XR6/XR3 Transmitter

Troubleshooting Manual

Document: XR6/XR3-TROUBLESHOOT

Issue: 3.1 2014-05-07

Status: Standard

nautel

Nautel Limited
10089 Peggy's Cove Road
Hackett's Cove, NS Canada B3Z 3J4
Phone: +1.902.823.3900 or
Toll Free: +1.877.6NAUTEL (6628835) (Canada & USA only)
Fax: +1.902.823.3183

Nautel Inc.
201 Target Industrial Circle
Bangor, Maine USA 04401
Phone: +1.207.947.8200
Fax: +1.207.947.3693

Customer Service (24 hour support)
+1.877.628.8353 (Canada & USA only)
+1.902.823.5100 (International)

Email: support@nautel.com
Web: www.nautel.com

The comparisons and other information provided in this document have been prepared in good faith based on publicly available information. The reader is encouraged to consult the respective manufacturer's most recent published data for verification.

© Copyright 2009 NAUTEL. All rights reserved.

Contents

About this manual ix

About safety xiii

Safety precautions xv

Responding to alarms 1-1

- Corrective maintenance 1-1
- Electrostatic protection 1-3
- Identifying an alarm 1-4
- Responding to alarms 1-8
- Removing and reinstalling RF power modules 1-20
- Troubleshooting RF power modules 1-24
- Exciter panel and PWB removal / replacement 1-36
- RF Drive Buffer PWB replacement 1-40
- Distribution PWB replacement 1-41
- RF Drive Power Supply assembly replacement 1-42
- Low Voltage Power Supply assembly replacement 1-42
- +24 Volt Power Supply assembly replacement 1-43
- Fan Power Supply assembly replacement 1-44
- RF Power Module assembly replacement 1-45

Detailed Circuit Descriptions 2-1

- Control/display PWB (NAPC147D) 2-1
- RF synthesizer PWB (NAPE70C) 2-4
- Interphase PDM driver PWB (NAPM10B) 2-8
- Remote interface PWB (NAPI83/01A) 2-13
- RF drive power supply PWB (62 V) (NAPS10B) 2-18

RF power module (NAP34A) 2-19
RF drive buffer PWB (NAPE77A/01) 2-30

Parts Lists 3-1
Family tree 3-1
How to locate information about a specific part 3-1
Column content 3-2
OEM code to manufacturer's cross-reference 3-3
Common abbreviations/acronyms 3-4

Wiring/connector lists 4-1
Wiring lists provided 4-1
Wiring lists not provided 4-1
Connector mating information 4-1
Wire colours 4-1
Printed wiring board patterns 4-1

Reading Electrical Schematics 5-1
Component values 5-1
Graphic symbols 5-1
Logic symbols 5-1
Reference designations 5-1
Unique symbols 5-2
Identifying schematic diagrams 5-2
Structure of schematics 5-3
Locating schematic diagram for a functional block 5-3
Locating a part or assembly on a schematic 5-4

Mechanical Drawings 6-1
Introduction 6-1
Locating assembly detail drawings 6-1
Content of mechanical drawings 6-1

List of terms 7-1

Index IX-1

About this manual

This manual provides troubleshooting information for the XR6/XR3 transmitter. It is intended for use by field technicians. This manual allows the troubleshooting technician to diagnose a fault to the system level, using alarm response procedures, parts lists, wiring lists, and electrical schematics. Electrical schematics and mechanical drawings are included at the end of the manual.

Performing procedures

When using procedures in this manual, perform each step in sequence.

- If you are asked to **see** another section of this manual, or another document, refer to that section or document for additional information, then continue the procedure.
- If you are asked to **go** to another step within the procedure, jump directly to that step without performing the intervening steps.
- If you are asked to **go** to another section or document, stop the procedure and perform the tasks described in the other section or document.
- If you are asked to **check a voltage**, use a digital voltmeter and test the voltage relative to ground (unless otherwise instructed).
- If you are asked to **check a signal**, use an oscilloscope and test the signal relative to ground (unless otherwise instructed).

Technical support

Nautel offers technical support to customers over the Internet and by telephone. Nautel's customer support team will answer your questions and work with you to identify and resolve problems.

For technical support, call the Customer Support Team at 902-823-3900 or - in U.S.A. and Canada only - call toll free at 1-877-6NAUTEL (662-8835). Or find us on the Internet at http://www.nautel.com.

For parts and tools information, see "Parts and tools" on page 12-1 of the *XR6/XR3 Pre-Installation Manual*.

For accessories or spares, see "Accessories" on page 10-1 of the *XR6/XR3 Pre-Installation Manual*.

For standard warranty information, see "Pre-installation assistance" on page 11-1 of the *XR6/XR3 Pre-Installation Manual*.

For extended warranty information, see "Pre-installation assistance" on page 11-1 of the *XR6/XR3 Pre-Installation Manual*.

XR6/XR3 transmitter manuals

The XR6/XR3 documentation suite includes the following documents:

XR6/XR3 Pre-installation Manual, XR6/XR3-PREINST. The Pre-installation Manual provides instructions and reference information needed when planning and preparing for the installation of an XR6/XR3 transmitter.

Nautel Site Protection Manual. The Site Protection Manual provides detailed information about protecting your site from lightning-related hazards.

XR6/XR3 Installation Manual, XR6/XR3-INST. The Installation Manual provides instructions and reference information needed when installing an XR6/XR3 transmitter.

XR6/XR3 Operating and Maintenance Manual, XR6/XR3-OPS-MAINT. The Operating and Maintenance Manual provides instructions for operating, maintaining and troubleshooting an XR6/XR3 transmitter. It also provides reference information needed when performing diagnostic procedures.

XR6/XR3 Troubleshooting Manual, XR6/XR3-TROUBLE. The Troubleshooting Manual provides detailed technical information about the XR6/XR3 transmitter, including electrical schematics and mechanical drawings.

Nautel website / Online resources

The Nautel website provides useful resources to keep you up to date on your XR6/XR3.

Nautel User Group (NUG)

The website includes a special section that customers can log into in order to access the Nautel customer newsletter, product manuals, frequently asked questions (FAQ), information sheets, and information about field upgrades. Registration is available online and is required.

Documentation: online and printed

The website's NUG section provides online access to all the documentation for your XR6/XR3. Documentation is provided in Acrobat (PDF) format. You can use the documentation online or print the sections that you need.

When using online documents:

- Click on blue text (hyperlinks) to jump to a related section, or to get additional information (e.g., view a term's definition).
- To search a document to find keywords, use Find in Acrobat Reader's Edit menu.
- To quickly find a specific section, click the section in the PDF file's Bookmarks list.

When using printed documents:

- To find keywords, go to the *Index* section at the end of the manual.
- To find a specific term, go to the *List of Terms* section near the end of the manual.

About safety

All Nautel transmitters are designed to meet the requirements of *EN60215, Safety Requirements for Radio Transmitters*.

The philosophy of *EN60215* is that the removal of any cover or panel that can only be opened using a tool is a maintenance activity, and that any person performing a maintenance activity is expected to be trained for that activity. Under *EN60215*, it is assumed that trained personnel will be knowledgeable and will take precautions such as removing all power to the transmitter before accessing its components.

Electrical hazards

To remove power from the transmitter, switch off and lock out the ac power. There are three amber LEDs at the bottom rear of the cabinet that glow to remind anyone who has not turned off the power that the system is live and serious danger is present.



WARNING: It is not enough to remove RF power. The power line is still connected.

Mount the transmitter ac power disconnect switch/breaker close to the transmitter so that it can be reached quickly in an emergency. Clearly label the disconnect switch/breaker (e.g., EMERGENCY SWITCH).

After turning off the power, always perform a measurement to confirm that the power is off before touching anything within the transmitter. If the wrong breaker was opened, the equipment will be live.



WARNING: Do not use an ordinary multimeter to check for voltage, since it may have been left inadvertently on the AMP (A) range, triggering a short and an arc blast that could result in severe burns and even death.

Use only a non-contact voltage probe or a safety voltmeter (available from vendors such as Fluke, Ideal, and Teagam).

Use a proper lockout procedure to ensure that another worker cannot accidentally reapply power while you are performing maintenance on any part of the transmitter or site.

Lightning hazards

Before opening the transmitter and touching internal parts, remove and solidly ground the antenna connection.



WARNING: It is not enough to ground the antenna terminal with the antenna still connected. Even a small impedance in the ground strap will result in lethal voltages during a lightning strike.

RF hazards

A serious RF hazard and very high voltages exist in the vicinity of the antenna and its networks during normal operations.

Toxic hazards

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 with "(BeO)" in the *Description* column of the *Troubleshooting 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.

Other hazards

Ensure that appropriate fire alarms and fire extinguishers are available. Extinguishers must be suitable for use on electrical fires.

Many other site safety risks exist. It is beyond the scope of this manual to identify all the risks and procedures.

Safety precautions

This section provides very important information about protecting the safety of personnel and equipment:

- Personal safety - see page xv
- Site safety - see page xvi
- Equipment safety - see page xviii

Personal safety

Training

The training of any personnel who will have physical access to the site or the transmitter is very important. Personnel must be familiar with the transmitter, so that they can avoid physical danger, and be aware of hazards to themselves and the equipment.

Nautel offers a number of training courses covering the basic fundamentals of RF systems and transmitters, and the operation and maintenance of the transmitter. For more information about available courses and schedules, go to the Nautel website at http://www.nautel.com/Training.aspx, or ask your Nautel sales representative.

Site orientation

When you give personnel access to the transmitter site (e.g., hiring new personnel, or giving access keys to personnel), perform a site orientation to ensure that they are familiar with the site, on-site procedures, and on-site hazards. Cover the following topics:

- Securing the site (locking doors and fences) to prevent unauthorized access
- How and when to call for technical support or emergency assistance
- Areas of the site and pieces of equipment that are *off limits*

Voltage awareness

Ensure that all personnel that are able to access areas with high voltage circuits or high field strengths are aware of the hazards associated with high voltage. Cover the following topics:

- High voltage or high field strength areas where caution is required
- Physical risks of electric shock
- Risks for personnel with pacemakers or other medical implants
- Induced voltages in high field strength areas
- On-site risks during thunderstorms and lightning strikes
- Operation of safety interlocks (if installed)

First aid

Nautel does not offer first aid training, since the hazards associated with high voltage and RF energy are not specific to the transmitter. However, the customer should provide first aid training to all personnel who have access to the transmitter site. First aid training should include CPR, care of burns, artificial respiration, and defibrillation if specific equipment is available on-site.

Site safety

Controlling access

Transmitters and antennas generate and carry dangerous voltages that can be harmful or fatal. It is very important that you control access to the site and its equipment. To secure your transmitter site, use:

- Locking steel or security doors to prevent casual access
- A perimeter fence to keep trespassers away from the antenna system and feedline
- "No Trespassing" signs
- An alarm system

Marking hazards

Place warning signs close to any hazardous areas or systems (e.g., the feedline or the antenna system). Make the signs large enough that they cannot be missed. Provide signage in all languages used in the region. These signs are intended not only for authorized personnel, but also for emergency responders or accidental trespassers.

Qualifying site personnel

Make sure that personnel who have access to the site are qualified to work around electronics and high voltage systems.

Ac power protection

You should take steps to protect equipment from surges (over-voltage spikes) on the ac power lines. Surges may occur during thunderstorms, or because of malfunctions in the electrical distribution grid. Surge suppressors and ac power conditioners can prevent serious damage to your on-site equipment, including the transmitter.

RF protection

Transmitters and their antenna systems create intense radio frequency fields at the transmitter site, particularly near the feedline, antenna and tower. At some sites, these fields may cause biological effects, including the heating of body tissues. Intense fields can also create dangerous high voltages on ungrounded, conductive surfaces and objects. At certain points where high voltage conductors come close to grounded conductors (e.g., at feedline junctions or on the tower), dangerous electrical arcing or flashovers can occur. It is very important that you take the following steps to prevent damage to equipment or personnel due to RF fields:

- Use safety interlocks to de-energize transmitters if personnel open doors or panels accessing high field areas
- Place warning signs in any locations where high fields can occur
- Train personnel about the short-term and long-term hazards of RF radiation
- Physically block access to the area around the antenna system, feedline and tower
- Ground all exposed conductive surfaces or objects in high field areas

The RF connection to the transmitter output can be a serious safety hazard. Connect a 50 Ω test load during installation and commissioning. It is recommended that a switch be used to automatically connect the transmitter to the antenna system without human contact with the transmitting conductors.

Safety interlocks

The transmitter contains an electrical interlock, which is an external circuit that turns off the RF output if any of its switches are opened.

Ac disconnect switch

Safe operation of the transmitter requires an ac disconnect switch. Lock the ac disconnect switch in the disconnected (open) position during the installation process.

Equipment safety

Electrostatic protection

The transmitter's systems are very rugged and resistant to damage. However, it is possible for damage to occur because of high voltage electrostatic discharges during servicing. Train all service personnel to ground themselves to bleed off any static charge before opening the transmitter or touching any exposed components. Provide a grounding wand or known ground (e.g., a grounded metal table) that personnel can use to discharge themselves.

Surge protection

Surge protection is recommended for your entire site. However, even if you do not use a surge protector on the service entrance to the site, you should install a surge protector in the transmitter's ac power feed to prevent over-voltage from entering the transmitter.

Lightning protection

The transmitter is designed to resist lightning strike damage. However, intense or repeated strikes could damage the transmitter. We recommend that you install lightning suppression on the antenna, tower and feedline to reduce the effect of lightning strikes on the transmitter itself (and to protect the rest of your site equipment and your personnel). For detailed information about lightning protection, see the *Nautel Site Preparation Manual*, available from your Nautel sales agent, or online from the Nautel website.

Physical protection

Consider physical hazards to equipment at your site, including the transmitter. Ensure that equipment is protected from weather (e.g., rain or flooding), even during extreme weather events. Place equipment so that it is not in the path of swinging doors or high-traffic areas. Do not allow wheeled items like office chairs or tables with wheels in the transmitter room, as these may damage equipment if accidentally pushed or knocked over. Do not place the transmitter under water pipes, drains, or sprinklers. Keep any equipment that generates heat, like the transmitter, away from flammable materials like ceiling panels, cubicle dividers, and curtains.

Earthquake protection

If the transmitter site is in a region that experiences any noticeable earthquake activity, take steps to prevent the transmitter from shifting or rocking during an earthquake. Even during minor earthquakes, rocking or movement of the transmitter is likely to damage the feedline connection, and could even cause a catastrophic failure of the ac power feed into the transmitter. During larger earthquakes, the weight of the transmitter chassis could be hazardous to nearby equipment or personnel.

Section 1: Responding to alarms

This section provides instructions you need when performing troubleshooting on the XR6/XR3 transmitter. This section includes the following topics:

- Corrective maintenance
- Electrostatic protection - see page 1-3
- Identifying an alarm - see page 1-4
- Responding to alarms - see page 1-8
- Troubleshooting RF power modules - see page 1-24

If none of the procedures and alarms described in this section address your problem, contact Nautel for assistance. See "Technical support" on page ix .

Corrective maintenance

Corrective maintenance procedures consist of identifying and correcting defects or deficiencies that arise during transmitter operation. Local and/or remote alarm signals are generated when a malfunction occurs. If an alarm condition is caused by a malfunction in the RF power stage, the transmitter may maintain operation at a reduced RF output level. The nature of the fault – and station policy – will dictate whether an 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: on-air troubleshooting, remote or local, and off-air troubleshooting.



CAUTION:
The 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 that circuits are not overdriven or disconnected from their loads while turned on.

On-air troubleshooting

On-air troubleshooting can be performed from a remote location, or locally at the transmitter site.

Remote troubleshooting

Remote on-air troubleshooting consists of monitoring the transmitter's radiated signal using an on-air monitor, and observing the status of each remote fault alarm indicator. Information obtained from these sources should enable an operator to decide whether an alarm response may be deferred to a more convenient time, an immediate corrective action must be taken, or if a 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 "Identifying an alarm" on page 1-4 to determine the remedial action required for a given fault.

Local troubleshooting

Local on-air troubleshooting consists of monitoring the transmitter's integral meters and fault alarm indicators. Analysis of this data will normally identify the type of fault, and in most cases will determine what corrective action must be taken. Refer to "Identifying an alarm" on page 1-4 to determine the remedial action required for a given fault.

The power amplifier stage contains an integral modular reserve (IMR) feature. This feature permits the transmitter to operate at full RF output power level, from a standby RF power module, if purchased. Replacement of the defective RF power module may be deferred to a convenient time.

A defective RF power module may be removed from the transmitter for servicing, while the transmitter is operating, provided that the conditions in the removal instructions detailed in "Removing an RF power module" on page 1-20 are met.

Off-air troubleshooting

Off-air troubleshooting must be performed when the replacement of a defective RF power amplifier module, or routine on-air calibration adjustments, will not restore operation.

It is recommended that the transmitter's output be connected to a precision 50 Ω resistive dummy load (rated for at least the maximum transmitter power rating) before starting off-air troubleshooting procedures. If an appropriate dummy load is not available, troubleshooting 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.



NOTE:
Reduce the RF output level to a minimal value when troubleshooting faults in the power amplifier stage while the transmitter's RF output is connected to the antenna system.

Electrostatic protection

The transmitter's assemblies contain semiconductor devices that are susceptible to damage from electrostatic discharge. The following precautions must be observed when handling an assembly which contains these devices.



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

Electrical discharging of personnel

Personnel should be electrically discharged by a suitable grounding system (e.g., anti-static mats, grounding straps) when removing an assembly from the transmitter, and while handling the assembly for maintenance procedures.

Handling/Storage

An assembly should be placed in an anti-static bag when it is not installed in a host transmitter, or when it is not undergoing maintenance. Electronic components should be stored in anti-static materials.

Tools/Test equipment

Testing and maintenance equipment – including soldering and unsoldering tools – should be suitable for contact with static sensitive semiconductor devices.

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 that *current is not flowing when an electrical connection is broken*, and that *voltages are not present on external control/monitoring circuits when they are connected.*

Identifying an alarm

The best way to identify an alarm is by viewing the transmitter's front panel. There are several ways to use the front panel to identify the occurrence and origin of a fault:

- The system diagram (Figure 1.1) is a flow diagram that indicates the operational status of various sections of the transmitter. If a lamp is on (red), a fault is occurring in the associated section of the transmitter.

Figure 1.1:

- The diagnostic display's meter screen has real-time meter indications (e.g., forward power) to assist in fault analysis.
- If an alarm occurs, a **Status** option appear's on the diagnostic display. Press the **Status** soft key to display all active faults.
- The diagnostic display's **Events Log** (see page 3-1 of the *Operating and Maintenance Manual*) provides a chronological list of faults and events to assist in fault diagnosis.

1. Determine the origin of the fault by noting which of the system diagram's lamps has turned on.
2. Attempt to clear the alarm from the **Status** screen by pressing the **Reset** button. If the alarm persists, it will not be cleared from the display.
3. Refer to Table 1.1 on page 1-5 for troubleshooting tips on the offending alarm(s), which may also reference replacement and subsequent re-calibration procedures.
4. If the troubleshooting and subsequent replacement of a suspect PWB or RF power module does not remove the fault condition, contact Nautel.

NOTE:
Before undertaking any troubleshooting, record all GUI meter readings. Then press the **STATUS** *button - if present - on the GUI to see if any other alarms have been registered on the* **STATUS** *page. Record all alarms.*

Table 1.1: Troubleshooting Alarms

System Diagram LEDs =**SD**
Remote Interface Alarms =**RI**

Status Message	System Diagram LEDs Remote Interface Alarms	Description/Action
Auto Changeover	SD: Changeover RI: Exciter Changeover	This event is caused by a fail in the active exciter while the Auto Changeover function is enabled. See page 1-15.
Cutback Level (1-8)	RI: Cutback	If three shutbacks occur within five seconds, the transmitter will enter a power reduction mode called a cutback. See page 1-16.
Ext. Interlock Open	SD: External Alarm	The external interlock input is wired to the remote interface PWB by the user. An alarm will be triggered by user-set conditions (e.g., the state of the door to the transmitter room). See page 1-9.
Ext. PDM Inhibit	SD: External Alarm	The external PDM Inhibit is wired to the remote interface PWB. See page 1-17.
Fan P/S Fault	SD: Low Voltage Power Supply RI: LVPS Fail	The fan power supply is monitored. An alarm will be triggered if the fan power supply voltage varies more than the specified limits. See page 1-12.
High B^+ Voltage	SD: AC Mains	An alarm occurs if the B^+ voltage exceeds its set threshold. See page 1-11.
High DC Current	SD: Power Supply	This alarm occurs when the dc current goes above its factory set threshold - approximately 41 A (XR6) or 21 A (XR3).
High RF Current	SD: Output Network RI: RF OverCurrent Alarm	This alarm occurs when the RF current exceeds its factory-set threshold.
High VSWR Shutback	SD: Output Network RI: High VSWR	This alarm occurs when the reflected power exceeds its factory-set threshold - approximately 480 W (XR3) or 960 W (XR6). See also page 1-13.

Status Message	System Diagram LEDs Remote Interface Alarms	Description/Action
Int. Serial Fail	SD: Exciter RI: Exciter Fail	This alarm occurs when there is no communication with the remote interface PWB for 2 seconds. See page 1-17.
Low B+ Voltage	SD: AC Mains RI: Low B^+	This alarm is triggered if the B^+ voltage falls below its factory-set threshold. See page 1-10.
Low Backup Battery	RI: Memory Battery Alarm	This alarm is triggered when the voltage of the backup battery has fallen below an acceptable level. See page 1-19.
LVPS Fault	SD: Low Voltage Power Supply RI: LVPS Fail	The +24 V, +15 V, -15 V and +5 V power supplies are monitored. This fault is reported if one or more of these voltages exceeds its specified limits. See page 1-12.
Mod Driver Fail A	SD: Exciter RI: Exciter Fail	This fail is reported if the modulator drive on exciter A is inoperative due to a high duty cycle. See page 1-14.
Mod Driver Fail B	SD: Exciter RI: Exciter Fail	This fail is reported if the modulator drive on exciter B is inoperative due to a high duty cycle. See page 1-14.
Mod. Protection	SD: External Alarm	This fail is reported from the remote interface PWB to prevent overmodulation. See page 1-18.
PDM Drive Fail	SD: Exciter RI: Exciter Fail	This fail indicates that the PDM drive on the active exciter is inoperative due to a low duty cycle. See page 1-14
PM Fault A	SD: IPA/PA RI: Power Mod Fail	This alarm is triggered when power module A reports a fault. See page 1-9.
PM Fault B	SD: IPA/PA RI: Power Mod Fail	This alarm is triggered when RF power module B (optional for XR6/XR3) reports a fault. See page 1-9.
RF Drive P/S Fail	SD: Low Voltage Power Supply RI: LVPS Fail	The RF drive power supply is monitored. This fault will be reported if the voltage exceeds or falls below the specified limits. See page 1-12.

Status Message	System Diagram LEDs Remote Interface Alarms	Description/Action
RF Driver Fail	SD: Exciter RI: Exciter Fail	This fail indicates a problem with the RF drive on the active exciter. See page 1-16.
SoftStart OverTemp	SD: Power Supply	The software keeps track of the calculated temperature of the softstart relays and triggers this fail if that value exceeds the specified limit. See page 1-19.
Total Power Limit	SD: Power Supply	This fail is triggered when the product of the B+ (dc) voltage and the dc current is greater than the limit set in software. See page 1-14.

Table 1.2: Module Replacement

Module	Replacement Procedure
RF Power Module	See page 1-20
Remote Interface PWB	See page 1-37
RF Synthesizer PWB	See page 1-37
Interphase PDM Driver PWB	See page 1-38
Exciter Interface PWB	See page 1-39
RF Drive Buffer PWB	See page 1-40
Distribution PWB	See page 1-41
RF Drive Power Supply PWB	See page 1-42
Low Voltage Power Supply	See page 1-42
+24 V Power Supply	See page 1-43
Fan Power Supply	See page 1-44
Modulator Assembly	See page 1-46
RF Amplifier	See page 1-47

Responding to alarms

PM fault

A **PM Fault** indicates a failure in at least one RF power module.

1. Select the **Meters** GUI page to view the forward power on the front panel **Diagnostic Display**. Record the forward power reading. See "Navigating from page to page" on page 2-6 of the *XR6/XR3 Operations and Maintenance Manual*.

2. If the forward power reading in Step 1 is less than the preset level, one or more RF power modules are defective. Proceed to "RF power module fault validation".

> *NOTE:*
> *If a spare RF power module is not installed, there may be no forward power. If a spare module is installed, the transmitter should continue to operate at full power. A defective RF power module can be removed for repair, without turning off the transmitter, as described in "Removing an RF power module" on page 1-20.*

3. If the forward power reading in Step 1 is normal press the **Status** button on the GUI to check for other alarms that may have triggered the RF power module alarm. Press and release the **Reset** button on the GUI to reset the power modules.

RF power module fault validation

Follow the procedure below to identify and isolate a defective RF power module, and verify the nature of the defect.

1. Check the **Alarm** LEDs on the RF power modules' front panels and note which RF power module indicates a fault (**Alarm** LED is on). Record which RF power module is displaying an alarm and which **Alarm** LEDs are on.

2. If no **Alarm** LEDs on the RF power modules are on, reset the RF power modules by pressing the **Reset** button on the GUI. See "Navigating from page to page" on page 2-6 of the *XR6/XR3 Operations and Maintenance Manual*. If the **Alarm** does not reset – or if it returns – remove the RF power module for troubleshooting. See "Removing an RF power module" on page 1-20.

RF power module troubleshooting

Refer to "Removing an RF power module" on page 1-20 for removal and installation instructions and then refer to "Troubleshooting RF power modules" on page 1-24 for detailed troubleshooting information.

PM fault A

A fault is being reported by RF power module A. See "PM fault" on page 1-8 to troubleshoot.

PM fault B

A fault is being reported by RF power module B. See "PM fault" on page 1-8 to troubleshoot.



NOTE:
A second RF power module is optional for the XR6/XR3 transmitter.

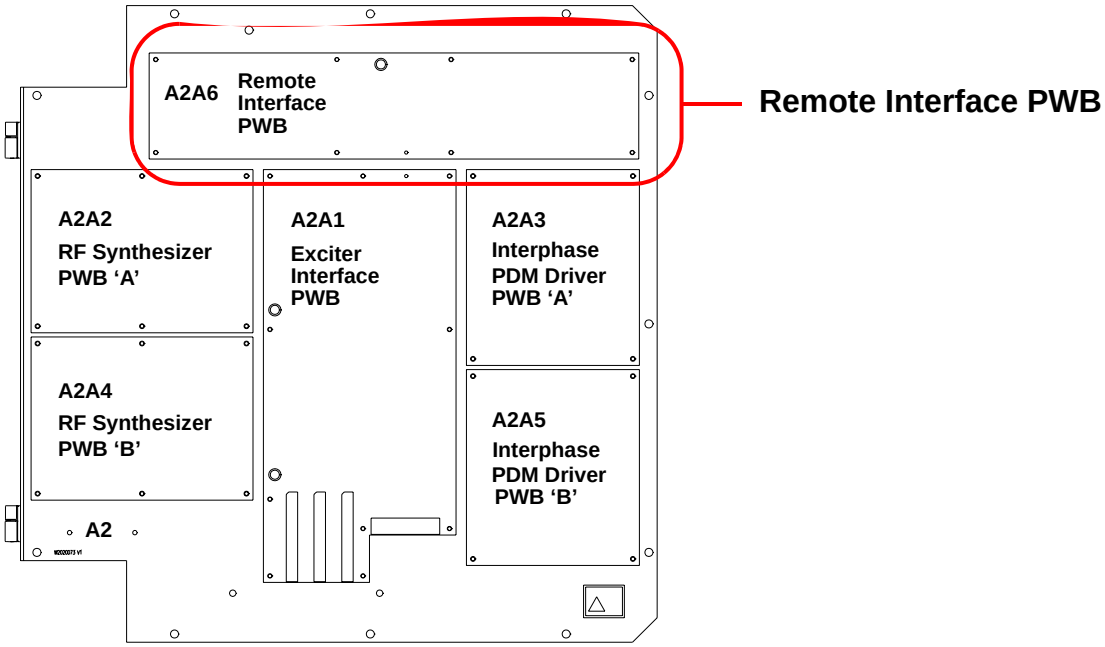
Ext. interlock open

An **Ext. Interlock Open** alarm indicates an external interlock is open. It will be accompanied by a **Shutback** alarm.

The external interlock input is wired to the remote interface PWB by the end user and triggered by the conditions that they set (e.g., the state of the door to the transmitter room).

1. Gain access to the **Exciter Panel** assembly (Figure 1.1) by opening the door containing the GUI and control panel on the front of the transmitter. The door is not latched and just swings open to the left.

Figure 1.2: XR6/XR3 Exciter Panel Assembly (NAE93 – A2)



2. Connect a digital multimeter (set to measure dc) between TB1-2 (EXT INTLK) of the remote interface PWB and ground.

3. If 24 V is present on TB1-2, the external interlock circuit is intact and the probable cause of the alarm is a defective monitoring circuit. Suspect the remote interface PWB or the control/display PWB.

4. If 24 V is not present on TB1-2, measure the voltage between TB1-17 (EXT +24V OUT) of remote interface PWB and ground, then between TB1-1 (EXT INTLK) and ground.

5. If 24 V is present on TB1-1 and TB1-17, the external interlock circuit is open (normally caused by an open interlock switch).

Low B+ voltage

A Low B+ Voltage alarm is triggered when the B+ voltage falls below its factory-set threshold of about 250 V (B+ = 315 V), 150 V (B+ = 190 V) or 91 V (B+ = 115 V) for 3-phase XR6; 177 V (B+ = 220 V) or 91 V (B+ = 115 V) for 3-phase XR3; 250 V (B+ = 315 V), 155 V (B+ = 196 V), 91 V (B+ = 115 V) or 55 V (B+ = 69 V) for 1-phase XR6; or 175 V (B+ = 220 V), 155 V (B+ = 196 V), 91 V (B+ = 115 V) or 55 V (B+ = 69 V) for 1-phase XR3.

Besides being noted on the status screen and the System Diagram, this alarm causes a shutback, the Softstart relays to open, and the fan and RF drive power supplies to turn off.

Recovery from a **Low B+ Voltage** alarm is automatic when the B+ voltage rises above 265 V (B+ = 315 V), 160 V (B+ = 190 V) or 97 V (B+ = 115 V) for 3-phase XR6; 187 V (B+ = 220 V) or 97 V (B+ = 115 V) for 3-phase XR3; 265 V (B+ = 315 V), 165 V (B+ = 196 V), 97 V (B+ = 115 V) or 59 V (B+ = 69 V) for 1-phase XR6; or 185 V (B+ = 220 V), 165 V (B+ = 196 V), 97 V (B+ = 115 V) or 59 V (B+ = 69 V) for 1-phase XR3. The recovery process is the same as the power on process.



NOTE:
While RF power is enabled, the transmitter will automatically switch B+ voltages, as required, to maintain low distortion.

If transmitter does not automatically recover from this alarm, the low B+ voltage is normally caused by low ac input voltage, improper primary taps on the power transformer, or a faulty rectifier assembly. Troubleshoot a **Low B+ Voltage** alarm as follows.



WARNING:
LETHAL VOLTAGES EXIST IN THE POWER SUPPLY SECTION OF THE TRANSMITTER.

1. Check the B+ voltage on the transmitter's diagnostic display's **Meters** screen. If it is less than 90% of desired, the ac power source voltage or power transformer tap selection is suspect.

2. Measure the ac input voltage and verify the power transformer is tapped as shown in Section 3, "Installing the power transformer" on page 3-1 of the *XR6/XR3 Installation Manual*.

3. If the transformer taps are correct, the monitoring circuit is suspect. Contact Nautel for troubleshooting information.

High B+ voltage

A **High B+ Voltage** alarm is reported when the B+ voltage goes above 380 V, but no other action is taken automatically.

The alarm is normally caused by high ac input voltage, or incorrect primary taps on the power transformer. Troubleshoot a **High B+ Voltage** alarm as follows.

1. Check the B+ voltage on the transmitter's front panel. If the voltage is greater than 110% of desired, continue to Step 2.

2. Measure the ac input voltage and verify the main power transformer is tapped as shown in Section 3, "Installing the power transformer" on page 3-1 of the *XR6/XR3 Installation Manual*.

3. If the transformer taps are correct, the monitoring circuit is suspect. Contact Nautel for troubleshooting information.

Fan P/S fault

The 48 V power supply used for the fans is monitored and will report a fault if the voltage is outside the range of 48 V ± 10%.

1. Check for accompanying alarms in the **Status** screen. If there is a **LVPS Fault**, troubleshoot it first (see LVPS fault).

2. Measure the voltage between R48-LHS and ground on the distribution PWB. If it is within the range of 48 V ± 10%, recalibrate the 48 V supply to read the measured voltage (see "Calibrating meters" on page 2-19 of the *Operating and Maintenance Manual*). Otherwise replace power supply U2.

RF drive P/S fault

The 62 V dc power supply used for the RF drive is monitored and will report a fault if the voltage is outside the range of 62 V ± 10%.

The alarm could result from a fault in the RF drive power supply PWB, or faulty detection circuitry on the RF drive power supply PWB. Troubleshoot an **RF Drive P/S Fault** alarm as follows.

1. Check for accompanying alarms in the **Status** screen. If there is a **LVPS Fault** or **Fan P/S Fault**, troubleshoot it first (see LVPS fault or Fan P/S fault).

2. Measure the voltage between R50-RHS and ground on the distribution PWB. If it is outside the range of 62 V ± 10%, adjust the RF drive power supply PWB's **VOLTAGE CONTROL** potentiometer R3 to restore the voltage within its acceptable range.

3. If the input voltages are satisfactory, and the output cannot be adjusted to the required level, suspect the RF drive power supply PWB.

4. If the output voltage is within 62 V ± 10%, and the alarm persists, recalibrate the RF drive power supply to read the measured voltage (see "Calibrating meters" on page 2-21 of the *Operating and Maintenance Manual*).

LVPS fault

The 24 V, 15 V, -15 V and 5 V power supplies are monitored and will report a fault if the voltage is outside the range of ± 10%. One or more of these faults will result in only one **LVPS Fault** message on the **Status** screen, though each one would be reported by the **Events Log**.

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 circuit on the control/display PWB. Troubleshoot a **LVPS Fault** as follows:

1. On the control/display PWB, measure the following. If any readings are outside ± 10%, suspect a problem in the low voltage power supply.
   - 5 V on TP9
   - 15 V on TP12
   - 24 V on TP18
   - -15 V on TP20
2. If the voltages in Step 1 are correct, recalibrate each of the voltages to read the measured voltages (see "Calibrating meters" on page 2-21 of the *Operating and Maintenance Manual*).
3. Measure the voltage between R46-RHS and ground on the distribution PWB. If it is outside the range of 15 V ± 10%, replace power supply U4.

VSWR ALARM

An output networks VSWR alarm indicates the reflected power is higher than normal. When VSWR reaches 1.5:1, the transmitter will shutback the RF output power to prevent damage.

An output network VSWR alarm can be caused by excessive reflected power, a fault in the forward/reflected power probe assembly or a fault in the system control PWB's alarm circuitry. Troubleshoot a VSWR alarm as follows.



NOTE:
A VSWR alarm will always cause a SHUTBACK. If the problem occurs three times within five seconds, the transmitter shall be in CUTBACK mode to reduce RF output power until the VSWR alarm no longer exists.

1. Read the forward and reflected power from the diagnostic display's **Meters** screen. If the forward power has been reduced and the reflected power meter indicates reflected power, there may be a matching problem between antenna and transmitter (de-tuned load, arcing or poor bandwidth.
2. Perform a visual inspection of the antenna feed line and antenna and correct any obvious problems that can cause excessive reflected power.

3. If there are no obvious problems between transmitter and antenna, measure the voltage at TP1 and TP2 of the control/display PWB. If the voltage at TP2 is greater than 30% of TP1, suspect the forward/reflected power probe. Otherwise suspect the control/display PWB.

Total power limit

This fail is triggered when the product of the B+ (dc) voltage and the dc current is greater than the limit set in software. For the XR6 the threshold is 11 kVA. For the XR3 the threshold is 5.5 kVA. This fail causes an immediate cutback (power reduction), but not a shutback.

Mod driver fail A

This alarm is reported to the microcontroller only if exciter A is selected. If the exciter transfer function is set to *auto* then the microcontroller will attempt a changeover to exciter B. If it cannot or if the exciter transfer function is set to manual, then this fault will cause a shutback.

This alarm indicates the PDM duty cycle of exciter A's modulator drive is too high. Try to reset the alarm. If the alarm persists, proceed to the steps listed in "PDM drive fail".

Mod driver fail B

This alarm is reported to the microcontroller only if exciter B is selected. If the exciter transfer function is set to *auto* then the microcontroller will attempt a changeover to exciter A. If it cannot or if the exciter transfer function is set to manual, then this fault will cause a shutback.

This alarm indicates the PDM duty cycle of exciter B's modulator drive is too high. Try to reset the alarm. If the alarm persists, proceed to the steps listed in "PDM drive fail".

PDM drive fail

This fault indicates that the PDM drive is inoperative. If the exciter transfer function is set to *auto*, then the microcontroller will attempt an exciter changeover to the other side. If it cannot complete an exciter changeover, or if the exciter transfer function is set to *manual*, then this fault will cause a shutback.

A PDM Drive Fail alarm indicates that the PDM drive signal's duty cycle is too low (pulse width too narrow). It may be caused by a fault on the interphase PDM driver PWB or the control display PWB's alarm circuitry. Troubleshoot a PDM Drive Fail alarm as follows:

1. The PDM Drive Fail alarm initiates an automatic exciter changeover to the standby exciter. To troubleshoot a defective exciter circuit, set changeover to manual as detailed in "Changing automation settings" in the *Operating and Maintenance Manual*.

2. If the transmitter successfully switched to the standby exciter, suspect the main exciter's interphase PDM driver PWB.

3. Use an oscilloscope to measure the voltage at TP6 on the interphase PDM driver PWB. The indication should have a dc offset of 1.4 V ± 10%. If not suspect the remote interface PWB or the IBOC/DRM exciter if you are operating in all-digital (HD) mode.

4. Measure the dc voltage at TP1 of the interphase PDM driver PWB. If the voltage is either 0 V (and transmitter not shut back) or 15 V, suspect the control/display PWB.

5. Use an oscilloscope to measure TP2 of the interphase PDM driver PWB. The signal should be a square wave at the transmitter's $2f_{PDM}$ frequency (nominal 130 kHz). If not, suspect the RF synthesizer PWB.

6. Measure the dc voltage at TP3 on the interphase PDM driver PWB. The voltage should be the B+ voltage multipled by 0.02 ± 10%. If not, suspect the wiring to the B+ distribution PWB or the exciter interface PWB.

7. If no faults were found in the previous steps, suspect the control/display PWB.

Auto changeover

This event is caused by a fault in the active exciter with the Auto Changeover function enabled. Faults that cause exciter changeovers are: Mod Driver Fail A/B, RF Driver Fail and PDM Drive Fail.

- This event triggers the Changeover LED to light, and it will remain lit until manually cleared.

- No further auto changeovers are possible until the alarm is cleared.

- The alarm can be cleared remotely by re-selecting the active exciter.

- The alarm can be cleared locally by use of the Preset screen.

An Auto Changeover alarm indicates that the standby exciter is operating and that the transmitter has switched from main exciter to standby exciter. The Auto Changeover alarm may be caused by a fault in the transmitter that initiated an automatic exciter changeover, or a fault in the control/display PWB's microprocessor or alarm circuit. Troubleshoot the Auto Changeover alarm as follows:

1. Check the Events Log to determine the possible cause of the exciter changeover.

2. Troubleshoot any alarms recorded in the Events Log to determine the cause of the exciter changeover.

RF driver fail

This fault indicates a problem with the RF drive on the current exciter. If the exciter transfer function is set to *auto* then the microcontroller will attempt an exciter changeover to the standby exciter. If it cannot complete an exciter changeover, or if the exciter transfer function is set to *manual*, then this fault will cause a shutback.

An **RF Driver Fail** alarm indicates an incorrect voltage waveform in the RF drive buffer PWB. The alarm could result from a failure in the RF drive buffer PWB, RF synthesizer PWB, or in the control/display PWB's alarm circuitry. Troubleshoot an **RF Driver Fail** alarm as follows:

1. The **RF Driver Fail** alarm initiates an automatic exciter changeover to the standby exciter. To troubleshoot a defective exciter circuit, set changeover to manual as detailed in "Changing automation settings" in the *Operating and Maintenance Manual*.

2. Use an oscilloscope to measure TP7 of the RF synthesizer PWB. The signal should be a 15 volt peak-to-peak square wave at the carrier frequency. If the signal is present, suspect the RF drive buffer PWB. Otherwise suspect the RF synthesizer PWB.

3. Use an oscilloscope to measure TP2 of the RF drive buffer PWB. The signal should be a 15 volt peak-to-peak square wave at the carrier frequency. If the signal is present, suspect the RF drive buffer PWB.

4. Measure the dc voltage at TP1 of the RF drive buffer PWB. If the voltage is less than 0.6 V, suspect the control/display PWB or transistor Q1 on the RF drive buffer PWB.

Cutback level (1-8)

Should there be three shutbacks within five seconds, the transmitter will enter a power reduction mode called a cutback.

There are eight levels of cutbacks, the last being a reduction to no forward power whatsoever. At any given cutback level, there is a predefined time limit that must expire before the cutback level is reduced to the previous level. If there are no further cutbacks, this process continues until Level 0 (normal) is reached.

The cutback recovery process can be overridden by adjusting the power (up or down), or by pressing **Reset** on the **Status** screen.

A Cutback Level (1-8) status indicates that several shutback alarms (at least three shutbacks in five seconds) have occurred. A cutback alarm may be triggered by a fault in the transmitter, large VSWR, or a fault in the control/display PWB's microprocessor or alarm circuitry. Troubleshoot a cutback alarm as follows:

1. Read the RF output power level on the RF KILOWATTS meter on the transmitter's front panel.

2. Press/release the Control - Power Increase switch to clear the cutback alarm and to restore the preset power level. If the fault persists, the output power will automatically cut back again. Observe the Events Log and note which alarm is causing shutback. Refer to the appropriate troubleshooting paragraph in this section.

Ext. PDM inhibit

The external PDM inhibit is wired to the remote interface PWB.

An Ext. PDM Inhibit alarm indicates that an external PDM inhibit command is present. The alarm could be caused by an short circuit in the external wiring path to the remote control PWB, a fault in the switching circuitry on the remote interface PWB, or a fault in the alarm circuitry on the control/display PWB. Troubleshoot an Ext. PDM Inhibit alarm as follows:

1. If E19 is between pins 2 and 3, verify the dc voltage between TB2-6 and ground on the remote interface PWB is approximately 24 V. This signifies there is no external PDM inhibit command.

2. If E19 is between pins 1 and 2, verify the dc voltage between TB1-3 and TB2-6 on the remote interface PWB is 0 V. This signifies there is no external PDM inhibit command.

3. If the conditions in Step 1 and Step 2 are met, suspect the remote interface PWB or the control/display PWB.

Int. serial fail

This alarm indicates that there is no communication with the remote interface PWB. This alarm is triggered if two seconds go by without acknowledgement from the remote interface PWB of the control/display PWB's request for information. (The control/display PWB requests updates from the remote interface PWB every 200 ms).

1. Check the cable between connector P1 (mates with J1 of the control/display PWB) and connector P15 (mates with J13 of the remote interface PWB). If the cable and connections are intact, suspect a problem with the control/dispaly PWB or remote interface PWB.

Mod. protection

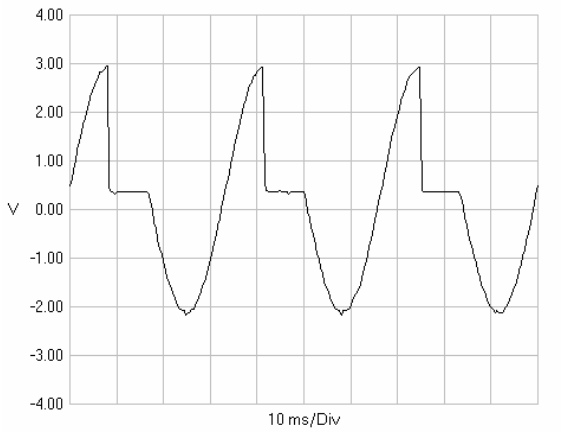
This fail is reported from the remote interface PWB.

The exciter monitors a sample of the RF output and conditions the modulator outputs if the RF drive current becomes great enough to damage the modulators. A **Mod Protection** alarm may occur from overdriving the transmitter (high output power, high modulation depth, or very low modulating frequency), a fault in the control/display PWB's alarm circuitry, or a fault in the remote interface PWB's circuitry. Troubleshoot a **Mod Protection** alarm as follows:

1. Examine the operating conditions under which the alarm occurred. A **Mod Protection** alarm may be initiated if the transmitter is running at rated power with high modulation at a low modulating frequency. If these conditions were present at the time of the alarm, adjust the modulating audio low frequency roll off to 30 Hz.

2. Use an oscilloscope to view TP6 on the interphase PDM driver PWB. If the transmitter is operating at rated power and the audio is clipped (see Figure 1.3), complete "Modulation Peak Limiting" on page 5-5 of the *XR6/XR3 Operating and Maintenance Manual*.

Figure 1.3: Chopper Control Waveform
Audio = 30Hz (AC Coupled)



Softstart active

The softstart relays are initially open for 1.6 seconds when the transmitter's power is first turned on. The software should close the relays after 1.6 seconds and clear this alarm. While active, this alarm causes a shutback and inhibits the RF drive and fan power supplies. The **Softstart Active** alarm should be accompanied by a **B+ Relay Open** alarm.

SoftStart OverTemp

The software keeps track of the calculated temperature of the softstart relays and triggers this fault if that value is greater than 150°C. While this fault is on, RF power is not available. The temperature is assumed to rise 20°C for each cold start and 10°C for each warm start. The temperature falls exponentially as calculated by the software. The temperature estimate decays over time. When the temperature falls below 150°C, the alarm clears on its own.



CAUTION:
Performing a warm or cold start while the SoftStart OverTemp fail is active is strongly discouraged.

Low backup battery

The voltage of the backup battery has fallen below an acceptable level. Replace the battery on **XBT1** of the control/display PWB (A1A1). This battery should be replaced while ac power is on. Should ac power fail without adequate battery power, then the **Events Log** and **Real Time Clock** will be cleared.

The fault may be caused by a weak battery, or a fault in the detection or alarm circuitry on the control/display PWB. If the alarm remains after the battery is replaced, suspect the control/display PWB circuitry.



NOTE:
Batteries should be replaced once a year or as soon as weak batteries cause the **Low Backup Battery** *alarm to turn on. This helps prevent chemical dripping from an old battery, and to ensure adequate backup voltage for the control/display PWB's microcontroller when the ac power is turned off.*

Removing and reinstalling RF power modules

Removing an RF power module

Refer to Figure 1.4 on page 1-21, and Figure 1.5 on page 1-23 for this procedure.

> *NOTE:*
> *The RF power module will shut down when the* RF FAIL *or* INHIBIT/TEMP *alarms are registered on its front panel.*

1. **An RF power module must be inhibited prior to its removal from the transmitter.** Press and then release the module's INHIBIT switch on the bottom of the module's front panel.

   - Make sure that the module's INHIBIT/TEMP alarm LED at the top of the module's front panel turns on.

2. Disconnect the cable from J1 at the bottom of the module's front panel. You should hear a relay in the rear of the transmitter drop out (turn off). If the module is a spare module that was not selected for operation, no relay dropout will be heard.

3. Remove both mounting screws from the top of the module's front panel.

4. Remove the mounting screw behind J1 at bottom of the module's front panel.

5. If the packing bolt at the rear of the module has not already been removed, press RF Off, switch off ac power, remove the upper transmitter cover, then remove the packing bolt. Make sure to replace the cover before restoring ac power and RF On status.

6. Grasp the handle on the front of the module, carefully pull the module forward, and grasp the cutout in the top of the module's rear panel. Carefully lift the module out of the transmitter.

> WARNING:
> The RF power module weighs approximately 20 kg (42 lbs.). Use care when lifting the module.

Figure 1.4: RF Power Module

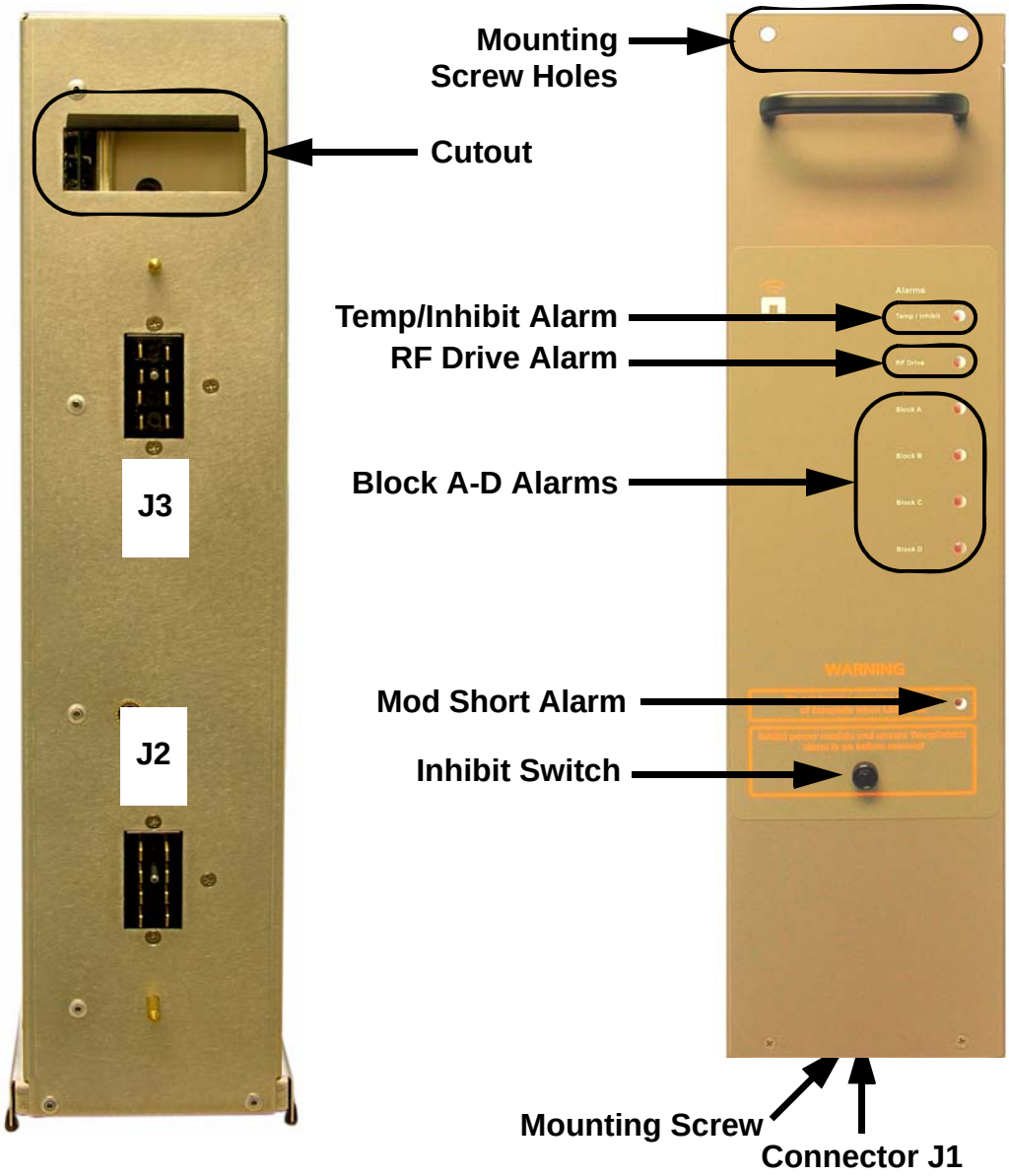
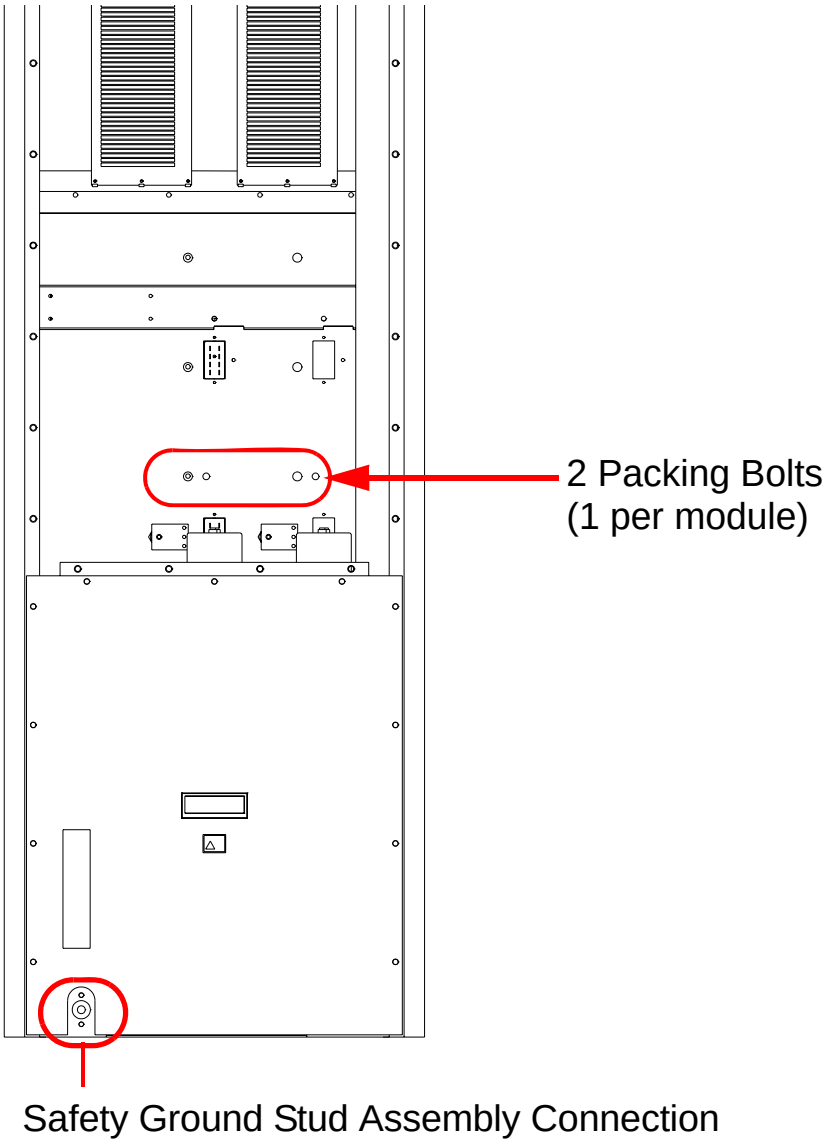


Figure 1.5: XR6/XR3 Transmitter - Rear View



Installing an RF power module

Refer to Figure 1.4 on page 1-21, and Figure 1.5 on page 1-23 for this procedure.

1. Verify that the RF power module has been tuned to the carrier frequency (see "RF drive tuning check" on page 1-35).

2. Grasp the handle on the front of the power module and the cutout in the top of the module's rear panel. Carefully lift the module and insert it into the transmitter.

> **WARNING:**
> **The RF power module weighs approximately 20 kg (42 lbs.). Use care when lifting the module.**

3. Carefully align the guide pins and the rear panel connectors, then push the power module firmly into place.

   - The **INHIBIT/TEMP** or other RF power module alarm LEDs may turn on.

4. Install the mounting screw behind J1 at the bottom of the power module's front panel.

5. Install both mounting screws into the top of the power module's front panel.

> **CAUTION:**
> **Do not connect a cable to J1 on the RF power module if the front panel LED next to the text "Do not insert connector at bottom of faceplate when LED is on" is flashing.**

6. Connect the cable removed in Step 2 on page 1-20 to J1. You should hear a relay in the rear of the transmitter pick up (turn on). If the module is a spare module that was not selected for operation, no relay pickup will be heard.

7. In the **Status** menu on the front panel GUI, press **Reset** to reset the RF power modules.

Troubleshooting RF power modules

Maintenance philosophy

Independent testing of an RF power module at the normal B+ voltage and RF power ratings requires specialized test equipment that is not available outside of the factory. Therefore, an optional RF power module test cable can be provided for testing and troubleshooting an RF power module outside of the transmitter.

An RF power module may be connected to the transmitter's integral RF power module test circuitry via a test cable, and serviced outside of the transmitter on an external work surface. In this test setup, the B+ voltage is restricted to 48 V. This voltage is not considered hazardous to maintainers, but can produce minor skin burns. Also, the resultant, low-level, RF output is applied to a test load and does not contribute to the transmitter's RF output.

NOTE:
Host transmitters have a built-in RF power module test capability. If the transmitter has more than one RF power module, an RF power module may be tested without affecting the transmitter's on-air status.

Special Tools and Test Equipment

The following test equipment and cables are required to troubleshoot an RF power module.

Power Module Test Kit

The power module test kit (Nautel part # 202-5015) is required to use the transmitter's integral test circuits. It is optionally provided by, or available from, Nautel. It contains:

- RF power module test cable (Nautel part # 202-5010).
- RF power module test load (Nautel part # 176-5720-01).

Test Equipment

Minimum required test equipment:

- A digital multimeter.
- A dual-channel oscilloscope with two 10X probes.

NOTE:
If the digital multimeter does not have diode checking capability, a dc voltage source (9 V dc battery) is required to turn on MOSFETs during troubleshooting procedures.

Special Tools

Required special tools:

- A torque wrench with a torque range of 0.0 to 2.26 N-m (0 - 20 in.-lbs). Required for installing MOSFET attaching hardware.
- A 5 mm (0.197 in.), hex, thin-walled socket, with the same size drive as the torque wrench. The outside diameter of the socket must be less than 7 mm (0.275 in.).
- A 5 mm (0.197 in., hex nut driver. The diameter of the outside wall must be less than 7 mm (0.275 in.).
- A 2.5 mm (0.098 in.), hex screw driver (Nautel part # HAZ65), included in the ancillary kit.

Electrostatic Precautions

The RF power module contains semiconductor devices that are susceptible to damage from electrostatic discharge. Be sure to follow the electrostatic precautions in "Electrostatic protection" on page 1-3 at all times.

Fault Alarm Response

If possible, determine which LEDs on the front of the RF power module were turned on prior to its removal from the transmitter.

- If it is not known which front panel LEDs were on, or if none were on, proceed to "Preparation for testing" on page 1-26.
- If the RF Drive LED was on, connect the module to the test cable (see "Test cable connection" on page 1-29) and perform the "RF drive tuning check" on page 1-35. If the problem persists after tuning, suspect the module's RF drive control PWB.
- If the Temp/Inhibit LED was on, connect the module to the test cable (see "Test cable connection" on page 1-29) and perform the "Temp/inhibit check" on page 1-35.
- If one or more Block LEDs were on, proceed to "Preparation for testing" on page 1-26.

Preparation for testing

1. Follow the procedure in "Removing an RF power module" on page 1-20 to remove the power module from the transmitter.

2. Place the RF power module on a suitable work surface in close proximity to the transmitter's RF power module test circuit, so that the RF power module test cable can reach the power module.

3. Remove all seven screws from the RF power module's left and right covers. Remove covers.

Resistance measurements

Prior to connecting an RF power module to the test circuit, complete the following resistance measurements for each RF power block.

Refer to Table 1.3 and Figures MD-14 and MD-15 in the Mechanical Drawings section to identify the assemblies associated with a specific RF power block.

Table 1.3: Assemblies Associated with Each RF Power Block

RF Power Block	B+ Fuse	PDM Fuse	Modulator Assembly	Modulator Filter	PA Input/Output PWB	RF Amplifier
A	A14F1	A14F3	A5	A6	A8	A10/A11
B	A14F4	A14F5	A4	A7	A9	A12/A13
C	A14F6	A14F7	A16	A17	A19	A21/A22
D	A14F8	A14F9	A15	A18	A20	A23/A24

1. Remove fuse A14F1 from its holder and measure its resistance using the digital multimeter. A blown fuse will measure an open circuit.

2. Repeat Step 1 for the remaining B+ fuses (A14F4, A14F6 and A14F8), PDM fuses (A14F3, A14F5, A14F7 and A14F9) and the +15 V dc fuse (A14F2), noting which fuses are good and which are blown. Blown fuses indicate a fault in the associated power block.

3. Also check the RF drive B+ fuse (F1) on the RF drive control PWB (A1). A blown A1F1 fuse indicates a fault in the RF drive section of the RF drive control (PWB).

PA VOLTS TO GROUND IMPEDANCE

Measure impedance between the PA volts and ground for each RF power block:

1. Measure resistance between terminal H (PA volts input) of each PA input/output PWB and ground, using a digital multimeter.

2. Each of the resistance measurements in Step 1 should be a nominal 77 kΩ If all measurements are satisfactory, proceed to "PA volts to B+ impedance" on page 1-28.

3. If any resistance measurement in Step 1 is less than 77 kΩ, disconnect connector P1 from J1 of the RF drive control PWB and repeat the resistance measurement.

4. Each resistance measurement in Step 3 should be open circuit. If they are now satisfactory, an impedance problem exists in the RF drive control PWB's PA volts circuit.



CAUTION:
The heat sinks of modulator assemblies and RF amplifiers are coated with a film of thermal compound. Use care to ensure the film does not become contaminated with foreign particles.

When installing an assembly, visually inspect the mating surfaces of its heat sink and the module's chassis. Ensure both surfaces are coated with a thin film of thermal compound. Ensure foreign particles that may affect thermal transfer are not embedded in the compound.

5. If a resistance measurement in Step 4 is not satisfactory, sequentially remove the modulator assembly and both RF amplifiers associated with the suspect RF power block (see Table 1.3 on page 1-26) and note the resistance measurement as each assembly is removed.

   - If a resistance measurement indicates an open circuit after the removal of an assembly, do not remove any additional assemblies. Assume the last assembly removed is defective.

   - Reinstall other removed assemblies (if any) for the RF power block being tested and note the resistance measurement as each assembly is installed. If the resistance measurement is unacceptable after the installation of an assembly, assume the assembly is defective and replace it (see "Modulator assembly replacement" on page 1-46 or "RF amplifier assembly replacement" on page 1-47).

6. Reinstall removed assemblies, using repaired or serviceable replacement assemblies.

   - If connector P1 was disconnected from J1 of the RF drive control PWB, reconnect it.

7. Restart impedance checks at Step 1.

PA volts to B+ impedance

Measure impedance between the B+ volts input and the PA volts output for each RF power block:

1. Measure the resistance between terminal H (PA volts) of each PA input/output PWB and its associated B+ fuse.

2. Each resistance measurement in Step 1 should be about 230 kΩ with the red meter lead on the H terminal, and about 400 kΩ with the black meter lead on the H terminal. If all measurements are satisfactory, proceed to "Functional test procedures" on page 1-28.

3. If any resistance measurement in Step 1 is greater than 1.0 MΩ, assume the modulator assembly associated with the RF power block is defective (contains defective MOSFETs). Replace the suspect modulator assembly (see "Modulator assembly replacement" on page 1-46).

4. Reinstall removed modulator assemblies, using serviceable replacement assemblies.

5. Restart impedance checks at Step 1.

PA output to ground impedance

Using a multimeter set to measure ohms, measure the resistance from the C terminal (+ or -) to ground, and the G terminal (+ or -) to ground, on all four PA input/output PWBs. If the module is cold, the resistance should measure about 1 MΩ or more. If the reading is near 0 Ω, the PA being measured contains shorted FETs and must be replaced or repaired. Replace the suspect PA assembly (see "RF amplifier assembly replacement" on page 1-47).

Functional test procedures

Perform a functional test to verify the status of suspect or repaired RF power modules as follows:

1. Verify that all assemblies suspected of being defective – based on the status of the front panel Alarms lamps, or by failing an impedance test given in "Resistance measurements" on page 1-26 – have been replaced with a serviceable assembly.

2. Verify that all of the RF power module's electrical assemblies are properly installed, and all mating connectors are properly connected.

Test cable connection

Connect the RF power module to be tested to the transmitter's test circuit as follows:

> **WARNING:**
> **Although the module under test is connected to low-level voltages, its RF output can still exceed 500 volts peak-to-peak. This voltage can cause painful RF burns. Avoid contact with the test load while the module is operating on the test circuit.**

1. Connect the test load (Nautel part # 176-5720-01) to **J3** of the RF power module. **J3** is the upper connector on the rear of the power module (see Figure 1.4 on page 1-21).

2. Connect P4 of the test cable (Nautel part # 202-5010) to J2 of the RF power module to be tested, noting that J2 is the lower connector on the rear of the power module.

3. Connect P2 of the test cable to J5 (**RF DRIVE/TEST**) of the transmitter's RF drive buffer PWB (A15).

4. Connect P1 of the test cable to J11 on the transmitter's distribution PWB (A11).

> *NOTE:*
> *The test circuit's B+ supply (48 V) is protected by a thermistor (PTC). Measure the dc voltage on modulator fuse A14F1 once the test cable's P3 is connected to the module's J1 connector. If there is a shorted modulator installed in the module, the voltage reading will be near 0 V. Repeat all of the checks in "Resistance measurements" on page 1-26.*
>
> *The test circuit's RF drive supply is protected by a thermistor (PTC). Measure the dc voltage on RF drive control PWB fuse A1F1 once the test cable's P3 is connected to the module's J1 connector. If there is a problem with the RF drive section of the RF drive control PWB, the voltage reading will be near 0 V. Repeat all of the checks in "Resistance measurements" on page 1-26.*

5. Connect P3 of the test cable to the module's J1 connector, noting that J1 is located on the bottom of the module near its front. The module will have to be placed on a table to allow access to J1. Ignore all alarm indications at this time.

NOTE:
The RF power module may be connected to the transmitter's test circuit without turning the transmitter off or interrupting its on-air operation.

The host transmitter must be turned on and its RF power stage must be enabled (its RF On *LED must be on) for dc voltages to be applied to the RF power module.*

Sufficient output power must be provided to allow the PDM signals, generated by the transmitter, to drive the module under test. Use an oscilloscope to measure the duty cycle on TP17 of the interphase PDM driver PWB. Increase power until the duty cycle is above 30%.

The RF power module's Block *(*A*,* B*,* C *and* D*) alarm LEDs will be on when the module is connected to the test circuit. This is normal operation and does not mean the modulators have failed. This false alarm is an indication that the modulator failure detector circuit is functioning, since the reduced test B+ voltage (48 V dc) is seen to be a modulator failure.*

6. Verify the test circuit is applying the dc voltages required by the RF power module. Use a multimeter to measure the dc voltages as tabulated in Table 1.4.

Table 1.4: Dc Voltages Provided By Transmitter

Test Point	Voltage
A14-F1	48 V
A1L1	24 V
A1L2	15 V
A1L3	5 V

7. Verify the alarm circuitry is operating properly by pressing Reset in the Status screen of the host transmitter's GUI. The Temp/Inhibit alarm should turn off, and the Block alarms should remain on. Then press the power module's Inhibit button and the Temp/Inhibit alarm should turn on.

   If the Temp/Inhibit alarm LED will not turn off and on as indicated, there is a fault with the alarm circuitry on the RF drive control PWB. This fault must be repaired before proceeding.

   If the RF Drive alarm LED remains on after Reset is pressed, proceed to "RF drive tuning

check" on page 1-35 to attempt tuning of the RF drive. If the RF Drive LED remains on after tuning, suspect the RF drive control PWB.

> *NOTE:*
> *If the test circuits B+ supply fails when the temporary jumper is installed in Step 8, suspect a failed power amplifier (NAA51A). Thermistor RT11 on the distribution PWB will limit the current available to the test circuit resulting in the 48 V going to near 0 V.*
>
> *Repeat the checks in "PA output to ground impedance" on page 1-28 to determine if there are any shorted PAs.*

8. Temporarily latch all of the protection/alarm circuits in their reset state by connecting a jumper between ground (TP3 or TP4) and TP2 on the RF drive control PWB.

9. All of the alarm LEDs, including the Block (A, B, C and D) alarm LEDs, shall turn off.

MODULATOR CHECKS

Measure the filtered PA volts output of each modulator, which is controlled by the on-time of the PDM input. The PA volts for each RF power block should be a percentage of the B+ (48 V) being applied to the associated modulator assembly. The output voltage of all four modulators should be within 1.5 V of each other. If one voltage measures low or high, suspect the associated modulator.

> *NOTE:*
> *Sufficient output power must be provided to allow the PDM signals, generated by the transmitter, to drive the module under test. Use an oscilloscope to measure the duty cycle on TP17 of the interphase PDM driver PWB. Increase power until the duty cycle is above 30%.*
>
> *The PDM input is a square wave with nominally equal on and off times. If the on time is 50% of each cycle, the PA volts would be 24 V (50% of the 48 V test B+ voltage).*

1. Measure the dc voltage between terminal H of each PA input/output PWB and ground, using a digital multimeter.

2. The voltage level depends on the PDM level being generated by the transmitter. If all measurements are satisfactory, proceed to "RF amplifier checks" on page 1-32.

3. If any voltage measurement in Step 1 is not satisfactory, assume the modulator assembly for the RF power block associated with the unsatisfactory measurement is defective. Replace the suspect modulator assembly (see "Modulator assembly replacement" on page 1-46).

4. Install a serviceable modulator assembly in each vacant modulator assembly position.

5. Repeat PA volts checks for RF blocks that required repairs.

RF AMPLIFIER CHECKS

Verify the RF amplifiers in each RF power block are functioning and producing an RF output.

1. Connect the oscilloscope's **A** probe to the test load's **TP2** and connect the probe's ground to the power module's chassis. Connect the oscilloscope's **B** probe to the test load's **TP1** and the probe's ground to the power module chassis.

> *NOTE:*
> *Power amplifiers (PAs) A10, A11, A12 and A13 are being viewed on the oscilloscope's channel* **A** *and PAs A21, A22, A23 and A24 are being viewed on the oscilloscope's channel* **B**.

2. The indication on the oscilloscope should be a ringing square wave at carrier frequency with a peak-to-peak voltage of about 400 volts. The indication on both traces (**A** and **B**) should be almost identical. If they are not almost identical, or the peak-to-peak voltage is not about 400 volts, suspect a problem with one or more PAs.

> CAUTION:
> **DO NOT** connect the oscilloscope test probes between the (+) terminations for the **C** and **G** outputs of a PA input/output PWB.
>
> If the oscilloscope probe's ground lead, which is usually referenced to ground, is connected to either the (+) or (-) **C** or **G** outputs, irreversible damage to the MOSFETs in the PAs can occur. The probe's ground lead **MUST** only be connected to the module's chassis.

3. To check the output of individual PAs, connect one scope probe to the **C** (+) and the probe's ground lead to chassis, connect the oscilloscope other probe to the **C** (-) and the probe's ground to chassis on the PA input/output PWB for the suspect PA. Both waveforms shall be a rectangular wave, 0 to 24 V dc (assuming 50% duty cycle; actual peak voltage is 48 V x duty cycle), with channel **A** phase shifted 180^0 from channel **B**.

4. Repeat this procedure for the **G** terminals on the PA input/output PWB. Connect one scope probe to the **G** (+) and the probe's ground lead to chassis. Connect the oscilloscope's other probe to the **G** (-) on the PA input/output PWB for the suspect PA. Both waveforms shall be a rectangular wave, 0 to 24 V dc (assuming 50% duty cycle; actual peak voltage is 48 V x duty cycle), with channel **A** phase shifted 180^0 from channel **B**.

5. Repeat Step 3 and Step 4 for the remaining suspect PAs. If any C or G waveform is not satisfactory (rectangular wave, 0 to 24 V, assuming 50% duty cycle), the PA associated with the unsatisfactory waveform is defective and must be replaced (see "RF amplifier assembly replacement" on page 1-47).

6. Install a repaired or serviceable replacement PA in each vacant PA position, and then restart the tests at Step 1.



WARNING:
THE POWER MODULE MUST BE REMOVED FROM THE TRANSMITTER'S TEST CIRCUIT BEFORE ANY SUB-ASSEMBLY IS INSTALLED OR REMOVED FROM THE POWER MODULE. FAILURE TO DO SO CAN RESULT IN DAMAGE TO THE ELECTRONIC COMPONENTS IN THE POWER MODULE.

IT IS IMPORTANT TO REMOVE THE POWER MODULE FROM THE TEST CIRCUIT BY FOLLOWING STEP 7 THROUGH STEP 12 IN THE ORDER THEY ARE LISTED TO AVOID PERSONAL INJURY AND DAMAGE TO THE POWER MODULE.

The following steps list the proper sequence for removing the power module from the transmitter's test circuit.

7. Remove the jumper that connects TP2 to ground (TP3 or TP4) on the RF drive control PWB that was installed in "Test cable connection", Step 8. on page 1-31. The Block (A, B, C and D) alarm LEDs will turn on.

8. On the front of the power module under test, press the INHIBIT button. The TEMP/INHIBIT alarm LED will turn on.

9. Remove the test cable's P3 plug from the power module's J1 connector. J1 is the connector on the bottom of the power module near the front. Ignore all alarm indications.

10. Remove the test cable's P1 connector from the distribution PWB's J11 connector.

11. Remove the test cable's P4 plug from the power module's J2 connector. J2 is the lower connector on the rear of the power module.

12. If repairs of the power module are complete, remove the test load from the power module's J3 connector, and remove the test cable's P2 plug from the transmitter's RF drive splitter's J9 connector

    If repairs on the power module are not complete, the test load and the test cable's connection to the RF drive splitter can remain in place.

Figure 1.6: RF Power Module – Left Side

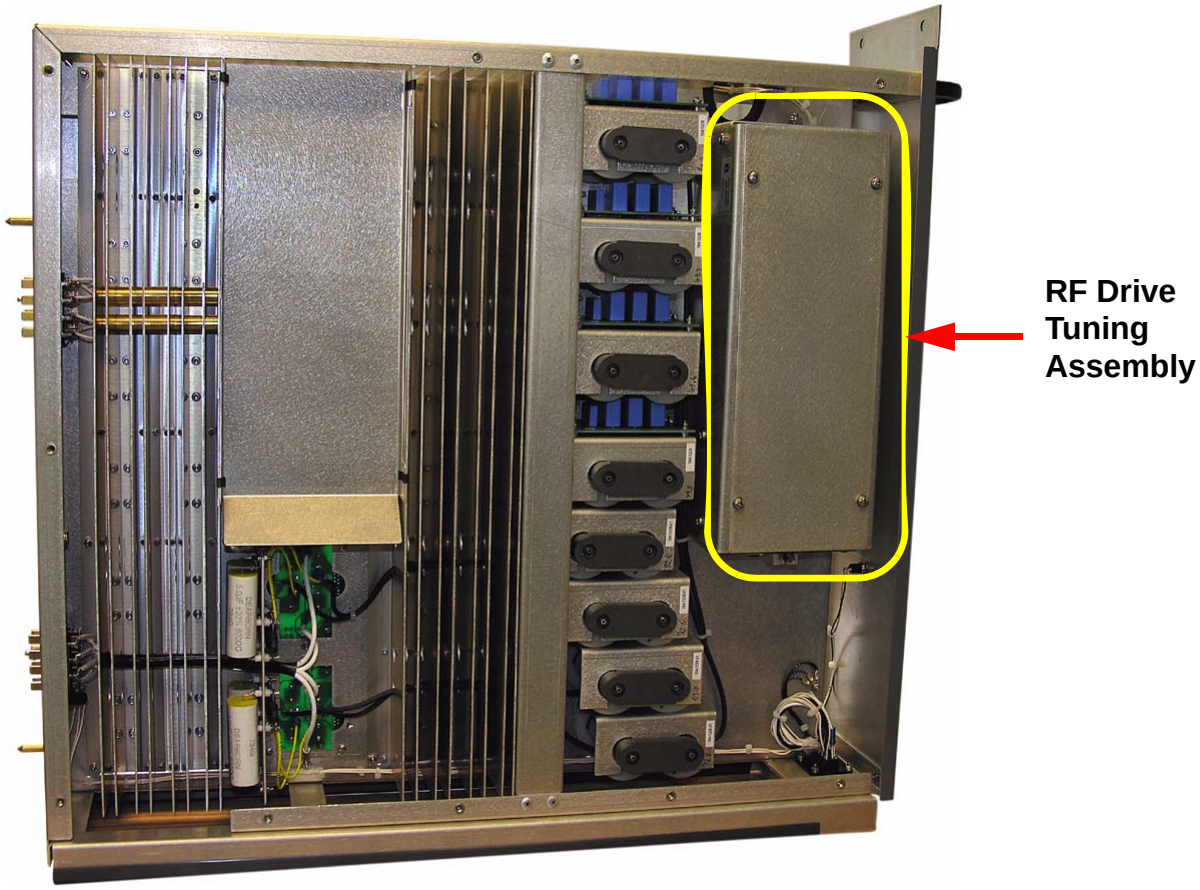


Figure 1.7: RF Drive tuning assembly – cover off



RF drive tuning check

Verify the RF drive tuning circuit is functional and the RF drive's tuned circuits are resonant, or can be tuned to resonance at the host transmitter's carrier frequency (*f* c).

Perform RF drive tuning check as follows.
See Figure 1.6 on page 1-34 and Figure 1.7 on page 1-34.

1. Remove the cover from the RF drive tuning assembly and loosen the locking hardware. Reinstall the cover.

2. Using an oscilloscope and 10X oscilloscope probes, monitor the RF voltage and RF current at TP14 and TP15 of the RF drive control PWB.

3. Adjust the RF drive tuning assembly's RF drive screw, using a 10 mm nut driver, until the zero crossing points of the two waveforms in Step 1 coincide.

4. Remove the jumper installed in "Test cable connection", Step 8. on page 1-31.

5. Remove the cover from the RF drive tuning assembly and tighten the locking hardware. Reinstall the cover.

Temp/Inhibit check

The Temp/Inhibit LED will turn on when the temperature of at least one heatsink exceeds 85°C. Troubleshoot a Temp/Inhibit alarm as follows:

1. Check the temperature of the RF amplifier/modulator heatsinks. If either heatsink is hot (approximately 85°C), suspect either a fan failure in the host transmitter or a frequency problem in the RF power module. See "RF drive tuning check" on page 1-35 in the case of the latter. If the heatsinks are cooler than 85°C, proceed to Step 2.

2. Measure the dc voltage at U3-3 of the RF drive control PWB (A1). The voltage should be greater than 20 V. If so, suspect the RF drive control PWB.

3. Measure the dc voltage at U2-6 of the RF drive control PWB (A1). The voltage should be greater than 5 V. If so, suspect the RF drive control PWB.

