

VIKING VX
UHF UNIVERSAL STATION
110W REPEATER

Part No. 242-20X4-313

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**VIKING VX
UHF UNIVERSAL STATION
PART NO. 242-20X4-313**

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SECTION 1 INTRODUCTION AND OPERATION

1.1 SCOPE OF MANUAL

This service manual provides installation, operation, programming, service, and alignment information for the VIKING VX Universal Station, Part No. 242-20X4-300.

1.2 DESCRIPTION

The VIKING VX Universal Station operates on the UHF frequencies from 380-520 MHz (transmit and receive). Channel spacing is 12.5 kHz and RF power output is adjustable from 25 to 110 watts.

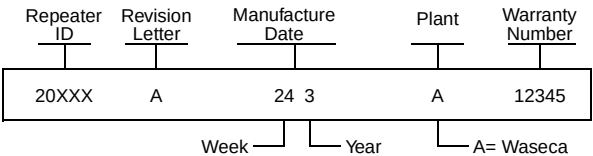
This Universal Station is modular in design for ease of service. There are separate assemblies for the logic, RF and power amplifier and power supply sections.

The Universal Station is programmed with a laptop or personal computer using the Universal Station software, Part No. 023-9998-391.

The VIKING VX Universal Station interfaces with a third party controller. All signal ports used to interface to the Station are on J2 located at the back of the cabinet.

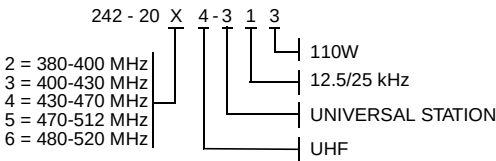
1.3 MODEL NUMBER BREAKDOWN

The following breakdown shows the part number scheme used for the VIKING VX Universal Station.



1.4 IDENTIFICATION NUMBER

The Universal Station identification number is printed on a label that is affixed to the inside of the repeater cabinet. The following information is contained in that number:



1.5 ACCESSORIES

The accessories available for the Viking VX LTR repeater are listed in Table 1-1. A brief description of some of these accessories follows.

External Speaker - This 16 ohm speaker plugs into the MAC card jack. The speaker provides local audio and is adjusted by the volume control.

RJ-11 to 6-BNC Adapter - This adapter box provides connections for the high speed data bus at the rear of the repeater and the data bus from the logic drawers in existing repeater systems.

19" Aluminum Shelf - Rack mounted shelf, 20" deep, that can be used to support the batteries.

12V DC Battery - This is a sealed 12V DC lead-acid battery intended for battery backup systems. Two batteries are required per repeater. At 25°C, with a 100% transmit duty cycle at 25W, the repeater will operate for 2 hours and at 110W, the repeater will operate for 1 hour.

2000 Series Service Kit - This kit contains an alarm wire harness, extender power cable, programming kit, extender card, extender harness, and a TIC bias cable. These items are used when tuning the repeater and while troubleshooting.

Battery Backup and Cable Option - This option can be factory or field installed. It includes the battery backup module that resides in the power supply and the necessary interconnect cabling to connect the repeater to the batteries (see Section 2.5).

Battery Backup Cable Kit - This kit provides the cables required for connecting the screw lugs on the power supply to the 12V DC batteries.

Table 1-1 VIKING VX REPEATER ACCESSORIES

Accessory	Part No.
RJ-11 to 6-BNC Adapter	023-2000-194
19" Aluminum Shelf	508-0500-029
12V DC Battery	503-5012-420
External speaker	250-0151-005
2000 Series Service Kit	250-2000-230
Power Supply Only	250-2000-800
Power Supply w/Batt Bkup, no cable	250-2000-801
Battery Backup board only	023-2000-830
Battery Backup option and cable	023-2000-835
Battery Backup Cable Kit	023-2000-223
RG-316-BNC/BNC cable 68" *	597-3003-260
RG-316-BNC/BNC cable 71" *	597-3003-261
RG-316-BNC/BNC cable 87" *	597-3003-262
RG-316-BNC/BNC cable 96" *	597-3003-263
RG-316-BNC/BNC cable 106" *	597-3003-264
RG316-BNC/BNC cable 12"	597-3003-253
RG316-BNC/BNC cable 118"	597-3003-265
PC programmer PGMR software	023-9998-390
Programming cable kit	023-2000-195
Extender Card	023-2000-230
Extender cable kit, 7 ft.	250-2000-010
Rack self supporting	
3 ft.	508-0500-021
5.5 ft.	508-0500-022
6 ft.	508-0500-023
6.5 ft.	508-0500-024
7 ft.	508-0500-025
7.5 ft.	508-0500-026
8 ft.	508-0500-027
9 ft.	508-0500-028
Combiner coaxial protector	585-0898-005
External speaker/microphone	589-0015-011
Power line protector	597-1004-010
RJ-11 to RJ-11, 3 ft. cable	597-2002-200
*Included in kit 023-2000-128	

Power Supply with Battery Backup - This power supply is equipped with battery backup (see Section 2.5). Battery cables are not included.

Battery Backup (board only) - This is a battery back-up module only for field replacement (refer to installation instructions 004-2000-830).

PC Programmer PGMR Software - 3.5" programming disk used to program the repeater.

Programming Cable Kit - This kit connects the MPC and a computer during programming and for monitoring repeater activity at the site.

Extender Card - Used to extend the cards plugged into the backplane beyond the card rack enclosure when tuning the repeater and while troubleshooting.

Extender Cable Kit - These are seven foot extension cables for the RF Transceiver power and data, when the transceiver is removed from the cabinet.

Rack Self Supporting - Accommodates from one to five repeaters mounted on vertical columns. This also provides space for combiners and duplexers.

Combiner Coaxial Protector - This accessory provides lightning and static suppression in-line between the antenna and combiner.

External Speaker/Microphone - This is a speaker and microphone combination that plugs into the MAC connectors. The microphone provides local audio and push-to-talk, while the speaker provides local audio adjusted with the volume control.

Power Line Protector - This accessory provides lightning, static and surge protection on the AC power line. This line protector is rack mounted with multiple outlets.

RJ-11 to RJ-11 Cable - This three foot cable is used to connect two or more repeaters to the high speed data bus through the modular jack on the rear of the repeater.

1.6 PRODUCT WARRANTY

The warranty statement is available from your product supplier or from the Warranty Department, E.F. Johnson Company, 299 Johnson Avenue, Box 1249, Waseca, MN 56093- 0514. This information may also be requested by phone from the Warranty Department. The Warranty Department may also be

contacted for Warranty Service Reports, claim forms, or any questions with warranties or warranty service by dialing (507) 835-6970.

1.7 FACTORY CUSTOMER SERVICE

The Customer Service Department of the E.F. Johnson Company provides customer assistance on technical problems and the availability of local and factory repair facilities. Customer Service hours are 7:30 a.m. - 4:30 p.m. Central Time, Monday - Friday. There is also a 24-hour emergency technical support telephone number. From within the continental United States, the Customer Service Department can be reached toll-free at:

1-800-328-3911

When your call is answered at the E.F. Johnson Company, you will hear a brief message informing you of numbers that can be entered to reach various departments. This number may be entered during or after the message using a tone-type telephone. If you have a pulse-type telephone, wait until the message is finished and an operator will come on the line to assist you. When you enter a first number of "1" or "2", another number is requested to further categorize the type of information. You may also enter the 4-digit extension number of the person that you want to reach.

FAX Machine - Sales (507) 835-6485
FAX Machine - Cust Serv (507) 835-6969

If you are calling from outside the continental United States, the Customer Service telephone numbers are as follows:

Customer Service Department - (507) 835-6911
Customer Service FAX Machine - (507) 835-6969

You may also contact the Customer Service Department by mail. Please include all information that may be helpful in solving your problem. The mailing address is as follows:

E.F. Johnson Company
Customer Service Department
299 Johnson Avenue
P.O. Box 1249
Waseca, MN 56093-0514

1.8 FACTORY RETURNS

Repair service is normally available through local authorized E.F. Johnson Land Mobile Radio Service Centers. If local service is not available, the equipment can be returned to the factory for repair. However, it is recommended that you contact the Field Service Department before returning equipment. A service representative may be able to suggest a solution to the problem so that return of the equipment would not be necessary.

Be sure to fill out a Factory Repair Request Form #271 for each unit to be repaired, whether it is in or out of warranty. These forms are available free of charge by calling the repair lab (see Section 1.7) or by requesting them when you send a unit in for repair. Clearly describe the difficulty experienced in the space provided and also note any prior physical damage to the equipment. Then include a form in the shipping container with each unit. Your phone number and contact name are very important because there are times when the technicians have specific questions that need to be answered in order to completely identify and repair a problem.

When returning equipment for repair, it is also a good idea to use a PO number or some other reference number on your paperwork in case you need to call the repair lab about your unit. These numbers are referenced on the repair order and it makes it easier and faster to locate your unit.

Return Authorization (RA) numbers are not necessary unless you have been given one by the Field Service Department. They require RA numbers for exchange units or if they want to be aware of a specific problem. If you have been given an RA number, reference this number on the Factory Repair Request Form sent with the unit. The repair lab will then contact the Field Service Department when the unit arrives.

1.9 REPLACEMENT PARTS

E.F. Johnson replacement parts can be ordered directly from the Service Parts Department. To order parts by phone, dial the toll-free number and then enter "1" as described in Section 1.7. When ordering, please supply the part number and quantity of each part ordered. E.F. Johnson dealers also need to give their account number.

If there is uncertainty about the part number, include the designator (C112, for example) and the model number of the equipment the part is from (refer to Section 1.4).

You may also send your order by mail or FAX. The mailing address is as follows and the FAX number is shown in Section 1.7.

E.F. Johnson Company
Service Parts Department
299 Johnson Avenue
P.O. Box 1249
Waseca, MN 56093-0514

1.10 SOFTWARE UPDATES/REVISIONS

All inquiries concerning updated software, its installation and revisions should be directed to the Customer Service Department (see Section 1.7).

1.11 UNIVERSAL STATION OPERATION

1.11.1 THIRD PARTY INTERFACE (TPI)

Programming Jack (Refer to Figure 1-2)

J1 provides input connection from the computer and the "flash memory" in the TPI. The programming information in an IBM® compatible personal computer programs the TPI directly from the serial port through interconnect cables connected to the COM1 or COM2 port.

Reset

S1 provides a manual reset of the Third Party Interface (TPI) microprocessor. A manual reset causes a complete power-up restart.

Display and LEDs

Each combination of DS1 display read-out and CR3/CR4 indication refers to an active alarm. See Table 1.4 for alarms and definitions. LED indications: CR1 blinking; TPI is operational, CR2 on; high power, off is low power and CR5 is not assigned at this time.

Alarms

When the Station is in the test mode the safety measures are disabled. Therefore, if the Universal Station is keyed for an extended period and the power amplifier temperature increases, thermal shutdown will not occur. There are pop-up windows that will appear in the Test mode screens to alert the user that there is an alarm and action should be taken. Refer to Figure 1-1 for an example of this type of alarm.

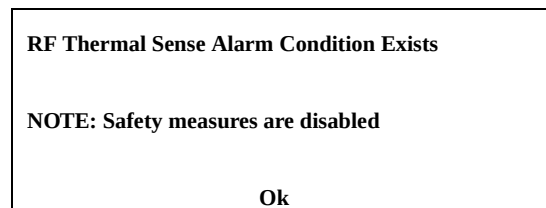


Figure 1-1 ALARM IN TEST MODE

External Speaker Jack

J104 provides local audio output to an external speaker. The local volume control adjusts the volume level of this speaker.

Speaker/Microphone Jacks

J102 provides audio input from a microphone. J101 provides the receive audio to the microphone.

Local On/Off/Volume Control

R164 provides control of the receive audio output to J101 and J104. Turning this control clockwise past the detent applies voltage to the local audio amplifier.

A/D Level Test Point

J100 provides audio/data level output for test level checks.

Ground

J103 is the ground connection for test equipment when monitoring test point J100.

1.11.2 INTERFACE ALARM CARD (IAC)

Voltage Test Output

J502 provides a test point to monitor +15V supply on the IAC. Refer to Figure 1.4.

Ground

J501 is connected to ground for test equipment when monitoring voltage test point J502.

A/D Level Test Point

J500 provides a test point to monitor audio and data levels, AC fail and thermal sensor.

Power Supply On/Off Switch

S508 turns the power supply DC voltages on and off from the front of the Station.

Power Indicator

CR501 indicates the +5V supply is at normal level and applied to the IAC. CR524 indicates -5V supply is at normal level and applied to the IAC.

CR523 indicates the +15V accessory supply is at normal level. CR525 indicates that the +15V supply is at normal level and applied to the IAC.

Xmit Indicator

Indicates that the Universal Station's transmitter is keyed by the logic.

1.11.3 POWER SUPPLY

The power supply is sealed and the line and supply fuses are inside. If a supply fuse opens, the power supply must be removed and sent to the manufacturer for repair (see Section 2.4 and 8.5).

Standby Battery Jack

This provides a connection point for a +24V DC standby battery. Current is drawn from the battery only when the power supply output voltage is lower than the battery voltage. A trickle charge switch on the supply ensures that the battery is fully charged. Turn this switch off when a separate battery charger is used.

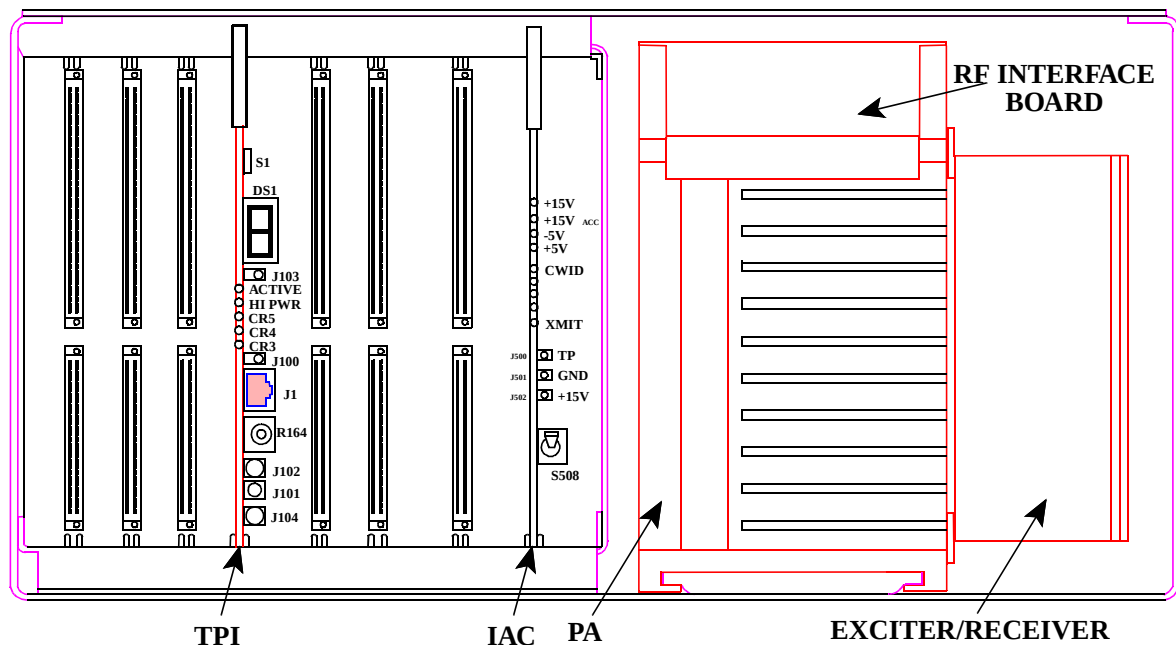


Figure 1-2 UNIVERSAL STATION CARDS

Table 1-2 ACTIVE ALARMS

Alarm No.	DS1	CR3	CR4	Definition
0	0	Off	On	Test Mode
1	1	Off	On	IAC input 1 Active
2	2	Off	On	IAC input 2 Active
3	3	Off	On	IAC input 3 Active
4	4	Off	On	IAC input 4 Active
16	0	On	Off	AC Power Failure
17	1	On	Off	Battery Power Failure
18	2	On	Off	Power supply thermal sense
19	3	On	Off	Fan 1 current out of specification
20	4	On	Off	Fan 2 current out of specification
21	5	On	Off	IAC mismatch
32	0	On	On	RF shutdown
33	1	On	On	RF Half Power Mode
34	2	On	On	Thermal sense in RF portion
35	3	On	On	RF Finals 1-2 power out failure
36	4	On	On	RF Finals 3-4 power out failure
37	5	On	On	RF VSWR Failure
38	6	On	On	Normal Synthesizer Tx Lock failure
39	7	On	On	Normal Synthesizer Rx Lock failure
40	8	On	On	HS Synthesizer Tx Lock failure
41	9	On	On	HS Synthesizer Rx Lock failure
42	A	On	On	RF Quarter Power Alarm

SPECIFICATIONS

GENERAL¹

Frequency Ranges	380-400, 400-430, 430-470, 470-512, 480-520 MHz Transmit/Receive
Dimensions	9.125" H x 17" W x 20.9" D
AC Voltage/Frequency	100-240V AC/50-60 Hz
AC Current	0.38A (Standby), 1.4A (25W), 5A (110W)
AC Input Power	45W (Standby), 170W (25W), 560W (110W)
DC Current at 26.5V DC (Low Power)	6.3A (25W), 16.5A (110W)
Number of Channels	1 (Synthesized, programmable)
Channel Spacing	12.5 kHz/25 kHz selectable
Channel Resolution	6.25 kHz
Temperature Range	-30°C to +60°C (-22°F to +140°F)
Duty Cycle	Continuous
FCC Type Acceptance	ATH2422004 (25 kHz)
FCC Compliance	Parts 15, 90

RECEIVER

12 dB SINAD	0.35 μ V
20 dB Quieting	0.50 μ V
Signal Displacement Bandwidth	± 1 kHz (12.5 kHz), ± 2.0 kHz (25 kHz)
Adjacent Channel Rejection	-85 dB (12.5 kHz), -90 dB (25 kHz)
Intermodulation Rejection	-85dB
Spurious & Image Rejection	-100 dB
Audio Squelch Sensitivity	12 dB SINAD
Audio Response	+1/-3 dB TIA
Audio Distortion	Less than 3% at 0.5W/16 ohms
Local Audio Power	0.5W/16 ohms
Audio Sensitivity	± 0.75 kHz (12.5 kHz), ± 1.5 kHz (25 kHz)
Hum & Noise Ratio	-50 dB
Frequency Spread	2 MHz
Frequency Stability	± 1 PPM -30°C to +60°C (-22°F to +140°F)
Modulation Acceptance Bandwidth	± 3.5 kHz (12.5 kHz), ± 7.0 kHz (25 kHz)

TRANSMITTER

RF Power Out	380-470 MHz 110W (Default setting), 25-110W (Variable Set Point) 470-520 MHz 100W (Default setting), 25-100W (Variable Set Point)
Spurious Emissions	-90 dBc
Harmonic Emissions	-90 dBc
Audio Deviation	± 1.6 kHz (12.5 kHz), ± 3.5 kHz (25 kHz)
LTR Data Deviation	± 0.8 kHz (12.5 kHz), ± 1 kHz (25 kHz)
CWID Deviation	± 1 kHz (12.5 kHz), ± 2 kHz (25 kHz)
Repeat Deviation	± 0.8 kHz (12.5 kHz), ± 1.5 kHz (25 kHz)
Audio Response	+1/-3 dB TIA
Audio Distortion	Less than 2%
Hum & Noise (TIA)	-50 dB (12.5 kHz), -55 dB (25 kHz)
Frequency Spread	6 MHz
Frequency Stability	± 1 PPM -30°C to +60°C (-22°F to +140°F)
Emission Designators	16K0F3E, 16K0F3D, 16K0F1D

These general specifications are intended for reference and are subject to change without notice. Contact the Systems Applications consultants for guaranteed or additional specifications.

SECTION 2 INSTALLATION

2.1 INTRODUCTION

Information in this section tells how to set up the Universal Station for operation. It is assumed that the Universal Station has been previously aligned at the factory or as described in the alignment procedure in Section 7.

Even though each Universal Station is thoroughly aligned and tested at the factory, it is good practice to check performance before it is placed in service. This ensures that no damage occurred during shipment and that the Universal Station is otherwise operating properly. Performance testing is described in Sections 7.1, 7.2 and 7.3.

2.1.1 SITE PREPARATION AND ANTENNA INSTALLATION

Site preparation and antenna installation are not within the scope of this manual. Basic installation requirements are discussed in the "Dealer Guide To Site Preparation", Part No. 004-8000-100. Factory installation is also available. Contact your Johnson representative for more information.

2.2 ENVIRONMENT

The following conditions should be considered when selecting a site for the Repeater.

Operating Temperature.

-30°C to +60°C (-22°F to +140°F).

Humidity.

Less than 95% non-condensing relative humidity at 50°C.

Air Quality.

For equipment operating in a controlled environment with the Repeaters rack mounted, the airborne particles must not exceed 30 µg/m³.

For equipment operating in an uncontrolled environment with the Repeaters rack mounted, the airborne particles must not exceed 100 µg/m³.

NOTE: If the Repeater is installed in an area that exceeds these environmental conditions, the site should be equipped with air filters to remove dust and dirt that could cause the equipment to overheat.

When the repeaters are installed in an environment that contains small airborne particles, e.g. grain dust or salt fog, the repeater cabinets need to be sealed. A heat exchanger, i.e. air conditioner, is then required to cool the cabinets. The air conditioners must be suited for the environment. Each repeater (110W) requires >2400 BTU/hr dissipation to maintain exterior cabinet temperature.

2.3 VENTILATION

The RF modules and the power supply are equipped with fans, controlled by thermostats, that force air through the equipment for cooling. The air flow is from the front to the back of the equipment. This permits the Repeaters to be stacked or rack mounted (see Figure 2-5). There are a few considerations when installing Repeaters to provide adequate air circulation.

1. The Repeaters should be mounted with a minimum of 6 inches clearance between the front or back of the cabinet for air flow.
2. The power supply requires a minimum of 18 inches at the back of the Station for removal.

NOTE: Repeaters should not touch. Leave a minimum of one empty screw hole (approximately 1/2") between repeaters vertically, especially for bottom ventilation slots in high power repeaters.

3. Cabinet enclosures must provide air vents for adequate air circulation.
4. Temperature and humidity must be considered when several Stations are installed at a site. This might require air conditioning the site.

2.4 AC POWER

The AC power source to the Universal Station can be 120V AC to 240V AC. Nothing need be done to the power supply for 240V AC operation. However, a 240V AC outlet requires the 120V AC power plug be replaced. A locking AC power cord is provided for the supply.

The 120V AC cord is a standard 3-wire grounded cord used with a standard AC wall outlet. The outlet must be capable of supplying a minimum of 560W. With the nominal 120V AC input, the source must supply 5A for each 110W Universal Station and should be protected by a circuit breaker. It is recommended that all of the repeaters in a rack should not be on the same breaker in order to provide one operational Station in the event a breaker trips. An AC surge protector is recommended for all equipment.

Each Universal Station requires an outlet and the Receiver multicouplers require one each, so for a 5-channel system a minimum of 7 outlets is required. An additional three should be added for test equipment. The outlets must be within 3 feet of each Universal Station cabinet. Future system expansion should be considered when electrical work is being planned for the initial system.

The Universal Station power supply can be equipped with an optional 24V DC back-up in the event of AC power failure. Since the transmitter will remain on full power, if desired, the DC power source must have a current capability of about 20A per 110W Station or 100A for 5 - 110W Stations. The multicoupler requires another 0.5A for a total system requirement at 24V DC of 100.5A for 110W Stations.

2.5 BATTERY BACKUP

If the power supply is equipped with battery backup, screw lugs are provided on the front of the power supply for battery connections (see Figure 2-1). A switch is provided for charging the battery or can be off if a separate battery charger is used. A battery temperature sensor connection is also provided. The temperature sensor cable is shown in Figure 2-2. LED indicators are provided to show Reverse Battery connection, Charger On/Off and Battery Fault.

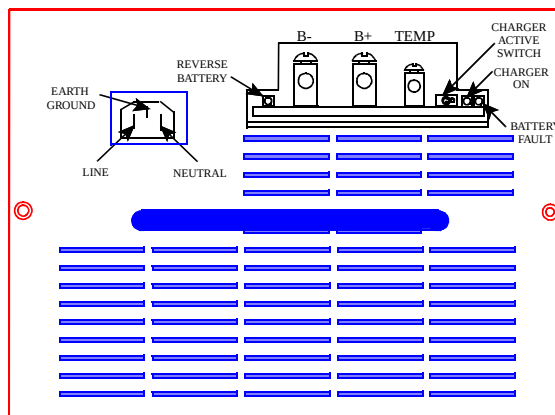


Figure 2-1 BATTERY BACKUP CONNECTOR

The temperature sensor is required to adjust the charging voltage over temperature.

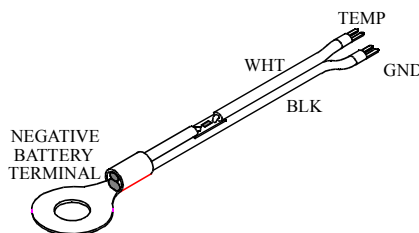


Figure 2-2 TEMPERATURE SENSOR CABLE

2.6 800W POWER SUPPLY

The power supply has four voltage output levels (see Table 2-1). Each voltage is set to $\pm 1\%$ at $+25^{\circ}\text{C}$ ($+77^{\circ}\text{F}$). The output of this supply is capable of running any 2000 series repeater.

Each output is overload protected such that the power supply current limits and automatically resets when the overload is removed (see Table 2-1).

Each output is over voltage protected such that the power supply shuts down when an over voltage condition exists, usually when a component in the supply has failed (see Table 2-2). The power supply must be manually reset by toggling the Enable Line or removing AC power for more than 10 seconds.

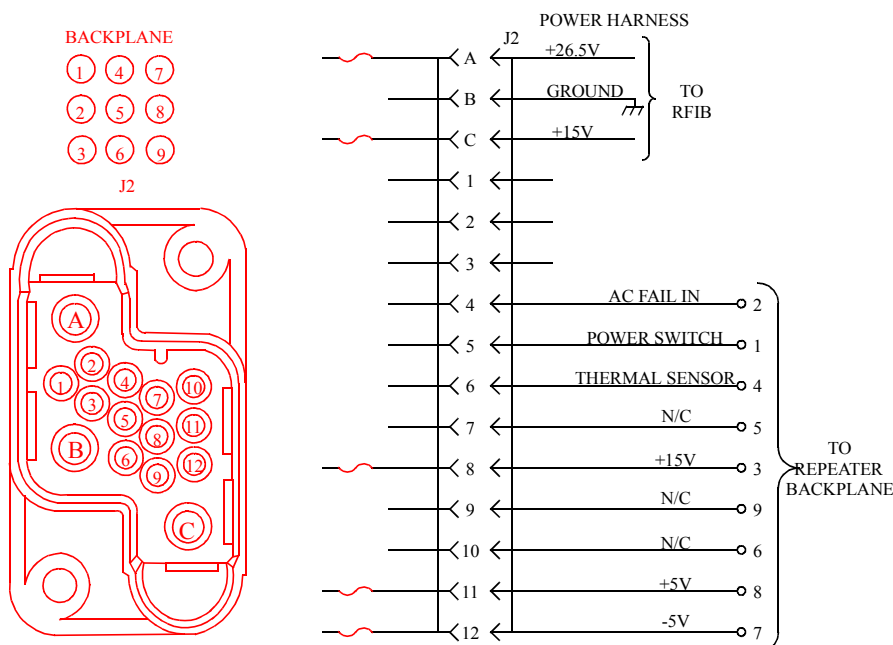


Figure 2-3 POWER CABLE CONNECTOR AND SCHEMATIC

Table 2-1 OUTPUT VOLTAGES

Voltage	Current	Wattage
+26.5V	22A	583W
+15V	5A	75W
+5.2V	5A	26W
-5V	1A	5W

Table 2-2 OVER VOLTAGE

Voltage	Range
+26.5V	+32V to +33V
+15V	+16V to +18V
+5.2V	+6V to +7V
-5V	-6V to -7V

2.6.1 AC INPUT REQUIREMENTS

AC Input Voltage:	100-240V AC
Line Frequency:	50-60 Hz
AC In-rush:	60A maximum
Overall Efficiency:	>70% at 100V AC >80% at 240V AC
Lightning protection:	6kV for < 1ms
Power Factor:	>0.97 at full load
Brown Out Voltage:	80V AC
Temperature	-30°C - +60°C (full power)

Power factor correction per IEC555. The Power supply has the following safety agency approvals pending: UL1950, CSA22.2-950, TUV EN60950 (IEC950)

When the AC input voltage is below 90V AC, the maximum output power is decreased to keep the input current constant. If a battery back-up is installed, the batteries take over when the AC input voltage falls below 80V AC (dependant on power output).

The AC input connector is an IEC connector equipped with a locking mechanism.

The operating temperature range is -30°C to +60°C (-22°F to +140°F), i.e. the same as the repeater. The fan is thermostatically controlled by the internal temperature. When the internal heatsink temperature reaches +45°C (113°F) the fan turns on. When the heatsink temperature drops below +35°C (95°F) the fan turns off. If the internal heatsink temperature reaches +90°C (+194°F) the power supply turns off until the heatsink temperature drops below +85°C (+185°F). The over-temperature shutdown and restart are automatic.

2.7 GROUNDING

CAUTION

PROPER SITE GROUNDING AND LIGHTNING PROTECTION ARE VERY IMPORTANT TO PREVENT PERMANENT DAMAGE TO THE UNIVERSAL STATION.

As in any fixed radio installation, measures should be taken to reduce the possibility of lightning damage to the Universal Station equipment. Proper grounding eliminates shock hazard, protects against electromagnetic interference (EMI) and lightning.

Ground each piece of equipment separately. Do not ground one piece of equipment by connecting it to another grounded piece of equipment.

A good DC ground must be found or created at the site. Rooftop site grounds can be researched through the building management or architects. Tower site grounds must be made with grounding rods. The many techniques for providing adequate grounds for towers and poles and for installing building ground bus lines are beyond the scope of this manual. Refer to National Electrical Code article 250 "Grounding Techniques," article 800 "Communications Systems" and follow local codes.

The ground bus should be routed to the floor area within 5 feet of the system with a runner of 6 AWG or larger solid copper wire or 8 AWG stranded copper wire.

The outer conductor of each transmission line at the point where it enters the building should be grounded using 6 AWG or larger solid copper wire or 8 AWG stranded wire.

Secondary protection (other than grounding) provides the equipment protection against line transients that result from lightning. There are two types of secondary protection, RF and Telephone Line. Use the same wire sizes as specified for coaxial cables for any ground connections required by the secondary protectors.

RF

An RF protector keeps any lightning strike to the antenna feed line or tower from damaging the Universal Stations. Install this protection in-line with the combiner and antenna feed line.

RF protectors are selected by calculating the maximum instantaneous voltage at the output of the combiner. Do this by using the following equation.

$$V_P = 1.414 (X) (\sqrt{P(50)})$$

Where:

V_P = Voltage at the output of the combiner.

P = Universal Station output in watts

X=	for	VSWR=
1.05		1.10 : 1
1.09		1.20 : 1
1.13		1.30 : 1
1.17		1.40 : 1
1.20		1.50 : 1
1.30		1.86 : 1

Example: Universal Station power output of 60W with a VSWR of 1.3 : 1 (VSWR, X = 1.13):

$$V_P = 1.414 (1.13) (\sqrt{60(50)})$$

$$V_P = 1.59782 (\sqrt{60(50)})$$

$$V_P = 1.59782 (54.772256)$$

$$V_P = 87.52V$$

Telephone Line

There are four types of protection suppressors for telephone lines; Gas Tube, Silicon Avalanche Diode, Metal Oxide Varistor and Hybrid.

The hybrid protector is ideal for E.F. Johnson equipment, and is strongly recommended. A hybrid suppressor combines several forms of protection not available in just one type of device.

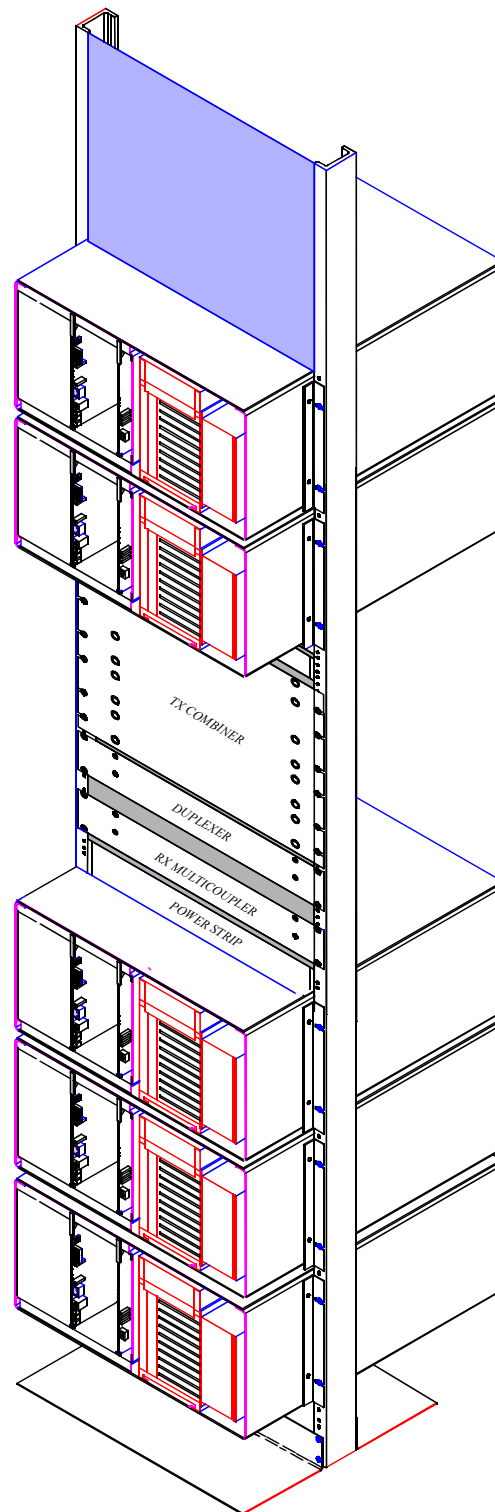


Figure 2-5 RACK MOUNTED UNIVERSAL STATIONS

2.9 CONNECTING RECEIVE AND TRANSMIT ANTENNAS

Receive and Transmit antenna connector locations are shown in Figure 2-6. Although each transmitter and receiver could be connected to a separate antenna, this is usually not done because of the large number of antennas required by a multiple Station installation. Therefore, an antenna combining system is usually used. An example of a combining system for a five-channel system is shown in Figure 2-7. The amount of power loss introduced by a combiner depends on the type of combiner used. If it has a loss of 3 dB, power output to the antenna is reduced by half.

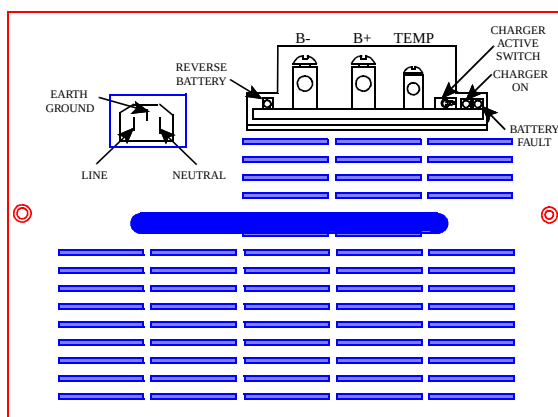


Figure 2-6 ANTENNA CONNECTIONS

2.10 RANGE/BANDWIDTH INDICATOR RESISTORS

Zero ohm resistors R311-R318 on the receiver board are used for identification of the frequency range and bandwidth only. If R311/R312 are both installed, this indicates that parts for both IFs are installed and either one can be selected using jumpers on J203, J204 and J205 (see Sections 6.1.4 and 6.1.5). One zero ohm resistor (R313-R318) is used to indicate the frequency range.

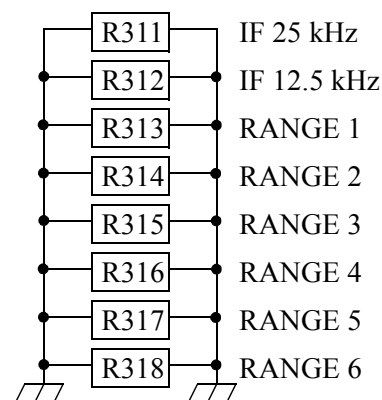


Figure 2-7 RANGE/BANDWIDTH INDICATOR RESISTORS

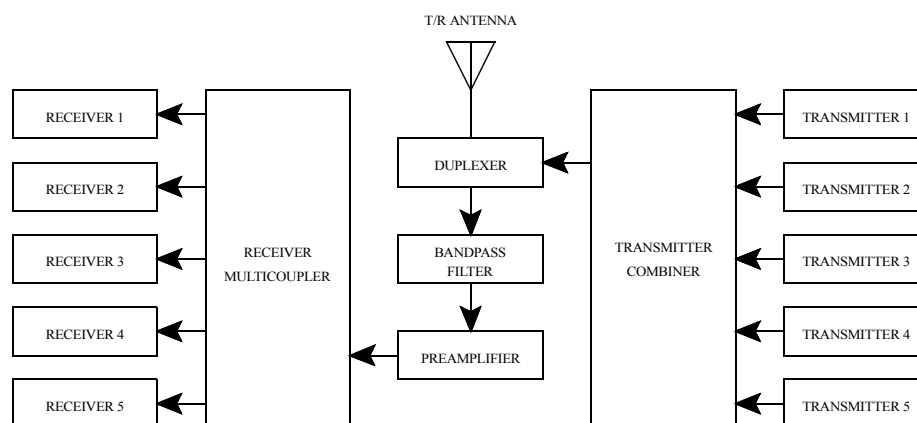


Figure 2-8 5-CHANNEL COMBINING SYSTEM

SECTION 3 SOFTWARE

3.1 INTRODUCTION

The Johnson Programming software on 3.5 inch disk, Part No. 023-9998-390, uses an IBM® personal computer or compatible to program the Flash Memory in the Third Party Interface (TPI) card. To lessen the chance of programming errors and simplify operation, the program uses yes/no questions or toggles through the available responses.

The computer is connected directly from the serial port to the TPI. The interconnect cables used are shown in Figure 3-2. The DB-9 to 8-pin modular adapter is connected to the serial port of the computer and an interconnect cable connects the adapter to the TPI card.

NOTE: These connections are for the IBM computer and may differ from an IBM compatible. In which case, consult the manuals for your computer for serial port outputs and connections.

3.1.1 HOW TO USE THIS MANUAL

This manual introduces the program and illustrates how to use the features. This manual is organized to easily find programming information with the Table of Contents, Index and Parameter Tables for the responses required for programming.

Graphic reproductions of the screens are shown for reference. Adjacent to the screens are tables to provide the parameters, available responses and a brief description of the parameter. It is not the intent of this manual to teach computer operation, but to allow the user to become familiar with the available screens and the responses without having to be at the computer.

3.1.2 GETTING STARTED

NOTE: Before starting you should already know how to start MS-DOS®, format and make backup copies of disks, copy and delete files, and run programs. If you are unfamiliar with any of these actions, refer to the MS-DOS manual for your computer for more information (see Section 5).

Follow the computer instructions for loading the disk. The MS-DOS Revision 3.3 or later operating system is needed to run the programs. The computer needs to have RS-232C capability, for example, the Serial port in slot "COM1" or "COM2".

3.1.3 COMPUTER DESCRIPTION

The programming software is designed to run on an IBM PC or compatible computer that meet the following minimum requirements.

1. One 3.5" high density disk drive.
2. 640K of memory
3. MS-DOS version 3.3 or higher
4. One serial port
5. Monochrome or color monitor and video card

Although the program uses color to highlight certain areas on the screen, a monochrome (black and white) monitor or LCD laptop also provides satisfactory operation. Most video formats (i.e. EGA and VGA) are supported. A serial port (standard with most computers) is required to connect the Universal Station to the computer.

The cables from the TPI card to the computer are not included. With most computers, the adapter-to-computer cable is a standard DB-25 M-F cable, PN 023-5800-017, (the male connector plugs into the adapter). If your computer requires a male connector, a male-to-male cable is also available, PN 023-5800-016. The cable from the adapter to the Universal Station has a DB-9 to 8-pin connector (see Figure 3-2).

3.1.4 EEPROM DATA STORAGE

The data programmed into the TPI card is stored in EEPROM Memory. Since this type of device is nonvolatile, data is stored indefinitely without the need for a constant power supply. A TPI can be removed from the site or even stored indefinitely without affecting programming. Since EEPROM Memory is also reprogrammable, a new device is not needed if programming is changed.

3.1.5 COMMAND LINE OPTIONS

HELP

To show all options available from the command line type: /h or /?. Either '/' or '-' can be used. For example: 2004pgmr /h

The options can be entered in any order. For example: 2004pgmr /d /b /c

COM PORT

The Johnson programming software defaults to serial port COM1. However, if this port is already in use, the software can be reconfigured to use serial port COM2. To do this, use one of the following methods:

- When running the compiled (.EXE) version, type /c2 on the command line after the program name. For example: 2004pgmr /c2 or -c2
- Select COM port from Utilities heading.

BAUD RATE

The software defaults to 9600 baud, however this rate can be changed. To do this from the command line, type /bxxxx (xxxx = baud rate). For example: 2004pgmr /b or -b

NOTE: When the baud rate is changed on the command line the baud rate jumpers on J10 in the TPI must also be changed to the same baud rate (see Section 6.7.20).

DEMO MODE

To view the screens for Read Setup Params and Write Setup Params from the Transfer menu when a Universal Station is not connected to the computer this option is used. Normally these screens are not available without a Universal Station connected. To do this from the command line, type: /d or -d. For example: 2000pgmr /d

3.1.6 COLOR OR MONOCHROME OPERATION

The programming software utilizes color for a color monitor and video card. However, with LCD-type displays, this may make some information hard

to read because the contrast is poor. To improve contrast, a monochrome mode can be selected in the display mode from Utilities heading.

3.2 REPEATER PROGRAM SOFTWARE

3.2.1 INSTALLING THE SOFTWARE

When you receive the programming software, make a backup copy and store the master in a safe place. Copy the distribution disks using DOS DISK-COPY command. For example, type:

DISKCOPY A: A: (single floppy drive)

or

DISKCOPY A: B: or C: (multi-drive systems).

If you have a hard disk drive, you may want to create one or more separate directories for transceiver programming and then transfer the program disk files to those directories. To create a new directory, use the MKDIR command. For example, to create directory RADIOPRG, type:

MKDIR \RADIOPRG.

Then to make the new directory the current directory, use the CHDIR command. For example, to change to the \RADIOPRG directory, type

CHDIR \RADIOPRG.

To copy all files from a floppy disk in drive A: to this directory, type:

COPY A:*.*

If you have a single floppy drive and no hard disk drive, you need to create programming disks. The reason for this is that there is not adequate space on the backup disk(s) for storing radio files. If your computer has dual floppy disk drives, the backup disk can be placed in one drive and then the radio files stored on a disk in the second drive.

To make a programming disk, format a blank disk using FORMAT B: or FORMAT B: /S (use "/S" if it must be a bootable disk). Then copy the required program file or files to the programming disk. To do

this, type COPY A:(filename.ext) B:(filename.ext).
For example, to copy the file 2004_pgm2.exe from drive A to drive B, type

COPY A:2004pgm2.exe B:2004pgm2.exe

This procedure works for either single or dual drive computers. Refer to your computer reference manual for more information on these DOS commands.

The programming software is shipped in a compressed format. The name of the compressed file is 2004pgm2.exe and it extracts the following files so the program can be used on a PC.

2004PGMR.EXE	473K
2004PGMR.HLP	42K
UHF12LMM.HLP	2K
2004PGMR.LNF	165K
UHF12HMN.LNF	11K
UHF12LMN.LNF	238K
UHF12LUS.LMF	59K
UHF25HMN.LNF	11K
UHF25LMN.LNF	229K
UHF25LUS.LMF	58K

The 2004PGMR2.EXE file is self extracting which means that the files extract automatically when executed. To extract these files so the program can be used, first make the current directory the destination directory for these files. For example, to make it the \RADIOPRG directory on drive C: (if not the current directory), type C: (Return) and then CD \RADIOPRG as just described. To make it the disk in drive B:, simply type B:. Then insert the program disk in drive A: and type A:2004PGM2 (or B: 2004PRM2 if drive B: is being used). The program files are automatically extracted into the current directory or disk.

3.2.2 MINIMUM FREE MEMORY REQUIRED

Approximately 560K of free conventional memory is required to run this program (use the CHKSK or MEM command to display the amount of free memory). If you have at least 640K of memory and not enough is available, there may be other programs that are also being loaded into conventional memory. Contact Customer Service for information on how these programs can be moved or disabled to make more space available.

3.3 UNIVERSAL STATION PROGRAMMER

When the program is loaded into the computer and executed, the menu shows the files available from the directory. The program is used to create, edit, transfer and receive the Universal Station and channel parameters described in Section 5.

IMPORTANT

The commands and displays referred to in this manual are for the IBM PC and may differ from IBM compatible. Refer to the computer's operating system manual for command explanations.

3.3.1 PROGRAM FILES

The files that appear in the program directory are needed for program operation:

3.4 ALIGNMENT SOFTWARE

The software for the Universal Station programs the TPI to open and close the audio/data gates necessary for the alignment selected from the Test-Full Universal Station menu. Under the menu heading Test are the alignment procedures for the PA (see Section 7.3), Receiver (see Section 7.1), Exciter (see Section 7.2) and overall Full Universal Station (see Section 7.4) including the TPI (see Figure 3-1).

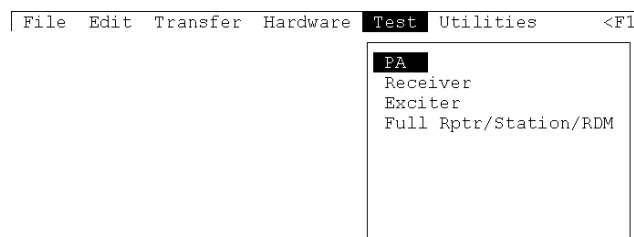


Figure 3-1 REPEATER TEST MENU

Refer to Section 7 for Alignment Procedures as shown in the program, alignment points diagrams and test setup diagrams.

3.5 HELP F1

Help screens are available for most parameters and options in this program. Whenever a parameter or options clarification is needed, press F1 and if a help screen is available it will pop-up on the screen. Press Escape <ESC> to exit the pop-up screen.

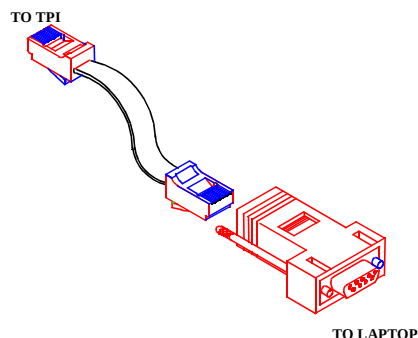


Figure 3-2 LAPTOP INTERCONNECT CABLE

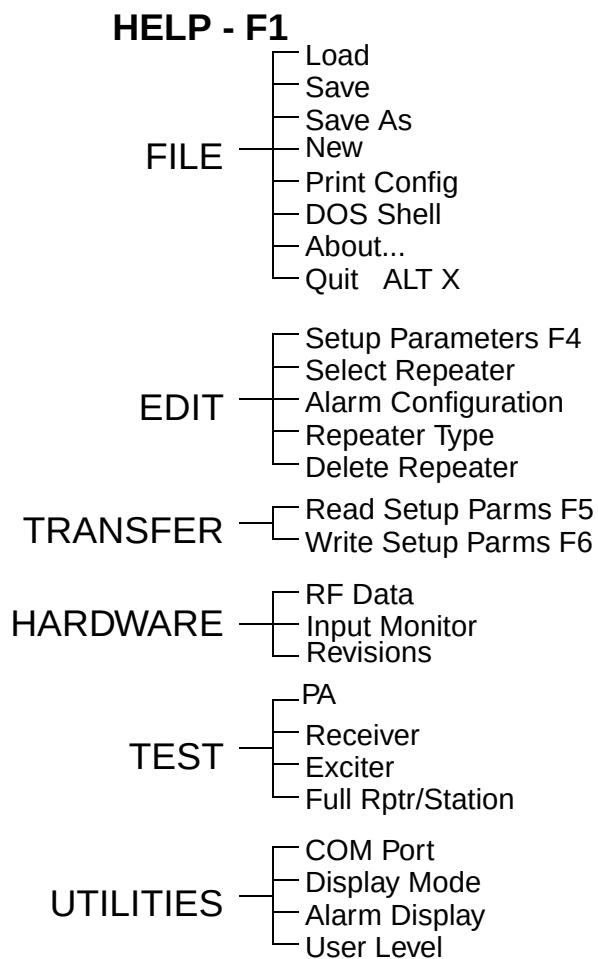


Figure 3-3 PROGRAMMING FLOWCHART

SECTION 4 PULL DOWN MENUS

4.1 MENU DISPLAYS

The menus available are listed at the top of the screen. Move the cursor with the arrow keys to highlight the menu name. Press Enter to view the menu and the arrow keys to scroll through the menu. Call up the highlighted selection by pressing Enter. The menu selections that do not apply to the Universal Station cannot be accessed and are shown in the menu as shaded text.

4.2 FILE MENU

This menu places new or existing files into directories and saves files to be called up at another time.

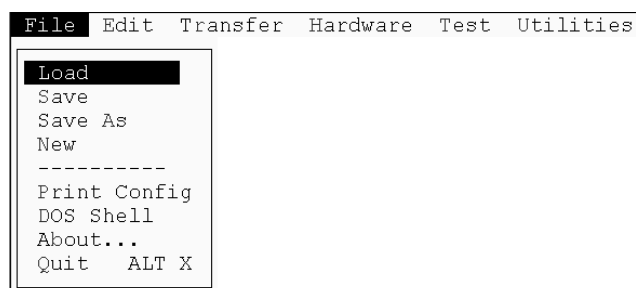


Figure 4-1 FILE MENU

4.2.1 LOAD

Load reads information from a stored file. The program requests the filename to be loaded into the buffer. The filename from a disk can be entered in the highlighted area. Then move the cursor down with the arrow key and highlight "Ok" and press Enter. To select an existing file, use the arrow keys to move down the menu list and press Enter when the highlighted filename is the file to load.

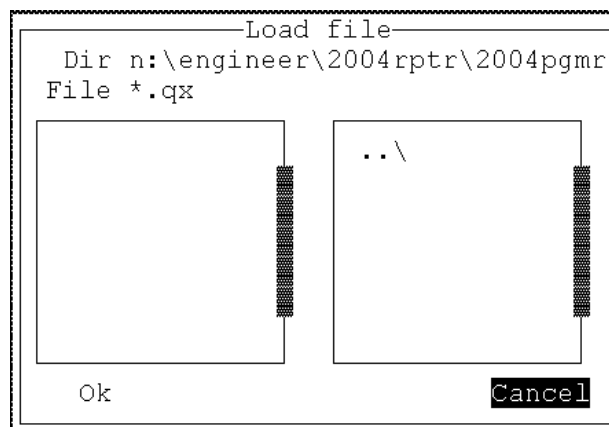


Figure 4-2 LOAD FILE

4.2.2 SAVE

This saves the edited version of an existing file loaded in the buffer under the same filename in the directory and deletes the old file. Loads a new file created in the Edit menu into the directory.

4.2.3 SAVE AS

Saves the edited version of an existing file loaded in the buffer under a new filename or gives a new file created in the Edit menu a filename.

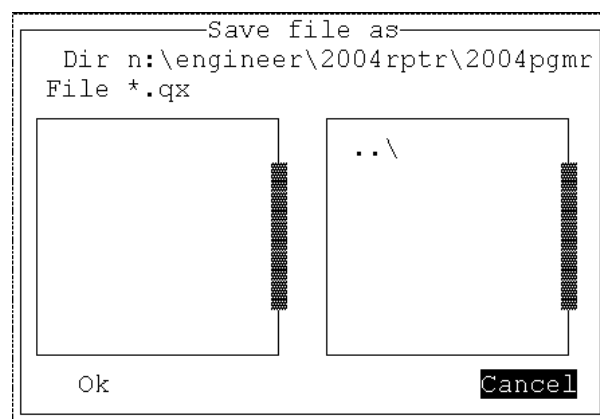


Figure 4-3 SAVE FILE

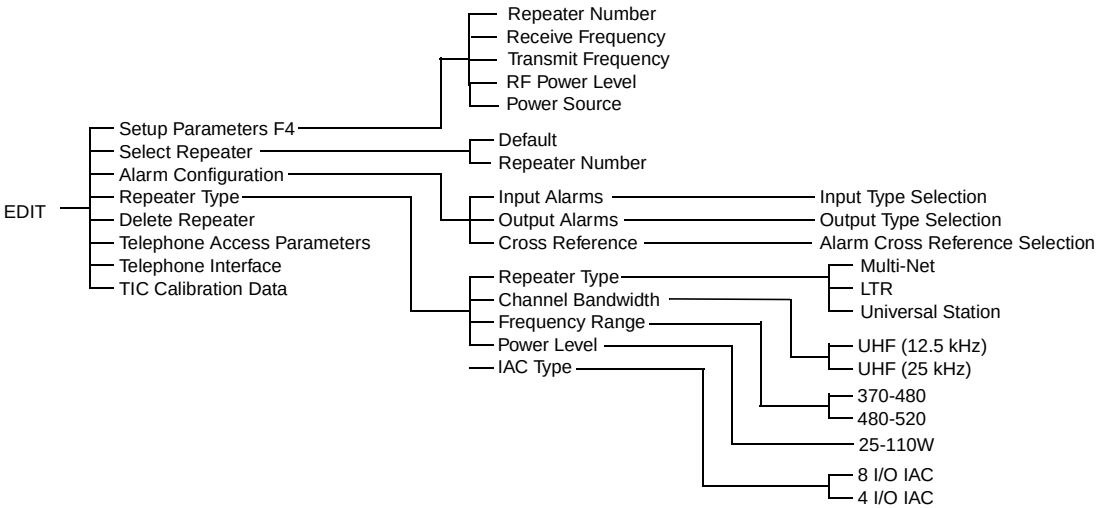


Figure 4-4 EDIT PROGRAMMING FLOWCHART

4.2.4 DOS SHELL

Temporarily suspends the program and returns to DOS. Directories and other DOS commands can be performed. To return to the program from DOS, type EXIT and press Enter.

4.2.5 QUIT (ALT X)

Exits the program and returns to DOS. Be sure all files are saved before exiting the program.

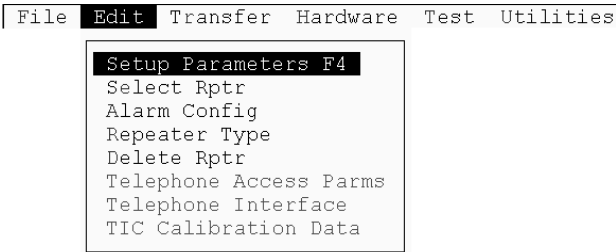


Figure 4-5 EDIT MENU

4.3 EDIT

This menu is used to create new files and set or change the operating parameters. The filename for the file being edited is shown in the lower left corner of the screen.

4.3.1 SETUP PARAMETERS

Programs the Universal Station parameters and options. Table 5.1 lists the parameters that are set by this screen (see Figure 5-1) and gives a brief description of each.

NOTE: The parameters are shown in the lower left of the pop-up screen for reference.

STATION NUMBER

Each Station is programmed with a Station number from 1-20. Make sure that this number agrees with the Home number programmed in the controller assigned to this Station.

NOTE: The Station Number is for reference only. It is not necessary for Station operation.

RECEIVE/TRANSMIT FREQUENCY

Each Universal Station is programmed with a Transmit and Receive frequency that it is operating on.

RF POWER LEVEL

This is the default power level. Select the power level (Watts) that the Station will use for transmit power. Range is from 25-110W. This value will change when transmitter power is adjusted during the Station test procedures.

NOTE: Not the actual power out level. Other factors must be considered for a true power out.

POWER SOURCE

Indicates the primary type of power source to the Station (AC or DC). When AC is selected and Battery Backup is installed, the transmitter goes to half rated power (maximum) in the event of AC failure. When DC is selected and AC fails, the power output is unchanged.

4.3.2 SELECT STATION

Select the Station number to be programmed or edited from the pop-up menu (see Figure 4-6). Move the cursor with the arrow keys to highlight the Station number and press Enter.

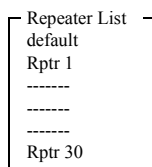


Figure 4-6 REPEATER LIST

4.3.3 ALARM CONFIGURATION

This programs the input alarm (see Figure 4-14) and output alarm (see Figure 4-15) configurations and provides a cross reference screen.

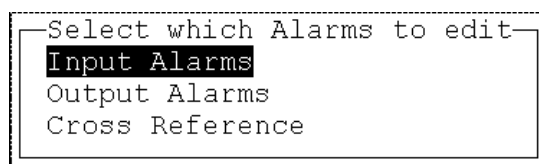


Figure 4-7 ALARM CONFIGURATION

Use the arrow keys to move down the list. Use the Space bar to toggle through the parameters: Disabled, Active Low, Active High, for each alarm.

INPUT ALARMS

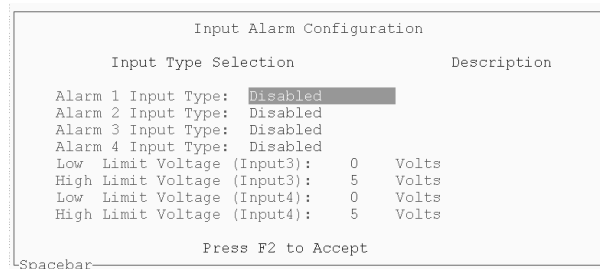


Figure 4-8 INPUT ALARMS

There are four input alarms that can be activated by external devices (see Section 6.8). These inputs can be disabled, energized or de-energized. Alarms 3 and 4 can also be analog input.

If the input is disabled, the input alarm line is inactive. When energized and current flow is detected, the alarm is activated. When de-energized and no current flow is detected, the alarm is activated. Analog inputs provide a detection of an analog input out of limit condition. Select the Low and High Limit pair to trip an Analog Input Alarm. The High Limit must be greater in value than the Low Limit (0.0V-5.0V in 0.1V steps).

OUTPUT TYPE SELECTION

Selects the operation of the Output Alarm. The available types are:

Active Open - An active alarm opens (no contact) the output lines.

Active Closed - An active alarm closes (contact) the output lines.

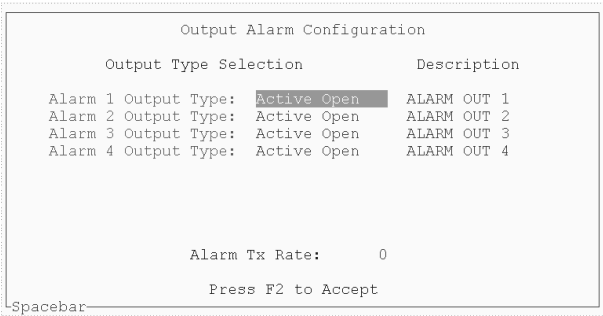


Figure 4-9 OUTPUT ALARMS

ALARM DESCRIPTION

This is a text string (up to 15 characters) to describe the alarm.

ALARM TRANSMIT RATE

This function is not used on Universal Stations.

CROSS REFERENCE

The cross reference screen selects the output alarm that is activated by each input alarm. There are up to 48 alarms (0-47), 4 external input alarms and 40 internal alarms (see Table 1.4). There are four output alarms. An alarm condition on any input can cause an output alarm. This screen configures which input alarm activates an output alarm.

