Supply Cabinet, 360-440V	NAR222B/01	176-8880-07	37338
♥	2	AC/DC Power Supply Cabinet, 414-506V	NAR222B/02	176-8880-08	37338
	2A1	Power Supply Control/Monitor PWB	NAPC92/04	See Table 8-15	37338
	2A2	Dc Power Supply	NASR106	See Table 8-16	37338
	2A3	3-Phase Rectifier, Dual	NASR95	See Table 8-18	37338
	2A4	B+ Distribution PWB	NAPX04	See Table 8-19	37338
	2A5	B+ Distribution PWB	NAPX04	See Table 8-19	37338
	2A6	B+ Distribution PWB	NAPX04	See Table 8-19	37338
	2A7	B+ Distribution PWB	NAPX04	See Table 8-19	37338
	2A8	Safety Ground Assembly	176-7200-02	176-7200-02	37338
	2A9	3ø SCR Power Supply Assembly	NAS44/01	See Table 8-20	37338
	2A10	Power Supply Monitor PWB	NAPX15/?	See NAPX15 Manual	37338
	2A11	MOV Assembly	NAX189	See Table 8-21	37338
	2A12	Transformer Assembly, Buck	176-7006	176-7006	37338
	2A12F1	Fuse, 5A, 250V, Slow 3AG	FA14	313005	75915
	2A12T1	Transformer, Control, 1ø, 208-480/24, 75VA	TZ56	PT75MSG	73831
	2B1	Fan, Brushless, 48 VDC, 240CFM, Speed	ZAP22	5920PL-07W-B49-D50	0D1M6
	2B2	Fan, Brushless, 48 VDC, 240CFM, Speed	ZAP22	5920PL-07W-B49-D50	0D1M6
	2B3	Fan, Brushless, 48 VDC, 240CFM, Speed	ZAP22	5920PL-07W-B49-D50	0D1M6
	2B4	Fan, Brushless, 48 VDC, 240CFM, Speed	ZAP22	5920PL-07W-B49-D50	0D1M6
	2B5	Fan, Brushless, 48 VDC, 240CFM, Speed	ZAP22	5920PL-07W-B49-D50	0D1M6
	2CB1	Circuit Breaker, 2-pole, 10A, 1 Amp	SD35	229-2-28755-1	07355
	2CR1	Diode, Power Rectifier, 1600V, 40A, Anode	QN36	40HFR160	81483
	2CR2	Diode, Power Rectifier, 1600V, 40A, Anode	QN36	40HFR160	81483
	2F1	Fuse, 8A, 500V, Time Delay	FD07	FNQ-8	71400
	2F2	Fuse, 30A, 125V, Slow, 3AB	FB42	MDA30	71400
	2F3	Fuse, 30A, 125V, Slow, 3AB	FB42	MDA30	71400
	2F4	Fuse, 30A, 125V, Slow, 3AB	FB42	MDA30	71400
	2F5	Fuse, 30A, 125V, Slow, 3AB	FB42	MDA30	71400
	2F6	Fuse, 30A, 125V, Slow, 3AB	FB42	MDA30	71400
	2F7	Fuse, 30A, 125V, Slow, 3AB	FB42	MDA30	71400
	2F8	Fuse, 10A, 250V, Slow, 3AB	FB37	MDA10	71400
	2F9	Fuse, 10A, 250V, Slow, 3AB	FB37	MDA10	71400
	2F10	Fuse, 15A, 250V, Slow, 3AB	FB38	MDA15	71400
	2F11	Fuse, 30A, 125V, Slow, 3AB	FB42	MDA30	71400
	2F12	Fuse, 15A, 250V, Slow, 3AB	FB38	MDA15	71400
	2F13	Fuse, 15A, 250V, Slow, 3AB	FB38	MDA15	71400
	2F14	Fuse, 8A, 500V, Time Delay	FD07	FNQ-8	71400
	2F15	Fuse, 20A, 500V, Time Delay	FD01	FNQ-20	71400
	2F16	Fuse, 20A, 500V, Time Delay	FD01	FNQ-20	71400
	2F17	Fuse, 20A, 500V, Time Delay	FD01	FNQ-20	71400
	2F18	Fuse, 20A, 500V, Time Delay	FD01	FNQ-20	71400
	2F19	Fuse, 20A, 500V, Time Delay	FD01	FNQ-20	71400
	2F20	Fuse, 20A, 500V, Time Delay	FD01	FNQ-20	71400
	2K1	Contactor, 3PST, 352A, 600V, 220 VAC Coil	KC29	8910SYD368V03	09710
	2K2	Contactor, 3PST, 16A, 600V, 24 VDC Coil	176-7140	176-7140	37338
	2L1	Inductor, Choke, 625uH, 320A, 3.75M Ohms	TG28A	176-7115-01	37338

Table 8-4 Ref Des Index - NAR222 AC/DC Power Supply Cabinet (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	2L2	Inductor, Choke, 625uH, 320A, 3.75M Ohms	TG28A	176-7115-01	37338
	2M1	Meter, Elapsed Time, 10-80Vdc, 0-99999 Hrs	MD14	03618 MODEL 109ET	35104
	2MP1	Wand, Ground	176-6130	176-6130	37338
	2P1	Connector, 'D' Sub-Min, 25 Socket-Contacts	176-5102	176-5102	37338
	2P2	Connector, 'D' Sub-Min, 15 Pin-Contacts	176-5101-01	176-5101-01	37338
	2P3	Connector, Size 17-16, 16 Pin-Contacts	176-5104	176-5104	37338
	2P4	Connector, 'D' Sub-Min, 9 Socket-Contacts	176-5100	176-5100	37338
	2P5	Connector, MTA, Closed End, 12 Pin, 22AWG	JU03	1-640433-2	09482
	2P6	Connector, MTA, Closed End, 8-Pin, 22AWG	JU06	640433-8	09482
	2R1	Resistor, Wirewound, 10 Ohms, 10% 300W	RX15	C300K10R	44655
	2R2	Resistor, Wirewound, 10 Ohms, 10% 300W	RX15	C300K10R	44655
	2R3	Resistor, Wirewound, 10 Ohms, 10% 300W	RX15	C300K10R	44655
	2R4	Resistor, Wirewound, 10 Ohms, 10% 300W	RX15	C300K10R	44655
	2R5	Resistor, Wirewound, 10 Ohms, 10% 300W	RX15	C300K10R	44655
	2R6	Resistor, Wirewound, 10 Ohms, 10% 300W	RX15	C300K10R	44655
	2R7	Resistor, Current Shunt, 50 mV, 800A	RX14	06511	35104
	2R8	Resistor, Wirewound, 20 Ohms, 10% 300W	RX16	C300K20R	44655
	2R9	Resistor, Metal Film, 100K Ohms, 5% 2W	RBP25	GS-3, 100K Ohms	75042
	2R10	Resistor, Wirewound, 1.0 Ohm, 5% 30W	RN36	HL-24-09Z-1 Ohm, 5%	35005
	2R11	Resistor, Wirewound, 5.0 Ohm, 5% 25W	RK04	HL25-06Z 5 Ohm, 5%	35005
	2R12	Resistor, Wirewound, 8200 Ohms, 1%, 5%	RN06	RS5-8200 Ohms-1%	35005
	2R13	Resistor, Wirewound, 8200 Ohms, 1%, 5%	RN06	RS5-8200 Ohms-1%	35005
	2R14	Resistor, Wirewound, 8200 Ohms, 1%, 5%	RN06	RS5-8200 Ohms-1%	35005
	2R15	Resistor, Wirewound, 8200 Ohms, 1%, 5%	RN06	RS5-8200 Ohms-1%	35005
	2RT1	Thermistor, 200K Ohms @ 25°C	RX07	135-204QAG-J01	1BH13
	2RT2	Thermistor, 200K Ohms @ 25°C	RX07	135-204QAG-J01	1BH13
	2RT3	Thermistor, 200K Ohms @ 25°C	RX07	135-204QAG-J01	1BH13
	2RT4	Thermistor, 200K Ohms @ 25°C	RX07	135-204QAG-J01	1BH13
	2S1	Switch Kit	176-5125-01	176-5125-01	37338
	2S2	Switch, Micro, 1PST	SC01	16-188051	04426
♦	2T1	Transformer, Power, 3-Ph, Wye Delta Sec	TZ49	176-7506	37338
♥	2T1	Transformer, Power, 3-Ph, Wye-Delta Sec	TZ50	176-7505	37338
♦	2T2	Transformer, Power, 1-Ph, 400 VAC, 420VA	TZ32A	176-7500	37338
♥	2T2	Transformer, Power, 1-Ph, 460 VAC, 420VA	TZ31A	185-7104	37338
	2TB1	Terminal Block, 9-Pos, Double, 15A	JR01	9-140	71785
	2XF1	Fuseholder, 2 FNQ Fuses	FD02	BM6032SQ	71400
	2XF2	Fuseholder, 1 MDA Fuse	BAP27	HKP	71400
	2XF3	Fuseholder, 1 MDA Fuse	BAP27	HKP	71400
	2XF4	Fuseholder, 1 MDA Fuse	BAP27	HKP	71400
	2XF5	Fuseholder, 1 MDA Fuse	BAP27	HKP	71400
	2XF6	Fuseholder, 1 MDA Fuse	BAP27	HKP	71400
	2XF7	Fuseholder, 1 MDA Fuse	BAP27	HKP	71400
	2XF8	Fuseholder, 2 3AG Fuses	159-3037-04	159-3037-04	37338
	2XF10	Fuseholder, 4 3AG Fuses	159-3037-03	159-3037-03	37338
	2XF15	Fuseholder, 3 Fuses	FC26	2812	71400
	2XF18	Fuseholder, 1 FNQ Fuse	FD08	BM6031SQ	71400
	2XF19	Fuseholder, 1 FNQ Fuse	FD08	BM6031SQ	71400
	2XF20	Fuseholder, 1 FNQ Fuse	FD08	BM6031SQ	71400

Table 8-4 Ref Des Index - NAR222 Ac/Dc Power Supply Cabinet (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE

NOTE: Duplicated reference designations indicate an option exists for that item. Refer to description and/or the use code to determine which item/variation is required for a specific installation.

USE CODE EXPLANATION:

♦ - Denotes item used when 3ø AC power source is between 360 and 440 VAC (line to line), 50/60Hz.

♥ - Denotes item used when 3ø AC power source is between 414 and 506 VAC (line to line), 50/60Hz.

Table 8-5 Ref Des Index - NAC100 100kW Control/Monitor Panel

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	-	Control/Monitor Panel, 100kW	NAC100	176-2200	37338
	A1	Meter Switch/Monitor PWB, 2-Input	NAPD04A/02	176-2020-06	37338
	A1C1	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CLR06BX104KRV	56289
	A1DS1	Not Used			
	A1DS2	Not Used			
	A1DS3	Diode, Light Emitting, Yellow, 8.6mm Lg	QM19	SSL-LX5093YD	1EM90
	A1DS4	Not Used			
	A1DS5	Not Used			
	A1DS6	Not Used			
	A1DS7	Diode, Light Emitting, Yellow, 8.6mm Lg	QM19	SSL-LX5093YD	1EM90
	A1DS8	Not Used			
	A1J1	Connector, 'D' Sub-Min, 15 Pin-Contacts	JS18	DA15P-FRS	63590
	A1R1	Not Used			
	A1R2	Not Used			
	A1R3	Resistor, Metal Film, 182 Ohms, 1% 1/4W	RAB16	MF55D1820F	59124
	A1R4	Not Used			
	A1R5	Not Used			
	A1R6	Not Used			
	A1R7	Resistor, Metal Film, 182 Ohms, 1% 1/4W	RAB16	MF55D1820F	59124
	A1R8	Not Used			
	A1S1	Switch, Push Button, 1PST-NO, Black Knob	SD14	MP01S02CBE	09353
	A2	Meter Switch/Monitor PWB, 8-Input	NAPD04A/01	176-2020-05	37338
	A2C1	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CLR06BX104KRV	56289
	A2DS1	Diode, Light Emitting, Yellow, 8.6mm Lg	QM19	SSL-LX5093YD	1EM90
	A2DS2	Diode, Light Emitting, Yellow, 8.6mm Lg	QM19	SSL-LX5093YD	1EM90
	A2DS3	Diode, Light Emitting, Yellow, 8.6mm Lg	QM19	SSL-LX5093YD	1EM90
	A2DS4	Diode, Light Emitting, Yellow, 8.6mm Lg	QM19	SSL-LX5093YD	1EM90
	A2DS5	Diode, Light Emitting, Yellow, 8.6mm Lg	QM19	SSL-LX5093YD	1EM90
	A2DS6	Diode, Light Emitting, Yellow, 8.6mm Lg	QM19	SSL-LX5093YD	1EM90
	A2DS7	Diode, Light Emitting, Yellow, 8.6mm Lg	QM19	SSL-LX5093YD	1EM90
	A2DS8	Diode, Light Emitting, Yellow, 8.6mm Lg	QM19	SSL-LX5093YD	1EM90
	A2J1	Connector, 'D' Sub-Min, 15 Pin-Contacts	JS18	DA15P-FRS	63590
	A2R1	Resistor, Metal Film, 182 Ohms, 1% 1/4W	RAB16	MF55D1820F	59124
	A2R2	Resistor, Metal Film, 182 Ohms, 1% 1/4W	RAB16	MF55D1820F	59124
	A2R3	Resistor, Metal Film, 182 Ohms, 1% 1/4W	RAB16	MF55D1820F	59124
	A2R4	Resistor, Metal Film, 182 Ohms, 1% 1/4W	RAB16	MF55D1820F	59124
	A2R5	Resistor, Metal Film, 182 Ohms, 1% 1/4W	RAB16	MF55D1820F	59124
	A2R6	Resistor, Metal Film, 182 Ohms, 1% 1/4W	RAB16	MF55D1820F	59124
	A2R7	Resistor, Metal Film, 182 Ohms, 1% 1/4W	RAB16	MF55D1820F	59124
	A2R8	Resistor, Metal Film, 182 Ohms, 1% 1/4W	RAB16	MF55D1820F	59124
	A2S1	Switch, Push Button, 1PST-NO, Black Knob	SD14	MP01S02CBE	09353
	A3	System Controller PWB	NAPC110	See Table 8-6	37338
	A4	Remote Interface PWB	NAPI17	See Table 8-7	37338
	C1	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CLR06BX104KRV	56289
	M1	Meter, 0-800A, 142 Ohms, 1mA FSD	MD45	176-2031	37338
	M2	Meter, 0-400Vdc, 0-200v, 0-80v, 142 Ohms	ME10	176-2009	37338
	M3	Meter, 0-190kW, 142 Ohms, 1mA FSD	MD46	176-2030	37338

Table 8-5 Ref Des Index - NAC100 100kW Control/Monitor Panel (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE

NOTE: Partial reference designation shown. Prefix with 1A1 (composite ref des prefix, including all higher assemblies) to obtain complete reference designation.

Table 8-6 Ref Des Index - NAPC110 System Controller PWB

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	-	System Controller PWB	NAPC110	176-2225	C/7	37338
	C1	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	C/7	56289
	C2	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	D/8	56289
	C3	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	N/8	56289
	C4	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	E/6	96095
	C5	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	C/8	56289
	C6	Capacitor, Ceramic, 18pF, 2%, 100V, NPO	CS40	681-10189	B/8	46897
	C7	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	F/7	56289
	C8	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	C/9	96095
	C9	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	H/7	56289
	C10	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	N/9	56289
	C11	Capacitor, Ceramic, 0.47uF 10% 50V	CCG09	CKR06BX474KRV	D/7	6289
	C12	Capacitor, Ceramic, 18pF, 2%, 100V, NPO	CS40	681-10189	B/8	46897
	C13	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	N/8	56289
	C14	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	F/9	56289
	C15	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV	N/8	56289
	C16	Capacitor, Ceramic, 0.47uF 10% 50V	CCG09	CKR06BX474KRV	E/8	56289
	C17	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	E/6	56289
	C18	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	D/9	96095
	C19	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	D/9	56289
	C20	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	N/9	56289
	C21	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	I/8	56289
	C22	Capacitor, Ceramic, 0.47uF 10% 50V	CCG09	CKR06BX474KRV	O/9	56289
	C23	Capacitor, Ceramic, 1.0uF 10% 50V	CCG10	CKR06BX105KRV	F/9	56289
	C24	Capacitor, Ceramic, 0.47uF 10% 50V	CCG09	CKR06BX474KRV	O/8	56289
	C25	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	E/8	56289
	C26	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	O/8	56289
	C27	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	E/8	96095
	C28	Capacitor, Ceramic, 0.47uF 10% 50V	CCG09	CKR06BX474KRV	F/9	56289
	C29	Capacitor, Ceramic, 0.047uF 10% 100V	CCG06	CKR06BX473KRV	K/9	56289
	C30	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	Q/8	56289
	C31	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	K/7	56289
	C32	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	K/6	56289
	C33	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	M/6	56289
	C34	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	K/2	56289
	C35	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	I/9	56289
	C36	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	K/6	56289
	C37	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	K/5	56289
	C38	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV	P/8	56289
	C39	Capacitor, Tantalum, 47uF, 10%, 20V	CM01	TAP476K020F	P/8	96095
	C40	Capacitor, Tantalum, 47uF, 10%, 20V	CM01	TAP476K020F	P/8	96095
	C41	Capacitor, Tantalum, 47uF, 10%, 20V	CM01	TAP476K020F	P/7	96095
	C42	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	P/9	96095
	C43	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	P/9	96095
	C44	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	P/2	96095
	C45	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	J/8	96095
	C46	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	M/4	96095

Table 8-6 Ref Des Index - NAPC110 System Controller PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	C47	Capacitor, Tantalum, 47uF, 10%, 20V	CM01	TAP476K020F	K/5	96095
	C48	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	M/4	96095
	C49	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	H/7	96095
	C50	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	G/2	96095
	C51	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	I/2	96095
	C52	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	E/3	96095
	C53	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	E/4	96095
	C54	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	I/5	96095
	C55	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	C/4	96095
	C56	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV	P/8	56289
	C57	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	P/8	56289
	C58	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	P/8	56289
	C59	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	P/7	56289
	C60	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	P/9	56289
	C61	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	P/9	56289
	C62	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	K/2	56289
	C63	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	M/6	56289
	C64	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV	D/4	56289
	C65	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV	H/9	56289
	C66	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	M/7	56289
	C67	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	D/5	96095
	C68	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	K/3	56289
	C69	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	H/8	96095
	C70	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	L/9	96095
	C71	Capacitor, Ceramic, 0.47uF 10% 50V	CCG09	CKR06BX474KRV	F/7	56289
	C72	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV	/	56289
	C73	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	P/6	56289
	C74	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	P/6	56289
	C75	Not Used				
	C76	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	P/6	56289
	C77	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	P/7	56289
	C78	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	P/7	56289
	C79	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	P/7	56289
	C80	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	P/7	56289
	C81	Not Used				
	C82	Not Used				
	C83	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	O/5	56289
	C84	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	O/5	56289
	C85	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	N/6	56289
	C86	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV	J/8	56289
	C87	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV	J/9	56289
	C88	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	D/8	56289
	C89	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	E/9	56289
	C90	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	P/3	56289
	C91	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	P/3	56289
	C92	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	P/4	56289
	C93	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	P/4	56289

Table 8-6 Ref Des Index - NAPC110 System Controller PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	C94	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	P/4	56289
	C95	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	N/7	56289
	C96	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	N/6	56289
	C97	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	N/5	56289
	C98	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	N/4	56289
	C99	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	N/5	56289
	C100	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	N/4	56289
	C101	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	N/3	56289
	C102	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	I/3	56289
	C103	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	I/4	56289
	C104	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	G/4	56289
	C105	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	G/4	96095
	C106	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	C/2	56289
	C107	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	F/7	56289
	C108	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	J/1	56289
	C109	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	F/7	56289
	C110	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	H/5	56289
	C111	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	D/4	56289
	C112	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	G/4	56289
	C113	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	D/3	56289
	C114	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	J/2	56289
	C115	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	F/3	56289
	C116	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	G/5	56289
	C117	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	F/4	56289
	C118	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	H/4	56289
	C119	Capacitor, Tantalum, 1uF 35V, 10%, Epoxy	CCF06	199D105X9035AA1	N/3	56289
	C120	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	/	56289
	CR1	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/8	27014
	CR2	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/8	27014
	CR3	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/8	27014
	CR4	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	A/9	27014
	CR5	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	A/8	27014
	CR6	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	P/4	27014
	CR7	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	P/4	27014
	CR8	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	P/5	27014
	CR9	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	P/4	27014
	CR10	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	A/7	27014
	CR11	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/7	27014
	CR12	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	A/9	27014
	CR13	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/6	27014
	CR14	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/7	27014
	CR15	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/6	27014
	CR16	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/6	27014
	CR17	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/6	27014
	CR18	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	F/2	27014
	CR19	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	F/8	27014
	CR20	Diode, Zener, 6.2V, 400mW, 5%	QG07	1N753A	F/8	04713

Table 8-6 Ref Des Index - NAPC110 System Controller PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	CR21	Diode, Hot Carrier	QK09	1N5711	D/7	50434
	CR22	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	F/8	27014
	CR23	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	O/9	27014
	CR24	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	O/9	27014
	CR25	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/7	27014
	CR26	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	E/6	27014
	CR27	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/8	27014
	CR28	Diode, Schottky, 1A, 40V	QS13	1N5819	P/9	04713
	CR29	Diode, Zener, 5.1V, 250mW, 5%	QN04	1N4689	P/10	04713
	CR30	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/5	27014
	CR31	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	A/5	27014
	CR32	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	L/3	27014
	CR33	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/5	27014
	CR34	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	A/5	27014
	CR35	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	L/3	27014
	CR36	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/4	27014
	CR37	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/4	27014
	CR38	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/4	27014
	CR39	Diode, Schottky, 1A, 40V	QS13	1N5819	H/8	04713
	CR40	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	H/8	27014
	CR41	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	L/3	27014
	CR42	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/9	27014
	CR43	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/9	27014
	CR44	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/9	27014
	CR45	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/9	27014
	CR46	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/8	27014
	CR47	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/7	27014
	CR48	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/8	27014
	CR49	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/8	27014
	CR50	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/8	27014
	CR51	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/8	27014
	CR52	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/8	27014
	CR53	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	L/3	27014
	CR54	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	H/3	27014
	CR55	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	P/6	27014
	CR56	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	P/6	27014
	CR57	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	L/8	27014
	CR58	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	L/7	27014
	CR59	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	P/5	27014
	CR60	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	L/6	27014
	CR61	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/9	27014
	CR62	Not Used				
	CR63	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/6	27014
	CR64	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/2	27014
	CR65	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/4	27014
	CR66	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/4	27014
	CR67	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/4	27014

Table 8-6 Ref Des Index - NAPC110 System Controller PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	CR68	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/4	27014
	CR69	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/4	27014
	CR70	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/4	27014
	CR71	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/3	27014
	CR72	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/3	27014
	CR73	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/3	27014
	CR74	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/3	27014
	CR75	Diode, Zener, 4.3V, 400mW, 5%	QK02	1N749A	F/9	04713
	CR76	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/7	27014
	CR77	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/7	27014
	CR78	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/6	27014
	CR79	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/6	27014
	CR80	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/7	27014
	CR81	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/6	27014
	CR82	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/6	27014
	CR83	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/6	27014
	CR84	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/7	27014
	CR85	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/7	27014
	CR86	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/6	27014
	CR87	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/6	27014
	CR88	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/6	27014
	CR89	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/6	27014
	CR90	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/5	27014
	CR91	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/5	27014
	CR92	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/7	27014
	CR93	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/2	27014
	CR94	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/2	27014
	CR95	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/1	27014
	CR96	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/1	27014
	CR97	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/1	27014
	CR98	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/1	27014
	CR99	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	L/1	27014
	CR100	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/1	27014
	CR101	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	L/1	27014
	CR102	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	O/6	27014
	CR103	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	O/5	27014
	CR104	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	O/5	27014
	CR105	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	O/5	27014
	CR106	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	O/5	27014
	CR107	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/6	27014
	CR108	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/6	27014
	CR109	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/6	27014
	CR110	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	O/5	27014
	CR111	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/7	27014
	CR112	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/5	27014
	CR113	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/7	27014
	CR114	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/4	27014

Table 8-6 Ref Des Index - NAPC110 System Controller PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	CR115	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/4	27014
	CR116	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	G/1	27014
	CR117	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/10	27014
	CR118	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	H/1	27014
	CR119	Diode, Power Rectifier, 200V, 1A	QN38	MUR120	D/9	04713
	CR120	Not Used				
	CR121	Not Used				
	CR122	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	O/5	27014
	CR123	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	P/5	27014
	CR124	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	P/5	27014
	CR125	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	P/5	27014
	CR126	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	P/5	27014
	CR127	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/9	27014
	CR128	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/9	27014
	CR129	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/4	27014
	CR130	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/4	27014
	CR131	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/4	27014
	CR132	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/4	27014
	CR133	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/4	27014
	CR134	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	H/1	27014
	CR135	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	G/1	27014
	CR136	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/2	27014
	CR137	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/4	27014
	CR138	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/4	27014
	CR139	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/4	27014
	CR140	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/3	27014
	CR141	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/3	27014
	CR142	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/3	27014
	CR143	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/3	27014
	CR144	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/3	27014
	CR145	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/3	27014
	CR146	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/3	27014
	CR147	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	K/4	27014
	CR148	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	L/8	27014
	CR149	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	-/-	27014
	CR150	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	-/-	27014
	CR151	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	-/-	27014
	DS1	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	K/2	1EM90
	DS2	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	H/2	1EM90
	DS3	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	L/9	1EM90
	DS4	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	M/5	1EM90
	DS5	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	O/8	1EM90
	DS6	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	L/7	1EM90
	DS7	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	M/7	1EM90
	DS8	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	O/7	1EM90
	DS9	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	I/5	1EM90
	DS10	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	O/8	1EM90

Table 8-6 Ref Des Index - NAPC110 System Controller PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	DS11	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	L/5	1EM90
	DS12	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	P/2	1EM90
	DS13	Not Used				
	DS14	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	H/9	1EM90
	DS15	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	J/2	1EM90
	DS16	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	Q/5	1EM90
	DS17	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	P/5	1EM90
	DS18	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	N/5	1EM90
	DS19	Not Used				
	DS20	Not Used				
	DS21	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	I/9	1EM90
	DS22	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	J/5	1EM90
	DS23	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	G/5	1EM90
	DS24	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	O/9	1EM90
	DS25	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	O/9	1EM90
	DS26	Diode, LED, Bicolor, Red & Green	QM16	SSL-LX5093IGW	F/7	1EM90
	E1	Post Shunt, 2 Socket-Contacts 0.10 Centre	JQ15	531220-2	M/5	09482
	J1	Connector, 'D' Sub-Min, 15 Socket-Contacts	JS19	DA15S-FRS	O/10	63590
	J2	Connector, 'D' Sub-Min, 15 Socket-Contacts	JS19	DA15S-FRS	C/10	63590
	J3	Connector, 'D' Sub-Min, 25 Pin-Contacts	JS12	DB25P-FRS	C/1	63590
	J4	Connector, 'D' Sub-Min, 25 Socket-Contacts	JS13	DB25S-FRS	H/1	63590
	J5	Connector, 'D' Sub-Min, 25-Pin-Contacts	JS12	DB25P-FRS	K/1	63590
	J6	Connector, 'D' Sub-Min, 25 Socket-Contacts	JS13	DB25S-FRS	Q/3	63590
	J7	Connector, 'D' Sub-Min, 25 Pin-Contacts	JS12	DB25P-FRS	Q/5	63590
	J8	Connector, 'D' Sub-Min, 15 Pin-Contacts	JS18	DA15P-FRS	Q/8	63590
	K1	Relay, Latching, 5 VDC Coil, 2PDT, 1A	KC26	TQ2-L2-5V	A/4	61529
	L1	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	Q/8	33062
	L2	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	Q/8	33062
	L3	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	Q/8	33062
	L4	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	Q/7	33062
	L5	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	Q/9	33062
	L6	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	P/9	33062
	L7	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	D/8	33062
	LS1	Alarm, Audio Piezoelectric, Sonalert	LP14	SNP428	O/1	90201
	Q1	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	F/8	04713
	Q2	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	F/9	04713
	Q3	Transistor, Field Effect, N Channel	QE19	MPF6661	N/9	04713
	Q4	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	O/9	04713
	Q5	Transistor, Field Effect, N Channel	QE19	MPF6661	E/7	04713
	Q6	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	E/9	04713
	Q7	Transistor, NPN, General Purpose	QAP04	2N2219A	Q/10	04713
	Q8	Transistor, FET, N Channel, 100V, 8A	QR13	IRF520	M/5	81483
	Q9	Transistor, FET, N Channel, 100V, 8A	QR13	IRF520	D/5	81483
	Q10	Transistor, Field Effect, N Channel	QE19	MPF6661	L/3	04713
	Q11	Not Used				
	Q12	Transistor, FET, N Channel, 100V, 8A	QR13	IRF520	H/5	81483
	R1	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	C/7	59124

Table 8-6 Ref Des Index - NAPC110 System Controller PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	R2	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	D/9	59124
	R3	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	E/2	59124
	R4	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	C/7	59124
	R5	Resistor, Metal Film, 1.0M Ohms, 1% 1/4W	RAC13	MF55D1004F	D/5	59124
	R6	Resistor, Metal Film, 1.0M Ohms, 1% 1/4W	RAC13	MF55D1004F	D/5	59124
	R7	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	D/5	59124
	R8	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	E/3	59124
	R9	Resistor, Metal Film, 47.5K Ohms, 1% 1/4W	RAB45	MF55D4752F	D/6	59124
	R10	Resistor, Metal Film, 475 Ohms, 1% 1/4W	RAB21	MF55D4750F	D/8	59124
	R11	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	F/7	59124
	R12	Resistor, Metal Film, 330 Ohms, 5% 2W	RBP10	GS3 330 Ohms	G/8	75042
	R13	Resistor, Metal Film, 475K Ohms, 1% 1/4W	RAC09	MF55D4753F	E/8	59124
	R14	Resistor, Metal Film, 2740 Ohms, 1% 1/4W	RAB30	MF55D2741F	M/8	59124
	R15	Resistor, Metal Film, 221 Ohms, 1% 1/4W	RAB17	MF55D2210F	E/8	59124
	R16	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	B/8	59124
	R17	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	F/9	59124
	R18	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	E/9	59124
	R19	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	M/9	59124
	R20	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	E/8	59124
	R21	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	D/7	59124
	R22	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	E/6	59124
	R23	Resistor, Metal Film, 475 Ohms, 1% 1/4W	RAB21	MF55D4750F	E/9	59124
	R24	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	D/9	59124
	R25	Resistor, Metal Film, 475 Ohms, 1% 1/4W	RAB21	MF55D4750F	D/9	59124
	R26	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	D/8	59124
	R27	Resistor, Metal Film, 68.1K Ohms, 1% 1/4W	RAB47	MF55D6812F	O/9	59124
	R28	Resistor, Metal Film, 1500 Ohms, 1% 1/4W	RAB27	MF55D1501F	N/9	59124
	R29	Resistor, Metal Film, 274K Ohms, 1% 1/4W	RAC06	MF55D2743F	I/8	59124
	R30	Resistor, Metal Film, 121K Ohms, 1% 1/4W	RAC02	MF55D1213F	O/9	59124
	R31	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	O/9	59124
	R32	Resistor, Metal Film, 27.4K Ohms, 1% 1/4W	RAB42	MF55D2742F	E/9	59124
	R33	Resistor, Metal Film, 121K Ohms, 1% 1/4W	RAC02	MF55D1213F	O/8	59124
	R34	Resistor, Metal Film, 182K Ohms, 1% 1/4W	RAC04	MF55D1823F	O/8	59124
	R35	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	I/8	59124
	R36	Resistor, Metal Film, 562K Ohms, 1% 1/4W	RAC10	MF55D5623F	E/7	59124
	R37	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	I/8	59124
	R38	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	K/9	59124
	R39	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	E/9	59124
	R40	Resistor, Metal Film, 100 Ohms, 1% 1/4W	RAB13	MF55D1000F	O/8	59124
	R41	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	F/8	59124
	R42	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	N/9	59124
	R43	Resistor, Metal Film, 47.5 Ohms, 1% 1/4W	RAB09	MF55D47R5F	E/6	59124
	R44	Resistor, Metal Film, 47.5 Ohms, 1% 1/4W	RAB09	MF55D47R5F	F/8	59124
	R45	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	M/8	59124
	R46	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	M/7	59124
	R47	Resistor, Metal Film, 2.21M Ohms, 1% 1/4W	RAC17	MF55D2214F	M/6	59124
	R48	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	P/10	59124

Table 8-6 Ref Des Index - NAPC110 System Controller PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	R49	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	M/5	59124
	R50	Resistor, Metal Film, 475K Ohms, 1% 1/4W	RAC09	MF55D4753F	K/2	59124
	R51	Resistor, Metal Film, 6810 Ohms, 1% 1/4W	RAB35	MF55D6811F	H/8	59124
	R52	Resistor, Metal Film, 47.5K Ohms, 1% 1/4W	RAB45	MF55D4752F	D/4	59124
	R53	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	B/5	59124
	R54	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	B/5	59124
	R55	Resistor, Metal Film, 1.0M Ohms, 1% 1/4W	RAC13	MF55D1004F	H/8	59124
	R56	Resistor, Metal Film, 47.5K Ohms, 1% 1/4W	RAB45	MF55D4752F	H/9	59124
	R57	Resistor, Metal Film, 47.5K Ohms, 1% 1/4W	RAB45	MF55D4752F	D/4	59124
	R58	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	D/4	59124
	R59	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	C/5	59124
	R60	Resistor, Metal Film, 332K Ohms, 1% 1/4W	RAC07	MF55D3323F	H/9	59124
	R61	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	H/9	59124
	R62	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	K/3	59124
	R63	Resistor, Metal Film, 1.0M Ohms, 1% 1/4W	RAC13	MF55D1004F	K/3	59124
	R64	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	C/5	59124
	R65	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	L/10	59124
	R66	Resistor, Metal Film, 1.82M Ohms, 1% 1/4W	RAC16	MF55D1824F	G/7	59124
	R67	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	K/9	59124
	R68	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	L/4	59124
	R69	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	J/7	59124
	R70	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	J/7	59124
	R71	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	J/6	59124
	R72	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	J/6	59124
	R73	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	J/6	59124
	R74	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	J/6	59124
	R75	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	J/5	59124
	R76	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	J/5	59124
	R77	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	L/9	59124
	R78	Resistor, Metal Film, 2210 Ohms, 1% 1/4W	RAB29	MF55D2211F	L/4	59124
	R79	Resistor, Metal Film, 2210 Ohms, 1% 1/4W	RAB29	MF55D2211F	J/7	59124
	R80	Resistor, Metal Film, 2210 Ohms, 1% 1/4W	RAB29	MF55D2211F	J/7	59124
	R81	Resistor, Metal Film, 2210 Ohms, 1% 1/4W	RAB29	MF55D2211F	J/6	59124
	R82	Resistor, Metal Film, 2210 Ohms, 1% 1/4W	RAB29	MF55D2211F	J/6	59124
	R83	Resistor, Metal Film, 2210 Ohms, 1% 1/4W	RAB29	MF55D2211F	J/6	59124
	R84	Resistor, Metal Film, 2210 Ohms, 1% 1/4W	RAB29	MF55D2211F	J/5	59124
	R85	Resistor, Metal Film, 2210 Ohms, 1% 1/4W	RAB29	MF55D2211F	J/5	59124
	R86	Resistor, Metal Film, 2210 Ohms, 1% 1/4W	RAB29	MF55D2211F	L/9	59124
	R87	Resistor, Metal Film, 15K Ohms, 1% 1/4W	RAB39	MF55D1502F	P/6	59124
	R88	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	P/6	59124
	R89	Not Used				
	R90	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	P/6	59124
	R91	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	D/8	59124
	R92	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	P/7	59124
	R93	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	P/7	59124
	R94	Resistor, Metal Film, 15K Ohms, 1% 1/4W	RAB39	MF55D1502F	P/7	59124
	R95	Resistor, Metal Film, 221 Ohms, 1% 1/4W	RAB17	MF55D2210F	H/3	59124

Table 8-6 Ref Des Index - NAPC110 System Controller PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	R96	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	O/6	59124
	R97	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	O/6	59124
	R98	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	M/8	59124
	R99	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	O/5	59124
	R100	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	O/8	59124
	R101	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	O/7	59124
	R102	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	O/7	59124
	R103	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	O/7	59124
	R104	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	H/3	59124
	R105	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	L/9	59124
	R106	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	L/9	59124
	R107	Resistor, Metal Film, 15K Ohms, 1% 1/4W	RAB39	MF55D1502F	L/8	59124
	R108	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	L/7	59124
	R109	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	L/7	59124
	R110	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	L/8	59124
	R111	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	L/7	59124
	R112	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	L/6	59124
	R113	Resistor, Metal Film, 2210 Ohms, 1% 1/4W	RAB29	MF55D2211F	L/9	59124
	R114	Resistor, Metal Film, 2210 Ohms, 1% 1/4W	RAB29	MF55D2211F	L/8	59124
	R115	Resistor, Metal Film, 2210 Ohms, 1% 1/4W	RAB29	MF55D2211F	L/7	59124
	R116	Resistor, Metal Film, 2210 Ohms, 1% 1/4W	RAB29	MF55D2211F	L/5	59124
	R117	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	J/8	59124
	R118	Resistor, Metal Film, 2740 Ohms, 1% 1/4W	RAB30	MF55D2741F	J/9	59124
	R119	Resistor, Metal Film, 1500 Ohms, 1% 1/4W	RAB27	MF55D1501F	J/8	59124
	R120	Resistor, Metal Film, 12.1K Ohms, 1% 1/4W	RAB38	MF55D1212F	J/9	59124
	R121	Resistor, Metal Film, 39.2K Ohms, 1% 1/4W	RAB44	MF55D3922F	F/9	59124
	R122	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	D/8	59124
	R123	Resistor, Metal Film, 475 Ohms, 1% 1/4W	RAB21	MF55D4750F	P/3	59124
	R124	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	P/3	59124
	R125	Resistor, Metal Film, 475 Ohms, 1% 1/4W	RAB21	MF55D4750F	P/3	59124
	R126	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	P/4	59124
	R127	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	P/4	59124
	R128	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	J/9	59124
	R129	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	-/-	59124
	R130	Not Used				
	R131	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	P/3	59124
	R132	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	P/3	59124
	R133	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	O/5	59124
	R134	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	O/4	59124
	R135	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	O/4	59124
	R136	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	O/4	59124
	R137	Resistor, Metal Film, 6810 Ohms, 1% 1/4W	RAB35	MF55D6811F	D/7	59124
	R138	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	E/6	59124
	R139	Resistor, Metal Film, 100 Ohms, 1% 1/4W	RAB13	MF55D1000F	P/6	59124
	R140	Not Used				
	R141	Not Used				
	R142	Not Used				

Table 8-6 Ref Des Index - NAPC110 System Controller PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	R143	Not Used				
	R144	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	I/7	59124
	R145	Not Used				
	R146	Not Used				
	R147	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	L/5	59124
	R148	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	L/5	59124
	R149	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	L/5	59124
	R150	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	L/4	59124
	R151	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	L/4	59124
	R152	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	L/4	59124
	R153	Not Used				
	R154	Resistor, Metal Film, 2210 Ohms, 1% 1/4W	RAB29	MF55D2211F	L/5	59124
	R155	Resistor, Metal Film, 2210 Ohms, 1% 1/4W	RAB29	MF55D2211F	L/4	59124
	R156	Resistor, Metal Film, 15K Ohms, 1% 1/4W	RAB39	MF55D1502F	I/7	59124
	R157	Resistor, Variable, Film, 10K Ohms, 1/2W	RW09	3339P-1-103	G/4	80294
	R158	Resistor, Metal Film, 27.4K Ohms, 1% 1/4W	RAB42	MF55D2742F	G/5	59124
	R159	Resistor, Metal Film, 3320 Ohms, 1% 1/4W	RAB31	MF55D3321F	G/3	59124
	R160	Resistor, Variable, Film, 10K Ohms, 1/2W	RW09	3339P-1-103	G/3	80294
	R161	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	G/5	59124
	R162	Resistor, Metal Film, 182 Ohms, 1% 1/4W	RAB16	MF55D1820F	G/3	59124
	R163	Resistor, Metal Film, 2740 Ohms, 1% 1/4W	RAB30	MF55D2741F	G/2	59124
	R164	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	G/3	59124
	R165	Resistor, Metal Film, 33.2K Ohms, 1% 1/4W	RAB43	MF55D3322F	C/3	59124
	R166	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	C/2	59124
	R167	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	G/7	59124
	R168	Resistor, Metal Film, 2740 Ohms, 1% 1/4W	RAB30	MF55D2741F	G/6	59124
	R169	Resistor, Metal Film, 221 Ohms, 1% 1/4W	RAB17	MF55D2210F	E/5	59124
	R170	Resistor, Metal Film, 825 Ohms, 1% 1/4W	RAB24	MF55D8250F	C/3	59124
	R171	Resistor, Metal Film, 681 Ohms, 1% 1/4W	RAB23	MF55D6810F	C/2	59124
	R172	Resistor, Metal Film, 475K Ohms, 1% 1/4W	RAC09	MF55D4753F	I/3	59124
	R173	Resistor, Metal Film, 475K Ohms, 1% 1/4W	RAC09	MF55D4753F	I/4	59124
	R174	Resistor, Metal Film, 475K Ohms, 1% 1/4W	RAC09	MF55D4753F	J/1	59124
	R175	Resistor, Metal Film, 1500 Ohms, 1% 1/4W	RAB27	MF55D1501F	G/5	59124
	R176	Resistor, Metal Film, 6810 Ohms, 1% 1/4W	RAB35	MF55D6811F	C/3	59124
	R177	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	F/7	59124
	R178	Resistor, Metal Film, 392 Ohms, 1% 1/4W	RAB20	MF55D3920F	G/3	59124
	R179	Resistor, Metal Film, 681 Ohms, 1% 1/4W	RAB23	MF55D6810F	F/3	59124
	R180	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	F/6	59124
	R181	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	F/3	59124
	R182	Resistor, Metal Film, 2740 Ohms, 1% 1/4W	RAB30	MF55D2741F	C/2	59124
	R183	Resistor, Metal Film, 3.32M Ohms, 1% 1/4W	RAC19	MF55D3324F	F/3	59124
	R184	Resistor, Metal Film, 1.0M Ohms, 1% 1/4W	RAC13	MF55D1004F	H/4	59124
	R185	Resistor, Metal Film, 1.0M Ohms, 1% 1/4W	RAC13	MF55D1004F	H/6	59124
	R186	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	C/3	59124
	R187	Resistor, Metal Film, 3.32M Ohms, 1% 1/4W	RAC19	MF55D3324F	F/4	59124
	R188	Resistor, Metal Film, 3320 Ohms, 1% 1/4W	RAB31	MF55D3321F	C/3	59124
	R189	Resistor, Variable, Film, 1000 Ohms, 1/2W	RV06	3339P-1-102	C/3	80294

Table 8-6 Ref Des Index - NAPC110 System Controller PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	R190	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	D/2	59124
	R191	Resistor, Metal Film, 3320 Ohms, 1% 1/4W	RAB31	MF55D3321F	D/2	59124
	R192	Resistor, Variable, Film, 1000 Ohms, 1/2W	RV06	3339P-1-102	D/2	80294
	R193	Resistor, Variable, Film, 10K Ohms, 1/2W	RW09	3339P-1-103	H/5	80294
	R194	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	P/4	59124
	R195	Resistor, Metal Film, 6810 Ohms, 1% 1/4W	RAB35	MF55D6811F	P/4	59124
	R196	Resistor, Metal Film, 8250 Ohms, 1% 1/4W	RAB36	MF55D8251F	H/5	59124
	R197	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	N/3	59124
	R198	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	/	59124
	S1	Switch, Push Button, Mom, SPDT LED- Amber	SD18	MP01S125CBE	A/6	09353
	S2	Switch, Push Button, Mom, SPDT LED- Amber	SD18	MP01S125CBE	B/6	09353
	S3	Switch, Push Button, Mom, SPDT LED- Amber	SD18	MP01S125CBE	A/9	09353
	S4	Switch, Push Button, Mom, SPDT LED- Amber	SD18	MP01S125CBE	A/8	09353
	S5	Switch, Push Button, Mom, SPDT LED- Amber	SD18	MP01S125CBE	A/7	09353
	S6	Switch, Push Button, Mom, SPDT LED- Amber	SD18	MP01S125CBE	B/3	09353
	S7	Switch, Push Button, Mom, SPDT LED- Amber	SD18	MP01S125CBE	A/3	09353
	S8	Switch, Push Button, Mom, SPDT LED- Amber	SD18	MP01S125CBE	B/1	09353
	S9	Switch, Pushbutton, Red, Mom, 1PST-NO LED	SD15	MP01S135CBE	A/1	09353
	S10	Switch, Push Button, Mom, SPDT LED- Amber	SD18	MP01S125CBE	E/2	09353
	S11	Switch, Push Button, Mom, SPDT LED- Amber	SD18	MP01S125CBE	E/3	09353
	S12	Switch, Push Button, Mom, SPDT LED- Amber	SD18	MP01S125CBE	B/4	09353
	S13	Switch, Push Button, Mom, SPDT LED- Amber	SD18	MP01S125CBE	A/4	09353
	S14	Switch, Push Button, Mom, SPDT LED- Amber	SD18	MP01S125CBE	L/2	09353
	S15	Switch, Push Button, Mom, SPDT LED- Amber	SD18	MP01S125CBE	G/2	09353
	S16	Switch, Push Button, Mom, SPDT LED- Amber	SD18	MP01S125CBE	E/4	09353
	S17	Switch, Keypad, Mom, NO, SPST	SD09	JB15FP	M/9	63426
	U1	IC, Programmed Microcontroller	190-5019	190-5019	C/9	37338
	U2	IC, Operational Amplifier, Dual	UW38	TL082CP	N/8	01295
	U3	Not Used				
	U4	IC, Programmed, GAL	190-5020	190-5020	E/8	37338
	U5	IC, CMOS, Hex Schmitt Trigger Inverter	UG05	MC74HC14AN	H/7	04713
	U6	IC, CMOS, Hex Schmitt Trigger Inverter	UG05	MC74HC14AN	E/7	04713
	U7	Not Used				
	U8	IC, CMOS, Analog Multiplexer, 8 Input	UF09	MC74HC4051N	F/4	04713
	U9	IC, CMOS, Analog Multiplexer, 8 Input	UF09	MC74HC4051N	F/5	04713
	U10	IC, CMOS, Dual D Flip-Flop	UX13	MC74HC74N	K/2	04713
	U11	IC, CMOS, Binary Ripple Counter, 4-Bit Dual	UW07	MC74HC393N	H/6	04713
	U12	IC, CMOS, Decoder/Demultiplexer, 1 of 8	UM07	MC74HC138AN	H/4	04713
	U13	Not Used				
	U14	Resistor Network, SIP, 7x220Ω, 2% Bussed	UW11	4608X-101-221	B/7	80294
	U15	Resistor Network, SIP, 7x220Ω, 2% Bussed	UW11	4608X-101-221	B/3	80294
	U16	IC, 2.5V Reference, Low Power	UF01	AD680JT	N/8	45496
	U17	Not Used				
	U18	IC, Operational Amplifier, Quad	UT01	TL084IN	K/7	01295
	U19	IC, Operational Amplifier, Quad	UT01	TL084IN	K/6	01295
	U20	IC, Operational Amplifier, Quad	UT01	TL084IN	M/7	01295
	U21	Not Used				

Table 8-6 Ref Des Index - NAPC110 System Controller PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	U22	Not Used				
	U23	IC, CMOS, D Flip-Flop, 3 State Output, Octal	UW06	MC74HC574AN	O/6	04713
	U24	IC, Operational Amplifier, Quad	UT01	TL084IN	N/7	01295
	U25	IC, Operational Amplifier, Quad	UT01	TL084IN	N/6	01295
	U26	IC, Operational Amplifier, Quad	UT01	TL084IN	N/5	01295
	U27	IC, Operational Amplifier, Quad	UT01	TL084IN	N/4	01295
	U28	Not Used				
	U29	Not Used				
	U30	IC, Comparator, Quad	UL02	MC3302L	I/9	04713
	U31	Not Used				
	U32	IC, CMOS, D Flip-Flop, 3 State Output, Octal	UW06	MC74HC574AN	O/3	04713
	U33	IC, CMOS, Inverter, Schmitt Trigger, Hex	UG05	MC74HC14AN	J/2	04713
	U34	Not Used				
	U35	IC, Operational Amplifier, Quad	UT01	TL084IN	D/3	01295
	XE1	Header Mod, Single - 3 PIN	161-3008-03	161-3008-03	-/-	37338
	XU1	Socket, Integrated Circuit, 28-Pin	UD38	1828AG111D	-/-	91506
	XU2	Socket, DIP, 8 Socket-Contacts	UC01	2-641260-1	-/-	00779
	XU3	Not Used				
	XU4	Socket, DIP, 24 Socket-Contacts	UR25	2-641932-1	-/-	00779
	XU5	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	-/-	00779
	XU6	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	-/-	00779
	XU7	Not Used				
	XU8	Socket, 16 Socket-Contacts	UC03	2-641262-1	-/-	00779
	XU9	Socket, 16 Socket-Contacts	UC03	2-641262-1	-/-	00779
	XU10	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	-/-	00779
	XU11	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	-/-	00779
	XU12	Socket, DIP, 16 Socket-Contacts	UC03	2-641262-1	-/-	00779
	XU13	Not Used				
	XU14	Not Used				
	XU15	Not Used				
	XU16	Not Used				
	XU17	Not Used				
	XU18	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	-/-	00779
	XU19	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	-/-	00779
	XU20	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	-/-	00779
	XU21	Not Used				
	XU22	Not Used				
	XU23	Socket, DIP, 20 Socket-Contacts	UD36	2-641264-3	-/-	00779
	XU24	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	-/-	00779
	XU25	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	-/-	00779
	XU26	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	-/-	00779
	XU27	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	-/-	00779
	XU28	Not Used				
	XU29	Not Used				
	XU30	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	-/-	00779
	XU31	Not Used				
	XU32	Socket, DIP, 20 Socket-Contacts	UD36	2-641264-3	-/-	00779

Table 8-6 Ref Des Index - NAPC110 System Controller PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	XU33	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	-/-	00779
	XU34	Not Used				
	XU35	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	-/-	00779
	Y1	Crystal, 12MHz, Short	XA40	AS-12.000000-18	B/8	RALTRO

NOTE: Partial reference designation shown. Prefix with 1A1A3 (composite ref des prefix, including all higher assemblies) to obtain complete reference designation.

Table 8-7 Ref Des Index - NAPI17 Remote Interface PWB

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	-	Remote Interface PWB	NAPI17	176-4015	-/-	37338
	BT1	Battery, Alkaline, 1.5V, Size AA	BT23	PC1500	B/6	09569
	BT2	Battery, Alkaline, 1.5V, Size AA	BT23	PC1500	A/5	09569
	BT3	Battery, Alkaline, 1.5V, Size AA	BT23	PC1500	B/5	09569
	C1	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	N/3	56289
	C2	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	N/2	56289
	C3	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	O/2	56289
	C4	Not Used				
	C5	Not Used				
	C6	Not Used				
	C7	Not Used				
	C8	Not Used				
	C9	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	M/2	56289
	C10	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	N/2	56289
	C11	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	L/2	56289
	C12	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	H/4	56289
	C13	Capacitor, Electrolytic, 1000uF, 35V	CCD29	226J102P035XX	L/3	14655
	C14	Not Used				
	C15	Not Used				
	C16	Not Used				
	C17	Not Used				
	C18	Not Used				
	C19	Not Used				
	C20	Not Used				
	C21	Not Used				
	C22	Not Used				
	C23	Not Used				
	C24	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	A/3	56289
	C25	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	A/3	56289
	C26	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	B/3	56289
	C27	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	B/3	56289
	C28	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/3	56289
	C29	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/3	56289
	C30	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/3	56289
	C31	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	D/3	56289
	C32	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	D/3	56289
	C33	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	E/3	56289
	C34	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	E/3	56289
	C35	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	E/3	56289
	C36	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	N/3	56289
	C37	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	F/4	56289
	C38	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	M/3	56289
	C39	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	O/3	56289
	C40	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	M/2	56289
	C41	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	I/3	56289
	C42	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	I/3	56289
	C43	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	I/3	56289

Table 8-7 Ref Des Index - NAPI17 Remote Interface PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	C44	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	K/3	56289
	C45	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	K/3	56289
	C46	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	G/3	56289
	C47	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	H/3	56289
	C48	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	K/3	56289
	C49	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	K/3	56289
	C50	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	H/3	56289
	C51	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	J/3	56289
	C52	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	J/3	56289
	C53	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	I/3	56289
	C54	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	H/3	56289
	C55	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	G/3	56289
	C56	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	J/3	56289
	C57	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	H/3	56289
	C58	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	G/3	56289
	C59	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	G/3	56289
	C60	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	K/3	56289
	C61	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	G/3	56289
	C62	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	J/3	56289
	C63	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	J/3	56289
	C64	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	H/3	56289
	C65	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	I/3	56289
	C66	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	H/4	56289
	CR1	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	H/4	27014
	CR2	Not Used				
	CR3	Not Used				
	CR4	Not Used				
	CR5	Not Used				
	CR6	Not Used				
	CR7	Not Used				
	CR8	Not Used				
	CR9	Not Used				
	CR10	Not Used				
	CR11	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	M/5	27014
	CR12	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	A/3	27014
	CR13	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/3	27014
	CR14	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/3	27014
	CR15	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/3	27014
	CR16	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/3	27014
	CR17	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/3	27014
	CR18	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/3	27014
	CR19	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/3	27014
	CR20	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/3	27014
	CR21	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	E/3	27014
	CR22	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	E/3	27014
	CR23	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	F/3	27014
	CR24	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	M/5	27014

Table 8-7 Ref Des Index - NAPI17 Remote Interface PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	CR25	Diode, Zener, 39V, 1.5W, 2%	QK03	1N5939C	G/3	04713
	CR26	Diode, Zener, 39V, 1.5W, 2%	QK03	1N5939C	H/3	04713
	CR27	Diode, Zener, 39V, 1.5W, 2%	QK03	1N5939C	J/3	04713
	CR28	Diode, Zener, 39V, 1.5W, 2%	QK03	1N5939C	J/5	04713
	E1	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	A/2	09482
	E2	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	A/2	09482
	E3	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	A/2	09482
	E4	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	B/2	09482
	E5	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	B/2	09482
	E6	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	B/2	09482
	E7	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	B/2	09482
	E8	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	B/2	09482
	E9	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	C/2	09482
	E10	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	C/2	09482
	E11	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	C/2	09482
	E12	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	C/2	09482
	E13	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	C/2	09482
	E14	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	D/2	09482
	E15	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	D/2	09482
	E16	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	D/2	09482
	E17	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	D/2	09482
	E18	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	D/2	09482
	E19	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	E/2	09482
	E20	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	E/2	09482
	E21	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	E/2	09482
	E22	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	E/2	09482
	E23	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	E/2	09482
	E24	Post Shunt, 2 Socket-Contacts, 0.1 Centre	JQ15	531220-2	F/2	09482
	J1	Connector, 'D' Sub-Min, 25 Socket-Contacts	JS13	DB25S-FRS	J/6	63590
	J2	Connector, 'D' Sub-Min, 25 Pin-Contacts	JS12	DB25P-FRS	G/6	63590
	J3	Connector, 'D' Sub-Min, 25 Socket-Contacts	JS13	DB25S-FRS	B/6	63590
	J4	Connector, Coaxial, BNC, PWB Mount	JF35	R141426161	O/5	0GP12
	J5	Connector, Coaxial, BNC, PWB Mount	JF35	R141426161	O/4	0GP12
	J6	Connector, Coaxial, BNC, PWB Mount	JF35	R141426161	L/6	0GP12
	K1	Relay, 5 VDC Coil, 2PDT, 1A	KC18	TQ2E-5V	M/5	61529
	K2	Relay, 5 VDC Coil, 2PDT, 1A	KC18	TQ2E-5V	N/5	61529
	L1	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	L/3	33062
	L2	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	L/3	33062
	L3	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	0/3	33062
	Q1	Not Used				
	Q2	Not Used				
	R1	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	L/3	59124
	R2	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	M/3	59124
	R3	Resistor, Metal Film, 3320 Ohms, 1% 1/4W	RAB31	MF55D3321F	H/5	59124
	R4	Not Used				
	R5	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	I/4	59124
	R6	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	N/2	59124

Table 8-7 Ref Des Index - NAPI17 Remote Interface PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	R7	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	N/2	59124
	R8	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	O/2	59124
	R9	Not Used				
	R10	Not Used				
	R11	Not Used				
	R12	Not Used				
	R13	Not Used				
	R14	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	M/2	59124
	R15	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	M/2	59124
	R16	Resistor, Variable, Film, 100 Ohms, 2W	RV41	3852A-162-101A	M/5	80294
	R17	Resistor, Variable, Film, 100 Ohms, 2W	RV41	3852A-162-101A	N/5	80294
	R18	Resistor, Variable, Film, 100 Ohms, 2W	RV41	3852A-162-101A	N/5	80294
	R19	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	A/2	59124
	R20	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	A/2	59124
	R21	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	A/2	59124
	R22	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	B/2	59124
	R23	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	B/2	59124
	R24	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	B/2	59124
	R25	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	B/2	59124
	R26	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	B/2	59124
	R27	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	C/2	59124
	R28	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	C/2	59124
	R29	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	C/2	59124
	R30	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	C/2	59124
	R31	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	C/2	59124
	R32	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	D/2	59124
	R33	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	D/2	59124
	R34	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	D/2	59124
	R35	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	D/2	59124
	R36	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	D/2	59124
	R37	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	E/2	59124
	R38	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	E/2	59124
	R39	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	E/2	59124
	R40	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	E/2	59124
	R41	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	E/2	59124
	R42	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	F/2	59124
	R43	Not Used				
	R44	Not Used				
	R45	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	E/4	59124
	R46	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	I/2	59124
	R47	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	I/2	59124
	R48	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	I/2	59124
	R49	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	K/2	59124
	R50	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	K/2	59124
	R51	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	G/2	59124
	R52	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	H/2	59124
	R53	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	K/2	59124

Table 8-7 Ref Des Index - NAPI17 Remote Interface PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	R54	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	K/2	59124
	R55	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	H/2	59124
	R56	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	J/2	59124
	R57	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	J/2	59124
	R58	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	I/2	59124
	R59	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	H/2	59124
	R60	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	G/2	59124
	R61	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	J/2	59124
	R62	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	H/2	59124
	R63	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	G/2	59124
	R64	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	G/2	59124
	R65	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	K/2	59124
	R66	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	K/2	59124
	R67	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	J/2	59124
	R68	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	J/2	59124
	R69	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	H/2	59124
	R70	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	C/4	59124
	R71	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	H/4	59124
	R72	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	I/2	59124
	R73	Resistor, Metal Film, 1.0M Ohms, 1% 1/4W	RAC13	MF55D1004F	B/4	59124
	R74	Resistor, Metal Film, 1.0M Ohms, 1% 1/4W	RAC13	MF55D1004F	B/4	59124
	R75	Resistor, Metal Film, 1.0M Ohms, 1% 1/4W	RAC13	MF55D1004F	C/4	59124
	RT1	Thermistor, PTC, 0.12Ω, Trip @ 2.3A	RT17	RXE110	L/2	06090
	TB1	Terminal Block, 15 Terminals	176-4017-15	176-4017-15	L/1	37338
	TB2	Terminal Block, 27 Terminals	176-4017-27	176-4017-27	A/1	37338
	TB3	Terminal Block, 27 Terminals	176-4017-27	176-4017-27	G/1	37338
	U1	IC, Operational Amplifier, Quad	UT01	TL084IN	N/3	01295
	U2	IC, CMOS, Inverter, Schmitt Trigger, Hex	UG05	MC74HC14AN	H/4	04713
	U3	IC, Operational Amplifier, Dual, Common Vcc	UM26	MC33072AU	M/3	04713
	U4	IC, Transistor Array, 8 Darlingtons	UM28	ULN2803A	H/3	04713
	U5	IC, Transistor Array, 8 Darlingtons	UM28	ULN2803A	I/3	04713
	U6	IC, Transistor Array, 8 Darlingtons	UM28	ULN2803A	K/3	04713
	U7	IC, Opto Coupler, Quad	UP37	ILQ32	A/4	37903
	U8	IC, Opto Coupler, Quad	UP37	ILQ32	C/4	37903
	U9	IC, Opto Coupler, Quad	UP37	ILQ32	D/4	37903
	U10	IC, Transistor Array, 8 Darlingtons	UM28	ULN2803A	I/4	04713
	XBT1	Holder, Battery, 3 AA Batteries	BA13	BH3AA-PC	B/5	65249
	XE1	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	A/2	37338
	XE2	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	A/2	37338
	XE3	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	A/2	37338
	XE4	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	B/2	37338
	XE5	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	B/2	37338
	XE6	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	B/2	27338
	XE7	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	B/2	37338
	XE8	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	B/2	37338
	XE9	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	C/2	37338
	XE10	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	C/2	37338

Table 8-7 Ref Des Index - NAPI17 Remote Interface PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	XE11	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	C/2	37338
	XE12	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	C/2	37338
	XE13	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	C/2	37338
	XE14	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	D/2	37338
	XE15	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	D/2	37338
	XE16	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	D/2	37338
	XE17	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	D/2	37338
	XE18	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	D/2	37338
	XE19	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	E/2	37338
	XE20	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	E/2	37338
	XE21	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	E/2	37338
	XE22	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	E/2	37338
	XE23	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	E/2	37338
	XE24	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	F/2	37338
	XU1	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	N/3	00779
	XU2	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	H/4	00779
	XU3	Socket, DIP, 8 Socket-Contacts	UC01	2-641260-1	M/3	00779
	XU4	Socket, DIP, 18 Socket-Contacts	UD35	2-641263-3	H/3	00779
	XU5	Socket, DIP, 18 Socket-Contacts	UD35	2-641263-3	I/3	00779
	XU6	Socket, DIP, 18 Socket-Contacts	UD35	2-641263-3	K/3	00779
	XU7	Socket, DIP, 16 Socket-Contacts	UC03	2-641262-1	A/4	00779
	XU8	Socket, DIP, 16 Socket-Contacts	UC03	2-641262-1	C/4	00779
	XU9	Socket, DIP, 16 Socket-Contacts	UC03	2-641262-1	D/4	00779
	XU10	Socket, DIP, 18 Socket-Contacts	UD35	2-641263-3	I/4	00779

NOTE: Partial reference designation shown. Prefix with 1A1A4 (composite ref des prefix, including all higher assemblies) to obtain complete reference designation.