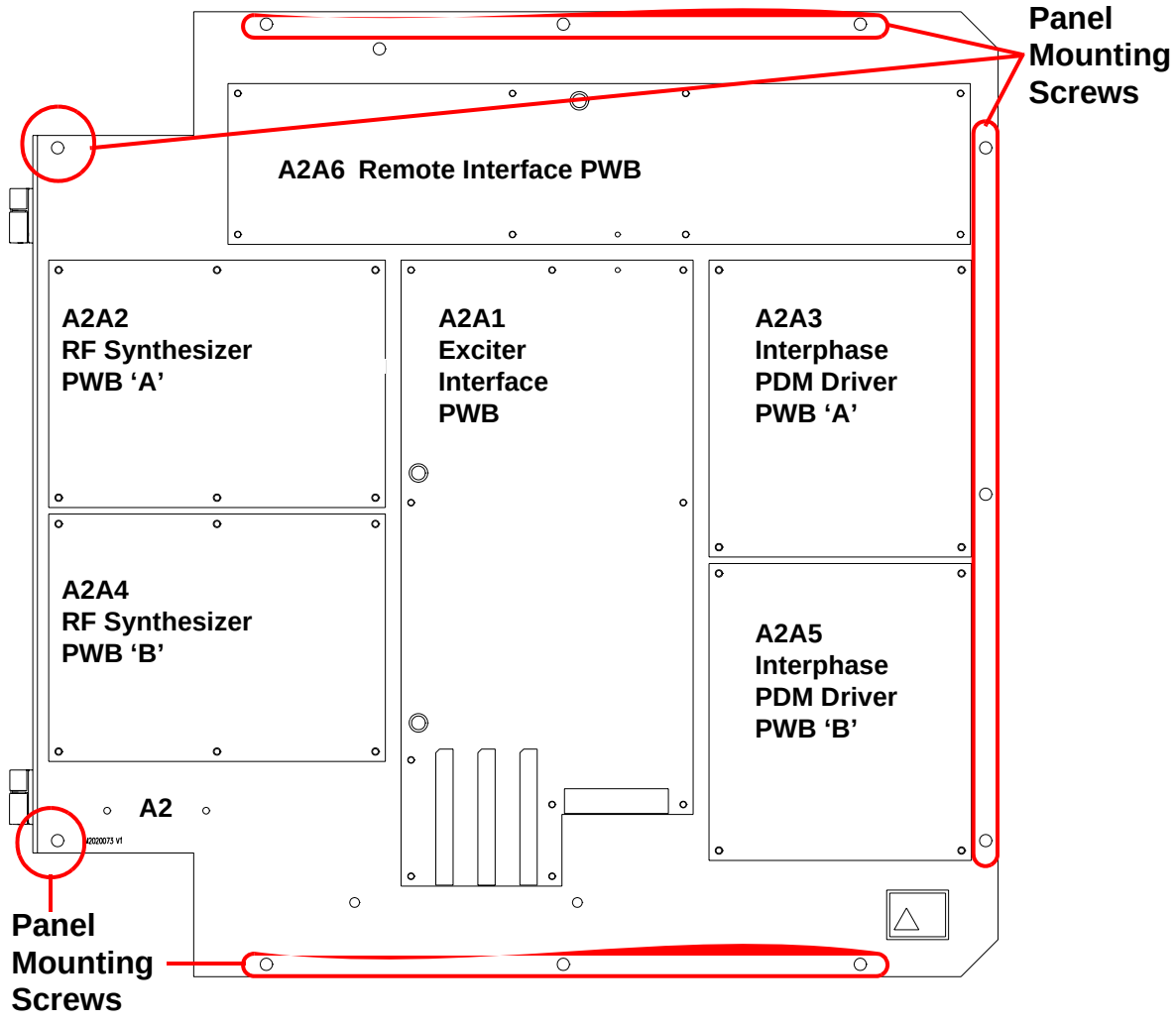
4. If the voltage in Step 3 is less than 5 V, suspect a fault with either thermistor RT1 or RT2, noting they are located above the RF amplifiers on the RF power module's chassis.

EXCITER PANEL AND PWB REMOVAL / REPLACEMENT

The exciter interface PWB (A2A1) physically interconnects with both RF synthesizer PWBs (A2A2 and A2A4), both interphase PDM driver PWBs (A2A3 and A2A5), and the remote interface PWB (A2A6).

> *NOTE:*
> *The remote interface PWB and interphase PDM driver PWBs that interconnect with the exciter interface PWB must be removed before the exciter interface PWB can be removed.*

Figure 1.8: XR6/XR3 Exciter Panel Assembly (NAE93 – A2)



Preparation



WARNING:
Lethal voltages exist inside the transmitter when the power is turned on. Turn off the power at the source and wait until the green LEDs on the B+ distribution PWB are off before removing any connections or PWBs (see Figure 1.9 on page 1-39).

Disconnect all the cables from the PWB(s) to be removed.
See Figure 1.8 on page 1-37.

Remote interface PWB replacement

1. Remove and retain eight sets of mounting hardware from the remote interface PWB (A2A6).

2. Pull the remote interface PWB away from the exciter interface PWB (A2A1). It may be helpful to gently pry the connector loose with a screwdriver.

3. Measure the resistance of the MAG GAIN (R127), AUDIO GAIN (R160), and MOD PROT THRESHOLD (R165) potentiometers on the defective PWB. Set the potentiometers on the replacement PWB to the same values.

4. Set the MAG (E18) and SINGLE/DIFF (E19) jumpers and AUDIO FILTER (S1:1 and S1:2) and BYPASS/GAIN (S2) switches on the replacement PWB to the same positions as the defective PWB.

5. Install the new remote interface PWB by reversing Step 1 and Step 2.

6. Reconnect all cables to the new remote interface PWB.

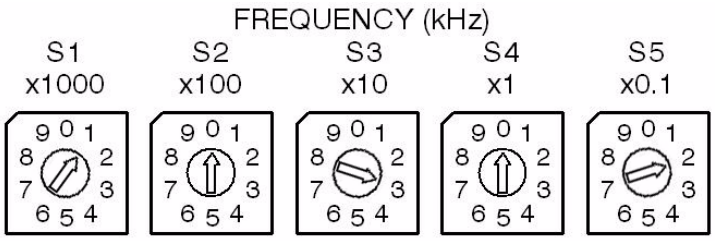
RF synthesizer PWB replacement

1. Remove and retain six sets of mounting hardware from the RF synthesizer PWB being replaced (A2A2 or A2A4).

2. Pull the RF synthesizer PWB away from the exciter interface PWB (A2A1). It may be helpful to gently pry the connector loose with a screwdriver.

3. Install the new RF synthesizer PWB by reversing Step 1 and Step 2.

4. Verify the carrier frequency has been properly selected on the new RF synthesizer PWB using binary coded decimal (BCD) switches S1 through S5. Each BCD switch represents one of the five most-significant digits in the carrier frequency, expressed in kHz, as follows:



- S1 is the thousands digit (x1000)
- S2 is the hundreds digit (x100)
- S3 is the tens digit (x10)
- S4 is the units digit (x1)
- S5 is the tenths digit (x0.1)

5. Set the **REF** (E1 and E2), **PDM** (E3), **SOURCE** (E4), **A-G** (E5) and **SYMMETRY ADJ** (E6) jumpers and switch S6 (S6:1 through S6:4) on the replacement PWB to the same positions as the defective PWB (see also "RF synthesizer PWB (NAPE70C)" on page 2-4). The **IPM BAL** potentiometer (R41) is not used and requires no adjustment.

6. Perform the "RF drive symmetry" adjustment procedure on page 5-4 of the *XR6/XR3 Operating and Maintenance Manual*.

INTERPHASE PDM DRIVER PWB REPLACEMENT

1. Remove and retain four sets of mounting hardware from the interphase PDM driver PWB being replaced (A2A3 or A2A5).

2. Pull the interphase PDM driver PWB away from the exciter interface PWB (A2A1). It may be helpful to gently pry the connector loose with a screwdriver.

3. Measure the resistance of the **GAIN TRIM** potentiometer (R31) on the defective PWB. Set the **GAIN TRIM** potentiometer on the replacement PWB to the same value. The **DUMP** potentiometer (R59) is not used and requires no adjustment.

4. Install the new interphase PDM driver PWB by reversing Step 1 and Step 2.

5. Perform the "Exciter Gain" adjustment procedure on page 5-5 of the *XR6/XR3 Operating and Maintenance Manual*.

Exciter interface PWB replacement

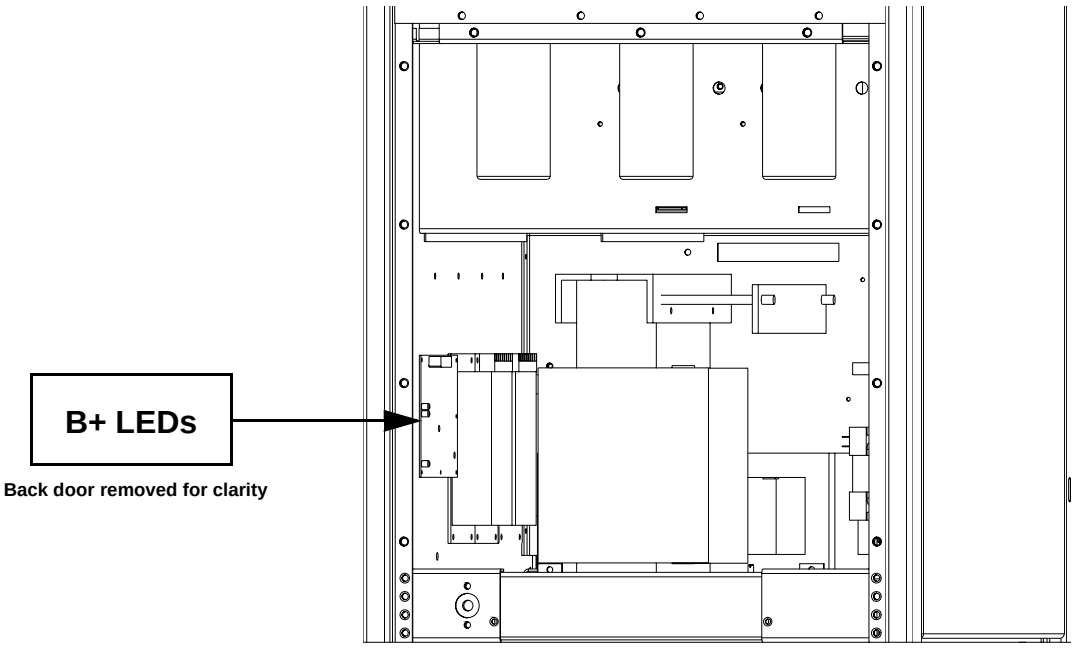
1. Remove the remote interface PWB (A2A6), both RF synthesizer PWBs (A2A2 and A2A4), and both interphase PDM driver PWBs (A2A3 and A2A5). It may be helpful to gently pry the connectors loose with a screwdriver.

2. Remove and retain nine sets of mounting hardware from the exciter interface PWB (A2A1).

3. Set the INT/EXT jumpers (E1 and E2) and NORM/TUNE switch (S2) on the replacement PWB to the same positions as the defective PWB.

4. Install the new exciter interface PWB by reversing Step 1 and Step 2.

Figure 1.9: B+ Status LEDs (seen through clear panel at back of transmitter)

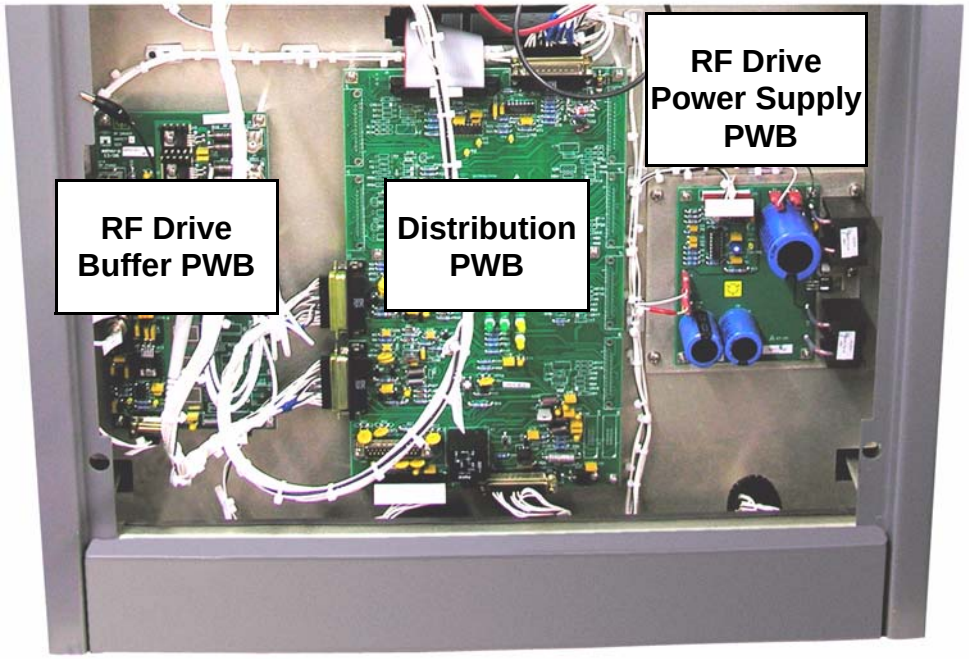


RF Drive Buffer PWB replacement

WARNING:
Lethal voltages exist inside the transmitter when the power is turned on. Turn off the power at the source and wait until the green LEDs on the B+ distribution PWB are off before removing any connections or PWBs (see Figure 1.9 on page 1-39).

See Figure 1.10.

Figure 1.10: Transmitter lower front PWBs



1. Turn off the ac power at the source and wait (about 5 minutes) for the green LEDs on the B+ distribution PWB to turn off, indicating the capacitors are discharged (see Figure 1.9 on page 1-39).

2. Remove the transmitter's lower front panel.

3. Disconnect all cables attached to the RF drive buffer PWB, taking note of the connector labels on the cables and the PWB.

4. Remove and save six sets of mounting hardware.

5. Remove the defective PWB from the transmitter.

6. Set the **EXCTR A** (E1), **EXCTR B** (E2) and **SENSITIVITY** (E3) jumpers on the replacement PWB to the same positions as the defective PWB.

7. Reverse Step 1 through Step 5 to install the new PWB.

Distribution PWB replacement



WARNING:
Lethal voltages exist inside the transmitter when the power is turned on. Turn off the power at the source and wait until the green LEDs on the B+ distribution PWB are off before removing any connections or PWBs (see Figure 1.9 on page 1-39).

See Figure 1.10 on page 1-40.

1. Turn off the ac power at the source and wait (about 5 minutes) for the green LEDs on the B+ distribution PWB to turn off, indicating the capacitors are discharged (see Figure 1.9 on page 1-39).

2. Remove the transmitter's lower front panel.

3. Disconnect all cables attached to the distribution PWB, taking note of the connector labels on the cables and the PWB.

4. Remove and save six sets of mounting hardware.

5. Remove the PWB from the transmitter.

6. Set the E1 and E2 jumpers on the replacement PWB to the same positions as the defective PWB. Ensure resistors R86, R87 and R97 on the replacement PWB are the same value as the resistors on the defective PWB.

7. Reverse Step 1 through Step 5 to reinstall the PWB.

RF Drive Power Supply assembly replacement

WARNING:
LETHAL VOLTAGES EXIST INSIDE THE TRANSMITTER WHEN THE POWER IS TURNED ON. TURN OFF THE POWER AT THE SOURCE AND WAIT UNTIL THE GREEN LEDS ON THE B+ DISTRIBUTION PWB ARE OFF BEFORE REMOVING ANY CONNECTIONS OR PWBS (SEE FIGURE 1.9 ON PAGE 1-39).

See Figure 1.10 on page 1-40.

1. Turn off the power at the source and wait (about 5 minutes) for the green LEDs on the B+ distribution PWB to turn off, indicating the capacitors are discharged (see Figure 1.9 on page 1-39).

2. Remove the transmitter's lower front panel.

3. Disconnect all cables attached to the RF drive power supply PWB, taking note of the connector labels on the cables and the PWB.

4. Remove and save four sets of mounting hardware from the base plate under the PWB. (The PWB is soldered to the base plate.)

5. Remove the PWB assembly from the transmitter.

6. Reverse Step 1 through Step 5 to reinstall the PWB.

Low Voltage Power Supply assembly replacement

WARNING:
LETHAL VOLTAGES EXIST INSIDE THE TRANSMITTER WHEN THE POWER IS TURNED ON. TURN OFF THE POWER AT THE SOURCE AND WAIT UNTIL THE GREEN LEDS ON THE B+ DISTRIBUTION PWB ARE OFF BEFORE REMOVING ANY CONNECTIONS OR PWBS (SEE FIGURE 1.9 ON PAGE 1-39).

See Figure MD-1.

1. Turn off the power at the source and wait (about 5 minutes) for the green LEDs on the B+ distribution PWB to turn off, indicating the capacitors are discharged (see Figure 1.9 on page 1-39).

2. Remove the two right-hand blank panels adjacent the RF power module(s). If the optional third RF power module is installed instead of a blank panel, remove it (see"Removing and reinstalling RF power modules" on page 1-20).

3. Remove the screws that secure the protective cover over the assemblies mounted on the right-hand side of the cabinet (see Figure MD-1).Disconnect all cables attached to the low voltage power supply assembly (U4), taking note of the connector labels on the cables and the assembly.

4. Remove and save four sets of mounting hardware that secure the assembly to the side of the transmitter.

5. Remove the assembly from the transmitter.

6. Reverse Step 1 through Step 5 to reinstall the replacement assembly.

+24 Volt Power Supply assembly replacement



WARNING:
LETHAL VOLTAGES EXIST INSIDE THE TRANSMITTER WHEN THE POWER IS TURNED ON. TURN OFF THE POWER AT THE SOURCE AND WAIT UNTIL THE GREEN LEDS ON THE B+ DISTRIBUTION PWB ARE OFF BEFORE REMOVING ANY CONNECTIONS OR PWBS (SEE FIGURE 1.9 ON PAGE 1-39).

See Figure MD-1.

1. Turn off the power at the source and wait (about 5 minutes) for the green LEDs on the B+ distribution PWB to turn off, indicating the capacitors are discharged (see Figure 1.9 on page 1-39).

2. Remove the two right-hand blank panels adjacent the RF power module(s). If the optional third RF power module is installed instead of a blank panel, remove it (see"Removing and reinstalling RF power modules" on page 1-20).

3. Remove the screws that secure the protective cover over the assemblies mounted on the right-hand side of the cabinet (see Figure MD-1). Disconnect all cables attached to the +24 V power supply assembly (U3), taking note of the connector labels on the cables and the assembly.

4. Remove and save four sets of mounting hardware that secure the assembly to the side of the transmitter.

5. Remove the assembly from the transmitter.

6. Reverse Step 1 through Step 5 to reinstall the replacement assembly.

Fan Power Supply assembly replacement



WARNING:
Lethal voltages exist inside the transmitter when the power is turned on. Turn off the power at the source and wait until the green LEDs on the B+ distribution PWB are off before removing any connections or PWBs (see Figure 1.9 on page 1-39).

See Figure MD-1.

1. Turn off the power at the source and wait (about 5 minutes) for the green LEDs on the B+ distribution PWB to turn off, indicating the capacitors are discharged (see Figure 1.9 on page 1-39).

2. Remove the two right-hand blank panels adjacent the RF power module(s). If the optional third RF power module is installed instead of a blank panel, remove it (see"Removing and reinstalling RF power modules" on page 1-20).

3. Remove the screws that secure the protective cover over the assemblies mounted on the right-hand side of the cabinet (see Figure MD-1).Disconnect all cables attached to the fan power supply assembly (U2), taking note of the connector labels on the cables and the assembly.

4. Remove and save four sets of mounting hardware that secure the assembly to the side of the transmitter.

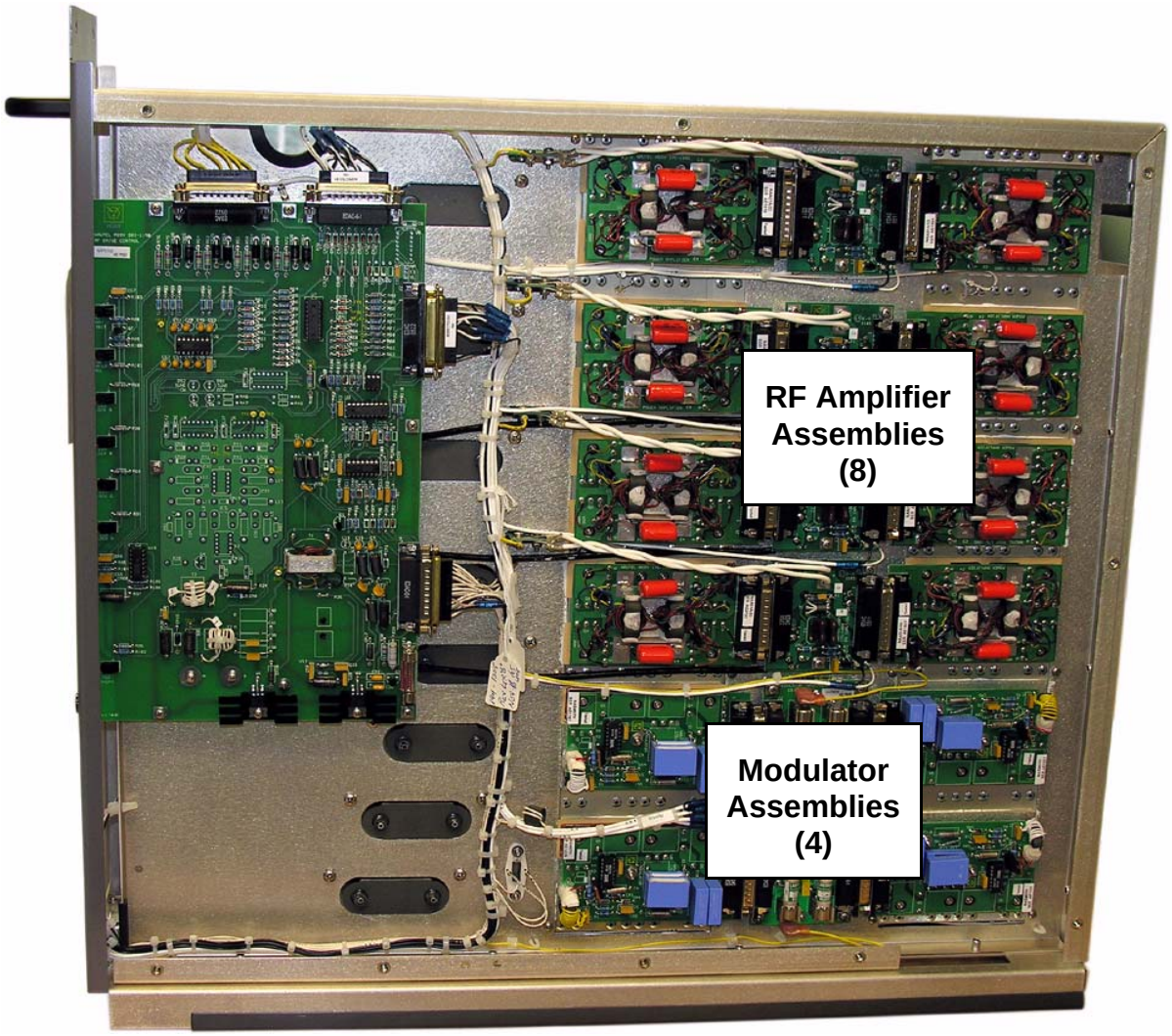
5. Remove the assembly from the transmitter.

6. Reverse Step 1 through Step 5 to reinstall the replacement assembly.

RF Power Module assembly replacement

Each RF power module contains RF amplifier assemblies and modulator assemblies (see Figure 1.11) that can be replaced.

Figure 1.11: RF Power Module – Right Side



Modulator assembly replacement

1. Remove the modulator assembly from RF power module. Use the hex screw driver (Nautel part # HAZ65) from the ancillary kit to remove the modulator assembly's attaching hardware (four M3 hex head screws) at the rear of the RF power module's heat sink.



CAUTION:
The heat sinks of modulator assemblies and RF amplifiers are coated with a film of thermal compound. Use care to ensure the film does not become contaminated with foreign particles.

When installing an assembly, visually inspect the mating surfaces of its heat sink and the module's chassis. Ensure both surfaces are coated with a thin film of thermal compound. Ensure foreign particles that may affect thermal transfer are not embedded in the compound.

2. Discard or repair the defective modulator assembly.

3. Apply a thin film of thermal compound to the modulator assembly's aluminum heatsink plate.

4. Install the replacement modulator assembly in the RF power module. Mate the modulator assembly's connector J1 to the modulator input/output PWB's connector in the RF power module.

5. Secure the modulator assembly to the RF power module's heatsink using the four M3 hex head screws removed in Step 1 .

RF amplifier assembly replacement

1. Remove the RF amplifier assembly from RF power module. Use the hex screw driver (Nautel part # HAZ65) from the ancillary kit to remove the RF amplifier assembly's attaching hardware (four M3 hex head screws) at the rear of the RF power module's heat sink.



CAUTION:
The heat sinks of modulator assemblies and RF amplifiers are coated with a film of thermal compound. Use care to ensure the film does not become contaminated with foreign particles.

When installing an assembly, visually inspect the mating surfaces of its heat sink and the module's chassis. Ensure both surfaces are coated with a thin film of thermal compound. Ensure foreign particles that may affect thermal transfer are not embedded in the compound.

2. Discard or repair the defective RF amplifier assembly.

3. Apply a thin film of thermal compound to the RF amplifier assembly's aluminum heatsink plate.

4. Install the replacement RF amplifier assembly in the RF power module. Mate the RF amplifier assembly's connector J1 to the PA input/output PWB's connector in the RF power module.

5. Secure the RF amplifier assembly to the RF power module's heatsink using the four M3 hex head screws removed in Step 1.

Section 2: Detailed Circuit Descriptions

Refer to the functional block diagram: "XR Series Transmitter Block Diagram" on page 1-7 and high level descriptions of the *XR6/XR3 Operation and Maintenance Manual*.

This section provides a detailed description of the transmitter's key modules and assemblies, including:

- Control/display PWB (NAPC147D) - see page 2-1
- RF synthesizer PWB (NAPE70C) - see page 2-4
- Interphase PDM driver PWB (NAPM10B) - see page 2-8
- Remote interface PWB (NAPI83/01A) - see page 2-13
- RF drive power supply PWB (62 V) (NAPS10B) - see page 2-18
- RF power module (NAP34A) - see page 2-19
- RF drive buffer PWB (NAPE77A/01) - see page 2-30

XR6/XR3 electrical schematics

The descriptions in this section all refer to the XR6/XR3 electrical schematics listed in Table 5.1 on page 5-5 of the *XR6/XR3 Troubleshooting Manual*.

Control/display PWB (NAPC147D)

See electrical schematics Figures SD-5 through SD-8.

Carrier reference voltage

The *Carrier Ref (A)* output (J7-38) is applied to the interphase PDM driver PWB of each exciter to generate the PDM drive pulse that ultimately controls the RF output of the transmitter. DAC U31, in conjunction with microcontroller U22, establishes a dc reference voltage for the *Carrier Ref* output. The voltage is buffered through operational amplifier U27B and associated components.

Alarm threshold circuits

Certain parameters that are monitored by the control/display PWB can initiate an alarm indication and appropriate transmitter control if an out of tolerance condition occurs.

Ac supply voltage

The *Ac Power* input (J4-21) is an unregulated dc voltage that is proportional to the ac source. The input is filtered and compared to the low ac ref fault threshold on operational amplifier U4C. If the *Ac Power* voltage is below this threshold, the ac low signals switch to 0 V. The *Carrier Ref (A)* output clamps to 0 V and the *Shutback (A)* (J7-1) and *(B)* (J7-2) outputs switch to 0 V and inhibit the exciter's modulator drive. The transmitter's RF output turns off (shuts back) and remains off until the ac power returns to an acceptable voltage. The system diagram's AC Mains lamp displays a fault condition. An *Ac Sample* signal is applied to ADC U9 for application to the diagnostic display.

Reflected power monitor

The *Refld Pwr Sample* input (J1-5) is a dc voltage that is proportional to the reflected power at the transmitter's output. The input is filtered and buffered by operational amplifier U1B and associated components, and then applied to the remote interface PWB via the external serial interface (microcontroller U22). The signal is also compared to a pre-determined *refld pwr shtbk ref fault* threshold on operational amplifier U4A. When the peak reflected power exceeds a 1.5:1 VSWR (based on rated forward power), the *refld pwr sample* input exceeds the fault threshold and the *refld_pwr_shutback* signal switches to 5 V. The *Carrier Ref (A)* output clamps to 0 V and the *Shutback (A)* (J7-1) and *(B)* (J7 2) outputs switch to 0 V and inhibit the exciter's modulator drive. A clock pulse is also applied to an alarm count/cutback circuit in complex programmable logic device (CPLD) U18. The RF output is instantly shut back (turn off). The system diagram's Output Network lamp displays a fault condition. A *Refld Pwr Sample* signal is applied to ADC U9 for application to the front panel's diagnostic display.

Turning off the RF output reduces the *refld pwr sample* input to 0 V. The *Carrier Ref (A)* output is restored to its pre-shutback levels, the *Shutback A* and *B* outputs return to open collector, and the RF output is restored at an exponential rate. If the fault threshold is exceeded before the pre-set power level is reached, the shutback cycle is repeated. If three or more shutback cycle clock pulses are applied within any five second period, the *Carrier Ref (A)* output is cut back (reduced) until the carrier level is cut back to a level that results in an acceptable reflected power. When the transmitter enters cutback mode, the system diagram's Output Network lamp flashes on and off. When the *refld pwr sample* input returns to or is maintained at a level which is less than the fault threshold, the *Shutback* outputs returns to open collector but the system diagram's Output Network lamp continues to display a fault as a maintenance aid. The lamp remains on until reset by the diagnostic display menu.

Sample monitoring circuits

Various parameters are applied to the control/display PWB for local (via the front panel's diagnostic display) and/or external (via the remote interface PWB) monitoring. In most cases, these parameters also have associated alarm detection circuitry, but it is not resident on the control/display PWB.

B+ sample

The *B+ Sample* input (J4-35) input is a dc voltages which represents the positive dc voltage applied to the RF power modules as their high current voltage source. The input is filtered and buffered by operational amplifier U7C and associated components. The *B+ Sample* signal is applied to ADC U12 for application to the front panel's diagnostic display.

PDM drive

The *PDM (A)* (J4-9) and *PDM (B)* (J4-7) inputs are pulses which represent the PDM signal applied to sides A and B of the RF power stage. The inputs are filtered through operational amplifiers U7B and U11B and associated components. *PDM (A) Sample* and *PDM (B) Sample* signals are applied to ADC U9 for application to the front panel's diagnostic display.

Dc current

The *Dc Current Sample* input (J4-33) is a dc voltage which represents the dc current being drawn by RF power modules. The input is filtered and buffered by operational amplifier U11A and associated components. The *Dc Current Sample* signal is applied to ADC U12 for application to the front panel's diagnostic display.

PA voltage

The *PA Volts Sample* input (J4-31) is a dc voltage which represents the voltage applied to the power amplifiers in the RF power modules. The input is filtered and buffered by operational amplifier U3C and associated components. The *PA Volts Sample* signal is applied to ADC U12 for application to the front panel's diagnostic display.

Forward power

The *Fwd Pwr Sample* input (J1-3) is a dc voltage which represents the forward power at the transmitter's RF output. The input is filtered through operational amplifier U2D and associated components. A *fwd_pwr_sample* signal is applied to ADC U9 for application to the front panel's diagnostic display. The *fwd_pwr_sample* input is also applied to the remote interface PWB via the external serial interface (microcontroller U22).

RF drive voltage sample

The *RF Dr Volts Sample* input (J4-39) is a dc voltage which represents the voltage supplied by the RF drive power supply. The input is filtered through operational amplifier U3A and associated components. The *bat_cur_sample* signal is applied to ADC U12 for application to the front panel's diagnostic display.

Low voltage power supplies

Attenuated, buffered samples of all low voltage dc power supplies (+24 V, +15 V, + 5 V and -15 V) are applied to ADCs U9 and U12 for application to the front panel's diagnostic display.

Cabinet temperature

Low voltage temperature sensor U5 provides a dc voltage (between 0 and 5 V) which represents the ambient cabinet temperature. This voltage is buffered by operational amplifier U8A and associated components and applied to ADC U12 for application to the front panel's diagnostic display.

Microcontroller

Microcontroller IC U22 interfaces between the diagnostic display and its associated soft-keys. It controls the level of the *Carrier Ref* signals (see "Carrier reference voltage" on page 2-1), which ultimately determines the forward power level of the transmitter. It also acts as an internal and external serial interface for transmitter alarm and status signals.

CPLD

Complex programmable logic device (CPLD) U18 continuously reads digital inputs for all transmitter alarm events. It is programmed to perform root cause detection of a fault as well as high-speed fault protection. Depending on the nature of the fault, the CPLD generates transmitter *Shutback* outputs (J7-1 and J7-2) or various digital control/inhibit signals via a parallel data bus.

RF synthesizer PWB (NAPE70C)

See electrical schematics Figures SD-12 and SD-13.

Microprocessor

The microprocessor consists of an 87C51 integrated circuit (U4) which is clocked at the system oscillator frequency (10.0000 MHz). Firmware resides in U4's internal four kilobytes of EPROM memory. The microprocessor's functions are to generate control information for the DDS circuit, generate control information for the N divider circuit, and provide control signals to all power modules during transmitter tuning.

DDS control information

The RF carrier frequency is set using five binary coded decimal (BCD) switches (S1 through S5). When a current sink to ground is applied at the *Reset DDS* input, or during turn on, the microprocessor monitors these switches and outputs the appropriate 48-bit value to the DDS frequency tuning word #1 register. The 48-bit value is written in six consecutive bytes to the DDS's six internal registers. The *WRB/SCLK* signal is enabled on each write cycle.

N divider control information

The $4f_c/B$ frequency is divided by an 'N' factor, to provide $2f_{PDM}$ output frequency between 126 kHz and 134 kHz (when E3 is set in **LOW PDM** mode) or between 245 kHz and 276 kHz (when E3 is set in **HIGH PDM** mode) (see "N divider" on page 2-7). E3 should be set to **HIGH PDM** mode when used in an XR6/XR3 transmitter. The microprocessor determines the value of N and outputs the information at pins 2, 3, 4, 5, 6 and 7. The N divider uses this information as the N dividing factor.

Direct digital synthesizer

The direct digital synthesizer consists of integrated circuit U5 (AD98525Q) and associated components. It generates a frequency of $4f_c$ based on information provided by microprocessor U4 (see "Microprocessor" on page 2-4). Integrated circuit U5 is a CMOS, numerically controlled oscillator with a 48-bit phase accumulator and 12-bit digital-to-analog converter (DAC). The phase accumulator, responsible for generating an output frequency is presented with a 48-bit value from the Frequency Tuning Word 1 registers whose contents determine the FTW as follows:

$$FTW = (\text{Desired Output Frequency} \times 2^{48})/SYSCLK$$

The 10 MHz clock input, coupled with U5's internal programmable reference clock multiplier, results in a system clock of 50 MHz (i.e. SYSCLK = 50 MHz).

The 12-bit output from the phase accumulator is input to the DAC, which outputs a stepped sine wave at a frequency of $4f_c$ which is low-pass filtered to remove high frequency components.

Low pass filter

A low-pass filter comprised of C21, L1 and C23 removes the high frequency images present in the DDS output signal. The output is a sine wave at a frequency of $4f_c$.

Digitizer

The output of the low-pass filter is connected to a digitizer circuit consisting of transistor Q4, inverter U10:B and associated components. U10:B's output is a square wave at frequency of $4f_c$ which is applied to a divide-by-4 circuit and to the N divider circuit.

IPM correction

The incidental phase modulation *IPM Correction* circuit forms part of a dynamic loop that monitors the I*PM compensation* input and compensates for any incidental phase modulation caused by the host transmitter's RF power stages.

Virtual capacitor

Complementary transistor pair U13:A and U13:B, capacitors C50 through C53 and associated components form a virtual capacitor, the value of which is determined by current flow through U13:A. Amplitude and phase of the *IPM compensation* input controls gain of U13:A, thereby controlling current flow in the transistor and ultimately the virtual capacitance of the IPM correction circuit. IPM BALance potentiometer (R41) is adjusted, when the RF synthesizer PWB is in a transmitter, for optimum correction of any incidental phase modulation.

Switch elements S6:1, S6:2 and S6:3 provide the proper capacitance depending on the carrier frequency. See the table below to determine the settings for the switch elements.

f_c (kHz)	Capacitance (pF)	S6 Switch Settings		
		1	2	3
190 - 589	48	1	1	1
590 - 879	36	1	1	0
880 - 1324	24	1	0	0
1325 - 1800	12	0	0	0
0 = switch open; 1 = switch closed				

IPM correction enable

The position of switch element S6:4 determines when the *IPM correction* circuit is enabled or disabled. The *IPM correction* circuit should be disabled (switch S6:4 set to CLOSED position) when used in an XR6/XR3 transmitter.

> *Note:*
> *It may be desirable to disable the IPM correction circuit for some testing purposes. Return the switch to its regular position during normal operation.*

Waveform symmetry

RF DRIVE SYMMETRY potentiometer R32 - which allows for minimizing of second harmonic levels - is adjusted for an RF drive output waveform which is a symmetrical square wave (50% duty cycle), as measured at the RF DRIVE (TEST) output (J5) of the RF drive buffer PWB. The position of SYMMETRY ADJust shorting jumper E6 determines when the *RF drive symmetry* circuit is enabled or disabled. E6 should be installed in the ENABLE position (shorting pins 1 and 2) when used in an XR6/XR3 transmitter.

Balanced drive

The balanced drive buffer is a switching circuit that ensures the rise and fall times of its output square wave are minimal. The f_c signal is a 15 V peak-to-peak square wave that is the low level RF drive signal for the RF power stage of the transmitter.

Balanced drive matching

Provision is made for several different values on the balanced drive output, depending on the host transmitter's requirements. The positioning of shorting shunt post E5 on seven-position header XE5 can be changed to choose between different capacitor and resistor values. E5 should be installed in the D position (shorting pins 7 and 8) for an XR6/XR3 transmitter.

N divider

The N divider circuit is a cascade counter made up of integrated circuits U6, U7, and inverters U8:A and U8:F. The $4f_c/B$ signal is divided by N, to provide a $2f_{PDM}$ frequency which is between 126 kHz and 134 kHz (when E3 is set in LOW PDM mode) or between 245 kHz and 276 kHz (when E3 is set in HIGH PDM mode). E3 should be set to HIGH PDM mode when used in an XR6/XR3 transmitter. The value of N is supplied by microprocessor U4 (see "N divider control information" on page 2-5). The $2f_{PDM}$ output, which is nominal 0 - 4 V peak pulses, is applied to the transmitter's pulse duration modulation (PDM) generation circuit, and ultimately determines the PDM frequency.

RF drive source selection

The RF drive source may be provided by the integral numerically controlled oscillator, an external RF generator at f_c or a 10 MHz reference. The positioning of shorting shunt posts E1, E2 and E4 determines which RF drive source is selected.

Internal f_C source

When the integral numerically controlled oscillator's output is to be used as the RF drive source, the shorting shunt posts must be configured as follows:

- E1 in INT position (pins 2 and 3 shorted)

- E2 in INT position (pins 2 and 3 shorted)

- E4 in INT position (pins 2 and 3 shorted)

External f_C source

When an externally generated carrier frequency is to be used as the RF drive source, the shorting shunt posts must be configured as follows:

- E1 in INT position (pins 2 and 3 shorted)

- E2 in INT position (pins 2 and 3 shorted)

- E4 in EXT position (pins 1 and 2 shorted)

The applied RF must be precisely the carrier frequency (f_c) and its peak-to-peak voltage (sine or square wave) must be between 5.0 V and 12.0 V.

External 10 mhz source

An external 10 MHz can be used for synchronization (i.e., GPS lock). When an external 10 MHz signal is to be used as the RF drive source, the shorting shunt posts must be configured as follows:

- E1 in EXT position (pins 1 and 2 shorted)

- E2 in EXT position (pins 1 and 2 shorted)

- E4 in INT position (pins 2 and 3 shorted)

The applied RF must be precisely 10.00 MHz and its peak-to-peak voltage (sine or square wave) must be between 2.2 V and 8.0 V

Interphase PDM driver PWB (NAPM10B)

See electrical schematic Figure SD-14.

Carrier level control

The carrier level control circuit consists of U6, U2A, U2D, U3B, U3D, and their associated components. U6 is a four-quadrant analog multiplier connected as a variable gain, wide-band, linear amplifier. The modulation reference (*I1*) input is multiplied by a factor determined by the level of the carrier ref (*I2*) and B+ ref (*I4*) inputs to determine the gain and, in turn, the *I3* output.

When there is no *unbalanced audio* input at J1-15, U2D's output (TP6), which is the modulation reference, will be a nominal 1.4 V. When a pure audio sine wave is present at a level that will produce 100% modulation, the output of U2D will be a sine wave varying from 0 V to 2.8 V. The resulting current flow through R12 is U6's *I1* input.

The *carrier ref* input at J1-2 is a dc voltage directly proportional to the expected RF carrier level squared. When the transmitter is operating at its rated carrier level, the expected *carrier ref* input at the output of buffer U2A (TP5) is a nominal 4.7 V. The resulting current flow through R13 is U6's *I2* input.

The *B+ ref (1)* input at J1-3 and the voltage at the output of buffer U3D (TP3) is a dc voltage directly proportional to the B+ voltage being applied to the transmitter's RF power stage. When the B+ voltage is 350 V (for high power operation), the voltage at TP3 is a nominal 6.1 V. The resulting current flow through R20 is U6's *I4* input.

The gain of U6 and, in turn, the current flowing from its *I3* output, is determined by the following formula:

$$I3 = I1 \times I2/I4$$

When the carrier ref input (I2) is 4.7 V (transmitter's rated output power) and the *B+ ref (1)* input (I4) is 6.1 V (B+ voltage of 350 V), the gain of U6 is 0.76 for the modulating reference applied to I1. U6's *I3* output current is 0.76 times its *I1* input current. U3B is connected as a less than unity amplifier and its gain is summed with U6's gain. The end result is the total voltage gain of the circuit, relative to the voltage at the output of U2D (1.4 V when no audio is present), is a nominal 0.67 when GAIN TRIM potentiometer R31 is set to the centre of its range. When there is no modulation present, the *carrier ref + audio* output of U3B (TP8) is 0.94 V (1.4 V x 0.67).

The gain of U6 will change in direct proportion to changes in the *carrier ref* voltage. If the *carrier ref* voltage is set to 0 V, or it is clamped to ground because Q1 is on, U6's gain is zero. In turn, the modulating reference's multiplication factor is minimum (zero). The transmitter's RF output is set to 0 W. The gain of U6 will change in inverse proportion to changes in the *B+ ref (1)* input. This feature eliminates the need for sophisticated filtering of the transmitter's B+ power supply and maintains the transmitter's RF output at the original level for B+ voltage variations of ±10%.

GAIN TRIM potentiometer R31 provides a nominal 10% adjustment in the *carrier ref + audio* output of U3B. It is adjusted in dual exciter applications to compensate for tolerance differences in the PDM generators of exciter A and exciter B. When it is set properly, the transmitter's RF output level is the same when either exciter is selected, provided the same desired ouput level is being applied.

PDM divider

The PDM divider circuit divides the $2f_{PDM}$ input frequency (J1-7) by two. The resulting f_{PDM} output (J1-10) is a 0 V to 15 V square wave at half the $2f_{PDM}$ frequency. See "N divider" on page 2-7.

Linear integrator

The linear integrator circuit converts the f_{PDM} square wave on its input to a triangular waveform at its output. The triangular waveform has negative and positive voltage excursions of equal amplitude and duration. The long R/C time constant formed by C27/R11 ensures a linear rise and fall time.

Integrator peak detector

The integrator peak detector circuit detects the positive going excursions of the linear integrator's triangular waveform. A portion of the resulting positive dc voltage (nominally 1.8 V) at U8A's output, is applied to the inverting input of differential amplifier U3A. The *carrier ref* + *audio* output of U3A is offset by this voltage which is proportional to the triangular waveform voltage peaks. This offset effectively sets the *carrier ref* + *audio*'s zero power reference to the triangular waveform's peak voltage. This technique ensures no RF output is produced when the carrier ref input (J1-2) is 0 V. It also ensures the RF output is reduced to near 0 W at the 100% modulation envelope valleys when operating at the transmitter's rated carrier level.

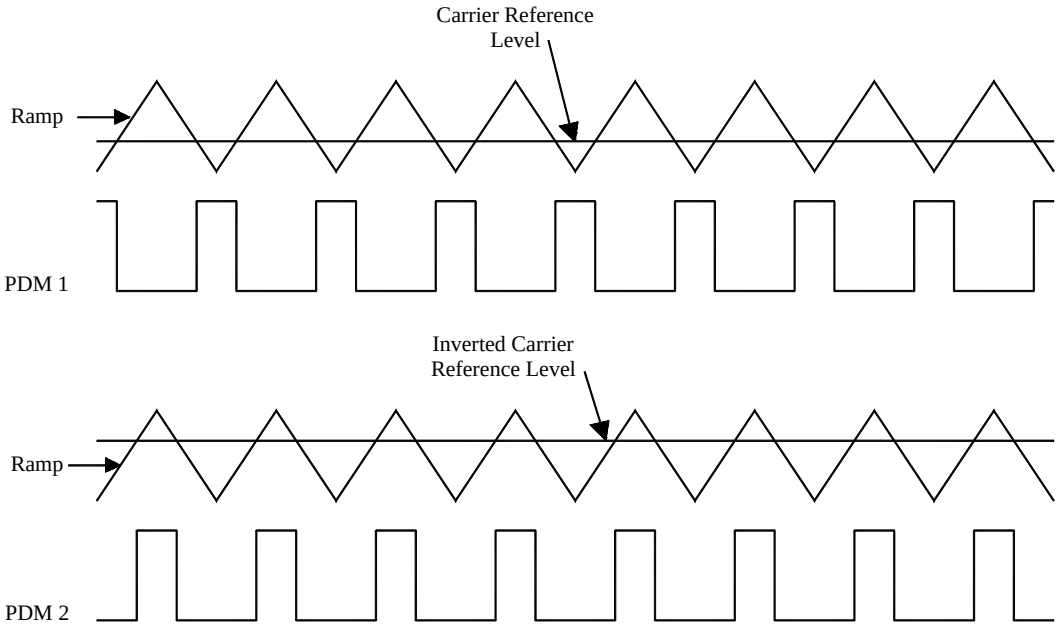
Interphase PDM generator

The interphase PDM generator consists of two variable pulse duration generators (PDM1 and PDM2). Both produce identical 0 V to +15 V rectangular waveforms at the PDM repetition rate, but they are 180^0 out of phase with each other. The waveform on/off ratio (duty cycle) is directly proportional to the carrier level and amplitude of the modulating audio.

PDM1 generator

The PDM1 generator consists of U10B, Q4, Q5, and their associated components. The compensated *carrier ref* + *audio* input from the integrator peak detector circuit is applied to differential amplifier U10B's non-inverting input, where it is compared to the triangular waveform from the linear integrator circuit. When the compensated *carrier ref* + *audio* is more positive than the triangular waveform, U10B's output is an open collector. +15 V is applied through R60 and R62 to the balanced drive formed by Q4/Q5. Q4 turns on and applies +15 V to K1-3 as the *PDM1* output (Q5 is off). For the remainder of the triangular waveform's period, the compensated *carrier ref* + *audio* is less positive than the triangular waveform. U10B's output is a current-sink-to -15 V and Q4 turns off. Q5 turns on and clamps the *PDM1* output to ground. The minimum 'on time' (zero RF power) occurs at the negative peaks of the triangular waveform. See Figure 2.1 on page 2-11 for a timing diagram.

Figure 2.1: Timing Diagram for PDM Differential Amplifier



PDM2 generator

The PDM2 generator consists of U3C, U11B, Q6, Q7, and their associated components. It operates similar to the PDM1 generator except U3C inverts the compensated *carrier ref* + *audio* input and applies it to differential comparator U11B's inverting input. The result is a PDM2 'on period' when the compensated *carrier ref* + *audio* is less positive than the triangular waveform and produces a minimum 'on time' at the positive peaks of the triangular waveform. The on/off ratio of the *PDM1* and *PDM2* outputs are the same, but the zero power reference change for the *PDM2* output is offset, relative to the *PDM1* output, by one half of the PDM repetition rate.

PDM fault detector

The PDM fault detector circuit contains two identical voltage controlled switches (one for each PDM output) that control the 'set/'reset' status of the shutback latch circuit and, in turn, controls the on/off status of relay K1. For explanation purposes, only the PDM1 fault detector is described.

The PDM1 fault detector circuit consists of U12A and its associated components. R67/C58 form an integrator with a long time constant, relative to the PDM frequency. C58's charge voltage is applied to U12A's inverting input and compared to the 7.3 V reference voltage applied to its non-inverting input from voltage divider R70/R71/ R72. U12A's output is an open collector and has no influence when C58's charge voltage is less positive than the reference voltage. U12A's output will switch to a current-sink-to-ground when C58's charge voltage goes more positive than the reference voltage.

During normal operation, C58 will charge through R67 towards 15 V when the PDM1 output is 15 V (during its 'on time') and CR3 is reversed biased. It will instantly discharge to ground potential, through CR3, when the PDM1 output switches to 0 V (during its 'off time'). The repetition rate of the PDM1 on/off periods ensures the charge on C58 will not exceed 7.3 V, provided each PDM1 cycle contains an 'off time'. If a PDM failure occurs that produces a continuous 'on time', C58 will charge more positively than 7.3 V. U12A's output will switch to a current-sink-to-ground and toggle the shutback latch circuit to its 'set' state.

Shutback latch

The shutback latch circuit inhibits the 'on time' of the PDM outputs and, in turn, the RF output of the transmitter whenever a transmitter originated *Inhibit PDM* (J1-16) command is applied. This circuit provides additional protection to the transmitter's RF power stages when faults are detected or actions are initiated that may cause RF stress current thresholds to be exceeded. Its function is to de-energize K1 and disconnect the *PDM 1/PDM 2* outputs from the transmitter circuits when the PDM fault detector output is a current-sink-to-ground (logic low). It also inhibits the PDM generators when relay K1 is de-energized or when a logic true *inhibit PDM* command is applied to J1-16.

U9A/U9B form a bistable flip/flop. The flip-flop's output, at U9-3, will be 15 V (logic high) when in its 'reset' state, and a current-sink-to-ground (logic low) when in its 'set' state.

Normally the *inhibit PDM* input and the output of the PDM fault detector circuit, which are the flip-flop's controlling inputs, are open collector. 5 V (logic high) are applied to U9-1 and U9 5 through their pull-up resistors and the flip-flop is latched in its 'reset' state. Relay K1 is held energized and the PDM outputs are applied to the transmitter circuits.

If a PDM fault is sensed, the PDM fault detector circuit applies a current-sink-to-ground (logic low) to U9-5 and causes the flip-flop to switch to and latch in its 'set' state. Relay K1 de-energizes and disconnects both PDM outputs from the transmitter circuits. The PDM latch output (J1-11) is activated (5 V). This condition is maintained until the flip-flop is reset by the removal of the logic low from U9-5 (no PDM fault) and the application of logic low to U9-1 (a logic true current-sink-to-ground *reset PDM* command is applied to J1-1).

PDM inhibit

The PDM inhibit circuit consists of U9D, Q2, Q3, and their associated circuits. Its function is to instantly clamp the output of both PDM generators to ground (zero carrier level) whenever a logic true (current-sink-to-ground) *inhibit PDM* input is applied to J1-16, or when the PDM fault detector circuit senses a PDM fault and the shutback latch circuit's flip-flop is latched in its 'set' state. When neither of these conditions are true, the PDM inhibit circuit has no influence.

Dump circuit

The dump circuit, consisting of DUMP potentiometer, U2C, U13A and U13B, is not used in this transmitter.

Remote interface PWB (NAPI83/01A)

See electrical schematics Figures SD-15 through SD-18.

The remote interface PWB performs the following functions:

- Buffers all external remote control inputs and remote status/alarm outputs.
- Provides buffered, analog sample voltages proportional to the B+ supply voltage, total dc current, audio, forward power, and reflected power for external monitoring.
- Conditions the audio (analog or DAB) input's gain and provides filtering and modulation protection.
- Provides monitoring samples of the transmitter's RF output (both analog and DAB). The magnitude of the analog sample is automatically adjusted to ensure a relatively constant voltage, nominally 1 V rms, regardless of RF output level.
- Provides the connection for the system's external interlock circuit between TB1-1 and TB1-2.

Remote inputs

RFI filtering is provided on all control input lines to ensure transmitter operation is not interrupted due to RF pick up on control lines. Opto-couplers are provided to buffer/isolate the external circuits and prevent any unwanted transients from affecting transmitter operation. The position of shorting SINGLE/DIFF jumper E19 allows the control inputs to be configured to operate from a single-ended or differential input. Refer to "Control and monitoring" section of the *XR6/XR3 Installation Manual* for a detailed description on single-ended versus differential inputs.

Remote outputs

Remote alarm/status outputs are provided on pins of connectors J2 and J3. A darlington transistor for each alarm/status output provides a negative logic (current-sink-to-ground) output when a logic 'true' (alarm condition or active status) exists. The switching circuit provides an open collector during logic 'false' conditions (non-alarm or non-active status condition) and has no influence on the external monitoring circuit. Each monitoring circuit must present impedance between the switching device and a positive dc voltage source that results in a current flow of not more than 50 mA. +24 V is available for use by the remote monitoring circuits on TB1-17.

Audio input

Analog audio input is applied to the AUDIO terminals [+ (TB2-1), - (TB2-3) and SHIELD (TB2-2)].

The Magnitude component of the IBOC audio input, if used, is applied to RJ45 connector J10 [MAG (IN)] of the remote interface PWB. The Phase component is applied to J14 (RF PHASE) of the RF drive buffer PWB.

The optional DCC inputs are applied to pins of D-sub connector J1. When the DCC option is used, the analog audio is routed to the DCC PWB via relays K2.

The audio signal is then applied to the balance/unbalance circuit. The state of relay K3C determines the amplitude modulating source - analog or IBOC program.

Balance/unbalance circuits

The balance/unbalance circuits, which converts the balanced audio input or IBOC magnitude input to an unbalanced signal, consists of U27A or U28A and its associated components. The output of differential amplifier U27A or U28A is an unbalanced audio that is a positive voltage for positive half cycles and a negative voltage for negative half cycles. Any unwanted noise transients that are induced on the audio input will be in-phase and of equal amplitude. Since the transients are in-phase and of equal amplitude, they have no influence on U27A's or U28A's output and they will not appear at U27A's or U28A's output.

Zero crossing detector

The zero crossing detector, for analog audio only, consists of U33C, Q17, CR36, and associated components. This circuit is the +15 V charge voltage source for C137 during the negative audio half-cycles. During positive audio half-cycles it is effectively open circuit and has no influence on the charge state of C137. A small dc bias (0.3 V) is present on U33C's non-inverting input.

Modulation level detector

The modulation level detector circuit monitors the on/off times of the *Forward Power Sample* input (J13-3) for excessive on times. It automatically inhibits a portion of any modulating audio's positive going half-cycle that would cause excessive 'on times' and results in the stress current threshold of the transmitter's RF power amplifier stages being exceeded. The circuit consists of comparators U32A, U32B, U32C, U32D, U33A, U33B and associated components. It provides a discharge path to -15 V for C137 when the 'on time' of the F*orward Power Sample* input will result in modulation peaks that exceed safe operating levels.

The *Forward Power Sample* input, applied to the inverting inputs of each comparator, is a varying positive dc voltage directly proportional to the RF output's modulation envelope. The audio component is synchronized with the audio output of U33C and is the most positive at the peak of the modulating audio's positive half-cycle.

Each comparator has a reference voltage applied to its non-inverting input that represents the RF stress current threshold for a specific carrier level/audio amplitude/audio frequency combination (see Table 2.1). MOD PROT THRESHOLD potentiometer R165 is adjusted to precisely set the threshold voltages, when the PWB is installed in a transmitter.

When the voltage representing the modulation envelope exceeds the RF stress current threshold of a comparator, that comparator connects its output resistor to -15 V and provides a discharge path for C137. The time for C137 to discharge to a negative voltage is dictated by the number of resistors connected to -15 V (modulation amplitude) and the period of time they are connected (audio frequency). C137's discharge time (dictated by the R/C time constant) is progressively faster as the modulation depth increases (more comparator thresholds are exceeded) and it has a longer time to discharge as the audio frequency decreases. See Table 2.1 for the duration of a positive half-cycle at the lowest unaffected audio frequency for specific modulation depths.

Table 2.1: Peak Modulation Limit Threshold

Mod Depth Peak %	Lowest Unaffected	
	Freq (Hz)	Duration (ms)
85	10	50.0
95	11	46.6
105	20	25.6
115	32	15.4
125	56	8.9
135	96	5.2

Audio chopper

The audio chopper circuit consists of U33D, Q1, and their associated components. It inhibits some portion of positive audio half-cycles that cause modulation peaks/durations that exceed the RF stress current threshold of the transmitter's RF power amplifiers. It accomplishes this by clamping the modulating audio to ground whenever the charge voltage on C137 switches from a positive value to a negative value and retains this state until C137's charge voltage returns to a positive value at the end of the positive audio half-cycle.

When C137 has a positive voltage charge, U33D's non-inverting input is more positive than its inverting input. U33D's output is an open collector. Q1 is reverse biased and has no influence on the modulating audio. The *Mod Protection* output (J13-31) is open collector (logic negative state). When the modulation level detector circuit provides C137 a discharge path to -15 V (because one or more RF stress current thresholds have been exceeded) for a long enough period of time to achieve a negative voltage charge, U33D's non-inverting input will go less positive than its inverting input. U33D's output is a current-sink-to -15V and causes Q1 to be forward biased (turned on). The modulating audio is clamped to ground by Q1 until the start of the next negative audio half-cycle (for the balance of the current positive audio half-cycle), when the zero crossing detector circuit provides a low impedance source to +15 V and charges C137 to a positive value. The *Mod Protection* output is a current-sink-to-ground (logic true state) for each offending positive audio half-cycle. The system diagram's Exciter lamp will flash on and off when this circuit is active.

Audio gain

U29A is connected as a unity gain, buffer amplifier. AUDIO GAIN potentiometer R160 is adjusted for the desired modulation depth when the interphase PDM driver PWB is installed in its host transmitter. It has sufficient range to set the modulation depth at 100% when the audio input is between 0 dBm and +12 dBm.

Audio filter

The audio filter circuit is a low pass filter with a -1.0 dB, high frequency roll-off at one of four user-selected frequencies. The AUDIO FILTER switch S1 has settings to select one of four roll-off frequencies (16.0 kHz, 13.5 kHz, 10.5 kHz or 7.5 kHz). The high frequency roll-off selection is normally dictated by complex factors, such as an antenna with sideband limitations, square wave overshoot, or the equipment that pre-processes the audio. The AUDIO FILTER switch and audio filter are bypassed when IBOC program input is used.

Magnitude gain

MAG GAIN potentiometer R127 is adjusted for the correct magnitude signal when connected to an NE IBOC exciter for IBOC operation.

RF monitor and gain setting

A sample of the transmitter's RF output is applied from the RF output filter to the *RF Sample* input (J7). The front panel GUI, in conjunction with microcontroller U24 and variable gain amplifier U22, provide a means to change the level at the RF MONITOR output (J8). This output (BNC connector) provides a true RF sample of the RF output voltage waveform and is intended for use by a modulation monitor.

The BYPASS/GAIN switch (S2) provides a means to multiply the RF monitor sample by five. When the BYPASS/GAIN switch is set to BYPASS, the RF monitor sample voltage is a nominal 1 V rms. When the BYPASS/GAIN switch is set to GAIN, the RF monitor sample voltage increases to a nominal 5 V rms.

RF drive power supply PWB (62 V) (NAPS10B)

See electrical schematic Figure SD-31.

The RF drive power supply PWB is a boost type switching power supply which provides a regulated dc supply voltage for the transmitter's RF drive amplifiers. A nominal +48V supply is applied to the drain of switching FET Q1 through inductor L2. The gate of FET Q1 is driven with pulses from pulse width modulation (PWM) switching power supply control U1. This device is a fixed-frequency PWM control circuit, incorporating the functions required for the control of a switching power supply. Internal to the device is a sawtooth oscillator which is set to a nominal frequency of 100 kHz by external components R6 and C6. The output, PWM control pulses to the gate of FET Q1, is generated by the comparison of this sawtooth waveform with a feedback voltage sample from the junction of U2-Cathode and the bias voltage created by VOLTAGE CONTROL potentiometer R3. The resultant variable pulse width output (U1-8) is applied to the gate of FET Q1. Q1 turns on and off, ringing inductor L2 with the appropriate pulses to maintain the desired set dc output voltage. Diode pair U2 rectifies the signal and inductor L3 and capacitor C9 provide filtering for the *RF Drive B+* output voltage. A sample of the dc output voltage level is applied through zener diode CR1 to the base of transistor Q2 which provides an alarm signal should the RF drive power supply fail. The *RF Drive B+ 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.

RF power module (NAP34A)

See electrical schematics Figures SD-19 and SD-20.

The RF power module is effectively two wideband RF amplifiers for the AM broadcast frequency band (530 - 1710 kHz). The RF power module consists of an RF drive control PWB, an RF drive tuning assembly, a modulator input/output PWB and duplicated assemblies for the two wideband amplifiers.

Each wideband amplifier contains two power blocks (A/B or C/D) that share an RF output transformer. A power block consists of a modulator assembly, a modulator filter, a PA input/output PWB and two RF amplifier sections.

RF drive control PWB

See electrical schematics Figures SD-21 through SD-23.

The RF drive control PWB (A1) performs a number of functions. They include:

- Buffering, amplifying and tuning the RF drive
- Monitoring RF drive level and tuned status
- Verifying PA volts is representative of the carrier level and modulation information contained in the PDM signals
- Splitting and distributing the PDM signals
- Monitoring the temperature of the RF amplifier's heat sinks
- Generating alarm signals for visual display of fault conditions when a failure occurs
- Inhibiting RF output when a failure occurs that would exceed the stress threshold of the MOSFETs in the RF amplifiers

RF drive amplifier

The RF drive amplifier is a class 'D' switching mode amplifier. It buffers and amplifies the low level RF drive applied between J4-5 and J4-2. The resultant (0 - 62 V, approximately) square wave, at the carrier frequency (f_c), is applied to C38 and C39, which form the first pole of the RF drive tuning filter. The secondary of T2 provides an RF drive sample at TP15 that represents its current waveform.

RF drive B+ current limiter

The RF drive B+ current limiter is effectively a voltage controlled variable resistor in the RF drive amplifier's B+ voltage path. The magnitude of the control voltage applied to the base of the reference power transistor is determined by circuitry which monitors the RF drive signal's voltage and current.

No Limiting:

- Under normal conditions, the 'reference' power transistor will be turned on and operating in its saturation region due to the voltage across R31. The reference transistor's emitter-collector voltage will be minimal (0.3 V) and unrestricted current from the RF drive volts supply will flow to the RF drive amplifier (see "RF drive amplifier" on page 2-19). If the RF load on the RF drive amplifier is not tuned properly, current will be limited by one of two out of tolerance parameters - excessive RF drive current or RF drive voltage.

High RF Drive Current Limiting:

- Resistors R20, R29 and transistor Q3, in conjunction with the 'reference' power transistor, form a circuit which limits the current drawn by the RF drive amplifier to 1.0 A. When the RF drive current flowing through the parallel combination of R20/R29 exceeds 1.0 A, Q3's base-emitter voltage will exceed 0.64 V. Q3 will turn on and conduct current, resulting in an increased voltage across resistor R31. This voltage, proportional to the level of current flowing through R20/R29, is applied to the 'reference' transistor's base. The 'reference' transistor drops out of saturation and enters its linear region. The voltage across its emitter-collector junction will increase, limiting the current drawn by the RF drive amplifier.

High RF Drive Voltage Limiting:

- Diode CR15, resistors R30, R31 and capacitor C19, in conjunction with the 'reference' power transistor, form a circuit which acts to limit the tuned RF drive peak voltage to approximately 100 V. When the tuned RF drive voltage exceeds approximately 61 V, CR15 begins to conduct during the tuned RF drive signal's positive half-cycles. The current conducted through CR15 is low-pass filtered by R30 and C19, resulting in an increased voltage drop across resistor R31. When the peak tuned RF drive voltage reaches 100 V, the voltage across R31 is sufficient to cause the reference transistor to enter its linear region. The voltage across its emitter-collector junction will increase and cause the current drawn by the RF drive amplifier to decrease, limiting the tuned RF drive voltage to approximately 100 V.

Latching low rf drive detector

Comparator U2D and the peak detector formed by CR8/C7/R6 form the latching low RF drive detector circuit. The RF drive level applied to CR8, which is a sample of the tuned RF drive voltage waveform (from the secondary of T3), is peak detected and applied to U2D's inverting input. It is compared to a 4.3 V reference, from voltage divider R5/R7, which is applied to U2D's non-inverting input as the low RF drive threshold.

When the RF drive level is satisfactory, the peak detected dc voltage applied to U2D's inverting input will be more positive than 4.3 V. U2D's output will be a current-sink-to-ground, causing U3E's output to be open collector. The latching low RF drive detector circuit will have no influence.

When the RF drive level is not satisfactory, the peak detected dc voltage applied to U2D's inverting input will be less positive than 4.3 V. U2D's output will switch to an open collector. 24 V will be applied, through pull-up resistors R16/R15, to U3E's input and through CR9 to U2D's non-inverting input.

U2D will latch in its open collector output state and remain there until +24 V is removed from pull-up resistor R15, by the application of a ground potential reset command to the junction of R16/R15, by the reset pulse generator circuit (see "Reset pulse generator" on page 2-24).

U3E's output will switch to a current-sink-to-ground. This current sink-to-ground will be applied to:

- RF DRIVE FAIL LED DS8, through R101. The RF DRIVE alarm lamp on the module's front panel will turn on.

- through CR13, to the inverting input of U2A. The output of U3G, also a current-sink-to-ground, is applied to CR27, CR29, CR41 and CR43, as a logic true *Pwr Mod Fail* signal which clamps the *PDM (A)/(B)/(C)* and *(D)* outputs to ground. All four low PA volts detectors will be latched in their no-fault states (see "Low PA volts detector" on page 2-22) and the modulators for all four power blocks will effectively be turned off.

When a logic true (+15 V) *Inh RF Dr Fault* command is applied to J4-11, indicating the automatic RF drive tuning feature has been enabled (normally after a repair or a frequency change), +15 V is applied to U2D's inverting input through CR7. The latching low RF drive detector will be latched in the acceptable level state, as described previously, for as long as the +15 V *Inh RF Dr Fault* command is applied to J4-11.

High temp detector

Comparator U2B in conjunction with two negative temperature coefficient thermistors mounted on the module's heat sinks, form the high temp detector circuit. The thermistors are connected in parallel and, with R1, form a voltage divider to +15 V. The voltage output of the voltage divider is applied to the inverting input of U2B. It is compared to a 4.83 V reference, from voltage divider R10/R12, which is applied to U2B's non-inverting input as the high temperature fault threshold.

When the temperature sensed by both thermistors is less than a nominal 85°C, the parallel impedance of the thermistors will be more than 6000 ohms and the dc voltage applied to U2B's inverting input will be more positive than +4.83 V. U2B's output will be a current-sink-to-ground, causing U3C's output to be an open collector. The high temp detector circuit will have no influence.

When the temperature sensed by one or both thermistors is greater than a nominal 85°C, the parallel impedance of the thermistors will be less than 6000 ohms. The dc voltage applied to U2B's inverting input will be less positive than +4.83 V and cause U2B's output to be an open collector. +24 V will be applied through pull-up resistors R16/R17 to U3C's input and cause U3C's output to switch to a current-sink-to-ground. This current-sink-to-ground will be applied to:

- U2B's inverting input, through CR12, and cause it to latch in the high temp fault state. This state will be maintained until +24 V is removed from R17, by the application of a ground potential reset command to the junction of R16/R17, by the reset pulse generator (see "Reset pulse generator" on page 2-24).

- HIGH TEMP LED DS7, through R103. The TEMP/INHIBIT alarm lamp on the module's front panel will turn on.

- through CR14, to the inverting input of U2A. The output of U3G, also a current-sink-to-ground, is applied to CR27, CR29, CR41 and CR43, as a logic true *Pwr Mod Fail* signal which clamps the *PDM (A)/(B)/(C)* and *(D)* outputs to ground. All four low PA volts detectors will be latched in their no-fault states (see "Low PA volts detector") and the modulators for all four power blocks will effectively be turned off.

The high temp detector is also used to inhibit operation of the RF power module when it is to be removed from an on-air transmitter. The module's Inhibit switch applies a ground potential as the RF inhibit command to the *RF Inhibit* input (J4-23) when it is pressed and released. This ground potential simulates an excessive temperature and causes the high temp detector to latch in its fault state as described previously.

Low PA volts detector

There are four identical low PA volts detectors, one for each power block. Since they are all identical, only the circuit for power block A is described.

Comparator U6A, inverter U7A and their associated components form the low PA volts detector 'A' circuit.

The *PDM 1* signal applied to J2-2 is applied through R52 to an average detector formed by R58/C48. The average detector's output, which will be a positive dc voltage, is applied to U6A's non-inverting input. Since the *PDM 1* input is 0-15 V, varying pulse width, the magnitude of this voltage is dependent on the on/off ratio of the pulses. The carrier level component of the PDM information, will produce a mean voltage level between 1.5 V (minimum) and 6.0 V (maximum). Modulation components are filtered out by capacitors C46 and C48.

The *PA Volts (A)* input applied to J1-5 is a dc voltage which is a derivative of the same PDM information as the *PDM 1* signal, but it is referenced to the B+ (330 V) voltage. The carrier level component of the PDM information will produce a mean voltage level of 33 V (minimum) to 130 V (maximum). A portion of the *PA Volts (A)* input is applied to U6A's inverting input by dual voltage divider R51/R56/R57. The voltage divider to +15 V formed by R56/R57, ensures a minimum of 3.0 V is applied to U6A's inverting input during initial turn on while the B+ power supplies are ramping up to full power.

During normal operation, the PA volts sample applied to U6A's inverting input is more positive than the reference voltage applied to its non-inverting input. U6A's output is a current-sink-to-ground and cause U7A's output to be an open collector.

- 15 V is applied to J3-11, through pull-up resistor R68, BLOCK A LED DS3 and diode CR35, as the current source for the thyristor in the PA input/output PWB's RF amplifier failure circuit. The logic level of the *RF Amp Fail (A)* signal is dependent on the status of the RF amplifier failure detector circuit (see "RF amplifier failure detector" on page 2-27).

- 15 V is applied to the pwr module fail detector circuit, from pull-up resistor R68, as a logic false block fail (A) output to the power module failure detector circuit; provided a ground potential is not being applied to J3-11 as a logic true *RF Amp Fail (A)* input.

When a modulator malfunction occurs that results in the PA volts being less than the expected level, the PA volts sample applied to U6A's inverting input will be less positive than the reference voltage applied to its non-inverting input. U6A's output will switch to an open collector. 24 V will be applied through pull-up resistor R64/CR32 to U6A's non-inverting input and through R65 to U7A's input.

U6A will latch in its fault (open collector) state and remain there until it is reset by the application of a ground potential reset command through CR26.

U7A's output will switch to a current-sink-to-ground. A ground potential will be applied to the junction of DS3/CR35 through CR34. The 15 V current source will be removed from J3-11. The PA input/output PWB's RF amplifier fault detector circuit will be reset if it was activated. Its fault detection capability will be inhibited as long as the junction of DS3/CR35 is a ground potential (see "RF amplifier failure detector" on page 2-27).

Modulator short circuit detector

There are four identical modulator short circuit detectors, one for each power block. Since they are all identical, only the circuit for power block A is described.

Comparator U10A and its associated components form the modulator short circuit detector. A +15 V reference voltage is applied to U10A's non-inverting input. The *PA Volts (A)* input (J1-5) is a dc voltage that is representative of the PDM1 signal. A portion of the *PA Volts (A)* input is applied to U10A's inverting input by dual voltage divider R51/R56/R57.

During normal operation, the PA voltage sample applied to U10A's inverting input will be less positive than the reference voltage applied to its non-inverting input. U10A's output will be open collector.

When a modulator malfunction occurs, which results in the PA voltage being the same as the B+ voltage (i.e., a shorted FET in the modulator), the PA voltage sample applied to U10A's inverting input will be more positive than the reference voltage applied to its non-inverting input. U10A's output will switch to a current-sink-to-ground, causing the MOD SHORT LED (DS9) to turn on.

Reset pulse generator

Transistor Q1 and inverter U3A are connected as a one shot pulse generator. When a momentary ground potential is applied to J4-10 as a logic true *Reset PM* command, Q1 will turn on. 5 V will be applied to the input of U3A and cause its output to switch to a current-sink-to-ground while Q1 is on. This current-sink-to-ground will:

- Remove the 24 V pull-up voltage from the junction of R16/R17 and effectively clamp U3C's input to ground potential. U3C's output will be clamped to its open collector state for the reset pulse period. If U2B was latched in its high temp fault state, U3C's open collector state will unlatch U2B and reset the high temp detector.

- Remove the 24 V pull-up voltage from the junction of R16/R15 and effectively clamp U2D's output to ground potential for the reset pulse period. If U2D was latched in its low RF drive fault state, the removal of the 24 V pull-up voltage will unlatch it. The latching low RF drive detector will be reset.

- Be applied to the cathodes of CR26, CR28, CR40 and CR42 as a logic true reset command. The PDM input to all four low PA volts detectors will effectively be clamped to ground for the duration of the reset pulse. Any low PA volts detector which was latched in its fault state will be reset.

Alarm indicators

The RF drive control PWB contains lamps (LEDs) which are visible through the RF power module's front panel. The dc voltage for all alarm lamps is applied through transistor Q7's base-emitter resistor R98. When an alarm lamp is turned on, the resultant current flow through R98 will forward bias Q7 and turn it on. A nominal 13 V will be applied to J3-12 as a logic true *PM Fault* output.

Manual RF drive tuning

See electrical schematic Figure SD-19.

The manual RF drive tuning assembly contains two variable inductors (L1 and L2) which are connected to form two poles of the RF drive's tuned circuit. Their inductance is determined by the positioning of their moveable cores. When the RF drive screw is turned clockwise, the inductance of the inductors decreases. See "RF drive tuning check" on page 1-36 for information on manually tuning an RF power module.

RF power blocks

See electrical schematics Figures SD-19 and SD-20.

There are four identical RF power blocks. Each utilizes one quarter of the modulator input/output PWB (A14), a modulator assembly, a modulator filter, PA input/output PWB and two RF amplifiers. The RF power blocks (A/B and C/D) are connected in parallel. See Figures SD-19 and SD-20 to determine which assemblies are associated with a specific RF power block.

Modulator stage

See electrical schematics Figures SD-19 and SD-20.

The modulator stage contains the modulator input/output PWB, four modulators, and four modulator filters. The function of each modulator is to act as a voltage regulator between the B+ voltage and the power MOSFETs in its associated RF amplifiers. The voltage control is provided by the carrier level/modulation envelope information on the PDM inputs.

Modulator input/output pwb

The modulator input/output PWB interfaces the B+ VDC, PDM, and gate bias drive inputs and the PDM (B+) outputs of the four modulator assemblies. The B+ voltage for each modulator is separately fused at 20 A. The PDM signal for each modulator and the 15 V input are separately fused at 0.5 A. Transient suppressors CR2 through CR5 limit transients from feeding back to the control circuitry during failures.

Modulator assembly

See electrical schematics Figures SD-20 and SD-24.

Each modulator assembly is effectively a logic level converter that converts the low level (0-15 V) logic of the PDM input to a high level (0-B+) logic PDM (B+) output.

13 V Power Supply:

- The 24 V ac *Gate Bias Drive* input, at the PDM frequency, is full-wave rectified by the bridge rectifier formed by CR1 through CR4. The resultant dc voltage is filtered by capacitor C4 and limited to 13 V by zener diode CR5. The power supply's less positive output is referenced to the source terminal of power MOSFETs Q3 through Q6 through R4, therefore the positive output will always be 13 V more positive than the voltage on the FET source terminals. The 13 V output is applied to the *VB* (+) and *VS* (-) inputs of FET driver U2 as the switched gate drive for the power MOSFETs.

FET Driver:

- FET driver U2 is an integrated circuit that is configured to produce outputs as follows: when the *HIN* input is high (15 V), the *HO* output is the dc voltage applied to *VB* input; when the *HIN* input is low (0 V), the *HO* output is the reference voltage applied to *VS* input. The *HO* output, which contains the PDM data, is applied to the gates of power MOSFETs Q3 through Q6 as their on/off control.

B+ Switching MOSFETs:

- Power MOSFETs Q3 through Q6 are connected to switch the *B+VDC* on and off at the on/off ratio of the PDM data on U2's *HO* output which is applied to their gates. The resultant *PDM (B+)* output contains the PDM data applied to J1-13 at a high level (0 - B+) logic level. U3 is connected as a free wheel diode to prevent the *PDM (B+)* output from going negative as the current collapses when Q3 through Q6 are turned off.

Modulator filter

See electrical schematic Figure SD-20.

An inductor, L/C components on the modulator filter and the input capacitance of two RF amplifiers form a low pass filter for the modulator's *PDM (B+)* output. The filter is connected as a multi-pole, tuned filter that shunts the PDM frequency component of the *PDM (B+)* input to ground. The filter output (*PA Volts*) will be a positive voltage that is the sum of a dc component (RF carrier level) and an ac component (modulating audio). The ratio of the *PA Volts* amplitude in relation to the B+ voltage is the same as the on/off ratio of the *PDM (B+)* input . When the on/off ratio is constant (carrier level only present), the *PA Volts* output will be a constant dc voltage. When the PDM (B+) on/off ratio is varying (carrier level plus modulation present), the *PA Volts* output will be a dc voltage that varies from the carrier level voltage at the modulating audio frequency. The amplitude of the variations is determined by the amount the PDM (B+) on/off ratio varies.

B+ decoupling assembly

See electrical schematic Figure SD-20.

The B+ decoupling assembly provides decoupling and transient suppression for the B+ inputs on the modulator input/output PWB.

PA input/output pwb

See electrical schematic Figure SD-19.

There are four identical PA input/output PWBs, one for each of RF power block. They:

- distribute PA volts to both RF amplifiers associated with the power block.
- split and apply the RF drive to both RF amplifiers associated with the power block.
- monitor RF drive current to both RF amplifiers and produce an RF amp fail output if they are not balanced (indicates a failure in one or both of the RF amplifiers).
- apply the RF output of both RF amplifiers to individual primary windings of an RF combining transformer.

RF amplifier failure detector

The RF drive is split and applied to the anti-phase wound primary windings of transformer T1. The voltage transformed to T1's secondary is directly proportional to the difference in the RF drive current flowing through its primary windings. Any voltage transformed to the secondary winding is half-wave rectified and applied to the gate of thyristor Q1.

Normally, the RF drive currents will be balanced, there will be minimal voltage across T1's secondary and the voltage applied to Q1's gate will not be sufficient to forward bias it. Q1 will be turned off and the *RF Amp Fail* signal will be logic false since 24 V is being applied from a pull-up resistor in the RF drive control PWB's crowbar switch circuit.