NOTE: More than one alarm condition can have the same output alarm (see Figure 4-10).

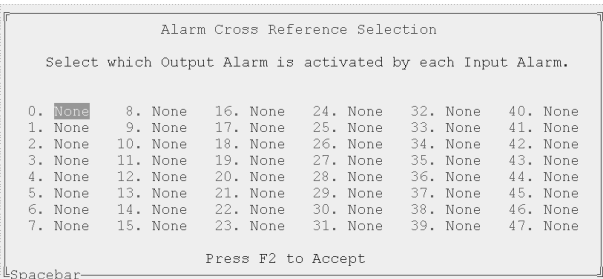


Figure 4-10 ALARM CROSS REFERENCE

4.3.4 REPEATER TYPE

This screen (see Figure 4-11) selects the Station type (Universal Station and features):

Frequency Band UHF (12.5 kHz)
 UHF (25 kHz)
Power Level 110W
IAC Type 4 I/O IAC
 8 I/O IAC

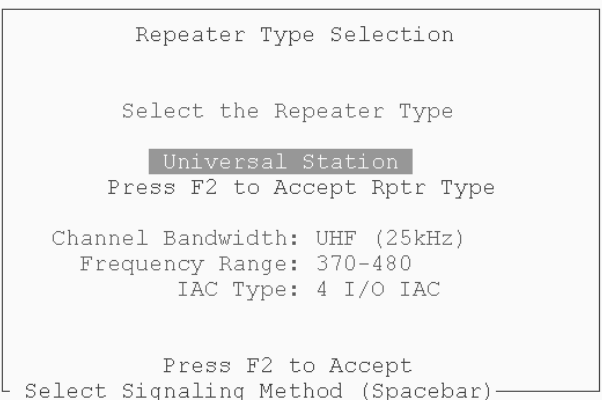


Figure 4-11 REPEATER TYPE SELECTION

4.3.5 DELETE REPEATER

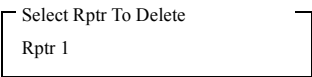


Figure 4-12 DELETE REPEATER

4.4 TRANSFER



Figure 4-13 TRANSFER MENU

4.4.1 WRITE SETUP PARAMETERS

This command sends the contents of a file to program the Flash memory in the TPI card.

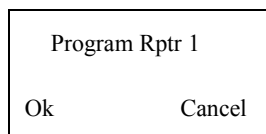


Figure 4-14 WRITE SETUP PARAMETERS

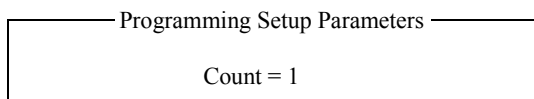


Figure 4-15 PROGRAM WRITE SETUP

4.4.2 READ SETUP PARAMETERS

This command reads the contents of the Flash memory of the TPI card and loads it into a buffer. The contents of the buffer is then displayed to show the programming of the Universal Station.

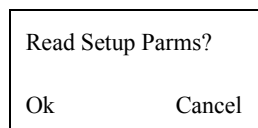


Figure 4-16 READ SETUP PARAMETERS

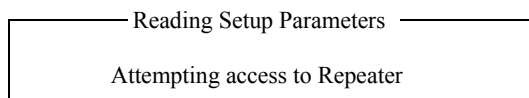


Figure 4-17 READING SETUP

4.5 HARDWARE

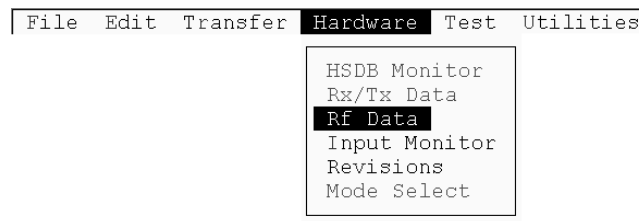


Figure 4-18 HARDWARE MENU

4.5.1 RF DATA

The A/D Monitor Screen shows the state of the lines (see Figure 4-19). These lines are being monitored by the A to D converter in the Interface Alarm Card (IAC). The normal values for each line are defined as follows.

Synthesizer Lock Lines	Yes or No
Forward Power	25-110 Watts
Reflected Power	0-6 Watts
Final Out (ratio)	approx equal
Chassis Temp	27°C-55°C
Battery Voltage	21V-28V
Wideband Audio Output	approx 200
LO Injection	approx 200
RSSI	20-150
Fan Current	100-200, 0
Fan	On or Off
Power Supply Temp	22°C-45°C

Values with no label are the actual A to D reading. To calculate the voltage on the line, divide the value by 51. Example: Value ÷ 51 = Volts. Any variation from the above values may indicate a problem in that area.

RF Line Monitor			
Synthesizer Lock Lines		Receive Parameters	
Exciter Synthesizer:	No	Wideband Audio Output:	0
Receive Synthesizer:	No	LO Injection:	0
Exciter High Stability:	No	RSSI:	0
Receive High Stability:	No		
Transmit Parameters (Not Calibrated)		System Parameters	
Forward Power:	0 Watts	Fan 1 Current:	0
Reflected Power:	0 Watts	Fan 2 Current:	0
Final Out 1/2:	0/ 0	Fan On:	Off
		Chassis Temp:	0 C
		Power Supply Temp:	0 C
		Battery Voltage:	0 Volts

Figure 4-19 RF LINE MONITOR

4.5.2 INPUT MONITOR

The Input Monitor is displayed for analog input alarms. The screen shows the actual voltage of the input and the high/low limits. The description of the alarm entered in the Edit-Alarm Config-Input Alarms menu as well as the Input Type (Energized, De-Energized or Analog).

4.5.3 REVISION/VERSION

The Revision/Version is displayed for the Universal Station modules in this screen. The format is R.V (revision.version) for all modules. The TPI card

information also includes the release date of the software and the serial number of the Universal Station (see Figure 4-20 these numbers are for example only).

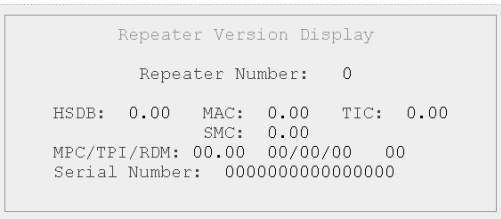


Figure 4-20 REVISION/VERSION

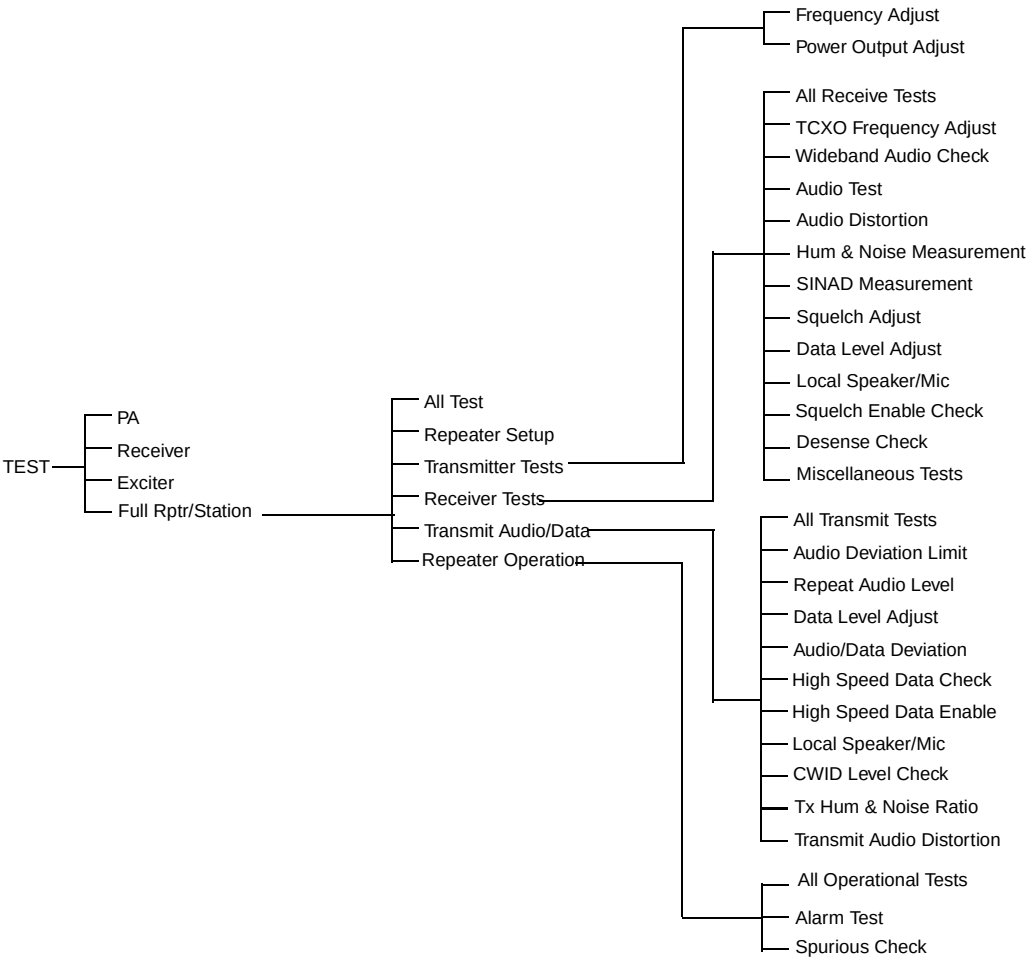


Figure 4-21 TEST PROGRAMMING FLOWCHART

4.6 TEST

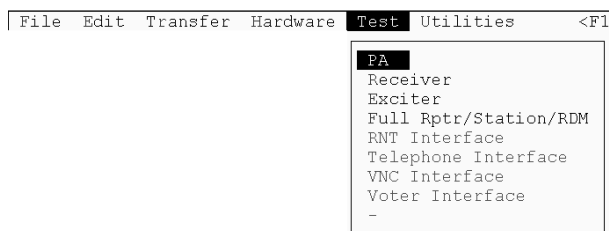


Figure 4-22 TEST MENU

4.6.1 POWER AMPLIFIER

This menu selection walks through the alignment of the Power Amplifier and RF Interface Board on the computer screen. Refer to Sections 7.3 and 7.4 for the PA and RFIB alignment in this manual and Figures 7-3 for an alignment points diagram and Figure 7-4 of the Power Amplifier.

4.6.2 RECEIVER

This menu selection walks through the alignment of the receiver on the computer screen. Refer to Section 7.1 for the Receiver alignment in this manual and Figure 7-1 for an alignment points diagram and Figure 7-7 of the Receiver.

4.6.3 EXCITER

This menu selection walks through the alignment of the Exciter on the computer screen. Refer to Section 7.2 for the Exciter alignment and Figure 7-2 for an alignment points diagram and Figure 7-8 for a test setup of the Exciter.

4.6.4 FULL REPEATER

This menu selection walks through the alignment of the entire Universal Station. The Receiver and Exciter portions are performance tests and adjustments. The Audio and Data portions are level adjustments for the TPI card. Refer to Figure 7-12 for an alignment points diagram for the TPI card.

4.7 UTILITIES

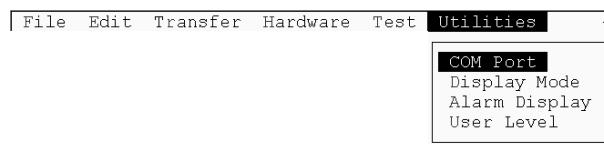


Figure 4-23 UTILITIES MENU

4.7.1 COM PORT

This is the COM port used to send and receive data from the repeater MPC. An interface cable connects the repeater to the computer (see Figure 3-2).

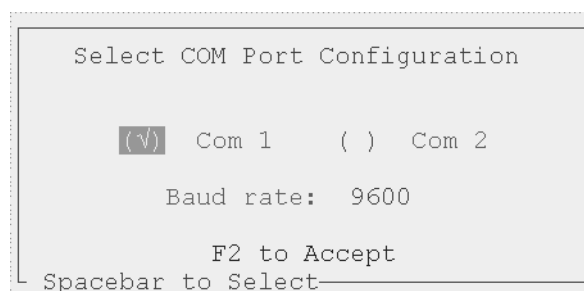
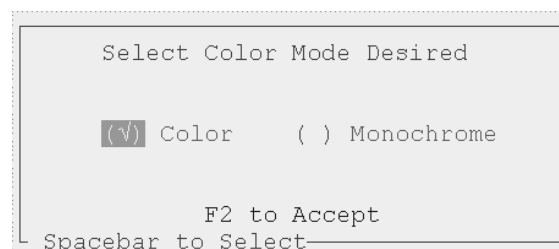


Figure 4-24 COM PORT SELECTION

4.7.2 DISPLAY MODE

This screen allows the color mode to be selected for color monitors. When using a laptop, monochrome is recommended for better resolution.

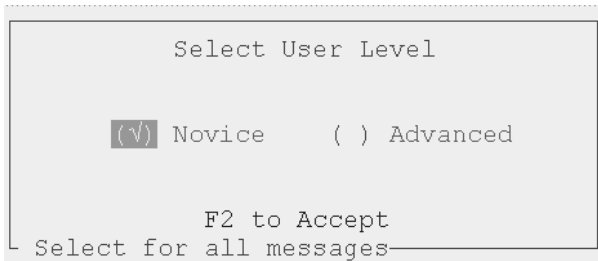


4.7.3 ALARM DISPLAY

This screen displays a scrolling list of alarms generated by the Station.

4.7.4 USER LEVEL

There are two levels to choose from, Novice and Advanced. The Novice uses prompts in the Edit-Parameters screens when Escape or F2 keys are pressed that ask "are you sure" before the task is executed. The Advanced selection performs the task without asking the question.



SECTION 5 REPEATER PROGRAMMING

5.1 CREATING A NEW FILE

An example will be used to show the programming for a new file.

NOTE: At any point in the programming sequence, if F1 is selected, a help screen appears to explain the menu selection highlighted at that point.

5.1.1 SELECT REPEATER TO EDIT

Universal Station is selected to program. When no file exists with programmed parameters, the default is selected and edited.

1. Highlight EDIT, press Enter.
2. Highlight Select Rptr, press Enter.
3. Default is the only Universal Station in the Station list, press Enter.
4. Highlight Setup Parameters, press Enter (or press F4).
5. The Setup Parameters screen appears (see Figure 5-1). Fill in the parameters for this Universal Station. A brief description of the parameters is in Table 5-1. Full descriptions are in Section 4.3.1.
6. Select parameters, press F2 to accept.
7. Highlight Alarm Configuration and press Enter, if alarms are to be configured.
8. Program the Alarms to be configured (see Section 4.3.3), press F2 to accept.
9. Highlight FILE, press Enter.
10. Highlight Save, press Enter.
11. Type in a valid DOS filename. For this example sta1.qx is used.
12. The file consists of default and Rptr 1 under the filename of sta1.qx.

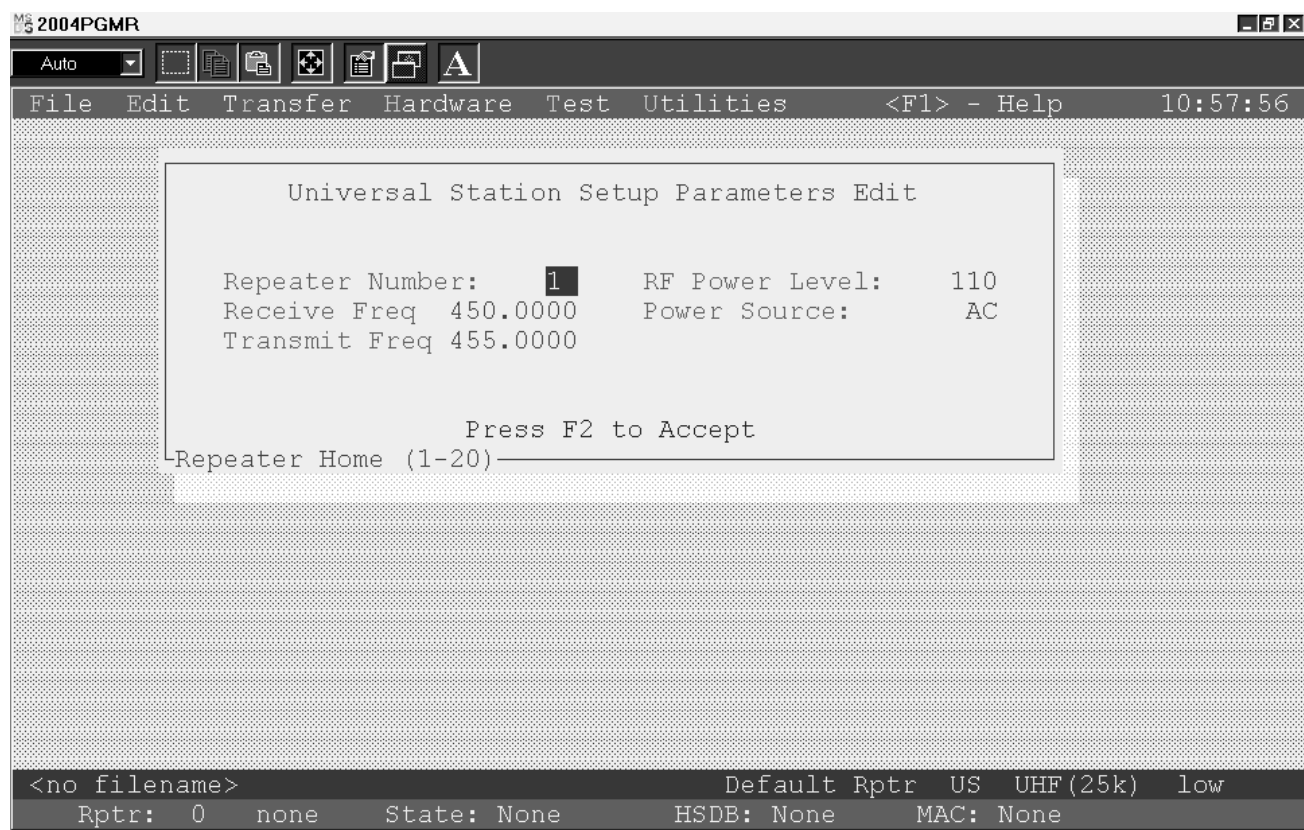
5.2 ADDING A REPEATER TO A FILE

The example used for Station 1 will again be used to add Stations to the filename sta1.qx.

1. Highlight EDIT, press Enter.
2. Highlight Select Rptr, press Enter.
3. The Station list shown for this file includes default and Rptr 1. These contain the same parameters with the exception that when selected for edit, the programmed information can be overwritten and the data lost.
4. Highlight Default, press Enter.
5. Highlight Setup Parameters, press Enter.
6. Change the Station Number and other parameters as required for this Universal Station, press F2.
7. Highlight Alarm Configuration and press Enter, if alarms are to be configured.
8. Program the Alarms to be configured (see Section 4.3.3), press F2 to accept.
9. Highlight FILE, press Enter.
10. Highlight Save, press Enter.
11. Rptr 2 is added to the List in file sta1.qx.

Table 5-1 REPEATER SETUP PARAMETERS

Parameter	Response	Description
Repeater Number	1-20	Each repeater is assigned a number from 1-20.
Receive Frequency	450.0000	Each Universal Station is programmed with the Receive frequency that it is operating on.
Transmit Frequency	455.0000	Each Universal Station is programmed with the Transmit frequency that it is operating on.
RF Power Level	25-110	Power level in watts for transmit power.
Power Source	AC or DC	The type of primary power source for the Universal Station.


Figure 5-1 SETUP PARAMETERS

SECTION 6 CIRCUIT DESCRIPTION

6.1 RECEIVER

6.1.1 INTRODUCTION

The receiver is a double conversion type with intermediate frequencies of 52.95 MHz and 450 kHz. The first injection frequency is phase locked to a temperature compensated crystal oscillator (TCXO) with a frequency stability of ± 1.0 PPM from -30° to $+60^{\circ}\text{C}$ (-22° to $+140^{\circ}\text{F}$). Two 3-pole bandpass filters in the front-end reject signals outside the receive band. Two 4-pole crystal filters and two 4-pole ceramic filter establish receiver selectivity (see block diagram Figure 6-1).

6.1.2 REGULATED VOLTAGE SUPPLIES

The +15V DC power source is supplied by the repeater power supply. The +15V supply enters the receiver on J201, pin 1. U302 provides the +12V DC receive voltage to the RF and IF amplifiers. U303 supplies +12V DC to the first and second injection amplifiers. U304 supplies +12V DC to the remaining RF circuits. U301 supplies +6V DC to the remaining circuits.

6.1.3 HELICAL FILTERS, RF AMPLIFIER

The receive signal enters the receiver on coaxial connector A201. A helical filter consisting of L102, L103 and L104 is a three-pole bandpass filter tuned to pass only a narrow band of frequencies within the 380-520 MHz band. This filter also attenuates the image and other unwanted frequencies.

Impedance matching between the helical filter and RF amplifier Q101 is provided by C103, L106, and C104. Q101 amplifies the receive signal to recover filter losses and increases receiver sensitivity. Biasing for Q101 is provided by R102/Q102/R107/R108 and C112 provides RF bypass. Additional filtering of the receive signal is provided by 3-pole helical filter L108-L110. L107/C113/C114 match the output from Q101 to 3-pole helical filter L108-L110.

6.1.4 12.5 KHZ IF

First Mixer and Crystal Filter

First mixer U101 mixes the receive frequency with the first injection frequency to produce the 52.95 MHz first IF. Since high-side injection is used, the injection frequency is 52.95 MHz above the receive frequency. Jumper J203 selects between a 12.5 kHz IF and a 25 kHz IF. Install jumper plug P203 on J203, pins 2-3 to select the 12.5 kHz IF. The output of U101 is matched to Z211 at 52.95 MHz by L211, C236 and C237.

Z211A and Z211B form a two-section, four-pole filter with a center frequency of 52.95 MHz and a -3 dB bandwidth of 8 kHz. This filter attenuates adjacent channels and other signals close to the receive frequency. The filter sections are a matched pair and the dot on the case indicates which leads connect together. Matching with Q202 is provided by C241, L213 and C240.

IF Amplifier, Crystal Filter

Q202 amplifies the 52.95 MHz IF signal to recover filter and mixer losses and improve receiver sensitivity. Biasing for Q202 is provided by R236/R233/R234/R235 and C242/C243/C246 provide RF bypass. The output of Q202 is matched to crystal filter Z212 at 52.95 MHz by C245, C247 and L214.

Z212A and Z212B form a two-section, four-pole filter with a center frequency of 52.95 MHz and a -3 dB bandwidth of 8 kHz. This filter establishes the selectivity of the receiver by further filtering the 52.95 MHz IF. The filter sections are a matched pair and the dot on the case indicates which leads connect together. Matching with U203 is provided by C250, C251, C252, L216 and R237.

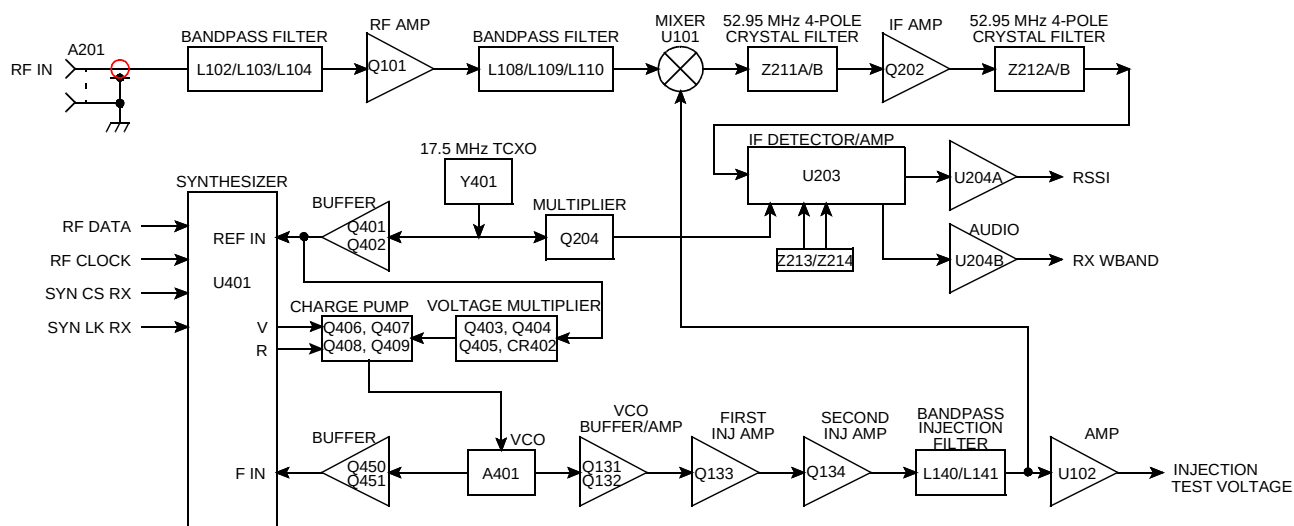


Figure 6-1 12.5 kHz IF RECEIVER BLOCK DIAGRAM

Second Mixer/Detector

As shown in Figure 6-2, U203 contains second oscillator, second mixer, limiter, detector and RSSI circuitry. The 52.95 MHz IF signal is mixed with a 52.5 MHz signal produced by TCXO Y401 and tripler Q204. The 17.5 MHz (± 1 PPM) output of Y401 is fed through C275 to tripler Q204. The tripler passes the third harmonic at 52.5 MHz to the oscillator input of U203.

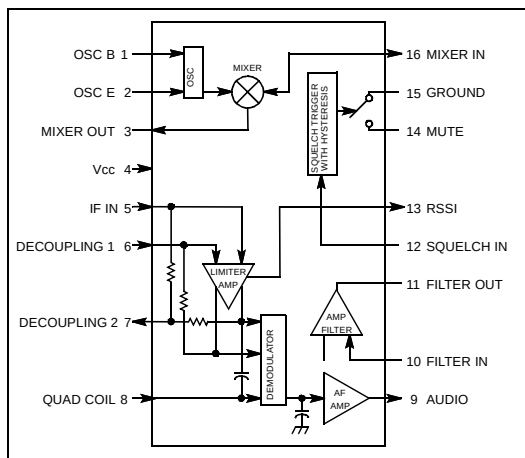


Figure 6-2 U201/U203 BLOCK DIAGRAM

Biasing of Q204 is provided by R258, R259 and R260. RF choke L222 blocks the flow of RF through R261. An AC voltage divider formed by C280/C281 matches Q204 to the highpass filter. The third harmonic of the TCXO frequency is then used to drive the OSC B input at 52.5 MHz. L223, C282 and L224 form a high pass filter to attenuate frequencies below 52.95 MHz. C283 and C284 match the output of the filter to U203.

The 450 kHz second IF is then fed to ceramic filter Z213/Z214, then into the IF amplifier. The center frequency of Z213/Z214 is 450 kHz with a bandwidth of 9 kHz used to attenuate wideband noise. The limiter amplifies the 450 kHz signal 92 dB which removes any amplitude fluctuations.

From the limiter the signal is fed to the quadrature detector. An external phase-shift network connected to U203, pin 8, shifts the phase of one of the detector inputs 90° at 450 kHz (the other inputs are unshifted in phase). When modulation occurs, the frequency of the IF signal changes at an audio rate as does the phase of the shifted signal. The detector, which has no output with a 90° phase shift, converts the phase shift into an audio signal. Z215 is adjusted to provide maximum undistorted output from the detector. The audio signal is then fed out on U203, pin 9.

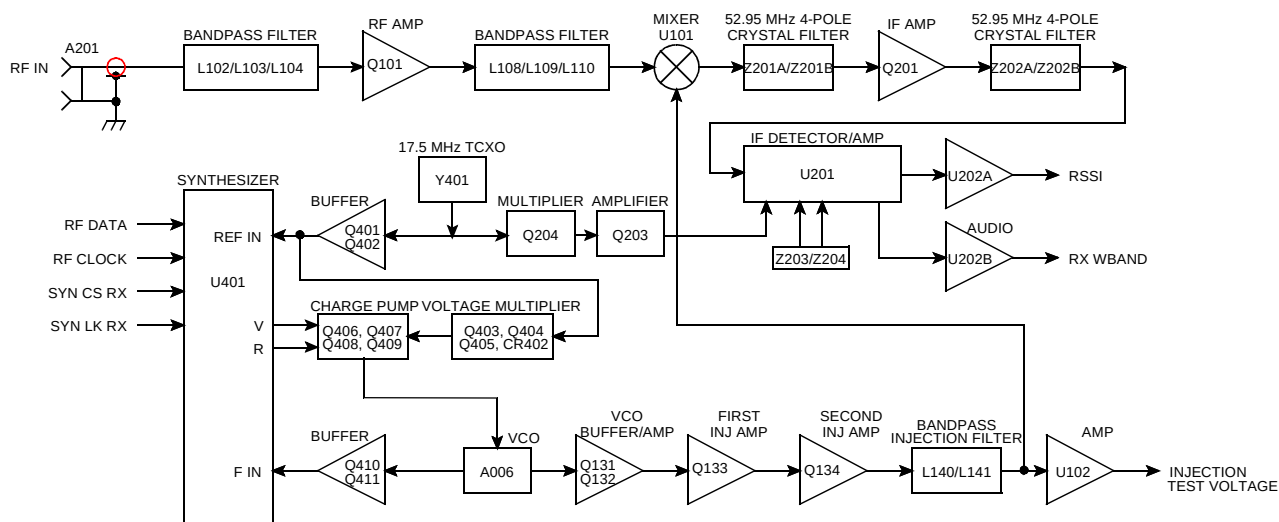


Figure 6-3 25 kHz IF RECEIVER BLOCK DIAGRAM

Wideband Audio Amplifier

U204B amplifies the detected audio and data signal. R244/R245/R246 set the gain of the amplifier and R247/R248/R249/R250/RT204 provide a DC reference level. C261 bypasses the 450 kHz IF signal and C262 bypasses other frequencies. The output signal is adjusted by R253 and fed to J205, pin 3. Install jumper plug P205 on J205, pins 2-3 to select the 12.5 kHz audio to be routed to J201, pin 9.

RSSI Amplifier

U203, pin 13 is an output from an internal RSSI (receive signal strength indicator) circuit which provides a current proportional to the strength of the 450 kHz IF signal. The RSSI output is buffered through U204A and the level is adjusted by R221. The DC output signal is then fed to J204, pin 3. Install jumper plug P204 on J204, pins 2-3 to select the 12.5 kHz RSSI to be routed to J201, pin 7.

6.1.5 25 KHZ IF

First mixer U101 mixes the receive frequency with the first injection frequency to produce the 52.95 MHz first IF. Since high-side injection is used, the injection frequency is 52.95 MHz above the receive frequency. Jumper J203 selects between a 12.5 kHz

IF and a 25 kHz IF. Install jumper plug P203 on J203, pins 1-2 to select the 25 kHz IF. The output of U101 is matched to the crystal filter at 52.95 MHz by L201, C201 and C202.

Z201A/B form a two-section, four-pole filter with a center frequency of 52.95 MHz and a -3 dB bandwidth of 15 kHz. This filter attenuates adjacent channels and other signals close to the receive frequency. The filter is a matched pair and the dot on the case indicates which leads connect together. Matching with Q201 is provided by C205, L203 and C206.

IF Amplifier, Crystal Filter

Q201 amplifies the 52.95 MHz IF signal to recover filter and mixer losses and improve receiver sensitivity. Biasing for Q201 is provided by R204/R201/R202/R203 and C207/C209/C211 provide RF bypass. The output of Q201 is matched to crystal filter Z202A at 52.95 MHz by C210, C212 and L204.

Z202A/B form a two-section, four-pole filter with a center frequency of 52.95 MHz and a -3 dB bandwidth of 15 kHz. This filter establishes the selectivity of the receiver by further filtering the 52.95 MHz IF. The filter sections are a matched pair and the dot on the case indicates which leads connect together. Matching with U201 is provided by C215, C216, C217, L206 and R205.

Second Mixer/Detector

As shown in Figure 6-2, U201 contains second oscillator, second mixer, limiter, detector and RSSI circuitry. The 52.95 MHz IF signal is mixed with a 52.5 MHz signal produced by TCXO Y401, tripler Q204 and amplifier Q203. The 17.5 MHz (± 1 PPM) output of Y401 is fed through C275 to tripler Q204. The tripler passes the third harmonic at 52.5 MHz to amplifier Q203. Amplifier Q203 amplifies the 52.5 MHz signal for the oscillator input of U201.

Biasing of Q204 is provided by R258, R259 and R260. RF choke L222 blocks the flow of RF through R261. An AC voltage divider formed by C280/C281 matches Q204 to the highpass filter. L223, C282 and L224 form a high pass filter to attenuate frequencies below 52.95 MHz. C283 and C284 match the output of the filter to U203. The third harmonic of the TCXO frequency is lightly coupled to amplifier Q203 through C270, R262 and C265. Biasing of Q203 is provided by R254, R255, R256 and R257. The amplified 52.5 MHz output is passed to U201 OSC B input through C271.

The 450 kHz second IF is then fed to ceramic filter Z203/Z204, then into the IF amplifier. The center frequency of Z203/Z204 is 450 kHz with a bandwidth of 15 kHz used to attenuate wideband noise. The limiter amplifies the 450 kHz signal 92 dB which removes any amplitude fluctuations.

From the limiter the signal is fed to the quadrature detector. An external phase-shift network connected to U201, pin 8, shifts the phase of one of the detector inputs 90° at 450 kHz (the other inputs are unshifted in phase). When modulation occurs, the frequency of the IF signal changes at an audio rate as does the phase of the shifted signal. The detector, that has no output with a 90° phase shift, converts the phase shift into an audio signal. Z205 is adjusted to provide maximum undistorted output from the detector. The audio signal is then fed out on U201, pin 9.

Wideband Audio Amplifier

U202B amplifies the detected audio and data signal. R212/R213/R214 set the gain of the amplifier and R215/R216/R217/R218 and RT202 provide a DC reference level. C226 bypasses the 450 kHz IF signal

and C227 bypasses other frequencies. The output signal is adjusted by R220 and fed to J205, pin 1. Install jumper plug P205 on J205, pins 1-2 to select the 25 kHz audio to be routed to J201, pin 6.

RSSI Amplifier

U201, pin 13 is an output from an internal RSSI (receive signal strength indicator) circuit which provides a current proportional to the strength of the 450 kHz IF signal. The RSSI output is buffered through U202A and the level is adjusted by R219. The DC output signal is then fed to J204, pin 1. Install jumper plug P204 on J201, pins 1-2 to select the 25 kHz RSSI to be routed to J201, pin 7.

6.1.6 VCO

The Voltage-Controlled Oscillator (VCO) is formed by Q802 circuitry and a resonator consisting of Z801. The VCO oscillates in a frequency range from 433-572 MHz. Biasing of Q802 is provided by R805, R806, R807 and R808. AC voltage divider C806, C807 and C808 initiates and maintains oscillation and matches Q802 to the tank circuit. The ceramic resonator is grounded at one end to provide shunt inductance to the tank circuit.

The VCO frequency is controlled in part by DC voltage across varactor diode CR802. As voltage across a reverse-biased varactor diode increases, its capacitance decreases. Therefore, VCO frequency increases as the control voltage increases. The control line is RF isolated from tank circuit by choke L802. The amount of frequency change produced by CR802 is controlled by series capacitor C804.

6.1.7 ACTIVE FILTER

Q801 functions as a capacitance multiplier to provide filtering of the 12V supply to Q802. R803 and R804 provide transistor bias, and C812 provides the capacitance that is effectively multiplied by the gain of Q801. If a noise pulse or other voltage change appears on the collector, the base voltage does not change because of C812. Therefore, the base current does not change and transistor current remains constant. R805 decouples the VCO output from AC ground. L803 is an RF choke and C810, C811, C813 and C814 provide RF bypass.

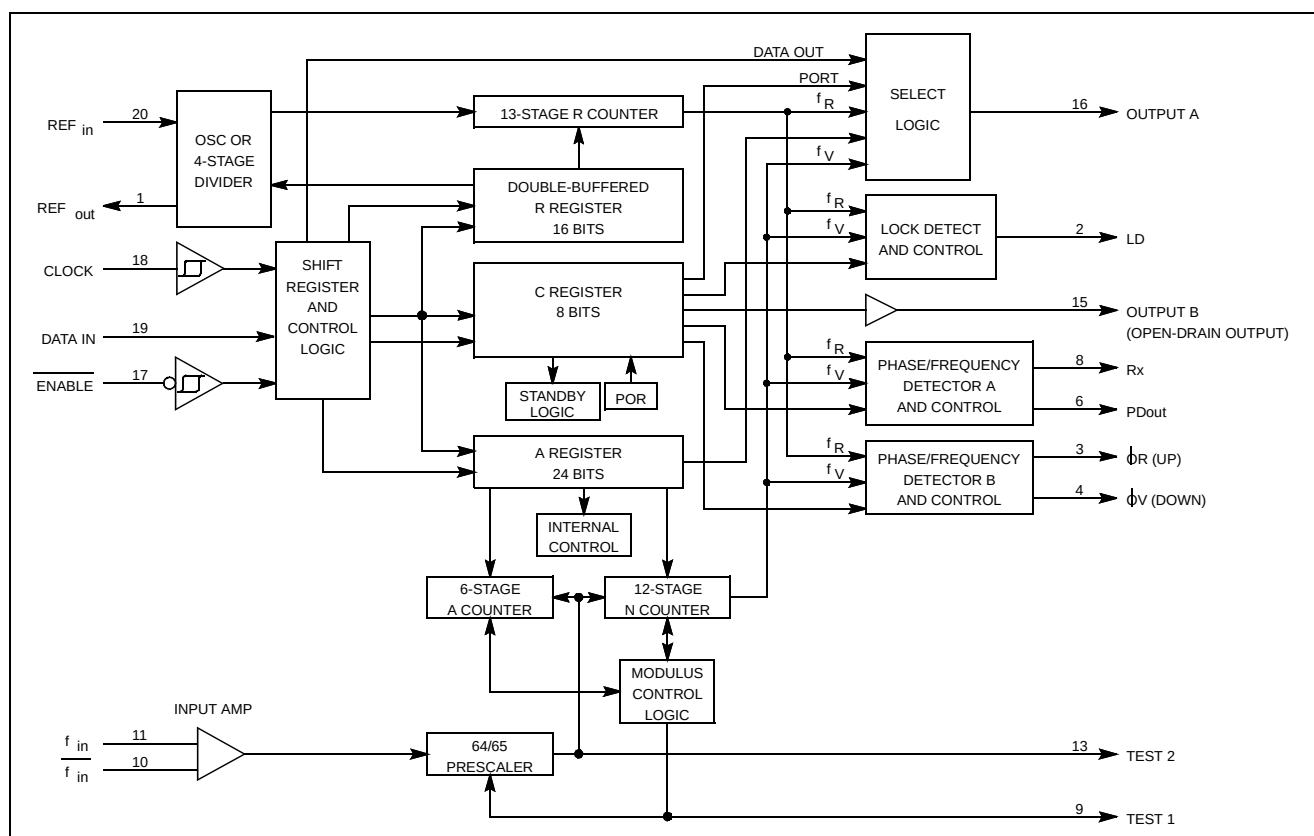


Figure 6-4 SYNTHESIZER BLOCK DIAGRAM

6.1.8 BUFFER

A cascode amplifier formed by Q410/Q411 provides amplification and isolation between the VCO and Synthesizer. A cascode amplifier is used because it provides high gain, high isolation and consumes only a small amount of power. The input signal to this amplifier is coupled from the VCO RF output on pin 5. DC blocking and coupling to the VCO is provided by C455 and to the buffer by C456. Bias for the amplifier is provided by R442, R445, R446 and R277. Q411 is a common-emitter amplifier and Q410 is a common-base with C458 and C457 providing RF bypass. L405 provides some filtering of the cascode output. R448 lowers the Q of L405. The output of the amplifier is coupled by C442/C441 to U401, pin 11.

6.1.9 SYNTHESIZER

The inputs/outputs of synthesizer U401 are shown in Figure 6-4. The output signal from the synthesizer loop is the receiver first injection frequency. This signal is produced by a VCO (voltage-controller oscillator). The frequency of this oscillator is controlled by a DC voltage. This DC voltage is generated by integrating the pulses from the phase detector in synthesizer chip U401.

Frequencies are selected by programming counters in U401 to divide by a certain number. This programming is provided through J201, pins 12, 18 and 20. The frequency stability of the synthesizer is established by the ± 1.0 PPM stability of TCXO Y401. The output of this oscillator is stable from -30°C to $+60^{\circ}\text{C}$ (-22°F to $+140^{\circ}\text{F}$).

The VCO frequency of A401 is controlled by a DC voltage produced by integrating the phase detector output pulses of U401. The phase detector senses the phase and frequency of the two input signals (f_v and f_R) and causes the VCO control voltage to increase or decrease if they are not the same. When the frequencies are the same the VCO is "locked" on frequency.

One input signal to the phase detector in U401 is the reference frequency (f_R). This is the 17.5 MHz TCXO frequency divided by the R (reference) counter to the channel spacing of 6.25 kHz.

The other input to the phase detector in U401 is from the VCO frequency divided down by the "N" counter and prescaler in synthesizer U401 to 6.25 kHz. The "N" counter is programmed through the synthesizer data line on J201, pin 20. U401 is programmed so that the phase detector input (f_v) is identical to the reference frequency (f_R) (6.25 kHz) when the VCO is locked on the correct frequency.

The synthesizer contains the R (reference), N, and A counters, phase and lock detectors and counter programming circuitry. Frequencies are selected by programming the three counters in U401 to divide by assigned numbers. The programming of these counters is performed by circuitry in the Main Processor Card (MPC), which is buffered and latched through the Interface Alarm Card (IAC) and fed into the synthesizer on J201, pin 20 to Data input port U401, pin 19.

Data is loaded into U401 serially on the Data input port U401, pin 19. Data is clocked into the shift registers a bit at a time by a low to high transition on the Clock input port U401, pin 18. The Clock pulses come from the MPC via the IAC to J201, pin 18.

As previously stated, the counter divide numbers are chosen so that when the VCO is operating on the correct frequency, the VCO-derived input to the phase detector (f_v) is the same frequency as the TCXO-derived input (f_R) which is 6.25 kHz.

The f_R input is produced by dividing the 17.5 MHz TCXO frequency by 2800. This division is done by the "R" counter in U401. The counter always divides by 2800 regardless of the channel frequency. This produces a reference frequency (f_R) of

6.25 kHz. Since the VCO is on frequency (receive frequency plus 52.95 MHz) and no multiplication is used, the channel frequencies change in 6.25 kHz steps and the reference frequency (f_R) is 6.25 kHz for all frequencies selected by this receiver.

The f_v input is produced by dividing the VCO frequency using the prescaler and N counter in U401. The prescaler divides by 64 or 65. The divide number of the prescaler is controlled by the N and A counters in U401.

The N and A counters function as follows: both the N and A counters begin counting down from their programmed number. When the A counter reaches zero, it halts until the N counter reaches zero. Both counters then reset and the cycle repeats. The A counter is always programmed with a smaller number than the N counter. While the A counter is counting down, the prescaler divides by 65. Then when the A counter is halted, the prescaler divides by 64.

Example:

Assume a receive frequency of 450.025 MHz. Since the VCO is 52.95 MHz above the receive frequency it must be 502.975 MHz. To produce this frequency, the N and A counters are programmed as follows:

N = 1257 A = 28

NOTE: Section 8.2.5 describes how the N and A counter numbers can be calculated for other channels.

To determine the overall divide number of the prescaler and N counter, the number of VCO output pulses required to produce one N counter output pulse can be counted. In this example, the prescaler divides by 65 for 65×28 or 1,820 input pulses. It then divides by 64 for $64 \times (1257 - 28)$ or 78,656 input pulses. The overall divide number K is therefore $(78,656 + 1,820)$ or 80,476. The VCO frequency of 502.975 MHz divided by 80,476 equals 6.25 kHz which is the f_R input to the phase detector. The overall divide number K can also be determined by the following formula:
K = 64N + A

Where,

N = N counter divide number and

A = A counter divide number.

6.1.10 BUFFER AMPLIFIER

A cascode amplifier formed by Q401 and Q402 provides amplification and also isolation between the TCXO and Synthesizer U401. A cascode amplifier is used because it provides high reverse isolation. The input signal to this amplifier is from TCXO Y401. C405 provides DC blocking. Bias for the amplifier is provided by R404, R406, R407, R408 and R409. L401 is an RF choke. RF bypass is provided by C403, C401 and C407. The output of Q401/Q402 is coupled to U401 by C432.

6.1.11 LOCK DETECT

When the synthesizer is locked on frequency, the Lock Detect output on U401, pin 2 is a logic high voltage with very narrow negative-going pulses. Then when the synthesizer is unlocked, these pulses become much wider, the width may vary at a rate determined by the frequency difference of f_V and f_R . The lock detect pulses are applied to J401, pin 14 and sent to the RF Interface on J103, pin 14 for detection and sampling in the IAC.

6.1.12 CHARGE PUMP, LOOP FILTER

The charge pump circuit charges and discharges C450, C451 and C452 in the loop filter to provide the 21V VCO control voltage (see Section 6.1.13). Pulses which control the charge pump are fed out of U401, pins 3/4. When both phase detector inputs are in phase, these output signals are high except for a very short period when both pulse low in phase. If the frequency of the f_R input to the phase detector is higher than that of the f_V input (or if the phase of f_R leads f_V), the VCO frequency is too low. The negative-going pulses on the f_V output (pin 4) then become much wider and the f_R output (pin 3) stays essentially high. If the frequency of the f_V input is greater than f_R (VCO frequency too high), the opposite occurs.

Q406 and Q407 are drivers which make the 5V levels and polarity of U401 phase detector outputs compatible with the high voltage supply to Q408 and Q409. Capacitors C444 and C446 momentarily bypass R432 and R437 when negative-going pulses occur. This speeds up the turn-off time of Q406 and Q407 by minimizing the effect of the base charge.

When a negative-going pulse occurs on pin 4, Q406 turns on which turns on Q408. Q408 sources current to charge up the loop filter capacitors C450/

C451, thereby increasing the VCO control line voltage. When a negative-going pulse occurs on pin 3, Q407 turns on which turns on Q409. Q409 sinks current to discharge the loop filter capacitors C450/C451 thereby decreasing the VCO control line voltage. The source current from Q408, when it is on, equals the sink current from Q409, when it is on.

6.1.13 VOLTAGE MULTIPLIER

The 17.5 MHz from Y401 is amplified by Q401/Q402 and passed to the reference input of synthesizer U401, pin 20. This signal is also coupled from the output of Q401/Q402 through C408 to amplifier Q403. Biasing for Q403 is provided by R410, R411 and R412. The output of Q403 is direct coupled to switching transistors Q404/Q405.

When Q405 is turned on and Q404 is off, C409 is grounded on the side connected to the emitter of Q405. This allows the other side of C409 to charge from the 12V supply through R414, CR402 to C409. When Q404 turns on and Q405 is off, C414 charges up to approximately 12V plus the voltage that was stored across C809 from the last cycle. The output voltage is 21V due to voltage loss in the transistor and diodes. C413 is an RF bypass and C414 charges to 21V to stabilize the voltage. The 21V output is filtered by C415/L403/C416 to remove the 17.5 MHz ripple. The 21V output is applied to the charge pump Q408/Q409 and the VCO control line.

6.1.14 BUFFER AMPLIFIER (Q131, Q132)

A cascode amplifier formed by Q131 and Q132 provides amplification and also isolation between the VCO and Receiver RF stages. A cascode amplifier is used because it provides high reverse isolation. The input signal to this amplifier is coupled from VCO A401 by C131. C131 also provides DC blocking. Bias for the amplifier is provided by R134, R133, R138, R132, R131 and R136. L131 is an RF choke and R135 sets the RF output impedance of the cascode. RF bypass is provided by C143, C142, C141, C140, C139, C138, C133, C134, C135 and C136. The output of Q131/Q132 is matched to the Receiver RF stages by a section of microstrip, C144, signal pad R139/R140/R141, C145, C146 and L133. C145 couples the signal to the input of the first injection amplifier.

6.1.15 FIRST AND SECOND INJECTION AMPLIFIERS (Q133, Q134)

U303 provides the +12V source for these amplifiers. First injection amplifier Q133 is biased by CR131, R143, R144, R145 and R146. C148, C151, C149 and C150 provide RF bypass from the DC line. L134 on the collector is an RF choke. Q133 is matched to the 50 ohm signal pad R147, R148 and R149 by lowpass filter C152/L135/C153, C154. C155, L136, L156, L137, C157 and a section of microstrip match Q134 to the 50 ohm signal pad.

Second injection amplifier/buffer Q134 is similar in design to Q133. The output of Q134 is matched to 50 ohms by L134/C162/C163 and C164 provides DC blocking. L140/L141 are tuned to the receive frequency plus 52.95 MHz and passed to Mixer U101. This injection frequency is also coupled through C165 to the injection test voltage circuit U102A. CR133, R158, R159 provide DC input to U102A, pin 3. The output of U102A, pin 1 is connected to J201, pin 13 for a receive injection test point and to the RF Interface Board on J103, pin 13.

6.2 EXCITER

6.2.1 VCO (A007)

The Voltage-Controlled Oscillator (VCO) is formed by Q802, associated circuitry and a resonator consisting of Z801. The VCO oscillates in a frequency range from 380-520 MHz. Biasing of Q802 is provided by R805, R806 and R807. An AC voltage divider formed by C807 and C808 initiates and maintains oscillation. C806 couples Q802 to resonator Z801. Resonator Z801 provides the shunt inductance of the tank circuit. The shunt capacitance of the tank circuit is made primarily of C804 in series with CR802. RF choke L804 completes the DC bias path to ground.

The VCO frequency is controlled in part by DC voltage across varactor diode CR802. As voltage across a reverse-biased varactor diode increases, its capacitance decreases. Therefore, VCO frequency increases as the control voltage increases. The control line is RF isolated from tank circuit by choke L802. The amount of frequency change produced by CR802 is controlled by series capacitor C804.

The frequency is modulated in a similar manner. The transmit audio/data signal is applied across varactor diode CR803 to vary the VCO frequency at an audio rate. C815/C816 in series with CR803 determine the amount of modulation produced by the audio signal.

6.2.2 ACTIVE FILTER

Q801 functions as a capacitance multiplier to provide filtering of the 12V supply to Q802. R803 and R804 provide transistor bias, and C812 provides capacitance that is effectively multiplied by the gain of Q801. If a noise pulse or other quick voltage change appears on the collector, base voltage does not change significantly because of C812. Therefore, the base current does not change and transistor current remains constant. R805 decouples the VCO output from AC ground. L803 is an RF choke and C810, C811, C813, C814 and C809 provide RF bypass.

6.2.3 VCO/TCXO FREQUENCY MODULATION

Both the VCO and TCXO are modulated in order to achieve the required frequency response. If only the VCO was modulated, the phase detector in U403 would sense the frequency change and increase or decrease the VCO control voltage to counteract the change (at the lower audio frequencies inside the closed loop bandwidth of the synthesizer). If only the TCXO frequency was modulated, the VCO would not track the higher audio frequencies (those beyond the closed loop bandwidth of the synthesizer). However, by modulating both the VCO and TCXO a flat audio response is achieved. Potentiometers R425 and R446 balance the modulating signals.

There are two 3.5V sources on the Exciter board; one is a reference for the modulation amplifier to the VCO, the other is for the modulation amplifier to the TCXO.

The reference voltage on U402B, pin 5 is also on buffer U407B, pin 5 to J401, pin 9 and RFIB connector J102, pin 9. The voltage leaves the RFIB on J101, pin 14 to J2, pin 27 on the backplane, to the bottom connectors via pin 7 and finally to the MAC on P100, pin 7.

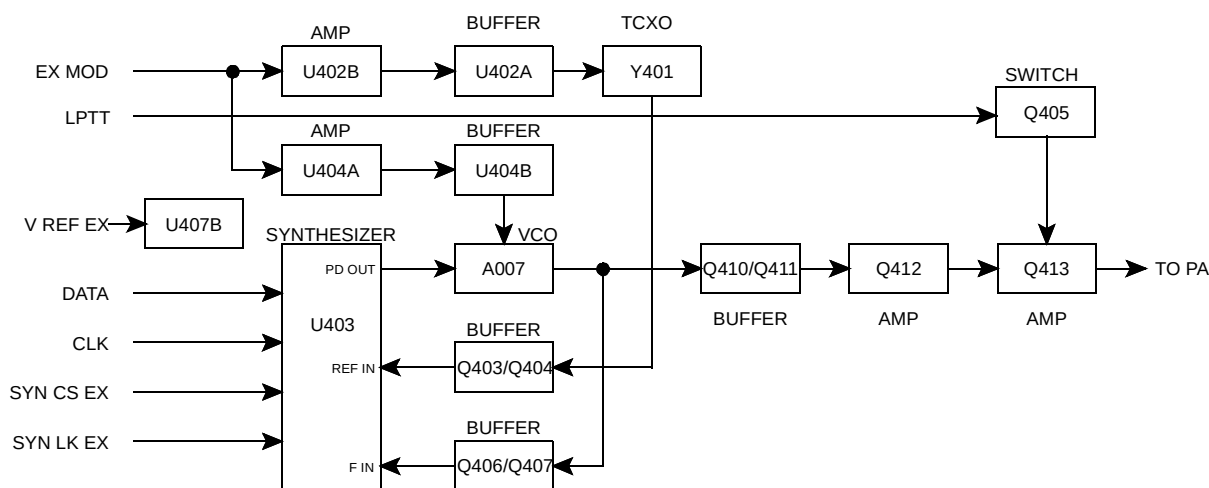


Figure 6-5 EXCITER BLOCK DIAGRAM

With reference to the ground on the Exciter, the 3.5V reference stability is maintained by U126B/C/D on the MAC. The 3.5V DC passes through summing amplifier U129B and transmit modulation gate U118D to P100, pin 29 (Tx MOD). P100, pin 29 is connected to backplane connector J2, pin 8 and RFIB connector J101, pin 22 to J102, pin 13. The transmit modulation and 3.5V reference enter the Exciter on J401, pin 13 and are routed to U402B, pin 6. R425 sets the TCXO modulation level. The modulation signal and the 3.5V DC are applied to U402A, pin 2.

6.2.4 BUFFER

A cascode amplifier formed by Q406/Q407 provides amplification and also isolation between the VCO and synthesizer. A cascode amplifier is used because it provides high reverse isolation. The input signal to this amplifier is tapped from the VCO RF output. DC blocking to the VCO is provided by C441 and to the buffer by C433. Bias for the amplifier is provided by R451, R453, R454 and R455. Q407 is a common-emitter amplifier and Q406 is a common-base with C432 providing RF bypass. L403 decouples the output from AC ground and R452 lowers the Q of L403. The amplifier is coupled by C429 to U403, pin 11.

6.2.5 SYNTHESIZER

The synthesizer inputs/outputs are shown in Figure 6-4. The synthesizer output signal is the transmit frequency. This signal is produced by a VCO (voltage-controller oscillator) that is frequency controlled by a DC voltage produced by synthesizer chip U403. This DC voltage is filtered by a loop filter made up of C805, C806 and R804 in the VCO circuitry.

Frequencies are selected by programming counters in U403 to divide by a certain number. This programming is provided through J401, pins 12, 19 and 20. The frequency stability of the synthesizer is established by the ± 1.0 PPM stability of TCXO Y401. This oscillator is stable from -30°C to $+60^{\circ}\text{C}$ (-22°F to $+140^{\circ}\text{F}$).

The VCO frequency of A007 is controlled by a DC voltage produced by the phase detector in U403. The phase detector senses the phase and frequency of the two input signals and causes the VCO control voltage to increase or decrease if they are not the same. When the frequencies are the same, the VCO is then "locked" on frequency.

The synthesizer contains the R (reference), N, and A counters, phase and lock detectors and counter programming circuitry.

One input signal to the phase detector in U403 is the reference frequency (f_R). This frequency is the 17.5 MHz TCXO frequency divided by the reference counter to the channel spacing or 12.5 kHz. The other input signal (f_V) is the VCO frequency divided by the "N" counter in U403. The counters are programmed through the synthesizer data line on J401, pin 20. Each channel is programmed by a divide number so that the phase detector input is identical to the reference frequency (f_R) when the VCO is locked on the correct frequency.

Frequencies are selected by programming the three counters in U403 to divide by assigned numbers. The programming of these counters is performed by circuitry in the Main Processor Card (MPC), buffered and latched through the Interface Alarm Card (IAC) and fed into the synthesizer on J401, pin 20 to Data input port U403, pin 19.

Data is loaded into U403 serially on the Data input port U403, pin 19 when U403, pin 17 is low. Data is clocked into the shift registers a bit at a time by a low to high transition on the Clock input port U403, pin 18. The Clock pulses come from the MPC via the IAC to J401, pin 19.

As previously stated, the counter divide numbers are chosen so that when the VCO is operating on the correct frequency, the VCO-derived input to the phase detector (f_V) is the same frequency as the TCXO-derived input (f_R). The f_R input is produced by dividing the 17.5 MHz TCXO frequency by 1400. This produces a reference frequency (f_R) of 12.5 kHz. Since the VCO is on frequency and no multiplication is used, the frequencies are changed in 12.5 kHz steps. The reference frequency is 12.5 kHz for all frequencies selected by this Exciter.

The f_V input is produced by dividing the VCO frequency using the prescaler and N counter in U403. The prescaler divides by 64 or 65. The divide number of the prescaler is controlled by the N and A counters in U403. The N and A counters function as follows:

Both the N and A counters begin counting down from their programmed number. When the A counter reaches zero, it halts until the N counter reaches zero. Both counters then reset and the cycle repeats. The A counter is always programmed with a smaller number

than the N counter. While the A counter is counting down, the prescaler divides by 65. Then when the A counter is halted, the prescaler divides by 64.

Example: To illustrate the operation of these counters, assume a transmit frequency of 450.250 MHz. Since the VCO is the channel frequency for transmit this frequency is used. To produce this frequency, the N and A counters are programmed as follows:

$$N = 562 \quad A = 52$$

To determine the overall divide number of the prescaler and N counter, the number of VCO output pulses required to produce one N counter output pulse can be counted. In this example, the prescaler divides by 65 for 65×52 or 3,380 input pulses. It then divides by 64 for $64 \times (562 - 52)$ or 32,640 input pulses. The overall divide number K is therefore $(32,640 + 3,380)$ or 36,020. The VCO frequency of 450.250 MHz divided by 36,020 equals 12.5 kHz which is the f_R input to the phase detector. The overall divide number K can also be determined by the following formula:

$$K = 64N + A$$

Where,

N = N counter divide number and

A = A counter divide number.

NOTE: Section 8.2.5 describes how the N and A counter numbers can be calculated for other channels.

6.2.6 BUFFER AMPLIFIER

A cascode amplifier formed by Q403 and Q404 provides amplification and isolation between the TCXO and Synthesizer U403. A cascode amplifier is used because it provides high gain, high reverse isolation and consumes only a small amount of power. The input signal to this amplifier is coupled from TCXO Y401, pin 5 by C420. C420 also provides DC blocking. Bias for the amplifier is provided by R430, R431, R432, R433 and R428. L402 is an RF choke. RF bypass is provided by C416, C418 and C419. The output of Q403/Q404 is coupled to U403, pin 20 by C417.

6.2.7 BUFFER AMPLIFIER

A cascode amplifier formed by Q406 and Q407 provides amplification and also isolation between the VCO and Synthesizer U403. A cascode amplifier is used because it provides high gain, high isolation and consumes only a small amount of power. The input signal to this amplifier is coupled from VCO A007, pin 6 by C433. C433 also provides DC blocking. Bias for the amplifier is provided by R450, R451, R453, R454 and R455. L403 is an RF choke. RF bypass is provided by C430, C431 and C479. The output of Q406/Q407 is coupled to U403, pin 11 by a non-polarized capacitor formed by C429/C499.