Table 8-8 Ref Des Index - NAPI31 Exciter Interface PWB

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	-	Exciter Interface PWB	NAPI31A	176-3040-01	-/-	37338
	C1	Capacitor, Ceramic, 0.47uF, 10% 50V	CCG09	CKR06BX474KRV	A/5	56289
	C2	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/9	56289
	C3	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/5	96095
	C4	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/8	56289
	C5	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/6	56289
	C6	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	D/11	56289
	C7	Capacitor, Ceramic, 0.01uF, 10% 100V	CCG04	CKR05BX103KRV	A/5	56289
	C8	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/7	56289
	C9	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	C/11	96095
	C10	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	E/11	96095
	C11	Not Used	-		D/7	
	C12	Capacitor, Electrolytic, 820uF, 100V	CT05	82D821M100JC2D	A/14	56289
	C13	Capacitor, Electrolytic, 820uF, 100V	CT05	82D821M100JC2D	A/3	56289
	C14	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	A/9	96095
	C15	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/10	96095
	C16	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/10	96095
	C17	Capacitor, Electrolytic, 820uF, 100V	CT05	82D821M100JC2D	B/11	56289
	C18	Capacitor, Tantalum, 47uF, 10%, 20V	CM01	TAP476K020F	B/11	96095
	C19	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/6	96095
	C20	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/6	96095
	C21	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/6	96095
	C22	Capacitor, Electrolytic, 820uF, 100V	CT05	82D821M100JC2D	B/7	56289
	C23	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/10	56289
	C24	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	A/11	96095
	C25	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	A/11	96095
	C26	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	A/11	96095
	C27	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	A/12	96095
	C28	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	A/7	96095
	C29	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	A/7	96095
	C30	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	A/7	96095
	C31	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	A/8	96095
	C32	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	C/10	96095
	C33	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	E/11	96095
	C34	Capacitor, Electrolytic, 8200uF, 35V	CX13	82DA822M035JC2D	E/14	62643
	C35	Capacitor, Electrolytic, 8200uF, 35V	CX13	82DA822M035JC2D	E/13	62643
	C36	Capacitor, Electrolytic, 8200uF, 35V	CX13	82DA822M035JC2D	D/4	62643
	C37	Capacitor, Electrolytic, 8200uF, 35V	CX13	82DA822M035JC2D	D/3	62643
	C38	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	C/7	96095
	C39	Not Used				
	C40	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	E/11	56289
	C41	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/11	56289
	C42	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	D/10	96095
	C43	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	D/12	56289
	C44	Not Used				
	C45	Not Used				
	C46	Capacitor, Tantalum, 47uF, 10%, 20V	CM01	TAP476K020F	B/15	96095
	C47	Capacitor, Ceramic, 0.001uF, 10% 200V	CCG01	CKR05BX102KRV	-/-	56289

Table 8-8 Ref Des Index - NAPI31 Exciter Interface PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	CR1	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/14	27014
	CR2	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/5	27014
	CR3	Not Used				
	CR4	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/14	27014
	CR5	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/3	27014
	CR6	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/15	27014
	CR7	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/4	27014
	CR8	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/14	27014
	CR9	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/3	27014
	CR10	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	E/12	27014
	CR11	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	E/2	27014
	CR12	Diode, Zener, 39V, 1.5W, 2%	QK03	1N5939C	C/12	04713
	CR13	Diode, Zener, 5.1V, 1W, 5%	QM07	1N4733A	C/7	04713
	CR14	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/14	27014
	CR15	Diode, Hot Carrier	QK09	1N5711	B/6	50434
	CR16	Diode, Hot Carrier	QK09	1N5711	B/6	50434
	CR17	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	E/10	27014
	CR18	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/8	27014
	CR19	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/9	27014
	CR20	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/15	27014
	CR21	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/4	27014
	CR22	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/14	27014
	CR23	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/4	27014
	CR24	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/15	27014
	CR25	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/4	27014
	CR26	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/5	27014
	CR27	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/15	27014
	CR28	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/15	27014
	CR29	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	E/15	27014
	CR30	Diode, Hot Carrier	QK09	1N5711	D/10	50434
	CR31	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/12	27014
	CR32	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/15	27014
	CR33	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/10	27014
	DS1	Not Used				
	DS2	Diode, Light Emitting, Green, 8.6mm Lg	QM20	SSL-LX5093GD	D/8	1EM90
	E1	Post Shunt, 2 Socket Contacts, 0.1 Centre	JQ15	531220-2	A/2	09482
	E2	Post Shunt, 2 Socket Contacts, 0.1 Centre	JQ15	531220-2	A/2	09482
	J1	Connector, 'D' Sub-Min, 25 Pin-Contacts	JS12	DB25P-FRS	B/16	63590
	J2	Connector, 'D' Sub-Min, 25 Pin-Contacts	JS12	DB25P-FRS	A/15	63590
	J3	Connector, 'D' Sub-Min, 25 Socket-Contacts	JS13	DB25S-FRS	A/9	63590
	J4	Connector, 'D' Sub-Min, 25 Pin-Contacts	JS12	DB25P-FRS	A/3	63590
	J5	Connector, 'D' Sub-Min, 25 Socket-Contacts	JS13	DB25S-FRS	A/6	63590
	J6	Connector, 'D' Sub-Min, 25 Socket-Contacts	JS13	DB25S-FRS	E/13	63590
	J7	Connector, 'D' Sub-Min, 25 Socket-Contacts	JS13	DB25S-FRS	E/4	63590
	J8	Connector, 'D' Sub-Min, 25 Pin-Contacts	JS12	DB25P-FRS	A/1	63590
	J9	Connector, 'D' Sub-Min, 25 Socket-Contacts	JS13	DB25S-FRS	E/1	63590
	J10	Connector, 'D' Sub-Min, 25 Socket-Contacts	JS13	DB25S-FRS	D/16	63590
	J11	Connector, Coaxial, BNC, PWB Mount	JF35	R141426161	A/5	0GP12

Table 8-8 Ref Des Index - NAPI31 Exciter Interface PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	J12	Connector, Coaxial, BNC, PWB Mount	JF35	R141426161	A/12	0GP12
	J13	Connector, Coaxial, BNC, PWB Mount	JF35	R141426161	A/4	0GP12
	J14	Header, SIP, 4 Pin-Contacts, 0.1 Centre	161-3008-04	161-3008-04	D/2	37338
	J15	Header, SIP, 4 Pin-Contacts, 0.1 Centre	161-3008-04	161-3008-04	A/2	37338
	K1	Relay, 24 VDC Coil, 4PDT, 5A	KC14	MY4-DC24	B/8	34361
	K2	Relay, 24 VDC Coil, 4PDT, 5A	KC14	MY4-DC24	B/9	34361
	K3	Relay, 5 VDC Coil, 2PDT, 1A	KC18	TQ2E-5V	C/14	61529
	K4	Relay, 5 VDC Coil, 2PDT, 1A	KC18	TQ2E-5V	C/15	61529
	K5	Relay, 5 VDC Coil, 2PDT, 1A	KC18	TQ2E-5V	D/15	61529
	K6	Relay, 5 VDC Coil, 2PDT, 1A	KC18	TQ2E-5V	E/15	61529
	K7	Relay, 5 VDC Coil, 2PDT, 1A	KC18	TQ2E-5V	E/10	61529
	L1	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/13	33062
	L2	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/4	33062
	L3	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	A/9	33062
	L4	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	A/6	33062
	L5	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	A/10	33062
	L6	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	A/6	33062
	L7	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	A/10	33062
	L8	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	A/6	33062
	L9	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	A/10	33062
	L10	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/6	33062
	L11	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/11	33062
	L12	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/7	33062
	L13	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/11	33062
	L14	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/7	33062
	L15	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/11	33062
	L16	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/7	33062
	L17	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/12	33062
	L18	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	A/8	33062
	L19	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	C/9	33062
	L20	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	E/10	33062
	L21	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	E/14	33062
	L22	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	D/12	33062
	L23	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	C/5	33062
	L24	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	C/4	33062
	L25	Not Used				
	Q1	Transistor, Field Effect, P Channel	QM21	2N5116	E/1	17856
	Q2	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	A/5	04713
	Q3	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	B/4	04713
	R1	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	A/12	59124
	R2	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	A/12	59124
	R3	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	A/12	59124
	R4	Resistor, Metal Film, 100 Ohms, 2% 1/2W	RAP05	RL20S101G	B/6	35005
	R5	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	D/1	59124
	R6	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	B/4	59124
	R7	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	B/3	59124
	R8	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	B/3	59124

Table 8-8 Ref Des Index - NAPI31 Exciter Interface PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	R9	Resistor, Variable, Film, 100 Ohms, 1/2W	RW34	3339P-1-101	A/5	80294
	R10	Not Used				
	R11	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	D/1	59124
	R12	Resistor, Metal Film, 12.1K Ohms, 1% 1/4W	RAB38	MF55D1212F	B/5	59124
	R13	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	B/5	59124
	R14	Resistor, Metal Film, 33.2K Ohms, 1% 1/4W	RAB43	MF55D3322F	B/5	59124
	R15	Resistor, Metal Film, 18.2K Ohms, 1% 1/4W	RAB40	MF55D1822F	B/5	59124
	R16	Resistor, Metal Film, 56.2K Ohms, 1% 1/4W	RAB46	MF55D5622F	B/6	59124
	R17	Resistor, Metal Film, 2210 Ohms, 1% 1/4W	RAB29	MF55D2211F	B/5	59124
	R18	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	C/12	59124
	R19	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	E/12	59124
	R20	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	B/5	59124
	R21	Resistor, Metal Film, 8250 Ohms, 1% 1/4W	RAB36	MF55D8251F	C/5	59124
	R22	Resistor, Metal Film, 1.0M Ohms, 1% 1/4W	RAC13	MF55D1004F	C/11	59124
	R23	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	C/11	59124
	R24	Resistor, Metal Film, 1.0M Ohms, 1% 1/4W	RAC13	MF55D1004F	E/11	59124
	R25	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	E/11	59124
	R26	Resistor, Metal Film, 33.2K Ohms, 1% 1/4W	RAB43	MF55D3322F	C/6	59124
	R27	Resistor, Metal Film, 2740 Ohms, 1% 1/4W	RAB30	MF55D2741F	C/6	59124
	R28	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	C/6	59124
	R29	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	B/4	59124
	R30	Resistor, Metal Film, 274K Ohms, 1% 1/4W	RAC06	MF55D2743F	D/10	59124
	R31	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	D/10	59124
	R32	Resistor, Metal Film, 562 Ohms, 1% 1/4W	RAB22	MF55D5620F	C/7	59124
	R33	Resistor, Metal Film, 562 Ohms, 1% 1/4W	RAB22	MF55D5620F	C/6	59124
	R34	Resistor, Metal Film, 274 Ohms, 1% 1/4W	RAB18	MF55D2740F	B/5	59124
	R35	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	A/13	59124
	R36	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	D/12	59124
	R37	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	C/3	59124
	R38	Resistor, Metal Film, 562 Ohms, 1% 1/4W	RAB22	MF55D5620F	C/12	59124
	R39	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	C/8	59124
	R40	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	C/9	59124
	R41	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	B/11	59124
	R42	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	C/8	59124
	R43	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	C/9	59124
	R44	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	D/13	59124
	R45	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	D/5	59124
	R46	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	C/15	59124
	R47	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	B/4	59124
	R48	Resistor, Metal Film, 47.5K Ohms, 1% 1/4W	RAB45	MF55D4752F	E/2	59124
	R49	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	B/13	59124
	R50	Resistor, Metal Film, 475 Ohms, 1% 1/4W	RAB21	MF55D4750F	B/13	59124
	R51	Resistor, Metal Film, 1500 Ohms, 2% 1/2W	RC39	RL20S152G	E/2	35005
	R52	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	C/15	59124
	R53	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	B/4	59124
	R54	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	C/14	59124
	R55	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	B/4	59124

Table 8-8 Ref Des Index - NAPI31 Exciter Interface PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	R56	Resistor, Metal Film, 22 Ohms, 5% 2W	RBP03	GS-3, 22 Ohms	D/13	75042
	R57	Resistor, Metal Film, 392 Ohms, 1% 1/4W	RAB20	MF55D3920F	C/13	59124
	R58	Resistor, Metal Film, 560 Ohms, 2% 1/2W	RAP08	RL20S561G	C/7	35005
	R59	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	B/6	59124
	R60	Not Used				
	R61	Not Used				
	R62	Not Used				
	R63	Not Used				
	R64	Not Used				
	R65	Not Used				
	R66	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	C/14	59124
	R67	Resistor, Metal Film, 221 Ohms, 1% 1/4W	RAB17	MF55D2210F	A/15	59124
	S1	Switch, Keypad, Mom, NO, SPST	SD09	JB15FP	B/13	63426
	S2	Switch, Slide, 6PDT	SD17	MSS-6200	C/12	95146
	U1	IC, Transistor Array, 8 Darlingtons	UM28	ULN2803A	B/12	04713
	U2	IC, Operational Amplifier, Quad	UT01	TL084IN	C/9	01295
	U3	IC, Comparator, Quad	UL02	MC3302L	C/6	04713
	U4	IC, Comparator, Quad	UL02	MC3302L	D/11	04713
	U5	Not Used				
	U6	Not Used				
	W1	Coaxial Cable, 50 Ohm, Strand, RG188A/U	WE38	A4188A	-/-	14433
	W2	Coaxial Cable, 50 Ohm, Strand, RG188A/U	WE38	A4188A	-/-	14433
	XK1	Socket, Relay, PWB Mount	KC19	1310-2PC	B/8	73949
	XK2	Socket, Relay, PWB Mount	KC19	1310-2PC	B/9	73949
	XK6	Socket, Relay, PWB Mount	159-4037-01	159-4037-01	E/15	37338
	XU1	Socket, DIP, 18 Socket-Contacts	UD35	2-641263-3	B/12	00779
	XU2	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	C/9	00779
	XU3	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	C/6	00779
	XU4	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	D/11	00779
	XU5	Not Used				
	XU6	Not Used				

NOTE: Partial reference designation shown. Prefix with 1A2A1 (composite ref des prefix, including all higher assemblies) to obtain complete reference designation.

Table 8-9 Ref Des Index - NAF103 100kW Frequency Agile RF Combiner/Output Filter

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	-	RF Combiner/Output Filter, 100kW, Freq Agile	NAF103	176-6700	37338
	A1	Tuning Control Panel	176-6120-03	176-6120-03	37338
	A1M1	Meter, Impedance -5 to +5	ME17	176-2016	37338
	A2	Forward/Reflected Power Probe, 100kW	NAFP85/01	See Table 8-11	37338
	A3	Staircase Capacitor Assembly	176-6199	176-6199	37338
	A3C1	Capacitor, Ceramic Plate, 100pF, 5% 15kV	CS31	PD100 15KVP 100PF R16	DRALO
	A3C2	Capacitor, Ceramic Plate, 200pF, 5% 15kV	CS30	PD100 15KVP 200PF R42	DRALO
	A3C3	Capacitor, Ceramic Plate, 200pF, 5% 15kV	CS30	PD100 15KVP 200PF R42	DRALO
	A3C4	Capacitor, Ceramic Plate, 600pF, 5% 13kV	CS56	PE140 13KVP 600PFR42	DRALO
	A3C5	Capacitor, Ceramic Plate, 1200pF, 5% 14kV	CS54	PE200 14KVP 1200PF R42	DRALO
	A3J1	Connector, Single Socket, 40A	JR45	108-0760-001	74970
	A3J2	Connector, Single Socket, 40A	JR45	108-0760-001	74970
	A3J3	Connector, Single Socket, 40A	JR45	108-0760-001	74970
	A3J4	Connector, Single Socket, 40A	JR45	108-0760-001	74970
	A3J5	Connector, Single Socket, 40A	JR45	108-0760-001	74970
	A3J6	Connector, Single Socket, 40A	JR45	108-0760-001	74970
	A3J7	Connector, Single Socket, 40A	JR45	108-0760-001	74970
	A3J8	Connector, Single Socket, 40A	JR45	108-0760-001	74970
	A3J9	Connector, Single Socket, 40A	JR45	108-0760-001	74970
	A3J10	Connector, Single Socket, 40A	JR45	108-0760-001	74970
	A3J11	Connector, Single Socket, 40A	JR45	108-0760-001	74970
	A3J12	Connector, Single Socket, 40A	JR45	108-0760-001	74970
	A3P1	Connector, Single Pin, 40A, Black	JR47	108-0772-001	74970
	A3P2	Connector, Single Pin, 40A, Black	JR47	108-0772-001	74970
	A3P3	Connector, Single Pin, 40A, Black	JR47	108-0772-001	74970
	A3P4	Connector, Single Pin, 40A, Black	JR47	108-0772-001	74970
	A3P5	Connector, Single Pin, 40A, Black	JR47	108-0772-001	74970
	A3P6	Connector, Single Pin, 40A, Black	JR47	108-0772-001	74970
	A4	Arc Detector PWB	NAPX11	See NAPX11 Manual	37338
	A5	Arc Detector PWB	NAPX11	See NAPX11 Manual	37338
	C1	Capacitor, Ceramic Plate, 1600pF, 5% 14kV	CS26	PE140 14KVP 1600PF R85	DRALO
	C2	Capacitor, Ceramic Plate, 1000pF, 5% 14kV	CS27	PE140 14KVP 1000PF R85	DRALO
	C3	Capacitor, Ceramic Plate, 1000pF,±5% 14kV	CS14	PE200 14KVP 1000PF R42	DRALO
	C4	Capacitor, Ceramic Plate, 1000pF,±5% 14kV	CS14	PE200 14KVP 1000PF R42	DRALO
	C5	Capacitor, Ceramic Plate, 500pF, 5% 14kV	CS28	PE140 14KVP 500PF R42	DRALO
	C6	Capacitor, Ceramic Plate, 500pF, 5% 14kV	CS28	PE140 14KVP 500PF RR2	DRALO
	C7	Capacitor, Ceramic Plate, 500pF, 5% 14kV	CS28	PE140 14KVP 500PF RR4	DRALO
	C8	Capacitor, Ceramic Plate, 500pF, 5% 14kV	CS28	PE140 14KVP 500PF R42	DRALO
	C9	Capacitor, Ceramic Plate, 500pF, 5% 14kV	CS28	PE140 14KVP 500PF R42	DRALO
	C10	Capacitor, Ceramic Plate, 500pF, 5% 14kV	CS28	PE140 14KVP 500PF R42	DRALO
	C11	Capacitor, Ceramic Plate, 500pF, 5% 14kV	CS28	PE140 14KVP 500PF R42	DRALO
	C12	Capacitor, Ceramic Plate, 500pF, 5% 14kV	CS28	PE140 14KVP 500PF R42	DRALO
	C13	Capacitor, Ceramic Plate, 500pF, 5% 14kV	CS28	PE140 14KVP 500PF R42	DRALO
	C14	Capacitor, Ceramic Plate, 1000pF, 5% 14kV	CS27	PE140 14KVP 1000PF R85	DRALO
	C15	Capacitor, Ceramic Plate, 1000pF, 5% 14kV	CS27	PE140 14KVP 1000PF R85	DRALO
	C16	Capacitor, Ceramic Plate, 1000pF, 5% 14kV	CS27	PE140 14KVP 1000PF R85	DRALO
	C17	Capacitor, Ceramic Plate, 1600pF, 5% 14kV	CS26	PE140 14KVP 1600PF R85	DRALO

Table 8-9 Ref Des Index - NAF103 100kW Frequency Agile RF Combiner/Output Filter

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	C18	Not Used			
	C19	Capacitor, Ceramic Plate, 400pF, 5% 14kV	CS29	PE140 14KVP 400PF R42	DRALO
	C20	Capacitor, Ceramic Plate, 200pF, 5% 15kV	CS30	PD100 15KVP 200PF R42	DRALO
	C21	Capacitor, Ceramic Plate, 100pF, 5% 15kV	CS31	PD100 15KVP 100PF R16	DRALO
	C22	Capacitor, Ceramic Plate, 50pF, 5% 15kV	CS32	PD100 15KVP 50PF R7	DRALO
	C23	Capacitor, Ceramic Plate, 25pF, 5% 14kV	CS33	PD70 14KVP 25PF R7	DRALO
	C24	Capacitor, Ceramic Plate, 2000pF, 5% 13kV	CS25	PE140 13KVP 2000PF R85	DRALO
	C25	Capacitor, Ceramic Plate, 2000pF, 5% 13kV	CS25	PE140 13KVP 2000PF R85	DRALO
	C26	Capacitor, Ceramic Plate, 1000pF, 5% 14kV	CS27	PE140 14KVP 1000PF R85	DRALO
	C27	Capacitor, Ceramic Plate, 500pF, 5% 14kV	CS28	PE140 14KVP 500PF R42	DRALO
	C28	Capacitor, Ceramic Plate, 2000pF, 5% 13kV	CS25	PE140 13KVP 2000PF R85	DRALO
	C29	Capacitor, Ceramic Plate, 1600pF, 5% 14kV	CS26	PE140 14KVP 1600PF R85	DRALO
	C30	Capacitor, Variable, Vacuum, 50-2300pF	CS24	CV1C-2300EW/15	COMET
	E1	Spark Gap, Air, Adjustable	-	Not Procurable	37338
	E2	Surge Arrestor, 12kV, +/- 10%	QR35	GXH120H11	1C532
	J1	Connector, Inner, Female 6 1/8 EIA	176-5056	176-5056	37338
	J2	Connector, Coaxial, BNC, Bulkhead, 50Ω	JT05	31-10	02660
	L1	Inductor	176-6060-02	176-6060-02	37338
	L2	Inductor	176-6060-03	176-6060-03	37338
	L3	Inductor	176-6060-06	176-6060-06	37338
	L4	Inductor	176-6060-07	176-6060-07	37338
	L5	Inductor	176-6070	176-6070	37338
	L6	Inductor	176-6070-01	176-6070-01	37338
	L7	Choke, Static Discharge	176-6080	176-6080	37338
	MP1	Wand, Ground	176-6130	176-6130	37338
	MP2	Wand, Ground	176-6130	176-6130	37338
	R1	Resistor, Metal Film, 100 Ohms, 5% 2W	RBP07	GS-3, 100 Ohms	75042
	S1	Switch, Micro, 1PST	SC01	16-188051	04426
	S2	Switch, Micro, 1PST	SC01	16-188051	04426
	S3	Switch Assembly, 1PST	-	Not Procurable	37338

NOTE: Partial reference designation shown. Prefix with 1A3 (composite ref des prefix, including all higher assemblies) to obtain complete reference designation.

Table 8-10 Ref Des Index - NAFP85/01 100kW Forward/Reflected Power Probe

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	-	Forward/Reflected Power Probe, 100kW	NAFP85/01B	176-6440-04	-/-	37338
	A1	Power Probe PWB	176-6148-17	176-6148-17	-/-	37338
	A1C1	Capacitor, Mica, Dipped, 15,000pF, 2% 500V	CD39	CM07FD153G03	A/3	14655
	A1C2	Capacitor, Mica, Dipped, 9100pF, 2% 500V	CB06	CM07FD912G03	A/4	14655
	A1C3	Not Used				
	A1C4	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/3	96095
	A1C5	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KL	C/2	56289
	A1C7	Capacitor, Mica, Dipped, 220pF, 2% 500V	CB29	CM05FD221G03	C/2	14655
	A1C7	Capacitor, Mica, Dipped, 47pF, 2% 500V	CB21	CM05ED470G03	C/1	14655
	A1C8	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KL	A/1	56289
	A1C9	Not Used				
	A1CR1	Diode, Zener, Transient Supressor, 30V	QM12	P6KE30CA	A/2	04713
	A1CR2	Diode, Zener, Transient Supressor, 30V	QM12	P6KE30CA	B/1	04713
	A1CR3	Diode, Hot Carrier	QK09	1N5711	B/2	50434
	A1CR4	Diode, Hot Carrier	QK09	1N5711	B/1	50434
	A1CR5	Diode, Zener, Transient Supressor, 30V	QM12	P6KE30CA	-/-	04713
	A1E1	Connector, Quick-Dis, M, 0.25 Tab, PWB	HR26	1287	-/-	91833
	A1E2	Connector, Quick-Dis, M, 0.25 Tab, PWB	HR26	1287	-/-	91833
	A1R1	Resistor, Metal Film, 100 Ohms, 5% 2W	RBP07	GS-3, 100 Ohms	A/2	75042
	A1R2	Resistor, Metal Film, 100 Ohms, 5% 2W	RBP07	GS-3, 100 Ohms	A/2	75042
	A1R3	Resistor, Metal Film, 100 Ohms, 5% 2W	RBP07	GS-3, 100 Ohms	B/2	75042
	A1R4	Resistor, Metal Film, 100 Ohms, 5% 2W	RBP07	GS-3, 100 Ohms	B/2	75042
	A1R5	Resistor, Metal Film, 220 ohms, 5% 2W	RK31	GS-3, 220 ohms	B/2	75042
	A1R6	Resistor, Metal Film, 390 Ohms, 5% 2W	RBP33	GS-3, 390 OHMS	B/2	75042
	A1R7	Resistor, Metal Film, 680 Ohms, 2% 1/2W	RC35	RL20S681G	C/2	35005
	A1R8	Resistor, Metal Film, 1200 Ohms, 2% 1/2W	RC38	RL20S122G	C/2	35005
	A1R9	Resistor, Metal Film, 2200 Ohms, 2% 1/2W	RC41	RL20S222G	C/2	35005
	A1R10	Resistor, Metal Film, 3900 Ohms, 2% 1/2W	RD02	RL20S392G	C/2	35005
	A1R11	Resistor, Metal Film, 10 Ohms, 2% 1/2W	RAP01	RL20S100G	A/1	35005
	A1R12	Resistor, Metal Film, 10 Ohms, 2% 1/2W	RAP01	RL20S100G	B/1	35005
	A1R13	Resistor, Metal Film, 470 Ohms, 2% 1/2W	RC33	RL20S471G	A/1	35005
	A1R14	Resistor, Metal Film, 470 Ohms, 2% 1/2W	RC33	RL20S471G	B/1	35005
	A1R15	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	B/1	59124
	A1R16	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	B/1	59124
	A1R17	Resistor, Metal Film, 1.0M Ohms, 1% 1/4W	RAC13	MF55D1004F	C/2	59124
	A1R18	Resistor, Metal Film, 221K Ohms, 1% 1/4W	RAC05	MF55D2213F	C/1	59124
	A1R19	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	C/2	59124
	A1R20	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	C/2	59124
	A1R21	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	C/2	59124
	A1R22	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	C/1	59124
	A1R23	Resistor, Metal Film, 100 Ohms, 1% 1/4W	RAB13	MF55D1000F	B/2	59124
	A1R24	Resistor, Metal Film, 100 Ohms, 1% 1/4W	RAB13	MF55D1000F	B/2	59124
	A1R25	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	-/-	59124
	A1S1	Switch, 8-Position, Piano, DIP, 1PST	SD28	76PSB08	C/1	81073
	A1U1	IC, Operational Amplifier, Dual, Common Vs	UP41	AD822AN	C/2	45496
	A1XU1	Socket, DIP, 8 Socket-Contacts	UC01	2-641260-1	C/2	00779
	C1	Capacitor, Ceramic, 50pF + 10% 15,000V	CCG42	T500K99COGW8570	-/-	99942

Table 8-10 Ref Des Index - NAFP85/01 100kW Forward/Reflected Power Probe

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	J1	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	-/-	02660
	J2	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	-/-	02660
	T1	Transformer, RF Current	149-6052-05	149-6052-05	-/-	37338

NOTE: Partial reference designation shown. Prefix with 1A3A2 (composite ref des prefix, including all higher assemblies) to obtain complete reference designation.

Table 8-11 Ref Des Index - NAPI33 Primary 50kW Distribution PWB

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	-	50kW Distribution PWB, Primary	NAPI33B	176-2040-04	-/-	37338
	C1	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	M/3	56289
	C2	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	L/3	56289
	C3	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	K/3	56289
	C4	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	M/3	56289
	C5	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	L/3	56289
	C6	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	K/3	56289
	C7	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	I/4	96095
	C8	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	H/4	96095
	C9	Capacitor, Ceramic, 0.022uF, 10% 100V	CCG05	CKR06BX223KRV	H/4	56289
	C10	Capacitor, Ceramic, 0.001uF, 10% 200V	CCG01	CKR05BX102KRV	E/4	56289
	C11	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	I/5	56289
	C12	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	G/3	96095
	C13	Capacitor, Tantalum, 47uF, 10%, 20V	CM01	TAP476K020F	G/3	96095
	C14	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	F/3	56289
	C15	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	G/4	56289
	C16	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	F/3	56289
	C17	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	H/3	56289
	C18	Capacitor, Ceramic, 0.047uF, 10% 100V	CCG06	CKR06BX473KRV	F/4	56289
	C19	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	G/2	56289
	C20	Capacitor, Electrolytic, 820uF, 100V	CT05	82D821M100JC2D	D/3	56289
	C21	Capacitor, Tantalum, 47uF, 10%, 20V	CM01	TAP476K020F	D/2	96095
	C22	Capacitor, Tantalum, 47uF, 10%, 20V	CM01	TAP476K020F	E/2	96095
	C23	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/2	56289
	C24	Capacitor, Tantalum, 47uF, 10%, 20V	CM01	TAP476K020F	A/2	96095
	C25	Capacitor, Tantalum, 47uF, 10%, 20V	CM01	TAP476K020F	F/2	96095
	C26	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	D/3	56289
	C27	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/3	56289
	C28	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/3	56289
	C29	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/3	56289
	C30	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/3	56289
	C31	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	B/3	56289
	C32	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	B/3	56289
	C33	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	B/3	56289
	C34	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	N/4	56289
	C35	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/5	96095
	C36	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/3	96095
	C37	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/4	96095
	C38	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/4	96095
	C39	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/5	96095
	C40	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/5	96095
	C41	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/4	96095
	C42	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/4	96095
	C43	Capacitor, Mica, Dipped, 47pF 2% 500V	CB21	CM05ED470G03	H/5	14655
	C44	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	J/4	56289
	C45	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	J/4	56289
	C46	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	I/4	56289

Table 8-11 Ref Des Index - NAPI33 Primary 50kW Distribution PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	C47	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	J/3	56289
	C48	Capacitor, Tantalum, 47uF, 10% 20V	CM01	TAP476K020F	-/-	96095
	C49	Capacitor, Ceramic, 0.001uF, 10% 200V	CCG01	CKR05BX102KRV	-/-	56289
	CR1	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/3	27014
	CR2	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/3	27014
	CR3	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/3	27014
	CR4	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	H/2	27014
	CR5	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	H/2	27014
	CR6	Diode, Hot Carrier	QK09	1N5711	E/4	50434
	CR7	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	E/4	27014
	CR8	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	H/5	27014
	CR9	Diode, Zener, 4.7V, 400mW, 5%	QN01	1N750A	F/4	04713
	CR10	Diode, Hot Carrier	QK09	1N5711	F/4	50434
	CR11	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/3	27014
	CR12	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/2	27014
	CR13	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/2	27014
	CR14	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/2	27014
	CR15	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/2	27014
	CR16	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/2	27014
	CR17	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/2	27014
	CR18	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/2	27014
	CR19	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/2	27014
	CR20	Diode, Power Rectifier, 200V, 1A	QN38	MUR120	C/5	04713
	CR21	Diode, Power Rectifier, 200V, 1A	QN38	MUR120	C/3	04713
	CR22	Diode, Power Rectifier, 200V, 1A	QN38	MUR120	C/4	04713
	CR23	Diode, Power Rectifier, 200V, 1A	QN38	MUR120	C/4	04713
	CR24	Diode, Power Rectifier, 200V, 1A	QN38	MUR120	C/5	04713
	CR25	Diode, Power Rectifier, 200V, 1A	QN38	MUR120	C/5	04713
	CR26	Diode, Power Rectifier, 200V, 1A	QN38	MUR120	C/3	04713
	CR27	Diode, Power Rectifier, 200V, 1A	QN38	MUR120	C/4	04713
	CR28	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	M/3	27014
	CR29	Diode, Zener, 39V, 1.5W, 2%	QK03	1N5939C	C/3	04713
	CR30	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/4	27014
	CR31	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/3	27014
	CR32	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/2	27014
	F1	Fuse, 5A, 250V, Fast, 3AG	FA15	312005	L/5	75915
	F2	Fuse, 3A, 250V, Fast, 3AG	FC10	312003	L/5	75915
	J1	Connector, Coaxial, BNC, PWB Mount	JF35	R141426161	E/5	0GP12
	J2	Connector, Coaxial, BNC, PWB Mount	JF35	R141426161	G/5	0GP12
	J3	Connector, 'D' Sub-Min, 25 Pin-Contacts	JS12	DB25P-FRS	A/3	63590
	J4	Connector, 'D' Sub-Min, 15 Socket-Contacts	JS19	DA15S-FRS	O/5	63590
	J5	Connector, 'D' Sub-Min, 25 Socket-Contacts	JS13	DB25S-FRS	A/3	63590
	J6	Connector, 'D' Sub-Min, 15 Pin-Contacts	JS18	DA15P-FRS	O/3	63590
	J7	Not Used				
	J8	Connector, 'D' Sub-Min, 15 Socket-Contacts	JS19	DA15S-FRS	O/2	63590
	J9	Connector, Coaxial, BNC, PWB Mount	JF35	R141426161	J/5	0GP12
	J10	Connector, Coaxial, BNC, PWB Mount	JF35	R141426161	K/5	0GP12
	J11	Connector, Coaxial, BNC, PWB Mount	JF35	R141426161	F/5	0GP12

Table 8-11 Ref Des Index - NAPI33 Primary 50kW Distribution PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	L1	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/2	33062
	L2	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/2	33062
	L3	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	A/1	33062
	L4	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	A/1	33062
	L5	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	A/2	33062
	L6	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/5	33062
	L7	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/5	33062
	L8	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/5	33062
	L9	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/3	33062
	L10	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/4	33062
	L11	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/4	33062
	L12	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/4	33062
	L13	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/4	33062
	Q1	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	M/3	04713
	Q2	Transistor, PNP, Switch/Amplifier	QA29	2N2907A	M/3	04713
	Q3	Transistor, NPN, General Purpose	QAP04	2N2219A	L/3	04713
	Q4	Transistor, PNP, Switch/Amplifier	QA23	2N2905A	L/3	04713
	Q5	Transistor, NPN, General Purpose	QAP04	2N2219A	K/3	04713
	Q6	Transistor, PNP, Switch/Amplifier	QA23	2N2905A	K/3	04713
	Q7	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	I/2	04713
	Q8	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	M/3	04713
	Q9	Transistor, PNP, Switch/Amplifier	QA29	2N2907A	M/3	04713
	Q10	Transistor, NPN, General Purpose	QAP04	2N2219A	L/3	04713
	Q11	Transistor, PNP, Switch/Amplifier	QA23	2N2905A	L/3	04713
	Q12	Transistor, NPN, General Purpose	QAP04	2N2219A	K/3	04713
	Q13	Transistor, PNP, Switch/Amplifier	QA23	2N2905A	K/3	04713
	Q14	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	J/2	04713
	Q15	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	N/4	04713
	Q16	Transistor, PNP, Switch/Amplifier	QA29	2N2907A	N/4	04713
	Q17	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	C/5	81483
	Q18	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	C/3	81483
	Q19	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	C/4	81483
	Q20	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	C/4	81483
	Q21	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	C/5	81483
	Q22	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	C/5	81483
	Q23	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	C/4	81483
	Q24	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	C/4	81483
	Q25	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	D/5	81483
	R1	Resistor, Metal Film, 562 Ohms, 1% 1/4W	RAB22	MF55D5620F	M/4	59124
	R2	Resistor, Metal Film, 121 Ohms, 1% 1/4W	RAB14	MF55D1210F	L/4	59124
	R3	Resistor, Metal Film, 121 Ohms, 1% 1/4W	RAB14	MF55D1210F	K/4	59124
	R4	Resistor, Metal Film, 332 Ohms, 1% 1/4W	RAB19	MF55D3320F	J/2	59124
	R5	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	N/3	59124
	R6	Resistor, Metal Film, 3.32 Ohms, 1% 1/2W	RZ04	MF60D3R32F	L/2	59124
	R7	Resistor, Metal Film, 3.32 Ohms, 1% 1/2W	RZ04	MF60D3R32F	K/2	59124
	R8	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	N/3	59124
	R9	Resistor, Metal Film, 562 Ohms, 1% 1/4W	RAB22	MF55D5620F	M/4	59124

Table 8-11 Ref Des Index - NAPI33 Primary 50kW Distribution PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	R10	Resistor, Metal Film, 121 Ohms, 1% 1/4W	RAB14	MF55D1210F	L/4	59124
	R11	Resistor, Metal Film, 121 Ohms, 1% 1/4W	RAB14	MF55D1210F	K/4	59124
	R12	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	J/2	59124
	R13	Resistor, Metal Film, 10 Ohms, 2% 1/2W	RAP01	RL20S100G	M/2	35005
	R14	Resistor, Metal Film, 560 Ohms, 2% 1/2W	RAP08	RL20S561G	I/2	35005
	R15	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	J/2	59124
	R16	Resistor, Metal Film, 10 Ohms, 2% 1/2W	RAP01	RL20S100G	M/2	35005
	R17	Resistor, Metal Film, 3.32 Ohms, 1% 1/2W	RZ04	MF60D3R32F	L/2	59124
	R18	Resistor, Metal Film, 3.32 Ohms, 1% 1/2W	RZ04	MF60D3R32F	K/2	59124
	R19	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	H/4	59124
	R20	Resistor, Metal Film, 100 Ohms, 5% 2W	RBP07	GS-3, 100 Ohms	D/5	75042
	R21	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	H/4	59124
	R22	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	H/4	59124
	R23	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	H/5	59124
	R24	Resistor, Metal Film, 47.5K Ohms, 1% 1/4W	RAB45	MF55D4752F	H/4	59124
	R25	Resistor, Metal Film, 47.5K Ohms, 1% 1/4W	RAB45	MF55D4752F	E/4	59124
	R26	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	E/4	59124
	R27	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	F/4	59124
	R28	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	E/5	59124
	R29	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	H/4	59124
	R30	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	H/4	59124
	R31	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	G/3	59124
	R32	Resistor, Metal Film, 6810K Ohms, 1% 1/4W	RAB35	MF55D6811F	H/5	59124
	R33	Resistor, Metal Film, 39.2K Ohms, 1% 1/4W	RAB44	MF55D3922F	E/3	59124
	R34	Resistor, Metal Film, 27.4K Ohms, 1% 1/4W	RAB42	MF55D2742F	E/4	59124
	R35	Resistor, Metal Film, 47.5K Ohms, 1% 1/4W	RAB45	MF55D4752F	E/3	59124
	R36	Resistor, Metal Film, 2210 Ohms, 1% 1/4W	RAB29	MF55D2211F	F/3	59124
	R37	Resistor, Metal Film, 47.5K Ohms, 1% 1/4W	RAB45	MF55D4752F	G/3	59124
	R38	Resistor, Metal Film, 22.1K Ohms, 1% 1/4W	RAB41	MF55D2212F	G/3	59124
	R39	Resistor, Metal Film, 8250 Ohms, 1% 1/4W	RAB36	MF55D8251F	G/3	59124
	R40	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	E/4	59124
	R41	Resistor, Metal Film, 332K Ohms, 1% 1/4W	RAC07	MF55D3323F	F/4	59124
	R42	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	E/4	59124
	R43	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	H/2	59124
	R44	Resistor, Variable, Film, 100K Ohms, 1/2W	RW01	3339P-1-104	I/3	80294
	R45	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	H/3	59124
	R46	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	F/5	59124
	R47	Resistor, Metal Film, 2740 Ohms, 1% 1/4W	RAB30	MF55D2741F	H/3	59124
	R48	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	I/3	59124
	R49	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	A/2	59124
	R50	Resistor, Metal Film, 562 Ohms, 1% 1/4W	RAB22	MF55D5620F	M/4	59124
	R51	Resistor, Metal Film, 100 Ohms, 1% 1/4W	RAB13	MF55D1000F	I/2	59124
	R52	Resistor, Metal Film, 221 Ohms, 1% 1/4W	RAB17	MF55D2210F	O/4	59124
	R53	Resistor, Metal Film, 100 Ohms, 2% 1/2W	RAP05	RL20S101G	N/4	35005
	R54	Resistor, Metal Film, 10 Ohms, 2% 1/2W	RAP01	RL20S100G	N/4	35005
	R55	Resistor, Metal Film, 10 Ohms, 2% 1/2W	RAP01	RL20S100G	N/4	35005
	R56	Resistor, Metal Film, 182 Ohms, 1% 1/4W	RAB16	MF55D1820F	J/3	59124

Table 8-11 Ref Des Index - NAPI33 Primary 50kW Distribution PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	R57	Resistor, Metal Film, 1820 Ohms, 1% 1/4W	RAB28	MF55D1821F	I/3	59124
	R58	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	H/5	59124
	R59	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	J/4	59124
	R60	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	J/3	59124
	R61	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	I/4	59124
	R62	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	J/3	59124
	R63	Resistor, Metal Film, 5620 Ohms, 1% 1/4W	RAB34	MF55D5621F	J/4	59124
	R64	Resistor, Metal Film, 5620 Ohms, 1% 1/4W	RAB34	MF55D5621F	J/3	59124
	R65	Resistor, Metal Film, 3320 Ohms, 1% 1/4W	RAB31	MF55D3321F	I/4	59124
	R66	Resistor, Metal Film, 3320 Ohms, 1% 1/4W	RAB31	MF55D3321F	I/3	59124
	R67	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	B/2	59124
	R68	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	I/5	59124
	R69	Resistor, Metal Film, 1.0M Ohms, 1% 1/4W	RAC13	MF55D1004F		59124
	R70	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	D/2	35005
	R71	Resistor, Variable, Film, 500 Ohms, 1/2W	RV37	3339W-1-501		80294
	RT1	Thermistor, PTC, 0.34Ω, Trip @ 1.35A	RT18	RXE090	D/2	06090
	RT2	Thermistor, PTC, 0.34Ω, Trip @ 1.35A	RT18	RXE090	D/2	06090
	RT3	Thermistor, PTC, 0.34Ω, Trip @ 1.35A	RT18	RXE090	E/2	06090
	RT4	Thermistor, PTC, 0.34Ω, Trip @ 1.35A	RT18	RXE090	E/2	06090
	RT5	Thermistor, PTC, 0.34Ω, Trip @ 1.35A	RT18	RXE090	E/2	06090
	RT6	Thermistor, PTC, 0.34Ω, Trip @ 1.35A	RT18	RXE090	F/2	06090
	RT7	Thermistor, PTC, 0.42Ω, Trip @ 1A	RT16	RXE050	N/5	06090
	RT8	Thermistor, PTC, 0.42Ω, Trip @ 1A	RT16	RXE050	N/5	06090
	RT9	Thermistor, PTC, 0.12Ω, Trip @ 2.3	RT17	RXE110	N/4	06090
	RT10	Thermistor, PTC, 0.42Ω, Trip @ 1A	RT16	RXE050	N/5	06090
	S1	Switch, Keypad, Mom, NO, SPST	SD09	JB15FP	N/5	63426
	TB1	Terminal Block, 15 Terminal, PWB Mount, 15A	JF24	12515	B/1	13150
	TB2	Terminal Block, 15 Terminal, PWB Mount, 15A	JF24	12515	I/1	13150
	U1	IC, Comparator, Quad	UL02	MC3302L	I/5	04713
	U2	IC, Operational Amplifier, Quad, Common VCC	UR42	MC34074AP	H/3	04713
	U3	IC, Operational Amplifier, Dual, Common VCC	UM26	MC33072AU	E/3	04713
	U4	IC, CMOS, Inverter, Schmitt Trigger, Hex	UG05	MC74HC14AN	F/4	04713
	U5	IC, Analog Multiplier	UN12	RC4200AN	F/2	09675
	U6	Resistor Network, SIP, 9x470Ω, 2%, Bussed	UF17	4610X-101-471	A/2	80294
	U7	Resistor Network, SIP, 9x10KΩ, 2%, Bussed	UF18	4610X-101-103	D/4	80294
	U8	Resistor Network, SIP, 9x10KΩ, 2%, Bussed	UF18	4610X-101-103	D/5	80294
	XF1	Fuseholder, PWB Mount, Type 3AG	FA31	4245	L/5	91833
	XF2	Fuseholder, PWB Mount, Type 3AG	FA31	4245	L/5	91833
	XU1	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	I/5	00779
	XU2	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	H/3	00779
	XU3	Socket, DIP, 8 Socket-Contacts	UC01	2-641260-1	E/3	00779
	XU4	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	F/4	00779
	XU5	Socket, DIP, 8 Socket-Contacts	UC01	2-641260-1	F/2	00779

NOTE: Partial reference designation shown. Prefix with 1A36 (composite ref des prefix, including all higher assemblies) to obtain complete reference designation.

Table 8-12 Ref Des Index - NAPA08/01 RF Drive Buffer PWB

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	-	RF Drive Buffer PWB	NAPA08E/01	176-3060-05	-/-	37338
	C1	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	E/2	56289
	C2	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	B/2	56289
	C3	Capacitor, Ceramic, 0.22uF, 10% 50V	CCG08	CKR06BX224KRV	A/2	56289
	C4	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/3	96095
	C5	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	B/1	56289
	C6	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	B/1	56289
	C7	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	A/3	56289
	C8	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	C/1	72982
	C9	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	C/1	72982
	C10	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	C/1	96095
	C11	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	C/1	72982
	C12	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	C/1	72982
	C13	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	C/1	72982
	C14	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	C/1	72982
	C15	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	D/3	56289
	C16	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	C/2	56289
	C17	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	E/1	56289
	C18	Capacitor, Ceramic, 0.01uF, 10% 100V	CCG04	CKR05BX103KRV	D/1	56289
	C19	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	D/2	56289
	CR1	Diode, Zener, Transient Supressor, 20V	QI29	P6KE20CA	D/1	04713
	CR2	Diode, Zener, Transient Supressor, 20V	QI29	P6KE20CA	D/1	04713
	CR3	Diode, Zener, 30V, 1W, 5%	QR30	1N4751A	E/2	04713
	CR4	Not Used				
	CR5	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/2	27014
	DS1	Diode, Light Emitting, Green	QK12	HLMP-3554	B/3	50434
	E1	Connector, Quick-Dis, M, 0.25 Tab, PWB	HR26	1287	C/1	91833
	J1	Connector, 'D' Sub-Min, 9 Pin-Contacts	JQ33	DE9P-FRS	C/3	63590
	K1	Relay, 24 VDC Coil, SPST-No, 8A	KC24	JG1AF-24V	C/2	61529
	L1	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/2	33062
	L2	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/2	33062
	Q1	Transistor, NPN, General Purpose	QAP04	2N2219A	A/2	04713
	Q2	Transistor, PNP, Switch/Amplifier	QA23	2N2905A	A/2	04713
	Q3	Transistor, Field Effect, N Channel, 100V, 15A	QM38	IRF530N	C/1	1483
	Q4	Transistor, Field Effect, N Channel, 100V, 15A	QM38	IRF530N	C/1	81483
	Q5	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	E/2	04713
	Q6	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	D/2	04713
	Q7	Transistor, PNP, 20A, 140V, 250W	QS07	MJ15004	D/2	04713
	Q8	Transistor, Field Effect, N Channel	QE19	MPF6661	C/2	04713
	R1	Resistor, Metal Film, 10 Ohms, 2% 1/2W	RAP01	RL20S100G	A/2	35005
	R2	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	B/3	59124
	R3	Resistor, Metal Film, 12.1K Ohms, 1% 1/4W	RAB38	MF55D1212F	B/1	59124
	R4	Resistor, Metal Film, 12.1K Ohms, 1% 1/4W	RAB38	MF55D1212F	B/1	59124
	R5	Resistor, Metal Film, 82.5K Ohms, 1% 1/4W	RAB48	MF55D8252F	B/2	59124
	R6	Resistor, Metal Film, 82.5K Ohms, 1% 1/4W	RAB48	MF55D8252F	B/2	59124
	R7	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	D/3	59124
	R8	Resistor, Metal Film, 2740 Ohms, 1% 1/4W	RAB30	MF55D2741F	E/2	59124

Table 8-12 Ref Des Index - NAPA08/01 RF Drive Buffer PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	R9	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	E/1	59124
	R10	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	C/2	59124
	R11	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	D/3	59124
	R12	Resistor, Wirewound, 4 Ohms, 5%, 50W	RT22	L50J4R0	-/-	44655
	R13	Resistor, Variable, Film, 10K Ohms, 1/2W	RW09	3339P-1-103	E/1	80294
	R14	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	E/1	59124
	R15	Resistor, Metal Film, 8250 Ohms, 1% 1/4W	RAB36	MF55D8251F	E/1	59124
	R16	Resistor, Metal Film, 3320 Ohms, 1% 1/4W	RAB31	MF55D3321F	E/1	59124
	R17	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	C/2	59124
	R18	Resistor, Metal Film, 33.2K Ohms, 1% 1/4W	RAB43	MF55D3322F	E/2	59124
	R19	Resistor, Metal Film, 39.2K Ohms, 1% 1/4W	RAB44	MF55D3922F	E/2	59124
	R20	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	-	59124
	T1	Transformer, RF Drive	176-1202	176-1202	A/2	37338
	U1	IC, Comparator, Quad	UL02	MC3302L	E/1	04713
	XU1	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	E/1	00779

NOTE: Partial reference designation shown. Prefix with 1A37 or 1A38 (composite ref des prefix, including all higher assemblies) to obtain complete reference designation.

Table 8-13 Ref Des Index - NAPI34 Secondary 50kW Distribution PWB

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	-	50kW Distribution PWB, Secondary	NAPI34B	176-2040-05	-/-	37338
	C1	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	M/3	56289
	C2	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	L/3	56289
	C3	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	K/3	56289
	C4	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	M/3	56289
	C5	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	L/3	56289
	C6	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	K/3	56289
	C7	Not Used				
	C8	Not Used				
	C9	Not Used				
	C10	Capacitor, Ceramic, 0.001uF, 10% 200V	CCG01	CKR05BX102KRV	E/4	56289
	C11	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	I/5	56289
	C12	Not Used				
	C13	Not Used				
	C14	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	F/3	56289
	C15	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	G/4	56289
	C16	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	F/3	56289
	C17	Not Used				
	C18	Capacitor, Ceramic, 0.047uF, 10% 100V	CCG06	CKR06BX473KRV	F/4	56289
	C19	Not Used				
	C20	Capacitor, Electrolytic, 820uF, 100V	CT05	82D821M100JC2D	D/3	56289
	C21	Capacitor, Tantalum, 47uF, 10%, 20V	CM01	TAP476K020F	D/2	96095
	C22	Capacitor, Tantalum, 47uF, 10%, 20V	CM01	TAP476K020F	E/2	96095
	C23	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/2	56289
	C24	Capacitor, Tantalum, 47uF, 10%, 20V	CM01	TAP476K020F	A/2	96095
	C25	Capacitor, Tantalum, 47uF, 10%, 20V	CM01	TAP476K020F	F/2	96095
	C26	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	D/3	56289
	C27	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/3	56289
	C28	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/3	56289
	C29	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/3	56289
	C30	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/3	56289
	C31	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	B/3	56289
	C32	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	B/3	56289
	C33	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	B/3	56289
	C34	Not Used				
	C35	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/5	96095
	C36	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/3	96095
	C37	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/4	96095
	C38	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/4	96095
	C39	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/5	96095
	C40	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/5	96095
	C41	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/4	96095
	C42	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/4	96095
	C43	Capacitor, Mica, Dipped, 47pF 2% 500V	CB21	CM05ED470G03	H/5	14655
	C44	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	J/4	56289
	C45	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	J/4	56289
	C46	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	I/4	56289

Table 8-13 Ref Des Index - NAPI34 Secondary 50kW Distribution PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	C47	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	J/3	56289
	C48	Capacitor, Tantalum, 47uF, 10% 20V	CM01	TAP476K020F		96095
	C49	Capacitor, Ceramic, 0.001uF, 10% 200V	CCG01	CKR05BX102KRV	-/-	56289
	CR1	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/3	27014
	CR2	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/3	27014
	CR3	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/3	27014
	CR4	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	H/2	27014
	CR5	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	H/2	27014
	CR6	Diode, Hot Carrier	QK09	1N5711	E/4	50434
	CR7	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	E/4	27014
	CR8	Not Used				
	CR9	Diode, Zener, 4.7V, 400mW, 5%	QN01	1N750A	F/4	04713
	CR10	Diode, Hot Carrier	QK09	1N5711	F/4	50434
	CR11	Not Used				
	CR12	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/2	27014
	CR13	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/2	27014
	CR14	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/2	27014
	CR15	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/2	27014
	CR16	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/2	27014
	CR17	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/2	27014
	CR18	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/2	27014
	CR19	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/2	27014
	CR20	Diode, Power Rectifier, 200V, 1A	QN38	MUR120	C/5	04713
	CR21	Diode, Power Rectifier, 200V, 1A	QN38	MUR120	C/3	04713
	CR22	Diode, Power Rectifier, 200V, 1A	QN38	MUR120	C/4	04713
	CR23	Diode, Power Rectifier, 200V, 1A	QN38	MUR120	C/4	04713
	CR24	Diode, Power Rectifier, 200V, 1A	QN38	MUR120	C/5	04713
	CR25	Diode, Power Rectifier, 200V, 1A	QN38	MUR120	C/5	04713
	CR26	Diode, Power Rectifier, 200V, 1A	QN38	MUR120	C/3	04713
	CR27	Diode, Power Rectifier, 200V, 1A	QN38	MUR120	C/4	04713
	CR28	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	M/3	27014
	CR29	Diode, Zener, 39V, 1.5W, 2%	QK03	1N5939C	C/3	04713
	CR30	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	I/4	27014
	CR31	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	J/3	27014
	CR32	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	B/2	27014
	F1	Not Used				
	F2	Not Used				
	J1	Connector, Coaxial, BNC, PWB Mount	JF35	R141426161	E/5	0GP12
	J2	Not Used				
	J3	Connector, 'D' Sub-Min, 25 Pin-Contacts	JS12	DB25P-FRS	A/3	63590
	J4	Not Used				
	J5	Connector, 'D' Sub-Min, 25 Socket-Contacts	JS13	DB25S-FRS	A/3	63590
	J6	Connector, 'D' Sub-Min, 15 Pin-Contacts	JS18	DA15P-FRS	O/3	63590
	J7	Not Used				
	J8	Connector, 'D' Sub-Min, 15 Socket-Contacts	JS19	DA15S-FRS	O/2	63590
	J9	Not Used				
	J10	Not Used				

	J11	Not Used				

Table 8-13 Ref Des Index - NAPI34 Secondary 50kW Distribution PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	L1	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/2	33062
	L2	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/2	33062
	L3	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	A/1	33062
	L4	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	A/1	33062
	L5	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	A/2	33062
	L6	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/5	33062
	L7	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/5	33062
	L8	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/5	33062
	L9	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/3	33062
	L10	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/4	33062
	L11	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/4	33062
	L12	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/4	33062
	L13	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	B/4	33062
	Q1	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	M/3	04713
	Q2	Transistor, PNP, Switch/Amplifier	QA29	2N2907A	M/3	04713
	Q3	Transistor, NPN, General Purpose	QAP04	2N2219A	L/3	04713
	Q4	Transistor, PNP, Switch/Amplifier	QA23	2N2905A	L/3	04713
	Q5	Transistor, NPN, General Purpose	QAP04	2N2219A	K/3	04713
	Q6	Transistor, PNP, Switch/Amplifier	QA23	2N2905A	K/3	04713
	Q7	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	I/2	04713
	Q8	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	M/3	04713
	Q9	Transistor, PNP, Switch/Amplifier	QA29	2N2907A	M/3	04713
	Q10	Transistor, NPN, General Purpose	QAP04	2N2219A	L/3	04713
	Q11	Transistor, PNP, Switch/Amplifier	QA23	2N2905A	L/3	04713
	Q12	Transistor, NPN, General Purpose	QAP04	2N2219A	K/3	04713
	Q13	Transistor, PNP, Switch/Amplifier	QA23	2N2905A	K/3	04713
	Q14	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	J/2	04713
	Q15	Not Used				
	Q16	Not Used				
	Q17	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	C/5	81483
	Q18	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	C/3	81483
	Q19	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	C/4	81483
	Q20	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	C/4	81483
	Q21	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	C/5	81483
	Q22	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	C/5	81483
	Q23	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	C/4	81483
	Q24	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	C/4	81483
	Q25	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	D/5	81483
	R1	Resistor, Metal Film, 562 Ohms, 1% 1/4W	RAB22	MF55D5620F	M/4	59124
	R2	Resistor, Metal Film, 121 Ohms, 1% 1/4W	RAB14	MF55D1210F	L/4	59124
	R3	Resistor, Metal Film, 121 Ohms, 1% 1/4W	RAB14	MF55D1210F	K/4	59124
	R4	Resistor, Metal Film, 332 Ohms, 1% 1/4W	RAB19	MF55D3320F	J/2	59124
	R5	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	N/3	59124
	R6	Resistor, Metal Film, 3.32 Ohms, 1% 1/2W	RZ04	MF60D3R32F	L/2	59124
	R7	Resistor, Metal Film, 3.32 Ohms, 1% 1/2W	RZ04	MF60D3R32F	K/2	59124
	R8	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	N/3	59124
	R9	Resistor, Metal Film, 562 Ohms, 1% 1/4W	RAB22	MF55D5620F	M/4	59124

Table 8-13 Ref Des Index - NAPI34 Secondary 50kW Distribution PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	R10	Resistor, Metal Film, 121 Ohms, 1% 1/4W	RAB14	MF55D1210F	L/4	59124
	R11	Resistor, Metal Film, 121 Ohms, 1% 1/4W	RAB14	MF55D1210F	K/4	59124
	R12	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	J/2	59124
	R13	Resistor, Metal Film, 10 Ohms, 2% 1/2W	RAP01	RL20S100G	M/2	35005
	R14	Resistor, Metal Film, 560 Ohms, 2% 1/2W	RAP08	RL20S561G	I/2	35005
	R15	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	J/2	59124
	R16	Resistor, Metal Film, 10 Ohms, 2% 1/2W	RAP01	RL20S100G	M/2	35005
	R17	Resistor, Metal Film, 3.32 Ohms, 1% 1/2W	RZ04	MF60D3R32F	L/2	59124
	R18	Resistor, Metal Film, 3.32 Ohms, 1% 1/2W	RZ04	MF60D3R32F	K/2	59124
	R19	Not Used				
	R20	Resistor, Metal Film, 100 Ohms, 5% 2W	RBP07	GS-3, 100 Ohms	D/5	75042
	R21	Not Used				
	R22	Not Used				
	R23	Not Used				
	R24	Not Used				
	R25	Resistor, Metal Film, 47.5K Ohms, 1% 1/4W	RAB45	MF55D4752F	E/4	59124
	R26	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	E/4	59124
	R27	Not Used				
	R28	Not Used				
	R29	Not Used				
	R30	Not Used				
	R31	Not Used				
	R32	Not Used				
	R33	Resistor, Metal Film, 39.2K Ohms, 1% 1/4W	RAB44	MF55D3922F	E/3	59124
	R34	Resistor, Metal Film, 27.4K Ohms, 1% 1/4W	RAB42	MF55D2742F	E/4	59124
	R35	Resistor, Metal Film, 47.5K Ohms, 1% 1/4W	RAB45	MF55D4752F	E/3	59124
	R36	Not Used				
	R37	Not Used				
	R38	Not Used				
	R39	Not Used				
	R40	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	E/4	59124
	R41	Resistor, Metal Film, 332K Ohms, 1% 1/4W	RAC07	MF55D3323F	F/4	59124
	R42	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	E/4	59124
	R43	Not Used				
	R44	Not Used				
	R45	Not Used				
	R46	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1002F	F/5	59124
	R47	Not Used				
	R48	Not Used				
	R49	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	A/2	59124
	R50	Not Used				
	R51	Not Used				
	R52	Not Used				
	R53	Not Used				
	R54	Not Used				
	R55	Not Used				
	R56	Resistor, Metal Film, 182 Ohms, 1% 1/4W	RAB16	MF55D1820F	J/3	59124

Table 8-13 Ref Des Index - NAPI34 Secondary 50kW Distribution PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	R57	Resistor, Metal Film, 1820 Ohms, 1% 1/4W	RAB28	MF55D1821F	I/3	59124
	R58	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	H/5	59124
	R59	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	J/4	59124
	R60	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	J/3	59124
	R61	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	I/4	59124
	R62	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	J/3	59124
	R63	Resistor, Metal Film, 5620 Ohms, 1% 1/4W	RAB34	MF55D5621F	J/4	59124
	R64	Resistor, Metal Film, 5620 Ohms, 1% 1/4W	RAB34	MF55D5621F	J/3	59124
	R65	Resistor, Metal Film, 3320 Ohms, 1% 1/4W	RAB31	MF55D3321F	I/4	59124
	R66	Resistor, Metal Film, 3320 Ohms, 1% 1/4W	RAB31	MF55D3321F	I/3	59124
	R67	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	B/2	59124
	R68	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	I/5	59124
	R69	Not Used				
	R70	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	D/2	35005
	R71	Resistor, Variable, Film, 500 Ohms, 1/2W	RV37	3339W-1-501		80294
	RT1	Thermistor, PTC, 0.34Ω, Trip @ 1.35A	RT18	RXE090	D/2	06090
	RT2	Thermistor, PTC, 0.34Ω, Trip @ 1.35A	RT18	RXE090	D/2	06090
	RT3	Thermistor, PTC, 0.34Ω, Trip @ 1.35A	RT18	RXE090	E/2	06090
	RT4	Thermistor, PTC, 0.34Ω, Trip @ 1.35A	RT18	RXE090	E/2	06090
	RT5	Thermistor, PTC, 0.34Ω, Trip @ 1.35A	RT18	RXE090	E/2	06090
	RT6	Thermistor, PTC, 0.34Ω, Trip @ 1.35A	RT18	RXE090	F/2	06090
	RT7	Not Used				
	RT8	Not Used				
	RT9	Not Used				
	RT10	Not Used				
	S1	Not Used				
	TB1	Terminal Block, 15 Terminal, PWB Mount, 15A	JF24	12515	B/1	13150
	TB2	Terminal Block, 15 Terminal, PWB Mount, 15A	JF24	12515	I/1	13150
	U1	IC, Comparator, Quad	UL02	MC3302L	I/5	04713
	U2	Not Used				
	U3	IC, Operational Amplifier, Dual, Common Vcc	UM26	MC33072AU	E/3	04713
	U4	IC, CMOS, Inverter, Schmitt Trigger, Hex	UG05	MC74HC14AN	F/4	04713
	U5	Not Used				
	U6	Resistor Network, SIP, 9x470Ω, 2%, Bussed	UF17	4610X-101-471	A/2	80294
	U7	Resistor Network, SIP, 9x10KΩ, 2%, Bussed	UF18	4610X-101-103	D/4	80294
	U8	Resistor Network, SIP, 9x10KΩ, 2%, Bussed	UF18	4610X-101-103	D/5	80294
	XF1	Not Used				
	XF2	Not Used				
	XU1	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	I/5	00779
	XU2	Not Used				
	XU3	Socket, DIP, 8 Socket-Contacts	UC01	2-641260-1	E/3	00779
	XU4	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	F/4	00779
	XU5	Not Used				

NOTE: Partial reference designation shown. Prefix with 1A40 (composite ref des prefix, including all higher assemblies) to obtain complete reference designation.

Table 8-14 Ref Des Index - NAF82 Frequency Agile, 8-Input RF Combiner

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	-	8-Input RF Combiner, Frequency Agile, RH	NAF82E/01	176-6160-16	37338
	-	8-Input RF Combiner, Frequency Agile, LH	NAF82E/02	176-6160-17	37338
	A1	Four Coil Assembly	176-6010-07	176-6010-07	37338
	A1L1	Coil, RF, Air Core, Wound CW	176-6011-20	176-6011-20	37338
	A1L2	Coil, RF, Air Core, Wound CCW	176-6011-21	176-6011-21	37338
	A1L3	Coil, RF, Air Core, Wound CCW	176-6011-22	176-6011-22	37338
	A1L4	Coil, RF, Air Core, Wound CW	176-6011-23	176-6011-23	37338
	A1T1	Transformer, RF Current	176-6173-01	176-6173-01	37338
	A2	Four Coil Assembly	176-6010-07	176-6010-07	37338
	A2L1	Coil, RF, Air Core, Wound CW	176-6011-20	176-6011-20	37338
	A2L2	Coil, RF, Air Core, Wound CCW	176-6011-21	176-6011-21	37338
	A2L3	Coil, RF, Air Core, Wound CCW	176-6011-22	176-6011-22	37338
	A2L4	Coil, RF, Air Core, Wound CW	176-6011-23	176-6011-23	37338
	A2T1	Transformer, RF Current	176-6173-01	176-6173-01	37338
	A3	Resistor Network Assembly	176-6150	176-6150	37338
	A3A1	Resistor Network PWB	176-6157	176-6157	37338
	A3A1E1	Connector, Quick-Dis, M, 0.25 TAB, PWB	HX42	1266	91833
	A3A1E2	Connector, Quick-Dis, M, 0.25 TAB, PWB	HX42	1266	91833
	A3A1E3	Connector, Quick-Dis, M, 0.25 TAB, PWB	HX42	1266	91833
	A3A1E4	Connector, Quick-Dis, M, 0.25 TAB, PWB	HX42	1266	91833
	A3A1R1	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	35005
	A3A1R2	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	35005
	A3A1R3	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	35005
	A3A1R4	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	35005
	A3A1R5	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	35005
	A3A1R6	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	35005
	A3A1R7	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	35005
	A3A1R8	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	35005
	A3A1R9	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	35005
	A3A1R10	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	35005
	A3A1R11	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	35005
	A3A1R12	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	35005
	A3A1R13	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	35005
	A3A1R14	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	35005
	A3A1R15	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	35005
	A3A1R16	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	35005
	A3A1R17	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	35005
	A3A1R18	Resistor, Metal Film, 68 Ohms, 2% 1/2W	RC23	RL20S680G	35005
	A3A1R19	Resistor, Metal Film, 47 Ohms, 5% 2W	RBP05	GS-3. 47 Ohms	75042
	A3J1	Connector, Coaxial, BNC, Bulkhead, 50Ω	JDP26	UG1094/U	02660
	A4	Arc Detector PWB	NAPX11	See NAPX11 Manual	37338
	C1	Capacitor, Ceramic Plate, 2000pF, 5% 13kV	CS25	PE140 13KVP 2000PF R85	DRALO
	C2	Capacitor, Ceramic Plate, 2000pF, 5% 13kV	CS25	PE140 13KVP 2000PF R85	DRALO
	C3	Capacitor, Ceramic Plate, 2000pF, 5% 13kV	CS25	PE140 13KVP 2000PF R85	DRALO
	C4	Capacitor, Ceramic Plate, 2000pF, 5% 13kV	CS25	PE140 13KVP 2000PF R85	DRALO
	C5	Capacitor, Ceramic Plate, 2000pF, 5% 13kV	CS25	PE140 13KVP 2000PF R85	DRALO
	C6	Capacitor, Ceramic Plate, 1600pF, 5% 14kV	CS26	PE140 14KVP 1600PF R85	DRALO
	C7	Capacitor, Ceramic Plate, 1600pF, 5% 14kV	CS26	PE140 14KVP 1600PF R85	DRALO

Table 8-14 Ref Des Index - NAF82 Frequency Agile, 8-Input RF Combiner (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	C8	Capacitor, Ceramic Plate, 1600pF, 5% 14kV	CS26	PE140 14KVP 1600PF R85	DRALO
	C9	Capacitor, Ceramic Plate, 1000pF, 5% 14kV	CS27	PE140 14KVP 1000PF R85	DRALO
	C10	Capacitor, Ceramic Plate, 500pF, 5% 14kV	CS28	PE140 14KVP 500PF R42	DRALO
	C11	Capacitor, Ceramic Plate, 1000pF, 5% 14kV	CS27	PE140 14KVP 1000PF R85	DRALO
	C12	Capacitor, Ceramic Plate, 1600pF, 5% 14kV	CS26	PE140 14KVP 1600PF R85	DRALO
	C13	Capacitor, Ceramic Plate, 1600pF, 5% 14kV	CS26	PE140 14KVP 1600PF R85	DRALO
	C14	Capacitor, Ceramic Plate, 2000pF, 5% 13kV	CS25	PE140 13KVP 2000PF R85	DRALO
	C15	Capacitor, Ceramic Plate, 2000pF, 5% 13kV	CS25	PE140 13KVP 2000PF R85	DRALO
	C16	Capacitor, Ceramic Plate, 2000pF, 5% 13kV	CS25	PE140 13KVP 2000PF R85	DRALO
	C17	Capacitor, Ceramic Plate, 2000pF, 5% 13kV	CS25	PE140 13KVP 2000PF R85	DRALO
	C18	Capacitor, Ceramic Plate, 2000pF, 5% 13kV	CS25	PE140 13KVP 2000PF R85	DRALO

NOTE: Duplicated reference designations indicate an option exists for that item. Refer to description and/or the use code to determine which item/variation is required for a specific installation.

Partial reference designation shown. Prefix with 1A41 or 1A42 (composite ref des prefix, including all higher assemblies) to obtain complete reference designation.

The NAF82E/01 and NAF82E/02 8-input rf combiners are electrically identical, except for RF buss bar's external connection point.