When the RF drive currents are significantly unbalanced, the voltage across T1's secondary will be sufficient to forward bias Q1 and Q1 will turn on. A current-sink-to-ground applied to its cathode from the RF drive control PWB will be applied to the RF drive control PWB's crowbar switch circuit as a logic true *RF Amp Fail* signal. This status will be maintained until the RF power module is removed from the transmitter or the transmitter's ac power source is turned off.

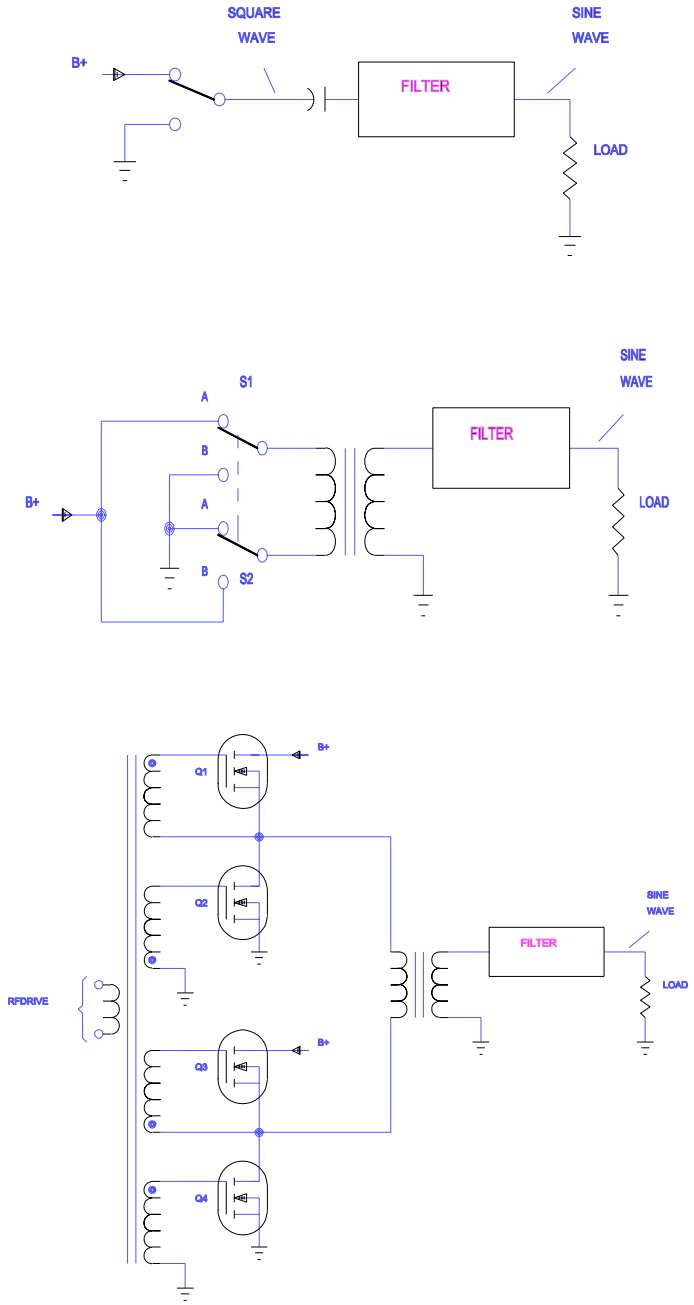
RF amplifiers

See electrical schematics Figures SD-19 and SD-25.

There are eight identical RF amplifiers in an RF power module. Refer to Figure SD-19 to determine which are associated with a specific RF power block and then to figure SD-25 for the electrical schematic of an RF amplifier.

Each RF amplifier uses four parallel-connected pairs of MOSFETs (Q1 through Q8) to produce unfiltered, modulated RF output. The power transistors are connected as two parallel, high efficiency, push-pull, class D RF power amplifiers which switch the *PA Volts* at the RF drive frequency (Figure 2.2 on page 2-29). RF drive splitter transformers U1T1 and U1T2 split the RF drive signal and apply it to transistors Q1 through Q8 with the required phase relationship. Diodes CR1 through CR4 prevent the output of the RF amplifier from going negative.

Figure 2.2: Simplified Principles of Class ‘D’ Operation



Simple Class 'D' Operation

If the switch is opened and closed with a 50% duty cycle, a square wave at the switching frequency results at the filter input. If the filter passes the switching frequency, but attenuate its harmonics, a sine wave is applied to the load.

Push Pull Class 'D' Operation

If S1 and S2 are opened and closed with a 50% duty cycle, a square wave of current, at the switching frequency, is passed through the primary of the transformer and transformed to its secondary. If the filter passes the switching frequency, but attenuate its harmonics, a sine wave is applied to the load.

Power MOSFET Class 'D' Operation

Power MOSFETs can be used to replace the switches as depicted in the simple class 'D' operation and push-pull class 'D' operation examples. Note that the switch contacts are replaced by the phase-oriented secondaries of an RF drive transformer. Q1 corresponds to S1-A, Q2 to S1-B, Q3 to S2-B and Q4 to S2-A, as depicted in the push-pull class 'D' operation example. Q1 and Q4 turn on/off together and Q2 and Q3 turn on/off together.

RF drive buffer PWB (NAPE77A/01)

See electrical schematic Figure SD-30.

The 0 - 15 V RF carrier frequency signals generated by the RF synthesizer PWBs are applied to the *RF Drive A* (J1) and *B* (J2) inputs. The active *RF Drive* signal, as selected by relay K1, is applied to MOSFET drivers U2A through U5A . The buffer amplified *RF Drive* and *(B)*signals are applied to the RF power modules. An identical test signal is provided on the RF DRIVE (TEST) output (J5).

A sample of the active *RF Drive* input is peak detected by diode CR1, resistor R5 and capacitor C1 and applied to the inverting input of operational amplifier U1A. During normal operation, this dc voltage is greater than the threshold voltage (4.2 V) applied to U1A's non-inverting input. U1A's output is 0 V, which turns off transistor Q1. The *RF Drive Fail* output (J3-8) is open collector (non-alarm state). If the RF drive signal becomes too low or disappears, the voltage applied to U1A's inverting inputs is below the 4.2 V on the non-inverting input. U1A's output switches to 15 V, which turns on transistor Q1. The *RF Drive Fail* output (J3-8) switches to a current-sink-to-ground (alarm state). This alarm signal is applied to the control/display PWB via the distribution PWB and exciter interface PWB. A SENSITIVITY jumper (E3) is provided to change the level required to cause an *RF Drive Fail* alarm. If the transmitter is configured for IBOC, this jumper should be set to LOW (shorting pins 2 and 3).

The IBOC phase input, if used, is applied to the *RF Phase In* inputs [J14 -5 (+) and J14-4 (-)]. The signal is applied through RF transformer T1 and inverters U12A and U12 D, where it is connected to both *RF Drive A* and *B* signal paths. Shorting jumpers E1 and E2 must be set in the EXT position (shorting pins 2 and 3) for IBOC use.

Section 3: Parts Lists

This section contains reference designation lists that provide descriptive and provisioning information for all electrical and mechanical parts that have an assigned reference designation and form a part of the XR6/XR3 transmitter.

Family tree

Figure 3.1 on page 3-6 depicts the family tree for an XR6/XR3 with 3-phase ac power. Figure 3.2 on page 3-7 depicts the family tree for an XR6/XR3 with 1-phase ac power. Figure 3.3 on page 3-8 depicts the family tree for an RF power moduleXR6/XR3. Family trees are based on the descending order of the reference designation hierarchy. They identify all assemblies that have an assigned Nautel configuration control number.

How to locate information about a specific part

To locate the information for a specific part, the assigned reference designation for the part must be known. In addition, the Nautel nomenclature (e.g., NAP34A) assigned to the assembly containing the part or the full reference designation, including the reference designation of all higher assemblies, must be known.

When the Nautel nomenclature is known:

- Refer to the parts list at the end of this section.

When the reference designation is known:

- Refer to the family tree depicted in Figure 3.1 on page 3-6 (for 3-phase transmitters) or Figure 3.2 on page 3-7 (for 1-phase transmitters) with the full reference designation.
- Follow the family tree branches to the block that represents the lowest level assembly assigned a Nautel nomenclature. Then refer to the parts list at the end of this section.

Reference designation lists

Individual reference designation lists are provided for:

- assemblies that are assigned an alpha-prefixed Nautel nomenclature (e.g., NAP34A)
- cable harnesses that are assigned a numbered Nautel part (e.g., 194-1002-01)
- optional kits that are assigned a numbered Nautel part.

To obtain the full reference designation for a specific part the Nautel configuration control number must be located in the family tree (see Figure 3.1 on page 3-6 or Figure 3.2 on page 3-7) to include the reference designation of all higher level assemblies. The reference designation lists, which are titled and presented in alphanumeric order, are divided into columns to aid in locating specific information.

Column content

The following paragraphs provide an explanation of the purpose and contents of each column in the part number indexes.

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.

Description column

This column contains the name and descriptive information for each part. The key word is presented first, followed by the adjective identifiers. When the description is See *Family Tree for Assembly Nomenclature*, the associated part is subject to its own part index table or is contained in an optional kit's list. Look up the reference designation list title (nomenclature) and the reference designation of the associated part in the family tree (Figure 3.1 on page 3-6 or Figure 3.2 on page 3-7) to determine where to locate its part information.

Nautel # column

This column contains the Nautel 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. When a Nautel configuration control number (e.g., NAPC*) is referenced in this column, the associated ref des item is subject to its own part index table.

Vendor # 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. The use of this number does not restrict Nautel from selecting and using commercial equivalents during manufacture, where their use will not degrade circuit operation or reliability.

OEM code column

This column typically 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).

OEM code to manufacturer's cross-reference

The OEM (CAGE) codes listed in the reference designation lists are representative of the original equipment manufacturers of those parts. To determine a specific part's manufacturer contact information, enter the five-character OEM (CAGE) code for that part in the following website:

https://www.bpn.gov/bincs/begin_search.asp

After entering the OEM (CAGE) code number, manufacturer pertinent information (address, telephone number, fax number, etc.) will be displayed. Please contact Nautel if a part cannot be obtained (see also "On-Line Part Quotes" in the Warranty section of this manual).

Manufacturer's index

For customers without web access, Table 3.1 on page 3-4 provides a cross-reference from the original equipment manufacturer's (OEM) codes to the manufacturer's name. The listing is sorted alphanumerically by the OEM code.

Common abbreviations/acronyms

The following abbreviations/acronyms may appear in the *Description of Part* column:

- SMT
  Denotes item is designed to be installed using Surface Mount Technology.
- MTA
  Denotes item is a Mass Termination Assembly connector.
- SIP
  Single In-line Package
- DIP
  Dual In-line Package
- IDC
  Denotes item is an Insulation Displacement connector for ribbon cable.

Table 3.1: OEM Codes / Manufacturers

OEM Code	Manufacturer	OEM Code	Manufacturer
00779	CTS Company Incorporated	30521	Optrex Incorporated
01295	Texas Instruments Incorporated	31433	Kemet Electronics Corporation
01961	Pulse Engineering Inc.	31781	Edac Incorporated
02660	Amphenol Corp., Spectra-Strip/ITD	33062	Ferronics Incorporated
04713	Motorola Incorporated	35005	Dale Electronics
06090	Raychem Corporation	37338	Nautel Limited
07263	Fairchild Camera & Instrument Corp	3AC42	Absopulse Electronics Ltd.
09482	Amp of Canada Limited	3DX59	Citizen America Corporation
0A5K5	IXYS Corporation	44655	Heico Ohmite LLC
0B0A9	Dallas Semiconductor Corporation	45496	Digital Systems
12969	Micro USPD Incorporated	50434	Hewlett Packard Company
13150	Axsys Technologies Inc.	50558	Electronic Concepts Inc.
14655	Cornell Dubilier Electronics	55680	Nichicon America Corp.
1AA44	Collmer Semiconductor Inc	56289	Sprague Electric Company
1BH13	Fenwall Electronics Incorporated	56699	BC Components
1C532	EEV Canada Ltd.	56845	Vishay Dale Electronics Inc.
1EM90	Lumex Opto/Components Inc.	57062	Biomation Corp.

Table 3.1: OEM Codes / Manufacturers

OEM Code	Manufacturer	OEM Code	Manufacturer
1FN41	Atmel Corporation	59124	KOA Speer Electronics Inc.
1JRT7	Epson Electronics American Inc.	5Y407	Phoenix Contact Inc.
1KK13	ITT Industries Incorporated	61529	Airmat Corporation
1MQ07	ZRG Incorporated	62643	United Chemi-Con Inc.
22421	Thomas and Betts Limited	62786	Hitachi America Ltd.
23875	M-Tron Industries Incorporated	63590	Premier Industrial Corp.
24355	Analog Devices Incorporated	64155	Linear Technology Corporation
27264	Molex Incorporated	65786	Cypress Semiconductor Corp.
68994	XILINX Incorporated	DEARBO	Dearborn Electronics Incorporated
71400	Cooper Bussman Inc.	EPCOS	Epcos
73831	Hammond Mfg	ER737	Texas Instruments
75042	TRW Incorporated	KYCON	Kycon Cable & Connector Inc.
7D893	Fairchild Semiconductor Corporation	MAGNE	MagneTek Triad
80294	Bourns Instrument Incorporated	MARKTEC	
81073	Grayhill Incorporated	MICRELL	Micrell Incorporated
81483	International Rectifier	NICCOMP	
83330	Dialight Corporation, DBA Dialight	PANAS	Panasonic
90201	Hammond Mfg. Co. Ltd.	QT	
91833	Keystone Electronics Corporation	RALTRON	Raltron Electronics
91929	Honeywell Incorporated	SB ELE	SB Electronics Incorporated
95146	Alco Electronic Products Inc.	SOSH	Soshin Electric Company, Limited
96095	AVX Ceramics, Div of AVX Corp	U3040	ST Microelectronics
97525	Transico Incorporated	UPE	

Figure 3.1: Family Tree - XR6/XR3 (3-Phase Ac Power)

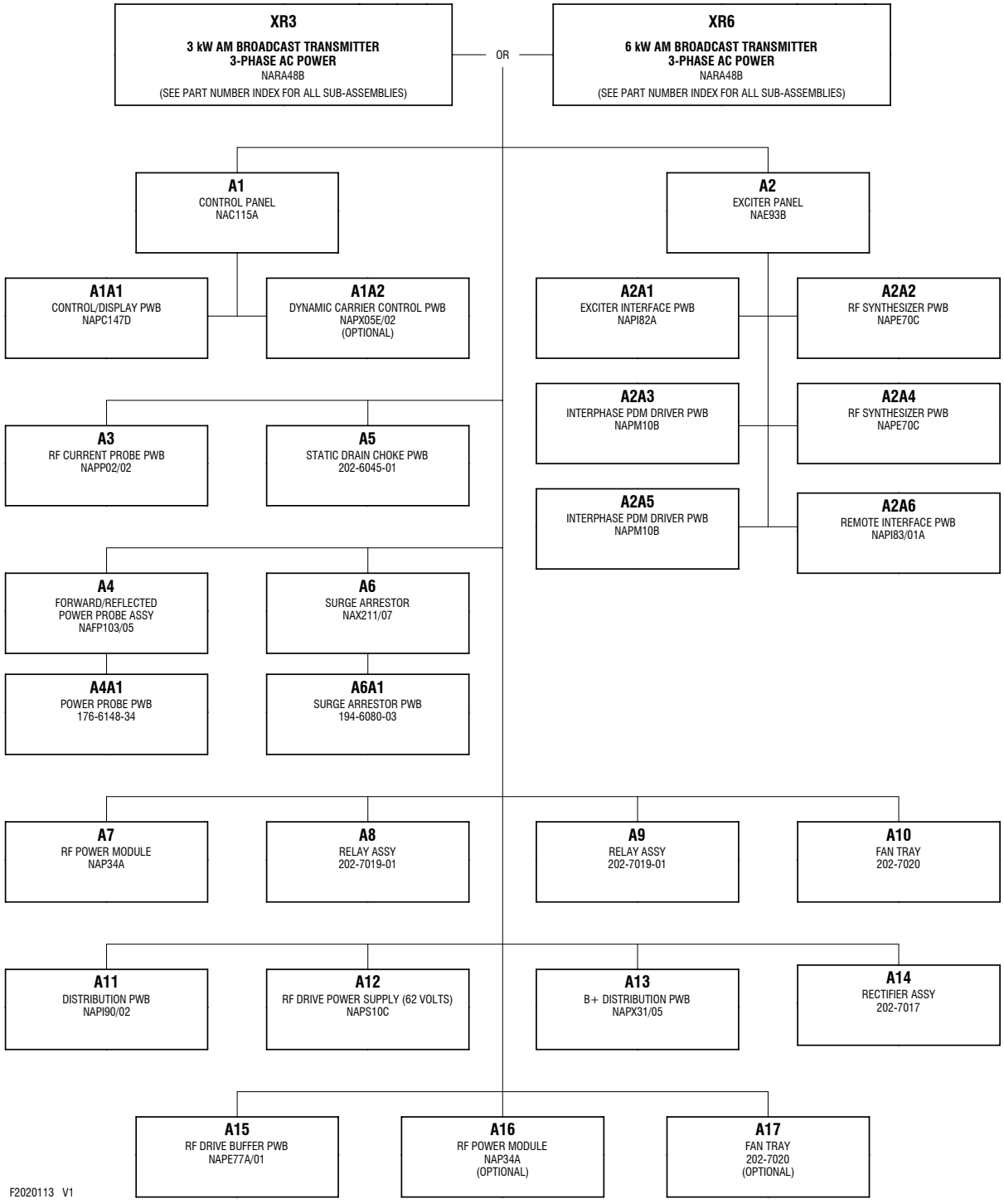


Figure 3.2: Family Tree - XR6/XR3 (1-Phase Ac Power)

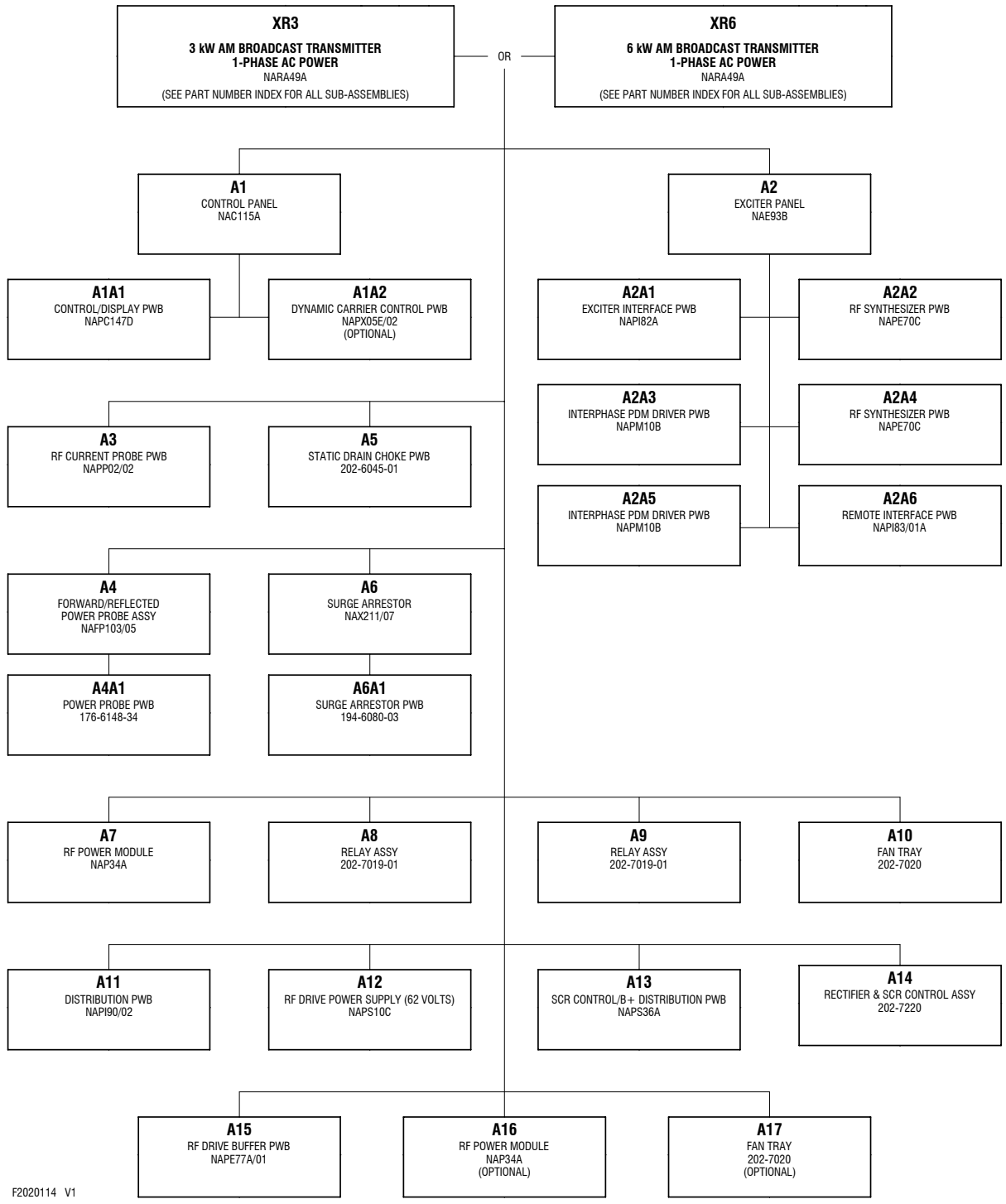
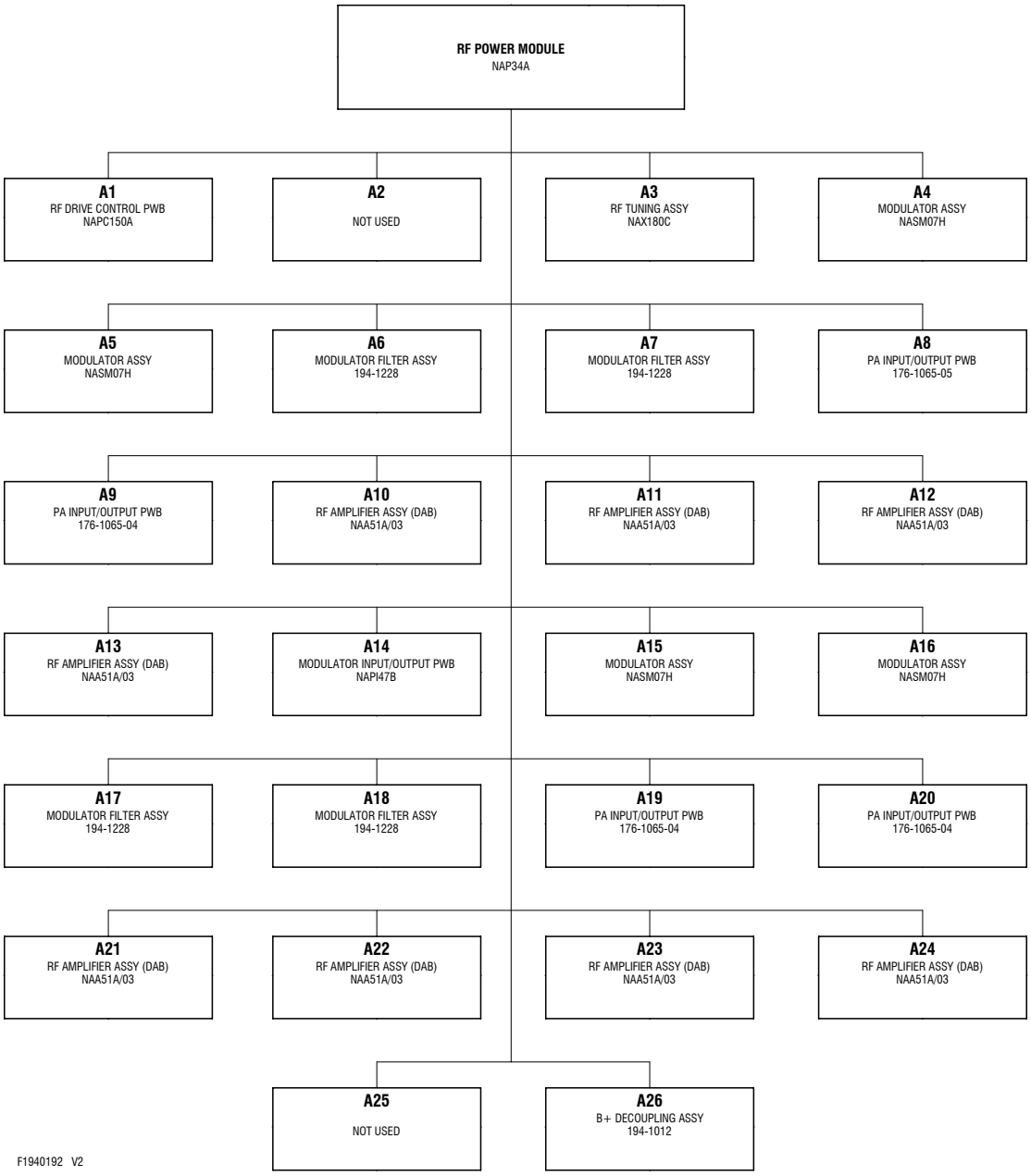


Figure 3.3: NAP34A RF Power Module Family Tree



Continued from previous page

176-1038-03 Coil Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R01	Resistor, Wirewound, 3.9 Ohms, 5%, 5W	RT34	PW-5 3.9 5%	75042
R02	Resistor, Wirewound, 3.9 Ohms, 5%, 5W	RT34	PW-5 3.9 5%	75042

176-1065-04 PA Input/Output PWB

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Capacitor, Mica, Dipped, 3900pF 5% 500V	CCC36	CD19FD392J03	14655
C02	Capacitor, Mica, Dipped, 3900pF 5% 500V	CCC36	CD19FD392J03	14655
C03	Capacitor, Ceramic, 0.22uF 10% 50V	CCG08	CKR06BX224KRV	56289
C04	Capacitor, Ceramic, 0.018uF 10% 50V	CAP24	CKR05BX183KRV SPRAG	56289
CR01	Diode, Schottky	QK09	1N5711 (STATIC)	50434
J01	Conn, Socket, D-Sub, 25 pin, PWB Mt	JS13	K22-B25S-NJ	22421
J02	Conn, Socket, D-Sub, 25 pin, PWB Mt	JS13	K22-B25S-NJ	22421
Q01	Thyristor, SCR, .8A, 60V	QN30	2N5061	04713
R01	Resistor, Film, 10 Ohms, 2%1/2W	RAP01	RL20S100G	35005
R02	Resistor, MF, 47.5 Ohms, 1PC 1/4W	RAB09	MF1/4DL47R5F	59124
R03	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
T01	Bead, Ferrite, 5.8mm, B Mtl	LY37	21-129-B	33062

176-1065-05 PA Input/Output PWB

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Capacitor, Mica, Dipped, 3900pF 5% 500V	CCC36	CD19FD392J03	14655
C02	Capacitor, Mica, Dipped, 3900pF 5% 500V	CCC36	CD19FD392J03	14655
C03	Capacitor, Ceramic, 0.22uF 10% 50V	CCG08	CKR06BX224KRV	56289
C04	Capacitor, Ceramic, 0.018uF 10% 50V	CAP24	CKR05BX183KRV SPRAG	56289
CR01	Diode, Schottky	QK09	1N5711 (STATIC)	50434
J01	Conn, Socket, D-Sub, 25 pin, PWB Mt	JS13	K22-B25S-NJ	22421
J02	Conn, Socket, D-Sub, 25 pin, PWB Mt	JS13	K22-B25S-NJ	22421
Q01	Thyristor, SCR, .8A, 60V	QN30	2N5061	04713
R01	Resistor, Film, 10 Ohms, 2%1/2W	RAP01	RL20S100G	35005
R02	Resistor, MF, 47.5 Ohms, 1PC 1/4W	RAB09	MF1/4DL47R5F	59124
R03	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
T01	Bead, Ferrite, 5.8mm, B Mtl	LY37	21-129-B	33062

176-1185 Modulator Filter PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Capacitor, Metal, Polyprop,.22uF, 5%, 630V	CAP50	2222-378-64224 BC COMP	56699
C02	Capacitor, Metal, Polyprop,.22uF, 5%, 630V	CAP50	2222-378-64224 BC COMP	56699
C03	Capacitor,Metal,Polyprop,.27uF,5%,630V	CNP45	2222-378-64274	56699
C04	Capacitor,Metal,Polyprop,.012uF,5%,1000V	CNP46	2222-378-74123	56699

176-6148-34 Power Probe PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Capacitor, Mica, Dipped, 5600pF 2% 500V	CAP14	CM07FD562G03	14655
C02	Capacitor, Mica, Dipped, 3300pF 2% 500V	CCD18	CM06FD332G03	14655
C03	Not Used	-	NOT USED	37338
C04	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C05	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C06	Capacitor, Mica, Dipped, 47pF2% 500V	CB21	CM05ED470G03	14655
C07	Capacitor, Mica, Dipped, 47pF2% 500V	CB21	CM05ED470G03	14655
C08	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C09	Not Used	-	NOT USED	37338
CR01	Diode, Zener Transient Supressor, 30V	QM12	P6KE30CA	04713
CR02	Diode, Zener Transient Supressor, 30V	QM12	P6KE30CA	04713
CR03	Diode, Schottky	QK09	1N5711 (STATIC)	50434
CR04	Diode, Schottky	QK09	1N5711 (STATIC)	50434
CR05	Diode, Zener Transient Supressor, 30V	QM12	P6KE30CA	04713
E01	Connector, Quick-Dis, M,1/4 Tab, PWB	HR26	1287	91833
E02	Connector, Quick-Dis, M,1/4 Tab, PWB	HR26	1287	91833
R01	Resistor, Film, 100 Ohms, 5%2W	RBP07	GS-3, 100 OHMS	75042
R02	Resistor, Film, 100 Ohms, 5%2W	RBP07	GS-3, 100 OHMS	75042
R03	Resistor, Film, 100 Ohms, 5%2W	RBP07	GS-3, 100 OHMS	75042
R04	Resistor, Film, 100 Ohms, 5%2W	RBP07	GS-3, 100 OHMS	75042
R05	Resistor, Film, 220 Ohms, 5%,2W	RK31	GS-3, 220 OHMS	75042
R06	Resistor, Film, 390 Ohms, 5%,2W	RBP33	GS-3, 390 OHMS	75042
R07	Resistor, Film, 680 Ohms, 2PC1/2W	RC35	RL20S681G	35005
R08	Resistor, Film, 1200 Ohms, 2PC 1/2W	RC38	RL20S122G	35005
R09	Resistor, Film, 2200 Ohms, 2PC 1/2W	RC41	RL20S222G	35005
R10	Resistor, Film, 3900 Ohms, 2PC 1/2W	RD02	RL20S392G	35005
R11	Resistor, Film, 10 Ohms, 2%1/2W	RAP01	RL20S100G	35005
R12	Resistor, Film, 10 Ohms, 2%1/2W	RAP01	RL20S100G	35005
R13	Resistor, Film, 470 Ohms, 2PC1/2W	RC33	RL20S471G	35005
R14	Resistor, Film, 470 Ohms, 2PC1/2W	RC33	RL20S471G	35005
R15	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R16	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R17	Resistor, MF, 1.00M Ohms, 1%1/4W	RAC13	MF1/4DL1004F	59124
R18	Resistor, MF, 68.1K Ohms, 1PC1/4W	RAB47	MF1/4DL6812F	59124
R19	Resistor, MF, 6.81K Ohms, 1PC1/4W	RAB35	MF1/4DL6811F	59124
R20	Resistor, MF, 6.81K Ohms, 1PC1/4W	RAB35	MF1/4DL6811F	59124
R21	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R22	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R23	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124

Continued from previous page

176-6148-34 Power Probe PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R24	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
R25	Resistor, Film, 100 Ohms, 5%2W	RBP07	GS-3, 100 OHMS	75042
S01	Switch, 8-Position, Piano, DIP, 1PST	SD28	76PSB08	81073
U01	IC, Op Amp, Dual, Single Supply	UP41	AD822AN(STATIC)	45496
XU01	Socket, IC, 8-pin	UC01	2-641260-1	00779

194-1002-01 Cableform Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
J01	Conn, Recept, Sq Flng, Size 17-28	JT07	205840-3	09482
L05	Toroid, Ferrite, Uncoated, 13mm, B Mtl	LA03	11-262-B	33062
P01	Conn, Socket, D-Sub, HDP-20, 25 pin	JR38	205207-1	09482
P01	Conn, Lock Screw, D-Sub, Male	JT16	205980-1	09482
P02	Conn, Socket, D-Sub, HDP-20, 25 pin	JR38	205207-1	09482
P02	Conn, Lock Screw, D-Sub, Male	JT16	205980-1	09482
P03	Conn, Plug, D-Sub, 25 pin, HDP-20	JR39	205208-1	09482
P03	Conn, Lock Screw, D-Sub, Male	JT16	205980-1	09482
P04	Conn, Socket, D-Sub, HDP-20, 25 pin	JR38	205207-1	09482
P04	Conn, Lock Screw, D-Sub, Male	JT16	205980-1	09482
P05	Not Used	-	NOT USED	37338
P06	Conn, Socket, D-Sub, 9 pin	JR27	205203-1	09482
P06	Conn, Lock Screw, D-Sub, Male	JT16	205980-1	09482
P07	Conn, Socket, D-Sub, 9 pin	JR27	205203-1	09482
P07	Conn, Lock Screw, D-Sub, Male	JT16	205980-1	09482

194-1012 Capacitor Bracket Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Capacitor, Metal,Polyprop, 5uF +/-20% 600V	CT40	734G505X0600	DEARBO
C02	Capacitor, Metal,Polyprop, 5uF +/-20% 600V	CT40	734G505X0600	DEARBO
C03	Capacitor, Metal,Polyprop, 5uF +/-20% 600V	CT40	734G505X0600	DEARBO
C04	Capacitor, Metal,Polyprop, 5uF +/-20% 600V	CT40	734G505X0600	DEARBO
R01	Resistor, Wirewound, 1 Ohms, 1%, 2.5W, NH	RS44	NS-2C-1 OHM-1%	35005
R02	Resistor, Wirewound, 1 Ohms, 1%, 2.5W, NH	RS44	NS-2C-1 OHM-1%	35005
R03	Resistor, Wirewound, 1 Ohms, 1%, 2.5W, NH	RS44	NS-2C-1 OHM-1%	35005
R04	Resistor, Wirewound, 1 Ohms, 1%, 2.5W, NH	RS44	NS-2C-1 OHM-1%	35005
R05	Resistor, Wirewound, 1 Ohms, 1%, 2.5W, NH	RS44	NS-2C-1 OHM-1%	35005
R06	Resistor, Wirewound, 1 Ohms, 1%, 2.5W, NH	RS44	NS-2C-1 OHM-1%	35005
R07	Resistor, Wirewound, 1 Ohms, 1%, 2.5W, NH	RS44	NS-2C-1 OHM-1%	35005
R08	Resistor, Wirewound, 1 Ohms, 1%, 2.5W, NH	RS44	NS-2C-1 OHM-1%	35005
R09	Resistor, Wirewound, 1 Ohms, 1%, 2.5W, NH	RS44	NS-2C-1 OHM-1%	35005
R10	Resistor, Wirewound, 1 Ohms, 1%, 2.5W, NH	RS44	NS-2C-1 OHM-1%	35005
R11	Resistor, Wirewound, 1 Ohms, 1%, 2.5W, NH	RS44	NS-2C-1 OHM-1%	35005
R12	Resistor, Wirewound, 1 Ohms, 1%, 2.5W, NH	RS44	NS-2C-1 OHM-1%	35005

194-6080-03 Surge Arrestor PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Capacitor, Ceramic, 0.047uF 10% 100V	CCG06	CKR06BX473KRV	56289
CR01	Diode, Zener Transient Supressor, 20V	QI29	P6KE20CA	07263
CR02	Diode, Power Rectifier, 1A, UltraFast	QN33	MUR160	04713
CR03	Diode, Power Rectifier, 1A, UltraFast	QN33	MUR160	04713
CR04	Diode, Power Rectifier, 1A, UltraFast	QN33	MUR160	04713
CR05	Diode, Power Rectifier, 1A, UltraFast	QN33	MUR160	04713
CR06	Diode, Zener, 4.7V, 1W, 5%, 0.14	QL43	1N4732A	04713
J01	Conn, BNC, Recept, Rt Angle, PWB Mt	JS21	R141665161	0GP12
R01	Not Used	-	NOT USED	37338
R02	Resistor, Film, 100 Ohms, 5%2W	RBP07	GS-3, 100 OHMS	75042
R03	Resistor, Film, 1000 Ohms, 2PC 1/2W	RAP09	RL20S102G	35005
R04	Not Used	-	NOT USED	37338
R05	Resistor, Film, 100 Ohms, 5%2W	RBP07	GS-3, 100 OHMS	75042
R06	Resistor, Film, 100 Ohms, 5%2W	RBP07	GS-3, 100 OHMS	75042

202-2004-02 Control Display Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
A01	Control Display PWB Assy	NAPC147D	195-2050-04	37338
U02	Mod, UDDS01	202-2020	202-2020	37338

202-6045-01 Static Drain Choke PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
E01	Not Used	-	NOT USED	37338
J01	Conn, BNC, Recept, PWB Mt	JF35	R141426161	0GP12
L01	Not Used	-	NOT USED	37338
L02	Not Used	-	NOT USED	37338
L03	Not Used	-	NOT USED	37338
L04	Not Used	-	NOT USED	37338
L05	Not Used	-	NOT USED	37338
L06	Not Used	-	NOT USED	37338
L07	Not Used	-	NOT USED	37338
L08	Not Used	-	NOT USED	37338
L09	Not Used	-	NOT USED	37338
L10	Not Used	-	NOT USED	37338
L11	Not Used	-	NOT USED	37338
L12	Not Used	-	NOT USED	37338
L13	Inductor, 30uh, 8A	LP31	1537G	73831
L14	Inductor, 30uh, 8A	LP31	1537G	73831
L15	Inductor, 30uh, 8A	LP31	1537G	73831
L16	Inductor, 30uh, 8A	LP31	1537G	73831
L17	Inductor, 30uh, 8A	LP31	1537G	73831
L18	Inductor, 30uh, 8A	LP31	1537G	73831
L19	Inductor, 30uh, 8A	LP31	1537G	73831
L20	Inductor, 30uh, 8A	LP31	1537G	73831
L21	Inductor, Choke, 5uH, 14A	LS14	1538M08	73831
L22	Inductor, Choke, 5uH, 14A	LS14	1538M08	73831
R01	Resistor, MF, 56.2 Ohms, 1PC 1/4W	RAB10	MF1/4DL56R2F	59124
R02	Resistor, Film, 560 Ohms, 2PC1/2W	RAP08	RL20S561G	35005

202-7005-04 Cableform Assy, P/S XR6

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
P24	MTA, Standard Dust Cover, 12 pin	JU04	1-640551-2	09482
P24	MTA, Keyed Closed End Housing,12pin,22AWG	JU26	1-644463-2	00779
P25	Conn, Socket, D-Sub, HDP-20, 25 pin	JR38	205207-1	09482
P25	Conn, Lock Screw, D-Sub, Male	JT16	205980-1	09482
P26	Conn,Socket,4-Pin,24-28 AWG	JT53	22-50-3045	27264
P27	MTA, Standard Dust Cover, 8 pin	JU07	640551-8	09482
P27	MTA, Keyed Closed End Housing,8 pin,22AWG	JU28	644463-8	00779
P28	MTA, Standard Dust Cover, 4 pin	JU02	640551-4	09482
P28	MTA, Keyed Closed End Housing,4 pin,22AWG	JU27	3-644463-4(ROHS) AMP	00779
P29	MTA, Standard Dust Cover, 4 pin	JU02	640551-4	09482
P29	MTA, Keyed Closed End Housing,4 pin,22AWG	JU27	3-644463-4(ROHS) AMP	00779

202-7017 Rectifier Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Capacitor,Polypro,0.015uF800Vac	CT39	715P1535800L	SBE
C02	Capacitor,Polypro,0.015uF800Vac	CT39	715P1535800L	SBE
C03	Capacitor,Polypro,0.015uF800Vac	CT39	715P1535800L	SBE
U01	Diode, (BeO), Rect,Dual Series, 1600V, 80A	UR70	IRKD71/16A	81483
U02	Diode, (BeO), Rect,Dual Series, 1600V, 80A	UR70	IRKD71/16A	81483
U03	Diode, (BeO), Rect,Dual Series, 1600V, 80A	UR70	IRKD71/16A	81483

202-7019-01 Relay Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
CR01	Diode, General Purpose, 400V,1A	QE28	1N4004	04713
K01	Relay, 24Vdc Coil	202-7040	202-7040	37338
R01	Resistor, Film, 560 Ohms, 5%,2W	RT14	GS-3, 560 OHM	75042

202-7020 Fan Tray Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
B01	Fan, Modified	200-5030-01	200-5030-01	37338
B02	Fan, Modified	200-5030-01	200-5030-01	37338
J01	Conn, Pin, Header, 3-PinMate'n Lock	JT64	350767-1	00779

202-7205-01 Cableform Assy,P/S,XR3/6,1-PH

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
P24	MTA, Standard Dust Cover, 12 pin	JU04	1-640551-2	09482
P24	MTA, Keyed Closed End Housing,12pin,22AWG	JU26	1-644463-2	00779
P25	Conn, Socket, D-Sub, HDP-20, 25 pin	JR38	205207-1	09482
P25	Conn, Lock Screw, D-Sub, Male	JT16	205980-1	09482
P26	Not Used	-	NOT USED	37338
P27	MTA, Standard Dust Cover, 8 pin	JU07	640551-8	09482
P27	MTA, Keyed Closed End Housing,8 pin,22AWG	JU28	644463-8	00779
P28	MTA, Standard Dust Cover, 12 pin	JU04	1-640551-2	09482
P28	MTA, Keyed Closed End Housing,12pin,22AWG	JU26	1-644463-2	00779
P29	MTA, Standard Dust Cover, 4 pin	JU02	640551-4	09482
P29	MTA, Keyed Closed End Housing,4 pin,22AWG	JU27	3-644463-4(ROHS) AMP	00779
P30	Plug, Mini, 2-pole,Screw Clamp	JU32	AKZ1550/2	0DV12

202-7220 Rectifier & SCR Control Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Capacitor,Polypro,0.015uF800Vac	CT39	715P1535800L	SBE
C02	Capacitor,Polypro,0.015uF800Vac	CT39	715P1535800L	SBE
U01	Diode, (BeO), Rect,Dual Series, 1600V, 80A	UR70	IRKD71/16A	81483
U02	Diode, (BeO), Rect,Dual Series, 1600V, 80A	UR70	IRKD71/16A	81483
U03	Rectifier,SCR,1-PH,480V/70A,c/w MOV,Pad	UR86	1652-48-70(STATIC)	IT5Z8
U04	Board Assy, SCR Control,0-5VDCControl	UR87	1022-FC-0/5V-SP33(STATIC)	IT5Z8

202-8050 Cableform, Power ModuleInterface, 40in

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
P01	Conn, Clamp, Strain Relief, Size 17, Lg	JE13	206322-1	09482
P01	Conn, Plug, Size 17-28	JT08	205839-3	09482
P02	Conn, Plug, 3-Pin, Mate-N-Lok	JT50	350766-1	00779
P03	Conn, Plug, D-Sub, 25 pin, HDP-20	JR39	205208-1	09482
P03	Conn, Lock Screw, D-Sub, Male	JT16	205980-1	09482
P04	Conn, Coax, BNC, Plug, 50ohm,Crimp	JDP24	225395-7	09482

202-8060-01 Plug Back Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
A08	Relay Assy	202-7019-01	202-7019-01	37338
A09	Relay Assy	202-7019-01	202-7019-01	37338
J01	Conn, Socket, 8 pin, 15A, Angle Bkt, Gold	JR44	385490268	13150
J02	Conn, Socket, 8 pin, 15A, Angle Bkt, Gold	JR44	385490268	13150
J03	Conn, Socket, 8 pin, 15A, Angle Bkt, Gold	JR44	385490268	13150
J04	Conn, Socket, 8 pin, 15A, Angle Bkt, Gold	JR44	385490268	13150

202-8108 Cableform, XR6

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
P01	Conn, Recept, Ribbon Cable, 40 pin	JP51	746288-9	00779
P02	Conn, Socket, D-Sub, HDP-20, 25 pin	JR38	205207-1	09482
P02	Conn, Lock Screw, D-Sub, Male	JT16	205980-1	09482
P03	Conn, Recept, Ribbon Cable, 40 pin	JP51	746288-9	00779
P04	Conn, Recept, Ribbon Cable, 40 pin	JP51	746288-9	00779
P05	MTA, Standard Dust Cover, 4 pin	JU02	640551-4	09482
P05	MTA, Keyed Closed End Housing,4 pin,22AWG	JU27	3-644463-4(ROHS) AMP	00779
P06	Conn, Recept, Ribbon Cable, 40 pin	JP51	746288-9	00779
P07	Conn, Recept, Ribbon Cable, 40 pin	JP51	746288-9	00779
P08	Conn, Recept, Ribbon Cable, 40 pin	JP51	746288-9	00779
P09	Conn, Socket, D-Sub, HDP-20, 25 pin	JR38	205207-1	09482
P09	Conn, Lock Screw, D-Sub, Male	JT16	205980-1	09482
P10	Conn, Plug, D-Sub, 9 pin	JR28	205204-1	09482
P10	Conn, Lock Screw, D-Sub, Male	JT16	205980-1	09482
P11	Conn, Coax, BNC, Plug, 50ohm,Crimp	JDP24	225395-7	09482
P12	Conn, Coax, BNC, Plug, 50ohm,Crimp	JDP24	225395-7	09482
P13	Conn, Coax, BNC, Plug, 50ohm,Crimp	JDP24	225395-7	09482
P14	Conn, Coax, BNC, Plug, 50ohm,Crimp	JDP24	225395-7	09482
P15	Conn, Recept, Ribbon Cable, 40 pin	JP51	746288-9	00779
P16	Conn, Coax, BNC, Plug, 50ohm,Crimp	JDP24	225395-7	09482
P17	Conn, Coax, BNC, Plug, 50ohm,Clamp	JDP25	69475	02660
P18	Conn, Coax, BNC, Plug, 50ohm,Clamp	JDP25	69475	02660
P19	Conn, Coax, BNC, Plug, 50ohm,Clamp	JDP25	69475	02660
P20	Conn, Recept, Ribbon Cable, 40 pin	JP51	746288-9	00779
P21	Conn, Socket, D-Sub, HDP-20, 25 pin	JR38	205207-1	09482
P21	Conn, Lock Screw, D-Sub, Male	JT16	205980-1	09482
P22	Conn, Coax, BNC, Plug, 50ohm,Crimp	JDP24	225395-7	09482
P23	Conn, Coax, BNC, Plug, 50ohm,Crimp	JDP24	225395-7	09482

NAA51A/00 RF Amplifier Assy, Basic

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
CR01	Diode, Power Rectifier, 4A, Ultra Fast	QM22	MUR460	04713
CR02	Diode, Power Rectifier, 4A, Ultra Fast	QM22	MUR460	04713
CR03	Diode, Power Rectifier, 4A, Ultra Fast	QM22	MUR460	04713
CR04	Diode, Power Rectifier, 4A, Ultra Fast	QM22	MUR460	04713
P01	Conn, Plug, D-Sub, 25 pin, PWB Mt	JS12	K22-B25P-NJ	63590
Q01	Transistor, FET, N Channel, MOS, 450V	QN34	2SK1169(STATIC) HITACHI	62786
Q02	Transistor, FET, N Channel, MOS, 450V	QN34	2SK1169(STATIC) HITACHI	62786
Q03	Transistor, FET, N Channel, MOS, 450V	QN34	2SK1169(STATIC) HITACHI	62786
Q04	Transistor, FET, N Channel, MOS, 450V	QN34	2SK1169(STATIC) HITACHI	62786
Q05	Transistor, FET, N Channel, MOS, 450V	QN34	2SK1169(STATIC) HITACHI	62786
Q06	Transistor, FET, N Channel, MOS, 450V	QN34	2SK1169(STATIC) HITACHI	62786
Q07	Transistor, FET, N Channel, MOS, 450V	QN34	2SK1169(STATIC) HITACHI	62786
Q08	Transistor, FET, N Channel, MOS, 450V	QN34	2SK1169(STATIC) HITACHI	62786
U01	RF Drive Transformer Assy	176-1012	176-1012	37338

NAA51A/03 RF Amplifier Assy, DAB

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Capacitor, Polyprop, 0.039uF,5%, 600V	CT42	716P39356KA3	SB ELEC
C02	Capacitor, Polyprop, 0.039uF,5%, 600V	CT42	716P39356KA3	SB ELEC
R01	Resistor, Film, 470 Ohms, 5%,2W	RBP11	GS-3, 470 OHMS	75042

NAE93B Exciter Panel Assembly

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
A01	Exciter Interface PWB,XRSeries	NAPI82A	202-4021-01	37338
A02	RF Synthesizer PWB Assy	NAPE70C	194-3060-04	37338
A03	Interphase PDM Driver	NAPM10B	197-3050-03	37338
A04	RF Synthesizer PWB Assy	NAPE70C	194-3060-04	37338
A05	Interphase PDM Driver	NAPM10B	197-3050-03	37338
A06	Remote Interface PWB,XR Series	NAPI83/01A	202-4030-02	37338

NAFP103/05 Forward/Reflected Power Probe,XR12/XR6/XR3

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
A01	Power Probe PWB Assy	176-6148-34	176-6148-34	37338
C01	Capacitor, Ceramic, 50pF +10%15000V	CCG42	T500K99COGW8570	56699
J01	Conn, Coax, BNC, Recept, 50ohm	JDP26	UG1094/U	02660
J02	Conn, Coax, BNC, Recept, 50ohm	JDP26	UG1094/U	02660
T01	Transformer Current Assy	149-6052-08	149-6052-08	37338

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
A01	RF Drive Control PWB Assy	NAPC150A	202-1150-02	37338
A02	Not Used	-	NOT USED	37338
A03	RF Tuning Assy (Manual)	NAX180C	184-1150-03	37338
A04	Modulator Assy	NASM07H	176-1020-08	37338
A05	Modulator Assy	NASM07H	176-1020-08	37338
A06	Modulator Filter Assy	194-1228	194-1228	37338
A07	Modulator Filter Assy	194-1228	194-1228	37338
A08	PA Input/Output PWB	176-1065-05	176-1065-05	37338
A09	PA Input/Output PWB	176-1065-04	176-1065-04	37338
A10	RF Amplifier Assy, DAB	NAA51A/03	183-1022-07	37338
A11	RF Amplifier Assy, DAB	NAA51A/03	183-1022-07	37338
A12	RF Amplifier Assy, DAB	NAA51A/03	183-1022-07	37338
A13	RF Amplifier Assy, DAB	NAA51A/03	183-1022-07	37338
A14	Modulator Input Output PWB Assy	NAPI47B	194-1120-02	37338
A14F1	Fuse, 20A, 500Vdc, Non Time Delay, KLM	FA34	KLM-20	71400
A14F4	Fuse, 20A, 500Vdc, Non Time Delay, KLM	FA34	KLM-20	71400
A14F6	Fuse, 20A, 500Vdc, Non Time Delay, KLM	FA34	KLM-20	71400
A14F8	Fuse, 20A, 500Vdc, Non Time Delay, KLM	FA34	KLM-20	71400
A15	Modulator Assy	NASM07H	176-1020-08	37338
A16	Modulator Assy	NASM07H	176-1020-08	37338
A17	Modulator Filter Assy	194-1228	194-1228	37338
A18	Modulator Filter Assy	194-1228	194-1228	37338
A19	PA Input/Output PWB	176-1065-04	176-1065-04	37338
A20	PA Input/Output PWB	176-1065-04	176-1065-04	37338
A21	RF Amplifier Assy, DAB	NAA51A/03	183-1022-07	37338
A22	RF Amplifier Assy, DAB	NAA51A/03	183-1022-07	37338
A23	RF Amplifier Assy, DAB	NAA51A/03	183-1022-07	37338
A24	RF Amplifier Assy, DAB	NAA51A/03	183-1022-07	37338
A25	Not Used	-	NOT USED	37338
A26	Capacitor Bracket Assy	194-1012	194-1012	37338
C01	Capacitor, Elect, 100uF 100V	CT32	KME100T101M10X25LL	1W344
J02	Connector Mod JT03	176-5110-03	176-5110-03	37338
J03	Connector Mod JT03	176-5110-04	176-5110-04	37338
L01	Inductor Assy	194-1228-01	194-1228-01	37338
L02	Inductor Assy	194-1228-01	194-1228-01	37338
L03	Inductor Assy	194-1228-01	194-1228-01	37338
L04	Inductor Assy	194-1228-01	194-1228-01	37338
Q01	Transistor, PNP, 140V, 20A, 250W	QS07	MJ15004(STATIC)	04713
R01	Resistor, Film, 330K Ohms, 2PC 1/2W	RAP19	RL20S334G	35005

Continued from previous page

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R02	Resistor, Film, 330K Ohms, 2PC 1/2W	RAP19	RL20S334G	35005
R03	Resistor, Film, 330K Ohms, 2PC 1/2W	RAP19	RL20S334G	35005
R04	Resistor, Film, 330K Ohms, 2PC 1/2W	RAP19	RL20S334G	35005
RT01	Thermistor, 200K Ohms @ 25C	RX07	135-204QAG-J01	1BH13
RT02	Thermistor, 200K Ohms @ 25C	RX07	135-204QAG-J01	1BH13
S01	Switch,Push-Button,Blk,Mom,SPST,NO	SA56	MSPS103C0	95146
T01	Combiner Transformer Assy	176-1060-01	176-1060-01	37338
T02	Combiner Transformer Assy	176-1060-01	176-1060-01	37338

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
BT01	Battery, Lithium, 3V,20mm Coin Cell	BBLT01	CR2032	PANAS
C001	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C002	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C003	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C004	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C005	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C006	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C007	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C008	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C009	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C010	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C011	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C012	Cap,SMT,Ceramic,0.001uF,10%,50V,X7R,0603	CCFS01	C0603C102K5RAC	31433
C013	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C014	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C015	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C016	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C017	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C018	Cap,SMT,Ceramic,0.001uF,10%,50V,X7R,0603	CCFS01	C0603C102K5RAC	31433
C019	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C020	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C021	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C022	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C023	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C024	Cap,SMT,Ceramic,0.001uF,10%,50V,X7R,0603	CCFS01	C0603C102K5RAC	31433
C025	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C026	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C027	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C028	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C029	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C030	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C031	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C032	Cap,SMT,Ceramic,0.0022uF,10%,50V,X7R,0603	CCFS02	C0603C222K5RAC	31433
C033	Cap,SMT,Ceramic,0.0047uF,10%,50V,X7R,0603	CCFS03	C0603C472K5RAC	31433
C034	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C035	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C036	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C037	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C038	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433

NAPC147D Control Display PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C039	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C040	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C041	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C042	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C043	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C044	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C045	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C046	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C047	Cap,SMT,Tantalum,10uF,10%,35V,2917	CTFS03	T494D106K035AS	31433
C048	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C049	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C050	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C051	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C052	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C053	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C054	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C055	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C056	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C057	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C058	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C059	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C060	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C061	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C062	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C063	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C064	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C065	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C066	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C067	Cap,SMT,Tantalum,10uF,10%,35V,2917	CTFS03	T494D106K035AS	31433
C068	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C069	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C070	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C071	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C072	Cap,SMT,Tantalum,10uF,10%,35V,2917	CTFS03	T494D106K035AS	31433
C073	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C074	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C075	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C076	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C077	Cap,SMT,Tantalum,10uF,10%,35V,2917	CTFS03	T494D106K035AS	31433

NAPC147D Control Display PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C078	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C079	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C080	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C081	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C082	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C083	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C084	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C085	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C086	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C087	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C088	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C089	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C090	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C091	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C092	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C093	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C094	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C095	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C096	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C097	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C098	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C099	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C100	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C101	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C102	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C103	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C104	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C105	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C106	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C107	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C108	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C109	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C110	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C111	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C112	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C113	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C114	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C115	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C116	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433

NAPC147D Control Display PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C117	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C118	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C119	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C120	Cap,SMT,Tantalum,10uF,10%,35V,2917	CTFS03	T494D106K035AS	31433
C121	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C122	Cap,SMT,Tantalum,10uF,10%,35V,2917	CTFS03	T494D106K035AS	31433
C123	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C124	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C125	Cap,SMT,Ceramic,18pF,2%,50V,C0G,0603	CCFS23	C0603C180G5GAC	31433
C126	Cap,SMT,Ceramic,18pF,2%,50V,C0G,0603	CCFS23	C0603C180G5GAC	31433
C127	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C128	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C129	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C130	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C131	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C132	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C133	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C134	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C135	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C136	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C137	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C138	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C139	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C140	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C141	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C142	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C143	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C144	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C145	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C146	Cap,SMT,Tantalum,10uF,10%,35V,2917	CTFS03	T494D106K035AS	31433
C147	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C148	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C149	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C150	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C151	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C152	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C153	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C154	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C155	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433

NAPC147D Control Display PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C156	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C157	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C158	Cap,SMT,Tantalum,10uF,10%,35V,2917	CTFS03	T494D106K035AS	31433
C159	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C160	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C161	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C162	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C163	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C164	Cap,SMT,Ceramic,0.47uF,10%,25V,X7R,0805	CCFS09	C0805C474K3RAC	31433
C165	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C166	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
CR01	Diode,SMT,Schottky,30V,0.2A,SOD-323	QDSS01	BAT54HT1(STATIC)	04713
CR02	Diode,SMT,Schottky,30V,0.2A,SOD-323	QDSS01	BAT54HT1(STATIC)	04713
CR03	Diode,SMT,Schottky,30V,0.2A,SOD-323	QDSS01	BAT54HT1(STATIC)	04713
CR04	Diode,SMT,Schottky,30V,0.2A,SOD-323	QDSS01	BAT54HT1(STATIC)	04713
CR05	Diode,SMT,Schottky,30V,0.2A,SOD-323	QDSS01	BAT54HT1(STATIC)	04713
CR06	Diode,SMT,Schottky,30V,0.2A,SOD-323	QDSS01	BAT54HT1(STATIC)	04713
CR07	Diode,SMT,Schottky,30V,0.2A,SOD-323	QDSS01	BAT54HT1(STATIC)	04713
CR08	Diode,SMT,Schottky,30V,0.2A,SOD-323	QDSS01	BAT54HT1(STATIC)	04713
CR09	Diode,SMT,Schottky,30V,0.2A,SOD-323	QDSS01	BAT54HT1(STATIC)	04713
CR10	Diode,SMT,Schottky,30V,0.2A,SOD-323	QDSS01	BAT54HT1(STATIC)	04713
CR11	Diode,SMT,Schottky,30V,0.2A,SOD-323	QDSS01	BAT54HT1(STATIC)	04713
CR12	Diode,SMT,Schottky,30V,0.2A,SOD-323	QDSS01	BAT54HT1(STATIC)	04713
CR13	Diode,SMT,Schottky,30V,0.2A,SOD-323	QDSS01	BAT54HT1(STATIC)	04713
CR14	Diode,SMT,Schottky,30V,0.2A,SOD-323	QDSS01	BAT54HT1(STATIC)	04713
CR15	Diode,SMT,Schottky,30V,0.2A,SOD-323	QDSS01	BAT54HT1(STATIC)	04713
CR16	Diode,SMT,Zener,39V,5%,3W,SMB	QDZS04	1SMB5939BT3	04713
E01	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
E02	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
E03	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
J01	Conn, Header, Ribbon Cbl, 40 pin	JP52	499910-9	00779
J02	Conn, Plug, D-Sub, 25 pin, PWB Mt	JS12	K22-B25P-NJ	63590
J03	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
J04	Conn, Header, Ribbon Cbl, 40 pin	JP52	499910-9	00779
J05	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
J06	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
J07	Conn, Header, Ribbon Cbl, 40 pin	JP52	499910-9	00779
J08	Conn, Header,Square Post,Gold,Dual,40-pin	JF47	4-102973-0	09482
J09	Conn, Header, Ribbon Cbl, 20Pin	JQ55	103308-5	00779

Continued from previous page

NAPC147D Control Display PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
J10	Conn, Header,Square Post,Gold,Dual,40-pin	JF47	4-102973-0	09482
J11	MTA, Keyed Square Post HeaderAssy, 4 pin	JU25	647123-4	00779
L01	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L02	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L03	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L04	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L05	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L06	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L07	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L08	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L09	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L10	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L11	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L12	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L13	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L14	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L15	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
LS01	Alarm, Audio Piezoelectric,Sonalert	LP30	MSR516N	90201
Q01	Transistor,SMT,NPN,Switch/Amp,SOT-23	QBNS01	MMBT4401LT1(STATIC)	04713
Q02	Transistor,SMT,NPN,Switch/Amp,SOT-23	QBNS01	MMBT4401LT1(STATIC)	04713
Q03	Transistor,SMT,NPN,Switch/Amp,SOT-23	QBNS01	MMBT4401LT1(STATIC)	04713
Q04	Transistor,SMT,NPN,Switch/Amp,SOT-23	QBNS01	MMBT4401LT1(STATIC)	04713
Q05	Transistor,SMT,MOSFET,N-Channel,60V,115mA,SOT-23	QN53	2N7002LT1G(STATIC) (ROHS)	1MQ07
R001	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R002	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R003	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R004	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R005	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R006	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R007	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R008	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R009	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R010	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R011	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R012	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R013	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R014	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124

Continued from previous page

NAPC147D Control Display PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R015	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R016	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R017	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R018	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R019	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R020	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R021	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R022	Resistor,SMT,MF,8250ohms,1%,1/10W,0603	RFFS49	RK73H1JLTD8251F	59124
R023	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R024	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R025	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R026	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R027	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R028	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R029	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R030	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R031	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R032	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R033	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R034	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R035	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R036	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R037	Resistor,SMT,MF,39.2Kohms,1%,1/10W,0603	RFFS57	RK73H1JLTD3922F	59124
R038	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R039	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R040	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R041	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R042	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R043	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R044	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R045	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R046	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R047	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R048	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R049	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R050	Not Used	-	NOT USED	37338
R051	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R052	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R053	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124

NAPC147D Control Display PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R054	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R055	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R056	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R057	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R058	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R059	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R060	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R061	Resistor,SMT,MF,5620ohms,1%,1/10W,0603	RFFS47	RK73H1JLTD5621F	59124
R062	Resistor,SMT,MF,8250ohms,1%,1/10W,0603	RFFS49	RK73H1JLTD8251F	59124
R063	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R064	Resistor,SMT,MF,100Kohms,1%,1/10W,0603	RFFS62	RK73H1JLTD1003F	59124
R065	Resistor,SMT,MF,1500ohms,1%,1/10W,0603	RFFS40	RK73H1JLTD1501F	59124
R066	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R067	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R068	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R069	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R070	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R071	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R072	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R073	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R074	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R075	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R076	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R077	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R078	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R079	Resistor,SMT,MF,100Kohms,1%,1/10W,0603	RFFS62	RK73H1JLTD1003F	59124
R080	Resistor,SMT,MF,1500ohms,1%,1/10W,0603	RFFS40	RK73H1JLTD1501F	59124
R081	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R082	Resistor,SMT,MF,15.0Kohms,1%,1/10W,0603	RFFS52	RK73H1JLTD1502F	59124
R083	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R084	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R085	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R086	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R087	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R088	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R089	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R090	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R091	Resistor, SMT, MF, 221 Ohms,1% 1/4W	RAD17	RK73H2BL2210F	59124
R092	Resistor, SMT, MF, 221 Ohms,1% 1/4W	RAD17	RK73H2BL2210F	59124

Continued from previous page

NAPC147D Control Display PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R093	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R094	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R095	Resistor,SMT,MF,68.1Kohms,1%,1/10W,0603	RFFS60	RK73H1JLTD6812F	59124
R096	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R097	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R098	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R099	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R100	Resistor,SMT,MF,681ohms,1%,1/10W,0603	RFFS36	RK73H1JLTD6810F	59124
R101	Resistor,SMT,MF,681ohms,1%,1/10W,0603	RFFS36	RK73H1JLTD6810F	59124
R102	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R103	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R104	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R105	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R106	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R107	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R108	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R109	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R110	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R111	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R112	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R113	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R114	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R115	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R116	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R117	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R118	Resistor,SMT,MF,47.5Kohms,1%,1/10W,0603	RFFS58	RK73H1JLTD4752F	59124
R119	Resistor,SMT,MF,1210ohms,1%,1/10W,0603	RFFS39	RK73H1JLTD1211F	59124
R120	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R121	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R122	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R123	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R124	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R125	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R126	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R127	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R128	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R129	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R130	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R131	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124

NAPC147D Control Display PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R132	Resistor,SMT,MF,22.1Kohms,1%,1/10W,0603	RFFS54	RK73H1JLTD2212F	59124
R133	Resistor,SMT,MF,1820ohms,1%,1/10W,0603	RFFS41	RK73H1JLTD1821F	59124
R134	Resistor,SMT,MF,12.1Kohms,1%,1/10W,0603	RFFS51	RK73H1JLTD1212F	59124
R135	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R136	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R137	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R138	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R139	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R140	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R141	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R142	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R143	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R144	Resistor,SMT,MF,475ohms,1%,1/10W,0603	RFFS34	RK73H1JLTD4750F	59124
R145	Resistor,SMT,MF,475ohms,1%,1/10W,0603	RFFS34	RK73H1JLTD4750F	59124
R146	Resistor,SMT,MF,475ohms,1%,1/10W,0603	RFFS34	RK73H1JLTD4750F	59124
R147	Not Used	-	NOT USED	37338
R148	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R149	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R150	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R151	Resistor,SMT,MF,475ohms,1%,1/10W,0603	RFFS34	RK73H1JLTD4750F	59124
R152	Resistor,SMT,MF,475ohms,1%,1/10W,0603	RFFS34	RK73H1JLTD4750F	59124
R153	Resistor,SMT,MF,475ohms,1%,1/10W,0603	RFFS34	RK73H1JLTD4750F	59124
R154	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R155	Resistor,SMT,MF,475ohms,1%,1/10W,0603	RFFS34	RK73H1JLTD4750F	59124
R156	Resistor,SMT,MF,2210ohms,1%,1/10W,0603	RFFS42	RK73H1JLTD2211F	59124
R157	Resistor,SMT,MF,2210ohms,1%,1/10W,0603	RFFS42	RK73H1JLTD2211F	59124
R158	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R159	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R160	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R161	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R162	Resistor,SMT,MF,2210ohms,1%,1/10W,0603	RFFS42	RK73H1JLTD2211F	59124
R163	Resistor,SMT,MF,2210ohms,1%,1/10W,0603	RFFS42	RK73H1JLTD2211F	59124
R164	Resistor,SMT,MF,2210ohms,1%,1/10W,0603	RFFS42	RK73H1JLTD2211F	59124
R165	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R166	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R167	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R168	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R169	Resistor,SMT,MF,2210ohms,1%,1/10W,0603	RFFS42	RK73H1JLTD2211F	59124
R170	Resistor,SMT,MF,2210ohms,1%,1/10W,0603	RFFS42	RK73H1JLTD2211F	59124

NAPC147D Control Display PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R171	Resistor,SMT,MF,2210ohms,1%,1/10W,0603	RFFS42	RK73H1JLTD2211F	59124
R172	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R173	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R174	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R175	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R176	Resistor,SMT,MF,2210ohms,1%,1/10W,0603	RFFS42	RK73H1JLTD2211F	59124
R177	Resistor,SMT,MF,2210ohms,1%,1/10W,0603	RFFS42	RK73H1JLTD2211F	59124
R178	Resistor,SMT,MF,2210ohms,1%,1/10W,0603	RFFS42	RK73H1JLTD2211F	59124
R179	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R180	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R181	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R182	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R183	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R184	Resistor,SMT,MF,475ohms,1%,1/10W,0603	RFFS34	RK73H1JLTD4750F	59124
R185	Resistor,SMT,MF,475ohms,1%,1/10W,0603	RFFS34	RK73H1JLTD4750F	59124
R186	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R187	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R188	Resistor,SMT,MF,2210ohms,1%,1/10W,0603	RFFS42	RK73H1JLTD2211F	59124
R189	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R190	Resistor,SMT,MF,475ohms,1%,1/10W,0603	RFFS34	RK73H1JLTD4750F	59124
R191	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R192	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R193	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R194	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R195	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R196	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R197	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R198	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R199	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R200	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R201	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R202	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R203	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R204	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R205	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R206	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R207	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R208	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R209	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124

NAPC147D Control Display PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R210	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R211	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R212	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R213	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R214	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R215	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R216	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R217	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R218	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R219	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R220	Resistor, Film, 4.75 Ohms, 1PC 1/2W	RC09	MF1/2DL4R75F	59124
R221	Resistor, Film, 4.75 Ohms, 1PC 1/2W	RC09	MF1/2DL4R75F	59124
R222	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R223	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R224	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R225	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R226	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R227	Resistor,SMT,MF,1500ohms,1%,1/10W,0603	RFFS40	RK73H1JLTD1501F	59124
R228	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R229	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R230	Resistor,SMT,MF,15.0Kohms,1%,1/10W,0603	RFFS52	RK73H1JLTD1502F	59124
R231	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R232	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R233	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R234	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R235	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R236	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R237	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R238	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R239	Resistor,SMT,MF,2740ohms,1%,1/10W,0603	RFFS43	RK73H1JLTD2741F	59124
R240	Resistor,SMT,MF,3920ohms,1%,1/10W,0603	RFFS45	RK73H1JLTD3921F	59124
R241	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R242	Resistor,SMT,MF,33.2Kohms,1%,1/10W,0603	RFFS56	RK73H1JLTD3322F	59124
R243	Resistor, Film, 3.92 Ohms, 1PC 1/2W	RC08	MF1/2DL3R92F	59124
R244	Resistor,SMT,MF,3920ohms,1%,1/10W,0603	RFFS45	RK73H1JLTD3921F	59124
R245	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R246	Resistor, Film, 3.92 Ohms, 1PC 1/2W	RC08	MF1/2DL3R92F	59124
R247	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R248	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124

Continued from previous page

NAPC147D Control Display PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R249	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R250	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R251	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R252	Resistor,SMT,MF,3920ohms,1%,1/10W,0603	RFFS45	RK73H1JLTD3921F	59124
R253	Resistor,SMT,MF,100Kohms,1%,1/10W,0603	RFFS62	RK73H1JLTD1003F	59124
R254	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R255	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
U01	IC,SMT,Opamp,Quad,Rail-To-Rail,SOIC-14	ULAS02	TLV2374ID(STATIC)	01295
U02	IC,SMT,Opamp,Quad,Rail-To-Rail,SOIC-14	ULAS02	TLV2374ID(STATIC)	01295
U03	IC,SMT,Opamp,Quad,Rail-To-Rail,SOIC-14	ULAS02	TLV2374ID(STATIC)	01295
U04	IC,SMT,Comparator,Quad,SOIC-14	ULCS01	MC3302D(STATIC)	04713
U05	IC,Low Voltage Temp Sensor,+/-3 Deg,TO-92	UC58	TMP36GT9(STATIC)	45496
U06	IC,SMT,RS-485 Transceiver,Sgl,SOIC-8	UDTS03	DS36C278TM(STATIC)	27014
U07	IC,SMT,Opamp,Quad,Rail-To-Rail,SOIC-14	ULAS02	TLV2374ID(STATIC)	01295
U08	IC,SMT,Opamp,Quad,Rail-To-Rail,SOIC-14	ULAS02	TLV2374ID(STATIC)	01295
U09	IC,SMT,ADC,10-Bit,11-ch,SPI,SOIC-20	UMAS01	TLC1543IDW(STATIC)	01295
U10	IC,SMT,4.096V Reference,0.1%,SOT-23-6	ULRS02	LT1790BIS6-4.096(STATIC)	64155
U11	IC,SMT,Opamp,Quad,Rail-To-Rail,SOIC-14	ULAS02	TLV2374ID(STATIC)	01295
U12	IC,SMT,ADC,10-Bit,11-ch,SPI,SOIC-20	UMAS01	TLC1543IDW(STATIC)	01295
U13	IC,CMOS,Hex Schmitt,Trigger Inverter,SOIC-14	UG35	MM74HC14M(STATIC)	07263
U14	IC,CMOS,Hex Schmitt,Trigger Inverter,SOIC-14	UG35	MM74HC14M(STATIC)	07263
U15	IC,CMOS,Hex Schmitt,Trigger Inverter,SOIC-14	UG35	MM74HC14M(STATIC)	07263
U16	IC,CMOS,Hex Schmitt,Trigger Inverter,SOIC-14	UG35	MM74HC14M(STATIC)	07263
U17	IC,CMOS,Hex Schmitt,Trigger Inverter,SOIC-14	UG35	MM74HC14M(STATIC)	07263
U18	IC,SMT,Complex Prog Logic Dev,PLCC-84	UX74	XC9572-15PC84I(STATIC)	68994
U19	Not Used	-	NOT USED	37338
U20	IC, SMT, SRAM, 32Kx8, SOIC-28(Wide)	UDMS01	CY62256LL-70SNI(STATIC)	65786
U21	IC,SMT,Non-Volatile RAM Ctrlr,SOIC-8	UDSS01	DS1312S-2(STATIC)	0B0A9
U22	IC, SMT, Micro, ADC, PWM,Flash, TQFP-64	UDMS02	ATMEGA128-16AI(STATIC)	1FN41
U23	IC, SMT, CMOS, Octal Latch,SOIC-20	UDLS02	SN74AHC573DW(STATIC)	01295
U24	IC,CMOS,Hex Schmitt,Trigger Inverter,SOIC-14	UG35	MM74HC14M(STATIC)	07263
U25	IC,SMT,Real-Time Clock,SPI,SOIC-16	UDTS01	M41T94MQ6(STATIC)	U3040

Continued from previous page

NAPC147D Control Display PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
U26	IC,SMT,2.5V Reference,0.1%,SOT-23-6	UX83	LT1790BIS6-2.5(STATIC)	64155
U27	IC,SMT,Opamp,Quad,Single Supply,SOIC-14	ULAS01	MC33074AD(STATIC)	04713
U28	IC,SMT,Opamp,Quad,Single Supply,SOIC-14	ULAS01	MC33074AD(STATIC)	04713
U29	IC,SMT,CMOS,Octal Flip Flop,SOIC-20	UDLS01	SN74AHC574DW(STATIC)	01295
U30	IC,SMT,Trans Array, 7 Darl.,SOIC-16	UDAS01	MC1413BD(STATIC)	04713
U31	IC,SMT,DAC,8-Bit,4-ch,SPI,SOIC-14	UMDS01	TLV5620ID(STATIC)	64155
U32	IC,SMT,DAC,8-Bit,4-ch,SPI,SOIC-14	UMDS01	TLV5620ID(STATIC)	64155
U33	IC,SMT,CMOS,Octal Flip Flop,SOIC-20	UDLS01	SN74AHC574DW(STATIC)	01295
U34	IC,SMT,Trans Array, 7 Darl.,SOIC-16	UDAS01	MC1413BD(STATIC)	04713
U35	IC,SMT,Trans Array, 7 Darl.,SOIC-16	UDAS01	MC1413BD(STATIC)	04713
U36	IC,SMT,CMOS,Octal Flip Flop,SOIC-20	UDLS01	SN74AHC574DW(STATIC)	01295
U37	IC,SMT,Trans Array, 7 Darl.,SOIC-16	UDAS01	MC1413BD(STATIC)	04713
U38	IC,SMT,Trans Array, 7 Darl.,SOIC-16	UDAS01	MC1413BD(STATIC)	04713
XBT01	Holder, 20mm Coin Cell, PWB Mt	BBHT01	1065	91833
XE01	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
XE02	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
XE03	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
XJ08	Conn, Header,Square Post,Gold,Dual,40-pin	JF47	4-102973-0	09482
Y01	Crystal,SMT,Fund,Par Res,11.0592MHz	XFPS01	CMR309T11.0592MABJTR	3DX59
Y02	Crystal,SMT,Fund,Par Res,32.768kHz	XFPS02	MC20632.7680KA-A0	1JRT7

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Not Used	-	NOT USED	37338
C02	Capacitor, Ceramic, 0.47uF 10% 50V	CCG09	CKR06BX474KRV	56289
C03	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C04	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C05	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C06	Not Used	-	NOT USED	37338
C07	Capacitor, Ceramic, 0.47uF 10% 50V	CCG09	CKR06BX474KRV	56289
C08	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C10	Not Used	-	NOT USED	37338
C11	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C12	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C13	Not Used	-	NOT USED	37338
C15	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C16	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C17	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C18	Not Used	-	NOT USED	37338
C19	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C20	Not Used	-	NOT USED	37338
C21	Not Used	-	NOT USED	37338
C22	Capacitor, Ceramic, 0.47uF 10% 50V	CCG09	CKR06BX474KRV	56289
C23	Capacitor, Ceramic, 1.0uF 100V	CAP16	RPE114Z5U105M100V	91929
C24	Not Used	-	NOT USED	37338
C25	Not Used	-	NOT USED	37338
C26	Not Used	-	NOT USED	37338
C27	Not Used	-	NOT USED	37338
C28	Capacitor, Ceramic, 1.0uF 100V	CAP16	RPE114Z5U105M100V	91929
C31	Not Used	-	NOT USED	37338
C32	Not Used	-	NOT USED	37338
C33	Not Used	-	NOT USED	37338
C34	Not Used	-	NOT USED	37338
C36	Not Used	-	NOT USED	37338
C37	Not Used	-	NOT USED	37338
C38	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C39	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C40	Not Used	-	NOT USED	37338
C41	Not Used	-	NOT USED	37338

Continued from previous page

NAPC150A RF Drive Control PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C42	Not Used	-	NOT USED	37338
C43	Not Used	-	NOT USED	37338
C44	Not Used	-	NOT USED	37338
C45	Not Used	-	NOT USED	37338
C46	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C47	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C48	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C49	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C50	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C51	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C52	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C53	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C54	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C55	Capacitor, Ceramic, 1.0uF 10%50V	CCG10	CKR06BX105KRV	56289
C56	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C57	Capacitor, Ceramic, 0.22uF 10% 50V	CCG08	CKR06BX224KRV	56289
C58	Capacitor, Ceramic, 0.22uF 10% 50V	CCG08	CKR06BX224KRV	56289
C59	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C60	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
CR01	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR02	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR03	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR04	Not Used	-	NOT USED	37338
CR05	Not Used	-	NOT USED	37338
CR06	Not Used	-	NOT USED	37338
CR07	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR08	Diode, Schottky	QK09	1N5711 (STATIC)	50434
CR09	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR10	Not Used	-	NOT USED	37338
CR12	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR13	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR14	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR15	Diode, Power Rectifier, 200V 1A	QN38	MUR120	04713
CR16	Not Used	-	NOT USED	37338
CR17	Diode, Zener Transient Supressor, 20V	QI29	P6KE20CA	07263