6.2.8 LOCK DETECT

When the synthesizer is locked on frequency, the Lock Detect output on U403, pin 2 is a high voltage with narrow negative-going pulses. When the synthesizer is unlocked, the negative-going pulses are much wider, the width may vary at a rate determined by the frequency difference of f_v/f_R .

The locked or unlocked condition of the synthesizer is filtered by R440/C423 and applied to J401, pin 16, then sent to the RF Interface on J102, pin 16 for detection.

6.2.9 BUFFER AMPLIFIER

A cascode amplifier formed by Q410/Q411 provides amplification and also isolation between the VCO and exciter RF stages. A cascode amplifier is used because it provides high gain, high isolation and consumes only a small amount of power. The input signal to this amplifier is tapped from VCO A007, pin 4 by C441. C441 also provides DC blocking. Bias for the amplifier is provided by R464, R465, R466, R467 and R468. L406 is an RF choke and R483 lowers the Q of the coil. RF bypass is provided by C434, C442, C445, C443, C444 and C480. The output of Q410/Q411 is matched to the Exciter RF stages by a section of microstrip, C446, signal pad R459/R460/R461, C498, C450 and L408.

6.2.10 RF AMPLIFIERS

RF amplifier Q412 is biased by CR402, R469, R470, R471 and R472. C448 provides RF bypass from the DC line and R471/R472 provide supply volt-

age isolation. L 409 is an RF choke to the supply line. Q412 is matched to Q413 by low pass filter C449/L410/C451, C503, signal pad R473/R474/R475 C504, C505 and a section of microstrip.

RF amplifier/buffer Q413 is similar in design to Q412. The collector voltage of Q413 is switched by Q405. When the Logic Push-To-Talk (LPTT) on J401, pin 11 is low Q405 turns on and conducts the 15V supply to the collector of Q405 and to Q413. The output of Q413 is matched to 50 ohms by L411, C509, L412, C510, and C465 provides DC blocking. A 3 dB attenuator R490/R491/R492 follows amplifier Q413. The RF output of the Exciter is on coaxial connector J402 to the Power Amplifier.

6.3 110W POWER AMPLIFIER

6.3.1 AMPLIFIER/PREDRIVER

RF input to the PA from the Exciter is through a coaxial cable and connector to WO511. C501 couples the RF to signal pad R501/R502/R503 that connects the input to U501. U501 is a 6W amplifier/pre-driver operating in the 380-520 MHz range.

Power control is connected to WO505 from the RF Interface board (RFIB). RF is filtered from the control voltage line by various capacitors to U501, pin 2. This control voltage regulates the RF output of the amplifier on U501, pin 5 to approximately 5W.

6.3.2 DRIVER

The output of U501 passes through several sections of 50 ohm microstrip and matching capacitors to the gate of Q501. Driver Q501 is a MOSFET amplifier with a normal output of approximately 22W. Supply voltage is RF bypassed by various capacitors. L501, C541, C542 and microstrip match the output of the driver to 35 ohms. The RF is applied to the input of the splitter and to the finals.

6.3.3 FINAL AMPLIFIERS

Q502 and Q503 are combined 60W amplifiers. The 22W RF input from the driver Q501 is applied to a 70.7 ohm Wilkinson splitter and then to the gate of each MOSFET amplifier. The 60W outputs on the drain of the amplifiers are combined using a Wilkinson combiner. Q502 has a half-wave transmission

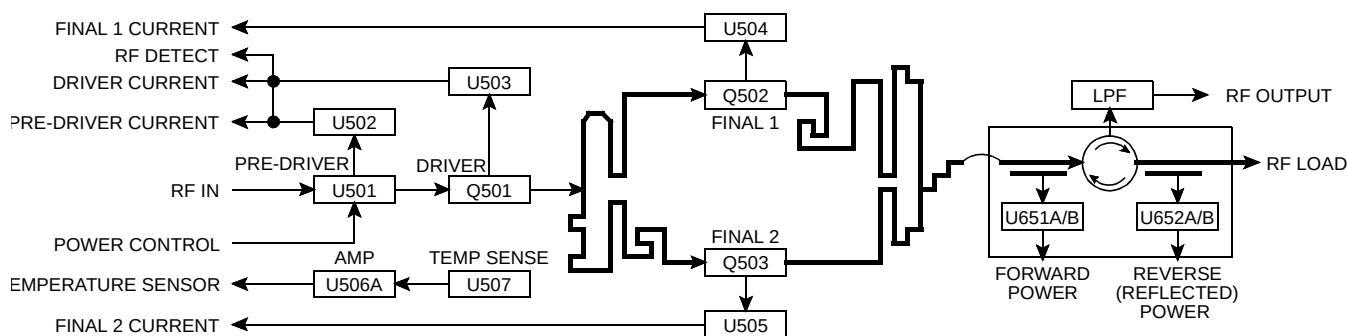


Figure 6-6 110W POWER AMPLIFIER BLOCK DIAGRAM

line on the input and Q503 has a half-wave on the output. These T-lines are used to drive the 60W amplifiers out of phase. The output of the combiner is fed from WO513 directly to the forward/reverse power detect board.

The Wilkinson splitter and combiner provide the capability to split the drive input and combine the final outputs while maintaining isolation between the two final amplifiers. The combiner consists of two quarter-wave transmission lines and a balancing resistor. During normal operation, a signal of relatively equal phase and amplitude is present on both ends of the balancing resistor. Therefore, no current flows and no power is dissipated in the balance resistor. If one final failed, the other final of a pair would continue to function.

6.3.4 POWER DETECTORS

The supply current is monitored through a resistor that creates a current output level indicative of the power output. The outputs of U503, U504 and U505 are monitored by the Universal Station software through the RF Interface Board. If a final amplifier fails, the software will reduce the output power to prevent over-driving the remaining final amplifier.

6.3.5 THERMAL SENSOR

Thermal protection is provided by temperature sensor U507. The operating range of the sensor is from -30° C to 100° C (-22° F to 212° F). Amplifier

U506A sends the output of U507 through WO509 to the RF Interface Board. The RF Interface Board reduces the power amplifier to half power (via the MPC) if the temperature reading is too high and turns the fan on and off (not via the MPC). The fan is turned on at approximately 50°C and off again at 42°C.

6.3.6 FORWARD/REVERSE POWER DETECT, CIRCULATOR, LOW-PASS FILTER

The power amplifier output is directly coupled to the forward/reverse power detect board via a jumper. The output then enters the circulator and exits to the low-pass filter board and the antenna jack for a minimum power output of 110W at the default setting. If an antenna is not connected, the circulator connects the output power to R685.

Forward and reverse power are electromagnetically coupled from the input and reflected ports of the circulator. R663/R680 calibrate the forward and reverse sense levels. The sensed levels are coupled to the RF Interface Board and software.

6.4 RF INTERFACE BOARD

The RF Interface Board (RFIB) connects the Receiver, Exciter and Power Amplifier to the back-plane and power supply (see Figure 6-7).

The input and output connectors for the RF Interface Board are defined as follows.

6.4.1 POWER CONNECTOR

The power supply is connected to the RF Interface Board when the RF module is inserted into the station cabinet (see Figure 10-3). The jack portion of the connection is on the RF Interface Board, the plug portion is attached to the station cabinet.

P101/P102 +26.5V DC - Supply voltage to PA. +26V $\pm$ 1%, 20A at 110W.

P103 +15V DC - Supply voltage to Exciter, Receiver and Power Control. 15V $\pm$ 1%, 5.5A max.

P104/P105 GROUND - Ground return for the RF assembly.

6.4.2 SIGNAL CONNECTOR (J101)

This is the signal interface connector (36 pin) that connects the RFIB to the backplane connector J2 (34 pin) through cable assembly A8.

Pin 1 GROUND

Pin 1 carries ground current between the RF Interface board and Backplane board.

Pin 2 PC STR

Pin 2 is the power Control Strobe. This is normally low until after the power control data is shifted into the power control register. Then the strobe line goes high and back to low. The clock or data lines cannot be changed until after the strobe is set.

Pin 3 HS CS EX

Pin 3 is not used at this time.

Pin 4 GROUND

Pin 4 carries ground current between the RF Interface board and Backplane board.

Pins 5-6 UNUSED

Pin 7 RX WBAND

The wide band audio is from the receive audio demodulator U202 and goes to the MAC in the Controller card cage. The typical amplitude is

387 mV RMS (-6 dBm) and 2V DC with Standard TIA Test Modulation into the receiver. Little wave shaping is done on the receiver board other than a 31 kHz RC LPF which strips off the 450 kHz IF. Buffering is done with an op-amp.

Pin 8 RF DATA A

Data A (U105, pin 11) is the least significant bit (LSB) in the 3 multiplex chips located on the RFIB. This pin is a CMOS input from the Controller requiring a logic high for activation.

Pin 9 RF DATA C

Data C (U105, pin 9) is the most significant bit (MSB) in the 3 multiplex chips located on the RFIB. This pin is a CMOS input from the Controller requiring a logic high for activation.

Pin 10 RF MUX2 INH

The Multiplexer-2 Inhibit (U106, pin 6) is a CMOS input from the Controller that inhibits (disables) the output from the RF 2 Multiplexer with a logic high.

Pin 11 RF CLK

The clock will control the synthesizer chip and power control circuit when loading. This pin is a TTL input from the Controller.

Pin 12 HS CS RX

Pin 12 is not used at this time

Pin 13 RF MUX1 INH

The Multiplexer-1 Inhibit (U105, pin 6) is a CMOS input from the Controller that inhibits (disables) the output from the RF 1 Multiplexer with a logic high.

Pin 14 V REF EX

This is the 3.5V reference to the Exciter TCXO. 3.5V from the Exciter is passed from J102, pin 9 to this pin and the backplane. The voltage then passes through the MAC and back to the backplane to J101, pin 22 with the TX MOD. These are connected to J102, pin 13 back to the Exciter.

Pins 15-18 UNUSED**Pin 19 RF MUX3 INH**

The Multiplexer-3 Inhibit (U104, pin 6) is a CMOS input from the Controller that inhibits (disables) the output from the RF 3 Multiplexer with a logic high.

Pin 20 LPTT

The Logic Push-To-Talk is an open collector from the Controller. It has a sink capability of 20 mA and a maximum voltage rating of 18V. The transmitter should produce power when this pin is a logic low.

Pin 21 SYN CS EX

This input goes low to enable the loading of data into the exciter synthesizer chip U403.

Pin 22 TX MOD

The audio from the MAC in the Controller processes a number of inputs to the station to produce the signals on this pin. This signal goes through the RFIB and then to the Exciter. A 707 mV RMS sine wave (2V P-P) at 1 kHz produces 60% of system deviation in the transmitter. The source impedance is low and the input impedance is less than 10k ohms.

Pin 23 GROUND

Pin 23 carries ground current between the RFIB and Chassis Backplane.

Pin 24 UNUSED**Pin 25 LOGIC CONTROL TO FANS**

Pin 25 is in parallel with the temperature sensor.

Pin 26 RF DATA B

The Data B (U105, pin 10) is the middle significant bit in the three multiplex chips located on the RFIB. This pin is a CMOS input from the Controller requiring a logic high for activation.

Pin 27 A D LEVEL

20 lines (of the possible 24) of RF functions sampled are multiplexed to the Controller through this pin using three multiplex chips.

- RF Forward Power Sense
- RF Power Sense Device 1
- RF Power Sense Device 2
- RF Power Sense Device 3
- RF Power Sense Device 4
- RF Reflected Power Sense
- PA Temperature
- Transmit Audio Modulation
- High Stability Exciter Lock Detector
- Exciter Lock Detector
- Receiver Detector Audio
- Receive Signal Strength Indicator
- Receiver Injection Level
- High Stability Receive Lock Detector
- Receiver Lock Detector
- Fan Current 1
- Fan Current 2
- Fan 1 On Sense
- Power Supply Temp
- Battery Voltage

Pin 28 RF DATA

A data pin with TTL levels from the Controller which has the dual role of loading the synthesizer chips and adjusting the power control D/A lines for proper output power. Up to four synthesizer chips and a shift-register could be connected to this pin.

Pin 29 SYN CS RX

This input goes low to enable the loading of data into the receiver synthesizer chip U401.

Pin 30 RSSI

This pin is the Receive Signal Strength Indication to the Controller. This RSSI is used for tune-up of the Receiver front-end during factory test mode. The dynamic range is 60 dB. It has an output from an op-amp with the voltage going from 0.5V to 4.5V. The level has an adjustment in the Receiver.

Pin 31 GROUND

Pin 31 carries ground current between the RFIB and Chassis Backplane.

Pins 32-36 UNUSED**6.4.3 FAN CONNECTOR (J104)**

The outputs to the fan connectors are 4-pin plug-in terminals that supply DC voltage. The plug on the fan is a 2-pin connector. The plug-in terminals are located on the back of the RFIB.

Pin 1 FAN 1 LOW

Pin 1 is the ground return for Fan 1.

Pin 2 FAN HI

Pin 2 carries the voltage to Fan 1. The current is 1/4A nominal at 20V to 30V. This pin goes high when the PA heat sensor rises above 50°C and goes low below 45°C.

Pin 3 FAN2 LO

Pin 3 is the ground return for Fan 2.

Pin 4 FAN HI

Pin 4 carries the voltage to Fan 2. The Voltage is 20V-30V at 1/4A nominal. Pin 4 goes high when the PA heat sensor rises above 50°C and goes low below 45°C.

6.4.4 POWER AMPLIFIER CONNECTIONS**WO 115 POWER SENSE**

This capacitive feedthrough pin is at +15V DC to the Power Detect Board.

WO 116 +26.5V DC

This capacitive feedthrough pin is at +26.5V DC and carries the PA current, 25A nominal at 110W from P102 to the Power Amplifier board.

WO 117 +26.5V DC GROUND

This capacitive feedthrough pin carries ground current from P105 to the Power Amplifier board. It must be capable of carrying up to 25A.

W118 +15V DC

This capacitive feedthrough pin connects +15V DC P103 to the PA, Exciter, and Forward/Reverse Power Detect boards. Maximum current handling is 6A (4A nominal at 110W).

WO 119 NOT USED**WO 120 CTRL OUT**

This capacitive feedthrough pin carries the output of the power control driver on the RFIB to the power control pin of the power module on the Power Amplifier board. The voltage varies from 0V-15V with current as high as 0.5A.

WO 121 FWD PWR

This capacitive feedthrough pin is the forward power sense line. It is a voltage source that is a function of the output power of the Power Amplifier. The voltage level will be between 0V-5V and drive a 10k ohm load. A typical voltage of 3.9V correlates to 110W out of the PA. This line goes through the multiplexers and A D LEVEL line to the Controller for processing.

WO 122 RF OUT 1

This capacitive feedthrough pin is a voltage source that is a function of the output power of Q701. The voltage level will be between 0V-5V and drive a 10k ohm load. This line goes through the multiplexers and A D LEVEL line to the Controller for processing.

WO 123 RF OUT 2

This capacitive feedthrough pin is a voltage source that is a function of the output power of Q702. The voltage level will be between 0V-5V and drive a 10k ohm load. This line goes through the multiplexers and A D LEVEL line to the Controller for processing.

WO 124 RF OUT 3

This capacitive feedthrough pin is a voltage source that is a function of the output power of Q703. The voltage level will be between 0V-5V and drive a 10k ohm load. This line goes through the multiplexers and A D LEVEL line to the Controller for processing.

WO 125 RF OUT 4

This capacitive feedthrough pin is a voltage source that is a function of the output power of Q704. The voltage level will be between 0V-5V and drive a 10k ohm load. This line goes through the multiplexers and A D LEVEL line to the Controller for processing.

WO 126 REFL PWR

This capacitive feedthrough pin is the reflected power sense line. It is a voltage indicative of the power reflected due to a mismatch. The voltage produced will typically be such that less than a 3:1 VSWR will not trigger alarms and when VSWR = 6:1 the controller will reduce power. The voltage level will be between 0V-5V and drive a 10k ohm load. This line goes through the multiplexers and A D LEVEL line to the Controller for processing. The time to sense and reduce the power takes several seconds.

WO 127 TEMP

This capacitive feedthrough pin is the temperature sense line of the Power Amplifier. It will be a linearly variable function of temperature ranging from 0V-5V output and 0°C to +100°C (+32°F to 212°F) input when driving a 10k ohm load. The primary functions of this line are for fan on/off and PA power reduction. The fan should be turned on at 50°C and off at 45°C. The PA should have power reduced when 90°C (194°F) is reached and with absolute turn-off at 95°C (203°F). This line goes through the multiplexers and A D LEVEL line to the Controller for processing.

WO147 RF DETECT PRE-DRIVER

This senses power out of the pre-driver. It is used to limit the power out of the pre-driver to 0.6 dB over 110W at room temperature.

WO143 +26V DC

This is the +26.5V DC source to the RFIB from P101.

WO144 +15V DC

This is the +15V DC source to the RFIB from P103.

WO145 GROUND

W145 carries ground current from P104 to the RFIB.

6.4.5 EXCITER CONNECTOR (J102)

The connector from the Exciter (J401) to the RF Interface board (J102) links the Exciter to the MPC in the Controller Backplane.

Pin 1 VCC1

The voltage on this pin is a fused +15V $\pm 1\%$, nominal current of 0.5A. It provides current to the Exciter from the RFIB.

Pins 2-8 GROUND**Pin 9 +3.5V DC**

Pin 9 is the +3.5V DC TCXO reference voltage from the Exciter to the MAC.

Pin 10 GROUND**Pin 11 LPTT**

The Logic Push-To-Talk (LPTT) is an open collector from the Controller. It has a sink capability of 20 mA nominal and a voltage rating of 18V maximum. The transmitter should produce power when this pin is a logic low.

Pin 12 SYN CS EX

Pin 12 is the Exciter synthesizer chip select. It allows data input to the synthesizer chip when the line is pulled to a logic low.

Pin 13 TX MOD

The audio from the MAC in the Controller processes a number of inputs to the station per the TIA specifications to produce the signal on this pin. This signal goes through the RFIB to the Exciter. A 707 mV RMS (2V P-P) sine wave at 1 kHz provides 60% of system deviation in the transmitter. The DC voltage on the line is 3.5V $\pm$ 0.1V. The source impedance should be low (output of an op-amp or analog switch < 200 ohms) and the input impedance will not be less than 10k ohms.

Pins 14-15 GROUND

These pins carry ground current between the RFIB and the Exciter board.

Pin 16 SYN LK EX

Pin 16 is the Exciter synthesizer lock detector output. The synthesizer is locked with a TTL logic high state.

Pin 17 HS LK EX

Pin 17 is not used at this time.

Pin 18 HS CS EX

This input is not used at this time.

Pin 19 RF CLK

The clock controls the Exciter synthesizer when loading. The input source in the Controller is TTL with the speed determined by the synthesizer chip. There could be as many as four synthesizers and a shift register.

Pin 20 RF DATA

Pin 20 is a data pin from the Controller which has the dual role of loading the synthesizer chip and adjusting the power control D/A lines for proper output power. The data has TTL levels. Up to four synthesizer chips and a shift register could be connected to this pin.

6.4.6 RECEIVER CONNECTOR (J103)

The connector from the Receiver (J201) to the RF Interface board (J103) links the Receiver to the MPC in the Controller Backplane.

Pin 1 VCC1

Pin 1 is fused +15V $\pm$ 1% with a nominal current of 1A provides current from the RFIB to the Receiver.

Pins 2-6 UNUSED**Pin 7 RSSI**

This pin is the Receive Signal Strength Indicator (RSSI) to the Controller. The RSSI is used for tune-up of the Receiver front-end during test mode. The dynamic range is 60 dB. Output from an op-amp with the voltage going from 0.5V to 4.5V. The level has an adjustment in the Receiver (see Section 6.1.4 or 6.1.5).

Pin 8 UNUSED**Pin 9 RX WBAND**

The receive wide band audio is from the demodulator and goes to the Main Audio Card (MAC) in the Controller card cage. The typical amplitude is 387 mV RMS (-6 dBm) and 2V DC with Standard TIA Test Modulation into the Receiver. Little wave shaping is done on the Receiver board other than a 31 kHz RC LPF which strips off the 450 kHz IF. Buffering is done with an op-amp which can drive a 10k ohm load.

Pin 10 UNUSED**Pin 11 GROUND**

Pin 11 carries ground current between the RFIB and the Receiver board.

Pin 12 SYN CS RX

Pin 12 is the Receiver synthesizer chip select. This chip is the same part as used in the Exciter. A low enables loading the Synthesizer.

Pin 13 RX INJ

This pin is the power sense for the Receiver injection. It is a linear voltage source that is a function of the injection power. The voltage level will be between 0V - 5V and be able to drive a 10k ohm load.

Pin 14 SYN LK RX

Pin 14 is the main synthesizer lock detector output for the Receiver. The synthesizer is locked with a TTL logic high state.

Pin 15 GROUND

Pin 15 carries ground current between the RFIB and the Receiver board.

Pin 16 HS CS RX

Pin 16 is not used at this time.

Pin 17 GROUND

Pin 17 carries ground current between the RFIB and the Receiver board.

Pin 18 RF CLK

The clock controls the Receiver synthesizers when loading. The input source in the Controller is TTL with the speed determined by the synthesizer chip.

Pin 19 HS LK RX

Pin 19 is not used at this time.

Pin 20 RF DATA

Pin 20 is a data pin from the Controller which has the dual role of loading the synthesizer chips and adjusting the power control D/A lines for proper output power. The data has TTL levels. Up to four synthesizer chips and a shift register could be connected to this pin.

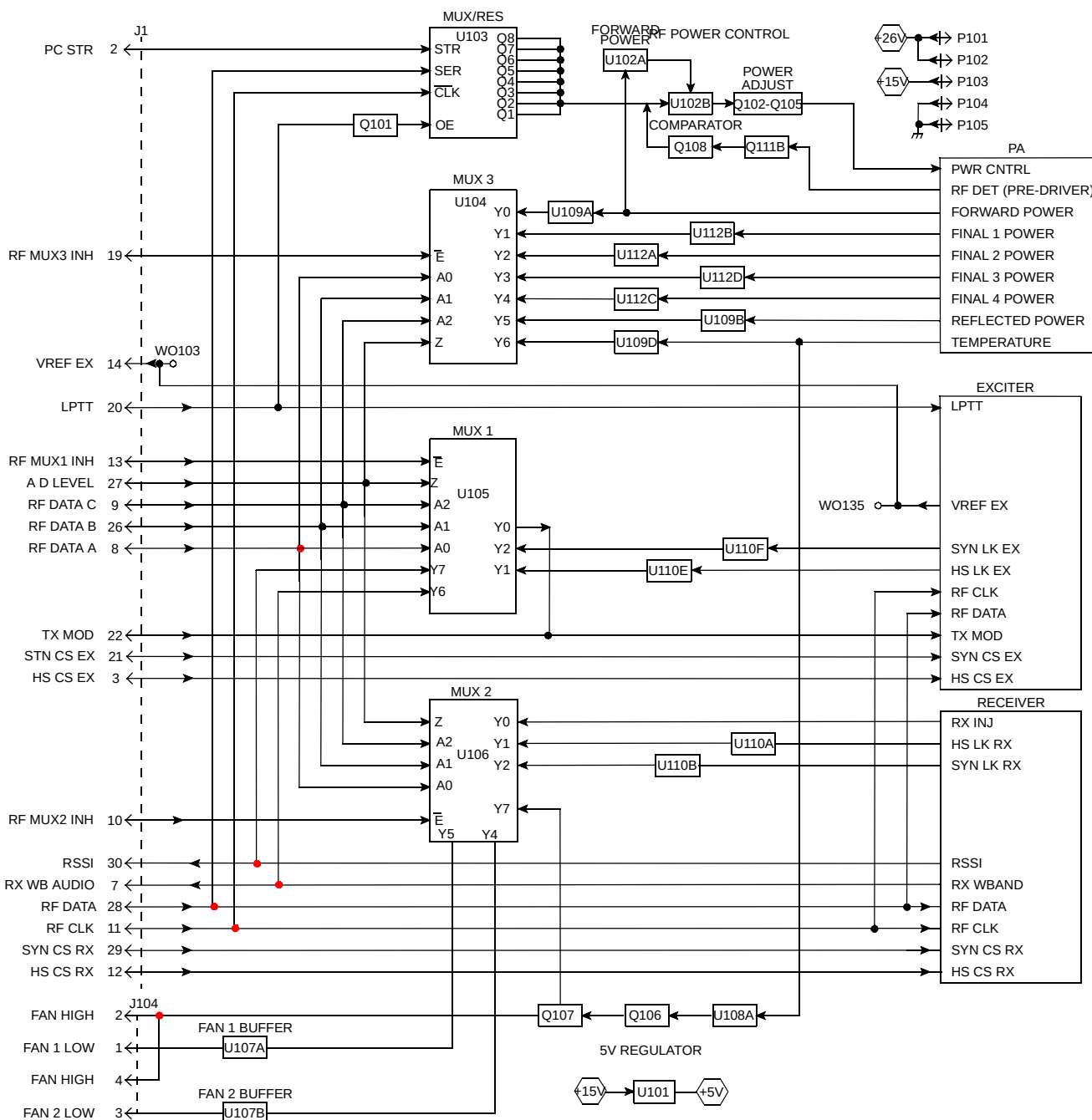


Figure 6-7 RF INTERFACE BOARD BLOCK DIAGRAM

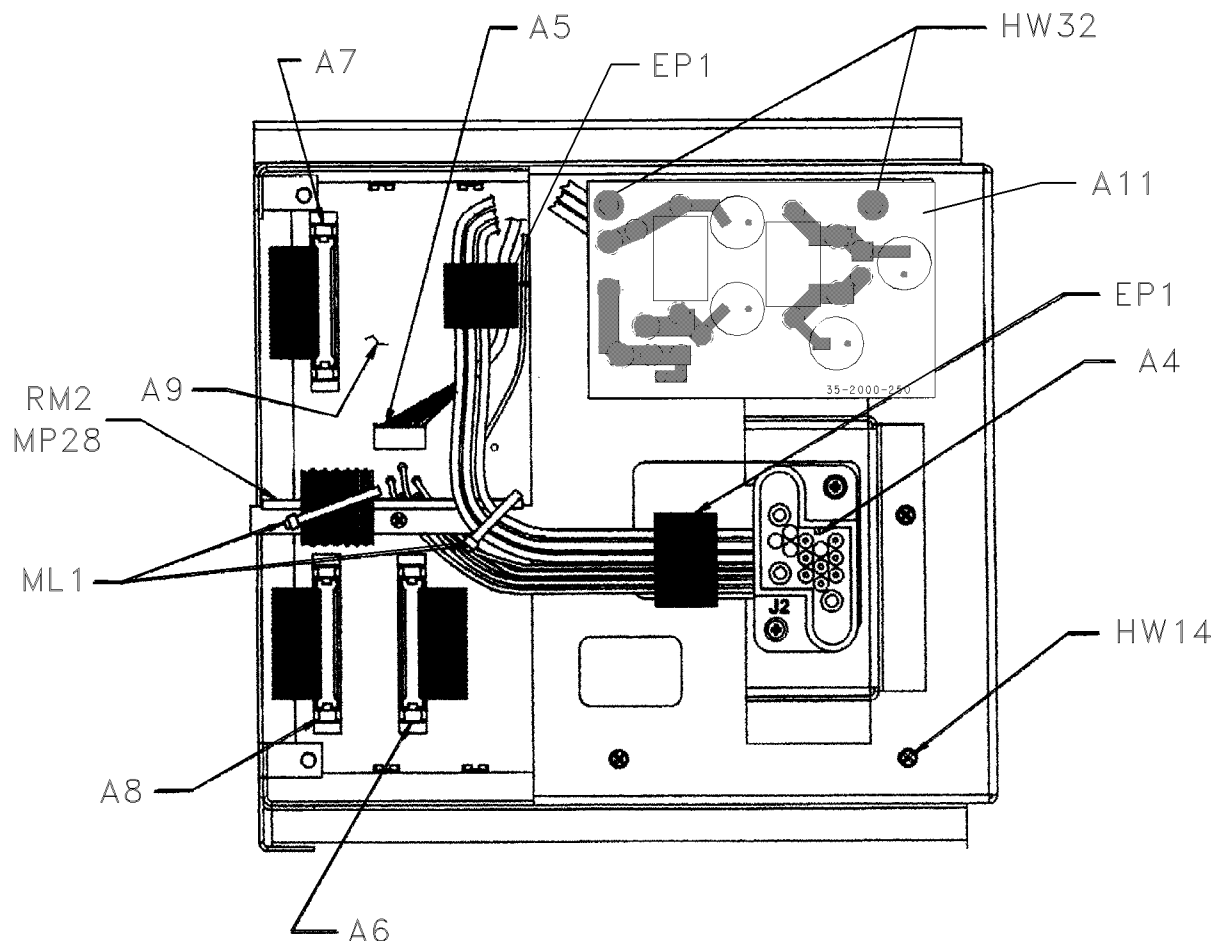


Figure 6-8 BACKPLANE CONNECTORS

6.5 CARD RACK

The card rack provides slots for up to eight logic cards; including Main Processor Card (MPC), Main Audio Card (MAC) and the Interface Alarm Card (IAC). The IAC has a notch in the card to accommodate a pin in Slot-8 so that no other card can be plugged into this slot.

On the back of the card rack is the Backplane with plug-in connectors to the cards and cables to the RF modules, Power Supply and External Connector Board.

Refer to the component layout and schematic diagram in Section 10 for more information on the Universal Station backplane.

6.6 EXTERNAL CONNECTOR BOARD

The external connector board (A10) is the interface for the alarm outputs, connecting repeaters through the high speed data bus.

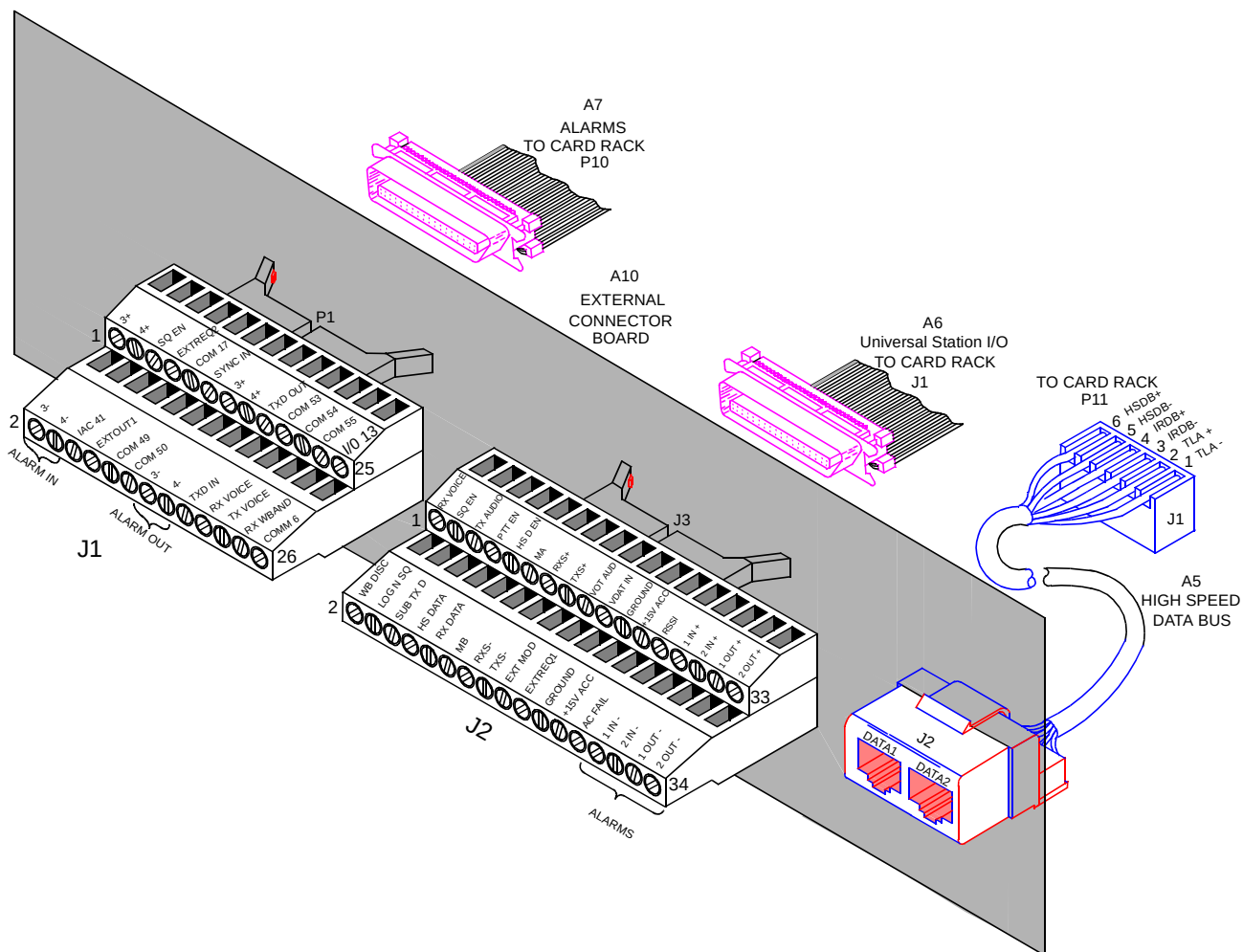


Figure 6-9 EXTERNAL CONNECTOR BOARD

6.7 THIRD PARTY INTERFACE

6.7.1 INTRODUCTION

The Third Party Interface (TPI) card connects directly to the computer serial port. Using Universal Station software, the computer programs Universal Station parameters, sets and reads the alarms, maintains the audio gating and handles initialization requests from the IAC. The TPI card also contains the RF data for the Receiver, Exciter and PA.

A TPI card is installed in each Universal Station to control functions performed by the main processor. The TPI card contains the main software and control over the Universal Station via microprocessor U7 (see Figure 6-10).

The TPI card stores the information required to operate the routing of audio and data from the inputs of the Universal Station to the outputs. The information received on the address bus addresses the microprocessor and the latches open and close gates to route a path for the audio or data.

Audio control functions for each Universal Station are performed by the Main Processor in the TPI card installed in each Universal Station. The TPI card contains the software and control over the Universal Station via microprocessor U7. The main processor has the programmable parameters for the gates.

Information is exchanged with the IAC through the Controller Backplane via a data bus and an address bus. The address bus provides the link between the main processor and the address latches. These latches control the octal latches that select the audio and data gates. The main processor controls the data to the octal latches and opens and closes the gates required to route audio/data in and out of the Universal Station. The TPI card also contains:

- Flash Memory.
- I/O chip select to allow the addressing of data latches for Input/Output.
- Read/Write selection to be sent and received on the Controller Backplane.

- Clock line, data line and chip select line from the IAC to load the Rx and Ex synthesizers.
- Serial communication circuitry and processes for the Intra-Universal Station Data Bus (IRDB) (Factory Use Only).
- Synchronous parallel communication to the IAC, i.e. alarm input and output circuitry.
- AC Power Failure indication from the IAC.
- Provides an output from the IAC to the power amplifier to control the output power.
- Exciter Logic Push-To-Talk (PTT).
- Receiver synthesizer lock, Exciter synthesizer lock, thermal level from the power amplifier, VSWR level from the PA, forward power level, RSSI signal level, audio levels from the Receiver and Exciter via the IAC.
- The audio interface between the receiver and exciter and to the external connections.
- The receive audio filtering with de-emphasis.
- The squelch filter and detector.
- Slow decay timing circuit that controls a mute gate on the main receive audio.
- A filter, DC restoration and center slicer circuitry for detecting the subaudible data.
- Transmit audio filter and limiter with pre-emphasis.

6.7.2 MICROPROCESSOR (U7)

This contains the main software and control over the Universal Station (see Figure 6-10).

The main controller (U7) is a VLSI (Very Large Scale Integration) CMOS 16-bit single chip computer with an 8-bit external data bus. This processor has software compatibility with the Intel 8086/8088. On chip components include; 256 bytes of RAM, serial and parallel inputs/outputs, comparator port lines and timers.

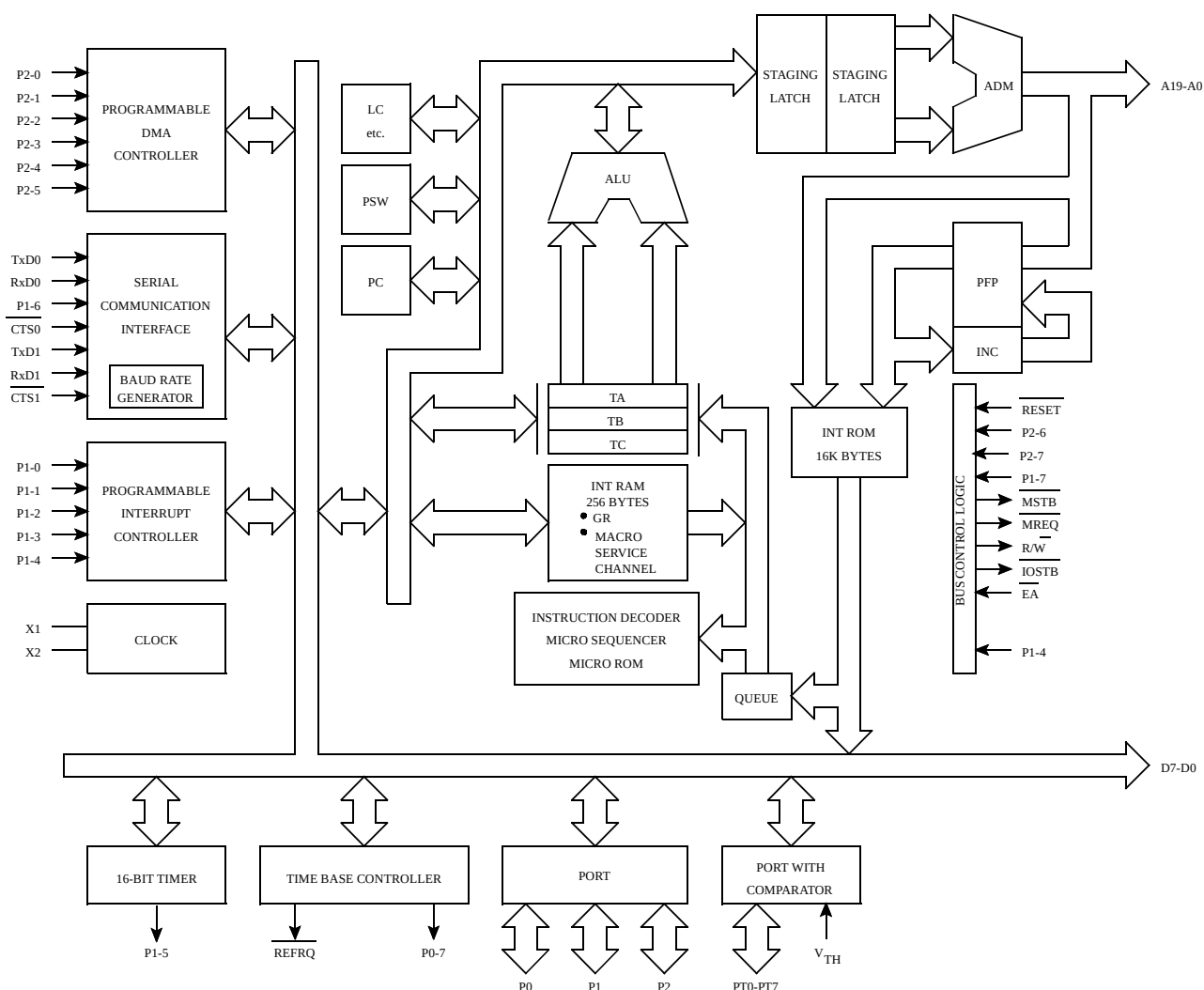


Figure 6-10 U7 BLOCK DIAGRAM

Eight banks of registers are mapped into internal RAM below an additional 256-byte special function register (SFR) area that is used to control on-chip peripherals. Internal RAM and the SFR area are together and can be relocated anywhere in the 1M-byte address space. This maintains compatibility with existing system memory maps.

The microprocessor can be reset by integrated circuit U2. Reset occurs when power is turned on, when the 5V supply drops below a threshold level or the reset switch (S1) is pressed.

When a microprocessor is reset, several internal registers are cleared and the program restarts. The reset circuitry provides additional protection against low voltage conditions.

When power is turned on, the RESET output U2, pin 6 is initially high. If the 5V supply drops below a nominal level, the RESET output changes states and microprocessor operation is halted until the 5V supply returns to normal.

The Watchdog timer resets the microprocessor if periodic pulses are interrupted to U2, pin 7. The jumper should be from J6 pin 2 to pin 3 for normal operation.

Manual reset can be accomplished by pressing push-button switch S1. When U2, pin 1 goes low, U2 goes into the reset sequence described.

6.7.3 RECEIVE AUDIO

The Receive Wide Band Audio (RX WBAND) signal from the Receiver is fed into the TPI card on P100, pin 27. This audio signal includes; audio, data, and noise. The audio processing circuit provides filtering and amplification of the audio signal before it is routed to the outputs on the TPI card.

A low-pass filter consisting of U101A/B attenuates frequencies above 3 kHz. This removes high-frequency noise from the audio signal. From the filter the signal is fed to amplifier U103A to increase the level before the high-pass filter to preserve adequate hum and noise ratio.

From the audio amplifier the signal is fed to a high-pass filter consisting of U103B/C/D. This filter attenuates frequencies below 300 Hz which removes data present in the wide band audio signal. The signal is then fed to U104A which provides 6 dB per octave de-emphasis.

Audio gates U131B/C/D permit noise squelch circuit, control logic, and audio switch to control gating of the audio signal. The control signal from the noise squelch circuit is applied to U131B through U131D. When a carrier is detected, this input is high and U131B passes the signal. Receive Mute Gate U131C is controlled by the TPI card Squelch Enable input on P100, pin 15. This input comes from rear connector J2. J105/P105 can also control U131C with jumper P105 in place to close the gate. When audio is passed by U131B/C and U132A, the audio can be routed through other gates to various outputs (see Section 6.7.6).

P100, pin 27 provides receive wide band audio to the input of U138A/B. The output of U138B is applied to wide band discriminator output P100, pin 14 and rear connector J2, pin 2.

6.7.4 RECEIVE SQUELCH CIRCUITRY

The receive wide band audio includes audio, data and noise. The squelch circuit detects this noise to determine receive signal strength. When no carrier or a weak carrier is received, there is a large amount of noise present. Conversely, when a strong carrier is present, there is very little noise present.

U105A is a high-pass filter which attenuates frequencies below approximately 30 kHz so that only high-frequency noise is passed. This noise is amplified by U105B and U107A. A level control adjusts the gain of amplifier U105B. The gain of U107A is partially set by a thermistor to compensate for circuit gain and noise level changes caused by temperature variations.

The amplified noise is then applied to a bridge rectifier. The difference between bridge rectifier outputs is applied to the inputs of U107B. The output of U107B is positive-going pulses. These pulses are applied to U107C which is a Schmitt trigger. When the input signal rises above the reference the output goes low and causes the reference voltage to decrease slightly adding hysteresis to the triggering level. This hysteresis prevents intermittent squelching when the receive signal strength is near the threshold level.

The output of U107C is applied to U107D and Logic Noise Squelch to Audio/Data Gate U137B. Gate U137B routes the squelch output to the Audio/Data Test Point J100. The output of U107C is also routed to the backplane on P100, pin 16 and then to rear connector J2. U107D functions as a timing buffer. The output of U107D is applied to Receive Squelch Active Gate U131D. When this gate is closed the squelch circuit controls Normal Receive Gate U131B to block receive audio if no signal is present.

6.7.5 RECEIVE DATA CIRCUITRY

The receive wide band audio signal is the unfiltered output of discriminator U202 in the Receiver. Therefore, this signal contains audio, data, and noise. A low-pass filter formed by U108A/B attenuates frequencies above 150 Hz by 24 dB per octave so that only the data frequencies are passed. From the filter the signal is fed to amplifier U110A. The gain of U110A is adjusted by a level control. The output of U110A can be routed through Data To Audio/Data Gate U137C and the Audio/Data Test Point J100.

DC restoration circuit converts the data signal from AC floating near ground to a digital signal at levels of 0 and 4.5V. U110B/C provide the reference voltage on the inverting input of comparator U110D. U110B handles the positive-going peaks of the data signal. Negative peak detector U110C handles the negative-going peaks of the data signal.

The voltage on non-inverting input to U110D is midway between the positive- and negative-going peaks. The data input is on the non-inverting input of U110D. When the data signal rises above the reference voltage, the output goes high. Conversely, when the input voltage drops below the reference voltage, the output goes low. The receive data is then passed to the receive data output on the backplane P100, pin 22 and then to rear connector J2.

6.7.6 RECEIVE AUDIO PROCESSING

Amplifier U113B provides amplification of the receive audio signal fed to P100, pin 13 (or Tx Audio P100, pin 17 if P106 is used). The gain of U113B is set by R172. J105/P105 can also control U131C with jumper P105 in place to close the gate.

When the received audio must be routed to the backplane (i.e. for external connector J2), Receive Voice Gate U133B is enabled by processor U7/latch U15 and passes the audio signal to amplifier U113B. The level of U113B is adjusted by R172. Receive To Backplane (RX TO BP) U133C is enabled and passes the amplified audio to the backplane.

When the audio received must be routed to the external speaker or speaker/microphone, Local Audio Mute Gate U132D is enabled by U7/latch U15. The audio is passed to local audio output amplifier U111. The gain of U111 is adjusted by the local audio volume control and on/off switch.

6.7.7 TRANSMIT AUDIO

The Local Microphone PTT switch (Q201) provides Push-To-Talk (PTT) indication to U14 when the collector of Q201 goes low. U14 then tells U7 via the data bus that the local microphone PTT has been activated. The PTT Enable input from rear connector J2 is applied to the TPI card on J100, pin 19. When the input is pulled low, Q102 provides a PTT indication to U14 that tells U7 via the data bus that the PTT has been activated.

U203A amplifies the microphone audio signal to provide the correct input level to U203B. Local Microphone Mute Gate U134C is controlled by A/D processor U7/latch 16. The function of U134C is to

mute the local microphone audio when the local microphone PTT switch is pressed. This prevents interference if the microphone remains live when the PTT switch is pressed.

Buffer U203B couples the microphone audio signal from U203A or the audio signal from the Repeat Gate U133C.

U204B/C form a high-pass filter that attenuates frequencies below 300 Hz to prevent interference with the data applied at U208B. Pre-emphasis at 6 dB per octave is provided by an RC combination before the signal is fed to the Limiter U204D.

Limiter U204D and rectifiers form a precision limiter which prevents over modulation caused by high-level input signals. With normal input levels, the output of a bridge rectifier follows the input of the bridge. When a high-level signal is applied to the bridge, the bridge opens and the output of the bridge is limited to a specific level.

The output of the limiter passes to a low pass filter formed by U204A/B and U205.

The output from U205A is fed to Normal Modulation Mute Gate U135B. This gate is controlled by U7/latch U17. When enabled, the gate passes transmit audio to EEPOT U207. U207 is an electronically adjustable potentiometer that adjusts the gain of transmit audio amplifier U208C. The gain of U208C can only be adjusted through the software. Therefore, a computer must be attached to the TPI card when levels are set.

The output of U208C is fed to summing amplifier U208B where it is combined with transmit data when present. The gain of audio and data are the same so unity gain is produced. The output signal is fed to the TCXO and VCO where it frequency modulates the transmit signal.

6.7.8 TRANSMIT AUDIO PROCESSING

Transmit voice from rear connector J2, pin 5 goes to the backplane and comes into the TPI card on P100, pin 17. When used this signal passes to the transmit voice amplifier U202A. The output level of the amplifier is adjusted by a level control R202. The output of U202A is applied to Transmit Voice Gate

U136A. U136A is controlled by processor U7/latch U16. When enabled, the gate passes the voice to Transmit Option Gate U136C and on to the transmit audio buffer U203B.

6.7.9 TRANSMIT DATA AND CWID PROCESSING

The subaudible transmit data from rear connector J2, pin 6 is connected to P100, pin 18 and fed to buffer U206A. The output of U206A is applied to amplifier U205B. R237 sets the output level of U205B. The output of U205B is applied to the non-inverting input of the summing amplifier U208B and passed to the transmit modulation output on P100, pin 29 to the RFIB and the Exciter.

During Universal Station test, U7, pin 11 generates a 10 Hz 5V P-P square wave that is applied to transmit tone enable gate U135D. U135D is controlled by U7/latch 17. When enabled the square wave passes through the gate to buffer U206A and the same path as the subaudible transmit data. The square wave is used to balance the levels at the TCXO/VCO in the Exciter test procedure.

The CWID output is only used in the TPI card to send out alarms and is controlled by processor U7/latch U15. This output is fed to CWID tone generator U209B/A and turns the tone generator on and off to create the Morse Code. From the tone generator the signal is fed to bandpass filter U208A. This filter passes the 800 Hz fundamental present in the signal. The output of the filter is applied to the summing amplifier, gate U208B, to the backplane on J100, pin 29 and to the modulation input of the Exciter via the RFIB.

6.7.10 HIGH SPEED DATA PROCESSING

The high speed data input on P100, pin 20 is fed to External Modulation Mute Gate U135C. Gate U135C is controlled by processor U7/latch U17. When enabled, this gate passes the high speed data on pin 20 to the summing amplifier U208B through buffer U208D and P100, pin 29 to the modulation input of the Exciter.

6.7.11 CHIP SELECT DECODERS (U10/U13)

Selects the peripheral chip for read/write.

6.7.12 P101 SIGNAL CONNECTOR

The signal interface connector P101 (64 pin) that connects the Address and Data buses and control lines to the backplane connector.

Pins 1-10/33-42 ADDRESS BUS

Provides a path between the main processor and the external memory on the TPI card and the IAC. This bus retrieves information programmed into memory for the operation of the Universal Station.

Pins 11-14 DATA BUS Pins 43-46

Provides a means of transferring data to and from the CPU on the TPI card, memory storage on each card and peripheral devices in and out of the TPI card and IAC.

Pin 15 MREQ

A memory request line operates in conjunction with the Read/Write lines. These provide the ability to read from or write to the main processor memory on the TPI card.

Pin 16 MSTB

A memory strobe line used during TPI card main processor Read/Write operations to external memory on the TPI card and IAC plugged into the backplane.

Pin 17-20 UNUSED

Pin 21 LPTT

The Logic Push-To-Talk is an open collector from the Controller. It has a sink capability of 20 mA and a maximum voltage rating of 18V. The transmitter should produce power when this pin is a logic low. Transmit indicator is on the IAC and is controlled independently of the LPTT.

Pin 22-24 UNUSED

Pins 25/57 UNUSED

Pin 26 UNUSED

Pin 27/59 -5V IN

This is the -5V input to the TPI card from the power supply via the Controller backplane.

Pins 28/29-60/61 +5V IN

This is the +5V input to the TPI card from the power supply via the Controller backplane.

Pins 30/62 +15V IN

This is the +15V input to the TPI card from the power supply via the Controller backplane.

Pins 31/32-63/64 GROUND

This is the ground connection to the TPI card from the power supply via the Controller backplane.

Pin 47 READ

Used with the MREQ line to read data from the main processor and external memory.

Pin 48 WRITE

Used with the MREQ line to write data to the main processor and external memory.

Pins 49-56/58 UNUSED

6.7.13 P100 EXTERNAL OUTPUTS

Connector P100 contains the audio and data outputs to the terminal block on the back of the Universal Station cabinet. These outputs are connected to other external devices.

The input and output connections for the connector are defined as follows.

Pin 1-6 UNUSED

Pins 7 V REF EX

The +3.5V DC TCXO reference voltage from the Exciter to the TPI card.

Pin 8-12 UNUSED

Pin 13 RX VOICE

This is the 300 Hz to 3 kHz de-emphasized filtered receive audio output to the backplane and rear connector J2, pin 1.

Pin 14 WB DISC

This is wide band audio and data from the discriminator in the receiver to the backplane and rear connector J2, pin 2.

Pin 15 SQ EN

Input from the rear connector J2, pin 3 to the backplane. This TTL level controls the receive mute gate in the TPI card. A low on this line opens the gate. P105 jumpers J105 on this line if external squelch gate control is not used.

Pin 16 LOG NOISE SQ

The logic noise squelch output to the rear connector J2, pin 4 via the backplane. This is a receive TTL level fast squelch.

Pin 17 TX AUDIO

This is a 300 Hz to 3 kHz transmit audio input from the rear connector J2, pin 5. Jumper P202 must be installed on J202, pins 1-2 to enable the signal from rear connector J2, pin 5.

Pin 18 SUB TX DATA

This input is subaudible transmit data from the rear connector J2, pin 6.

Pin 19 PTT N

This input is from the rear connector J2, pin 7. The push-to-talk line is an active low TTL level control that keys the Universal Station.

Pin 20 HS DATA

The high speed data is passed from the rear connector J2, pin 8 to J100, pin 29, the transmit modulation output to the RFIB and Exciter.

Pin 21 HS DATA EN

This input is from the rear connector J2, pin 9. The TTL level control line is active low.

Pin 22 RX DATA

This output is on the rear connector J2, pin 10. The output is TTL level sub-audible receive data.

Pin 23-26 UNUSED**Pin 27 RX WB AUDIO**

Receive Wide Band Audio from the Receiver audio discriminator through the RF Interface Board. The typical amplitude is 387 mV RMS (-6 dBm) and 2V DC with Standard TIA Test Modulation into the receiver.

Pin 28 A/D LEVEL

This is the Audio/Data Level output for the computer. The gates in the TPI are controlled by U7 and the software to provide the specific output for alignment.

Pin 29 TX MOD

This output of this pin is produced by audio and data inputs to the Universal Station to produce the signals on this pin. This signal goes through the RFIB and then to the Exciter.

Pin 30-32 UNUSED**6.7.14 J100 A D LEVEL TEST POINT**

This test point (on the front card edge) is used during alignment to monitor audio and data levels.

6.7.15 J101 SPEAKER/MICROPHONE

This jack is used in conjunction with J102 when a combination speaker/microphone is used during setup and testing of the Universal Station.

6.7.16 J102 LOCAL MICROPHONE

This jack is used for a microphone to key the Exciter and inject transmit audio.

6.7.17 J103 GROUND

This jack provides a ground connection for the TPI card when monitoring the test points.

6.7.18 J104 EXTERNAL SPEAKER

Provides an external speaker connection at the Universal Station site for monitoring.

6.7.19 J1 COMPUTER CONNECTOR

J1 is the TPI card connection to the computer or modem.

Pin 1	Ground
Pin 2	Computer Tx
Pin 3	Computer Rx

6.7.20 J10 BAUD RATE

J10 is jumpered to select the baud rate from the computer to the TPI card, these two I/O baud rates must be the same. The baud rate of the computer can be found from the command line by either requesting /b, /h or /? (see Section 3.1.5). To change jumper J10:

1. Power off the station.
2. Move jumper J10 on the TPI card to the proper rate.
3. Power on the station.

6.7.21 J6/P6 WATCHDOG TIMER/RESET

Enables or disables the watchdog timer for reset. Normal operating mode is P6 jumpering J6, pins 2/3. This jumper should not be moved or removed.

6.7.22 J7/P7 J8/P8 IRDB

These jumpers are used in factory testing. P7 and P8 should be removed for normal operation.

6.7.23 J105/P105 RX MUTE GATE

Jumper P105 is used to connect +5V to the control pin of receive mute gate U131C. When the TPI card Squelch Enable input on J2, pin 3 is not used, this voltage keeps the gate closed so audio can be routed to other gates and outputs in the TPI card.

6.7.24 J106/P106 LTR LOGIC JUMPER

This jumper is normally removed. If the Universal Station is connected to an E.F. Johnson LTR logic drawer, this jumper is installed to complete the repeat audio path.

6.7.25 J201/P201 SUB TX DATA

Capacitors C215/C216 are used for DC blocking on the data input.

6.8 INTERFACE ALARM CARD

This card utilizes the information required to operate the alarms designated in the programming of the Universal Station. Data is received on the address bus from the MPC for the; operation to perform, the processor and external memory, open and close relays on the outputs, and receive alarm indications on the inputs. This information is either routed to external devices or alarm outputs can be wired to alarm inputs (see Figure 4-10).

The Interface Alarm Card (IAC) contains 4-input contacts and 4-output contacts. The 4- inputs can be disabled, energized or de-energized. The 4-output relays are dry contacts that have a 2A rating and can be either normally open or normally closed.

The electromechanical relay outputs are comprised of eight SPDT (normally open) relays. The relays are all open at power-on. Data to the relay is latched by a write to the base address.

The IAC activates relays when alarm trigger events occur. The IAC monitors for alarm activity in the system and can set the various output relays as defined by the user during programming. When an external alarm is set it can be monitored from a remote location. Refer to Section 4.3.3 for alarm programming.

6.8.1 RELAY OUTPUTS

The alarm relay outputs are provided via a terminal block on the back of the Universal Station (see Figures 6-12 and 6-13).

The alarm outputs are on the terminal block at the rear of the Universal Station.

6.8.2 ISOLATED INPUTS

The isolated alarm inputs are provided via a terminal block on the back of the Universal Station (see Figures 6-12 and 6-13).

The isolated inputs are driven by either AC or DC signals. The active high inputs can be set by switches to be polarity sensitive, non-polarity sensitive or add a resistance in series to dissipate unused power (see Figure 6-11).

The active low inputs can also be set for either +5V or +15V operation when a ground closure is required to provide an active alarm.

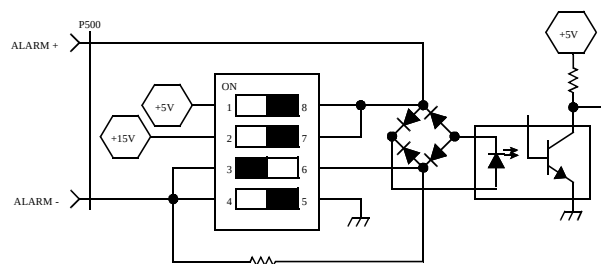


Figure 6-11 S500-S503

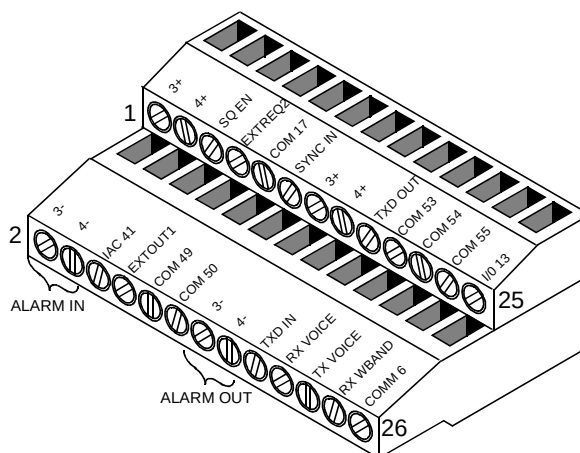


Figure 6-12 4 I/O J1 ALARM OUTPUTS

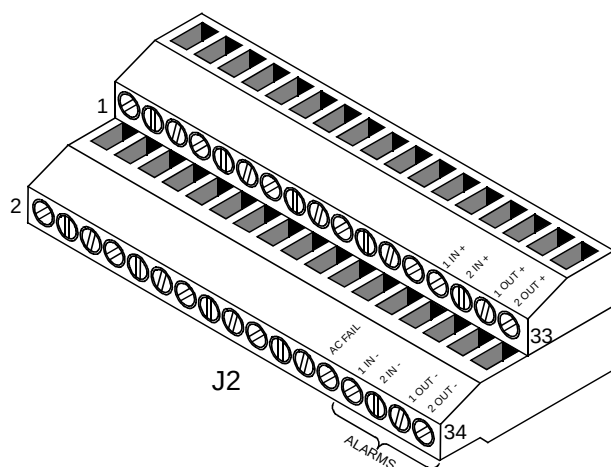


Figure 6-13 4 I/O J2 ALARM OUTPUTS

Standard 12V/24V AC control transformer outputs can be accepted as well as DC voltages. This input voltage range is 5-24V RMS. External resistors connected in series may be used to extend the input voltage range.