Table 8-15 Ref Des Index - NAPC92/04 Power Supply Control/Monitor PWB

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	-	Power Supply Control/Monitor PWB	NAPC92D/04	176-7015-12	-/-	37338
	C1	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	G/4	96095
	C2	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	C/4	72982
	C3	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	C/4	72982
	C4	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	C/4	72982
	C5	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	D/4	72982
	C6	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	D/4	72982
	C7	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	C/2	96095
	C8	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	F/4	96095
	C9	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	D/2	96095
	C10	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/2	56289
	C11	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	G/4	96095
	C12	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	C/2	56289
	C13	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	C/4	96095
	C14	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	C/4	96095
	C15	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	C/4	96095
	C16	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	D/4	96095
	C17	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	D/4	96095
	C18	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	D/3	56289
	C19	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	G/4	56289
	C20	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	E/5	56289
	C21	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	D/3	56289
	C22	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	F/5	56289
	C23	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	F/4	56289
	C24	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	F/5	96095
	C25	Capacitor, Ceramic, 0.01uF, 10% 100V	CCG04	CKR05BX103KRV	B/2	56289
	C26	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	G/3	56289
	C27	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	F/3	56289
	C28	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	E/3	72982
	C29	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	F/3	72982
	C30	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	F/2	72982
	C31	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	C/3	96095
	C32	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/2	96095
	C33	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/2	96095
	C34	Not Used				
	C35	Capacitor, Plastic, 0.12uF, 5% 630V	CAP30	2222 378 62124	G/2	46897
	C36	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	D/2	96095
	C37	Capacitor, Tantalum, 47uF, 10%, 20V	CM01	TAP476K020F	C/2	96095
	C38	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	H/4	56289
	C39	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	F/1	56289
	C40	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	D/2	56289
	C41	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	D/2	56289
	C42	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	G/1	56289
	C43	Capacitor, Ceramic, 0.47uF, 10% 50V	CCG09	CKR06BX474KRV	G/5	56289
	C44	Not Used				
	C45	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	E/3	96095
	C46	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	F/3	96095

Table 8-15 Ref Des Index - NAPC92/04 Power Supply Control/Monitor PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	C47	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	G/2	96095
	C48	Capacitor, Electrolytic, 8200uF, 35V	CX13	82DA822M035JC2D	D/5	62643
	C49	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	H/1	56289
	C50	Not Used				
	C51	Not Used				
	C52	Not Used				
	C53	Not Used				
	C54	Not Used				
	C55	Not Used				
	C56	Not Used				
	C57	Capacitor, Plastic, 0.12uF, 5% 630V	CAP30	2222 378 62124	A/4	46897
	C58	Capacitor, Ceramic, 0.001uF, 10% 200V	CCG01	CKR05BX102KRV	-/-	56289
	C59	Capacitor, Ceramic, 0.001uF, 10% 200V	CCG01	CKR05BX102KRV	-/-	56289
	CR1	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	G/1	27014
	CR2	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/4	27014
	CR3	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/4	27014
	CR4	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/4	27014
	CR5	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/4	27014
	CR6	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/4	27014
	CR7	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/3	27014
	CR8	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/4	27014
	CR9	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/4	27014
	CR10	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/4	27014
	CR11	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/4	27014
	CR12	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/4	27014
	CR13	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	D/3	27014
	CR14	Diode, Zener, 5.1V, 1W, 5%	QM07	1N4733A	C/2	04713
	CR15	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	F/1	27014
	CR16	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/5	27014
	CR17	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/5	27014
	CR18	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/5	27014
	CR19	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/5	27014
	CR20	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	C/5	27014
	CR21	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	F/4	27014
	CR22	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	H/4	27014
	CR23	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	H/5	27014
	CR24	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	G/5	27014
	CR25	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	F/5	27014
	CR26	Diode, Zener, 12V, 400mW, 5%	QG08	1N759A	B/2	04713
	CR27	Diode, General Purpose, 400V, 1A	QE28	1N4004	E/2	04713
	CR28	Diode, General Purpose, 400V, 1A	QE28	1N4004	F/2	04713
	CR29	Diode, General Purpose, 400V, 1A	QE28	1N4004	F/2	04713
	CR30	Diode, Zener, 15V, 1W, 5%	QE40	1N4744A	C/2	04713
	CR31	Diode, General Purpose, 400V, 1A	QE28	1N4004	C/1	04713
	CR32	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	G/1	27014
	CR33	Not Used				
	CR34	Not Used				

Table 8-15 Ref Des Index - NAPC92/04 Power Supply Control/Monitor PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	CR35	Not Used				
	CR36	Not Used				
	CR37	Not Used				
	CR38	Not Used				
	CR39	Not Used				
	CR40	Not Used				
	CR41	Not Used				
	CR42	Not Used				
	CR43	Not Used				
	CR44	Not Used				
	CR45	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	E/2	27014
	J1	Connector, 'D' Sub-Min, 25 Pin-Contacts	JS12	DB25P-FRS	C/1	63590
	J2	Connector, 'D' Sub-Min, 15 Socket-Contacts	JS19	DA15S-FRS	H/4	63590
	J3	Not Used				
	J4	Connector, 'D' Sub-Min, 15 Socket-Contacts	JS19	DA15S-FRS	G/1	63590
	L1	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	C/1	33062
	L2	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	C/1	33062
	L3	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	G/4	33062
	L4	Not Used				
	Q1	Not Used				
	Q2	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	F/4	04713
	Q3	Transistor, IGBT, N Channel, 600V, 31A	QR17	IRGPC40S	A/2	81483
	Q4	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	H/5	04713
	Q5	Not Used				
	Q6	Not Used				
	Q7	Thyristor, Triac, 800V, 25A	QN24	MAC223A10	H/2	04713
	Q8	Transistor, Field Effect, N Channel	QE19	MPF6661	G/3	04713
	Q9	Transistor, Field Effect, N Channel	QE19	MPF6661	B/3	04713
	Q10	Transistor, Field Effect, N Channel, 100V, 8A	QR13	IRF520	E/2	81483
	R1	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	G/4	59124
	R2	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	C/3	59124
	R3	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	C/3	59124
	R4	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	C/3	59124
	R5	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	D/3	59124
	R6	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	D/3	59124
	R7	Resistor, Metal Film, 12.1K Ohms, 1% 1/4W	RAB38	MF55D1212F	G/1	59124
	R8	Not Used				
	R9	Not Used				
	R10	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	G/4	59124
	R11	Resistor, Metal Film, 33 Ohms, 2% 1/2W	RAP03	RL20S330G	C/2	35005
	R12	Resistor, Metal Film, 12.1K Ohms, 1% 1/4W	RAB38	MF55D1212F	D/3	59124
	R13	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	H/4	59124
	R14	Resistor, Metal Film, 12.1K Ohms, 1% 1/4W	RAB38	MF55D1212F	D/3	59124
	R15	Resistor, Metal Film, 12.1K Ohms, 1% 1/4W	RAB38	MF55D1212F	F/1	59124
	R16	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	C/4	59124
	R17	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	C/4	59124
	R18	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	C/4	59124

Table 8-15 Ref Des Index - NAPC92/04 Power Supply Control/Monitor PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	R19	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	D/4	59124
	R20	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	D/4	59124
	R21	Resistor, Metal Film, 475K Ohms, 1% 1/4W	RAC09	MF55D4753F	H/1	59124
	R22	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	G/4	59124
	R23	Resistor, Metal Film, 100 Ohms, 1% 1/4W	RAB13	MF55D1000F	G/5	59124
	R24	Resistor, Metal Film, 332K Ohms, 1% 1/4W	RAC07	MF55D3323F	E/2	59124
	R25	Resistor, Metal Film, 475K Ohms, 1% 1/4W	RAC09	MF55D4753F	G/1	59124
	R26	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	E/5	59124
	R27	Resistor, Metal Film, 475K Ohms, 1% 1/4W	RAC09	MF55D4753F	G/1	59124
	R28	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	E/5	59124
	R29	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	H/5	59124
	R30	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	H/5	59124
	R31	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	H/5	59124
	R32	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	F/1	59124
	R33	Resistor, Metal Film, 15K Ohms, 1% 1/4W	RAB39	MF55D1502F	H/5	59124
	R34	Resistor, Metal Film, 100K Ohms, 2% 1/2W	RAP17	RL20S104G	C/2	35005
	R35	Resistor, Metal Film, 332K Ohms, 1% 1/4W	RAC07	MF55D3323F	F/2	59124
	R36	Resistor, Metal Film, 182 Ohms, 1% 1/4W	RAB16	MF55D1820F	F/4	59124
	R37	Resistor, Metal Film, 150K Ohms, 1% 1/4W	RAC03	MF55D1503F	E/3	59124
	R38	Resistor, Metal Film, 150K Ohms, 1% 1/4W	RAC03	MF55D1503F	F/3	59124
	R39	Resistor, Metal Film, 150K Ohms, 1% 1/4W	RAC03	MF55D1503F	F/2	59124
	R40	Resistor, Metal Film, 562K Ohms, 1% 1/4W	RAC10	MF55D5623F	A/3	59124
	R41	Resistor, Metal Film, 12.1K Ohms, 1% 1/4W	RAB38	MF55D1212F	C/3	59124
	R42	Resistor, Metal Film, 5620 Ohms, 1% 1/4W	RAB34	MF55D5621F	E/3	59124
	R43	Resistor, Metal Film, 5620 Ohms, 1% 1/4W	RAB34	MF55D5621F	F/3	59124
	R44	Resistor, Metal Film, 5620 Ohms, 1% 1/4W	RAB34	MF55D5621F	G/2	59124
	R45	Resistor, Metal Film, 270 Ohms, 2% 1/2W	RC30	RL20S271G	D/2	35005
	R46	Resistor, Metal Film, 332K Ohms, 1% 1/4W	RAC07	MF55D3323F	F/2	59124
	R47	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	B/2	59124
	R48	Resistor, Metal Film, 1500 Ohms, 1% 1/4W	RAB27	MF55D1501F	E/2	59124
	R49	Not Used				
	R50	Resistor, Metal Film, 39.2K Ohms, 1% 1/4W	RAB44	MF55D3922F	E/3	59124
	R51	Resistor, Metal Film, 39.2K Ohms, 1% 1/4W	RAB44	MF55D3922F	F/3	59124
	R52	Resistor, Metal Film, 39.2K Ohms, 1% 1/4W	RAB44	MF55D3922F	F/3	59124
	R53	Resistor, Metal Film, 470K Ohms, 2% 1/2W	RD27	RL20S474G	A/2	35005
	R54	Resistor, Metal Film, 330K Ohms, 2% 1/2W	RAP19	RL20S334G	A/3	35005
	R55	Resistor, Metal Film, 8250 Ohms, 1% 1/4W	RAB36	MF55D8251F	C/2	59124
	R56	Resistor, Metal Film, 8250 Ohms, 1% 1/4W	RAB36	MF55D8251F	C/3	59124
	R57	Not Used				
	R58	Not Used				
	R59	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	G/4	59124
	R60	Resistor, Metal Film, 1500 Ohms, 1% 1/4W	RAB27	MF55D1501F	G/3	59124
	R61	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	F/5	59124
	R62	Resistor, Metal Film, 150 Ohms, 1% 1/4W	RAB15	MF55D1500F	G/2	59124
	R63	Resistor, Metal Film, 27 Ohms, 2% 1/2W	RC18	RL20S270G	H/2	35005
	R64	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	E/5	59124
	R65	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	E/3	59124

Table 8-15 Ref Des Index - NAPC92/04 Power Supply Control/Monitor PWB (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	R66	Resistor, Metal Film, 332 Ohms, 1% 1/4W	RAB19	MF55D3320F	G/2	59124
	R67	Resistor, Metal Film, 10 Ohms, 1% 1/4W	RAB01	MF55D10R0F	G/3	59124
	R68	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	E/4	59124
	R69	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	E/3	59124
	R70	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	E/4	59124
	R71	Resistor, Metal Film, 12.1K Ohms, 1% 1/4W	RAB38	MF55D1212F	H/1	59124
	R72	Resistor, Metal Film, 6810 Ohms, 1% 1/4W	RAB35	MF55D6811F	B/3	59124
	R73	Resistor, Metal Film, 6810 Ohms, 1% 1/4W	RAB35	MF55D6811F	C/3	59124
	R74	Resistor, Metal Film, 6810 Ohms, 1% 1/4W	RAB35	MF55D6811F	C/3	59124
	R75	Resistor, Metal Film, 6810 Ohms, 1% 1/4W	RAB35	MF55D6811F	C/3	59124
	R76	Resistor, Metal Film, 6810 Ohms, 1% 1/4W	RAB35	MF55D6811F	D/3	59124
	R77	Not Used				
	R78	Not Used				
	R79	Not Used				
	R80	Not Used				
	R81	Not Used				
	R82	Not Used				
	R83	Not Used				
	R85	Not Used				
	R86	Not Used				
	R87	Not Used				
	R88	Resistor, Metal Film, 8250 Ohms, 1% 1/4W	RAB36	MF55D8251F	C/3	59124
	R89	Resistor, Metal Film, 10 Ohms, 2% 1/2W	RAP19	RL20S100G	D/3	35005
	U1	IC, Operational Amplifier, Low Power	UG04	AD620AN	F/3	45496
	U2	IC, Comparator, Quad	UL02	MC3302L	E/4	04713
	U3	IC, Comparator, Quad	UL02	MC3302L	F/5	04713
	U4	Not Used				
	U5	IC, Comparator, Quad	UL02	MC3302L	F/4	04713
	U6	IC, Optoisolator, Triac Driver Output	UX41	MOC3063	G/3	04713
	XU1	Socket, DIP, 8 Socket-Contacts	UC01	2-641260-1	F/3	00779
	XU2	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	E/4	00779
	XU3	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	F/5	00779
	XU4	Not Used				
	XU5	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	F/4	00779
	XU6	Socket, Integrated Circuit, 6-Pin	UD43	2-641259-1	G/3	00779

NOTE: Partial reference designation shown. Prefix with 2A1 (composite ref des prefix, including all higher assemblies) to obtain complete reference designation.

Table 8-16 Ref Des Index - NASR106 DC Power Supply

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	-	Dc Power Supply	NASR106	176-7320	37338
	A1	RF Drive Dc Power Supply	NAPS11	See Table 8-17	37338
	A2	RF Drive Dc Power Supply	NAPS11	See Table 8-17	37338
	C1	Capacitor, Electrolytic, 47000uF, 50V	CBP12	36DA473FO50CB2T	62643
	C2	Capacitor, Electrolytic, 47000uF, 50V	CBP12	36DA473FO50CB2T	62643
	C3	Capacitor, Electrolytic, 47000uF, 50V	CBP12	36DA473FO50CB2T	62643
	C4	Capacitor, Electrolytic, 47000uF, 50V	CBP12	36DA473FO50CB2T	62643
	C5	Capacitor, Electrolytic, 27000uF, 63V	CBP11	36DA273FO63CB2T	62643
	C6	Capacitor, Electrolytic, 2900 uF, 75V	CCD35	3188BA292UO75AL	56699
	C7	Capacitor, Electrolytic, 27000uF, 63V	CBP11	36DA273FO63CB2T	62643
	DS1	Diode, Light Emitting, Green, 8.6mm Lg	QM20	SSL-LX5093GD	1EM90
	DS2	Diode, Light Emitting, Green, 8.6mm Lg	QM20	SSL-LX5093GD	1EM90
	DS3	Diode, Light Emitting, Green, 8.6mm Lg	QM20	SSL-LX5093GD	1EM90
	DS4	Diode, Light Emitting, Green, 8.6mm Lg	QM20	SSL-LX5093GD	1EM90
	DS5	Diode, Light Emitting, Green, 8.6mm Lg	QM20	SSL-LX5093GD	1EM90
	DS6	Diode, Light Emitting, Green, 8.6mm Lg	QM20	SSL-LX5093GD	1EM90
	DS7	Diode, Light Emitting, Green, 8.6mm Lg	QM20	SSL-LX5093GD	1EM90
	DS8	Diode, Light Emitting, Green, 8.6mm Lg	QM20	SSL-LX5093GD	1EM90
	F1	Fuse, 5A, 250V, Slow, 3AG	FA14	313005	75915
	F2	Fuse, 5A, 250V, Slow, 3AG	FA14	313005	75915
	F3	Fuse, 20A, 250V, Slow, 3AB	FB41	MDA20	71400
	F4	Fuse, 2A, 250V, Slow, 3AG	FA11	313002	75915
	F5	Fuse, 30A, 250V, Slow, 3AB	FB42	MDA30	71400
	F6	Fuse, 4A, 250V, Slow, 3AG	FA12	313004	75915
	F7	Fuse, 30A, 250V, Slow, 3AB	FD17	MDA30	71400
	F8	Fuse, 30A, 250V, Slow, 3AB	FD17	MDA30	71400
	J1	Connector, Size 23-37, 16 Socket-Contacts	JF07	206151-1	09482
	J2	Connector, Size 23-37, 16 Socket-Contacts	JF07	206151-1	09482
	L1	Inductor, Choke, 1mH, 30A	TZ20	195C30	73831
	L2	Inductor, Choke, 1mH, 20A	TZ15	195C20	73831
	L3	Inductor, Choke, 36mH, 3.0 ADC	TF02	147-1092-1	37338
	P1	Connector, 'D' Sub-Min, 9 Socket-Contacts	176-5100	176-5100	37338
	P2	Connector, 'D' Sub-Min, 9 Socket-Contacts	176-5100	176-5100	37338
	R1	Resistor, Metal Film, 820 Ohms, 2% 1/2W	RC36	RL20S821G	35005
	R2	Resistor, Metal Film, 820 Ohms, 2% 1/2W	RC36	RL20S821G	35005
	R3	Resistor, Metal Film, 2200 Ohms, 5% 2W	RBP15	GS-3, 2200 Ohms	75042
	R4	Resistor, Metal Film, 2200 Ohms, 5% 2W	RBP15	GS-3, 2200 Ohms	75042
	R5	Resistor, Metal Film, 4700 Ohms, 5% 2W	RBP17	GS-3, 4700 Ohms	75042
	R6	Resistor, Metal Film, 4700 Ohms, 5% 2W	RBP17	GS-3, 4700 Ohms	75042
	R7	Resistor, Metal Film, 4700 Ohms, 5% 2W	RBP17	GS-3, 4700 Ohms	75042
	R8	Resistor, Metal Film, 4700 Ohms, 5% 2W	RBP17	GS-3, 4700 Ohms	75042
	U1	Rectifier Bridge, 100V, 15A	UF15	MB151	51182
	U2	Rectifier Bridge, 200V, 25A	UG15	MB252	51182
	U3	Rectifier Bridge, 100V, 15A	UF15	MB151	51182
	XF1	Fuseholder, Panel, Type 3AG Fuse	BAP30	342012A	75915
	XF2	Fuseholder, Panel, Type 3AG Fuse	BAP30	342012A	75915
	XF3	Fuseholder, Panel, Type 3AG Fuse	BAP30	342012A	75915

Table 8-16 Ref Des Index - NASR106 DC Power Supply (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	XF4	Fuseholder, Panel, Type 3AG Fuse	BAP30	342012A	75915
	XF5	Fuseholder, Panel, Type 3AG Fuse	BAP30	342012A	75915
	XF6	Fuseholder, Panel, Type 3AG Fuse	BAP30	342012A	75915
	XF7	Fuseholder, Panel, Type 3AG Fuse	BAP27	HK7	71400
	XF8	Fuseholder, Panel, Type 3AG Fuse	BAP27	HK7	71400

NOTE: Partial reference designation shown. Prefix with 2A2 (composite ref des prefix, including all higher assemblies) to obtain complete reference designation.

Table 8-17 Ref Des Index - NAPS11 RF Drive Dc Power Supply

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	-	RF Drive Power Supply PWB	NAPS11A	185-7110-01	A/1	37338
	C1	Capacitor, Ceramic, 1.0uF 100V	CAP16	RPE114Z5U105M100V	A/1	72982
	C2	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	B/1	96095
	C3	Capacitor, Ceramic, 0.47uF 10% 50V	CCG09	CKR06BX474KRV	C/2	56289
	C4	Capacitor, Ceramic, 0.0047uF 10% 100V	CCG03	CKR05BX472KRV	D/2	56289
	C5	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	D/2	56289
	C6	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV	D/2	56289
	C7	Capacitor, Ceramic, 0.1uF 10% 100V	CCG07	CKR06BX104KRV	C/2	56289
	C8	Capacitor, Electrolytic, 820uF, 100V	CT33	URZA100VH821U25X64LL	A/7	1W344
	C9	Capacitor, Electrolytic, 820uF, 100V	CT33	URZA100VH821U25X64LL	C/5	1W344
	C10	Capacitor, Electrolytic, 820uF, 100V	CT33	URZA100VH821U25X64LL	D/5	1W344
	C11	Capacitor, Ceramic, 1.0uF 100V	CAP16	RPE114Z5U105M100V	D/4	72982
	C12	Capacitor, Electrolytic, 820uF, 100V	CT33	URZA100VH821U25X64LL	B/7	1W344
	C13	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	C/3	96095
	C14	Capacitor, Mica, Dipped, 5100pF 2% 500V	CCC32	CD19FD512G03	A/4	14655
	CR1	Diode, Zener, 56V, 1.5W, 2%	QG36	1N5943C	D/1	04713
	DS1	Diode, Light Emitting, Green	QK12	HLMP-3554	B/2	50434
	E1	Connector, Quick-Dis, M, 1/4 Tab, PWB	HR26	1287	A/1	91833
	E2	Connector, Quick-Dis, M, 1/4 Tab, PWB	HR26	1287	B/1	91833
	E3	Post Shunt, 2 Pos, .10 Centreline	JQ15	531220-2	C/2	09482
	E4	Connector, Quick-Dis, M, 1/4 Tab, PWB	HR26	1287	D/4	91833
	E5	Connector, Quick-Dis, M, 1/4 Tab, PWB	HR26	1287	D/3	91833
	J1	Connector, 'D' Sub-Min, 9-Pin-Contacts	JQ33	DE9P-FRS	C/1	63590
	L1	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	C/1	33062
	L2	Inductor Assembly	176-3014-01	176-3014-01	A/2	37338
	L3	Toroid, Ferrite, 6mm	LY09	11-122-B	B/4	33062
	L4	Toroid, Ferrite, 6mm	LY09	11-122-B	B/4	33062
	L5	Inductor Assembly	176-3014-01	176-3014-01	D/6	37338
	Q1	Transistor, Field Effect, N Channel	QA43	IRFP260	A/4	81483
	Q2	Transistor, Field Effect, N Channel	QA43	IRFP260	A/3	81483
	Q3	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	C/1	04713
	Q4	Transistor, NPN, General Purpose	QAP04	2N2219A	C/3	04713
	Q5	Transistor, PNP, Switch/Amplifier	QA23	2N2905A	B/3	04713
	R1	Resistor, Metal Film, 1210 Ohms, 1% 1/4W	RAB26	MF55D1211F	C/1	59124
	R2	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	C/2	59124
	R3	Resistor, Variable, Film, 1000 Ohms, 1/2W	RV06	3339P-1-102	C/2	80294
	R4	Resistor, Metal Film, 1.0M Ohms, 1% 1/4W	RAC13	MF55D1004F	D/2	59124
	R5	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	C/3	59124
	R6	Resistor, Metal Film, 12.1K Ohms, 1% 1/4W	RAB38	MF55D1212F	D/2	59124
	R7	Resistor, Metal Film, 22.1K Ohms, 1% 1/4W	RAB41	MF55D2212F	C/3	59124
	R8	Resistor, Metal Film, 1500 Ohms, 1% 1/4W	RAB27	MF55D1501F	D/2	59124
	R9	Resistor, Metal Film, 22.1K Ohms, 1% 1/4W	RAB41	MF55D2212F	D/2	59124
	R10	Resistor, Metal Film, 2210 Ohms, 1% 1/4W	RAB29	MF55D2211F	D/1	59124
	R11	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	C/1	59124
	R12	Resistor, Metal Film, 100 Ohms, 5% 2W	RBP07	GS-3, 100 Ohms	B/3	75042
	R13	Resistor, Metal Film, 1500 Ohms, 1% 1/4W	RAB27	MF55D1501F	D/3	59124
	R14	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	D/1	59124

Table 8-17 Ref Des Index - NAPS11 RF Drive Dc Power Supply (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	R15	Resistor, Wirewound, 0.1 Ohms 5%, 10W	RT35	NH-10 0.1 OHM ±5%	/	35005
	R16	Resistor, Wirewound, 0.1 Ohms 5%, 10W	RT35	NH-10 0.1 OHM ±5%	/	35005
	R17	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	C/3	59124
	R18	Resistor, Metal Film, 5.0 Ohms, 1% 30W	RA43	MP930-5.0-1%	A/4	CADDOCK
	U1	IC, Switchmode PWM Control Circuits	UM39	MC34060L	C/2	04713
	U2	Rect/Assy Diode Pair, 600V, 50A	UN42	HFA50PA60C	A/5	81483
	U3	Rect/Assy, Diode Pair, 200V, 30A	UT33	MUR3020PT	D/4	04713
	XE3	Header, SIP, 3 Pin-Contacts, 0.1 Centre	161-3008-03	161-3008-03	/	37338
	XU1	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	/	00779

NOTE: Partial reference designation shown. Prefix with 2A2A1 or 2A2A2 (composite ref des prefix, including all higher assemblies) to obtain complete reference designation.

Table 8-18 Ref Des Index - NASR95 Dual 3-Phase Rectifier

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	-	3-Phase Rectifier, Dual	NASR95A	176-7030-01	37338
	CR1	Diode, Power Rectifier, 1200V, 400A	QS08	SW12PHN400	1C498
	CR2	Diode, Power Rectifier, 1200V, 400A	QS08	SW12PHN400	1C498
	CR3	Diode, Power Rectifier, 1200V, 400A	QS08	SW12PHN400	1C498
	CR4	Diode, Power Rectifier, 1200V, 400A	QS09	SW12PHR400	1C498
	CR5	Diode, Power Rectifier, 1200V, 400A	QS09	SW12PHR400	1C498
	CR6	Diode, Power Rectifier, 1200V, 400A	QS09	SW12PHR400	1C498
	CR7	Diode, Power Rectifier, 1200V, 400A	QS08	SW12PHN400	1C498
	CR8	Diode, Power Rectifier, 1200V, 400A	QS08	SW12PHN400	1C498
	CR9	Diode, Power Rectifier, 1200V, 400A	QS08	SW12PHN400	1C498
	CR10	Diode, Power Rectifier, 1200V, 400A	QS09	SW12PHR400	1C498
	CR11	Diode, Power Rectifier, 1200V, 400A	QS09	SW12PHR400	1C498
	CR12	Diode, Power Rectifier, 1200V, 400A	QS09	SW12PHR400	1C498
	RV1	Varistor, 385 VAC, 220 Joules	QM15	SIOV-S20K385	37903
	RV2	Varistor, 385 VAC, 220 Joules	QM15	SIOV-S20K385	37903
	RV3	Varistor, 385 VAC, 220 Joules	QM15	SIOV-S20K385	37903
	RV4	Varistor, 385 VAC, 220 Joules	QM15	SIOV-S20K385	37903
	RV5	Varistor, 385 VAC, 220 Joules	QM15	SIOV-S20K385	37903
	RV6	Varistor, 385 VAC, 220 Joules	QM15	SIOV-S20K385	37903
	RV7	Varistor, 385 VAC, 220 Joules	QM15	SIOV-S20K385	37903
	RV8	Varistor, 385 VAC, 220 Joules	QM15	SIOV-S20K385	37903
	RV9	Varistor, 385 VAC, 220 Joules	QM15	SIOV-S20K385	37903
	RV10	Varistor, 385 VAC, 220 Joules	QM15	SIOV-S20K385	37903
	RV11	Varistor, 385 VAC, 220 Joules	QM15	SIOV-S20K385	37903
	RV12	Varistor, 385 VAC, 220 Joules	QM15	SIOV-S20K385	37903
	S1	Switch, Thermal, 1PST-NC, Open @ 82°C	SCP32	3100U-003-1445	14604
	S2	Switch, Thermal, 1PST-NC, Open @ 82°C	SCP32	3100U-003-1445	14604

NOTE: Partial reference designation shown. Prefix with 2A3 (composite ref des prefix, including all higher assemblies) to obtain complete reference designation.

Table 8-19 Ref Des Index - NAPX04 B+ Distribution PWB

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	X/Y GRID	OEM CODE
	-	B+ Distribution PWB	NAPX04	176-7017	-/-	37338
	C1	Capacitor, Polyester, 1.0uF, 10%, 400V	CP22	B32231-1.0-10-400	A/3	37903
	DS1	Diode, Light Emitting Green, 8.6mm Lg	QM20	SSL-LX5093GD	B/1	1EM90
	DS2	Diode, Light Emitting Green, 8.6mm Lg	QM20	SSL-LX5093GD	C/1	1EM90
	DS3	Diode, Light Emitting Green, 8.6mm Lg	QM20	SSL-LX5093GD	E/1	1EM90
	DS4	Diode, Light Emitting Green, 8.6mm Lg	QM20	SSL-LX5093GD	F/1	1EM90
	F1	Fuse, 40A, 600V	FC42	A4J40	B/4	21574
	F2	Fuse, 40A, 600V	FC42	A4J40	D/4	21574
	F3	Fuse, 40A, 600V	FC42	A4J40	F/4	21574
	F4	Fuse, 40A, 600V	FC42	A4J40	G/4	21574
	R1	Resistor, Metal Film, 82K Ohms, 5% 2W	RBP37	GS-3, 82K Ohms	B/1	75042
	R2	Resistor, Metal Film, 82K Ohms, 5% 2W	RBP37	GS-3, 82K Ohms	D/1	75042
	R3	Resistor, Metal Film, 82K Ohms, 5% 2W	RBP37	GS-3, 82K Ohms	E/1	75042
	R4	Resistor, Metal Film, 82K Ohms, 5% 2W	RBP37	GS-3, 82K Ohms	G/1	75042

NOTE: Partial reference designation shown. Prefix with 2A4, 2A5, 2A6 or 2A7 (composite ref des prefix, including all higher assemblies) to obtain complete reference designation.

Table 8-20 Ref Des Index - NAS44/01 3-ø SCR Power Supply

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	-	3-ø SCR Power Supply	NAS44/01	185-7050-01	37338
	C1	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	96095
	C2	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	96095
	C3	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	56289
	C4	Capacitor, Plastic, 0.22uF, 5% 100V	CA06	150224J100CB	90201
	C5	Capacitor, Plastic, 0.22uF, 5% 100V	CA06	150224J100CB	90201
	C6	Capacitor, Plastic, 0.22uF, 5% 100V	CA06	150224J100CB	90201
	C7	Capacitor, Ceramic, 0.01uF, 10% 100V	CCG04	CKR05BX103KRV	56289
	C8	Capacitor, Ceramic, 0.01uF, 10% 100V	CCG04	CKR05BX103KRV	56289
	C9	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	56289
	C10	Capacitor, Ceramic, 0.1uF, 10% 100V	CCG07	CKR06BX104KRV	56289
	C11	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	72982
	C12	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	72982
	C13	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	72982
	C14	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	72982
	C15	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	72982
	C16	Capacitor, Ceramic, 1.0uF, 100V	CAP16	RPE114Z5U105M100V	72982
	C17	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	96095
	C18	Capacitor, Ceramic, 1.0uF, 10% 50V	CCG10	CKR06BX105KRV	56289
	C19	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	TAP106K035G	96095
	CR1	Diode, Zener, Transient Supressor, 20V	QI29	P6KE20CA	04713
	CR2	Diode, Zener, Transient Supressor, 20V	QI29	P6KE20CA	04713
	CR3	Diode, Zener, Transient Supressor, 20V	QI29	P6KE20CA	04713
	CR4	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	27014
	CR5	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	27014
	CR6	Diode, General Purpose, 200V, 0.1A	QAP29	1N4938	27014
	CR7	Diode, General Purpose, 400V, 1A	QE28	1N4004	04713
	CR8	Diode, General Purpose, 400V, 1A	QE28	1N4004	04713
	CR9	Diode, General Purpose, 400V, 1A	QE28	1N4004	04713
	CR10	Diode, General Purpose, 400V, 1A	QE28	1N4004	04713
	CR11	Diode, General Purpose, 400V, 1A	QE28	1N4004	04713
	CR12	Diode, General Purpose, 400V, 1A	QE28	1N4004	04713
	CR13	Diode, Fast Recovery, 400V, 12A	QN27	1N3893R	81483
	CR14	Diode, Fast Recovery, 400V, 12A	QN27	1N3893R	81483
	CR15	Diode, Zener, 15V, 1W, 5%	QE40	1N4744A	04713
	E1	Terminal, Screw, 10-32	HAC46	1202	91833
	E2	Terminal, Screw, 10-32	HAC46	1202	91833
	E3	Terminal, Screw, 10-32	HAC46	1202	91833
	E4	Terminal, Screw, 10-32	HAC46	1202	91833
	E5	Terminal, Screw, 10-32	HAC46	1202	91833
	E6	Terminal, Screw, 10-32	HAC46	1202	91833
	E7	Terminal, Screw, 10-32	HAC46	1202	91833
	E8	Terminal, Screw, 10-32	HAC46	1202	91833
	E9	Terminal, Standoff, Swage	HAC34	1502-2	91833
	J1	Connector, 'D' Sub-Min, 9 Pin-Contacts	JQ33	DE9P-FRS	63590
	L1	Inductor, Choke, 2.5 Turns, J Material	LA16	82-152-J	33062
	Q1	Transistor, PNP, Power, High Voltage	QB11	2N5416	50088

Table 8-20 Ref Des Index - NAS44/01 3-ø SCR Power Supply (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	Q2	Transistor, Field Effect, P Channel	QM21	2N5116	17856
	Q3	Transistor, Field Effect, P Channel	QM21	2N5116	17856
	Q4	Transistor, Field Effect, P Channel	QM21	2N5116	17856
	Q5	Transistor, NPN, Power, High Voltage	QE02	2N3439	04713
	Q6	Transistor, NPN, Power, High Voltage	QE02	2N3439	04713
	Q7	Transistor, NPN, Power, High Voltage	QE02	2N3439	04713
	Q8	Transistor, NPN, Power, High Voltage	QE02	2N3439	04713
	Q9	Transistor, NPN, Power, High Voltage	QE02	2N3439	04713
	Q10	Transistor, NPN, Power, High Voltage	QE02	2N3439	04713
	Q11	Transistor, PNP, Power, High Voltage	QB11	2N5416	50088
	Q12	Transistor, PNP, Power, High Voltage	QB11	2N5416	50088
	Q13	Transistor, PNP, Power, High Voltage	QB11	2N5416	50088
	Q14	Transistor, PNP, Power, High Voltage	QB11	2N5416	50088
	Q15	Transistor, PNP, Power, High Voltage	QB11	2N5416	50088
	Q16	Transistor, PNP, Power, High Voltage	QB11	2N5416	50088
	Q17	Thyristor, SCR, 65A, 400V	QR28	S4065K	27194
	Q18	Thyristor, SCR, 65A, 400V	QR28	S4065K	27194
	Q19	Thyristor, SCR, 65A, 400V	QR28	S4065K	27194
	Q20	Thyristor, SCR, 65A, 400V	QR28	S4065K	27194
	Q21	Thyristor, SCR, 65A, 400V	QR28	S4065K	27194
	Q22	Thyristor, SCR, 65A, 400V	QR28	S4065K	27194
	Q23	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	04713
	R1	Resistor, Metal Film, 47.5K Ohms, 1% 1/4W	RAB45	MF55D4752F	59124
	R2	Not Used			
	R3	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	59124
	R4	Resistor, Metal Film, 15K Ohms, 1% 1/4W	RAB39	MF55D1502F	59124
	R5	Resistor, Metal Film, 15K Ohms, 1% 1/4W	RAB39	MF55D1502F	59124
	R6	Resistor, Metal Film, 15K Ohms, 1% 1/4W	RAB39	MF55D1502F	59124
	R7	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	59124
	R8	Resistor, Metal Film, 392 Ohms, 1% 1/4W	RAB20	MF55D3920F	59124
	R9	Resistor, Variable, Film, 1000 Ohms, 1/2W	RV06	3339P-1-102	80294
	R10	Resistor, Metal Film, 8250 Ohms, 1% 1/4W	RAB36	MF55D8251F	59124
	R11	Resistor, Metal Film, 332K Ohms, 1% 1/4W	RAC07	MF55D3323F	59124
	R12	Resistor, Metal Film, 33.2K Ohms, 1% 1/4W	RAB43	MF55D3322F	59124
	R13	Resistor, Metal Film, 47.5K Ohms, 1% 1/4W	RAB45	MF55D4752F	59124
	R14	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	59124
	R15	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	59124
	R16	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	59124
	R17	Resistor, Metal Film, 100K Ohms, 1% 1/4W	RAC01	MF55D1003F	59124
	R18	Not Used			
	R19	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	59124
	R20	Resistor, Metal Film, 5620 Ohms, 1% 1/4W	RAB34	MF55D5621F	59124
	R21	Resistor, Metal Film, 5620 Ohms, 1% 1/4W	RAB34	MF55D5621F	59124
	R22	Resistor, Metal Film, 5620 Ohms, 1% 1/4W	RAB34	MF55D5621F	59124
	R23	Resistor, Metal Film, 5620 Ohms, 1% 1/4W	RAB34	MF55D5621F	59124
	R24	Resistor, Metal Film, 5620 Ohms, 1% 1/4W	RAB34	MF55D5621F	59124
	R25	Resistor, Metal Film, 5620 Ohms, 1% 1/4W	RAB34	MF55D5621F	59124

Table 8-20 Ref Des Index - NAS44/01 3-ø SCR Power Supply (Continued)

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	R26	Resistor, Metal Film, 1500 Ohms, 5% 2W	RBP14	GS-3, 1500 Ohms	75042
	R27	Resistor, Metal Film, 1500 Ohms, 5% 2W	RBP14	GS-3, 1500 Ohms	75042
	R28	Resistor, Metal Film, 1500 Ohms, 5% 2W	RBP14	GS-3, 1500 Ohms	75042
	R29	Resistor, Metal Film, 1500 Ohms, 5% 2W	RBP14	GS-3, 1500 Ohms	75042
	R30	Resistor, Metal Film, 1500 Ohms, 5% 2W	RBP14	GS-3, 1500 Ohms	75042
	R31	Resistor, Metal Film, 1500 Ohms, 5% 2W	RBP14	GS-3, 1500 Ohms	75042
	R32	Resistor, Current Shunt	185-7054-01	185-7054-01	37338
	R33	Resistor, Metal Film, 1000 Ohms, 1% 1/4W	RAB25	MF55D1001F	59124
	R34	Resistor, Metal Film, 8250 Ohms, 1% 1/4W	RAB36	MF55D8251F	59124
	R35	Resistor, Metal Film, 33.2K Ohms, 1% 1/4W	RAB43	MF55D3322F	59124
	R36	Resistor, Metal Film, 332K Ohms, 1% 1/4W	RAC07	MF55D3323F	59124
	R37	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	59124
	R38	Resistor, Metal Film, 4750 Ohms, 1% 1/4W	RAB33	MF55D4751F	59124
	R39	Resistor, Metal Film, 10K Ohms, 1% 1/4W	RAB37	MF55D1002F	59124
	R40	Resistor, Metal Film, 2200 Ohms, 5% 2W	RBP15	GS-3, 2200 Ohms	75042
	U1	IC, Operational Amplifier, Quad, Common VCC	UR42	MC34074AP	04713
	U2	IC, Operational Amplifier, Quad, Common VCC	UR42	MC34074AP	04713
	XU1	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	00779
	XU2	Socket, DIP, 14 Socket-Contacts	UC02	2-641261-1	00779

NOTE: Partial reference designation shown. Prefix with 2A9 (composite ref des prefix, including all higher assemblies) to obtain complete reference designation.

Table 8-21 Ref Des Index - NAX189 MOV Assembly

USE CODE	REF DES	NAME OF PART AND DESCRIPTION	NAUTEL'S PART NO.	JAN/MIL/OEM PART NO.	OEM CODE
	-	MOV Assembly	NAX189	184-7090	37338
	C1	Capacitor, Polypropylene, 0.015uF, 800 VAC	CT39	715P1535800L	SBELEC
	C2	Capacitor, Polypropylene, 0.015uF, 800 VAC	CT39	715P1535800L	SBELEC
	C3	Capacitor, Polypropylene, 0.015uF, 800 VAC	CT39	715P1535800L	SBELEC
	C4	Capacitor, Polypropylene, 0.015uF, 800 VAC	CT39	715P1535800L	SBELEC
	C5	Capacitor, Polypropylene, 0.015uF, 800 VAC	CT39	715P1535800L	SBELEC
	C6	Capacitor, Polypropylene, 0.015uF, 800 VAC	CT39	715P1535800L	SBELEC
	F1	Fuse, 30A, 600V, 5AB, Fibre	FC25	KTK-30	71400
	F2	Fuse, 30A, 600V, 5AB, Fibre	FC25	KTK-30	71400
	F3	Fuse, 30A, 600V, 5AB, Fibre	FC25	KTK-30	71400
	F4	Fuse, 30A, 600V, 5AB, Fibre	FC25	KTK-30	71400
	F5	Fuse, 30A, 600V, 5AB, Fibre	FC25	KTK-30	71400
	F6	Fuse, 30A, 600V, 5AB, Fibre	FC25	KTK-30	71400
	RV1	Varistor, 275V, 860J, 70kA	QAP43	SIOV-B60K275	37903
	RV2	Varistor, 275V, 860J, 70kA	QAP43	SIOV-B60K275	37903
	RV3	Varistor, 275V, 860J, 70kA	QAP43	SIOV-B60K275	37903
	RV4	Varistor, 275V, 860J, 70kA	QAP43	SIOV-B60K275	37903
	RV5	Varistor, 275V, 860J, 70kA	QAP43	SIOV-B60K275	37903
	RV6	Varistor, 275V, 860J, 70kA	QAP43	SIOV-B60K275	37903
	XF1	Fuse Block, 30A, 600V, 3-Position	FC26	2812	71400
	XF2	Fuse Block, 30A, 600V, 3-Position	FC26	2812	71400

NOTE: Partial reference designation shown. Prefix with 2A11 (composite ref des prefix, including all higher assemblies) to obtain complete reference designation.

SECTION 9
WIRING LISTS

INTRODUCTION

9.1 This section contains wiring information for hard-wired assemblies of the subject unit. Refer to table 9-1 for an itemized listing of assemblies that have wiring lists.

WIRING LISTS NOT PROVIDED

9.2 Separate wiring lists are not provided for some assemblies, as described below.

9.2.1 Wiring lists are not provided for assemblies that have separate maintenance manuals. Refer to the associated maintenance manual for detailed wiring information of these assemblies.

9.2.2 Wiring lists are not provided for assemblies that have their wiring information adequately depicted/tabulated on their assembly detail drawings. Refer to the associated assembly detail drawing for detailed wiring information of these assemblies.

PRINTED WIRING PATTERNS

9.3 The need for printed wiring pattern information is beyond the scope of this manual; therefore, detailed printed wiring patterns for printed circuit boards are not included.

WIRE COLORS

9.4 Every effort is made to manufacture the assemblies using wire that is the color tabulated in the 'Code' column of the wiring list tables. In some instances, a white wire will be substituted. In this case identification must be determined by locating the assigned identification number.

WIRING LISTS PROVIDED

9.5 The wiring lists tabulated in table 9-1 are provided. These lists provide non-printed wiring pattern, point-to-point (source/destination) interconnecting information.

Table 9-1 Wiring Lists Provided

Table 9-2	Wiring List - NA100 100kW AM Broadcast Transmitter
Table 9-3	Wiring List - 176-8304-02 50kW Distribution Cableform (1W1)
Table 9-4	Wiring List - 176-8304-02 50kW Distribution Cableform (1W2)
Table 9-5	Wiring List - 176-6199 Staircase Capacitor Assembly
Table 9-6	Wiring List - 176-8250-05 and 176-8250-07 Back Plate Assemblies
Table 9-7	Wiring List - NAR222B AC/DC Power Supply Cabinet
Table 9-8	Wiring List - NASR106 DC Power Supply
Table 9-9	Wiring List - 176-7600-01 Power Supply Fan Tray
Table 9-10	Wiring List - MOV Assembly
Table 9-11	Wiring List - 176-5710 Power Module Test Cable (Optional)
Table 9-12	Connector Mating Information - Sorted by Floating Connector
Table 9-13	Connector Mating Information - Sorted by Fixed Connector

Table 9-2 Wiring List - NA100 100kW AM Broadcast Transmitter Cableform

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	P1-1	P12-4	1	White	22	
	P1-2	P12-7	2	White	22	
	P1-3	P12-8	3	White	22	
	P1-4	P12-12	4	White	22	
	P1-6	E44-A	5	White	22	
	P1-7	E23-A	6	White	22	
	P1-8	P7-16	7	White	22	
	P1-9	P5-4	8	White	22	
	P1-10	P6-14	9	White	22	
	P1-11	P7-6	10	White	22	
	P1-12	P5-25	11	White	22	
	P1-14	P12-2	12	White	22	
	P1-16	P12-5	13	White	22	
	P1-17	P12-6	14	White	22	
	P1-24	P5-11	15A	White	22	2-Conductor
	P1-23	P5-12	15B	Black	22	
	P1-22	P5-10	15	Shield	-	Shielded
	P21-10	P1-5	16	White	22	
	P1-25	1A1M1(-)	17	White	22	
	P2-1	P7-2	18	White	22	
	P2-2	E33-A	19	White	22	2-Conductor
	P2-14	E34-A	19	Shield	-	Shielded
	P-3	E15-B	20	White	22	
	P-4	E24-A	21	White	22	
	P-5	P12-1	22	White	22	
	P2-6	1A3S1-3	23	White	22	
	P2-7	P7-1	24	White	22	
	P2-8	E32-A	25	White	22	
	P2-9	P21-12	26	Core	RG174	Coaxial Cable
	P2-21	P21-25	26	Shield		
	P2-10	P7-14	27	White	22	
	P2-11	P7-7	28	White	22	
	P2-12	P15-Centre	29	Core	RG174	Coaxial Cable
	P2-24	P15-Body	29	Shield		
	P2-13	P22-4	30	White	22	
	P2-17	E18-B	31	Black	22	
	P2-18	E18-B	32	Black	22	
	P2-15	P12-13	33	White	22	
	P2-25	P5-13	34	White	22	
	P3-1	E4-B	35	White	22	
	P3-9	E4-B	36	White	22	
	P3-2	E2-B	37	White	22	
	P3-3	E6-B	38	White	22	
	P3-4	E9-B	39	White	22	
	P3-5	P5-22	40	White	22	1-Conductor
	P3-12	P5-21	40	Shield	-	Shielded
	P3-6	E18-B	41	Black	22	
	P3-13	E18-B	42	Black	22	

Table 9-2 Wiring List - NA100 100kW AM Broadcast Transmitter Cableform (Continued)

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	P3-7	E5-B	43	White	22	
	P3-14	E5-B	44	White	22	
	P3-8	E11-B	45	White	22	
	P3-15	E11-B	46	White	22	
	P3-10	E14-A	47	White	22	
	P4-Centre	P16-Centre	48	Core	RG174	Coaxial Cable
	P4-Body	P16-Body	48	Shield		
	P5-6	E3-B	49	White	22	
	P5-7	E3-B	50	White	22	
	P5-2	E5-B	51	White	22	
	P5-15	E5-B	52	White	22	
	P5-8	E4-B	53	White	22	
	P5-20	E4-B	54	White	22	
	P5-1	E2-B	55	White	22	
	P5-14	E2-B	56	White	22	
	P24-10	P21-9	57	White	22	
	P25-4	P22-8	58	White	22	
	1A59A1-5	P26-Centre	59	Core	RG58	Coaxial Cable
	Gnd at 1A59A1	P26-Body	59	Shield		
			60	Not Used		
	P7-3	E45-B	61	White	22	1-Conductor
	P7-15	E46-B	61	Shield	-	Shielded
	P7-8	E33-A	62	White	22	1-Conductor
	P7-18	E34-A	62	Shield	-	Shielded
	P6-3	E6-A	63	White	22	
	P6-4	E6-A	64	White	22	
	P6-5	E6-A	65	White	22	
	P6-6	E6-A	66	White	22	
	P6-7	E9-A	67	White	22	
	P6-8	E9-A	68	White	22	
	P6-9	E10-A	69	White	22	
	P6-10	E10-A	70	White	22	
	P6-24	E14-A	71	White	22	
	P7-9	E37-A	72	White	22	1-Conductor
	P7-10	E38-A	72	Shield	-	Shielded
	P7-11	E39-A	73	White	22	1-Conductor
	P7-12	E40-A	73	Shield	-	Shielded
	P5-18	E41-A	74	White	22	1-Conductor
	P5-19	E42-A	74	Shield	-	Shielded
	P5-5	E43-A	75	White	22	
	P5-9	E32-A	76	White	22	
	P5-3	E31-A	77	White	22	
	P7-19	P13-8	78	White	22	
	P7-4	P10-1	79	White	22	
	P7-5	P11-1	80	White	22	
	P7-22	P13-13	81	White	22	
	P7-23	P13-14	82	White	22	
			83	Not Used		

Table 9-2 Wiring List - NA100 100kW AM Broadcast Transmitter Cableform (Continued)

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	P8-Centre	P10-9	84	Core	RG174	Coaxial Cable
	P8-Body	P10-8	84	Shield		
	P9-Centre	P11-9	85	Core	RG174	Coaxial Cable
	P9-Body	P11-8	85	Shield		
	P6-23	P10-7	86	White	22	
	P6-22	P11-7	87	White	22	
	P7-24	E25-A	88	White	22	
	P7-25	E26-A	89	White	22	
	P10-3	E25-B	90	White	22	
	P10-4	E29-B	91	White	22	
	P10-5	E29-B	92	White	22	
	P10-6	E23-A	93	White	22	
	P11-3	E26-B	94	White	22	
	P11-4	E29-B	95	White	22	
	P11-5	E29-B	96	White	22	
	P11-6	E23-A	97	White	22	
	-		98	Not Used		
	P12-9	E23-B	99	White	22	
	P12-11	E30-B	100	White	22	
	P12-15	E9-B	101	White	22	
	P13-1	E4-A	102	White	16	
	P13-2	E5-A	103	White	16	
	P13-3	E1-A	104	White	16	
	P13-4	E3-A	105	White	18	
	P13-5	E27-A	106	White	14	
	P13-6	E28-A	107	White	14	
	P13-7	E29-A	108	White	16	
	P13-9	E15-A	109	White	16	
	P13-10	E15-A	110	White	16	
	P13-12	E25-B	111	White	22	
	P13-15	E26-B	112	White	22	
	P14-Centre	P20-Centre	113	White	22	1-Conductor
	P14-Body Shielded	P20-Body	113	Shield	-	
	P17-Centre	P19-Centre	114	Core	RG58	Coaxial Cable
	P17-Body	P19-Body	114	Shield		
	P18-Centre	P23-Centre	115	Core	RG58	Coaxial Cable
	P18-Body	P23-Body	115	Shield		
	P21-1	E16-B	116	White	22	
	P21-2	E16-B	117	White	22	
	P21-14	E16-B	118	White	22	
	P21-3	E1-B	119	White	22	
	P21-4	E7-B	120	White	22	
	P21-5	E7-B	121	White	22	
	P21-6	E43-B	122	White	22	
	P21-7	E9-B	123	White	22	
	P21-8	E14-B	124	White	22	
	P21-22	E12-B	125	White	22	
	P21-23	E12-B	126	White	22	

Table 9-2 Wiring List - NA100 100kW AM Broadcast Transmitter Cableform (Continued)

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	P21-11	E31-B	127	White	22	
	P21-13	E24-A	128	White	22	
	P21-15	E32-B	129	White	22	
	P21-16	E45-B	130	White	22	1-Conductor
	P21-19	E46-B	130	Shield	-	Shielded
	P21-18	E30-A	131	White	22	
	-		132	Not Used		
	P21-24	1A3A1M1 (+)	133	White	22	1-Conductor
	P21-21	1A3A1M1 (-)	133	Shield	-	Shielded
	P22-1	E27-B	134	White	22	
	P22-2	E27-B	135	White	22	
	P22-9	E27-B	136	White	22	
	P22-3	E39-B	137	White	22	1-Conductor
	P22-10	E40-B	137	Shield	-	Shielded
	P22-5	E44-B	138	White	22	
	P22-6	E37-B	139	White	22	1-Conductor
	P22-11	E38-B	139	Shield	-	Shielded
	P22-7	E33-B	140	White		1-Conductor
	P22-15	E34-B	140	Shield	-	Shielded
	P22-12	E41-B	141	White	22	1-Conductor
	P22-13	E42-B	141	Shield	-	Shielded
	P22-14	E23-A	142	White	22	
	P24-1	E17-B	143	White	22	
	P24-2	E17-B	144	White	22	
	P24-14	E17-B	145	White	22	
	P24-3	E1-B	146	White	22	
	P24-4	E8-B	147	White	22	
	P24-5	E8-B	148	White	22	
	P24-6	E43-B	149	White	22	
	P24-8	E14-B	150	White	22	
	P24-22	E13-B	151	White	22	
	P24-23	E13-B	152	White	22	
	P24-11	E31-B	153	White	22	
	P24-13	E24-B	154	White	22	
	P24-15	E32-B	155	White	22	
	P25-1	E28-B	156	White	22	
	P25-2	E28-B	157	White	22	
	P25-9	E28-B	158	White	22	
	P25-3	E39-B	159	White	22	1-Conductor
	P25-10	E40-B	159	Shield	-	Shielded
	P25-5	E44-B	160	White	22	
	P25-6	E37-B	161	White	22	1-Conductor
	P25-11	E38-B	161	Shield	-	Shielded
	P25-7	E33-B	162	White	22	1-Conductor
	P25-15	E34-B	162	Shield	-	Shielded
	P25-12	E41-B	163	White	22	1-Conductor
	P25-13	E42-B	163	Shield	-	Shielded
	P25-14	E23-B	164	White	22	

Table 9-2 Wiring List - NA100 100kW AM Broadcast Transmitter Cableform (Continued)

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	E1-B	E2-A	165	White	20	
	E6-B	E7-A	166	White	20	
	E6-B	E8-A	167	White	20	
	E10-A	E11-A	168	White	20	
	E10-B	E12-A	169	White	20	
	E10-B	E13-A	170	White	20	
	E15-B	E16-A	171	White	18	
	E15-B	E17-A	172	White	18	
	E30-A	1A1M1 (+)	173	White	22	
			174	Not Used		
	E45-A	1A59E18	175	White	22	1-Conductor
	E46-A	Gnd at 1A59E17	175	Shield	-	Shielded
	1A3S1-4	1S2-3	176	White	20	
	1S2-4	1S1-3	177	White	20	
	1S1-4	1A3S2-3	178	White	20	
	1A3S2-4	2S2-3	179	White	20	
	P1-19	P5-23	180	White	22	
			181	Not Used		
	Rack1 Gnd A	1A2E1	182	Black	12	
	Rack2 Gnd A	1A2E1	183	Black	12	
	2A2E1 ( )	1A2E1	184	White	10	
	-		185	Not Used		
	E18-A	1A2E1	186	Black	16	
	Gnd at CM	1A2E1	187	Black	16	
	-		188	Not Used		
	1A43C1 (+)	2A4-A	189	Black	8	
	1A44C1 (+)	2A4-B	190	Black	8	
	1A45C1 (+)	2A4-C	191	Black	8	
	1A46C1 (+)	2A4-D	192	Black	8	
	1A47C1 (+)	2A5-A	193	Black	8	
	1A48C1 (+)	2A5-B	194	Black	8	
	1A49C1 (+)	2A5-C	195	Black	8	
	1A50C1 (+)	2A5-D	196	Black	8	
	1A51C1 (+)	2A6-A	197	Black	8	
	1A52C1 (+)	2A6-B	198	Black	8	
	1A53C1 (+)	2A6-C	199	Black	8	
	1A54C1 (+)	2A6-D	200	Black	8	
	1A55C1 (+)	2A7-A	201	Black	8	
	1A56C1 (+)	2A7-B	202	Black	8	
	1A57C1 (+)	2A7-C	203	Black	8	
	1A58C1 (+)	2A7-D	204	Black	8	
	E1-A	1A3A2A1E1	205	White	2	
	1A3A2A1E2	Gnd at 1A3A2	206	Black	22	
	1A59E19	P27-5	207	White	22	
	1A59E19	P29-5	208	White	22	
	P3-11	P27-1	209	White	22	
	P2-23	P27-7	210	Black	22	
	P27-6	P1-13	211	White	22	

Table 9-2 Wiring List - NA100 100kW AM Broadcast Transmitter Cableform (Continued)

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	P27-2	P28-1	212	White	22	
	P27-9	P28-5	213	White	22	
	P27-8	P28-7	214	Black	22	
	P28-6	P27-4	215	White	22	
	P28-2	P29-1	216	White	22	
	P28-8	P29-7	217	Black	22	
	P29-6	P28-4	218	White	22	
	P29-8	P30-7	219	Black	22	
	P29-2	P30-1	220	White	22	
	P29-9	P30-5	221	White	22	
	P30-6	P29-4	222	White	22	
	1A37E1	1A39E1	-	White	16	
	1A38E1	1A39E2	-	White	16	
	1A1A1-A	1A1M3 (+)	-	White	20	
	1A1A1-B	1A1M3 (-)	-	Black	20	
	1A1A2-A	1A1M2 (+)	-	White	20	
	1A1A2-B	1A1M2 (-)	-	Black	20	
	2S2-4	Ground	-	Black	20	
	1A41A1E1	1A60T1-C	-	Yellow	10	Teflon
	1A41A1E2	1A60T4-C	-	Yellow	10	Teflon
	1A41A1E3	1A60T2-C	-	Yellow	10	Teflon
	1A41A1E4	1A60T3-C	-	Yellow	10	Teflon
	1A41A2E1	1A60T5-C		Yellow	10	Teflon
	1A41A2E2	1A60T8-C	-	Yellow	10	Teflon
	1A41A2E3	1A60T6-C	-	Yellow	10	Teflon
	1A41A2E4	1A60T7-C	-	Yellow	10	Teflon
	1A42A1E1	1A59T1-C	-	Yellow	10	Teflon
	1A42A1E2	1A59T4-C	-	Yellow	10	Teflon
	1A42A1E3	1A59T2-C	-	Yellow	10	Teflon
	1A42A1E4	1A59T3-C	-	Yellow	10	Teflon
	1A42A2E1	1A59T5-C	-	Yellow	10	Teflon
	1A42A2E2	1A59T8-C	-	Yellow	10	Teflon
	1A42A2E3	1A59T6-C	-	Yellow	10	Teflon
	1A42A2E4	1A59T7-C	-	Yellow	10	Teflon

Table 9-3 Wiring List - 176-8304-02 50kW Distribution Cableform (1W1)

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	1W1P1-1	1A36XTB2-5	1	White	22	
	1W1P1-2	1A36XTB2-3	2	White	22	
	1W1P1-3	1A36XTB1-3	3	White	22	
	1W1P1-4	1A36XTB2-10	4	White	22	1-Conductor
	1W1P1-5	1A36-Ground	4	Shield	-	Shielded
	1W1P1-6	1A36XTB2-12	5	White	22	1-Conductor
	1W1P1-7	1A36-Ground	5	Shield	-	Shielded
	1W1P1-8	1A36XTB2-14	6	White	22	1-Conductor
	1W1P1-9	1A36-Ground	6	Shield	-	Shielded
	1W1P1-10	1W1P17-Centre	7	Core	RG174/U	Coaxial Cable
	1W1P1-11	1W1P17-Body	7	Shield	-	
	1W1P1-12	1A36XTB2-1	8	White	22	
	1W1P1-13	1A36XTB1-5	9	White	22	
	1W1P1-14	1A36XTB1-10	10	White	22	
	1W1P1-15	1A36XTB1-7	11	White	22	
	1W1P1-16	1A36XTB1-14	12	White	22	
	1W1P1-17	1W1E1-A	13	Black	20	
	1W1P1-18	1A36XTB2-7	14	White	22	
	1W1P1-19	1A36-Ground	15	Black	20	
	1W1P1-20	1W1P25-15	16	White	22	
	1W1P1-21	1W1P25-7	17	White	22	
	1A59K8-B	1W1P25-11	18	White	22	
	1W1P9-1	1W1P26-2	19	White	22	
	1W1P9-2	Ground	20	Black	22	
	1W1P2-1	1A36XTB2-5	21	White	22	
	1W1P2-2	1A36XTB2-3	22	White	22	
	1W1P2-3	1A36XTB1-3	23	White	22	
	1W1P2-4	1A36XTB2-10	24	White	22	1-Conductor
	1W1P2-5	1A36-Ground	24	Shield	-	Shielded
	1W1P2-6	1A36XTB2-12	25	White	22	1-Conductor
	1W1P2-7	1A36-Ground	25	Shield	-	Shielded
	1W1P2-8	1A36XTB2-14	26	White	22	1-Conductor
	1W1P2-9	1A36-Ground	26	Shield	-	Shielded
	1W1P2-10	1W1P18-Centre	27	Core	RG174A/U	Coaxial Cable
	1W1P2-11	1W1P18-Body	27	Shield	-	
	1W1P2-12	1A36XTB2-1	28	White	22	
	1W1P2-13	1A36XTB1-5	29	White	22	
	1W1P2-14	1A36XTB1-10	30	White	22	
	1W1P2-15	1A36XTB1-7	31	White	22	
	1W1P2-16	1A36XTB1-14	32	White	22	
	1W1P2-17	1W1E1-A	33	Black	20	
	1W1P2-18	1A36XTB2-7	34	White	22	
	1W1P2-19	1A36-Ground	35	Black	20	
	1W1P2-20	1W1P25-16	36	White	22	
	1W1P2-21	1W1P25-6	37	White	22	
	1A59K7-B	1W1P25-12	38	White	22	
	1W1P10-1	1W1P26-4	39	White	22	
	1W1P10-2	1W1P9-2	40	White	22	

Table 9-3 Wiring List - 176-8304-02 50kW Distribution Cableform (1W1) Continued

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	1W1P3-1	1A36XTB2-5	41	White	22	
	1W1P3-2	1A36XTB2-3	42	White	22	
	1W1P3-3	1A36XTB1-3	43	White	22	
	1W1P3-4	1A36XTB2-10	44	White	22	1-Conductor
	1W1P3-5	1A36-Ground	44	Shield	-	Shielded
	1W1P3-6	1A36XTB2-12	45	White	22	1-Conductor
	1W1P3-7	1A36-Ground	45	Shield	-	Shielded
	1W1P3-8	1A36XTB2-14	46	White	22	1-Conductor
	1W1P3-9	1A36-Ground	46	Shield	-	Shielded
	1W1P3-10	1W1P19-Centre	47	Core	RG174A/U	Coaxial Cable
	1W1P3-11	1W1P19-Body	47	Shield	-	
	1W1P3-12	1A36XTB2-1	48	White	22	
	1W1P3-13	1A36XTB1-5	49	White	22	
	1W1P3-14	1A36XTB1-10	50	White	22	
	1W1P3-15	1A36XTB1-7	51	White	22	
	1W1P3-16	1A36XTB1-14	52	White	22	
	1W1P3-17	1W1E1-A	53	Black	20	
	1W1P3-18	1A36XTB2-7	54	White	22	
	1W1P3-19	1A36-Ground	55	Black	20	
	1W1P3-20	1W1P25-17	56	White	22	
	1W1P3-21	1W1P25-5	57	White	22	
	1A59K6-B	1W1P25-13	58	White	22	
	1W1P11-1	1W1P26-5	59	White	22	
	1W1P11-2	Ground	60	White	22	
	1W1P4-1	1A36XTB2-5	61	White	22	
	1W1P4-2	1A36XTB2-3	62	White	22	
	1W1P4-3	1A36XTB1-3	63	White	22	
	1W1P4-4	1A36XTB2-10	64	White	22	1-Conductor
	1W1P4-5	1A36-Ground	64	Shield	-	Shielded
	1W1P4-6	1A36XTB2-12	65	White	22	1-Conductor
	1W1P4-7	1A36-Ground	65	Shield	-	Shielded
	1W1P4-8	1A36XTB2-14	66	White	22	1-Conductor
	1W1P4-9	1A36-Ground	66	Shield	-	Shielded
	1W1P4-10	1W1P20-Centre	67	Core	RG174A/U	Coaxial Cable
	1W1P4-11	1W1P20-Body	67	Shield	-	
	1W1P4-12	1A36XTB2-1	68	White	22	
	1W1P4-13	1A36XTB1-5	69	White	22	
	1W1P4-14	1A36XTB1-10	70	White	22	
	1W1P4-15	1A36XTB1-7	71	White	22	
	1W1P4-16	1A36XTB1-14	72	White	22	
	1W1P4-17	1W1E1-A	73	Black	20	
	1W1P4-18	1A36XTB2-7	74	White	22	
	1W1P4-19	1A36-Ground	75	Black	20	
	1W1P4-20	1W1P25-18	76	White	22	
	1W1P4-21	1W1P25-4	77	White	22	
	1A59K5-B	1W1P25-21	78	White	22	
	1W1P12-1	1W1P26-8	79	White	22	
	1W1P12-2	1W1P11-2	80	White	22	

Table 9-3 Wiring List - 176-8304-02 50kW Distribution Cableform (1W1) Continued

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	1W1P5-1	1A36XTB2-6	81	White	22	
	1W1P5-2	1A36XTB2-4	82	White	22	
	1W1P5-3	1A36XTB1-4	83	White	22	
	1W1P5-4	1A36XTB2-11	84	White	22	1-Conductor
	1W1P5-5	1A36-Ground	84	Shield	-	Shielded
	1W1P5-6	1A36XTB2-13	85	White	22	1-Conductor
	1W1P5-7	1A36-Ground	85	Shield	-	Shielded
	1W1P5-8	1A36XTB2-15	86	White	22	1-Conductor
	1W1P5-9	1A36-Ground	86	Shield	-	Shielded
	1W1P5-10	1W1P21-Centre	87	Core	RG174A/U	Coaxial Cable
	1W1P5-11	1W1P21-Body	87	Shield	-	
	1W1P5-12	1A36XTB2-2	88	White	22	
	1W1P5-13	1A36XTB1-6	89	White	22	
	1W1P5-14	1A36XTB1-11	90	White	22	
	1W1P5-15	1A36XTB1-8	91	White	22	
	1W1P5-16	1A36XTB1-15	92	White	22	
	1W1P5-17	1W1E2-A	93	Black	20	
	1W1P5-18	1A36XTB2-8	94	White	22	
	1W1P5-19	1A36-Ground	95	Black	20	
	1W1P5-20	1W1P25-22	96	White	22	
	1W1P5-21	1W1P25-3	97	White	22	
	1A59K4-B	1W1P25-20	98	White	22	
	1W1P13-1	1W1P26-1	99	White	22	
	1W1P13-2	Ground	100	Black	22	
	1W1P6-1	1A36XTB2-6	101	White	22	
	1W1P6-2	1A36XTB2-4	102	White	22	
	1W1P6-3	1A36XTB1-4	103	White	22	
	1W1P6-4	1A36XTB2-11	104	White	22	1-Conductor
	1W1P6-5	1A36-Ground	104	Shield	-	Shielded
	1W1P6-6	1A36XTB2-13	105	White	22	1-Conductor
	1W1P6-7	1A36-Ground	105	Shield	-	Shielded
	1W1P6-8	1A36XTB2-15	106	White	22	1-Conductor
	1W1P6-9	1A36-Ground	106	Shield	-	Shielded
	1W1P6-10	1W1P22-Centre	107	Core	RG174A/U	Coaxial Cable
	1W1P6-11	1W1P22-Body	107	Shield	-	
	1W1P6-12	1A36XTB2-2	108	White	22	
	1W1P6-13	1A36XTB1-6	109	White	22	
	1W1P6-14	1A36XTB1-11	110	White	22	
	1W1P6-15	1A36XTB1-8	111	White	22	
	1W1P6-16	1A36XTB1-15	112	White	22	
	1W1P6-17	1W1E2-A	113	Black	20	
	1W1P6-18	1A36XTB2-8	114	White	22	
	1W1P6-19	1A36-Ground	115	Black	20	
	1W1P6-20	1W1P25-23	116	White	22	
	1W1P6-21	1W1P25-2	117	White	22	
	1A59K3-B	1W1P25-10	118	White	22	
	1W1P14-1	1W1P26-3	119	White	22	
	1W1P14-2	1W1P13-2	120	White	22	

Table 9-3 Wiring List - 176-8304-02 50kW Distribution Cableform (1W1) Continued

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	1W1P7-1	1A36XTB2-6	121	White	22	
	1W1P7-2	1A36XTB2-4	122	White	22	
	1W1P7-3	1A36XTB1-4	123	White	22	
	1W1P7-4	1A36XTB2-11	124	White	22	1-Conductor
	1W1P7-5	1A36-Ground	124	Shield	-	Shielded
	1W1P7-6	1A36XTB2-13	125	White	22	1-Conductor
	1W1P7-7	1A36-Ground	125	Shield	-	Shielded
	1W1P7-8	1A36XTB2-15	126	White	22	1-Conductor
	1W1P7-9	1A36-Ground	126	Shield	-	Shielded
	1W1P7-10	1W1P23-Centre	127	Core	RG174A/U	Coaxial Cable
	1W1P7-11	1W1P23-Body	127	Shield	-	
	1W1P7-12	1A36XTB2-2	128	White	22	
	1W1P7-13	1A36XTB1-6	129	White	22	
	1W1P7-14	1A36XTB1-11	130	White	22	
	1W1P7-15	1A36XTB1-8	131	White	22	
	1W1P7-16	1A36XTB1-15	132	White	22	
	1W1P7-17	1W1E2-A	133	Black	20	
	1W1P7-18	1A36XTB2-8	134	White	22	
	1W1P7-19	1A36-Ground	135	Black	20	
	1W1P7-20	1W1P25-25	136	White	22	
	1W1P7-21	1W1P25-1	137	White	22	
	1A59K2-B	1W1P25-9	138	White	22	
	1W1P15-1	1W1P26-6	139	White	22	
	1W1P15-2	Ground	140	Black	22	
	1W1P8-1	1A36XTB2-6	141	White	22	
	1W1P8-2	1A36XTB2-4	142	White	22	
	1W1P8-3	1A36XTB1-4	143	White	22	
	1W1P8-4	1A36XTB2-11	144	White	22	1-Conductor
	1W1P8-5	1A36-Ground	144	Shield	-	Shielded
	1W1P8-6	1A36XTB2-13	145	White	22	1-Conductor
	1W1P8-7	1A36-Ground	145	Shield	-	Shielded
	1W1P8-8	1A36XTB2-15	146	White	22	1-Conductor
	1W1P8-9	1A36-Ground	146	Shield	-	Shielded
	1W1P8-10	1W1P24-Centre	147	Core	RG174A/U	Coaxial Cable
	1W1P8-11	1W1P24-Body	147	Shield	-	
	1W1P8-12	1A36XTB2-2	148	White	22	
	1W1P8-13	1A36XTB1-6	149	White	22	
	1W1P8-14	1A36XTB1-11	150	White	22	
	1W1P8-15	1A36XTB1-8	151	White	22	
	1W1P8-16	1A36XTB1-15	152	White	22	
	1W1P8-17	1W1E2-A	153	Black	20	
	1W1P8-18	1A36XTB2-8	154	White	22	
	1W1P8-19	1A36-Ground	155	Black	20	
	1W1P8-20	1W1P25-24	156	White	22	
	1W1P8-21	1W1P25-14	157	White	22	
	1A59K1-B	1W1P25-8	158	White	22	
	1W1P16-1	1W1P26-7	159	White	22	
	1W1P16-2	1W1P15-2	160	White	22	