NAPC150A RF Drive Control PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
CR18	Diode, Zener Transient Supressor, 20V	QI29	P6KE20CA	07263
CR19	Not Used	-	NOT USED	37338
CR20	Not Used	-	NOT USED	37338
CR21	Not Used	-	NOT USED	37338
CR22	Not Used	-	NOT USED	37338
CR23	Not Used	-	NOT USED	37338
CR24	Diode, Power Rectifier, 4A, Ultra Fast	QM22	MUR460	04713
CR25	Diode, Power Rectifier, 4A, Ultra Fast	QM22	MUR460	04713
CR26	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR27	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR28	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR29	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR30	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR31	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR32	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR33	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR34	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR35	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR36	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR37	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR38	Diode, Power Rectifier, 4A, Ultra Fast	QM22	MUR460	04713
CR39	Diode, Power Rectifier, 4A, Ultra Fast	QM22	MUR460	04713
CR40	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR41	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR42	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR43	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR44	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR45	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR46	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR47	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR48	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR49	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR50	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR51	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR52	Diode, Power Rectifier, 4A, Ultra Fast	QM22	MUR460	04713
CR53	Diode, Power Rectifier, 4A, Ultra Fast	QM22	MUR460	04713
CR54	Diode, Power Rectifier, 4A, Ultra Fast	QM22	MUR460	04713
CR55	Diode, Power Rectifier, 4A, Ultra Fast	QM22	MUR460	04713
CR56	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263

Continued from previous page

NAPC150A RF Drive Control PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
CR57	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR58	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR59	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR60	Diode, Zener, 15V, 1W, 5%	QE40	1N4744A	04713
CR61	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
DS01	Not Used	-	NOT USED	37338
DS02	Not Used	-	NOT USED	37338
DS03	Diode, LED, Red, 8.6mm Lg	QM18	SSL-LX5093ID	1EM90
DS04	Diode, LED, Red, 8.6mm Lg	QM18	SSL-LX5093ID	1EM90
DS05	Diode, LED, Red, 8.6mm Lg	QM18	SSL-LX5093ID	1EM90
DS06	Diode, LED, Red, 8.6mm Lg	QM18	SSL-LX5093ID	1EM90
DS07	Diode, LED, Red, 8.6mm Lg	QM18	SSL-LX5093ID	1EM90
DS08	Diode, LED, Red, 8.6mm Lg	QM18	SSL-LX5093ID	1EM90
DS09	Diode, LED, Red, Flashing	QK44	SSL-LX5093BID	1EM90
E01	Not Used	-	NOT USED	37338
F01	Fuse, 2A, 250V, Fast, 3AG	FC21	312002	75915
J01	Conn, Plug, D-Sub, 25 pin, PWB Mt	JS12	K22-B25P-NJ	63590
J02	Conn, Socket, D-Sub, 25 pin, PWB Mt	JS13	K22-B25S-NJ	22421
J03	Conn, Plug, D-Sub, 25 pin, PWB Mt	JS12	K22-B25P-NJ	63590
J04	Conn, Plug, D-Sub, 25 pin, PWB Mt	JS12	K22-B25P-NJ	63590
K01	Not Used	-	NOT USED	37338
K02	Not Used	-	NOT USED	37338
L01	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L02	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L03	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L04	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L05	Not Used	-	NOT USED	37338
L06	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L07	Not Used	-	NOT USED	37338
L08	Not Used	-	NOT USED	37338
L09	Not Used	-	NOT USED	37338
L10	Not Used	-	NOT USED	37338
L11	Not Used	-	NOT USED	37338
L12	Not Used	-	NOT USED	37338
L13	Not Used	-	NOT USED	37338
L14	Not Used	-	NOT USED	37338
Q01	Transistor, PNP, Switch/Amplifier	QA14	2N3906	04713
Q03	Transistor, PNP, Amplifier, 150V	QS21	2N5401	04713
Q04	Not Used	-	NOT USED	37338

NAPC150A RF Drive Control PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
Q05	Transistor, FET, N Channel, 100V, 8A	QR13	IRF520(STATIC)	81483
Q06	Transistor, FET, N Channel, 100V, 8A	QR13	IRF520(STATIC)	81483
Q07	Transistor, PNP, Switch/Amplifier	QA14	2N3906	04713
Q08	Transistor, FET, N Channel	QN54	2N7000(STATIC)	04713
R001	Resistor, MF, 12.1K Ohms, 1PC1/4W	RAB38	MF1/4DL1212F	59124
R002	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
R003	Not Used	-	NOT USED	37338
R004	Not Used	-	NOT USED	37338
R005	Resistor, MF, 82.5K Ohms, 1PC1/4W	RAB48	MF1/4DL8252F	59124
R006	Resistor, MF, 56.2K Ohms, 1PC1/4W	RAB46	MF1/4DL5622F	59124
R007	Resistor, MF, 33.2K Ohms, 1PC1/4W	RAB43	MF1/4DL3322F	59124
R008	Resistor, MF, 100K Ohms, 1PC 1/4W	RAC01	MF1/4DL1003F	59124
R010	Resistor, MF, 8.25K Ohms, 1PC1/4W	RAB36	MF1/4DL8251F	59124
R011	Resistor, MF, 100K Ohms, 1PC 1/4W	RAC01	MF1/4DL1003F	59124
R012	Resistor, MF, 3.92K Ohms, 1PC1/4W	RAB32	MF1/4DL3921F	59124
R013	Resistor, MF, 332K Ohms, 1%1/4W	RAC07	MF1/4DL3323F	59124
R014	Not Used	-	NOT USED	37338
R015	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R016	Resistor, Film, 470 Ohms, 2PC1/2W	RC33	RL20S471G	35005
R017	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R018	Not Used	-	NOT USED	37338
R020	Resistor, Film, 10 Ohms, 2%1/2W	RAP01	RL20S100G	35005
R022	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R028	Not Used	-	NOT USED	37338
R029	Resistor, Metal Oxide, .68 Ohms, 5%, 2W	RK02	M02XLR68J	59124
R030	Resistor, Film, 1500 Ohms, 5%, 2W	RBP14	GS-3, 1500 OHMS	75042
R031	Resistor, Film, 3300 Ohms, 5%, 2W	RBP16	GS-3, 3300 OHMS	75042
R032	Not Used	-	NOT USED	37338
R033	Resistor, Film, 47 Ohms, 5% 2W	RBP05	GS-3, 47 OHMS	75042
R034	Resistor, Film, 47 Ohms, 5% 2W	RBP05	GS-3, 47 OHMS	75042
R035	Not Used	-	NOT USED	37338
R041	Not Used	-	NOT USED	37338
R042	Not Used	-	NOT USED	37338
R043	Not Used	-	NOT USED	37338
R044	Not Used	-	NOT USED	37338
R045	Resistor, Film, 47 Ohms, 5% 2W	RBP05	GS-3, 47 OHMS	75042
R046	Not Used	-	NOT USED	37338
R047	Not Used	-	NOT USED	37338
R048	Not Used	-	NOT USED	37338

Continued from previous page

NAPC150A RF Drive Control PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R049	Resistor, MF, 2.21K Ohms, 1PC1/4W	RAB29	MF1/4DL2211F	59124
R050	Resistor, Film, 150K Ohms, 2PC 1/2W	RD21	RL20S154G	35005
R051	Resistor, Film, 150K Ohms, 2PC 1/2W	RD21	RL20S154G	35005
R052	Resistor, MF, 332 Ohms, 1PC 1/4W	RAB19	MF1/4DL3320F	59124
R053	Resistor, Film, 150K Ohms, 2PC 1/2W	RD21	RL20S154G	35005
R054	Resistor, Film, 150K Ohms, 2PC 1/2W	RD21	RL20S154G	35005
R055	Resistor, MF, 332 Ohms, 1PC 1/4W	RAB19	MF1/4DL3320F	59124
R056	Resistor, MF, 47.5K Ohms, 1PC1/4W	RAB45	MF1/4DL4752F	59124
R057	Resistor, MF, 15.0K Ohms, 1PC1/4W	RAB39	MF1/4DL1502F	59124
R058	Resistor, MF, 18.2K Ohms, 1PC1/4W	RAB40	MF1/4DL1822F	59124
R059	Resistor, MF, 47.5K Ohms, 1PC1/4W	RAB45	MF1/4DL4752F	59124
R060	Resistor, MF, 15.0K Ohms, 1PC1/4W	RAB39	MF1/4DL1502F	59124
R061	Resistor, MF, 100K Ohms, 1PC 1/4W	RAC01	MF1/4DL1003F	59124
R062	Resistor, MF, 18.2K Ohms, 1PC1/4W	RAB40	MF1/4DL1822F	59124
R063	Resistor, MF, 100K Ohms, 1PC 1/4W	RAC01	MF1/4DL1003F	59124
R064	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R065	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R066	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R067	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R068	Resistor, MF, 2.21K Ohms, 1PC1/4W	RAB29	MF1/4DL2211F	59124
R069	Resistor, MF, 2.21K Ohms, 1PC1/4W	RAB29	MF1/4DL2211F	59124
R070	Resistor, MF, 1.50K Ohms, 1PC1/4W	RAB27	MF1/4DL1501F	59124
R071	Resistor, MF, 2.21K Ohms, 1PC1/4W	RAB29	MF1/4DL2211F	59124
R072	Resistor, Film, 150K Ohms, 2PC 1/2W	RD21	RL20S154G	35005
R073	Resistor, Film, 150K Ohms, 2PC 1/2W	RD21	RL20S154G	35005
R074	Resistor, MF, 332 Ohms, 1PC 1/4W	RAB19	MF1/4DL3320F	59124
R075	Resistor, Film, 150K Ohms, 2PC 1/2W	RD21	RL20S154G	35005
R076	Resistor, Film, 150K Ohms, 2PC 1/2W	RD21	RL20S154G	35005
R077	Resistor, MF, 332 Ohms, 1PC 1/4W	RAB19	MF1/4DL3320F	59124
R078	Resistor, MF, 47.5K Ohms, 1PC1/4W	RAB45	MF1/4DL4752F	59124
R079	Resistor, MF, 15.0K Ohms, 1PC1/4W	RAB39	MF1/4DL1502F	59124
R080	Resistor, MF, 18.2K Ohms, 1PC1/4W	RAB40	MF1/4DL1822F	59124
R081	Resistor, MF, 47.5K Ohms, 1PC1/4W	RAB45	MF1/4DL4752F	59124
R082	Resistor, MF, 15.0K Ohms, 1PC1/4W	RAB39	MF1/4DL1502F	59124
R083	Resistor, MF, 18.2K Ohms, 1PC1/4W	RAB40	MF1/4DL1822F	59124
R084	Resistor, MF, 100K Ohms, 1PC 1/4W	RAC01	MF1/4DL1003F	59124
R085	Resistor, MF, 100K Ohms, 1PC 1/4W	RAC01	MF1/4DL1003F	59124
R086	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R087	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124

NAPC150A RF Drive Control PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R088	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R089	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R090	Resistor, MF, 2.21K Ohms, 1PC1/4W	RAB29	MF1/4DL2211F	59124
R091	Resistor, MF, 2.21K Ohms, 1PC1/4W	RAB29	MF1/4DL2211F	59124
R092	Not Used	-	NOT USED	37338
R093	Not Used	-	NOT USED	37338
R094	Resistor, MF, 1.50K Ohms, 1PC1/4W	RAB27	MF1/4DL1501F	59124
R095	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R096	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R097	Resistor, Film, 220 Ohms, 5%,2W	RK31	GS-3, 220 OHMS	75042
R098	Resistor, MF, 332 Ohms, 1PC 1/4W	RAB19	MF1/4DL3320F	59124
R099	Resistor, MF, 1.50K Ohms, 1PC1/4W	RAB27	MF1/4DL1501F	59124
R100	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R101	Resistor, MF, 2.21K Ohms, 1PC1/4W	RAB29	MF1/4DL2211F	59124
R102	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
R103	Resistor, MF, 2.21K Ohms, 1PC1/4W	RAB29	MF1/4DL2211F	59124
R104	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R105	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R106	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R107	Resistor, MF, 100K Ohms, 1PC 1/4W	RAC01	MF1/4DL1003F	59124
R108	Resistor, MF, 100K Ohms, 1PC 1/4W	RAC01	MF1/4DL1003F	59124
R109	Resistor, MF, 1.82M Ohms, 1%1/4W	RAC16	MF1/4DL1824F	59124
R110	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
RT01	Thermistor, PTC, .50-.77 Ohms, 0.5A Hold	RT16	RXE050	06090
RT02	Thermistor, PTC, .50-.77 Ohms, 0.5A Hold	RT16	RXE050	06090
RT03	Thermistor, PTC, .50-.77 Ohms, 0.5A Hold	RT16	RXE050	06090
RT04	Not Used	-	NOT USED	37338
T01	RF Drive Transformer Assy	176-1078-01	176-1078-01	37338
T02	Rf Drive Current Transformer	176-1069	176-1069	37338
T03	Rf Drive Current Transformer	176-1069	176-1069	37338
U01	Not Used	-	NOT USED	37338
U02	IC, Comparator, Quad	UL02	MC3302L(STATIC)	04713
U03	IC, Transistor Array, 8 Darlingtons	UM28	(N)ULN-2803A	04713
U04	Not Used	-	NOT USED	37338
U05	Not Used	-	NOT USED	37338
U06	IC, Comparator, Quad	UL02	MC3302L(STATIC)	04713
U07	IC, Transistor Array, 8 Darlingtons	UM28	(N)ULN-2803A	04713
U08	Not Used	-	NOT USED	37338
U09	IC, Opto-Coupler/Isolator	UD05	4N26	04713

Continued from previous page

NAPC150A RF Drive Control PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
U10	IC, Comparator, Quad	UL02	MC3302L(STATIC)	04713
U11	Not Used	-	NOT USED	37338
XE01	Not Used	-	NOT USED	37338
XF01	Fuseholder, PWB Mount, Type 3AG	FA31	4245	91833
XU01	Not Used	-	NOT USED	37338
XU02	Socket, IC, 14-pin	UC02	2-641261-1	00779
XU03	Socket, IC, 18-Pin	UD35	390261-5	00779
XU04	Not Used	-	NOT USED	37338
XU05	Not Used	-	NOT USED	37338
XU06	Socket, IC, 14-pin	UC02	2-641261-1	00779
XU07	Socket, IC, 18-Pin	UD35	390261-5	00779
XU08	Not Used	-	NOT USED	37338
XU09	Socket, IC, 6-pin	UD43	390261-1	00779
XU10	Socket, IC, 14-pin	UC02	2-641261-1	00779

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Not Used	-	NOT USED	37338
C02	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C03	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C04	Capacitor, Tantalum, 2.2uF 10PC 20V	CCP16	CSR13E225KM	56289
C05	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C06	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C07	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C08	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C09	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C10	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C11	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C12	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C13	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C14	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C15	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C16	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C17	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C18	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C19	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C20	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C21	Capacitor, Mica, Dipped, 390pF 2% 500V	CB32	CM05FD391G03	14655
C22	Capacitor, Mica, Dipped, 100pF 2% 500V	CB25	CM05FD101G03	SOSH
C23	Capacitor, Mica, Dipped, 390pF 2% 500V	CB32	CM05FD391G03	14655
C24	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C25	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C26	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C27	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C28	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C29	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C30	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C31	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C32	Capacitor, Ceramic, 0.22uF 10% 50V	CCG08	CKR06BX224KRV	56289
C33	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C34	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C35	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C36	Capacitor, Ceramic, 0.47uF 10% 50V	CCG09	CKR06BX474KRV	56289

NAPE70C RF Synthesizer PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C37	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C38	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C39	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C40	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C41	Capacitor, Tantalum, 47uF 10%20V	CM01	T356K476K020AT(RoHS) KEMET	96095
C42	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C43	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C44	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C45	Capacitor, Ceramic, 0.0047uF10% 100V	CCG03	CKR05BX472KRV	56289
C46	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C47	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C48	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C49	Capacitor, Ceramic, 0.0068uF 10% 100V	CCG30	CKR05BX682KRV	56289
C50	Capacitor, Ceramic, 12pF, 2%,100V	CS71	D120G20C0GH63J5	56699
C51	Capacitor, Ceramic, 12pF, 2%,100V	CS71	D120G20C0GH63J5	56699
C52	Capacitor, Ceramic, 12pF, 2%,100V	CS71	D120G20C0GH63J5	56699
C53	Capacitor, Ceramic, 12pF, 2%,100V	CS71	D120G20C0GH63J5	56699
C54	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV SPRAGUE	91929
C55	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C56	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C57	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C58	Capacitor, Ceramic, 0.47uF 10% 50V	CCG09	CKR06BX474KRV	56289
CR01	Diode, Schottky	QR15	MBD301(STATIC)	04713
CR02	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR03	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR04	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR05	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR06	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
E01	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
E02	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
E03	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
E04	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
E05	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
E06	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
J01	Conn, Socket, D-Sub, 25 pin, PWB Mt	JS13	K22-B25S-NJ	22421
J02	Conn, BNC, Recept, PWB Mt	JF35	R141426161	0GP12

Continued from previous page

NAPE70C RF Synthesizer PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
L01	Inductor, Moulded, Shielded, 1.8uH	LAP28	IMS-5-1.8UH+/-10%	35005
L02	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L03	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L04	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L05	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L06	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L07	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L08	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L09	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L10	Inductor, Moulded, Shielded, 1000uH	LAP39	IMS-5-1000UH+/-10%	35005
Q01	Transistor, NPN, Switch/Amplifier	QA15	2N3904	04713
Q02	Transistor, NPN, Switch/Amplifier	QA15	2N3904	04713
Q03	Transistor, NPN, Switch/Amplifier	QA15	2N3904	04713
Q04	Transistor, NPN, Switch/Amplifier	QA15	2N3904	04713
Q05	Transistor, NPN, General Purpose	QAP04	2N2219A	04713
Q06	Transistor, PNP, Switch/Amplifier	QA23	2N2905A	04713
R01	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
R02	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R03	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R04	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R05	Resistor, MF, 274 Ohms, 1PC 1/4W	RAB18	MF1/4DL2740F	59124
R06	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
R07	Resistor, MF, 1.21K Ohms, 1PC1/4W	RAB26	MF1/4DL1211F	59124
R08	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
R09	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
R10	Resistor, MF, 47.5 Ohms, 1PC 1/4W	RAB09	MF1/4DL47R5F	59124
R11	Resistor, MF, 47.5 Ohms, 1PC 1/4W	RAB09	MF1/4DL47R5F	59124
R12	Resistor, MF, 47.5 Ohms, 1PC 1/4W	RAB09	MF1/4DL47R5F	59124
R13	Resistor, MF, 3.92K Ohms, 1PC1/4W	RAB32	MF1/4DL3921F	59124
R14	Resistor, MF, 47.5 Ohms, 1PC 1/4W	RAB09	MF1/4DL47R5F	59124
R15	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
R16	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R17	Resistor, MF, 10.0 Ohms, 1PC 1/4W	RAB01	MF1/4DL10R0F	59124
R18	Resistor, MF, 10.0 Ohms, 1PC 1/4W	RAB01	MF1/4DL10R0F	59124
R19	Resistor, MF, 10.0 Ohms, 1PC 1/4W	RAB01	MF1/4DL10R0F	59124
R20	Resistor, MF, 82.5 Ohms, 1PC 1/4W	RAB12	MF1/4DL82R5F	59124
R21	Resistor, Film, 22 Ohms, 5% 2W	RBP03	GS-3, 22 OHMS	75042
R22	Resistor, MF, 27.4K Ohms, 1PC1/4W	RAB42	MF1/4DL2742F	59124
R23	Resistor, MF, 1.82K Ohms, 1PC1/4W	RAB28	MF1/4DL1821F	59124

NAPE70C RF Synthesizer PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R24	Not Used	-	NOT USED	37338
R25	Resistor, MF, 1.50K Ohms, 1PC1/4W	RAB27	MF1/4DL1501F	59124
R26	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
R27	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R28	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R29	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R30	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R31	Resistor, MF, 562 Ohms, 1PC 1/4W	RAB22	MF1/4DL5620F	59124
R32	Resistor, Variable, Film, 1000 Ohms, 1/2W	RV06	3339P-1-102	80294
R33	Resistor, MF, 562 Ohms, 1PC 1/4W	RAB22	MF1/4DL5620F	59124
R34	Resistor, MF, 2.21K Ohms, 1PC1/4W	RAB29	MF1/4DL2211F	59124
R35	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R36	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R37	Resistor, MF, 3.32K Ohms, 1PC1/4W	RAB31	MF1/4DL3321F	59124
R38	Resistor, MF, 3.32K Ohms, 1PC1/4W	RAB31	MF1/4DL3321F	59124
R39	Resistor, MF, 22.1 Ohms, 1PC 1/4W	RAB05	MF1/4DL22R1F	59124
R40	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
R41	Resistor, Variable, Film, 50KOhms, 1/2W	RW35	3339P-1-503	80294
R42	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R43	Resistor, MF, 2.74K Ohms, 1PC1/4W	RAB30	MF1/4DL2741F	59124
R44	Resistor, MF, 22.1 Ohms, 1PC 1/4W	RAB05	MF1/4DL22R1F	59124
R45	Resistor, MF, 1.21K Ohms, 1PC1/4W	RAB26	MF1/4DL1211F	59124
R46	Resistor, MF, 47.5 Ohms, 1PC 1/4W	RAB09	MF1/4DL47R5F	59124
R47	Resistor, MF, 27.4 Ohms, 1PC 1/4W	RAB06	MF1/4DL27R4F	59124
R48	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R49	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R50	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R51	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
R52	Not Used	-	NOT USED	37338
S01	Switch, DIP, Rotary, 10-pos, BCD	SB40	230002G	97525
S02	Switch, DIP, Rotary, 10-pos, BCD	SB40	230002G	97525
S03	Switch, DIP, Rotary, 10-pos, BCD	SB40	230002G	97525
S04	Switch, DIP, Rotary, 10-pos, BCD	SB40	230002G	97525
S05	Switch, DIP, Rotary, 10-pos, BCD	SB40	230002G	97525
S06	Switch,DIP,Recessed,4-way,SPST	SC50	78RB04T(ROHS)	GRAYHILL
U01	Oscillator, TCXO, 10.000MHz,2ppm	UT55	RTXT-781DJZ5-C-10.000(STATIC)	RALTRON
U02	Res, Network, SIP, 9 x 4700 Ohms, 2% Bus	RT07	4610X-101-472	80294
U03	IC, CMOS, Hex Inverter	UG03	MC74AC04N(STATIC)	04713
U04	IC, Programmed MicrocontrollerDDS	190-5043-02	190-5043-02	37338

NAPE70C RF Synthesizer PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
U05	IC, CMOS, 48-bit DDS	UT58	AD9852ASQ(STATIC)	45496
U06	IC, CMOS, Synchronous Counter	UT56	74ACT163PC(STATIC)	07263
U07	IC, CMOS, Synchronous Counter	UT56	74ACT163PC(STATIC)	07263
U08	IC, CMOS, Hex Inverter	UX11	MC74HC04AN(STATIC)	01295
U09	IC, Voltage Regulator, +5V, 1A, Plastic	UX17	MC7805ACT	04713
U10	IC, CMOS, Hex Schmitt Trigger	UM23	MC14584BCP(STATIC)	04713
U11	IC, Voltage Regulator, +3.3V,1A	UT59	LM3940IT-3.3	27014
U12	IC, CMOS, Dual, Type D, Flip Flop	UB15	MC14013BCP(STATIC)	04713
U13	IC, Transistor Pair, Bipolar,Matched	UT60	LM394CH(STATIC)	27014
XE01	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
XE02	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
XE03	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
XE04	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
XE06	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
XE5A	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
XE5B	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
XS01	Socket, IC, 6-pin	UD43	390261-1	00779
XS02	Socket, IC, 6-pin	UD43	390261-1	00779
XS03	Socket, IC, 6-pin	UD43	390261-1	00779
XS04	Socket, IC, 6-pin	UD43	390261-1	00779
XS05	Socket, IC, 6-pin	UD43	390261-1	00779
XU01	Not Used	-	NOT USED	37338
XU02	Not Used	-	NOT USED	37338
XU03	Socket, IC, 14-pin	UC02	2-641261-1	00779
XU04	Not Used	-	NOT USED	37338
XU05	Not Used	-	NOT USED	37338
XU06	Socket, IC, 16-pin	UC03	2-641262-1	00779
XU07	Socket, IC, 16-pin	UC03	2-641262-1	00779
XU08	Socket, IC, 14-pin	UC02	2-641261-1	00779
XU09	Not Used	-	NOT USED	37338
XU10	Socket, IC, 14-pin	UC02	2-641261-1	00779
XU11	Not Used	-	NOT USED	37338
XU12	Socket, IC, 14-pin	UC02	2-641261-1	00779
XU13	Not Used	-	NOT USED	37338

NAPE77A/01 RF Driver Buffer PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Capacitor, Ceramic, 0.022uF 10% 100V	CCG05	CKR06BX223KRV	56289
C02	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C03	Not Used	-	NOT USED	37338
C04	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C05	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C06	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C07	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C08	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C09	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C10	Capacitor, Ceramic, 1.0uF 10%50V	CCG10	CKR06BX105KRV	56289
C11	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C12	Capacitor, Ceramic, 1.0uF 10%50V	CCG10	CKR06BX105KRV	56289
C13	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C14	Capacitor, Ceramic, 1.0uF 10%50V	CCG10	CKR06BX105KRV	56289
C15	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C16	Capacitor, Ceramic, 1.0uF 10%50V	CCG10	CKR06BX105KRV	56289
C17	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C18	Not Used	-	NOT USED	37338
C19	Not Used	-	NOT USED	37338
C20	Not Used	-	NOT USED	37338
C21	Not Used	-	NOT USED	37338
C22	Not Used	-	NOT USED	37338
C23	Not Used	-	NOT USED	37338
C24	Not Used	-	NOT USED	37338
C25	Not Used	-	NOT USED	37338
C26	Not Used	-	NOT USED	37338
C27	Not Used	-	NOT USED	37338
C28	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C29	Capacitor, Ceramic, 1.0uF 10%50V	CCG10	CKR06BX105KRV	56289
C30	Capacitor, Ceramic, 1.0uF 10%50V	CCG10	CKR06BX105KRV	56289
C31	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C32	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C33	Capacitor, Ceramic, 0.022uF 10% 100V	CCG05	CKR06BX223KRV	56289
C34	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C35	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C36	Capacitor, Ceramic, 1.0uF 10%50V	CCG10	CKR06BX105KRV	56289
C37	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C38	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV SPRAGUE	91929

Continued from previous page

NAPE77A/01 RF Driver Buffer PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
CR01	Diode, Schottky	QR15	MBD301(STATIC)	04713
CR02	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
E01	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
E02	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
E03	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
J01	Conn, BNC, Recept, PWB Mt	JF35	R141426161	0GP12
J02	Conn, BNC, Recept, PWB Mt	JF35	R141426161	0GP12
J03	Conn, Socket, D-Sub, 9-Pin,Vertical PWB	JS50	164A16669X	C3057
J04	MTA, Keyed Square Post HeaderAssy, 4 pin	JU25	647123-4	00779
J05	Conn, BNC, Recept, PWB Mt	JF35	R141426161	0GP12
J06	Conn, BNC, Recept, PWB Mt	JF35	R141426161	0GP12
J07	Conn, BNC, Recept, PWB Mt	JF35	R141426161	0GP12
J08	Conn, BNC, Recept, PWB Mt	JF35	R141426161	0GP12
J09	Not Used	-	NOT USED	37338
J10	Not Used	-	NOT USED	37338
J11	Not Used	-	NOT USED	37338
J12	Not Used	-	NOT USED	37338
J13	Not Used	-	NOT USED	37338
J14	Connector,Modular,RJ-45,Vert.,PWB	JPMT01	557969-1	09482
K01	Relay, 12Vdc Coil, 2PDT, 1A	KC07	DF2E-DC12V	61529
L01	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
Q01	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713
Q02	Transistor, PNP, Switch/Amplifier	QA44	2N4403	04713
R01	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R02	Resistor, MF, 3.92K Ohms, 1PC1/4W	RAB32	MF1/4DL3921F	59124
R03	Resistor, MF, 5.62K Ohms, 1PC1/4W	RAB34	MF1/4DL5621F	59124
R04	Resistor, MF, 3.32K Ohms, 1PC1/4W	RAB31	MF1/4DL3321F	59124
R05	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R06	Resistor, Film, 56 Ohms, 5% 2W	RBP38	GS-3, 56 OHMS	75042
R07	Resistor, MF, 182 Ohms, 1PC 1/4W	RAB16	MF1/4DL1820F	59124
R08	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R09	Resistor, MF, 1.50K Ohms, 1PC1/4W	RAB27	MF1/4DL1501F	59124
R10	Resistor, Film, 10 Ohms, 5%, 2W	RBP01	GS-3, 10 OHMS	75042
R11	Resistor, Film, 10 Ohms, 5%, 2W	RBP01	GS-3, 10 OHMS	75042
R12	Resistor, Film, 10 Ohms, 5%, 2W	RBP01	GS-3, 10 OHMS	75042
R13	Resistor, Film, 10 Ohms, 5%, 2W	RBP01	GS-3, 10 OHMS	75042
R14	Resistor, Film, 10 Ohms, 5%, 2W	RBP01	GS-3, 10 OHMS	75042
R15	Resistor, Film, 10 Ohms, 5%, 2W	RBP01	GS-3, 10 OHMS	75042
R16	Resistor, Film, 10 Ohms, 5%, 2W	RBP01	GS-3, 10 OHMS	75042

Continued from previous page

NAPE77A/01 RF Driver Buffer PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R17	Resistor, Film, 10 Ohms, 5%, 2W	RBP01	GS-3, 10 OHMS	75042
R18	Not Used	-	NOT USED	37338
R19	Not Used	-	NOT USED	37338
R20	Not Used	-	NOT USED	37338
R21	Not Used	-	NOT USED	37338
R22	Not Used	-	NOT USED	37338
R23	Not Used	-	NOT USED	37338
R24	Not Used	-	NOT USED	37338
R25	Not Used	-	NOT USED	37338
R26	Not Used	-	NOT USED	37338
R27	Not Used	-	NOT USED	37338
R28	Resistor, Film, 56 Ohms, 5% 2W	RBP38	GS-3, 56 OHMS	75042
R29	Resistor, Film, 56 Ohms, 5% 2W	RBP38	GS-3, 56 OHMS	75042
R30	Resistor, MF, 150 Ohms, 1PC 1/4W	RAB15	MF1/4DL1500F	59124
R31	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R32	Resistor, Film, 120 Ohms, 2PC1/2W	RC26	RL20S121G	35005
R33	Resistor, MF, 8.25K Ohms, 1PC1/4W	RAB36	MF1/4DL8251F	59124
T01	Transformer RF, 1:1,0.01 to150MHz	TE21	T1-6-X65+(RoHS)	15542
U01	IC, Op Amp, Dual	UN25	TL072CP(STATIC)	04713
U02	IC, Mosfet Driver, T0220-5-12A	UD54	MIC4452CT(STATIC)	MICRELL
U03	IC, Mosfet Driver, T0220-5-12A	UD54	MIC4452CT(STATIC)	MICRELL
U04	IC, Mosfet Driver, T0220-5-12A	UD54	MIC4452CT(STATIC)	MICRELL
U05	IC, Mosfet Driver, T0220-5-12A	UD54	MIC4452CT(STATIC)	MICRELL
U06	Not Used	-	NOT USED	37338
U07	Not Used	-	NOT USED	37338
U08	Not Used	-	NOT USED	37338
U09	Not Used	-	NOT USED	37338
U10	Not Used	-	NOT USED	37338
U11	IC, Voltage Regulator, +5V, 1A, Plastic	UX17	MC7805ACT	04713
U12	IC, CMOS, Hex Inverter	UG03	MC74AC04N(STATIC)	04713
U13	IC, Mosfet Driver, T0220-5-12A	UD54	MIC4452CT(STATIC)	MICRELL
XE01	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
XE02	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
XE03	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482

NAPI47B Modulator Input Output PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Capacitor, Ceramic, 1.0uF 10%50V	CCG10	CKR06BX105KRV	56289
C02	Capacitor, Ceramic, 0.022uF 10% 100V	CCG05	CKR06BX223KRV	56289
C03	Capacitor, Ceramic, 0.022uF 10% 100V	CCG05	CKR06BX223KRV	56289
C04	Capacitor, Ceramic, 0.022uF 10% 100V	CCG05	CKR06BX223KRV	56289
C05	Capacitor, Ceramic, 0.022uF 10% 100V	CCG05	CKR06BX223KRV	56289
CR01	Diode, Zener Transient Supressor, 20V	QI29	P6KE20CA	07263
CR02	Diode, Zener Transient Supressor, 20V	QI29	P6KE20CA	07263
CR03	Diode, Zener Transient Supressor, 20V	QI29	P6KE20CA	07263
CR04	Diode, Zener Transient Supressor, 20V	QI29	P6KE20CA	07263
CR05	Diode, Zener Transient Supressor, 20V	QI29	P6KE20CA	07263
CR06	Diode, General Purpose, 400V,1A	QE28	1N4004	04713
CR07	Diode, General Purpose, 400V,1A	QE28	1N4004	04713
CR08	Diode, General Purpose, 400V,1A	QE28	1N4004	04713
CR09	Diode, General Purpose, 400V,1A	QE28	1N4004	04713
E01	Connector, Quick-Dis, M,1/4 Tab, PWB	HR26	1287	91833
E02	Not Used	-	NOT USED	37338
E03	Connector, Quick-Dis, M,1/4 Tab, PWB	HR26	1287	91833
E04	Not Used	-	NOT USED	37338
E05	Connector, Quick-Dis, M,1/4 Tab, PWB	HR26	1287	91833
E06	Not Used	-	NOT USED	37338
E07	Connector, Quick-Dis, M,1/4 Tab, PWB	HR26	1287	91833
E08	Not Used	-	NOT USED	37338
E09	Connector, Quick-Dis, M,3/16 Tab PWB	HAM52	1212	91833
E10	Connector, Quick-Dis, M,3/16 Tab PWB	HAM52	1212	91833
F01	Installed at Next Higher Assy	+	INSTALLED AT NEXT HIGHER ASSY	37338
F02	Fuse, 1/2A, 450Vdc, 250Vac,Fast, PWB Mt	FD16	TR/PCB1/2	71400
F03	Fuse, 1/2A, 450Vdc, 250Vac,Fast, PWB Mt	FD16	TR/PCB1/2	71400
F04	Installed at Next Higher Assy	+	INSTALLED AT NEXT HIGHER ASSY	37338
F05	Fuse, 1/2A, 450Vdc, 250Vac,Fast, PWB Mt	FD16	TR/PCB1/2	71400
F06	Installed at Next Higher Assy	+	INSTALLED AT NEXT HIGHER ASSY	37338
F07	Fuse, 1/2A, 450Vdc, 250Vac,Fast, PWB Mt	FD16	TR/PCB1/2	71400
F08	Installed at Next Higher Assy	+	INSTALLED AT NEXT HIGHER ASSY	37338
F09	Fuse, 1/2A, 450Vdc, 250Vac,Fast, PWB Mt	FD16	TR/PCB1/2	71400
J01	Conn, Plug, D-Sub, 25 pin, PWB Mt	JS12	K22-B25P-NJ	63590
J02	Conn, Plug, D-Sub, 25 pin, PWB Mt	JS12	K22-B25P-NJ	63590
J03	Conn, Plug, D-Sub, 25 pin, PWB Mt	JS12	K22-B25P-NJ	63590
J04	Conn, Plug, D-Sub, 25 pin, PWB Mt	JS12	K22-B25P-NJ	63590

Continued from previous page

NAPI47B Modulator Input Output PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
J05	Conn, Plug, D-Sub, 9 pin, PWBMt	JQ33	K22-E9P-NJ	31781
Q01	Transistor, NPN, TO-220, 100V	QS19	TIP31C	04713
Q02	Transistor, PNP, TO-220, 100V	QS18	TIP32C	04713
R01	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
XF01	Fuse Clip, 13/32 Dia Fuse, PWB Mt	FC27	1A3400-09	71400
XF02	Socket, Fuse, 2-pin	UC48	PCS	71400
XF03	Socket, Fuse, 2-pin	UC48	PCS	71400
XF04	Fuse Clip, 13/32 Dia Fuse, PWB Mt	FC27	1A3400-09	71400
XF05	Socket, Fuse, 2-pin	UC48	PCS	71400
XF06	Fuse Clip, 13/32 Dia Fuse, PWB Mt	FC27	1A3400-09	71400
XF07	Socket, Fuse, 2-pin	UC48	PCS	71400
XF08	Fuse Clip, 13/32 Dia Fuse, PWB Mt	FC27	1A3400-09	71400
XF09	Socket, Fuse, 2-pin	UC48	PCS	71400

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C02	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C03	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C04	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C05	Not Used	-	NOT USED	37338
C06	Capacitor, Elect, 1000uF 50V	CT41	SME50VB102M16X25 LL	1W344
C07	Not Used	-	NOT USED	37338
C08	Capacitor, Elect, 1000uF 50V	CT41	SME50VB102M16X25 LL	1W344
C09	Capacitor, Elect, 1000uF 50V	CT41	SME50VB102M16X25 LL	1W344
C10	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C11	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C12	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C13	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C14	Not Used	-	NOT USED	37338
C15	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C16	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C17	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C18	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
CR01	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR02	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR03	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR04	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR05	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR06	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR07	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR08	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR09	Not Used	-	NOT USED	37338
CR10	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR11	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR12	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR13	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
DS01	Diode, LED, Yellow, 8.6mm Lg	QM19	SSL-LX5093YD	1EM90
E01	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
E02	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
J01	Conn, Plug, D-Sub, 25 pin, PWB Mt	JS12	K22-B25P-NJ	63590
J02	Conn, Plug, D-Sub, 25 pin, PWB Mt	JS12	K22-B25P-NJ	63590
J03	Conn, Socket, D-Sub, 25 pin, PWB Mt	JS13	K22-B25S-NJ	22421

Continued from previous page

NAPI82A Exciter Interface PWB,XRSeries

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
J04	Conn, Socket, D-Sub, 25 pin, PWB Mt	JS13	K22-B25S-NJ	22421
J05	Conn, Header, Ribbon Cbl, 40 pin	JP52	499910-9	00779
J06	Conn, Header, Ribbon Cbl, 40 pin	JP52	499910-9	00779
J07	Conn, Header, Ribbon Cbl, 40 pin	JP52	499910-9	00779
J08	Conn, Plug, D-Sub, 25 pin, PWB Mt	JS12	K22-B25P-NJ	63590
J09	Conn, Plug, D-Sub, 25 pin, PWB Mt	JS12	K22-B25P-NJ	63590
J10	Conn, BNC, Recept, PWB Mt	JF35	R141426161	0GP12
J11	Conn, BNC, Recept, PWB Mt	JF35	R141426161	0GP12
J12	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
J13	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
K01	Relay, 24Vdc, 4PDT, PWB Mount	KC11	DS4E-M-DC24V	61529
K02	Relay, 24Vdc, 4PDT, PWB Mount	KC11	DS4E-M-DC24V	61529
L01	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L02	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L03	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L04	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
Q01	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713
Q02	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713
Q03	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713
Q04	Transistor, PNP, Switch/Amplifier	QA44	2N4403	04713
R01	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R02	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R03	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R04	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R05	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R06	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R07	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R08	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R09	Resistor, MF, 392 Ohms, 1PC 1/4W	RAB20	MF1/4DL3920F	59124
R10	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R11	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R12	Resistor, Film, 22 Ohms, 5% 2W	RBP03	GS-3, 22 OHMS	75042
R13	Resistor, MF, 475K Ohms, 1%1/4W	RAC09	MF1/4DL4753F	59124
R14	Not Used	-	NOT USED	37338
R15	Not Used	-	NOT USED	37338
R16	Not Used	-	NOT USED	37338
R17	Resistor, MF, 68.1K Ohms, 1PC1/4W	RAB47	MF1/4DL6812F	59124
R18	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R19	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124

Continued from previous page

NAPI82A Exciter Interface PWB,XRSeries

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R20	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R21	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R22	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R23	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R24	Resistor, MF, 2.21K Ohms, 1PC1/4W	RAB29	MF1/4DL2211F	59124
R25	Resistor, MF, 10.0 Ohms, 1PC 1/4W	RAB01	MF1/4DL10R0F	59124
R26	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R27	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R28	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R29	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R30	Not Used	-	NOT USED	37338
R31	Resistor, MF, 332 Ohms, 1PC 1/4W	RAB19	MF1/4DL3320F	59124
S01	Switch, Push Button, MOM, 1PSTNC	SA55	KSL0M211	1KK13
S02	Switch, Slide, 6PDT	SD17	MSS-6200	95146
U01	IC, Transistor Array, 8 Darlingtons	UM28	(N)ULN-2803A	04713
U02	IC, Op Amp, Dual	UN25	TL072CP(STATIC)	04713
U03	IC, Voltage Regulator, -5V,IA, Plastic	UX21	MC7905CT	04713
XE01	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
XE02	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C001	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C002	Cap,SMT,Tantalum,10uF,10%,16V,1411	CTFS01	T494B106K016AS	31433
C003	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C004	Cap,SMT,Tantalum,10uF,10%,35V,2917	CTFS03	T494D106K035AS	31433
C005	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C006	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C007	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C008	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C009	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C010	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C011	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C012	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C013	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C014	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C015	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C016	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C017	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C018	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C019	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C020	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C021	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C022	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C023	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C024	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C025	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C026	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C027	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C028	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C029	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C030	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C031	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C032	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C033	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C034	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C035	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C036	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C037	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C038	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C039	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433

NAPI83/01A Remote Interface PWB,XR Series

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C040	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C041	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C042	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C043	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C044	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C045	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C046	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C047	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C048	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C049	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C050	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C051	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C052	Cap,SMT,Tantalum,10uF,10%,16V,1411	CTFS01	T494B106K016AS	31433
C053	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C054	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C055	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C056	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C057	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C058	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C059	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C060	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C061	Cap,SMT,Tantalum,1uF,10%,35V,1411	CTFS02	T494B105K035AS	31433
C062	Cap,SMT,Tantalum,10uF,10%,35V,2917	CTFS03	T494D106K035AS	31433
C063	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C064	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C065	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C066	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C067	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C068	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C069	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C070	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C071	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C072	Cap,SMT,Tantalum,10uF,10%,35V,2917	CTFS03	T494D106K035AS	31433
C073	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C074	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C075	Cap,SMT,Tantalum,1uF,10%,35V,1411	CTFS02	T494B105K035AS	31433
C076	Cap,SMT,Tantalum,10uF,10%,35V,2917	CTFS03	T494D106K035AS	31433
C077	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C078	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C079	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C080	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C081	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C082	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C083	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C084	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C085	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C086	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C087	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C088	Capacitor, Non-Polarized, 10uf, +/-20%, 35V	CS68	NNR100M35V5X11	NICCOMP
C089	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C090	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C091	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C092	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C093	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C094	Cap,SMT,Ceramic,150pF,1%,50V,C0G,0603	CCFS33	06035A151FAT2A	56289
C095	Cap,SMT,Ceramic,18pF,2%,50V,C0G,0603	CCFS23	C0603C180G5GAC	31433
C096	Cap,SMT,Ceramic,18pF,2%,50V,C0G,0603	CCFS23	C0603C180G5GAC	31433
C097	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C098	Cap,SMT,Ceramic,150pF,1%,50V,C0G,0603	CCFS33	06035A151FAT2A	56289
C099	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C100	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C101	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C102	Capacitor, Non-Polarized, 10uf, +/-20%, 35V	CS68	NNR100M35V5X11	NICCOMP
C103	Cap,SMT,Ceramic,150pF,1%,50V,C0G,0603	CCFS33	06035A151FAT2A	56289
C104	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C105	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C107	Cap,SMT,Ceramic,150pF,1%,50V,C0G,0603	CCFS33	06035A151FAT2A	56289
C108	Cap,SMT,Ceramic,0.47uF,10%,25V,X7R,0805	CCFS09	C0805C474K3RAC	31433
C109	Cap,SMT,Ceramic,1000pF,2%,50V,C0G,0805	CCFS42	C0805C102G5GAC	31433
C110	Cap,SMT,Ceramic,0.47uF,10%,25V,X7R,0805	CCFS09	C0805C474K3RAC	31433
C111	Not Used	-	NOT USED	37338
C112	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C113	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C114	Cap,SMT,Ceramic,1000pF,2%,50V,C0G,0805	CCFS42	C0805C102G5GAC	31433
C115	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C116	Cap,SMT,Ceramic,1000pF,2%,50V,C0G,0805	CCFS42	C0805C102G5GAC	31433
C117	Not Used	-	NOT USED	37338
C118	Not Used	-	NOT USED	37338

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C119	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C120	Not Used	-	NOT USED	37338
C121	Cap,SMT,Tantalum,10uF,10%,35V,2917	CTFS03	T494D106K035AS	31433
C123	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C124	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C125	Cap,SMT,Tantalum,1uF,10%,35V,1411	CTFS02	T494B105K035AS	31433
C126	Cap,SMT,Ceramic,0.01uF,10%,50V,X7R,0603	CCFS04	C0603C103K5RAC	31433
C127	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C128	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C129	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C130	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C131	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C132	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C133	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C134	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C135	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C136	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C137	Cap,SMT,Ceramic,0.047uF,10%,50V,X7R,0603	CCFS06	C0603C473K5RAC	31433
C138	Not Used	-	NOT USED	37338
C139	Cap,SMT,Ceramic,0.47uF,10%,25V,X7R,0805	CCFS09	C0805C474K3RAC	31433
C140	Cap,SMT,Ceramic,0.001uF,10%,50V,X7R,0603	CCFS01	C0603C102K5RAC	31433
C141	Cap,SMT,Tantalum,10uF,10%,35V,2917	CTFS03	T494D106K035AS	31433
C142	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C143	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C144	Cap,SMT,Tantalum,10uF,10%,35V,2917	CTFS03	T494D106K035AS	31433
C145	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C146	Cap,SMT,Ceramic,0.1uF,10%,50V,X7R,0805	CCFS07	C0805C104K5RAC	31433
C147	Cap,SMT,Tantalum,10uF,10%,35V,2917	CTFS03	T494D106K035AS	31433
CR01	Not Used	-	NOT USED	37338
CR02	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR03	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR04	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR05	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR06	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR07	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR08	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR09	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR10	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR11	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
CR12	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR13	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR14	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR15	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR16	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR17	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR18	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR19	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR20	Diode,SMT,Zener,39V,5%,3W,SMB	QDZS04	1SMB5939BT3	04713
CR21	Diode,SMT,Zener,39V,5%,3W,SMB	QDZS04	1SMB5939BT3	04713
CR22	Diode,SMT,Zener,39V,5%,3W,SMB	QDZS04	1SMB5939BT3	04713
CR23	Diode,SMT,Zener,39V,5%,3W,SMB	QDZS04	1SMB5939BT3	04713
CR24	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR25	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR26	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR27	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR28	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR29	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR30	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR31	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR32	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR33	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR34	Diode, Zener, 13V, 1W, 10%	QK19	1N4743	04713
CR35	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR36	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR37	Diode,SMT,Switching,250V,0.2A,SOD-323	QDRS01	BAS21HT1(STATIC)	04713
CR38	Diode, Zener, 13V, 1W, 10%	QK19	1N4743	04713
DS01	Diode, SMT, LED, Green,(560nm), 0603	QDLS01	597-5312-402F(STATIC)(RoHS)	83330
E01	Not Used	-	NOT USED	37338
E02	Not Used	-	NOT USED	37338
E03	Not Used	-	NOT USED	37338
E04	Not Used	-	NOT USED	37338
E05	Not Used	-	NOT USED	37338
E06	Not Used	-	NOT USED	37338
E07	Not Used	-	NOT USED	37338
E08	Not Used	-	NOT USED	37338
E09	Not Used	-	NOT USED	37338
E10	Not Used	-	NOT USED	37338
E11	Not Used	-	NOT USED	37338

Continued from previous page

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
E12	Not Used	-	NOT USED	37338
E13	Not Used	-	NOT USED	37338
E14	Not Used	-	NOT USED	37338
E15	Not Used	-	NOT USED	37338
E16	Not Used	-	NOT USED	37338
E17	Not Used	-	NOT USED	37338
E18	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
E19	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
J01	Conn, Plug, D-Sub, 25 pin, Vert PWB	JS43	627 025 220 017	31781
J02	Conn, Plug, D-Sub, 25 pin, Vert PWB	JS43	627 025 220 017	31781
J03	Conn,Socket,D-Sub,25 pin,VertPWB	JS53	628-025-220-017	31781
J04	Conn, Socket, D-Sub, 25 pin, PWB Mt	JS13	K22-B25S-NJ	22421
J05	Conn, BNC, Recept, Rt Angle, PWB Mt	JS21	R141665161	0GP12
J06	Conn, BNC, Recept, Rt Angle, PWB Mt	JS21	R141665161	0GP12
J07	Conn, BNC, Recept, Rt Angle, PWB Mt	JS21	R141665161	0GP12
J08	Conn, BNC, Recept, Rt Angle, PWB Mt	JS21	R141665161	0GP12
J09	Conn, Header,Square Post,Gold,Dual,40-pin	JF47	4-102973-0	09482
J10	Conn, Jack, RJ45, PWB Mount	JM44	556591-1	09482
J11	Conn, Jack, RJ45, PWB Mount	JM44	556591-1	09482
J12	Conn, Socket, D-Sub, 9 pin, PWB Mt	JQ34	K22-E9S-NJ	KYCON
J13	Conn, Header, Ribbon Cbl, 40 pin	JP52	499910-9	00779
K01	Relay, 24Vdc, 2PDT, 1A, PWB Mount	KC06	DF2E-DC24V	61529
K02	Relay, 24Vdc, 4PDT, PWB Mount	KC11	DS4E-M-DC24V	61529
K03	Relay, 24Vdc, 2PDT, 1A, PWB Mount	KC06	DF2E-DC24V	61529
L01	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L02	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L03	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L04	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L05	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L06	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L07	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
L08	Inductor, SMT, Choke, 600ohms,2A, 0805	LCFS01	ILHB0805RK601V	56845
Q01	Transistor,SMT,NPN,Switch/Amp,SOT-23	QBNS01	MMBT4401LT1(STATIC)	04713
Q02	Transistor,SMT,NPN,Switch/Amp,SOT-23	QBNS01	MMBT4401LT1(STATIC)	04713
Q03	Transistor,SMT,NPN,Switch/Amp,SOT-23	QBNS01	MMBT4401LT1(STATIC)	04713
Q04	Transistor, PNP, Switch/Amplifier	QA44	2N4403	04713
Q05	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713
Q06	Transistor, PNP, Switch/Amplifier	QA44	2N4403	04713

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
Q07	Transistor,SMT,NPN,Switch/Amp,SOT-23	QBNS01	MMBT4401LT1(STATIC)	04713
Q08	Transistor,SMT,NPN,Switch/Amp,SOT-23	QBNS01	MMBT4401LT1(STATIC)	04713
Q12	Transistor,SMT,MOSFET,N-Channel,60V,115mA,SOT-23	QN53	2N7002LT1G(STATIC)(ROHS)	1MQ07
Q13	Not Used	-	NOT USED	37338
Q17	Transistor,SMT,NPN,Switch/Amp,SOT-23	QBNS01	MMBT4401LT1(STATIC)	04713
R001	Not Used	-	NOT USED	37338
R002	Not Used	-	NOT USED	37338
R003	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R004	Resistor, SMT, MF, 4750 Ohms,1%, 1/4W	RAD33	RK73H2BL4751F	59124
R005	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R006	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R007	Resistor, SMT, MF, 4750 Ohms,1%, 1/4W	RAD33	RK73H2BL4751F	59124
R008	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R009	Resistor, SMT, MF, 4750 Ohms,1%, 1/4W	RAD33	RK73H2BL4751F	59124
R010	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R011	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R012	Resistor, SMT, MF, 4750 Ohms,1%, 1/4W	RAD33	RK73H2BL4751F	59124
R013	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R014	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R015	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R016	Resistor, SMT, MF, 4750 Ohms,1%, 1/4W	RAD33	RK73H2BL4751F	59124
R017	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R018	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R019	Resistor, SMT, MF, 4750 Ohms,1%, 1/4W	RAD33	RK73H2BL4751F	59124
R020	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R021	Resistor, SMT, MF, 4750 Ohms,1%, 1/4W	RAD33	RK73H2BL4751F	59124
R022	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R023	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R024	Resistor, SMT, MF, 4750 Ohms,1%, 1/4W	RAD33	RK73H2BL4751F	59124
R025	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R026	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R027	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R028	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R029	Resistor, SMT, MF, 4750 Ohms,1%, 1/4W	RAD33	RK73H2BL4751F	59124
R030	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R031	Resistor, SMT, MF, 4750 Ohms,1%, 1/4W	RAD33	RK73H2BL4751F	59124
R032	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R033	Resistor, SMT, MF, 4750 Ohms,1%, 1/4W	RAD33	RK73H2BL4751F	59124
R034	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R035	Resistor, SMT, MF, 4750 Ohms,1%, 1/4W	RAD33	RK73H2BL4751F	59124
R036	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R037	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R038	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R039	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R040	Resistor, SMT, MF, 4750 Ohms,1%, 1/4W	RAD33	RK73H2BL4751F	59124
R041	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R042	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R043	Resistor, SMT, MF, 4750 Ohms,1%, 1/4W	RAD33	RK73H2BL4751F	59124
R044	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R045	Resistor, SMT, MF, 4750 Ohms,1%, 1/4W	RAD33	RK73H2BL4751F	59124
R046	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R047	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R048	Resistor, SMT, MF, 4750 Ohms,1%, 1/4W	RAD33	RK73H2BL4751F	59124
R049	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R050	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R051	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R052	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R053	Resistor,SMT,MF,3320ohms,1%,1/10W,0603	RFFS44	RK73H1JLTD3321F	59124
R054	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R055	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R056	Resistor, SMT, MF, 4750 Ohms,1%, 1/4W	RAD33	RK73H2BL4751F	59124
R057	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R058	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R059	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R060	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R061	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R062	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R063	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R064	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R065	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R066	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R067	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R068	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R069	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R070	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R071	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R072	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R073	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R074	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R075	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R076	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R077	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R078	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R079	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R080	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R081	Resistor,SMT,MF,18.2Kohms,1%,1/10W,0603	RFFS53	RK73H1JLTD1822F	59124
R082	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R083	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R084	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R085	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R086	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R087	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R088	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R089	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R090	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R091	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R092	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R093	Resistor,SMT,MF,10.0ohms,1%,1/10W,0603	RFFS14	RK73H1JLTD10R0F	59124
R094	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R095	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R096	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R097	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R098	Resistor,SMT,MF,221ohms,1%,1/10W,0603	RFFS30	RK73H1JLTD2210F	59124
R099	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R100	Resistor,SMT,MF,3320ohms,1%,1/10W,0603	RFFS44	RK73H1JLTD3321F	59124
R101	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R102	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R103	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R104	Resistor, SMT, MF, 22.1 Ohms,1% 1/4W	RAD05	RK73H2BL22R1F	59124
R105	Resistor, SMT, MF, 22.1 Ohms,1% 1/4W	RAD05	RK73H2BL22R1F	59124
R106	Resistor, SMT, MF, 10 Ohms, 1% 1/4W	RAD01	RK73H2BL10R0F	59124
R107	Resistor, SMT, MF, 10 Ohms, 1% 1/4W	RAD01	RK73H2BL10R0F	59124
R108	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R109	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R110	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124

Continued from previous page

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R111	Resistor,SMT,MF,332ohms,1%,1/10W,0603	RFFS32	RK73H1JLTD3320F	59124
R112	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R113	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R114	Resistor, SMT, MF, 332 Ohms,1% 1/4W	RAD19	RK73H2BL3320F	59124
R115	Resistor, SMT, MF, 221 Ohms,1% 1/4W	RAD17	RK73H2BL2210F	59124
R116	Resistor, SMT, MF, 221 Ohms,1% 1/4W	RAD17	RK73H2BL2210F	59124
R117	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R118	Resistor,SMT,MF,47.5Kohms,1%,1/10W,0603	RFFS58	RK73H1JLTD4752F	59124
R119	Resistor, SMT, MF, 332 Ohms,1% 1/4W	RAD19	RK73H2BL3320F	59124
R120	Resistor,SMT,MF,681ohms,1%,1/10W,0603	RFFS36	RK73H1JLTD6810F	59124
R121	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R122	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R123	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R124	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R125	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R126	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R127	Resistor, Variable, Film, 50KOhms, 1/2W	RW35	3339P-1-503	80294
R128	Resistor,SMT,MF,475ohms,1%,1/10W,0603	RFFS34	RK73H1JLTD4750F	59124
R129	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R130	Resistor, SMT, MF, 332 Ohms,1% 1/4W	RAD19	RK73H2BL3320F	59124
R131	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R132	Resistor, SMT, MF, 332 Ohms,1% 1/4W	RAD19	RK73H2BL3320F	59124
R133	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R134	Resistor,SMT,MF,56.2Kohms,1%,1/10W,0603	RFFS59	RK73H1JLTD5622F	59124
R138	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R139	Resistor,SMT,MF,56.2Kohms,1%,1/10W,0603	RFFS59	RK73H1JLTD5622F	59124
R140	Resistor,SMT,MF,27.4Kohms,1%,1/10W,0603	RFFS55	RK73H1JLTD2742F	59124
R141	Resistor,SMT,MF,121Kohms,1%,1/10W,0603	RFFS63	RK73H1JLTD1213F	59124
R142	Resistor,SMT,MF,121Kohms,1%,1/10W,0603	RFFS63	RK73H1JLTD1213F	59124
R143	Resistor,SMT,MF,15.0Kohms,1%,1/10W,0603	RFFS52	RK73H1JLTD1502F	59124
R144	Resistor,SMT,MF,100Kohms,1%,1/10W,0603	RFFS62	RK73H1JLTD1003F	59124
R145	Resistor,SMT,MF,3920ohms,1%,1/10W,0603	RFFS45	RK73H1JLTD3921F	59124
R146	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R147	Resistor,SMT,MF,3920ohms,1%,1/10W,0603	RFFS45	RK73H1JLTD3921F	59124
R148	Resistor,SMT,MF,3920ohms,1%,1/10W,0603	RFFS45	RK73H1JLTD3921F	59124
R149	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R150	Not Used	-	NOT USED	37338
R151	Not Used	-	NOT USED	37338
R152	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R153	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R154	Resistor,SMT,MF,1210ohms,1%,1/10W,0603	RFFS39	RK73H1JLTD1211F	59124
R155	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R156	Not Used	-	NOT USED	37338
R158	Not Used	-	NOT USED	37338
R159	Not Used	-	NOT USED	37338
R160	Resistor, Variable, Film, 10Kohms, 1/2W	RW39	3299W-1-103	80294
R165	Resistor, Variable, Film, 50KOhms, 1/2W	RW35	3339P-1-503	80294
R166	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R167	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R168	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R169	Resistor,SMT,MF,15.0Kohms,1%,1/10W,0603	RFFS52	RK73H1JLTD1502F	59124
R171	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R172	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R173	Resistor,SMT,MF,15.0Kohms,1%,1/10W,0603	RFFS52	RK73H1JLTD1502F	59124
R174	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R175	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R176	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R177	Resistor,SMT,MF,6810ohms,1%,1/10W,0603	RFFS48	RK73H1JLTD6811F	59124
R178	Resistor,SMT,MF,100Kohms,1%,1/10W,0603	RFFS62	RK73H1JLTD1003F	59124
R179	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R180	Resistor,SMT,MF,33.2Kohms,1%,1/10W,0603	RFFS56	RK73H1JLTD3322F	59124
R181	Resistor,SMT,MF,150Kohms,1%,1/10W,0603	RFFS64	RK73H1JLTD1503F	59124
R182	Resistor,SMT,MF,681Kohms,1%,1/10W,0603	RFFS72	RK73H1JLTD6813F	59124
R183	Resistor,SMT,MF,4750ohms,1%,1/10W,0603	RFFS46	RK73H1JLTD4751F	59124
R184	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R185	Resistor,SMT,MF,56.2Kohms,1%,1/10W,0603	RFFS59	RK73H1JLTD5622F	59124
R186	Resistor,SMT,MF,100Kohms,1%,1/10W,0603	RFFS62	RK73H1JLTD1003F	59124
R187	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R188	Resistor,SMT,MF,150Kohms,1%,1/10W,0603	RFFS64	RK73H1JLTD1503F	59124
R189	Resistor,SMT,MF,475Kohms,1%,1/10W,0603	RFFS70	RK73H1JLTD4753F	59124
R191	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R192	Not Used	-	NOT USED	37338
R193	Resistor,SMT,MF,1000ohms,1%,1/10W,0603	RFFS38	RK73H1JLTD1001F	59124
R194	Resistor,SMT,MF,100ohms,1%,1/10W,0603	RFFS26	RK73H1JLTD1000F	59124
R195	Resistor,SMT,MF,39.2ohms,1%,1/10W,0603	RFFS21	RK73H1JLTD39R2F	59124
R196	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R197	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R198	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R199	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R200	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R201	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R202	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R203	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R204	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R205	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R206	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R207	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R208	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R209	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R210	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R211	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R212	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R213	Resistor,SMT,MF,0.0ohms,Jumper,0603	RFFS01	RK73Z1JLTD	59124
R214	Resistor,SMT,MF,10.0Kohms,1%,1/10W,0603	RFFS50	RK73H1JLTD1002F	59124
R215	Resistor,SMT,MF,3320ohms,1%,1/10W,0603	RFFS44	RK73H1JLTD3321F	59124
R216	Resistor, SMT, MF, 1500 Ohms,1% 1/4W	RAD27	RK73H2BL1501F	59124
R217	Resistor,SMT,150 Ohms,,1%,2W	RAD55	CR2512-2W-1500F	3EQW4
RT01	Thermistor, PTC, .15-.25 Ohms, 1.1A Hold	RT17	RXE110	06090
RT02	Thermistor, PTC, .15-.25 Ohms, 1.1A Hold	RT17	RXE110	06090
S01	Switch, DIP, 2-way, 1PST	SC33	76SB02T (ROHS)	81073
S02	Switch, Slide, DPDT, ON, ON	SD07	MHS-222	95146
T01	Transformer, Gate Drive, HighFreq	TZ74	P0584	01961
T02	Transformer, Gate Drive, HighFreq	TZ74	P0584	01961
TB01	Terminal Block,5mm,3-pos,PWBMt,Angled,Blue	JR49	796688-3	5Y407
TB02	Terminal Block,5mm,3-pos,PWBMt,Angled,Blue	JR49	796688-3	5Y407
U01	IC,SMT,Dual Optocoupler,SOIC-8	UDOS01	MOCD223-M(STATIC)	7D893
U02	IC,SMT,Dual Optocoupler,SOIC-8	UDOS01	MOCD223-M(STATIC)	7D893
U03	IC,SMT,CMOS,8-Bit Shft Reg,Par I/P, SOIC-16	UDLS04	MC74HC165AD(STATIC)	04713
U04	IC,SMT,Dual Optocoupler,SOIC-8	UDOS01	MOCD223-M(STATIC)	7D893
U05	IC,SMT,Dual Optocoupler,SOIC-8	UDOS01	MOCD223-M(STATIC)	7D893
U06	IC,SMT,Dual Optocoupler,SOIC-8	UDOS01	MOCD223-M(STATIC)	7D893
U07	IC,SMT,CMOS,8-Bit Shft Reg,Par I/P, SOIC-16	UDLS04	MC74HC165AD(STATIC)	04713
U08	IC,SMT,Dual Optocoupler,SOIC-8	UDOS01	MOCD223-M(STATIC)	7D893
U09	IC,SMT,Dual Optocoupler,SOIC-8	UDOS01	MOCD223-M(STATIC)	7D893
U10	IC,SMT,Dual Optocoupler,SOIC-8	UDOS01	MOCD223-M(STATIC)	7D893
U11	IC,SMT,Dual Optocoupler,SOIC-8	UDOS01	MOCD223-M(STATIC)	7D893

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
U12	IC,SMT,Trans Array, 7 Darl.,SOIC-16	UDAS01	MC1413BD(STATIC)	04713
U13	IC,SMT,Trans Array, 7 Darl.,SOIC-16	UDAS01	MC1413BD(STATIC)	04713
U14	IC,SMT,Trans Array, 7 Darl.,SOIC-16	UDAS01	MC1413BD(STATIC)	04713
U15	IC,SMT,Trans Array, 7 Darl.,SOIC-16	UDAS01	MC1413BD(STATIC)	04713
U16	IC,SMT,CMOS,8-Bit Shft Reg,Par O/P, SOIC-16	UDLS05	MC74HC595AD(STATIC)	04713
U17	IC,SMT,CMOS,8-Bit Shft Reg,Par O/P, SOIC-16	UDLS05	MC74HC595AD(STATIC)	04713
U18	IC,SMT,CMOS,8-Bit Shft Reg,Par O/P, SOIC-16	UDLS05	MC74HC595AD(STATIC)	04713
U19	IC,SMT,Opamp,Quad,Single Supply,SOIC-14	ULAS01	MC33074AD(STATIC)	04713
U20	IC,SMT,4.096V Reference,0.1%,SOT-23-6	ULRS02	LT1790BIS6-4.096(STATIC)	64155
U21	IC,SMT,DAC,8-Bit,4-ch,SPI,SOIC-14	UMDS01	TLV5620ID(STATIC)	64155
U22	IC,Variable Gain Amp,SMT,90MHz,SOIC-8	UT79	AD603AR(STATIC)	45496
U23	IC,SMT,RS-485 Transceiver,Sgl,SOIC-8	UDTS03	DS36C278TM(STATIC)	27014
U24	IC, SMT, Micro, ADC, PWM,Flash, TQFP-32	UDMS03	ATMEGA8-16AI(STATIC)	1FN41
U25	IC,SMT,CMOS,Quad Tri-State Buffer, SOIC-14	UDLS06	MC74HC125AD(STATIC)	04713
U26	IC,SMT,Microprocessor Supervisor, SC70	UDSS02	ADM803-MAKS(STATIC)	24355
U27	IC,SMT,Instrumentation Amp,SOIC-8	UP98	AD620AR(STATIC)	45496
U28	IC,SMT,Instrumentation Amp,SOIC-8	UP98	AD620AR(STATIC)	45496
U29	IC,SMT,Opamp,Quad,Single Supply,SOIC-14	ULAS01	MC33074AD(STATIC)	04713
U30	Not Used	-	NOT USED	37338
U31	IC,SMT,RS-232 Transceiver,3.3V,SO-16	UDTS05	ADM3202ARN(STATIC)	45496
U32	IC,SMT,Comparator,Quad,SOIC-14	ULCS01	MC3302D(STATIC)	04713
U33	IC,SMT,Comparator,Quad,SOIC-14	ULCS01	MC3302D(STATIC)	04713
U34	IC,SMT,Amp,35MHz,CurrentFeedback 1.1A,TO263-7	UT90	LT1210CR(STATIC)	64155
U35	Not Used	-	NOT USED	37338
XE01	Not Used	-	NOT USED	37338
XE02	Not Used	-	NOT USED	37338
XE03	Not Used	-	NOT USED	37338
XE04	Not Used	-	NOT USED	37338
XE05	Not Used	-	NOT USED	37338
XE06	Not Used	-	NOT USED	37338
XE07	Not Used	-	NOT USED	37338
XE08	Not Used	-	NOT USED	37338
XE09	Not Used	-	NOT USED	37338
XE10	Not Used	-	NOT USED	37338
XE11	Not Used	-	NOT USED	37338

Continued from previous page

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
XE12	Not Used	-	NOT USED	37338
XE13	Not Used	-	NOT USED	37338
XE14	Not Used	-	NOT USED	37338
XE15	Not Used	-	NOT USED	37338
XE16	Not Used	-	NOT USED	37338
XE17	Not Used	-	NOT USED	37338
XE18	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
XE19	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
Y01	Crystal,SMT,Fund,Par Res,3.6864MHz,Comm	XFPS03	ATSM49-3.6864MHz	23875

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C02	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C03	Not Used	-	NOT USED	37338
C04	Not Used	-	NOT USED	37338
C05	Not Used	-	NOT USED	37338
C06	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C07	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C08	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C09	Not Used	-	NOT USED	37338
C10	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C11	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C12	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C13	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C14	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C15	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C16	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C17	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C18	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C19	Not Used	-	NOT USED	37338
C20	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C21	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C22	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C23	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C24	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C25	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C26	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C27	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C28	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C29	Not Used	-	NOT USED	37338
C30	Not Used	-	NOT USED	37338
C31	Not Used	-	NOT USED	37338
C32	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C33	Not Used	-	NOT USED	37338
C34	Not Used	-	NOT USED	37338
C35	Not Used	-	NOT USED	37338
C36	Capacitor, Ceramic, 0.047uF 10% 100V	CCG06	CKR06BX473KRV	56289
C37	Capacitor, Tantalum, 22uF 10PC 35V	CCP20	CSR13F226KM	56289

NAPI90/02 Distribution PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C38	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C39	Not Used	-	NOT USED	37338
C40	Not Used	-	NOT USED	37338
C41	Not Used	-	NOT USED	37338
C42	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C43	Not Used	-	NOT USED	37338
C44	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C45	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C46	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C47	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C48	Not Used	-	NOT USED	37338
C49	Not Used	-	NOT USED	37338
C50	Not Used	-	NOT USED	37338
C51	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C52	Capacitor, Mica, Dipped, 100pF 2% 500V	CB25	CM05FD101G03	SOSH
C53	Not Used	-	NOT USED	37338
C54	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C55	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C56	Not Used	-	NOT USED	37338
C57	Not Used	-	NOT USED	37338
C58	Not Used	-	NOT USED	37338
C59	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C60	Not Used	-	NOT USED	37338
C61	Not Used	-	NOT USED	37338
C62	Not Used	-	NOT USED	37338
C63	Not Used	-	NOT USED	37338
C64	Not Used	-	NOT USED	37338
C65	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C66	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C67	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C68	Not Used	-	NOT USED	37338
C69	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C70	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C71	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C72	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
CR01	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR02	Not Used	-	NOT USED	37338

NAPI90/02 Distribution PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
CR03	Not Used	-	NOT USED	37338
CR04	Not Used	-	NOT USED	37338
CR05	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR06	Not Used	-	NOT USED	37338
CR07	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR08	Not Used	-	NOT USED	37338
CR09	Not Used	-	NOT USED	37338
CR10	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR11	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR12	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR13	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR14	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR15	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR16	Not Used	-	NOT USED	37338
CR17	Not Used	-	NOT USED	37338
CR18	Not Used	-	NOT USED	37338
CR19	Not Used	-	NOT USED	37338
CR20	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR21	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR22	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR23	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR24	Diode, General Purpose, 400V,1A	QE28	1N4004	04713
CR25	Diode, General Purpose, 400V,1A	QE28	1N4004	04713
CR26	Diode, General Purpose, 400V,1A	QE28	1N4004	04713
DS01	Diode, LED, Green, 8.6mm Lg	QM20	SSL-LX5093GD	1EM90
DS02	Diode, LED, Green, 8.6mm Lg	QM20	SSL-LX5093GD	1EM90
DS03	Diode, LED, Green, 8.6mm Lg	QM20	SSL-LX5093GD	1EM90
DS04	Diode, LED, Green, 8.6mm Lg	QM20	SSL-LX5093GD	1EM90
DS05	Diode, LED, Green, 8.6mm Lg	QM20	SSL-LX5093GD	1EM90
DS06	Diode, LED, Yellow, 8.6mm Lg	QM19	SSL-LX5093YD	1EM90
DS07	Diode, LED, Yellow, 8.6mm Lg	QM19	SSL-LX5093YD	1EM90
E01	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
E02	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
J01	Conn, Socket, D-Sub, 25 pin, PWB Mt	JS13	K22-B25S-NJ	22421
J02	Conn, Socket, D-Sub, 25 pin, PWB Mt	JS13	K22-B25S-NJ	22421
J03	Not Used	-	NOT USED	37338
J04	Not Used	-	NOT USED	37338
J05	Not Used	-	NOT USED	37338
J06	Not Used	-	NOT USED	37338

Continued from previous page

NAPI90/02 Distribution PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
J07	Not Used	-	NOT USED	37338
J08	Not Used	-	NOT USED	37338
J09	Conn, Header, Ribbon Cbl, 40 pin	JP52	499910-9	00779
J10	Conn, Plug, D-Sub, 25 pin, PWB Mt	JS12	K22-B25P-NJ	63590
J11	Conn, Plug, D-Sub, 25 pin, Vert PWB	JS43	627 025 220 017	31781
J12	MTA, Keyed Square Post HeaderAssy,12 Pin	JU23	1-647123-2	00779
J13	Conn, Plug, D-Sub, 25 pin, Vert PWB	JS43	627 025 220 017	31781
J14	Not Used	-	NOT USED	37338
J15	Not Used	-	NOT USED	37338
K01	Relay,24Vdc,FORM A,NO,80 AmpPWB	KC51	AZ983-1A-24D	26806
L01	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L02	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L03	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L04	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L05	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L06	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L07	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L08	Not Used	-	NOT USED	37338
L09	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L10	Not Used	-	NOT USED	37338
L11	Not Used	-	NOT USED	37338
L12	Not Used	-	NOT USED	37338
L13	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L14	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L15	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L16	Not Used	-	NOT USED	37338
L17	Not Used	-	NOT USED	37338
L18	Not Used	-	NOT USED	37338
L19	Not Used	-	NOT USED	37338
Q01	Transistor, PNP, Switch/Amplifier	QA44	2N4403	04713
Q02	Transistor, PNP, Switch/Amplifier	QA44	2N4403	04713
Q03	Not Used	-	NOT USED	37338
Q04	Not Used	-	NOT USED	37338
Q05	Transistor, PNP, Switch/Amplifier	QA44	2N4403	04713
Q06	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713
Q07	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713
Q08	Not Used	-	NOT USED	37338
Q09	Not Used	-	NOT USED	37338
Q10	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713

Continued from previous page

NAPI90/02 Distribution PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
Q11	Transistor, PNP, Switch/Amplifier	QA44	2N4403	04713
Q12	Transistor, FET, N Channel, 100V, 8A	QR13	IRF520(STATIC)	81483
Q13	Transistor, FET, N Channel, 100V, 8A	QR13	IRF520(STATIC)	81483
Q14	Transistor, FET, N Channel, 100V, 8A	QR13	IRF520(STATIC)	81483
Q15	Transistor, FET, N Channel, 100V, 8A	QR13	IRF520(STATIC)	81483
Q16	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713
Q17	Not Used	-	NOT USED	37338
Q18	Not Used	-	NOT USED	37338
Q19	Not Used	-	NOT USED	37338
Q20	Not Used	-	NOT USED	37338
Q21	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713
Q22	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713
Q23	Transistor, PNP, Switch/Amplifier	QA44	2N4403	04713
Q24	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713
Q25	Not Used	-	NOT USED	37338
Q26	Transistor, PNP, Switch/Amplifier	QA44	2N4403	04713
Q27	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713
Q28	Not Used	-	NOT USED	37338
Q29	Not Used	-	NOT USED	37338
Q30	Not Used	-	NOT USED	37338
Q31	Not Used	-	NOT USED	37338
Q32	Not Used	-	NOT USED	37338
Q33	Not Used	-	NOT USED	37338
Q34	Not Used	-	NOT USED	37338
Q35	Not Used	-	NOT USED	37338
Q36	Not Used	-	NOT USED	37338
Q37	Transistor, FET, N Channel, 100V, 8A	QR13	IRF520(STATIC)	81483
Q38	Transistor, FET, N Channel, 100V, 8A	QR13	IRF520(STATIC)	81483
Q39	Transistor, FET, N Channel	QN54	2N7000(STATIC)	04713
R001	Not Used	-	NOT USED	37338
R002	Not Used	-	NOT USED	37338
R003	Resistor, MF, 221 Ohms, 1PC 1/4W	RAB17	MF1/4DL2210F	59124
R004	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
R005	Resistor, MF, 221 Ohms, 1PC 1/4W	RAB17	MF1/4DL2210F	59124
R006	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
R007	Not Used	-	NOT USED	37338
R008	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
R009	Not Used	-	NOT USED	37338
R010	Resistor, Film, 10 Ohms, 2%1/2W	RAP01	RL20S100G	35005

NAPI90/02 Distribution PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R011	Resistor, Film, 10 Ohms, 2%1/2W	RAP01	RL20S100G	35005
R012	Resistor, Film, 10 Ohms, 2%1/2W	RAP01	RL20S100G	35005
R013	Not Used	-	NOT USED	37338
R014	Not Used	-	NOT USED	37338
R015	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R016	Resistor, Film, 10 Ohms, 2%1/2W	RAP01	RL20S100G	35005
R017	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R018	Not Used	-	NOT USED	37338
R019	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R020	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R021	Resistor, Film, 100 Ohms, 2PC1/2W	RAP05	RL20S101G DALE	35005
R022	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R023	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R024	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R025	Not Used	-	NOT USED	37338
R026	Not Used	-	NOT USED	37338
R027	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R028	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R029	Not Used	-	NOT USED	37338
R030	Resistor, MF, 2.21K Ohms, 1PC1/4W	RAB29	MF1/4DL2211F	59124
R031	Resistor, MF, 47.5K Ohms, 1PC1/4W	RAB45	MF1/4DL4752F	59124
R032	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R033	Not Used	-	NOT USED	37338
R034	Not Used	-	NOT USED	37338
R035	Not Used	-	NOT USED	37338
R036	Not Used	-	NOT USED	37338
R037	Not Used	-	NOT USED	37338
R038	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R039	Not Used	-	NOT USED	37338
R040	Resistor, MF, 681 Ohms, 1PC 1/4W	RAB23	MF1/4DL6810F	59124
R041	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R042	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R043	Not Used	-	NOT USED	37338
R044	Resistor, MF, 100K Ohms, 1PC 1/4W	RAC01	MF1/4DL1003F	59124
R045	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R046	Resistor, MF, 1.82K Ohms, 1PC1/4W	RAB28	MF1/4DL1821F	59124
R047	Resistor, MF, 15.0K Ohms, 1PC1/4W	RAB39	MF1/4DL1502F	59124
R048	Resistor, MF, 15.0K Ohms, 1PC1/4W	RAB39	MF1/4DL1502F	59124
R049	Resistor, MF, 18.2K Ohms, 1PC1/4W	RAB40	MF1/4DL1822F	59124