6.8.3 ALARM INDICATORS

There are two forms of alarm indicators from the Universal Station. One form is the two red LEDs and display combination on the MPC. Refer to Table 1.4 for the combinations and definitions of the active alarms.

Another form is the output relay to the terminal blocks at the rear of the Universal Station where outputs can be wired to external devices or to alarm inputs.

6.8.4 ALARM FUNCTIONS

The alarms can be configured in various modes to alert the system owner to conditions and hazards with the equipment and the Universal Station site facility. A few of the possibilities are shown in Figure 6-14.

In this example the input alarm 2 of Universal Station 1 is connected to the door of the building, input alarm 3 of Universal Station 5 is connected to the fire alarm system, the AC fail alarm (#16 see Table 1.4) is mapped to alarm 2 output so it can be

transmitted (see Figure 4-10) and the output alarm 1 of Universal Station 1 is connected to the input alarm 1 of Universal Station 2 and so on until the output alarm 1 is fed back to the input alarm 1 of Universal Station 1.

Then the RF Shutdown alarm (#32) is mapped for alarm 1 in each Universal Station. This configuration allows Universal Station 2 to give an alarm when Universal Station 1 has an RF Shutdown alarm output, etc.

There are 40 internal alarms that can be included in the output alarm configuration (see Table 1.4). These alarms can also be programmed to send an output as shown in the cross reference screen of the alarm configuration menu (see Figure 4-10). Among these alarms are the thermal sense from the PA and the AC fail alarm output on the terminal block at the rear of the Universal Station to activate the battery backup.

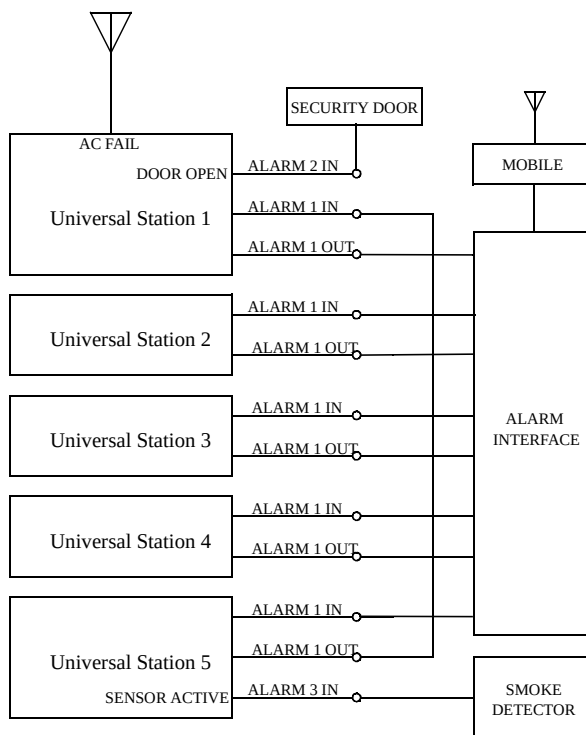


Figure 6-14 ALARM EXAMPLE

6.8.5 P500 SIGNALING CONNECTOR

The input and output connectors for the IAC are defined as follows. The signal interface connector P500 (64 pin) connects the Address and Data buses and control lines to the backplane connector. See Figure 6-19.

Pins 1-4 ADDRESS BUS (A12-A19 Only) **Pins 33-36**

This address bus provides a path between the MPC main processor and the latches and multiplexers of the IAC. This bus retrieves information programmed into the MPC memory for the operation of the IAC.

Pins 5/37 ALARM 1 IN +/-ALARM 1 IN -

This is an input received from a connection to an external device as a specific alert condition.

Pins 6/38 ALARM 2 IN +/-ALARM 2 IN -

This is an input received from a connection to an external device as a specific alert condition.

Pins 7/39 ALARM 3 IN +/-ALARM 3 IN -

This is an input received from a connection to an external device as a specific condition.

Pins 8/40 ALARM 4 IN +/-ALARM 4 IN -

This is an input received from a connection to an external device as a specific alert condition.

Pin 9 SQUELCH ENABLE

This is an output to rear connector J1. It can be configured for inverted output, non-inverted output or logic controlled non-inverted output.

Pin 10 EXTERNAL REQ 2

This is an input received from a connection to an external device.

Pins 11-14 DATA BUS **Pins 43-46**

This data bus provides a means of transferring data to and from the latches and multiplexers on the IAC with peripheral devices in the IAC.

Pin 15 MREQ

A memory request line operates in conjunction with the Read/Write lines. These lines read from or write to the MPC processor memory.

Pins 16/17 UNUSED

Pin 18 SYNC IN

This is an input received from a connection to an external device.

Pins 19/51 ALARM 1 OUT +/-ALARM 1 OUT -

This is an output to an external device to perform a specific function.

Pins 20/52 ALARM 2 OUT +/-ALARM 2 OUT -

This is an output to an external device to perform a specific function.

Pins 21-23 UNUSED

Pins 24/25 +15V ACCESSORY

This DC supply is an output to an external device through rear connector J1.

Pins 26/58 +15V FILTERED

This DC supply is an output to an external device through rear connector J1.

Pins 27/59 -5V IN

This is the -5V input from the power supply via the Controller backplane.

Pins 28-29 +5V IN
Pins 60-61

This is the +5V input to the MPC from the power supply via the Controller backplane.

Pins 30/62 +15V IN

This is the +15V input to the MPC from the power supply via the Controller backplane.

Pins 31-32 GROUND
Pins 63-64

This is the ground connection to the MPC from the power supply via the Controller backplane.

Pins 41-42 UNUSED**Pin 47 READ**

Read is used with the MREQ line to read data from the MPC processor and external memory.

Pin 48 WRITE

Write is used with the MREQ line to write data to the MPC processor and external memory.

Pins 49-50 UNUSED**Pins 53-55 UNUSED****Pin 56 THERMAL SENSOR**

The Thermal Sensor monitors the PA temperature and creates an alarm condition if the temperature exceeds the limit.

Pin 57 POWER SWITCH

Pin 57 turns the voltage from the power supply to the Universal Station on and off. This pin is connected to the on/off toggle switch S508.

6.8.6 P501 EXTERNAL OUTPUTS

Connector P501 contains data and control outputs to the terminal block on the back of the Universal Station cabinet. These outputs are connected to other external devices.

The input and output connectors for the connector are defined as follows.

Pins 1/17 ALARM 3 OUT +/ALARM 3 OUT -
Pins 2/18 ALARM 4 OUT +/ALARM 4 OUT -

These are outputs to external devices to perform a specific function.

Pin 3 RX WBAND

Receive Wide Band Audio from the Receiver audio demodulator through the RF Interface Board. The typical amplitude is 387 mV RMS (-6 dBm) and 2V DC with Standard TIA Test Modulation into the receiver.

Pins 4-6 UNUSED**Pin 7 EXT OUT 1**

This is an external output to rear connector J1.

Pin 8 RF CLOCK

The clock will control the synthesizer chips and power control circuit when loading. This pin is a TTL input from the Controller.

Pin 9 AC FAIL IN

This input from the AC supply is used by the AC fail output to indicate that the AC has been interrupted.

Pin 10 SYN CS RX

This is the chip select pin for the main receiver synthesizer chip. This chip is the same part as used in the Exciter. A low loads the synthesizer.

Pin 11 UNUSED**Pin 12 RF MUX 1 INH**

The Multiplexer-1 Inhibit (U105, pin 6) is a CMOS input from the Controller that inhibits (disables) the Multiplexer-1 output with a logic high.

Pin 13 RF MUX 2 INH

The Multiplexer-2 Inhibit (U106, pin 6) is a CMOS input from the Controller that inhibits (disables) the Multiplexer-2 output with a logic high.

Pin 14 RF MUX 3 INH

The Multiplexer-3 Inhibit (U104, pin 6) is a CMOS input from the Controller that inhibits (disables) the output from the RF 3 Multiplexer with a logic high.

Pin 15 PC STR

The Power Control Strobe is normally low until after the power control data is shifted into the power control register. Then the strobe line goes high and back to low. The clock or data lines cannot be changed until after the strobe is set.

Pin 16 HS CS EX

This is the Exciter high stability synthesizer chip select. A low enables loading the high stability synthesizer loop. This pin is only used on high stability equipped units.

Pins 19-21 UNUSED**Pin 22 BUF RX WBAND**

This is buffered Receive Wide Band Audio from the receiver audio demodulator through the RF Interface Board. The typical amplitude is 387 mV RMS (-6 dBm) and 5V DC with Standard TIA Test Modulation into the receiver. This is an output to the rear connector J1.

Pin 23 AC FAIL OUT

This is an indication that the AC power has been interrupted.

Pin 24 UNUSED**Pin 25 HS CS RX**

This is the receiver high stability synthesizer chip select. A low enables loading the high stability synthesizer loop. This pin is only used on high stability equipped units.

Pin 26 SYN CS EX

Pin 26 is the exciter main Synthesizer Chip Select that allows input of data to U403 when the line is pulled to logic low.

Pin 27 UNUSED**Pin 28 A D LEVEL**

20 lines (of the possible 24) of RF functions sampled are multiplexed to the Controller through this pin using three multiplex chips.

Pin 29 RF DATA A

Data A (U105, pin 11) is the least significant bit (LSB) in the 3 multiplex chips located on the RFIB. This pin is a CMOS input from the Controller requiring a logic high for activation.

Pin 30 RF DATA B

Data B (U105, pin 10) is the middle significant bit in the 3 multiplex chips located on the RFIB. This pin is a CMOS input from the Controller requiring a logic high for activation.

Pin 31 RF DATA C

Data C (U105, pin 9) is the most significant bit (MSB) in the 3 multiplex chips located on the RFIB. This pin is a CMOS input from the Controller requiring a logic high for activation.

Pin 32 RF DATA

This is a data pin with TTL levels from the Controller which has the dual role of loading the synthesizer chips and adjusting the power control D/A lines for proper output power. Up to four synthesizer chips and a shift-register could be connected to this pin.

6.8.7 J500 A D LEVEL TEST POINT

20 lines (of the possible 24) of RF functions sampled are multiplexed to the Controller through this pin using three multiplex chips.

6.8.8 J501 GROUND

J501 is an IAC ground reference for test points.

6.8.9 J502 +15V

J502 is a voltage test point.

6.8.10 POWER SWITCH

S508 turns the power supply DC voltage on and off from the front of the IAC.

6.8.11 J505 SQUELCH ENABLE OUTPUT

P505 jumpers J505, pins 1/2 to configure the squelch enable output for an inverted output. P505 jumpers J505, pins 2/3 to configure the squelch enable output for a non-inverted output. P505 jumpers J505, pins 3/4 to configure the squelch enable output for a non-inverted output under the control of U503.

6.9 800W POWER SUPPLY

WARNING

This power supply contains voltage potentials greater than 400V. Considering the dangerous voltages and the complexity of the switch-mode power supply, it is strongly recommended the power supply be returned to E.F. Johnson for repair (see Section 1.8).

6.9.1 FILTER BOARD

AC power is brought into the power supply through the IEC connector in the front of the power supply (see Figure 2). This connector is attached to the EMI filter assembly, Part No. 023-2000-820. The filter contains common mode and differential mode filtering such that the supply complies with FCC Class-A regulations. In addition to the filter components (C1, C2, L1, C3, C4, L2, C5) R1 is used to discharge the filter capacitors when AC is removed.

Metal-oxide varistors (RV001/RV002) are placed across the line on the input and output of the EMI filter that clamp transients on the AC line to prevent damage to the power supply. The AC power is fused with F001 after the connector and before the filter. Replace fuse with a 15A/250V (314015) fuse.

At the output of the filter board is a bridge rectifier. The rectifier is heat sunk to the filter bracket through a Grafoil thermal interface pad. Filtered AC power is connected to the main board via wires W001 and W003. Filter and rectified current is brought to the main board via wires W004 and W005. The safety ground is connected from the filter board to a stud in the chassis through W002.

6.9.2 POWER FACTOR CORRECTION

The power factor switching frequency is set at 87.5 kHz, ± 5 kHz. The average current mode boost converter is comprised of L107, Q101, CR145, C110, C111. Half of U102 is used for power factor correction. RT101/RT102 are negative temperature coefficient thermistors that limit the in-rush current to C110/C111. The resistor network connected to CR104 charges up C106/C107 to +18V off the line. This provides the bias voltage required to start the controller IC U102. Once the IC turns on current is being switched on L107. A small tap winding on L107 provides sustaining current to the U102. When AC is first connected it could take several seconds for C106/C107 to charge to +14V before the unit starts.

U102 samples the input voltage through R105/R106/R107; the input current through T103/T104/CR146/CR108/R113/R114; and the output voltage through the divider at R127. U102 modulates the duty cycle to MOSFET Q101 such that the input current is shaped like and in phase with the input voltage. The controller has two feedback loops; a voltage loop to keep the 400V constant and a current loop to keep input current correct. Compensation for the current error amp is C120/R141/C121 on U102, pin 1. Compensation for the voltage error amp is provided by C127/C142/C126 on U102, pin 16. U102, pin 4 and associated circuitry automatically adjust the Power Factor Correction (PFC) for input voltage (100-240V AC), line frequency (50-60 Hz) and load on the power factor.

NOTE: The output voltage of the power factor section is at 400V DC. This voltage is bled off slowly. After turning off, it can take more than 5 minutes to discharge.

6.9.3 MAIN PULSE WIDTH MODULATOR

The +26.5V output is created from a two-transistor forward converter Q116/Q118. It uses the 400V output of the power factor correction on C110/C111 for an input voltage. The same controller IC (U102) drives the +26.5V stage. This stage runs at exactly twice the power factor correction frequency and uses trailing edge modulation. The pulse width modulator uses the PFC supplied current for modulation scheme that reduces ripple current in C110/C111.

The output of the IC, U102, pin 11 is fed to a level shifting gate drive network comprised of C139, C140, T106, C136, C197, C137 and C228. Each MOSFET (Q116, Q118) of the two-transistor forward converter has a gate protection zener diode CR117, CR120 respectively. In addition, each power MOSFET has a gate turnoff network.

In operation, the power MOSFETs Q116, Q118 are on for approximately one-third of the period providing current to the primary side of T107. During that time CR121 is forward conducting and charging L101. When the MOSFETs are switched off, the magnetizing current of T107 continues to flow through CR118, CR119. These diodes place 400V across the transformer in opposite polarity that resets the transformer core. During the off period CR128 is free wheeling and L101 is discharging. Transformer T107 provides the isolation between the low voltage and high voltage sections.

The +26.5V pulse width modulator is peak current mode controlled. This type of converter requires current and voltage sense. T105, CR112, R125, R146 and C125 provide the current sense circuit. The voltage sense circuit is U109 and the associated circuitry on the isolated side of the supply.

An opto-isolator is used to cross the boundary from high to low voltage sections. In the event of an over-voltage condition ($>+32\text{V}$) U115 and associated components turn the power supply off. This shutdown mechanism latches the power supply Off. The enable

line must be turned Off for 10 seconds for the power supply to reset. T106 has a tap to provide current to the optional battery back-up (Part No. 023-3-2000-830). The +26.5V is available at the high current output connector to the power supply and it also powers the +15V, +5V and -5V converters through F102.

6.9.4 SYNCHRONIZING CIRCUITS

The +15V and +5V sections run at the same frequency as the +26.5V pulse width modulator. In order for a beat note not to be produced, a sync circuit is used. If two converters are not synchronized, the difference frequency may show up at an undesired location in the repeater.

Divider R151/R152 samples the output of the main pulse width modulator. When Q116 and Q118 turn on, the output on U104A, pin 3 goes high. C138, R176, CR122 along with U104B creates a very narrow pulse on U104B, pin 6. Q110, Q111 and Q112 level shift and buffer this pulse. When the narrow pulse is presented to the timing capacitor of the +15V and +5V converters, the cycle terminates and a new one starts. This forces the +15V and +5V converters to run at the same frequency and is slightly delayed from the +26.5V converter.

6.9.5 FAN AND THERMAL SHUTDOWN

The voltage supply to the thermal measurement circuit is generated from transformer T101 and the associated bridge rectifier consisting of CR101, CR102, CR110 and CR111 and bulk storage capacitor C101. This voltage is approximately +9V when the AC voltage is at 120V AC.

NOTE: This DC voltage is dependent on the input AC voltage.

U106 provides a very accurate +5V required for proper operation of the temperature sense circuit. A precision temperature sensor (U101) is mounted to the +26.5V rectifier heatsink. The output of this sensor is $10\text{ mV}/^{\circ}\text{C}$ with a $\pm 1\%$ accuracy. This voltage is amplified by U110A with precision resistors R183/R184 setting the gain.

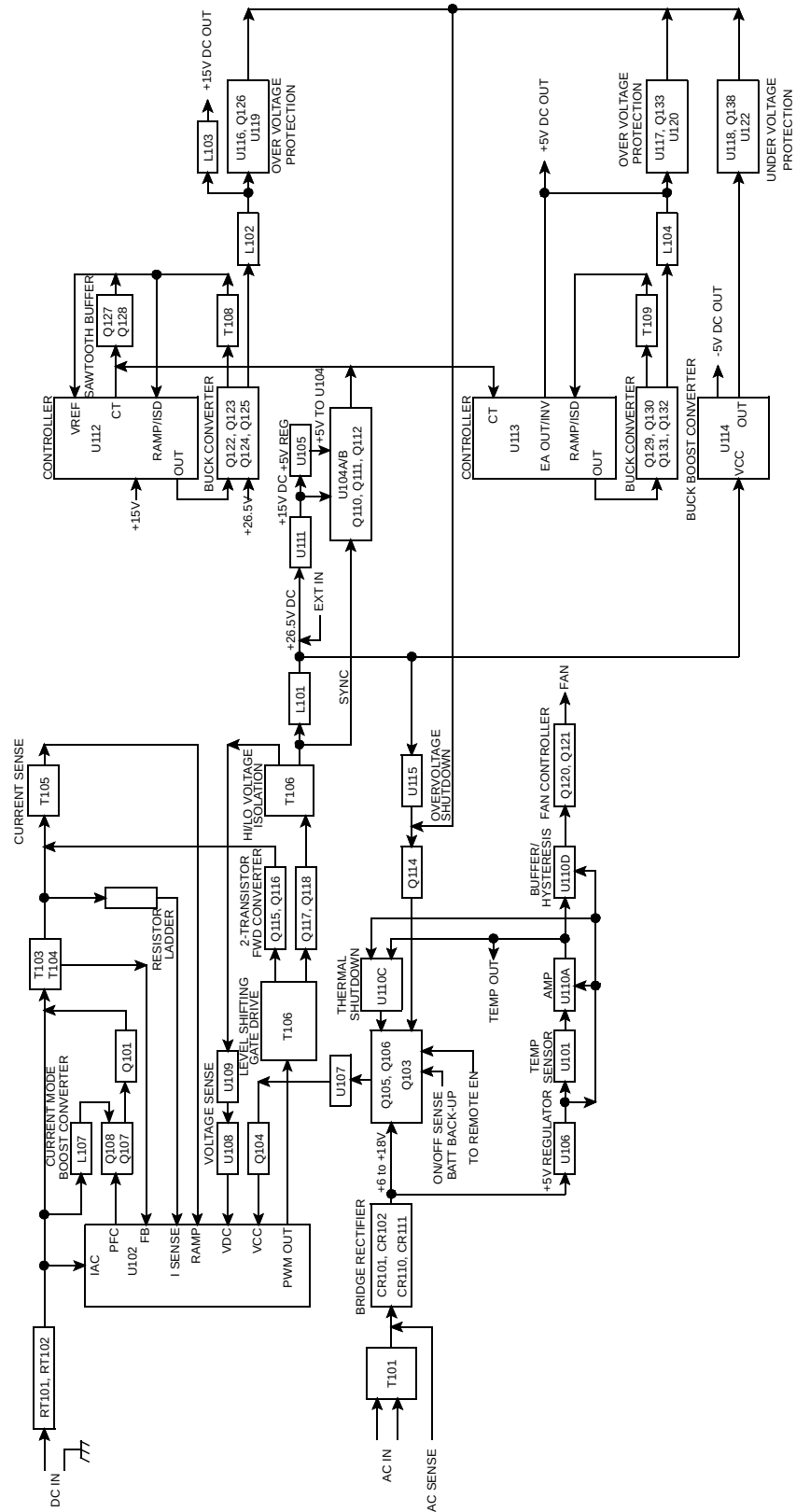


Figure 6-15 POWER SUPPLY BLOCK DIAGRAM

The output of gain stage U110A is fed to the computer interface via WO116 to monitor power supply temperature with the programmer. The output of U110A, pin 3 is also connected to the thermal shut-down circuit U110C, R135, R136, R137, R138 and R139. If the heatsink temperature reaches 92°C (198°F) the output of U110C, pin 8 goes high and saturates Q103. When Q103 is turned on U107 is turned off and the power supply turns off. The remote voltage is always present so when the heatsink temperature drops to 80°C (176°F) the power supply restarts. The high temperature condition would only exist if the fan was blocked or faulty.

The output of U110A, pin 1 also connects to the fan controller. U110D with the associated resistors provides a means to turn the fan on/off. Transistors Q120/Q121 provide current gain and a voltage level shift to run the fan. The fan turns on when the heatsink reaches approximately 45°C (113°F) and turns off again when the temperature reaches 35°C (95°C). In normal operation the fan turns on and off.

6.9.6 +15V CONVERTER

The input voltage to this "Buck" DC/DC converter is the main +26.5V output fused through F102. The bias voltage for the controller IC U112, pin 15 is provided by a +15V regulator U111. The basic buck converter consists of MOSFET Q125, Schottky diode CR126 and storage inductor L102. C165, C166, C167, L103, C169 and C170 filter the output voltage and attenuate the ripple at the switching frequency (160 kHz). The capacitors are an integral part of the feedback loop. The duty cycle is approximately 60%.

The +15V buck converter is peak current mode controlled. T108 samples the inductor current while MOSFET Q125 is on. The sampled current is translated to a voltage via CR127, R209 and R210.

Because the MOSFET is a high-side switch, a charge pump is required to get the gate voltage above the input voltage. The charge pump operates as follows. When the output from IC U112, pin 14 is low, capacitor C162 is charged through CR124, R198, R199, R200 and Q122/Q123 are off. When U112, pin 14 goes high, the capacitor stays charged and CR124 is reverse biased. Q122/Q123 are turned on forward biasing CR125 and applying a gate-to-source voltage

of approximately +12V. During this time Q124 is off. When U112, pin 14 goes low, Q124 turns on and rapidly discharges the gate capacitance.

Resistors R231/R208 coupled with C164 provide snubbing for Schottky diode CR126.

Because the +15V converter operates at greater than 50% duty cycle, slope compensation is required. Capacitor C176 is the time capacitor for this converter and R223 is the resistor that sets the charge current. A sawtooth wave is present on the high side of C176 that is buffered by Q127/Q128. The resistor divider network of R315, R227, R229 and R232 provide the correct amount of compensation for stable operation and current limiting.

The output voltage is sampled by R215, R216 and R217 and sent to the inverting side of the error amplifier internal to the controller IC on U112, pin 1. Voltage loop compensation is set by C174, C175 and R221.

Sync pulse is added into the low side of C176 via C172 and R225. The free running frequency of the 15V converter (approximately 145 kHz) is set about 10% lower than the 26.5V converter. This longer duty cycle allows the sync circuit to synchronize the converter.

Over voltage is sensed using U116 as a reference and amplifier, CR129 acts as a crowbar on the output. Once the crowbar is turned on, opto-isolator U119 is activated to shutdown the power supply. The enable line must be toggled or AC voltage removed for 10 seconds to reset the power supply.

6.9.7 +5V CONVERTER

Operation of the +5V "Buck" DC/DC converter is the same as the +15V, except slope compensation is not required. Some values are different to get the 5.2V DC and current limit to 6A. The duty cycle is approximately 20%.

6.9.8 -5V CONVERTER

The -5V "Buck-Boost" converter scales and inverts the voltage. This converter is free running at approximately 75 kHz. The output switch and control-

ler are built into the 5-leg TO-220 IC U114. L105 is the storage inductor. C204, R270 and R271 close the voltage feedback loop and are set for optimum stable transient response. C208/C209 reduce output ripple. Under-voltage protection is required on this stage and works the same as the over-voltage protection of the +15V and +5V buck converters, but has opposite polarity.

6.9.9 POWER SUPPLY REPAIR AND ALIGNMENT

If a power supply fails it is typically a Power MOSFET or Power Diode. In some cases the MOSFET gate may short and cause some of the driver circuits to be damaged. When replacing heat sunk components it is advisable to replace the sil-pad thermal interface material at the same time. The mounting hardware must be replaced exactly as built in the factory. The mounting screws for the power semiconductors **MUST BE** torqued to 4-5 in/lbs. Under torque and over torque can shorten the life of the semiconductor.

The majority of the voltage and current limits are set with fixed value components in the power supply. However, the +26.5V, +15V and +5.2V supplies are adjustable. When certain components are replaced, the voltages must be adjusted. The voltages should be set at light load (i.e. repeater in the Receive mode).

1. The +26.5V supply can be adjusted with R174 when any of the following components are replaced: R173, R174, R175, U109, U108, U102, R143, R170 or R171.
2. The +15V supply can be adjusted with R216 when any of the following components are replaced: R215, R216, R217 or U112.
3. The +5.2V supply can be adjusted with R254 when any of the following components are replaced: R253, R254, R255 or U113.

6.10 BATTERY BACK-UP MODULE

6.10.1 OPERATION

When a battery back-up module is installed in a power supply it performs the function of running a repeater in the absence of AC voltage. When AC is present it can be used to charge a pair of lead-acid bat-

teries in series. The charger is a temperature compensated constant voltage charger. The maximum output current from the charger is 2.2A. The charger works when AC is present and the repeater is enabled. The charger switch on the battery back-up module must be "On". The temperature compensation thermal sensor is part of 023-2000-223 battery back-up module cable assembly.

When AC is low or not applied to the 023-2000-800 power supply the battery input takes over if the voltage is within range. The input voltage to the battery back-up module acts as the 26.5V supply and the other voltages in the power supply also are present, +15, +5.2 and -5V. When AC is restored, the battery back-up module disengages automatically. The change over from battery to AC or AC to battery may cause the repeater to reset, depending on battery condition and load status.

NOTE: When using a generator, the DC voltage must be between 23-28.5V (26.5V DC is recommended) and ripple voltage less than 1% or approximately 0.25V P-P.

6.10.2 CHARGER

The charger charges the batteries when the repeater is on and switch S101 is "on". A tap off of the main transformer of the power supply through wire W104 and a +26.5V line via wire W102 are what supply the charger with the necessary voltage to charge the batteries. The tap off of the transformer is biased by the +26.5V and then filtered through L101, C105 and C119. Since the tap from the power supply is not a regulated voltage, bleeder resistors R136/R137 dissipate some power when the batteries are fully charged. No load situation, the peak voltage of the tap is approximately 63V, is not impressed across the 50V capacitors C105/C119. During a battery charging condition the line voltage to the charger on U107, pin 2 should be about 35V.

While charging batteries, if the charge voltage is varied with respect to the temperature of the batteries, the lifetime of the batteries is increased dramatically. Figure 6-16 shows the algorithm used in float charge applications for two 12V lead-acid batteries in series. Figure 6-16 shows that the charge voltage should be 27.3V DC $\pm 0.15V$ at 25°C (77°F) with -55 mV/°C temperature compensation.

An LM317M linear voltage regulator (U107) is used to create the temperature compensated charge voltage. This device is capable of delivering 2.2A of continuous current to the batteries.

To create a temperature compensated voltage an op amp (U104) is used as a voltage gain device from a temperature probe attached to the batteries (part of 023-2000-223). This op amp with R148/R149 defines the slope for the algorithm of Figure 6-16. The output of the temperature compensation is attached to the adjust pin of U107. R138-R140 allow the output voltage to be set properly at a given ambient temperature. F101 is a 4A resettable fuse used to prevent thermal run away in the event of U107 failure. If the output current to the batteries exceeds 4A this fuse opens. Once the current drops below 100 mA, the fuse closes automatically.

NOTE: If any of the charging components are replaced, R140 needs to be adjusted to set the output (battery back-up battery terminals) voltage to 27.3V $\pm 0.15V$ when temperature sensor is at 22°C (71.6°F).

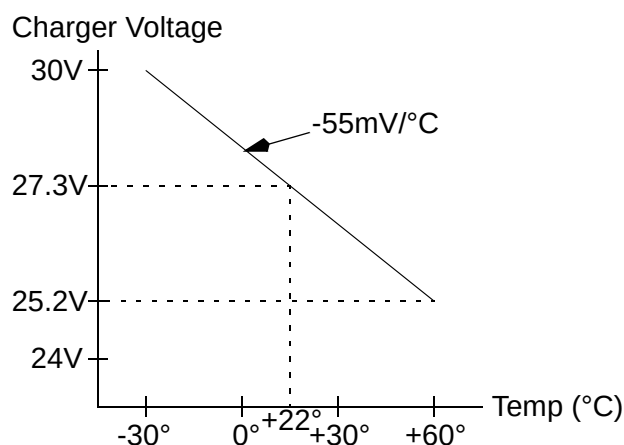


Figure 6-16 NO LOAD CHARGE VOLTAGE vs. TEMPERATURE

6.10.3 REVERSE BATTERY PROTECTION

To obtain reverse battery protection a number of techniques were implemented. Q108/Q110 are arranged in a Darlington configuration to isolate the output capacitors C109-C111 from conducting in the event the batteries are connected backwards. This cir-

cuit also provides a means to turn the battery charger off in case the user wants to run the repeater off of another DC source. S101 opens the base of Q105 which turns off Q104. CR111 is a green light emitting diode (LED) located on the right hand side of the battery back-up module when looking at the front of the power supply that tells the user the charger is in charge mode and is marked "On".

To notify the user that the batteries are connected improperly R101/CR101 are connected in series across the batteries. CR101 is a red LED that lights when the batteries are connected backwards and is located on the left hand side of the battery back-up module when looking at the front of the power supply. This LED is marked "Reverse Bat.". CR113 eliminates a path for the reverse battery current through the relay and over/under voltage protection circuitry.

NOTE: Exceeding -30V across the battery back-up terminals with the power supply on will destroy Q105.

6.10.4 ENGAGING THE RELAY

The main purpose of the Battery Back-Up Module (BBM) is that when the power supply loses AC line voltage, a pair of series connected 12V lead acid batteries (approximately 26.4V) or other 23-28.5V DC source will engage to the supply allowing the repeater to operate. To perform this function a voltage comparator (U101) is used to monitor the charge tap coming from the power supply.

A 2.5V reference voltage is supplied to the comparator from U102. The transformer tap voltage is smoothed and divided by CR114, C118, R116, R121 and R122. The values for these components were calculated so that when the AC line voltage is dropped to 70V AC, the output of the comparator turns Q103/Q102 on which in turn engages the relay K101. The relay is capable of 30A which delivers the battery energy to the power supply via W102 with the return line being W103.

NOTE: When AC is restored, the relay disengages and the charger automatically begins to charge the batteries.

6.10.5 OVER/UNDERVOLTAGE SHUTDOWN

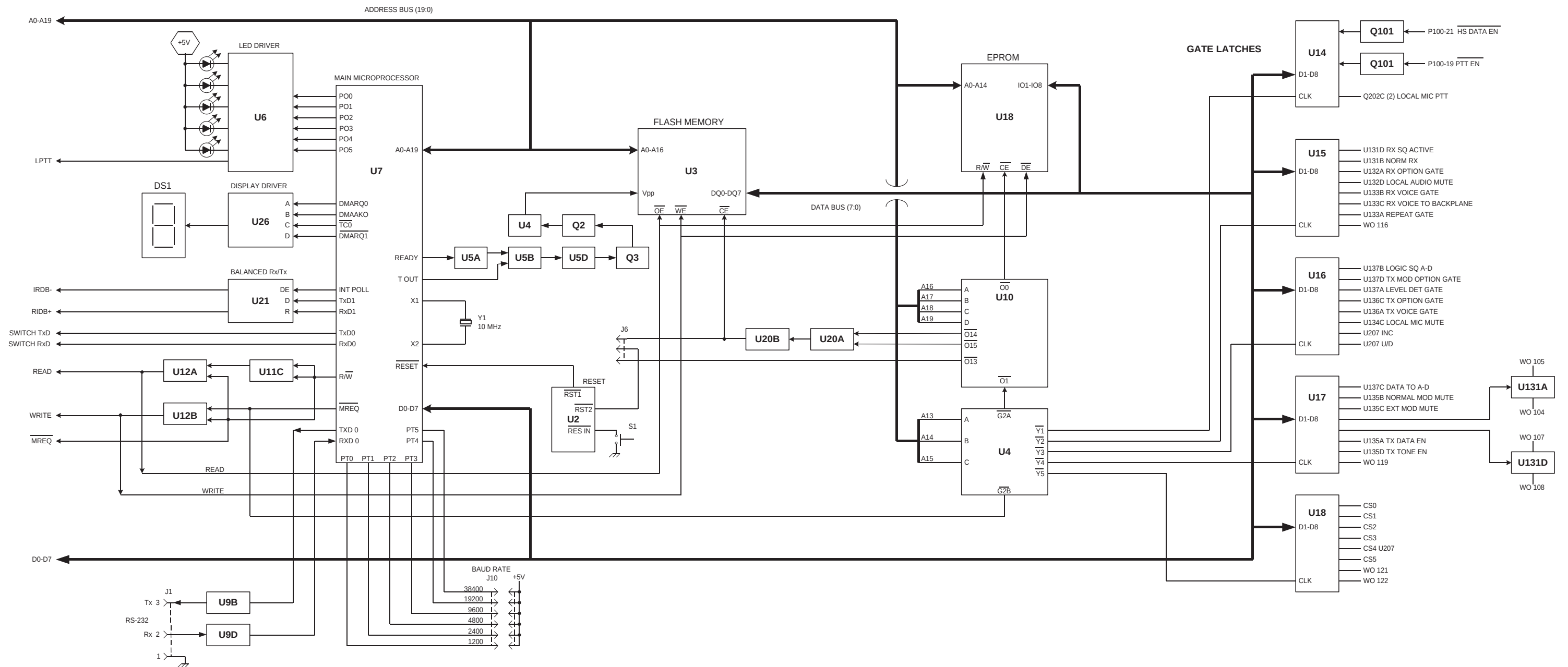
U101 is a quad comparator IC used to create the overvoltage and undervoltage shutdown circuitry. If the batteries are drained sufficiently enough such that the voltage of the batteries drops below 20.3V DC the output of the comparator goes low and turns Q102 off. By turning Q102 off the batteries are switched out of the circuit. The batteries cannot be switched back into the repeater until the voltage rises to 22.6V DC. This operation is in place to protect the repeater and the batteries. In the event the batteries are over charged, or the repeater is driven by the generator that has the voltage set too high, the relay will disengage above 30.5V DC. In order to switch the batteries back to the repeater, the voltage must drop below 29V DC.

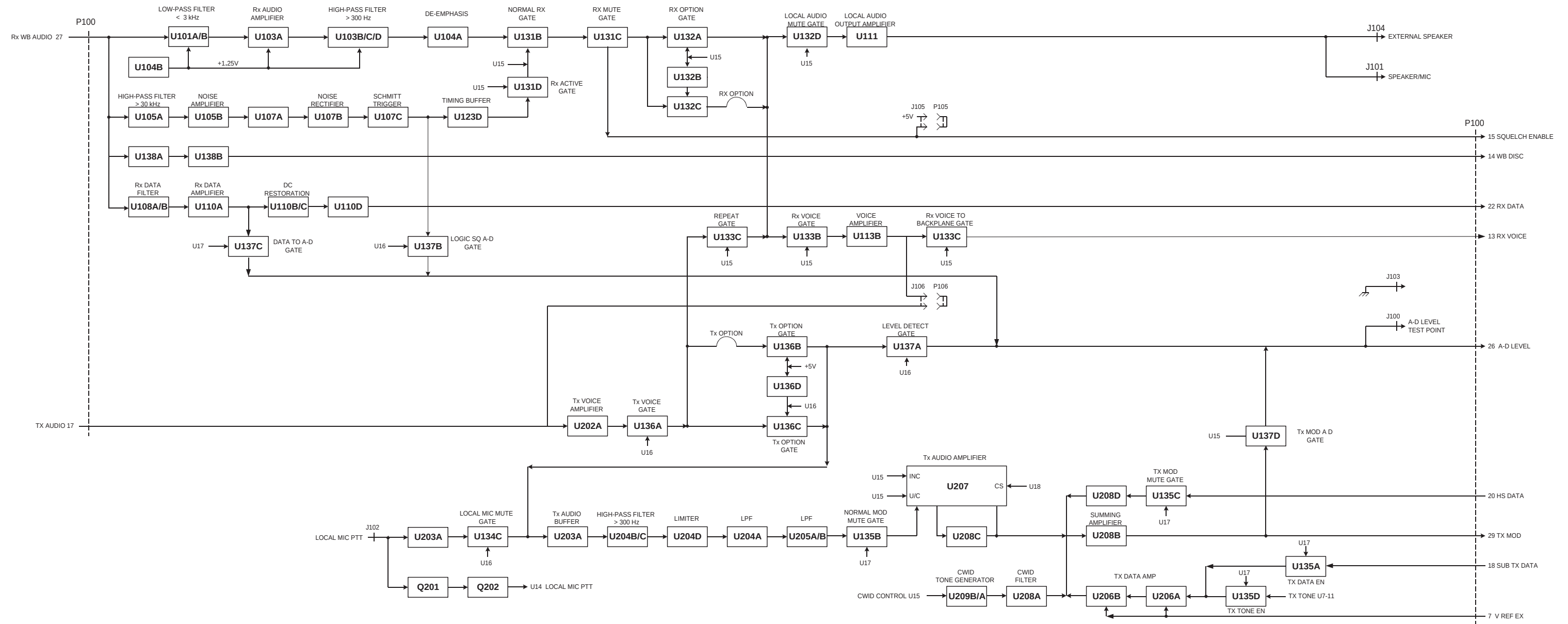
In an overvoltage or undervoltage situation, whether AC is present or not, the red LED (CR105) lights until the problem is rectified. This light is located on the right-hand side of the battery back-up module when looking at the front of the power supply and is marked BAT-BAD.

6.10.6 BBM FAN CONTROL

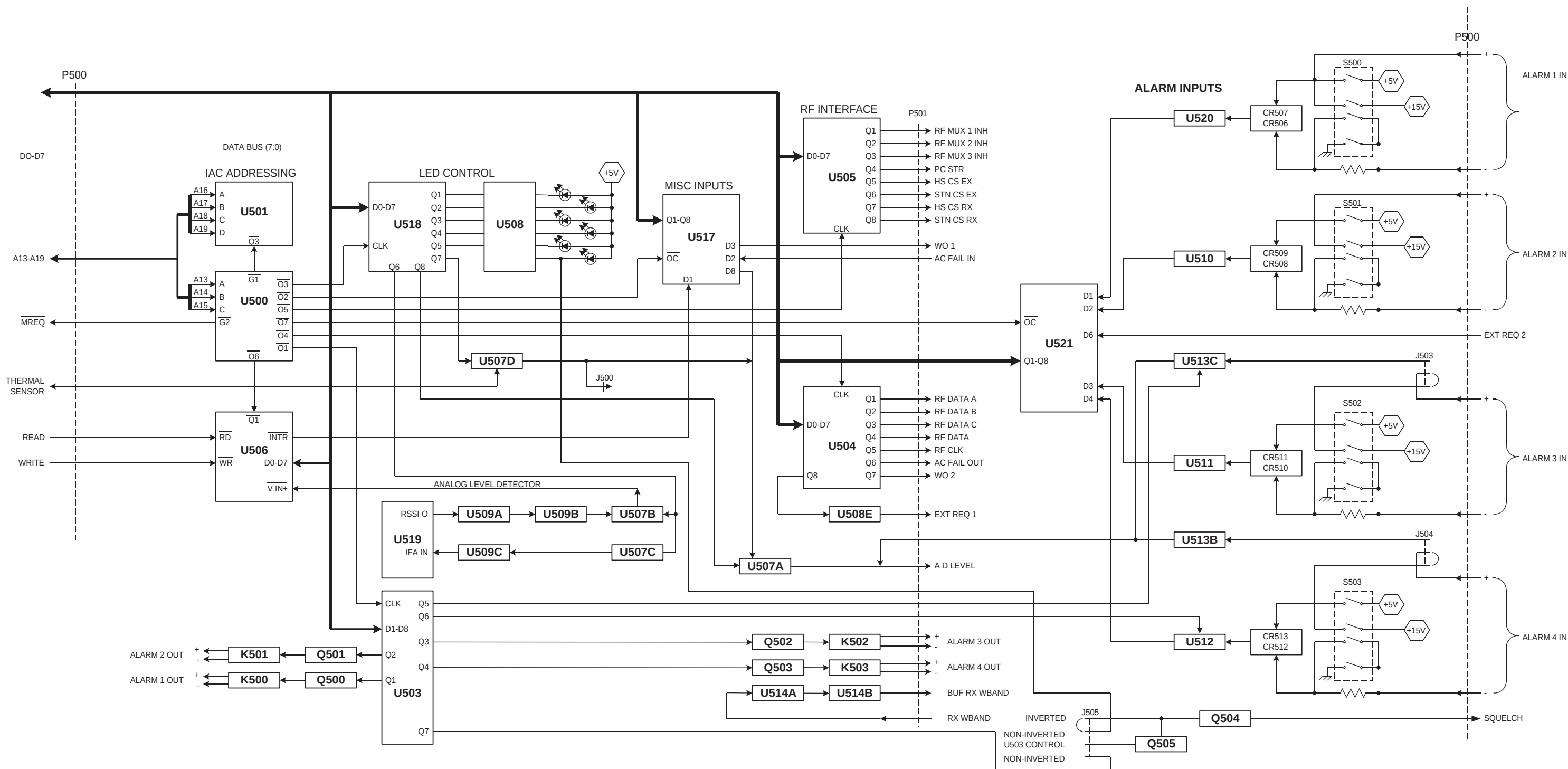
The voltage supply to the thermal measurement circuit is taken from the 26.5V DC line into the BBM. A precision temperature sensor U106 is mounted on the PC board near a screw into the BBM bracket which transfers heat to the sensor. The output of this sensor is 10 mV/°C with a $\pm 1\%$ accuracy. This voltage is amplified by U105 with resistors R153/R154 setting the gain.

The output of this gain stage (pin 1) is fed to another gain stage that performs as a comparator. The output (pin 7) will go high when the heatsink temperature reaches 45°C and will go low when the temperature goes below 35°C. This output is sent to the power supply through Q106 to turn the fan on and off.





TPI CARD AUDIO BLOCK DIAGRAM
FIGURE 6-18



SECTION 7 ALIGNMENT AND TEST PROCEDURES

7.1 RECEIVER ALIGNMENT

CRITICAL ADJUSTMENT

The TCXO must be adjusted within 5 minutes of turning the AC power on to the repeater. Do not under any circumstances try to set frequency later on in any of the tests, as TCXO frequency stability cannot then be guaranteed.

Refer to Figure 7-1 for component locations. Refer to Figure 7-6 for equipment needed and setup diagram. Select "RECEIVER" from the "TEST" menu in the Repeater Software.

7.1.1 PRETEST

Preset L102, L103, L104, L108, L109, L110, L140 and L141 tuning screws about 1/4 inch above the top of the casting.

For 12.5 kHz operation, place jumper plugs P203, P204 and P205 across pins 2-3 of J203, J204 and J205.

For 25 kHz operation, place jumper plugs P203, P204 and P205 across pins 1-2 of J203, J204 and J205.

7.1.2 VOLTAGE MEASUREMENTS

Apply power to the Receiver by plugging the 20-pin cable from the RF Interface Board into J201 (see Figure 7-1).

Measure the voltages at the following pins.

U301, pin 1	+6V DC $\pm 0.2V$
U302, pin 1	+12V DC $\pm 0.4V$
U303, pin 1	+12V DC $\pm 0.4V$
U304, pin 1	+12V DC $\pm 0.4V$
R402/R403 junction	+3.5V DC $\pm 0.1V$

7.1.3 PROGRAM TUNE-UP CHANNEL

For Receivers operating between:
403-427 MHz, 433-467 MHz or 473-509 MHz.

1. Using the PC and software, program the Synthesizer for the Receive frequency.
2. Tune the VCO capacitor C803 for +7V DC $\pm 0.05V$ at TP401.
Increase the receive frequency by 1 MHz. The voltage on TP401 shall be less than 10.5V.
Decrease the receive frequency by 1 MHz. The voltage on TP401 shall be greater than 3.5V.
3. Alternately tune L140 and L141 in 1/2-turn to 1-turn increments until a voltage is measured at TP101. At that time, tune L140 for a peak, then L141 for a peak.
4. Retune L140/L141 for a peak at TP101.

For Receivers operating within 3 MHz of the top of the receive band (427-430, 467-470 or 509-512 MHz).

1. Program the Synthesizer for the *Highest* receive frequency (i.e. 430, 470 or 512 MHz).
2. Set the control line voltage for 12V at TP401. Check 3 MHz *below* the programmed frequency (i.e. 427, 467 or 509 MHz) to verify that the control voltage at TP401 is *greater than* 2V. The repeater receiver can now be programmed for the desired operating frequency.

For Receivers operating within 3 MHz of the bottom of the receive band (400-403, 430-433 or 470-473 MHz).

1. Program the Synthesizer for the *Lowest* receive frequency (i.e. 400, 430 or 470 MHz).
2. Set the control line voltage for 2V at TP401. Check 3 MHz *above* the programmed frequency (i.e. 403, 433 or 473 MHz) to verify that the control voltage at TP401 is *less than* 12V. The repeater receiver can now be programmed for the desired operating frequency.

NOTE: The Channel Frequency and Synthesizer Frequency appear at the bottom of the screen.

7.1.4 RECEIVER FREQUENCY ADJUST

1. Place a pick-up loop (sniffer) or RF probe connected to a frequency counter near L139.
2. Set Y401 (TCXO) for the Injection Frequency ± 50 Hz (Inj Freq = chnl freq + 52.95 MHz).

7.1.5 VCO TEST

1. The software programs the synthesizer for 1 MHz above the receive channel.
2. The voltage on TP401 should be $< 10V$.
3. Record the voltage on TP101 _____.
4. The software programs the synthesizer for 1 MHz below the receive channel.
5. The voltage on TP401 should be $> 4V$.
6. Record the voltage on TP101 _____.
7. If the voltages recorded in Steps 3 and 6 are not within $\pm 0.2V$, tune L141 as required to balance the voltage readings.
8. The software programs the synthesizer for the receive frequency.

7.1.6 FRONT END ADJUSTMENTS

NOTE: Verify that the appropriate IF jumpers (J203, J204, J205) are selected.

1. Set the signal generator to the receive frequency at a level sufficient to produce an output voltage at TP201 or J201, pin 7 (RSSI Output).
2. Tune L102, L103, L104, L108, L109 and L110, then repeat, for a peak voltage at TP201. Decrease the generator output level to maintain a 2-3V reading at TP201.

FOR 12.5 kHz CHANNELS:

NOTE: Perform this test if C239 and C249 are placed on the board.

1. Set the generator to an RF level sufficient to produce 2V DC at TP201.
2. Remove any modulation from the signal generator.
3. Increase the signal generator RF frequency 2.5 kHz.
4. Adjust C239 for peak DC voltage at TP201.
5. Adjust C249 for peak DC voltage at TP201.
6. Reset the signal generator to the tune-up frequency.
7. Set the signal generator to 100 μV into the receiver with a 1 kHz tone at ± 1.5 kHz deviation. (1000 μV at the generator with 20 dB pad gives 100 μV at the receive antenna.)
8. Tune Z215 for 2V $\pm 0.05V$ at U203, pin 9.
9. Tune R253 for 387 mV RMS, ± 5 mV RMS, at TP202.
10. Adjust R248 for 2V $\pm 0.05V$ at TP202.
11. Connect a distortion analyzer to TP202.
12. Tune L211, L213, L214 and L216 for minimum distortion $< 5\%$, (typically $< 3\%$).
13. Repeat Step 12 then Steps 8, 9 and 10.

7.1.7 AUDIO DISTORTION

1. Plug a 16 ohm load at J101 or J104 on the MAC (Main Audio Card).
2. Connect a distortion analyzer to the 16 ohm load.
3. Measure the distortion of the receive audio at J101 or J104 on the MAC with the local volume control set to 2.8V RMS.
4. The reading shall be less than 3%. (Typically less than 1%).
5. Measure receive sensitivity at J101 or J104 on the MAC.
6. The reading should be less than 0.35 μV . (Typically 0.25 μV .)

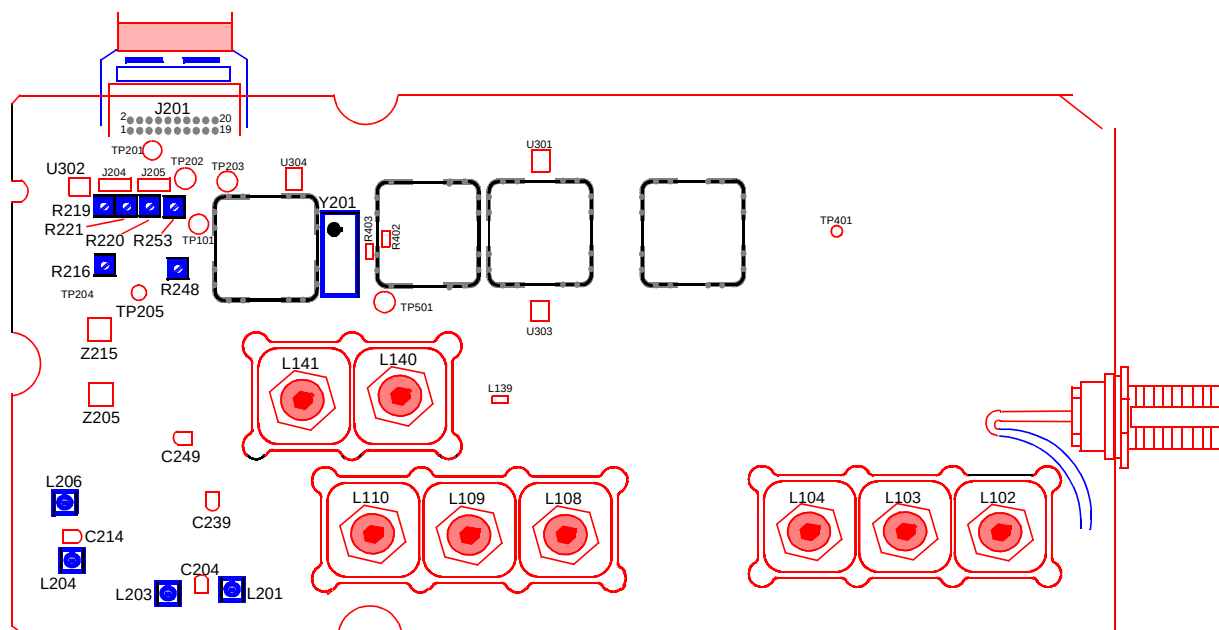


Figure 7-1 RECEIVER ALIGNMENT POINTS

7. The software programs the synthesizer for 1 MHz above the Receive frequency.
8. Receive sensitivity should be less than 0.35 μV . (Typically less than 0.30 μV .)
9. The software programs the synthesizer for 1 MHz below the Receive frequency.
10. Receive sensitivity should be less than 0.35 μV . (Typically less than 0.30 μV .)
11. Adjust the signal generator level to produce 15 dB SINAD.
12. Adjust R221 for 0.5V $\pm$ 0.02V at TP201.
3. Increase the signal generator RF frequency 5 kHz.
4. Adjust C204 for peak DC voltage at TP201.
5. Adjust C249 for peak DC voltage at TP201.
6. Reset the signal generator to the tune-up frequency.
7. Set the generator to 100 μV into the receiver with a 1 kHz tone at $\pm$ 3 kHz deviation. (1000 μV at the generator with 20 dB pad gives 100 μV at the receive antenna.)
8. Tune Z205 for 2V $\pm$ 0.05V at U201, pin 9.
9. Tune R220 for 387 mV RMS, $\pm$ 5 mV RMS, at TP202.

FOR 25 kHz CHANNELS:

NOTE: Perform this test if C204 and C214 are placed on the board.

1. Set the generator to an RF level sufficient to produce 2V DC at TP201.
2. Remove any modulation from the signal generator.
10. Adjust R216 for 2V $\pm$ 0.05V at TP202.
11. Connect a distortion analyzer to TP202.
12. Tune L201, L203, L204 and L206 for minimum distortion <5%, (typically <3%).
13. Repeat Step 12 then Steps 8, 9 and 10.

7.1.8 AUDIO DISTORTION

1. Plug a 16 ohm load at J101 or J104 on the MAC (Main Audio Card).
2. Connect a distortion analyzer to the 16 ohm load.
3. Measure the distortion of the receive audio at J101 or J104 on the MAC with the local volume control set to 2.8V RMS.
4. The reading shall be less than 3%.
(Typically less than 1%).
5. Measure receive sensitivity at J101 or J104 on the MAC.
6. The reading should be less than 0.35 μ V.
(Typically 0.25 μ V.)
7. The software programs the synthesizer for 1 MHz above the Receive frequency.
8. Receive sensitivity should be less than 0.35 μ V.
(Typically less than 0.30 μ V.)
9. The software programs the synthesizer for 1 MHz below the Receive frequency.
10. Receive sensitivity should be less than 0.35 μ V.
(Typically less than 0.30 μ V.)
11. Adjust the signal generator level to produce 15 dB SINAD.
12. Adjust R219 for 0.5V $\pm$ 0.02V at TP201.

NOTE: Some adjustments will be made using the cursor "Up"/"Dn" or "PgUp"/"PgDn" keys.

WARNING

SAFETY MEASURES ARE DISABLED IN TEST MODE. ALARMS ARE ACTIVE. HOWEVER, FEATURES SUCH AS THERMAL SHUTDOWN IN THE PA ARE DISABLED.

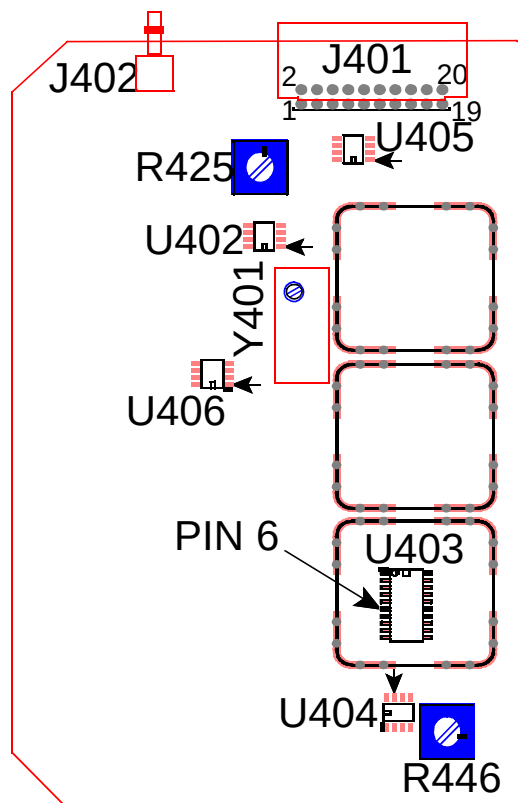


Figure 7-2 EXCITER ALIGNMENT POINTS

7.2 EXCITER ALIGNMENT

CRITICAL ADJUSTMENT

The TCXO must be adjusted within 5 minutes of turning the AC power on to the repeater. Do not under any circumstances try to set frequency later on in any of the tests, as TCXO frequency stability cannot then be guaranteed.

Refer to Figure 7-2 for component locations.
Refer to Figure 7-7 for equipment needed and setup diagram.

7.2.1 PRETEST

1. Set TCXO modulation adjust R425 fully counter-clockwise.
2. Connect the power meter to J402.

7.2.2 VOLTAGE MEASUREMENTS

Apply power to the Exciter by plugging the 20-pin cable from the RF Interface Board into J401.

Measure the voltages at the following pins.

U406, pin 1	+12V DC $\pm 0.4V$
U405, pin 1	+5V DC $\pm 0.2V$
U402, pin 1	+3.5V DC $\pm 0.1V$
U404, pin 7	+3.5V DC $\pm 0.1V$

7.2.3 PROGRAM TUNE-UP CHANNEL

For Exciters operating between:
406-424 MHz, 436-464 MHz or 476-506 MHz.

1. Using the PC and software, program the Synthesizer for the Transmit frequency.
2. Press the space bar to key the Exciter.
3. Tune the VCO capacitor C803 for +4.5V DC $\pm 0.05V$ at TP1 (U403, pin 6).
Increase the transmit frequency by 3 MHz. The voltage on TP1 shall be less than 7.5V.
Decrease the transmit frequency by 3 MHz. The voltage on TP401 shall be greater than 2V.
4. Measure the Power Output of the Exciter at J402. Reading should be $> +18$ dBm.
5. Press the space bar to unkey the Exciter.

For Transmitters operating within 6 MHz of the top of the transmit band (424-430, 464-470 or 506-512 MHz).

1. Program the Synthesizer for the *Highest* transmit frequency (i.e. 430, 470 or 512 MHz).
2. Press the space bar to key the Exciter.
3. Set the control line voltage for 7.5V at TP1. Check 6 MHz *below* the programmed frequency (i.e. 424, 464 or 506 MHz) to verify that the control voltage at TP1 is *greater than* 2V. The repeater receiver can now be programmed for the desired operating frequency.
4. Press the space bar to unkey the Exciter.

For Transmitters operating within 6 MHz of the bottom of the transmit band (400-406, 430-436 or 470-476 MHz).

1. Program the Synthesizer for the *Lowest* transmit frequency (i.e. 400, 430 or 470 MHz).

2. Set the control line voltage for 2V at TP1. Check 6 MHz *above* the programmed frequency (i.e. 406, 436 or 476 MHz) to verify that the control voltage at TP1 is *less than* 7.5V. The repeater receiver can now be programmed for the desired operating frequency.

7.2.4 VCO TEST

1. The software programs the synthesizer for 3 MHz above the Tune-Up frequency.
2. Press the space bar to key the Exciter.
3. The voltage on U403, pin 6 should be $< 7V$. Power output should be $> +18$ dBm.
4. Press the space bar to unkey the Exciter.
5. The software programs the synthesizer for 3 MHz below the Tune-Up frequency.
6. Press the space bar to key the Exciter.
7. The voltage on U403, pin 6 should be $> 2.5V$. Power output should be $> +18$ dBm.
8. Press the space bar to unkey the Exciter.
9. The software programs the synthesizer for the Transmit Channel.

7.2.5 TCXO FREQUENCY ADJUST

1. Connect a 10 dB pad and frequency counter to J402.
2. Press the space bar to key the Exciter.
3. Tune TCXO Y401 for the Transmit Channel Frequency, ± 50 Hz.
4. Press the space bar to unkey the Exciter.

7.2.6 TRANSMIT MODULATION ADJUST

1. Connect a 10 dB pad and modulation analyzer to J402.
2. Press the "FM" and "3 kHz LPF" switches of the modulation analyzer.

3. Inject a 1 kHz sine wave at 400 mV RMS into P2, pin 5 on the rear green connector.
4. Adjust U207 with "Up/Dn" and "PgUp/PgDn" keys for 707 mV RMS on P100, pin 29. This waveform should be a "clean" sine wave.