Table 9-3 Wiring List - 176-8304-02 50kW Distribution Cableform (1W1) Continued

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	1A36XTB1-1	1A59J9-2	161	White	22	
	1A59J10-2	1A59J9-2	162	White	22	
	1A59J10-2	1A59J11-2	163	White	22	
	1A59J12-2	1A59J11-2	164	White	22	
	1A59J12-2	1A59J13-2	165	White	22	
	1A59J14-2	1A59J13-2	166	White	22	
	1A59J14-2	1A59J15-2	167	White	22	
	1A59J16-2	1A59J15-2	168	White	22	
	1A36XTB1-13	1W1E1-B	169	Black	16	
	1A36XTB1-13	1W1E2-B	170	Black	16	
	1A36XTB1-2	1A59K1-A	171	White	22	
	1A59K2-A	1A59K1-A	172	White	22	
	1A59K2-A	1A59K3-A	173	White	22	
	1A59K4-A	1A59K3-A	174	White	22	
	1A59K4-A	1A59K5-A	175	White	22	
	1A59K6-A	1A59K5-A	176	White	22	
	1A59K6-A	1A59K7-A	177	White	22	
	1A59K8-A	1A59K7-A	178	White	22	
	1A36XTB2-9	1W1P25-19	179	Black	22	
	1A36XTB2-9	1W1P26-13	180	Black	22	
	1A36XTB2-9	1W1P26-14	181	Black	22	
	1A36XTB2-9	1A36-Ground	182	Black	18	

Table 9-4 Wiring List - 176-8304-02 50kW Distribution Cableform (1W2)

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	1W2P1-1	1A40XTB2-5	1	White	22	
	1W2P1-2	1A40XTB2-3	2	White	22	
	1W2P1-3	1A40XTB1-3	3	White	22	
	1W2P1-4	1A40XTB2-10	4	White	22	1-Conductor
	1W2P1-5	1A40-Ground	4	Shield	-	Shielded
	1W2P1-6	1A40XTB2-12	5	White	22	1-Conductor
	1W2P1-7	1A40-Ground	5	Shield	-	Shielded
	1W2P1-8	1A40XTB2-14	6	White	22	1-Conductor
	1W2P1-9	1A40-Ground	6	Shield	-	Shielded
	1W2P1-10	1W2P17-Centre	7	Core	RG174/U	Coaxial Cable
	1W2P1-11	1W2P17-Body	7	Shield	-	
	1W2P1-12	1A40XTB2-1	8	White	22	
	1W2P1-13	1A40XTB1-5	9	White	22	
	1W2P1-14	1A40XTB1-10	10	White	22	
	1W2P1-15	1A40XTB1-7	11	White	22	
	1W2P1-16	1A40XTB1-14	12	White	22	
	1W2P1-17	1W2E1-A	13	Black	20	
	1W2P1-18	1A40XTB2-7	14	White	22	
	1W2P1-19	1A40-Ground	15	Black	20	
	1W2P1-20	1W2P25-15	16	White	22	
	1W2P1-21	1W2P25-7	17	White	22	
	1A60K8-B	1W2P25-11	18	White	22	
	1W2P9-1	1W2P26-2	19	White	22	
	1W2P9-2	Ground	20	Black	22	
	1W2P2-1	1A40XTB2-5	21	White	22	
	1W2P2-2	1A40XTB2-3	22	White	22	
	1W2P2-3	1A40XTB1-3	23	White	22	
	1W2P2-4	1A40XTB2-10	24	White	22	1-Conductor
	1W2P2-5	1A40-Ground	24	Shield	-	Shielded
	1W2P2-6	1A40XTB2-12	25	White	22	1-Conductor
	1W2P2-7	1A40-Ground	25	Shield	-	Shielded
	1W2P2-8	1A40XTB2-14	26	White	22	1-Conductor
	1W2P2-9	1A40-Ground	26	Shield	-	Shielded
	1W2P2-10	1W2P18-Centre	27	Core	RG174A/U	Coaxial Cable
	1W2P2-11	1W2P18-Body	27	Shield	-	
	1W2P2-12	1A40XTB2-1	28	White	22	
	1W2P2-13	1A40XTB1-5	29	White	22	
	1W2P2-14	1A40XTB1-10	30	White	22	
	1W2P2-15	1A40XTB1-7	31	White	22	
	1W2P2-16	1A40XTB1-14	32	White	22	
	1W2P2-17	1W2E1-A	33	Black	20	
	1W2P2-18	1A40XTB2-7	34	White	22	
	1W2P2-19	1A40-Ground	35	Black	20	
	1W2P2-20	1W2P25-16	36	White	22	
	1W2P2-21	1W2P25-6	37	White	22	
	1A60K7-B	1W2P25-12	38	White	22	
	1W2P10-1	1W2P26-4	39	White	22	
	1W2P10-2	1W2P9-2	40	White	22	

Table 9-4 Wiring List - 176-8304-02 50kW Distribution Cableform (1W2) Continued

*	SOURCE	DESTINATION	CODE	SIZE	REMARKS
	1W2P3-1	1A40XTB2-5	41 White	22	
	1W2P3-2	1A40XTB2-3	42 White	22	
	1W2P3-3	1A40XTB1-3	43 White	22	
	1W2P3-4	1A40XTB2-10	44 White	22	1-Conductor
	1W2P3-5	1A40-Ground	44 Shield	-	Shielded
	1W2P3-6	1A40XTB2-12	45 White	22	1-Conductor
	1W2P3-7	1A40-Ground	45 Shield	-	Shielded
	1W2P3-8	1A40XTB2-14	46 White	22	1-Conductor
	1W2P3-9	1A40-Ground	46 Shield	-	Shielded
	1W2P3-10	1W2P19-Centre	47 Core	RG174A/U	Coaxial Cable
	1W2P3-11	1W2P19-Body	47 Shield	-	
	1W2P3-12	1A40XTB2-1	48 White	22	
	1W2P3-13	1A40XTB1-5	49 White	22	
	1W2P3-14	1A40XTB1-10	50 White	22	
	1W2P3-15	1A40XTB1-7	51 White	22	
	1W2P3-16	1A40XTB1-14	52 White	22	
	1W2P3-17	1W2E1-A	53 Black	20	
	1W2P3-18	1A40XTB2-7	54 White	22	
	1W2P3-19	1A40-Ground	55 Black	20	
	1W2P3-20	1W2P25-17	56 White	22	
	1W2P3-21	1W2P25-5	57 White	22	
	1A60K6-B	1W2P25-13	58 White	22	
	1W2P11-1	1W2P26-5	59 White	22	
	1W2P11-2	Ground	60 White	22	
	1W2P4-1	1A40XTB2-5	61 White	22	
	1W2P4-2	1A40XTB2-3	62 White	22	
	1W2P4-3	1A40XTB1-3	63 White	22	
	1W2P4-4	1A40XTB2-10	64 White	22	1-Conductor
	1W2P4-5	1A40-Ground	64 Shield	-	Shielded
	1W2P4-6	1A40XTB2-12	65 White	22	1-Conductor
	1W2P4-7	1A40-Ground	65 Shield	-	Shielded
	1W2P4-8	1A40XTB2-14	66 White	22	1-Conductor
	1W2P4-9	1A40-Ground	66 Shield	-	Shielded
	1W2P4-10	1W2P20-Centre	67 Core	RG174A/U	Coaxial Cable
	1W2P4-11	1W2P20-Body	67 Shield	-	
	1W2P4-12	1A40XTB2-1	68 White	22	
	1W2P4-13	1A40XTB1-5	69 White	22	
	1W2P4-14	1A40XTB1-10	70 White	22	
	1W2P4-15	1A40XTB1-7	71 White	22	
	1W2P4-16	1A40XTB1-14	72 White	22	
	1W2P4-17	1W2E1-A	73 Black	20	
	1W2P4-18	1A40XTB2-7	74 White	22	
	1W2P4-19	1A40-Ground	75 Black	20	
	1W2P4-20	1W2P25-18	76 White	22	
	1W2P4-21	1W2P25-4	77 White	22	
	1A60K5-B	1W2P25-21	78 White	22	
	1W2P12-1	1W2P26-8	79 White	22	
	1W2P12-2	1W2P11-2	80 White	22	

Table 9-4 Wiring List - 176-8304-02 50kW Distribution Cableform (1W2) Continued

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	1W2P5-1	1A40XTB2-6	81	White	22	
	1W2P5-2	1A40XTB2-4	82	White	22	
	1W2P5-3	1A40XTB1-4	83	White	22	
	1W2P5-4	1A40XTB2-11	84	White	22	1-Conductor
	1W2P5-5	1A40-Ground	84	Shield	-	Shielded
	1W2P5-6	1A40XTB2-13	85	White	22	1-Conductor
	1W2P5-7	1A40-Ground	85	Shield	-	Shielded
	1W2P5-8	1A40XTB2-15	86	White	22	1-Conductor
	1W2P5-9	1A40-Ground	86	Shield	-	Shielded
	1W2P5-10	1W2P21-Centre	87	Core	RG174A/U	Coaxial Cable
	1W2P5-11	1W2P21-Body	87	Shield	-	
	1W2P5-12	1A40XTB2-2	88	White	22	
	1W2P5-13	1A40XTB1-6	89	White	22	
	1W2P5-14	1A40XTB1-11	90	White	22	
	1W2P5-15	1A40XTB1-8	91	White	22	
	1W2P5-16	1A40XTB1-15	92	White	22	
	1W2P5-17	1W2E2-A	93	Black	20	
	1W2P5-18	1A40XTB2-8	94	White	22	
	1W2P5-19	1A40-Ground	95	Black	20	
	1W2P5-20	1W2P25-22	96	White	22	
	1W2P5-21	1W2P25-3	97	White	22	
	1A60K4-B	1W2P25-20	98	White	22	
	1W2P13-1	1W2P26-1	99	White	22	
	1W2P13-2	Ground	100	Black	22	
	1W2P6-1	1A40XTB2-6	101	White	22	
	1W2P6-2	1A40XTB2-4	102	White	22	
	1W2P6-3	1A40XTB1-4	103	White	22	
	1W2P6-4	1A40XTB2-11	104	White	22	1-Conductor
	1W2P6-5	1A40-Ground	104	Shield	-	Shielded
	1W2P6-6	1A40XTB2-13	105	White	22	1-Conductor
	1W2P6-7	1A40-Ground	105	Shield	-	Shielded
	1W2P6-8	1A40XTB2-15	106	White	22	1-Conductor
	1W2P6-9	1A40-Ground	106	Shield	-	Shielded
	1W2P6-10	1W2P22-Centre	107	Core	RG174A/U	Coaxial Cable
	1W2P6-11	1W2P22-Body	107	Shield	-	
	1W2P6-12	1A40XTB2-2	108	White	22	
	1W2P6-13	1A40XTB1-6	109	White	22	
	1W2P6-14	1A40XTB1-11	110	White	22	
	1W2P6-15	1A40XTB1-8	111	White	22	
	1W2P6-16	1A40XTB1-15	112	White	22	
	1W2P6-17	1W2E2-A	113	Black	20	
	1W2P6-18	1A40XTB2-8	114	White	22	
	1W2P6-19	1A40-Ground	115	Black	20	
	1W2P6-20	1W2P25-23	116	White	22	
	1W2P6-21	1W2P25-2	117	White	22	
	1A60K3-B	1W2P25-10	118	White	22	
	1W2P14-1	1W2P26-3	119	White	22	
	1W2P14-2	1W2P13-2	120	White	22	

Table 9-4 Wiring List - 176-8304-02 50kW Distribution Cableform (1W2) Continued

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	1W2P7-1	1A40XTB2-6	121	White	22	
	1W2P7-2	1A40XTB2-4	122	White	22	
	1W2P7-3	1A40XTB1-4	123	White	22	
	1W2P7-4	1A40XTB2-11	124	White	22	1-Conductor
	1W2P7-5	1A40-Ground	124	Shield	-	Shielded
	1W2P7-6	1A40XTB2-13	125	White	22	1-Conductor
	1W2P7-7	1A40-Ground	125	Shield	-	Shielded
	1W2P7-8	1A40XTB2-15	126	White	22	1-Conductor
	1W2P7-9	1A40-Ground	126	Shield	-	Shielded
	1W2P7-10	1W2P23-Centre	127	Core	RG174A/U	Coaxial Cable
	1W2P7-11	1W2P23-Body	127	Shield	-	
	1W2P7-12	1A40XTB2-2	128	White	22	
	1W2P7-13	1A40XTB1-6	129	White	22	
	1W2P7-14	1A40XTB1-11	130	White	22	
	1W2P7-15	1A40XTB1-8	131	White	22	
	1W2P7-16	1A40XTB1-15	132	White	22	
	1W2P7-17	1W2E2-A	133	Black	20	
	1W2P7-18	1A40XTB2-8	134	White	22	
	1W2P7-19	1A40-Ground	135	Black	20	
	1W2P7-20	1W2P25-25	136	White	22	
	1W2P7-21	1W2P25-1	137	White	22	
	1A60K2-B	1W2P25-9	138	White	22	
	1W2P15-1	1W2P26-6	139	White	22	
	1W2P15-2	Ground	140	Black	22	
	1W2P8-1	1A40XTB2-6	141	White	22	
	1W2P8-2	1A40XTB2-4	142	White	22	
	1W2P8-3	1A40XTB1-4	143	White	22	
	1W2P8-4	1A40XTB2-11	144	White	22	1-Conductor
	1W2P8-5	1A40-Ground	144	Shield	-	Shielded
	1W2P8-6	1A40XTB2-13	145	White	22	1-Conductor
	1W2P8-7	1A40-Ground	145	Shield	-	Shielded
	1W2P8-8	1A40XTB2-15	146	White	22	1-Conductor
	1W2P8-9	1A40-Ground	146	Shield	-	Shielded
	1W2P8-10	1W2P24-Centre	147	Core	RG174A/U	Coaxial Cable
	1W2P8-11	1W2P24-Body	147	Shield	-	
	1W2P8-12	1A40XTB2-2	148	White	22	
	1W2P8-13	1A40XTB1-6	149	White	22	
	1W2P8-14	1A40XTB1-11	150	White	22	
	1W2P8-15	1A40XTB1-8	151	White	22	
	1W2P8-16	1A40XTB1-15	152	White	22	
	1W2P8-17	1W2E2-A	153	Black	20	
	1W2P8-18	1A40XTB2-8	154	White	22	
	1W2P8-19	1A40-Ground	155	Black	20	
	1W2P8-20	1W2P25-24	156	White	22	
	1W2P8-21	1W2P25-14	157	White	22	
	1A60K1-B	1W2P25-8	158	White	22	
	1W2P16-1	1W2P26-7	159	White	22	
	1W2P16-2	1W2P15-2	160	White	22	

Table 9-4 Wiring List - 176-8304-02 50kW Distribution Cableform (1W2) Continued

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	1A40XTB1-1	1A60J9-2	161	White	22	
	1A60J10-2	1A60J9-2	162	White	22	
	1A60J10-2	1A60J11-2	163	White	22	
	1A60J12-2	1A60J11-2	164	White	22	
	1A60J12-2	1A60J13-2	165	White	22	
	1A60J14-2	1A60J13-2	166	White	22	
	1A60J14-2	1A60J15-2	167	White	22	
	1A60J16-2	1A60J15-2	168	White	22	
	1A40XTB1-13	1W2E1-B	169	Black	16	
	1A40XTB1-13	1W2E2-B	170	Black	16	
	1A40XTB1-2	1A60K1-A	171	White	22	
	1A60K2-A	1A60K1-A	172	White	22	
	1A60K2-A	1A60K3-A	173	White	22	
	1A60K4-A	1A60K3-A	174	White	22	
	1A60K4-A	1A60K5-A	175	White	22	
	1A60K6-A	1A60K5-A	176	White	22	
	1A60K6-A	1A60K7-A	177	White	22	
	1A60K8-A	1A60K7-A	178	White	22	
	1A40XTB2-9	1W2P25-19	179	Black	22	
	1A40XTB2-9	1W2P26-13	180	Black	22	
	1A40XTB2-9	1W2P26-14	181	Black	22	
	1A40XTB2-9	1A40-Ground	182	Black	18	

Table 9-5 Wiring List - 176-6199 Staircase Capacitor Assembly

*	SOURCE	DESTINATION	CODE	SIZE	REMARKS
	C1	P1	1 -	12	Litz (Sleeved)
	C2	P2	2 -	12	Litz (Sleeved)
	C3	P3	3 -	12	Litz (Sleeved)
	C4	P4	4 -	12	Litz (Sleeved)
	C5	P5	5 -	12	Litz (Sleeved)
	C5	P6	6 -	12	Litz (Sleeved)

Table 9-6 Wiring List - 176-8250-05 and 176-8250-07 Back Plate Assemblies

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	K1-A	K1-B	-	Resistor	560 Ohms	R1
	K2-A	K2-B	-	Resistor	560 Ohms	R2
	K3-A	K3-B	-	Resistor	560 Ohms	R3
	K4-A	K4-B	-	Resistor	560 Ohms	R4
	K5-A	K5-B	-	Resistor	560 Ohms	R5
	K6-A	K6-B	-	Resistor	560 Ohms	R6
	K7-A	K7-B	-	Resistor	560 Ohms	R7
	K8-A	K8-B	-	Resistor	560 Ohms	R8
♦	E17	E18	-	Resistor	33K Ohms	R9
♦	E18	Ground	-	Resistor	1800 Ohms	R10
♦	E17	E19	-	Resistor	390K	R11
♦	E1	E9	-	Thermistor	TR600-150	RT1
♦	E2	E10	-	Thermistor	TR600-150	RT2
♦	E3	E11	-	Thermistor	TR600-150	RT3
♦	E4	E12	-	Thermistor	TR600-150	RT4
♦	E5	E13	-	Thermistor	TR600-150	RT5
♦	E6	E14	-	Thermistor	TR600-150	RT6
♦	E7	E15	-	Thermistor	TR600-150	RT7
♦	E8	E16	-	Thermistor	TR600-150	RT8
	K1-11	J1-5	-	White	20	
	K1-11	J1-7	-	White	20	
	K1-13	J1-1	-	White	20	
	K1-13	J1-3	-	White	20	
	K2-11	J2-5	-	White	20	
	K2-11	J2-7	-	White	20	
	K2-13	J2-1	-	White	20	
	K2-13	J2-3	-	White	20	
	K3-11	J3-5	-	White	20	
	K3-11	J3-7	-	White	20	
	K3-13	J3-1	-	White	20	
	K3-13	J3-3	-	White	20	
	K4-11	J4-5	-	White	20	
	K4-11	J4-7	-	White	20	
	K4-13	J4-1	-	White	20	
	K4-13	J4-3	-	White	20	
	K5-11	J5-5	-	White	20	
	K5-11	J5-7	-	White	20	
	K5-13	J5-1	-	White	20	
	K5-13	J5-3	-	White	20	
	K6-11	J6-5	-	White	20	
	K6-11	J6-7	-	White	20	
	K6-13	J6-1	-	White	20	
	K6-13	J6-3	-	White	20	
	K7-11	J7-5	-	White	20	
	K7-11	J7-7	-	White	20	
	K7-13	J7-1	-	White	20	
	K7-13	J7-3	-	White	20	
	K8-11	J8-5	-	White	20	
	K8-11	J8-7	-	White	20	
	K8-13	J8-1	-	White	20	
	K8-13	J8-3	-	White	20	
	T1-1	J1-1	-	Yellow	14	Lead of T1

Table 9-6 Wiring List - 176-8250-05 and 176-8250-07 Back Plate Assemblies (Continued)

*	SOURCE	DESTINATION	CODE	SIZE	REMARKS
	T1-2	J1-3	- Yellow	14	Lead of T1
	T1-3	J1-5	- Yellow	14	Lead of T1
	T1-4	J1-7	- Yellow	14	Lead of T1
	T2-1	J2-1	- Yellow	14	Lead of T2
	T2-2	J2-3	- Yellow	14	Lead of T2
	T2-3	J2-5	- Yellow	14	Lead of T2
	T2-4	J2-7	- Yellow	14	Lead of T2
	T3-1	J3-1	- Yellow	14	Lead of T3
	T3-2	J3-3	- Yellow	14	Lead of T3
	T3-3	J3-5	- Yellow	14	Lead of T3
	T3-4	J3-7	- Yellow	14	Lead of T3
	T4-1	J4-1	- Yellow	14	Lead of T4
	T4-2	J4-3	- Yellow	14	Lead of T4
	T4-3	J4-5	- Yellow	14	Lead of T4
	T4-4	J4-7	- Yellow	14	Lead of T4
	T5-1	J5-1	- Yellow	14	Lead of T5
	T5-2	J5-3	- Yellow	14	Lead of T5
	T5-3	J5-5	- Yellow	14	Lead of T5
	T5-4	J5-7	- Yellow	14	Lead of T5
	T6-1	J6-1	- Yellow	14	Lead of T6
	T6-2	J6-3	- Yellow	14	Lead of T6
	T6-3	J6-5	- Yellow	14	Lead of T6
	T6-4	J6-7	- Yellow	14	Lead of T6
	T7-1	J7-1	- Yellow	14	Lead of T7
	T7-2	J7-3	- Yellow	14	Lead of T7
	T7-3	J7-5	- Yellow	14	Lead of T7
	T7-4	J7-7	- Yellow	14	Lead of T7
	T8-1	J8-1	- Yellow	14	Lead of T8
	T8-2	J8-3	- Yellow	14	Lead of T8
	T8-3	J8-5	- Yellow	14	Lead of T8
	T8-4	J8-7	- Yellow	14	Lead of T8
♦	E1	E2	- Yellow	20	Teflon
♦	E2	E3	- Yellow	20	Teflon
♦	E3	E4	- Yellow	20	Teflon
♦	E4	E5	- Yellow	20	Teflon
♦	E5	E6	- Yellow	20	Teflon
♦	E6	E7	- Yellow	20	Teflon
♦	E7	E8	- Yellow	20	Teflon
♦	E9	J9-7	- Yellow	20	Teflon
♦	E10	J10-7	- Yellow	20	Teflon
♦	E11	J11-7	- Yellow	20	Teflon
♦	E12	J12-7	- Yellow	20	Teflon
♦	E13	J13-7	- Yellow	20	Teflon
♦	E14	J14-7	- Yellow	20	Teflon
♦	E15	J15-7	- Yellow	20	Teflon
♦	E16	J16-7	- Yellow	20	Teflon
♦	E8	E17	- Yellow	20	Teflon
♦	J8-5	A1-1	- Yellow	20	Teflon

NOTE: ♦ - Denotes not used on 176-8250-05

Table 9-7 Wiring List - NAR222B AC/DC Power Supply Cabinet

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	CR1-Cathode	E3	-	Resistor	-	R9
	E5	E9	-	Resistor	-	R12
	E6	E10	-	Resistor	-	R13
	E7	E12	-	Resistor	-	R15
	E8	E11	-	Resistor	-	R14
	K2-T1	R1-1	1	White	12	
	K2-T2	R3-1	2	White	12	
	K2-T3	R5-1	3	White	12	
	K2-L1	XF15-1	4	White	12	
	K2-L2	XF15-3	5	White	12	
	K2-L3	XF15-5	6	White	12	
	T1-X1	XF8-1	7	Grey	16	
	T1-X2	XF8-3	8	Grey	16	
	A3-1	T1-X1	9	White	1	
	A3-2	T1-X2	10	White	1	
	A3-3	T1-X3	11	White	1	
	A3-4	T1-Y1	12	White	1	
	A3-5	T1-Y2	13	White	1	
	A3-6	T1-Y3	14	White	1	
	XF2-Side	A9E1	15	Grey	12	
	XF3-Side	A9E2	16	Grey	12	
	XF4-Side	A9E3	17	Grey	12	
	XF5-Side	A9E5	18	Grey	12	
	XF6-Side	A9E6	19	Grey	12	
	XF7-Side	A9E7	20	Grey	12	
	K1-T1	T1-H1	21	White	1	
	K1-T1	T1-H1	22	White	1	
	K1-T2	T1-H2	23	White	1	
	K1-T2	T1-H2	24	White	1	
	K1-T3	T1-H3	25	White	1	
	K1-T3	T1-H3	26	White	1	
	A3-7	L1-1	27	White	1	
	A3-7	L1-1	28	White	1	
	A3-8	L2-1	29	White	1	
	A3-8	L2-1	30	White	1	
	R1-2	XF18-1	31	White	12	
	R3-2	XF19-1	32	White	12	
	R5-2	XF20-1	33	White	12	
	P2-1	K1-B	34	Grey	22	
	P2-2	K1-B	35	Grey	22	
	P2-5	XF7-Side	36	Grey	22	
	P2-4	R7-2	37	White	22	
	P2-6	XF6-Side	38	Grey	22	
	P2-7	XF5-Side	39	Grey	22	
	P2-8	RT4	40	White	22	
	P2-9	XF8-2	41	Grey	22	
	P2-10	XF8-2	42	Grey	22	
	P2-12	R7-3	43	White	22	

Table 9-7 Wiring List - NAR222B AC/DC Power Supply Cabinet (Continued)

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	P2-13	RT1	44	White	22	
	P2-15	K2-A2	45	White	22	
	P1-16	E3	46	White	22	
	P1-7	TB1-7	47	White	22	
	P1-10	TB1-1	48	White	22	
	P1-13	P3-16	49	White	22	
	P1-25	P4-3	50	White	22	
	R10-1	R8-1	51	White	18	
	P1-17	RT2	52	White	22	
	P1-4	TB1-2	53	White	22	
	P1-9	TB1-8	54	White	22	
	P1-11	TB1-9	55	White	22	
	P1-19	K2-53	56	White	22	1-Conductor
	GND near P1	K2-54	56	Shield	-	Shielded
	P1-3	P3-15	57	White	22	
	P1-6	RT3	58	White	22	
	A1E1	R8-1	59	White	14	
	P3-1	XF10-6	60	Grey	14	
	P3-2	T2-Z0	61	Grey	14	
	P3-3	XF10-8	62	Grey	14	
	P3-4	XF10-4	63	Grey	14	
	P3-5	T2-Y0	64	Grey	14	
	P3-6	XF10-2	65	Grey	14	
	P3-7	T2-X0	66	Grey	14	
	P3-8	A9R32-3	67	White	16	
	P3-9	A9R32-3	68	White	16	
	P3-10	A9R32-3	69	White	16	
	P3-19	A9R32-3	70	White	16	
	P3-11	A9E8	71	White	16	
	P3-12	A9E8	72	White	16	
	P3-13	A9E8	73	White	16	
	P3-14	TB1-5	74	White	18	
	P2-14	Ground	75	Black	22	
	XF1-2	CB1-B1	76	Grey	16	
	XF1-4	T2-H1	77	Grey	16	
	CB1-B2	T2-H4	78	Grey	16	
	XF10-2	S1-3-Bottom	79	Grey	16	
	CB1-A2	R11-1	80	Grey	16	
	R8-2	CR1-Cathode	81	White	12	
	CB1-A1	S1-4-Bottom	82	Grey	16	
	R10-2	K2-32	83	White	18	
	A12T1-X2	XF8-4	84	Grey	16	
	K2-44	K1-A	85	Grey	16	
	-	-	86	Not Used		
	K2-31	Ground	87	Black	18	
	P1-12	K2-A1	88	White	22	
	P3-17	P4-4	89	White	22	
	P3-18	P4-1	90	White	22	

Table 9-7 Wiring List - NAR222B AC/DC Power Supply Cabinet (Continued)

*	SOURCE	DESTINATION	CODE	SIZE	REMARKS
	T1-Z1	XF2-Centre	91 Grey	12	
	T1-Z2	XF3-Centre	92 Grey	12	
	T1-Z3	XF4-Centre	93 Grey	12	
	P3-14	M1(+)	94 White	22	
	M1 (-)	Ground	95 Black	22	
	T1-Z0	Ground	96 Black	8	
	CR1-Cathode	CR2-Cathode	97 White	14	
	L1-2	E2	98 White	1	
	L1-2	E2	99 White	1	
	L2-2	E4	100 White	1	
	L2-2	E4	101 White	1	
	-	-	102 Not Used		
	R11-2	T2-X0	103 Grey	16	
	P4-5	K2-A1	104 White	22	
	P4-2	Ground	105 Black	22	
	S2-4	A3E9	106 White	20	
	TB1-3	Ground	107 Black	18	
	XF10-1	T2-X1	108 Grey	14	
	XF10-3	T2-Y1	109 Grey	14	
	XF10-5	T2-Z1	110 Grey	14	
	XF10-7	T2-Z2	111 Grey	14	
	T1-Z1	XF5-Centre	112 Grey	12	
	T1-Z2	XF6-Centre	113 Grey	12	
	T1-Z3	XF7-Centre	114 Grey	12	
	R5-1	E5	115 Grey	16	
	R5-2	E6	116 Grey	16	
	R8-1	E7	117 White	16	
	R8-2	E8	118 White	16	
	P6-1	RT1	119 White	22	
	P6-7	P2-11	120 Black	22	
	P6-8	P1-24	121 White	22	
	E9	P5-10	122 Grey	22	
	E10	P5-7	123 Grey	22	
	E11	P5-4	124 White	22	
	E12	P5-1	125 White	22	
	T1-X1	A11XF1-1	126 Black	6	
	T1-X2	A11XF1-3	127 Black	6	
	T1-X3	A11XF1-5	128 Black	6	
	T1-Y1	A11XF2-2	129 Black	6	
	T1-Y2	A11XF2-4	130 Black	6	
	T1-Y3	A11XF2-6	131 Black	6	
	Gnd near A11	T1-Gnd Stud	132 Black	6	
	T1-X1	A12T1-H1	133 Grey	16	
	T1-X2	A12T1-H3	134 Grey	16	
	A12T1-XF	K2-43	135 Grey	16	
	R1-1	R2-1	Tinned Copper Wire	14	
	R1-2	R2-2	Tinned Copper Wire	14	
	R3-1	R4-1	Tinned Copper Wire	14	

Table 9-7 Wiring List - NAR222B AC/DC Power Supply Cabinet (Continued)

*	SOURCE	DESTINATION	CODE	SIZE	REMARKS
	R3-2	R4-2	Tinned Copper Wire	14	
	R5-1	R6-1	Tinned Copper Wire	14	
	R5-2	R6-2	Tinned Copper Wire	14	
	XF15-3	XF1-3	- Grey	16	
	XF15-1	XF1-1	- Grey	16	
	XF18-2	T1-H1	- White	12	
	XF19-2	T1-H2	- White	12	
	XF20-2	T1-H3	- White	12	
	XF15-2	K1-L1	- White	12	
	XF15-4	K1-L2	- White	12	
	XF15-6	K1-L3	- White	12	

Table 9-8 Wiring List - NASR106 DC Power Supply

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	XF1-Side	XDS1-Anode	-	Resistor	820 Ohms	R1
	XF2-Side	XDS2-Cathode	-	Resistor	820 Ohms	R2
	XF3-Side	XDS3-Anode	-	Resistor	2200 Ohms	R3
	XF4-Side	XDS4-Cathode	-	Resistor	3300 Ohms	R4
	XF5-Side	XDS5-Anode	-	Resistor	4700 Ohms	R5
	C6-(+)	XDS6-Anode	-	Resistor	4700 Ohms	R6
	XF7-Side	XDS7-Anode	-	Resistor	4700 Ohms	R7
	XF8-Side	XDS8-Anode	-	Resistor	4700 Ohms	R8
	J1-1	U1-AC1	1	White	16	
	J1-2	E1-Common	2	Black	16	
	J1-3	U1-AC2	3	White	16	
	XF2-Side	C2 (-)	4	White	16	
	C2 (-)	J2-2	5	White	16	
	XF1-Side	C1 (+)	6	White	16	
	C1 (+)	J2-1	7	White	16	
	J1-4	U2-AC1	8	White	16	
	J1-5	U2-AC2	9	White	16	
	U2 (-)	E1-Common	10	White	16	
	XF3-Side	C3 (+)	11	White	16	
	C3 (+)	J2-3	12	White	16	
	J1-6	U3-AC1	13	White	20	
	J1-7	U3-AC2	14	White	20	
	U3 (+)	E1-Common	15	White	20	
	XF4-Side	C4 (-)	16	White	20	
	C4 (-)	J2-4	17	White	16	
	J1-8	L1-1	18	White	18	
	J1-9	L1-1	19	White	18	
	J1-10	L1-1	20	White	18	
	J1-19	L1-1	21	White	18	
	L1-2	C5 (+)	22	White	10	
	C5 (+)	XF5-Centre	23	White	10	
	J1-17	XF5-Centre	24	White	20	
	XF5-Side	J2-5	25	White	14	
	XF5-Side	J2-6	26	White	14	
	C6 (+)	J2-7	27	White	20	
	J2-12	P1-3	28	White	20	
	J2-13	P1-1	29	White	20	
	J1-11	L2-1	30	White	18	
	J1-12	L2-1	31	White	18	
	J1-13	L2-1	32	White	18	
	L2-2	C7 (+)	33	White	14	
	C7 (+)	XF7-Centre	34	White	14	
	C7 (+)	XF8-Centre	35	White	14	
	XF7-Side	A2E2	36	White	14	
	XF8-Side	A1E2	37	White	14	
	J2-14	P2-1	38	White	20	
	J2-15	P2-3	39	White	20	
	A1E4	E2-A	40	White	14	

Table 9-8 Wiring List - NASR106 DC Power Supply (Continued)

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	A2E4	E2-A	41	White	14	
	E2-B	J2-9	42	White	14	
	E2-B	J2-10	43	White	14	
	P1-5	J2-8	44	White	22	
	P2-5	J2-8	45	White	22	
	XDS4-Anode	E1-Common	46	Black	22	
	XF6-Centre	J1-18	47	White	20	
	C1(+)	J1-15	48	White	20	
	C3(+)	J1-16	49	White	20	
	XF5-Side	J1-14	50	White	20	
	U1 (-)	XF2-Centre	-	White	16	
	U1 (+)	XF1-Centre	-	White	16	
	U2 (+)	XF3-Centre	-	White	16	
	U3 (-)	XF4-Centre	-	White	20	
	XDS1-Cathode	XDS2-Anode	-	Black	22	
	XDS2-Anode	XDS3-Cathode	-	Black	22	
	XDS3-Cathode	XDS4-Anode	-	Black	22	
	XDS5-Cathode	Gnd near XDS5	-	Black	22	
	XDS6-Cathode	Gnd near XDS6	-	Black	22	
	XDS7-Cathode	Gnd near XDS7	-	Black	22	
	XDS8-Cathode	Gnd near XDS8	-	Black	22	
	XF6-Centre	XF8-Centre	-	White	20	
	XF6-Side	L3-1	-	Black	18	Lead of L3
	L3-2	C6 (+)	-	Black	18	Lead of L3
	C6 (-)	Gnd near C6	-	Black	18	

Table 9-9 Wiring List - 176-7600-01 Power Supply Fan Tray

*	SOURCE	DESTINATION	CODE	SIZE	REMARKS
	B1-Red	TB1-5	- Red	20	Lead of B1
	B1-Blue	TB1-3	- Blue	20	Lead of B1
	B1-White	TB1-1	- White	20	Lead of B1
	B2-Red	TB1-5	- Red	20	Lead of B2
	B2-Blue	TB1-3	- Blue	20	Lead of B2
	B2-White	TB1-2	- White	20	Lead of B2
	B3-Red	TB1-6	- Red	20	Lead of B3
	B3-Blue	TB1-4	- Blue	20	Lead of B3
	B3-White	TB1-7	- White	20	Lead of B3
	B4-Red	TB1-6	- Red	20	Lead of B4
	B4-Blue	TB1-4	- Blue	20	Lead of B4
	B4-White	TB1-8	- White	20	Lead of B4
	B5-Red	TB1-6	- Red	20	Lead of B5
	B5-Blue	TB1-4	- Blue	20	Lead of B5
	B5-White	TB1-9	- White	20	Lead of B5
	TB1-5	TB1-6	Metal Link	-	
	TB1-3	TB1-4	Metal Link	-	

Table 9-10 Wiring List - NAX189 MOV Assembly

*	SOURCE	DESTINATION	CODE	SIZE	REMARKS
	RV1-1	Gnd near RV1	- -	-	C1
	RV2-1	Gnd near RV2	- -	-	C2
	RV2-2	Gnd near RV2	- -	-	C3
	RV4-1	Gnd near RV4	- -	-	C4
	RV4-2	Gnd near RV5	- -	-	C6
	RV5-1	Gnd near RV5	- -	-	C5
	XF1-2	RV1-1	- Black	8	
	XF1-4	RV1-2	- Black	8	
	XF1-6	RV2-2	- Black	8	
	XF2-1	RV4-1	- Black	8	
	XF2-3	RV4-2	- Black	8	
	XF2-5	RV5-1	- Black	8	

Table 9-11 Wiring List - 176-5710 Power Module Test Cable (Optional)

*	SOURCE	DESTINATION	CODE		SIZE	REMARKS
	P4-7	P4-8	-	Capacitor	5.0 uF	C1
	P1-1	P3-3	1	White	22	
	P1-2	P3-4	2	White	22	1-Conductor
	E1-B	P3-5	2	Shield	-	Shielded
	P1-3	P3-6	3	White	22	1-Conductor
	E1-B	P3-7	3	Shield	-	Shielded
	P1-4	P4-2	4	White	20	
	P1-5	P3-2	5	White	22	
	P1-6	P3-13	6	White	22	
	P1-7	P3-14	7	White	22	
	P1-8	P3-15	8	White	22	
	P1-10	P3-8	9	White	22	1-Conductor
	E1-B	P3-9	9	Shield	-	Shielded
	P1-11	P3-12	10	White	22	
	P1-12	P3-16	11	White	22	
	P1-13	E1-A	12	White	22	
	P2-Centre	P3-10	13	Core	RG174A/U	Coaxial Cable
	P2-Body	P3-11	13	Shield		
	P1-14	P3-17	14	Black	22	
	P1-9	P4-3	15	White	22	
	E1-A	P4-6	16	Black	20	
	P4-4	P4-6	Tinned Copper Wire		22	
	P4-6	P4-8	Tinned Copper Wire		22	
	P4-1	P4-3	Tinned Copper Wire		22	
	P4-3	P4-5	Tinned Copper Wire		22	
	P4-5	P4-7	Tinned Copper Wire		22	

Table 9-12 Connector Mating Information - Sorted by Floating Connector

FLOATING CONNECTOR		FIXED CONNECTOR	
REF DES	**DESCRIPTION**	**REF DES**	**DESCRIPTION**
-	BNC (Ext RF Monitor)	1A1A4J5	BNC
-	BNC (Ext Serial In)	1A1A4J6	BNC
-	25 Pin-Contacts (Ext DCC)	1A2A1J10	25 Socket-Contacts
-	BNC (Ext RF)	1A2A1J11	BNC
-	EIA (Ext RF Out)	1A3J1	EIA
-	15 Pin-Contacts (Ext PM Test)	1A36J4	15 Socket-Contacts
-	N/A	1A36J7	Not Used
-	BNC (Ext PM Test)	1A39J17	BNC
-	N/A	1A40J2	Not Used
-	N/A	1A40J4	Not Used
-	N/A	1A40J7	Not Used
-	N/A	2A1J3	Not Used
-	N/A	1A2A1J14	4 Pin-Contacts
1A1A1J1	15 Pin-Contacts	1A1A3J1	15 Socket-Contacts
1A1A2J1	15 Pin-Contacts	1A1A3J2	15 Socket-Contacts
1A1A4J1	25 Socket-Contacts	1A1A3J5	25 Pin-Contacts
1A1A4J2	25 Pin-Contacts	1A1A3J4	25 Socket-Contacts
1A1A4J3	25 Socket-Contacts	1A1A3J3	25 Pin-Contacts
1A2A1E1	2 Socket-Contacts	1A2A1J15	4 Pin-Contacts
1A2A1E2	2 Socket-Contacts	1A2A1J15	4 Pin-Contacts
1A2A2J1	25 Socket-Contacts	1A2A1J2	25 Pin-Contacts
1A2A3J1	25 Pin-Contacts	1A2A1J6	25 Socket-Contacts
1A2A4J1	25 Pin-Contacts	1A2A1J3	25 Socket-Contacts
1A2A5J1	25 Socket-Contacts	1A2A1J4	25 Pin-Contacts
1A2A6J1	25 Pin-Contacts	1A2A1J7	25 Socket-Contacts
1A2A7J1	25 Pin-Contacts	1A2A1J5	25 Socket-Contacts
1A4J2	8 Pin-Contacts	1A59J16	8 Socket-Contacts
1A4J3	8 Pin-Contacts	1A59J8	8 Socket-Contacts
1A5J2	8 Pin-Contacts	1A59J15	8 Socket-Contacts
1A5J3	8 Pin-Contacts	1A59J7	8 Socket-Contacts
1A6J2	8 Pin-Contacts	1A59J14	8 Socket-Contacts
1A6J3	8 Pin-Contacts	1A59J6	8 Socket-Contacts
1A7J2	8 Pin-Contacts	1A59J13	8 Socket-Contacts
1A7J3	8 Pin-Contacts	1A59J5	8 Socket-Contacts
1A8J2	8 Pin-Contacts	1A59J12	8 Socket-Contacts
1A8J3	8 Pin-Contacts	1A59J4	8 Socket-Contacts
1A9J2	8 Pin-Contacts	1A59J11	8 Socket-Contacts
1A9J3	8 Pin-Contacts	1A59J3	8 Socket-Contacts
1A10J2	8 Pin-Contacts	1A59J10	8 Socket-Contacts
1A10J3	8 Pin-Contacts	1A59J2	8 Socket-Contacts
1A11J2	8 Pin-Contacts	1A59J9	8 Socket-Contacts
1A11J3	8 Pin-Contacts	1A59J1	8 Socket-Contacts

Table 9-12 Connector Mating Information - Sorted by Floating Connector (Continued)

FLOATING CONNECTOR		FIXED CONNECTOR	
REF DES	**DESCRIPTION**	**REF DES**	**DESCRIPTION**
1A12J2	8 Pin-Contacts	1A60J16	8 Socket-Contacts
1A12J3	8 Pin-Contacts	1A60J8	8 Socket-Contacts
1A13J2	8 Pin-Contacts	1A60J15	8 Socket-Contacts
1A13J3	8 Pin-Contacts	1A60J7	8 Socket-Contacts
1A14J2	8 Pin-Contacts	1A60J14	8 Socket-Contacts
1A14J3	8 Pin-Contacts	1A60J6	8 Socket-Contacts
1A15J2	8 Pin-Contacts	1A60J13	8 Socket-Contacts
1A15J3	8 Pin-Contacts	1A60J5	8 Socket-Contacts
1A16J2	8 Pin-Contacts	1A60J12	8 Socket-Contacts
1A16J3	8 Pin-Contacts	1A60J4	8 Socket-Contacts
1A17J2	8 Pin-Contacts	1A60J11	8 Socket-Contacts
1A17J3	8 Pin-Contacts	1A60J3	8 Socket-Contacts
1A18J2	8 Pin-Contacts	1A60J10	8 Socket-Contacts
1A18J3	8 Pin-Contacts	1A60J2	8 Socket-Contacts
1A19J2	8 Pin-Contacts	1A60J9	8 Socket-Contacts
1A19J3	8 Pin-Contacts	1A60J1	8 Socket-Contacts
1W1P1	21 Socket-Contacts	1A4J1	21 Pin-Contacts
1W1P2	21 Socket-Contacts	1A5J1	21 Pin-Contacts
1W1P3	21 Socket-Contacts	1A6J1	21 Pin-Contacts
1W1P4	21 Socket-Contacts	1A7J1	21 Pin-Contacts
1W1P5	21 Socket-Contacts	1A8J1	21 Pin-Contacts
1W1P6	21 Socket-Contacts	1A9J1	21 Pin-Contacts
1W1P7	21 Socket-Contacts	1A10J1	21 Pin-Contacts
1W1P8	21 Socket-Contacts	1A11J1	21 Pin-Contacts
1W1P9	2 Socket-Contacts	1A20J1	2 Pin-Contacts
1W1P10	2 Socket-Contacts	1A21J1	2 Pin-Contacts
1W1P11	2 Socket-Contacts	1A22J1	2 Pin-Contacts
1W1P12	2 Socket-Contacts	1A23J1	2 Pin-Contacts
1W1P13	2 Socket-Contacts	1A24J1	2 Pin-Contacts
1W1P14	2 Socket-Contacts	1A25J1	2 Pin-Contacts
1W1P15	2 Socket-Contacts	1A26J1	2 Pin-Contacts
1W1P16	2 Socket-Contacts	1A27J1	2 Pin-Contacts
1W1P17	BNC	1A39J1	BNC
1W1P18	BNC	1A39J2	BNC
1W1P19	BNC	1A39J3	BNC
1W1P20	BNC	1A39J4	BNC
1W1P21	BNC	1A39J5	BNC
1W1P22	BNC	1A39J6	BNC
1W1P23	BNC	1A39J7	BNC
1W1P24	BNC	1A39J8	BNC
1W1P25	25 Pin-Contacts	1A36J5	25 Socket-Contacts
1W1P26	15 Pin-Contacts	1A36J8	15 Socket-Contacts

Table 9-12 Connector Mating Information - Sorted by Floating Connector (Continued)

FLOATING CONNECTOR		FIXED CONNECTOR	
REF DES	**DESCRIPTION**	**REF DES**	**DESCRIPTION**
1W2P1	21 Socket-Contacts	1A12J1	21 Pin-Contacts
1W2P2	21 Socket-Contacts	1A13J1	21 Pin-Contacts
1W2P3	21 Socket-Contacts	1A14J1	21 Pin-Contacts
1W2P4	21 Socket-Contacts	1A15J1	21 Pin-Contacts
1W2P5	21 Socket-Contacts	1A16J1	21 Pin-Contacts
1W2P6	21 Socket-Contacts	1A17J1	21 Pin-Contacts
1W2P7	21 Socket-Contacts	1A18J1	21 Pin-Contacts
1W2P8	21 Socket-Contacts	1A19J1	21 Pin-Contacts
1W2P9	2 Socket-Contacts	1A28J1	2 Pin-Contacts
1W2P10	2 Socket-Contacts	1A29J1	2 Pin-Contacts
1W2P11	2 Socket-Contacts	1A30J1	2 Pin-Contacts
1W2P12	2 Socket-Contacts	1A31J1	2 Pin-Contacts
1W2P13	2 Socket-Contacts	1A32J1	2 Pin-Contacts
1W2P14	2 Socket-Contacts	1A33J1	2 Pin-Contacts
1W2P15	2 Socket-Contacts	1A34J1	2 Pin-Contacts
1W2P16	2 Socket-Contacts	1A35J1	2 Pin-Contacts
1W2P17	BNC	1A39J9	BNC
1W2P18	BNC	1A39J10	BNC
1W2P19	BNC	1A39J11	BNC
1W2P20	BNC	1A39J12	BNC
1W2P21	BNC	1A39J13	BNC
1W2P22	BNC	1A39J14	BNC
1W2P23	BNC	1A39J15	BNC
1W2P24	BNC	1A39J16	BNC
1W2P25	25 Pin-Contacts	1A40J5	25 Socket-Contacts
1W2P26	15 Pin-Contacts	1A40J8	15 Socket-Contacts
2A2P1	9 Socket-Contacts	2A2A1J2	9 Pin-Contacts
2A2P2	9 Socket-Contacts	2A2A2J2	9 Pin-Contacts
2P1	25 Socket-Contacts	2A1J1	25 Pin-Contacts
2P2	15 Pin-Contacts	2A1J4	15 Socket-Contacts
2P3	16 Pin-Contacts	2A2J1	16 Socket-Contacts
2P4	9 Socket-Contacts	2A9J1	9 Pin-Contacts
2P5	MTA, 12 Socket-Contacts	2A10J1	MTA, 12 Pin-Contacts
2P6	MTA, 8 Socket-Contacts	2A10J2	MTA, 8 Pin-Contacts
P1	25 Pin-Contacts	1A1A3J6	25 Socket-Contacts
P2	25 Socket-Contacts	1A1A3J7	25 Pin-Contacts
P3	15 Socket-Contacts	1A1A3J8	15 Pin-Contacts
P4	BNC	1A1A4J4	BNC
P5	25 Socket-Contacts	1A2A1J1	25 Pin-Contacts
P6	25 Socket-Contacts	1A2A1J8	25 Pin-Contacts
P7	25 Pin-Contacts	1A2A1J9	25 Socket-Contacts
P8	BNC	1A2A1J12	BNC

Table 9-12 Connector Mating Information - Sorted by Floating Connector (Continued)

FLOATING CONNECTOR		FIXED CONNECTOR	
REF DES	DESCRIPTION	REF DES	DESCRIPTION
P9	BNC	1A2A1J13	BNC
P10	9 Socket-Contacts	1A37J1	9 Pin-Contacts
P11	9 Socket-Contacts	1A38J1	9 Pin-Contacts
P12	15 Pin-Contacts	2A1J2	15 Socket-Contacts
P13	14 Pin-Contacts	2A2J2	14 Socket-Contacts
P14	BNC	1A3A2J1	BNC
P15	BNC	1A3A2J2	BNC
P16	BNC	1A3J2	BNC
P17	BNC	1A42A3J1	BNC
P18	BNC	1A41A3J1	BNC
P19	BNC	1A36J1	BNC
P20	BNC	1A36J2	BNC
P21	25 Socket-Contacts	1A36J3	25 Pin-Contacts
P22	15 Socket-Contacts	1A36J6	15 Pin-Contacts
P23	BNC	1A40J1	BNC
P24	25 Socket-Contacts	1A40J3	25 Pin-Contacts
P25	15 Socket-Contacts	1A40J6	15 Pin-Contacts
P26	BNC	1A36J9	BNC
P27	9 Socket-Contacts	1A42A4J1	9 Pin-Contacts
P28	9 Socket-Contacts	1A41A4J1	9 Pin-Contacts
P29	9 Socket-Contacts	1A3A4J1	9 Pin-Contacts
P30	9 Socket-Contacts	1A3A5J1	9 Pin-Contacts

Table 9-13 Connector Mating Information - Sorted by Fixed Connector

FIXED CONNECTOR		FLOATING CONNECTOR	
REF DES	**DESCRIPTION**	**REF DES**	**DESCRIPTION**
1A1A3J1	15 Socket-Contacts	1A1A1J1	15 Pin-Contacts
1A1A3J2	15 Socket-Contacts	1A1A2J1	15 Pin-Contacts
1A1A3J3	25 Pin-Contacts	1A1A4J3	25 Socket-Contacts
1A1A3J4	25 Socket-Contacts	1A1A4J2	25 Pin-Contacts
1A1A3J5	25 Pin-Contacts	1A1A4J1	25 Socket-Contacts
1A1A3J6	25 Socket-Contacts	P1	25 Pin-Contacts
1A1A3J7	25 Pin-Contacts	P2	25 Socket-Contacts
1A1A3J8	15 Pin-Contacts	P3	15 Socket-Contacts
1A1A4J4	BNC	P4	BNC
1A1A4J5	BNC	-	BNC (Ext Rf Monitor)
1A1A4J6	BNC	-	BNC (Ext Serial In)
1A2A1J1	25 Pin-Contacts	P5	25 Socket-Contacts
1A2A1J2	25 Pin-Contacts	1A2A2J1	25 Socket-Contacts
1A2A1J3	25 Socket-Contacts	1A2A4J1	25 Pin-Contacts
1A2A1J4	25 Pin-Contacts	1A2A5J1	25 Socket-Contacts
1A2A1J5	25 Socket-Contacts	1A2A7J1	25 Pin-Contacts
1A2A1J6	25 Socket-Contacts	1A2A3J1	25 Pin-Contacts
1A2A1J7	25 Socket-Contacts	1A2A6J1	25 Pin-Contacts
1A2A1J8	25 Pin-Contacts	P6	25 Socket-Contacts
1A2A1J9	25 Socket-Contacts	P7	25 Pin-Contacts
1A2A1J10	25 Socket-Contacts	-	25 Pin-Contacts (Ext DCC)
1A2A1J11	BNC	-	BNC (Ext Rf)
1A2A1J12	BNC	P8	BNC
1A2A1J13	BNC	P9	BNC
1A2A1J14	4 Pin-Contacts	Not Used	
1A2A1J15	4 Pin-Contacts	1A2A1E1/E2	2 Socket-Contacts (x2)
1A3A2J1	BNC	P14	BNC
1A3A2J2	BNC	P15	BNC
1A3A4J1	9 Pin-Contacts	P29	9 Socket-Contacts
1A3A5J1	9 Pin-Contacts	P30	9 Socket-Contacts
1A3J1	EIA	-	EIA (Ext Rf Out)
1A3J2	BNC	P16	BNC
1A4J1	21 Pin-Contacts	1W1P1	21 Socket-Contacts
1A5J1	21 Pin-Contacts	1W1P2	21 Socket-Contacts
1A6J1	21 Pin-Contacts	1W1P3	21 Socket-Contacts
1A7J1	21 Pin-Contacts	1W1P4	21 Socket-Contacts
1A8J1	21 Pin-Contacts	1W1P5	21 Socket-Contacts
1A9J1	21 Pin-Contacts	1W1P6	21 Socket-Contacts
1A10J1	21 Pin-Contacts	1W1P7	21 Socket-Contacts
1A11J1	21 Pin-Contacts	1W1P8	21 Socket-Contacts
1A12J1	21 Pin-Contacts	1W2P1	21 Socket-Contacts
1A13J1	21 Pin-Contacts	1W2P2	21 Socket-Contacts

Table 9-13 Connector Mating Information - Sorted by Fixed Connector (Continued)

FIXED CONNECTOR		FLOATING CONNECTOR	
REF DES	**DESCRIPTION**	**REF DES**	**DESCRIPTION**
1A14J1	21 Pin-Contacts	1W2P3	21 Socket-Contacts
1A15J1	21 Pin-Contacts	1W2P4	21 Socket-Contacts
1A16J1	21 Pin-Contacts	1W2P5	21 Socket-Contacts
1A17J1	21 Pin-Contacts	1W2P6	21 Socket-Contacts
1A18J1	21 Pin-Contacts	1W2P7	21 Socket-Contacts
1A19J1	21 Pin-Contacts	1W2P8	21 Socket-Contacts
1A20J1	2 Pin-Contacts	1W1P9	2 Socket-Contacts
1A21J1	2 Pin-Contacts	1W1P10	2 Socket-Contacts
1A22J1	2 Pin-Contacts	1W1P11	2 Socket-Contacts
1A23J1	2 Pin-Contacts	1W1P12	2 Socket-Contacts
1A24J1	2 Pin-Contacts	1W1P13	2 Socket-Contacts
1A25J1	2 Pin-Contacts	1W1P14	2 Socket-Contacts
1A26J1	2 Pin-Contacts	1W1P15	2 Socket-Contacts
1A27J1	2 Pin-Contacts	1W1P16	2 Socket-Contacts
1A28J1	2 Pin-Contacts	1W2P9	2 Socket-Contacts
1A29J1	2 Pin-Contacts	1W2P10	2 Socket-Contacts
1A30J1	2 Pin-Contacts	1W2P11	2 Socket-Contacts
1A31J1	2 Pin-Contacts	1W2P12	2 Socket-Contacts
1A32J1	2 Pin-Contacts	1W2P13	2 Socket-Contacts
1A33J1	2 Pin-Contacts	1W2P14	2 Socket-Contacts
1A34J1	2 Pin-Contacts	1W2P15	2 Socket-Contacts
1A35J1	2 Pin-Contacts	1W2P16	2 Socket-Contacts
1A36J1	BNC	P19	BNC
1A36J2	BNC	P20	BNC
1A36J3	25 Pin-Contacts	P21	25 Socket-Contacts
1A36J4	15 Socket-Contacts	-	15 Pin-Cont (Ext PM Test)
1A36J5	25 Socket-Contacts	1W1P25	25 Pin-Contacts
1A36J6	15 Pin-Contacts	P22	15 Socket-Contacts
1A36J7	Not Used	-	N/A
1A36J8	15 Socket-Contacts	1W1P26	15 Pin-Contacts
1A36J9	BNC	P26	BNC
1A37J1	9 Pin-Contacts	P10	9 Socket-Contacts
1A38J1	9 Pin-Contacts	P11	9 Socket-Contacts
1A39J1	BNC	1W1P17	BNC
1A39J2	BNC	1W1P18	BNC
1A39J3	BNC	1W1P19	BNC
1A39J4	BNC	1W1P20	BNC
1A39J5	BNC	1W1P21	BNC
1A39J6	BNC	1W1P22	BNC
1A39J7	BNC	1W1P23	BNC
1A39J8	BNC	1W1P24	BNC
1A39J9	BNC	1W2P17	BNC

Table 9-13 Connector Mating Information - Sorted by Fixed Connector (Continued)

FIXED CONNECTOR		FLOATING CONNECTOR	
REF DES	DESCRIPTION	REF DES	DESCRIPTION
1A39J10	BNC	1W2P18	BNC
1A39J11	BNC	1W2P19	BNC
1A39J12	BNC	1W2P20	BNC
1A39J13	BNC	1W2P21	BNC
1A39J14	BNC	1W2P22	BNC
1A39J15	BNC	1W2P23	BNC
1A39J16	BNC	1W2P24	BNC
1A39J17	BNC	-	BNC (Ext PM Test)
1A40J1	BNC	P23	BNC
1A40J2	Not Used	-	N/A
1A40J3	25 Pin-Contacts	P24	25 Socket-Contacts
1A40J4	Not Used	-	N/A
1A40J5	25 Socket-Contacts	1W2P25	25 Pin-Contacts
1A40J6	15 Pin-Contacts	P25	15 Socket-Contacts
1A40J7	Not Used	-	N/A
1A40J8	15 Socket-Contacts	1W2P26	15 Pin-Contacts
1A41A3J1	BNC	P18	BNC
1A41A4J1	9 Pin-Contacts	P28	9 Socket-Contacts
1A42A3J1	BNC	P17	BNC
1A42A4J1	9 Pin-Contacts	P27	9 Socket-Contacts
1A59J1	8 Socket-Contacts	1A11J3	8 Pin-Contacts
1A59J2	8 Socket-Contacts	1A10J3	8 Pin-Contacts
1A59J3	8 Socket-Contacts	1A9J3	8 Pin-Contacts
1A59J4	8 Socket-Contacts	1A8J3	8 Pin-Contacts
1A59J5	8 Socket-Contacts	1A7J3	8 Pin-Contacts
1A59J6	8 Socket-Contacts	1A6J3	8 Pin-Contacts
1A59J7	8 Socket-Contacts	1A5J3	8 Pin-Contacts
1A59J8	8 Socket-Contacts	1A4J3	8 Pin-Contacts
1A59J9	8 Socket-Contacts	1A11J2	8 Pin-Contacts
1A59J10	8 Socket-Contacts	1A10J2	8 Pin-Contacts
1A59J11	8 Socket-Contacts	1A9J2	8 Pin-Contacts
1A59J12	8 Socket-Contacts	1A8J2	8 Pin-Contacts
1A59J13	8 Socket-Contacts	1A7J2	8 Pin-Contacts
1A59J14	8 Socket-Contacts	1A6J2	8 Pin-Contacts
1A59J15	8 Socket-Contacts	1A5J2	8 Pin-Contacts
1A59J16	8 Socket-Contacts	1A4J2	8 Pin-Contacts
1A60J1	8 Socket-Contacts	1A19J3	8 Pin-Contacts
1A60J2	8 Socket-Contacts	1A18J3	8 Pin-Contacts
1A60J3	8 Socket-Contacts	1A17J3	8 Pin-Contacts
1A60J4	8 Socket-Contacts	1A16J3	8 Pin-Contacts
1A60J5	8 Socket-Contacts	1A15J3	8 Pin-Contacts
1A60J6	8 Socket-Contacts	1A14J3	8 Pin-Contacts

Table 9-13 Connector Mating Information - Sorted by Fixed Connector (Continued)

FIXED CONNECTOR		FLOATING CONNECTOR	
REF DES	DESCRIPTION	REF DES	DESCRIPTION
1A60J7	8 Socket-Contacts	1A13J3	8 Pin-Contacts
1A60J8	8 Socket-Contacts	1A12J3	8 Pin-Contacts
1A60J9	8 Socket-Contacts	1A19J2	8 Pin-Contacts
1A60J10	8 Socket-Contacts	1A18J2	8 Pin-Contacts
1A60J11	8 Socket-Contacts	1A17J2	8 Pin-Contacts
1A60J12	8 Socket-Contacts	1A16J2	8 Pin-Contacts
1A60J13	8 Socket-Contacts	1A15J2	8 Pin-Contacts
1A60J14	8 Socket-Contacts	1A14J2	8 Pin-Contacts
1A60J15	8 Socket-Contacts	1A13J2	8 Pin-Contacts
1A60J16	8 Socket-Contacts	1A12J2	8 Pin-Contacts
2A1J1	25 Pin-Contacts	2P1	25 Socket-Contacts
2A1J2	15 Socket-Contacts	P12	15 Pin-Contacts
2A1J3	Not Used	-	N/A
2A1J4	15 Socket-Contacts	2P2	15 Pin-Contacts
2A2A1J1	Not Used	-	N/A
2A2A1J2	9 Pin-Contacts	2A2P1	9 Socket-Contacts
2A2A2J1	Not Used	-	N/A
2A2A2J2	9 Pin-Contacts	2A2P2	9 Socket-Contacts
2A2J1	16 Socket-Contacts	2P3	16 Pin-Contacts
2A2J2	14 Socket-Contacts	P13	14 Pin-Contacts
2A9J1	9 Pin-Contacts	2P4	9 Socket-Contacts
2A10J1	MTA, 12 Pin-Contacts	2P5	MTA, 12 Socket-Contacts
2A10J2	MTA, 8 Pin-Contacts	2P6	MTA, 8 Socket-Contacts

SECTION 10
ELECTRICAL SCHEMATICS

INTRODUCTION

10.1 This section contains electrical schematics/ logic diagrams for the subject equipment. Block diagrams, simplified electrical schematics and/or logic diagrams may be included. Refer to table 10-1 for an itemized listing.

COMPONENT VALUES

10.2 Unless otherwise specified on the logic/ schematic diagram:

- Resistor values are shown in ohms.
  (K = 1 000 and M = 1 000 000).

- Capacitor values are shown in microfarads (uF).

- Unidentified diodes are part number 1N4938.

GRAPHIC SYMBOLS

10.3 The graphic symbols used on electrical schematics are in accordance with American National Standard ANSI Y32.2-1975 - Graphic Symbols for Electrical and Electronic Diagrams.

LOGIC SYMBOLS

10.4 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.

REFERENCE DESIGNATIONS

10.5 Reference designations were assigned 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.

UNIQUE SYMBOLOGY

10.6 Nautel utilizes unique symbology on electrical schematics to describe two-state (logic) inputs/outputs which differ from those inputs/ outputs having only one distinct state or multiple states (analog).

10.6.1 TYPE OF INPUTS/OUTPUTS: On electrical schematics, names used to describe two-state (logic) inputs/outputs are prefixed by a '#'. Those inputs/outputs representing a one-state or analog signal will have no prefix.

10.6.2 LOGIC LEVEL/CONVENTION: The '#' prefix identifies an input/output that has two distinct states - 'high' and 'low'. A suffix, '+' or '-', identifies the active (true) state of the input/ output. The 'high' (+) will be the more positive of the two levels used to represent the logic states. The 'low' (-) will be the less positive of the two levels used to represent the logic states. Two types of logic, positive and negative, may be represented on a particular schematic. In positive logic, a 'high' represents the active (true) state and a 'low' represents the inactive (false) state. In negative logic, a 'low' represents the active state and a 'high' represents the inactive state.

IDENTIFICATION OF SCHEMATIC DIAGRAMS

10.7 Each illustration in this section is identified by a number that is both the figure number and the page number. The numbers are assigned sequentially and are prefixed by the letters 'SD-'. The electrical schematics/logic diagrams included in this section are listed in table 10-1.

STRUCTURE OF SCHEMATICS

10.8 The electrical schematics have been structured in a hierarchical format that is based on function and signal flow. Wherever practical, the signal flow is from left to right. Inputs will normally originate on the left-hand side and outputs will be extended to the right-hand side. Exceptions will be indicated by an arrow indicating the direction of signal flow.

NOTE

The physical location of a part/assembly was not necessarily a factor when a schematic was drawn. The full reference designation assigned to a part/ assembly, in conjunction with the family tree in figure 8-1 and the assembly detail drawings in section 11, will identify its location.

10.8.1 Figure SD-1 identifies the major functional blocks and their detailed interconnection. Figures SD-2, SD-3, SD-5, SD-6 and SD-7 further expand the functional breakdown of each block and contain cross references that identify which block is the signal source for inputs or the destination for outputs.

10.8.2 When a sub-function is treated as a block in figures SD-2, SD-3, SD-5, SD-6 and SD-7, its detailed circuit information will be included in its own schematic drawing(s). These schematics may be included in this section or in an appended service instruction manual(s).

LOCATING THE SCHEMATIC DIAGRAM(S) FOR A FUNCTIONAL BLOCK

10.9 The text inside a functional block, provides the key to locating its schematic diagram(s).

10.9.1 WHEN FIGURE NUMBER IDENTIFIED: In some instances the figure number of the schematic will be identified. These schematics will be included in this section.

10.9.2 WHEN REFERENCE DESIGNATION ASSIGNED TO BLOCK: When a functional block has been assigned a reference designation, enter the family tree depicted in figure 8-1 and follow the family tree branches to the block that contains the reference designation.

10.9.2.1 If the family tree's block references a service instruction manual that is keyed to a Nautel nomenclature number, the schematic will be included in the referenced manual.

10.9.2.2 If the family tree's block references a table in section 8 of this manual, the schematic will be in this section. Enter table 10-1 to with the Nautel nomenclature number and/or the description to identify the appropriate figure number(s).

10.9.3 TITLE OF BLOCK: When a functional block has not been assigned a reference designation and a figure number has not been referenced, the schematic is included in this section. Enter table 10-1 with the name of the functional block to identify the appropriate figure number(s).

LOCATING A PART/ASSEMBLY IDENTIFIED ON A SCHEMATIC

10.10 The full reference designation assigned to a part/assembly is the key to physically locating that part/assembly.

NOTE

Full reference designations contain the assembly hierarchical coding. When the end item is divided into units (cabinets) the first coding is a unit number (1, 2, 3, etc). When the end item is divided into assemblies, the first coding is an assembly number (A1, A2, A3, etc). If a unit or an assembly is divided into sub-assemblies, assembly codings that identify assembly relationship (1A1, A2A1, A2A1A1, etc) are added.

10.10.1 Enter the family tree depicted in figure 8-1 with the full reference designation and follow the family tree branches to the appropriate block, noting the name and Nautel nomenclature number of all higher assemblies in the path.

NOTE

The drawings in section 11 depict the assembly detail of the transmitter and any of its modules/ assemblies that are not the subject of their own service instruction manual. If the block in the family tree references a manual that is keyed to a Nautel nomenclature number, the assembly detail for that assembly will be included in the referenced service instruction manual.

10.10.2 Enter table 11-1 with the name and Nautel nomenclature number of each family tree block in the path, starting at the highest assembly (normally figure MD-1) and determine the figure number(s) for that assembly. Refer to the referenced figure and locate the next lower level assembly. Repeat this procedure until the location of the required part/assembly has been identified.