NAPI90/02 Distribution PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R050	Resistor, MF, 18.2K Ohms, 1PC1/4W	RAB40	MF1/4DL1822F	59124
R051	Resistor, MF, 221 Ohms, 1PC 1/4W	RAB17	MF1/4DL2210F	59124
R052	Not Used	-	NOT USED	37338
R053	Resistor, MF, 475 Ohms, 1PC 1/4W	RAB21	MF1/4DL4750F	59124
R054	Resistor, Film, 10 Ohms, 2%1/2W	RAP01	RL20S100G	35005
R055	Resistor, Film, 10 Ohms, 2%1/2W	RAP01	RL20S100G	35005
R056	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R057	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R058	Resistor, Film, 10 Ohms, 2%1/2W	RAP01	RL20S100G	35005
R059	Not Used	-	NOT USED	37338
R060	Resistor, MF, 3.32K Ohms, 1PC1/4W	RAB31	MF1/4DL3321F	59124
R061	Resistor, MF, 3.32K Ohms, 1PC1/4W	RAB31	MF1/4DL3321F	59124
R062	Resistor, MF, 1.82K Ohms, 1PC1/4W	RAB28	MF1/4DL1821F	59124
R063	Resistor, MF, 475 Ohms, 1PC 1/4W	RAB21	MF1/4DL4750F	59124
R064	Not Used	-	NOT USED	37338
R065	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R066	Resistor, MF, 3.32K Ohms, 1PC1/4W	RAB31	MF1/4DL3321F	59124
R067	Not Used	-	NOT USED	37338
R068	Not Used	-	NOT USED	37338
R069	Not Used	-	NOT USED	37338
R070	Resistor, MF, 392K Ohms, 1%1/4W	RAC08	MF1/4DL3923F	59124
R071	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R072	Not Used	-	NOT USED	37338
R073	Resistor, MF, 332K Ohms, 1%1/4W	RAC07	MF1/4DL3323F	59124
R074	Resistor, MF, 2.21K Ohms, 1PC1/4W	RAB29	MF1/4DL2211F	59124
R075	Resistor, MF, 100K Ohms, 1PC 1/4W	RAC01	MF1/4DL1003F	59124
R076	Resistor, MF, 5.62K Ohms, 1PC1/4W	RAB34	MF1/4DL5621F	59124
R077	Not Used	-	NOT USED	37338
R078	Not Used	-	NOT USED	37338
R079	Resistor, MF, 2.21K Ohms, 1PC1/4W	RAB29	MF1/4DL2211F	59124
R080	Not Used	-	NOT USED	37338
R081	Resistor, MF, 39.2K Ohms, 1PC1/4W	RAB44	MF1/4DL3922F	59124
R082	Resistor, MF, 150K Ohms, 1PC 1/4W	RAC03	MF1/4DL1503F	59124
R083	Resistor, MF, 39.2K Ohms, 1PC1/4W	RAB44	MF1/4DL3922F	59124
R084	Not Used	-	NOT USED	37338
R085	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R086	Not Used	-	NOT USED	37338
R087	Not Used	-	NOT USED	37338
R088	Resistor, MF, 15.0K Ohms, 1PC1/4W	RAB39	MF1/4DL1502F	59124

Continued from previous page

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R089	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R090	Resistor, MF, 332K Ohms, 1%1/4W	RAC07	MF1/4DL3323F	59124
R091	Not Used	-	NOT USED	37338
R092	Not Used	-	NOT USED	37338
R093	Not Used	-	NOT USED	37338
R094	Not Used	-	NOT USED	37338
R095	Not Used	-	NOT USED	37338
R096	Not Used	-	NOT USED	37338
R097	Not Used	-	NOT USED	37338
R098	Not Used	-	NOT USED	37338
R099	Not Used	-	NOT USED	37338
R100	Resistor, MF, 150K Ohms, 1PC 1/4W	RAC03	MF1/4DL1503F	59124
R101	Resistor, MF, 22.1K Ohms, 1PC1/4W	RAB41	MF1/4DL2212F	59124
R102	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R103	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R104	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R105	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R106	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R107	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R108	Resistor, MF, 2.21K Ohms, 1PC1/4W	RAB29	MF1/4DL2211F	59124
R109	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
RT01	Thermistor, PTC, .20-.31 Ohms, 0.9A Hold	RT18	RXE 090	06090
RT02	Thermistor, PTC, .20-.31 Ohms, 0.9A Hold	RT18	RXE 090	06090
RT03	Not Used	-	NOT USED	37338
RT04	Not Used	-	NOT USED	37338
RT05	Not Used	-	NOT USED	37338
RT06	Not Used	-	NOT USED	37338
RT07	Thermistor, PTC, .20-.31 Ohms, 0.9A Hold	RT18	RXE 090	06090
RT08	Thermistor, PTC, .20-.31 Ohms, 0.9A Hold	RT18	RXE 090	06090
RT09	Thermistor, PTC, .20-.31 Ohms, 0.9A Hold	RT18	RXE 090	06090
RT10	Thermistor, PTC, .20-.31 Ohms, 0.9A Hold	RT18	RXE 090	06090
RT11	Thermistor, PTC, .20-.31 Ohms, 0.9A Hold	RT18	RXE 090	06090
RT12	Thermistor, PTC, .20-.31 Ohms, 0.9A Hold	RT18	RXE 090	06090
RT13	Thermistor, PTC, .20-.31 Ohms, 0.9A Hold	RT18	RXE 090	06090
RT14	Thermistor, PTC, .20-.31 Ohms, 0.9A Hold	RT18	RXE 090	06090
RT15	Not Used	-	NOT USED	37338
RT16	Not Used	-	NOT USED	37338
RT17	Not Used	-	NOT USED	37338
RT18	Not Used	-	NOT USED	37338

Continued from previous page

NAPI90/02 Distribution PWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
RT19	Not Used	-	NOT USED	37338
RT20	Not Used	-	NOT USED	37338
RT21	Not Used	-	NOT USED	37338
RT22	Not Used	-	NOT USED	37338
S01	Switch, SMT, Momentary PushButton	SD62	EVQ-PAC04M	5Y407
U01	IC, Op Amp, Quad, Single Supply	UR42	MC34074AP(STATIC)	04713
U02	IC, Voltage Regulator, -5V,IA, Plastic	UX21	MC7905CT	04713
U03	IC, Comparator, Dual, High Speed	UD07	LM319J(STATIC)	27014
XE01	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
XE02	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C02	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C03	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C04	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C08	Capacitor, Ceramic, 0.0047uF10% 100V	CCG03	CKR05BX472KRV	56289
C09	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C10	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C11	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C12	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C14	Capacitor, Mica, Dipped, 100pF 2% 500V	CB25	CM05FD101G03	SOSH
C15	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C16	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C17	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C18	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C21	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C22	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C23	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C25	Capacitor, Mica, Dipped, 100pF 2% 500V	CB25	CM05FD101G03	SOSH
C26	Capacitor, Ceramic, 0.047uF 10% 100V	CCG06	CKR06BX473KRV	56289
C27	Capacitor, Mica, Dipped, 330pF 2% 500V	CB31	CM05FD331G03	14655
C28	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C29	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C31	Capacitor, Ceramic, 0.0047uF10% 100V	CCG03	CKR05BX472KRV	56289
C33	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C34	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C35	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C36	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C37	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C38	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C39	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C40	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C41	Capacitor, Ceramic, 0.22uF 10% 50V	CCG08	CKR06BX224KRV	56289
C42	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C43	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C44	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C45	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV SPRAGUE	91929
C46	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C47	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(Ro HS) KEMET	96095
C48	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV SPRAGUE	91929
C49	Capacitor, Mica, Dipped, 100pF 2% 500V	CB25	CM05FD101G03	SOSH
C50	Capacitor, Mica, Dipped, 100pF 2% 500V	CB25	CM05FD101G03	SOSH
C51	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV SPRAGUE	91929
C52	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV SPRAGUE	91929
C53	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV SPRAGUE	91929
C54	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C55	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C56	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(Ro HS) KEMET	96095
C57	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(Ro HS) KEMET	96095
C58	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C59	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C60	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C61	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C62	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C63	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV SPRAGUE	91929
C64	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(Ro HS) KEMET	96095
C65	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C66	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C67	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C68	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C69	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV SPRAGUE	91929
C70	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV SPRAGUE	91929
CR01	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR02	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR03	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR04	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR05	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
E01	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482

Continued from previous page

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
E02	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482
J01	Conn, Plug, D-Sub, 25 pin, PWB Mt	JS12	K22-B25P-NJ	63590
K01	Relay, 5V Coil, 2PDT, 1A	KC18	TQ2-5V	61529
L01	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L02	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L04	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L06	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L08	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
Q01	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713
Q02	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713
Q03	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713
Q04	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713
Q05	Transistor, PNP, Switch/Amplifier	QA44	2N4403	04713
Q06	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713
Q07	Transistor, PNP, Switch/Amplifier	QA44	2N4403	04713
Q10	Transistor, NPN, Switch/Amplifier	QA45	2N4401	04713
R01	Resistor, MF, 100K Ohms, 1PC 1/4W	RAC01	MF1/4DL1003F	59124
R02	Not Used	-	NOT USED	37338
R03	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R04	Resistor, MF, 681K Ohms, 1%1/4W	RAC11	MF1/4DL6813F	59124
R05	Resistor, MF, 562 Ohms, 1PC 1/4W	RAB22	MF1/4DL5620F	59124
R06	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R07	Resistor, MF, 100K Ohms, 1PC 1/4W	RAC01	MF1/4DL1003F	59124
R08	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R09	Not Used	-	NOT USED	37338
R10	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R11	Resistor, MF, 2.21M Ohms, 1%1/4W	RAC17	MF1/4DL2214F	59124
R12	Resistor, MF, 22.1K Ohms, 1PC1/4W	RAB41	MF1/4DL2212F	59124
R13	Resistor, MF, 47.5K Ohms, 1PC1/4W	RAB45	MF1/4DL4752F	59124
R14	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R15	Resistor, MF, 681K Ohms, 1%1/4W	RAC11	MF1/4DL6813F	59124
R16	Resistor, MF, 100K Ohms, 1PC 1/4W	RAC01	MF1/4DL1003F	59124
R18	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R20	Resistor, MF, 47.5K Ohms, 1PC1/4W	RAB45	MF1/4DL4752F	59124
R22	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R23	Resistor, MF, 100K Ohms, 1PC 1/4W	RAC01	MF1/4DL1003F	59124
R25	Resistor, MF, 1.21K Ohms, 1PC1/4W	RAB26	MF1/4DL1211F	59124
R26	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R27	Resistor, MF, 18.2K Ohms, 1PC1/4W	RAB40	MF1/4DL1822F	59124

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R29	Resistor, MF, 2.21M Ohms, 1%1/4W	RAC17	MF1/4DL2214F	59124
R30	Resistor, MF, 2.21M Ohms, 1%1/4W	RAC17	MF1/4DL2214F	59124
R31	Resistor, Variable, Film, 5000 Ohms, 1/2W	RV10	3339P-1-502	80294
R33	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R34	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R35	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R36	Resistor, MF, 100K Ohms, 1PC 1/4W	RAC01	MF1/4DL1003F	59124
R37	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R38	Resistor, MF, 10K Ohms, 0.1%,1/4W	RAC28	MF55E1002B	59124
R39	Resistor, MF, 10K Ohms, 0.1%,1/4W	RAC28	MF55E1002B	59124
R42	Resistor, MF, 10K Ohms, 0.1%,1/4W	RAC28	MF55E1002B	59124
R44	Resistor, MF, 10K Ohms, 0.1%,1/4W	RAC28	MF55E1002B	59124
R46	Resistor, MF, 10K Ohms, 0.1%,1/4W	RAC28	MF55E1002B	59124
R47	Resistor, MF, 4990 Ohms, 1%1/4W	RAC32	MF1/4DL4991F	59124
R48	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R49	Resistor, MF, 10K Ohms, 0.1%,1/4W	RAC28	MF55E1002B	59124
R50	Resistor, MF, 562 Ohms, 1PC 1/4W	RAB22	MF1/4DL5620F	59124
R51	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R52	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R53	Resistor, MF, 562 Ohms, 1PC 1/4W	RAB22	MF1/4DL5620F	59124
R54	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R55	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R56	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R57	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R58	Resistor, MF, 15.0K Ohms, 1PC1/4W	RAB39	MF1/4DL1502F	59124
R59	Resistor, Variable, Film, 1000 Ohms, 1/2W	RV06	3339P-1-102	80294
R60	Resistor, MF, 1.21K Ohms, 1PC1/4W	RAB26	MF1/4DL1211F	59124
R61	Resistor, MF, 1.21K Ohms, 1PC1/4W	RAB26	MF1/4DL1211F	59124
R62	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R63	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R65	Resistor, MF, 56.2K Ohms, 1PC1/4W	RAB46	MF1/4DL5622F	59124
R66	Resistor, MF, 56.2K Ohms, 1PC1/4W	RAB46	MF1/4DL5622F	59124
R67	Resistor, MF, 1.00M Ohms, 1%1/4W	RAC13	MF1/4DL1004F	59124
R68	Resistor, MF, 1.00M Ohms, 1%1/4W	RAC13	MF1/4DL1004F	59124
R69	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R70	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R71	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R72	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R73	Resistor, MF, 1.50K Ohms, 1PC1/4W	RAB27	MF1/4DL1501F	59124

Continued from previous page

NAPM10B Interphase PDM Driver

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R74	Resistor, MF, 10.0 Ohms, 1PC 1/4W	RAB01	MF1/4DL10R0F	59124
R75	Resistor, MF, 10.0 Ohms, 1PC 1/4W	RAB01	MF1/4DL10R0F	59124
R76	Resistor, MF, 10.0 Ohms, 1PC 1/4W	RAB01	MF1/4DL10R0F	59124
R77	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R78	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R80	Resistor, MF, 33.2K Ohms, 1PC1/4W	RAB43	MF1/4DL3322F	59124
R81	Resistor, MF, 475K Ohms, 1%1/4W	RAC09	MF1/4DL4753F	59124
R82	Resistor, MF, 82.5K Ohms, 1PC1/4W	RAB48	MF1/4DL8252F	59124
R83	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
U01	IC, CMOS, Dual, Type D, Flip-Flop	UX13	MC74HC74N(STATIC)	04713
U02	IC, Op Amp, Quad, Single Supply	UR42	MC34074AP(STATIC)	04713
U03	IC, Op Amp, Quad, Single Supply	UR42	MC34074AP(STATIC)	04713
U04	IC, Voltage Regulator, +5V, 1A, Plastic	UX17	MC7805ACT	04713
U05	IC, Comparator, Dual, High Speed	UD07	LM319J(STATIC)	27014
U06	IC, Analog Multiplier	UN12	RC4200AN(STATIC)	07263
U07	IC, Op Amp, Dual	UN25	TL072CP(STATIC)	04713
U08	IC, Op Amp, Dual	UN25	TL072CP(STATIC)	04713
U09	IC, CMOS, Quad, 2-input NAND GAte	UM15	MC74HC00N(STATIC)	04713
U10	IC, Comparator, Dual, High Speed	UD07	LM319J(STATIC)	27014
U11	IC, Comparator, Dual, High Speed	UD07	LM319J(STATIC)	27014
U12	IC, Comparator, Quad	UL02	MC3302L(STATIC)	04713
U13	IC, Op Amp, Dual, Single Supply	UM26	MC33072AU (STATIC) MOTO	04713
XE01	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482
XE02	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482

NAPP02/02 RF Current Probe PWB Assy(1371 - 1710 kHz)

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
J01	Conn, BNC, Recept, PWB Mt	JF35	R141426161	0GP12
R01	Not Used	-	NOT USED	37338
R02	Resistor, Film, 47 Ohms, 2PC 1/2W	RC21	RL20S470G	35005
R03	Resistor, Film, 47 Ohms, 2PC 1/2W	RC21	RL20S470G	35005
R04	Resistor, Film, 56 Ohms, 2PC 1/2W	RAP04	RL20S560G	35005
R05	Resistor, Film, 39 Ohms, 2PC 1/2W	RC20	RL20S390G	35005
T01	Rf Current Transformer Assy	183-6052-02	183-6052-02 NAUTEL	37338

NAPS10C Regulated Power Supply PWB AssAssy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Capacitor, Ceramic, 1.0uF 100V	CAP16	RPE114Z5U105M100V	91929
C02	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C03	Capacitor, Ceramic, 0.47uF 10% 50V	CCG09	CKR06BX474KRV	56289
C04	Capacitor, Ceramic, 0.0047uF10% 100V	CCG03	CKR05BX472KRV	56289
C05	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C06	Capacitor, Ceramic, 0.001uF 10% 200V	CCG01	CKR05BX102KRV SPRAGUE	91929
C07	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C08	Capacitor, Elect, 820uF 100V	CT05	82D821M100JC2D	56289
C09	Capacitor, Elect, 820uF 100V	CT05	82D821M100JC2D	56289
C10	Capacitor, Ceramic, 1.0uF 100V	CAP16	RPE114Z5U105M100V	91929
C11	Capacitor, Elect,Snap Mt,4700uF +/-20% 100V	CJ20	82DA472M100ME2D	62643
CR01	Diode, Zener, 56V, 1W, 5%	QM23	1N4758A	04713
DS01	Diode, LED, Green	QK12	HLMP-3554	50434
J01	MTA, Square Post Header Assy,8 Pin	JU08	640383-8	09482
L01	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
L02	Inductor Assy	176-3014	176-3014	37338
L03	Inductor Assy	176-3014	176-3014	37338
Q01	Transistor, FET, N Channel, Plas	QR52	IRF540N(STATIC)	81483
Q02	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	04713
R01	Resistor, MF, 1.21K Ohms, 1PC1/4W	RAB26	MF1/4DL1211F	59124
R02	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R03	Resistor, Variable, Film, 1000 Ohms, 1/2W	RV06	3339P-1-102	80294
R04	Resistor, MF, 1.00M Ohms, 1%1/4W	RAC13	MF1/4DL1004F	59124
R05	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R06	Resistor, MF, 12.1K Ohms, 1PC1/4W	RAB38	MF1/4DL1212F	59124
R07	Resistor, MF, 22.1K Ohms, 1PC1/4W	RAB41	MF1/4DL2212F	59124
R08	Resistor, MF, 1.21K Ohms, 1PC1/4W	RAB26	MF1/4DL1211F	59124
R09	Resistor, MF, 22.1K Ohms, 1PC1/4W	RAB41	MF1/4DL2212F	59124
R10	Resistor, MF, 2.21K Ohms, 1PC1/4W	RAB29	MF1/4DL2211F	59124
R11	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R12	Resistor, Film, 100 Ohms, 2PC1/2W	RAP05	RL20S101G DALE	35005
R13	Resistor, MF, 1.50K Ohms, 1PC1/4W	RAB27	MF1/4DL1501F	59124
R14	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
U01	IC, Switchmode PWM Control Circuits	UM39	MC33060AP(STATIC) MOTO	04713
U02	Rect/Assy, Diode Pair, 400V, 8A	UT03	MUR1640CT(STATIC)	04713
XU01	Socket, IC, 14-pin	UC02	2-641261-1	00779

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C02	Capacitor, Tantalum, Epoxy, 1uF 10% 35V	CCF06	T351A105K035AT(RoHS) KEMET	56289
C03	Capacitor, Ceramic, 1.0uF 100V	CAP16	RPE114Z5U105M100V	91929
C04	Not Used	-	NOT USED	37338
C05	Capacitor, Ceramic, 1.0uF 100V	CAP16	RPE114Z5U105M100V	91929
C06	Capacitor, Ceramic, 1.0uF 100V	CAP16	RPE114Z5U105M100V	91929
C07	Capacitor, Ceramic, 1.0uF 100V	CAP16	RPE114Z5U105M100V	91929
C08	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C09	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C10	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C11	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C12	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C13	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C14	Capacitor, Tantalum, Dipped, 10uF, 35V	CCP36	T351G106K035AT(RoHS) KEMET	96095
C15	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C16	Capacitor, Ceramic, 0.01uF 10% 100V	CCG04	CKR05BX103KRV	56289
C17	Capacitor, Tantalum, Epoxy, 1uF 10% 35V	CCF06	T351A105K035AT(RoHS) KEMET	56289
C18	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
CR01	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR02	Diode, General Purpose, 1000V, 1A	QM08	1N4007	04713
CR03	Diode, Zener, 15V, 1W, 5%	QE40	1N4744A	04713
CR04	Diode, Zener, 5.1V, 1W, 5%	QM07	1N4733A	04713
CR05	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR06	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR07	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR08	Not Used	-	NOT USED	37338
CR09	Diode, Zener, 56V, 1W, 5%	QM23	1N4758A	04713
CR10	Not Used	-	NOT USED	37338
CR11	Diode, General Purpose, 1000V, 1A	QM08	1N4007	04713
DS01	Not Used	-	NOT USED	37338
DS02	Diode, LED, Red, 8.6mm Lg	QM18	SSL-LX5093ID	1EM90
DS03	Diode,LED,Ultrabright,Grn,5mm	QM49	LC503QBG1-30H-A(STATIC)	MARKTEC
E01	Terminal, Screw, 10-32	HAC48	1293	91833
E02	Terminal, Screw, 10-32	HAC48	1293	91833
E03	Conn, Post Shunt, 2 Pos, .10 Centreline	JQ15	390088-2	09482

Continued from previous page

NAPS36A SCR Control/B+ DistributionPWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
F01	Fuse, 40A, 600V	FC42	A4J40	21574
J01	MTA, Keyed Square Post HeaderAssy,12 Pin	JU23	1-647123-2	00779
J02	Terminal Block,2-pos,PWB Mount	JR51	1803277(ROHS)	PHOENIX
L01	Inductor, Choke, 2.5 Turns, JMtl	LA16	82-152-J	33062
Q01	Transistor, FET, N Channel, 100V, 8A	QR13	IRF520(STATIC)	81483
Q02	Transistor, FET, N Channel	QN54	2N7000(STATIC)	04713
Q03	Transistor, NPN, Switch/Amplifier	QA03	2N2222A	04713
Q04	Transistor, FET, N Channel	QN54	2N7000(STATIC)	04713
Q05	Transistor, FET, N Channel	QN54	2N7000(STATIC)	04713
Q06	Transistor, FET, N Channel	QN54	2N7000(STATIC)	04713
Q07	Transistor, FET, N Channel	QN54	2N7000(STATIC)	04713
Q08	Transistor, FET, N Channel	QN54	2N7000(STATIC)	04713
R01	Resistor, MF, 562 Ohms, 1PC 1/4W	RAB22	MF1/4DL5620F	59124
R02	Resistor, MF, 150 Ohms, 1PC 1/4W	RAB15	MF1/4DL1500F	59124
R03	Resistor, Film, 33K Ohms, 5%,2W	RBP22	GS-3, 33K OHMS	75042
R04	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R05	Resistor, Film, 33K Ohms, 5%,2W	RBP22	GS-3, 33K OHMS	75042
R06	Resistor, MF, 1.50K Ohms, 1PC1/4W	RAB27	MF1/4DL1501F	59124
R07	Resistor, Wirewound, 33K ohms, 1PC5W	RN13	RS5-33K OHMS-1%	35005
R08	Resistor, MF, 100K Ohms, 1PC 1/4W	RAC01	MF1/4DL1003F	59124
R09	Resistor, MF, 1.00M Ohms, 1%1/4W	RAC13	MF1/4DL1004F	59124
R10	Resistor, Film, 100K Ohms, 5%, 2W	RBP25	GS-3, 100K OHMS	75042
R11	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R12	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R13	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R14	Resistor, MF, 182K Ohms, 1%1/4W	RAC04	MF1/4DL1823F	59124
R15	Resistor, MF, 18.2K Ohms, 1PC1/4W	RAB40	MF1/4DL1822F	59124
R16	Resistor, MF, 3.32K Ohms, 1PC1/4W	RAB31	MF1/4DL3321F	59124
R17	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R18	Resistor, MF, 5.62K Ohms, 1PC1/4W	RAB34	MF1/4DL5621F	59124
R19	Resistor, MF, 15.0K Ohms, 1PC1/4W	RAB39	MF1/4DL1502F	59124
R20	Resistor, MF, 1.82K Ohms, 1PC1/4W	RAB28	MF1/4DL1821F	59124
R21	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
R22	Not Used	-	NOT USED	37338
R23	Resistor, MF, 3.92K Ohms, 1PC1/4W	RAB32	MF1/4DL3921F	59124
R24	Resistor, MF, 121 Ohms, 1%, 1/4W	RAB14	MF1/4DL1210F	59124
R25	Resistor, MF, 332 Ohms, 1PC 1/4W	RAB19	MF1/4DL3320F	59124
R26	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R27	Resistor, MF, 475K Ohms, 1%1/4W	RAC09	MF1/4DL4753F	59124

Continued from previous page

NAPS36A SCR Control/B+ DistributionPWB Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R28	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R29	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R30	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R31	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R32	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R33	Resistor, MF, 4.75K Ohms, 1PC1/4W	RAB33	MF1/4DL4751F	59124
R34	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
R35	Resistor, MF, 332 Ohms, 1PC 1/4W	RAB19	MF1/4DL3320F	59124
R36	Resistor, Film, 47K ohms, 2PC1/2W	RD15	RL20S473G	35005
R37	Resistor, Film, 470K Ohms, 2PC 1/2W	RD27	RL20S474G	35005
R38	Resistor, Film, 470K Ohms, 2PC 1/2W	RD27	RL20S474G	35005
R39	Resistor, MF, 475K Ohms, 1%1/4W	RAC09	MF1/4DL4753F	59124
R40	Resistor, MF, 1.00M Ohms, 1%1/4W	RAC13	MF1/4DL1004F	59124
R41	Resistor, MF, 100 Ohms, 1PC 1/4W	RAB13	MF1/4DL1000F	59124
R42	Not Used	-	NOT USED	37338
R43	Resistor, MF, 100K Ohms, 1PC 1/4W	RAC01	MF1/4DL1003F	59124
R44	Resistor, MF, 22.1K Ohms, 1PC1/4W	RAB41	MF1/4DL2212F	59124
R45	Resistor, MF, 10.0K Ohms, 1PC1/4W	RAB37	MF1/4DL1002F	59124
R46	Resistor, MF, 1.82K Ohms, 1PC1/4W	RAB28	MF1/4DL1821F	59124
R47	Resistor, Film, 1500 Ohms, 5%, 2W	RBP14	GS-3, 1500 OHMS	75042
R48	Resistor, Film, 68K Ohms, 5%,2W	RBP24	GS-3, 68K OHMS	75042
U01	IC, Op Amp, Dual, Single Supply	UM26	MC33072AU (STATIC) MOTO	04713
U02	Current sensor,Hall,50A,5VDCUniDirect	UP102	ACS755LCB-050-PFF(STATIC)(ROHS) AMI	OCVK3
U03	IC, CMOS, Quad, 2-input NOR GAte	UD23	MC74HC02AN(STATIC)	04713
U04	Voltage Regulator, Adj Voltage, 3A	UT36	LM350T	27014
U05	IC, Op Amp, Dual, Single Supply	UM26	MC33072AU (STATIC) MOTO	04713
XE03	Conn, Header, SIP,12 Pin Breakaway,.10 Ctr	JQ16	1-103185-2	09482

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Not Used	-	NOT USED	37338
C02	Not Used	-	NOT USED	37338
C03	Capacitor, Elect, 2200uF 50V	CD12	UVX1H222MRA	55680
CR01	Diode, Zener, 56V, 1W, 5%	QM23	1N4758A	04713
CR02	Diode, General Purpose, 400V,1A	QE28	1N4004	04713
CR03	Diode, Zener, Transient Supressor, 7.5V	QI48	P6KE7.5CA	07263
CR04	Diode, General Purpose, 400V,1A	QE28	1N4004	04713
CR05	Diode, Zener, 15V, 1W, 5%	QE40	1N4744A	04713
DS01	Diode,LED,Ultrabright,Grn,5mm	QM49	LC503QBG1-30H-A(STATIC)	MARKTEC
DS02	Diode,LED,Ultrabright,Grn,5mm	QM49	LC503QBG1-30H-A(STATIC)	MARKTEC
DS03	Not Used	-	NOT USED	37338
DS04	Not Used	-	NOT USED	37338
DS05	Not Used	-	NOT USED	37338
E01	Terminal, PWB, 6-32, Vert	HR08	8191	91833
E02	Terminal, PWB, 6-32, Vert	HR08	8191	91833
E03	Terminal, Screw, 10-32	HAC48	1293	91833
E04	Not Used	-	NOT USED	37338
E05	Not Used	-	NOT USED	37338
E06	Not Used	-	NOT USED	37338
F01	Fuse, 20A, 500Vdc, Non Time Delay, KLM	FA34	KLM-20	71400
F02	Fuse, 60A, 600V, Class J	FD19	A4J60	57062
F03	Not Used	-	NOT USED	37338
F04	Not Used	-	NOT USED	37338
F05	Not Used	-	NOT USED	37338
J01	MTA, Keyed Square Post HeaderAssy, 4 pin	JU25	647123-4	00779
K01	Relay,24Vdc,FORM A,NO,80 AmpPWB	KC51	AZ983-1A-24D	26806
K02	Relay,24Vdc,FORM A,NO,80 AmpPWB	KC51	AZ983-1A-24D	26806
K03	Not Used	-	NOT USED	37338
K04	Not Used	-	NOT USED	37338
K05	Not Used	-	NOT USED	37338
R01	Resistor, Film, 470K Ohms, 2PC 1/2W	RD27	RL20S474G	35005
R02	Resistor, Film, 470K Ohms, 2PC 1/2W	RD27	RL20S474G	35005
R03	Not Used	-	NOT USED	37338
R04	Resistor, Film, 10 Ohms, 5%, 2W	RBP01	GS-3, 10 OHMS	75042
R05	Resistor, Film, 47K ohms, 2PC1/2W	RD15	RL20S473G	35005
R06	Resistor, Ceramic Comp, 22ohm,5.5W,2800J	RF46	AZ220K	44655
R07	Resistor, Wirewound, 33K ohms, 1PC5W	RN13	RS5-33K OHMS-1%	35005
R08	Resistor, Wirewound, 33K ohms, 1PC5W	RN13	RS5-33K OHMS-1%	35005

Continued from previous page

NAPX31/05 B+ Distribution PWB Assy, XR6

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
R09	Resistor, Ceramic Comp, 22ohm,5.5W,2800J	RF46	AZ220K	44655
R10	Not Used	-	NOT USED	37338
R11	Not Used	-	NOT USED	37338
R12	Not Used	-	NOT USED	37338
R13	Not Used	-	NOT USED	37338
R14	Not Used	-	NOT USED	37338
R15	Not Used	-	NOT USED	37338
U01	Diode, Power Rectifier, 1600VDual 2x28A	UR68	DSP25-16A(STATIC)	0A5K5

NARA48B Final Assy, XR3/6,3-PH

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
A01	Control Panel Assembly	NAC115A	202-2100-01	37338
A02	Exciter Panel Assembly	NAE93B	202-3100-02	37338
A03	RF Current Probe PWB Assy(1371 - 1710 kHz)	NAPP02/02	183-6050-04	37338
A04	Forward/Reflected Power Probe,XR12/XR6/XR3	NAFP103/05	184-6325-09	37338
A05	Static Drain Choke PWB Assy	202-6045-01	202-6045-01	37338
A06	Surge Arrestor Assy, 4000V	NAX211/07	194-6090-08	37338
A07	RF Power Module Assy,XR Series	NAP34A	194-1300-01	37338
A10	Fan Tray Assy	202-7020	202-7020	37338
A11	Distribution PWB Assy	NAPI90/02	202-8065-02	37338
A12	Regulated Power Supply PWB AssAssy	NAPS10C	183-3027-03	37338
A13	B+ Distribution PWB Assy, XR6	NAPX31/05	202-7050-05	37338
A14	Rectifier Assy	202-7017	202-7017	37338
A15	RF Driver Buffer PWB Assy	NAPE77A/01	202-4050-03	37338
C08	Capacitor,Elect.,10,000uf,450Vdc	CT54	3186GN103T450MPA1	14655
C09	Capacitor,Elect.,10,000uf,450Vdc	CT54	3186GN103T450MPA1	14655
K01	Relay,4PDT,24VDC,35A,OpenStyle	KC59	PM-17DY-24V	94696
K01	Relay,Plastic Cover,for PM-17DY-24	KC60	35D203	94696
K02	Relay,4PDT,24VDC,35A,OpenStyle	KC59	PM-17DY-24V	94696
K02	Relay,Plastic Cover,for PM-17DY-24	KC60	35D203	94696
L01	Input Inductor Assy, CW	202-6037	202-6037	
L02	Input Inductor Assy, CCW	202-6037-01	202-6037-01	
L03	Inductor Assy	202-6033-01	202-6033-01	37338
L04	Inductor Assy, Air	202-6038-01	202-6038-01	37338
L05	Inductor Assy	202-6033-01	202-6033-01	37338
L06	Inductor,Choke, 6mh, 40A	TE20	C-80U	16741
M01	See Sales Order	%	% SEE SALES ORDER	37338
R01	Resistor, Cap Discharge, 18Kohms, 5%, 13W	RC43	UP10SR-18K-J	4KQ5
R02	Resistor, Cap Discharge, 18Kohms, 5%, 13W	RC43	UP10SR-18K-J	4KQ5
T01	See Sales Order	%	% SEE SALES ORDER	37338
U01	Current Sensor, Hall, 400 amp	UC59	HCTF400V4B15	1AA44
U02	Pwr Sply,24V@150W,In 95-264Vacor 120-360Vdc	UG40	MIW150-24PT-P7190	3AC42
U03	Pwr Sply,24V@150W,In 95-264Vacor 120-360Vdc	UG40	MIW150-24PT-P7190	3AC42
U04	Power Supply,Univ Input,+/-15V,5V,100W	UG32	MIW103-PT-P4699	3AC42

NARA49A Final Assy, XR3/6,1-PH

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
A01	Control Panel Assembly	NAC115A	202-2100-01	37338
A02	Exciter Panel Assembly	NAE93B	202-3100-02	37338
A03	RF Current Probe PWB Assy(1371 - 1710 kHz)	NAPP02/02	183-6050-04	37338
A04	Forward/Reflected Power Probe,XR12/XR6/XR3	NAFP103/05	184-6325-09	37338
A05	Static Drain Choke PWB Assy	202-6045-01	202-6045-01	37338
A06	Surge Arrestor Assy, 4000V	NAX211/07	194-6090-08	37338
A07	RF Power Module Assy,XR Series	NAP34A	194-1300-01	37338
A10	Fan Tray Assy	202-7020	202-7020	37338
A11	Distribution PWB Assy	NAPI90/02	202-8065-02	37338
A12	Regulated Power Supply PWB AssAssy	NAPS10C	183-3027-03	37338
A13	SCR Control/B+ DistributionPWB Assy	NAPS36A	202-7060-01	37338
A14	Rectifier & SCR Control Assy	202-7220	202-7220	37338
A15	RF Driver Buffer PWB Assy	NAPE77A/01	202-4050-03	37338
C08	Capacitor,Elect.,10,000uf,450Vdc	CT54	3186GN103T450MPA1	14655
C09	Capacitor,Elect.,10,000uf,450Vdc	CT54	3186GN103T450MPA1	14655
C10	Capacitor,Elect.,10,000uf,450Vdc	CT54	3186GN103T450MPA1	14655
CB01	Circuit Breaker, 1P, 100A, 277V, RlyTrp (12VDCP)	SD71	AM1S-B6-AAA05MDLW-100-277/12DC-SW/P	
F01	Fuse, 20A, 500V, Time Delay, FNQ	FD01	FNQ-20	71400
F02	Fuse, 20A, 500V, Time Delay, FNQ	FD01	FNQ-20	71400
F03	Fuse, 3A, 600V, Time Delay, FNQ-R	FD10	FNQ-R-3	71400
L01	Input Inductor Assy, CW	202-6037	202-6037	
L02	Input Inductor Assy, CCW	202-6037-01	202-6037-01	
L03	Inductor Assy	202-6033-01	202-6033-01	37338
L04	Inductor Assy, Air	202-6038-01	202-6038-01	37338
L05	Inductor Assy	202-6033-01	202-6033-01	37338
L06	Inductor, Choke, 20mH, 30Adc	TZ95A	EC207082 Rev A	
L07	Inductor, Choke, 20mH, 30Adc	TZ95A	EC207082 Rev A	
L08	Inductor, Choke, 20mH, 30Adc	TZ95A	EC207082 Rev A	
M01	See Sales Order	%	% SEE SALES ORDER	37338
R01	Resistor, Cap Discharge, 18Kohms, 5%, 13W	RC43	UP10SR-18K-J	4KQ5
R02	Resistor, Cap Discharge, 18Kohms, 5%, 13W	RC43	UP10SR-18K-J	4KQ5
R03	Resistor, Cap Discharge, 18Kohms, 5%, 13W	RC43	UP10SR-18K-J	4KQ5
T01	See Sales Order	%	% SEE SALES ORDER	37338
T02	Transformer, Control 1-Ph 208-480/24 75VA	TZ56	PT75MSG	73831
TB01	Terminal Block, 4-Pos, Double, 75A	JR14	H-4	73631
U01	Not Used	-	NOT USED	37338

Continued from previous page

NARA49A Final Assy, XR3/6,1-PH

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
U02	Pwr Sply,24V@150W,In 95-264Vacor 120-360Vdc	UG40	MIW150-24PT-P7190	3AC42
U03	Pwr Sply,24V@150W,In 95-264Vacor 120-360Vdc	UG40	MIW150-24PT-P7190	3AC42
U04	Power Supply,Univ Input,+/-15V,5V,100W	UG32	MIW103-PT-P4699	3AC42
XF01	Fuseblock, 2-Pole, 30A, 600V	FD02	BM6032SQ	71400

NASM07H Modulator Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
C01	Capacitor, Ceramic, 1.0uF 10%50V	CCG10	CKR06BX105KRV	56289
C02	Capacitor, Tantalum, 6.8uF 10PC 35V	CCP19	CSR13F685KM	56289
C03	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C04	Capacitor, Tantalum, 6.8uF 10PC 35V	CCP19	CSR13F685KM	56289
C05	Capacitor, Ceramic, 0.1uF 10%100V	CCG07	CKR06BX104KRV	56289
C06	Not Used	-	NOT USED	37338
C07	Not Used	-	NOT USED	37338
C08	Not Used	-	NOT USED	37338
C09	Capacitor, Metal,Polyprop, .12uF 5% 630V	CAP30	2222 378 62124	56699
C10	Capacitor, Metal,Polyprop, .12uF 5% 630V	CAP30	2222 378 62124	56699
C11	Not Used	-	NOT USED	37338
C12	Capacitor, Metal,Polyprop, .12uF 5% 630V	CAP30	2222 378 62124	56699
C13	Capacitor, Metal,Polyprop, .12uF 5% 630V	CAP30	2222 378 62124	56699
CR01	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR02	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR03	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR04	Diode, General Purpose, 200V,0.1A	QAP29	1N4938	07263
CR05	Diode, Zener, 13V, 1W, 10%	QK19	1N4743	04713
CR06	Not Used	-	NOT USED	37338
CR07	Diode, Ultrafast, Soft Recovery, 600V, 8A	QR24	HFA08TB60(STATIC)	81483
J01	Conn, Socket, D-Sub, 25 pin, PWB Mt	JS13	K22-B25S-NJ	22421
L02	Bead, Ferrite, 3.5mm	LA09	21-030-J	33062
L03	Bead, Ferrite, 3.5mm	LA09	21-030-J	33062
L04	Bead, Ferrite, 3.5mm	LA09	21-030-J	33062
L05	Bead, Ferrite, 3.5mm	LA09	21-030-J	33062
Q01	Not Used	-	NOT USED	37338
Q02	Not Used	-	NOT USED	37338
Q03	Transistor, FET, N Channel,MOS, 500V	QN50	IRFP460A(STATIC) IR	81483
Q04	Transistor, FET, N Channel,MOS, 500V	QN50	IRFP460A(STATIC) IR	81483
Q05	Transistor, FET, N Channel,MOS, 500V	QN50	IRFP460A(STATIC) IR	81483
Q06	Transistor, FET, N Channel,MOS, 500V	QN50	IRFP460A(STATIC) IR	81483
R01	Resistor, MF, 10.0 Ohms, 1PC 1/4W	RAB01	MF1/4DL10R0F	59124
R02	Resistor, MF, 1.82K Ohms, 1PC1/4W	RAB28	MF1/4DL1821F	59124
R03	Not Used	-	NOT USED	37338
R04	Resistor, Film, 2.21 Ohms, 1%, 1/2W	RC05	MF1/2DL2R21F	59124
R05	Resistor, MF, 1K Ohms, 1PC 1/4W	RAB25	MF1/4DL1001F	59124
T01	Transformer Assy	176-1030	176-1030	37338
U01	Not Used	-	NOT USED	37338
U02	IC, MOS Gate Driver, High Voltage	UN18	IR2110(STATIC)	81483

Continued from previous page

NASM07H Modulator Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
U03	Diode, Pair, UltraFast Power Rectifier	UN40	HFA30PA60C(STATIC)	81483
XU02	Socket, IC, 14-pin	UC02	2-641261-1	00779

NAX211/07 Surge Arrestor Assy, 4000V

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
A01	Surge Arrestor PWB Assy	194-6080-03	194-6080-03	37338
E01	Surge Arrester, 4000Vdc 10PC	UM33	GXH40	1C532
T01	Rf Current Transformer Assy	183-6052-01	183-6052-01	37338

Section 4: Wiring/connector lists

This section contains the wiring information for the hard-wired assemblies of the transmitter, and applicable connector mating information.

Wiring lists provided

Wiring lists are provided in tabular format. Table 4.1 on page 4-2 lists the tables containing wiring information. These tables provide non-printed wiring pattern, point-to-point (source and destination) interconnection information.

Wiring lists not provided

Separate wiring lists are not provided for some assemblies, including:

- Assemblies that have a separate maintenance manual. Refer to the appropriate maintenance manual for detailed wiring information for these assemblies, if provided.
- Assemblies that have their wiring information shown in tables on their assembly detail drawings. Refer to the *Mechanical Drawings* section of this manual for detailed wiring information for these assemblies.

Connector mating information

Where applicable, a connector mating table is provided after the corresponding wiring list. Table 4.2 on page 4-2 identifies all provided connector information.

Wire colours

Every effort is made to manufacture assemblies using the wire colour shown in the **Colour** column of the wiring list tables. Sometimes, a white wire will be substituted for the listed colour. In such cases, wires must be identified by their assigned numbers.

Printed wiring board patterns

Printed wiring pattern information for printed wiring boards (PWBs) is beyond the scope of this manual, and therefore not provided.

Table 4.1: Wiring Lists Provided

Table #	Description
Table 4.3	XR6/XR3 Transmitter - 3-phase ac power (page 4-2)
Table 4.4	XR6/XR3 Transmitter - 1-phase ac power (page 4-7)
Table 4.6	Interface Between RF Power Module and Distribution PWB (page 4-12)
Table 4.7	NAFP103/05 Forward/Reflected Power Probe (page 4-13)
Table 4.8	NAP34A RF Power Module (page 4-13)
Table 4.10	Fan Tray Assembly (Nautel Part # 202-7020, page 4-16)

Table 4.2: Connector Mating Information Provided

Table #	Description
Table 4.5	XR6/XR3 Transmitter (page 4-11)
Table 4.9	NAP34A RF Power Module (page 4-16)
Table 4.11	Fan Tray Assembly (Nautel Part # 202-7020, page 4-17)

Table 4.3: Wiring List - XR6/XR3 Transmitter - 3-phase ac power

Source	Destination	Wire #	Colour	Size	Remarks
P2-02	P17-Centre	1	White	22	1 conductor
P2-03	P17-Body	1	Shield	-	Shielded
P2-04	P18-Centre	2	White	22	1 conductor
P2-05	P18-Body	2	Shield	-	Shielded
P2-08	P21-18	3	White	22	1 conductor
P2-09	P21-17	3	Shield	-	Shielded
P5-03	M1-(+)	-	White	22	
P5-04	M1-(-)	-	Black	22	
P9-01	P21-01	4	White	22	1 conductor

Table 4.3: Wiring List - XR6/XR3 Transmitter - 3-phase ac power

Source	Destination	Wire #	Colour	Size	Remarks
P9-02	P21-02	4	Shield	-	Shielded
P9-03	P21-03	5	White	22	1 conductor
P9-04	P21-04	5	Shield	-	Shielded
P9-05	P21-05	6	White	22	1 conductor
P9-06	P21-06	6	Shield	-	Shielded
P9-07	P21-07	7	White	22	
P9-08	P21-08	8	White	22	
P9-09	P21-09	9	Black	22	
P9-10	P21-10	10	Black	22	
P9-11	P21-11	11	White	22	
P9-12	P21-12	12	White	22	
P9-16	P21-16	13	White	22	
P9-19	P21-19	14	White	22	
P9-20	P21-20	15	Black	22	
P9-21	P28-04	16	White	22	1 conductor
P9-22	-	16	Shield	-	Shielded
P9-25	P21-25	17	White		
P10-07	P21-22	18	White	22	
P10-08	P21-23	19	White	22	
P11-Core	P22-Core	20	Centre	RG188	Coaxial Cable
P11-Body	P22-Body	20	Shield		
P12-Core	P23-Core	21	Centre	RG188	Coaxial Cable
P12-Body	P23-Body	21	Shield	-	
P13-Core	P14-Core	22	Centre	RG188	Coaxial Cable
P13-Body	P14-Body	22	Shield	-	
P16-Core	P21-15	23	Centre	RG188	Coaxial Cable
P16-Body	P21-14	23	Shield	-	
P19-Core	P21-23	24	Centre	22	1 conductor
P19-Body	P21-24	24	Shield	-	Shielded
A4A1E1	U3-(DC OUT+)	25	Centre	22	
A4A1E2	U3-(DC OUT-)	26	Shield		
L1-TAP#	E10-A	-	Yellow	14	
L2-TAP#	E10-B	-	Yellow	14	
A5-A	A4C1	-	Yellow	14	
A5-B	GND NEAR A5	-	Black	20	
A4-C1	E11	-	Yellow	14	
A6-E1	E12	-	Yellow	14	

Table 4.3: Wiring List - XR6/XR3 Transmitter - 3-phase ac power

Source	Destination	Wire #	Colour	Size	Remarks
E13	L03	-	Yellow	14	Twisted wires
E13	L04	-	Yellow	14	Twisted wires
E14	L05		Yellow	14	Twisted wires
E14	E15	-	Yellow	14	Twisted wires
L1-TAP 37	L1-TAP #		Yellow	14	
L2-TAP 37	L2-TAP #		Yellow	14	
P24-01	A12-E3	102	White	22	
P24-03	A12-E4	103	Black	22	
P24-05	U2-(DC OUT+)	104	White	22	
P24-07	U3-(DC OUT-)	105	Black	22	
P24-09	U3-(DC OUT+)	106	White	22	
P25-01	U4-(+5V)	107	White	22	
P25-02	U4-(+15V)	108	White	22	
P25-03	U4-(-15V)	109	White	22	
P25-04	U4-(COM)	110	Black	22	
P25-06	A8K1	111	White	22	
P25-07	A9K1	112	White	22	
P25-08	K1-(-24V)	113	White	20	
P25-18	P28-01	114	White	22	
P25-20	P26-03	115	White	24	
P25-25	K1(+24V)	116	White	22	
P26-01	U4-(+15V)	117	White	24	
P26-02	U4-(-15V)	118	White	24	
P26-04	U4-(COM)	119	Black	24	
P27-03	U4-(COM)	120	Black	22	
P27-04	U4-(+15V)	121	White	22	
P28-02	U3-(DC OUT+)	122	White	22	
P29-01	U4-(+15V)	123	White	22	
P29-02	U4-(COM)	124	Black	22	
A12E1	U2-(DC OUT+)	125	White	22	
A12E2	U3-(DC OUT-)	126	Black	22	
A13E1	U2-(IN+)	127	White	14	
A13E2	C9-(+)	128	White	14	
A13E3	E8-01	129	White	10	
U3-(IN+)	U2-(IN+)	130	White	14	
U3-(IN+)	U4-(IN+)	131	White	14	
A8K1-B	U3-(DC OUT+)	132	White	22	

Table 4.3: Wiring List - XR6/XR3 Transmitter - 3-phase ac power

Source	Destination	Wire #	Colour	Size	Remarks
A9K1-B	U3-(DC OUT+)	133	White	22	
J2-02	U3-(DC OUT+)	134	White	22	
U2-(DC OUT-)	U3-(DC OUT+)	135	White	22	
U2-(DC OUT-)	J4-02	136	White	22	
U4-(GND)	U4-(COM)	137	Black	22	
U4-(GND)	U4-(IN-)	138	Black	22	
GND 2	U4-(IN-)	139	Black	22	
GND 2	U2-(GND)	140	Black	22	
U3-(GND)	U3-(IN-)	141	Black	22	
U3-(GND)	U3-(DC OUT-)	142	Black	22	
GND 2	U3-(DC OUT-)	143	Black	22	
P25-09	K2(-24V)	144	White	22	
P25-23	K2(+24V)	145	White	22	
U2-(IN-)	U2-GND	-	Black	22	Jumper
K1L5-(NC)	K1L1-(NO)	-	White	10	Jumper
A14U1-01	K1L1-(NO)	-	White	10	
K1L6-(NC)	K1L2-(NO)	-	White	10	Jumper
A14U2-01	K1L2-(NO)	-	White	10	
K1L7-(NC)	K1L3-(NO)	-	White	10	Jumper
A14U3-01	K1L3-(NO)	-	White	10	
K1-T1-(NO)	T1-H1(244V)	-	White	10	
K1-T5-(NC)	T1-H1(120V)	-	White	10	
K1-T2-(NO)	T1-H2(244V)	-	White	10	
K1-T6-(NC)	T1-H2(120V)	-	White	10	
K1-T3-(NO)	T1-H3(244V)	-	White	10	
K1-T7-(NC)	T1-H3(120V)	-	White	10	
L6-01	A14E2	-	Black	6	
L6-02	A13	-	Black	6	
GND 1	A14E1	-	Black	6	
RF-OUT	STA-REF	-	Black	2	
T1-GND	STA-REF	-	Black	8	
J1-01	E1-A	-	Yellow	14	
J1-03	E1-A	-	Yellow	14	
J1-05	E2-A	-	Yellow	14	
J1-07	E2-A	-	Yellow	14	
J3-01	E3-A	-	Yellow	14	

Table 4.3: Wiring List - XR6/XR3 Transmitter - 3-phase ac power

Source	Destination	Wire #	Colour	Size	Remarks
J3-03	E3-A	-	Yellow	14	
J3-05	E4-A	-	Yellow	14	
J3-07	E4-A	-	Yellow	14	
E1-B	A8K1-11	-	Yellow	14	
E2-B	A8K1-13	-	Yellow	14	
E3-B	A9K1-11	-	Yellow	14	
E4-B	A9K1-13	-	Yellow	14	
A8K1-14	E5-A	-	Yellow	14	
A9K1-14	E5-A	-	Yellow	14	
A8K1-12	E6-A	-	Yellow	14	
A9K1-12	E6-A	-	Yellow	14	
E5-B	L1-Tap #0	-	Yellow	14	
E6-B	L1-Tap #0	-	Yellow	14	
J1-02	GND	-	Yellow	14	
J1-04	GND	-	Yellow	14	
J1-06	GND	-	Yellow	14	
J1-08	GND	-	Yellow	14	
J3-02	GND	-	Yellow	14	
J3-04	GND	-	Yellow	14	
J3-06	GND	-	Yellow	14	
J3-08	GND	-	Yellow	14	
J2-01	E7-03	-	Yellow	14	
J2-03	E7-03	-	Yellow	14	
J2-05	E7-02	-	Yellow	14	
J2-07	E7-02	-	Yellow	14	
J4-01	E8-03	-	Yellow	14	
J4-03	E8-03	-	Yellow	14	
J4-05	E8-02	-	Yellow	14	
J4-07	E8-02	-	Yellow	14	
J2-04	GND	-	Yellow	14	
C8-(-)	GND	-	Black	14	
J2-06	GND	-	Yellow	14	
J2-08	GND	-	Yellow	14	
J4-04	GND	-	Yellow	14	
C9-(-)	GND	-	Black	14	
J4-06	GND	-	Yellow	14	
J4-08	GND	-	Yellow	14	

Table 4.3: Wiring List - XR6/XR3 Transmitter - 3-phase ac power

Source	Destination	Wire #	Colour	Size	Remarks
C8-(+)	E7-04	-	White	14	
E7-04	E8-04	-	White	10	
A8C1-(-)	GND near A8C1	-			
A9C1-(-)	GND near A9C1	-			

Table 4.4: Wiring List - XR6/XR3 Transmitter - 1-phase ac power

Source	Destination	Wire #	Colour	Size	Remarks
P2-02	P17-Centre	1	White	22	1 conductor
P2-03	P17-Body	1	Shield	-	Shielded
P2-04	P18-Centre	2	White	22	1 conductor
P2-05	P18-Body	2	Shield	-	Shielded
P2-08	P21-18	3	White	22	1 conductor
P2-09	P21-17	3	Shield	-	Shielded
P5-03	M1-(+)	-	White	22	
P5-04	M1-(-)	-	Black	22	
P9-01	P21-01	4	White	22	1 conductor
P9-02	P21-02	4	Shield	-	Shielded
P9-03	P21-03	5	White	22	1 conductor
P9-04	P21-04	5	Shield	-	Shielded
P9-05	P21-05	6	White	22	1 conductor
P9-06	P21-06	6	Shield	-	Shielded
P9-07	P21-07	7	White	22	
P9-08	P21-08	8	White	22	
P9-09	P21-09	9	Black	22	
P9-10	P21-10	10	Black	22	
P9-11	P21-11	11	White	22	
P9-12	P21-12	12	White	22	
P9-16	P21-16	13	White	22	
P9-19	P21-19	14	White	22	
P9-20	P21-20	15	Black	22	
P9-21	P28-04	16	White	22	1 conductor
P9-22	-	16	Shield	-	Shielded
P9-25	P21-25	17	White		
P10-07	P21-22	18	White	22	
P10-08	P21-23	19	White	22	

Table 4.4: Wiring List - XR6/XR3 Transmitter - 1-phase ac power

Source	Destination	Wire #	Colour	Size	Remarks
P11-Core	P22-Core	20	Centre	RG188	Coaxial Cable
P11-Body	P22-Body	20	Shield		
P12-Core	P23-Core	21	Centre	RG188	Coaxial Cable
P12-Body	P23-Body	21	Shield	-	
P13-Core	P14-Core	22	Centre	RG188	Coaxial Cable
P13-Body	P14-Body	22	Shield	-	
P16-Core	P21-15	23	Centre	RG188	Coaxial Cable
P16-Body	P21-14	23	Shield	-	
P19-Core	P21-23	24	Centre	22	1 conductor
P19-Body	P21-24	24	Shield	-	Shielded
A4A1E1	U3-(DC OUT+)	25	Centre	22	
A4A1E2	U3-(DC OUT-)	26	Shield		
L1-TAP#	E10-A	-	Yellow	14	
L2-TAP#	E10-B	-	Yellow	14	
A5-A	A4C1	-	Yellow	14	
A5-B	GND NEAR A5	-	Black	20	
A4-C1	E11	-	Yellow	14	
A6-E1	E12	-	Yellow	14	
E13	L03	-	Yellow	14	Twisted wires
E13	L04	-	Yellow	14	Twisted wires
E14	L05	-	Yellow	14	Twisted wires
E14	E15	-	Yellow	14	Twisted wires
L1-TAP 37	L1-TAP #	-	Yellow	14	
L2-TAP 37	L2-TAP #	-	Yellow	14	
P24-01	A12-E3	101	White	22	
P24-03	A12-E4	102	Black	22	
P24-05	U2-(DC OUT+)	103	White	22	
P24-07	U3-(DC OUT-)	104	Black	22	
P24-09	U3-(DC OUT+)	105	White	22	
P25-01	U4-(+5V)	106	White	22	
P25-02	U4-(+15V)	107	White	22	
P25-03	U4-(-15V)	108	White	22	
P25-04	U4-(COM)	109	Black	22	
P25-08	P28-08	110	White	22	
P25-09	P28-09	111	White	22	
P25-20	P28-01	112	White	22	
P27-03	U4-(COM)	113	Black	22	

Table 4.4: Wiring List - XR6/XR3 Transmitter - 1-phase ac power

Source	Destination	Wire #	Colour	Size	Remarks
P27-04	U4-(+15V)	114	White	22	
P28-06	A14A14P1-01	115	White	22	1-conductor
P28-05	A14A14P1-02	116	Shield	-	Shielded
P28-10	U4-(COM)	117	Black	22	
P28-12	U4-(+15V)	118	White	22	
P29-01	U4-(+15V)	119	White	22	
P29-02	U4-(COM)	120	Black	22	
A8K1-B	U3-(DC OUT+)	121	White	22	
A9K1-B	U3-(DC OUT+)	122	White	22	
A12E1	U2-(DC OUT+)	123	White	22	
A12E2	U3-(DC OUT-)	124	Black	20	
A13E2	E8-01	125	White	10	
U3-(N)	U2-(N)	126	White	14	
U3-(PH)	U2-(PH)	127	White	14	
U4-(N)	U2-(N)	128	White	14	
U4-(PH)	U2-(PH)	129	White	14	
U4-(N)	XF1-02	130	White	14	
U4-(PH)	XF1-04	131	White	14	
J2-2	U3-(DC OUT+)	132	White	22	
J4-2	U3-(DC OUT+)	133	White	22	
U2-(DC OUT-)	U3-(DC OUT+)	134	White	22	
U3-(GND)	U3-(DC OUT-)	135	Black	20	
U3-(GND)	U2-(GND)	136	Black	16	
U4-(GND)	U4-(COM)	137	Black	20	
U4-(GND)	U3-(GND)	138	Black	16	
GND 2	U2-(GND)	139	Black	16	
T2-H01	XF1-02	140	White	14	
T2-H02	XF2-04	141	White	14	
E07-01	E08-01	142	White	10	
C9-(+)	E08-01	143	White	14	
P25-06	A8K1-A	144	White	22	
P25-07	A9K1-A	145	White	22	
T2-X02	A14A4P2-01	-	White	18	
T2-XF	A14A4P2-02	-	White	18	
A14U1-01	T1-LOAD-01	-	Black	6	
A14U2-01	T1-LOAD-02	-	Black	6	
A14-E2	L6-01	-	Black	6	

Table 4.4: Wiring List - XR6/XR3 Transmitter - 1-phase ac power

Source	Destination	Wire #	Colour	Size	Remarks
A14-E1	GND 1	-	Black	6	
A14-U3-01	TB1-02	-	Black	6	
A14-U3-02	T1-LINE 1	-	Black	6	
TB1-01	T1-LINE 2	-	Black	6	
XF1-01	TB1-01	-	White	16	
XF1-03	TB1-02	-	White	16	
L6-02	L7-01	-	-	-	Fab piece
L7-02	L8-01	-	-	-	Fab piece
E8-01	A7-01	-	White	10	
E8-01	C9-(+)	-	White	14	
E7-04	C10-(+)	-	White	14	
C10-(-)	GND	-	Black	14	
RF OUT GND	STA-REF	-	Black	2	
T1-GND	STA-REF	-	Black	6	
TB1-04	T1-GND	-	Black	6	
J1-01	E1-A	-	Yellow	14	
J1-03	E1-A	-	Yellow	14	
J1-05	E2-A	-	Yellow	14	
J1-07	E2-A	-	Yellow	14	
J3-01	E3-A	-	Yellow	14	
J3-03	E3-A	-	Yellow	14	
J3-05	E4-A	-	Yellow	14	
J3-07	E4-A	-	Yellow	14	
E1-B	A8K1-11	-	Yellow	14	
E2-B	A8K1-13	-	Yellow	14	
E3-B	A9K1-11	-	Yellow	14	
E4-B	A9K1-13	-	Yellow	14	
A8K1-14	E5-A	-	Yellow	14	
A9K1-14	E5-A	-	Yellow	14	
A8K1-12	E6-A	-	Yellow	14	
A9K1-12	E6-A	-	Yellow	14	
E5-B	L1-Tap #0	-	Yellow	14	
E6-B	L1-Tap #0	-	Yellow	14	
J1-02	GND	-	Yellow	14	
J1-04	GND	-	Yellow	14	
J1-06	GND	-	Yellow	14	

Table 4.4: Wiring List - XR6/XR3 Transmitter - 1-phase ac power

Source	Destination	Wire #	Colour	Size	Remarks
J1-08	GND	-	Yellow	14	
J3-02	GND	-	Yellow	14	
J3-04	GND	-	Yellow	14	
J3-06	GND	-	Yellow	14	
J3-08	GND	-	Yellow	14	
J2-01	E7-03	-	Yellow	14	
J2-03	E7-03	-	Yellow	14	
J2-05	E7-02	-	Yellow	14	
J2-07	E7-02	-	Yellow	14	
J4-01	E8-03	-	Yellow	14	
J4-03	E8-03	-	Yellow	14	
J4-05	E8-02	-	Yellow	14	
J4-07	E8-02	-	Yellow	14	
J2-04	GND	-	Yellow	14	
C8-(-)	GND	-	Black	14	
J2-06	GND	-	Yellow	14	
J2-08	GND	-	Yellow	14	
J4-04	GND	-	Yellow	14	
C9-(-)	GND	-	Black	14	
J4-06	GND	-	Yellow	14	
J4-08	GND	-	Yellow	14	
C8-(+)	E7-04	-	White	14	
E7-04	E8-04	-	White	10	
A8C1-(-)	GND near A8C1	-			
A9C1-(-)	GND near A9C1	-			

Table 4.5: XR6/XR3 Transmitter - Connector Mating Information

Connector	Mate
A14A4P1 (1-ph only)	A4A4J1
A14A4P2 (1-ph only)	A4A4J2
P1	A1A1J1
P2	A1A1J2
P3	A1A1J4
P4	A1A1J7
P5	A1A1J11
P6	A2A1J5
P7	A2A1J6

Table 4.5: XR6/XR3 Transmitter - Connector Mating Information

Connector	Mate
P8	A2A1J7
P9	A2A1J8
P10	A15J3
P11	A2A1J10
P12	A2A1J11
P13	A5J1
P14	A2A6J7
P15	A2A6J13
P16	A3J1
P17	A4J1
P18	A4J2
P19	A6A1J1
P20	A11J9
P21	A11J10
P22	A15J1
P23	A15J2
P24	A11J12
P25	A11J13
P26	U1J1 (3-ph) or Not Used (1-ph)
P27	A12J1
P28	A13J1
P29	A15J4

Table 4.6: Wiring List - Interface Between RF Power Module and Distribution PWB

Source	Destination	Wire #	Colour	Size	Remarks
P3-01	P1-01	1	White	22	
P3-02	P1-02	2	White	22	
P3-03	P1-03	3	White	22	
P3-04	P1-04	4	Center	22	
P3-05	P1-05	4	Shield	-	
P3-06	P1-06	5	Center	22	
P3-07	P1-07	5	Shield	-	
P3-08	P1-08	6	Center	22	
P3-09	P1-09	6	Shield	-	
P1-10	P4	7	Center		
P1-11	P4	7	Shield	-	
P3-12	P1-12	8	White	22	

Table 4.6: Wiring List - Interface Between RF Power Module and Distribution PWB

Source	Destination	Wire #	Colour	Size	Remarks
P3-13	P1-13	9	White	22	
P3-14	P1-14	10	White	22	
P3-15	P1-15	11	White	22	
P3-16	P1-16	12	White	22	
P3-17	P1-17	13	Black	22	
P3-18	P1-18	14	White	22	
P3-20	P1-20	15	White	22	
P3-21	P1-21	16	White	22	
P3-23	P2-01	17	White	22	
P3-24	P2-02	18	White	22	
P3-25	P2-03	19	Black	22	

Table 4.7: Wiring List - NAFP103/05 Forward/Reflected Power Probe

Source	Destination	Wire #	Colour	Size	Remarks
J1-Center	A1-D	-	White	22	Jumper
J2-Center	A1-E	-	White	22	Jumper
C1	A1-C	-	White	22	Jumper
T1-01	A1-B	-	-	22	T1 Lead
T1-02	A1-C	-	-	22	T1 Lead
T1-03	A1-C	-	-	22	T1 Lead
T1-04	A1-A	-	-	22	T1 Lead

Table 4.8: Wiring List - NAP34A RF Power Module

Source	Destination	Wire #	Colour	Size	Remarks
J2-02	Ground	-		C1	+ Lead - J2-2
J2-03	J2-04	-		R1	
J2-07	J2-08	-		R2	
P1-01	A7-B	1	Yellow	20	
P1-05	A6-B	2	Yellow	20	
P1-10	A17-B	3	Yellow	20	
P1-13	A18-B	4	Yellow	20	
P1-03	A14-E9	5	Yellow	20	
P1-07	A14-E10	6	Yellow	20	
P2-25	J1-18	7	White	22	

Table 4.8: Wiring List - NAP34A RF Power Module

Source	Destination	Wire #	Colour	Size	Remarks
P2-08	A9-A	8	White	22	1 Conductor
P2-24	A9-B	8	Shield	-	Shielded
P2-02	A19-A	9	White	22	1 Conductor
P2-15	A19-B	9	Shield	-	Shielded
P2-11	A8-A	11	White	22	1 Conductor
P2-18	A8-B	11	Shield	-	Shielded
P2-06	A20-A	13	White	22	1 Conductor
P2-21	A20-B	13	Shield	-	Shielded
P3-02	J1-04	18	White	22	1 Conductor
P3-15	J1-05	18	Shield	-	Shielded
P3-06	J1-06	19	White	22	1 Conductor
P3-18	J1-07	19	Shield	-	Shielded
P4-06	J1-13	30	White	22	
P4-12	J1-14	31	White	22	
P4-07	J1-15	33	White	22	
P4-05	J1-10	34	Core	RG174	Coaxial Cable
P4-02	J1-11	34	Shield	-	
P4-04	J1-12	35	White	22	
P4-10	J1-01	36	White	22	
P4-14	J1-03	37	White	22	
P4-11	J1-16	38	White	22	
P4-15	Q1-Emitter	39	White	22	
P4-01	Q1-Base	40	White	22	
P4-03	Q1-Collector	41	White	22	
P4-22	RT1	42	White	22	
P4-20	RT2	43	White	22	
P4-18	P6-09	45	White	22	
P4-23	S1-01	46	White	22	
P4-24	P7-09	47	White	22	
P4-25	P7-05	48	White	22	
P2-12	J1-20	49	White	22	
P4-11	J1-16	38	White	22	
P6-05	J1-08	50	White	22	1 Conductor
P6-07	J1-09	50	Shield	-	Shielded
P6-01	P3-01	51	White	22	1 Conductor
P6-07	P3-14	51	Shield	-	Shielded
P6-06	P3-05	52	White	22	1 Conductor

Table 4.8: Wiring List - NAP34A RF Power Module

Source	Destination	Wire #	Colour	Size	Remarks
P6-07	P3-17	52	Shield	-	Shielded
P6-02	P3-03	53	White	22	1 Conductor
P6-08	P3-16	53	Shield	-	Shielded
P6-04	P3-07	54	White	22	1 Conductor
P6-08	P3-19	54	Shield	-	Shielded
P7-07	J1-02	55	White	22	
Gnd at E1	J1-17	61	Black	22	
P3-13	J1-21	62	Black	22	
Gnd at E1	S1-02	63	Black	22	
Gnd at E1	P7-02	64	Black	22	
Gnd at E1	P4-16	65	Black	22	
J2-02	P7-08	67	White	22	
J2-02	P6-03	68	White	22	
J2-02	P4-08	69	White	22	
J2-01	A14-H	75	White	14	1 Conductor
J2-04	Gnd Near A14	75	Shield		Shielded
J2-03	A14-E	76	White	14	1 Conductor
J2-04	Gnd Near A14	76	Shield		Shielded
J2-05	A14-C	77	White	14	1 Conductor
J2-06	Gnd Near A14	77	Shield		Shielded
J2-07	A14-A	78	White	14	1 Conductor
J2-08	Gnd Near A14	78	Shield		Shielded
A14-E3	A26-E4	81	Yellow	18	
A14-E1	A26-E3	82	Yellow	18	
A14-E7	A26-E2	83	Yellow	18	
A14-E5	A26-E1	84	Yellow	18	
A14-B	A6-E	-	Inductor	12	L1 Leads
A14-D	A7-E	-	Inductor	12	L2 Leads
A14-F	A17-E	-	Inductor	12	L3 Leads
A14-J	A18-E	-	Inductor	12	L4 Leads
T1-A-1	A8G (+)	-	White	x2x18	T1 Lead
T1-A-	A8G (+)	-	White	x2x18	T1 Lead
T1-B-1	A8C (+)	-	White	x2x18	T1 Lead
T1-B-	A8C (+)	-	White	x2x18	T1 Lead
T1-C-1	A9G (+)	-	White	x2x18	T1 Lead
T1-C-	A9G (-)	-	White	x2x18	T1 Lead
T1-D-1	A9C (+)	-	White	x2x18	T1 Lead

Table 4.8: Wiring List - NAP34A RF Power Module

Source	Destination	Wire #	Colour	Size	Remarks
T1-D-	A9C (-)	-	White	x2x18	T1 Lead
T1-1	J3-6/8	-	White	x2x18	T1 Lead
T1-2	J3-5/7	-	White	x2x18	T1 Lead
T2-A-1	A19G (+)	-	White	x2x18	T2 Lead
T2-A-	A19G (+)	-	White	x2x18	T2 Lead
T2-B-1	A19C (+)	-	White	x2x18	T2 Lead
T2-B-	A19C (+)	-	White	x2x18	T2 Lead
T2-C-1	A20G (+)	-	White	x2x18	T2 Lead
T2-C-	A20G (-)	-	White	x2x18	T2 Lead
T2-D-1	A20C (+)	-	White	x2x18	T2 Lead
T2-D-	A20C (-)	-	White	x2x18	T2 Lead
T2-1	J3-2/4	-	White	x2x18	T2 Lead
T2-2	J3-1/3	-	White	x2x18	T2 Lead

Table 4.9: NAP34A RF Power Module - Connector Mating Information

Connector	Mate
P1	A1A1
P2	A1J3
P3	A1J2
P4	A1J4
P6	A14J5
P7	A3J1

Table 4.10: Wiring List - Fan Tray Assembly (Nautel Part # 202-7020)

Source	Destination	Wire #	Colour	Size	Remarks
B1-Red	E01	-	Red		Lead of B1
B1-Black	E02	-	Black		Lead of B2
B2-Red	E03	-	Red		Lead of B3
B2-Black	E04	-	Black		Lead of B4
E05	J1-01	1	White	22	
E06	E08	2	White	22	
E07	J1-02	3	White	22	
E08	J1-03	4	White	22	

Table 4.11: Fan Tray Assembly - Connector Mating Information

Connector	Mate
E1	E5
E2	E6
E3	E7
E4	E8

Section 5: Reading Electrical Schematics

This section contains electrical schematics and logic diagrams for the XR6/XR3 transmitter. Block diagrams, simplified electrical schematics, and logic diagrams may be included. Refer to Table 5.1 on page 5-5 for an itemized listing.

Component values

Unless otherwise specified on the logic or schematic diagram, the following defaults apply:

- Resistor values are shown in ohms (k = 1,000 and M = 1,000,000)
- Resistor power ratings are not shown when less than 0.5 W
- Capacitor values are shown in microfarads (uF)
- Unidentified diodes are part number 1N4938

Graphic symbols

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

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

Referenced designations were assigned in accordance with American National Standard ANSI Y32.16-1975 - Reference Designations for Electrical and Electronic Parts and Equipment. Each electrical symbol is identified with its basic reference designation. To obtain the full reference designation for a specific part, prefix this basic identifier with the reference designation assigned to all higher assemblies.

Unique symbols

Nautel uses unique symbols on electrical schematics to describe logic (two-state) signals. These signals differ from single-state signals or analog signals that may have multiple values.

Type of inputs and outputs

On electrical schematics, names used to describe logic (two-state) input and output signals are prefixed with a # symbol.

Logic level convention

The # symbol prefix identifies an input or output signal that has two distinct states: high and low. The suffix on the signal name identifies the active (true) state of the signal. The high (+ suffix) is the more positive of the two levels used to represent the logic states. The low (- suffix) is the less positive of the two levels.

Two types of logic, positive and negative, may be represented on a particular schematic.

- In positive logic, high represents the active (true) state and low represents the inactive (false) state.
- In negative logic, low represents the active (true) state and high represents the inactive (false) state.

Identifying schematic diagrams

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 and logic diagrams included in this section are listed in Table 5.1 on page 5-5.

Structure of schematics

The electrical schematics are structured in a hierarchical format that is based on function and signal flow. Wherever practical, the signal flow is from left to right. Normally, inputs originate on the left-hand side and outputs extend to the right-hand side. Exceptions are shown by an arrow indicating the direction of signal flow.

> Note: The physical location of a part or assembly was not necessarily a factor during creation of the schematic. The full reference designation assigned to a part or assembly, in conjunction with the family tree (see Section 3, "Parts Lists" on page 3-1) and the assembly detail drawings (see Section 6, "Mechanical Drawings" on page 6-1), will identify its location.

Figures SD-1 through SD-4 identify each major stage and its detailed interconnection. Each stage contains cross-references that identify which block is the signal source for inputs or the destination for outputs.

When a sub-function is treated as a block in Figures SD-1 through SD-4, its detailed circuit information is included in its own schematic drawing, which is also included in this section.

Locating schematic diagram for a functional block

The text inside a functional block provides the key to locating its schematic diagram. When a functional block is assigned a reference designation, refer to the family trees in *Section 3, "Parts Lists" on page 3-1*, and follow the family tree branches to the block that contains the reference designation and associated Nautel nomenclature (e.g., NAP34A). Refer to Table 5.1 with the Nautel nomenclature number and the description to identify the appropriate figure number.

> Note: Schematics for some functional blocks may consist of more than one figure.

Locating a part or assembly on a schematic

The full reference designation assigned to a part or assembly is the key to physically locating that part or 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 coding that identifies assembly relationship (1A1, A2A1, A2A1A1, etc.) is added.

Refer to the family trees in *Section 3, "Parts Lists" on page 3-1* 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 6, "Mechanical Drawings" on page 6-1 depict the assembly detail of the transmitter and its modules and assemblies.

Refer to Table 4.1 with the name and Nautel nomenclature number of each family tree block in the path, starting at the highest assembly (normally Figure MD-1). Determine the figure number for that assembly. Refer to the referenced figure and locate the next lower-level assembly. Repeat this procedure until the desired part or assembly is found.

> Note: Mechanical drawings for some assemblies may consist of more than one figure.