NOTE: This test changes the Tx audio deviation limit. To correct the limit, perform adjustment per Section 7.4.5.

5. Press the space bar to key the Exciter.
6. Set R446 for ± 3 kHz deviation (25 kHz channels) or ± 1.5 kHz deviation (12.5 kHz channels).
7. Press the space bar to unkey the Exciter.
8. Adjust R237 for a 2V P-P square wave on P100, pin 29.

NOTE: This test changes the Tx audio deviation limit. To correct the limit, perform adjustment per Section 7.4.5.

9. Press the space bar to key the Exciter.
10. Set R425 for "best" square wave as observed on the modulation analyzer output to the oscilloscope.

NOTE: Ensure that the oscilloscope is "DC" coupled and the Modulation Analyzer has the 3 kHz LPF switch set but NOT the 300 Hz HPF or 50 Hz HPF switches set.

11. Press the space bar to unkey the Exciter.
12. Repeat Steps 1-7. Very little adjustment of R446 should be needed.
13. Press the spacebar to unkey the Exciter.

7.3 110W POWER AMPLIFIER ALIGNMENT

7.3.1 INTRODUCTION

Refer to Figures 7-3 and 7-4 for component locations. Refer to Figure 7-8 for equipment needed and setup diagram. Select "PA" from the "TEST" menu in the Repeater Software.

IMPORTANT NOTE

No field alignment is required. Adjustments in Sections 7.3.2 and 7.3.3 are part of a new unit production test procedure. They should only be performed as required on "out-of-warranty" and "field-repaired" units. Broken seals on R76, R611 or R661 will void the warranty! Full power control range of 25-110W is controlled by the repeater configuration parameters under the Edit-Setup Parameters menu selection.

The adjustments in Section 7.3.2 provide for proper matching for the output of Q501 and set a protective limit on the drive to the final transistors. This limit is approached only under certain unusual operating or repair conditions. However, improper adjustment may impair normal operation of the PA, especially at temperature extremes.

No other adjustments are necessary in this case. Replacement of U501, Q501, Q502 or Q503 requires adjustments shown in Section 7.3.3 Replacement of active components within the power control circuitry of the RF Interface Board would require Section 7.3.3 adjustments.

These adjustments are necessary only if repairs are made and such repairs are likely to affect the sensitivity/calibration of the forward or reverse power detectors (e.g. replacement of detector diodes CR601/CR651 or of the entire forward/reverse power detector assembly). Replacement of components within the power control circuitry of the RF Interface Board are unlikely to affect the calibration of the power control.

*NOTE: Replacement of Q501, Q502, Q503 or U501 does **not** require the adjustments in this Section.*

7.3.2 DRIVER TUNING AND LIMIT ADJUSTMENTS

1. Connect an antenna or dummy load to the RF port (50 ohm impedance).
2. Connect the:
 - Power supply ground lead to P105
 - +15V DC lead to P103
 - +26.5V DC lead to P101
 - 36-pin cable to J101 on the RFIB
3. Set the signal generator to +19 dBm ± 0.1 dB. Connect the signal generator to A9.
4. Press the space bar to key the PA.
5. Monitor the voltage on R45 on the RFIB and set R76 for 1.3V DC (see Figure 7-4).

7.3.3 POWER AMPLIFIER TUNING

This procedure assumes that either:

- The carrier is chosen and the coaxial cable from the exciter is putting out +19 dBm

OR

- A test signal is being injected to the PA with +19 dBm.

Connect an antenna or dummy load to the RF port (50 ohm impedance). Use the carrier frequency needed.

1. Set R510, R521 and R530 on the PA board full **clockwise** before applying power to the PA (or PA deck and RFIB assembly), see Figure 7-3.
2. Set Forward Power Adjust R611 and Reflected Power Adjust R661 on the power detector board fully **counterclockwise** (see Figure 7-3).

3. Monitor the voltage on R45 on the RFIB and set R76 for 1.3V DC (see Figure 7-4). This sets the current limit point for driver Q501 at hot temperatures.
4. Set each of the quiescent currents for Q501, Q502 and Q503 for 100 mA (DC) each.
5. Program the power output for the correct frequency range as follows:

400-430 MHz	110W
430-470 MHz	110W
470-512 MHz	100W
6. Press the space bar to key the PA. Output power will be approximately 80W.
7. Monitor the voltage on U501, pin 2 (power control voltage) and tune C600 for **minimum** voltage (see Figure 7-3).
8. Set Forward Power Adjust R611 for rated power (110W or 100W).
9. Press the space bar to unkey the PA.
10. Disconnect the antenna or dummy load from the RF port.
11. Press the space bar to key the PA.
NOTE: This will not harm the PA.
12. Adjust Reverse Power Calibration Pot R661 for equal voltages on W121 and W126 on the RFIB or for equal Forward and Reverse Power (see Figure 7-4).
13. Press the space bar to unkey the PA.

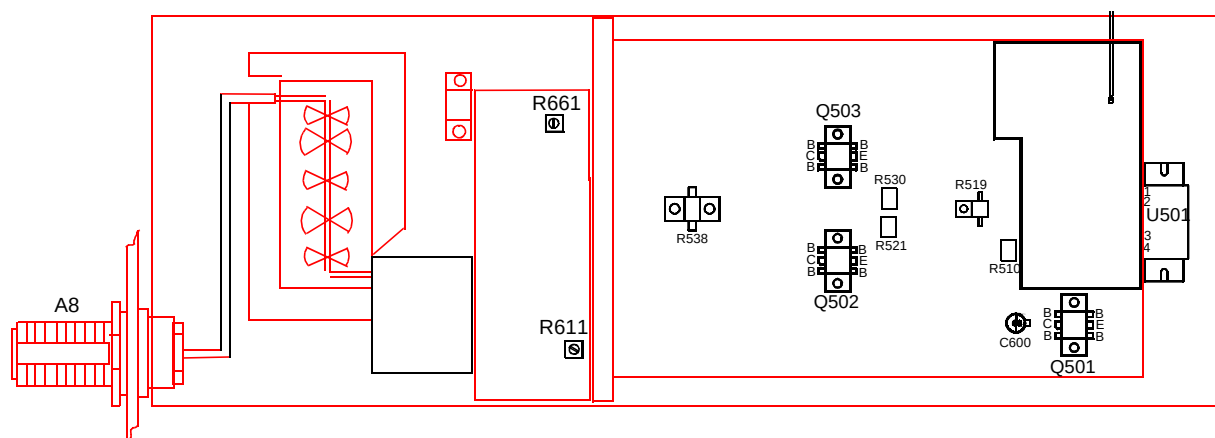


Figure 7-3 110W POWER AMPLIFIER ALIGNMENT POINTS

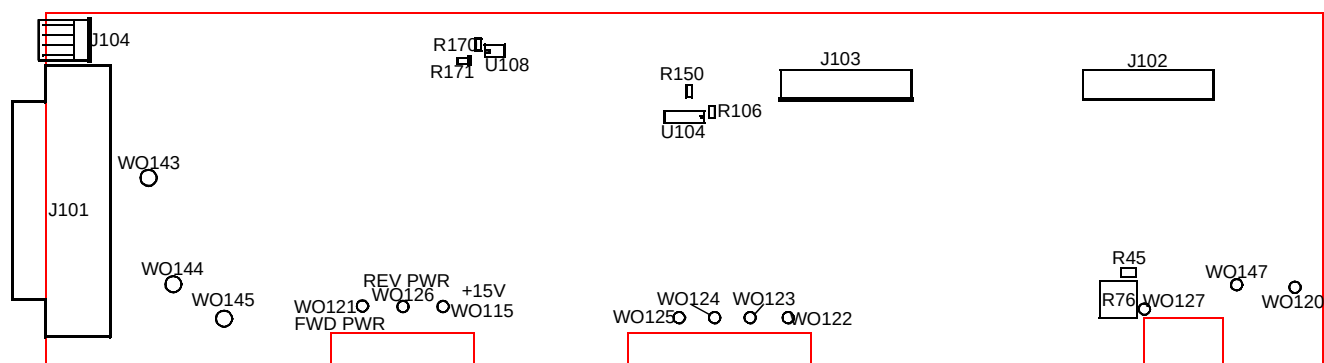
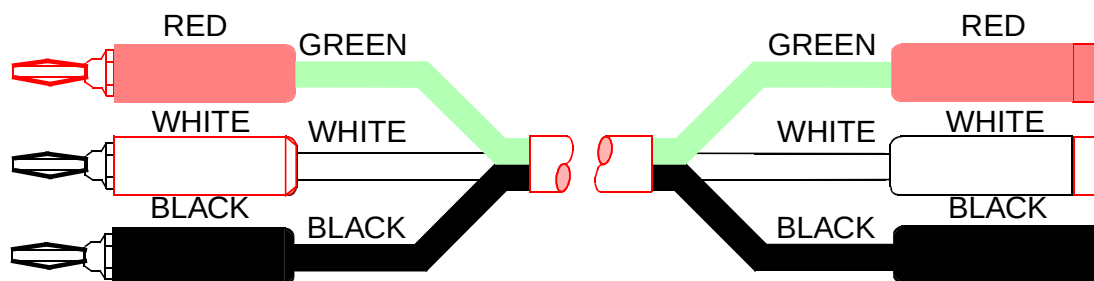


Figure 7-4 RF INTERFACE BOARD ALIGNMENT POINTS



(INCLUDED IN 2000 SERIES SERVICE KIT 250-2000-230)

Figure 7-5 POWER EXTENDER CABLES

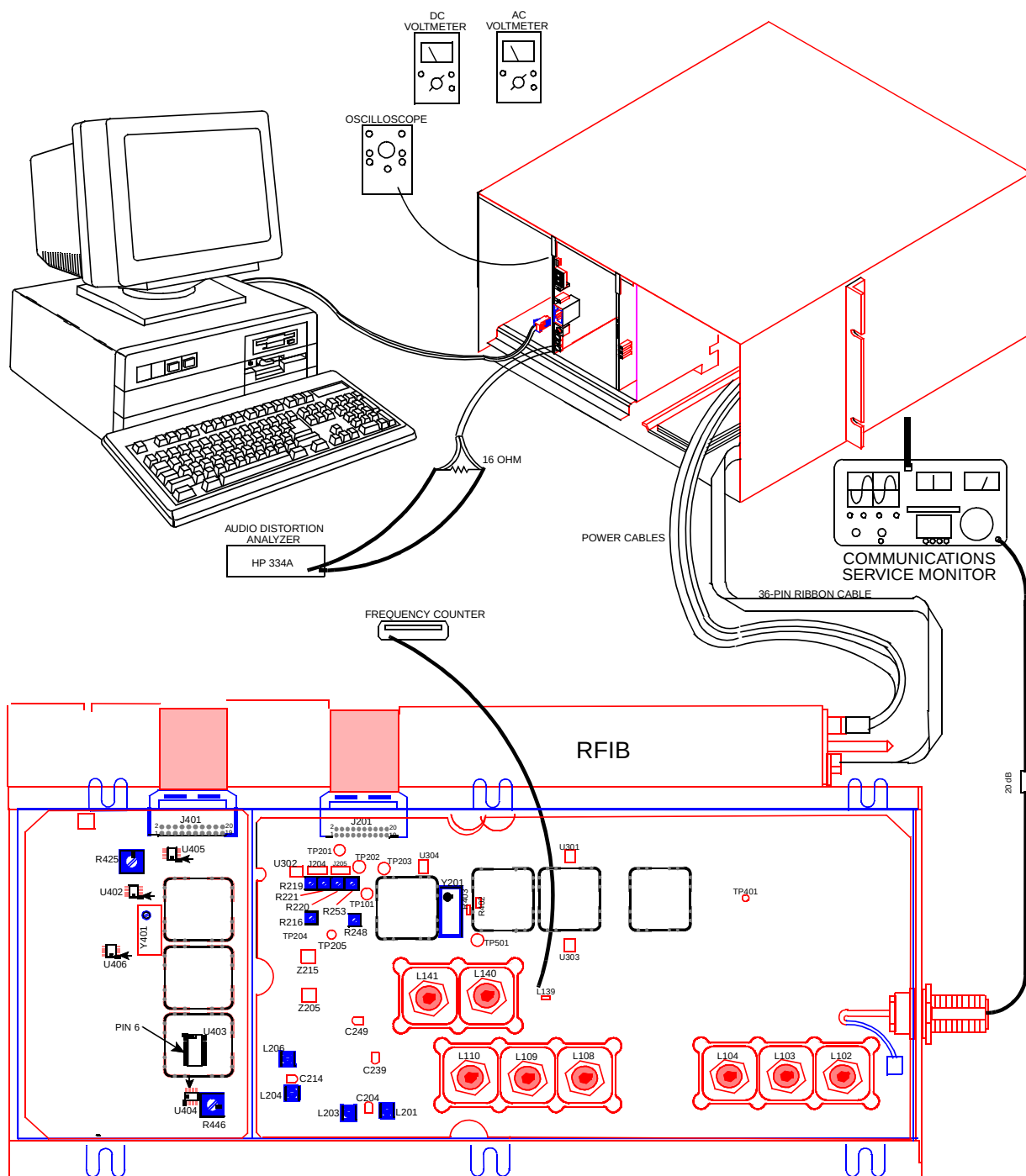


Figure 7-6 RECEIVER TEST SETUP

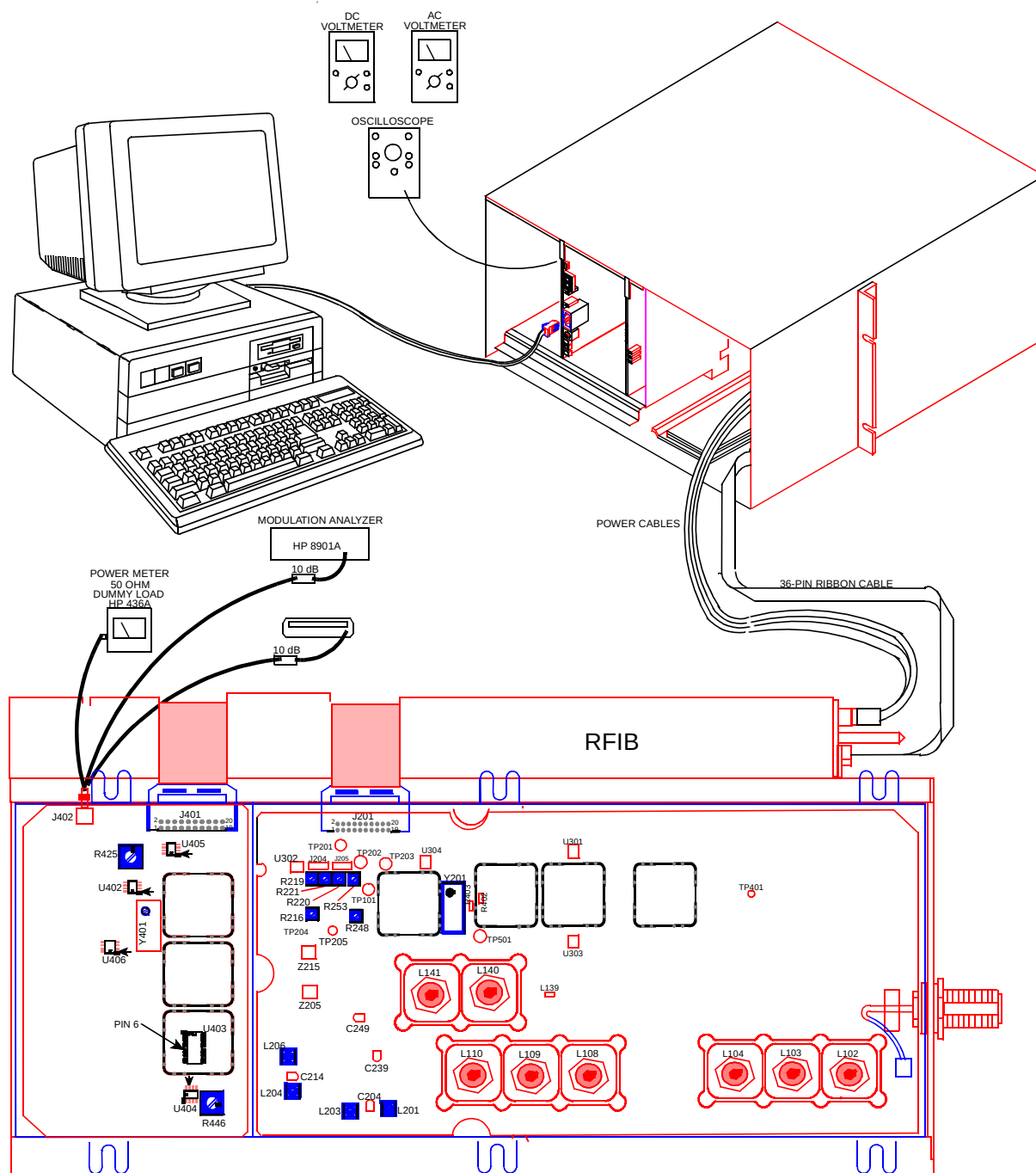


Figure 7-7 EXCITER TEST SETUP

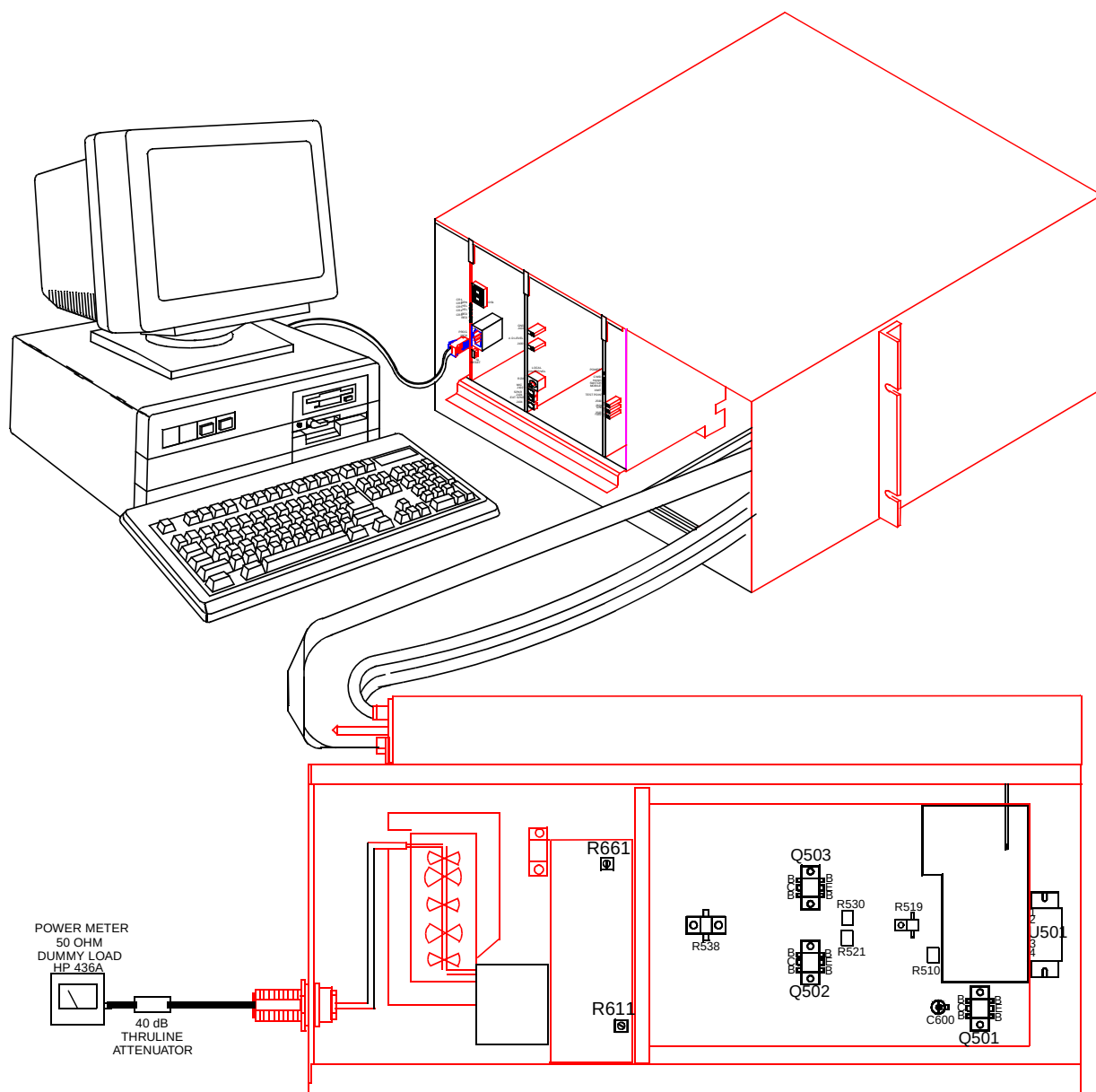


Figure 7-8 110W POWER AMPLIFIER TEST SETUP

7.4 FULL REPEATER ALIGNMENT

7.4.1 PERFORMANCE TEST PROGRAM

Select the TEST - FULL Universal Station - ALL TEST and press Enter.

7.4.2 REPEATER SETUP

The TPI Universal Station has been pretested at the factory, therefore only performance tests are required to check the Universal Station. Refer to test setup diagrams for equipment and cabling diagram.

Turn on the Universal Station power supply switch (S508) in the IAC or engage the locking lever (see Figure 7-13).

The baud rate for communications between the Universal Station and the PC Programmer is user configurable using J10 on the TPI card. The factory default is 9600 baud.

The operating code has been programmed at the factory. The parameters are programmed into the TPI card. If these parameters have changed or are incorrect, exit this test and reprogram the Universal Station.

It may be necessary to remove the RF assembly from the chassis and connect via extension cables for some of the tests or adjustments.

NOTE: All audio generators and audio voltmeters are unbalanced unless specifically stated otherwise. All references to J2 refer to the green connector on the back of the Universal Station.

Program the Universal Station for the required parameters using the PC Programmer. Select TPI card as the Universal Station Type by choosing Edit/Universal Station Type within the PC Programmer. Confirm the placement of the following jumpers on the TPI card: J105-ON; J106, J201, J6, J7 and J8-OFF.

7.4.3 TRANSMITTER TEST/ADJUSTMENTS

Transmit Mode

1. Press the space bar to key the transmitter.
2. The Transmit LED on the IAC should turn on to indicate transmitting.
3. Press the space bar to unkey the transmitter.

Transmit TCXO Frequency Adjustment

CRITICAL ADJUSTMENT

The TCXO must be adjusted within 5 minutes of turning the AC power on to the Universal Station. Do not under any circumstances try to set frequency later on in any of the tests, as TCXO frequency stability cannot then be guaranteed.

1. Press the space bar to key the transmitter.
2. Check the frequency of the transmitted signal. The frequency should be ± 50 Hz of the channel frequency.
3. Adjust the frequency with Y401 (TCXO) on the Exciter (see Section 7.2.5).
4. Press the space bar to unkey the transmitter.

Transmitter Output Power Adjustment

1. Press the space bar to key the transmitter.
2. Check the transmit output power. The power can be adjusted from the computer using the cursor Up/Dn and PgUp/PgDn keys. The test equipment should be calibrated for ± 2 W.
3. Press the space bar to unkey the transmitter.
4. Use a jumper wire to ground pin 7 (PTT_N) to pin 21 (GND) on J2 on the back of the cabinet (see Figure 7-9). The transmitter should key up and achieve rated power.
5. Remove the wire. The transmitter should unkey.

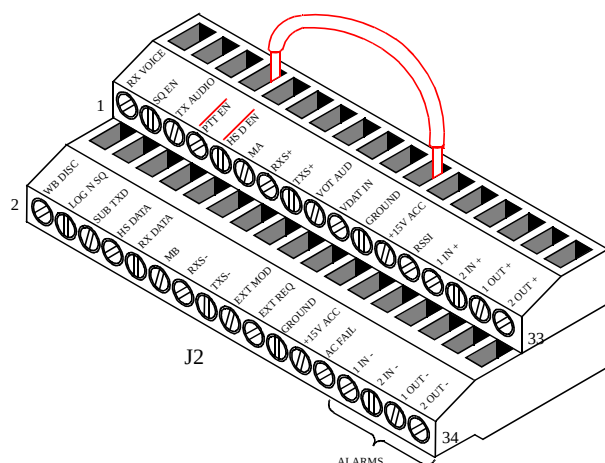


Figure 7-9 J2 - PTT JUMPER

7.4.4 RECEIVER TESTS/ADJUSTMENT

Receiver TCXO Frequency Adjustment

CRITICAL ADJUSTMENT

The TCXO must be adjusted within 5 minutes of turning the AC power on to the Universal Station. Do not under any circumstances try to set frequency later on in any of the tests, as TCXO frequency stability cannot then be guaranteed.

1. Check the receiver injection frequency by using a "sniffer" pickup loop, or RF probe connected to a suitable frequency counter placed near L210 in the Receiver (see Section 7.1.4).
2. Adjust Y201 (TCXO) on the Receiver to within ± 50 Hz of the channel frequency.

Receiver Wide Band Audio Test

1. Adjust the RF generator for 100 μ V into the Receiver with 1 kHz tone at ± 3 kHz deviation.
2. Verify the following voltages on J2, pin 2.

AC voltage - 387 mV RMS ± 25 mV RMS
DC voltage - 5V DC ± 0.2 V DC

Receiver Audio Distortion Measurement

1. Place J105 on TPI card to 'ON' position (see Figure 7-12).
2. Adjust the RF generator for 100 μ V output with a 1 kHz tone at ± 3 kHz deviation.
3. Insert test cables into J100/J103 on the TPI card and connect to an AC voltmeter.
4. Adjust R107 for 0 dBm (775 mV RMS).
5. Adjust R172 for 0 dBm (775 mV RMS) at J2, pin 1.
6. Connect a 16 ohm load and distortion analyzer to J101 or J104 of the TPI card.
7. Adjust R164 for 2.8V RMS and measure the distortion. Distortion should be $< 3\%$.

Receiver Hum and Noise Measurement

1. Place J105 on TPI to 'ON' position.
2. Adjust the RF generator for 100 μ V output with a 1 kHz tone at ± 3 kHz deviation.
3. Connect a 16 ohm load and distortion analyzer to J101 or J104 of the TPI card.
4. Adjust R164 for 2.8V RMS (see Figure 7-12).
5. Remove modulation from the RF generator. The measured level must be ≤ -45 dB.

Receiver SINAD Measurement

1. Place J105 on TPI to 'ON' position.
2. Adjust the RF generator for 100 μ V output with a 1 kHz tone at ± 3 kHz deviation.
3. Connect a 16 ohm load and distortion analyzer to J101 or J104 of the TPI card.
4. Adjust R164 for 2.8V RMS.
5. 12 dB SINAD reading should be ≤ 0.35 μ V.

Receiver Squelch Adjustment

1. Place J105 on TPI card to 'ON' position.
2. Adjust the RF generator for 100 μ V output with a 1 kHz tone at ± 3 kHz deviation.
3. Connect a 16 ohm load and distortion analyzer to J101 or J104 of the TPI card.
4. Adjust R164 for 2.8V RMS (see Figure 7-12).
5. Set the RF generator output for 5 dB SINAD.
6. Adjust R123 on the TPI card so the Receiver just squelches. Verify on J2, pin 4 (TPI_SQ_EN) for a logic 0 (< 0.8 V DC).
7. Increase the RF generator output until the Receiver unsquelches. Reading should be ≤ 10 dB SINAD. Verify on J2, pin 4 for a logic 1 (> 3.7 V DC $\pm 10\%$).

Receiver Data Level Adjustment

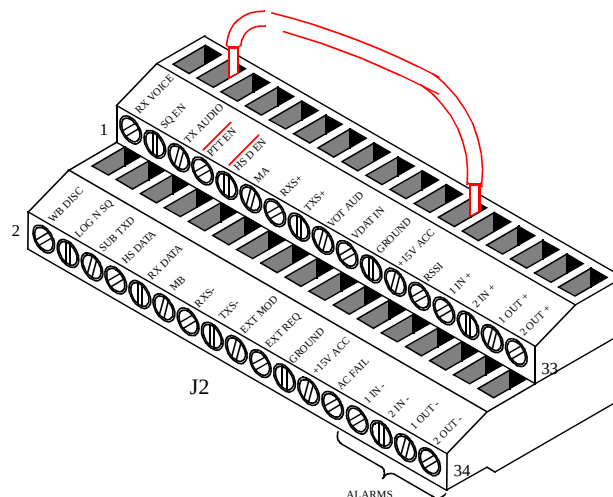
1. Place J105 on TPI card to 'ON' position.
2. Adjust the RF generator for 100 μ V output with a 100 Hz tone at ± 1 kHz deviation for 25 kHz channels or ± 800 Hz for 12.5 kHz channels.
3. Insert test cables into J100/J103 on the TPI card and connect to an AC voltmeter.
4. Adjust R154 to achieve 283 mV RMS.
5. Connect an oscilloscope probe to J2, pin 10 and verify for a 100 Hz square wave with 0V DC to 5V DC levels (5 ms high, 5 ms low).

Local Speaker/Microphone Check

1. Place J105 on TPI card to 'ON' position.
2. Adjust the RF generator for 100 μ V output with a 1 kHz tone at ± 3 kHz deviation.
3. Plug a Speaker/Microphone into J101/J102 of the TPI card (see Figure 7-12).
4. Adjust R164 until the 1 kHz tone is heard.

Squelch Enable Check

1. Place J105 on TPI card to 'OFF' position.
2. Adjust R164 for 1/4 turn clockwise from off.
3. Connect a Spkr/Mic to J101/J104 on the TPI card.
4. Connect a shorting wire from J2, pin 3 (TPI_SQ_EN) to J2, pin 23 (+15V ACC).
5. Verify 1 kHz tone is present on speaker.
6. Disconnect shorting wire and verify 1 kHz tone is not present.
7. Place J105 on TPI card to 'ON' position.

**Figure 7-10 J2 - SQUELCH JUMPER**Receiver Desense Check

1. Place J105 on TPI card to 'ON' position.
2. Adjust the RF generator for 100 μ V output with a 1 kHz tone at ± 3 kHz deviation.
3. Connect a 16 ohm load and distortion analyzer to J101 or J104 of the TPI card.
4. Adjust R164 for 2.8V RMS.
5. Adjust the RF generator output for 12 dB SINAD.

6. Press the space bar to key the transmitter.
7. SINAD should degrade a maximum of 1 dB or to no less than 11 dB SINAD.
8. Press the space bar to unkey the transmitter.

Receiver Miscellaneous Tests (Optional)

Several additional tests may be performed on the Universal Station Receiver as listed below:

1. Signal Displacement Bandwidth
2. Adjacent Channel Rejection
3. Offset Channel Selectivity
4. Intermodulation Rejection
5. Spurious Rejection
6. Audio Response
7. Audio Sensitivity

Perform the Test desired using the appropriate RF Generators, modulation frequencies and levels, R164 levels and test probes following the latest TIA document measurement procedures.

7.4.5 TRANSMIT AUDIO/DATA LEVEL ADJUSTMENTS

*NOTE: All audio generators and audio voltmeters are **unbalanced** unless specifically stated otherwise.*

Audio Deviation Limit Adjustment

1. Apply a 1 kHz tone at -3 dBm (578 mV RMS) to J2, pin 5.
2. Insert AC voltmeter test cables into J100/J103.
3. Adjust R202 for 0 dBm (775 mV RMS).
4. Apply a 1 kHz tone at +7 dBm (1.73V RMS) to J2, pin 5.
5. Press the space bar to key the transmitter.

6. Adjust U207 with the PgUp/PgDn and CurUp/CurDn keys to set the maximum allowed deviation at ± 3.5 kHz (± 200 Hz) for 25 kHz channels or ± 1.5 kHz (± 100 Hz) for 12.5 kHz channels. (Set modulation analyzer LPF switch to 3 kHz.)

7. Press the space bar to unkey the transmitter.
8. Remove the signal from J2, pin 5.

Repeat Audio Level Adjustment

1. Place jumper J105 and J106 on TPI card to 'ON'.
2. Adjust the RF generator for 100 μ V output with a 1 kHz tone at ± 3 kHz deviation.
3. Insert AC voltmeter test cables into J100/J103.
4. AC level should be 0 dBm (775 mV RMS).
5. Place jumper J106 on the TPI to 'OFF'.

Data Level Adjustment

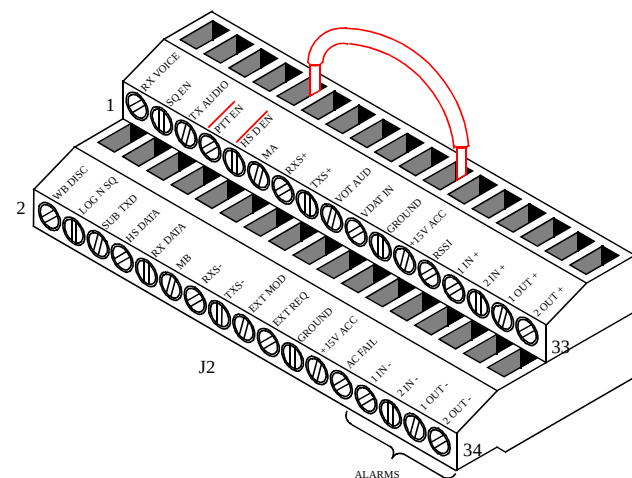
1. Apply 100 Hz at 237 mV RMS to J2, pin 6.
2. Press the space bar to key the transmitter.
3. Adjust R237 to achieve ± 1 kHz (± 100 Hz) transmit deviation. (Set modulation analyzer LPF switch to 3 kHz.)
4. Press the space bar to unkey the transmitter.

Audio/Data Deviation Check

1. Apply -10 dBm (237V RMS) at 100 Hz to J2, pin 6.
2. Apply +10 dBm (2.45V RMS) at 1 kHz to J2, pin 5.
3. Press the space bar to key the transmitter.
4. Check for measured deviation out of the modulation analyzer to be ± 4.5 kHz (± 200 Hz). (Set modulation analyzer LPF to 3 kHz.)
5. Press the space bar to unkey the transmitter.
6. Disconnect all cables.

High Speed Data Check

1. Apply 0 dBm at 1 kHz to J2, pin 8.
2. Press the space bar to key the transmitter.
3. Deviation should measure ± 3 kHz ± 300 Hz. (Set modulation analyzer LPF to 15 kHz.)
4. Press the space bar to unkey the transmitter.
5. Increase the frequency to 5 kHz.
6. Press the space bar to key the transmitter.
7. Deviation should measure ± 2.5 kHz ± 300 Hz. (± 2 to ± 2.5 kHz for NPSPAC.) (Set modulation analyzer LPF to 15 kHz.)
8. Press the space bar to unkey the transmitter.

**Figure 7-11 J2 - HIGH SPEED DATA JUMPER**High Speed Data Enable Check

1. Connect a shorting wire from J2, pin 9 to J2, pin 21 (see Figure 7-11).
2. Verify Transmit LED on IAC is 'ON'.
3. Remove shorting wire.

4. Verify Transmit LED on IAC is 'OFF'.

Local Speaker/Microphone Check

1. Plug a Speaker/Microphone into J101/J102 of the TPI.
2. Press the space bar to key the transmitter.
3. Press the microphone PTT and say "four" loudly into the microphone.
4. Deviation should measure ± 3 to ± 3.5 kHz. (Set modulation analyzer LPF to 3 kHz.)
5. Release the microphone PTT.
6. Press the space bar to unkey the transmitter.
7. Remove the Speaker/Mic from J101/J102.

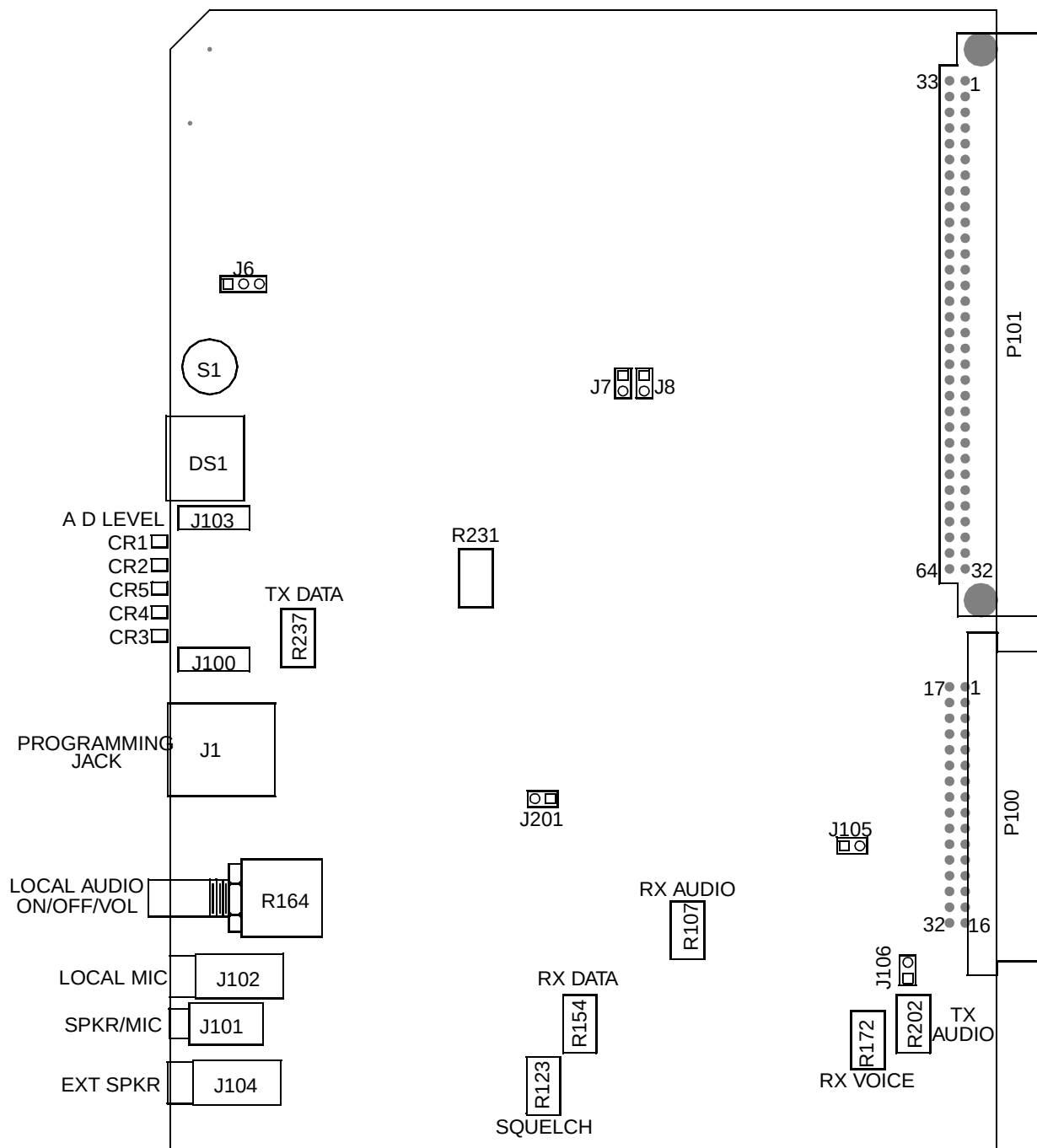
Transmitter Hum and Noise Ratio (Optional)

NOTE: An HP8901A modulation analyzer is required for this test.

1. On the modulation analyzer press:
300 Hz HPF, 3000 Hz LPF, FM,
Pre-Display, 750 μ S, Avg RMS Cal
.44, dB
2. Press the space bar to key the transmitter and measure the Hum and Noise Ratio. The reading should be < -45 dB.
3. Press the space bar to unkey the transmitter.

7.4.6 ALARM TEST

1. The Universal Station is now in Normal Operation mode.
2. Verify by the TPI card front panel indicators that no alarms have occurred (see Table 1-2). See the latest Active Universal Station Alarm chart for TPI Displayed and LED definitions.

**Figure 7-12 TPI CARD ALIGNMENT POINTS DIAGRAM**

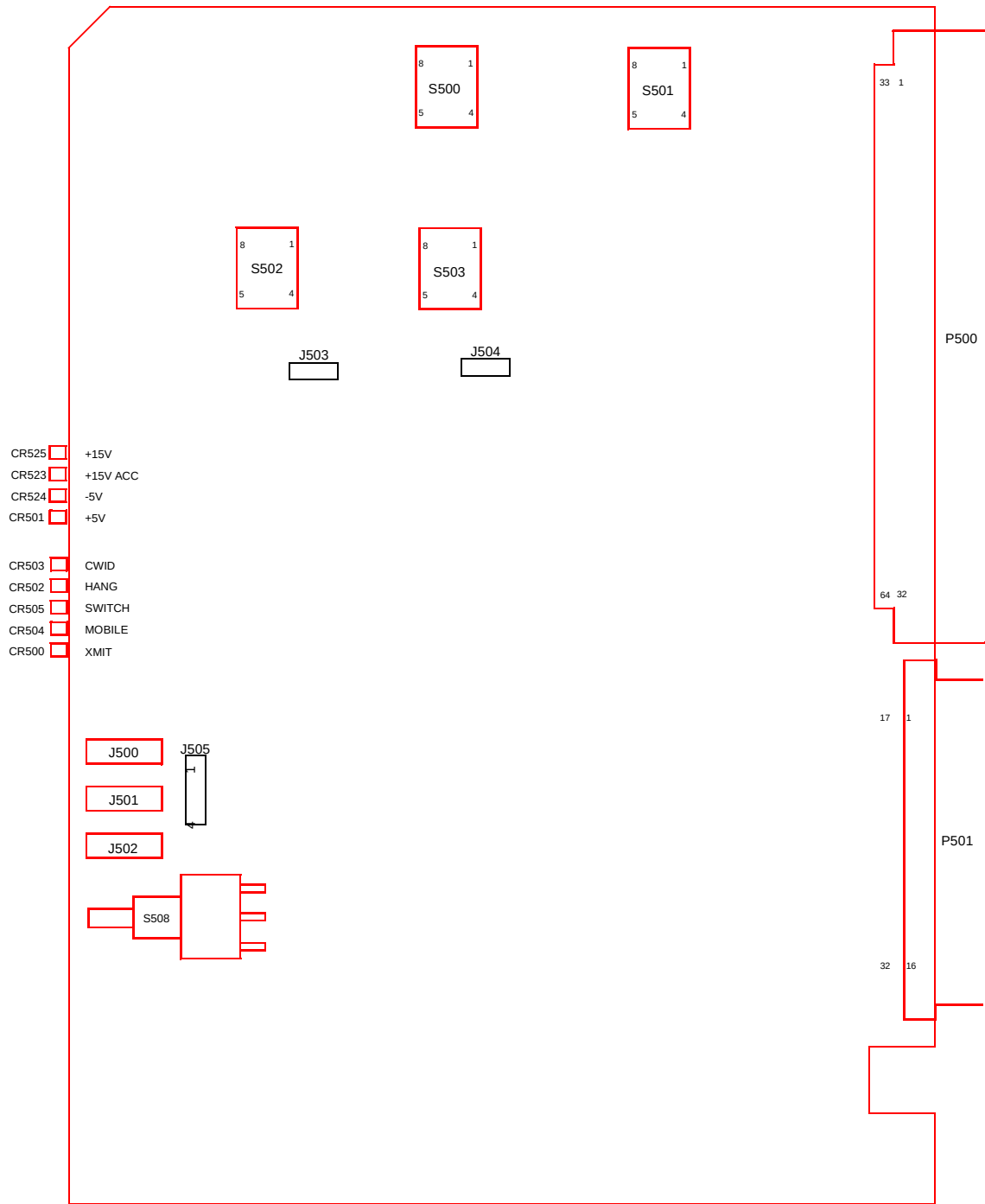


Figure 7-13 INTERFACE ALARM CARD ALIGNMENT POINTS

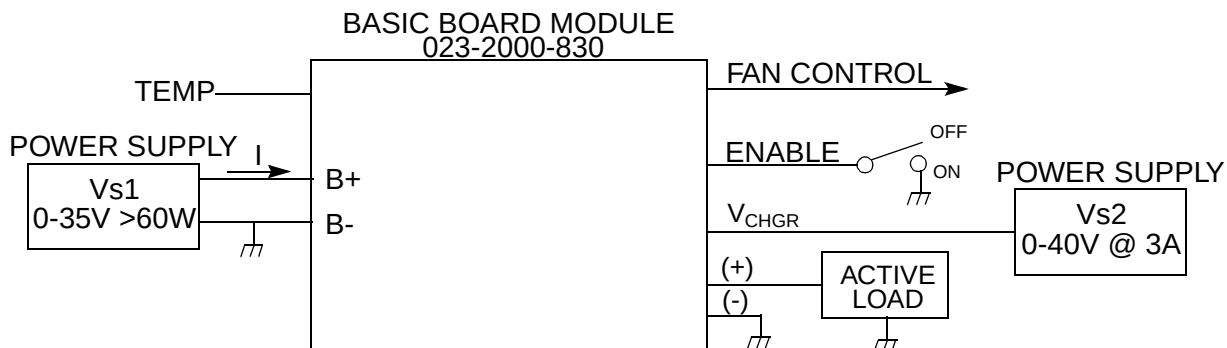


Figure 7-14 BATTERY REVERT TEST SETUP

7.5 VISUAL CHECK

1. Make sure the heat sunk parts are not shorted to the heat-sink.
2. Verify all electrolytic capacitors are installed correctly.
3. Connect 023-2000-830 Battery Back-Up as shown in Figure 7-14.

7.6 BATTERY REVERT TEST

1. Connect the circuit as shown in Figure 7-14.
2. Turn the active load to current mode at 1A.
3. Turn enable to On, battery fault LED should be on.
4. Increase Vs1 until:
the relay engages
the voltage is present on the active load
the battery fault LED is off.

This voltage will be 22V DC $\pm 0.5V$.

5. Increase Vs1 until:
the relay disengages
the LED lights
no voltage is present at the active load.

This voltage will be 31V DC $\pm 0.5V$.

6. Decrease VS1 until:
the relay engages
the LED goes out
voltage is present at the active load.

This voltage will be 28V DC $\pm 0.5V$.

7. Set Vs1 to 26.5V DC and turn the enable line to OFF. No voltage will be present at the active load.

8. Decrease Vs1 until:
the relay disengages
the LED lights
no voltage is present at the active load.

This voltage will be 19V DC $\pm 0.5V$.

9. With the enable line OFF measure current Is, it should be less than 20 mA.

10. Reverse the polarity of Vs1
Set to 26.5V DC
BBM Enable ON

Reverse Battery LED will light and Is should be less than 50 mA.

11. Disconnect the test setup.

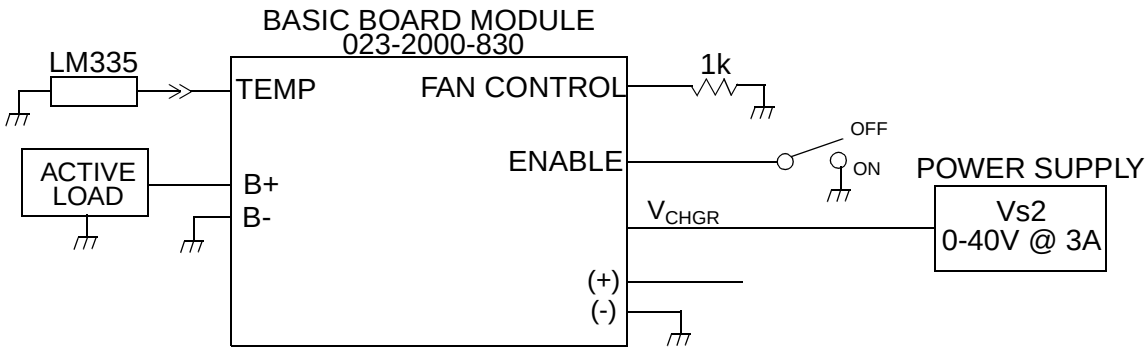


Figure 7-15 BATTERY CHARGER TEST SETUP

7.7 BATTERY CHARGER SECTION

1. Connect Battery Backup Module as shown in Figure 7-15.
2. Set the active load to 0A and set Vs2 to 40V at 3A.
3. Adjust R140 so the voltage at the active load reads 27.55V DC $\pm 0.1V$.

NOTE: The temperature sensor LM335 has to be at 22°C (room temperature).

4. Increase the active load current to 1.8A and verify voltage at the load is greater than 26V.

NOTE: The fan control line will stay at 0V until the heat sink is above 50°C.

5. Set the active load current to zero, shut off Vs2 and disconnect the BBM. Glyptol R140.

SECTION 8 SERVICING

8.1 INTRODUCTION

8.1.1 PERIODIC CHECKS

This repeater should be put on a regular maintenance schedule and an accurate performance record maintained. Important checks are receiver sensitivity and transmitter frequency, modulation, and power output. It is recommended that repeater performance be checked regularly even though periodic checks are not specifically required by the FCC.

8.1.2 SURFACE-MOUNTED COMPONENTS

A large number of the components used in this repeater are the surface-mounted type. Since these components are relatively small in size and are soldered directly to the PC board, care must be used when they are replaced to prevent damage to the component or PC board. Surface-mounted components should not be reused since they may be damaged by the unsoldering process. For more information on replacing surface-mounted components, refer to the Surface-Mounted Device Handbook, Part No. 001-0576-002.

8.1.3 SCHEMATIC DIAGRAMS AND COMPONENT LAYOUTS

Schematic diagrams and component layouts of the PC boards used in this repeater are located in Section 10. A component locator guide is also provided for both the schematic and board layouts to aid in component location.

8.1.4 REPLACEMENT PARTS LIST

A replacement parts list containing all the parts used in this repeater is located in Section 9. Parts are listed alpha numerically according to designator. For information on ordering parts, refer to Section 1.9.

8.1.5 TCXO MODULES NOT SERVICEABLE

Transmit or Receive TCXOs are not field serviceable because if a part is changed, a factory recalibration must be performed to ensure that it stays within its ± 1 PPM tolerance.

8.2 SYNTHESIZER SERVICING

8.2.1 INTRODUCTION

Synthesizer malfunctions can be caused by no VCO output, or the VCO is unlocked. The VCO can be unlocked due to a bad synthesizer chip, an incomplete synthesizer phase-lock loop, or because the synthesizer chip is programmed incorrectly.

To make certain that the synthesizer chip is receiving programming data, pins 17, 18 and 19 of the chip should be monitored during programming. Pin 17 (Enable) will go from a high to a low level. Pin 18 (Clock) will go from low to high in narrow pulses. Pin 19 (Data) goes from high to low with wider data pulses.

When the VCO is locked, the lock detect line of the synthesizer pin 2 is high with very narrow negative-going pulses. These pulses become wider when the VCO is out of lock. When this unlock condition exists either in the Exciter VCO or the Receiver VCO, it is relayed by the RF Interface board and is detected by the MPC via the RF Data lines. The MPC then does not allow the transmitter to key and the receiver cannot unsquelch.

When the VCO is unlocked, the f_R and f_V inputs to the phase detector are not in phase (refer to Sections 6.1.12 and 6.2.5). The phase detector in the synthesizer then causes the VCO control voltage to go to the high or low end of its operating range (Tx VCO 0 or 9V, Rx VCO 0 or 18V). This in turn causes the VCO to oscillate at the high or low end of its range.

As shown in Figures 6-1 and 6-4, a loop is formed by the VCO, buffer, frequency input (F_{IN}) and the phase detector output (PD OUT). Therefore, if any of these components begin to malfunction, improper signals appear throughout the loop. However, correct operation of the counters can still be verified by measuring the input and output frequencies to check the divide number.

Proceed as follows to check the input and output signal of the synthesizer modules to determine if they are operating properly.

8.2.2 TCXO MODULE

Check the signal at TCXO, pin 5. It should be 17.5 MHz for Y201 and Y401 at a level of approximately 3V P-P. If the TCXO is defective, it is not serviceable and must be replaced with a new unit as described in Section 8.1.5.

Measure the signal at pin 20 (Ref In) of the synthesizer chip. It will be approximately 1V P-P. If the signal is low here, the TCXO buffer circuit may be defective.

8.2.3 VOLTAGE CONTROLLED OSCILLATOR (VCO)

Check for VCO output signal with a high impedance RF voltmeter. If there is no output signal, or if the frequency is greatly off, the VCO is defective.

Next, monitor the signal level at pin 11 (F In) of the synthesizer chip. If the signal is less than 100 mV P-P, the VCO buffer is defective.

Lock Detector

When the VCO is locked on frequency, the waveform at pin 2 (Lock Det) should be as follows. When the VCO is unlocked, the negative-going pulses should be much wider than those shown in Figure 8-1. If the lock detect circuit is operating properly, check prescaler input pin 11 (F In).

The operation of the N and A counters can be observed by monitoring pins 16 and 19. Pin 16 (fv) equals $\text{fin} \div (64N+A) = 6.25 \text{ kHz}$ if the synthesizer is locked. Pin 9 is the modulus control signal.

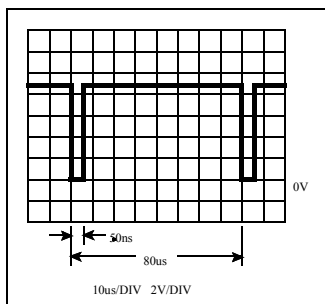


Figure 8-1 LOCK DETECT WAVEFORM

Modulus Control Signal

1. The frequency of the modulus control signal on TEST 1, pin 9 should be equal to the N counter output frequency (either in or out of lock). When the VCO is in lock, this frequency should be 6.25 kHz.
2. The duty cycle of the modulus control signal determines the divide number of the prescaler. The duty cycle ($T1 \div T2$) should be as follows:

$$T1 \div T2 = A \text{ Cntr Div No} \div N \text{ Cntr Div No}$$

$$T2 = 160 \mu\text{s} \text{ when locked.}$$

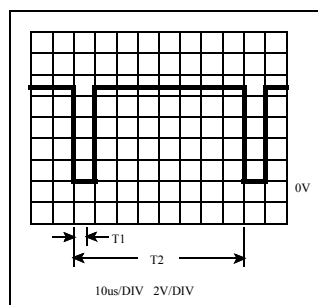


Figure 8-2 MODULUS CONTROL WAVEFORM

If the modulus control signal is not correct, the synthesizer may be defective or the logic may not be programming the correct divide number.

8.2.4 INTERNAL PRESCALER

Checking Prescaler Divide Number

The prescaler divide number can be checked by measuring the input and output frequencies. The prescaler divide number can be calculated as follows. (A and N counter divide numbers are calculated as described in Section 8.2.5.)

$$\text{Prescaler Divide Number} = 64 + (A \text{ Cntr Div No} \div N \text{ Cntr Div No})$$

Example: 450.250 MHz (receive)

$$\text{Prescaler Div No} = 64 + (40 \div 496) = 64.080645$$

Measure the prescaler input frequency at f_{in} , pin 11. Then measure the output frequency at TEST 2, pin 13 and calculate the divide number. If the VCO is not locked on frequency, the divide number should still be correct. The measured frequencies may not be exactly as calculated due to counter accuracy and resolution limitations.

NOTE: The counter should be connected to a high stability reference oscillator.

Example: 450.250 MHz VCO locked on frequency

$$397.3 \text{ (pin 11)} \div 6.2 \text{ (pin 13)} = 64.080645$$

8.2.5 CALCULATING "N" AND "A" COUNTER DIVIDE NUMBERS

"N" Counter

N Counter Divide Number =
Integer (VCO Freq. (MHz) $\div$ 0.4)

$$6.25 \text{ kHz (64)} \div 1 \text{ MHz} = 0.4$$

EXAMPLE: 450.025 MHz (receive)

$$\begin{aligned} \text{VCO freq} &= 450.025 + 52.95 = 502.975 \text{ MHz} \\ \text{N Cntr Div No} &= 502.975 \div 0.4 = 1257.4375 \\ \text{Integer (whole no.) of } 1257.4375 &= \mathbf{1257} \end{aligned}$$

EXAMPLE: 450.250 MHz (transmit)

$$\begin{aligned} \text{N Cntr Div No} &= 450.250 \div 0.4 = 1125.625 \\ \text{Integer (whole no.) of } 1125.625 &= \mathbf{1125} \end{aligned}$$

"A" Counter

A Counter Divide Number =
(VCO freq (MHz) $\div$.00625) - (N Cntr Div No x 64)

EXAMPLE: 450.025 MHz (receive)

$$\begin{aligned} \text{A Cntr Div No} &= (502.975 \div .00625) - (1257 \times 64) \\ &= 80,476 - 80,448 \\ &= \mathbf{28} \end{aligned}$$

EXAMPLE: 450.250 MHz (transmit)

$$\begin{aligned} \text{A Cntr Div No} &= (450.250 \div .00625) - (1125 \times 64) \\ &= 72,040 - 72,000 \\ &= \mathbf{40} \end{aligned}$$

8.3 RECEIVER SERVICING

To isolate a receiver problem to a defective section, start by checking the DC voltages shown in Section 7.1.2 and on the schematic diagram (Section 10). If that does not indicate the problem, perform the performance tests in Section 7.1 to isolate the problem. If the synthesizer is out of lock, the receiver is also non-functional because the first injection and IF signals will be incorrect.

8.4 TRANSMITTER SERVICING

To isolate a transmitter problem to a defective section, start by checking the DC voltages shown in Sections 7.2.2 and 7.3.2 and on the schematic diagram (Section 10). If that does not indicate the problem, perform the performance tests in Section 7.4.1 to isolate the problem. If the synthesizer is out of lock, the exciter is also nonfunctional because the software will not allow the repeater to transmit.

8.5 POWER SUPPLY SERVICING

The power supply is a switch mode type with very high voltages. It is recommended that the power supply be returned to the factory for servicing (see Section 1.8). Customers that desire to do their own repairs can refer to Section 10.