Table 10-1 List of Electrical Schematics

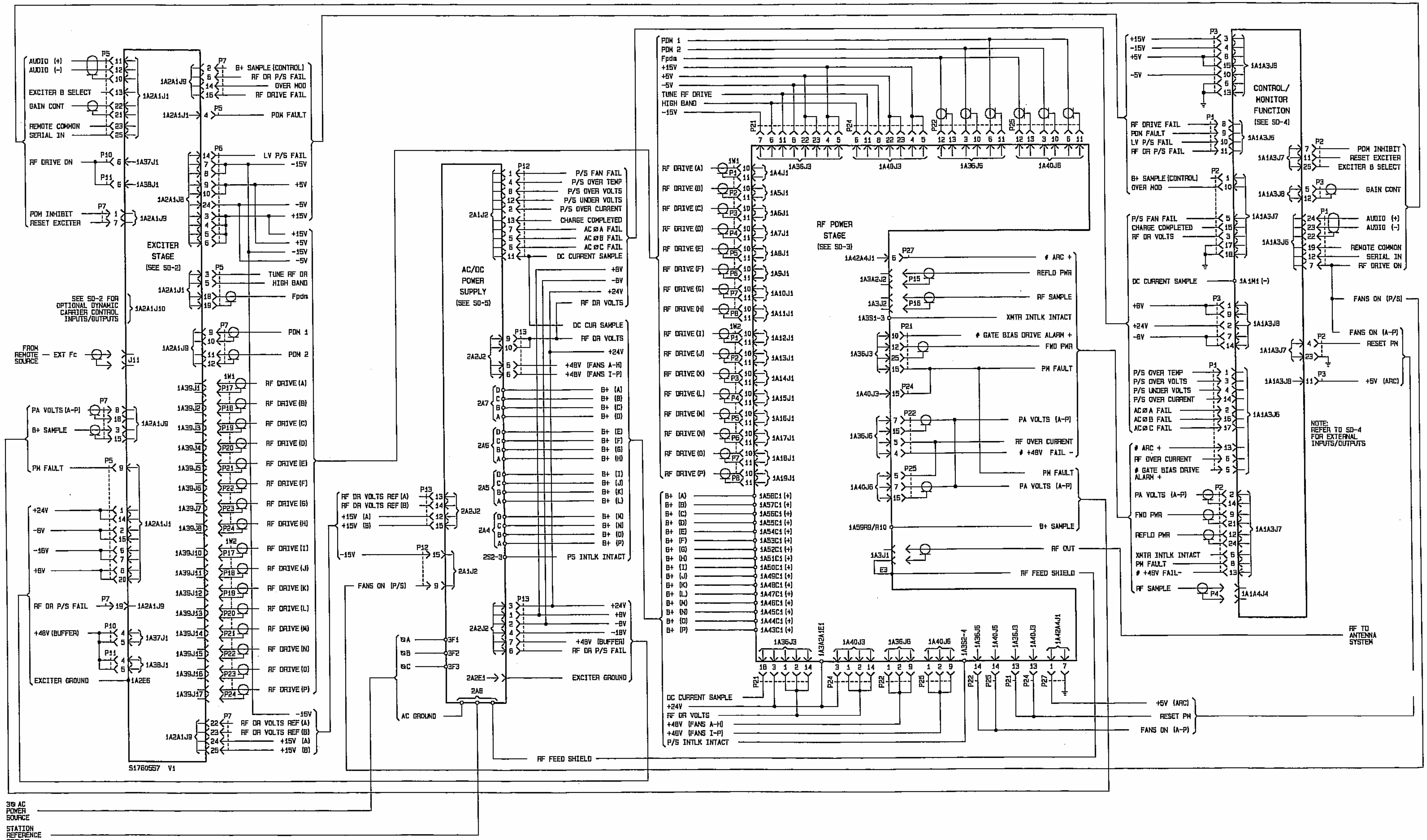


Figure SD-1 Electrical Schematic - NA100 100kW AM Broadcast Transmitter

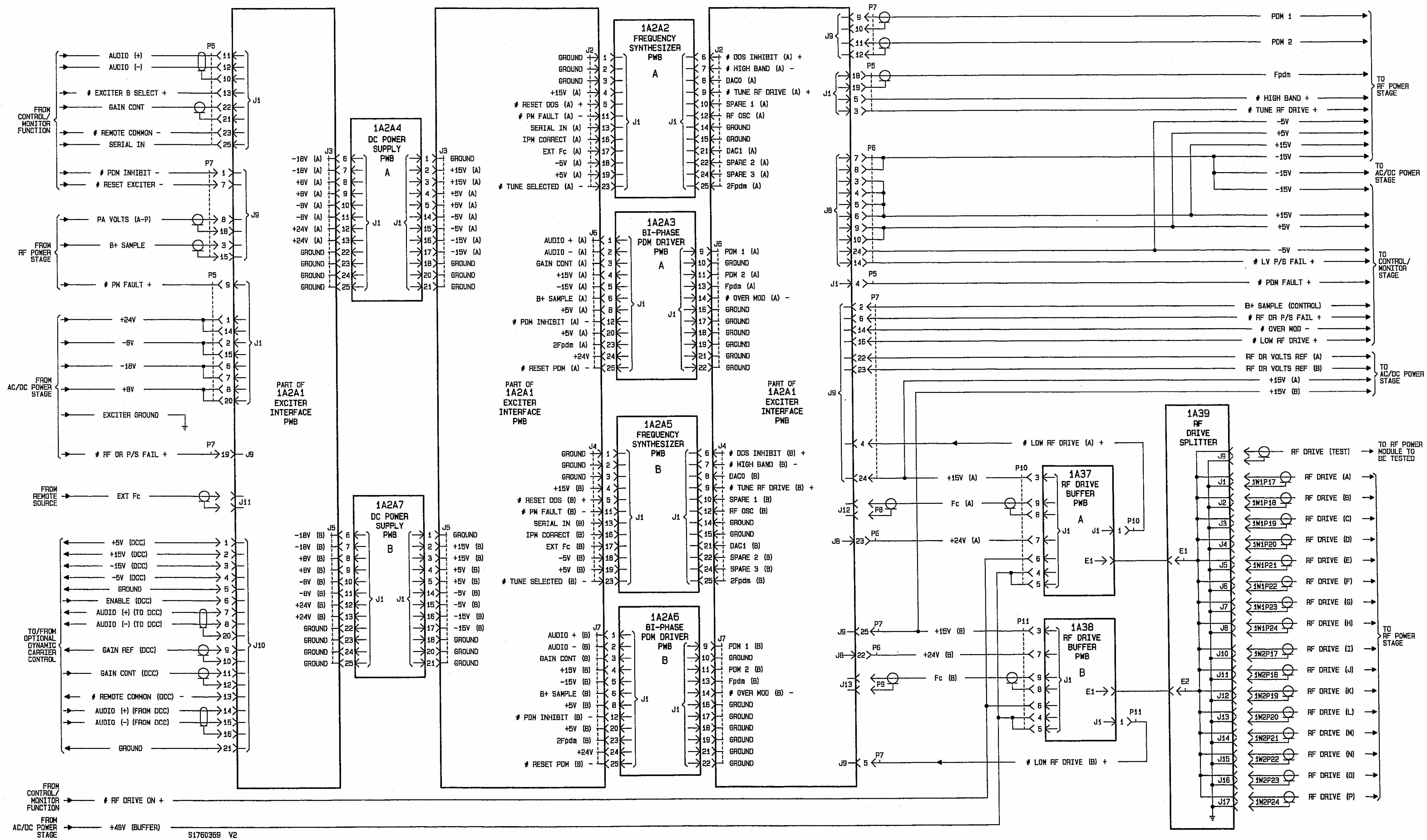


Figure SD-2 Electrical Schematic - Exciter Stage

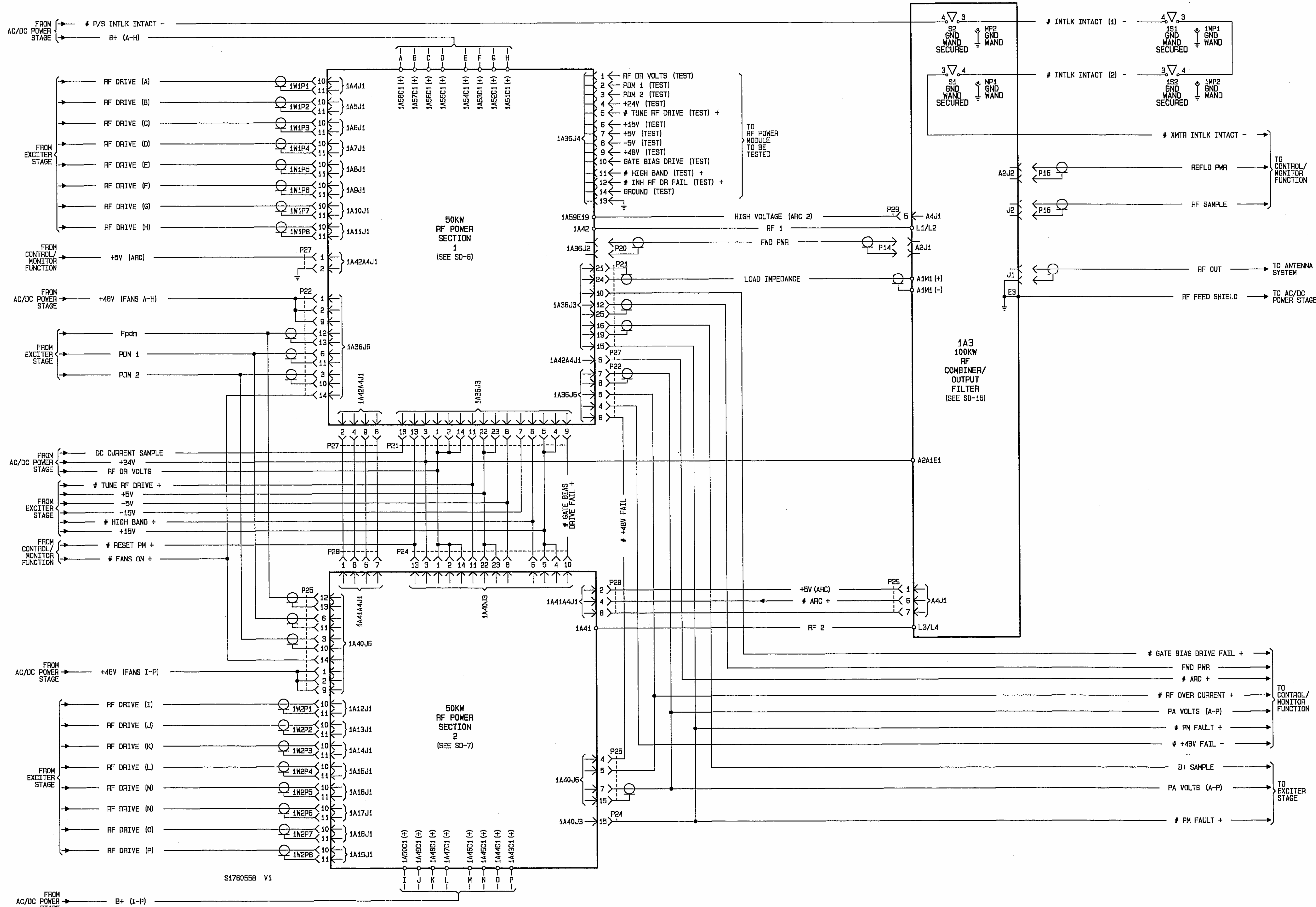
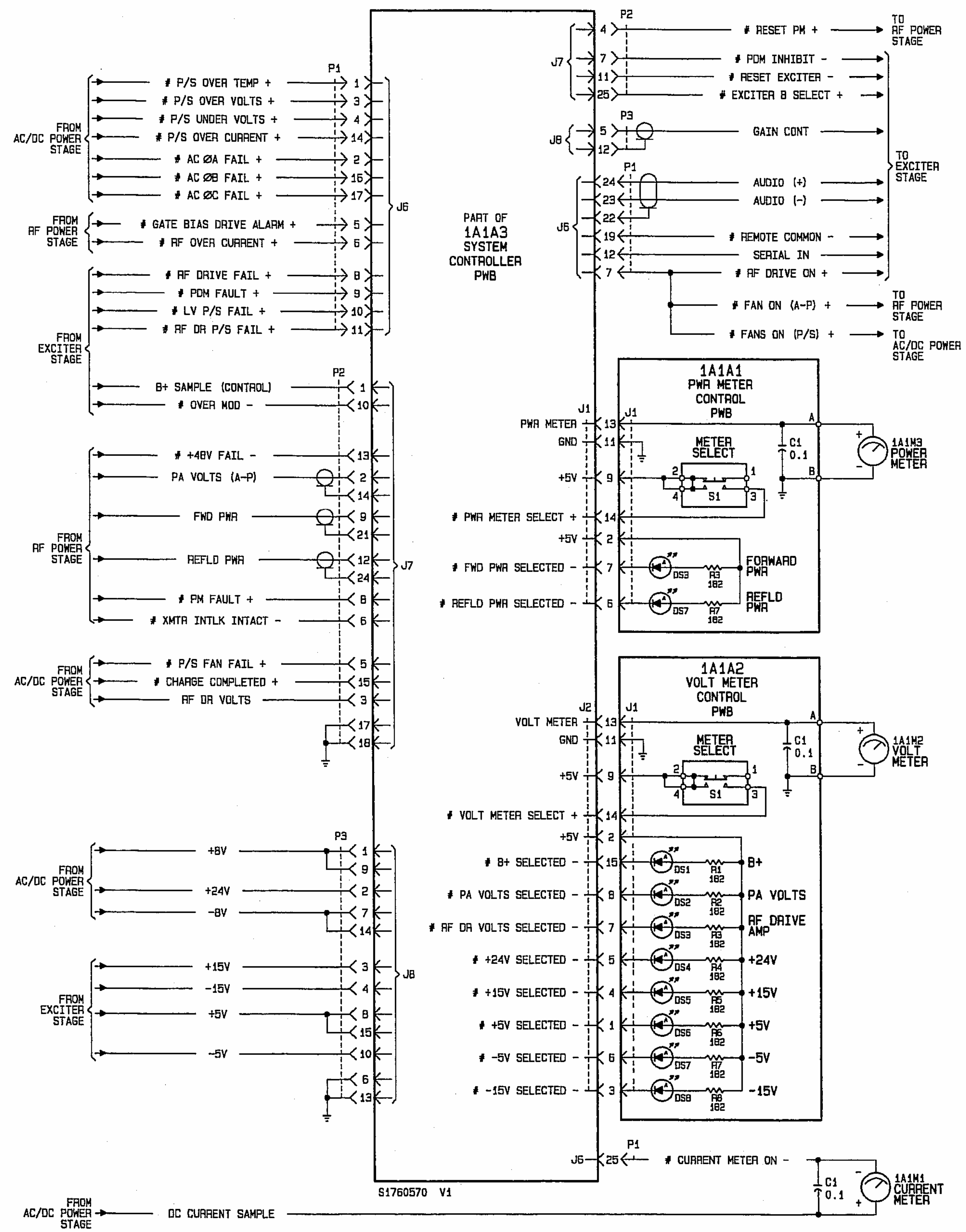


Figure SD-3 Electrical Schematic - RF Power Stage



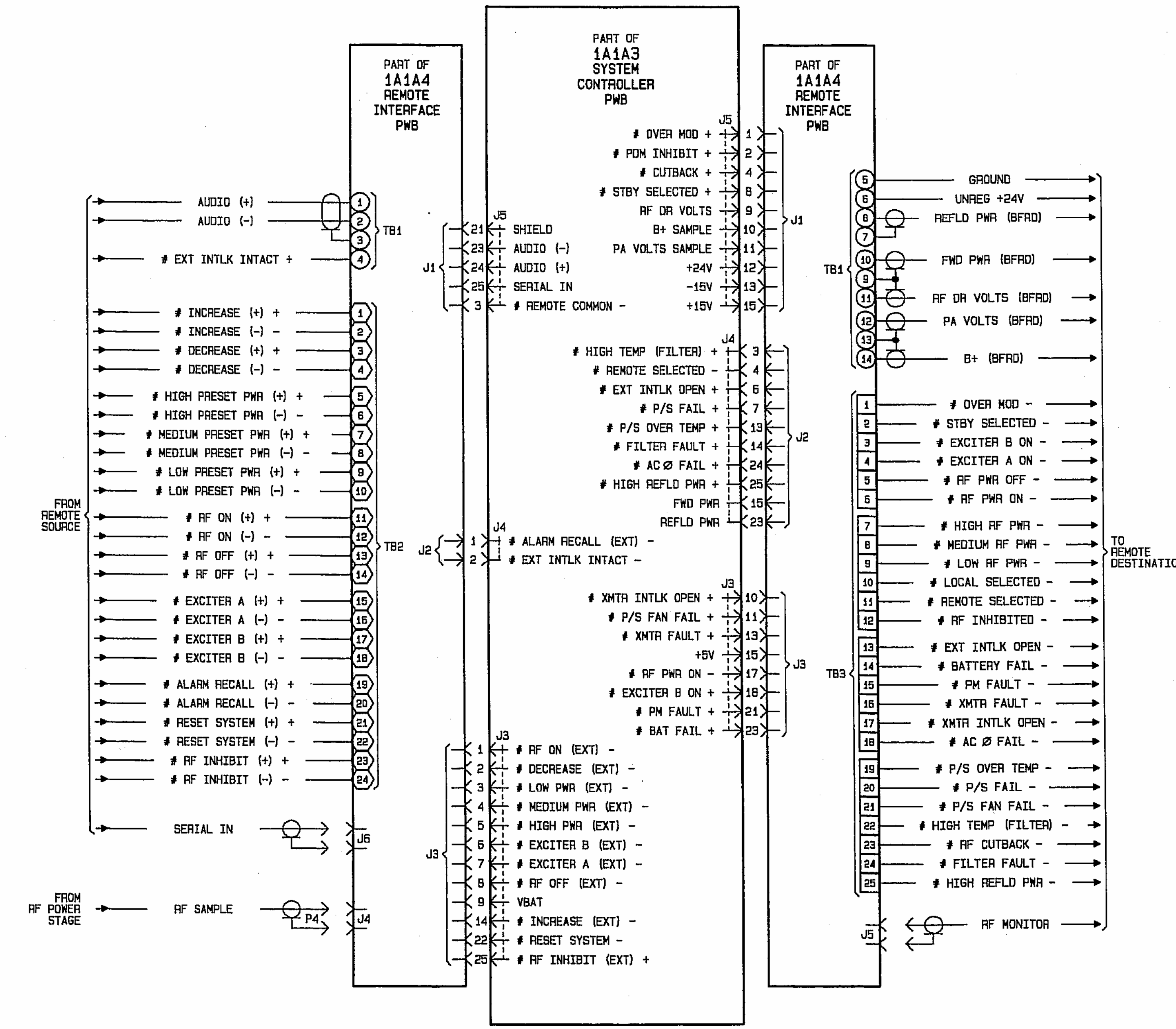


Figure SD-4 Electrical Schematic - Control/Monitor Function

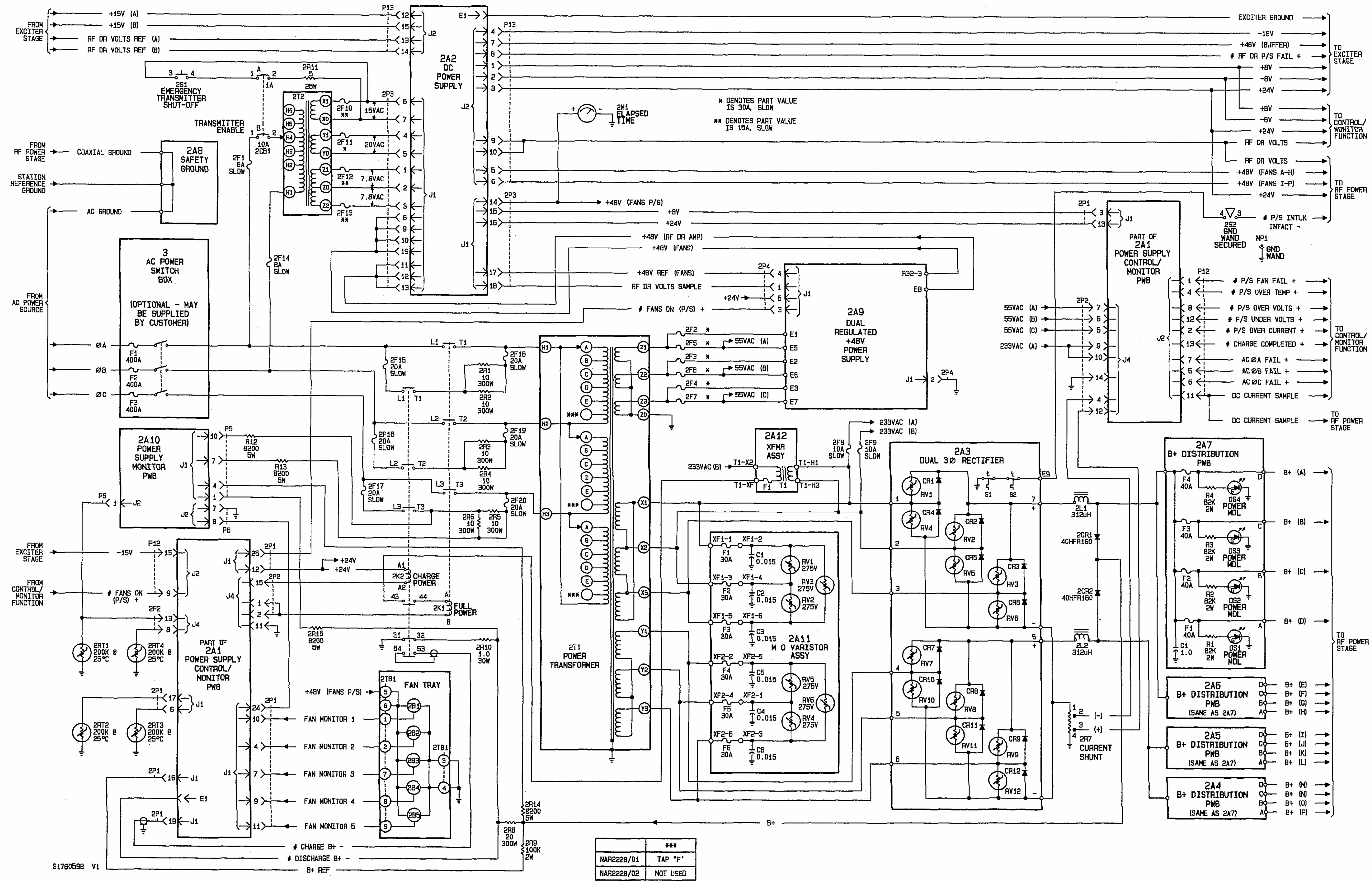
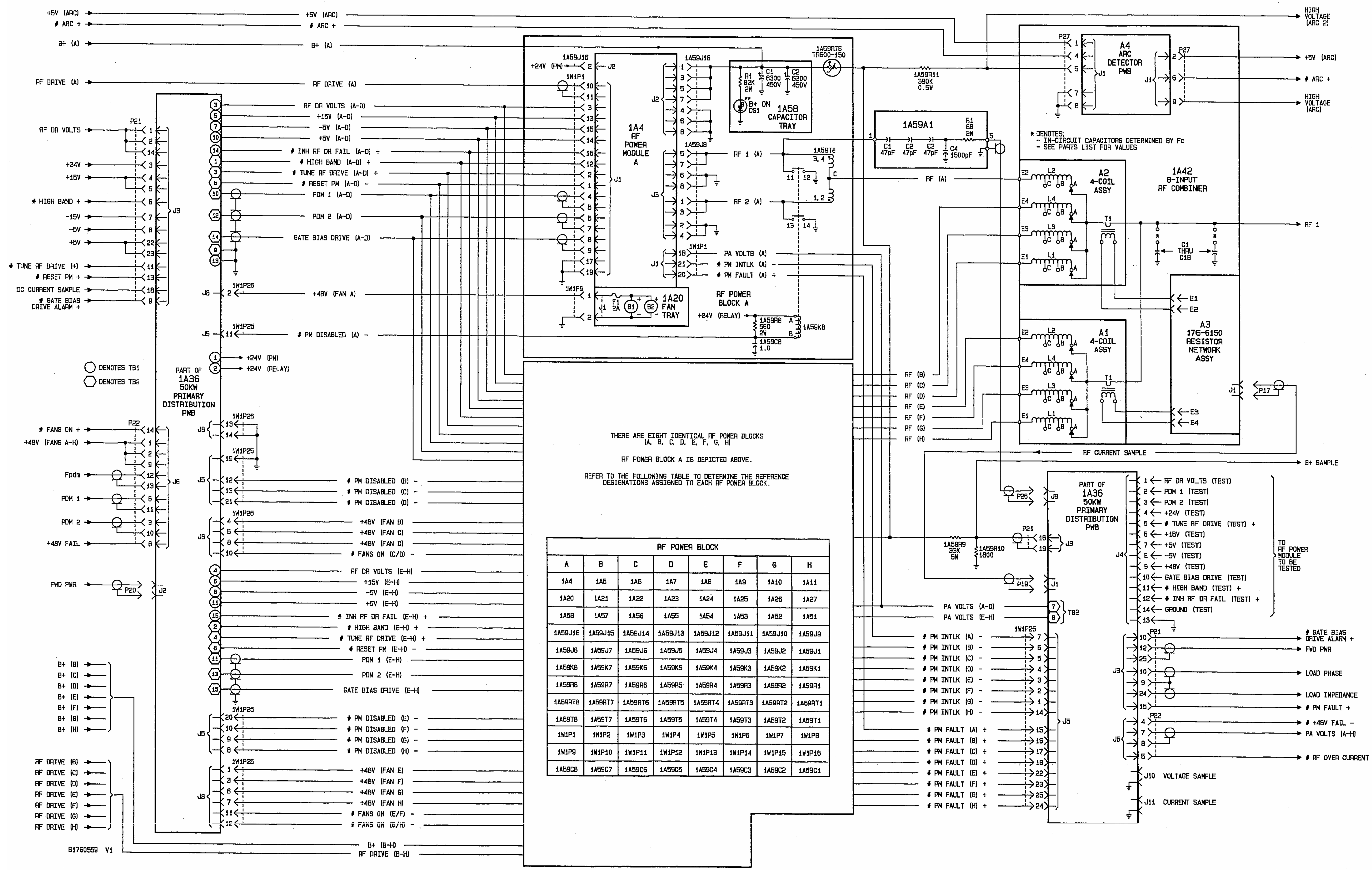


Figure SD-5 Electrical Schematic - AC/DC Power Supply



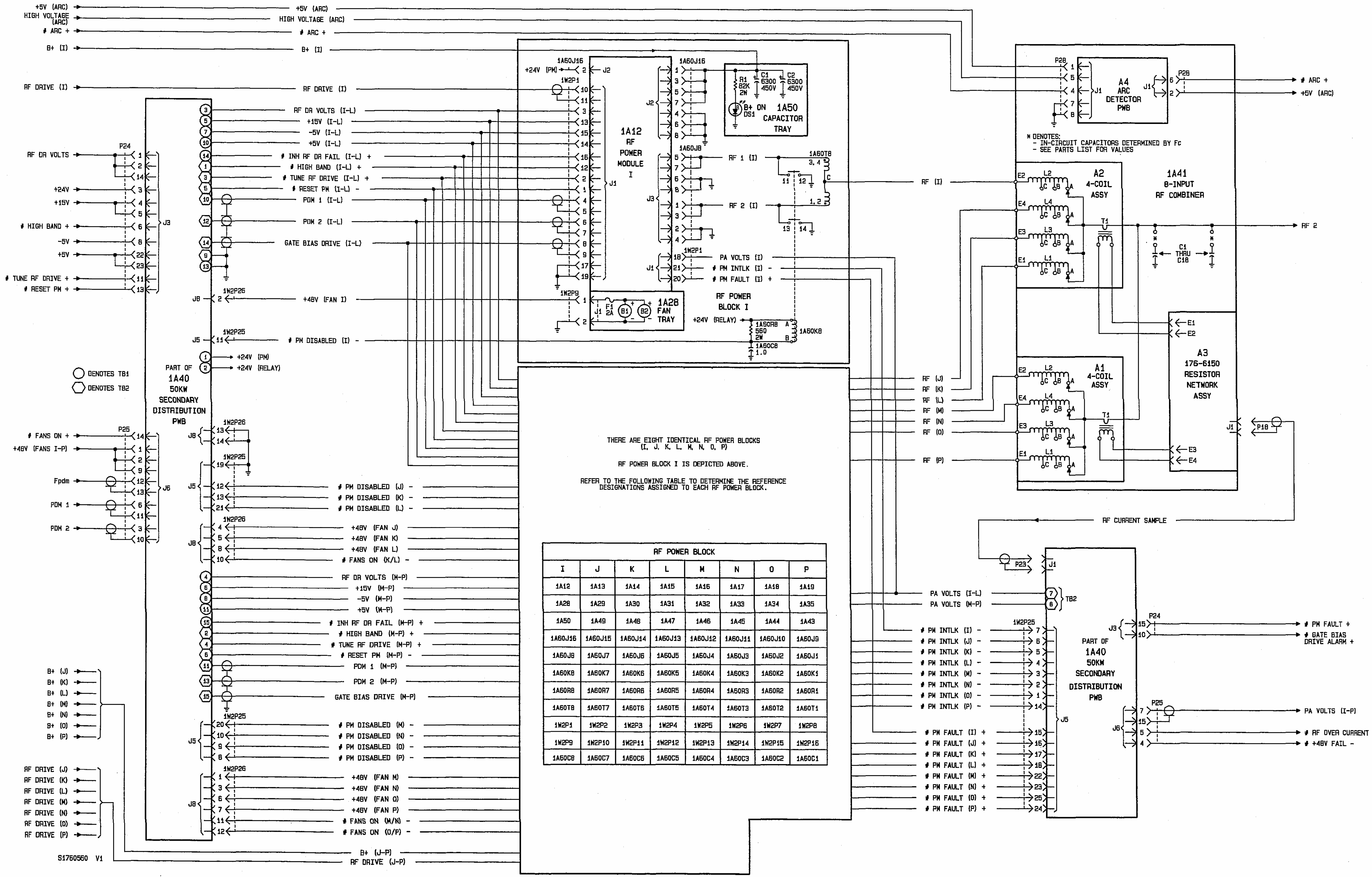
THERE ARE EIGHT IDENTICAL RF POWER BLOCKS (A, B, C, D, E, F, G, H)

RF POWER BLOCK A IS DEPICTED ABOVE.

REFER TO THE FOLLOWING TABLE TO DETERMINE THE REFERENCE DESIGNATIONS ASSIGNED TO EACH RF POWER BLOCK.

RF POWER BLOCK							
A	B	C	D	E	F	G	H
1A4	1A5	1A6	1A7	1A8	1A9	1A10	1A11
1A20	1A21	1A22	1A23	1A24	1A25	1A26	1A27
1A58	1A57	1A56	1A55	1A54	1A53	1A52	1A51
1A59J16	1A59J15	1A59J14	1A59J13	1A59J12	1A59J11	1A59J10	1A59J9
1A59J8	1A59J7	1A59J6	1A59J5	1A59J4	1A59J3	1A59J2	1A59J1
1A59K8	1A59K7	1A59K6	1A59K5	1A59K4	1A59K3	1A59K2	1A59K1
1A59R8	1A59R7	1A59R6	1A59R5	1A59R4	1A59R3	1A59R2	1A59R1
1A59RT8	1A59RT7	1A59RT6	1A59RT5	1A59RT4	1A59RT3	1A59RT2	1A59RT1
1A59T8	1A59T7	1A59T6	1A59T5	1A59T4	1A59T3	1A59T2	1A59T1
1W1P1	1W1P2	1W1P3	1W1P4	1W1P5	1W1P6	1W1P7	1W1P8
1W1P9	1W1P10	1W1P11	1W1P12	1W1P13	1W1P14	1W1P15	1W1P16
1A59C8	1A59C7	1A59C6	1A59C5	1A59C4	1A59C3	1A59C2	1A59C1

Figure SD-6 Electrical Schematic - 50 kW RF Power Section 1



RF POWER BLOCK							
I	J	K	L	M	N	O	P
1A12	1A13	1A14	1A15	1A16	1A17	1A18	1A19
1A28	1A29	1A30	1A31	1A32	1A33	1A34	1A35
1A50	1A49	1A48	1A47	1A46	1A45	1A44	1A43
1A60J16	1A60J15	1A60J14	1A60J13	1A60J12	1A60J11	1A60J10	1A60J9
1A60J8	1A60J7	1A60J6	1A60J5	1A60J4	1A60J3	1A60J2	1A60J1
1A60K8	1A60K7	1A60K6	1A60K5	1A60K4	1A60K3	1A60K2	1A60K1
1A60R8	1A60R7	1A60R6	1A60R5	1A60R4	1A60R3	1A60R2	1A60R1
1A60T8	1A60T7	1A60T6	1A60T5	1A60T4	1A60T3	1A60T2	1A60T1
1W2P1	1W2P2	1W2P3	1W2P4	1W2P5	1W2P6	1W2P7	1W2P8
1W2P9	1W2P10	1W2P11	1W2P12	1W2P13	1W2P14	1W2P15	1W2P16
1A60C8	1A60C7	1A60C6	1A60C5	1A60C4	1A60C3	1A60C2	1A60C1

Figure SD-7 Electrical Schematic - 50 kW RF Power Section 2

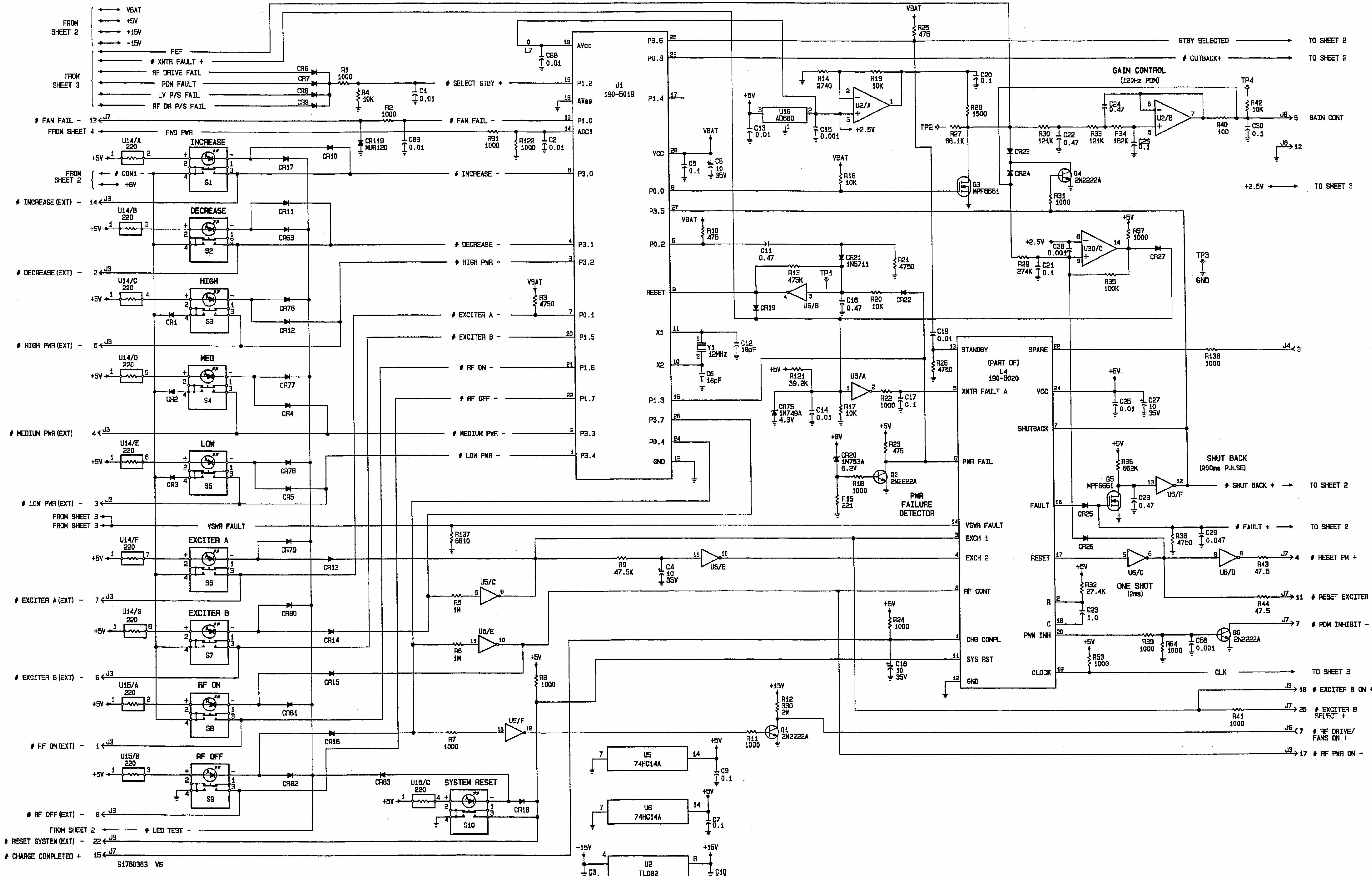


Figure SD-8 Electrical Schematic - System Controller PWB (NAPC110) (Sheet 1 of 4)

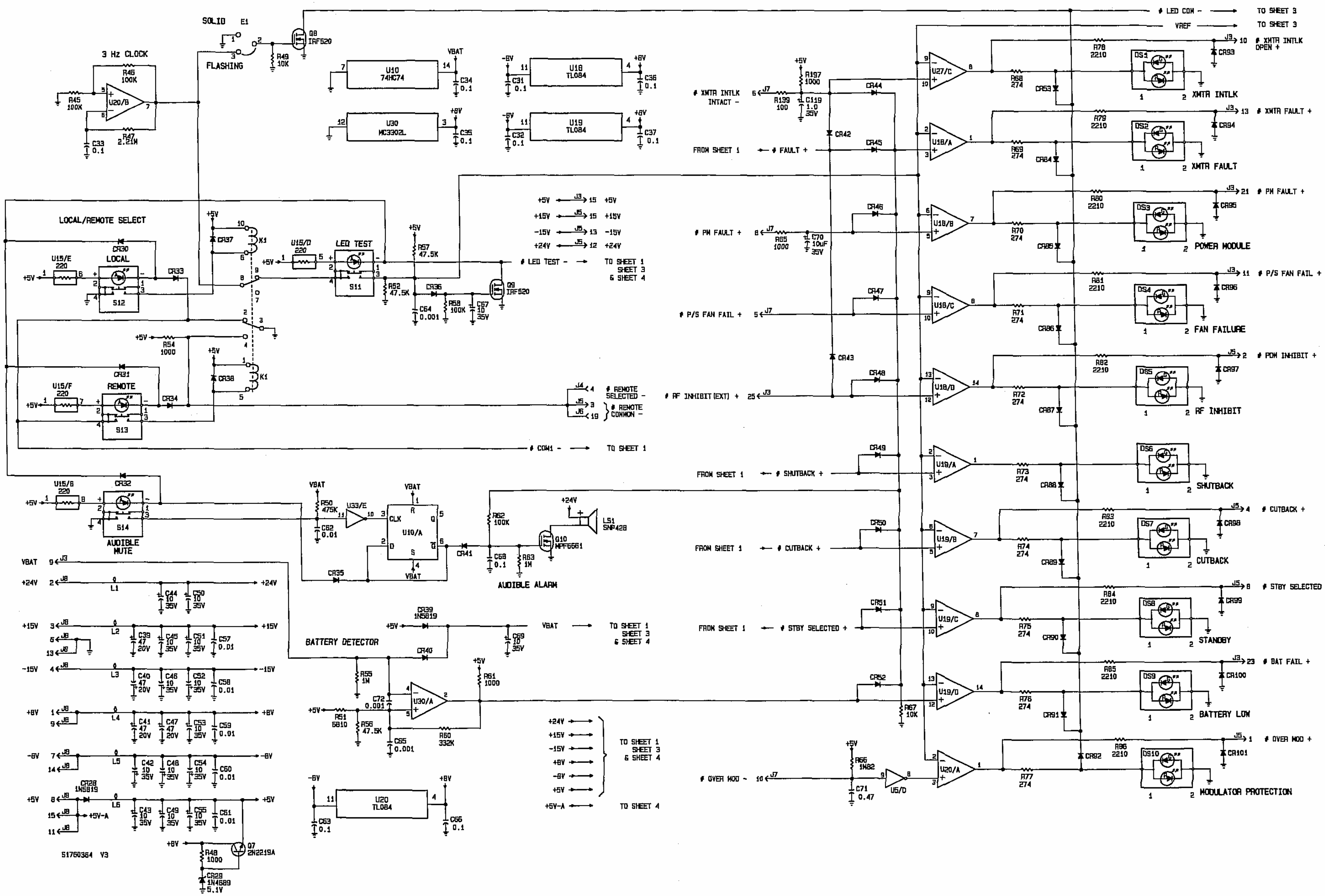


Figure SD-9 Electrical Schematic - System Controller PWB (NAPC110) (Sheet 2 of 4)

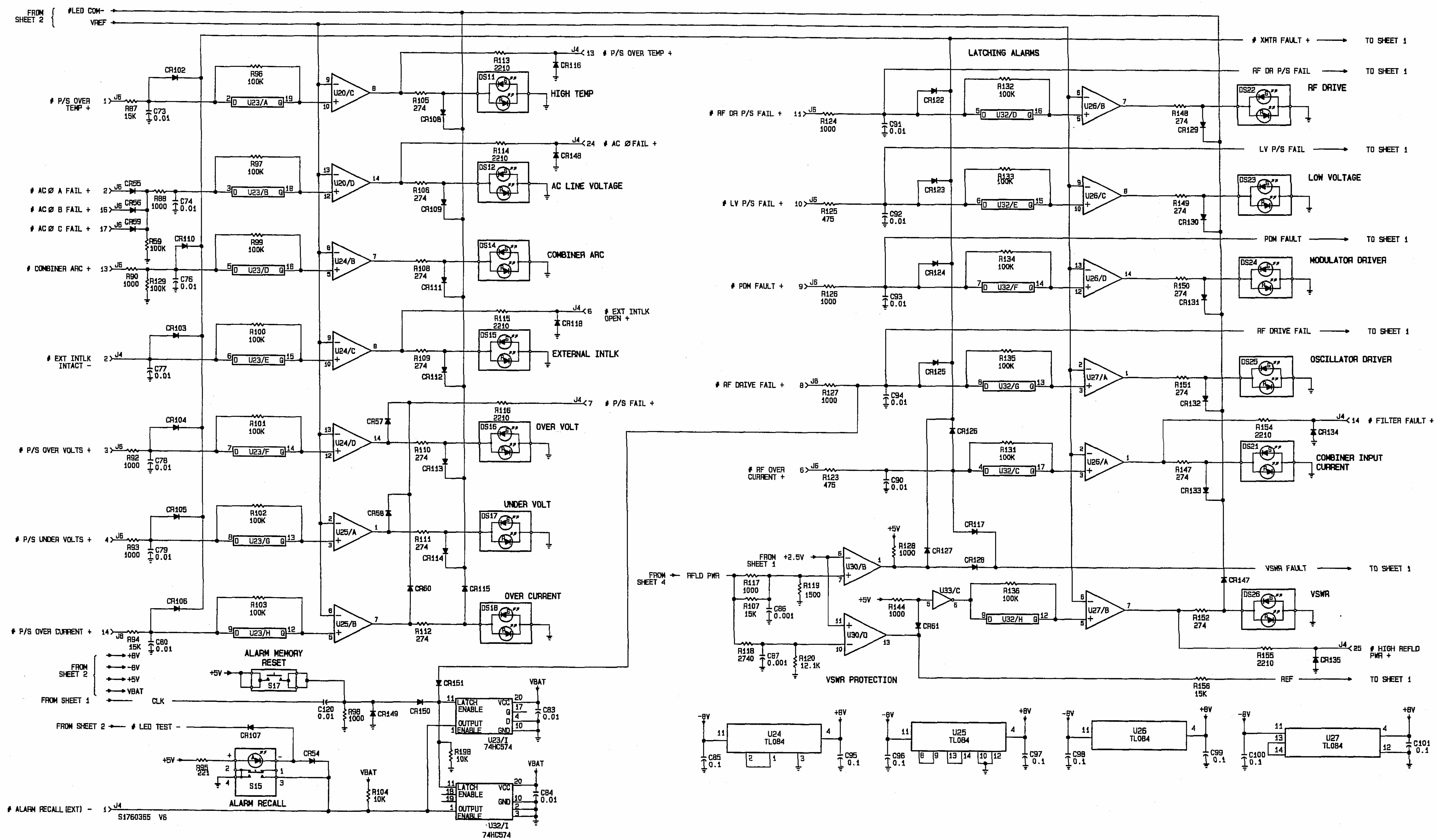


Figure SD-10 Electrical Schematic - System Controller PWB (NAPC110) (Sheet 3 of 4)

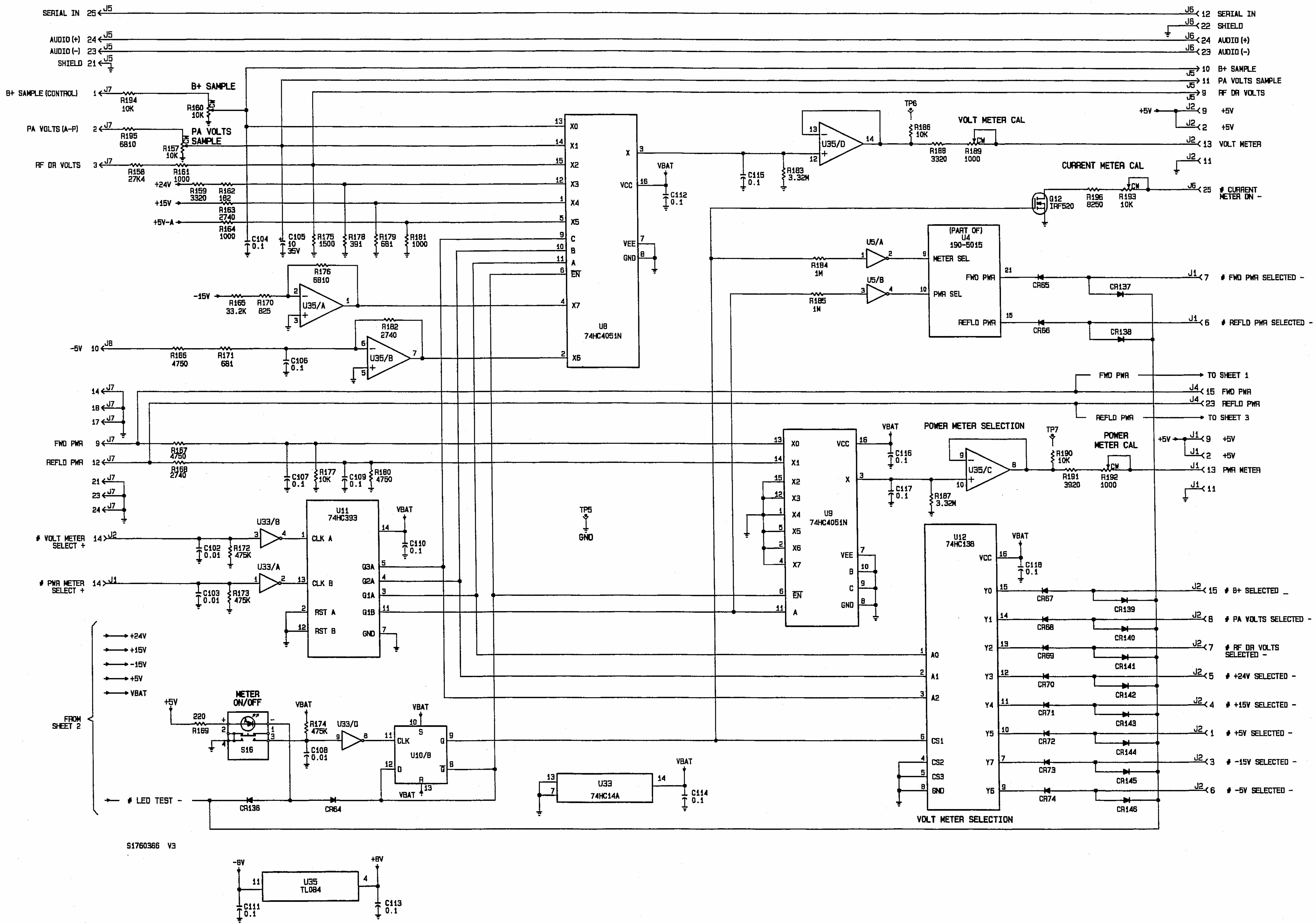


Figure SD-11 Electrical Schematic - System Controller PWB (NAPC110) (Sheet 4 of 4)

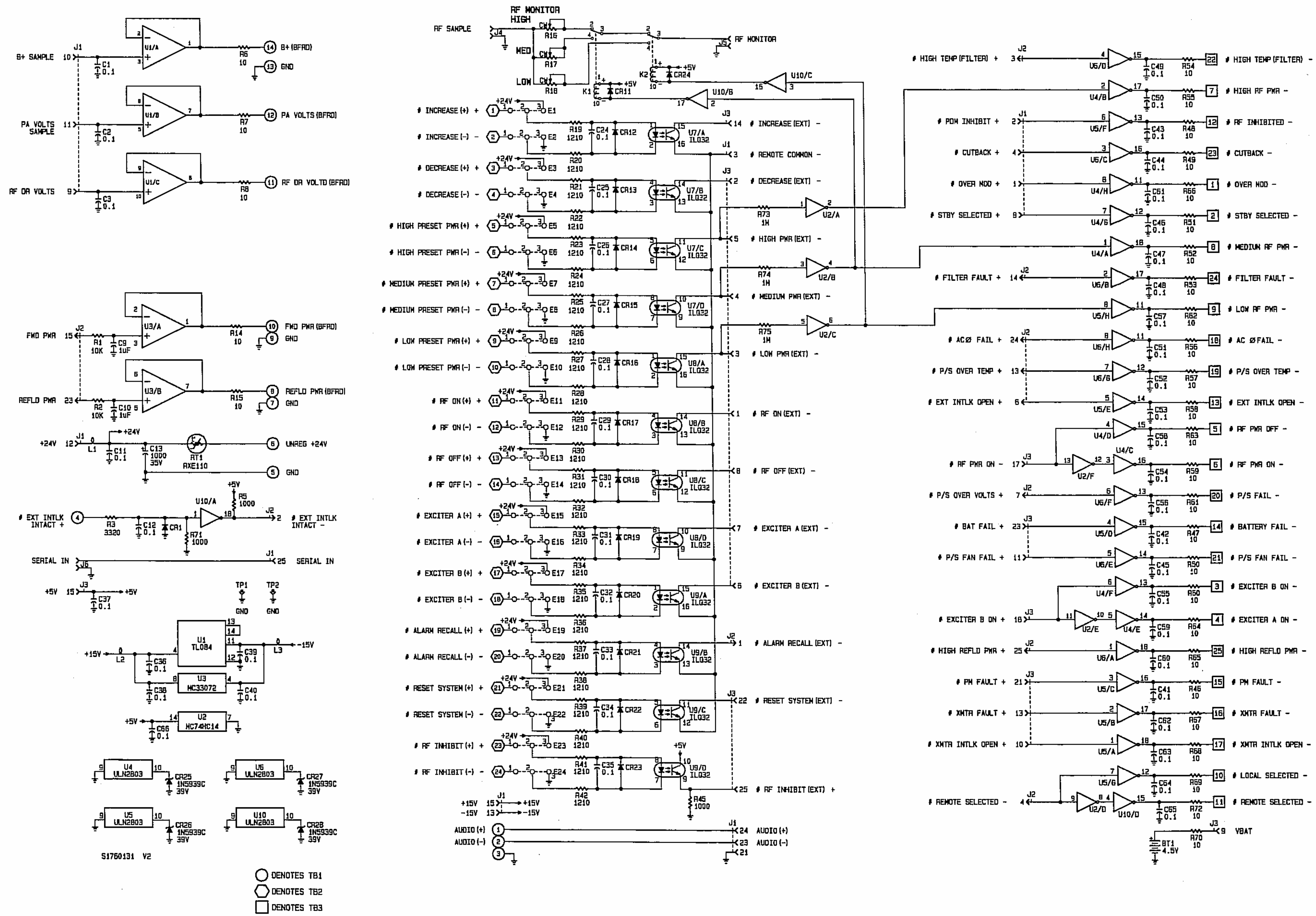


Figure SD-12 Electrical Schematic - Remote Interface PWB (NAPI17)

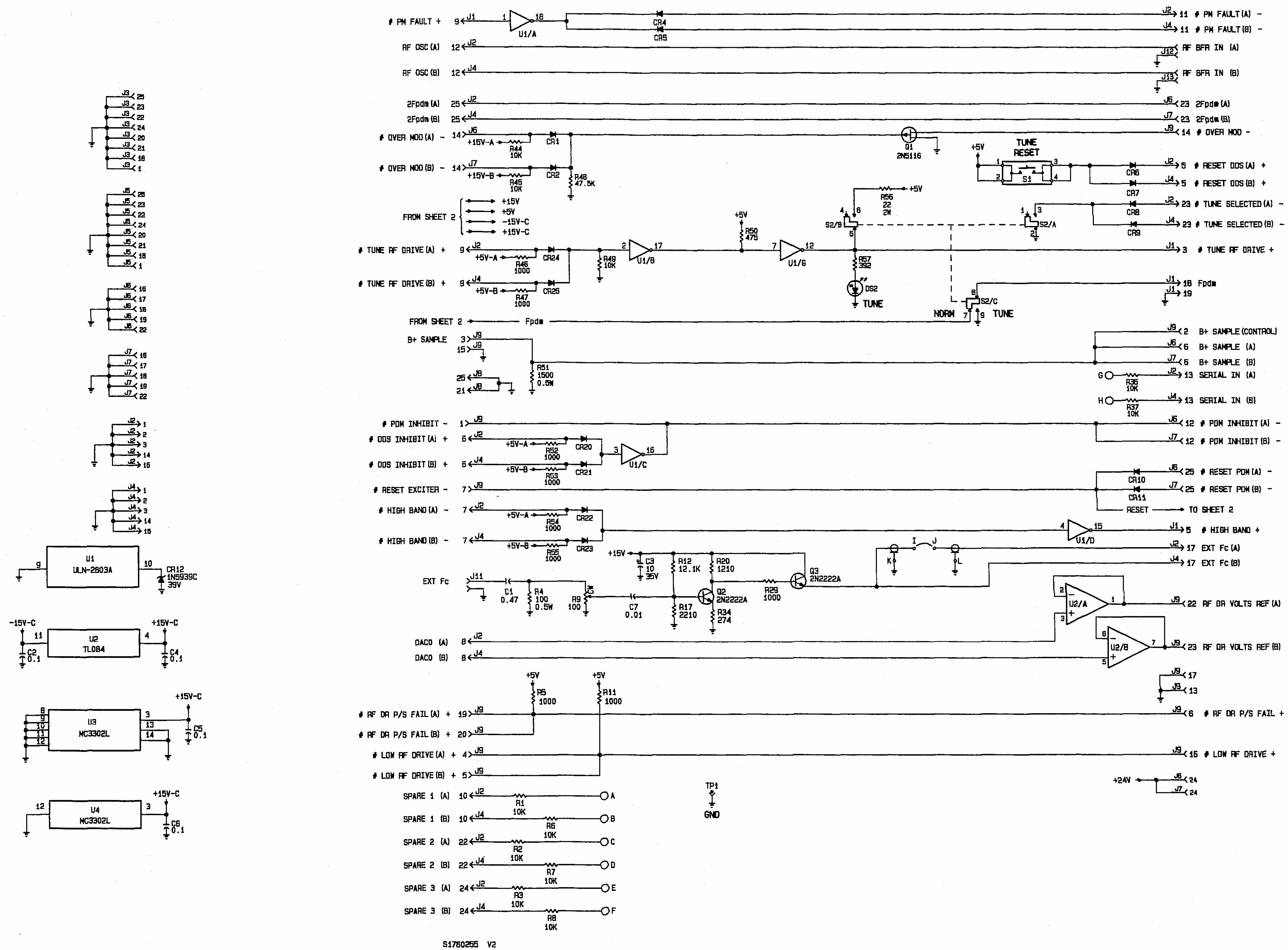


Figure SD-13 Electrical Schematic - Exciter Interface PWB (NAPI31A) (Sheet 1 of 2)

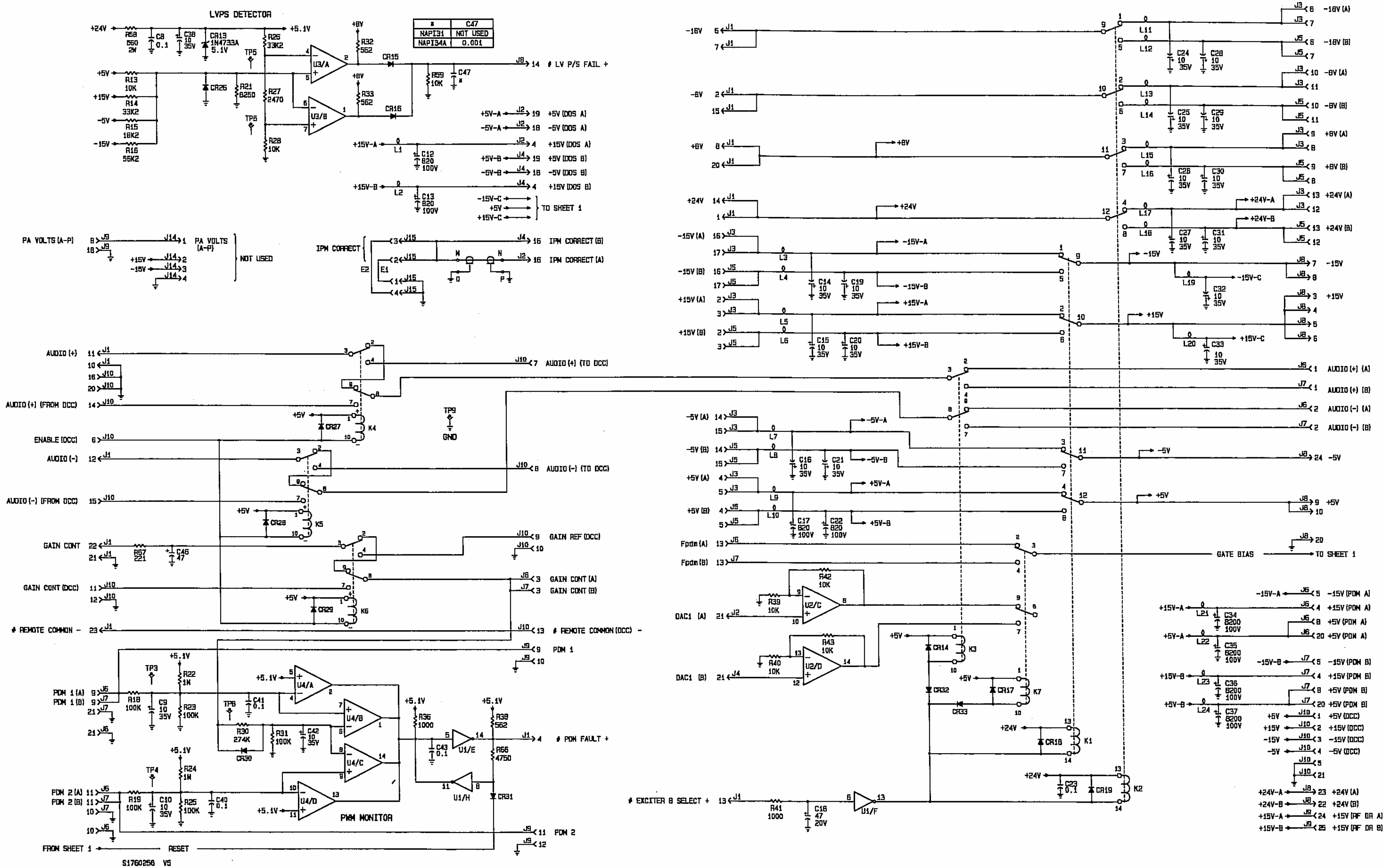


Figure SD-14 Electrical Schematic - Exciter Interface PWB (NAPI31A) (Sheet 2 of 2)

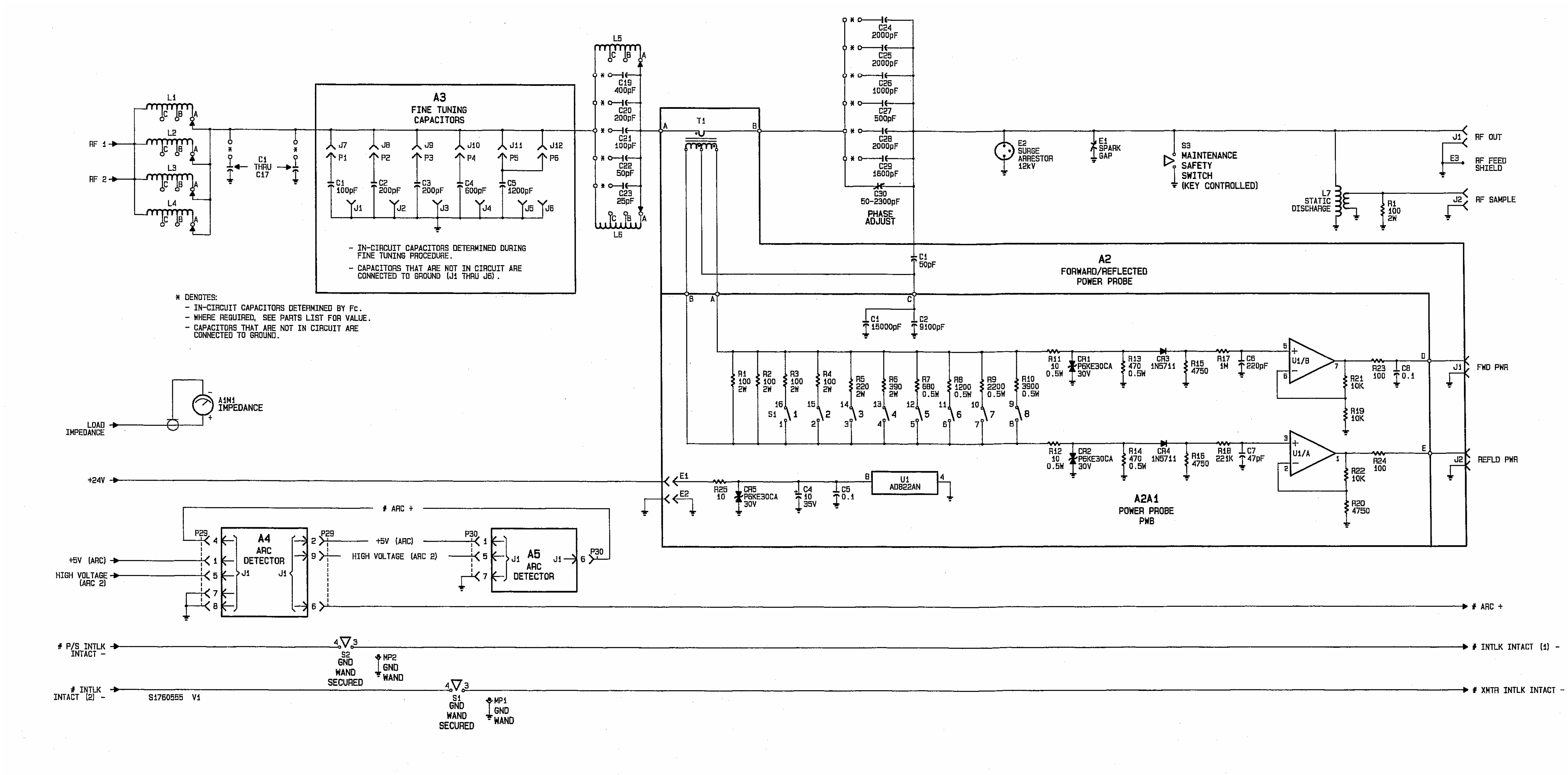
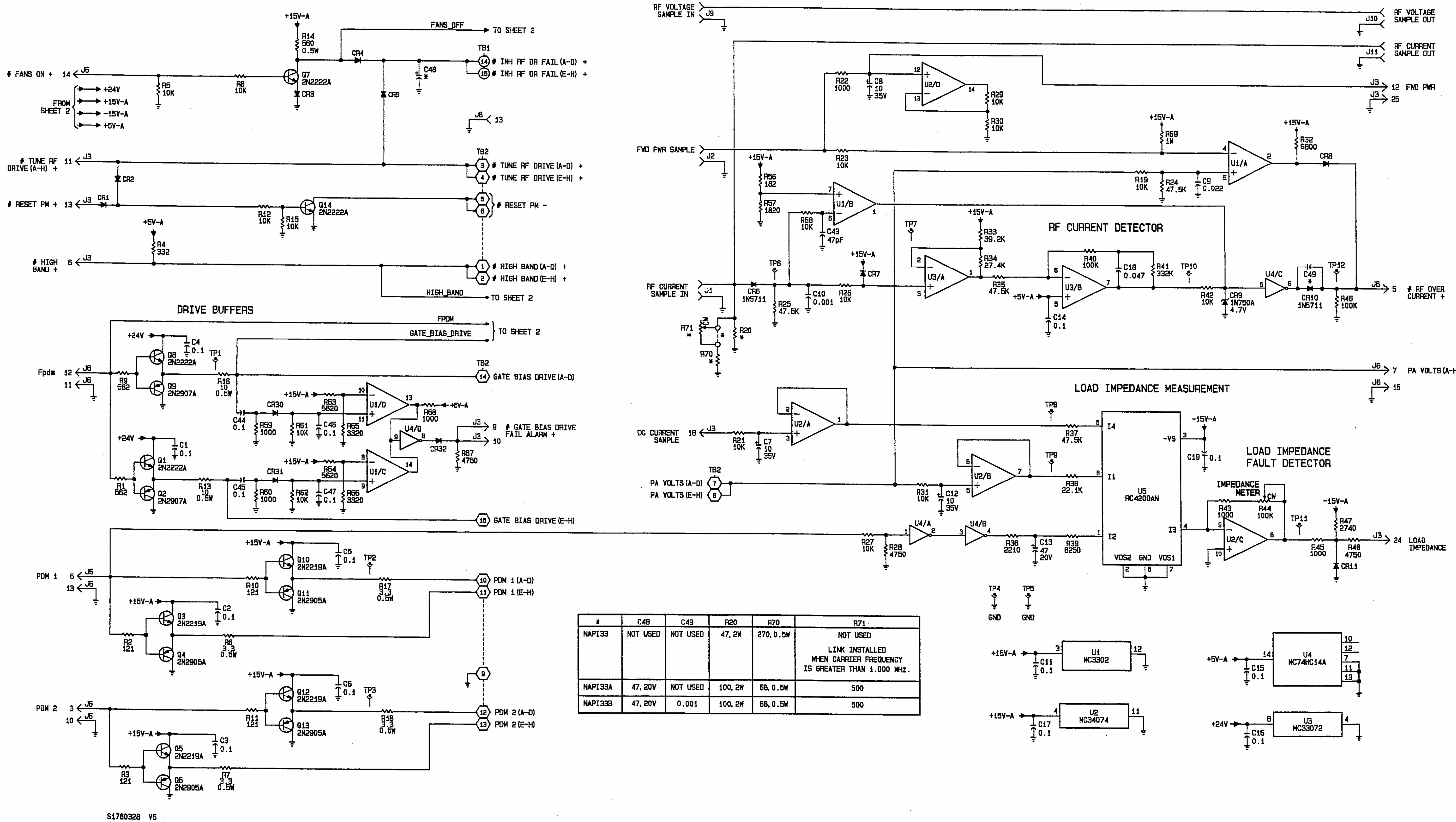


Figure SD-15 Electrical Schematic - 100kW RF Combiner/Output Filter (Freq Agile) (NAF103)



*	C48	C49	R20	R70	R71
NAPI33	NOT USED	NOT USED	47, 2W	270, 0.5W	NOT USED LINK INSTALLED WHEN CARRIER FREQUENCY IS GREATER THAN 1.000 MHz.
NAPI33A	47, 20V	NOT USED	100, 2W	68, 0.5W	500
NAPI33B	47, 20V	0.001	100, 2W	68, 0.5W	500

Figure SD-16 Electrical Schematic - 50kW Distribution PWB (Primary) (NAPI33B) (Sheet 1 of 2)