Table 5.1: List of Electrical Schematics

Figure #	Title
SD-1	XR6/XR3 Transmitter - Control/Monitor Stage (Sheet 1 of 4)
SD-2	XR6/XR3 Transmitter - Exciter Stage (Sheet 2 of 4)
SD-3A	XR6/XR3 Transmitter - Ac/Dc Power Stage (3-Phase Ac) and RF Power Stage (Sheet 3 of 4)
SD-3B	XR6/XR3 Transmitter - Ac/Dc Power Stage (1-Phase Ac) and RF Power Stage (Sheet 3 of 4)
SD-4	XR6/XR3 Transmitter - RF Output Filter (Sheet 4 of 4)
SD-5	NAPC147D Control/Display PWB (Sheet 1 of 4)
SD-6	NAPC147D Control/Display PWB (Sheet 2 of 4)
SD-7	NAPC147D Control/Display PWB (Sheet 3 of 4)
SD-8	NAPC147D Control/Display PWB (Sheet 4 of 4)
SD-9	NAPX05E/02 Dynamic Carrier Control PWB (Sheet 1 of 2)
SD-10	NAPX05E/02 Dynamic Carrier Control PWB (Sheet 2 of 2)
SD-11	NAPI82A Exciter Interface PWB
SD-12	NAPE70C RF Synthesizer PWB (Sheet 1 of 2)
SD-13	NAPE70C RF Synthesizer PWB (Sheet 2 of 2)
SD-14	NAPM10B Interphase PDM Driver PWB
SD-15	NAPI83/01A Remote Interface PWB (Sheet 1 of 4)
SD-16	NAPI83/01A Remote Interface PWB (Sheet 2 of 4)
SD-17	NAPI83/01A Remote Interface PWB (Sheet 3 of 4)
SD-18	NAPI83/01A Remote Interface PWB (Sheet 4 of 4)
SD-19	NAP34A RF Power Module - Overall (Sheet 1 of 2)
SD-20	NAP34A RF Power Module - Modulator Stage (Sheet 2 of 2)
SD-21	NAPC150A RF Drive Control PWB (Sheet 1 of 3)
SD-22	NAPC150A RF Drive Control PWB (Sheet 2 of 3)
SD-23	NAPC150A RF Drive Control PWB (Sheet 3 of 3)
SD-24	NASM07H Modulator Assembly
SD-25	NAA51A/03 RF Amplifier Assembly
SD-26	NAPI90/02 Distribution PWB (Sheet 1 of 2)
SD-27	NAPI90/02 Distribution PWB (Sheet 2 of 2)
SD-28	Not Used
SD-29A	NAPX31/05 B+ Distribution PWB, 3-Phase Ac
SD-29B	NAPS36A SCR Control/B+ Distribution PWB, 1-Phase Ac
SD-30	NAPE77A/01 RF Drive Buffer PWB
SD-31	NAPS10C RF Drive Power Supply PWB

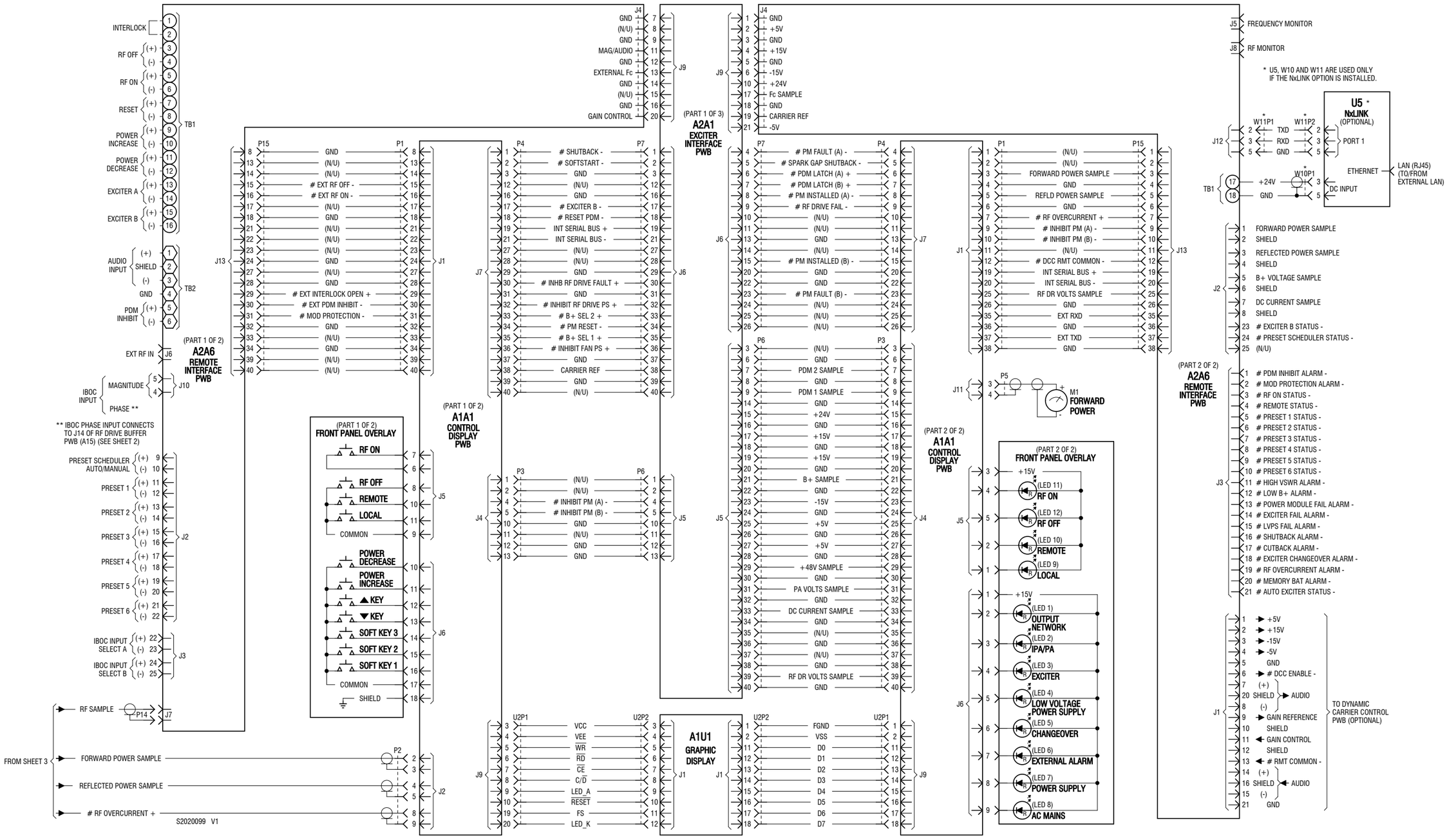


Figure SD-1: XR6/XR3 Transmitter - Control/Monitor Stage (Sheet 1 of 4)

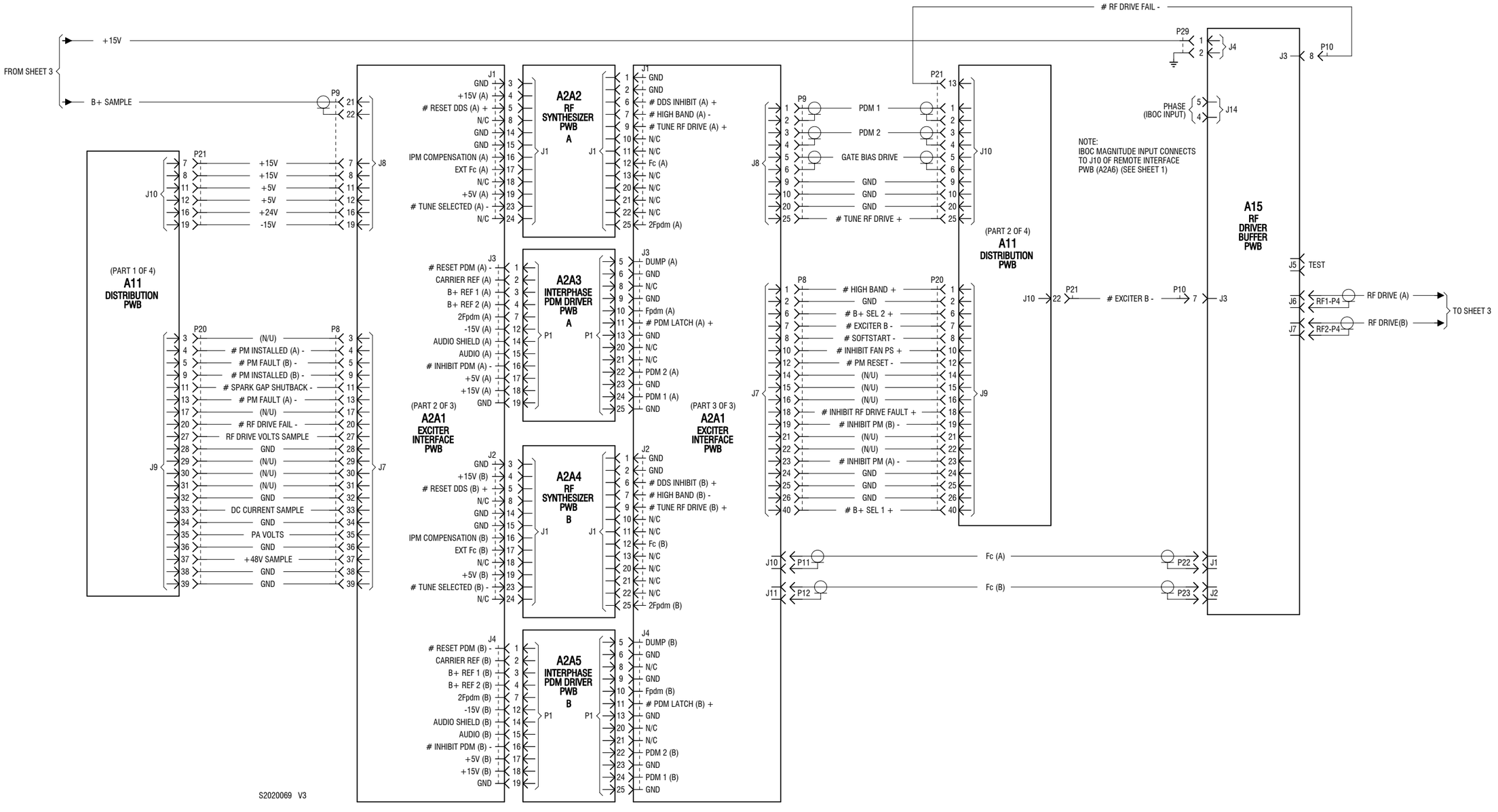
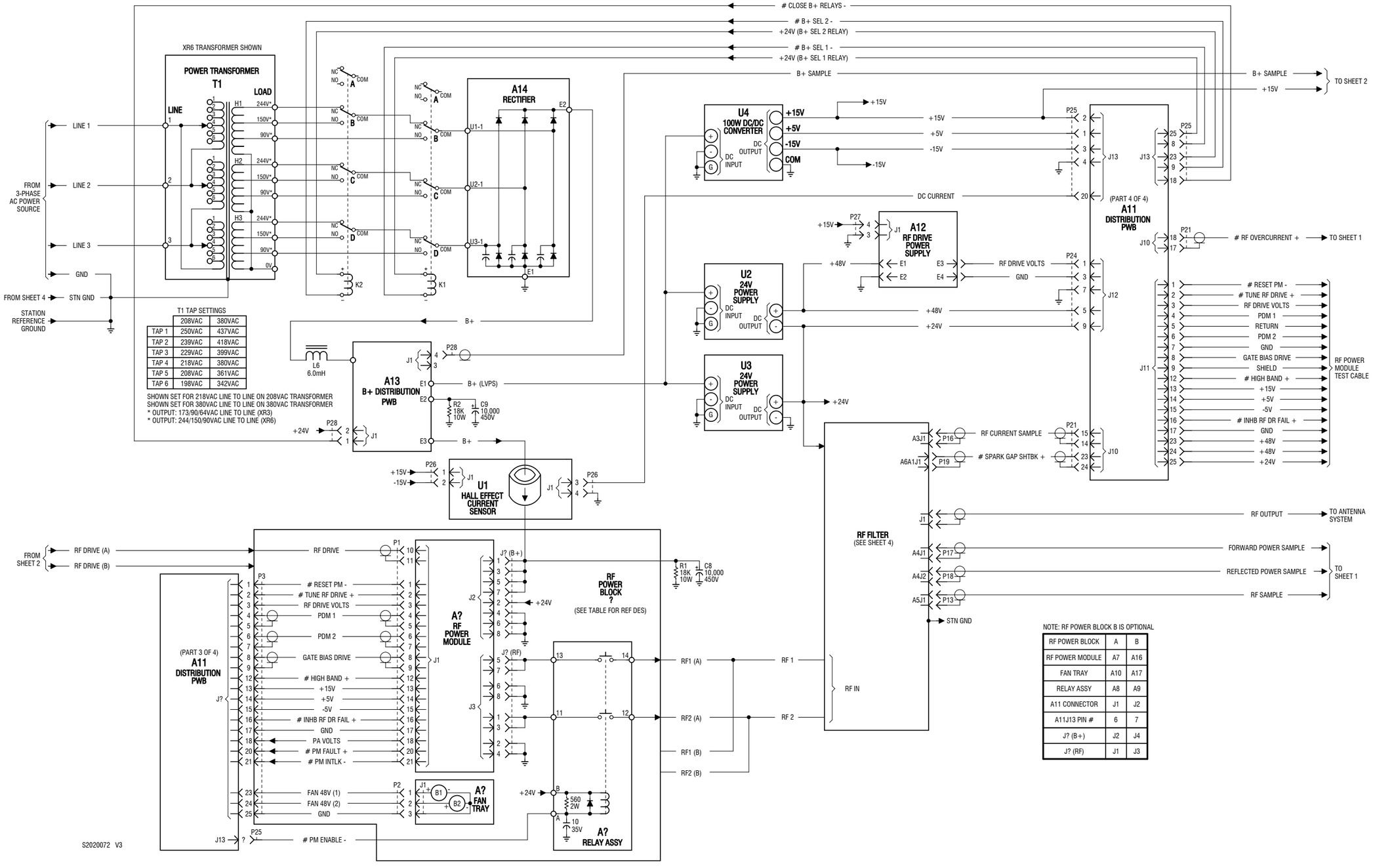


Figure SD-2: XR6/XR3 Transmitter - Exciter Stage (Sheet 2 of 4)



TAP	208VAC	380VAC
TAP 1	250VAC	437VAC
TAP 2	239VAC	418VAC
TAP 3	229VAC	399VAC
TAP 4	218VAC	380VAC
TAP 5	208VAC	361VAC
TAP 6	198VAC	342VAC

RF POWER BLOCK	A	B
RF POWER MODULE	A7	A16
FAN TRAY	A10	A17
RELAY ASSY	A8	A9
A11 CONNECTOR	J1	J2
A11J13 PIN #	6	7
J? (B+)	J2	J4
J? (RF)	J1	J3

Figure SD-3A: XR6/XR3 Transmitter - Ac/Dc Power Stage (3-Phase Ac) and RF Power Stage (Sheet 3 of 4)

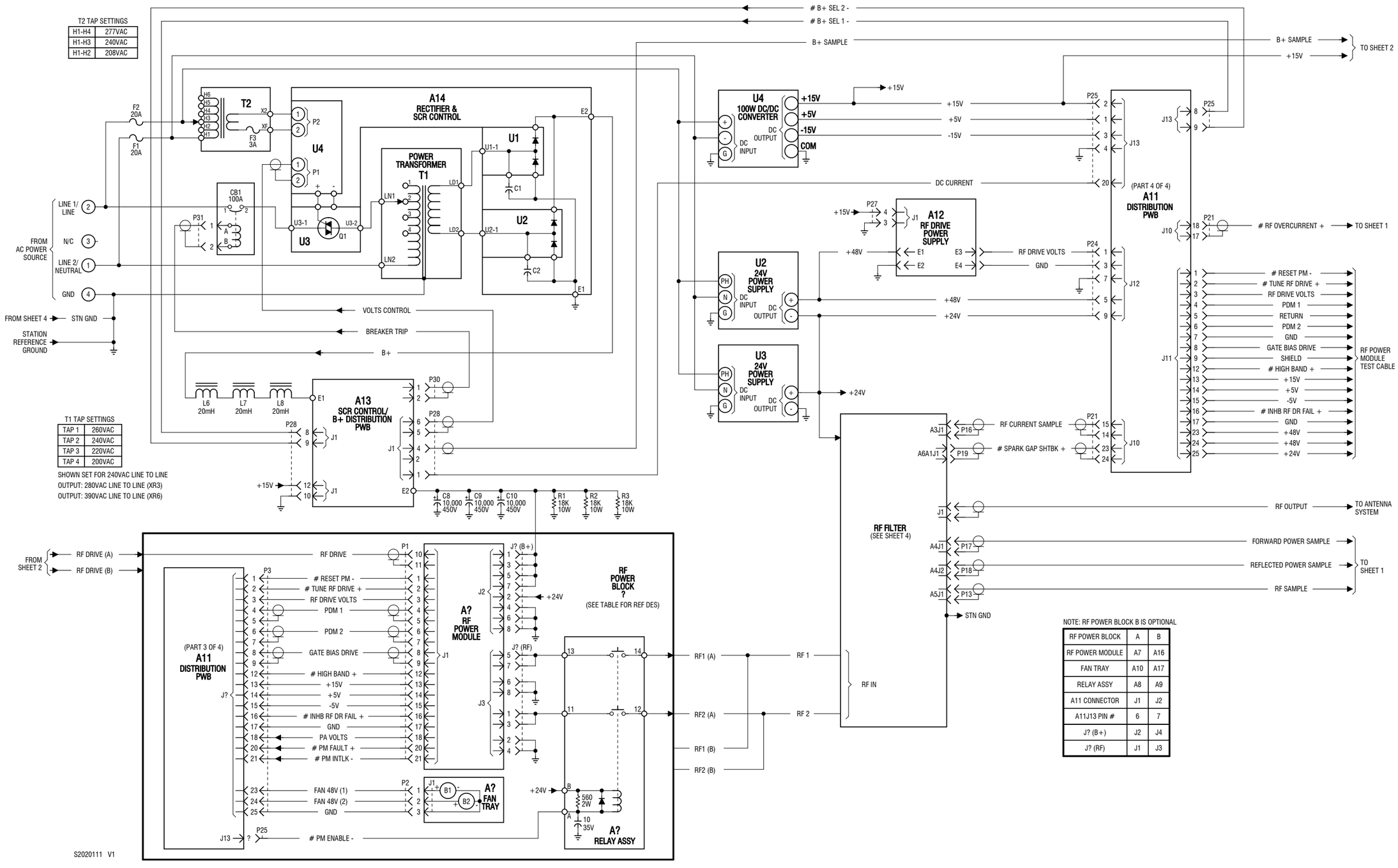


Figure SD-3B: XR6/XR3 Transmitter - Ac/Dc Power Stage (1-Phase Ac) and RF Power Stage (Sheet 3 of 4)

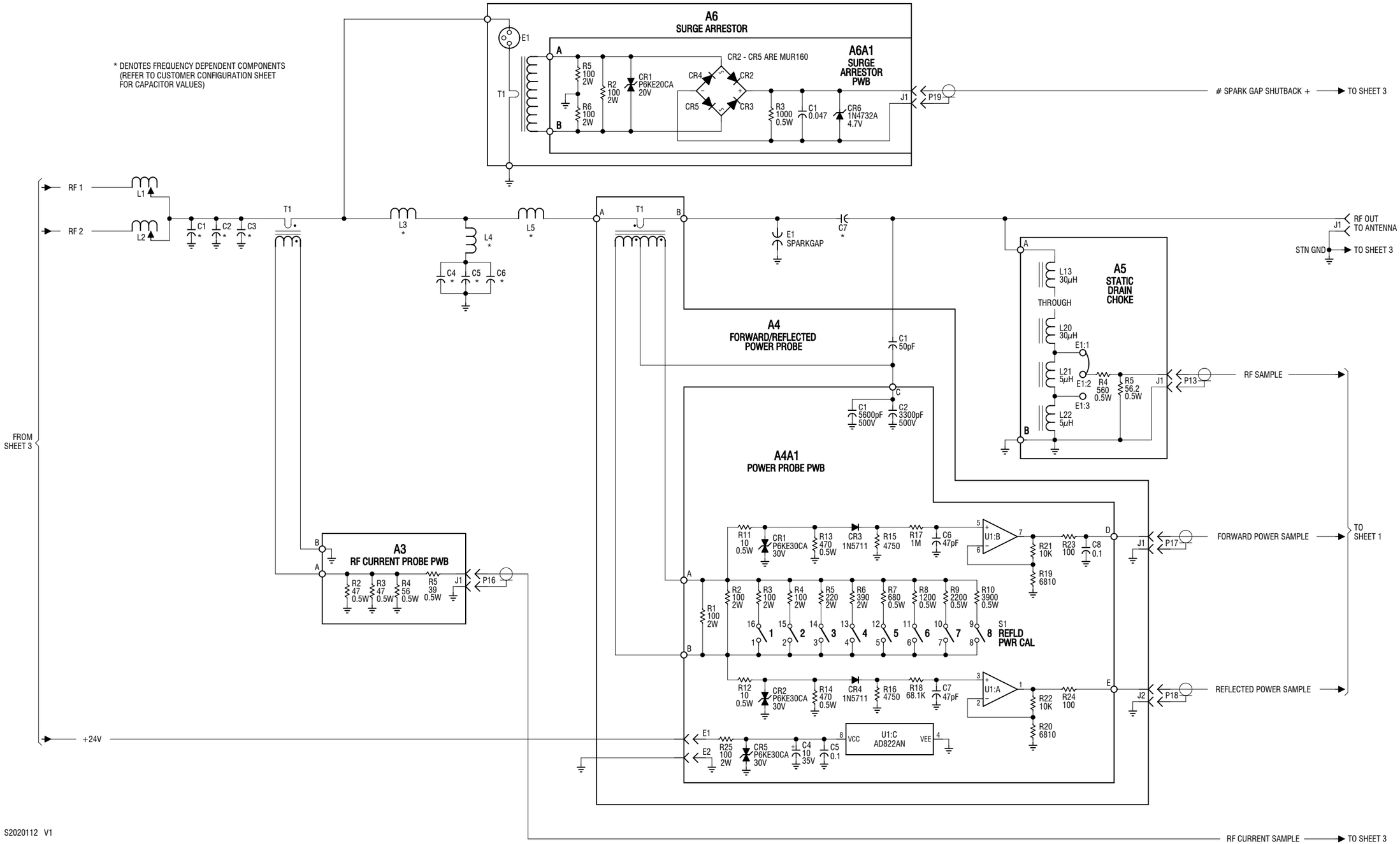


Figure SD-4: XR6/XR3 Transmitter - RF Output Filter (Sheet 4 of 4)

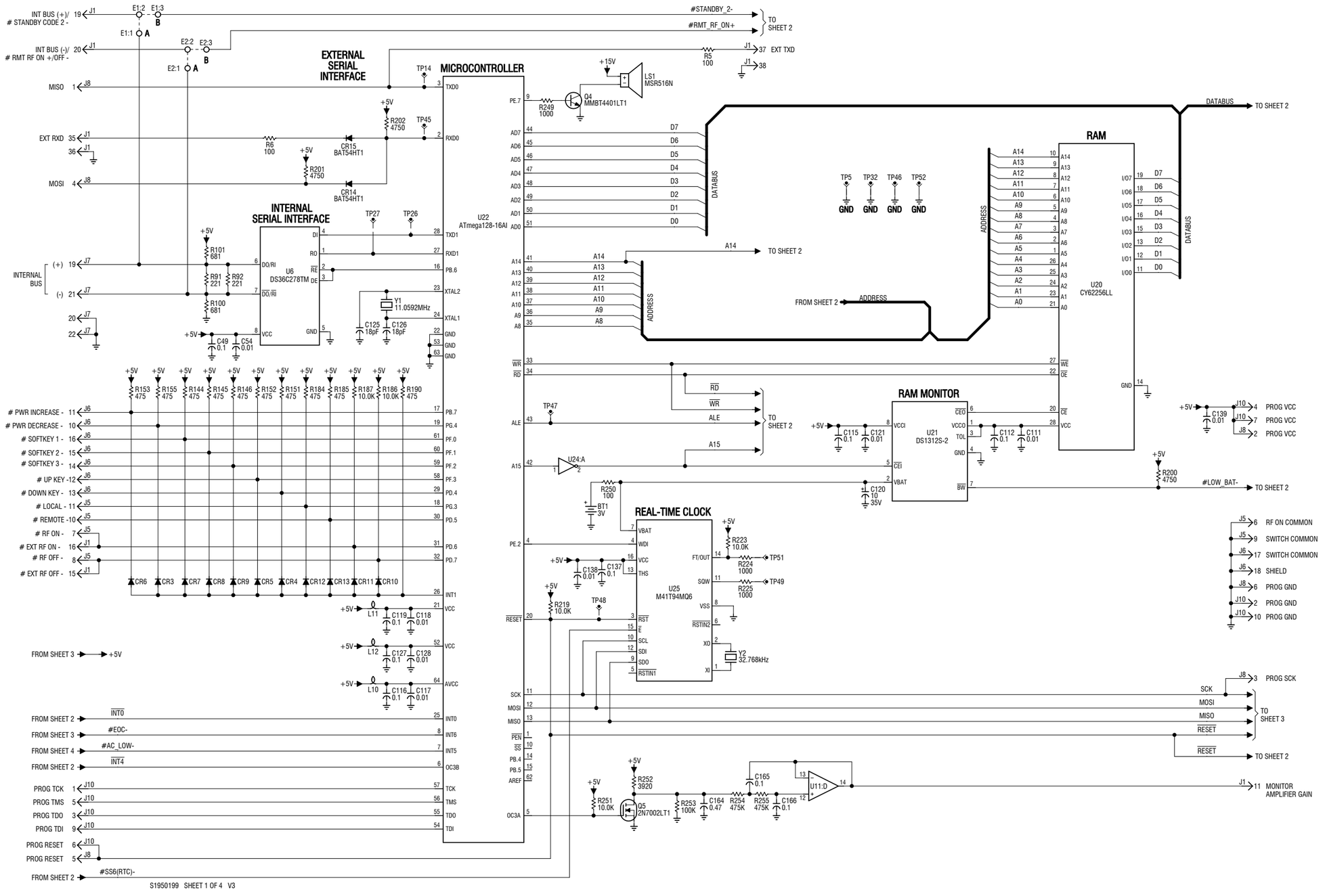


Figure SD-5: NAPC147D Control/Display PWB (Sheet 1 of 4)

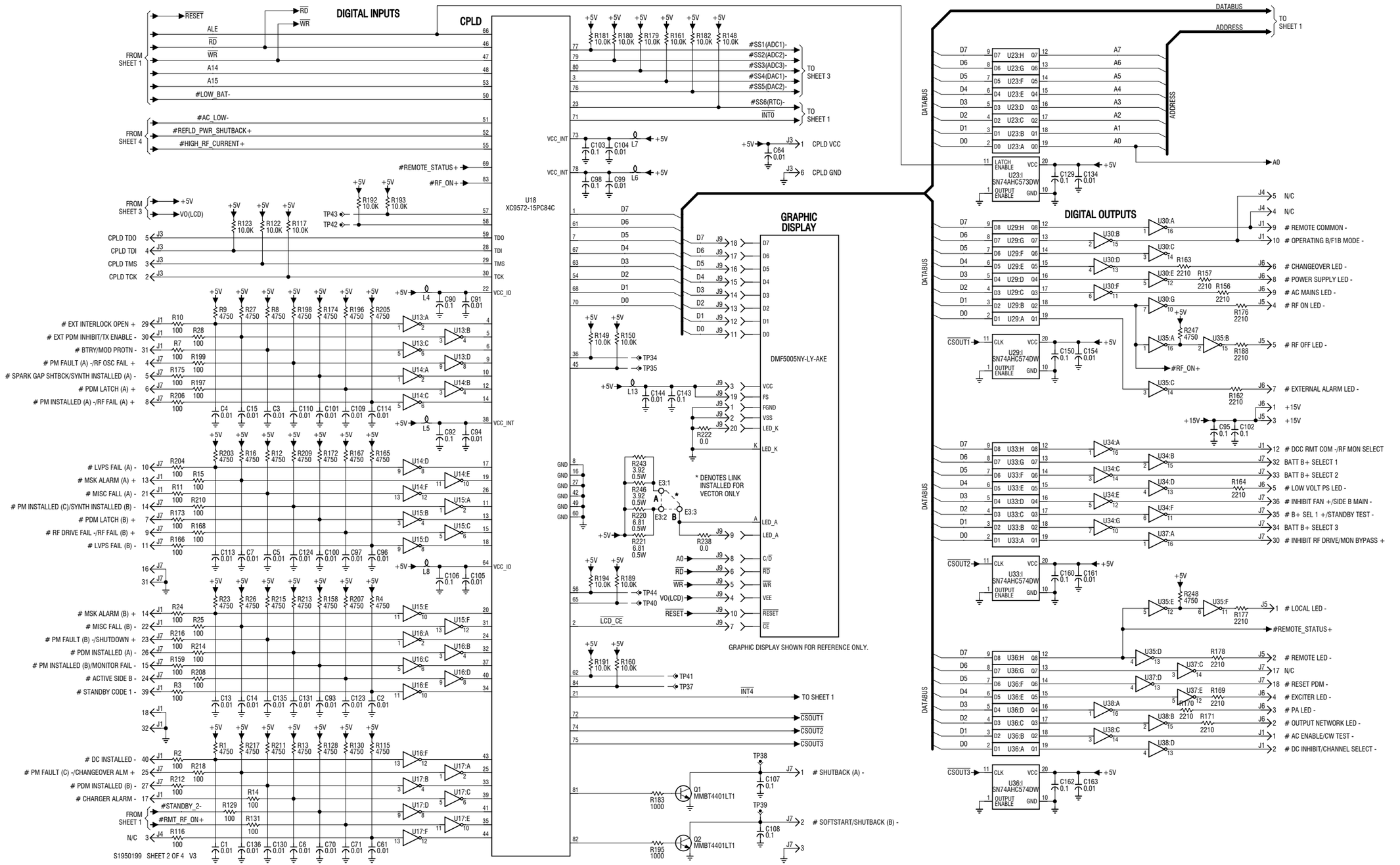


Figure SD-6: NAPC147D Control/Display PWB (Sheet 2 of 4)

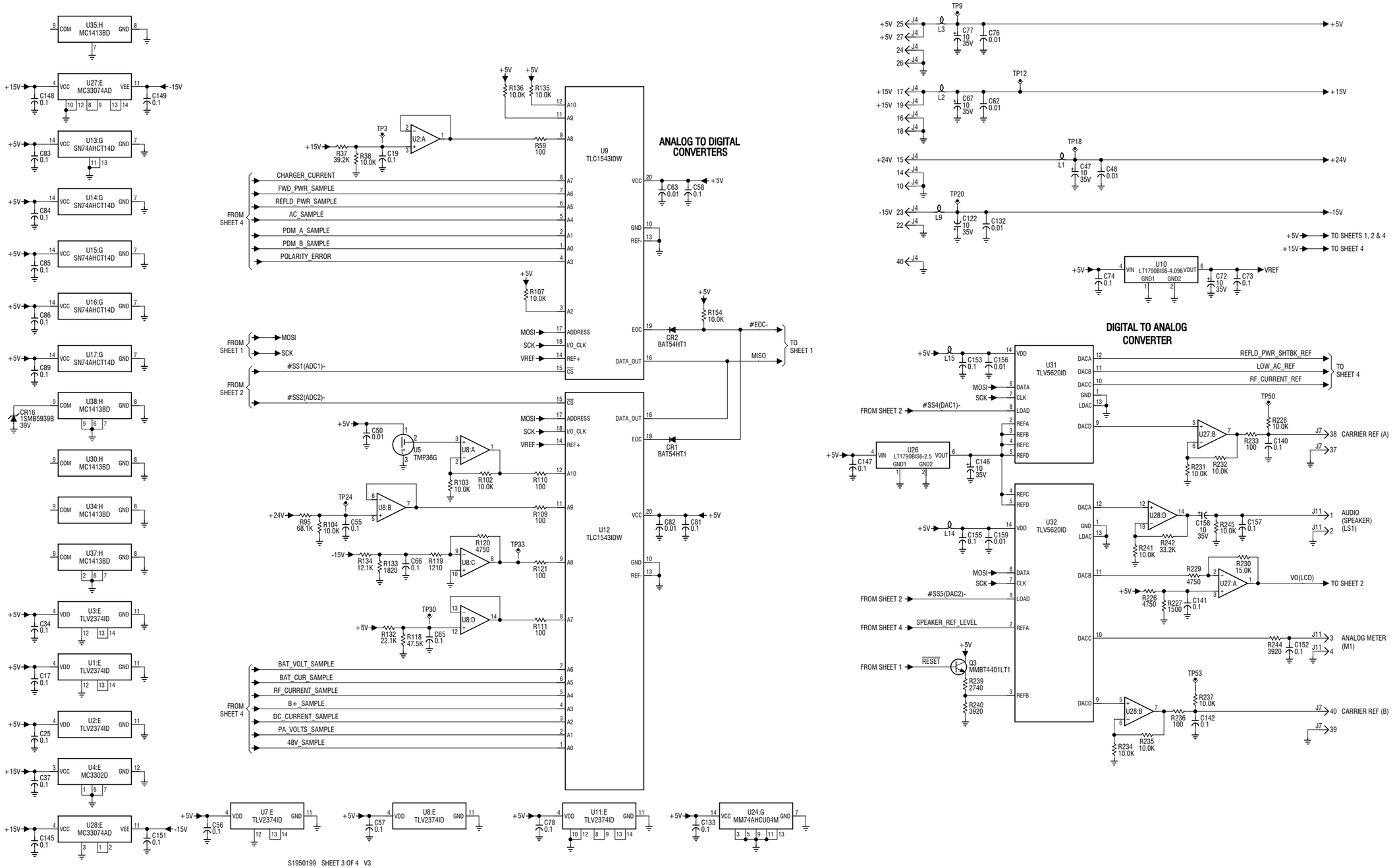
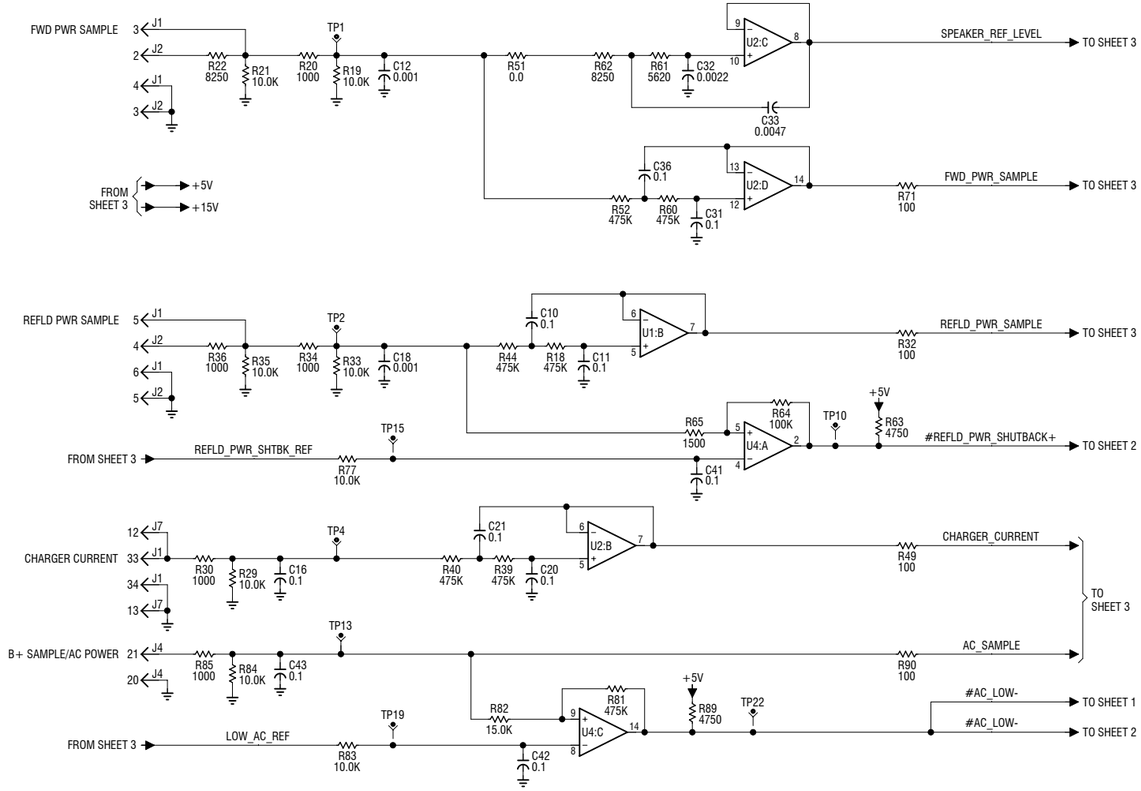


Figure SD-7: NAPC147D Control/Display PWB (Sheet 3 of 4)



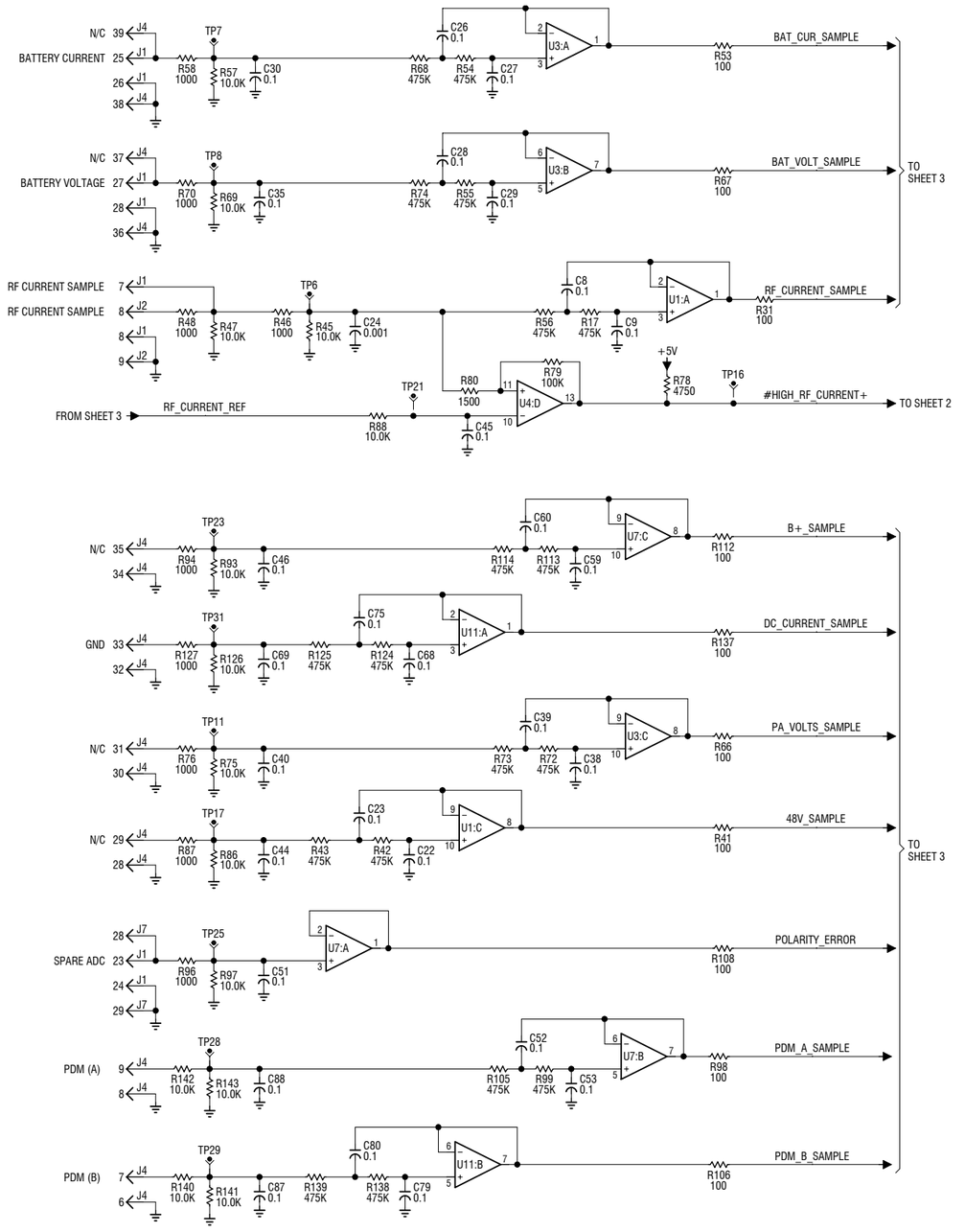


Figure SD-8: NAPC147D Control/Display PWB (Sheet 4 of 4)

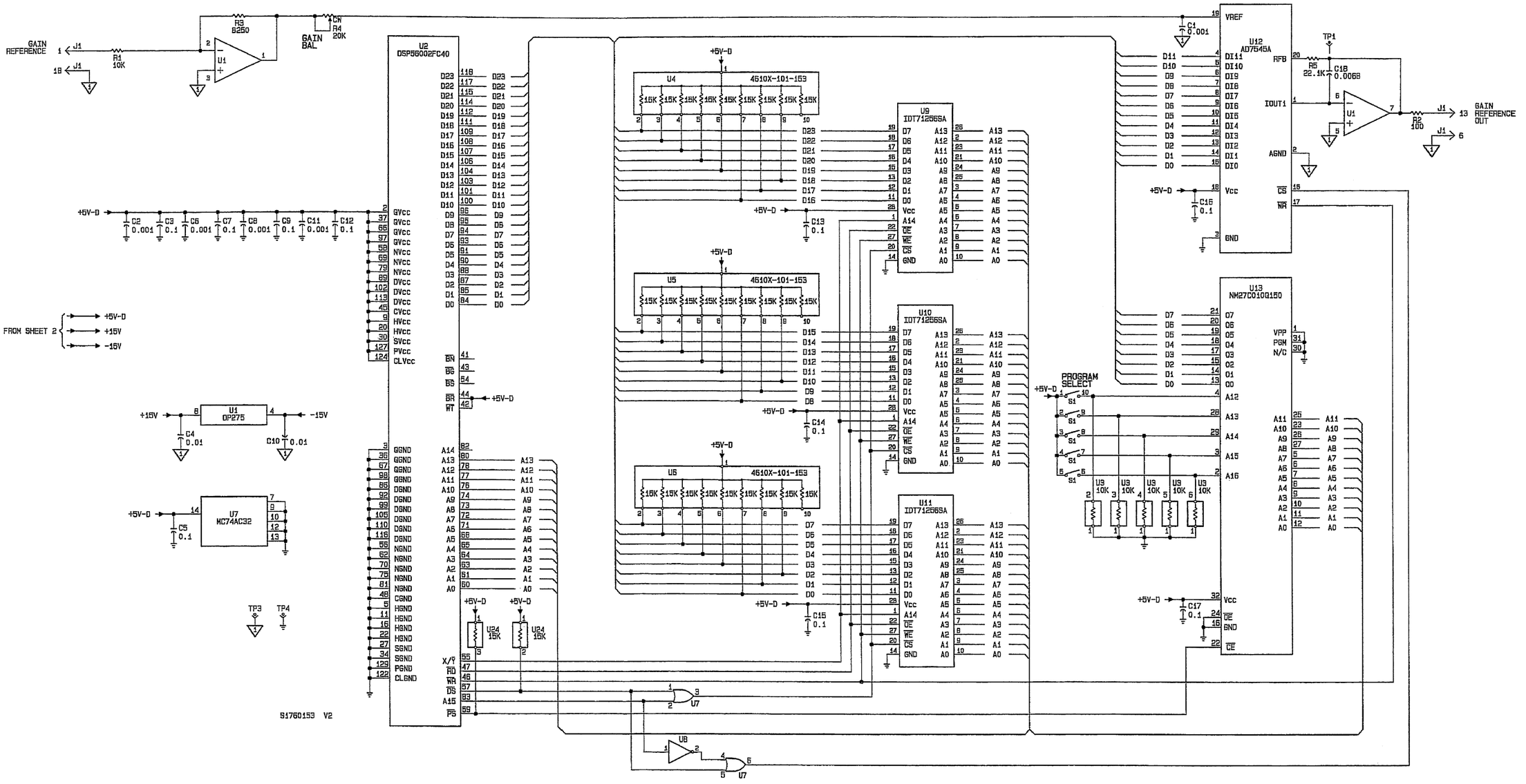
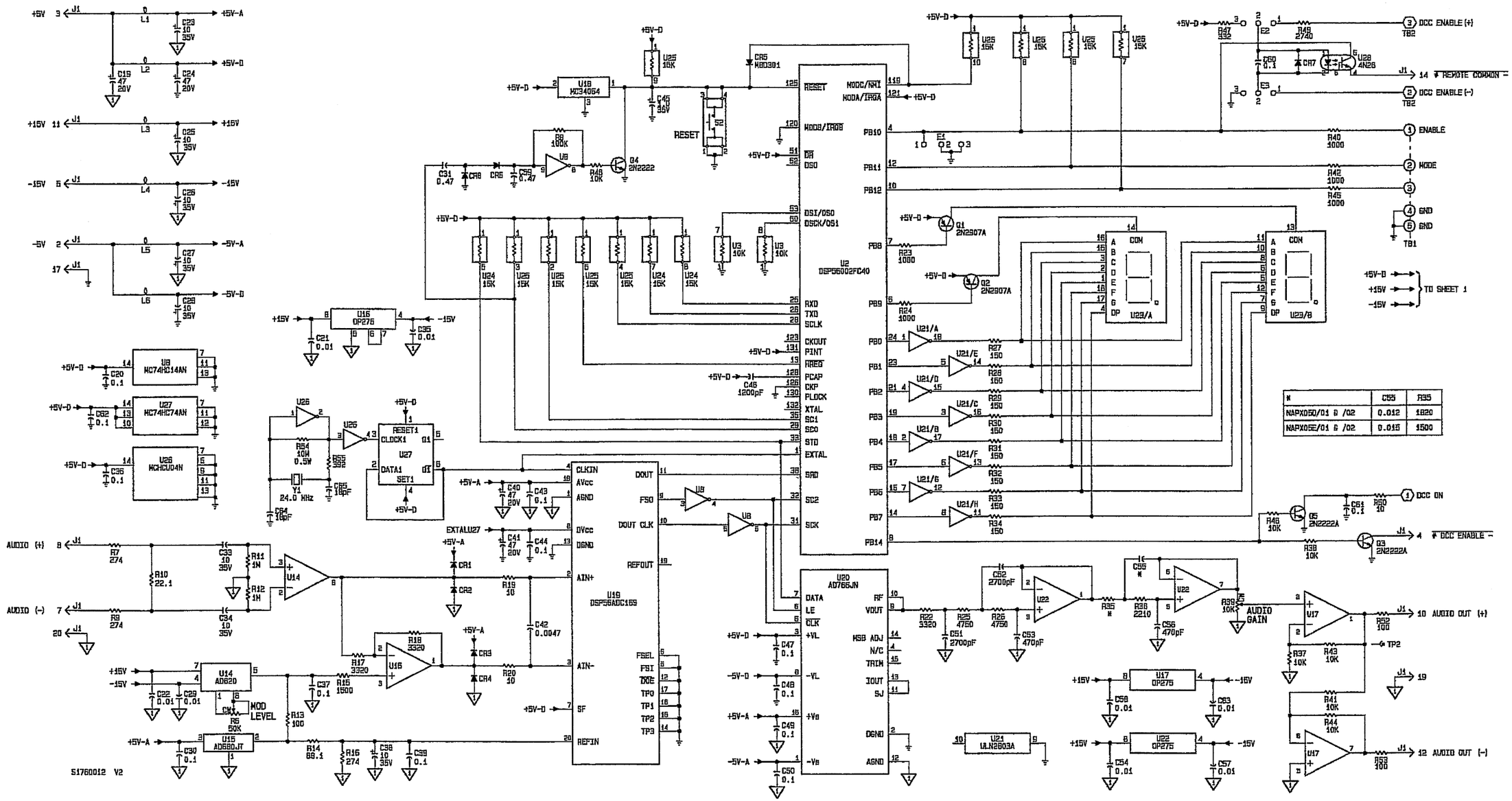


Figure SD-9: NAPX05E/02 Dynamic Carrier Control PWB (Sheet 1of 2)



#	C55	R35
NAPX05D/01 & /02	0.012	1820
NAPX05E/01 & /02	0.015	1500

Figure SD-10: NAPX05E/02 Dynamic Carrier Control PWB (Sheet 2 of 2)

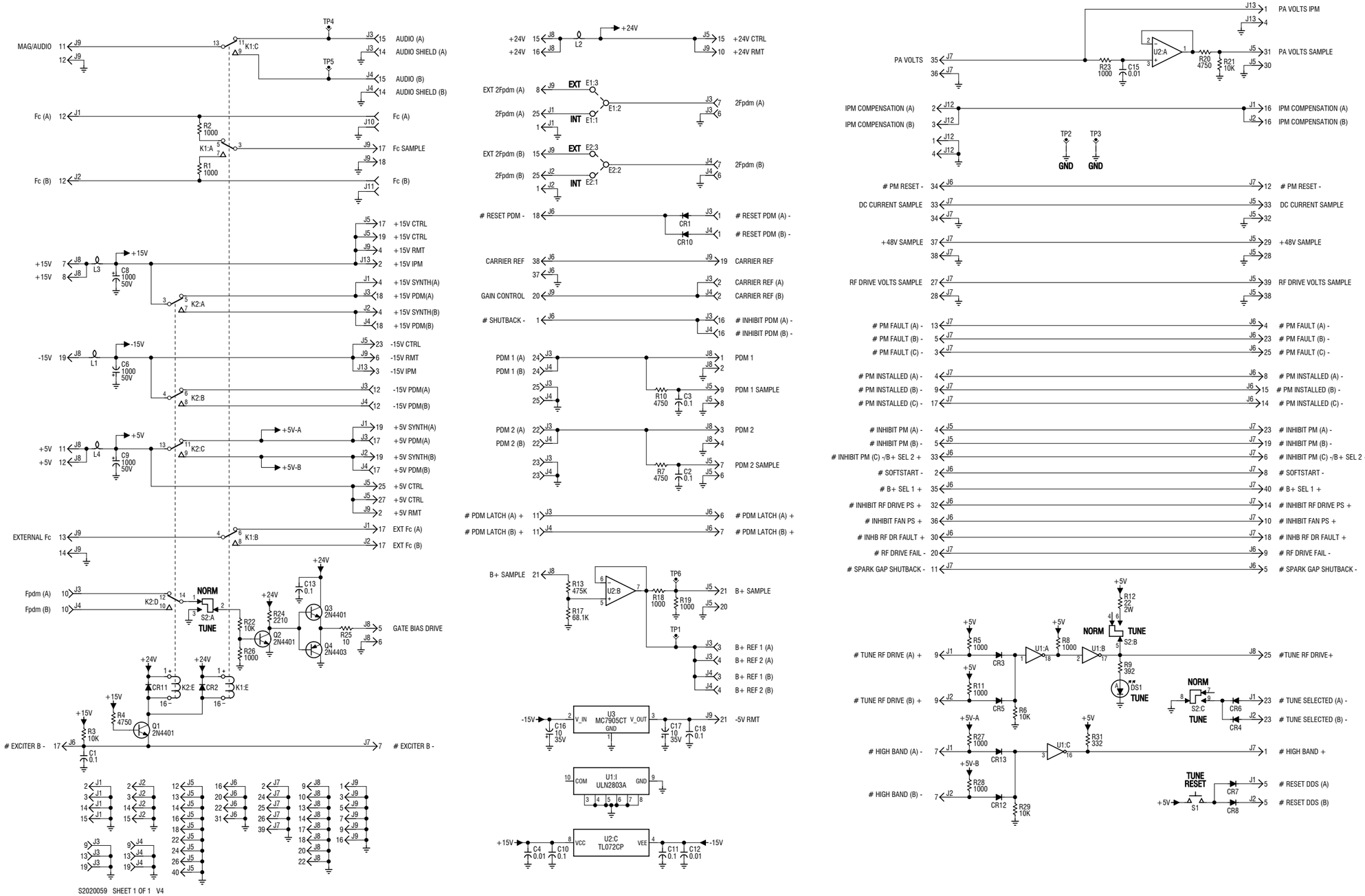
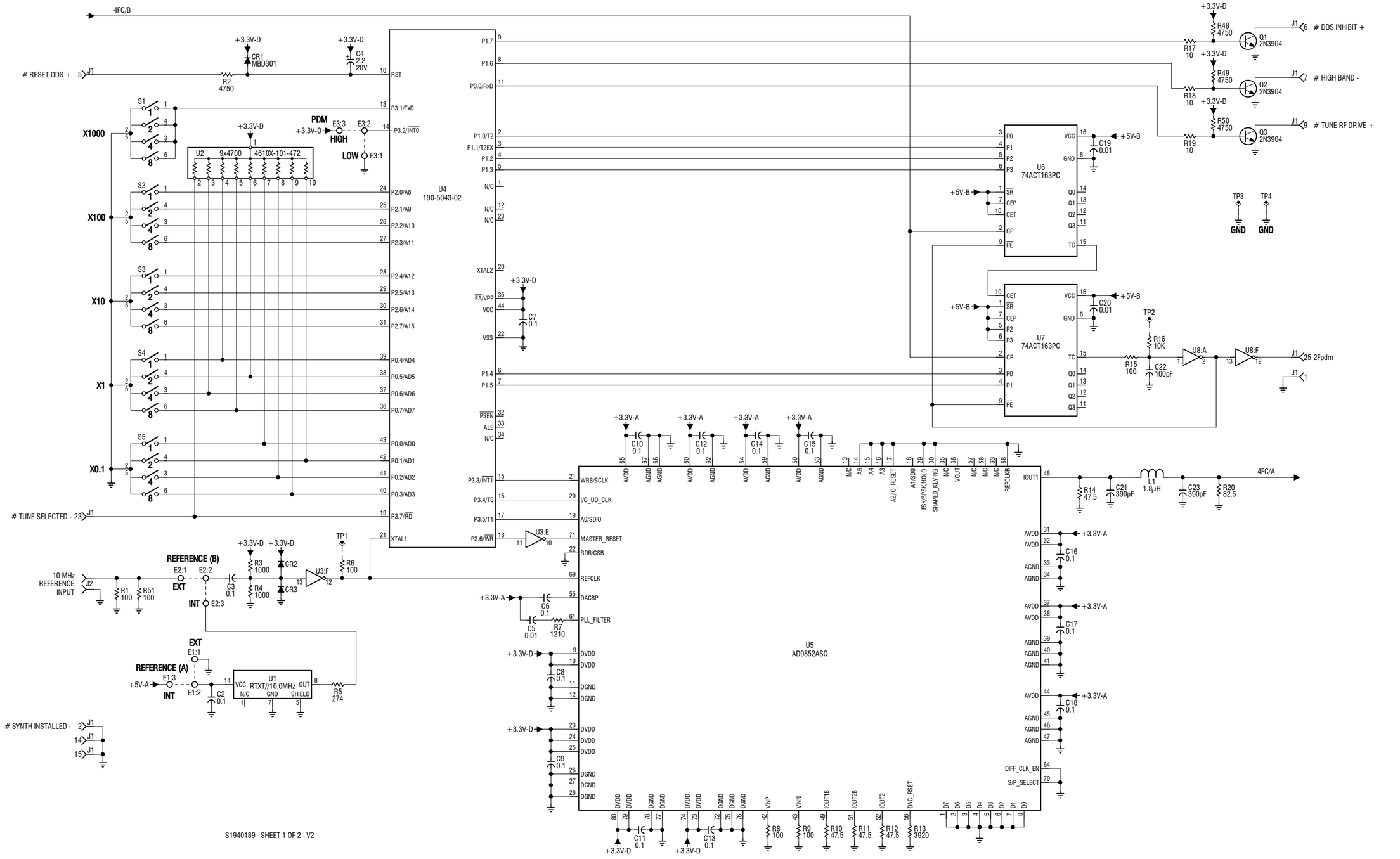


Figure SD-11: NAPI82A Exciter Interface PWB



S1940189 SHEET 1 OF 2 V2

Figure SD-12: NAPE70C RF Synthesizer PWB (Sheet 1 of 2)

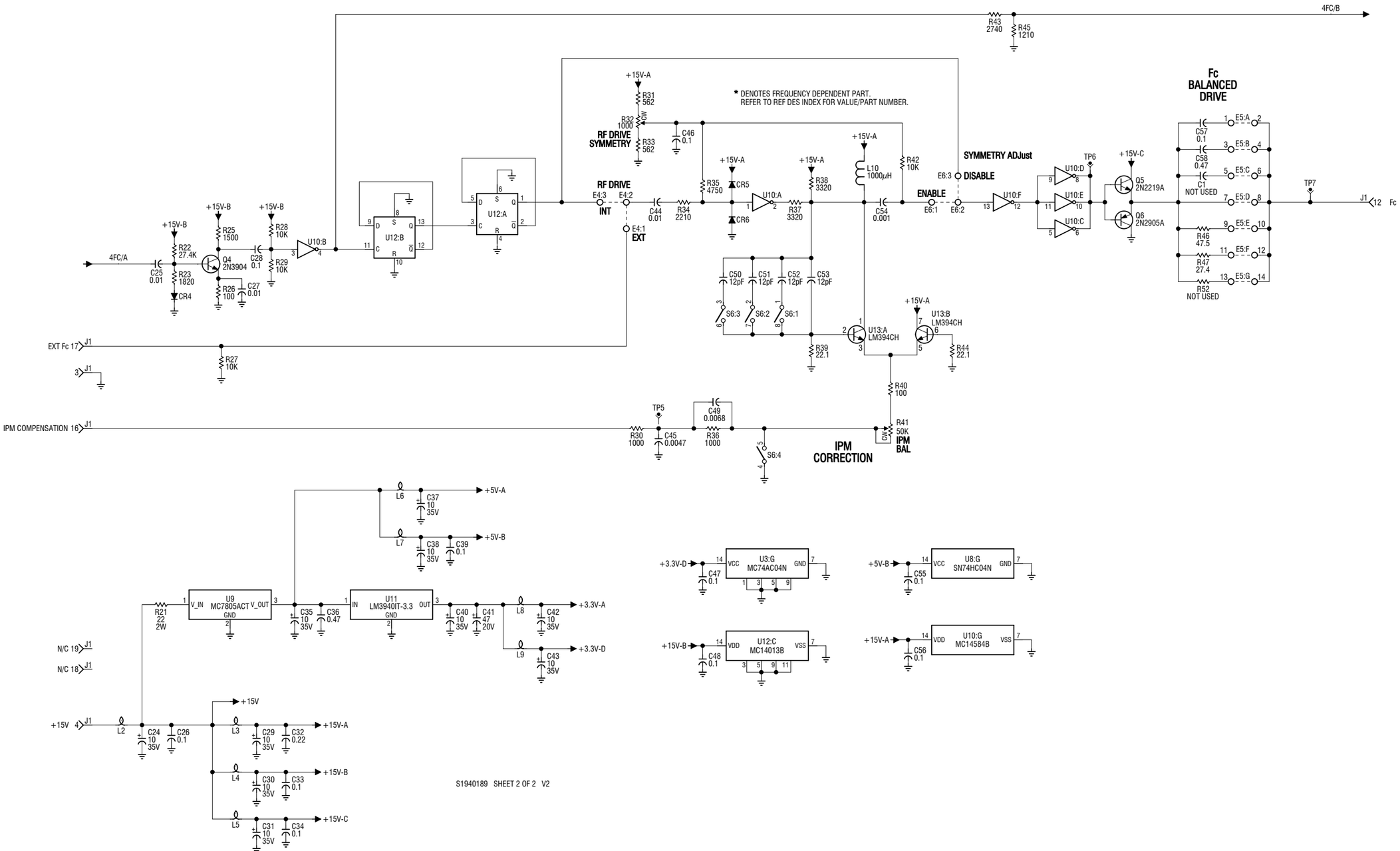


Figure SD-13: NAPE70C RF Synthesizer PWB (Sheet 2 of 2)

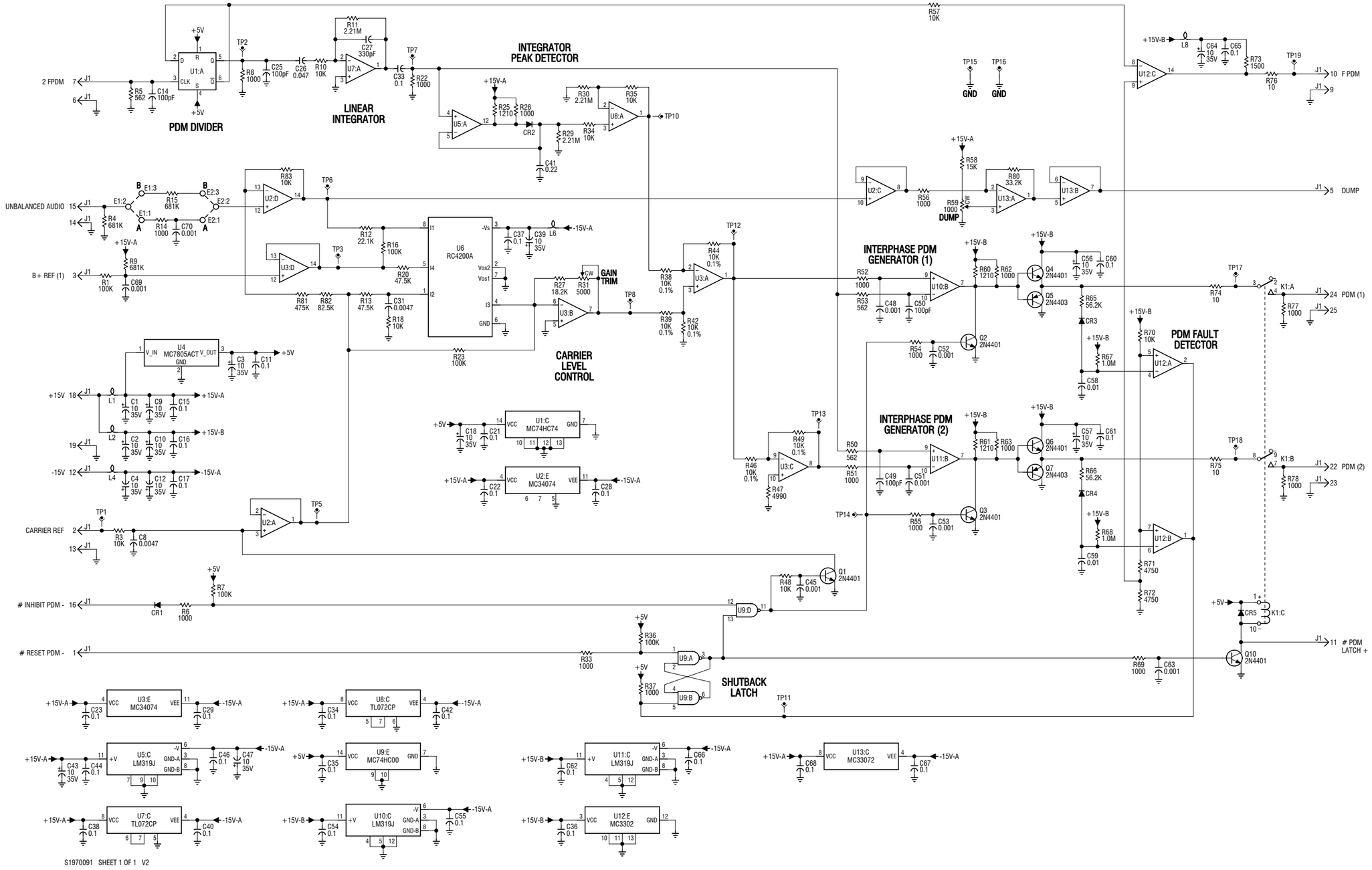


Figure SD-14: NAPM10B Interphase PDM Driver PWB

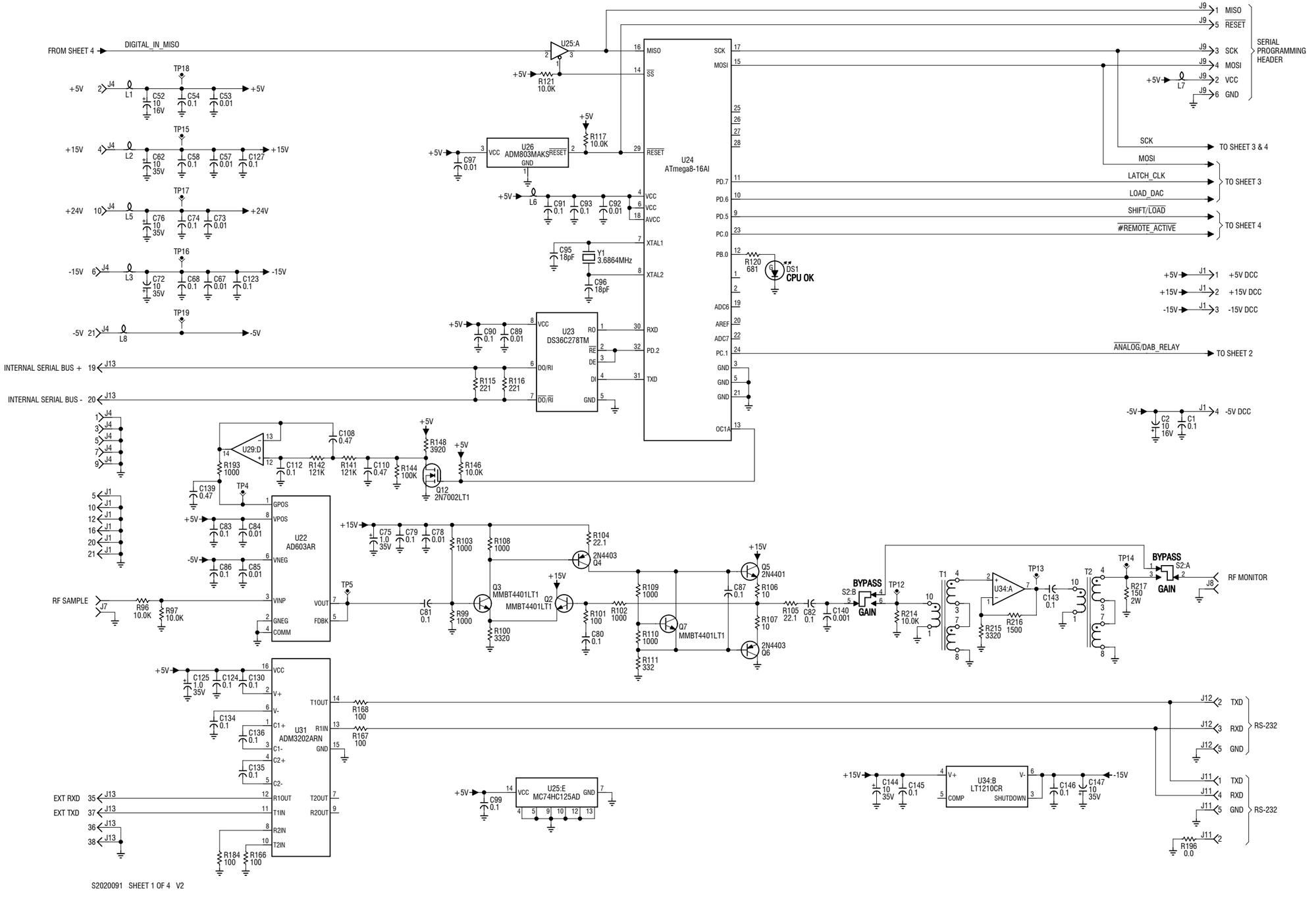
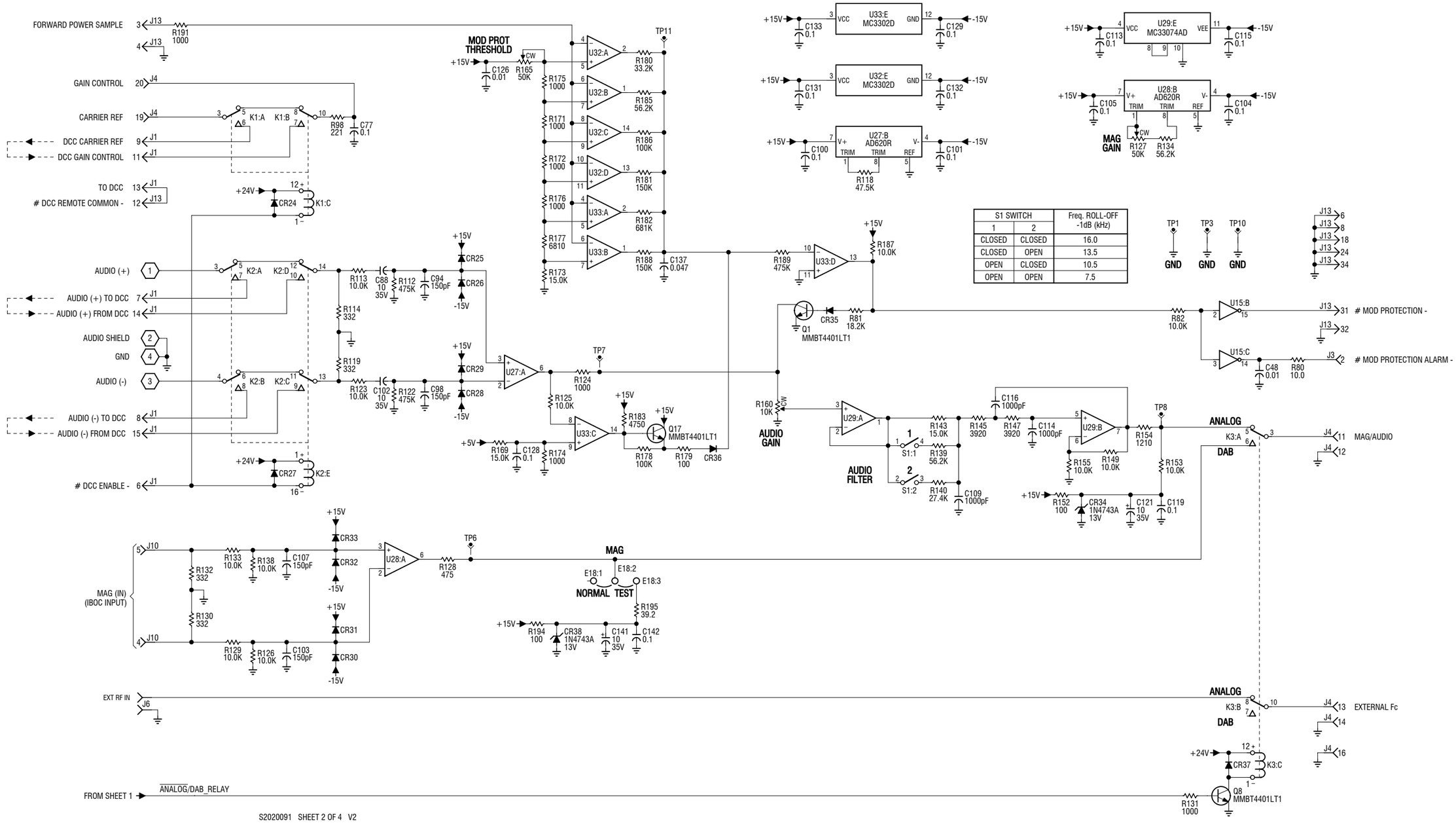


Figure SD-15: NAPI83/01A Remote Interface PWB (Sheet 1 of 4)



S1 SWITCH		Freq. ROLL-OFF -1dB (kHz)
1	2	
CLOSED	CLOSED	16.0
CLOSED	OPEN	13.5
OPEN	CLOSED	10.5
OPEN	OPEN	7.5

Figure SD-16: NAPI83/01A Remote Interface PWB (Sheet 2of 4)

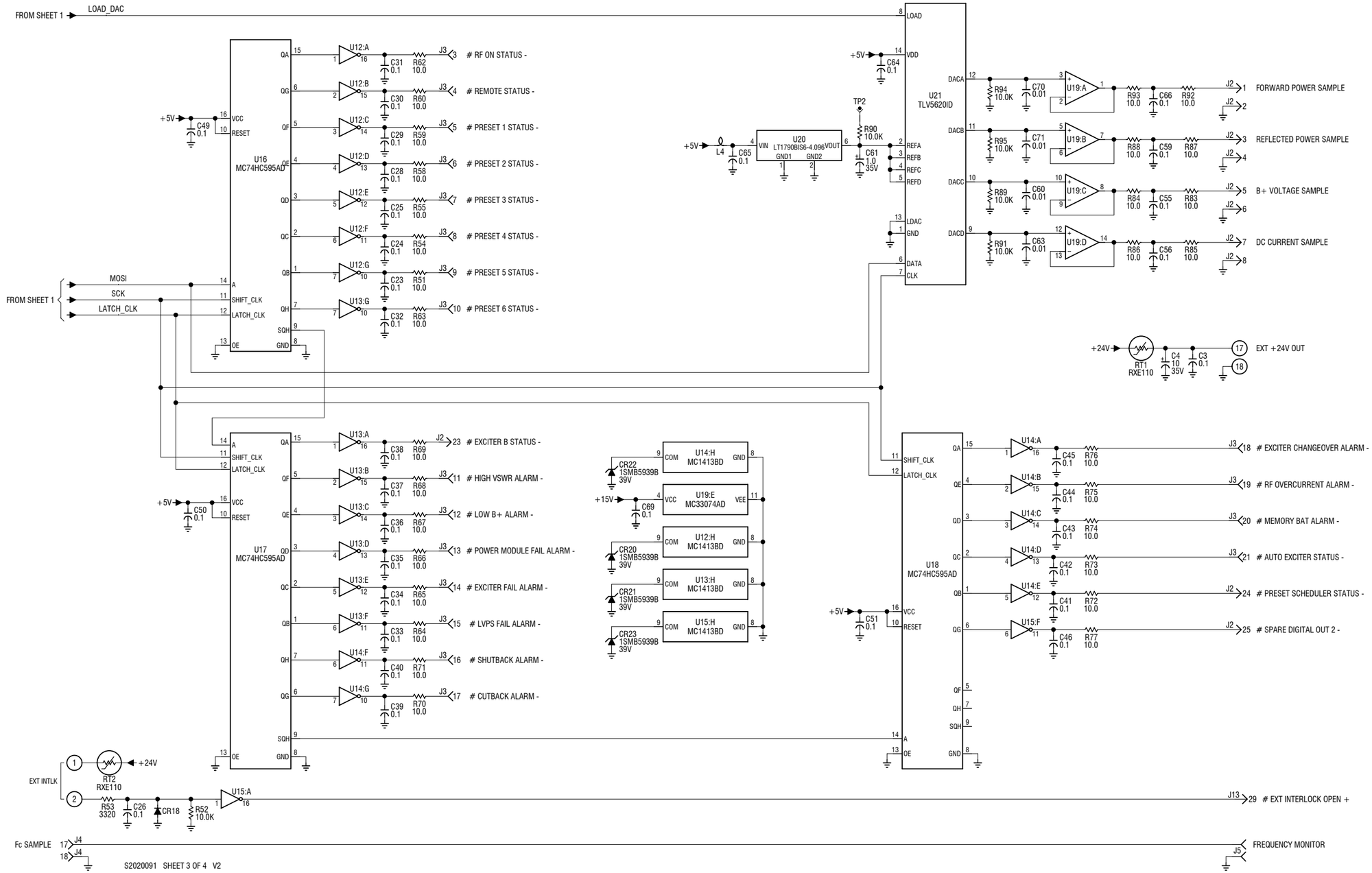


Figure SD-17: NAPI83/01A Remote Interface PWB (Sheet 3 of 4)

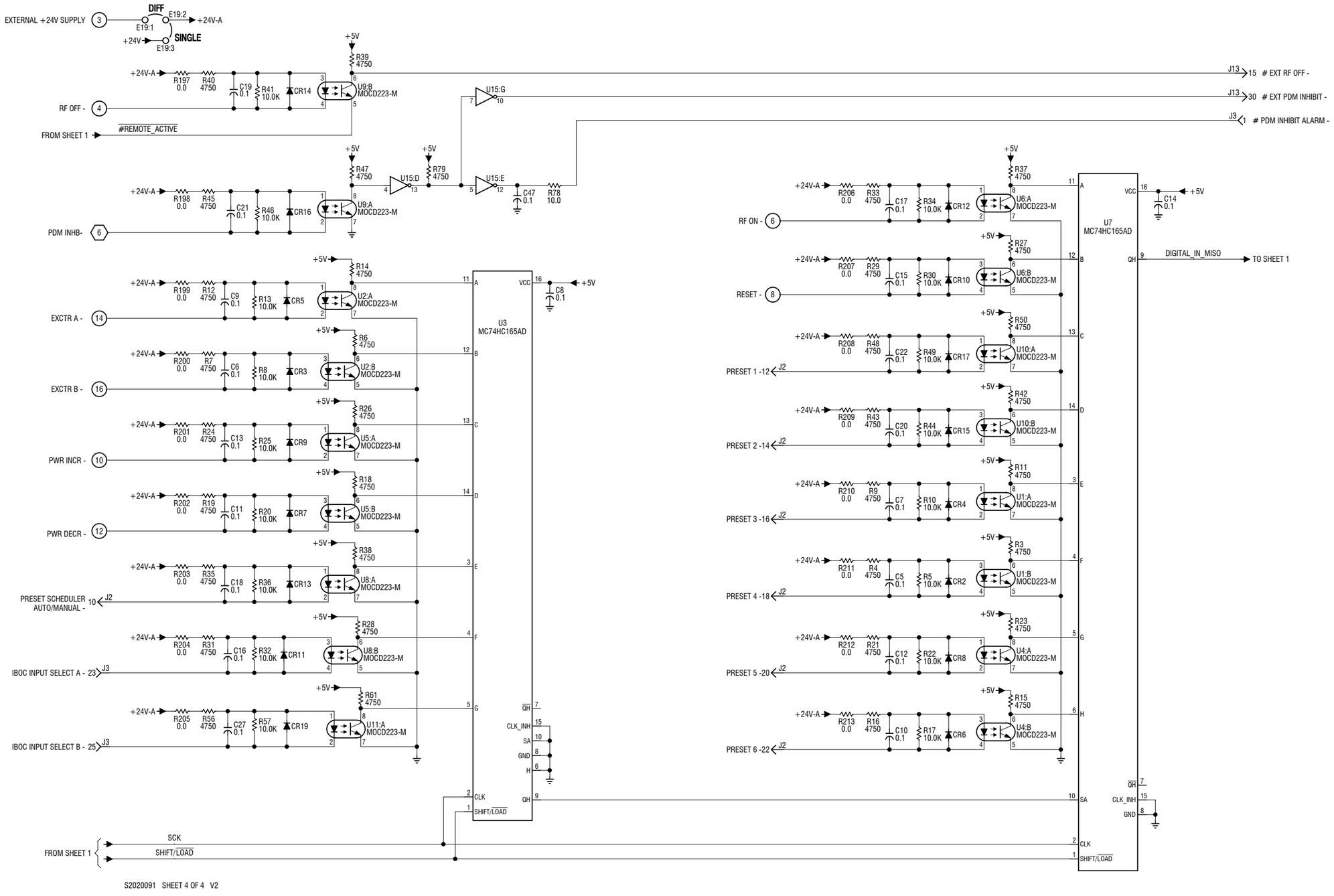
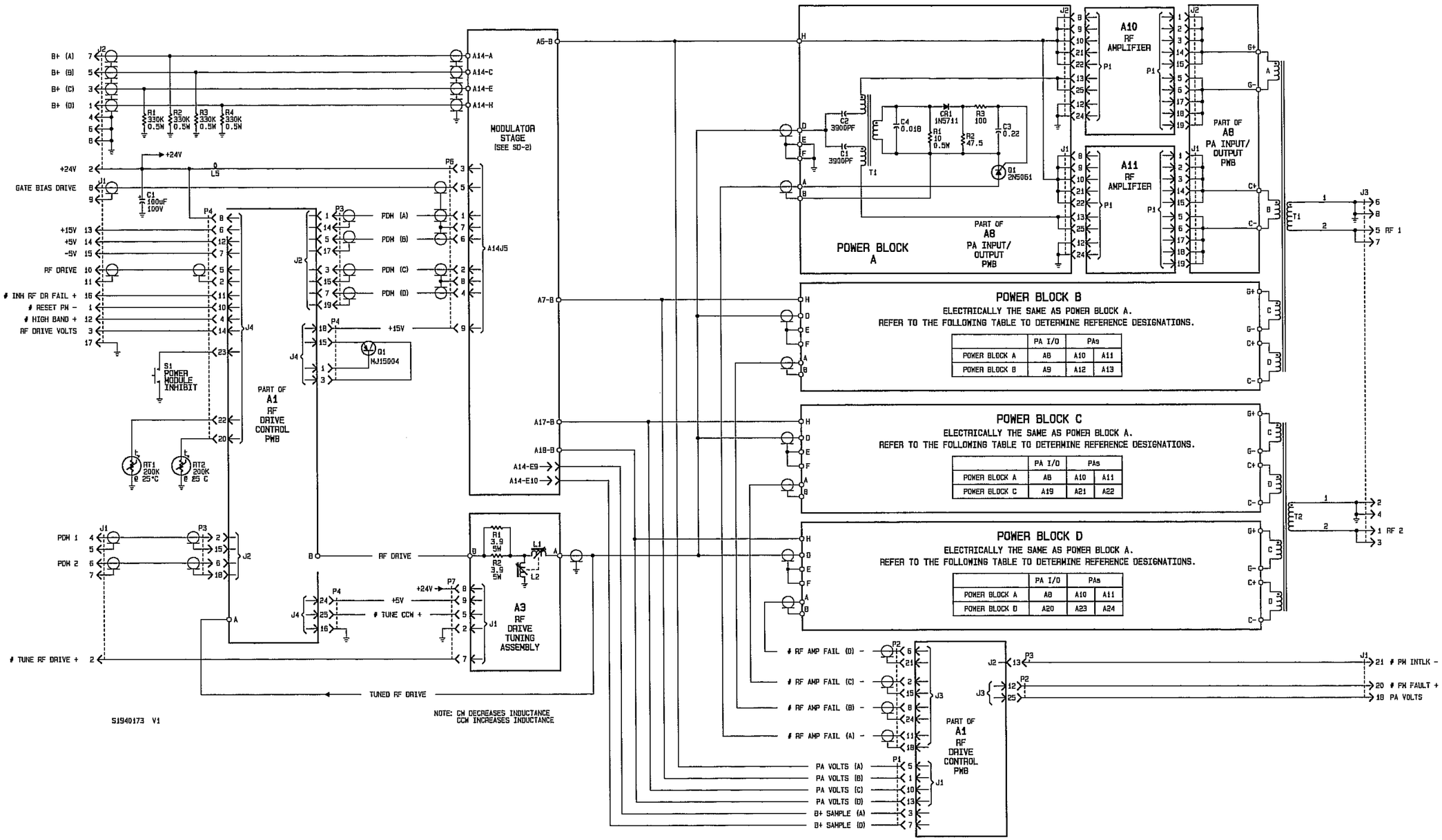


Figure SD-18: NAPI83/01A Remote Interface PWB (Sheet 4 of 4)



	PA I/O	PAs	
POWER BLOCK A	A8	A10	A11
POWER BLOCK B	A9	A12	A13

	PA I/O	PAs	
POWER BLOCK A	A8	A10	A11
POWER BLOCK C	A19	A21	A22

	PA I/O	PAs	
POWER BLOCK A	A8	A10	A11
POWER BLOCK D	A20	A23	A24

Figure SD-19: NAP34A RF Power Module - Overall (Sheet 1 of 2)