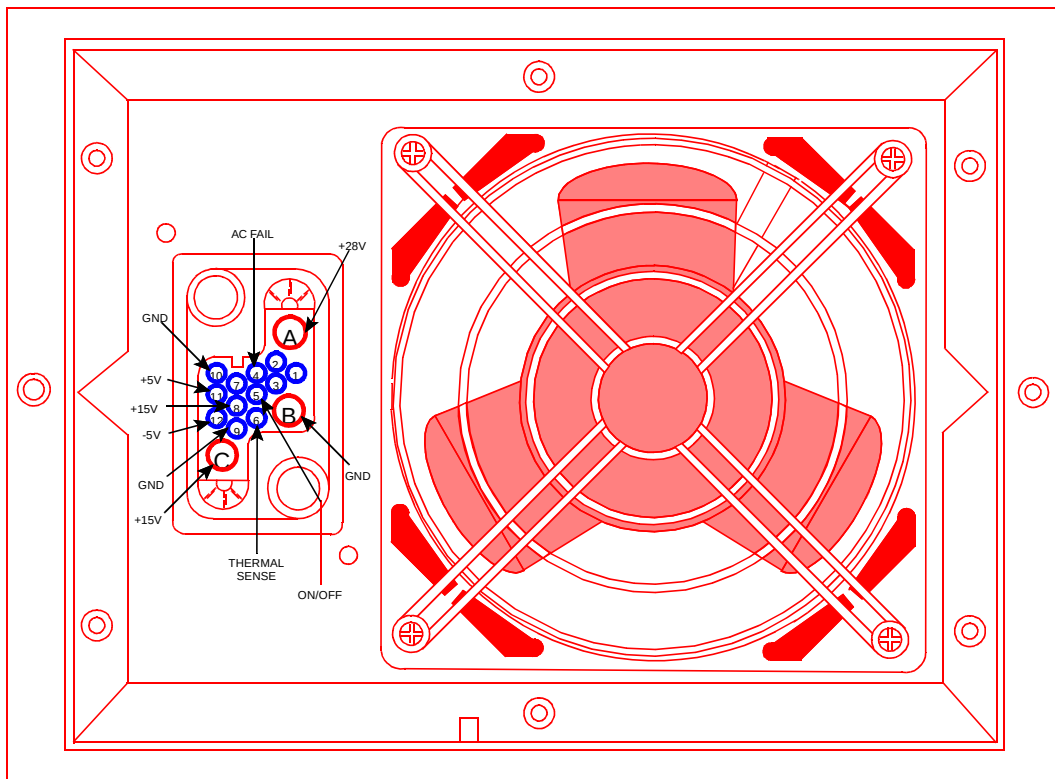


Figure 8-3 POWER SUPPLY REAR VIEW

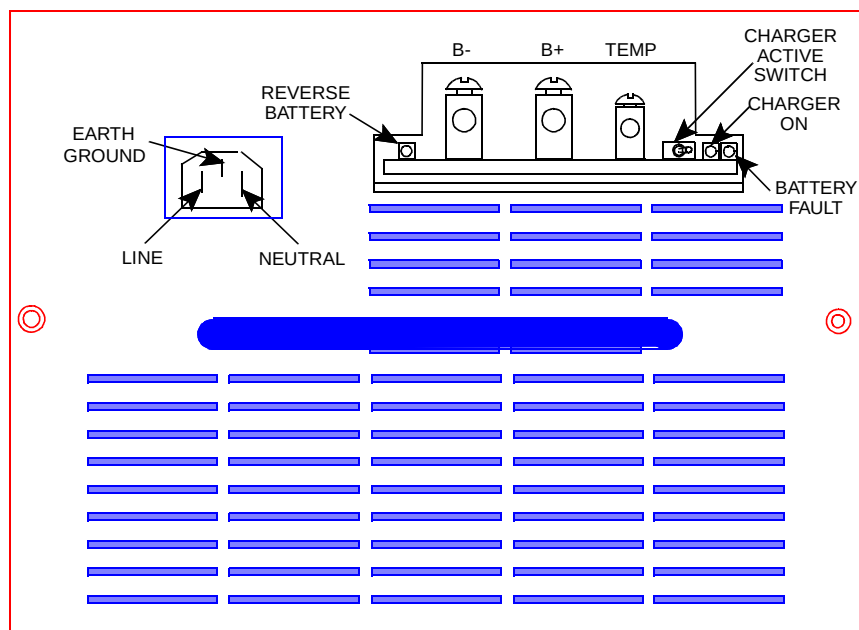


Figure 8-4 POWER SUPPLY FRONT VIEW

Table 8-1 CHIP INDUCTOR IDENTIFICATION

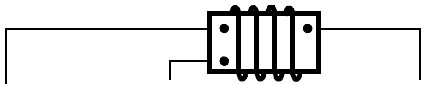
			
Color	1st Digit	2nd Digit	Multiplier (Last PN Digit)
Black	0	0	1 (7)
Brown	1	1	10 (8)
Red	2	2	100 (9)
Orange	3	3	1000 (0)
Yellow	4	4	10,000 (1)
Green	5	5	100,000 (2)
Blue	6	6	---
Violet	7	7	---
Gray	8	8	---
White	9	9	0.1 (6)

Table 8-2 CERAMIC CHIP CAP IDENTIFICATION

American EIA Standard		Japanese EIA Standard	
First Letter/ Number	Value (pF)	First Letter/ Number	Value (pF)
A	10	A	1.0
B	11	B	1.1
C	12	C	1.2
D	13	D	1.3
E	15	E	1.5
H	16	F	1.6
I	18	G	1.8
J	20	H	2.0
K	22	J	2.2
L	24	K	2.4
N	27	L	2.7
O	30	M	3.0
R	33	N	3.3
S	36	P	3.6
T	39	Q	3.9
V	43	R	4.3
W	47	S	4.7
X	51	T	5.1
Y	56	U	5.6
Z	62	V	6.2
3	68	W	6.8
4	75	X	7.5
7	82	Y	8.2
9	91	Z	9.1
Color	Multiplier	Second Number	Multiplier
Orange	0.1	0	1
Black	1	1	10
Green	10	2	100
Blue	100	3	1000
Violet	1000	4	10,000
Red	10,000	5	100,000

8.6.5 CHIP TRANSISTORS AND DIODES

Surface mounted transistors and diodes are identified by a special number that is shown in a table on Section 10.

8.7 BERYLLIUM PRODUCT WARNING

Q501, Q502, Q503, R519, R538 and R668 in the Power Amplifier contain Beryllium (BeO). Inhalation of dust or fumes may cause serious chronic lung disease. Refer to the Material Safety Data Sheets for further details.

8.8 GRAFOIL REPLACEMENT PROCEDURE

When replacing a device that uses Grafoil for the thermal interface, the Grafoil must be replaced. The old Grafoil must be completely removed from the heatsink. To avoid scuffing the heatsink a plastic scraper (e.g. tuning tool) should be used to remove the old Grafoil.

SECTION 9 PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
VIKING VX 400 MHz UNIVERSAL STATION PART NO. 242-20X4-313			C 005	1000 pF $\pm 20\%$ 1kV feedthru	510-3149-102
A 003	400-430 MHz PA/RFIB assem	023-2034-932	C 006	1000 pF $\pm 20\%$ 1kV feedthru	510-3149-102
A 003	430-470 MHz PA/RFIB assem	023-2044-932	C 007	1000 pF $\pm 20\%$ 1kV feedthru	510-3149-102
A 003	475-512 MHz PA/RFIB assem	023-2054-932	C 008	1000 pF $\pm 20\%$ 1kV feedthru	510-3149-102
A 006	400-430 MHz Rx/Tx assembly	023-2034-836	C 009	1000 pF $\pm 20\%$ 1kV feedthru	510-3149-102
A 006	430-470 MHz Rx/Tx assembly	023-2044-836	C 010	1000 pF $\pm 20\%$ 1kV feedthru	510-3149-102
A 006	475-512 MHz Rx/Tx assembly	023-2054-836	C 011	1000 pF $\pm 20\%$ 1kV feedthru	510-3149-102
A 010	2000 series power supply	023-2000-800	C 012	1000 pF $\pm 20\%$ 1kV feedthru	510-3149-102
HW001	6-32 machine panhead philips	575-1606-012	C 013	1000 pF $\pm 20\%$ 1kV feedthru	510-3149-102
MP033	PA hold down bracket	017-2210-032	C 527	9.1 pF $\pm 5\%$ NPO 1206 chip (400-430 MHz)	510-3602-919
PA002	Third Party Interface assem	023-2000-390	C 528	47 pF $\pm 5\%$ 250V mica (400-430 MHz)	510-0220-470
PA003	Interface Alarm Card assem**	023-2000-350		39 pF $\pm 5\%$ 250V mica (430-512 MHz)	510-0220-390
PA004	Station enclosure assembly	023-2000-200	C 529	47 pF $\pm 5\%$ 250V mica (400-430 MHz)	510-0220-470
W 013	AC power cord 6'7"	597-1001-013		39 pF $\pm 5\%$ 250V mica (430-512 MHz)	510-0220-390
**Requires Application Engineering authorization to purchase.			C 541	68 pF $\pm 5\%$ 250V mica (400-430 MHz)	510-0220-680
110W UHF PA/RFIB MODULE PART NO. 023-20X4-932				43 pF $\pm 5\%$ 250V mica (430-512 MHz)	510-0220-430
A 002	403-470 MHz 175W circulator	585-0590-006	C 542	68 pF $\pm 5\%$ 250V mica (400-430 MHz)	510-0220-680
A 002	470-524 MHz 175W circulator	585-0590-007		43 pF $\pm 5\%$ 250V mica (430-512 MHz)	510-0220-430
A 004	PA - Rx/Tx 20-cond ribbon	023-2000-190	C 543	18 pF $\pm 5\%$ 250V mica (400-430 MHz)	510-0220-180
A 005	PA - Rx/Tx 20-cond ribbon	023-2000-190		22 pF $\pm 5\%$ 250V mica (430-470 MHz)	510-0220-220
A 008	7.25" cable N-BNC	597-3003-292		16 pF $\pm 5\%$ 250V mica (475-512 MHz)	510-0220-160
A 009	PA RF input coax assembly	597-3002-031	C 546	9.1 pF hi Q .110 cube (400-430 MHz)	510-3663-919
A 011	UHF LPF Rptr to Final	023-2004-600	C 547	47 pF $\pm 5\%$ 250V mica (400-430 MHz)	510-0220-470
A 501	UHF feedback top	023-2004-530		51 pF $\pm 5\%$ 250V mica (430-512 MHz)	510-0220-510
A 502	UHF feedback top	023-2004-530	C 548	47 pF $\pm 5\%$ 250V mica (400-430 MHz)	510-0220-470
A 503	UHF feedback top	023-2004-530		51 pF $\pm 5\%$ 250V mica (430-512 MHz)	510-0220-510
C 001	1000 pF $\pm 20\%$ 1kV feedthru	510-3149-102			
C 002	1000 pF $\pm 20\%$ 1kV feedthru	510-3149-102			
C 003	1000 pF $\pm 20\%$ 1kV feedthru	510-3149-102			
C 004	1000 pF $\pm 20\%$ 1kV feedthru	510-3149-102			

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
C 560	68 pF ±5% 250V mica (400-430 MHz)	510-0220-680	C 603	11 pF ±5% NPO 1206 chip (400-430 MHz)	510-3602-110
	82 pF ±5% 250V mica (430-470 MHz)	510-0220-820	C 604	12 pF hi Q .110 cube (400-430 MHz)	510-3663-120
	47 pF ±5% 250V mica (475-512 MHz)	510-0220-470	C 605	12 pF hi Q .110 cube (400-430 MHz)	510-3663-120
C 561	68 pF ±5% 250V mica (400-430 MHz)	510-0220-680	EP500	Jumper RF power detect	016-2228-015
	82 pF ±5% 250V mica (430-470 MHz)	510-0220-820	HW003	5/8-24 x 0.094 hex nut NPB	560-9079-028
	47 pF ±5% 250V mica (475-512 MHz)	510-0220-470	HW004	5/8 x 0.02 lockwasher int CPS	596-9119-028
C 562	18 pF ±5% 250V mica (400-430 MHz)	510-0220-180	J 001	2-pin lock receptacle #22	515-9032-232
	22 pF ±5% 250V mica (430-470 MHz)	510-0220-220	J 002	2-pin lock receptacle #22	515-9032-232
	10 pF ±5% 250V mica (475-512 MHz)	510-0220-100	L 501	3T 0.250 ID air core	542-0020-093
C 565	9.1 pF hi Q .110 cube (400-430 MHz)	510-3663-919	L 502	3T 0.250 ID air core	542-0020-093
C 568	47 pF ±5% 250V mica (400-430 MHz)	510-0220-470	L 503	3T 0.250 ID air core	542-0020-093
	51 pF ±5% 250V mica (430-512 MHz)	510-0220-510	PA001	110W PA mechanical assem	023-2004-732
C 569	47 pF ±5% 250V mica (400-430 MHz)	510-0220-470	PA008	RF Interface board assembly	023-2008-110
	51 pF ±5% 250V mica (430-512 MHz)	510-0220-510	PA009	110W 400-430 MHz PA	023-2034-500
C 579	47 pF ±5% 250V mica (400-430 MHz)	510-0220-470		110W 430-470 MHz PA	023-2044-500
	51 pF ±5% 250V mica (430-512 MHz)	510-0220-510		110W 470-512 MHz PA	023-2054-500
C 580	68 pF ±5% 250V mica (400-430 MHz)	510-0220-680	PA010	UHF Fwd/Rev Power Detect	023-2004-660
	82 pF ±5% 250V mica (430-470 MHz)	510-0220-820	Q 501*	100W UHF RF power amp	576-0006-119
	47 pF ±5% 250V mica (475-512 MHz)	510-0220-470	Q 502*	100W UHF RF power amp	576-0006-119
C 581	68 pF ±5% 250V mica (400-430 MHz)	510-0220-680	Q 503*	100W UHF RF power amp	576-0006-119
	82 pF ±5% 250V mica (430-470 MHz)	510-0220-820	R 519*	100 ohm 20W flange mount	569-5001-001
	47 pF ±5% 250V mica (475-512 MHz)	510-0220-470	R 538*	100 ohm 100W flange mount	569-5001-002
C 580	68 pF ±5% 250V mica (400-430 MHz)	510-0220-680	R 668*	50 ohm 250W flange mount	569-5001-003
	82 pF ±5% 250V mica (430-470 MHz)	510-0220-820	U 501	13W pwr mod 430-470 MHz	544-4001-065
	47 pF ±5% 250V mica (475-512 MHz)	510-0220-470		13W pwr mod 470-512 MHz	544-4001-068
C 581	18 pF ±5% 250V mica (400-430 MHz)	510-0220-180	STATION ENCLOSURE ASSEMBLY PART NO. 023-2000-200		
	22 pF ±5% 250V mica (430-470 MHz)	510-0220-220			
	10 pF ±5% 250V mica (475-512 MHz)	510-0220-100			
			A 004	Shelf power harness assembly	023-2000-165
			A 005	High speed data bus harness	023-2000-170
			A 006	Input/Output harness assem	023-2000-175
			A 007	Alarm harness assembly	023-2000-180

* **DANGER** Beryllium Product. Inhalation of dust or fumes may cause serious chronic lung disease.

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
A 008	RF input harness assembly	023-2000-185	MP024	Slide lock cam	537-9007-012
A 009	Controller backplane card	023-2000-210	MP025	Card guide 4.5"	574-9015-006
A 010	External connector board	023-2000-220	MP026	PA conn floating plate	017-2226-020
A 011	Power supply filter board	023-2000-250	MP028	Flexible grommet	574-0001-025
CH017	Chassis	017-2210-080	MP029	Flexible grommet	574-0001-025
EP001	Ferrite bead	517-2002-008	MP030	Spacer	013-1723-228
EP002	Ferrite bead	517-2002-009	MP031	Spacer	013-1723-229
EP010	3/8" heat shrink tubing	042-0241-556	MP032	Dowel pin guide	013-1723-230
EP011	3/8" heat shrink tubing	042-0241-556	NP001	Nameplate E.F. Johnson	559-5861-163
HW0136-32 machine panhead philips		575-1606-014	TRANSCIEVER MECHANICAL		
HW0146-32 panhead philips ZPS		575-1606-012	PART NO. 023-2000-205		
HW0168-32 panhead philips ZPS		575-1608-012	CH252	Transceiver housing	015-0902-010
HW01710-32 machine panhead phil		575-1610-016	EP252	0.093 OD RF shield gasket	574-3002-036
HW0186-19 panhead philips ZPS		575-5606-008	HW2726-32 pan torx ZPS		575-0006-010
HW0196-32 machine flathead philips		575-8206-016	HW2736-32 machine panhead philips		575-1606-016
HW0206-32 x 0.094 nut		560-1106-010	MP253	Transceiver deck cover	015-0902-015
HW0218-32 socket head shield screw		575-9078-106	CONTROLLER BACKPLANE CARD		
HW0228 x 0.032 flat washer NPB		596-2408-012	PART NO. 023-2000-210		
HW023#10 flat washer NPB		596-1410-016	F 001	4 Amp 250V submin fuse	534-0017-020
HW0241/2" cable clamp		572-0001-007	F 002	4 Amp 250V submin fuse	534-0017-020
HW025 Ratcheting flat wire		572-0011-005	F 003	1 Amp 250V submin fuse	534-0017-014
HW026 Floating connector shield		018-1007-028	FH001	Fuse holder	534-0017-001
HW027 Floating connector cushion		018-1132-150	FH002	Fuse holder	534-0017-001
HW029 Speed nut 0.093 stud		537-0002-004	FH003	Fuse holder	534-0017-001
HW0304-40 shield screw		575-9078-105	HW012	Polarizing key box cont	515-7109-010
HW031 Lens, adhesive		574-3002-115	J 001	34 pin latch ejection header	515-9031-400
HW0326-32 machine panhead philips		575-1606-024	J 002	34 pin latch ejection header	515-9031-400
HW0336 x 0.018 lockwasher		596-1106-009	MP001	Round swage spacer 0.5"	312-2483-216
HW036 High vinyl foot		574-1004-003	MP002	Round swage spacer 0.75"	312-2483-224
J 010	Banana jack assembly .166	108-2302-621	P 001	64-pin DIN female straight	515-7082-201
J 011	Banana jack assembly .166	108-2303-621	P 002	32-pin DIN female straight	515-7082-200
J 012	Banana jack assembly .166	108-2301-621	P 003	64-pin DIN female straight	515-7082-201
MP001	PA floating connector bracket	017-2210-099			
MP012	8-32 x 1.15 spacer 0.375	013-1723-221			
MP013	Guide pin shield	013-1723-220			
MP015	Chassis top cover	017-2210-070			
MP017	Door lock rod	013-1723-225			
MP018	Mounting ears	017-2210-085			
MP019	Door lock cam	017-2210-110			
MP020	Front door lens	032-0758-025			
MP021	PA slide	032-0758-015			
MP022	Front door	032-0758-020			

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
P 004	32-pin DIN female straight	515-7082-200	RF INTERFACE BOARD		
P 005	64-pin DIN female straight	515-7082-201	PART NO. 023-2008-110		
P 006	32-pin DIN female straight	515-7082-200	C 101	.1 μ F $\pm$ 10% X7R chip	510-3606-104
P 007	64-pin DIN female straight	515-7082-201	C 102	2.2 μ F 20V tantalum SMD	510-2626-229
P 008	32-pin DIN female straight	515-7082-200	C 103	4.7 μ F 16V tantalum SMD	510-2625-479
P 009	32-pin DIN female straight	515-7082-200	C 104	.1 μ F $\pm$ 10% X7R 1206 chip	510-3606-104
P 010	26-pin locking straight header	515-9031-397	C 105	39 pF $\pm$ 5% NPO 1206 chip	510-3602-390
P 011	6-pin friction lock conn	515-9031-205	C 107	2.2 μ F 20V tantalum SMD	510-2626-229
P 012	64-pin DIN female straight	515-7082-201	C 108	.018 μ F $\pm$ 10% X7R 0805 chip	510-3605-183
P 013	32-pin DIN female straight	515-7082-200	C 109	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102
P 014	64-pin DIN female straight	515-7082-201	C 110	.1 μ F $\pm$ 10% X7R 1206 chip	510-3606-104
P 015	32-pin DIN female straight	515-7082-200	C 111	.047 μ F $\pm$ 10% X7R 1206 chip	510-3606-473
P 016	64-pin DIN female straight	515-7082-201	C 112	1 μ F 35V tantalum SMD	510-2628-109
P 017	32-pin DIN female straight	515-7082-200	C 113	.047 μ F $\pm$ 10% X7R 1206 chip	510-3606-473
P 018	64-pin DIN female straight	515-7082-201	C 114	1 μ F 35V tantalum SMD	510-2628-109
PC001	PC board	035-2000-210	C 115	.047 μ F $\pm$ 10% X7R 1206 chip	510-3606-473
EXTERNAL CONNECTOR BOARD			C 116	.01 μ F $\pm$ 10% X7R 1206 chip	510-3606-103
PART NO. 023-2000-220			C 117	1000 μ F 50V axial low temp	510-4350-102
HW001	6-32 ss pem fastener	560-9106-010	C 119	.1 μ F $\pm$ 10% X7R 1206 chip	510-3606-104
HW002	Polarizing key box cnt	515-7109-010	C 120	.1 μ F $\pm$ 10% X7R 1206 chip	510-3606-104
J 001	26-pos terminal block PC mt	515-7110-426	C 125	.01 μ F $\pm$ 10% X7R 1206 chip	510-3606-103
J 002	34-pos terminal block PC mt	515-7110-434	C 126	.018 μ F $\pm$ 10% X7R 0805 chip	510-3605-183
J 003	34-pos latch ejection header	515-9031-400	C 130	.1 μ F $\pm$ 10% X7R 1206 chip	510-3606-104
NP001	External connector label	559-0069-060	C 132	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102
P 001	26-pin locking straight header	515-9031-397	C 135	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102
PC001	PC board	035-2000-220	C 138	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102
POWER SUPPLY FILTER BOARD			C 141	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102
PART NO. 023-2000-250			C 143	.1 μ F $\pm$ 10% X7R 1206 chip	510-3606-104
C 001	1000 μ F 50V axial low temp	510-4350-102	C 149	.1 μ F $\pm$ 10% X7R 1206 chip	510-3606-104
C 002	1000 μ F 50V axial low temp	510-4350-102	C 150	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102
C 003	1000 μ F 50V axial low temp	510-4350-102	CR101	Switching SOT-23	523-1504-002
EP020	Ferrite bead	517-2002-007	CR103	3.9V zener SOT-23	523-2016-399
EP021	Ferrite bead	517-2002-007	CR104	4.7V zener SOT-23	523-2016-479
PC001	PC board	035-2000-240	CR107	5.1V zener SOT-23	523-2016-519
			CR108	5.1V zener SOT-23	523-2016-519
			CR109	5.1V zener SOT-23	523-2016-519
			CR110	5.1V zener SOT-23	523-2016-519
			CR111	Dual switching common-cath	523-1504-022
			EP101	Terminal lug 2104-06	586-0005-106
			EP102	Terminal lug 2104-06	586-0005-106
			EP103	Terminal lug 2104-06	586-0005-106
			EP104	Terminal lug 2104-06	586-0005-106
			EP105	Terminal lug 2104-06	586-0005-106

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
F 101	2A 250V AC sub-min	534-0017-017	R 057	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
F 102	2A 250V AC sub-min	534-0017-017	R 059	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
FH101	Fuse holder PC mount	534-1017-001	R 061	43k ohm $\pm 5\%$ 1206 SMD	569-0115-433
FH102	Fuse holder PC mount	534-1017-001	R 063	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
HW105	Polarizing key box cnt	515-7109-010	R 064	43k ohm $\pm 5\%$ 1206 SMD	569-0115-433
HW106	Polarizing key box cnt	515-7109-010	R 065	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
HW2476-32	machine panhead philips	575-1606-012	R 066	43k ohm $\pm 5\%$ 1206 SMD	569-0115-433
J 101	36-pin right angle radial	515-0511-001	R 073	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
J 102	20-pin straight low profile	515-9031-376	R 074	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
J 103	20-pin straight low profile	515-9031-376	R 075	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
J 104	4-pin right angle header	515-9035-004	R 076	5k ohm single turn trimmer	562-0112-502
L 101	3 μ H filter choke PC mount	542-5007-031	R 078	270k ohm $\pm 5\%$ 1206 SMD	569-0115-274
MP101	PA connector mounting shield	032-0758-028	R 079	1k ohm $\pm 1\%$ 1206 SMD	569-0111-301
P 101	Banana plug panel mount	108-0753-001	R 080	1k ohm $\pm 1\%$ 1206 SMD	569-0111-301
P 102	Banana plug panel mount	108-0753-001	R 081	470 ohm $\pm 5\%$ 1206 SMD	569-0115-471
P 103	Banana plug panel mount	108-0753-001	R 082	270k ohm $\pm 5\%$ 1206 SMD	569-0115-274
P 104	Banana plug panel mount	108-0753-001	R 083	1k ohm $\pm 1\%$ 1206 SMD	569-0111-301
P 105	Banana plug panel mount	108-0753-001	R 084	1k ohm $\pm 1\%$ 1206 SMD	569-0111-301
PC100	PC board	035-2008-110	R 085	470 ohm $\pm 5\%$ 1206 SMD	569-0115-471
Q 101	Si PNP low noise SOT-23	576-0003-657	R 086	270k ohm $\pm 5\%$ 1206 SMD	569-0115-274
Q 102	Si NPN SOT-23	576-0003-600	R 087	1k ohm $\pm 1\%$ 1206 SMD	569-0111-301
Q 103	PNP D-pak power	576-0002-603	R 088	1k ohm $\pm 1\%$ 1206 SMD	569-0111-301
Q 104	Si NPN low noise SOT-23	576-0003-657	R 089	470 ohm $\pm 5\%$ 1206 SMD	569-0115-471
Q 105	Si NPN amp SOT-23	576-0003-658	R 090	270k ohm $\pm 5\%$ 1206 SMD	569-0115-274
Q 106	Si NPN SOT-23	576-0003-600	R 091	1k ohm $\pm 1\%$ 1206 SMD	569-0111-301
Q 107	PNP D-pak power	576-0002-603	R 092	1k ohm $\pm 1\%$ 1206 SMD	569-0111-301
Q 108	Si NPN gen purp sw/amp	576-0001-300	R 093	470 ohm $\pm 5\%$ 1206 SMD	569-0115-471
R 045	100 ohm $\pm 5\%$ 1206 SMD	569-0115-101	R 094	5.1k ohm $\pm 5\%$ 1206 SMD	569-0115-512
R 046	100 ohm $\pm 5\%$ 1206 SMD	569-0115-101	R 095	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 048	7.5k ohm $\pm 5\%$ 1206 SMD	569-0115-752	R 100	100 ohm $\pm 5\%$ 1206 SMD	569-0115-101
R 049	1.5k ohm $\pm 5\%$ 1206 SMD	569-0115-152	R 101	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 050	4.99k ohm $\pm 1\%$ 1206 SMD	569-0111-368	R 102	2.7k ohm $\pm 5\%$ 1206 SMD	569-0115-272
R 051	100 ohm $\pm 5\%$ 1206 SMD	569-0115-101	R 103	270k ohm $\pm 5\%$ 1206 SMD	569-0115-274
R 052	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 104	270k ohm $\pm 5\%$ 1206 SMD	569-0115-274
R 053	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 105	2.7k ohm $\pm 5\%$ 1206 SMD	569-0115-272
R 054	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 106	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 055	2.7k ohm $\pm 5\%$ 1206 SMD	569-0115-272	R 107	560 ohm $\pm 5\%$ 1206 SMD	569-0115-561
R 056	470k ohm $\pm 5\%$ 1206 SMD	569-0115-474	R 108	2.7k ohm $\pm 5\%$ 1206 SMD	569-0115-272
			R 109	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
			R 110	5.1k ohm $\pm 5\%$ 1206 SMD	569-0115-512
			R 111	330 ohm $\pm 5\%$ 1206 SMD	569-0115-331
			R 112	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
			R 113	1.8k ohm $\pm 5\%$ 1206 SMD	569-0115-182
			R 114	1.8k ohm $\pm 5\%$ 1206 SMD	569-0115-182
			R 115	470 ohm $\pm 5\%$ 1206 SMD	569-0115-471
			R 116	470 ohm $\pm 5\%$ 1206 SMD	569-0115-471
			R 117	270 ohm $\pm 5\%$ 1206 SMD	569-0115-271

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
R 118	20k ohm $\pm 1\%$ 1206 SMD	569-0111-430	R 166	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223
R 119	20k ohm $\pm 1\%$ 1206 SMD	569-0111-430	R 167	1k ohm $\pm 1\%$ 1206 SMD	569-0111-301
R 120	10k ohm $\pm 1\%$ 1206 SMD	569-0111-401	R 168	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 121	20k ohm $\pm 1\%$ 1206 SMD	569-0111-430	R 169	270k ohm $\pm 5\%$ 1206 SMD	569-0115-274
R 122	10k ohm $\pm 1\%$ 1206 SMD	569-0111-401	R 170	1k ohm $\pm 1\%$ 1206 SMD	569-0111-301
R 123	20k ohm $\pm 1\%$ 1206 SMD	569-0111-430	R 171	511 ohm $\pm 1\%$ 1206 SMD	569-0111-269
R 124	10k ohm $\pm 1\%$ 1206 SMD	569-0111-401	R 172	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 125	20k ohm $\pm 1\%$ 1206 SMD	569-0111-430	R 173	3.3k ohm $\pm 5\%$ 1206 SMD	569-0115-332
R 126	10k ohm $\pm 1\%$ 1206 SMD	569-0111-401	R 174	8.2k ohm $\pm 5\%$ 1206 SMD	569-0115-822
R 127	20k ohm $\pm 1\%$ 1206 SMD	569-0111-430	R 175	8.2k ohm $\pm 5\%$ 1206 SMD	569-0115-822
R 128	10k ohm $\pm 1\%$ 1206 SMD	569-0111-401	R 176	8.2k ohm $\pm 5\%$ 1206 SMD	569-0115-822
R 129	20k ohm $\pm 1\%$ 1206 SMD	569-0111-430	R 177	8.2k ohm $\pm 5\%$ 1206 SMD	569-0115-822
R 130	10k ohm $\pm 1\%$ 1206 SMD	569-0111-401	R 178	8.2k ohm $\pm 5\%$ 1206 SMD	569-0115-822
R 131	20k ohm $\pm 1\%$ 1206 SMD	569-0111-430	R 179	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 132	10k ohm $\pm 1\%$ 1206 SMD	569-0111-401	R 180	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 133	20k ohm $\pm 1\%$ 1206 SMD	569-0111-430	R 181	22 ohm $\pm 5\%$ 1206 SMD	569-0115-220
R 134	20k ohm $\pm 1\%$ 1206 SMD	569-0111-430	R 182	22 ohm $\pm 5\%$ 1206 SMD	569-0115-220
R 135	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223	R 183	22 ohm $\pm 5\%$ 1206 SMD	569-0115-220
R 136	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223	R 184	22 ohm $\pm 5\%$ 1206 SMD	569-0115-220
R 137	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223	R 185	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223
R 138	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223	R 186	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 139	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 187	15k ohm $\pm 5\%$ 1206 SMD	569-0115-153
R 140	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 188	22 ohm $\pm 5\%$ 1206 SMD	569-0115-220
R 141	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 189	22 ohm $\pm 5\%$ 1206 SMD	569-0115-220
R 142	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 190	22 ohm $\pm 5\%$ 1206 SMD	569-0115-220
R 143	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223	R 191	22 ohm $\pm 5\%$ 1206 SMD	569-0115-220
R 144	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223	R 192	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223
R 145	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223	R 193	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 146	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223	R 194	15k ohm $\pm 5\%$ 1206 SMD	569-0115-153
R 147	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223	R 197	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 148	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223	R 198	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 149	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223	R 199	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 151	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	U 101	+5V regulator 78L05	544-2603-039
R 152	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	U 102	Dual op amp SOIC LM2904	544-2019-004
R 153	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223	U 103	8-bit shift register MC14094	544-3016-094
R 154	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223	U 104	8-chan mux 4051	544-3016-051
R 155	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223	U 105	8-chan mux 4051	544-3016-051
R 156	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223	U 106	8-chan mux 4051	544-3016-051
R 157	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	U 107	Dual op amp SOIC LM2904	544-2019-004
R 158	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	U 108	Dual op amp SOIC LM2904	544-2019-004
R 159	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	U 109	Quad op amp SOIC LM224	544-2020-014
R 160	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223	U 110	Hex non-inv buffer 4050B	544-3016-050
R 161	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223	U 111	Dual op amp SO-8 LM2904	544-2019-004
R 162	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223	U 112	Quad op amp SOIC LM224	544-2020-014
R 163	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223			
R 164	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223			
R 165	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223			

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
REPEATER RX/EX MODULE PART NO. 023-2034-836			L 801	150 nH $\pm 10\%$ 0805 SMD (430-512 MHz)	542-9003-158
HW001	5/8-24 x 0.094 hex nut	560-9079-028	L 802	180 nH $\pm 10\%$ 0805 SMD (400-430 MHz)	542-9003-188
HW002	5/8 x 0.02 int lockwasher CPS	596-9119-028	L 802	150 nH $\pm 10\%$ 0805 SMD (430-512 MHz)	542-9003-158
HW249	10-32 machine panhead ZPS	575-1610-020	L 803	150 nH $\pm 10\%$ 0805 SMD	542-9003-158
HW250	#10 flat washer ZPS	596-1410-016	L 804	150 nH $\pm 10\%$ 0805 SMD	542-9003-158
MP200	Transceiver pad	017-2210-105	L 805	12mm resonator SMD	542-9006-004
PA002	Transceiver mechanical	023-2000-205	MP400	UHF VCO shield	017-2226-044
PA004	Receiver 400-430 MHz	023-2034-270	PC800	PC board	035-2044-800
PA004	Receiver 430-470 MHz	023-2044-270	Q 801	Si NPN gen purp switch/amp	576-0001-300
PA004	Receiver 470-512 MHz	023-2034-270	Q 802	NPN UHF low noise SOT-23	576-0003-636
PA005	Exciter 400-430 MHz	023-2054-400	R 803	10 ohm $\pm 5\%$ 0805 chip	569-0105-100
PA005	Exciter 430-470 MHz	023-2044-400	R 804	3.6k ohm $\pm 5\%$ 0805 chip	569-0105-362
PA005	Exciter 470-512 MHz	023-2054-400	R 805	10 ohm $\pm 5\%$ 0805 chip	569-0105-100
RECEIVE VCO 403-470 MHz PART NO. 023-2044-800			R 806	5.1k ohm $\pm 5\%$ 0805 chip	569-0105-512
C 803	0.6-4.5 pF vertical SMT	512-0006-011	R 807	6.2k ohm $\pm 5\%$ 0805 SMD	569-0105-622
C 804	1.5 pF $\pm 5\%$ NPO 0805 chip (400-470 MHz)	510-3601-159	R 808	200 ohm $\pm 5\%$ 1206 SMD	569-0115-201
C 804	1.2 pF $\pm 5\%$ NPO 0805 chip (470-512 MHz)	510-3601-129	12.5/25 kHz RECEIVER PART NO. 023-2034-270 (400-430 MHz) PART NO. 023-2044-270 (430-470 MHz) PART NO. 023-2054-270 (470-512 MHz)		
C 805	68 pF $\pm 5\%$ NPO 0805 chip	510-3601-680	A 201	RF input coax	023-2000-161
C 806	0.5 pF ± 0.1 pF high Q	510-3710-508	A 203	Top Shield	023-2000-199
C 807	7.5 pF $\pm 5\%$ NPO 0805 chip	510-3601-759	A 401	VCO 400-430 MHz	023-2034-800
C 808	7.5 pF $\pm 5\%$ NPO 0805 chip	510-3601-759		VCO 430-470 MHz	023-2044-800
C 809	68 pF $\pm 5\%$ NPO 0805 chip	510-3601-680		VCO 470-512 MHz	023-2054-800
C 810	68 pF $\pm 5\%$ NPO 0805 chip	510-3601-680	C 101	5.6 pF $\pm 5\%$ NPO 1206 chip (400-430 MHz)	510-3602-569
C 811	68 pF $\pm 5\%$ NPO 0805 chip	510-3601-680		7.5 pF $\pm 5\%$ NPO 1206 chip (403-470 MHz)	510-3602-759
C 812	15 μ F 20V tantalum SMD	510-2626-150		6.8 pF $\pm 5\%$ NPO 1206 chip (470-512 MHz)	510-3602-689
C 813	68 pF $\pm 5\%$ NPO 0805 chip	510-3601-680	C 103	12 pF $\pm 5\%$ NPO 1206 chip	510-3602-120
C 814	68 pF $\pm 5\%$ NPO 0805 chip	510-3601-680	C 104	7.5 pF $\pm 5\%$ NPO 1206 chip (400-430 MHz)	510-3602-759
CR801	Varactor SOD-323 BB535	523-5005-022		6.2 pF $\pm 5\%$ NPO 1206 chip (403-470 MHz)	510-3602-629
CR802	Varactor SOD-323 BB535	523-5005-022		4.7 pF $\pm 5\%$ NPO 1206 chip (470-512 MHz)	510-3602-479
J 001	2-pin PC mount wafer	515-9031-101			
J 002	2-pin PC mount wafer	515-9031-101			
J 003	4-pin PC mount wafer	515-9031-103			
L 801	180 nH $\pm 10\%$ 0805 SMD (400-430 MHz)	542-9003-188			

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
C 105	4.7 μ F 16V tantalum SMD	510-2625-479	C 161	4.7 μ F 16V tantalum SMD	510-2625-479
C 106	150 pF $\pm$ 5% NPO 1206 chip	510-3602-151	C 162	5.6 pF $\pm$ 5% NPO 1206	510-3602-569
C 107	4.7 μ F 16V tantalum SMD	510-2625-479	C 163	8.2 pF $\pm$ 5% NPO 1206 chip	510-3602-829
C 108	150 pF $\pm$ 5% NPO 1206 chip	510-3602-151	C 164	.018 μ F $\pm$ 10% X7R 0805 chip	510-3605-183
C 109	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102	C 165	1 pF $\pm$ 5% NPO 1206 chip	510-3602-109
C 110	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102	C 166	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102
C 111	4.7 μ F 16V tantalum SMD	510-2625-479	C 167	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102
C 112	150 pF $\pm$ 5% NPO 1206 chip	510-3602-151	C 169	6.8 pF $\pm$ 5% NPO 1206	510-3602-689
C 113	150 pF $\pm$ 5% NPO 1206 chip	510-3602-151	C 201	10 pF $\pm$ 5% NPO 1206 chip	510-3602-100
C 114	6.2 pF $\pm$ 5% NPO 1206 chip (400-430 MHz)	510-3602-629	C 202	39 pF $\pm$ 5% NPO 1206	510-3602-390
	6.8 pF $\pm$ 5% NPO 1206 chip (403-512 MHz)	510-3602-689	C 203	4.7 pF $\pm$ 5% NPO 1206	510-3602-479
C 115	6.8 pF $\pm$ 5% NPO 1206 chip (400-430 MHz)	510-3602-689	C 204	1.5-5 pF ceramic SMD	510-1602-001
	7.5 pF $\pm$ 5% NPO 1206 chip (403-512 MHz)	510-3602-759	C 205	39 pF $\pm$ 5% NPO 1206	510-3602-390
C 131	3.9 pF $\pm$ 5% NPO 1206 chip	510-3602-399	C 206	10 pF $\pm$ 5% NPO 1206 chip	510-3602-100
C 132	10 pF $\pm$ 5% NPO 1206 chip	510-3602-100	C 207	.01 μ F $\pm$ 10% X7R chip	510-3606-103
C 133	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 208	4.7 pF $\pm$ 5% NPO 1206	510-3602-479
C 134	.018 μ F $\pm$ 10% X7R 0805 chip	510-3605-183	C 209	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102
C 135	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 210	10 pF $\pm$ 5% NPO 1206 chip	510-3602-100
C 136	.018 μ F $\pm$ 10% X7R 0805 chip	510-3605-183	C 211	.01 μ F $\pm$ 10% X7R chip	510-3606-103
C 137	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 212	39 pF $\pm$ 5% NPO 1206	510-3602-390
C 138	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 213	4.7 pF $\pm$ 5% NPO 1206	510-3602-479
C 139	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 214	1.5-5 pF ceramic SMD	510-1602-001
C 140	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 215	6.8 pF $\pm$ 5% NPO 1206	510-3602-689
C 141	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102	C 216	39 pF $\pm$ 5% NPO 1206	510-3602-390
C 142	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 217	3.9 pF $\pm$ 5% NPO 1206 chip	510-3602-399
C 143	.1 μ F $\pm$ 10% X7R 1210	510-3607-104	C 218	.01 μ F $\pm$ 10% X7R 1206 chip	510-3606-103
C 144	.018 μ F $\pm$ 10% X7R 0805 chip	510-3605-183	C 219	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102
C 145	.018 μ F $\pm$ 10% X7R 0805 chip	510-3605-183	C 220	.1 μ F $\pm$ 10% X7R chip	510-3606-104
C 146	7.5 pF $\pm$ 5% NPO 1206 chip	510-3602-759	C 221	.1 μ F $\pm$ 10% X7R chip	510-3606-104
C 147	22 pF $\pm$ 5% NPO 1206 chip	510-3602-220	C 222	.1 μ F $\pm$ 10% X7R chip	510-3606-104
C 148	4.7 μ F 16V tantalum SMD	510-2625-479	C 223	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102
C 149	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 225	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102
C 150	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102	C 226	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102
C 151	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 227	4.7 pF $\pm$ 5% NPO 1206	510-3602-479
C 152	3.9 pF $\pm$ 5% NPO 1206 chip	510-3602-399	C 228	27 pF $\pm$ 5% NPO 1206 chip	510-3602-270
C 153	5.6 pF $\pm$ 5% NPO 1206 chip	510-3602-569	C 236	8.2 pF $\pm$ 5% NPO 1206	510-3602-829
C 154	.018 μ F $\pm$ 10% X7R 0805 chip	510-3605-183	C 237	39 pF $\pm$ 5% NPO 1206	510-3602-390
C 155	.018 μ F $\pm$ 10% X7R 0805 chip	510-3605-183	C 238	4.7 pF $\pm$ 5% NPO 1206	510-3602-479
C 156	10 pF $\pm$ 5% NPO 1206 chip	510-3602-100	C 239	1.5-5 pF ceramic SMD	510-1602-001
C 157	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 240	100 pF $\pm$ 5% NPO 1206 chip	510-3602-101
C 158	1.5 μ F 25V tantalum SMD	510-2627-159	C 241	6.8 pF $\pm$ 5% NPO 1206	510-3602-689
C 159	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102	C 242	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102
C 160	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 243	.01 μ F $\pm$ 10% X7R 1206 chip	510-3606-103
			C 244	4.7 pF $\pm$ 5% NPO 1206	510-3602-479
			C 245	7.5 pF $\pm$ 5% NPO 1206 chip	510-3602-759
			C 246	.01 μ F $\pm$ 10% X7R 1206 chip	510-3606-103
			C 247	39 pF $\pm$ 5% NPO 1206 chip	510-3602-390

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
C 248	4.7 pF $\pm 5\%$ NPO 1206	510-3602-479	C 316	1.5 μ F 25V tantalum SMD	510-2627-159
C 249	1.5-5 pF ceramic SMD	510-1602-001	C 317	4.7 μ F 16V tantalum SMD	510-2625-479
C 250	5.6 pF $\pm 5\%$ NPO 1206 chip	510-3602-569	C 318	.001 μ F $\pm 5\%$ NPO 1206 chip	510-3602-102
C 251	39 pF $\pm 5\%$ NPO 1206	510-3602-390	C 401	.01 μ F $\pm 10\%$ X7R 1206	510-3606-103
C 252	5.6 pF $\pm 5\%$ NPO 1206 chip	510-3602-569	C 402	4.7 μ F 16V tantalum SMD	510-2625-479
C 253	.01 μ F $\pm 10\%$ X7R 1206 chip	510-3606-103	C 403	.01 μ F $\pm 10\%$ X7R 1206	510-3606-103
C 254	.001 μ F $\pm 5\%$ NPO 1206 chip	510-3602-102	C 404	820 pF $\pm 5\%$ NPO 1206 chip	510-3602-821
C 255	.1 μ F $\pm 10\%$ X7R	510-3606-104	C 405	100 pF $\pm 5\%$ NPO 1206 chip	510-3602-101
C 256	.1 μ F $\pm 10\%$ X7R	510-3606-104	C 406	.01 μ F $\pm 10\%$ X7R 1206	510-3606-103
C 257	.1 μ F $\pm 10\%$ X7R	510-3606-104	C 407	.001 μ F $\pm 5\%$ NPO 1206 chip	510-3602-102
C 258	.001 μ F $\pm 10\%$ X7R 1206	510-3606-102	C 408	.01 μ F $\pm 5\%$ NPO 1206 chip	510-3602-103
C 260	.001 μ F $\pm 10\%$ X7R 1206	510-3606-102	C 409	.01 μ F $\pm 5\%$ NPO 1206 chip	510-3602-103
C 261	.001 μ F $\pm 10\%$ X7R 1206	510-3606-102	C 410	.001 μ F $\pm 5\%$ NPO 1206 chip	510-3602-102
C 262	4.7 μ F 16V tantalum SMD	510-2625-479	C 411	.1 μ F $\pm 10\%$ X7R	510-3606-104
C 263	27 pF $\pm 5\%$ NPO 1206 chip	510-3602-270	C 412	.1 μ F $\pm 10\%$ X7R	510-3606-104
C 265	100 pF $\pm 5\%$ NPO 1206	510-3602-101	C 413	.01 μ F $\pm 10\%$ X7R 1206	510-3606-103
C 266	.01 μ F $\pm 10\%$ X7R 1206 chip	510-3606-103	C 414	6.8 μ F 35V tantalum SMD	510-2628-689
C 267	4.7 μ F 16V tantalum SMD	510-2625-479	C 415	.1 μ F $\pm 10\%$ X7R	510-3606-104
C 268	.01 μ F $\pm 10\%$ X7R 1206 chip	510-3606-103	C 416	.1 μ F $\pm 10\%$ X7R	510-3606-104
C 269	.001 μ F $\pm 10\%$ X7R 1206	510-3606-102	C 431	100 pF $\pm 5\%$ NPO 1206 chip	510-3602-101
C 270	5.6 pF $\pm 5\%$ NPO 1206 chip	510-3602-569	C 432	100 pF $\pm 5\%$ NPO 1206 chip	510-3602-101
C 271	220 pF $\pm 5\%$ NPO 1206 chip	510-3602-221	C 433	68 pF $\pm 5\%$ NPO 1206 chip	510-3602-680
C 275	100 pF $\pm 5\%$ NPO 1206 chip	510-3602-101	C 434	.1 μ F $\pm 10\%$ X7R	510-3606-104
C 276	.01 μ F $\pm 10\%$ X7R 1206 chip	510-3606-103	C 435	68 pF $\pm 5\%$ NPO 1206 chip	510-3602-680
C 277	4.7 μ F 16V tantalum SMD	510-2625-479	C 436	.1 μ F $\pm 10\%$ X7R	510-3606-104
C 278	.01 μ F $\pm 10\%$ X7R 1206 chip	510-3606-103	C 437	.1 μ F $\pm 10\%$ X7R	510-3606-104
C 279	.001 μ F $\pm 10\%$ X7R 1206	510-3606-102	C 438	4.7 μ F 16V tantalum SMD	510-2625-479
C 280	220 pF $\pm 5\%$ NPO 1206 chip	510-3602-221	C 439	68 pF $\pm 5\%$ NPO 1206 chip	510-3602-680
C 281	220 pF $\pm 5\%$ NPO 1206 chip	510-3602-221	C 440	.018 μ F $\pm 10\%$ X7R 0805 chip	510-3605-183
C 282	5.6 pF $\pm 5\%$ NPO 1206 chip	510-3602-569	C 441	68 pF $\pm 5\%$ NPO 1206 chip	510-3602-680
C 283	120 pF $\pm 5\%$ NPO 1206 chip	510-3602-121	C 442	.018 μ F $\pm 10\%$ X7R 0805 chip	510-3605-183
C 284	390 pF $\pm 5\%$ NPO 1206 chip	510-3602-391	C 443	68 pF $\pm 5\%$ NPO 1206 chip	510-3602-680
C 301	.001 μ F $\pm 10\%$ X7R 1206	510-3606-102	C 444	10 pF $\pm 5\%$ NPO 1206 chip	510-3602-100
C 302	1.5 μ F 25V tantalum SMD	510-2627-159	C 445	.1 μ F $\pm 5\%$ X7R 1206	510-3609-104
C 303	4.7 μ F 16V tantalum SMD	510-2625-479	C 446	5.1 pF $\pm 5\%$ NPO 1206 chip	510-3602-519
C 304	4.7 μ F 16V tantalum SMD	510-2625-479	C 447	1 μ F 16V tantalum SMD	510-2625-109
C 305	.001 μ F $\pm 5\%$ NPO 1206 chip	510-3602-102	C 448	1 μ F 16V tantalum SMD	510-2625-109
C 306	56 pF $\pm 5\%$ NPO 1206 chip	510-3602-560	C 449	.1 μ F $\pm 10\%$ X7R	510-3606-104
C 307	.001 μ F $\pm 5\%$ NPO 1206 chip	510-3602-102	C 450	1.5 μ F 25V tantalum SMD	510-2627-159
C 308	1.5 μ F 25V tantalum SMD	510-2627-159	C 451	.1 μ F $\pm 10\%$ X7R	510-3606-104
C 309	4.7 μ F 16V tantalum SMD	510-2625-479	C 452	10 pF $\pm 5\%$ NPO 1206 chip	510-3602-100
C 310	.001 μ F $\pm 5\%$ NPO 1206 chip	510-3602-102	C 454	.001 μ F $\pm 5\%$ NPO 1206 chip	510-3602-102
C 311	.001 μ F $\pm 5\%$ NPO 1206 chip	510-3602-102	C 455	68 pF $\pm 5\%$ NPO 1206 chip	510-3602-680
C 312	1.5 μ F 25V tantalum SMD	510-2627-159	C 456	3.3 pF $\pm 5\%$ NPO 1206 chip	510-3602-339
C 313	.001 μ F $\pm 5\%$ NPO 1206 chip	510-3602-102	C 457	.018 μ F $\pm 10\%$ X7R 0805 chip	510-3605-183
C 314	4.7 μ F 16V tantalum SMD	510-2625-479	C 458	68 pF $\pm 5\%$ NPO 1206 chip	510-3602-680
C 315	.001 μ F $\pm 5\%$ NPO 1206 chip	510-3602-102	C 459	68 pF $\pm 5\%$ NPO 1206 chip	510-3602-680

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
C 460	68 pF ±5% NPO 1206 chip	510-3602-680	L 104	5.125T helical coil (400-430 MHz)	016-1929-161
C 461	68 pF ±5% NPO 1206 chip	510-3602-680		4.8125T helical coil (430-470 MHz)	016-1929-158
C 462	68 pF ±5% NPO 1206 chip	510-3602-680		4.4375T helical coil (470-512 MHz)	016-1929-155
C 463	68 pF ±5% NPO 1206 chip	510-3602-680	L 105	3T 22 AWG 0.05 ID SMD (470-512 MHz)	542-0015-003
C 464	15 µF 20V tantalum SMD	510-2626-150	L 106	6T 22 AWG 0.05 ID SMD	542-0015-006
			L 107	6T 22 AWG 0.05 ID SMD	542-0015-006
CH200	3-cavity helical front end	015-0901-038	L 108	5.125T helical coil (400-430 MHz)	016-1929-161
CH201	3-cavity helical front end	015-0901-038		4.8125T helical coil (430-470 MHz)	016-1929-158
CH202	2-cavity helical front end	015-0901-028		4.4375T helical coil (470-512 MHz)	016-1929-155
			L 109	5.125T helical coil (400-430 MHz)	016-1929-162
CR101	Switching diode SOT-23	523-1504-002		4.8125T helical coil (430-470 MHz)	016-1929-159
CR131	5.6V zener SOT-23	523-2016-569		4.4375T helical coil (470-512 MHz)	016-1929-156
CR132	5.6V zener SOT-23	523-2016-569		5.125T helical coil (400-430 MHz)	016-1929-161
CR133	Hot carrier diode SOT-23	523-1504-016		4.8125T helical coil (430-470 MHz)	016-1929-158
CR401	Si 9.1V zener SOT-23	523-2016-919		4.4375T helical coil (470-512 MHz)	016-1929-155
CR402	Dual switching diode SOT-23	523-1504-023	L 110	5.125T helical coil (400-430 MHz)	016-1929-161
EP200	Crystal pin cer insulator mini	010-0345-280		4.8125T helical coil (430-470 MHz)	016-1929-158
				4.4375T helical coil (470-512 MHz)	016-1929-155
HW201	Helical screw	013-1563-001		4.8125T helical coil (430-470 MHz)	016-1929-158
HW202	Tension lock nut CPS	560-1810-022		4.4375T helical coil (470-512 MHz)	016-1929-155
HW203	6-32 panhead 1/4" taptite	575-0606-008	L 111	4T 22 AWG 0.05 ID SMD (400-470 MHz)	542-0015-004
HW205	Polarizing key box cnt	515-7109-010		3T 22 AWG 0.05 ID SMD (470-512 MHz)	542-0015-003
J 201	20-pin right angle header	515-9031-375			
J 203	3-pin single inline header	515-7100-003	L 131	.1 µH SMD inductor	542-9001-108
J 204	3-pin single inline header	515-7100-003	L 132	.1 µH SMD inductor	542-9001-108
J 205	3-pin single inline header	515-7100-003	L 133	5.6 nH ceramic inductor	542-9003-566
			L 134	.068 µH SMD inductor	542-9001-687
L 101	2T 22 AWG 0.05 ID SMD (400-470 MHz)	542-0015-002	L 135	15 nH inductor LL2012 F15N	542-9003-157
	3T 22 AWG 0.05 ID SMD (470-512 MHz)	542-0015-003	L 136	18 nH inductor LL2012 F18N	542-9003-187
L 102	5.125T helical coil (400-430 MHz)	016-1929-161	L 137	6.8 nH inductor LL2012 F6N8	542-9003-686
	4.8125T helical coil (430-470 MHz)	016-1929-159	L 138	.068 µH SMD inductor	542-9001-687
	4.4375T helical coil (470-512 MHz)	016-1929-155	L 139	12 nH inductor LL2012 F12N	542-9003-127
L 103	5.125T helical coil (400-430 MHz)	016-1929-162	L 140	4.625T helical coil (400-430 MHz)	016-1929-157
	4.8125T helical coil (430-470 MHz)	016-1929-159		4.375T helical coil (430-470 MHz)	016-1929-153
	4.4375T helical coil (470-512 MHz)	016-1929-156		4.0625T helical coil (470-512 MHz)	016-1929-151

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
L 141	4.625T helical coil (400-430 MHz)	016-1929-157	Q 403	Si NPN amp	576-0003-658
	4.375T helical coil (430-470 MHz)	016-1929-153	Q 404	Si NPN amp	576-0003-658
	4.0625T helical coil (470-512 MHz)	016-1929-151	Q 405	Si PNP low noise SOT-23	576-0003-657
L 201	1 μ H $\pm$ 6% variable inductor	542-1012-015	Q 406	Si NPN GP sw/amp SOT-23	576-0001-300
L 202	.82 μ H SMD inductor	542-9001-828	Q 407	Si PNP low noise SOT-23	576-0003-650
L 203	1 μ H $\pm$ 6% variable inductor	542-1012-015	Q 408	Si PNP low noise SOT-23	576-0003-650
L 204	1 μ H $\pm$ 6% variable inductor	542-1012-015	Q 409	Si NPN GP sw/amp SOT-23	576-0001-300
L 205	.82 μ H SMD inductor	542-9001-828	Q 410	NPN UHF low noise SOT-23	576-0003-636
L 206	1 μ H $\pm$ 6% variable inductor	542-1012-015	Q 411	NPN UHF low noise SOT-23	576-0003-636
L 211	1 μ H $\pm$ 6% variable inductor	542-1012-015	R 101	24 ohm $\pm$ 5% 1206 SMD	569-0115-240
L 212	.82 μ H SMD inductor	542-9001-828	R 102	10k ohm $\pm$ 5% 1206 SMD	569-0115-103
L 213	1 μ H $\pm$ 6% variable inductor	542-1012-015	R 103	1.8k ohm $\pm$ 5% 1206 SMD	569-0115-182
L 214	1 μ H $\pm$ 6% variable inductor	542-1012-015	R 104	10k ohm $\pm$ 5% 1206 SMD	569-0115-103
L 215	.82 μ H SMD inductor	542-9001-828	R 106	1k ohm $\pm$ 5% 1206 SMD	569-0115-102
L 216	1 μ H $\pm$ 6% variable inductor	542-1012-015	R 107	43 ohm $\pm$ 5% 1206 SMD	569-0115-430
L 222	.1 μ H inductor SMD	542-9001-108	R 108	43 ohm $\pm$ 5% 1206 SMD	569-0115-430
L 223	.1 μ H inductor SMD	542-9001-108	R 131	1.3k ohm $\pm$ 5% 1206 SMD	569-0115-132
L 224	.1 μ H inductor SMD	542-9001-108	R 132	1.5k ohm $\pm$ 5% 1206 SMD	569-0115-152
L 401	.1 μ H inductor SMD	542-9001-108	R 133	1.3k ohm $\pm$ 5% 1206 SMD	569-0115-132
L 402	.1 μ H inductor SMD	542-9001-108	R 134	3k ohm $\pm$ 5% 1206 SMD	569-0115-302
L 403	.1 μ H inductor SMD	542-9001-108	R 135	51 ohm $\pm$ 5% 1206 SMD	569-0115-510
L 404	.1 μ H inductor SMD	542-9001-108	R 136	10 ohm $\pm$ 5% 1206 SMD	569-0115-100
L 405	.1 μ H inductor SMD	542-9001-108	R 137	36 ohm $\pm$ 5% 1206 SMD	569-0115-360
MP204	Bottom shield	017-2210-101	R 138	75 ohm $\pm$ 5% 1206 SMD	569-0115-750
P 203	2-pos shorting socket	515-5010-001	R 139	300 ohm $\pm$ 5% 1206 SMD	569-0115-101
P 204	2-pos shorting socket	515-5010-001	R 140	18 ohm $\pm$ 5% 1206 SMD	569-0115-180
P 205	2-pos shorting socket	515-5010-001	R 141	300 ohm $\pm$ 5% 1206 SMD	569-0115-101
PC200	PC board	035-2004-200	R 142	270 ohm $\pm$ 5% 1206 SMD	569-0115-271
Q 101	NPN .2-2 GHz SO-8 amp	576-0003-604	R 143	1k ohm $\pm$ 5% 1206 SMD	569-0115-102
Q 102	Si PNP low noise SOT-23	576-0003-657	R 144	390 ohm $\pm$ 5% 1206 SMD	569-0115-391
Q 131	NPN UHF low noise SOT-23	576-0003-636	R 145	240 ohm $\pm$ 5% 1206 SMD	569-0115-241
Q 132	NPN UHF low noise SOT-23	576-0003-636	R 146	240 ohm $\pm$ 5% 1206 SMD	569-0115-241
Q 133	NPN .2-2 GHz SO-8 amp	576-0003-604	R 147	300 ohm $\pm$ 5% 1206 SMD	569-0115-101
Q 134	NPN 750 mW UHF/800 MHz	576-0004-098	R 148	18 ohm $\pm$ 5% 1206 SMD	569-0115-180
Q 201	Si NPN RF amp SOT-23	576-0003-602	R 149	300 ohm $\pm$ 5% 1206 SMD	569-0115-101
Q 202	Si NPN RF amp SOT-23	576-0003-602	R 150	270 ohm $\pm$ 5% 1206 SMD	569-0115-271
Q 203	Si NPN amp	576-0003-658	R 151	1.2k ohm $\pm$ 5% 1206 SMD	569-0115-122
Q 204	Si NPN amp	576-0003-658	R 152	270 ohm $\pm$ 5% 1206 SMD	569-0115-271
Q 401	Si NPN amp	576-0003-658	R 153	68 ohm $\pm$ 5% 1206 SMD	569-0115-680
Q 402	Si NPN amp	576-0003-658	R 154	68 ohm $\pm$ 5% 1206 SMD	569-0115-680
			R 157	1k ohm $\pm$ 5% 1206 SMD	569-0115-102
			R 158	51k ohm $\pm$ 5% 1206 SMD	569-0115-513
			R 159	100k ohm $\pm$ 5% 1206 SMD	569-0115-104
			R 160	10k ohm $\pm$ 5% 1206 SMD	569-0115-103
			R 161	100k ohm $\pm$ 5% 1206 SMD	569-0115-104
			R 201	1.8k ohm $\pm$ 5% 1206 SMD	569-0115-182