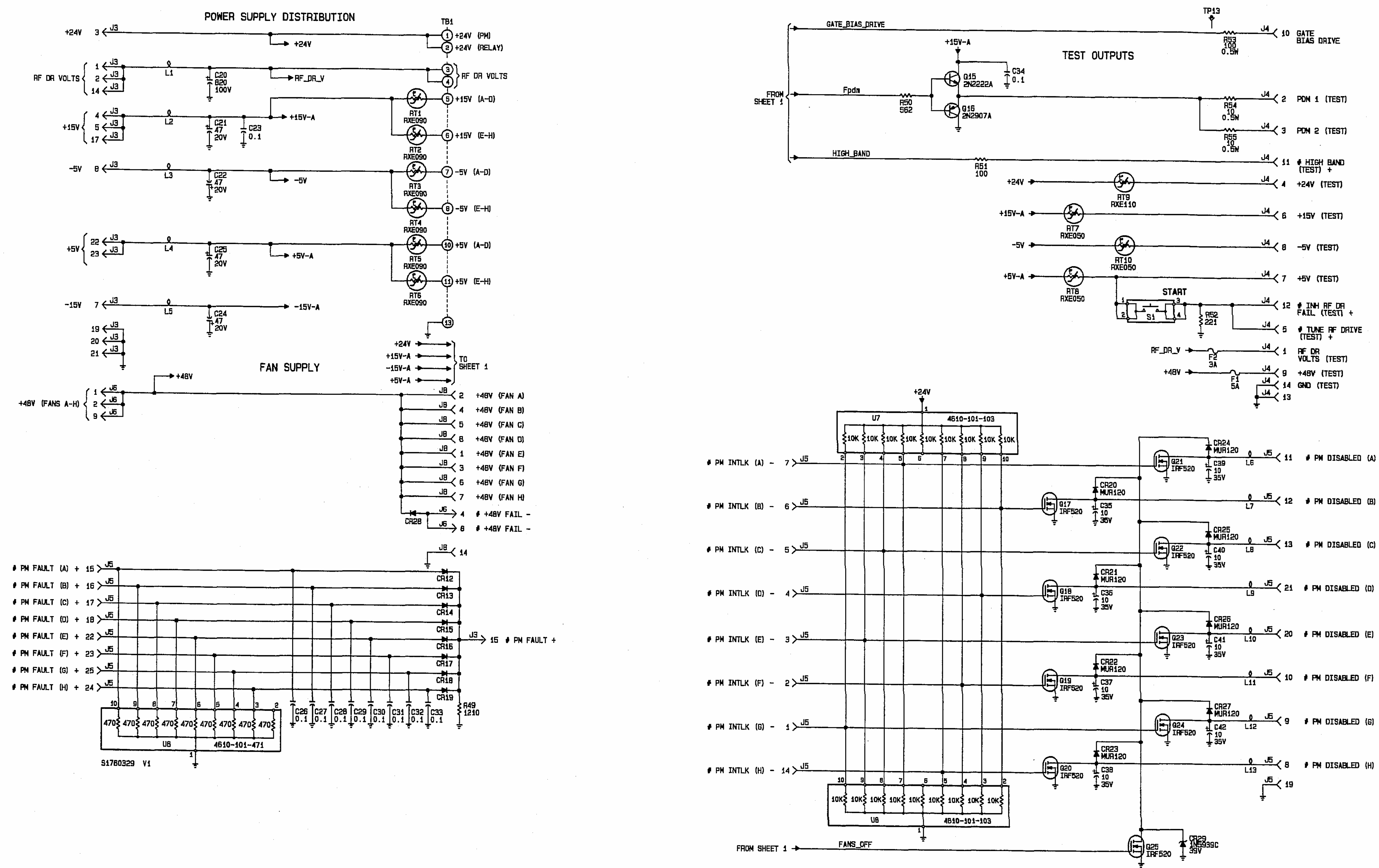
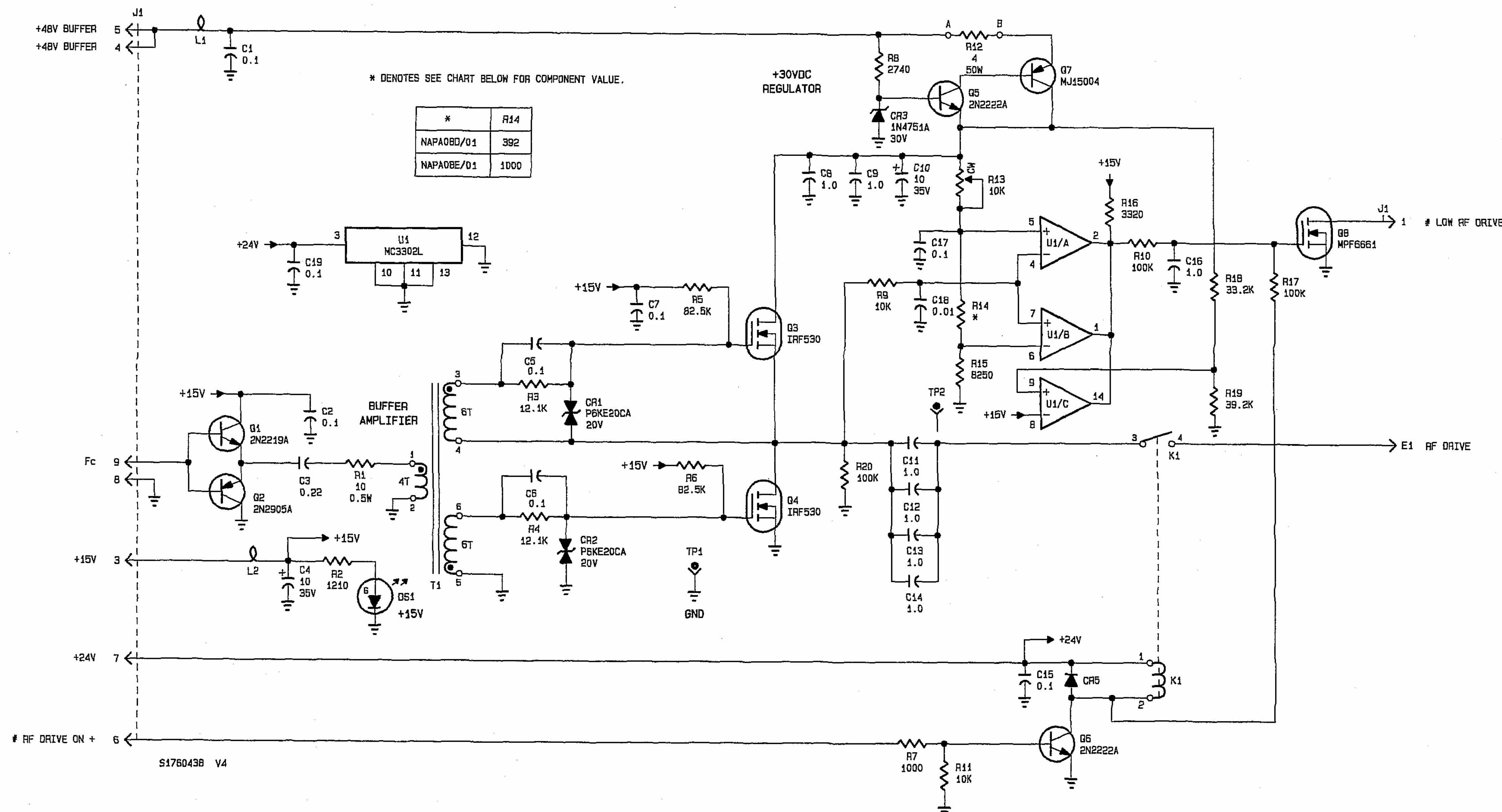
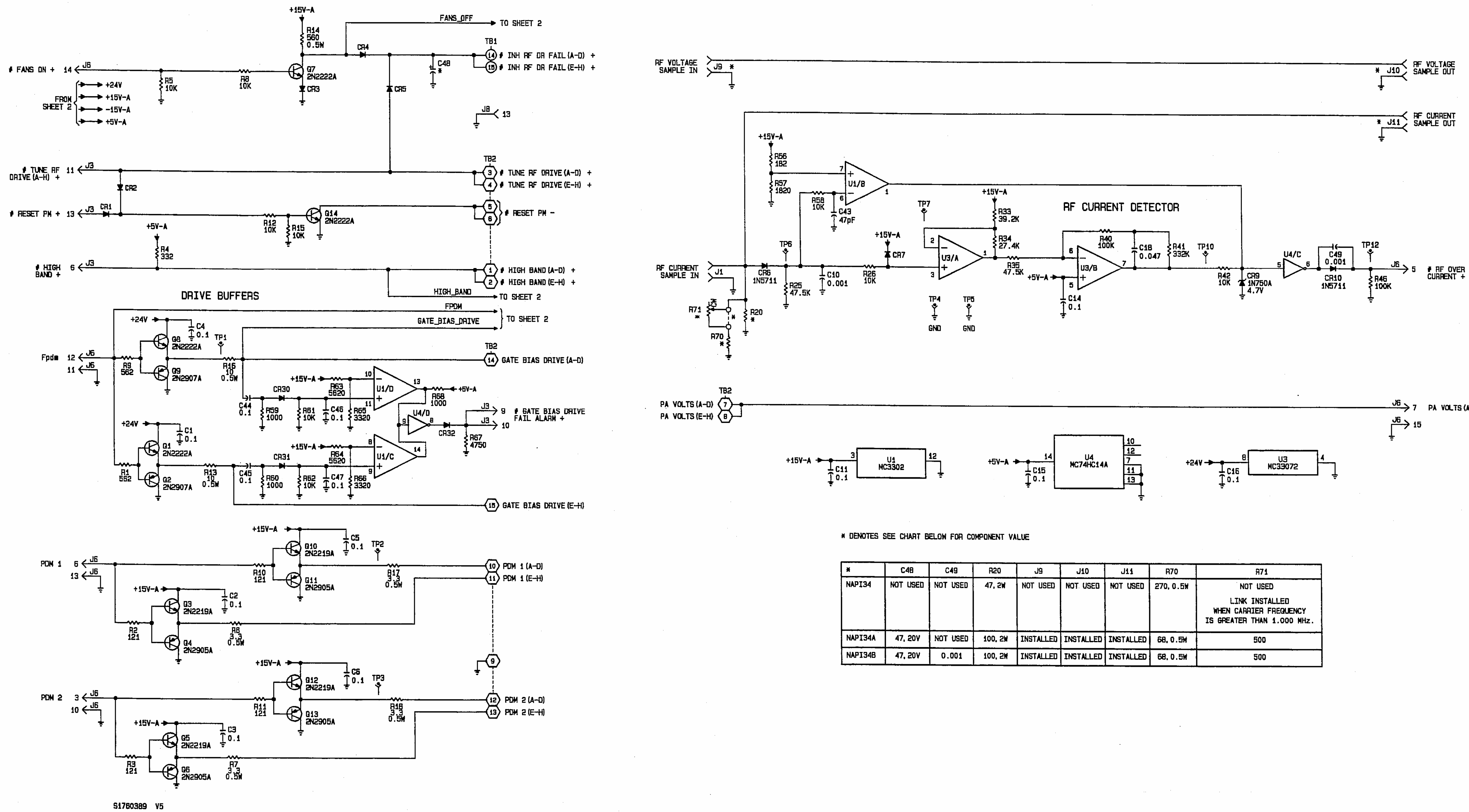


Figure SD-17 Electrical Schematic - 50kW Distribution PWB (Primary) (NAPI33B) (Sheet 2 of 2)



*	R14
NAPA08D/01	392
NAPA08E/01	1000

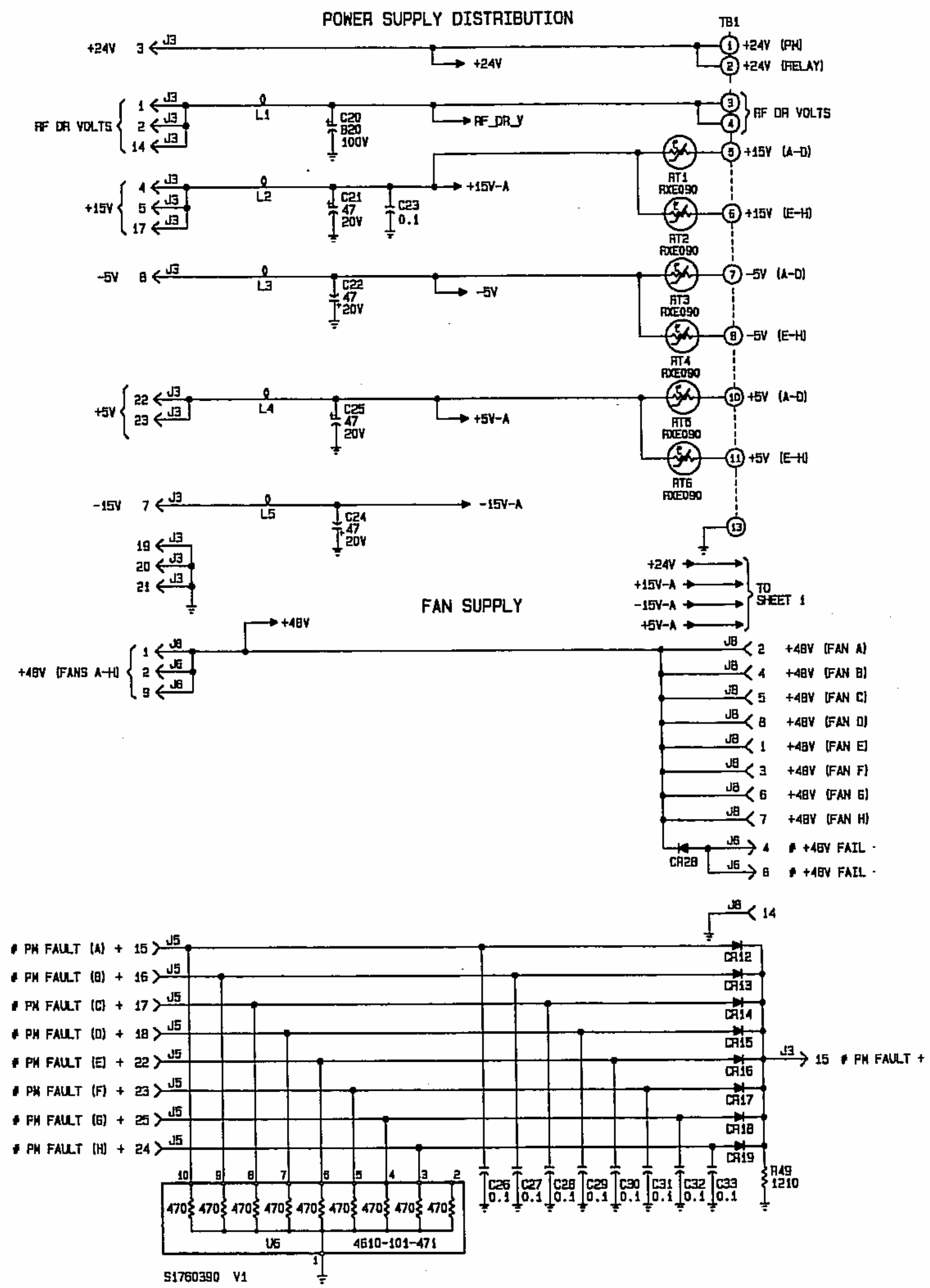
Figure SD-18 Electrical Schematic - RF Drive Buffer PWB (NAPA08E/01)



* DENOTES SEE CHART BELOW FOR COMPONENT VALUE

*	C48	C49	R20	J9	J10	J11	R70	R71
NAPI34	NOT USED	NOT USED	47, 2W	NOT USED	NOT USED	NOT USED	270, 0.5W	NOT USED LINK INSTALLED WHEN CARRIER FREQUENCY IS GREATER THAN 1.000 MHz.
NAPI34A	47, 20V	NOT USED	100, 2W	INSTALLED	INSTALLED	INSTALLED	68, 0.5W	500
NAPI34B	47, 20V	0.001	100, 2W	INSTALLED	INSTALLED	INSTALLED	68, 0.5W	500

Figure SD-19 Electrical Schematic - 50kW Distribution PWB (Secondary) (NAPI34B) (Sheet 1 of 2)



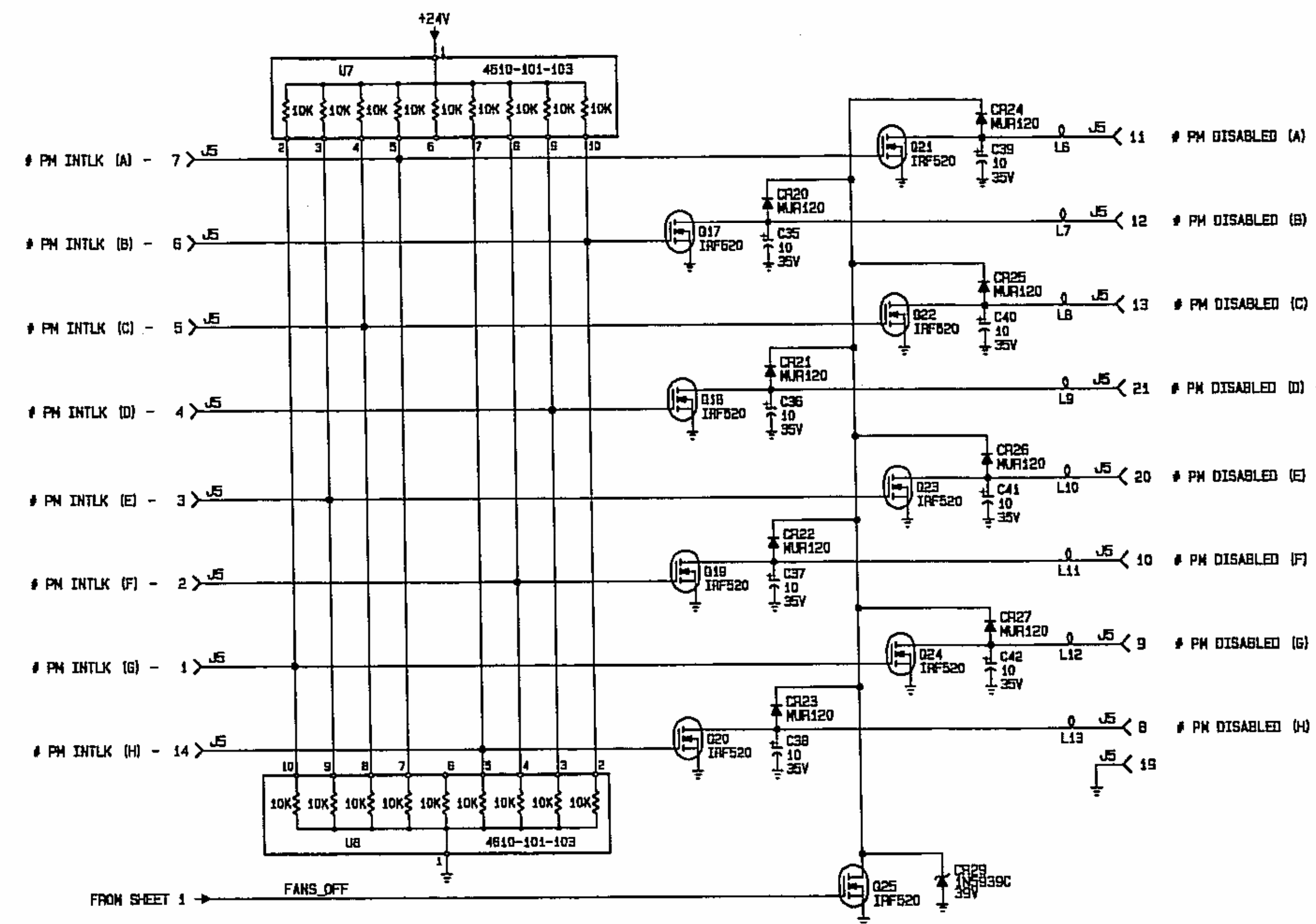
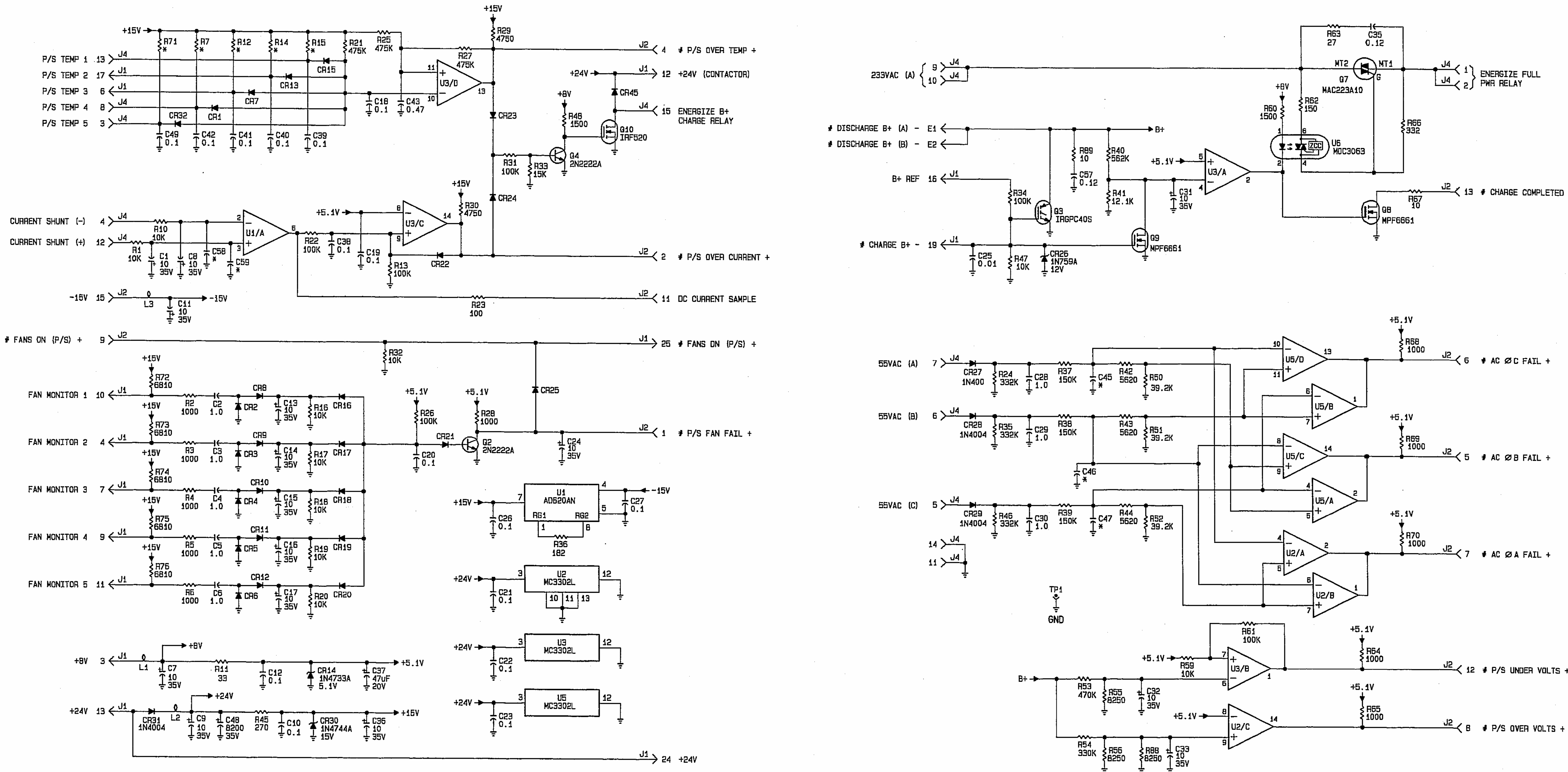


Figure SD-20 Electrical Schematic - 50kW Distribution PWB (Secondary) (NAPI34B) (Sheet 2 of 2)



*	R7	R12	R14	R15	R71	C45	C46	C47	C58	C59
NAPC92/04	22.1K	22.1K	22.1K	22.1K	22.1K	0.1	0.1	0.1	NOT USED	NOT USED
NAPC92A/04	22.1K	22.1K	22.1K	22.1K	22.1K	0.1	0.1	0.1	NOT USED	NOT USED
NAPC92B/04	22.1K	22.1K	22.1K	22.1K	22.1K	0.1	0.1	0.1	NOT USED	NOT USED
NAPC92C/04	12.1K	12.1K	12.1K	12.1K	12.1K	10	10	10	NOT USED	NOT USED
NAPC92D/04	12.1K	12.1K	12.1K	12.1K	12.1K	10	10	10	0.001	0.001

S1760280 V6

Figure SD-21 Electrical Schematic - Power Supply Control/Monitor PWB (NAPC92D/04)

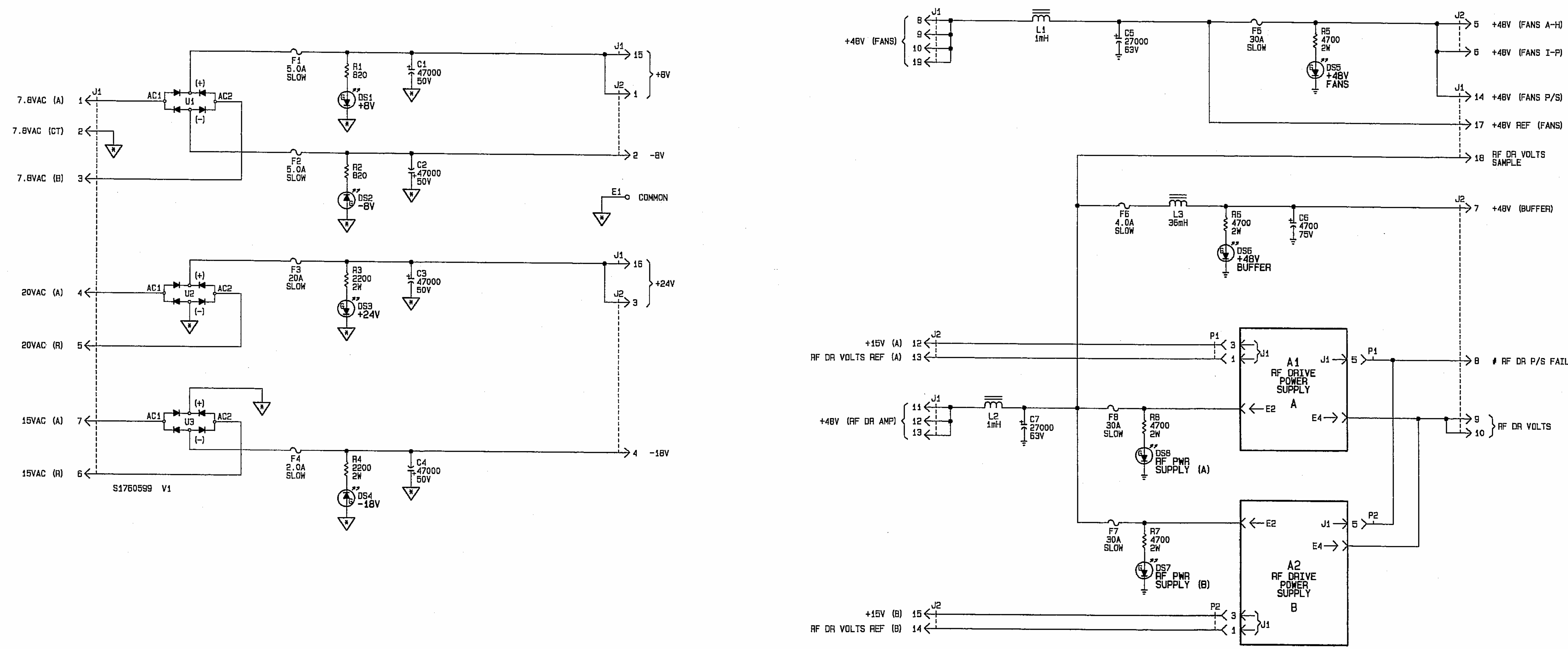


Figure SD-22 Electrical Schematic - DC Power Supply (NASR106)

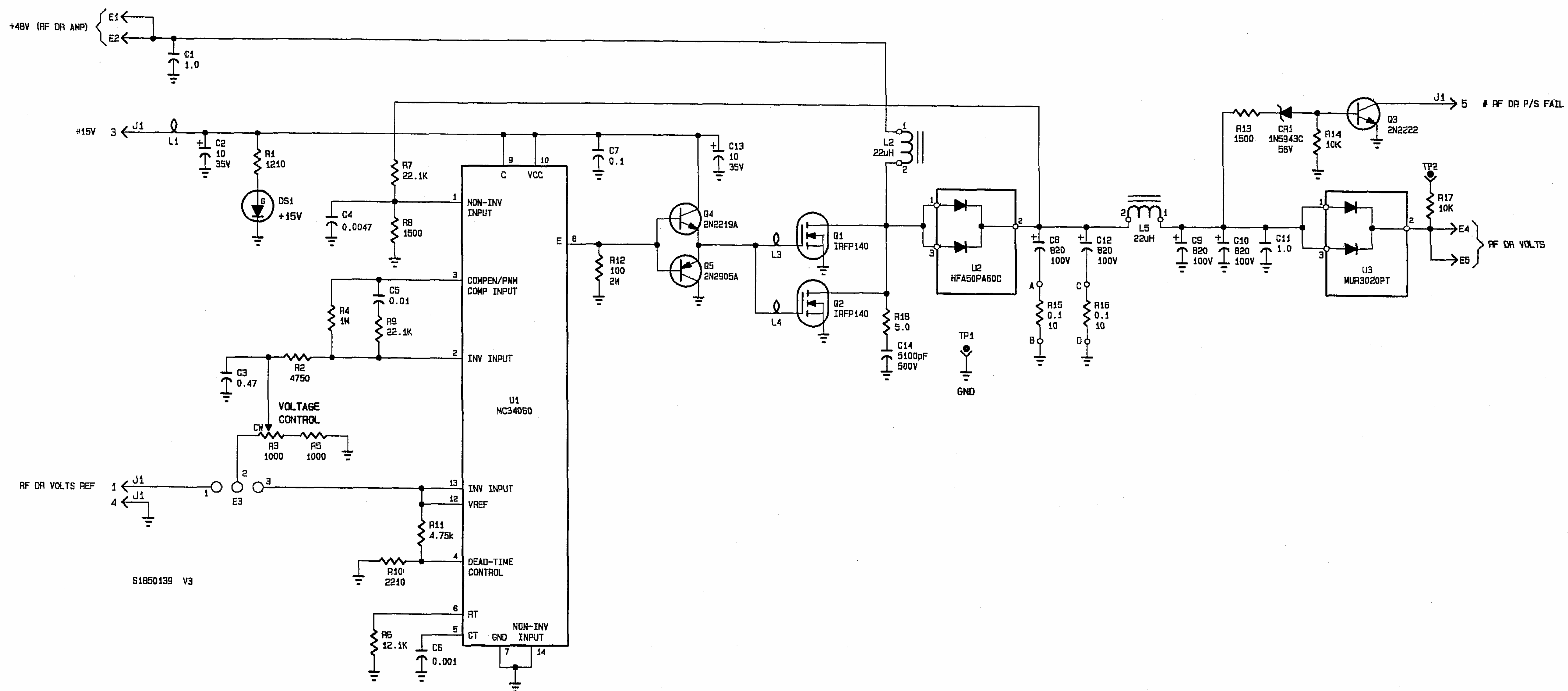


Figure SD-23 Electrical Schematic - RF Drive DC Power Supply (NAPS11A)

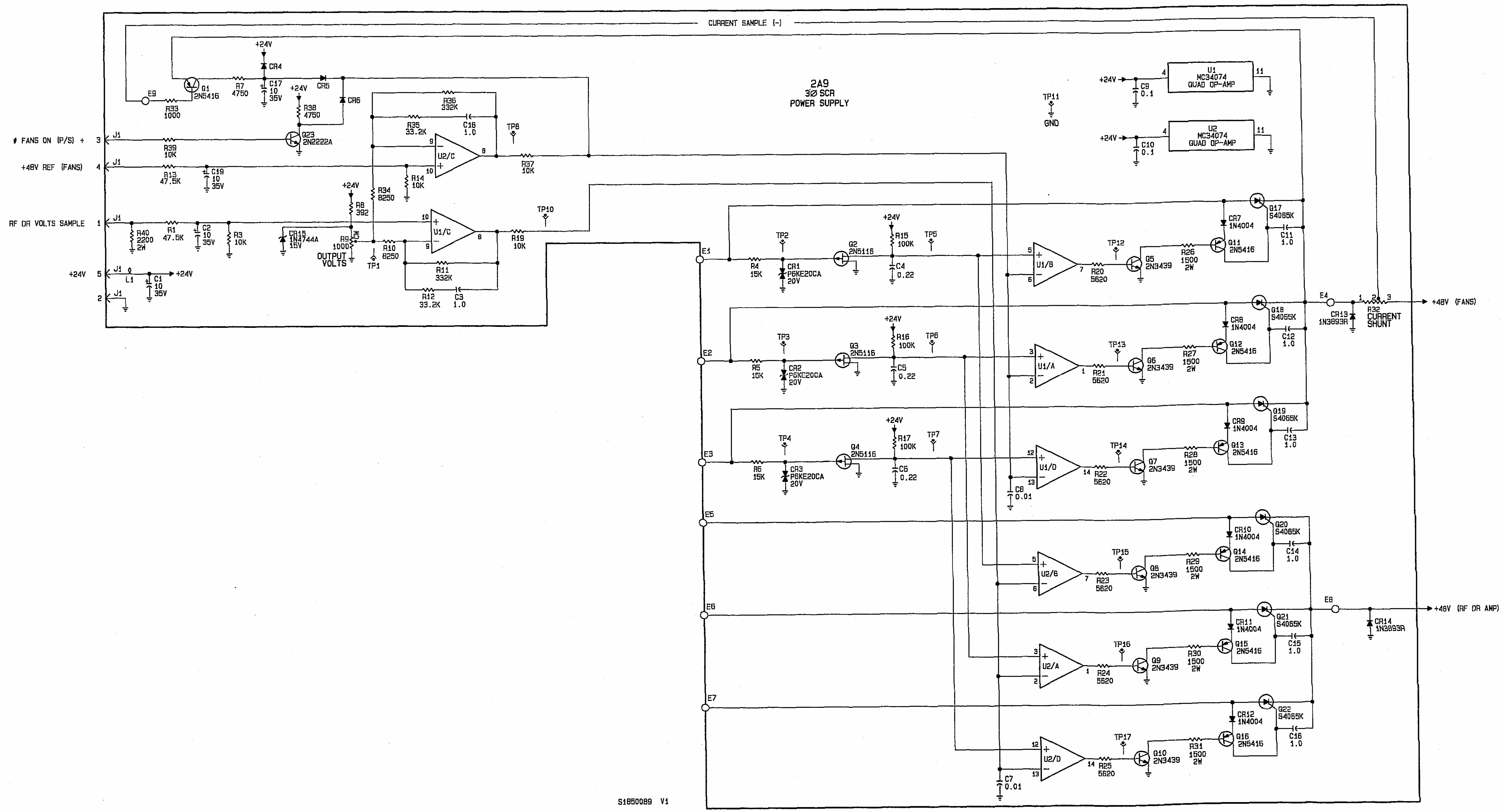


Figure SD-24 Electrical Schematic - Dual Regulated +48 VDC Power Supply (NAS44/01)

SECTION 11
MECHANICAL DRAWINGS

INTRODUCTION

11.1 This section contains assembly detail drawings for the subject equipment. Dimensional drawings may be included. Refer to table 11-1 for an itemized listing of drawings provided.

CONTENT OF MECHANICAL DRAWINGS

11.2 Mechanical drawings are illustrations that depict the location of electrical components and show assembly outline detail. Where appropriate, dimensional information will be included.

LOCATING ASSEMBLY DETAIL DRAWINGS

11.3 Each illustration in this section is identified by a number that is both the figure number and the page number. The numbers are assigned sequentially and are prefixed by the letters 'MD-'. Drawings in this section are listed in table 11-1.

Table 11-1 List of Mechanical Drawings

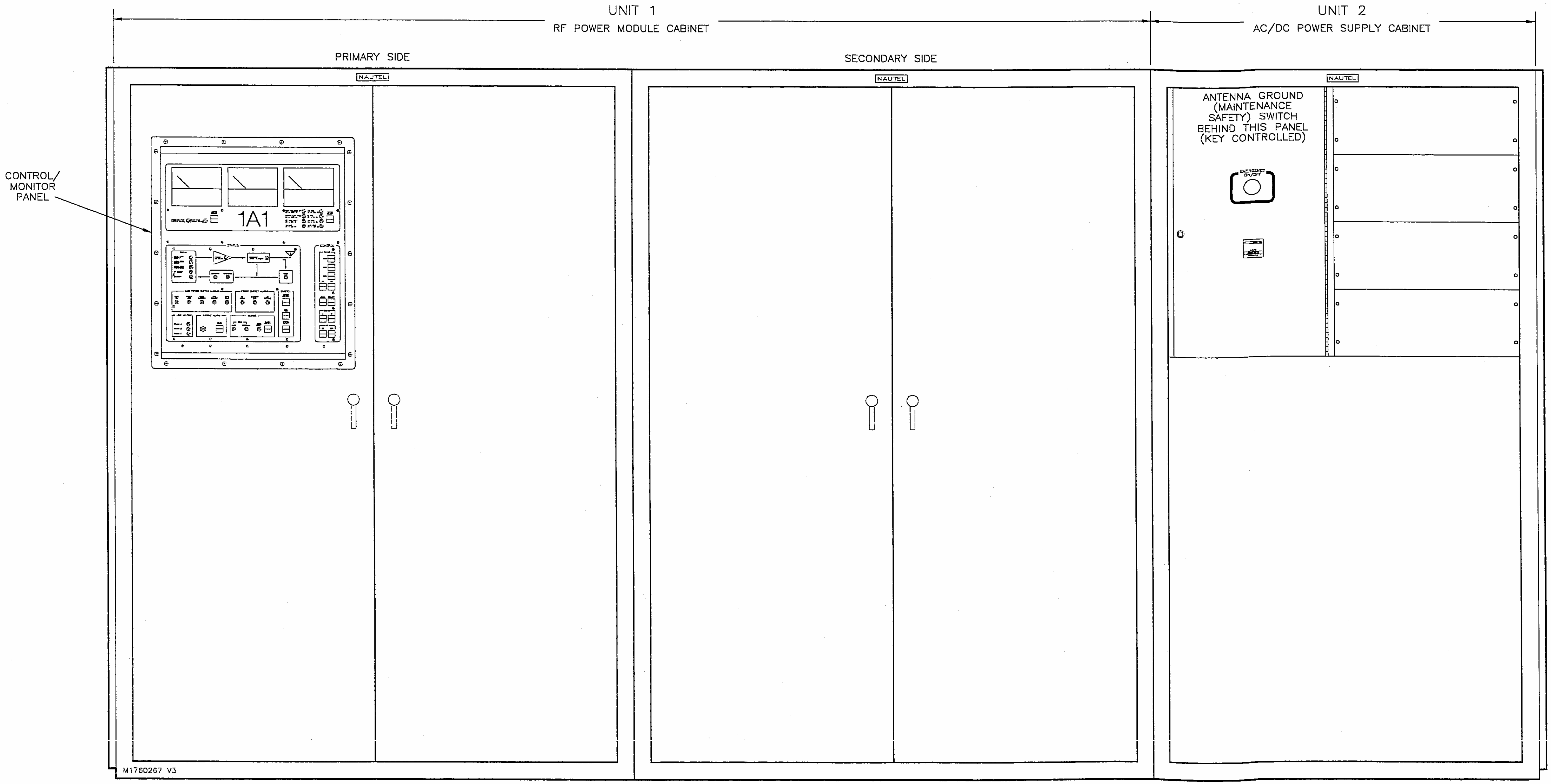


Figure MD-1 Assembly Detail - NA100 100kW AM Broadcast Transmitter (Front)

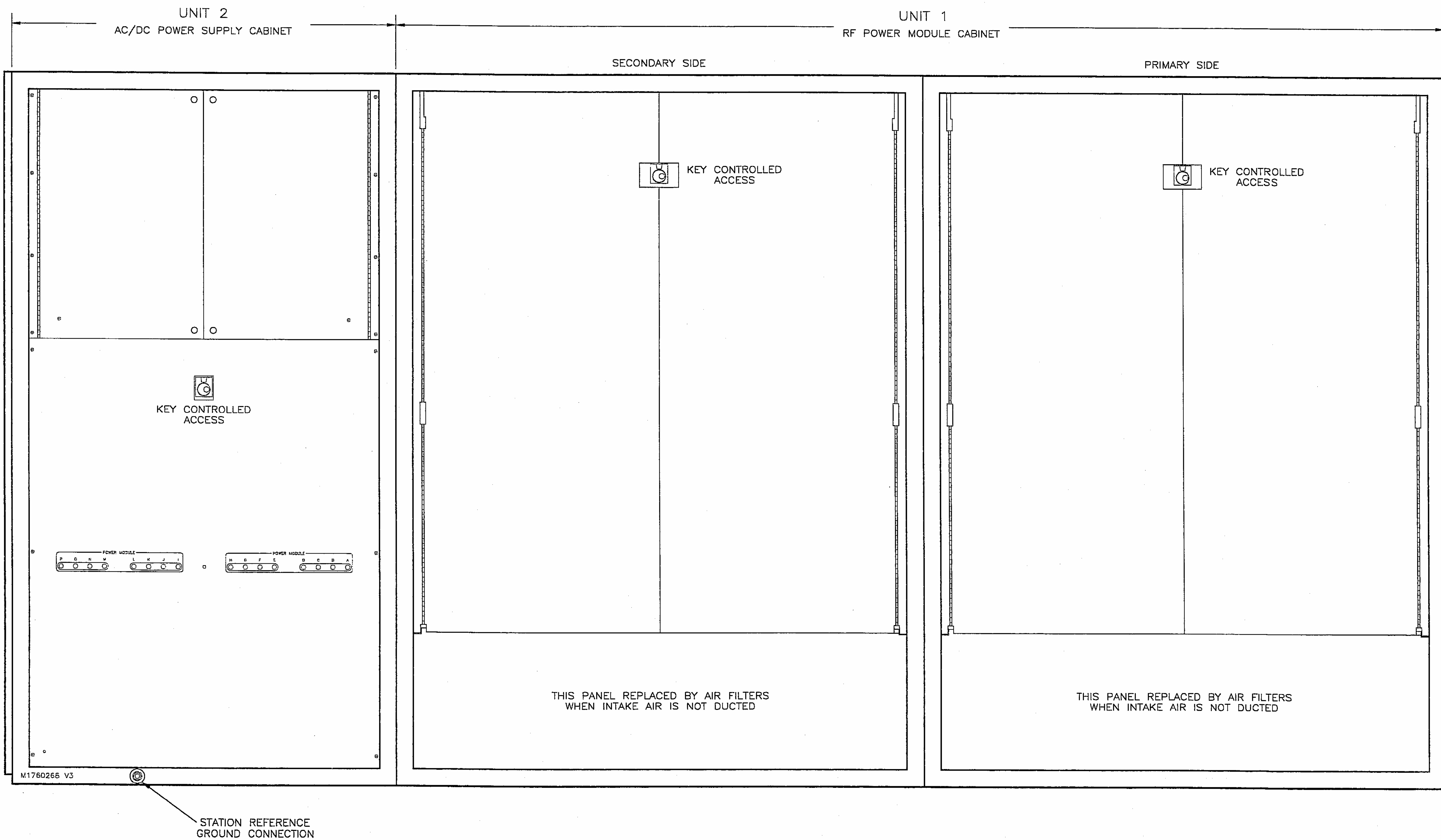


Figure MD-2 Assembly Detail - NA100 100kW AM Broadcast Transmitter (Rear)

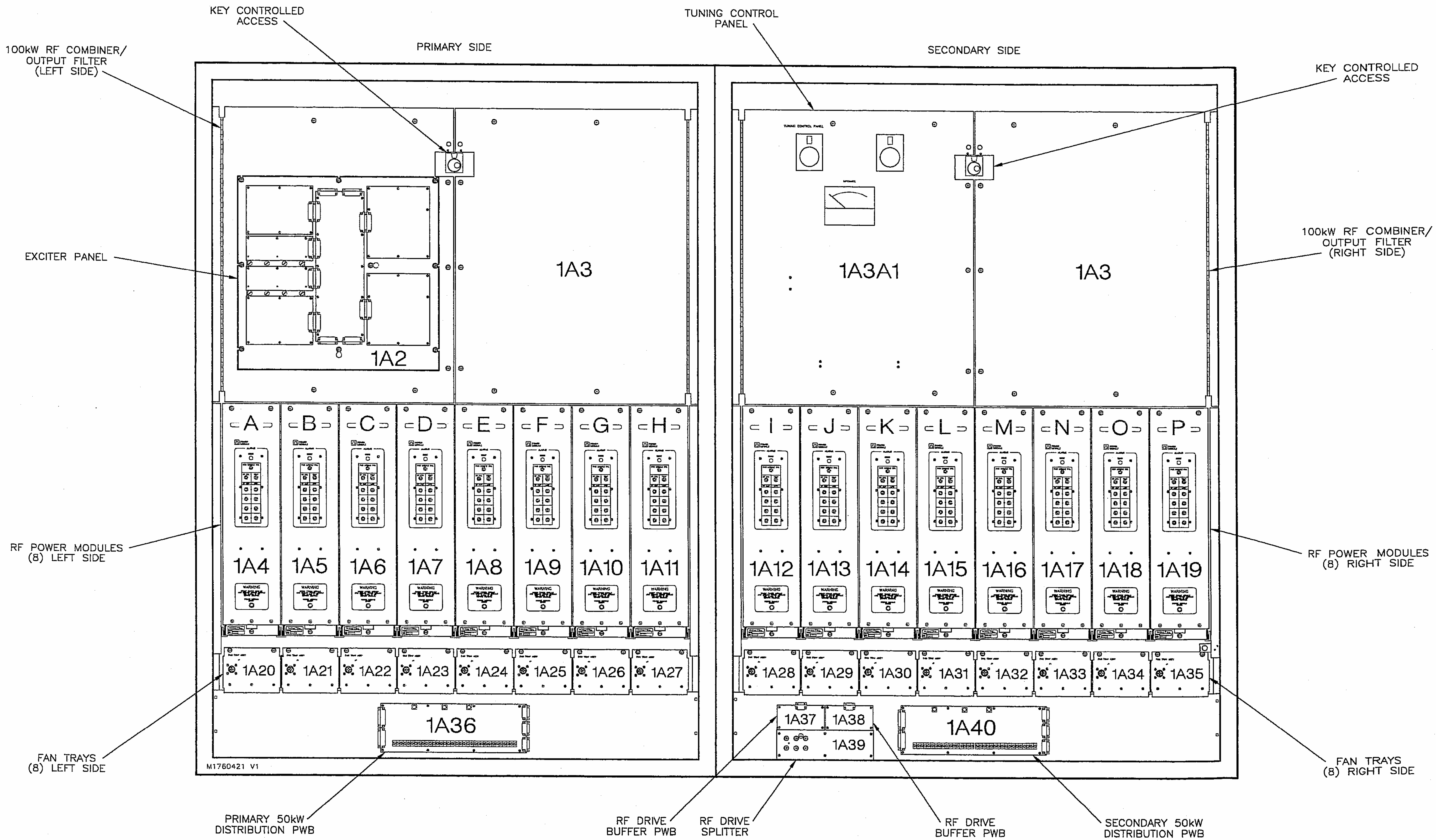


Figure MD-3 Assembly Detail - NAR199D 100kW RF Power Module Cabinet (Front)

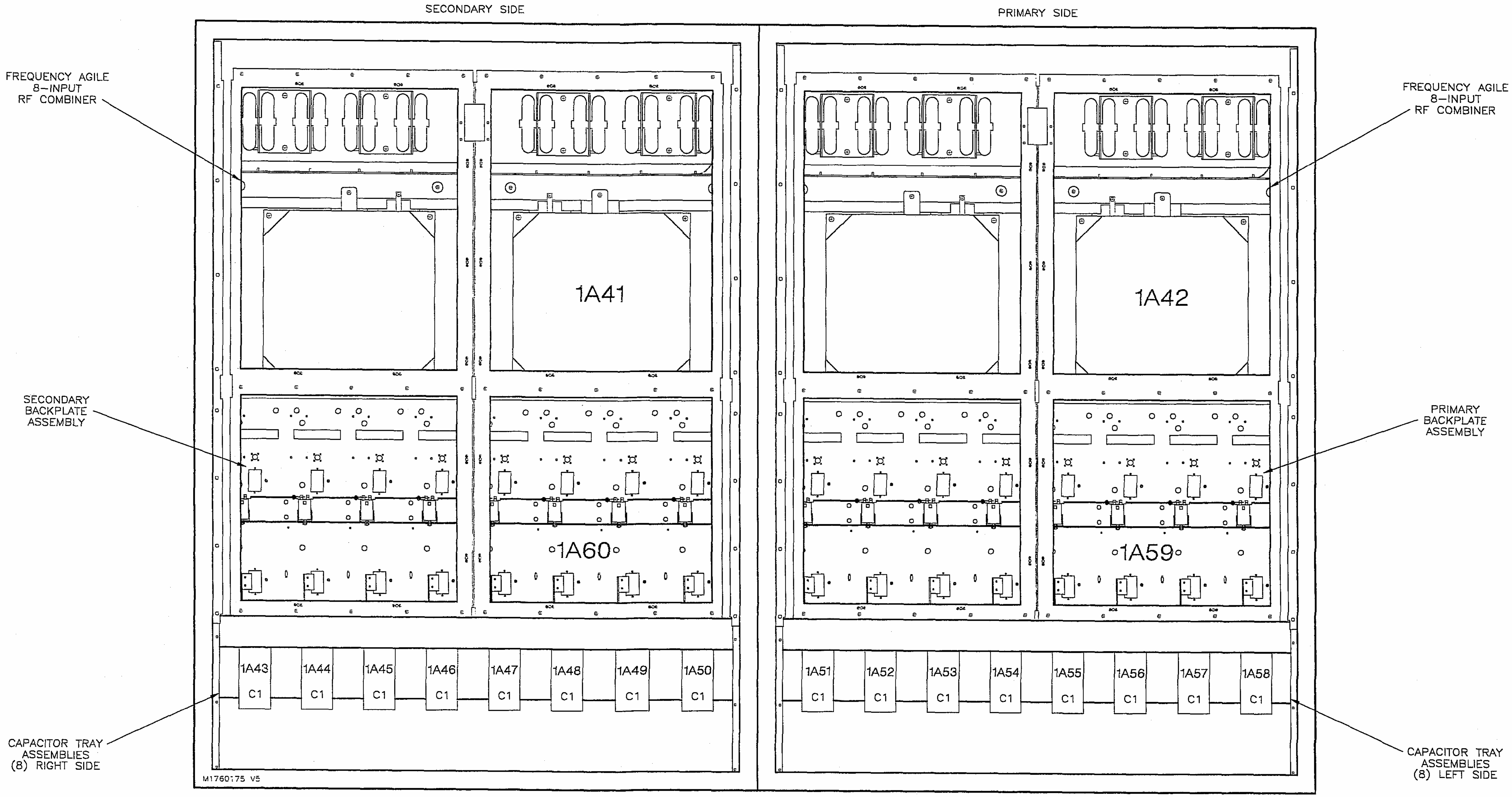


Figure MD-4 Assembly Detail - NAR199D 100kW RF Power Module Cabinet (Rear)

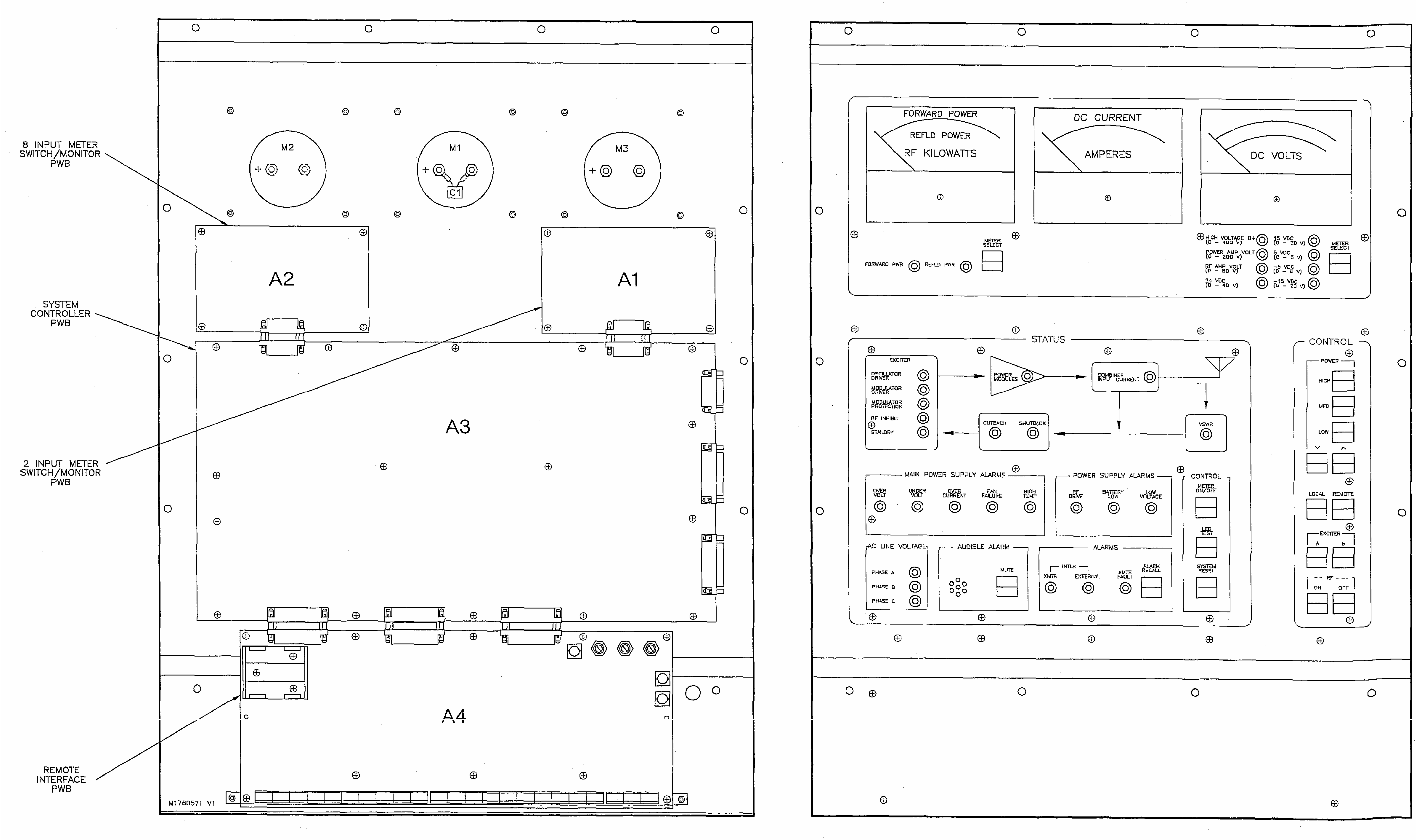
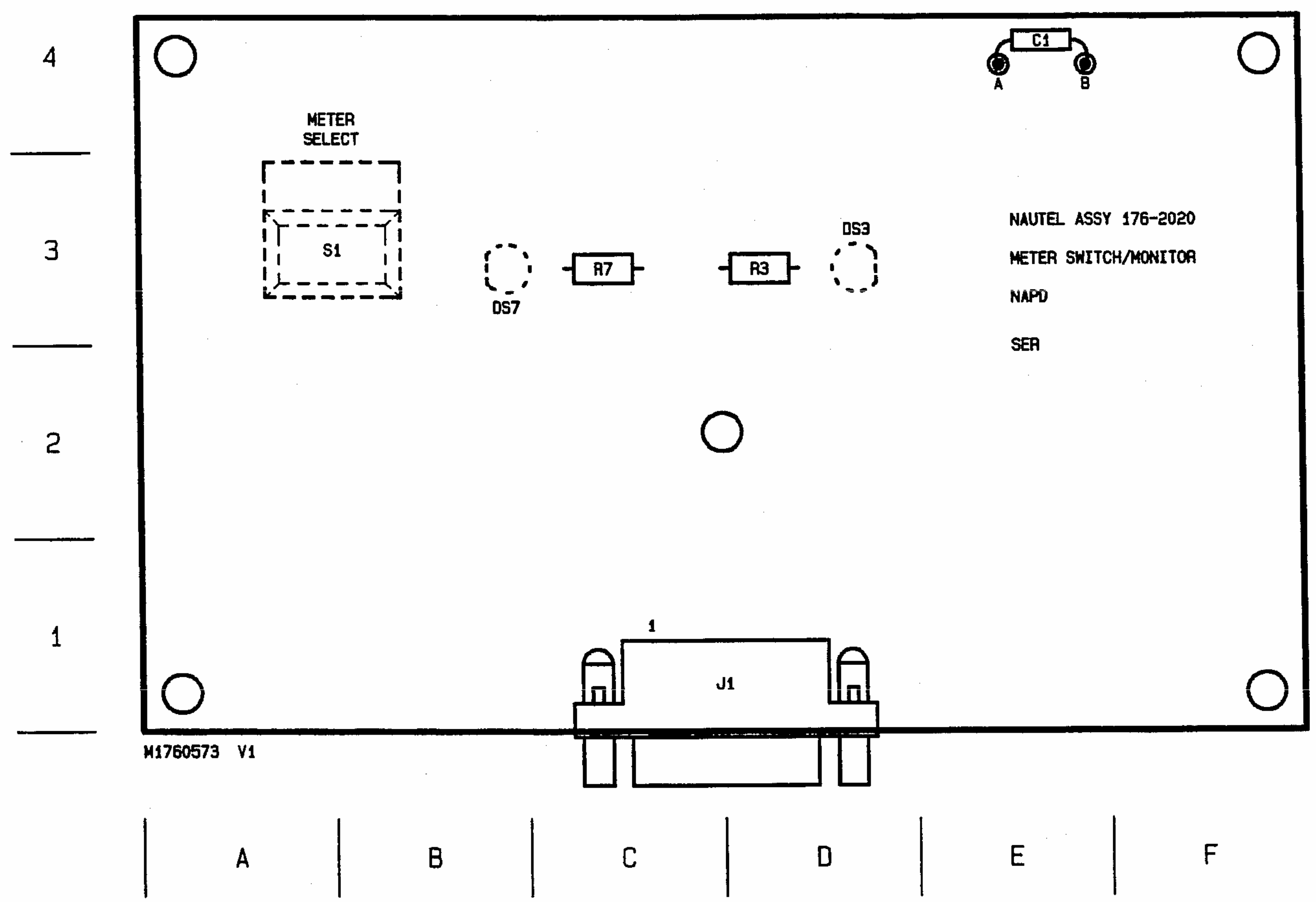
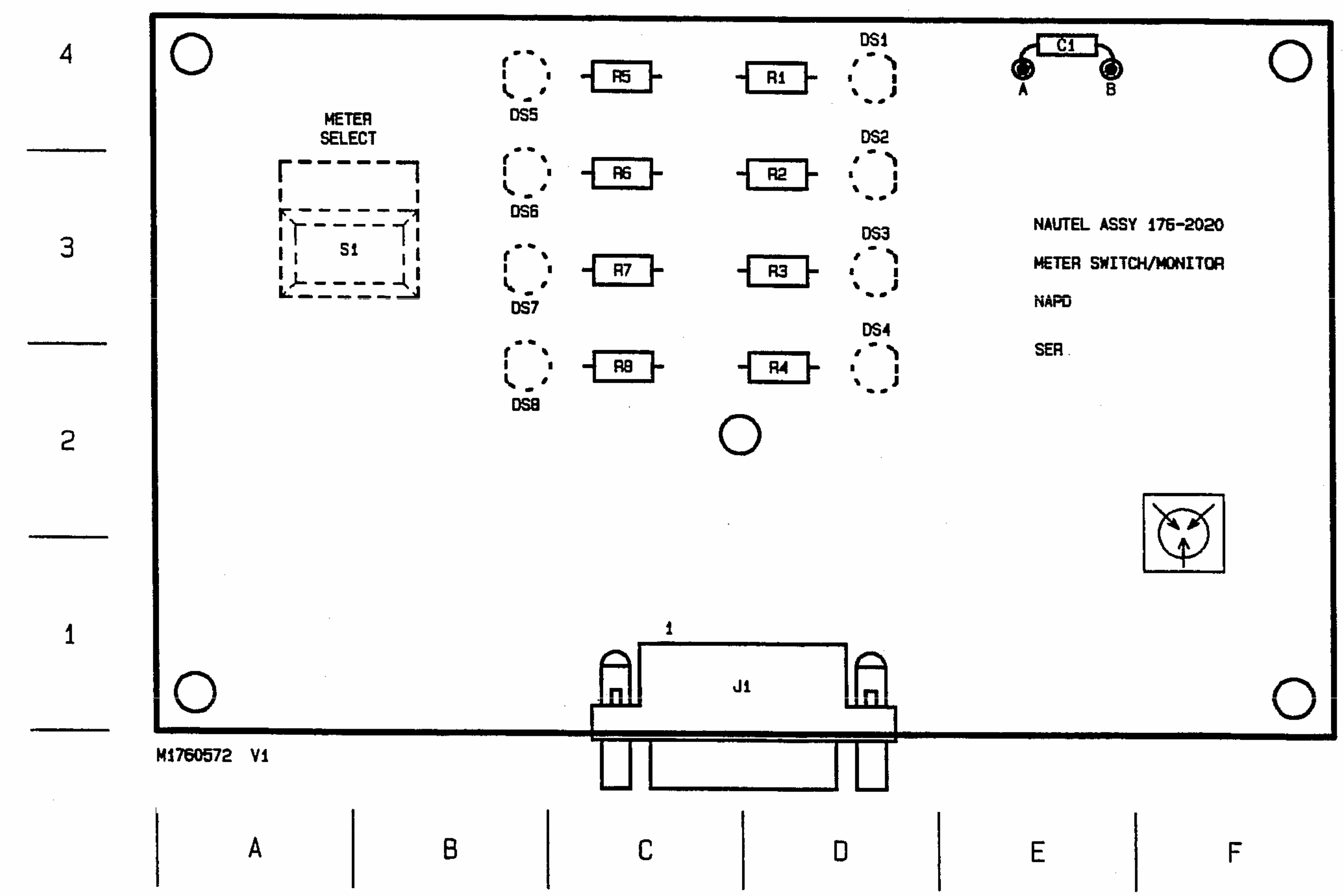


Figure MD-5 Assembly Detail - NAC100 Control/Monitor Panel



DS3, DS7 AND S1 ARE MOUNTED ON REVERSE SIDE

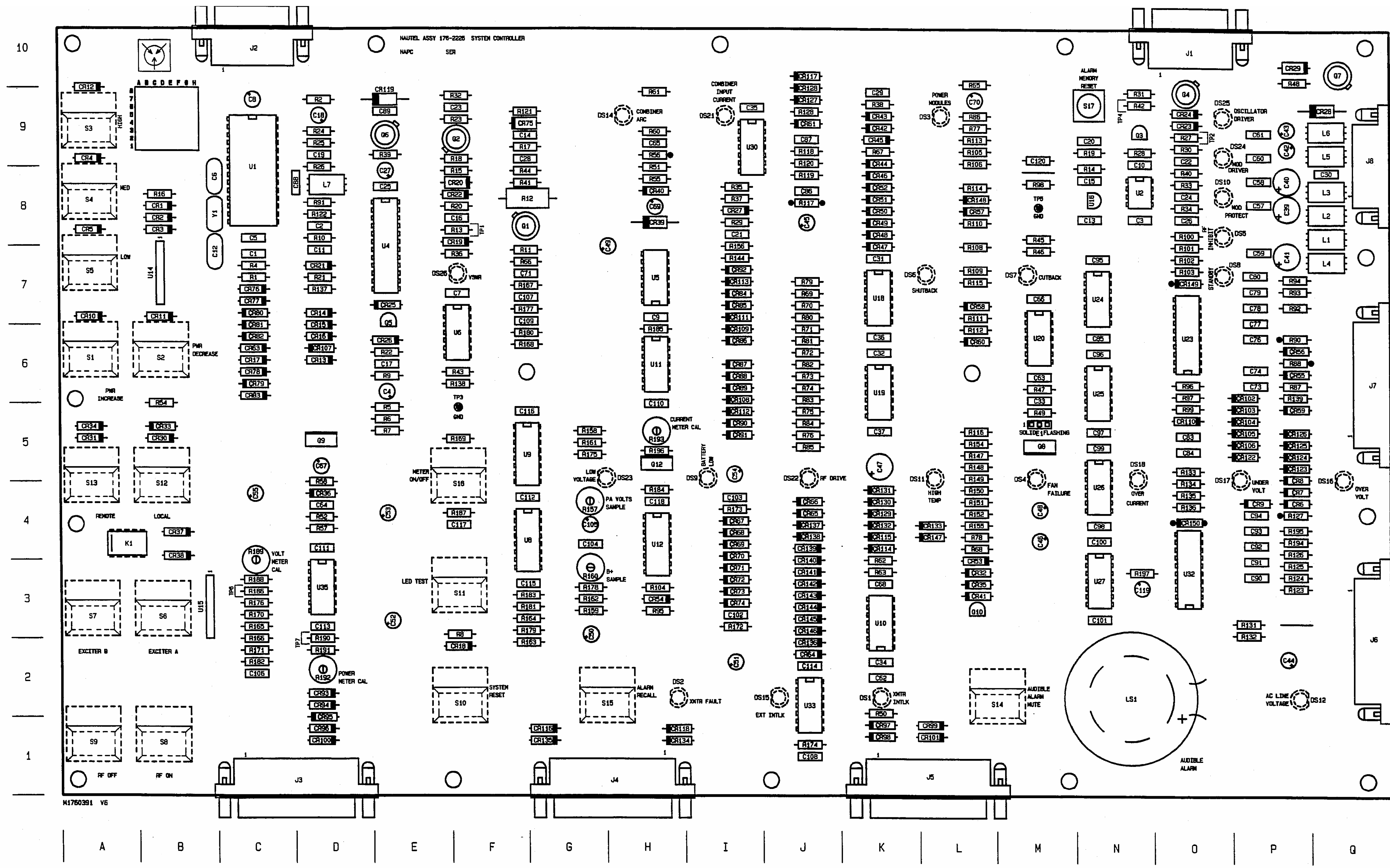
NAPD04A/02 - 2 INPUTS



DS1 THRU DS8 AND S1 ARE MOUNTED ON REVERSE SIDE

NAPD04A/01 - 8 INPUTS

Figure MD-6 Assembly Detail - NAPD04A Meter Switch/Monitor PWBs



C38, C56, C72, CR151, R3, R53, R59, R64, R107, R129, R198 MOUNTED ON REVERSE SIDE

Figure MD-7 Assembly Detail - NAPC110 System Controller PWB

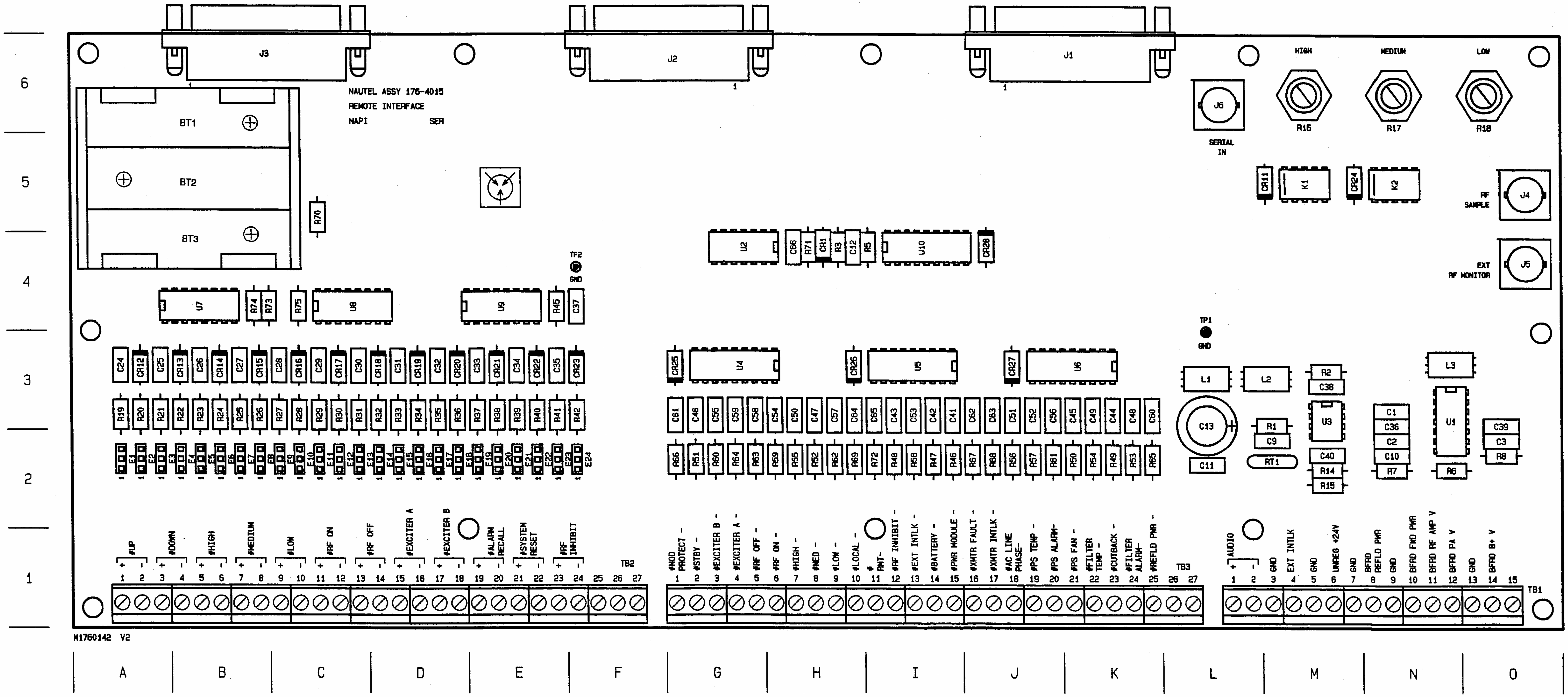


Figure MD-8 Assembly Detail – NAPI17 Remote Interface PWB

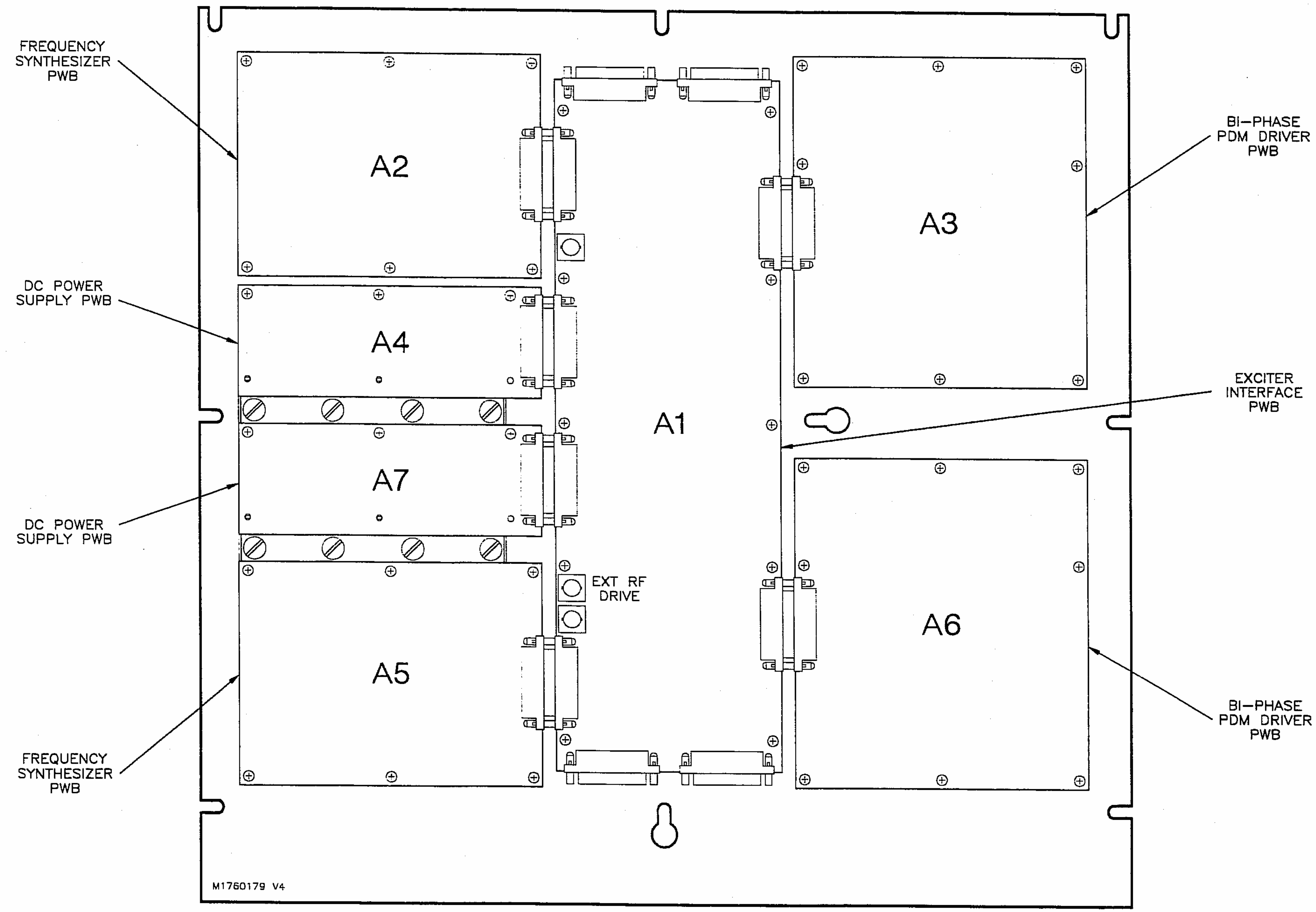


Figure MD-9 Assembly Detail – Exciter Panel (P/N 176-3100)