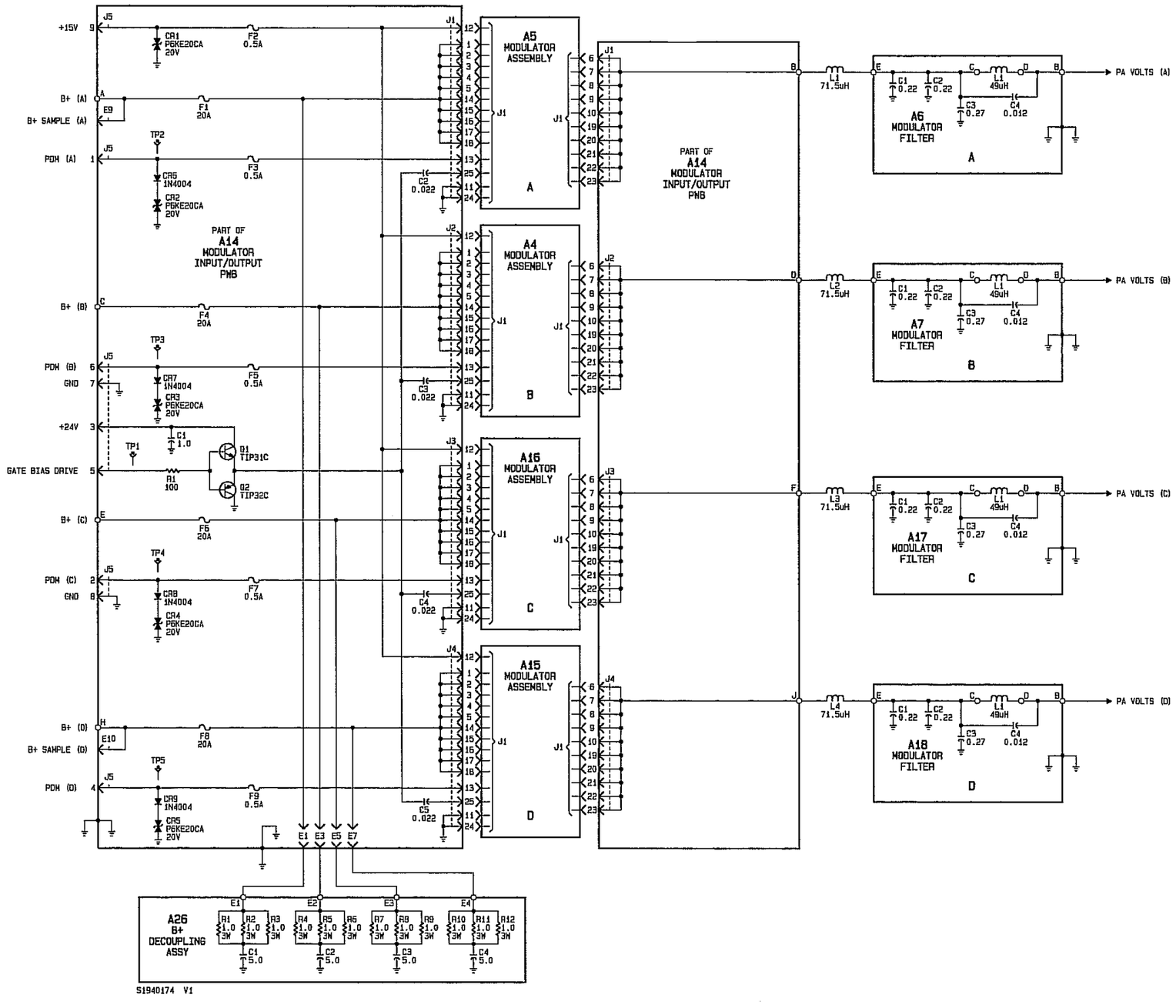


Figure SD-20: NAP34A RF Power Module - Modulator Stage (Sheet 2 of 2)

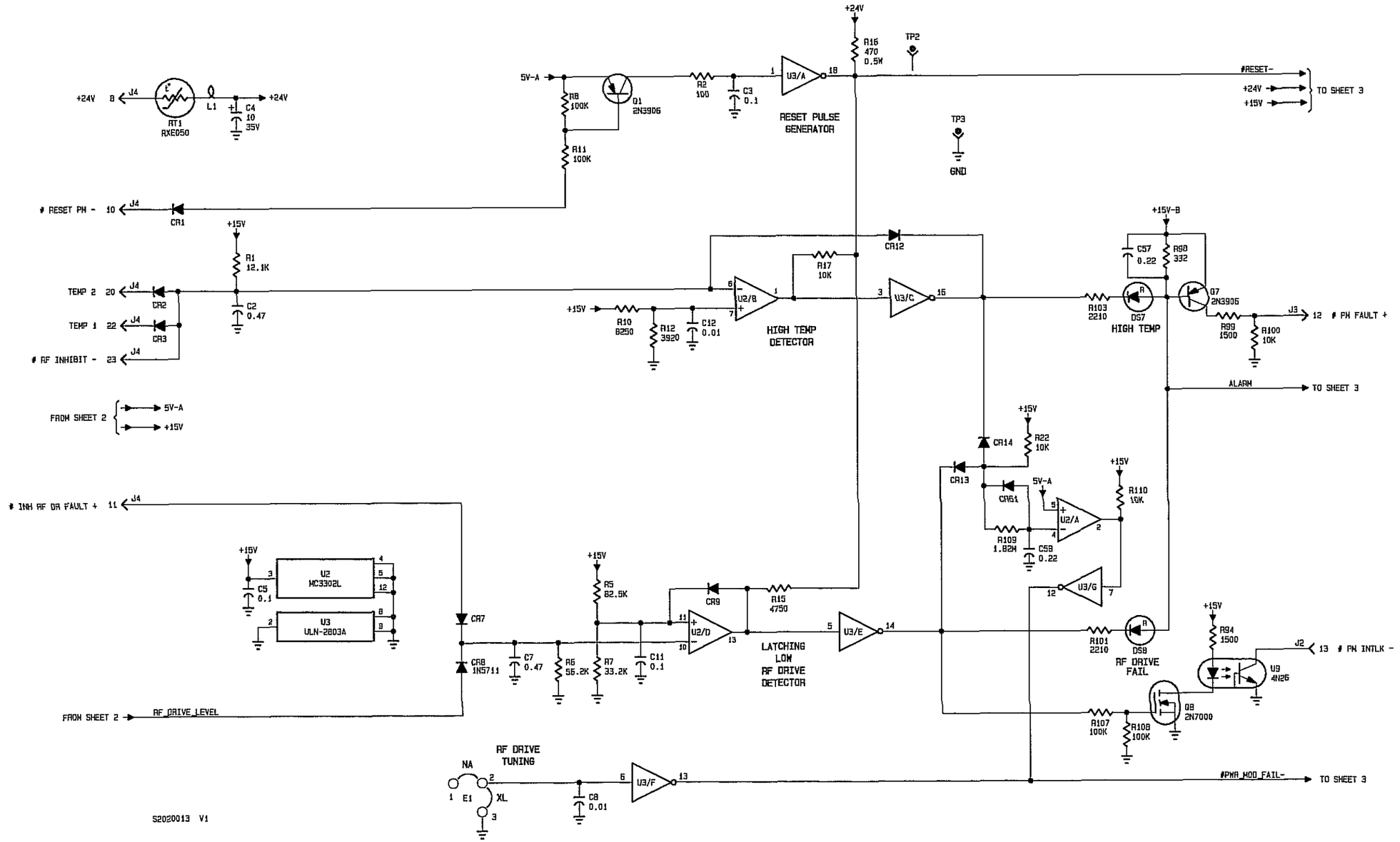


Figure SD-21: NAPC150A RF Drive Control PWB (Sheet 1 of 3)

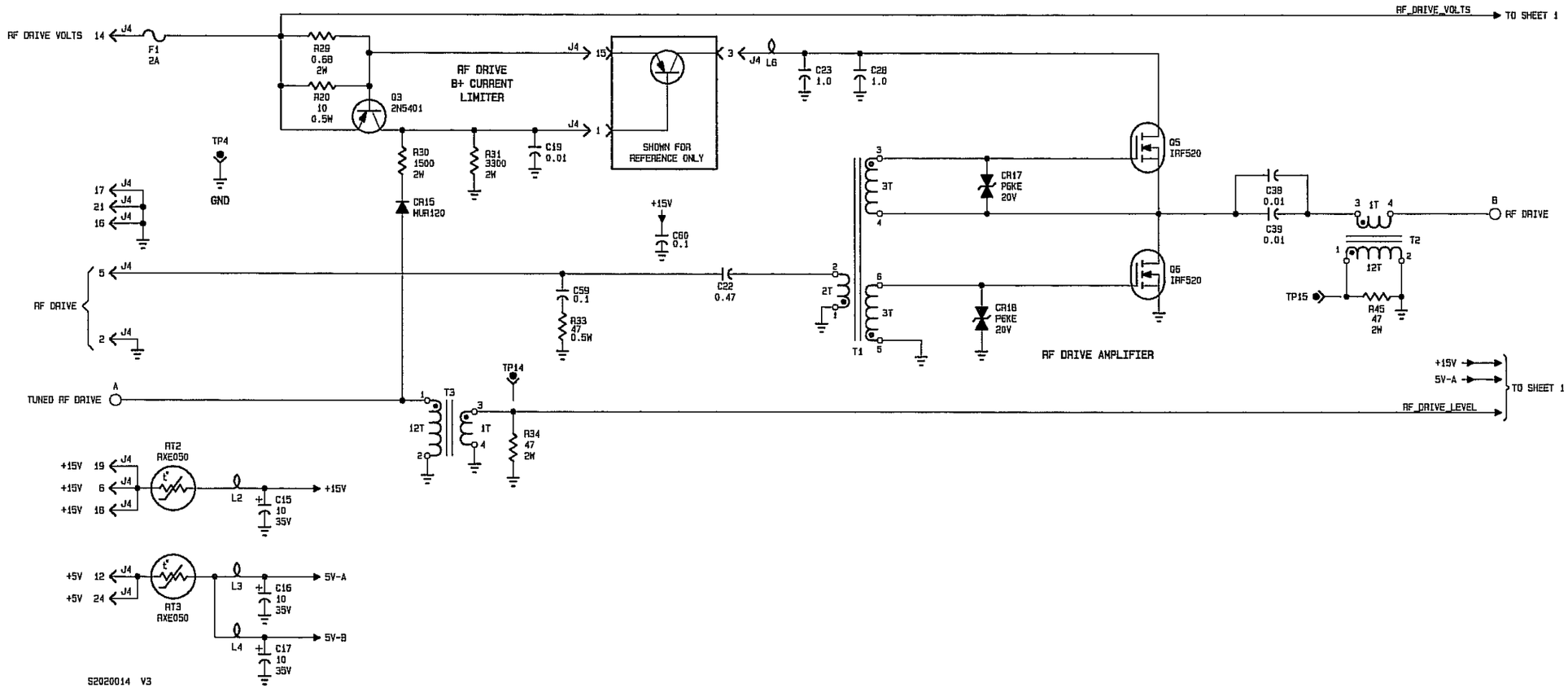
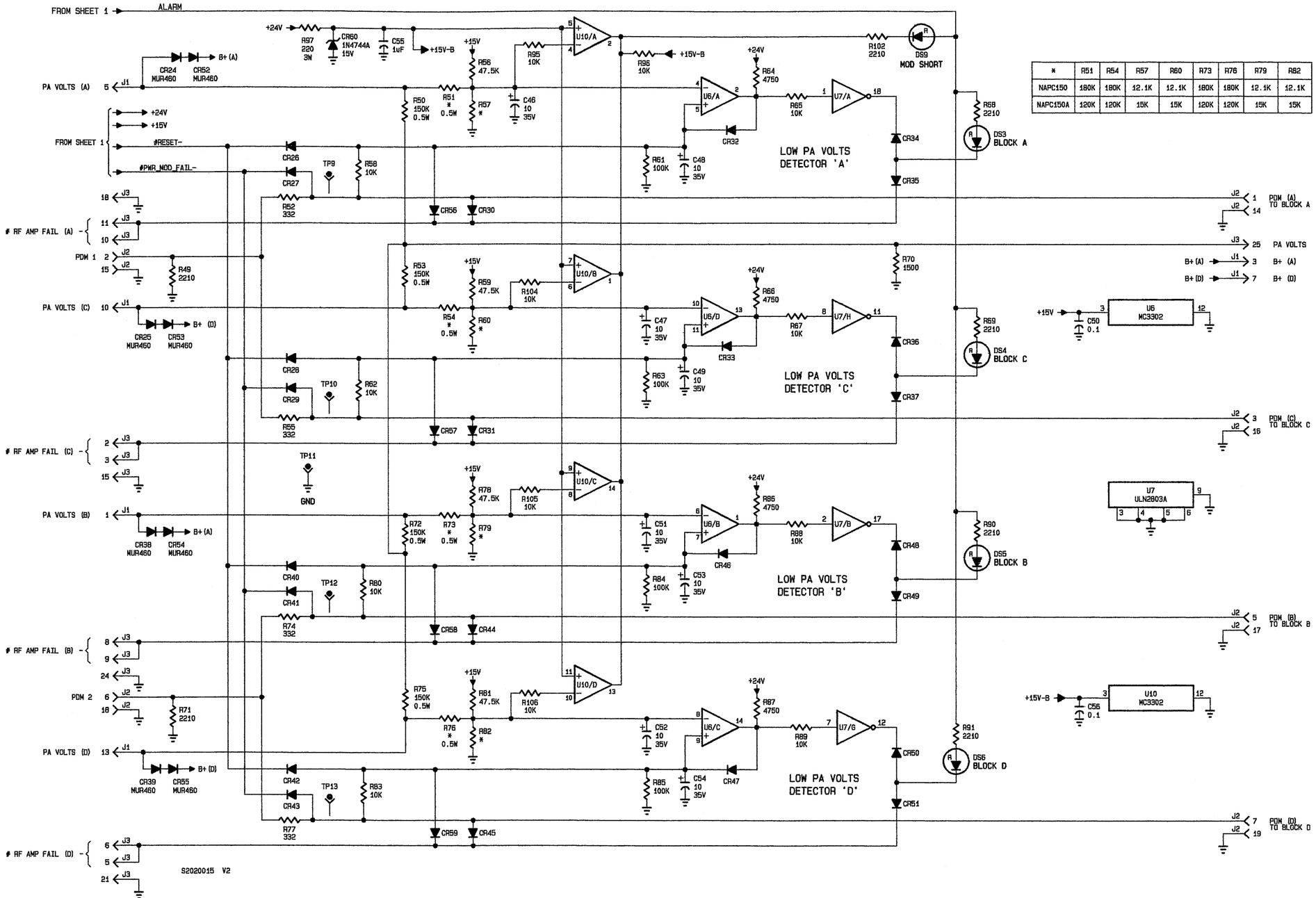


Figure SD-22: NAPC150A RF Drive Control PWB (Sheet 2 of 3)



*	R51	R54	R57	R60	R73	R76	R79	R82
NAPC150	180K	180K	12.1K	12.1K	180K	180K	12.1K	12.1K
NAPC150A	120K	120K	15K	15K	120K	120K	15K	15K

Figure SD-23: NAPC150A RF Drive Control PWB (Sheet 3 of 3)

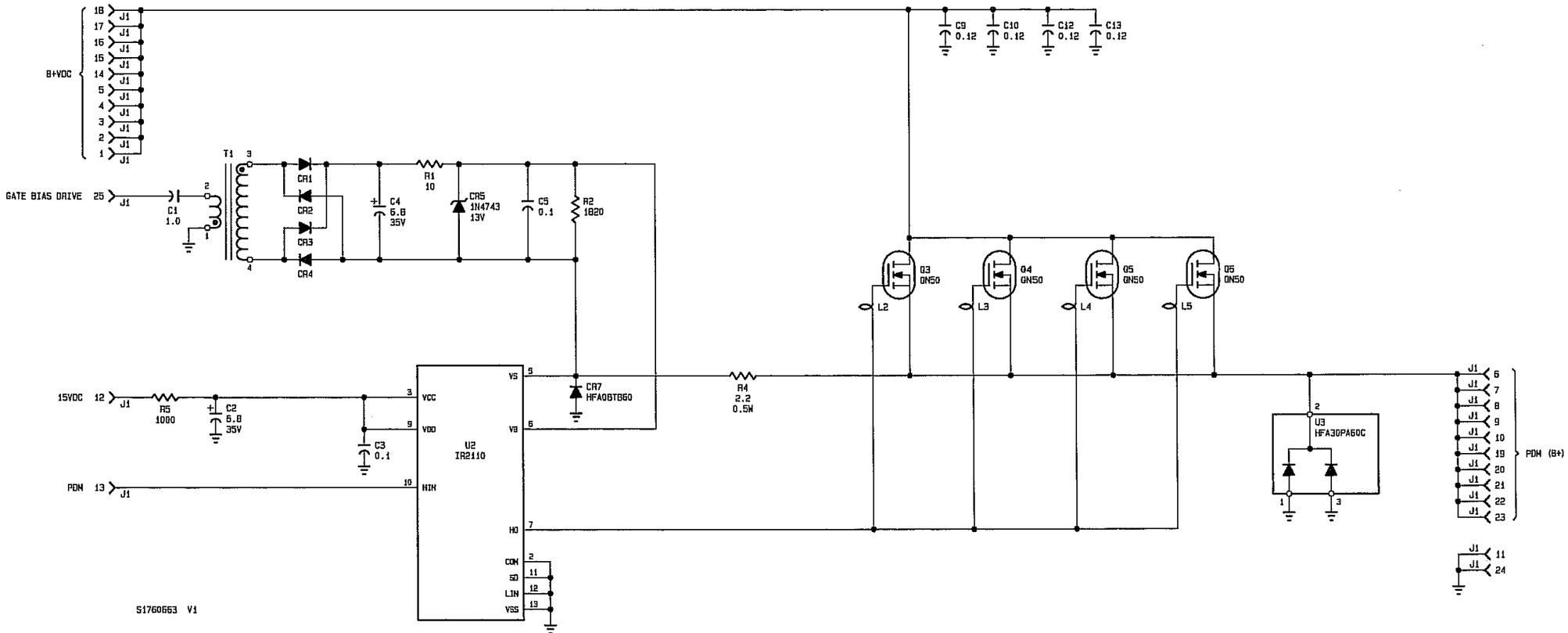


Figure SD-24: NASM07H Modulator Assembly

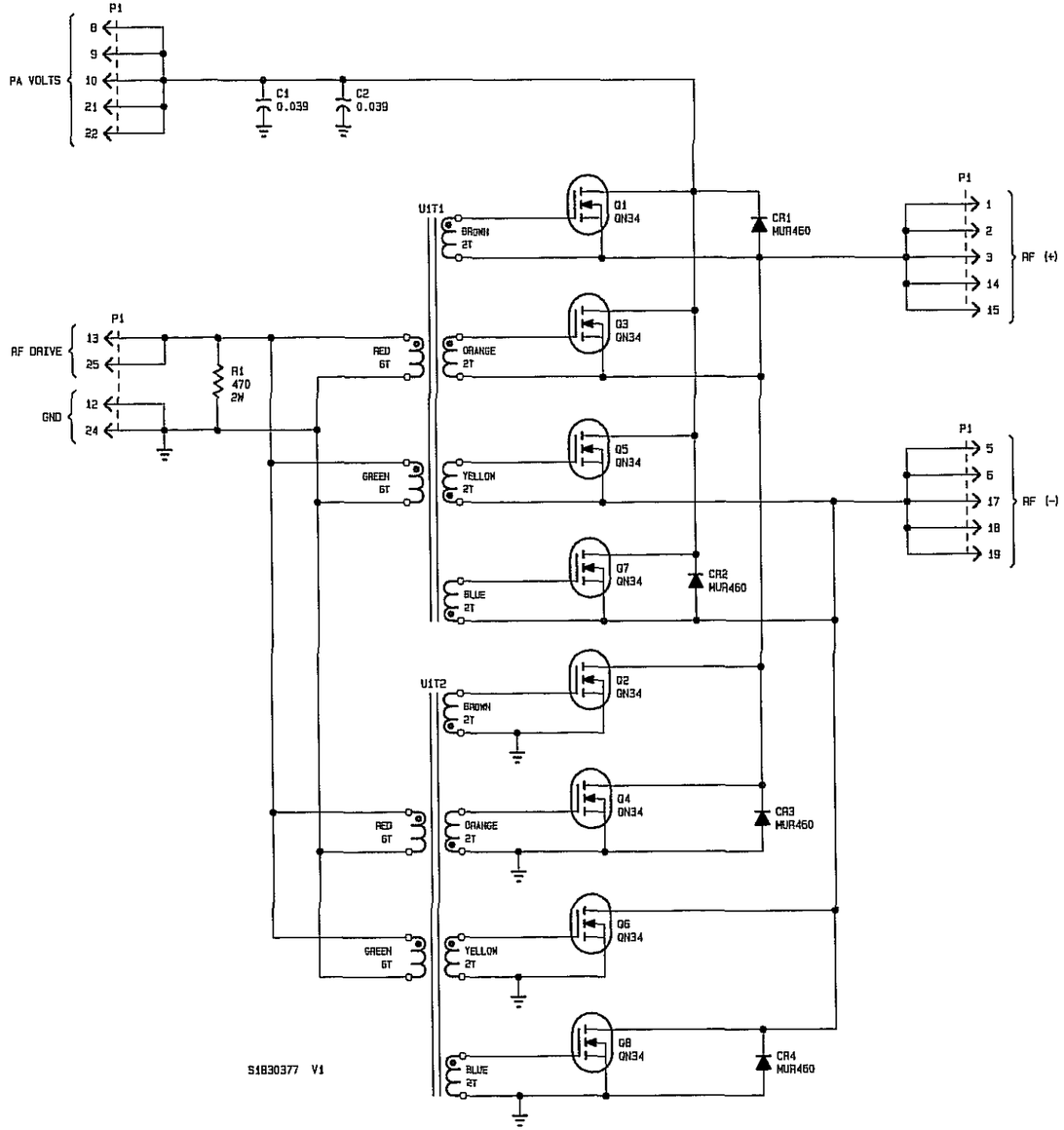
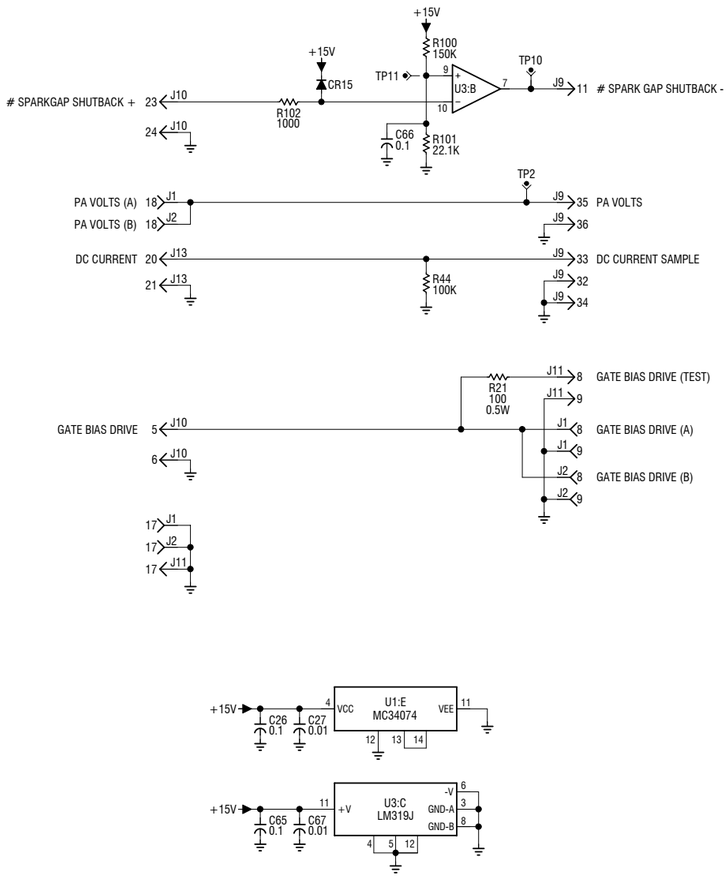


Figure SD-25: NAA51A/03 RF Amplifier Assembly



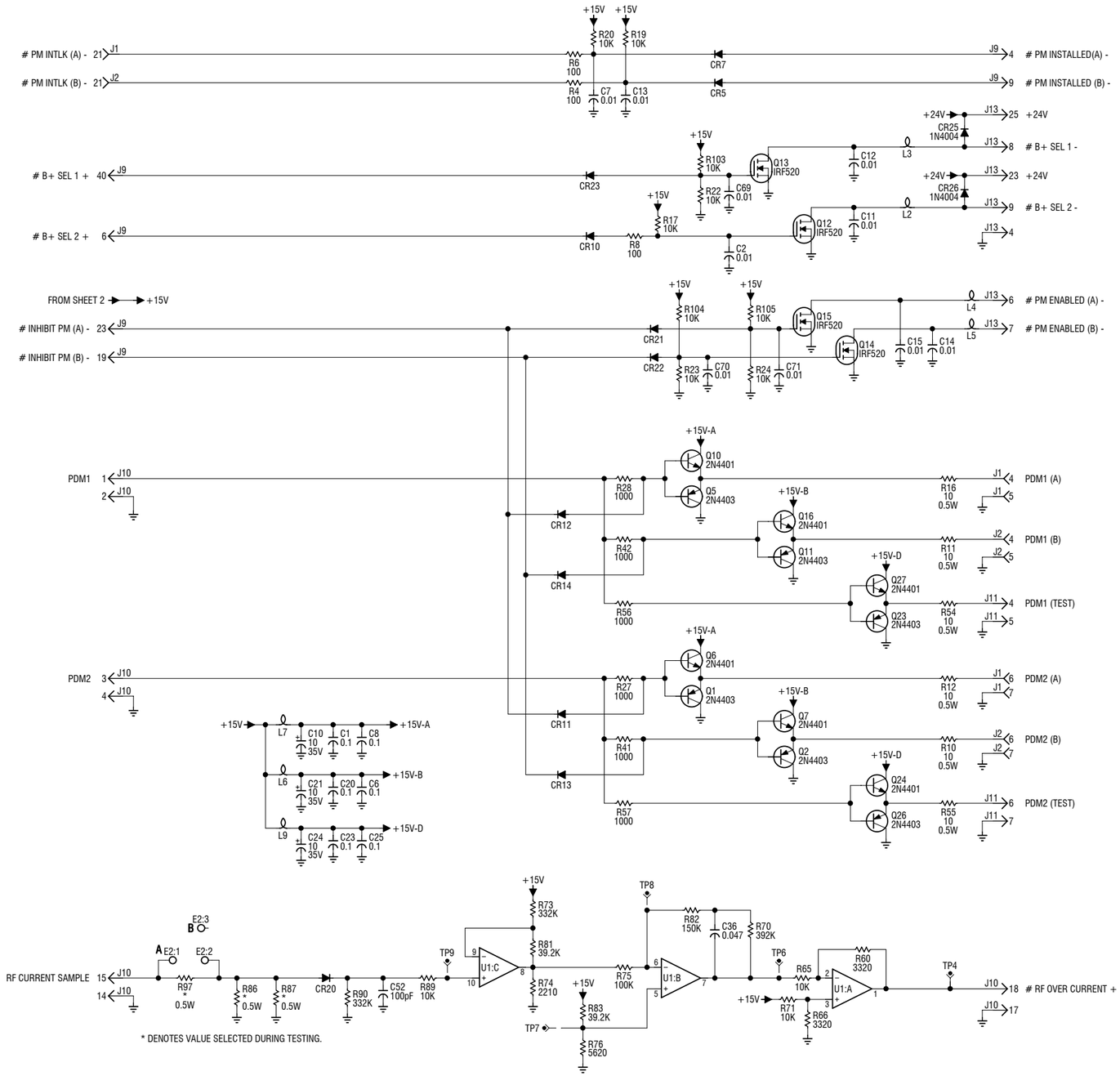
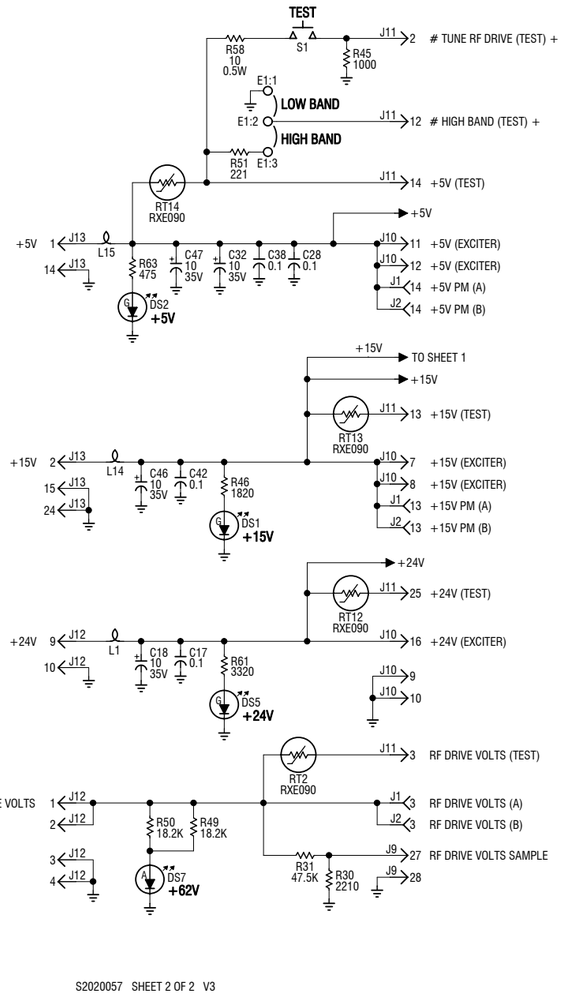


Figure SD-26: NAPI90/02 Distribution PWB (Sheet 1 of 2)



S2020057 SHEET 2 OF 2 V3

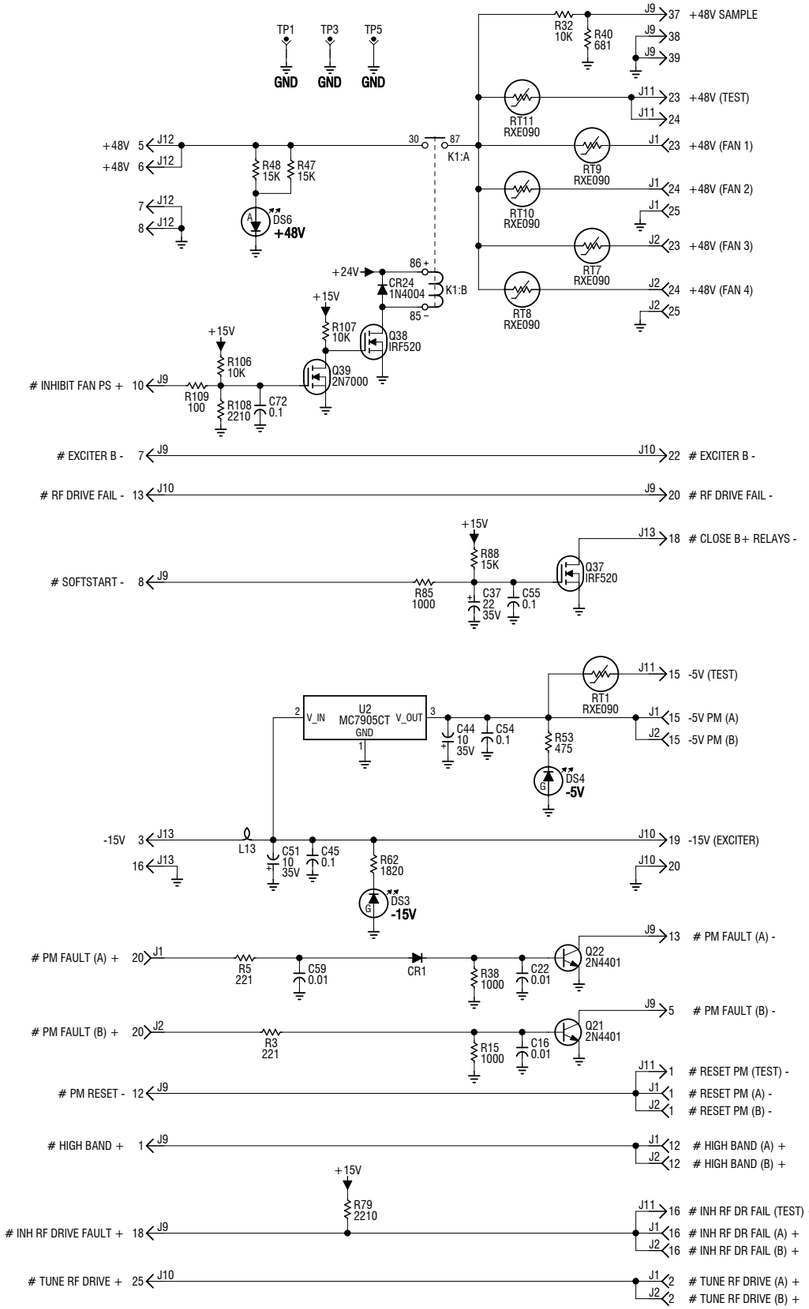


Figure SD-27: NAPI90/02 Distribution PWB (Sheet 2 of 2)

Figure SD-28: Not Used

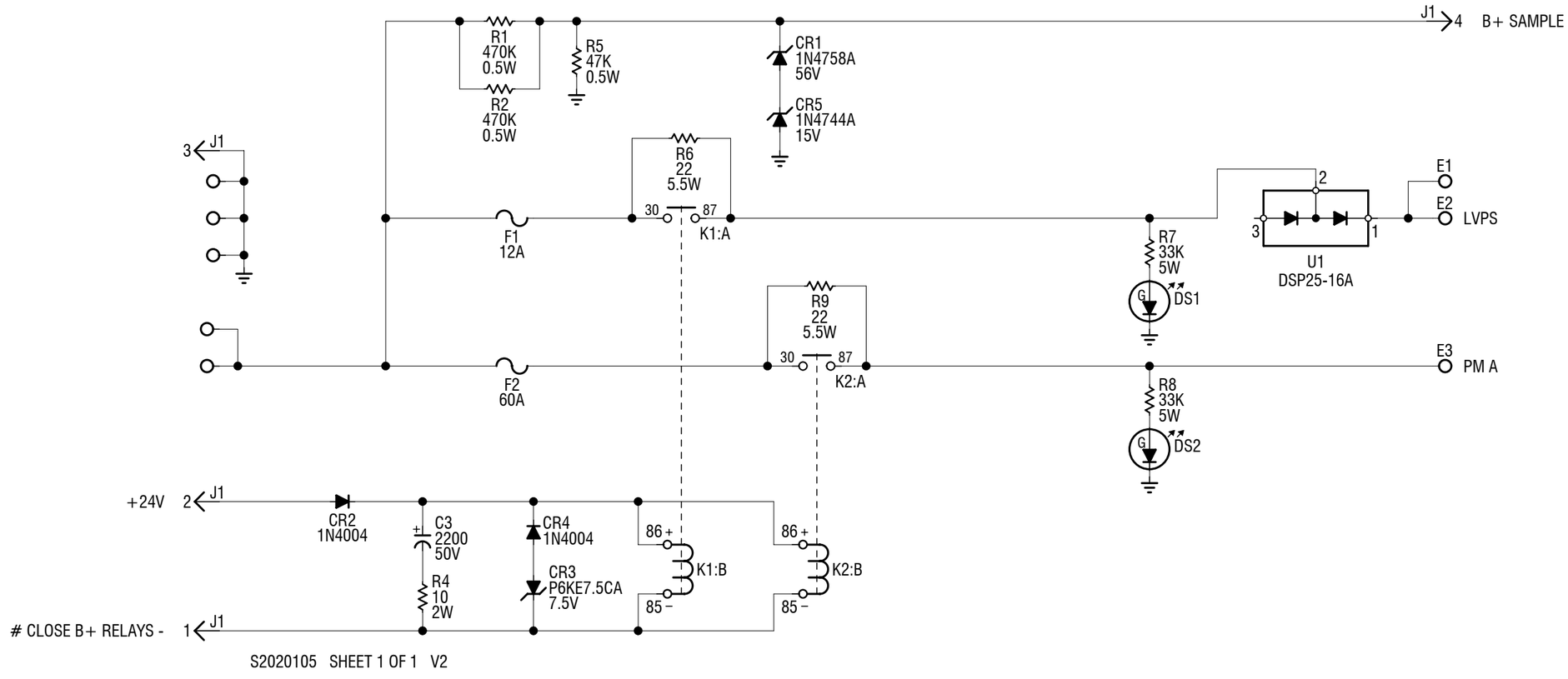


Figure SD-29A: NAPX31/05 B+ Distribution PWB

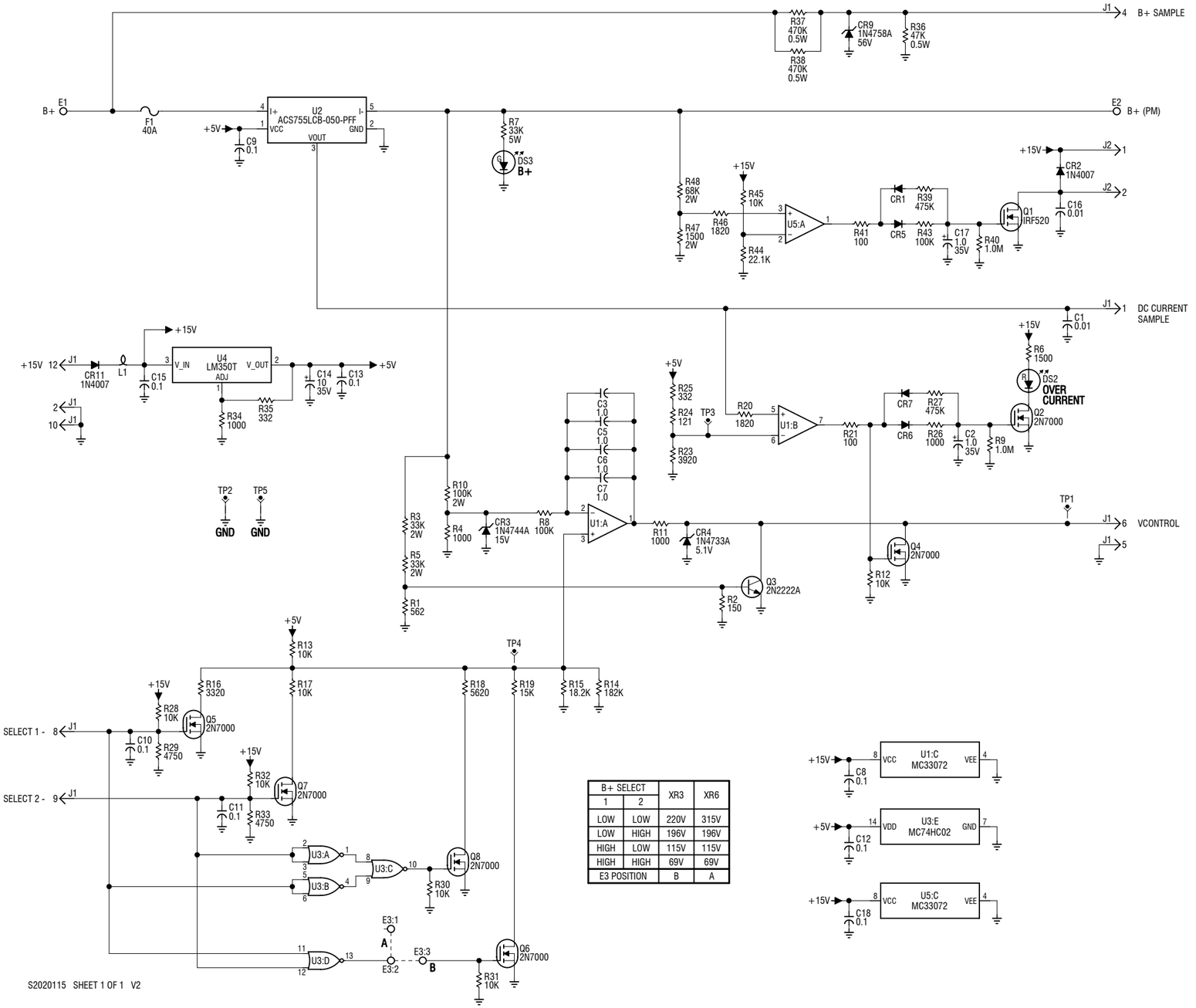


Figure SD-29B: NAPS36A SCR Control/B+ Distribution PWB, 1-Phase Ac

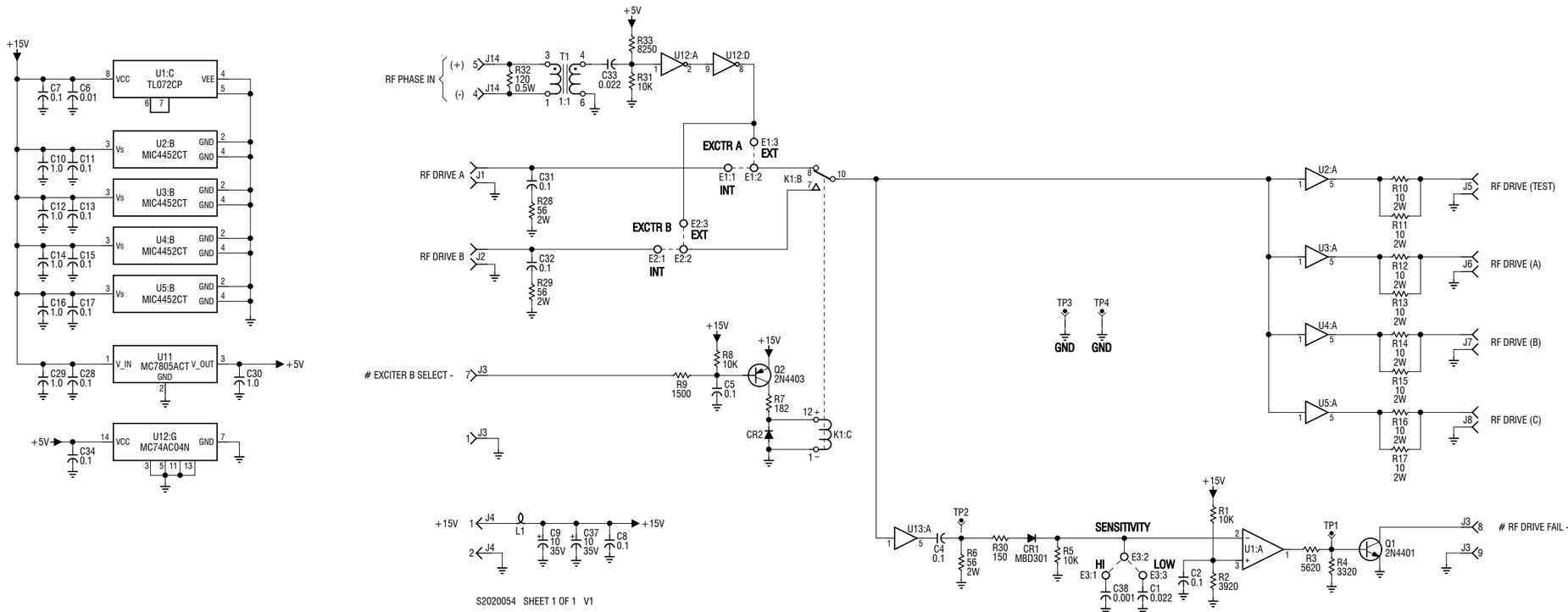


Figure SD-30: NAPE77A/01RF Drive Buffer PWB

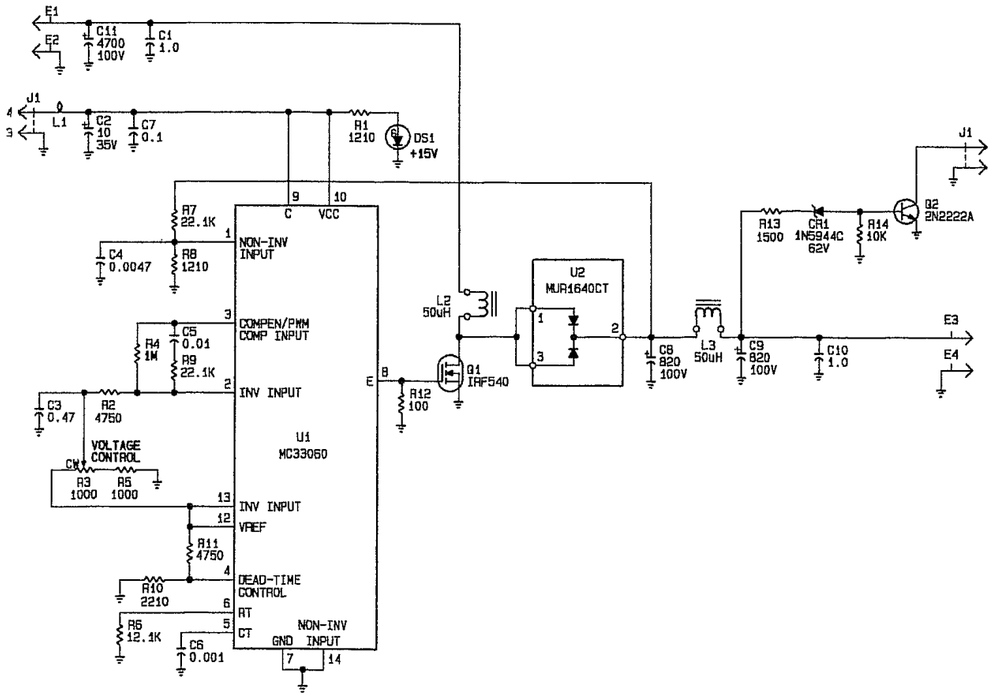


Figure SD-31: NAPS10B RF Drive Power Supply PWB

Section 6: Mechanical Drawings

Introduction

This section contains mechanical drawings for assemblies of the XR6/XR3. Dimensional drawings may be included. Refer to Table 6.1 for an itemized list.

Assembly detail drawings for assemblies and modules that have separate maintenance manuals are not included. Refer to the appropriate maintenance manual for the assembly detail of these assemblies.

Locating assembly detail drawings

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 6.1.

Content of mechanical drawings

Mechanical drawings are illustrations that depict the location of electrical components and show assembly outline detail. Dimensional information is included, where appropriate.

When a module or assembly is the subject of its own assembly detail drawing, and it is also shown in a higher-level assembly, the detail depicted in the higher-level assembly may have minor differences from the module or assembly actually installed. In this case, always refer to the assembly detail drawing of the module or assembly for detailed information.

Table 6.1: List of Mechanical Drawings

Figure #	Title
MD-1A	XR6/XR3 Transmitter, 3-Phase Ac
MD-1B	XR6/XR3 Transmitter, 1-Phase Ac
MD-2	NAC115A Control Panel (Rear View)
MD-3	NAPC147D Control/Display PWB
MD-4	NAPX05E/02 Dynamic Carrier Control PWB (optional)
MD-5	NAE93B Exciter Panel
MD-6	NAPI82A Exciter Interface PWB
MD-7	NAPE70C RF Synthesizer PWB
MD-8	NAPM10B Interphase PDM Driver PWB
MD-9	NAPI83/01A Remote Interface PWB
MD-10	NAPP02/02 RF Current Probe PWB
MD-11	Static Drain Choke PWB (202-6045)
MD-12	NAFP103/05 Forward/Reflected Power Probe Assembly
MD-13	NAX211/07 Surge Arrestor
MD-14	NAP34A RF Power Module (Front and Right-Side Views)
MD-15	NAP34A RF Power Module (Rear and Left-Side Views)
MD-16	NAPC150A RF Drive Control PWB
MD-17	NAX180C RF Tuning Assembly
MD-18	NASM07H Modulator Assembly
MD-19	PA Input/Output PWB (176-1065-04 and -05)
MD-20	NAA51A/03 RF Amplifier Assembly
MD-21	NAPI47B Modulator Input/Output PWB
MD-22	Capacitor Bracket Assembly (194-1012)
MD-23	NAPI90/02 Distribution PWB
MD-24	Relay Assembly (202-7019-01)
MD-25	Fan Tray (202-7020)
MD-26	NAPS10C RF Drive Power Supply PWB (62 V)
MD-27A	NAPX31/05 B+ Distribution PWB, 3-Phase Ac
MD-27B	NAPS36A SCR Control/B+ Distribution PWB, 1-Phase Ac
MD-28A	Rectifier Assembly (202-7017), 3-Phase Ac
MD-28B	Rectifier Assembly (202-7220), 1-Phase Ac
MD-29	NAPE77A/01 RF Drive Buffer PWB

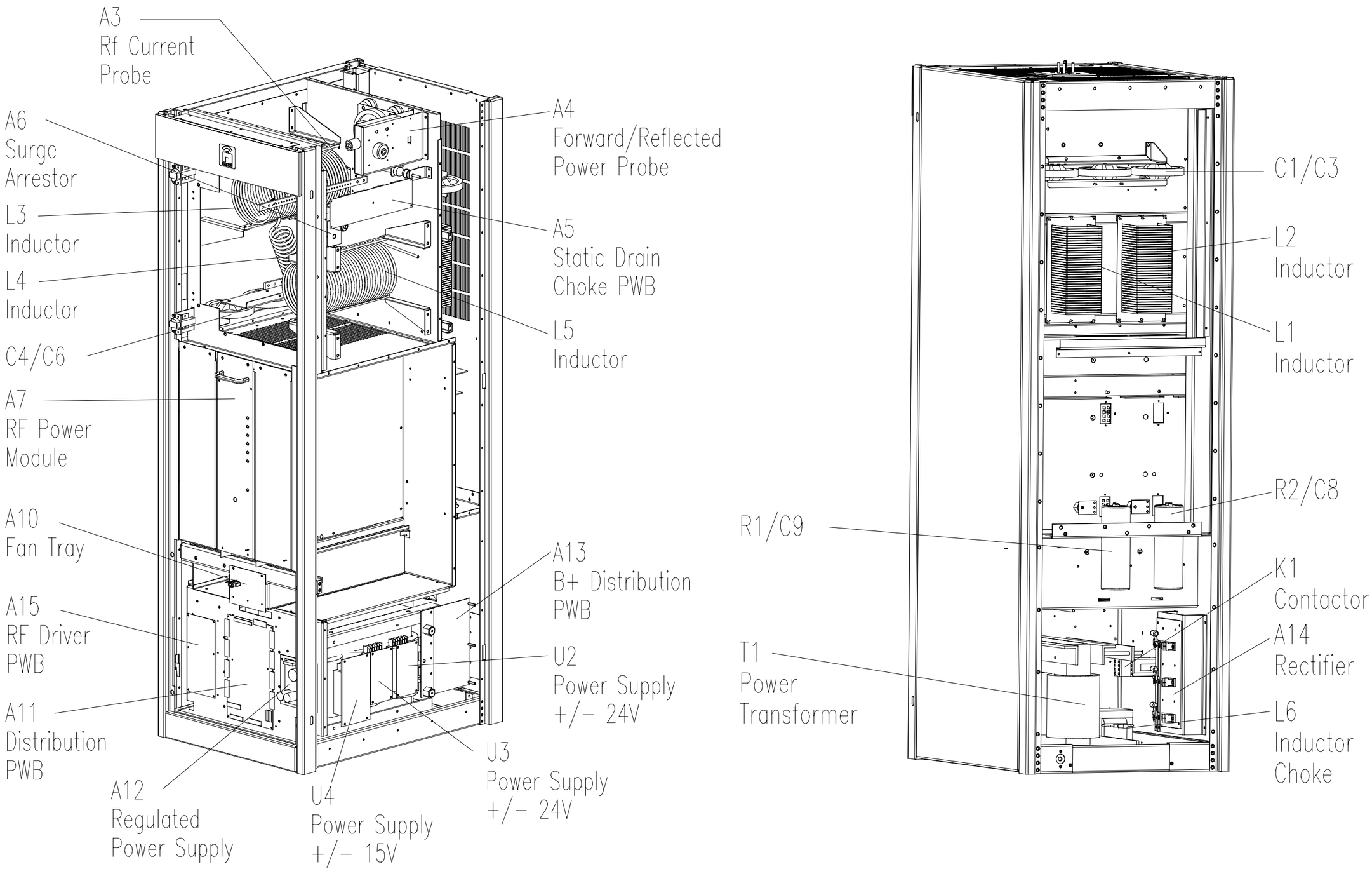


Figure MD-1A: XR6/XR3 Transmitter (3-Phase Ac)

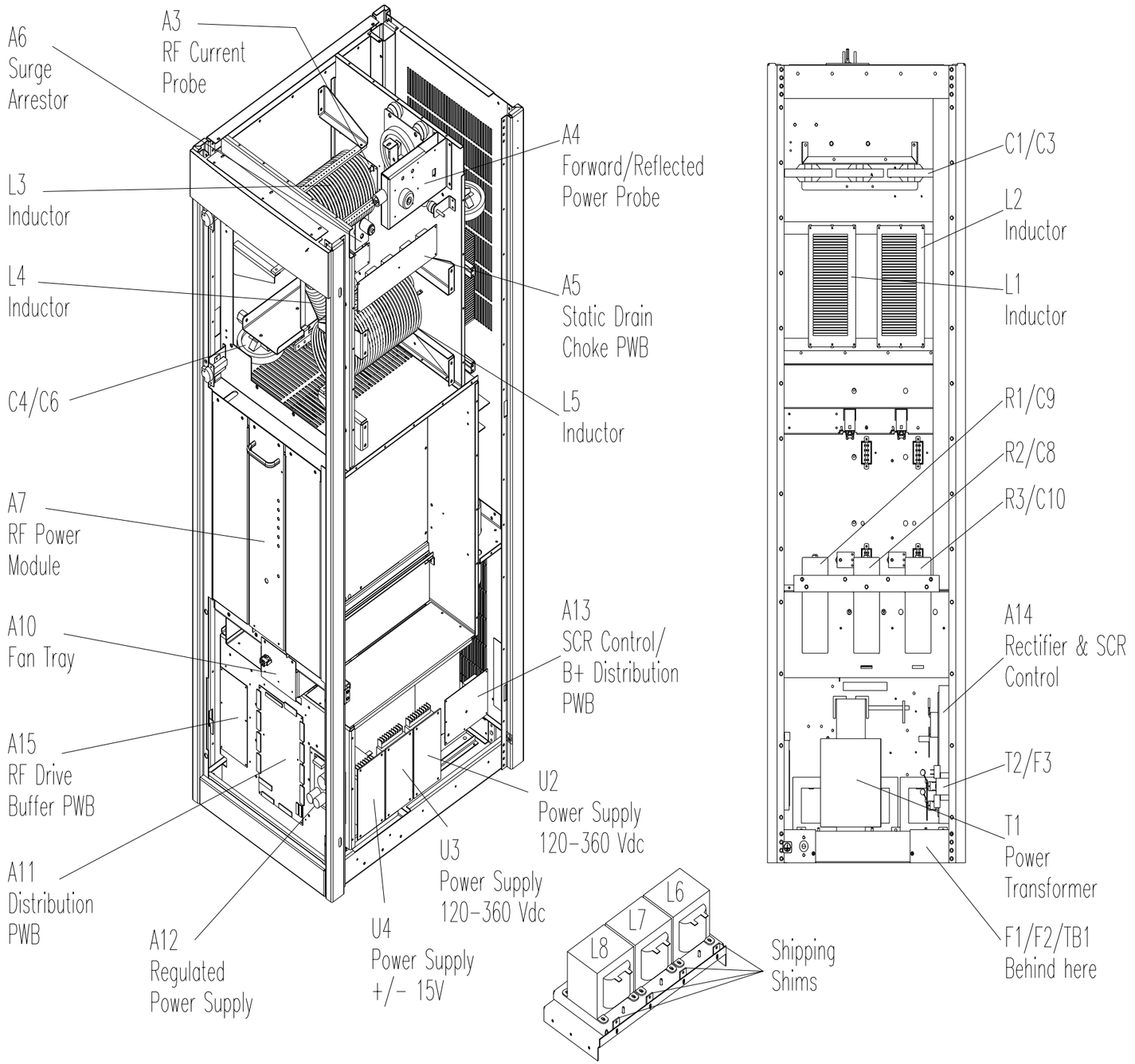


Figure MD-1B: XR6/XR3 Transmitter (1-Phase Ac)

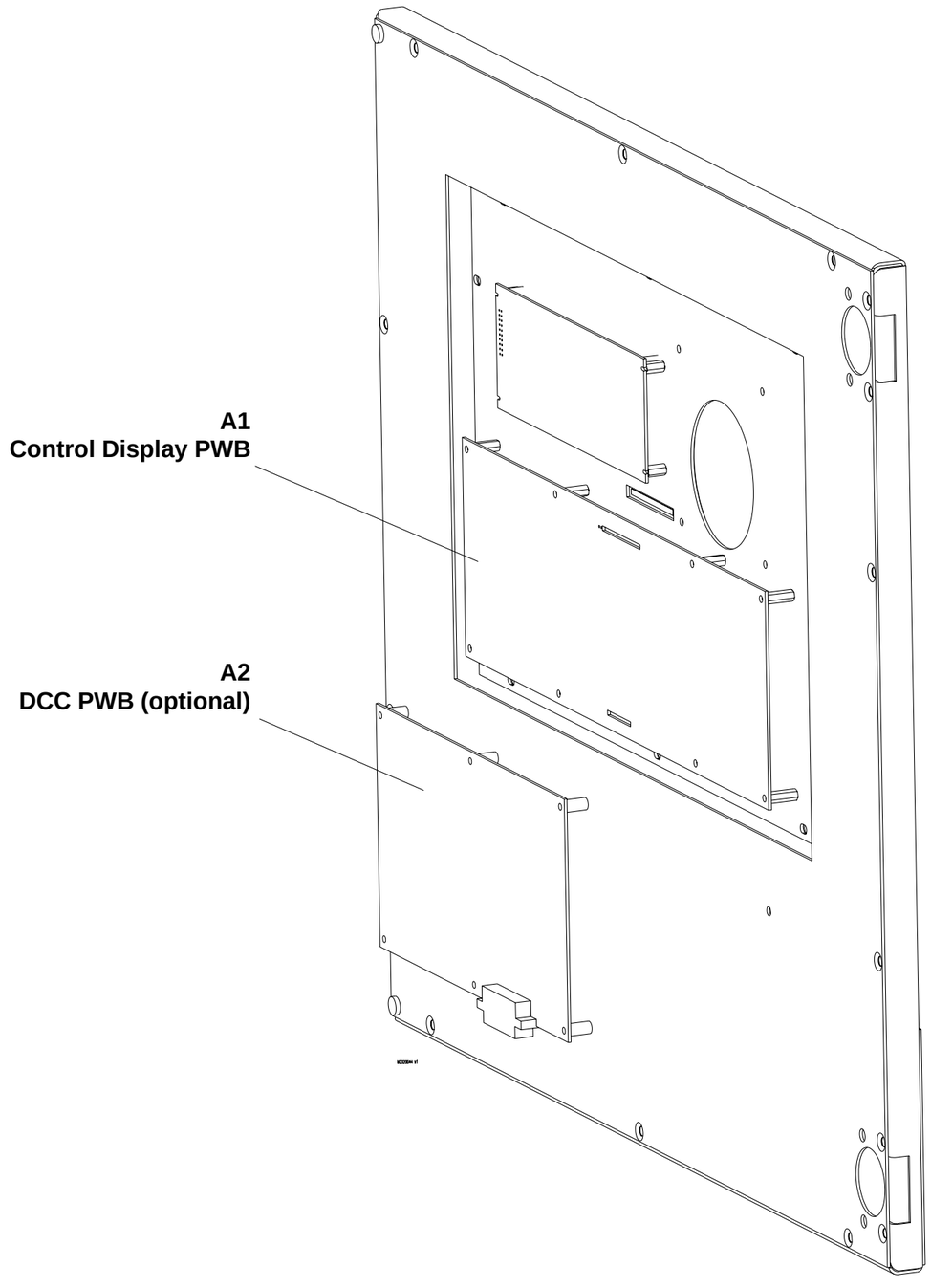


Figure MD-2: NAC115A Control Panel (Rear View)

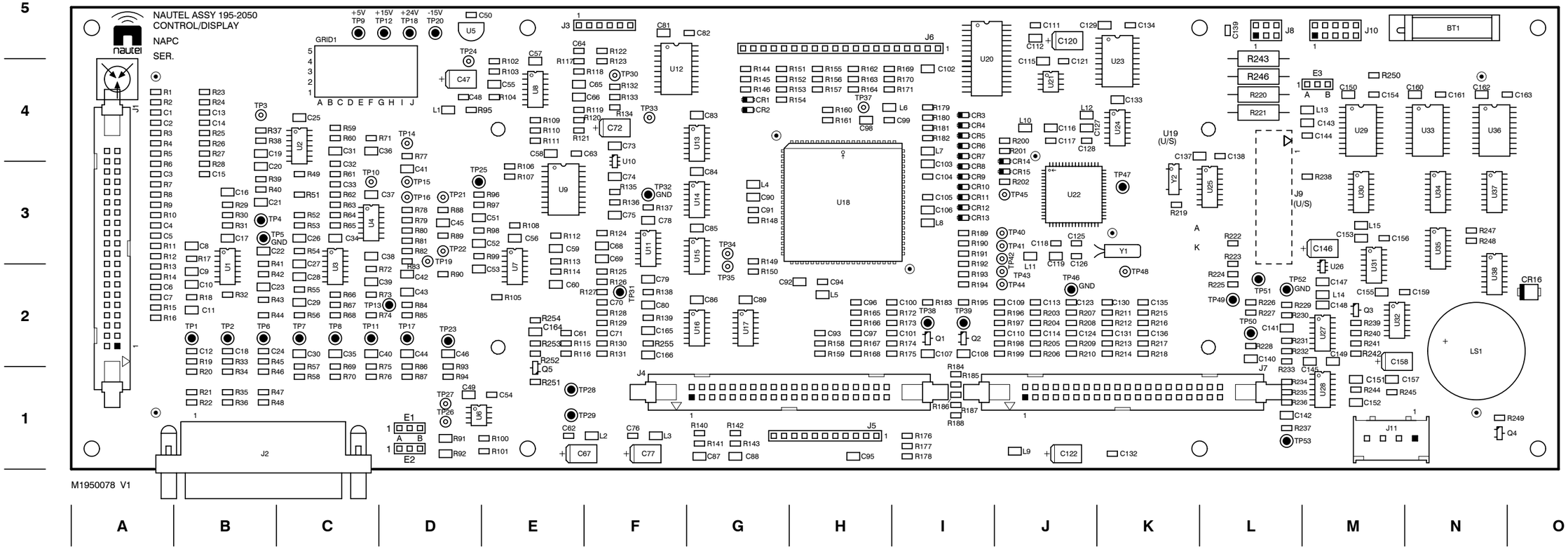
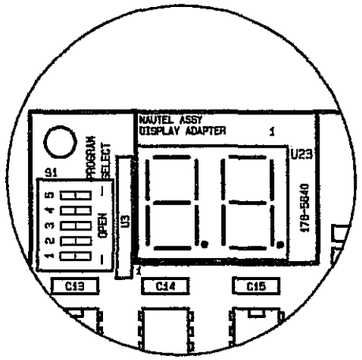
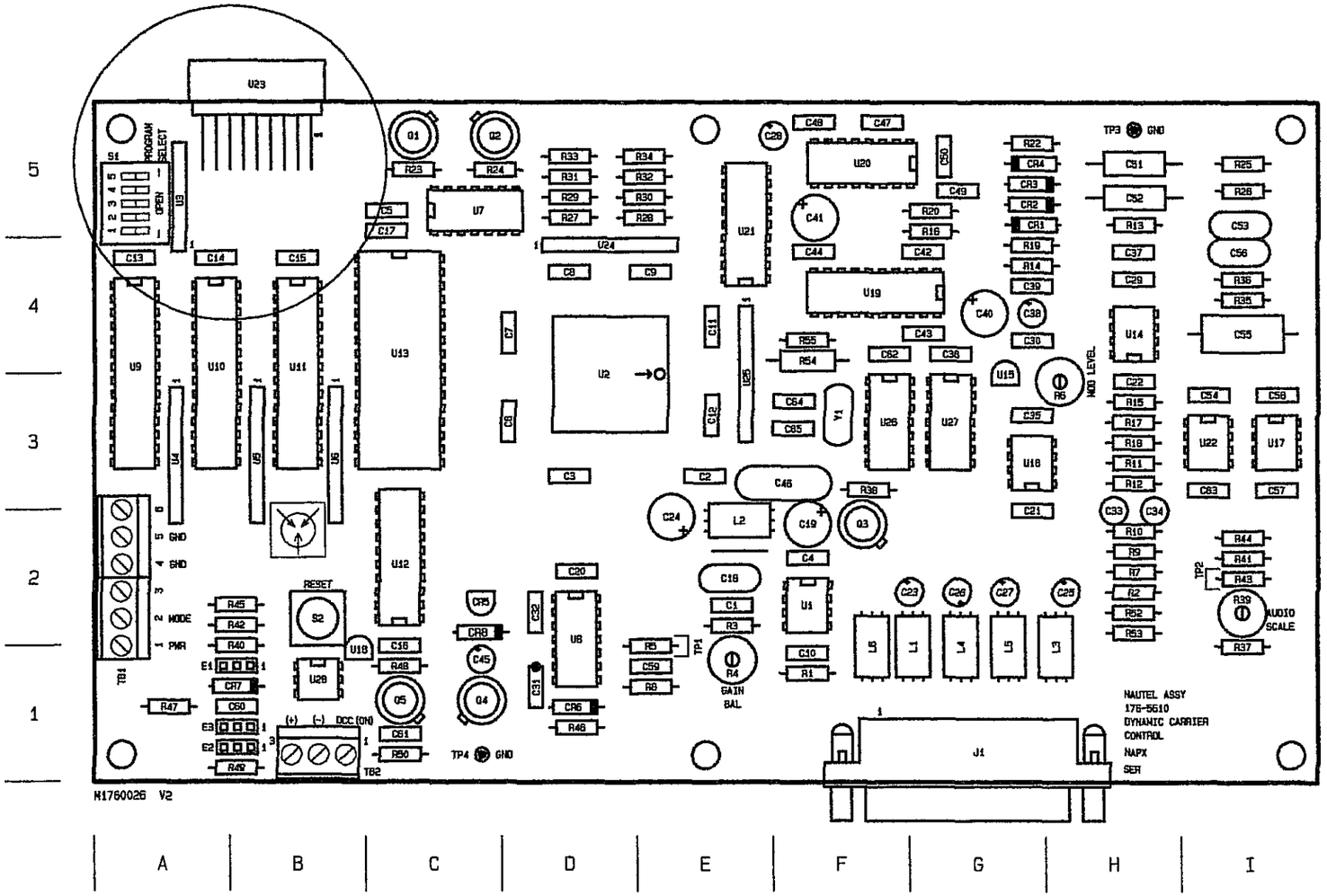


Figure MD-3: NAPC147D Control/Display PWB



NAPX05E/02



NAPX05E/01 shown

Figure MD-4: NAPX05E/02 Dynamic Carrier Control PWB (optional)

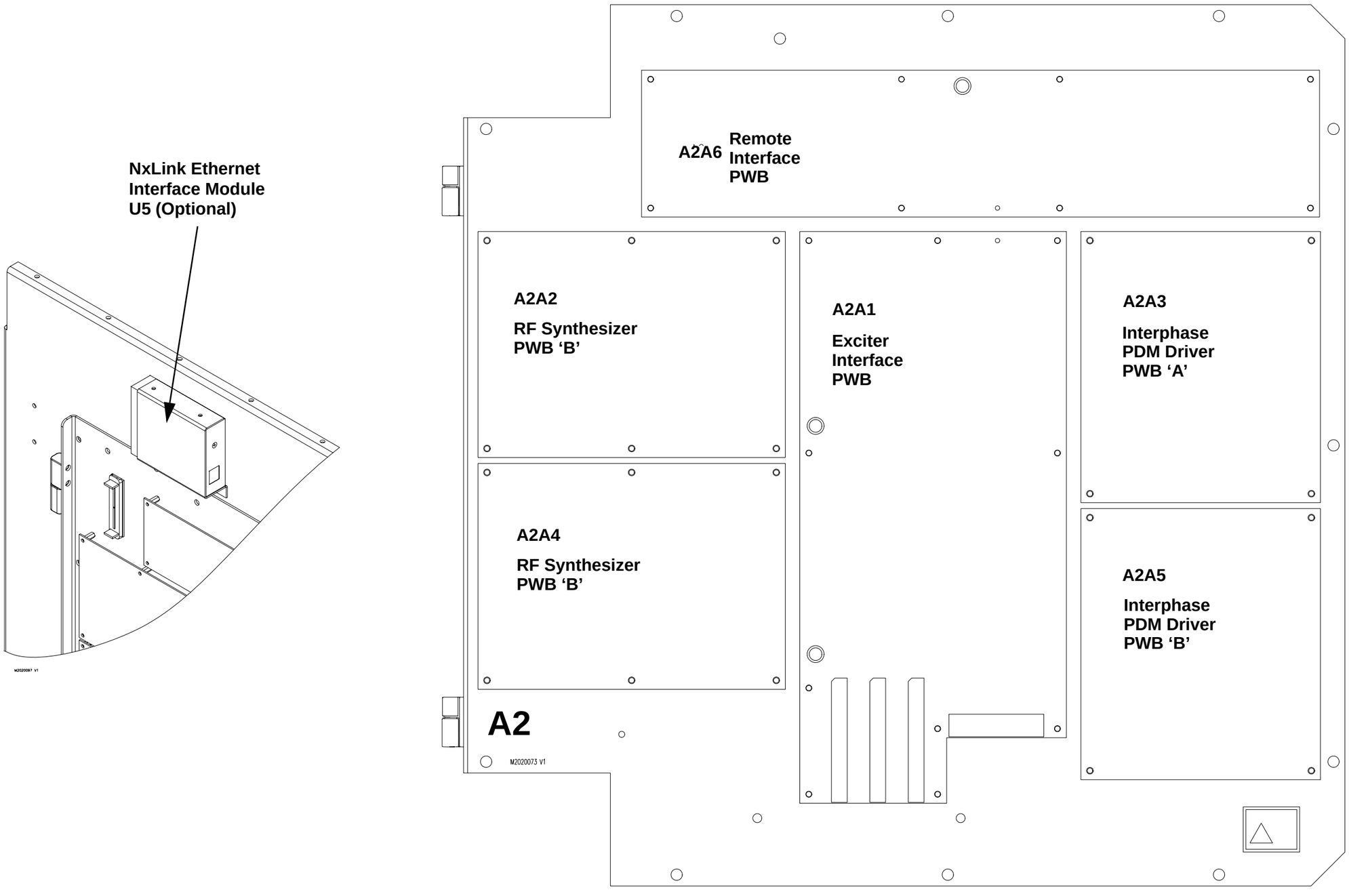


Figure MD-5: NAE93B Exciter Panel

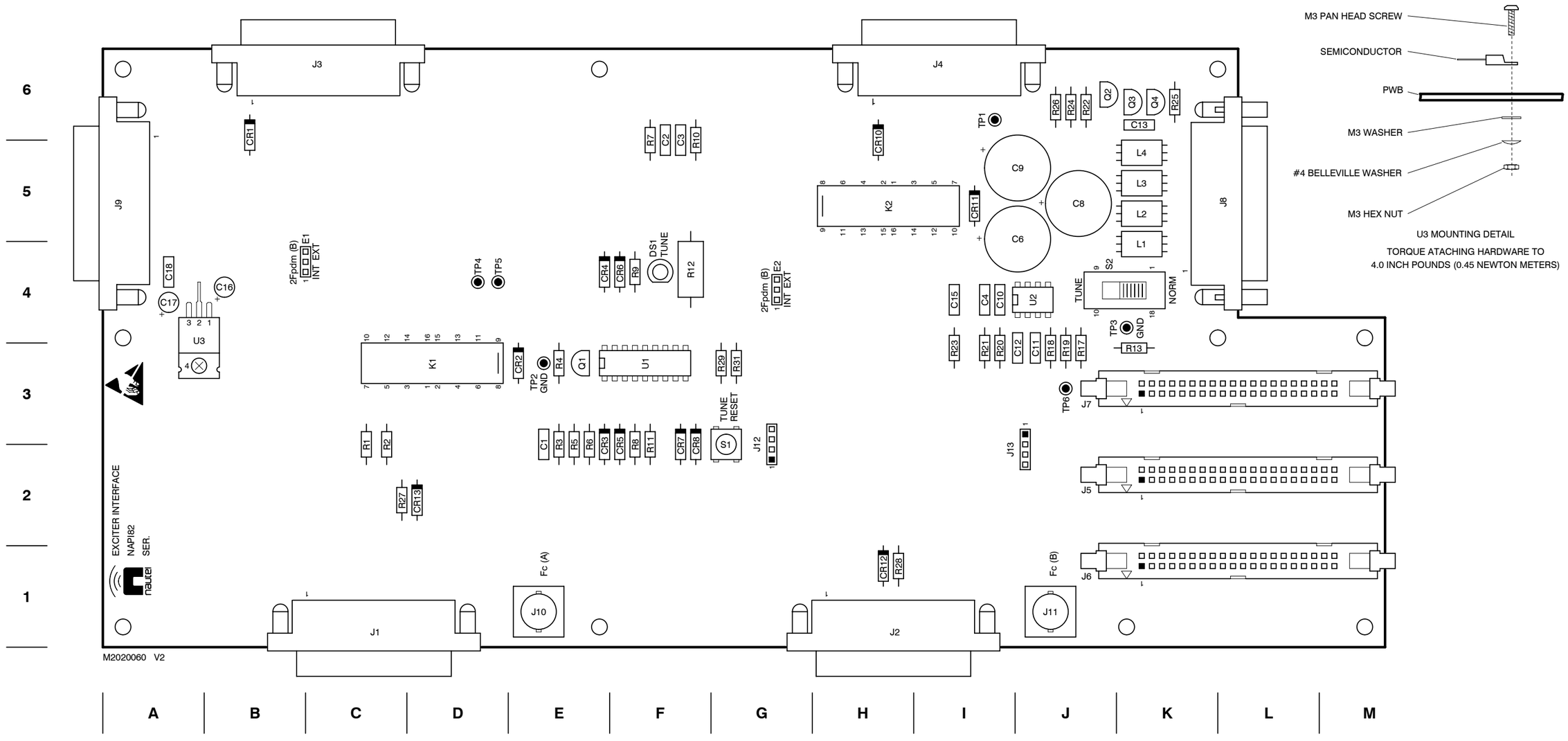
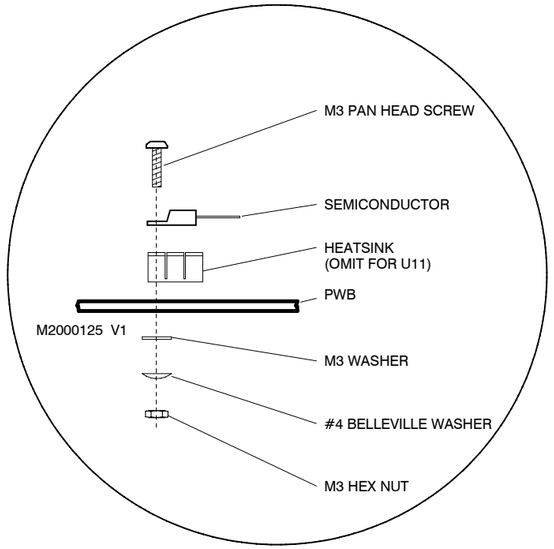
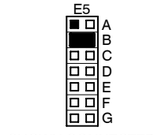


Figure MD-6: NAPI82A Exciter Interface PWB

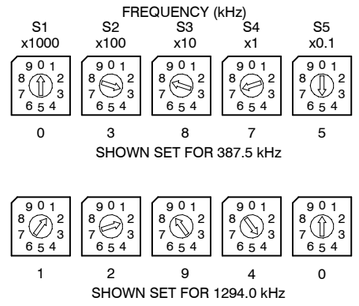


U9 & U11 MOUNTING DETAIL

TORQUE ATACHING HARDWARE TO
4.0 INCH POUNDS (0.45 NEWTON METERS)