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
R 202	680 ohm $\pm 5\%$ 1206 SMD	569-0115-681	R 304	240 ohm $\pm 5\%$ 1206 SMD	569-0115-241
R 203	51 ohm $\pm 5\%$ 1206 SMD	569-0115-510	R 305	43 ohm $\pm 5\%$ 1206 SMD	569-0115-430
R 204	220 ohm $\pm 5\%$ 1206 SMD	569-0115-221	R 311	Zero ohm $\pm 10\%$ 1206 SMD	569-0115-001
R 205	560 ohm $\pm 5\%$ 1206 SMD	569-0115-561	R 312	Zero ohm $\pm 10\%$ 1206 SMD	569-0115-001
R 206	1.8k ohm $\pm 5\%$ 1206 SMD	569-0115-182	R 315	Zero ohm $\pm 10\%$ 1206 SMD	569-0115-001
R 207	51k ohm $\pm 5\%$ 1206 SMD	569-0115-513	R 401	270 ohm $\pm 5\%$ 1206 SMD	569-0115-271
R 208	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104	R 402	12.1k ohm $\pm 1\%$ 1206 SMD	569-0111-409
R 211	5.1k ohm $\pm 5\%$ 1206 SMD	569-0115-512	R 403	4.99k ohm $\pm 1\%$ 1206 SMD	569-0111-368
R 212	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104	R 404	10 ohm $\pm 5\%$ 1206 SMD	569-0115-100
R 213	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 406	2.7k ohm $\pm 5\%$ 1206 SMD	569-0115-272
R 214	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104	R 407	3.3k ohm $\pm 5\%$ 1206 SMD	569-0115-332
R 215	20k ohm $\pm 5\%$ 1206 SMD	569-0115-203	R 408	3.3k ohm $\pm 5\%$ 1206 SMD	569-0115-332
R 216	5k ohm SMD top adjust	562-0135-502	R 409	270 ohm $\pm 5\%$ 1206 SMD	569-0115-271
R 217	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 410	68k ohm $\pm 5\%$ 1206 SMD	569-0115-683
R 218	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 411	240 ohm $\pm 5\%$ 1206 SMD	569-0115-241
R 219	5k ohm SMD top adjust	562-0135-502	R 412	4.3k ohm $\pm 5\%$ 1206 SMD	569-0115-432
R 220	5k ohm SMD top adjust	562-0135-502	R 413	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 221	5k ohm SMD top adjust	562-0135-502	R 414	51 ohm $\pm 5\%$ 1206 SMD	569-0115-510
R 233	1.8k ohm $\pm 5\%$ 1206 SMD	569-0115-182	R 421	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 234	680 ohm $\pm 5\%$ 1206 SMD	569-0115-681	R 423	100 ohm $\pm 5\%$ 1206 SMD	569-0115-101
R 235	51 ohm $\pm 5\%$ 1206 SMD	569-0115-510	R 424	100 ohm $\pm 5\%$ 1206 SMD	569-0115-101
R 236	220 ohm $\pm 5\%$ 1206 SMD	569-0115-221	R 426	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 237	560 ohm $\pm 5\%$ 1206 SMD	569-0115-561	R 427	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 238	1.8k ohm $\pm 5\%$ 1206 SMD	569-0115-182	R 428	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 239	51k ohm $\pm 5\%$ 1206 SMD	569-0115-513	R 429	910 ohm $\pm 5\%$ 1206 SMD	569-0115-911
R 240	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104	R 430	240 ohm $\pm 5\%$ 1206 SMD	569-0115-241
R 243	5.1k ohm $\pm 5\%$ 1206 SMD	569-0115-512	R 431	51 ohm $\pm 5\%$ 1206 SMD	569-0115-510
R 244	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104	R 432	47k ohm $\pm 5\%$ 1206 SMD	569-0115-473
R 245	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104	R 433	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104
R 246	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104	R 434	30k ohm $\pm 5\%$ 1206 SMD	569-0115-303
R 247	20k ohm $\pm 5\%$ 1206 SMD	569-0115-203	R 435	3k ohm $\pm 5\%$ 1206 SMD	569-0115-302
R 248	5k ohm SMD top adjust	562-0135-502	R 436	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 249	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102	R 437	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104
R 250	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 438	9.1k ohm $\pm 5\%$ 1206 SMD	569-0115-912
R 253	5k ohm SMD top adjust	562-0135-502	R 439	3.6k ohm $\pm 5\%$ 1206 SMD	569-0115-362
R 254	1.8k ohm $\pm 5\%$ 1206 SMD	569-0115-182	R 440	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 255	680 ohm $\pm 5\%$ 1206 SMD	569-0115-681	R 441	15k ohm $\pm 5\%$ 1206 SMD	569-0115-153
R 256	51 ohm $\pm 5\%$ 1206 SMD	569-0115-510	R 442	10 ohm $\pm 5\%$ 1206 SMD	569-0115-100
R 257	220 ohm $\pm 5\%$ 1206 SMD	569-0115-221	R 443	51 ohm $\pm 5\%$ 1206 SMD	569-0115-510
R 258	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 444	4.3k ohm $\pm 5\%$ 1206 SMD	569-0115-432
R 259	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102	R 445	1.5k ohm $\pm 5\%$ 1206 SMD	569-0115-152
R 260	270 ohm $\pm 5\%$ 1206 SMD	569-0115-271	R 446	1.3k ohm $\pm 5\%$ 1206 SMD	569-0115-132
R 261	10 ohm $\pm 5\%$ 1206 SMD	569-0115-100	R 447	150 ohm $\pm 5\%$ 1206 SMD	569-0115-151
R 262	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102	R 448	36 ohm $\pm 5\%$ 1206 SMD	569-0115-360
R 301	220 ohm $\pm 5\%$ 1206 SMD	569-0115-221			
R 302	220 ohm $\pm 5\%$ 1206 SMD	569-0115-221	RT202	1k ohm $\pm 5\%$ chip thermistor	569-3013-002
R 303	220 ohm $\pm 5\%$ 1206 SMD	569-0115-221	RT204	1k ohm $\pm 5\%$ chip thermistor	569-3013-002

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
TP101	Red vertical tip jack 0.08	105-2202-211	C 810	68 pF ±5% NPO 0805 chip	510-3601-680
TP201	Red vertical tip jack 0.08	105-2202-211	C 811	68 pF ±5% NPO 0805 chip	510-3601-680
TP202	Red vertical tip jack 0.08	105-2202-211	C 812	15 µF 20V tantalum SMD	510-2626-150
TP203	Red vertical tip jack 0.08	105-2202-211	C 813	68 pF ±5% NPO 0805 chip	510-3601-680
U 101	Mixer LRMS-2H	544-0007-013	C 814	68 pF ±5% NPO 0805 chip	510-3601-680
U 102	Op amp SO-8 MC33172D	544-2019-017	C 815	1.2 pF ±5% NPO 0805 chip	510-3601-129
U 201	FM IF MC3371D SO-16	544-2002-031	C 816	1 pF ±5% NPO 0805 chip	510-3601-109
U 202	Dual op amp SO-8	544-2019-004	CR801	Varactor SOD-323 BB535	523-5005-022
U 203	FM IF MC3371D SO-16	544-2002-031	CR802	Varactor SOD-323 BB535	523-5005-022
U 204	Dual op amp SO-8	544-2019-004	CR803	Varactor SOD-323 BB535	523-5005-022
U 301	+5V regulator 78L05 SO-8	544-2603-039	J 001	2-pin PC mount wafer	515-9031-101
U 302	+12V regulator 78L12 SO-8	544-2603-032	J 002	2-pin PC mount wafer	515-9031-101
U 303	+12V regulator 78L12 SO-8	544-2603-032	J 003	4-pin PC mount wafer	515-9031-103
U 304	+12V regulator 78L12 SO-8	544-2603-032	L 801	150 nH ±10% 0805 SMD	542-9003-158
U 401	Synthesizer MC145190F SOIC	544-3954-026	L 802	150 nH ±10% 0805 SMD	542-9003-158
Y 401	17.5 MHz crystal 1 PPM	518-7117-500	L 803	150 nH ±10% 0805 SMD	542-9003-158
Z 201	52.95 MHz 4-pole 15 kHz BW	532-0009-009	L 804	150 nH ±10% 0805 SMD	542-9003-158
Z 202	52.95 MHz 4-pole 15 kHz BW	532-0009-009	L 805	12mm resonator SMD	542-9006-004
Z 203	450 kHz cer filter 20 kHz BW	532-2004-013	MP400	UHF VCO shield	017-2226-044
Z 204	450 kHz cer filter 20 kHz BW	532-2004-013	PC800	PC board	035-2044-850
Z 205	680 µH quad coil	542-5102-001	Q 801	Si NPN gen purp switch/amp	576-0001-300
Z 211	52.95 MHz 4-pole 8 kHz BW	532-0009-011	Q 802	NPN UHF low noise SOT-23	576-0003-636
Z 212	52.95 MHz 4-pole 8 kHz BW	532-0009-011	R 803	10 ohm ±5% 0805 chip	569-0105-100
Z 213	450 kHz cer filter 9 kHz BW	532-2004-015	R 804	3.6k ohm ±5% 0805 chip	569-0105-362
Z 214	450 kHz cer filter 9 kHz BW	532-2004-015	R 805	10 ohm ±5% 0805 chip	569-0105-100
Z 215	680 µH quad coil	542-5102-001	R 806	5.1k ohm ±5% 0805 chip	569-0105-512
TRANSMIT VCO 403-470 MHz			R 807	6.2k ohm ±5% 0805 SMD	569-0105-622
PART NO. 023-20X4-850			R 808	200 ohm ±5% 1206 SMD	569-0115-201
C 801	68 pF ±5% NPO 0805 SMD	510-3601-680	R 809	47k ohm ±5% 0805 SMD	569-0105-473
C 803	0.6-4.5 pF vertical SMT	512-0006-011	EXCITER 403-470 MHz		
C 804	3.9 pF ±5% NPO 0805 chip	510-3601-399	PART NO. 023-2044-400		
C 804	3.6 pF ±5% NPO 0805 chip	510-3601-369	A 007	430-470 MHz VCO	023-2044-850
C 805	68 pF ±5% NPO 0805 chip	510-3601-680	C 409	.01 µF ±10% X7R chip	510-3606-103
C 806	0.7 pF ±0.1 pF high Q	510-3710-708	C 410	.01 µF ±10% X7R chip	510-3606-103
C 807	7.5 pF ±5% NPO 0805 chip	510-3601-759	C 416	.1 µF ±10% X7R 1210	510-3607-104
C 808	7.5 pF ±5% NPO 0805 chip	510-3601-759	C 417	.01 µF ±10% X7R 1206 chip	510-3606-103
C 809	68 pF ±5% NPO 0805 chip	510-3601-680	C 418	.001 µF ±5% NPO 1206 chip	510-3602-102

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
C 419	.01 μ F $\pm$ 10% X7R chip	510-3606-103	C 479	.01 μ F $\pm$ 10% X7R 1206 chip	510-3606-103
C 420	5.6 pF $\pm$ 5% NPO 1206 chip	510-3602-569	C 480	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680
C 421	4.7 μ F 16V tantalum SMD	510-2625-479	C 481	1 μ F 16V tantalum SMD	510-2625-109
C 422	.1 μ F $\pm$ 10% X7R 1210	510-3607-104	C 482	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680
C 423	100 pF $\pm$ 5% NPO 1206 chip	510-3602-101	C 483	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680
C 424	.1 μ F $\pm$ 10% X7R 1210	510-3607-104	C 484	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680
C 425	.1 μ F $\pm$ 10% X7R 1210	510-3607-104	C 485	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680
C 426	4.7 μ F 16V tantalum SMD	510-2625-479	C 496	15 μ F 20V tantalum SMD	510-2626-150
C 427	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 498	.018 μ F $\pm$ 10% X7R 0805 chip	510-3605-183
C 428	4.7 μ F 16V tantalum SMD	510-2625-479	C 499	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680
C 429	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 500	22 pF $\pm$ 5% NPO 1206 chip	510-3602-220
C 430	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 501	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680
C 431	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 502	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102
C 432	.01 μ F $\pm$ 10% X7R chip	510-3606-103	C 503	.018 μ F $\pm$ 10% X7R 0805 chip	510-3605-183
C 433	6.8 pF $\pm$ 5% NPO 1206 chip	510-3602-689	C 504	.018 μ F $\pm$ 10% X7R 0805 chip	510-3605-183
C 434	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 505	8.2 pF $\pm$ 5% NPO 1206 chip	510-3602-829
C 441	100 pF $\pm$ 5% NPO 1206 chip	510-3602-101	C 506	75 pF $\pm$ 5% NPO 1206 chip	510-3602-750
C 442	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 507	4.7 μ F 16V tantalum SMD	510-2625-479
C 443	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 508	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680
C 444	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 509	3.3 pF $\pm$ 5% NPO 1206 chip	510-3602-339
C 446	.018 μ F $\pm$ 10% X7R 0805 chip	510-3605-183	C 510	6.2 pF $\pm$ 5% NPO 1206 chip	510-3602-629
C 447	4.7 μ F 16V tantalum SMD	510-2625-479	C 511	3.3 μ F 16V tantalum SMD	510-2625-339
C 448	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	C 512	.33 μ F 35V tantalum SMD	510-2628-338
C 449	2.7 pF $\pm$ 5% NPO 1206 chip	510-3602-279	C 513	.018 μ F $\pm$ 10% X7R 0805 chip	510-3605-183
C 450	7.5 pF $\pm$ 5% NPO 1206 chip	510-3602-759	C 514	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680
C 451	4.3 pF $\pm$ 5% NPO 1206 chip	510-3602-439			
C 452	6.2 pF $\pm$ 5% NPO 1206 chip	510-3602-629	CR401	Si 9.1V zener SOT-23	523-2016-919
C 453	820 pF $\pm$ 5% NPO 1206 chip	510-3602-821	CR402	Si 5.6V zener SOT-23	523-2016-569
C 454	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	CR403	Si 5.6V zener SOT-23	523-2016-569
C 455	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680			
C 456	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	HW404	Polarized key box connector	515-7109-010
C 457	.018 μ F $\pm$ 10% X7R 0805 chip	510-3605-183			
C 461	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	J 401	20-pin right angle header	515-9031-375
C 462	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102	J 402	Right angle PC JCM-B	131-3701-301
C 463	15 μ F 20V tantalum SMD	510-2626-150			
C 464	.01 μ F $\pm$ 10% X7R chip	510-3606-103	L 402	.1 μ H inductor SMD	542-9001-108
C 465	.018 μ F $\pm$ 10% X7R 0805 chip	510-3605-183	L 403	.1 μ H inductor SMD	542-9001-108
C 466	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102	L 405	.1 μ H inductor SMD	542-9001-108
C 467	1.5 μ F 25V tantalum SMD	510-2627-159	L 406	.1 μ H inductor SMD	542-9001-108
C 468	4.7 μ F 16V tantalum SMD	510-2625-479	L 407	.1 μ H inductor SMD	542-9001-108
C 469	4.7 μ F 16V tantalum SMD	510-2625-479	L 408	10 nH $\pm$ 10% 0805 SMD	542-9003-107
C 470	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102	L 409	.068 μ H inductor SMD	542-9001-687
C 471	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102	L 410	15 nH inductor LL2012 F15N	542-9003-157
C 472	1.5 μ F 25V tantalum SMD	510-2627-159	L 411	.068 μ H inductor SMD	542-9001-687
C 474	4.7 μ F 16V tantalum SMD	510-2625-479	L 412	18 nH inductor LL2012 F18N	542-9003-187
C 475	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102			
C 476	4.7 μ F 16V tantalum SMD	510-2625-479	PC401	PC board	035-2044-400

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
Q 403	Si NPN amp	576-0003-658	R 453	1.5k ohm $\pm 5\%$ SMD 1206	569-0115-152
Q 404	Si NPN amp	576-0003-658	R 454	1.3k ohm $\pm 5\%$ SMD 1206	569-0115-132
Q 405	Si PNP switching	576-0003-612	R 455	150 ohm $\pm 5\%$ SMD 1206	569-0115-151
Q 406	Si NPN low noise SOT-23	576-0003-636	R 456	470 ohm $\pm 5\%$ SMD 1206	569-0115-471
Q 407	Si NPN low noise SOT-23	576-0003-636	R 457	36 ohm $\pm 5\%$ SMD 1206	569-0115-360
Q 410	Si NPN amp	576-0003-658	R 458	3k ohm $\pm 5\%$ SMD 1206	569-0115-302
Q 411	Si NPN low noise SOT-23	576-0003-636	R 459	150 ohm $\pm 5\%$ SMD 1206	569-0115-151
Q 412	NPN 0.2-2 GHz SO-8	576-0003-604	R 460	36 ohm $\pm 5\%$ SMD 1206	569-0115-360
Q 413	NPN 750 mW UHF/800 MHz	576-0004-098	R 461	150 ohm $\pm 5\%$ SMD 1206	569-0115-151
R 402	10k ohm $\pm 5\%$ SMD 1206	569-0115-103	R 462	10 ohm $\pm 5\%$ SMD 1206	569-0115-100
R 403	10k ohm $\pm 5\%$ SMD 1206	569-0115-103	R 463	51 ohm $\pm 5\%$ SMD 1206	569-0115-510
R 404	100 ohm $\pm 5\%$ SMD 1206	569-0115-101	R 464	330 ohm $\pm 5\%$ SMD 1206	569-0115-331
R 405	1k ohm $\pm 5\%$ SMD 1206	569-0115-102	R 465	1.3k ohm $\pm 5\%$ SMD 1206	569-0115-132
R 414	12.1k ohm $\pm 1\%$ SMD 1206	569-0111-409	R 466	1.5k ohm $\pm 5\%$ SMD 1206	569-0115-152
R 415	4.99k ohm $\pm 1\%$ SMD 1206	569-0111-368	R 467	1.3k ohm $\pm 5\%$ SMD 1206	569-0115-132
R 416	270 ohm $\pm 5\%$ SMD 1206	569-0115-271	R 468	75 ohm $\pm 5\%$ SMD 1206	569-0115-750
R 417	10k ohm $\pm 5\%$ SMD 1206	569-0115-103	R 469	2k ohm $\pm 5\%$ SMD 1206	569-0115-202
R 419	12.1k ohm $\pm 1\%$ SMD 1206	569-0111-409	R 470	270 ohm $\pm 5\%$ SMD 1206	569-0115-271
R 424	10k ohm $\pm 5\%$ SMD 1206	569-0115-103	R 471	300 ohm $\pm 5\%$ SMD 1206	569-0115-301
R 425	50k ohm single turn trimmer	562-0112-503	R 472	300 ohm $\pm 5\%$ SMD 1206	569-0115-301
R 426	10k ohm $\pm 5\%$ SMD 1206	569-0115-103	R 473	150 ohm $\pm 5\%$ SMD 1206	569-0115-151
R 427	10k ohm $\pm 5\%$ SMD 1206	569-0115-103	R 474	36 ohm $\pm 5\%$ SMD 1206	569-0115-360
R 428	10 ohm $\pm 5\%$ SMD 1206	569-0115-100	R 475	150 ohm $\pm 5\%$ SMD 1206	569-0115-151
R 429	4.99k ohm $\pm 1\%$ SMD 1206	569-0111-368	R 476	150 ohm $\pm 5\%$ SMD 1206	569-0115-151
R 430	2.7k ohm $\pm 5\%$ SMD 1206	569-0115-272	R 477	1.5k ohm $\pm 5\%$ SMD 1206	569-0115-152
R 431	3.3k ohm $\pm 5\%$ SMD 1206	569-0115-332	R 478	200 ohm $\pm 5\%$ SMD 1206	569-0115-201
R 432	3.3k ohm $\pm 5\%$ SMD 1206	569-0115-332	R 479	150 ohm $\pm 5\%$ SMD 1206	569-0115-151
R 433	270 ohm $\pm 5\%$ SMD 1206	569-0115-271	R 480	7.5k ohm $\pm 5\%$ SMD 1206	569-0115-752
R 434	150 ohm $\pm 5\%$ SMD 1206	569-0115-151	R 481	1.3k ohm $\pm 5\%$ SMD 1206	569-0115-132
R 435	470 ohm $\pm 5\%$ SMD 1206	569-0115-471	R 482	Zero ohm $\pm 5\%$ SMD 1206	569-0115-001
R 436	100 ohm $\pm 5\%$ SMD 1206	569-0115-101	R 486	12.1k ohm $\pm 1\%$ SMD 1206	569-0111-409
R 437	100 ohm $\pm 5\%$ SMD 1206	569-0115-101	R 487	4.99k ohm $\pm 1\%$ SMD 1206	569-0111-368
R 438	10k ohm $\pm 5\%$ SMD 1206	569-0115-103	R 488	10k ohm $\pm 5\%$ SMD 1206	569-0115-103
R 439	1k ohm $\pm 5\%$ SMD 1206	569-0115-102	R 489	150 ohm $\pm 5\%$ SMD 1206	569-0115-151
R 440	1k ohm $\pm 5\%$ SMD 1206	569-0115-102	R 491	Zero ohm $\pm 5\%$ SMD 1206	569-0115-001
R 441	47k ohm $\pm 5\%$ SMD 1206	569-0115-473	R 493	6.8k ohm $\pm 5\%$ SMD 1206	569-0115-682
R 442	100 ohm $\pm 5\%$ SMD 1206	569-0115-101	U 402	Dual op amp SO-8 2904	544-2019-004
R 444	10k ohm $\pm 5\%$ SMD 1206	569-0115-103	U 403	Synthesizer SOIC MC145190	544-3954-026
R 445	82k ohm $\pm 5\%$ SMD 1206	569-0115-823	U 404	Dual op amp SO-8	544-2019-004
R 446	50k ohm single turn trimmer	562-0112-503	U 405	+5V regulator 78L05 SO-8	544-2603-039
R 447	1k ohm $\pm 5\%$ SMD 1206	569-0115-102	U 406	+12V regulator 78L12 SO-8	544-2603-032
R 448	10k ohm $\pm 5\%$ SMD 1206	569-0115-103	U 407	Dual op amp SO-8	544-2019-004
R 449	10k ohm $\pm 5\%$ SMD 1206	569-0115-103	Y 401	17.5 MHz, 1 PPM TCXO	518-7117-500
R 450	10 ohm $\pm 5\%$ SMD 1206	569-0115-100			
R 451	4.3k ohm $\pm 5\%$ SMD 1206	569-0115-432			
R 452	110 ohm $\pm 5\%$ SMD 1206	569-0115-111			

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
UHF FEEDBACK LOOP PART NO. 023-2004-530			C 528	30 pF ±5% NPO 1206 chip (403-430 MHz)	510-3602-300
C 001	.1 µF µ% X7R 1206	510-3609-104		27 pF ±5% 250V mica (430-470 MHz)	510-0220-270
L 001	.082 µH inductor SMD	542-9001-827		22 pF ±5% 250V mica (470-512 MHz)	510-0220-220
P 001	Edge clip 48 mil	515-9034-004	C 529	27 pF ±5% 250V mica (400-470 MHz)	510-0220-270
P 002	Edge clip 48 mil	515-9034-004		39 pF ±5% 250V mica (470-512 MHz)	510-0220-390
PC502	PC board	035-2004-530	C 530	.018 µF ±10% X7R 0805 chip	510-3605-183
R 001	100 ohm ±5% X7R 1206	569-0175-101	C 531	.018 µF ±10% X7R 0805 chip	510-3605-183
110 WATT POWER AMPLIFIER PART NO. 023-2044-500			C 532	100 pF ±10% high Q cube	510-3663-101
C 501	.018 µF ±10% X7R 0805 chip	510-3605-183	C 533	.018 µF ±10% X7R 0805 chip	510-3605-183
C 502	2.2 µF 20v tantalum SMD	510-2626-229	C 534	6.8 µF 35V tantalum SMD	510-2635-689
C 503	.1 µF ±10% X7R chip	510-3606-104	C 535	100 pF ±10% high Q cube	510-3663-101
C 504	100 pF ±10% high Q cube	510-3663-101	C 536	.018 µF ±10% X7R 0805 chip	510-3605-183
C 505	100 pF ±10% high Q cube	510-3663-101	C 537	6.8 µF 35V tantalum SMD	510-2635-689
C 506	.018 µF ±10% X7R 0805 chip	510-3605-183	C 538	100 pF ±10% high Q cube	510-3663-101
C 507	4.7 µF 16V tantalum SMD	510-2626-479	C 539	.018 µF ±10% X7R 0805 chip	510-3605-183
C 508	100 pF ±10% high Q cube	510-3663-101	C 540	.018 µF ±10% X7R 0805 chip	510-3605-183
C 509	.018 µF ±10% X7R 0805 chip	510-3605-183	C 541	27 pF ±5% 250V mica (400-470 MHz)	510-0220-270
C 510	1 µF 35V tantalum SMD	510-2628-109		39 pF ±5% 250V mica (470-512 MHz)	510-0220-390
C 511	.018 µF ±10% X7R 0805 chip	510-3605-183	C 542	22 pF ±5% 250V mica (400-470 MHz)	510-0220-220
C 512	100 pF ±10% high Q cube	510-3663-101		39 pF ±5% 250V mica (470-512 MHz)	510-0220-390
C 513	6.8 µF 35V tantalum SMD	510-2635-689	C 543	18 pF ±5% 250V mica (400-430 MHz)	510-0220-180
C 514	.018 µF ±10% X7R 0805 chip	510-3605-183		15 pF ±5% 250V mica (430-470 MHz)	510-0220-150
C 515	100 pF ±10% high Q cube	510-3663-101		10 pF ±5% 250V mica (470-512 MHz)	510-0220-100
C 516	.018 µF ±10% X7R 0805 chip	510-3605-183	C 545	27 pF ±5% 250V mica (400-430 MHz)	510-0220-270
C 517	100 pF ±10% high Q cube	510-3663-101		56 pF ±10% high Q cube (430-470 MHz)	510-3663-560
C 518	.1 µF ±10% X7R chip	510-3606-104		27 pF ±5% 250V mica (470-512 MHz)	510-0220-270
C 519	100 pF ±10% high Q cube	510-3663-101	C 546	12 pF ±5% 250V mica (400-430 MHz)	510-0220-120
C 520	.018 µF ±10% X7R 0805 chip	510-3605-183		8.2 pF ±10% high Q cube (430-470 MHz)	510-3663-829
C 521	.1 µF ±10% X7R chip	510-3606-104		12 pF ±5% 250V mica (470-512 MHz)	510-0220-120
C 522	6.8 µF 35V tantalum SMD	510-2635-689			
C 523	100 pF ±10% high Q cube	510-3663-101			
C 524	.018 µF ±10% X7R 0805 chip	510-3605-183			
C 525	.018 µF ±10% X7R 0805 chip	510-3605-183			
C 526	62 pF ±5% NPO 1206 chip	510-3602-620			
C 527	12 pF ±5% NPO 1206 chip (403-430 MHz)	510-3602-120			
	8.2 pF ±5% NPO 1206 chip (430-470 MHz)	510-3602-829			
	9.1 pF ±5% NPO 1206 chip (470-512 MHz)	510-3602-919			

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
C 547	30 pF ±5% 250V mica (400-430 MHz)	510-0220-300	C 567	.018 µF ±10% X7R 0805 chip	510-3605-183
	22 pF ±5% 250V mica (430-512 MHz)	510-0220-220	C 568	30 pF ±5% 250V mica (400-430 MHz)	510-0220-300
C 548	27 pF ±5% 250V mica (400-470 MHz)	510-0220-270		22 pF ±5% 250V mica (430-512 MHz)	510-0220-220
	39 pF ±5% 250V mica (470-512 MHz)	510-0220-390	C 569	27 pF ±5% 250V mica (400-470 MHz)	510-0220-270
C 549	.018 µF ±10% X7R 0805 chip	510-3605-183		39 pF ±5% 250V mica (470-512 MHz)	510-0220-390
C 550	.018 µF ±10% X7R 0805 chip	510-3605-183	C 570	100 pF ±10% high Q cube	510-3663-101
C 551	100 pF ±10% high Q cube	510-3663-101	C 571	.018 µF ±10% X7R 0805 chip	510-3605-183
C 552	.018 µF ±10% X7R 0805 chip	510-3605-183	C 572	6.8 µF 35V tantalum SMD	510-2635-689
C 553	6.8 µF 35V tantalum SMD	510-2635-689	C 573	100 pF ±10% high Q cube	510-3663-101
C 554	100 pF ±10% high Q cube	510-3663-101	C 574	.018 µF ±10% X7R 0805 chip	510-3605-183
C 555	.018 µF ±10% X7R 0805 chip	510-3605-183	C 575	6.8 µF 35V tantalum SMD	510-2635-689
C 556	6.8 µF 35V tantalum SMD	510-2635-689	C 576	100 pF ±10% high Q cube	510-3663-101
C 557	100 pF ±10% high Q cube	510-3663-101	C 577	.018 µF ±10% X7R 0805 chip	510-3605-183
C 558	.018 µF ±10% X7R 0805 chip	510-3605-183	C 578	.018 µF ±10% X7R 0805 chip	510-3605-183
C 559	.018 µF ±10% X7R 0805 chip	510-3605-183	C 579	27 pF ±5% 250V mica (400-470 MHz)	510-0220-270
C 560	27 pF ±5% 250V mica (400-470 MHz)	510-0220-270		39 pF ±5% 250V mica (470-512 MHz)	510-0220-390
	39 pF ±5% 250V mica (470-512 MHz)	510-0220-390	C 580	27 pF ±5% 250V mica (400-430 MHz)	510-0220-270
C 561	27 pF ±5% 250V mica (400-430 MHz)	510-0220-270		30 pF ±5% 250V mica (430-470 MHz)	510-0220-300
	30 pF ±5% 250V mica (430-470 MHz)	510-0220-300		39 pF ±5% 250V mica (470-512 MHz)	510-0220-390
	39 pF ±5% 250V mica (470-512 MHz)	510-0220-390	C 581	22 pF ±5% 250V mica (400-430 MHz)	510-0220-220
C 562	22 pF ±5% 250V mica (400-430 MHz)	510-0220-220		12 pF ±5% 250V mica (430-512 MHz)	510-0220-120
	12 pF ±5% 250V mica (430-512 MHz)	510-0220-120	C 582	100 pF ±10% high Q cube	510-3663-101
C 563	100 pF ±10% high Q cube	510-3663-101	C 583	.018 µF ±10% X7R 0805 chip	510-3605-183
C 564	27 pF ±5% 250V mica (400-430 MHz)	510-0220-270	C 584	.001 µF ±5% NPO 1206 chip	510-3602-102
	56 pF ±10% high Q cube (430-470 MHz)	510-3663-560	C 585	39 pF ±5% NPO 1206 chip	510-3602-390
	27 pF ±5% 250V mica (470-512 MHz)	510-0220-270	C 586	1 µF 16V tantalum SMD	510-2625-109
C 565	12 pF ±5% 250V mica (400-430 MHz)	510-0220-120	C 587	.018 µF ±10% X7R 0805 chip	510-3605-183
	8.2 pF ±10% high Q cube (430-470 MHz)	510-3663-829	C 588	100 pF ±10% high Q cube	510-3663-101
	12 pF ±5% 250V mica (470-512 MHz)	510-0220-120	C 589	1 µF 35V tantalum SMD	510-2628-109
C 566	.018 µF ±10% X7R 0805 chip	510-3605-183	C 590	4.7 µF 16V tantalum SMD	510-2625-479
			C 591	4.7 µF 16V tantalum SMD	510-2625-479
			C 592	.018 µF ±10% X7R 0805 chip	510-3605-183
			C 593	.001 µF ±5% NPO 1206 chip	510-3602-102
			C 594	100 pF ±10% high Q cube	510-3663-101
			C 595	1 µF 35V tantalum SMD	510-2628-109
			C 596	4.7 µF 16V tantalum SMD	510-2625-479

*** DANGER** Beryllium Product. Inhalation of dust or fumes may cause serious chronic lung disease.

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
C 597	.018 μ F $\pm$ 10% X7R 0805 chip	510-3605-183	R 512	10k ohm $\pm$ 5% 1206 SMD	569-0115-103
C 598	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102	R 513	4.7k ohm $\pm$ 5% 1206 SMD	569-0115-472
C 600	1.7-11 pF vert mt T-cap (430-512 MHz)	187-0106-175	R 514	.03 ohm $\pm$ 5% SMD 2W	569-2019-307
C 601	.1 μ F $\pm$ 10% X7R chip	510-3606-104	R 515	200 ohm $\pm$ 5% 1206 SMD	569-0115-201
C 602	.1 μ F $\pm$ 10% X7R chip	510-3606-104	R 516	200 ohm $\pm$ 5% 1206 SMD	569-0115-201
C 603	.018 μ F $\pm$ 10% X7R 0805 chip	510-3605-183	R 517	Zero ohm $\pm$ 5% 1206 SMD	569-0115-001
C 604	10 pF $\pm$ 5% 250V mica (400-430 MHz)	510-0220-100	R 518	2k ohm $\pm$ 5% 1206 SMD	569-0115-202
CR501	Si 6.2V $\pm$ 5% zener SOT-23	523-2016-629	R 519*	100 ohm 20W flange mount	569-5001-001
CR502	Si 6.2V $\pm$ 5% zener SOT-23	523-2016-629	R 520	4.7k ohm $\pm$ 5% 1206 SMD	569-0115-472
CR503	Si 6.2V $\pm$ 5% zener SOT-23	523-2016-629	R 521	5k ohm SMD top adjust	569-0115-502
EP501	Ferrite bead SMD 1233	517-2503-010	R 522	2.2k ohm $\pm$ 5% 1206 SMD	569-0115-222
EP502	Ferrite bead SMD 1233	517-2503-010	R 523	10k ohm $\pm$ 5% 1206 SMD	569-0115-103
EP503	Ferrite bead SMD 1233	517-2503-010	R 524	4.7k ohm $\pm$ 5% 1206 SMD	569-0115-472
EP504	Ferrite bead SMD 1233	517-2503-010	R 525	.03 ohm $\pm$ 5% SMD 2W	569-2019-307
EP505	Ferrite bead SMD 1233	517-2503-010	R 526	200 ohm $\pm$ 5% 1206 SMD	569-0115-201
EP506	Ferrite bead SMD 1233	517-2503-010	R 527	200 ohm $\pm$ 5% 1206 SMD	569-0115-201
EP507	Ferrite bead SMD 1233	517-2503-010	R 528	2k ohm $\pm$ 5% 1206 SMD	569-0115-202
EP508	Ferrite bead SMD 1233	517-2503-010	R 529	4.7k ohm $\pm$ 5% 1206 SMD	569-0115-472
EP509	Ferrite bead SMD 1233	517-2503-010	R 530	5k ohm SMD top adjust	569-0115-502
EP510	Ferrite bead SMD 1233	517-2503-010	R 531	2.2k ohm $\pm$ 5% 1206 SMD	569-0115-222
EP511	Ferrite bead SMD 1233	517-2503-010	R 532	10k ohm $\pm$ 5% 1206 SMD	569-0115-103
EP520	Ferrite bead SMD 1233	517-2503-010	R 533	4.7k ohm $\pm$ 5% 1206 SMD	569-0115-472
L 504	.1 μ H inductor SMD	542-9001-108	R 534	.03 ohm $\pm$ 5% SMD 2W	569-2019-307
L 505	.1 μ H inductor SMD	542-9001-108	R 535	200 ohm $\pm$ 5% 1206 SMD	569-0115-201
L 506	.1 μ H inductor SMD	542-9001-108	R 536	200 ohm $\pm$ 5% 1206 SMD	569-0115-201
PC500	PC board	035-2044-500	R 537	2k ohm $\pm$ 5% 1206 SMD	569-0115-202
Q 501*	100W UHF RF power amp	576-0006-119	R 538*	100 ohm 100W flange mount	569-5001-002
Q 502*	100W UHF RF power amp	576-0006-119	R 539	470 ohm $\pm$ 5% 1206 SMD	569-0115-471
Q 503*	100W UHF RF power amp	576-0006-119	R 540	301k ohm $\pm$ 1% 1206 SMD	569-0111-547
Q 504	Si NPN GP sw/amp SOT-23	576-0001-300	R 541	100k ohm $\pm$ 1% 1206 SMD	569-0111-501
Q 505	Si NPN GP sw/amp SOT-23	576-0001-300	R 542	75 ohm $\pm$ 5% 1206 SMD	569-0115-750
R 501	150 ohm $\pm$ 5% 1206 SMD	569-0115-151	R 543	56 ohm $\pm$ 5% 1206 SMD	569-0115-560
R 502	36 ohm $\pm$ 5% 1206 SMD	569-0115-360	R 544	240 ohm $\pm$ 5% 1206 SMD	569-0115-241
R 503	150 ohm $\pm$ 5% 1206 SMD	569-0115-151	R 545	Zero ohm $\pm$ 5% 1206 SMD	569-0115-001
R 504	.03 ohm $\pm$ 5% SMD 2W	569-2019-307	R 547	51 ohm $\pm$ 5% 2512 SMD	569-0175-510
R 505	200 ohm $\pm$ 5% 1206 SMD	569-0115-201	R 548	51 ohm $\pm$ 5% 2512 SMD	569-0175-510
R 506	200 ohm $\pm$ 5% 1206 SMD	569-0115-201	R 549	51 ohm $\pm$ 5% 2512 SMD	569-0175-510
R 508	2k ohm $\pm$ 5% 1206 SMD	569-0115-202	R 550	10k ohm $\pm$ 5% 1206 SMD	569-0115-103
R 509	4.7k ohm SMD top adjust	569-0115-472	R 551	100k ohm $\pm$ 5% 1206 SMD	569-0115-104
R 510	5k ohm $\pm$ 5% 1206 SMD	569-0135-502	R 552	10k ohm $\pm$ 5% 1206 SMD	569-0115-103
R 511	2.2k ohm $\pm$ 5% 1206 SMD	569-0115-222	RT501	80k $\pm$ 5% chip thermistor	569-3006-803
			RT502	80k $\pm$ 5% chip thermistor	569-3006-803
			RT503	80k $\pm$ 5% chip thermistor	569-3006-803
			U 501	5W power module (400-430 MHz)	544-4001-063
				5W power module (430-512 MHz)	544-4001-064

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
U 502	High side current sense	544-2039-002	CR601	Dual Schottky SOT-143	523-1504-033
U 503	High side current sense	544-2039-002	CR651	Dual Schottky SOT-143	523-1504-033
U 504	High side current sense	544-2039-002	L 602	9T 35.5 nH SMD air core	542-0030-009
U 505	High side current sense	544-2039-002	L 603	.1 μ H SMD inductor	542-9001-108
U 506	Dual op amp 532 SO-8	544-2019-004	L 652	.1 μ H SMD inductor	542-9001-108
U 507	Temp sensor LM35 SO-8	544-2032-003	L 653	9T 35.5 nH SMD air core	542-0030-009
U 508	+5V regulator 78L05 SO-8	544-2603-039	L 654	9T 35.5 nH SMD air core	542-0030-009
U 509	+5V regulator 78L05 SO-8	544-2603-039			
LOW-PASS FILTER					
PART NO. 023-2004-600			MP601	PC board shield	017-2210-211
A 620	Low pass filter assembly	023-2004-620	MP651	PC board shield	017-2210-211
MP600	LPF mounting plate	017-2222-264	MP653	Power detector board	017-2210-212
FORWARD/REVERSE POWER DETECTOR			PC601	PC board	035-2004-660
PART NO. 023-2004-660			R 601	51 ohm $\pm$ 5% 1206 SMD	569-0115-510
C 601	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	R 603	51 ohm $\pm$ 5% 1206 SMD	569-0115-510
C 602	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	R 604	51 ohm $\pm$ 5% 1206 SMD	569-0115-510
C 603	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	R 605	10k ohm $\pm$ 1% 1206 SMD	569-0111-401
C 604	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	R 606	10k ohm $\pm$ 1% 1206 SMD	569-0111-401
C 605	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	R 607	20k ohm $\pm$ 1% 1206 SMD	569-0111-430
C 606	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	R 608	10k ohm $\pm$ 1% 1206 SMD	569-0111-401
C 607	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102	R 609	10k ohm $\pm$ 1% 1206 SMD	569-0111-401
C 608	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	R 610	160 ohm $\pm$ 5% 1206 SMD	569-0115-161
C 609	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102	R 611	5k ohm SMD top adjust	569-0135-502
C 610	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	R 612	10k ohm $\pm$ 1% 1206 SMD	569-0111-401
C 611	4.7 μ F 10V tantalum SMD	510-2624-479	R 613	10k ohm $\pm$ 1% 1206 SMD	569-0111-401
C 612	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102	R 614	10k ohm $\pm$ 1% 1206 SMD	569-0111-401
C 613	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	R 615	470 ohm $\pm$ 5% 1206 SMD	569-0115-471
C 614	4.7 μ F 10V tantalum SMD	510-2624-479	R 616	2k ohm $\pm$ 5% 1206 SMD	569-0115-202
C 651	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	R 651	51 ohm $\pm$ 5% 1206 SMD	569-0115-510
C 652	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	R 653	51 ohm $\pm$ 5% 1206 SMD	569-0115-510
C 653	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	R 654	51 ohm $\pm$ 5% 1206 SMD	569-0115-510
C 654	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	R 655	10k ohm $\pm$ 1% 1206 SMD	569-0111-401
C 655	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	R 656	20k ohm $\pm$ 1% 1206 SMD	569-0111-430
C 656	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	R 657	10k ohm $\pm$ 1% 1206 SMD	569-0111-401
C 657	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	R 658	10k ohm $\pm$ 1% 1206 SMD	569-0111-401
C 658	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102	R 659	10k ohm $\pm$ 1% 1206 SMD	569-0111-401
C 659	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102	R 660	150 ohm $\pm$ 5% 1206 SMD	569-0115-151
C 660	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	R 661	5k ohm SMD top adjust	569-0135-502
C 661	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102	R 662	10k ohm $\pm$ 1% 1206 SMD	569-0111-401
C 662	2.2 μ F 20V tantalum SMD	510-2626-229	R 663	7.5k ohm $\pm$ 5% 1206 SMD	569-0115-752
C 663	4.7 μ F 10V tantalum SMD	510-2624-479	R 664	12k ohm $\pm$ 5% 1206 SMD	569-0115-123
C 664	.001 μ F $\pm$ 5% NPO 1206 chip	510-3602-102	R 665	470 ohm $\pm$ 5% 1206 SMD	569-0115-471
C 665	4.7 μ F 10V tantalum SMD	510-2624-479	R 666	240 ohm $\pm$ 5% 1206 SMD	569-0115-241
C 666	68 pF $\pm$ 5% NPO 1206 chip	510-3602-680	R 667	47 ohm $\pm$ 5% 1206 SMD	569-0115-470
			R 669	2k ohm $\pm$ 5% 1206 SMD	569-0115-202

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
U 601	Dual op amp SO-8	544-2019-004	2000 SERIES REPEATER POWER SUPPLY PART NO. 023-2000-800		
U 651	Dual op amp SO-8	544-2019-004	A 801	Main board assembly	023-2000-810
U 652	5V regulator 78L05	544-2603-039	A 803	AC filter board assembly	023-2000-820
POWER AMPLIFIER MECHANICAL PART NO. 023-2004-732			B 800	24V DC fan 3.14" sq x 1.26"	529-2002-012
B 252	24V DC fan 3.14" sq x 1.26"	529-2002-027	HW800	Speed nut	537-0001-002
EP200	6-14 ground lug	586-0007-070	HW801	10-32 x 0.375 CPS nut	560-1110-012
HW251	6-32 panhead philips ZPS	575-1606-008	HW802	6-32 x 0.094 nut	560-1106-010
HW253	6-32 panhead philips ZPS	575-1606-012	HW803	4-40 machine panhead ZPS	575-1604-010
HW254	1/8" cable clamp	572-0001-001	HW804	6-32 machine panhead ZPS	575-1606-010
HW255	6-32 pan torx ZPS	575-0006-010	HW805	6-32 machine panhead ZPS	575-1606-016
HW256	4-40 panhead philips ZPS	575-1604-010	HW806	Washer	596-2406-012
HW257	6-32 panhead philips ZPS	575-1606-010	HW809	6 x 0.018 lockwasher int.	596-1106-009
HW258	6-32 panhead philips ZPS	575-1606-016	HW810	3/8" cable clamp	572-0001-005
HW259	6-19 panhead philips ZPS	575-5606-008	HW811	#10 split lock washer	596-1310-010
HW260	6 x 0.018 lockwasher int ZPS	596-1206-010	HW812	Snap rivet 0.157 dia. x 0.29	574-9015-052
HW261	0.26 x 0.54 grafoil flgres	018-1007-030	HW813	Connector mounting screw	515-7141-215
HW262	0.42 x 0.995 grafoil mrf	018-1007-032	J 800	2-pos lock receptacle #22 wire	515-9032-262
HW265	Grafoil M67709	018-1007-105	MP801	Main enclosure	017-2210-165
HW266	Grafoil isolator	018-1007-041	MP802	Top cover	017-2210-166
HW268	10-32 HHSL Sems scr ZPS	575-9810-012	MP803	Handle	017-2139-202
HW269	0.062 x 0.85 x 5.65 poron stp	574-3002-110	MP804	Strain releif	016-2187-270
HW270	8-32 panhead CPS philips	575-0608-008	MP805	Fan finger guard	578-1000-001
HW300	Solder ground terminal	017-2210-213	NP800	Nameplate holder	015-0900-406
HW777	Self mount wire tie	574-9008-025	NP801	Nameplate label	559-5861-161
MP240	PA coax ground tab	017-2210-038	WIREHARNESS PART NO. 023-2000-803		
MP254	M PA plate align dowel pin	013-1723-216	EP001	Power socket	515-9012-284
MP256	PA shield, left	017-2210-121	EP002	Signal socket	515-9012-291
MP257	PA shield, top	017-2210-022	MP001	15-pos plug	515-9012-272
MP258	PA shield, right, 1 fan	017-2210-023			
MP262	Low-pass filter shield	017-2210-209			
MP268	M PA stop	013-1723-222			
MP270	PA shield	017-2210-207			

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
800W POWER SUPPLY MAIN BOARD			C 143	2700 μ F 35V aluminum	510-4075-272
PART NO. 023-2000-810			C 144	2700 μ F 35V aluminum	510-4075-272
A 002	Pin feed EPROM blank label	559-1154-004	C 145	2700 μ F 35V aluminum	510-4075-272
A 802	Wireharness	023-2000-803	C 146	.1 μ F $\pm$ 5% X7R 1206	510-3609-104
A 803	Thermal sensor board assem	023-2000-840	C 147	.1 μ F $\pm$ 5% X7R 1206	510-3609-104
C 101	220 μ F 25V aluminum radial	510-4225-221	C 148	.1 μ F $\pm$ 5% X7R 1206	510-3609-104
C 102	.01 μ F $\pm$ 5% X7R 1206	510-3609-103	C 149	.1 μ F $\pm$ 5% X7R 1206	510-3609-104
C 103	220 nF $\pm$ 10% X7R 1210	510-3606-224	C 150	.01 μ F $\pm$ 5% X7R 1206	510-3609-103
C 104	1 μ F 35V tantalum SMD	510-2628-109	C 152	.1 μ F $\pm$ 5% X7R 1206	510-3609-104
C 105	1 μ F 35V tantalum SMD	510-2628-109	C 153	1 μ F 35V tantalum SMD	510-2628-109
C 106	1500 μ F 35V aluminum elect	510-4075-152	C 154	.1 μ F $\pm$ 5% X7R chip	510-3609-104
C 107	1500 μ F 35V aluminum elect	510-4075-152	C 156	.01 μ F $\pm$ 5% X7R 1206	510-3609-103
C 108	470 pF $\pm$ 5% NPO 1206	510-3602-471	C 159	6.8 μ F 35V tantalum SMD	510-2635-689
C 109	.1 μ F $\pm$ 10% X7R 1206	510-3609-104	C 160	15 μ F 20V tantalum SMD	510-2633-150
C 110	330 μ F 450V aluminum	510-4574-331	C 161	.01 μ F $\pm$ 5% X7R 1206	510-3609-103
C 111	330 μ F 450V aluminum	510-4574-331	C 162	.1 μ F $\pm$ 5% X7R 1206	510-3609-104
C 113	.0047 μ F $\pm$ 10% X7R 1206	510-3609-472	C 163	2700 μ F 35V aluminum	510-4075-272
C 114	.1 μ F $\pm$ 10% X7R 1206	510-3609-104	C 164	.001 μ F $\pm$ 5% NPO 1206	510-3602-102
C 115	.1 μ F $\pm$ 10% X7R 1206	510-3609-104	C 165	1500 μ F 35V aluminum	510-4075-152
C 116	.1 μ F $\pm$ 10% X7R 1206	510-3609-104	C 166	1500 μ F 35V aluminum	510-4075-152
C 117	.47 μ F 16V tantalum SMD	510-2625-478	C 167	.01 μ F $\pm$ 5% X7R 1206	510-3609-103
C 118	270 pF $\pm$ 5% NPO 1206	510-3602-271	C 168	.01 μ F $\pm$ 5% X7R 1206	510-3609-103
C 119	1 μ F 35V tantalum SMD	510-2628-109	C 169	1500 μ F 35V aluminum	510-4075-152
C 120	270 pF $\pm$ 5% NPO 1206	510-3602-271	C 170	.01 μ F $\pm$ 5% X7R 1206	510-3609-103
C 121	.0027 μ F $\pm$ 5% X7R 1206	510-3609-272	C 172	.01 μ F $\pm$ 5% X7R 1206	510-3609-103
C 122	470 pF $\pm$ 5% NPO 1206	510-3602-471	C 173	.1 μ F $\pm$ 5% X7R 1206	510-3609-104
C 123	1 μ F 35V tantalum SMD	510-2628-109	C 174	2200 pF $\pm$ 5% NPO 1206	510-3602-222
C 124	.1 μ F $\pm$ 10% X7R 1206	510-3609-104	C 175	.22 μ F $\pm$ 10% X7R 1210	510-3606-224
C 125	.0022 μ F $\pm$ 5% X7R 1206	510-3609-222	C 176	.001 μ F $\pm$ 5% NPO 1206	510-3602-102
C 126	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	C 178	1 μ F 35V tantalum SMD	510-2628-109
C 127	.01 μ F $\pm$ 10% X7R 1206	510-3609-103	C 180	6.8 μ F 35V tantalum SMD	510-2635-689
C 128	6.8 μ F 35V tantalum SMD	510-2635-689	C 181	.01 μ F $\pm$ 5% X7R 1206	510-3609-103
C 129	.1 μ F $\pm$ 10% X7R 1206	510-3609-104	C 182	470 pF $\pm$ 5% NPO 1206	510-3602-471
C 131	.1 μ F $\pm$ 10% X7R 1206	510-3609-104	C 183	270 pF $\pm$ 5% NPO 1206	510-3602-271
C 132	1 μ F 35V tantalum SMD	510-2628-109	C 184	.1 μ F $\pm$ 5% X7R 1206	510-3609-104
C 133	1 μ F 35V tantalum SMD	510-2628-109	C 185	.001 μ F $\pm$ 5% NPO 1206	510-3602-102
C 134	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	C 186	1500 μ F 35V aluminum	510-4075-152
C 135	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	C 187	1500 μ F 35V aluminum	510-4075-152
C 136	2.2 μ F 16V tantalum SMD	510-2625-229	C 188	1500 μ F 35V aluminum	510-4075-152
C 137	2.2 μ F 16V tantalum SMD	510-2625-229	C 189	.01 μ F $\pm$ 5% X7R 1206	510-3609-103
C 138	.001 μ F $\pm$ 5% NPO 1206	510-3602-102	C 190	.01 μ F $\pm$ 5% X7R 1206	510-3609-103
C 139	6.8 μ F 35V tantalum SMD	510-2635-689	C 192	.1 μ F $\pm$ 5% X7R 1206	510-3609-104
C 140	6.8 μ F 35V tantalum SMD	510-2635-689	C 193	2200 pF $\pm$ 5% NPO 1206	510-3602-222
C 141	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	C 194	.22 μ F $\pm$ 10% X7R 1210	510-3606-224
C 142	1 nF 600V AC double m	510-1023-102	C 195	.01 μ F $\pm$ 5% X7R 1206	510-3609-103
			C 196	.001 μ F $\pm$ 5% NPO 1206	510-3602-102
			C 197	2.2 μ F 16V tantalum SMD	510-2625-229

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
C 198	1 μ F 35V tantalum SMD	510-2628-109	CR111	Switching diode SOT-23	523-1504-002
C 199	6.8 μ F 35V tantalum SMD	510-2635-689	CR112	Switch diode SOT-23	523-1504-017
C 200	6.8 μ F 35V tantalum SMD	510-2635-689	CR113	5.1V zener SOT-23	523-2016-519
C 201	.01 μ F $\pm$ 5% X7R 1206	510-3609-103	CR114	1A Schottky diode	523-0519-031
C 202	470 pF $\pm$ 5% NPO 1206	510-3602-471	CR115	1A Schottky diode	523-0519-031
C 203	470 pF $\pm$ 5% NPO 1206	510-3602-471	CR116	1A Schottky diode	523-0519-031
C 204	.047 μ F $\pm$ 5% X7R 1206	510-3609-473	CR117	18V zener SOT-23	523-2016-180
C 205	1500 μ F 35V aluminum	510-4075-152	CR118	3A ultra-fast diode	523-1507-004
C 207	2200 pF $\pm$ 5% NPO 1206	510-3602-222	CR119	3A ultra-fast diode	523-1507-004
C 208	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	CR120	18V zener SOT-23	523-2016-180
C 209	1500 μ F 35V aluminum	510-4075-152	CR121	Ultra-fast rectifier	523-0019-024
C 210	2200 pF $\pm$ 5% NPO 1206	510-3602-222	CR122	Switch diode SOT-23	523-1504-017
C 211	.01 μ F $\pm$ 5% X7R 1206	510-3609-103	CR123	1A Schottky diode	523-0519-031
C 212	.01 μ F $\pm$ 5% X7R 1206	510-3609-103	CR124	1A Schottky diode	523-0519-031
C 213	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	CR125	1A Schottky diode	523-0519-031
C 214	.01 μ F $\pm$ 5% X7R 1206	510-3609-103	CR126	Schottkey diode 20A	523-0519-030
C 215	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	CR127	Switch diode SOT-23	523-1504-017
C 216	.01 μ F $\pm$ 5% X7R 1206	510-3609-103	CR128	Ultra-fast rectifier	523-0019-024
C 217	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	CR129	25A 400V SCR TO-220	523-3021-001
C 218	.01 μ F $\pm$ 5% X7R 1206	510-3609-103	CR130	1A Schottky diode	523-0519-031
C 219	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	CR131	1A Schottky diode	523-0519-031
C 220	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	CR132	Schottkey diode 20A	523-0519-030
C 221	.01 μ F $\pm$ 5% X7R 1206	510-3609-103	CR133	Switch diode SOT-23	523-1504-017
C 222	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	CR134	1A Schottky diode	523-0519-031
C 223	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	CR135	25A 400V SCR TO-220	523-3021-001
C 224	.01 μ F $\pm$ 5% X7R 1206	510-3609-103	CR136	3A ultra-fast diode	523-1507-004
C 225	.01 μ F $\pm$ 5% X7R 1206	510-3609-103	CR137	Switching diode SOT-23	523-1504-002
C 227	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	CR138	Switching diode SOT-23	523-1504-002
C 228	2.2 μ F 16V tantalum SMD	510-2625-229	CR139	Dual switching common cath	523-1504-022
C 229	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	CR140	4.7V zener SOT-23	523-2016-479
C 230	1 μ F 35V tantalum SMD	510-2628-109	CR141	25A 400V SCR TO-220	523-3021-001
C 232	6.8 μ F 35V tantalum SMD	510-2635-689	CR142	Switch diode SOT-23	523-1504-017
C 233	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	CR143	Switch diode SOT-23	523-1504-017
C 234	.001 μ F $\pm$ 5% NPO 1206	510-3602-102	CR145	8A 600V ultrafast diode	523-0019-026
C 235	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	CR148	13V 1W zener SMT	523-2026-130
C 236	.1 μ F $\pm$ 5% X7R 1206	510-3609-104			
CR101	Switching diode SOT-23	523-1504-002	EP100	Ferrite bead	517-2002-008
CR102	Switching diode SOT-23	523-1504-002	EP101	0.25" spade lug	586-3502-021
CR103	3A ultra-fast diode	523-1507-004	EP103	0.25" spade lug	586-3502-021
CR104	18V zener $\pm$ 5% SMD	523-2026-180	EP104	0.25" spade lug	586-3502-021
CR105	1A Schottky diode	523-0519-031	EP105	0.25" spade lug	586-3502-021
CR106	1A Schottky diode	523-0519-031	EP106	0.25" spade lug	586-3502-021
CR107	Switching diode SOT-23	523-1504-017	EP110	0.25" spade lug	586-3502-021
CR108	Switching diode SOT-23	523-1504-017	EP111	0.25" spade lug	586-3502-021
CR110	Switching diode SOT-23	523-1504-002	EP112	0.25" spade lug	586-3502-021
			F 102	10A 250V fastblow AGC fuse	534-0003-036

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
FH102	Fuse clip	534-1007-001	Q 112	Si NPN amp/sw SOT-23	576-0003-600
HW100	Cam5 x 3.795 sil-pad	018-1007-051	Q 114	PNP switching	576-0003-612
HW101	0.89 x 1.37 sil-pad	018-1007-052	Q 115	PNP high current SOT-223	576-0006-026
HW102	1.06 x 4.73 sil-pad	018-1007-053	Q 116	14A 500V N-MOSFET	576-0006-351
HW104	0.83 x 5 Teflon spacer	018-1007-056	Q 117	PNP high current SOT-223	576-0006-026
HW105	0.83" Teflon spacer	018-1007-057	Q 118	14A 500V N-MOSFET	576-0006-351
HW106	1.28" Teflon spacer	018-1007-058	Q 120	Si NPN amp/sw SOT-23	576-0003-600
HW107	4-40 3/8" hex socket CPS	575-9076-122	Q 121	PNP 6A SMD MJD42C	576-0002-603
HW108	6-32 3/8" socket hoodcap	575-9076-112	Q 122	PNP high current SOT-223	576-0006-026
HW109	6-32 machine panhead ZPS	575-1606-012	Q 123	N-Chnl E-MOSFET SOT-23	576-0006-110
HW110	#4 x 0.046 shoulder washer	596-4504-008	Q 124	PNP high current SOT-223	576-0006-026
HW111	#4 x 0.040 flat washer NPB	596-2404-008	Q 125	20A 200V N-MOSFET	576-0006-352
HW112	#6 x 0.028 flat washer NPB	596-2406-010	Q 126	PNP switching	576-0003-612
HW113	#4 shakeproof washer	596-1104-008	Q 127	Si NPN amp/sw SOT-23	576-0003-600
HW114	#6 x 0.018 int lockwasher	596-1106-009	Q 128	PNP switching	576-0003-612
HW115	#4 spring washer	596-9604-009	Q 129	PNP high current SOT-223	576-0006-026
HW120	TO-220 clamp	537-9055-051	Q 130	N-Chnl E-MOSFET SOT-23	576-0006-110
J 101	2-pin friction header	515-9031-201	Q 131	PNP high current SOT-223	576-0006-026
J 102	2-pin friction header	515-9031-201	Q 132	20A 200V N-MOSFET	576-0006-352
L 101	15 μ H 30A DC inductor	542-5010-005	Q 133	PNP switching	576-0003-612
L 102	20 μ H 8A DC inductor	542-5010-006	Q 138	PNP switching	576-0003-612
L 103	7.5 μ H 8A DC inductor	542-5010-008	R 101	330k ohm $\pm$ 5% 1206 SMD	569-0115-334
L 104	10 μ H 5A DC inductor	542-5010-007	R 102	330k ohm $\pm$ 5% 1206 SMD	569-0115-334
L 105	100 μ H 1A DC inductor	542-5010-012	R 103	240k ohm $\pm$ 5% 1206 SMD	569-0115-244
L 107	300 μ H 17A DC inductor	542-5010-004	R 104	100k ohm $\pm$ 5% 1206 SMD	569-0115-104
MP100	5.7" heat sink	014-0771-130	R 105	330k ohm $\pm$ 5% 1206 SMD	569-0115-334
MP101	2.9" heat sink	014-0771-131	R 106	330k ohm $\pm$ 5% 1206 SMD	569-0115-334
MP102	5.7" heat sink	014-0771-133	R 107	330k ohm $\pm$ 5% 1206 SMD	569-0115-334
MP105	TO-202 spacer	017-2210-162	R 108	20k ohm $\pm$ 5% 2512 SMD	569-0175-203
PC001	PC board	035-2000-810	R 109	20k ohm $\pm$ 5% 2512 SMD	569-0175-203
Q 101	30A 500V N-chnl pwr module	576-0006-354	R 110	20k ohm $\pm$ 5% 2512 SMD	569-0175-203
Q 102	PNP switching	576-0003-612	R 111	220 ohm $\pm$ 5% 1206 SMD	569-0115-221
Q 103	Si NPN amp/sw SOT-23	576-0003-600	R 112	10 ohm $\pm$ 5% 1206 SMD	569-0115-100
Q 104	PNP high current SOT-223	576-0006-026	R 113	0.03 ohm 55W low ind wire	569-4151-307
Q 105	PNP switching	576-0003-612	R 114	0.03 ohm 55W low ind wire	569-4151-307
Q 106	Si NPN amp/sw SOT-23	576-0003-600	R 115	4.7k ohm $\pm$ 5% 1206 SMD	569-0115-472
Q 107	PNP high current SOT-223	576-0006-026	R 116	36k ohm $\pm$ 5% 1206 SMD	569-0115-363
Q 108	NPN high current SOT-223	576-0006-027	R 117	330 ohm $\pm$ 5% 1206 SMD	569-0115-331
Q 110	Si NPN amp/sw SOT-23	576-0003-600	R 118	18.2k ohm $\pm$ 1% 1206 SMD	569-0111-426
Q 111	Si NPN amp/sw SOT-23	576-0003-600	R 119	24.3k ohm $\pm$ 1% 1206 SMD	569-0111-438
			R 120	20k ohm $\pm$ 5% 2512 SMD	569-0175-203
			R 121	100k ohm $\pm$ 1% 1206 SMD	569-0111-501
			R 122	100k ohm $\pm$ 1% 1206 SMD	569-0111-501
			R 123	100k ohm $\pm$ 1% 1206 SMD	569-0111-501
			R 124	100k ohm $\pm$ 1% 1206 SMD	569-0111-501
			R 125	13 ohm $\pm$ 5% 1206 SMD	569-0115-130