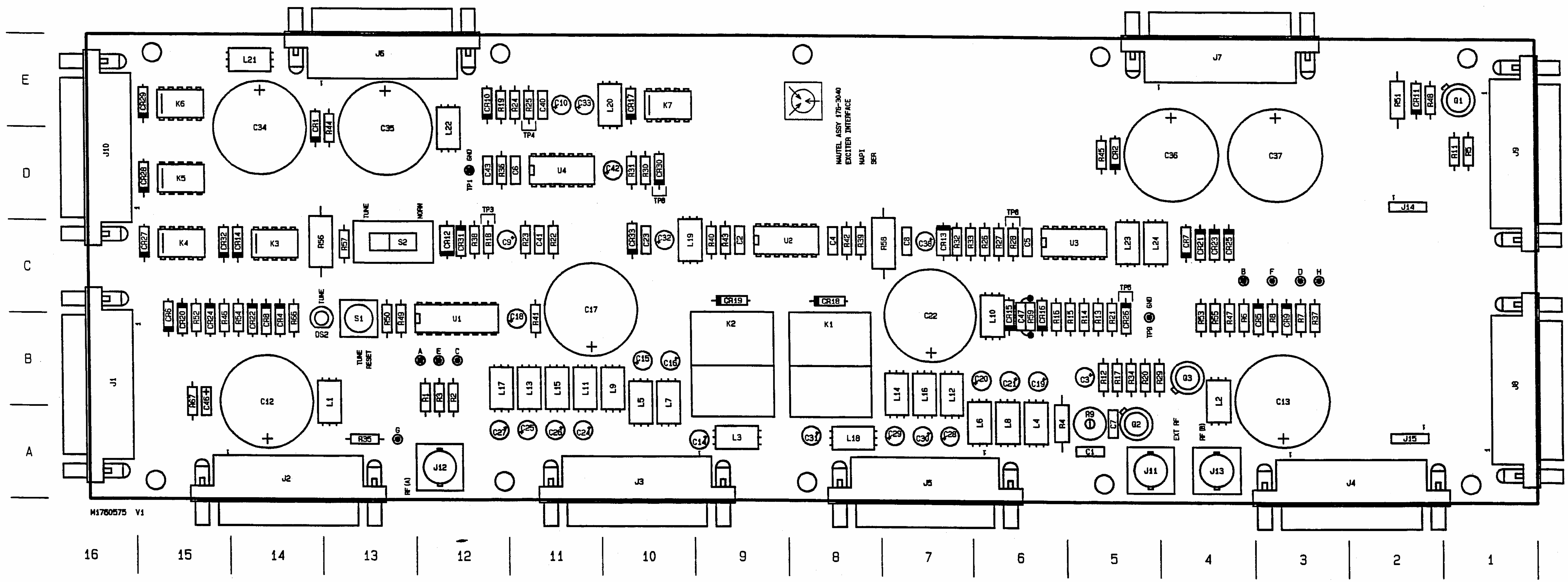


Figure MD-10 Assembly Detail – NAPI31A Exciter Interface PWB

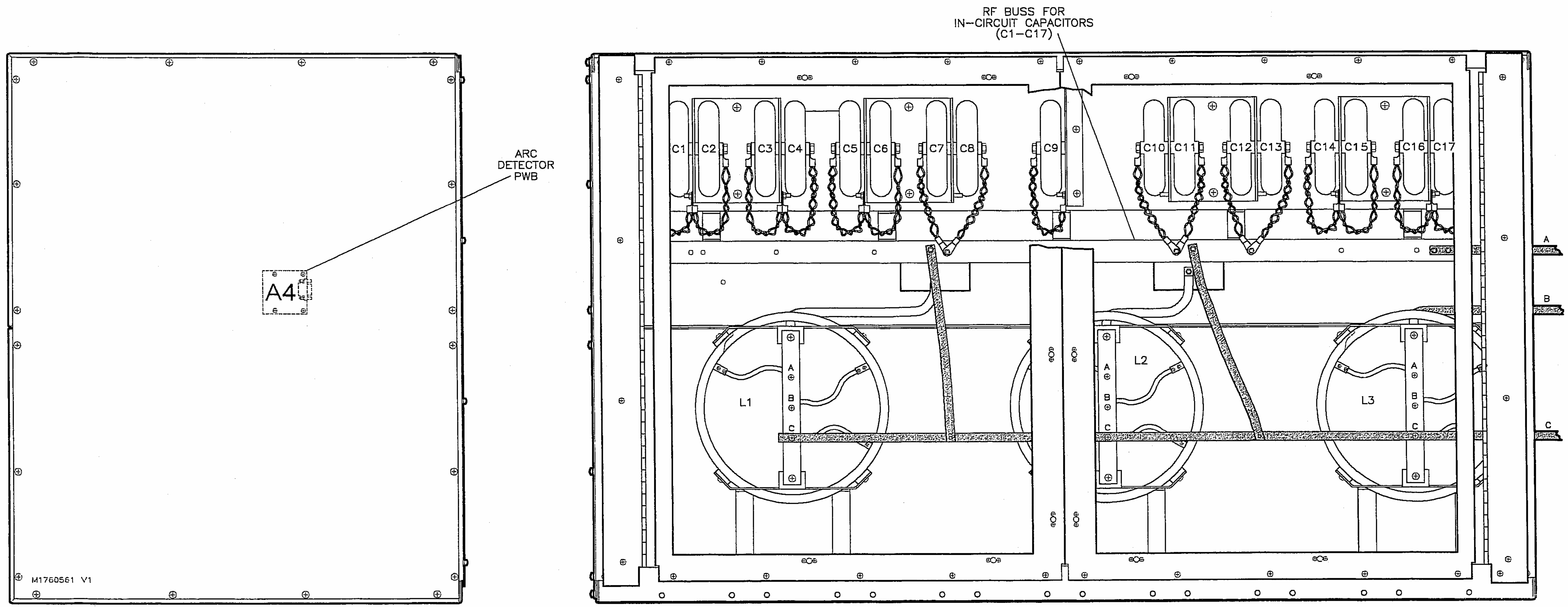


Figure MD-11 Assembly Detail – NAF103 100kW RF Combiner/Output Filter (Freq Agile) (Left Side)

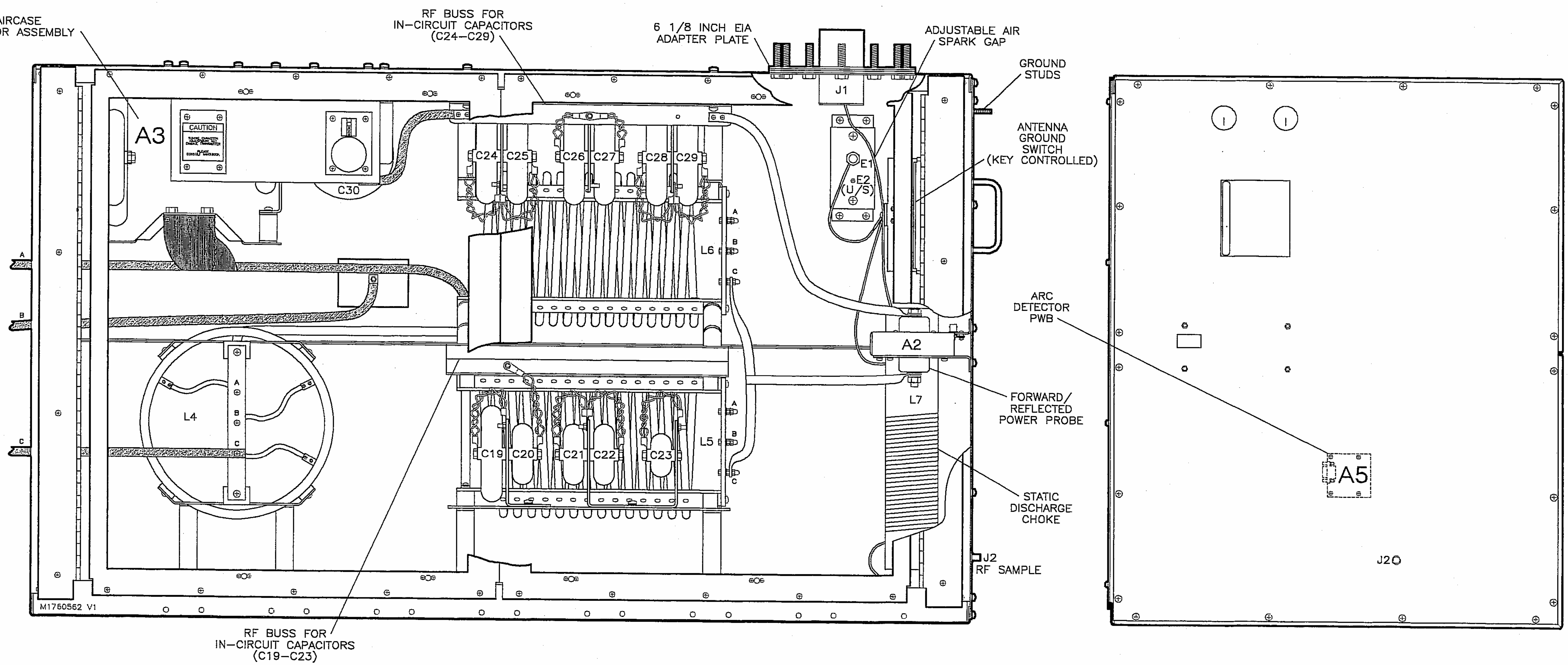


Figure MD-12 Assembly Detail - NAF103 100kW RF Combiner/Output Filter (Freq Agile)(Right Side)

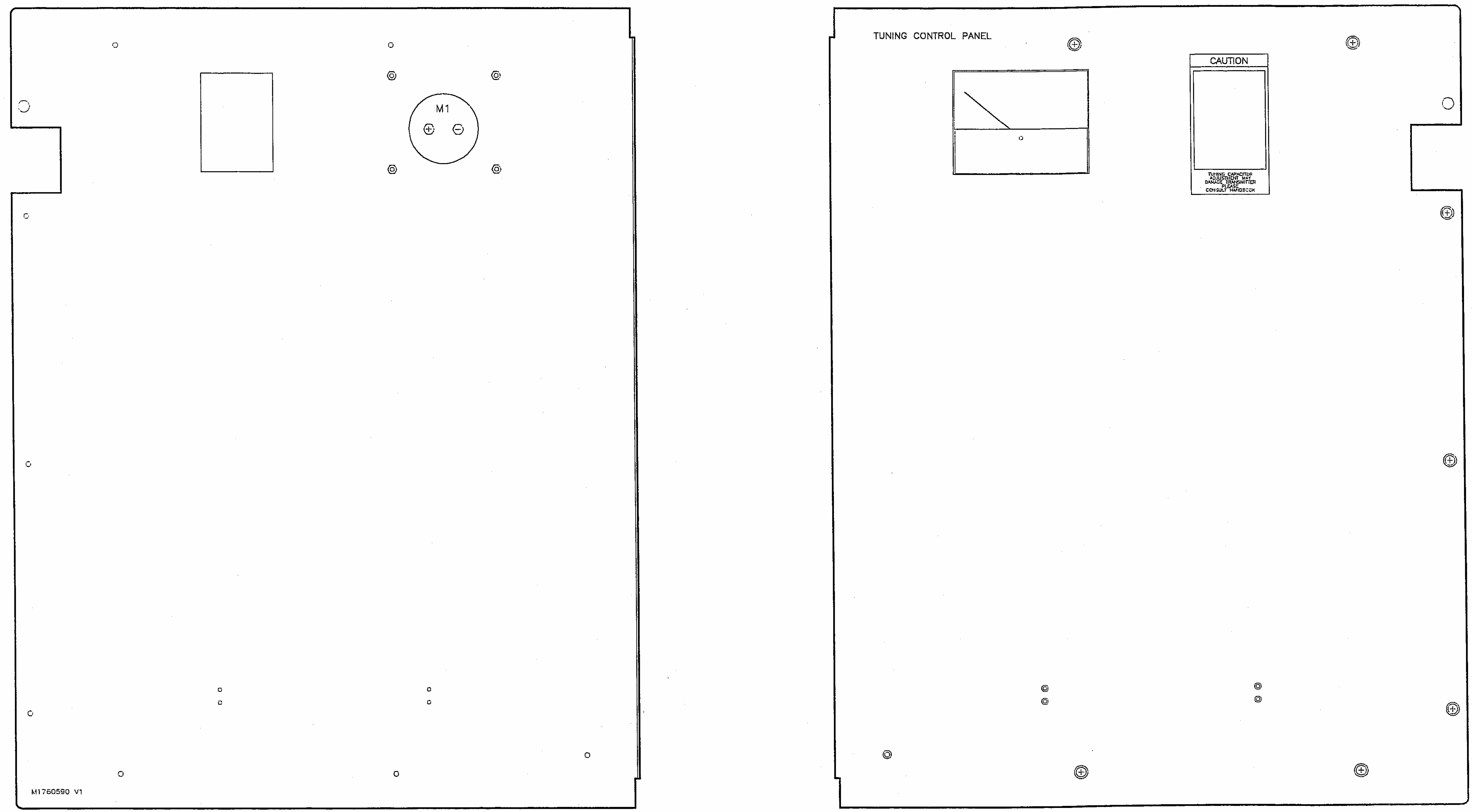
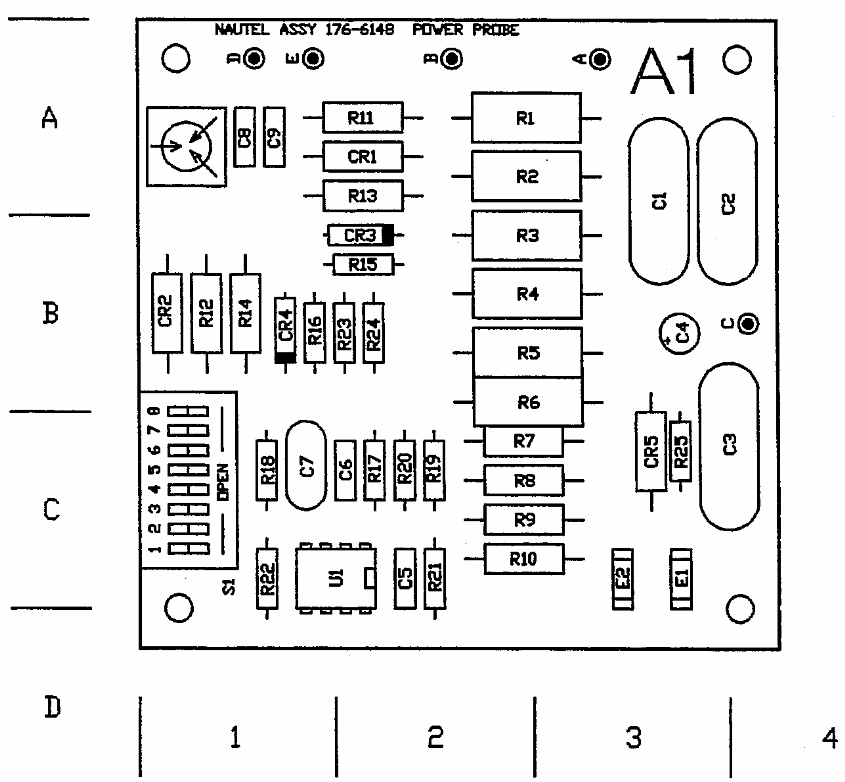


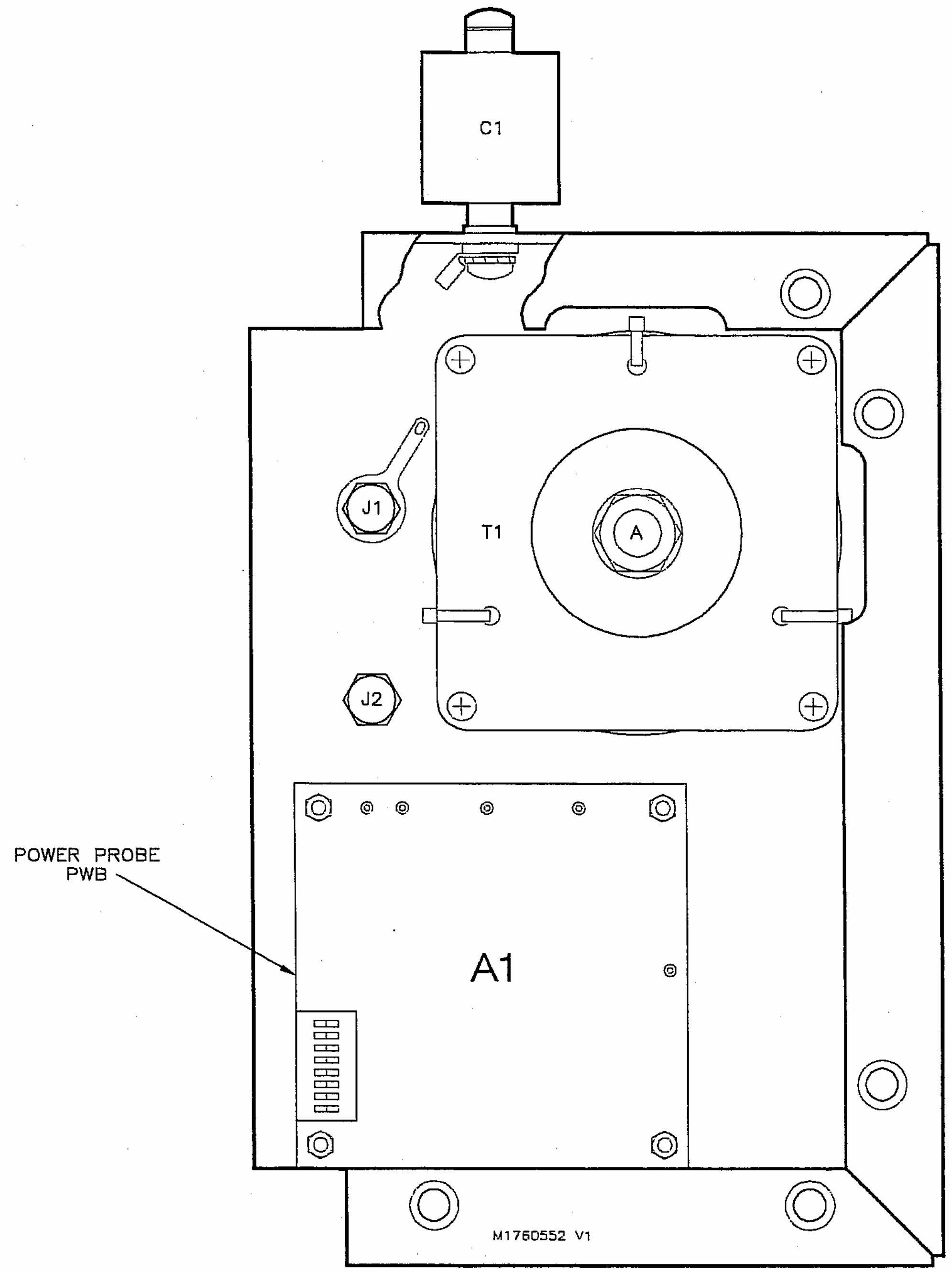
Figure MD-13 Assembly Detail - Tuning Control Panel (P/N 176-6120-03)

WIRING INFORMATION

SOURCE	DESTINATION
J1–CENTER	A1–D
J2–CENTER	A1–E
C1 (UPPER SIDE)	A1–C
T1–1	A1–A
T1–2	A1–C
T1–3	A1–C
T1–4	A1–B

NOTE: E1 & E2 MOUNTED ON REVERSE SIDE





COVER REMOVED

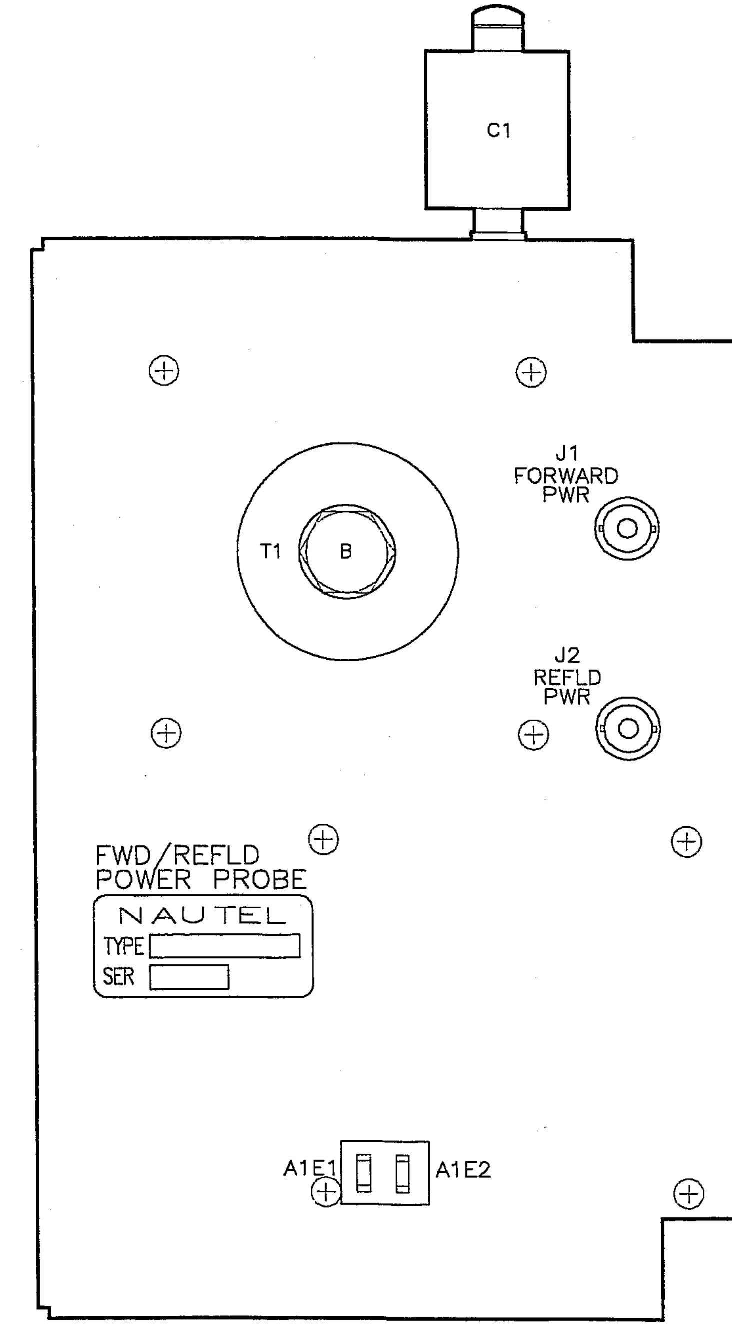


Figure MD-14 Assembly Detail - NAFP85/01B Forward/Reflected Power Probe

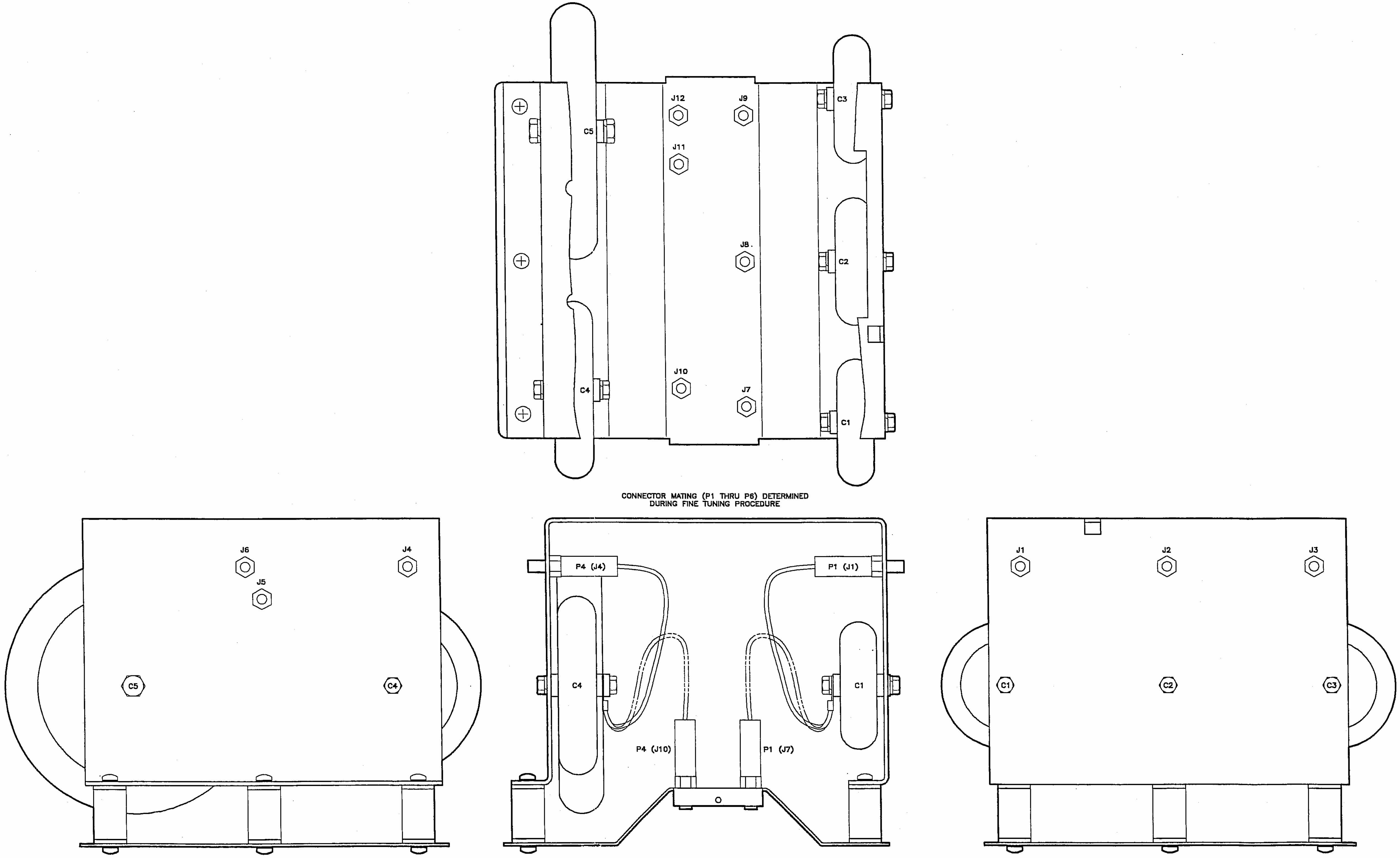


Figure MD-15 Assembly Detail – Staircase Capacitor Assembly (176-6199)

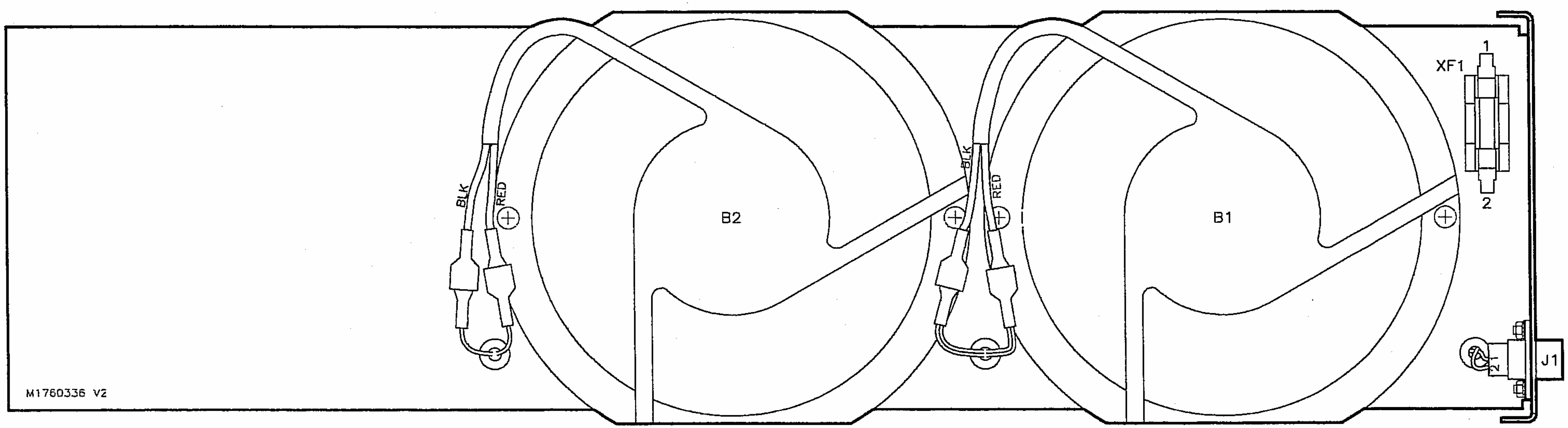
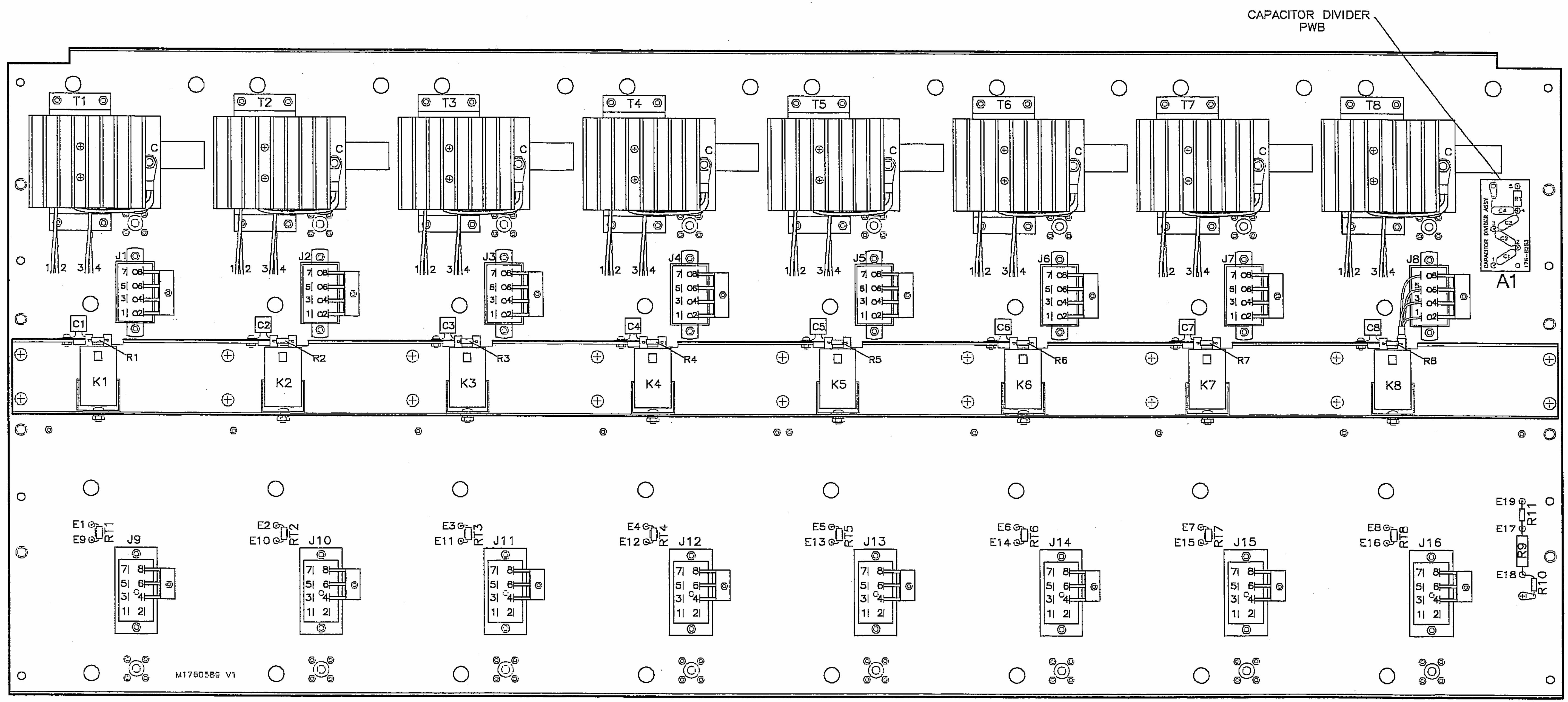
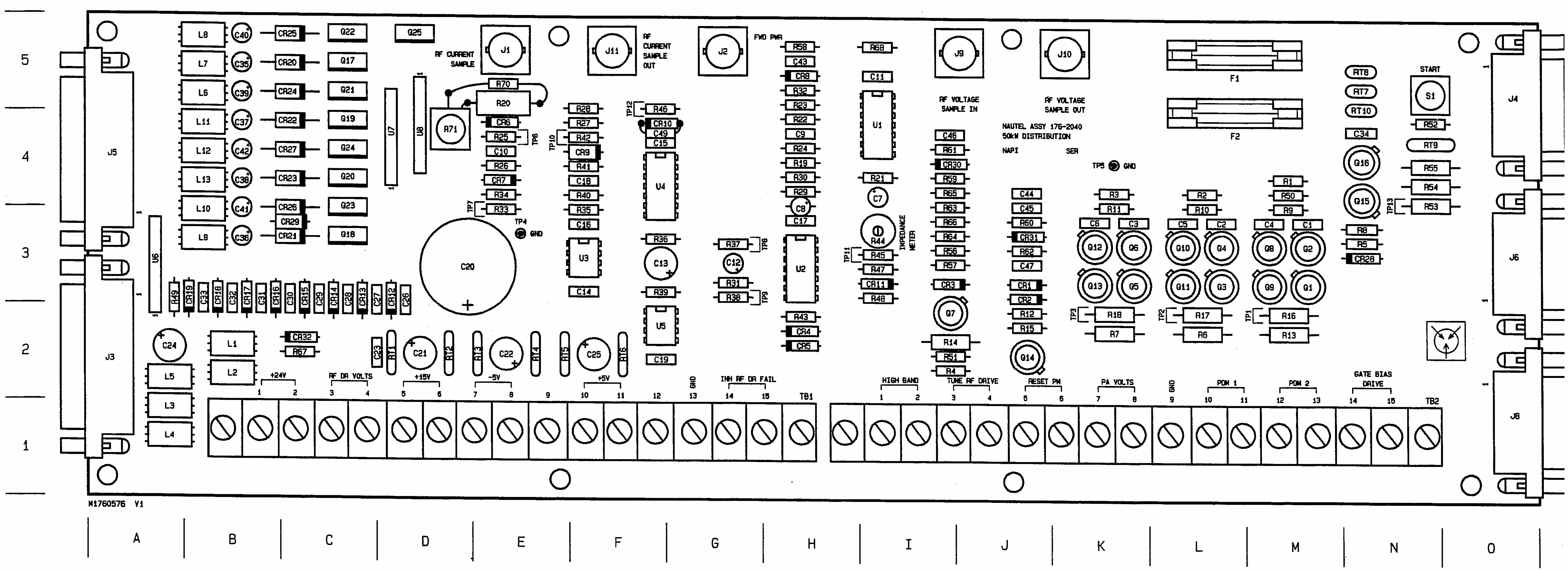


Figure MD-16 Assembly Detail - NAX168 Fan Tray



NOTE:
CAPACITOR DIVIDER A1, E1 THRU E19, R9, R10, R11, RT1 THRU RT8 AND SOLDER TAB FOR R10, ARE NOT USED ON 176-8250-05

Figure MD-17 Assembly Detail - Back Plate Assemblies (P/N 176-8250-05 and 176-8250-07)

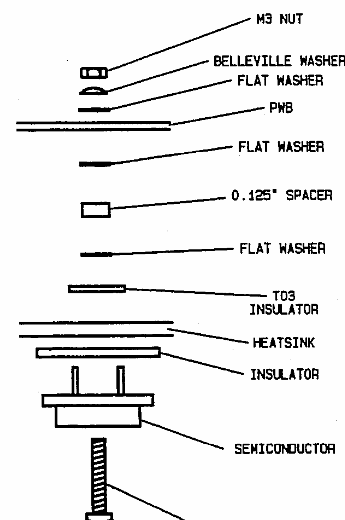


R69 & C48 LOCATED ON REVERSE SIDE

Figure MD-18 Assembly Detail - NAPI33B 50kW Distribution PWB (Primary)

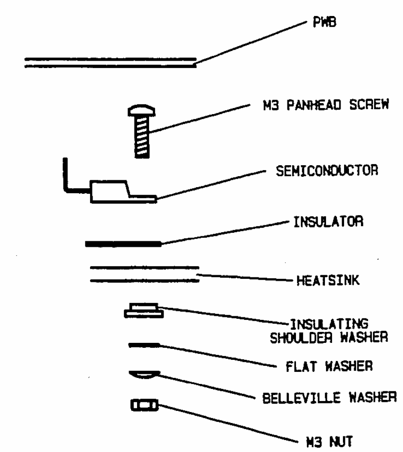
T1 WIRE DATA

T1 LEAD	DESTINATION
GREEN	1
ORANGE	1
BROWN	1
GREEN/BLACK	2
ORANGE/BLACK	2
BROWN/BLACK	2
RED	3
RED/BLACK	4
YELLOW	5
YELLOW/BLACK	6



Q7 MOUNTING DETAIL

TORQUE ATTACHED HARDWARE TO
4 in/lbs (0.45 NEWTON METRES)



Q3/Q4 MOUNTING DETAIL

TORQUE ATTACHED HARDWARE TO
4 in/lbs (0.45 NEWTON METRES)

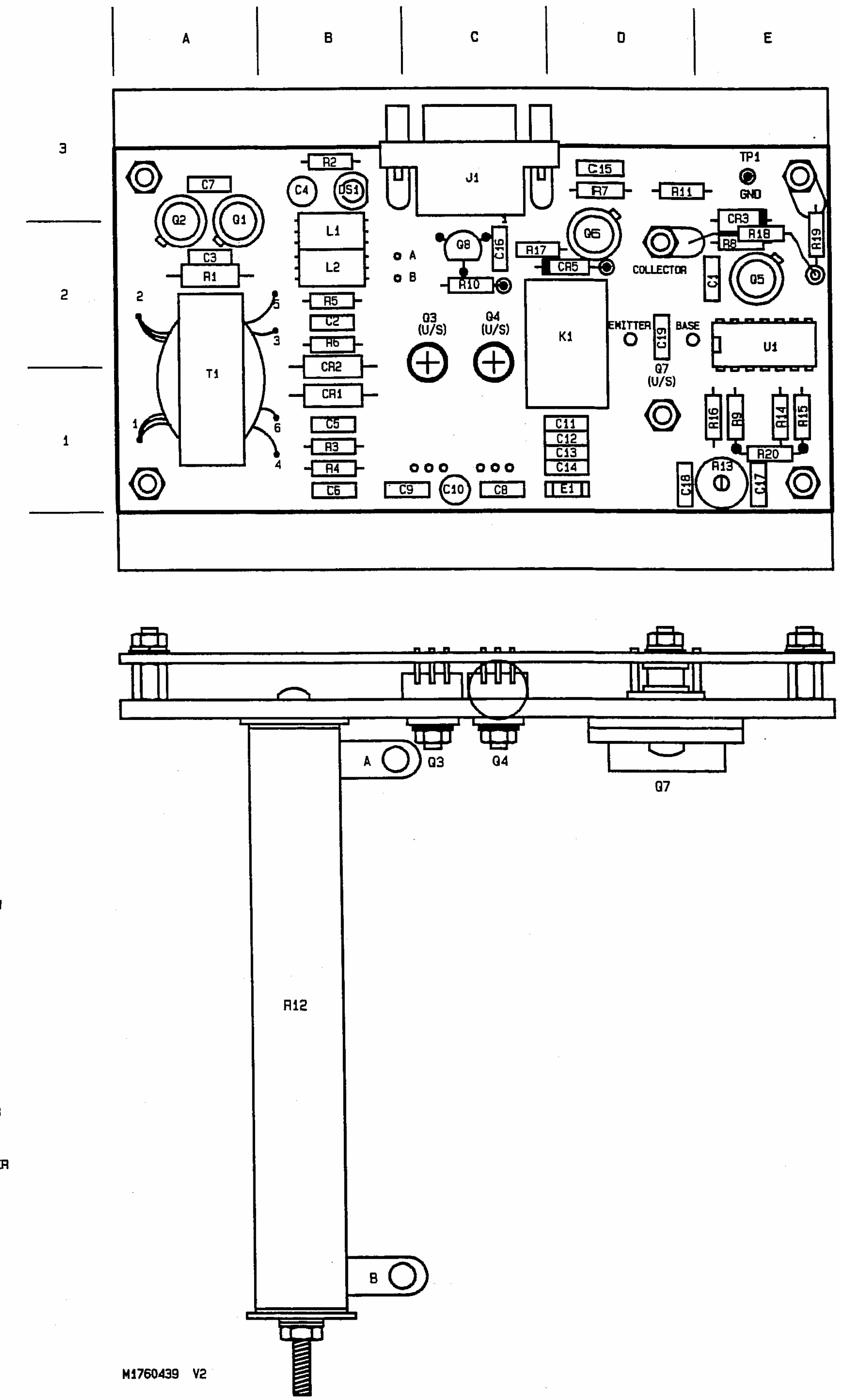


Figure MD-19 Assembly Detail – NAPA08E/01 RF Drive Buffer PWB

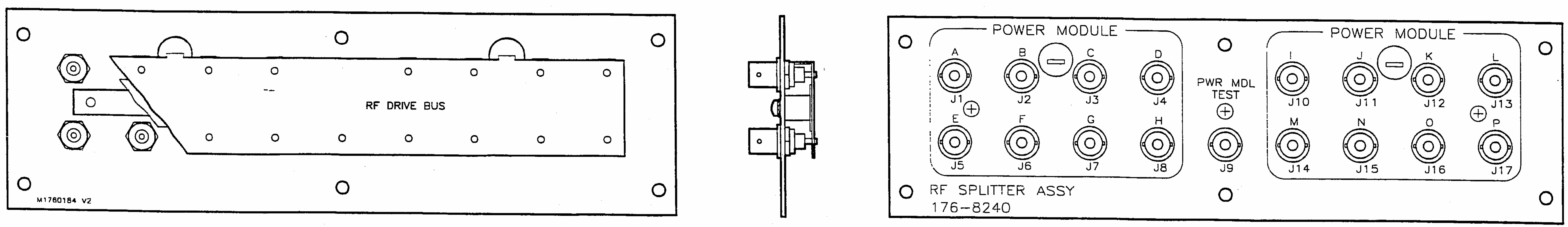
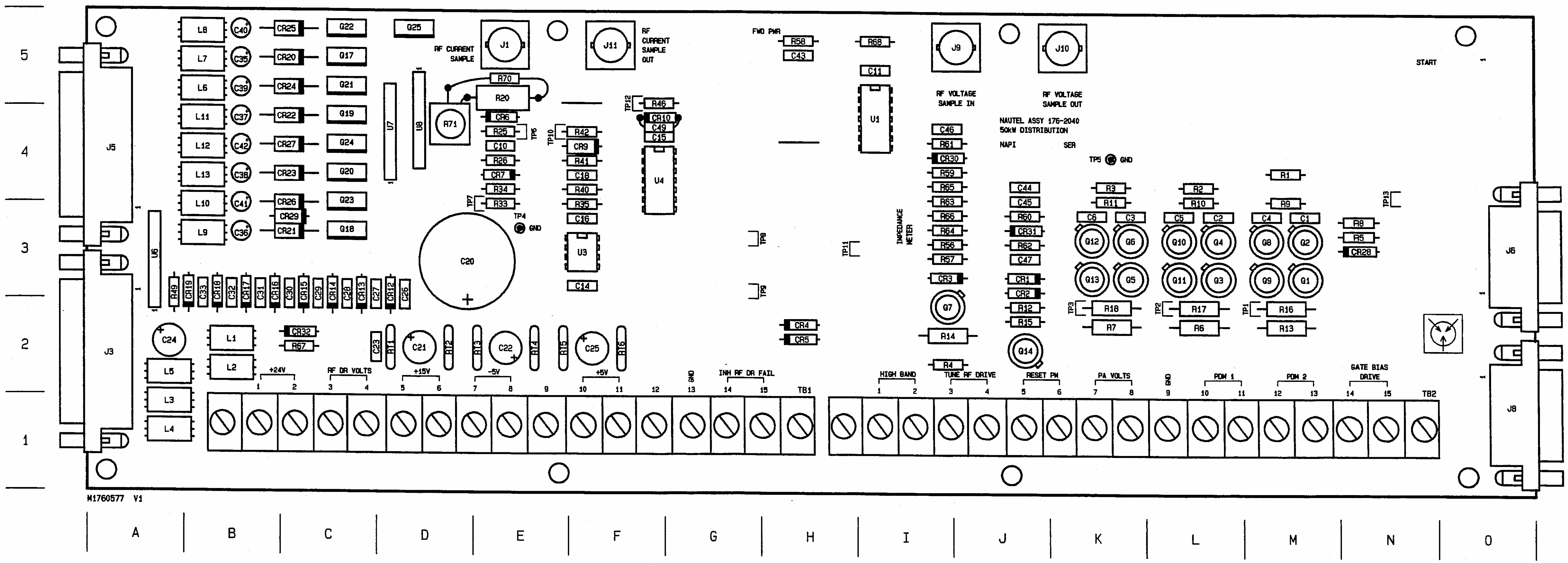


Figure MD-20 Assembly Detail - RF Drive Splitter (P/N 176-8240)



C48 LOCATED ON REVERSE SIDE

Figure MD-21 Assembly Detail - NAPI34B 50kW Distribution PWB (Secondary)

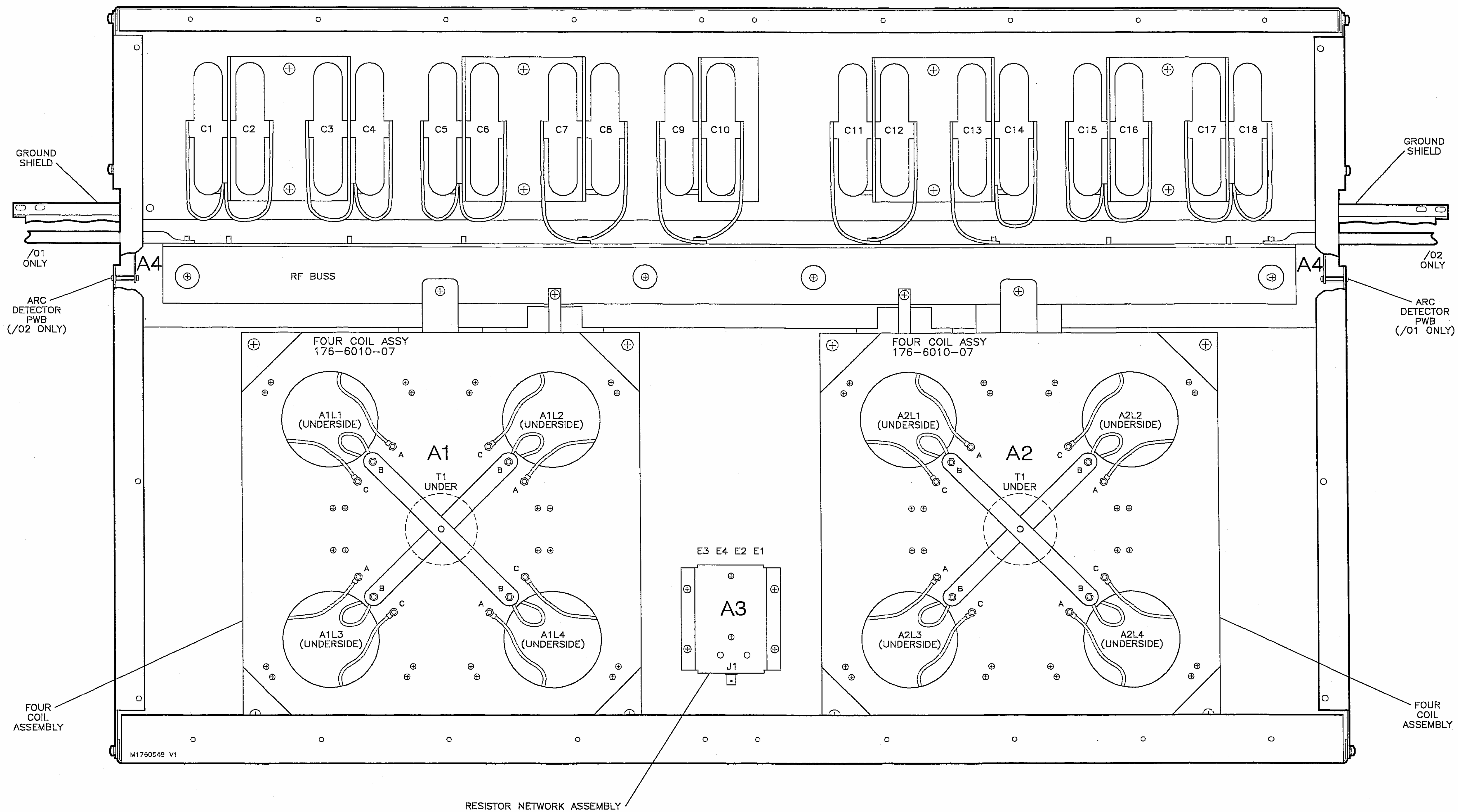
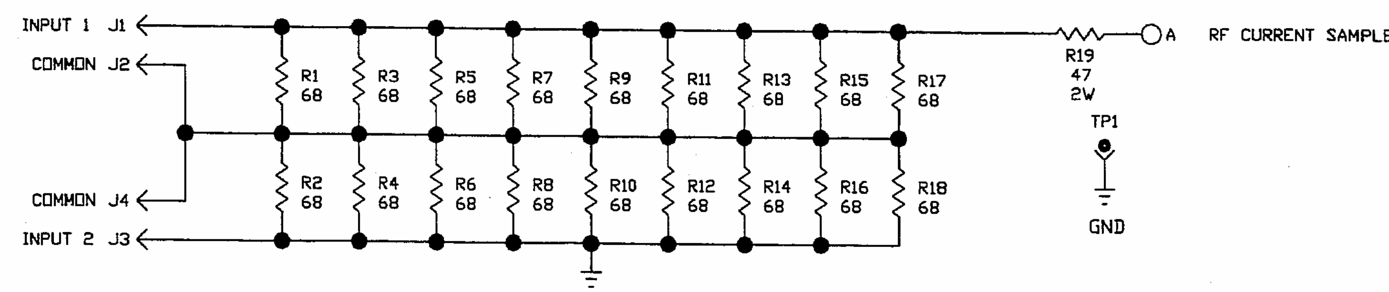
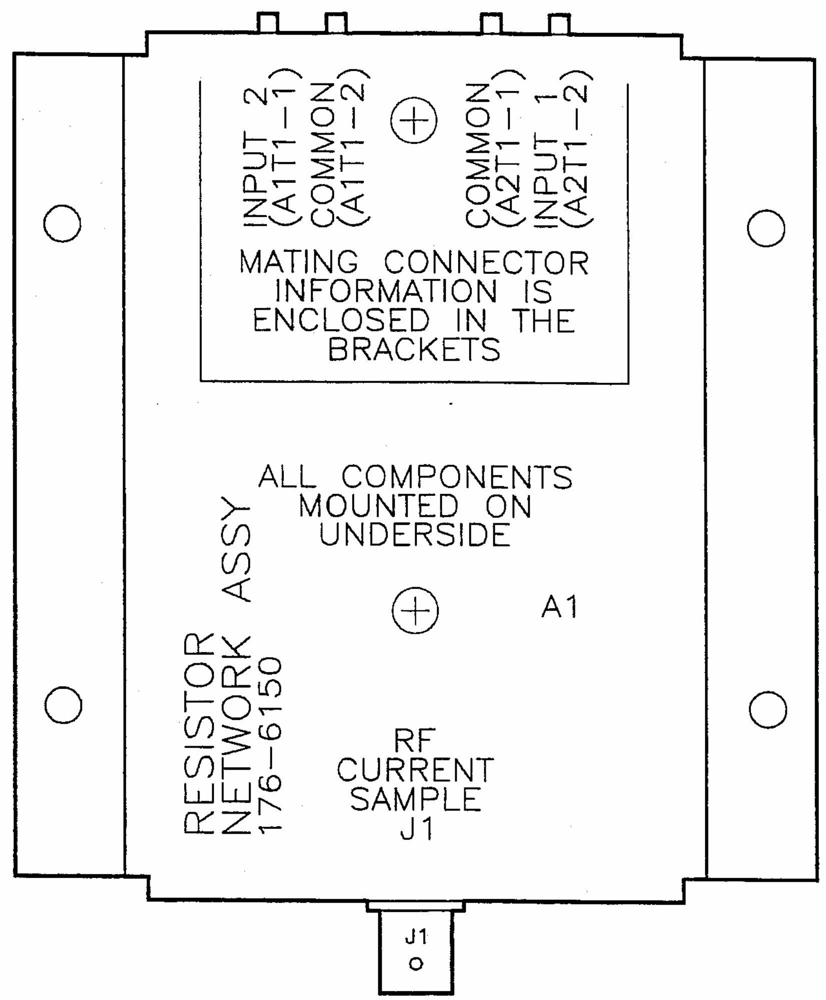


Figure MD-22 Assembly Detail - NAF82E 8-Input RF Combiner, Freq Agile (RH & LH)





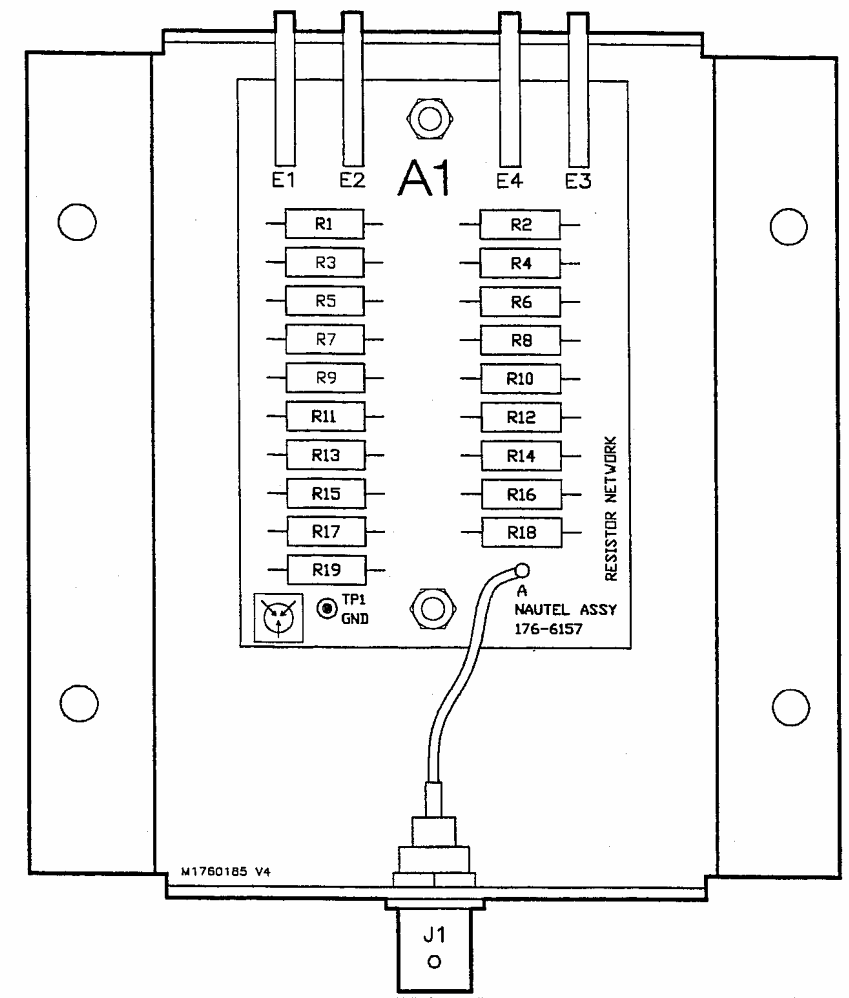


Figure MD-23 Assembly Detail - Resistor Network Assembly (P/N 176-6150)

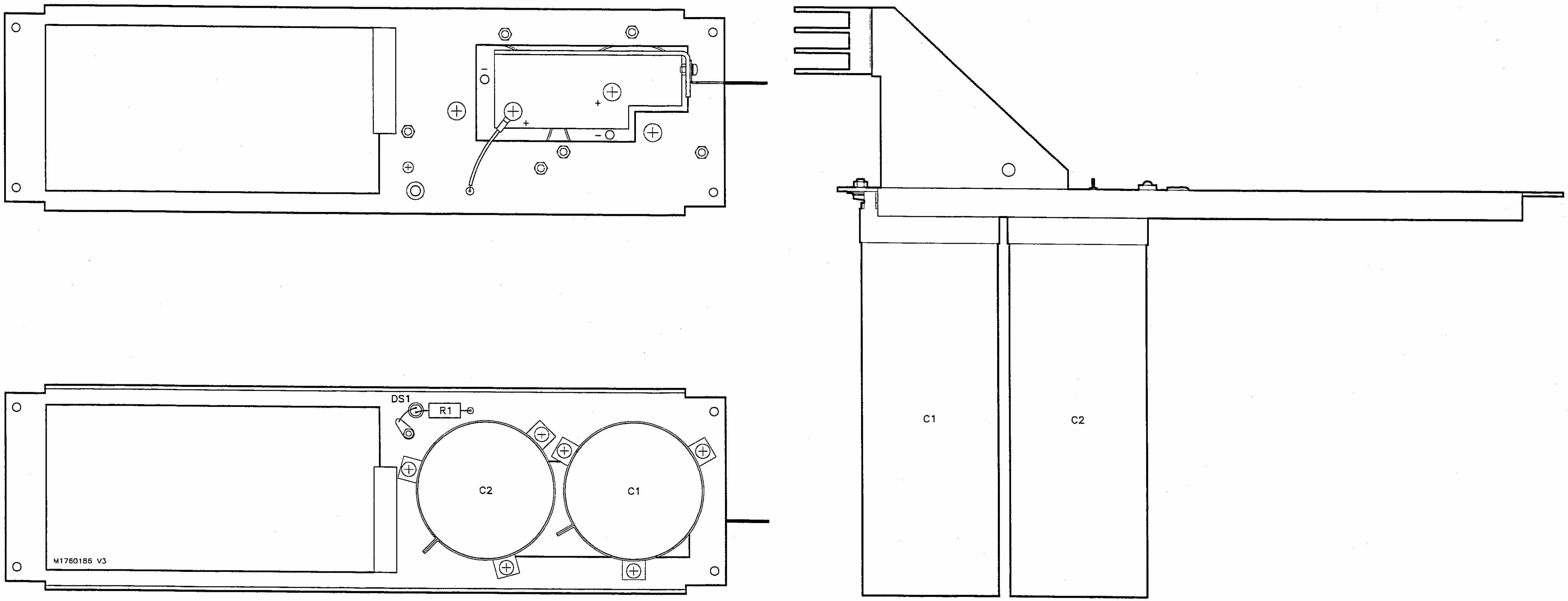


Figure MD-24 Assembly Detail - Capacitor Tray (P/N 176-8220)

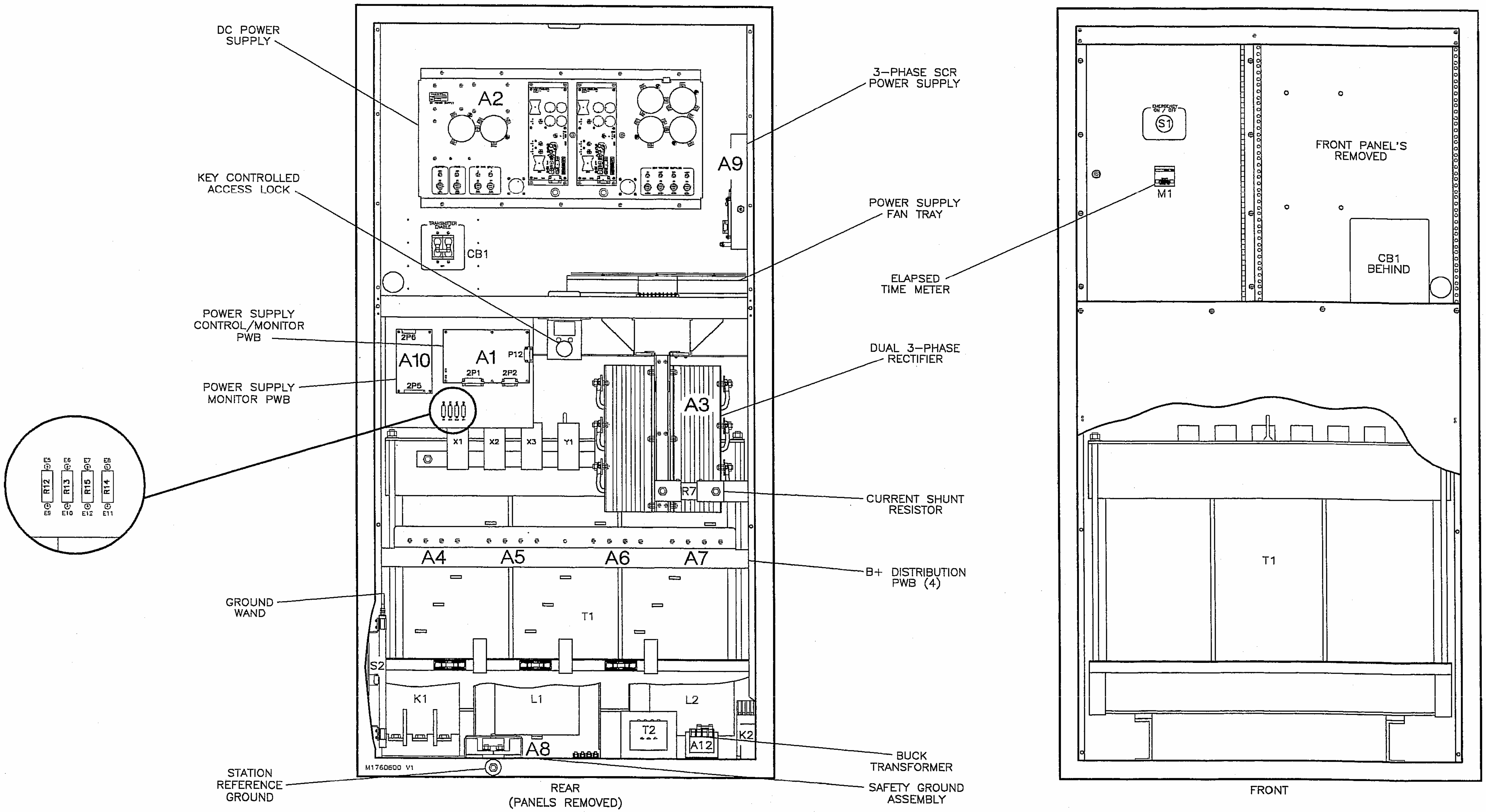
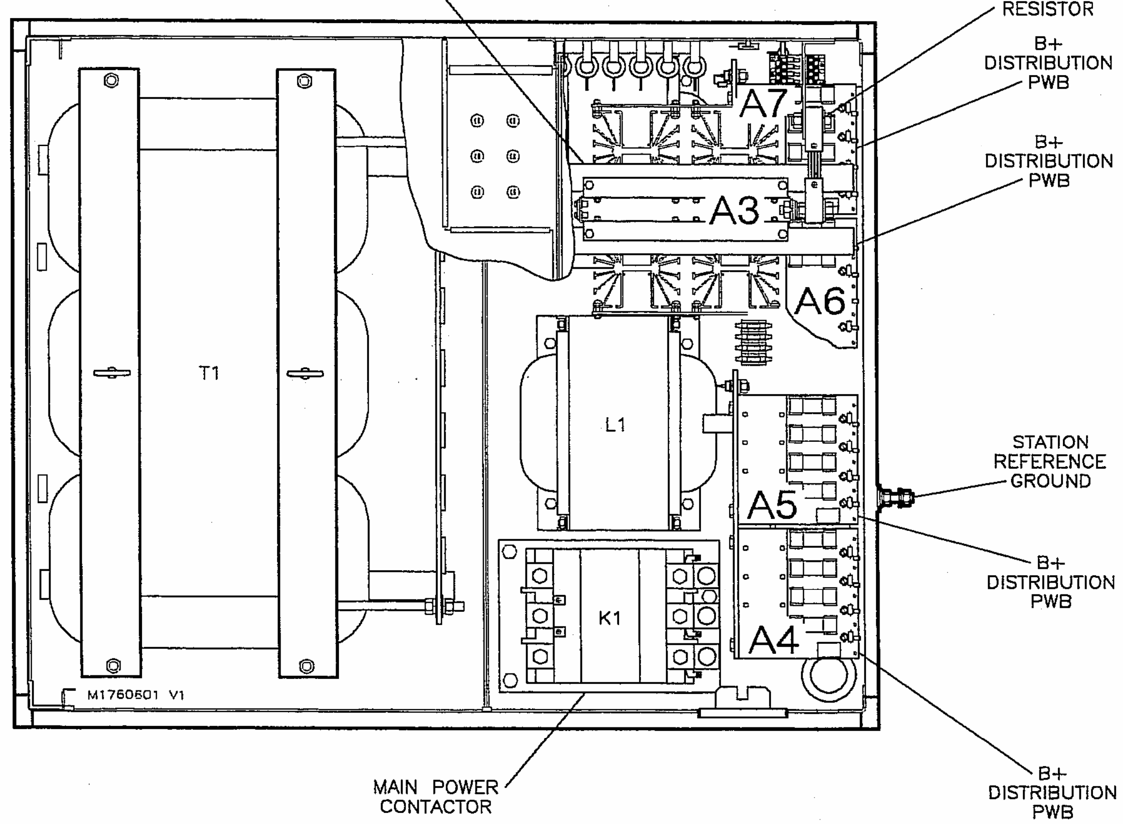


Figure MD-25 Assembly Detail - NAR222B AC/DC Power Supply Cabinet (Front/Rear)

NOTE: RF COMBINER/OUTPUT FILTER IS SHOWN FOR REFERENCE ONLY. IT IS PART OF THE RF POWER MODULE CABINET.