SHOWN CONNECTED
IN 'B' POSITION



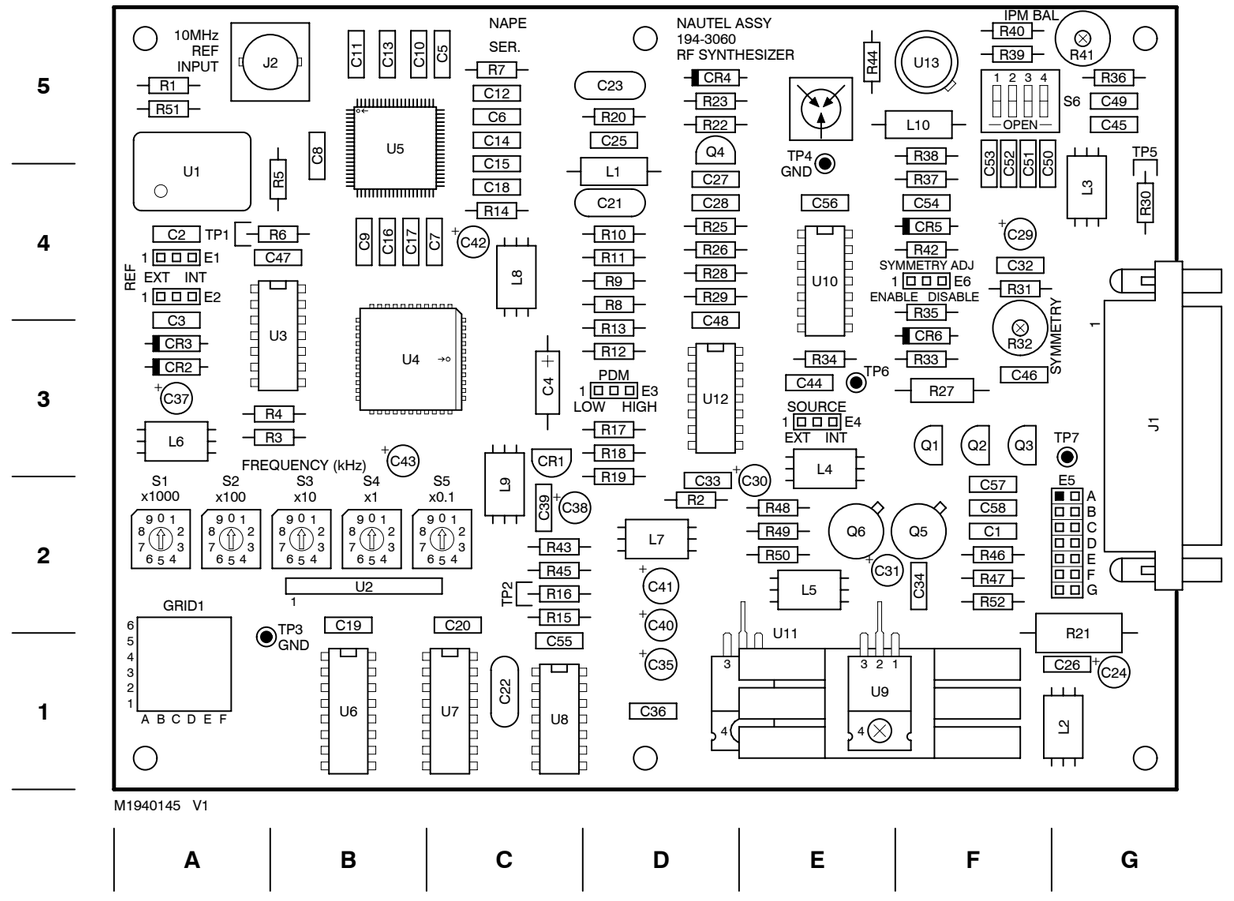


Figure MD-7: NAPE70C RF Synthesizer PWB

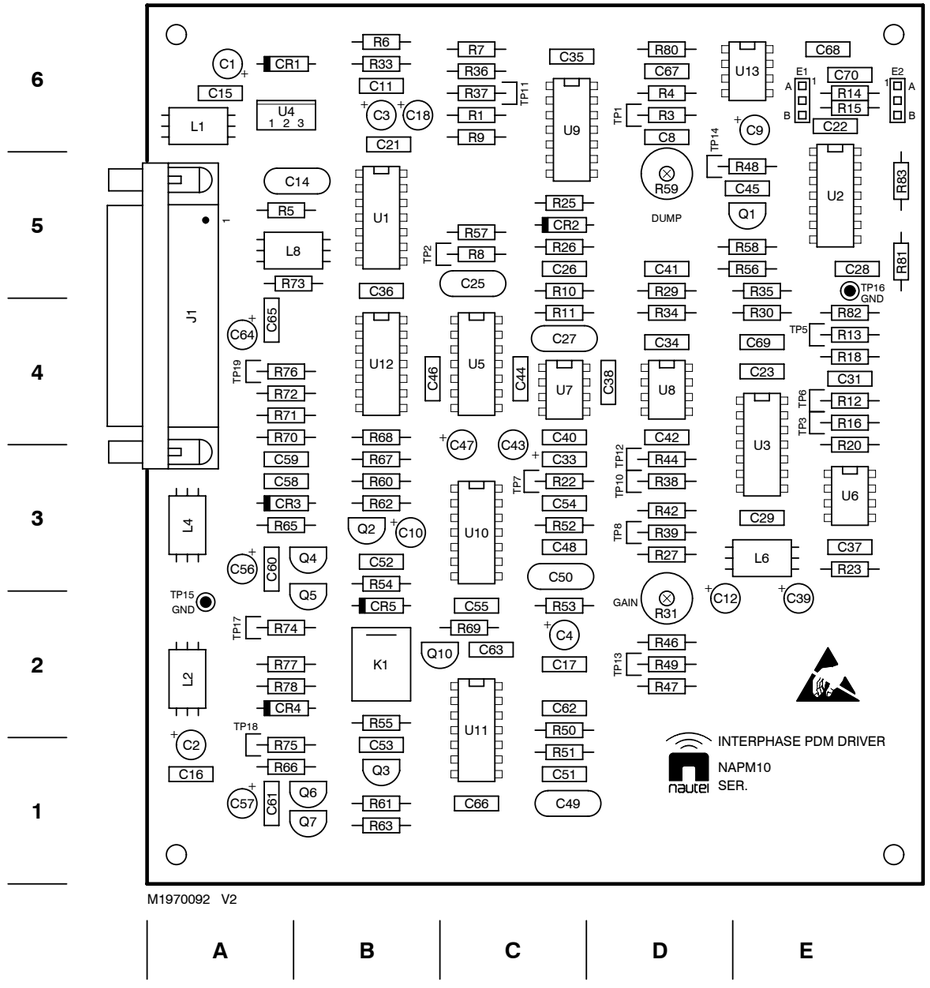


Figure MD-8: NAPM10B Interphase PDM Driver PWB

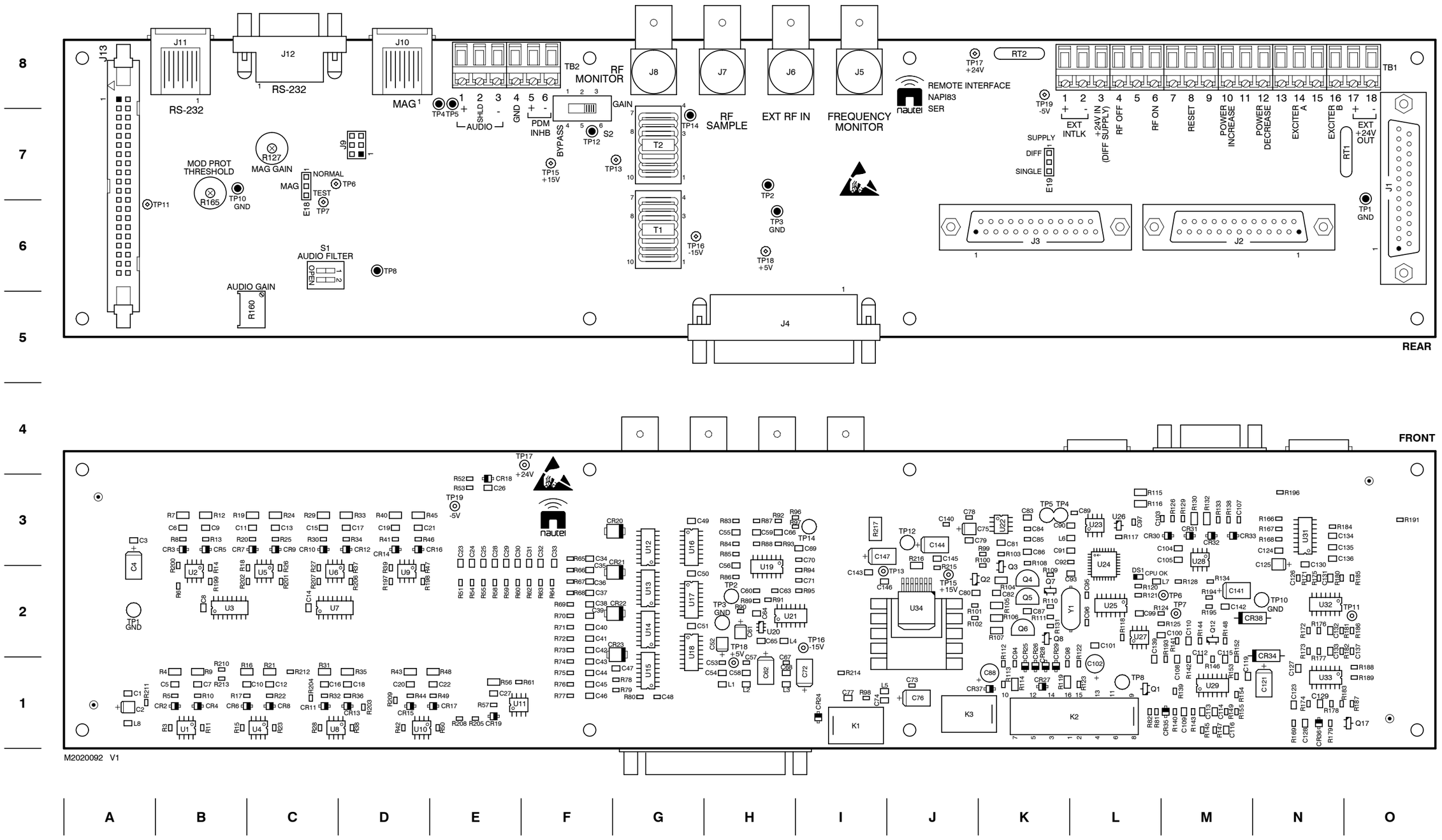


Figure MD-9: NAPI83/01A Remote Interface PWB

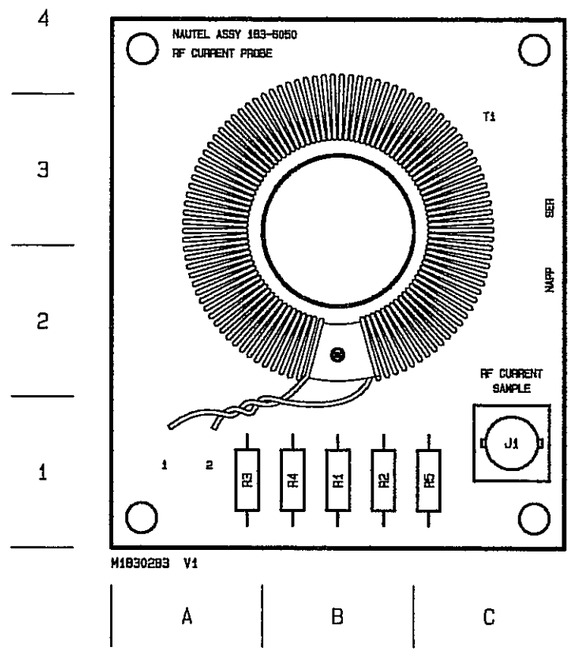


Figure MD-10: NAPP02/02 RF Current Probe PWB:

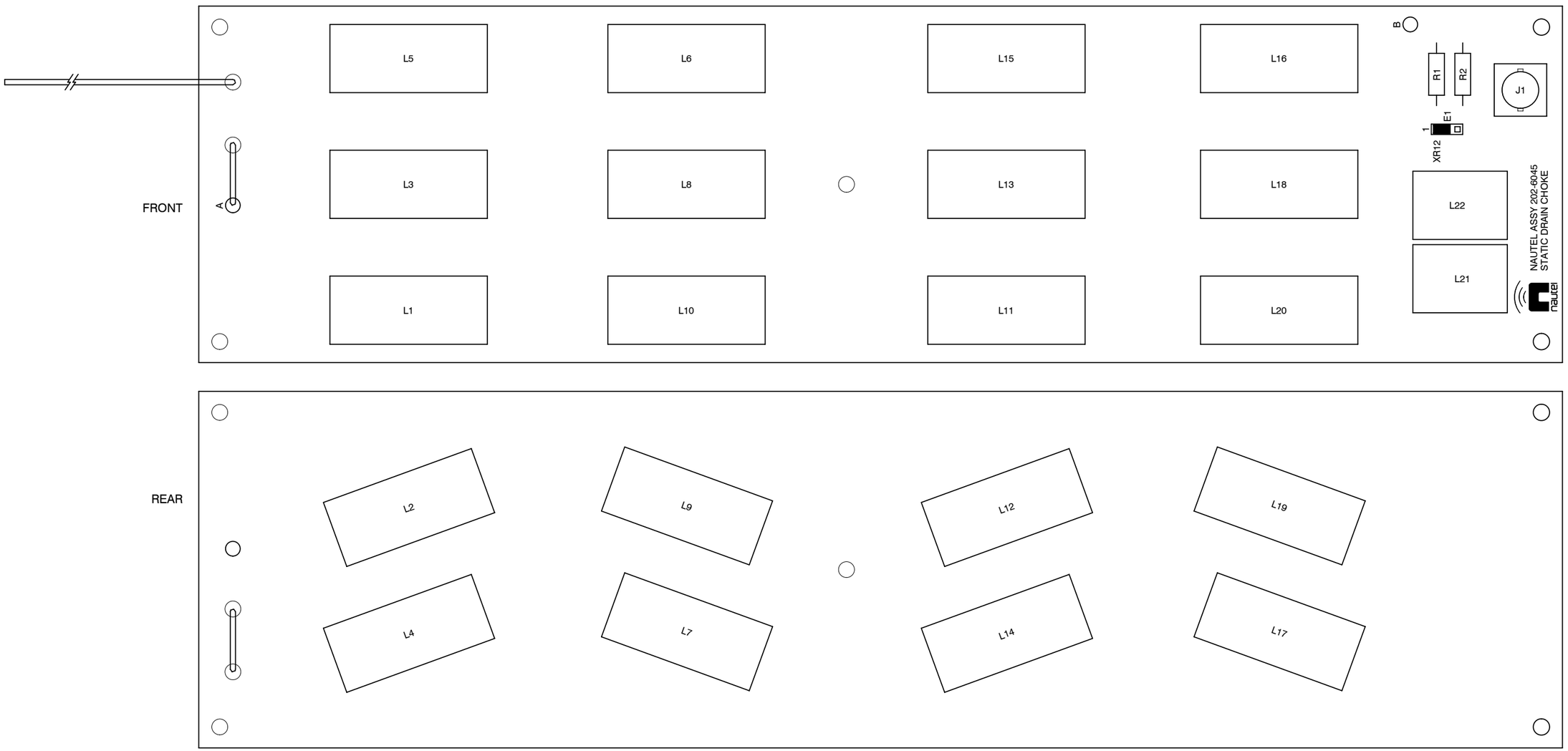
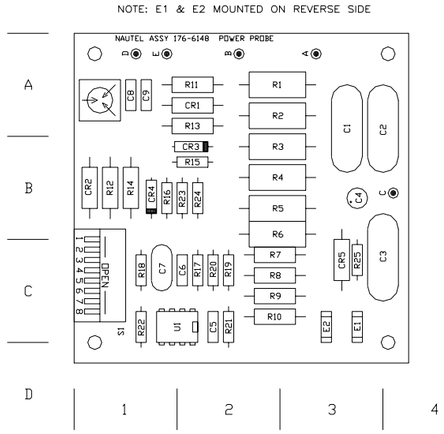
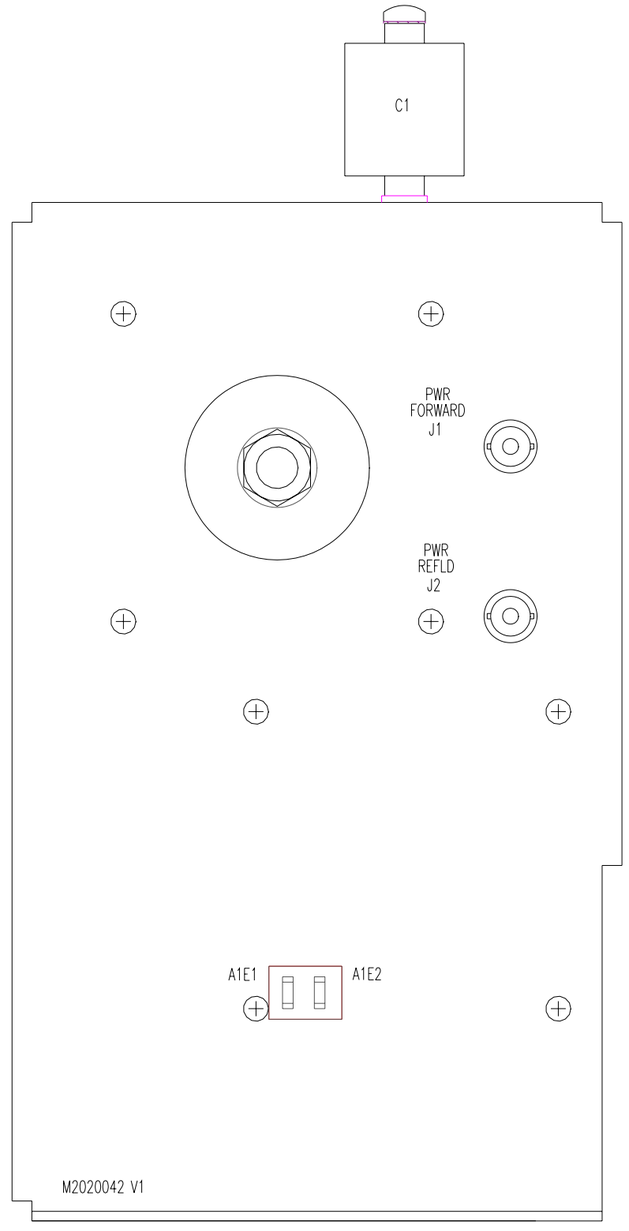


Figure MD-11: Static Drain Choke PWB (202-6045)



A1 DETAIL



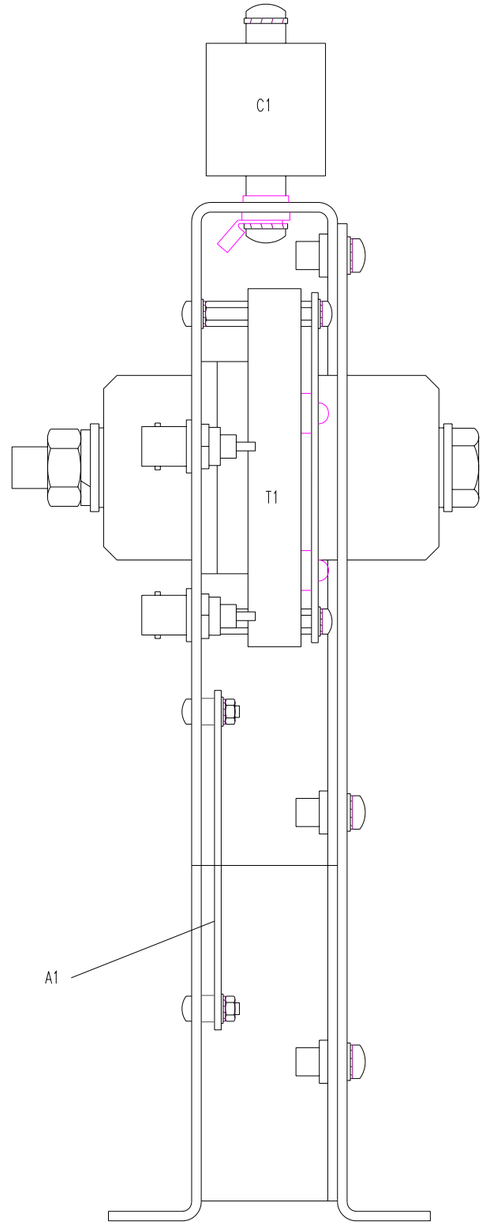
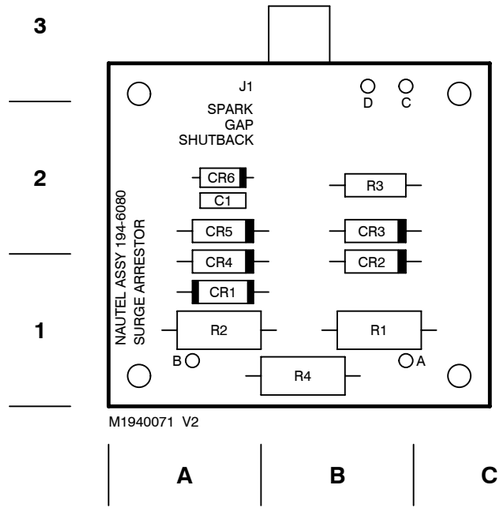
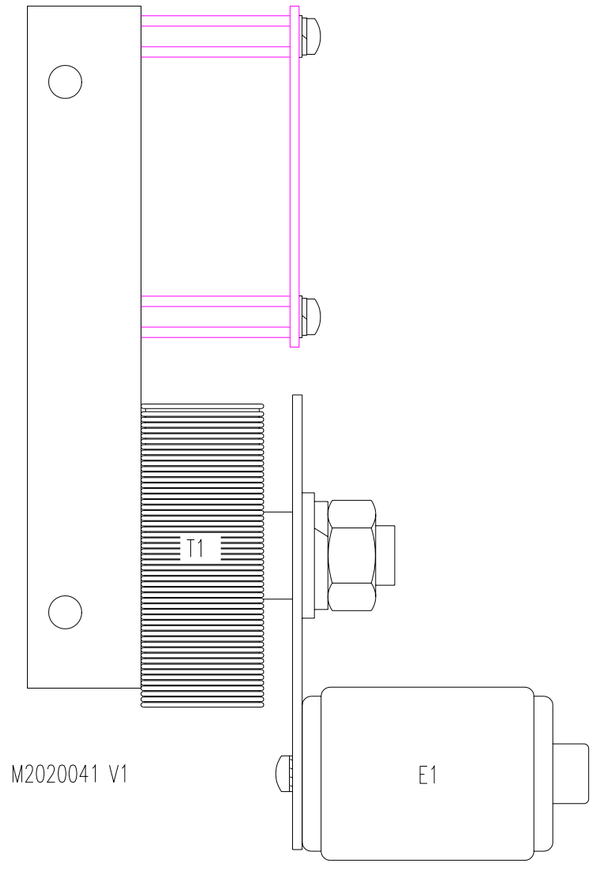


Figure MD-12: NAFP103/05 Forward/Reflected Power Probe





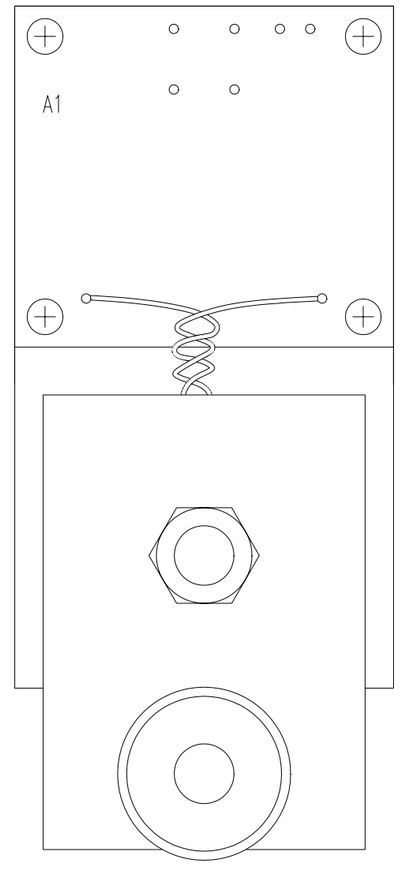


Figure MD-13: NAX211 Surge Arrestor:



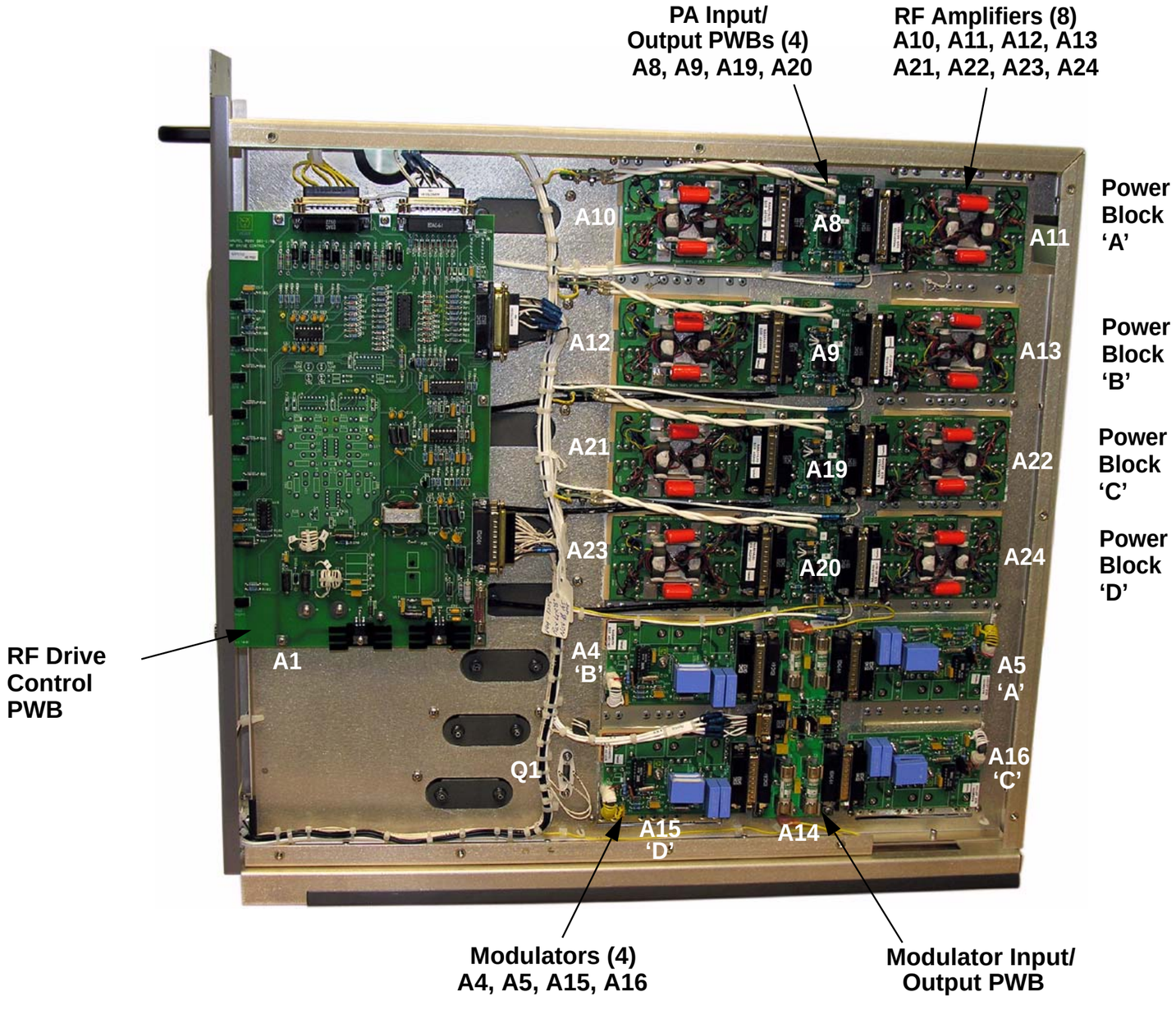


Figure MD-14: NAP34A RF Power Module (Front and Right-Side Views)



Figure MD-15: NAP34A RF Power Module (Rear and Left-Side Views)

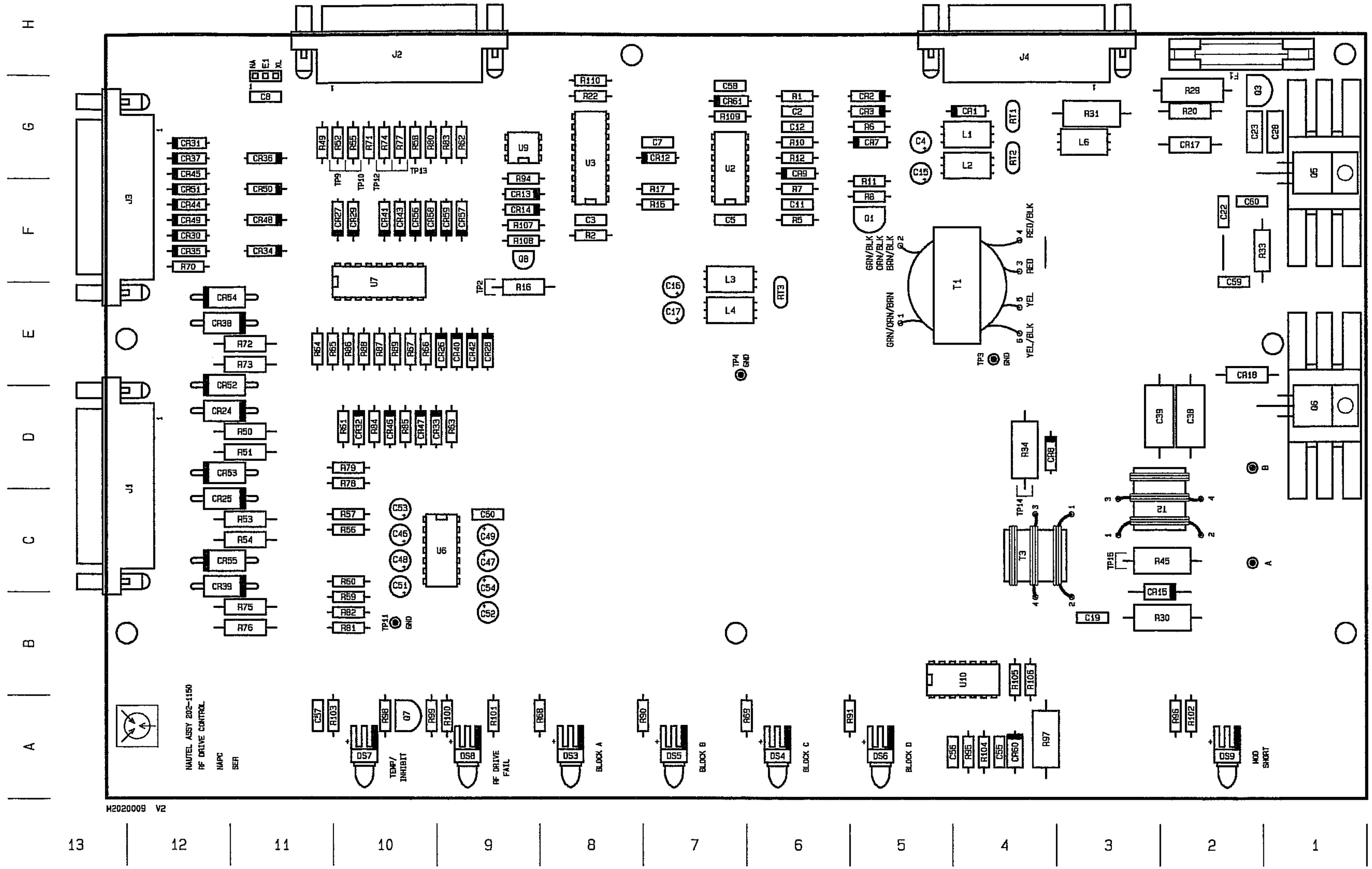


Figure MD-16: NAPC150A RF Drive Control PWB

CARRIER FREQUENCY (kHz)	COARSE TUNING POSITION (mm)
530	114
600	110
700	104
800	98
900	93
1000	90
1100	86
1200	84
1300	80
1400	77
1500	75
1600	72

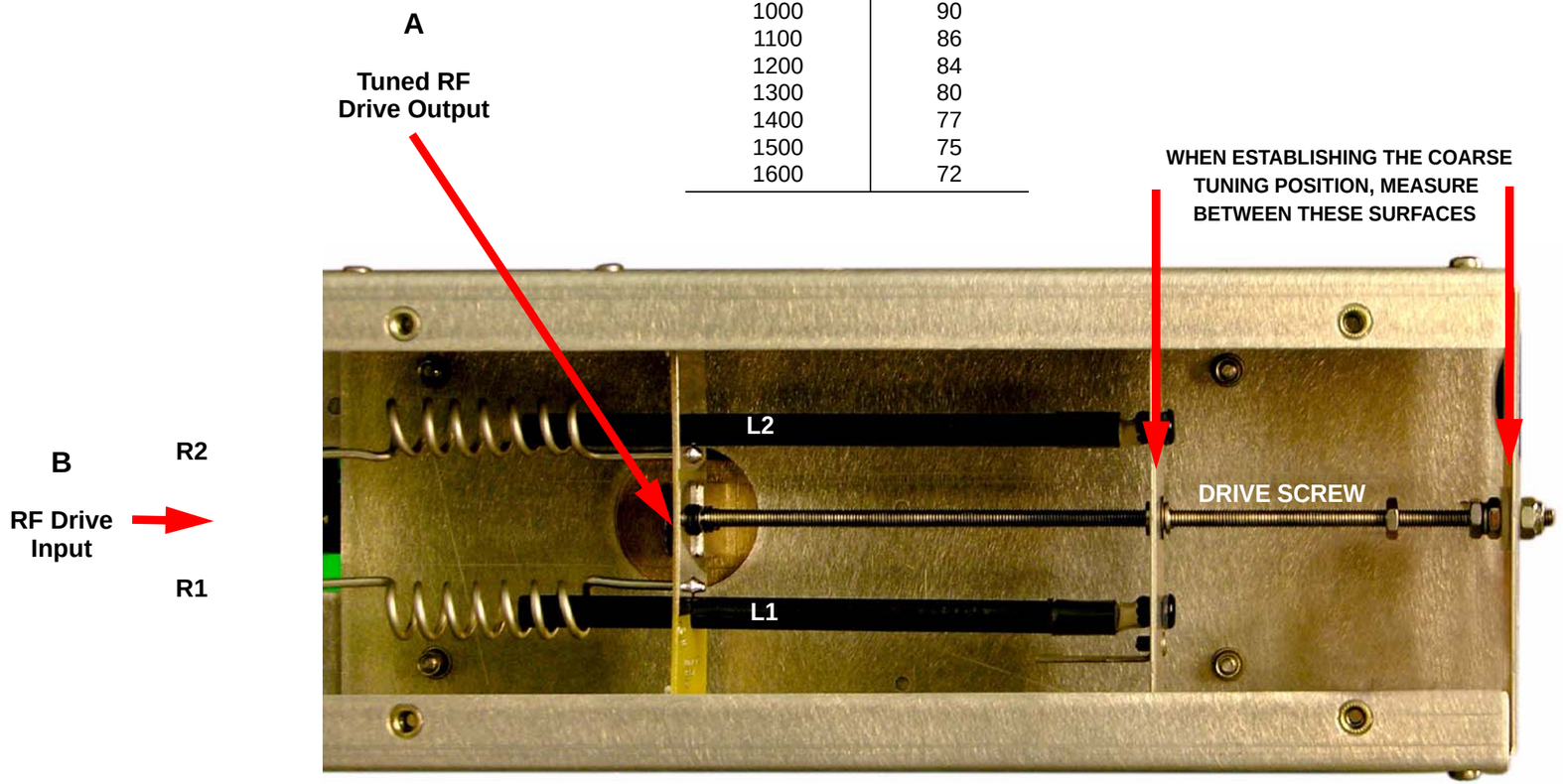
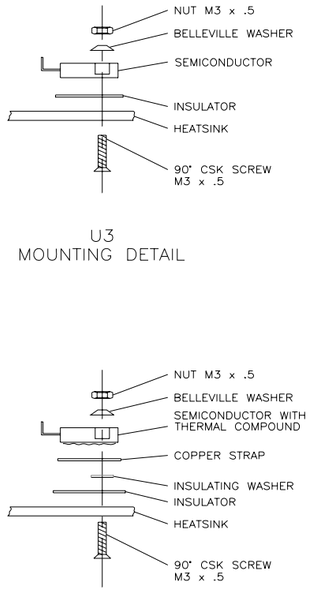
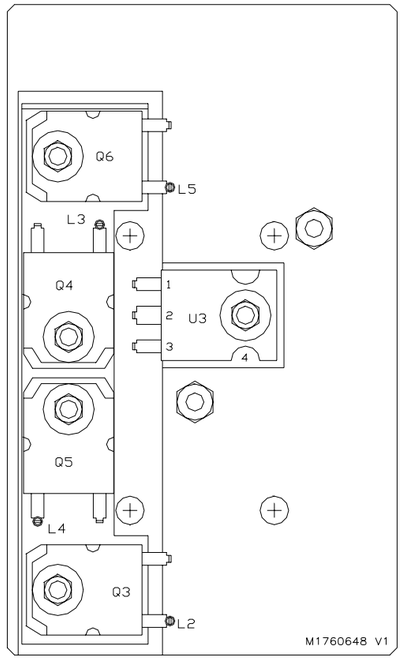


Figure MD-17: NAX180C RF Tuning Assembly

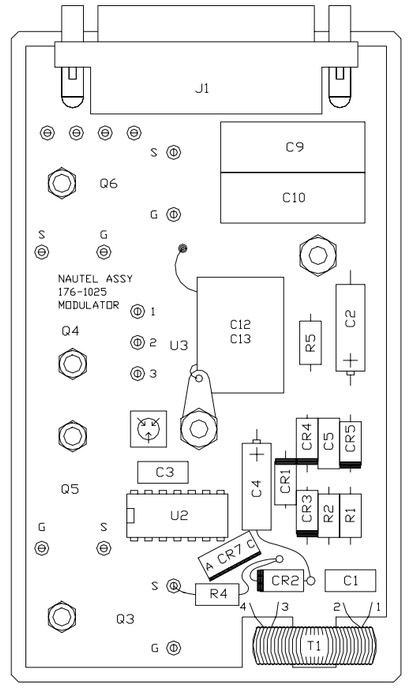


U3
MOUNTING DETAIL

Q3 THRU Q6
MOUNTING DETAIL



VIEW WITH PWB REMOVED



VIEW WITH COVER REMOVED

Figure MD-18: NASM07H Modulator Assembly

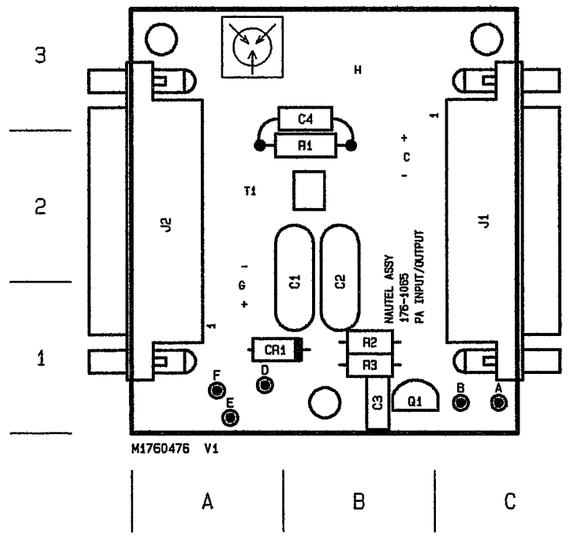
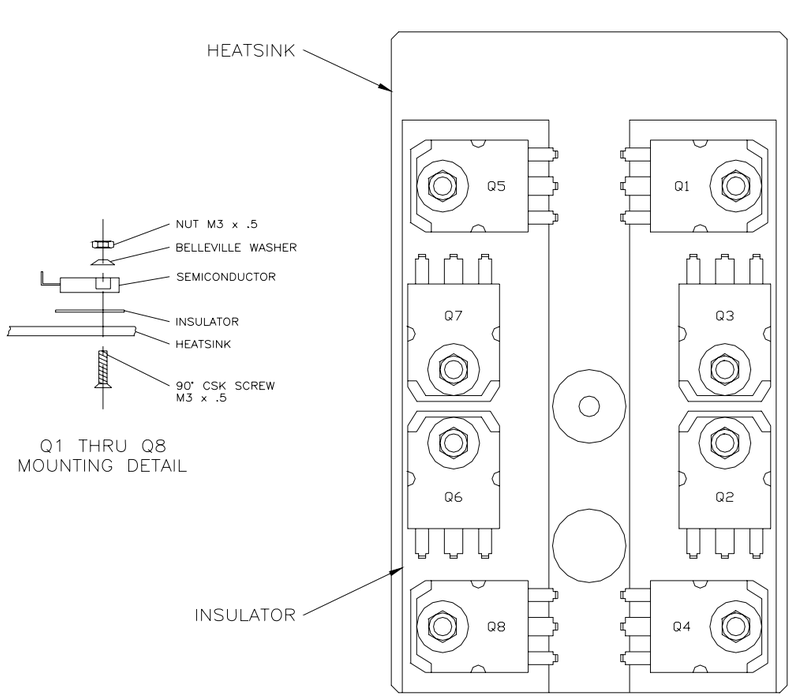
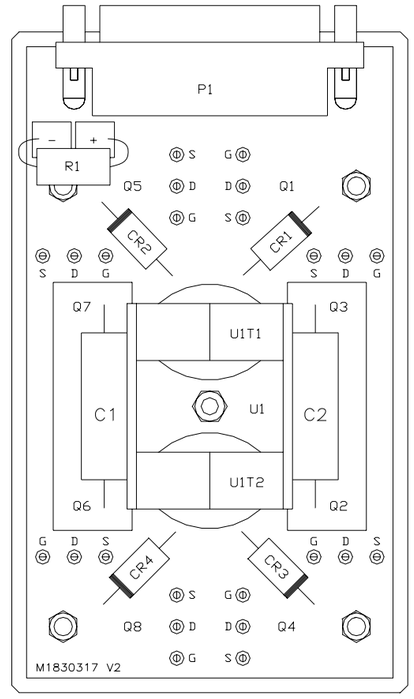


Figure MD-19: PA Input/Output PWB (176-1065-04 and -05)



VIEW WITH PWB REMOVED

Q1 THRU Q8
MOUNTING DETAIL



WIRE COLOR	U1T1	U1T2
RED	– PAD NEAR P1	– PAD NEAR P1
RED/BLACK	+ PAD NEAR P1	+ PAD NEAR P1
GREEN	– PAD NEAR P1	– PAD NEAR P1
GREEN/BLACK	+ PAD NEAR P1	+ PAD NEAR P1
BROWN	Q1 SOURCE	Q2 GATE
BROWN/BLACK	Q1 GATE	Q2 SOURCE
ORANGE	Q3 SOURCE	Q4 GATE
ORANGE/BLACK	Q3 GATE	Q4 SOURCE
YELLOW	Q5 GATE	Q6 SOURCE
YELLOW/BLACK	Q5 SOURCE	Q6 GATE
BLUE	Q7 GATE	Q8 SOURCE
BLUE/BLACK	Q7 SOURCE	Q8 GATE

Figure MD-20: NAA51A/03 RF Amplifier Assembly

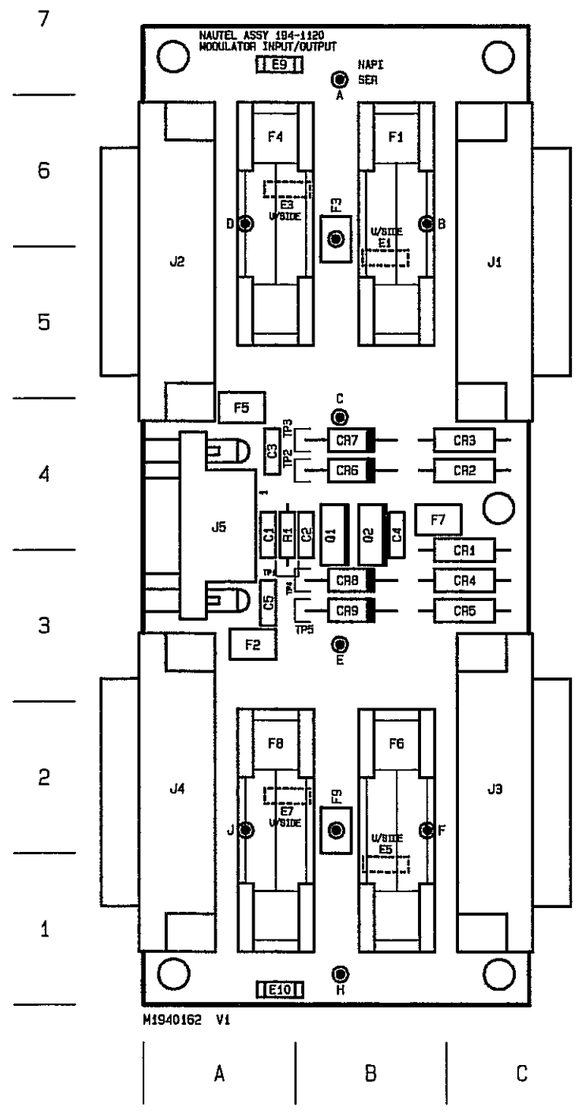


Figure MD-21: NAPI47B Modulator Input/Output PWB

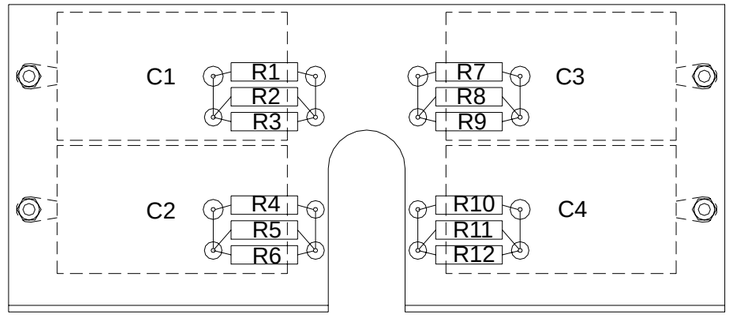
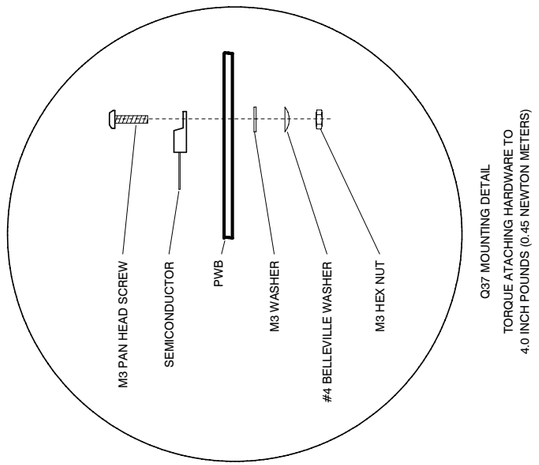


Figure MD-22: Capacitor Bracket Assembly (194-1012)



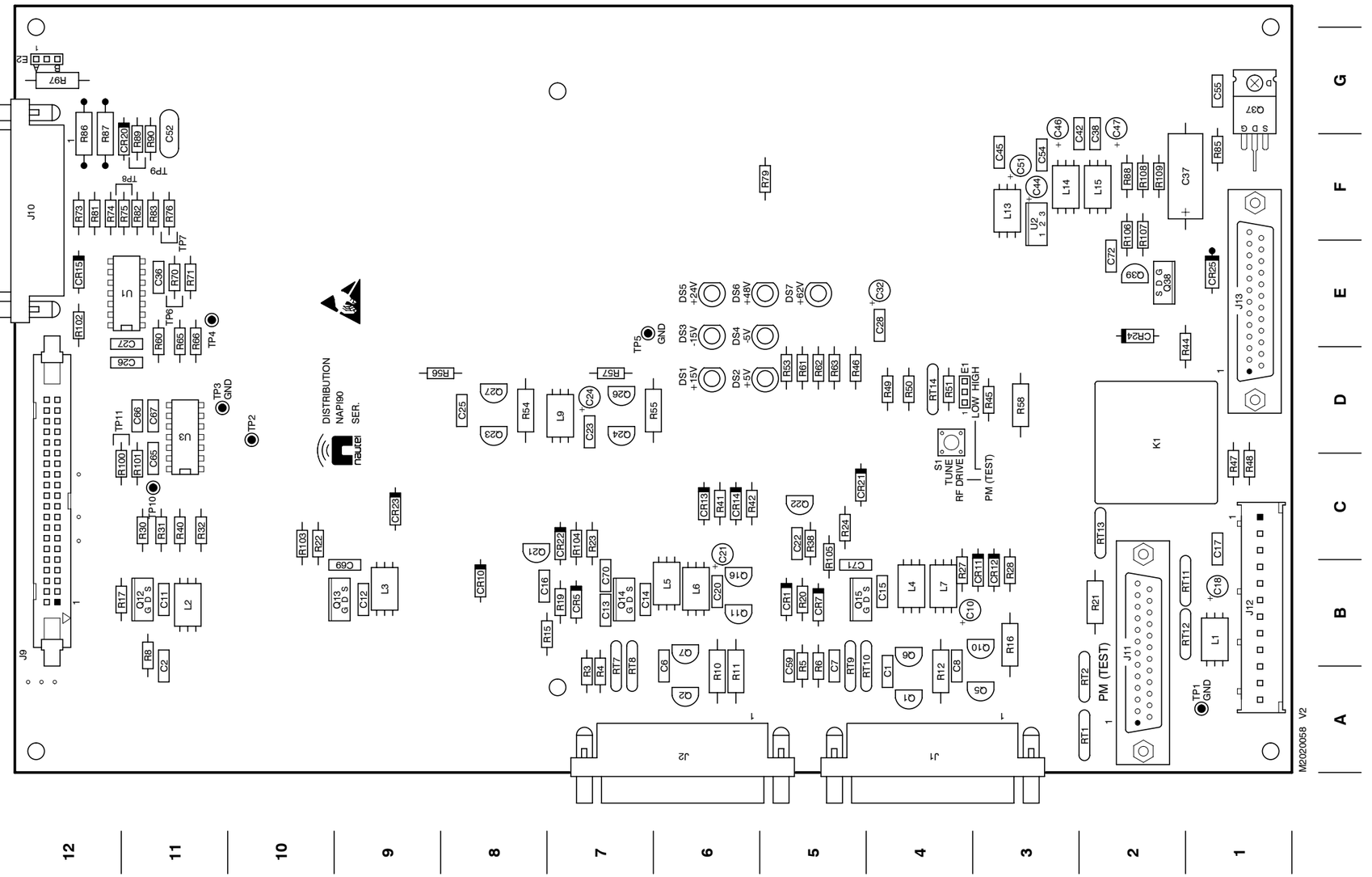
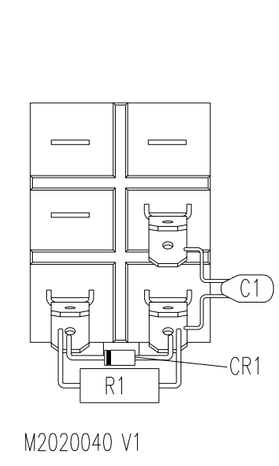


Figure MD-23: NAPI90/02 Distribution PWB



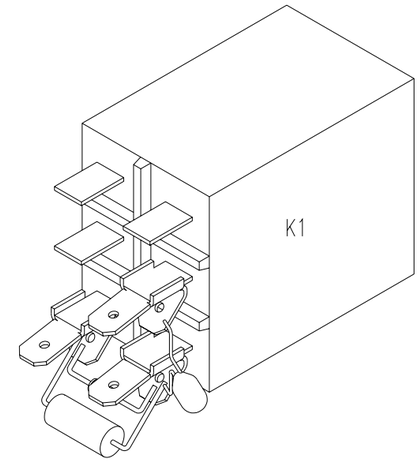


Figure MD-24: Relay Assy (202-7019-01)

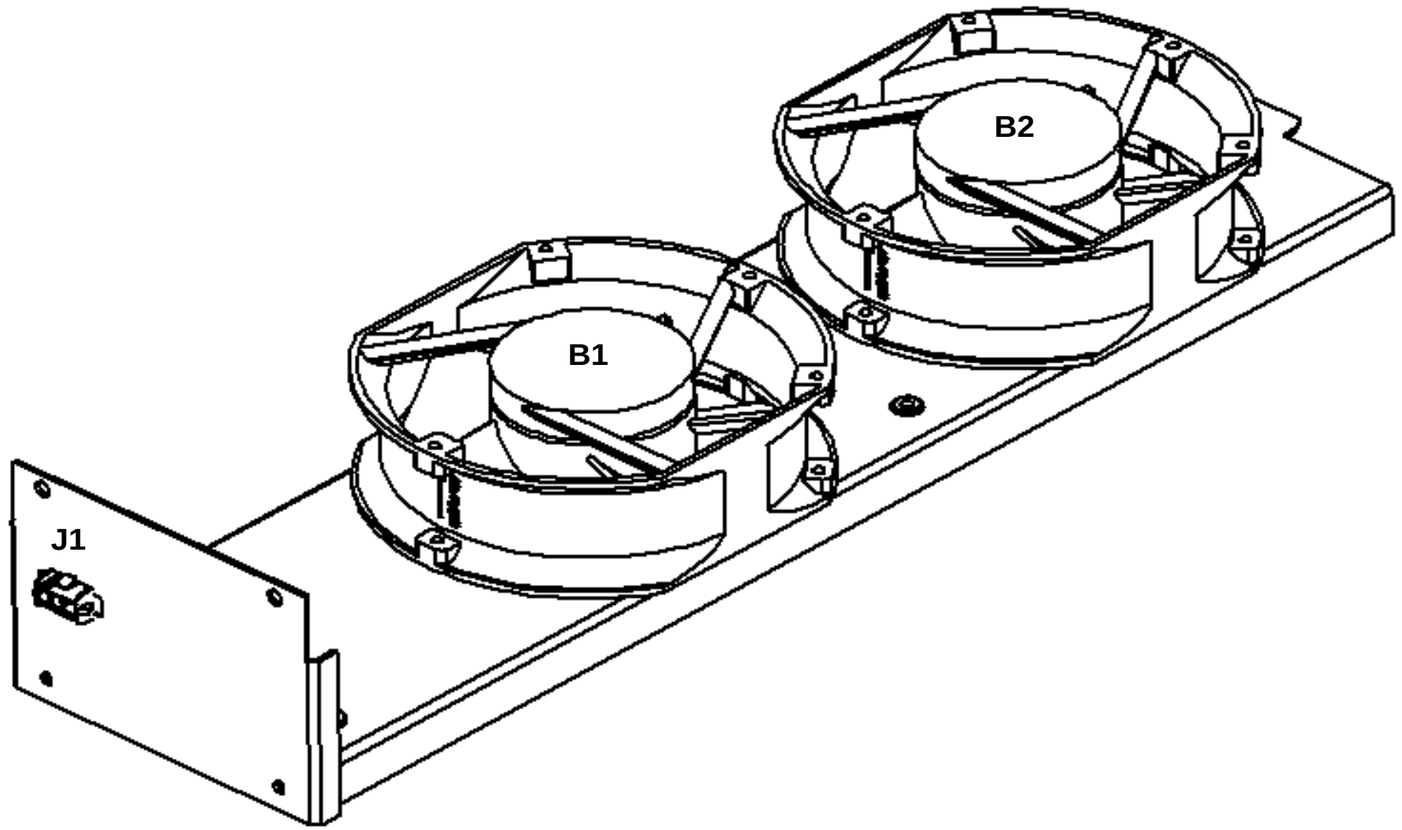


Figure MD-25: Fan Tray (202-7020)

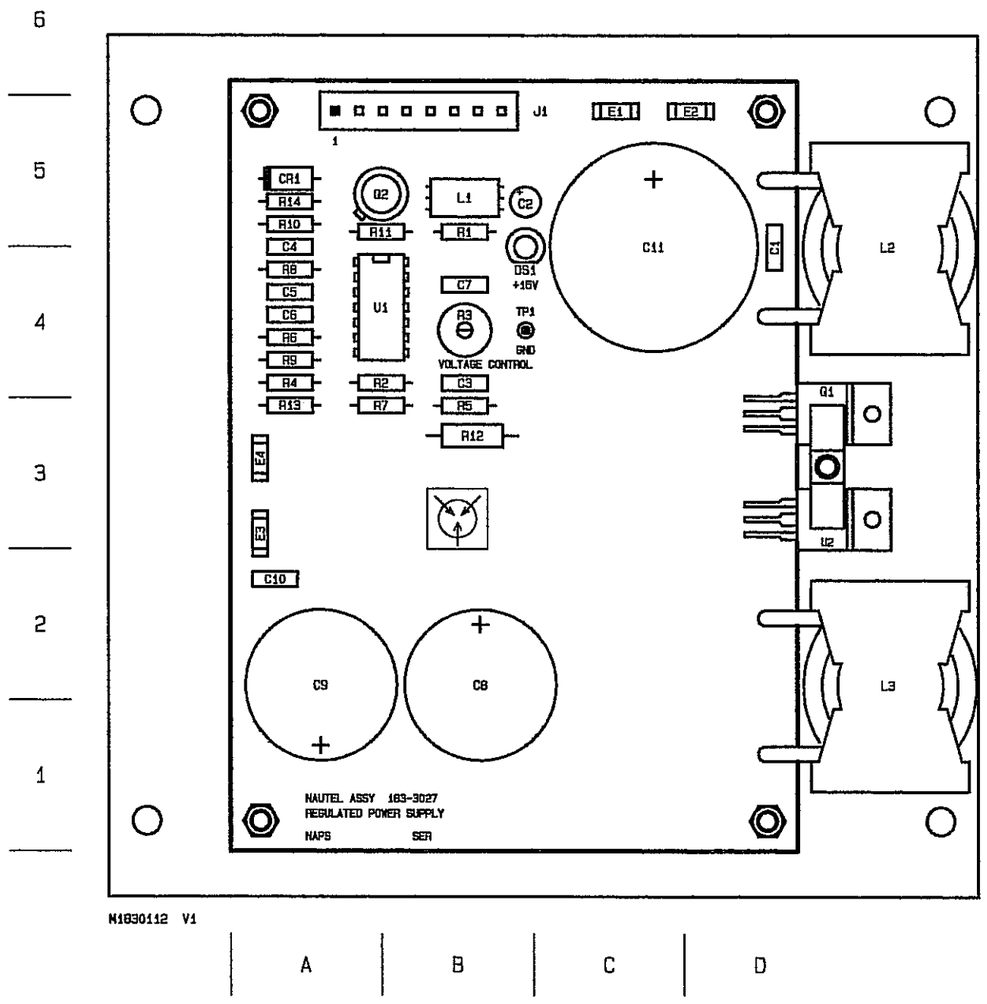


Figure MD-26: NAPS10C RF Drive Power Supply (62 V)

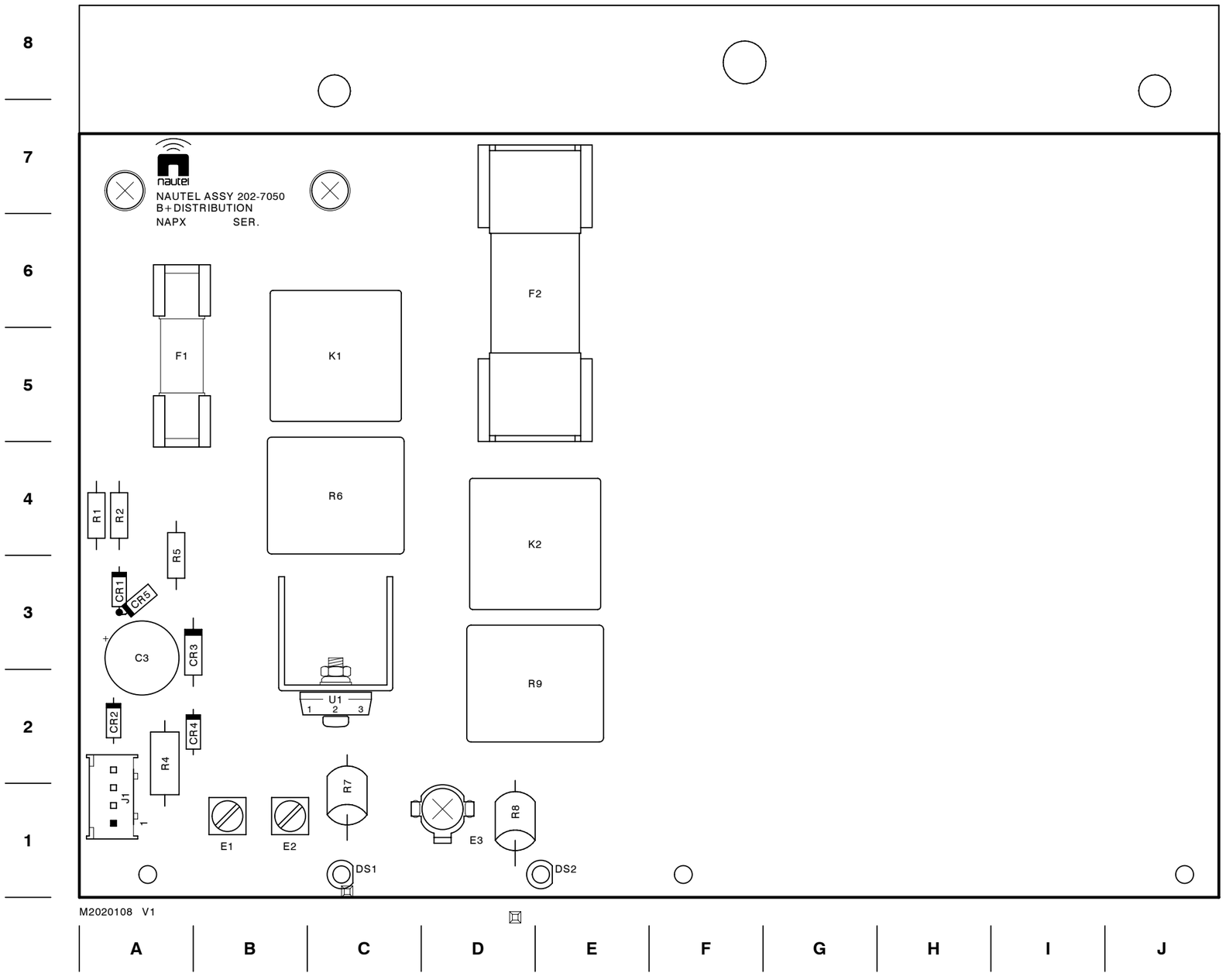


Figure MD-27A: NAPX31/05 B+ Distribution PWB (3-Phase Ac)

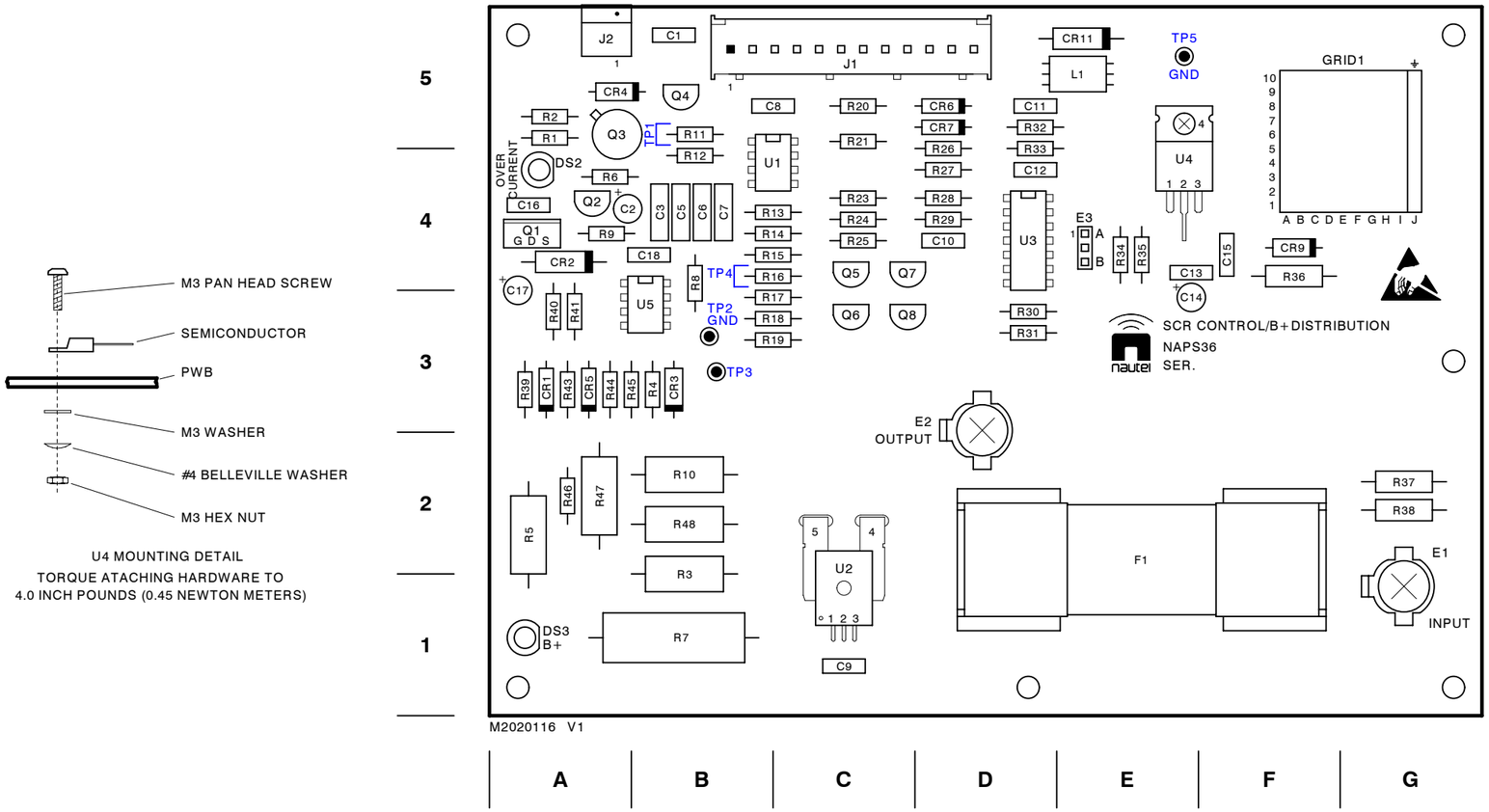


Figure MD-27B: NAPS36A SCR Control/B+ Distribution PWB (1-Phase Ac)

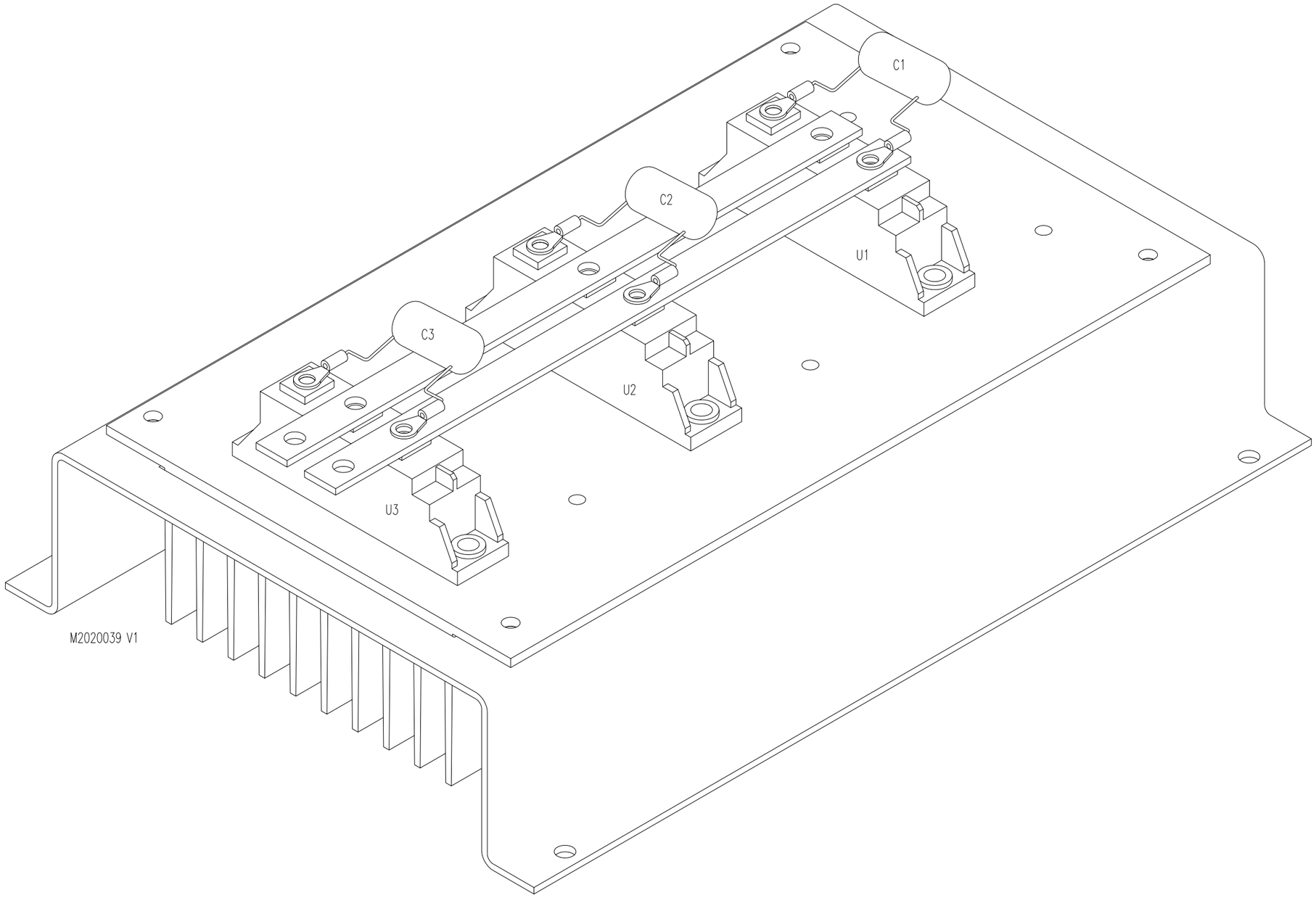


Figure MD-28A: Rectifier Assembly, 3-Phase Ac (202-7017)

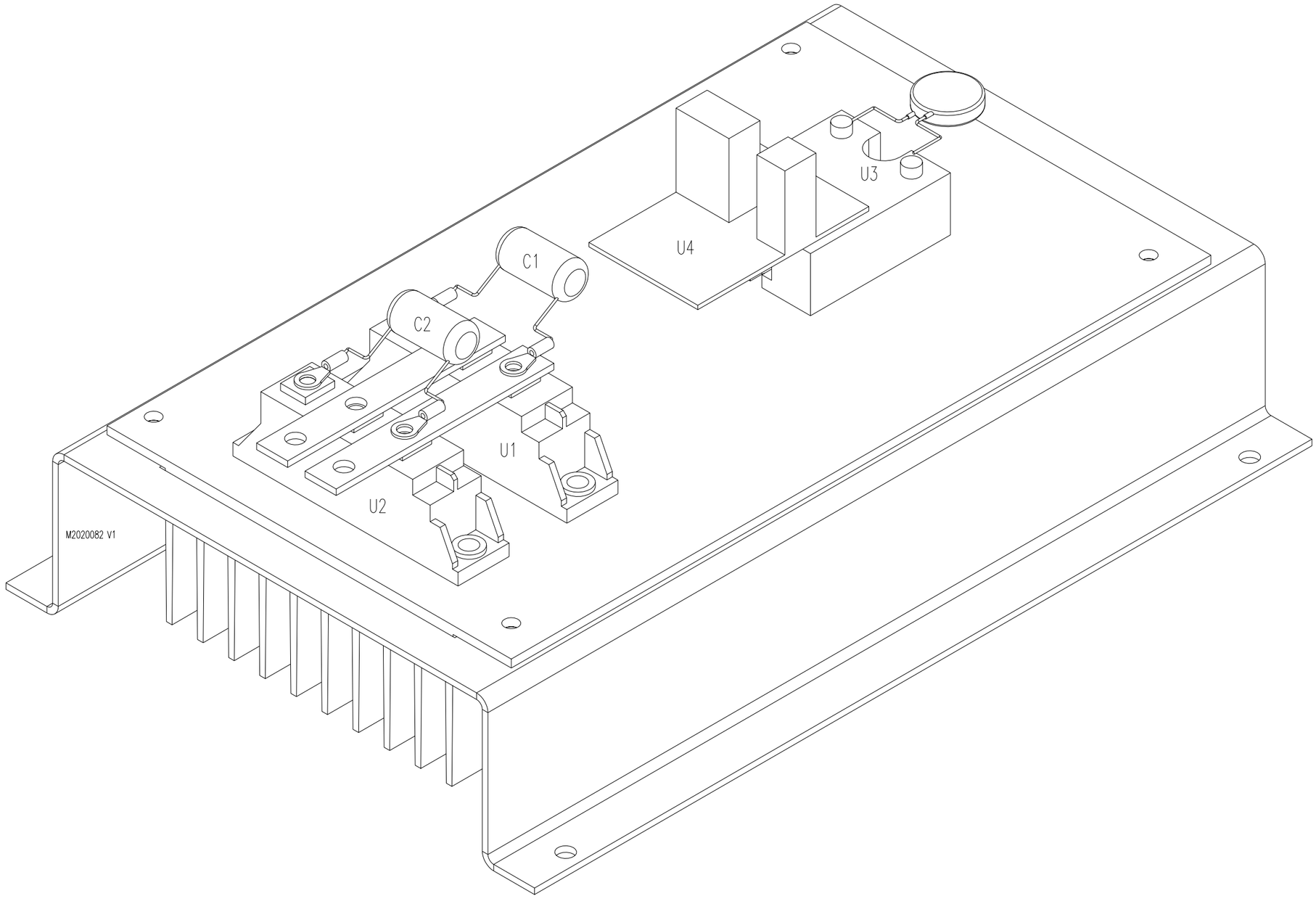
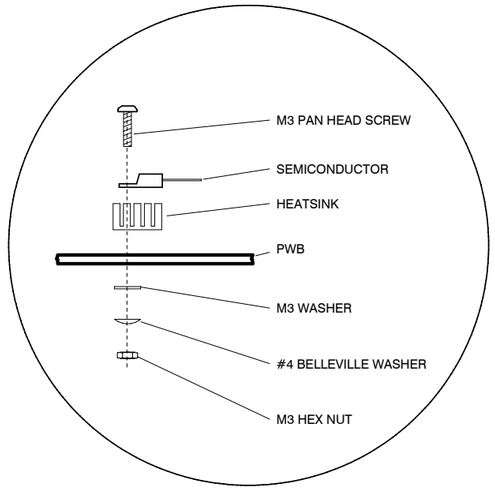


Figure MD-28B: Rectifier Assembly, 1-Phase Ac (202-7220)



U2 THROUGH U5 & U13 MOUNTING DETAIL

TORQUE ATACHING HARDWARE TO
4.0 INCH POUNDS (0.45 NEWTON METERS)

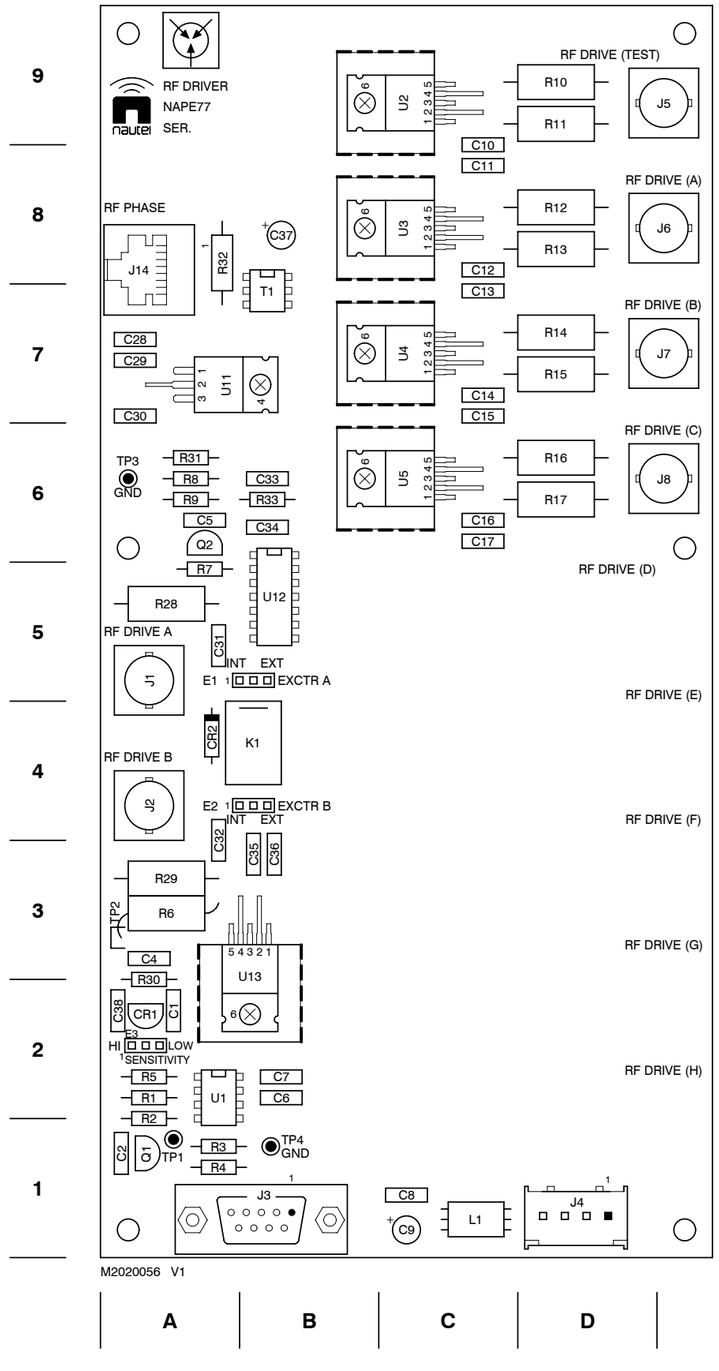


Figure MD-29: NAPE77A/01 RF Drive Buffer PWB

Section 7: List of terms

This section defines some of the terms that are used in Nautel documentation.

AES-EBU. Audio Engineering Society/European Broadcasting Union (AES/EBU) is the name of a digital audio transfer standard. The AES/EBU digital interface is usually implemented using 3-pin XLR connectors (the same type connector used in professional microphones). One cable carries both left- and right-channel audio data to the receiving device.

AMC. Amplitude Modulation Companding

Antenna Tuning Unit (ATU). A device that matches the transmitter to the impedance of the antenna.

B+. The high voltage dc generated by the transmitter's ac power supply for use within the transmitter. The B+ voltage is used to supply the transmitter's modulators and other transmitter circuitry.

Cutback. A reduction in RF output power, caused by a total power limit fault or the occurrence of three shutbacks within a five second period.

DAM. Dynamic Amplitude Modulation.

DCC. Dynamic Carrier Control.

DSP. Digital Signal Processing.

HD Radio. High Definition (HD) Radio is another term for In Band On Channel (IBOC) technology. HD Radio is a trademark of iBiquity Digital Corporation.

IBOC. Nautel In-Band-On-Channel technology provides high quality digital audio over existing AM radio channels.

IPM. Incidental Phase Modulation

NE IBOC. Nautel's In-Band-On-Channel signal generator. See IBOC. Required for XR series IBOC installations.

PDM. Pulse Duration Modulation.

Preset. A setting that controls power level, active exciter, and power scheduler status on a time-of-day and date basis. Exciters can be configured on a preset for a specific operating mode (for example, Exciter A - conventional AM, and Exciter B - IBOC). The XR6/XR3 allows you to pre-program up to six presets.

Shutback. A complete loss of RF output power, caused by any one of a variety of faults, including high VSWR, low B+ voltage, high RF current, RF drive failure, external interlock or spark gap.

Surge protection board. An electrical panel that protects equipment from electrical surges in the ac power supply, antenna or site ground caused by lightning strikes.

VSWR. Voltage standing wave ratio. This is an expression of the ratio of forward voltage to reverse voltage on the feedline and antenna system. An ideal VSWR of 1:1 provides maximum transmitter-antenna efficiency.

Index

A

Abbreviations/Acronyms, 3-24
about this manual, vii
Acrobat documentation, viii
arcing, xiii

C

Connector mating information, 4-1
customer newsletter, viii

D

Description column, 3-22

E

Electrical schematics, list, 5-4, 6-1

F

Family tree, description, 3-21
Family Tree, illustration, 3-26
FAQ, on Nautel website, viii
features of this manual, vii
field upgrades, viii
fields, RF, xiii
flashovers, xiii
frequently asked questions, on Nautel website, viii

H

high field areas, xiii

M

manual
  about, vii
  features, vii
  using, vii
manuals, supplied, vii
manuals, technical, viii

N

NAPE70B RF synthesizer PWB 2-1
Nautel # column, 3-22
Nautel User Group, on website, viii
newsletter, for customers, viii
NUG, Nautel User Group, viii

O

OEM code column, 3-23
OEM code to manufacturer's cross-reference, 3-23
online
  Acrobat Reader, viii
  keywords, finding, viii
  section, finding, viii
online documentation, viii
online resources, viii

P

Parts information, 3-21
PDF documentation, viii
personnel training, xi
printed
  keywords, finding, viii
  specific term, finding, viii
Printed wiring patterns, 4-1

R

Ref des column, 3-22
resources for customers, online, viii

resources, online, viii

S

Schematics, component values, 5-1
Schematics, for a functional block, locating 5-3
Schematics, for a part, locating 5-4
Schematics, graphic symbols, 5-1
Schematics, identifying, 5-2
Schematics, logic symbols, 5-1
Schematics, reference designations, 5-1
Schematics, structure, 5-3
Schematics, unique symbols, 5-2

T

training, xi
typical program content 2-3

U

ungrounded surfaces, xiii
user group, on Nautel website, viii
user guides, viii
using this manual, vii

V

Vendor # column, 3-23

W

warning signs, xiii
website, Nautel, viii
website, OEM (CAGE) codes, 3-23
Wire colours, 4-1
Wiring lists
    not provided, 4-1
    provided, 4-1

XR6/XR3

Troubleshooting Manual

Document: XR6/XR3-TROUBLESHOOT

Issue: 3.0 2009-07-15

Nautel Limited
10089 Peggy's Cove Road
Hackett's Cove, NS Canada B3Z 3J4
Phone: +1.902.823.3900 or
Toll Free: +1.877.6NAUTEL (6628835) (Canada & USA only)
Fax: +1.902.823.3183

Nautel Inc.
201 Target Industrial Circle
Bangor, Maine USA 04401
Phone: +1.207.947.8200
Fax: +1.207.947.3693

Customer Service (24 hour support)
+1.877.628.8353 (Canada & USA only)
+1.902.823.5100 (International)

Email: support@nautel.com
Web: www.nautel.com
© Copyright 2009 NAUTEL. All rights reserved.