SECTION A–A



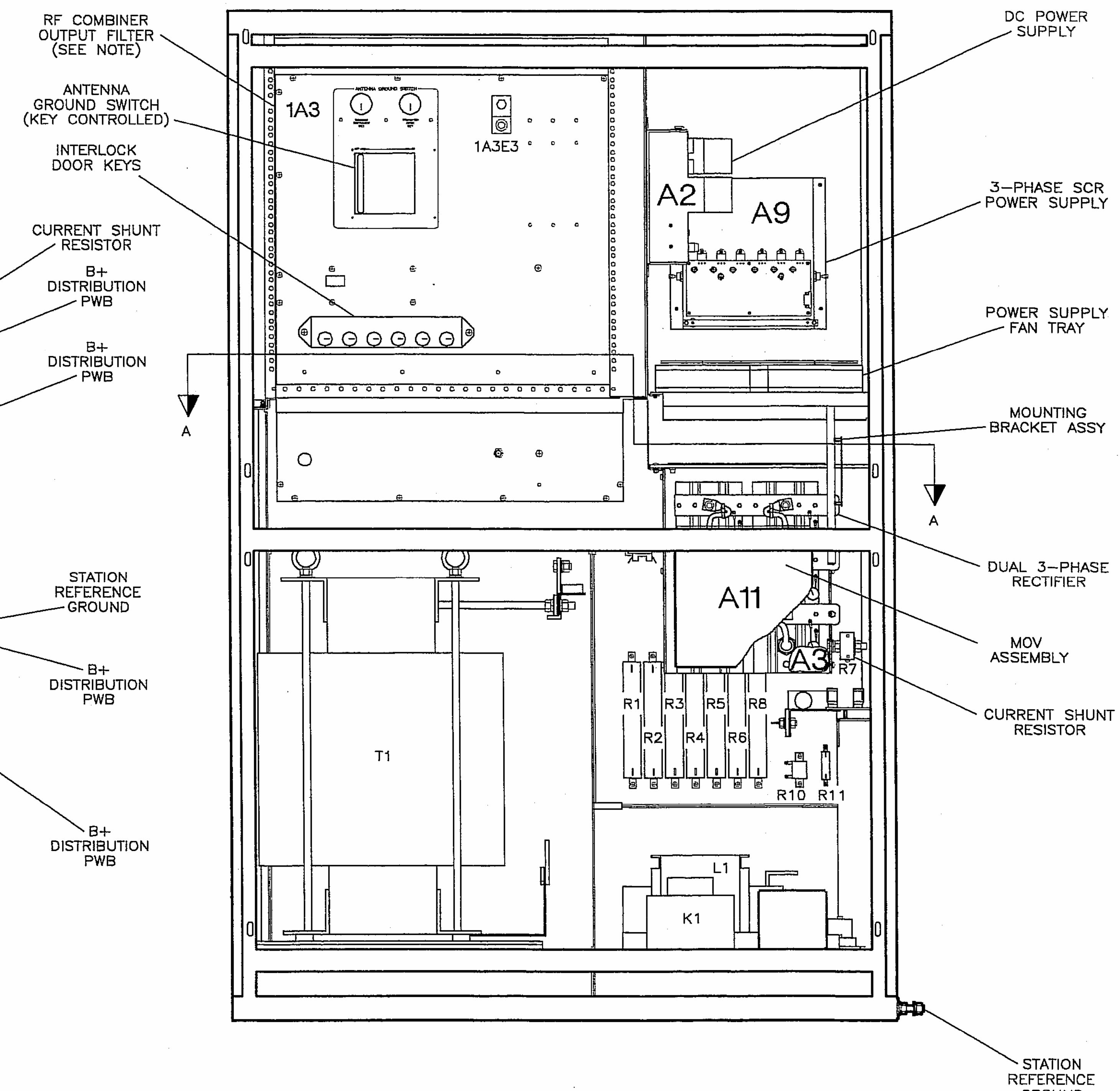
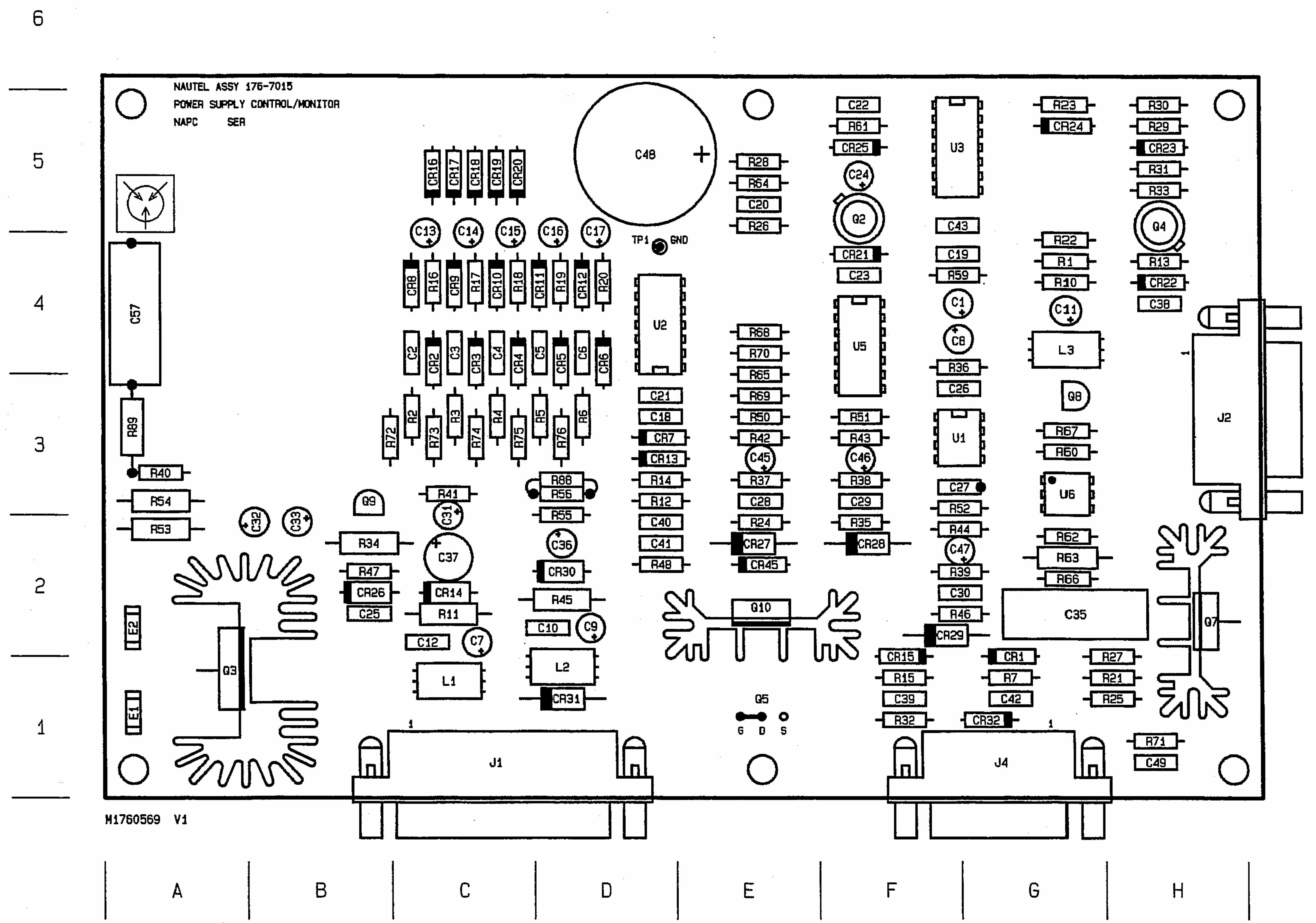


Figure MD-26 Assembly Detail - NAR222B AC/DC Power Supply Cabinet (Side/Cross Section)



C58 & C59 LOCATED ON REVERSE SIDE

Figure MD-27 Assembly Detail - NAPC92D/04 Power Supply Control/Monitor PWB

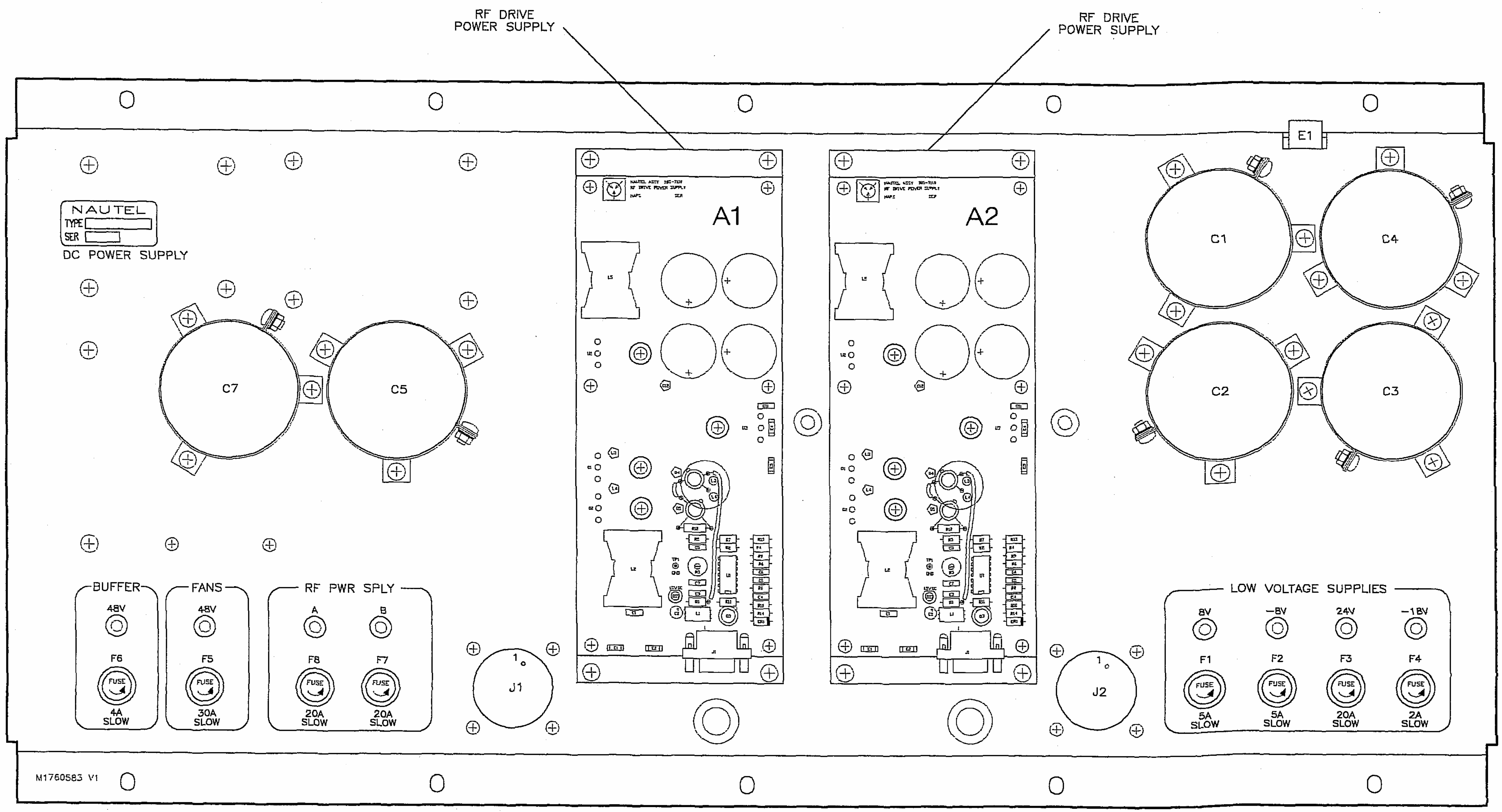


Figure MD-28 Assembly Detail - NASR106 Dc Power Supply (Top)

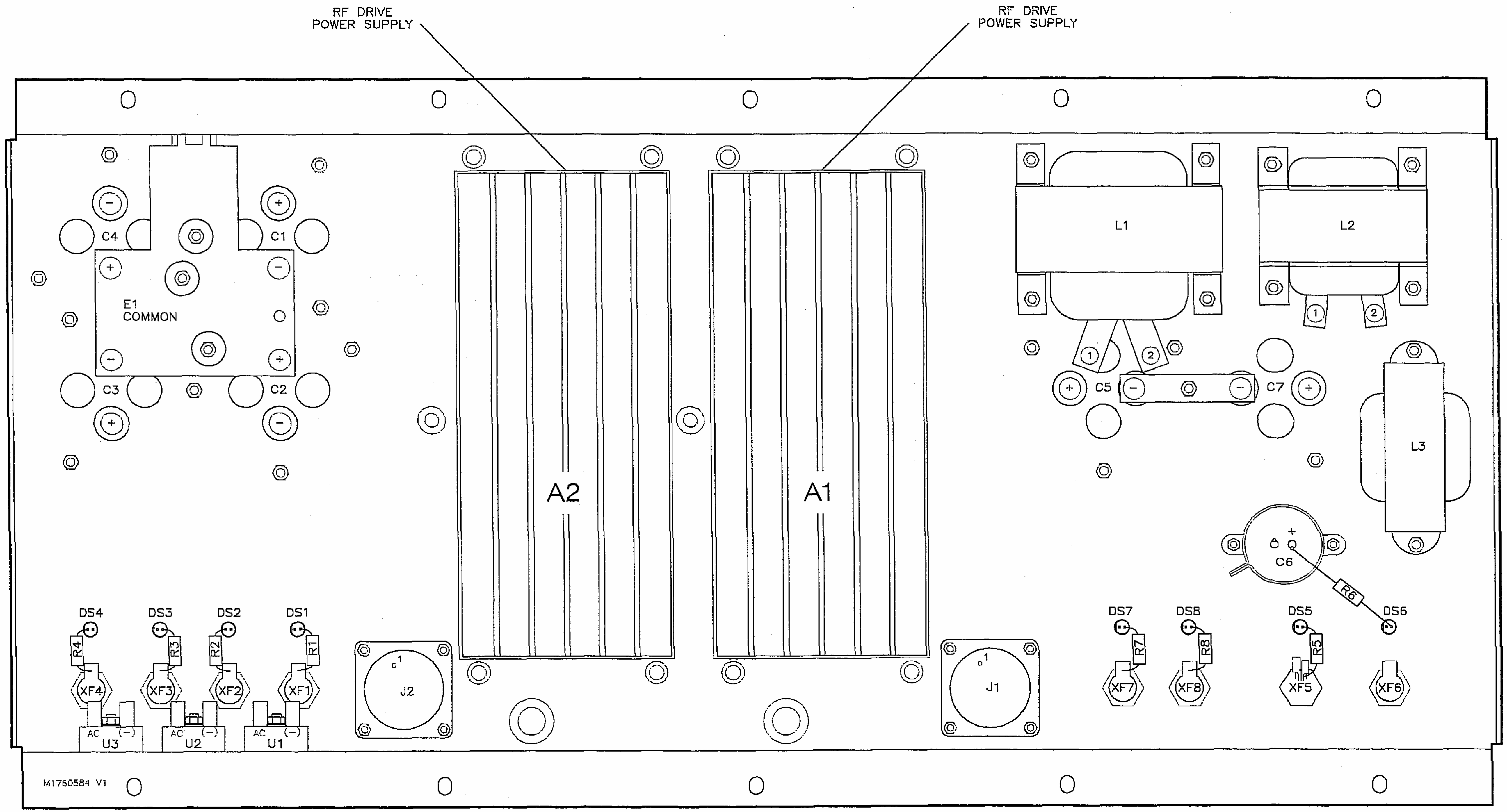


Figure MD-29 Assembly Detail - NASR106 DC Power Supply (Bottom)

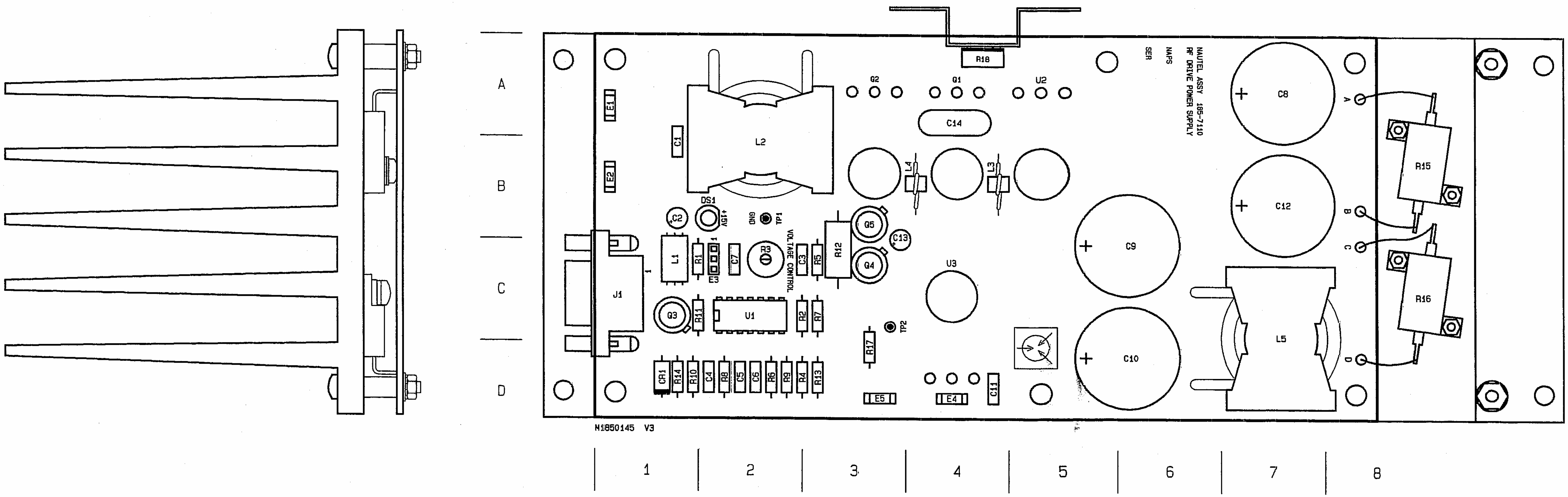


Figure MD-30 Assembly Detail - NAPS11A RF Drive DC Power Supply

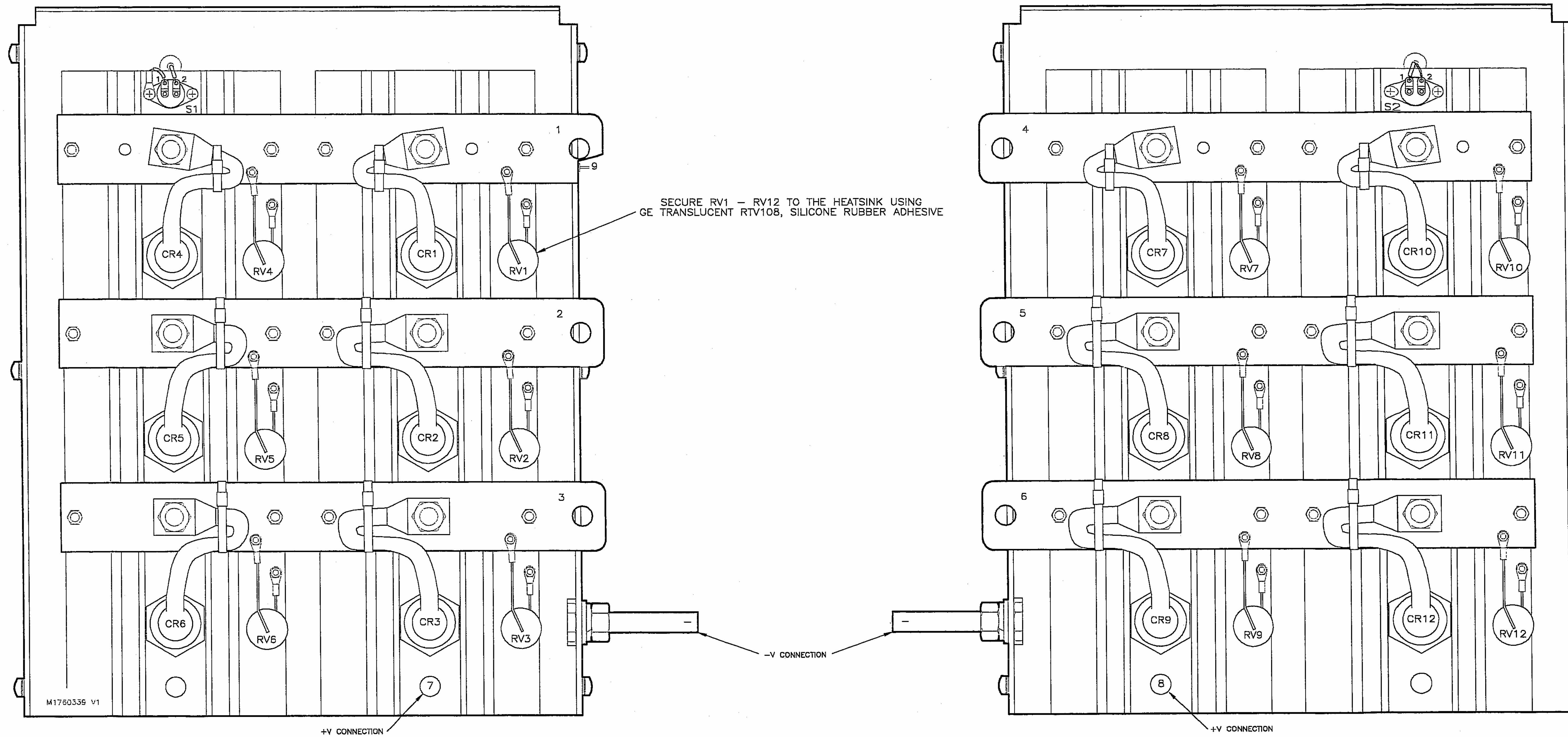


Figure MD-31 Assembly Detail - NASR95A Dual 3-Phase Rectifier

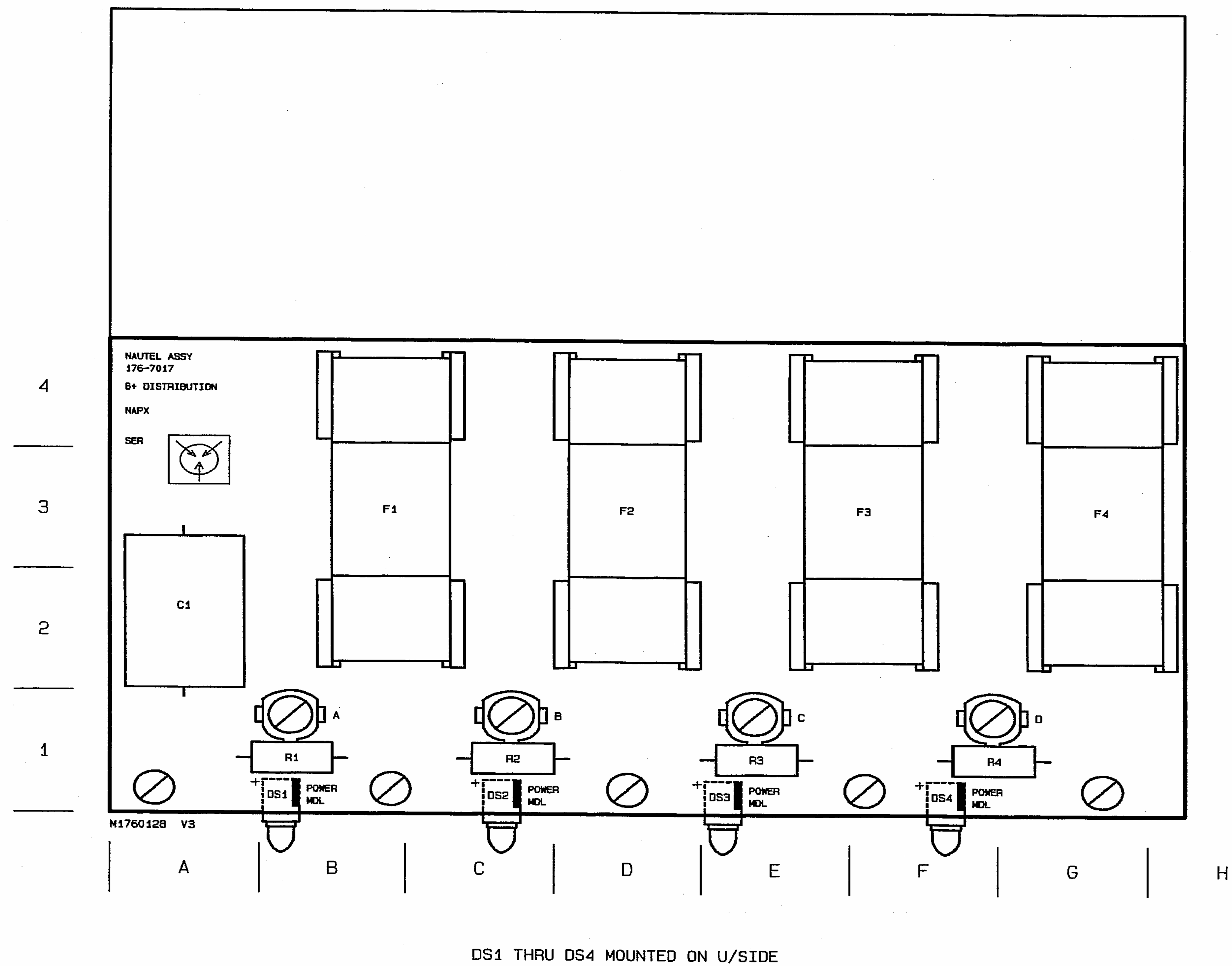


Figure MD-32 Assembly Detail - NAPX04 B+ Distribution PWB

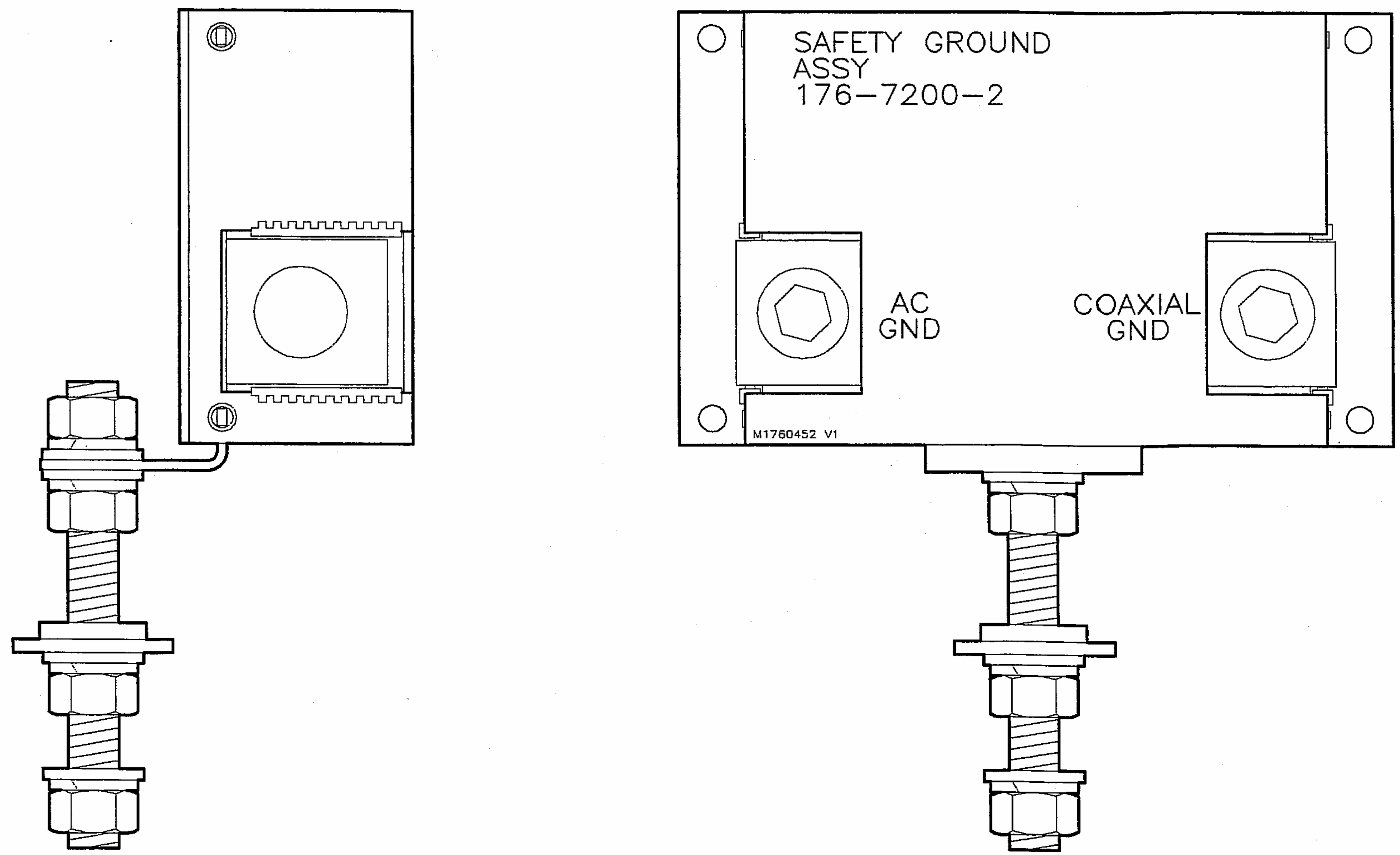


Figure MD-33 Assembly Detail - Safety Ground Assembly (P/N 176-7200-02)

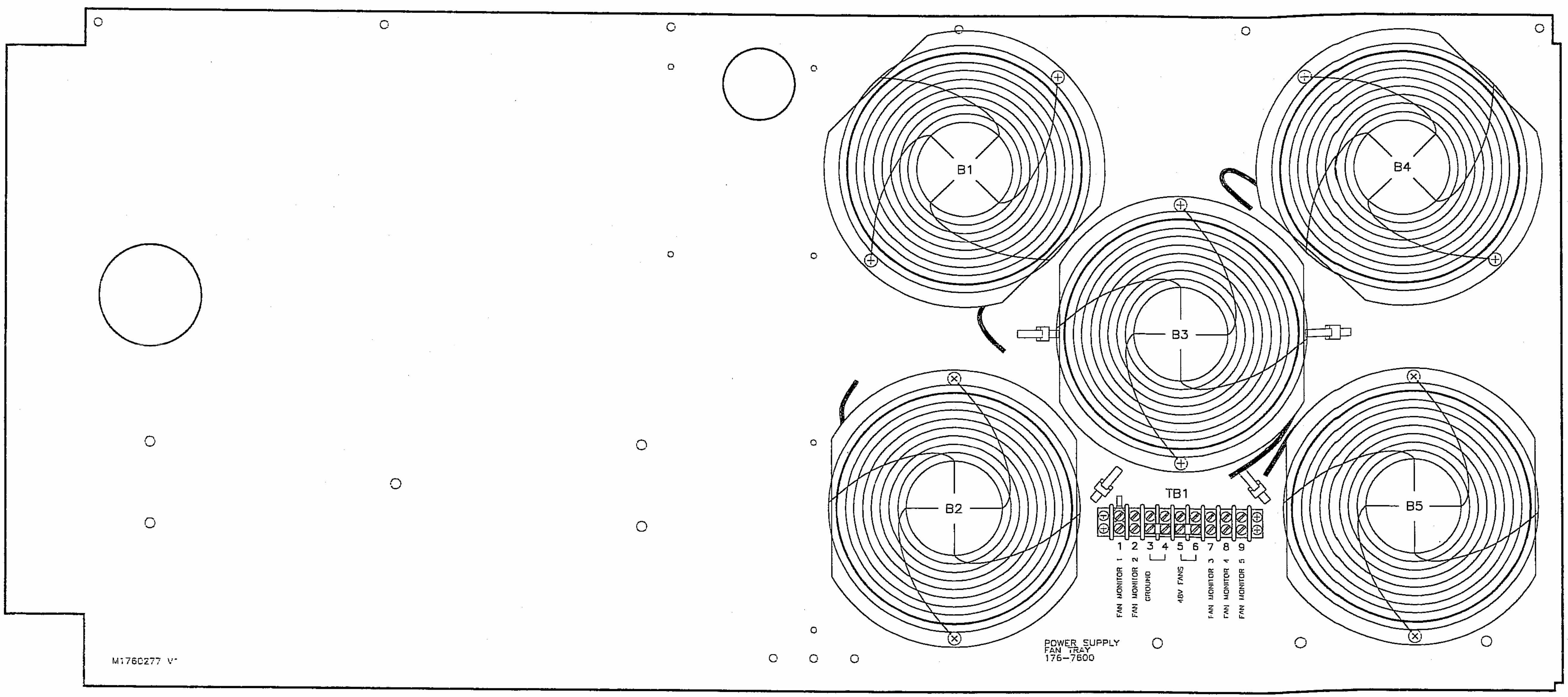


Figure MD-34 Assembly Detail - Power Supply Fan Tray (P/N 176-7600-01)

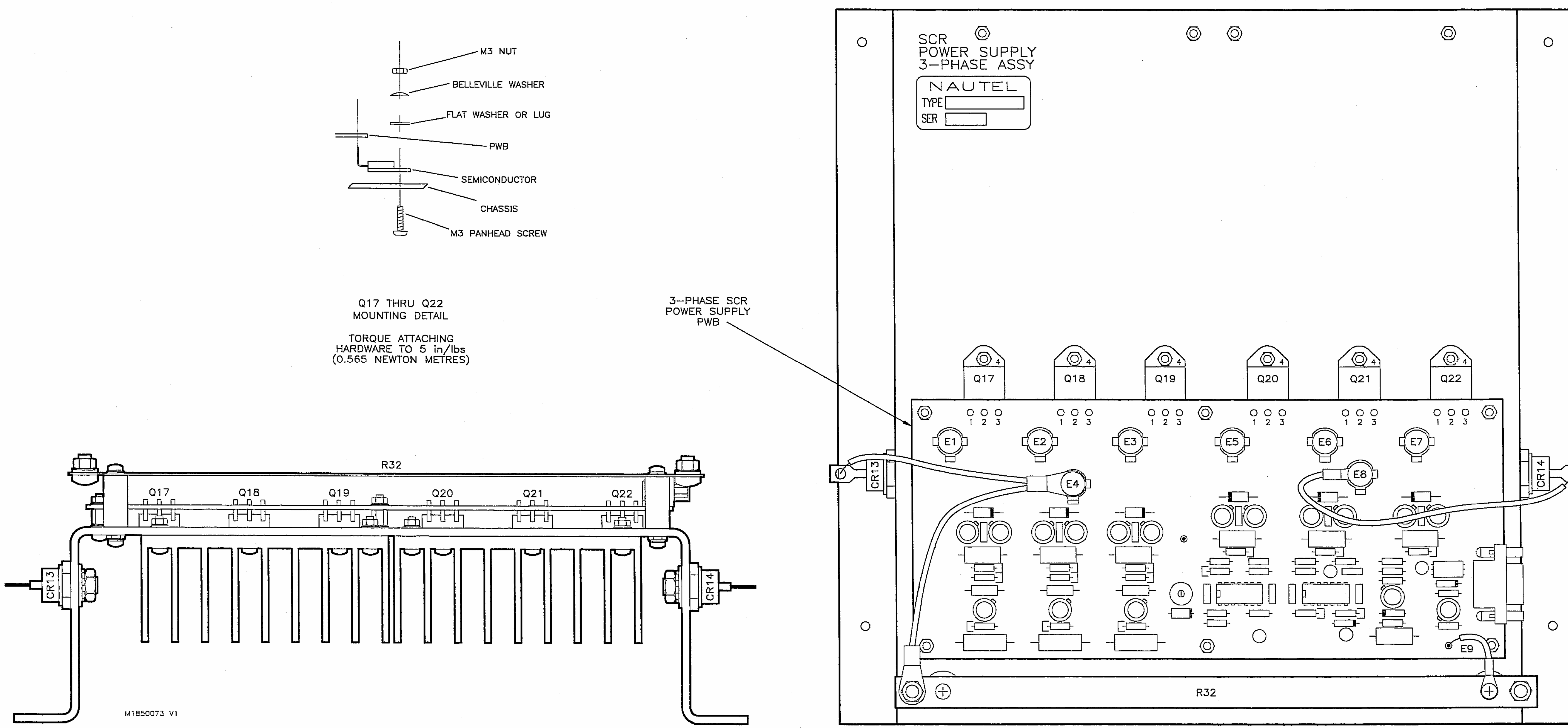


Figure MD-35 Assembly Detail - 3ø SCR Power Supply Assembly (NAS44/01)

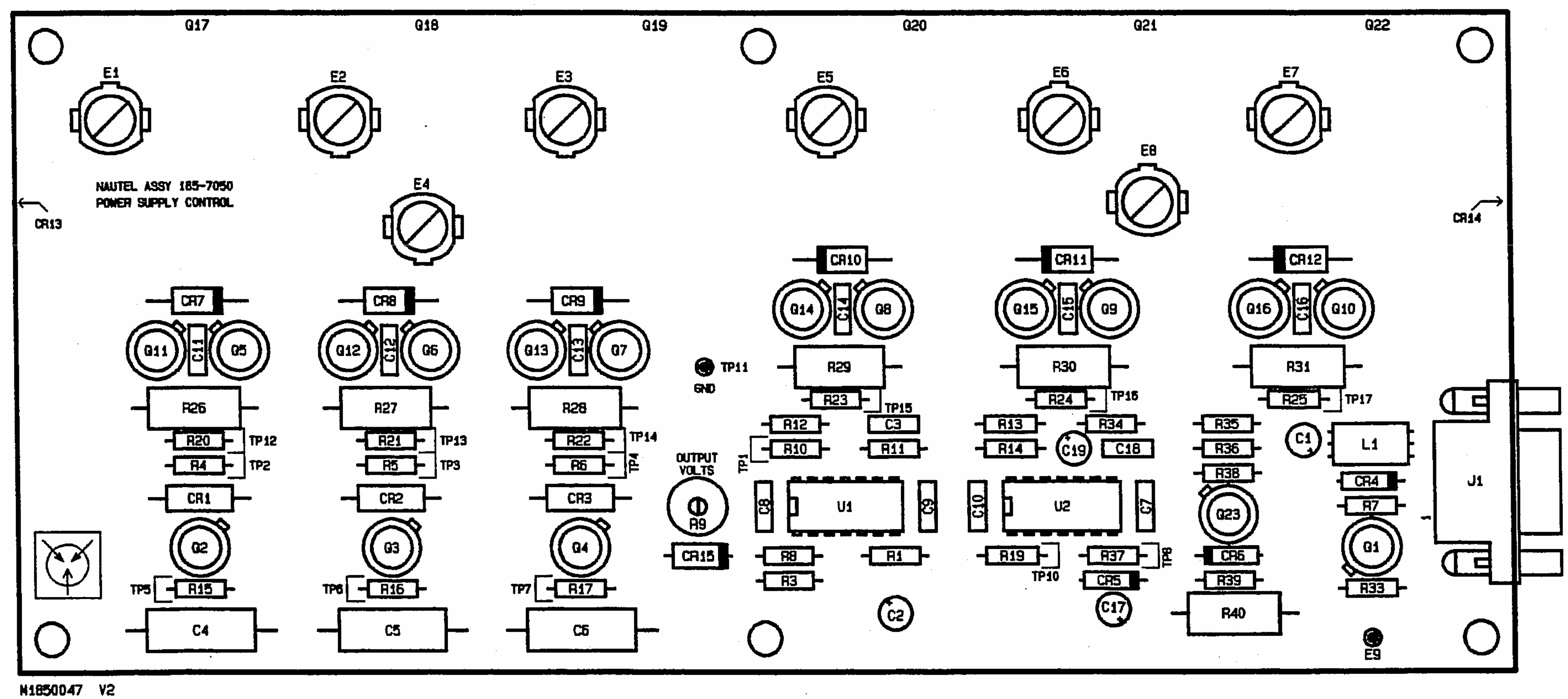


Figure MD-36 Assembly Detail - 3ø SCR Power Supply PWB (185-7051)

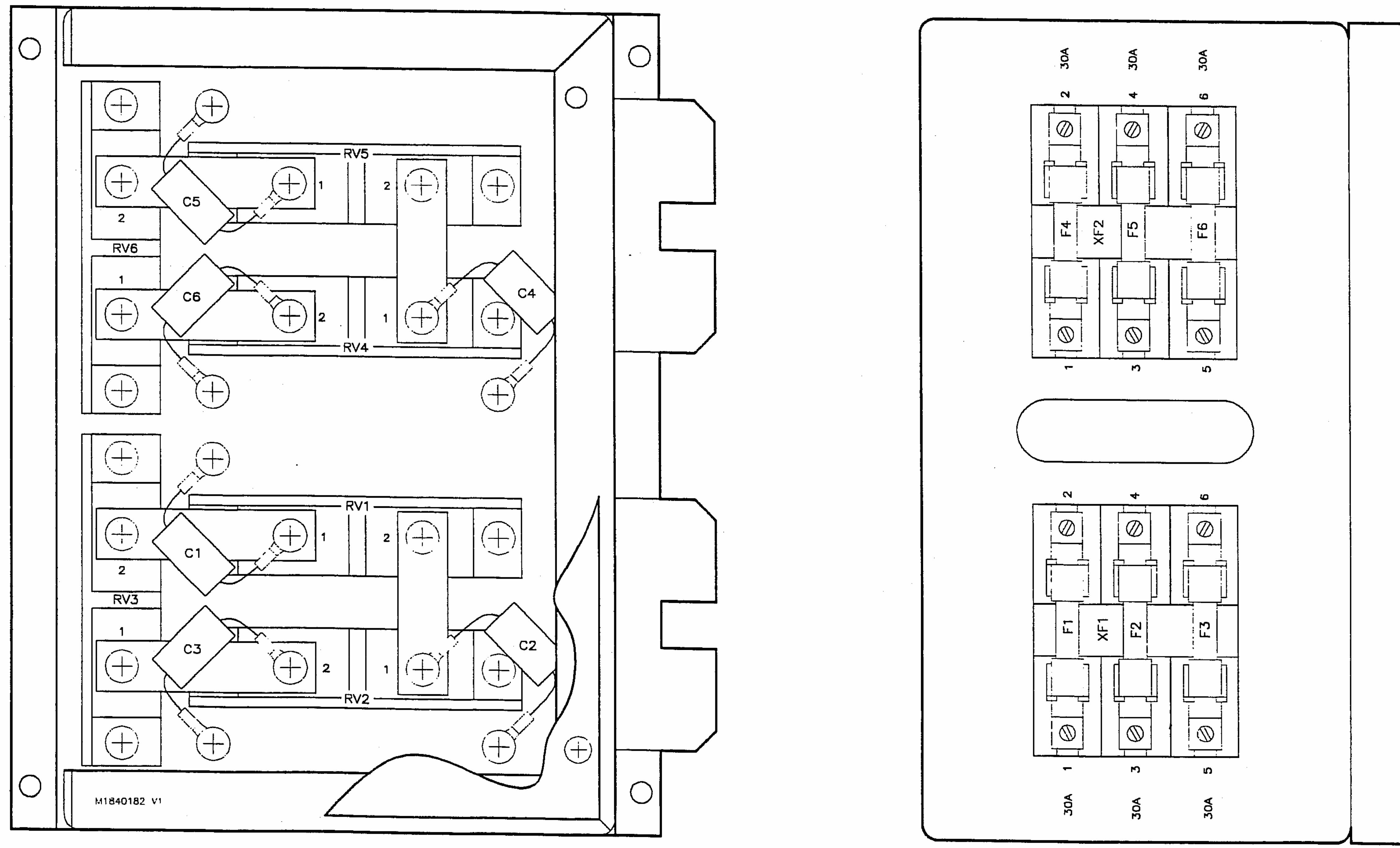
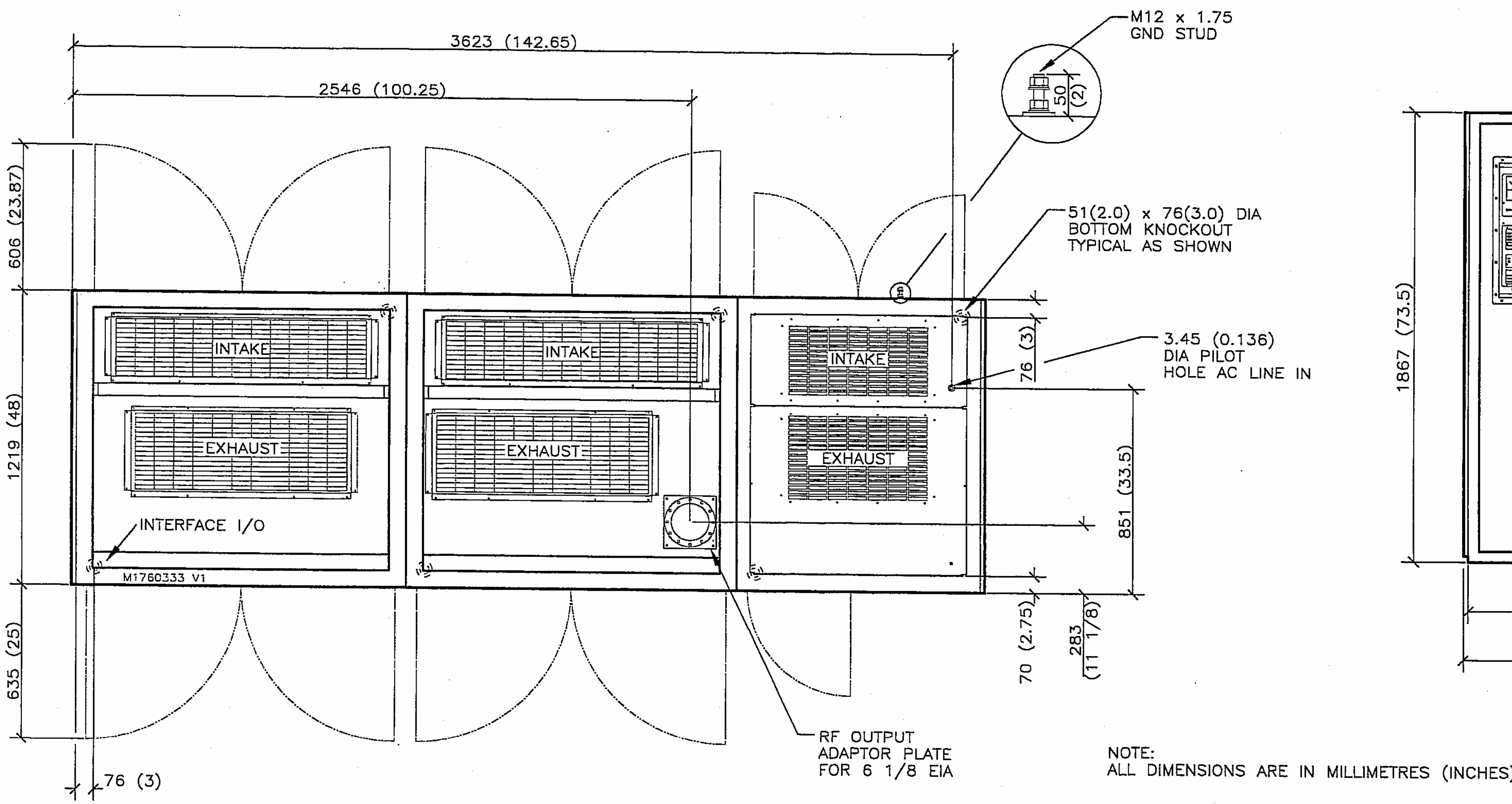


Figure MD-37 Assembly Detail - NAX189 MOV Assembly



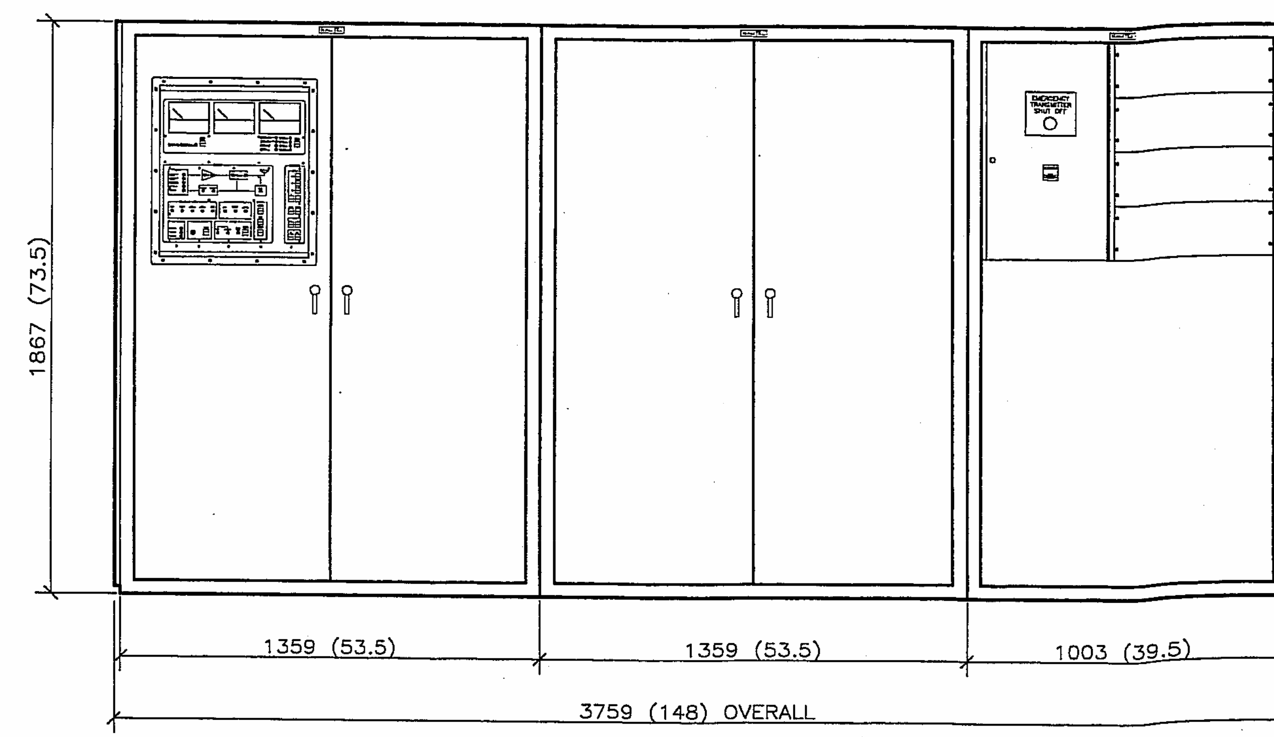
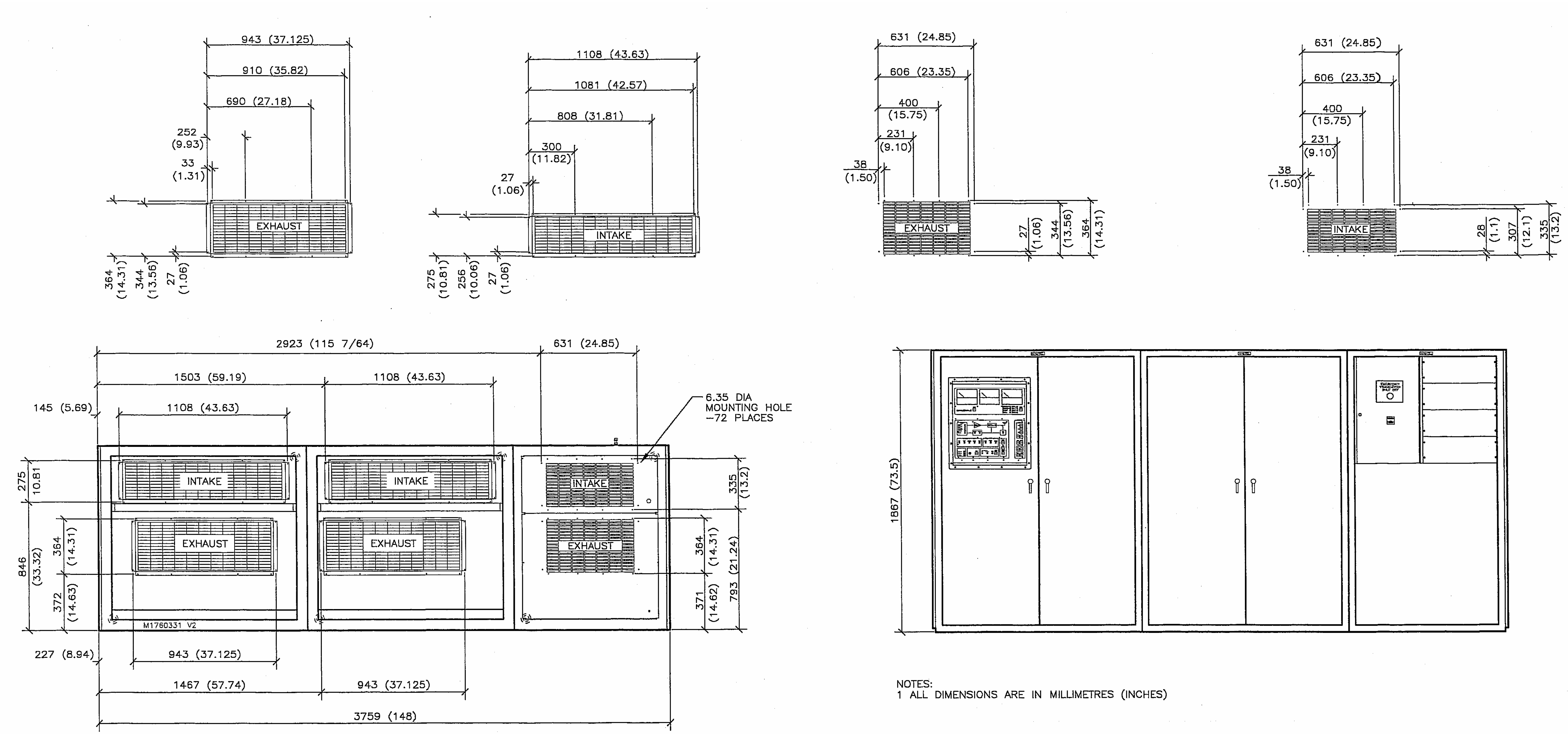


Figure MD-38 Dimensional Information NA100 AM Broadcast Transmitter



NOTES:
1 ALL DIMENSIONS ARE IN MILLIMETRES (INCHES)

Figure MD-39A Dimensional Information - NA100 Ventilation Ducting (External Intake/External Exhaust)

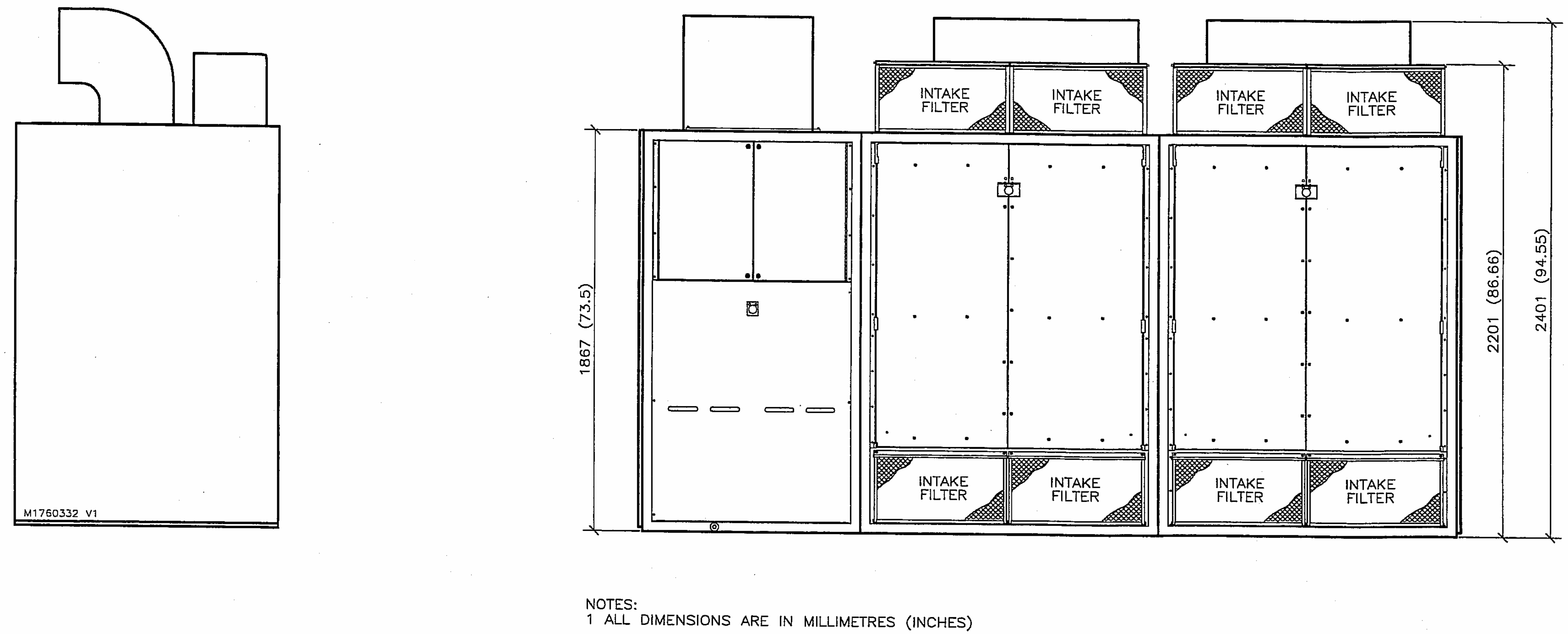
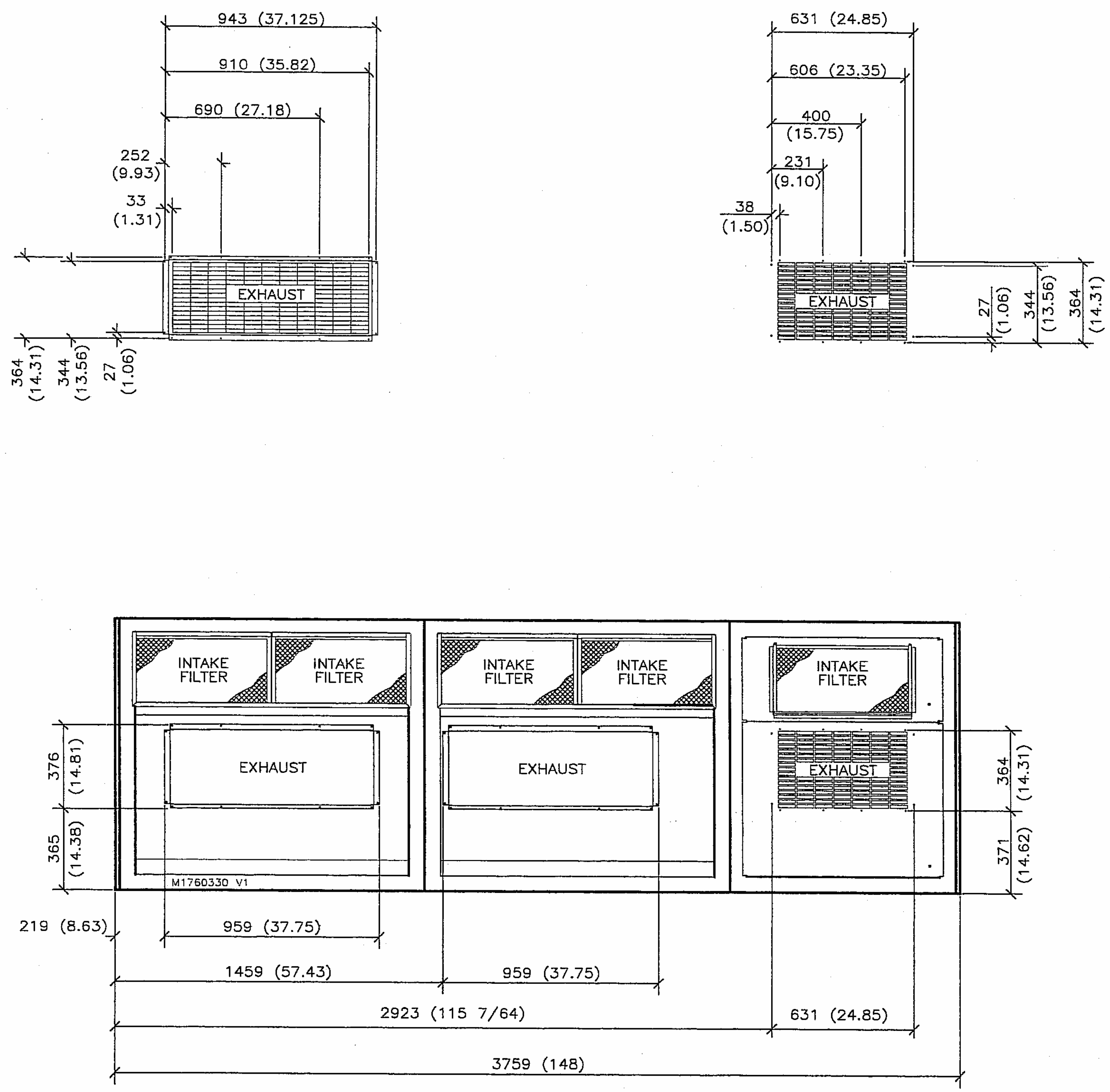
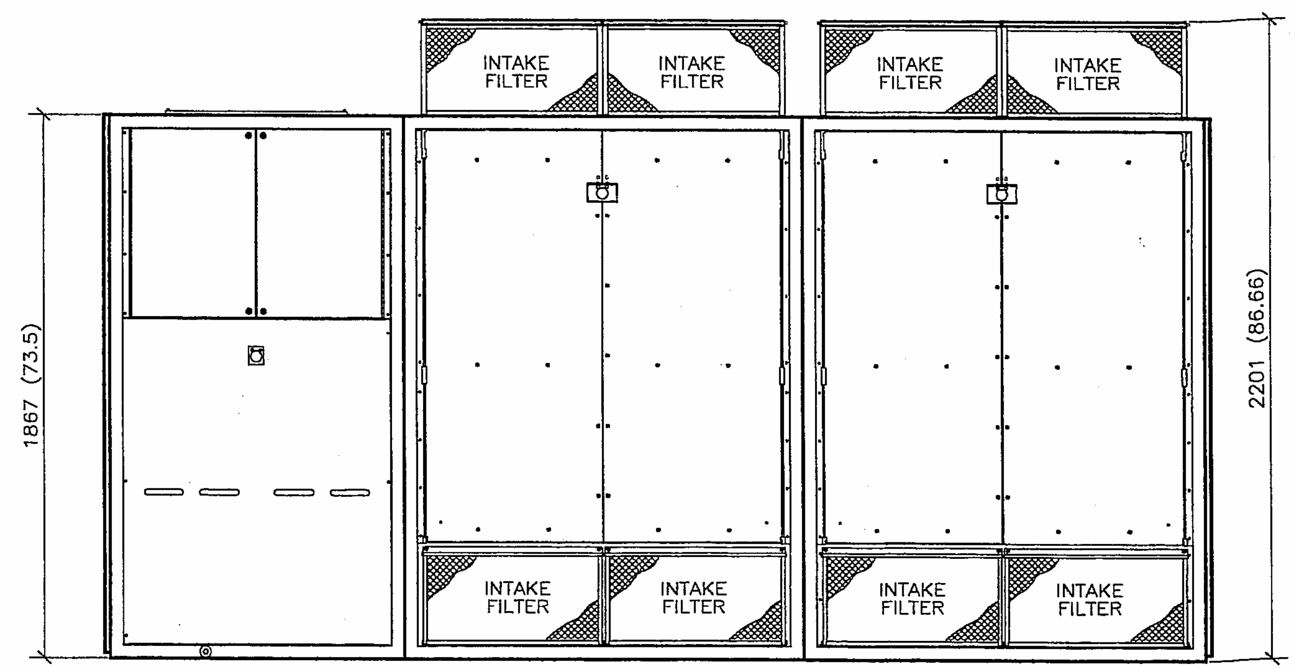


Figure MD-39B Dimensional Information - NA100 Ventilation Ducting (Room Intake/Room Exhaust)





NOTES:
1 ALL DIMENSIONS ARE IN MILLIMETRES (INCHES)

Figure MD-39C Dimensional Information - NA100 Ventilation Ducting (Room Intake/External Exhaust)