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
R 126	10 ohm $\pm 5\%$ 1206 SMD	562-0115-100	R 175	1.8k ohm $\pm 5\%$ 1206 SMD	569-0115-182
R 127	1.27k ohm $\pm 1\%$ 1206 SMD	569-0111-311	R 176	100 ohm $\pm 5\%$ 1206 SMD	569-0115-101
R 128	51 ohm $\pm 5\%$ 2512 SMD	569-0175-510	R 178	2k ohm $\pm 5\%$ 1206 SMD	569-0115-202
R 129	36k ohm $\pm 5\%$ 1206 SMD	569-0115-363	R 179	4.7k ohm $\pm 5\%$ 1206 SMD	569-0115-472
R 130	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104	R 180	7.5k ohm $\pm 5\%$ 1206 SMD	569-0115-752
R 131	36k ohm $\pm 5\%$ 1206 SMD	569-0115-363	R 181	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 132	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 182	75 ohm $\pm 5\%$ 1206 SMD	569-0115-750
R 133	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104	R 183	95.3k ohm $\pm 1\%$ 1206 SMD	569-0111-495
R 134	20k ohm $\pm 5\%$ 1206 SMD	569-0115-203	R 184	357k ohm $\pm 1\%$ 1206 SMD	569-0111-554
R 135	13k ohm $\pm 1\%$ 1206 SMD	569-0111-412	R 185	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 136	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104	R 186	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 137	1M ohm $\pm 5\%$ 1206 SMD	569-0115-105	R 187	95.3k ohm $\pm 1\%$ 1206 SMD	569-0111-495
R 138	2.26k ohm $\pm 1\%$ 1206 SMD	569-0111-335	R 188	10k ohm $\pm 1\%$ 1206 SMD	569-0111-401
R 139	2.26k ohm $\pm 1\%$ 1206 SMD	569-0111-335	R 189	6.81k ohm $\pm 1\%$ 1206 SMD	569-0111-381
R 140	15k ohm $\pm 1\%$ 1206 SMD	569-0111-418	R 190	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 141	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 191	3.3k ohm $\pm 5\%$ 1206 SMD	569-0115-332
R 142	560k ohm $\pm 5\%$ 1206 SMD	569-0115-564	R 192	8.2k ohm $\pm 5\%$ 1206 SMD	569-0115-822
R 143	3k ohm $\pm 5\%$ 1206 SMD	569-0115-302	R 193	8.2k ohm $\pm 5\%$ 1206 SMD	569-0115-822
R 144	25.5k ohm $\pm 1\%$ 1206 SMD	569-0111-440	R 194	8.2k ohm $\pm 5\%$ 1206 SMD	569-0115-822
R 146	100 ohm $\pm 5\%$ 1206 SMD	569-0115-101	R 195	8.2k ohm $\pm 5\%$ 1206 SMD	569-0115-822
R 148	4.7k ohm $\pm 5\%$ 1206 SMD	569-0115-472	R 196	8.2k ohm $\pm 5\%$ 1206 SMD	569-0115-822
R 149	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102	R 197	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 150	2k ohm $\pm 5\%$ 1206 SMD	569-0115-202	R 198	18 ohm $\pm 5\%$ 1206 SMD	569-0115-180
R 151	20k ohm $\pm 5\%$ 2512 SMD	569-0175-203	R 199	18 ohm $\pm 5\%$ 1206 SMD	569-0115-180
R 152	4.7k ohm $\pm 5\%$ 1206 SMD	569-0115-472	R 200	18 ohm $\pm 5\%$ 1206 SMD	569-0115-180
R 153	100 ohm $\pm 5\%$ 1206 SMD	569-0115-101	R 201	180 ohm $\pm 5\%$ 1206 SMD	569-0115-181
R 154	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 202	20k ohm $\pm 5\%$ 1206 SMD	569-0115-203
R 155	36k ohm $\pm 5\%$ 1206 SMD	569-0115-363	R 203	2k ohm $\pm 5\%$ 1206 SMD	569-0115-202
R 156	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102	R 204	2k ohm $\pm 5\%$ 2512 SMD	569-0175-202
R 157	20k ohm $\pm 5\%$ 1206 SMD	569-0115-203	R 205	10 ohm $\pm 5\%$ 1206 SMD	569-0115-100
R 158	15k ohm $\pm 5\%$ 1206 SMD	569-0115-153	R 206	10 ohm $\pm 5\%$ 1206 SMD	569-0115-100
R 159	20 ohm $\pm 5\%$ 1206 SMD	569-0115-200	R 207	180 ohm $\pm 5\%$ 1206 SMD	569-0115-181
R 160	470 ohm $\pm 5\%$ 1206 SMD	569-0115-471	R 208	51 ohm $\pm 5\%$ 1206 SMD	569-0115-510
R 161	20 ohm $\pm 5\%$ 1206 SMD	569-0115-200	R 209	820 ohm $\pm 5\%$ 1206 SMD	569-0115-821
R 162	Zero ohm $\pm 5\%$ 1206 SMD	569-0115-001	R 210	820 ohm $\pm 5\%$ 1206 SMD	569-0115-821
R 163	20 ohm $\pm 5\%$ 1206 SMD	569-0115-200	R 211	12.4k ohm $\pm 1\%$ 1206 SMD	569-0111-410
R 164	470 ohm $\pm 5\%$ 1206 SMD	569-0115-471	R 212	2.26k ohm $\pm 1\%$ 1206 SMD	569-0111-335
R 165	20 ohm $\pm 5\%$ 1206 SMD	569-0115-200	R 213	200 ohm $\pm 5\%$ 1206 SMD	569-0115-201
R 166	10 ohm $\pm 5\%$ 2512 SMD	569-0175-100	R 214	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 167	10 ohm $\pm 5\%$ 2512 SMD	569-0175-100	R 215	6.2k ohm $\pm 5\%$ 1206 SMD	569-0115-622
R 168	10 ohm $\pm 5\%$ 2512 SMD	569-0175-100	R 216	1k ohm single turn trimmer	562-0112-102
R 169	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102	R 217	1.2k ohm $\pm 5\%$ 1206 SMD	569-0115-122
R 170	820 ohm $\pm 5\%$ 1206 SMD	569-0115-821	R 218	4.7k ohm $\pm 5\%$ 1206 SMD	569-0115-472
R 171	820 ohm $\pm 5\%$ 1206 SMD	569-0115-821	R 219	470 ohm $\pm 5\%$ 1206 SMD	569-0115-471
R 172	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104	R 220	2k ohm $\pm 1\%$ 1206 SMD	569-0111-330
R 173	16.9k ohm $\pm 1\%$ 1206 SMD	569-0111-423	R 221	36k ohm $\pm 5\%$ 1206 SMD	569-0115-363
R 174	1k ohm trim pot	562-0110-102	R 222	Zero ohm $\pm 5\%$ 1206 SMD	569-0115-001

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
R 223	13k ohm $\pm 5\%$ 1206 SMD	569-0115-133	R 272	51 ohm $\pm 5\%$ 2512 SMD	569-0175-510
R 224	Zero ohm $\pm 5\%$ 1206 SMD	569-0115-001	R 273	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 225	68 ohm $\pm 5\%$ 1206 SMD	569-0115-680	R 274	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 226	24 ohm $\pm 5\%$ 1206 SMD	569-0115-240	R 275	20k ohm $\pm 5\%$ 1206 SMD	569-0115-203
R 227	180 ohm $\pm 5\%$ 1206 SMD	569-0115-181	R 276	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 228	2k ohm $\pm 1\%$ 1206 SMD	569-0111-330	R 277	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 229	820 ohm $\pm 5\%$ 1206 SMD	569-0115-821	R 278	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 230	100 ohm $\pm 5\%$ 1206 SMD	569-0115-101	R 279	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 231	51 ohm $\pm 5\%$ 2512 SMD	569-0175-510	R 280	75 ohm $\pm 5\%$ 1206 SMD	569-0115-750
R 232	820 ohm $\pm 5\%$ 1206 SMD	569-0115-821	R 281	470 ohm $\pm 5\%$ 1206 SMD	569-0115-471
R 233	3.3k ohm $\pm 5\%$ 1206 SMD	569-0115-332	R 284	3.4k ohm $\pm 1\%$ 1206 SMD	569-0111-352
R 234	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102	R 285	2.49k ohm $\pm 1\%$ 1206 SMD	569-0111-339
R 235	18 ohm $\pm 5\%$ 1206 SMD	569-0115-180	R 286	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 236	18 ohm $\pm 5\%$ 1206 SMD	569-0115-180	R 287	200 ohm $\pm 5\%$ 1206 SMD	569-0115-201
R 237	18 ohm $\pm 5\%$ 1206 SMD	569-0115-180	R 302	20k ohm $\pm 5\%$ 1206 SMD	569-0115-203
R 238	180 ohm $\pm 5\%$ 1206 SMD	569-0115-181	R 303	200 ohm $\pm 5\%$ 1206 SMD	569-0115-201
R 240	2k ohm $\pm 5\%$ 1206 SMD	569-0115-202	R 306	20k ohm $\pm 5\%$ 1206 SMD	569-0115-203
R 241	2k ohm $\pm 5\%$ 2512 SMD	569-0175-202	R 307	Zero ohm $\pm 5\%$ 1206 SMD	569-0115-001
R 242	10 ohm $\pm 5\%$ 1206 SMD	569-0115-100	R 308	Zero ohm $\pm 5\%$ 1206 SMD	569-0115-001
R 243	10 ohm $\pm 5\%$ 1206 SMD	569-0115-100	R 309	Zero ohm $\pm 5\%$ 1206 SMD	569-0115-001
R 244	180 ohm $\pm 5\%$ 1206 SMD	569-0115-181	R 311	100k ohm $\pm 1\%$ 1206 SMD	569-0111-501
R 245	51 ohm $\pm 5\%$ 1206 SMD	569-0115-510	R 312	100k ohm $\pm 1\%$ 1206 SMD	569-0111-501
R 246	200 ohm $\pm 5\%$ 1206 SMD	569-0115-201	R 313	100k ohm $\pm 1\%$ 1206 SMD	569-0111-501
R 247	36 ohm $\pm 5\%$ 1206 SMD	569-0115-360	R 314	100k ohm $\pm 1\%$ 1206 SMD	569-0111-501
R 249	3.4k ohm $\pm 1\%$ 1206 SMD	569-0111-352	R 315	820 ohm $\pm 5\%$ 1206 SMD	569-0115-821
R 250	2.49k ohm $\pm 1\%$ 1206 SMD	569-0111-339			
R 251	200 ohm $\pm 5\%$ 1206 SMD	569-0115-201	RT101	8A 2.5 ohm NTC thermistor	569-3014-001
R 252	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102	RT102	8A 2.5 ohm NTC thermistor	569-3014-001
R 253	4.7k ohm $\pm 5\%$ 1206 SMD	569-0115-472			
R 254	1k ohm single turn trimmer	562-0112-102			
R 255	4.3k ohm $\pm 5\%$ 1206 SMD	569-0115-432	T 101	0.5 line freq. bias transformer	592-3041-004
R 256	2k ohm $\pm 1\%$ 1206 SMD	569-0111-330	T 103	1:200 current transformer	592-3041-002
R 257	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	T 104	1:200 current transformer	592-3041-002
R 258	36k ohm $\pm 5\%$ 1206 SMD	569-0115-363	T 105	100:1 current transformer	592-3041-005
R 259	13k ohm $\pm 5\%$ 1206 SMD	569-0115-133	T 106	1:1 transformer	592-3041-003
R 260	68 ohm $\pm 5\%$ 1206 SMD	569-0115-680	T 107	4.5:1 switch mode transformer	592-3041-001
R 261	24 ohm $\pm 5\%$ 1206 SMD	569-0115-240			
R 262	29.4k ohm $\pm 1\%$ 1206 SMD	569-0111-446			
R 263	2.49k ohm $\pm 1\%$ 1206 SMD	569-0111-339	U 102	PFC/PWN combo SOIC	544-2002-035
R 264	2k ohm $\pm 1\%$ 1206 SMD	569-0111-330	U 104	Quad 2-in AND SOIC HC08	544-3766-008
R 265	3.3k ohm $\pm 5\%$ 1206 SMD	569-0115-332	U 105	5V regulator LM78L05ABD	544-2603-039
R 266	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102	U 106	5V regulator LM78L05ABD	544-2603-039
R 267	430 ohm $\pm 5\%$ 1206 SMD	569-0115-431	U 107	Opto-isolator surface mt	544-9022-001
R 268	4.7k ohm $\pm 5\%$ 1206 SMD	569-0115-472	U 108	Opto-isolator	544-2010-005
R 269	360 ohm $\pm 5\%$ 1206 SMD	569-0115-361	U 109	Programmable TL431AID	544-2003-097
R 270	33k ohm $\pm 5\%$ 1206 SMD	569-0115-333	U 110	Quad op amp LMC660 SOIC	544-2020-020
R 271	3.3k ohm $\pm 5\%$ 1206 SMD	569-0115-332	U 111	Adj volt reg full temp LM317T	544-2003-094

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
U 112	PWM current mode ML4823	544-2002-034	RV002	Metal oxide varistor	569-3503-001
U 113	PWM current mode ML4823	544-2002-034			
U 114	5V 3A regulator power supply	544-2003-098	W 001	Wire 1 assembly	023-2000-825
U 115	Programmable TL431AID	544-2003-097	W 002	Wire 2 assembly	023-2000-826
U 116	Programmable TL431AID	544-2003-097	W 003	Wire 3 assembly	023-2000-827
U 117	Programmable TL431AID	544-2003-097	W 004	Wire 4 assembly	023-2000-828
U 118	Programmable TL431AID	544-2003-097	W 005	Wire 5 assembly	023-2000-829
U 119	Opto-isolator SOIC-8	544-2010-006			
U 120	Opto-isolator SOIC-8	544-2010-006			
U 121	Programmable volt TL431AID	544-2003-097			
U 122	Opto-isolator SOIC-8	544-2010-006			
	AC FILTER BOARD			BATTERY BACK-UP	
	PART NO. 023-2000-820			PART NO. 023-2000-830	
C 001	.22 μ F 275V AC $\pm$ 2%	510-1024-224	C 101	.01 μ F $\pm$ 10% X7R chip	510-3606-103
C 003	.0022 μ F $\pm$ 2% Y2	510-1022-222	C 103	6.8 μ F 35V tantalum SMD	510-2635-689
C 004	.0022 μ F $\pm$ 2% Y2	510-1022-222	C 104	.1 μ F $\pm$ 5% X7R 1206	510-3609-104
C 005	1 μ F 275V X2 class capacitor	510-1024-105	C 105	1000 μ F 50V aluminum elect	510-4076-102
CR001	600V 35A rectifier bridge	523-4004-025	C 106	.1 μ F $\pm$ 5% X7R 1206	510-3609-104
EP006	1/2" tubing	042-0241-557	C 107	.1 μ F $\pm$ 5% X7R 1206	510-3609-104
F 001	15A 250V ceramic body	534-0003-045	C 109	.1 μ F $\pm$ 5% X7R 1206	510-3609-104
FH001	Fuse clip	534-1007-001	C 110	6.8 μ F 35V tantalum SMD	510-2635-689
HW001	#10 shakeproof washer	596-1110-012	C 111	1000 μ F 50V aluminum elect	510-4076-102
HW002	4-40 machine panhead ZPS	575-1604-016	C 112	.1 μ F $\pm$ 5% X7R 1206	510-3609-104
HW003	9/16" ID rubber grommet	574-0002-004	C 113	1 μ F 35V tantalum SMD	510-2628-109
HW004	10-32 machine panhead ZPS	575-1610-016	C 114	.1 μ F $\pm$ 5% X7R 1206	510-3609-104
HW005	#4 shakeproof washer	596-1104-008	C 115	.1 μ F $\pm$ 5% X7R 1206	510-3609-104
HW007	Heatsink Grafoil TO-15	018-1007-055	C 118	1 μ F $\pm$ 10% 100V polyester	510-1031-105
J 001	AC power cord connector	515-0028-008	C 119	220 μ F 25V aluminum radial	510-4225-221
L 001	1 μ H 10A coil	542-5010-010	C 124	1 μ F 35V tantalum SMD	510-2628-109
L 002	4.2 μ H 10A coil	542-5010-009	C 125	.1 μ F $\pm$ 5% X7R 1206	510-3609-104
MP001	Filter bracket	017-2210-167	C 126	.1 μ F $\pm$ 5% X7R 1206	510-3609-104
PC001	PC board	035-2000-820	C 127	.1 μ F $\pm$ 5% X7R 1206	510-3606-104
R 001	1M ohm $\pm$ 5% 1/4W CF	569-0513-105	C 128	.01 μ F $\pm$ 10% X7R 1206	510-3606-103
RV001	Metal oxide varistor	569-3503-001	C 129	.1 μ F $\pm$ 10% X7R 1206	510-3606-104
			C 130	.01 μ F $\pm$ 10% X7R 1206	510-3606-103
			C 131	.1 μ F $\pm$ 10% X7R 1206	510-3606-104
			C 132	.01 μ F $\pm$ 10% X7R 1206	510-3606-103
			C 133	.1 μ F $\pm$ 10% X7R 1206	510-3606-104
			C 134	.01 μ F $\pm$ 10% X7R 1206	510-3606-103
			CR101	Red LED right angle PC mt	549-4001-035
			CR102	3A ultra-fast diode	523-1507-004
			CR103	12V zener diode	523-2016-120
			CR104	18V $\pm$ 5% zener SMT	523-2026-180
			CR105	Red LED right angle PC mt	549-4001-035
			CR109	8A 600V ultra-fast diode	523-0019-026
			CR111	Green LED rt angle PC mt	549-4001-037
			CR113	Switching diode SOT-23	523-1504-002
			CR114	3A ultra-fast diode	523-1507-004

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
CR115	Switching diode SOT-23	523-1504-002	R 104	2k ohm $\pm 5\%$ 1206 SMD	569-0115-202
CR116	3A ultra-fast diode	523-1507-004	R 105	2k ohm $\pm 5\%$ 1206 SMD	569-0115-202
CR117	13V 1W zener SMT	523-2026-130	R 106	2k ohm $\pm 5\%$ 2512 SMD	569-0175-202
CR118	18V $\pm 5\%$ zener SMT	523-2026-180	R 107	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
			R 108	2k ohm $\pm 5\%$ 1206 SMD	569-0115-202
EP100	Heat sink insulator TO-220	574-5005-060	R 109	2k ohm $\pm 5\%$ 1206 SMD	569-0115-202
EP101	Copper terminal lug	586-0007-072	R 110	2k ohm $\pm 5\%$ 1206 SMD	569-0115-202
EP102	Copper terminal lug	586-0007-072	R 111	51 ohm $\pm 5\%$ 1W 2512 SMD	569-0175-510
EP103	Copper terminal lug	586-0007-071	R 112	7.5k ohm $\pm 1\%$ 1206 SMD	569-0111-385
			R 112	1k ohm $\pm 1\%$ 1206 SMD	569-0111-301
F 101	4A resettable polyfuse	534-0020-001	R 115	470 ohm $\pm 5\%$ 1W 2512 SMD	569-0175-471
			R 116	47 ohm $\pm 5\%$ 1206 SMD	569-0115-470
HW100	4-40 machine panhead ZPS	575-1604-012	R 117	3.3k ohm $\pm 5\%$ 1206 SMD	569-0115-332
HW101	6-32 machine panhead ZPS	575-1606-008	R 118	10.5k ohm $\pm 1\%$ 1206 SMD	569-0111-403
HW102	4 x 0.04 flat washer	596-2404-008	R 119	1k ohm $\pm 1\%$ 1206 SMD	569-0111-301
HW103	6 x 0.018 int lockwasher	596-1106-009	R 120	1k ohm $\pm 1\%$ 1206 SMD	569-0111-301
HW104	#4 shakeproof washer	596-1104-008	R 121	62k ohm $\pm 5\%$ 1206 SMD	569-0115-623
HW105	10-32 machine panhead ZPS	575-1610-012	R 122	4.7k ohm $\pm 5\%$ 1206 SMD	569-0115-472
HW106	#10 shakeproof washer	596-1110-012	R 123	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
HW107	4 x 0.46 shoulder washer	596-4504-008	R 124	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
HW108	10-32 x 0.375 CPS	560-1110-012	R 125	1k ohm $\pm 1\%$ 1206 SMD	569-0111-301
HW800	Speed nut	537-0001-002	R 126	42.2k ohm $\pm 1\%$ 1206 SMD	569-0111-461
			R 127	82.5k ohm $\pm 1\%$ 1206 SMD	569-0111-489
J 100	2-pin lock receptacle	515-9032-232	R 128	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
			R 129	20k ohm $\pm 5\%$ 1206 SMD	569-0115-203
K 101	Single pole 24V relay	567-0031-001	R 130	33k ohm $\pm 5\%$ 1206 SMD	569-0115-333
			R 136	3.3k ohm $\pm 5\%$ 2512 SMD	569-0175-332
L 101	70 μ H 3A Toroid inductor	542-5010-014	R 137	3.3k ohm $\pm 5\%$ 2512 SMD	569-0175-332
			R 138	240 ohm $\pm 5\%$ 2512 SMD	569-0115-241
MP100	Bracket	017-2210-169	R 139	3.3k ohm $\pm 5\%$ 2512 SMD	569-0175-332
MP101	Terminal cover	032-0758-050	R 140	1k ohm single turn trimmer	562-0112-102
			R 141	Zero ohm $\pm 5\%$ 1206 SMD	569-0115-001
NP100	Max input 28.5V Bat/Backup	559-5861-166	R 142	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
NP800	Nameplate holder	015-0900-406	R 143	2k ohm $\pm 5\%$ 2512 SMD	569-0175-202
NP801	Nameplate	559-5861-161	R 144	15k ohm $\pm 5\%$ 1206 SMD	569-0115-153
			R 145	15k ohm $\pm 5\%$ 1206 SMD	569-0115-153
PC001	PC board	035-2000-830	R 146	3.9k ohm $\pm 5\%$ 1206 SMD	569-0115-392
			R 147	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
Q 101	PNP high current SOT-223	576-0006-026	R 148	15k ohm $\pm 5\%$ 1206 SMD	569-0115-153
Q 102	PNP high current SOT-223	576-0006-026	R 149	82k ohm $\pm 5\%$ 1206 SMD	569-0115-823
Q 103	N-channel E-MOSFET	576-0006-110	R 150	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
Q 104	PNP TO-220 ISO	576-0002-057	R 151	100 ohm $\pm 5\%$ 1206 SMD	569-0115-101
Q 105	PNP high current SOT-223	576-0006-026	R 152	75 ohm $\pm 5\%$ 1206 SMD	569-0115-750
			R 153	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104
R 101	4.7k ohm $\pm 5\%$ 1206 SMD	569-0115-472	R 154	300k ohm $\pm 5\%$ 1206 SMD	569-0115-304
R 102	330 ohm $\pm 5\%$ 1206 SMD	569-0115-331	R 155	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 103	2k ohm $\pm 5\%$ 1206 SMD	569-0115-202	R 156	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
R 157	15k ohm $\pm 1\%$ 1206 SMD	569-0111-301	C 006	47 μ F 10V tantalum SMD	510-2624-470
R 158	1k ohm $\pm 1\%$ 1206 SMD	569-0111-301	C 007	.01 μ F $\pm 10\%$ X7R 1206	510-3606-103
R 159	180k ohm $\pm 5\%$ 1206 SMD	569-0115-184	C 008	.01 μ F $\pm 10\%$ X7R 1206	510-3606-103
R 160	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	C 009	.01 μ F $\pm 10\%$ X7R 1206	510-3606-103
R 165	2k ohm $\pm 5\%$ 2512 SMD	569-0175-202	C 010	.01 μ F $\pm 10\%$ X7R 1206	510-3606-103
S 101	Toggle switch on/on rt angle	583-0006-014	C 011	.01 μ F $\pm 10\%$ X7R 1206	510-3606-103
U 101	Quad comparator 2901	544-2025-011	C 012	.01 μ F $\pm 10\%$ X7R 1206	510-3606-103
U 102	Programmable voltage reg	544-2003-097	C 013	.01 μ F $\pm 10\%$ X7R 1206	510-3606-103
U 103	Programmable voltage reg	544-2003-097	C 101	.1 μ F $\pm 10\%$ X7R 1206	510-3606-104
U 104	Dual op amp SO-8	544-2019-004	C 102	.0022 μ F $\pm 10\%$ X7R 1206	510-3606-222
U 105	Dual op amp SO-8	544-2019-004	C 103	.001 μ F $\pm 2\%$ NPO 1206	510-3616-102
U 106	Temp sensor LM-35 SO-8	544-2032-003	C 104	820 pF $\pm 2\%$ NPO 1206	510-3616-821
U 107	Full temp adjustable LM317T	544-2003-094	C 105	.001 μ F $\pm 2\%$ NPO 1206	510-3616-102
W 101	Green wire assembly	023-2000-836	C 106	100 pF $\pm 2\%$ NPO 1206	510-3616-101
W 102	Red wire assembly	023-2000-837	C 107	68 pF $\pm 5\%$ NPO 1206	510-3602-680
W 103	Black wire assembly	023-2000-838	C 108	.033 μ F $\pm 5\%$ X7R 1210	510-3610-333
W 104	Orange wire assembly	023-2000-839	C 109	.22 μ F $\pm 5\%$ X7R 1210	510-3610-224
THERMAL SENSOR BOARD			C 110	.033 μ F $\pm 5\%$ X7R 1210	510-3610-333
PART NO. 023-2000-840			C 111	.068 μ F $\pm 5\%$ X7R 1206	510-3609-683
A 001	Thermal sensor board assem	023-2000-841	C 112	.022 μ F $\pm 5\%$ X7R 1206	510-3609-223
C 001	.1 μ F 10% X7R chip	510-3606-104	C 113	2200 pF $\pm 2\%$ NPO 1206	510-3616-222
J 001	48 mil edge clip, short	515-9034-004	C 114	4700 pF $\pm 2\%$ NPO 1206	510-3616-472
J 002	48 mil edge clip, short	515-9034-004	C 115	.047 μ F $\pm 5\%$ X7R 1206	510-3609-473
J 003	48 mil edge clip, short	515-9034-004	C 116	.1 μ F $\pm 5\%$ X7R 1206	510-3609-104
PC001	Thermal sensor board	035-2000-840	C 117	.022 μ F $\pm 5\%$ X7R 1206	510-3609-223
U 001	Temp sensor LM-35 SO-8	544-2032-003	C 118	6800 pF $\pm 2\%$ NPO 1206	510-3617-682
THIRD PARTY INTERFACE CARD			C 119	.068 μ F $\pm 5\%$ X7R 1206	510-3609-683
PART NO. 023-2000-390			C 120	.1 μ F $\pm 5\%$ X7R 1206	510-3609-104
C 001	10 pF $\pm 5\%$ NPO 1206	510-3602-100	C 121	.022 μ F $\pm 5\%$ X7R 1206	510-3609-223
C 002	10 pF $\pm 5\%$ NPO 1206	510-3602-100	C 122	.022 μ F $\pm 5\%$ X7R 1206	510-3609-223
C 003	15 μ F tantalum SMD	510-2626-150	C 123	.01 μ F $\pm 5\%$ X7R 1206	510-3609-103
C 004	.01 μ F $\pm 10\%$ X7R 1206	510-3606-103	C 124	.1 μ F $\pm 5\%$ X7R 1206	510-3609-104
C 005	10 μ F tantalum SMD	510-2625-100	C 125	100 pF $\pm 5\%$ NPO 1206	510-3602-101
			C 126	100 pF $\pm 5\%$ NPO 1206	510-3602-101
			C 127	100 pF $\pm 5\%$ NPO 1206	510-3602-101
			C 128	.001 μ F $\pm 5\%$ NPO 1206	510-3602-102
			C 129	.01 μ F $\pm 5\%$ X7R 1206	510-3609-103
			C 130	.01 μ F $\pm 5\%$ X7R 1206	510-3609-103
			C 131	.1 μ F $\pm 5\%$ X7R 1206	510-3609-104
			C 132	.1 μ F $\pm 5\%$ X7R 1206	510-3609-104
			C 133	1 μ F 16V tantalum SMD	510-2625-109
			C 134	.022 μ F $\pm 5\%$ X7R 1206	510-3609-223
			C 135	.01 μ F $\pm 5\%$ X7R 1206	510-3609-103
			C 136	.047 μ F $\pm 5\%$ X7R 1206	510-3609-473
			C 137	.0068 μ F $\pm 10\%$ X7R 1206	510-3606-682
			C 138	15 μ F 20V SMD tantalum	510-2626-150
			C 139	15 μ F 20V SMD tantalum	510-2626-150

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
C 140	.001 μ F $\pm$ 2% NPO 1206	510-3616-102	C 198	.01 μ F $\pm$ 10% X7R 1206	510-3606-103
C 141	220 μ F 25V aluminum axial	510-4325-221	C 199	.01 μ F $\pm$ 10% X7R 1206	510-3606-103
C 142	10 μ F 16V tantalum SMD	510-2625-100	C 201	.1 μ F $\pm$ 10% X7R 1206	510-3606-104
C 143	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 202	.1 μ F $\pm$ 10% X7R 1206	510-3606-104
C 144	15 μ F 20V SMD tantalum	510-2626-150	C 203	.1 μ F $\pm$ 10% X7R 1206	510-3606-104
C 145	.1 μ F $\pm$ 10% X7R 1206	510-3606-104	C 204	5600 pF $\pm$ 2 NPO 1210	510-3617-562
C 146	.1 μ F $\pm$ 10% X7R 1206	510-3606-104	C 205	4700 pF $\pm$ 2 NPO 1206	510-3616-472
C 147	220 μ F 25V aluminum axial	510-4325-221	C 206	3300 pF $\pm$ 2 NPO 1206	510-3616-332
C 148	.1 μ F $\pm$ 10% X7R 1206	510-3606-104	C 207	3900 pF $\pm$ 2 NPO 1206	510-3616-392
C 149	470 μ F 16V axial low temp	510-4316-471	C 208	.0047 μ F $\pm$ 5% X7R 1206	510-3609-472
C 150	360 pF $\pm$ 5% NPO 1206 chip	510-3602-361	C 209	470 pF $\pm$ 2% NPO 1206	510-3616-471
C 151	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	C 210	470 pF $\pm$ 2% NPO 1206	510-3616-471
C 152	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	C 211	3300 pF $\pm$ 2% NPO 1206	510-3616-332
C 153	10 μ F 16V tantalum SMD	510-2625-100	C 212	680 pF $\pm$ 2% NPO 1206	510-3616-681
C 154	.1 μ F $\pm$ 10% X7R 1206	510-3606-104	C 213	.01 μ F $\pm$ 2 NPO 1210	510-3617-103
C 155	100 pF $\pm$ 2% NPO 1206	510-3616-101	C 214	680 pF $\pm$ 2% NPO 1206	510-3616-681
C 156	100 pF $\pm$ 2% NPO 1206	510-3616-101	C 215	100 μ F 25V aluminum axial	510-4325-101
C 157	20 pF $\pm$ 5% NPO 1206	510-3602-200	C 216	100 μ F 25V aluminum axial	510-4325-101
C 158	.1 μ F $\pm$ 5% X7R 1206	510-3609-104	C 217	100 pF $\pm$ 5% NPO 1206 chip	510-3602-101
C 170	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 218	360 pF $\pm$ 5% NPO 1206 chip	510-3602-361
C 171	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 219	.047 μ F $\pm$ 5% X7R 1206	510-3609-473
C 172	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 220	.1 μ F $\pm$ 10% X7R 1206	510-3606-104
C 173	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 221	100 pF $\pm$ 2% NPO 1206 chip	510-3616-101
C 174	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 222	.047 μ F $\pm$ 5% X7R 1206	510-3609-473
C 175	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 223	390 pF $\pm$ 5% NPO 1206 chip	510-3602-391
C 176	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 224	.22 μ F $\pm$ 5% X7R 1210	510-3610-224
C 177	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 225	.1 μ F $\pm$ 10% X7R 1206	510-3606-104
C 178	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 226	.1 μ F $\pm$ 10% X7R 1206	510-3606-104
C 179	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 227	100 pF $\pm$ 2% NPO 1206	510-3616-101
C 180	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 228	100 pF $\pm$ 2% NPO 1206	510-3616-101
C 181	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 229	100 pF $\pm$ 2% NPO 1206	510-3616-101
C 182	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 230	.01 μ F $\pm$ 2 NPO 1210	510-3617-103
C 183	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 231	4700 pF $\pm$ 2% NPO 1206	510-3616-472
C 184	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 232	4700 pF $\pm$ 2% NPO 1206	510-3616-472
C 185	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 233	.022 μ F $\pm$ 5% X7R 1206	510-3609-223
C 186	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 234	.01 μ F $\pm$ 10% X7R 1206	510-3606-103
C 187	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 235	.01 μ F $\pm$ 10% X7R 1206	510-3606-103
C 188	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 251	.01 μ F $\pm$ 10% X7R 1206	510-3606-103
C 189	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 252	.01 μ F $\pm$ 10% X7R 1206	510-3606-103
C 190	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 253	.01 μ F $\pm$ 10% X7R 1206	510-3606-103
C 191	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 254	.01 μ F $\pm$ 10% X7R 1206	510-3606-103
C 192	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 256	.01 μ F $\pm$ 10% X7R 1206	510-3606-103
C 193	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 258	1 μ F 16V tantalum SMD	510-2625-109
C 194	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 259	47 μ F 10V tantalum SMD	510-2624-470
C 195	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 260	47 μ F 10V tantalum SMD	510-2624-470
C 196	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 261	.01 μ F $\pm$ 10% X7R 1206	510-3606-103
C 197	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	C 262	.01 μ F $\pm$ 10% X7R 1206	510-3606-103

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
C 263	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	CR203	2.4V 1W zener	523-2505-249
C 264	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	CR204	Dual switch diode SOT-23	523-1504-023
C 265	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	CR205	Dual switch diode SOT-23	523-1504-023
C 266	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	CR206	3.9V zener SOT-23	523-2016-399
C 267	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	CR207	3.9V zener SOT-23	523-2016-399
C 268	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	CR208	3.9V zener SOT-23	523-2016-399
C 270	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	CR209	3.9V zener SOT-23	523-2016-399
C 271	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	CR210	3.9V zener SOT-23	523-2016-399
C 272	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	CR211	3.9V zener SOT-23	523-2016-399
C 273	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	CR212	Diode SOT-23 BZXC15	523-2016-150
C 275	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	CR213	Diode SOT-23 BZXC15	523-2016-150
C 276	47 μ F 10V SMD tantalum	510-2624-470	CR214	Diode SOT-23 BZXC15	523-2016-150
C 277	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	CR215	Diode SOT-23 BZXC15	523-2016-150
C 278	47 μ F 10V SMD tantalum	510-2624-470	CR216	Diode SOT-23 BZXC15	523-2016-150
C 279	47 μ F 10V SMD tantalum	510-2624-470	CR217	Diode SOT-23 BZXC15	523-2016-150
C 280	.01 μ F $\pm$ 10% X7R 1206	510-3606-103			
C 281	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	DS001	7-segment display 0.3" green	549-4002-020
C 282	.01 μ F $\pm$ 10% X7R 1206	510-3606-103			
C 283	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	HW100	2-hole crystal pin insulator	018-1080-001
C 284	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	HW101	Card injector/extractor nylon	537-9057-020
C 287	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	HW102	Snap rivet 0.142 dia	574-9015-050
C 288	47 μ F 10V SMD tantalum	510-2624-470			
C 289	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	J 001	8-cond modular PC mt jack	515-2006-040
C 290	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	J 006	3-pin single inline header	515-7100-003
C 291	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	J 007	2-pin single inline header	515-7100-002
C 292	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	J 008	2-pin single inline header	515-7100-002
C 293	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	J 010	2-pos shorting socket	515-5010-001
C 294	.01 μ F $\pm$ 10% X7R 1206	510-3606-103	J 100	Horiz tip jack 0.8 green	105-2204-105
C 295	15 μ F 20V tantalum SMD	510-2626-150	J 101	Speaker jack	515-2002-012
			J 102	3.6 mm enclosed jack	515-2001-011
CR001	Green LED subminiature	549-4001-122	J 103	Horiz tip jack 0.8 black	105-2203-101
CR002	Yellow LED subminiature	549-4001-121	J 104	3.6 mm enclosed jack	515-2001-011
CR003	Red LED subminiature	549-4001-120	J 105	2-pin single inline header	515-7100-002
CR004	Red LED subminiature	549-4001-120	J 106	2-pin single inline header	515-7100-002
CR005	Yellow LED subminiature	549-4001-121	J 201	2-pin single inline header	515-7100-002
CR101	Dual switch diode SOT-23	523-1504-023	MP010	Control knob	032-0792-010
CR102	Dual switch diode SOT-23	523-1504-023			
CR103	4.3V zener SOT-23	523-2016-439	P 006	2-pos shorting socket	515-5010-001
CR104	UHF/VHF band switch SOT	523-1504-012	P 007	2-pos shorting socket	515-5010-001
CR105	UHF/VHF band switch SOT	523-1504-012	P 008	2-pos shorting socket	515-5010-001
CR106	UHF/VHF band switch SOT	523-1504-012	P 010	12-pin header	515-7101-406
CR107	Switching diode SOT-23	523-1504-002	P 100	32-pin DIN right angle male	515-7082-102
CR108	Switching diode SOT-23	523-1504-002	P 101	64-pin DIN right angle male	515-7082-101
CR109	5.1V zener SOT-23	523-2016-519	P 105	2-pos shorting socket	515-5010-001
CR110	5.1V zener SOT-23	523-2016-519	P 106	2-pos shorting socket	515-5010-001
CR201	Dual switch diode SOT-23	523-1504-023	P 201	2-pos shorting socket	515-5010-001
CR202	2.4V 1W zener	523-2505-249			

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
PC001	PC board	035-2000-390	R 108	390k ohm $\pm 5\%$ 1206 SMD	569-0115-394
Q 002	PNP switching	576-0003-612	R 109	15k ohm $\pm 1\%$ 1206 SMD	569-0111-418
Q 003	Si NPN gen purp sw/amp	576-0001-300	R 110	100 ohm $\pm 1\%$ 1206 SMD	569-0111-201
Q 101	NPN 80V SOT-23	576-0003-616	R 111	1.07M ohm $\pm 1\%$ 1206 SMD	569-0111-604
Q 102	NPN 80V SOT-23	576-0003-616	R 112	110 ohm $\pm 1\%$ 1206 SMD	569-0111-205
Q 201	Si PNP SOT-23	576-0003-657	R 113	1.07M ohm $\pm 1\%$ 1206 SMD	569-0111-604
Q 202	Si NPN SOT-23	576-0003-658	R 114	110 ohm $\pm 1\%$ 1206 SMD	569-0111-205
R 001	Zero ohm $\pm 5\%$ 1206 SMD	569-0115-001	R 115	1.07M ohm $\pm 1\%$ 1206 SMD	569-0111-604
R 002	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 116	18.2k ohm $\pm 1\%$ 1206 SMD	569-0111-426
R 003	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 117	47k ohm $\pm 5\%$ 1206 SMD	569-0115-473
R 004	2.2k ohm $\pm 5\%$ 1206 SMD	569-0115-222	R 118	6.2k ohm $\pm 5\%$ 1206 SMD	569-0115-622
R 005	2.2k ohm $\pm 5\%$ 1206 SMD	569-0115-222	R 119	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 006	2.2k ohm $\pm 5\%$ 1206 SMD	569-0115-222	R 120	18k ohm $\pm 5\%$ 1206 SMD	569-0115-183
R 007	2.2k ohm $\pm 5\%$ 1206 SMD	569-0115-222	R 121	150k ohm $\pm 5\%$ 1206 SMD	569-0115-154
R 008	2.2k ohm $\pm 5\%$ 1206 SMD	569-0115-222	R 122	5.1k ohm $\pm 5\%$ 1206 SMD	569-0115-512
R 009	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 123	100k ohm trim pot	562-0110-104
R 010	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 124	47k ohm $\pm 5\%$ 1206 SMD	569-0115-473
R 011	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 125	1.5k ohm $\pm 5\%$ 1206 SMD	569-0115-152
R 012	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 126	6.2k ohm $\pm 5\%$ 1206 SMD	569-0115-622
R 013	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104	R 127	12k ohm $\pm 5\%$ 1206 SMD	569-0115-123
R 014	4.7k ohm $\pm 5\%$ 1206 SMD	569-0115-472	R 128	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 015	4.7k ohm $\pm 5\%$ 1206 SMD	569-0115-472	R 129	47k ohm $\pm 5\%$ 1206 SMD	569-0115-473
R 016	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 130	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 017	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 131	47k ohm $\pm 5\%$ 1206 SMD	569-0115-473
R 018	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 132	330k ohm $\pm 5\%$ 1206 SMD	569-0115-334
R 019	240 ohm $\pm 5\%$ 1206 SMD	569-0115-241	R 133	1M ohm $\pm 5\%$ 1206 SMD	569-0115-105
R 020	27 ohm $\pm 5\%$ 1206 SMD	569-0115-270	R 134	3.9k ohm $\pm 5\%$ 1206 SMD	569-0115-392
R 021	1.2k ohm $\pm 5\%$ 1206 SMD	569-0115-122	R 135	2.4k ohm $\pm 5\%$ 1206 SMD	569-0115-242
R 022	200 ohm $\pm 5\%$ 1206 SMD	569-0115-201	R 136	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 023	1.2k ohm $\pm 5\%$ 1206 SMD	569-0115-122	R 137	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 024	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 138	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104
R 025	100 ohm $\pm 5\%$ 1206 SMD	569-0115-101	R 139	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104
R 026	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 140	470k ohm $\pm 5\%$ 1206 SMD	569-0115-474
R 027	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 141	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 028	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 142	3.9k ohm $\pm 5\%$ 1206 SMD	569-0115-392
R 029	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 143	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 030	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 144	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 031	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 145	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 101	29.4k ohm $\pm 1\%$ 1206 SMD	569-0111-446	R 146	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104
R 102	54.9k ohm $\pm 1\%$ 1206 SMD	569-0111-472	R 147	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104
R 103	1M ohm $\pm 5\%$ 1206 SMD	569-0115-105	R 148	47k ohm $\pm 5\%$ 1206 SMD	569-0115-473
R 104	147k ohm $\pm 1\%$ 1206 SMD	569-0111-517	R 149	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 105	69.8k ohm $\pm 1\%$ 1206 SMD	569-0111-482	R 150	7.5k ohm $\pm 5\%$ 1206 SMD	569-0115-752
R 106	43k ohm $\pm 5\%$ 1206 SMD	569-0115-433	R 151	56k ohm $\pm 5\%$ 1206 SMD	569-0115-563
R 107	100k ohm trim pot	562-0110-104	R 152	56k ohm $\pm 5\%$ 1206 SMD	569-0115-563
			R 153	51k ohm $\pm 5\%$ 1206 SMD	569-0115-513
			R 154	100k ohm trim pot	562-0110-104

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
R 155	270k ohm $\pm 5\%$ 1206 SMD	569-0115-274	R 211	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 156	47k ohm $\pm 5\%$ 1206 SMD	569-0115-473	R 212	43k ohm $\pm 5\%$ 1206 SMD	569-0115-433
R 157	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104	R 213	43k ohm $\pm 5\%$ 1206 SMD	569-0115-433
R 158	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104	R 214	22k ohm $\pm 5\%$ 1206 SMD	569-0115-223
R 159	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 215	43.2k ohm $\pm 1\%$ 1206 SMD	569-0111-462
R 160	5.1k ohm $\pm 5\%$ 1206 SMD	569-0115-512	R 216	86.6k ohm $\pm 1\%$ 1206 SMD	569-0111-491
R 161	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102	R 217	25.5k ohm $\pm 1\%$ 1206 SMD	569-0111-440
R 162	18k ohm $\pm 5\%$ 1206 SMD	569-0115-183	R 218	909k ohm $\pm 1\%$ 1206 SMD	569-0111-593
R 163	47k ohm $\pm 5\%$ 1206 SMD	569-0115-473	R 219	3.3k ohm $\pm 5\%$ 1206 SMD	569-0115-332
R 164	10k ohm volume/audio switch	562-0018-044	R 220	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 165	39 ohm $\pm 5\%$ 1206 SMD	569-0115-390	R 221	150k ohm $\pm 5\%$ 1206 SMD	569-0115-154
R 166	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 222	150k ohm $\pm 5\%$ 1206 SMD	569-0115-154
R 167	220 ohm $\pm 5\%$ 1206 SMD	569-0115-221	R 223	150k ohm $\pm 5\%$ 1206 SMD	569-0115-154
R 168	2.2 ohm $\pm 5\%$ 1206 SMD	569-0115-229	R 224	121k ohm $\pm 1\%$ 1206 SMD	569-0111-509
R 169	100 ohm $\pm 5\%$ 1/4W CF	569-0513-101	R 225	121k ohm $\pm 1\%$ 1206 SMD	569-0111-509
R 170	100 ohm $\pm 5\%$ 1/4W CF	569-0513-101	R 226	35.7k ohm $\pm 1\%$ 1206 SMD	569-0111-454
R 171	36k ohm $\pm 5\%$ 1206 SMD	569-0115-363	R 227	27.4k ohm $\pm 1\%$ 1206 SMD	569-0111-443
R 172	100k ohm trim pot	562-0110-104	R 228	22.6k ohm $\pm 1\%$ 1206 SMD	569-0111-435
R 173	36k ohm $\pm 5\%$ 1206 SMD	569-0115-363	R 229	17.4k ohm $\pm 1\%$ 1206 SMD	569-0111-424
R 174	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 230	180k ohm $\pm 5\%$ 1206 SMD	569-0115-184
R 175	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	R 232	39k ohm $\pm 5\%$ 1206 SMD	569-0115-393
R 176	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104	R 233	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 177	47k ohm $\pm 5\%$ 1206 SMD	569-0115-473	R 234	1.2k ohm $\pm 5\%$ 1206 SMD	569-0115-122
R 178	47k ohm $\pm 5\%$ 1206 SMD	569-0115-473	R 235	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 179	47k ohm $\pm 5\%$ 1206 SMD	569-0115-473	R 236	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104
R 180	47k ohm $\pm 5\%$ 1206 SMD	569-0115-473	R 237	100k ohm trim pot	562-0110-104
R 181	10k ohm $\pm 1\%$ 1206 SMD	569-0111-401	R 238	82k ohm $\pm 5\%$ 1206 SMD	569-0115-823
R 182	10k ohm $\pm 1\%$ 1206 SMD	569-0111-401	R 239	82k ohm $\pm 5\%$ 1206 SMD	569-0115-823
R 183	10k ohm $\pm 1\%$ 1206 SMD	569-0111-401	R 240	82k ohm $\pm 5\%$ 1206 SMD	569-0115-823
R 184	10k ohm $\pm 1\%$ 1206 SMD	569-0111-401	R 241	82k ohm $\pm 5\%$ 1206 SMD	569-0115-823
R 185	4.32k ohm $\pm 1\%$ 1206 SMD	569-0111-362	R 242	36k ohm $\pm 5\%$ 1206 SMD	569-0115-363
R 186	10k ohm $\pm 1\%$ 1206 SMD	569-0115-401	R 243	18k ohm $\pm 5\%$ 1206 SMD	569-0115-183
R 187	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102	R 244	82k ohm $\pm 5\%$ 1206 SMD	569-0115-823
R 188	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102	R 245	82k ohm $\pm 5\%$ 1206 SMD	569-0115-823
R 189	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102	R 246	100 ohm $\pm 5\%$ 1206 SMD	569-0115-101
R 190	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102	R 258	430k ohm $\pm 5\%$ 1206 SMD	569-0115-434
R 191	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102	R 259	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 201	36k ohm $\pm 5\%$ 1206 SMD	569-0115-363	R 260	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103
R 202	100k ohm trim pot	562-0110-104	R 261	240k ohm $\pm 5\%$ 1206 SMD	569-0115-244
R 203	36k ohm $\pm 5\%$ 1206 SMD	569-0115-363	RT100	10k ohm chip thermistor	569-3013-007
R 204	2.2k ohm $\pm 5\%$ 1206 SMD	569-0115-222	S 001	SPST momentary	583-4005-002
R 205	6.8k ohm $\pm 5\%$ 1206 SMD	569-0115-682	U 001	BCD-7 latch MC14495L	544-3014-495
R 206	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	U 002	Micro monitor 50-8 DS1232	544-2003-085
R 207	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	U 003	1M flash EPROM DIP-28	544-5001-201
R 208	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103			
R 209	16k ohm $\pm 5\%$ 1206 SMD	569-0115-163			
R 210	180k ohm $\pm 5\%$ 1206 SMD	569-0115-184			

[illegible]

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
C 536	.1 μ F $\pm$ 10% X7R 1210	510-3607-104	J 505	4-pin single inline header	515-7100-004
C 537	.1 μ F $\pm$ 10% X7R 1210	510-3607-104	K 500	12V SPDT 1A relay submin	567-2002-021
C 538	.01 μ F $\pm$ 10% X7R chip	510-3606-103	K 501	12V SPDT 1A relay submin	567-2002-021
C 539	.01 μ F $\pm$ 10% X7R chip	510-3606-103	K 502	12V SPDT 1A relay submin	567-2002-021
CR500	Red LED submin radial	549-4001-120	K 503	12V SPDT 1A relay submin	567-2002-021
CR501	Green LED submin radial	549-4001-122	L 501	3 μ H filter choke PC mount	542-5007-031
CR502	Yellow LED submin radial	549-4001-121	P 500	64-pin DIN male right angle	515-7082-101
CR503	Green LED submin radial	549-4001-122	P 501	32-pin DIN male right angle	515-7082-102
CR504	Green LED submin radial	549-4001-122	P 503	2-pos shorting socket	515-5010-001
CR505	Yellow LED submin radial	549-4001-121	P 504	2-pos shorting socket	515-5010-001
CR506	Dual switch diode SOT-23	523-1504-023	P 505	2-pos shorting socket	515-5010-001
CR507	Dual switch diode SOT-23	523-1504-023	PC500	PC board	035-2000-350
CR508	Dual switch diode SOT-23	523-1504-023	Q 500	Si NPN SOT-23 2N3904	576-0003-658
CR509	Dual switch diode SOT-23	523-1504-023	Q 501	Si NPN SOT-23 2N3904	576-0003-658
CR510	Dual switch diode SOT-23	523-1504-023	Q 502	Si NPN SOT-23 2N3904	576-0003-658
CR511	Dual switch diode SOT-23	523-1504-023	Q 503	Si NPN SOT-23 2N3904	576-0003-658
CR512	Dual switch diode SOT-23	523-1504-023	Q 504	NPN dig SOT-23F RN1404	576-0003-616
CR513	Dual switch diode SOT-23	523-1504-023	Q 505	NPN dig SOT-23F RN1404	576-0003-616
CR522	5.1V zener SOT-23	523-2016-519	R 500	4.7k ohm $\pm$ 5% 1206 SMD	569-0115-472
CR523	Green LED submin radial	549-4001-122	R 501	4.7k ohm $\pm$ 5% 1206 SMD	569-0115-472
CR524	Green LED submin radial	549-4001-122	R 502	430 ohm $\pm$ 5% 1/4W CF	569-0513-431
CR525	Green LED submin radial	549-4001-122	R 503	5.1k ohm $\pm$ 5% 1206 SMD	569-0115-512
CR526	200V 1.5A rectifier 1N4818	523-0013-201	R 504	1k ohm $\pm$ 5% 1206 SMD	569-0115-102
CR527	5.1V zener SOT-23	523-2016-519	R 505	2k ohm $\pm$ 5% 1206 SMD	569-0115-202
CR528	5.1V zener SOT-23	523-2016-519	R 506	1k ohm $\pm$ 5% 1206 SMD	569-0115-102
CR529	15V zener SOT-23	523-2016-150	R 507	100k ohm $\pm$ 5% 1206 SMD	569-0115-104
CR530	15V zener SOT-23	523-2016-150	R 508	10k ohm $\pm$ 1% 1206 SMD	569-0111-401
CR531	15V zener SOT-23	523-2016-150	R 509	10k ohm $\pm$ 1% 1206 SMD	569-0111-401
CR532	15V zener SOT-23	523-2016-150	R 510	10k ohm $\pm$ 5% 1206 SMD	569-0115-103
CR533	15V zener SOT-23	523-2016-150	R 511	20k ohm $\pm$ 5% 1206 SMD	569-0115-203
CR534	15V zener SOT-23	523-2016-150	R 512	10k ohm $\pm$ 5% 1206 SMD	569-0115-103
CR535	4.3V zener SOT-23	523-2016-439	R 513	10k ohm $\pm$ 5% 1206 SMD	569-0115-103
CR536	15V zener SOT-23	523-2016-150	R 514	10k ohm $\pm$ 5% 1206 SMD	569-0115-103
CR537	15V zener SOT-23	523-2016-150	R 515	1k ohm $\pm$ 5% 1206 SMD	569-0115-102
F 501	1A 250V submin fuse	534-0017-014	R 516	2.7k ohm $\pm$ 5% 1/4W CF	569-0115-272
FH501	Fuse holder	534-1017-001	R 517	2.7k ohm $\pm$ 5% 1/4W CF	569-0115-272
HW500	Card inj/ext nylon pull	537-9057-020	R 518	2.7k ohm $\pm$ 5% 1/4W CF	569-0115-272
J 500	Horizontal green tip jack .080	105-2204-105	R 519	2.7k ohm $\pm$ 5% 1/4W CF	569-0115-272
J 501	Horizontal black tip jack .080	105-2203-101	R 520	2.7k ohm $\pm$ 5% 1/4W CF	569-0115-272
J 502	Horizontal red tip jack .080	105-2202-101	R 521	4.7k ohm $\pm$ 5% 1206 SMD	569-0115-472
J 503	3-pin single inline header	515-7100-003	R 522	10k ohm $\pm$ 1% 1206 SMD	569-0111-401
J 504	3-pin single inline header	515-7100-003			

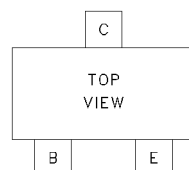
SYMBOL NUMBER	DESCRIPTION	PART NUMBER	SYMBOL NUMBER	DESCRIPTION	PART NUMBER
R 523	10k ohm $\pm 1\%$ 1206 SMD	569-0111-401	R 573	5.1k ohm $\pm 5\%$ 1206 SMD	569-0115-512
R 524	4.7k ohm $\pm 5\%$ 1206 SMD	569-0115-472	R 574	51k ohm $\pm 5\%$ 1206 SMD	569-0115-513
R 525	10k ohm $\pm 1\%$ 1206 SMD	569-0111-401	R 575	82k ohm $\pm 5\%$ 1206 SMD	569-0115-823
R 526	10k ohm $\pm 1\%$ 1206 SMD	569-0111-401	R 576	2.7k ohm $\pm 5\%$ 1206 SMD	569-0115-272
R 527	4.7k ohm $\pm 5\%$ 1206 SMD	569-0115-472	R 577	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102
R 528	1.2k ohm $\pm 5\%$ 1206 SMD	569-0115-122	R 578	2.7k ohm $\pm 5\%$ 1206 SMD	569-0115-272
R 529	4.7k ohm $\pm 5\%$ 1206 SMD	569-0115-472	S 500	4-pos recessed DIP switch	583-5002-104
R 530	10k ohm $\pm 1\%$ 1206 SMD	569-0111-401	S 501	4-pos recessed DIP switch	583-5002-104
R 531	4.32k ohm $\pm 1\%$ 1206 SMD	569-0111-362	S 502	4-pos recessed DIP switch	583-5002-104
R 532	4.7k ohm $\pm 5\%$ 1206 SMD	569-0115-472	S 503	4-pos recessed DIP switch	583-5002-104
R 533	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102	S 508	Toggle switch on/on rt angle	583-0006-014
R 534	1M ohm $\pm 5\%$ 1206 SMD	569-0115-105	U 500	1 of 16 demux SOIC 74HC154	544-3766-154
R 535	4.7k ohm $\pm 5\%$ 1206 SMD	569-0115-472	U 501	1 of 16 demux SOIC 74HC154	544-3766-154
R 536	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	U 503	D flip flop SOIC 74HC574	544-3766-574
R 538	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104	U 504	D flip flop SOIC 74HC574	544-3766-574
R 539	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104	U 505	D flip flop SOIC 74HC574	544-3766-574
R 540	100k ohm $\pm 5\%$ 1206 SMD	569-0115-104	U 506	8-bit A/D converter	544-2031-001
R 541	200 ohm $\pm 5\%$ 1206 SMD	569-0115-201	U 507	Bilateral switch SOIC 4066B	544-3016-066
R 542	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	U 508	Hex open drain buffer SO-14	544-3716-906
R 543	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	U 509	Quad op amp SOIC	544-2020-008
R 544	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102	U 510	NPN out opto isolator 4N35	544-2010-001
R 545	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	U 511	NPN out opto isolator 4N35	544-2010-001
R 546	430 ohm $\pm 5\%$ 1/4W CF	569-0513-431	U 512	NPN out opto isolator 4N35	544-2010-001
R 547	430 ohm $\pm 5\%$ 1/4W CF	569-0513-431	U 513	Bilateral switch SOIC 4066B	544-3016-066
R 548	430 ohm $\pm 5\%$ 1/4W CF	569-0513-431	U 514	Dual op amp SOIC LM2904	544-2019-004
R 549	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	U 515	NPN out opto isolator 4N35	544-2010-001
R 550	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	U 516	NPN out opto isolator 4N35	544-2010-001
R 551	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	U 517	Transparent latch SOIC	544-3766-573
R 552	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	U 518	D flip flop SOIC 74HC574	544-3766-574
R 553	1.2k ohm $\pm 5\%$ 1206 SMD	569-0115-122	U 519	Low pwr FM IF SO-16	544-2026-008
R 554	1.2k ohm $\pm 5\%$ 1206 SMD	569-0115-122	U 520	NPN out opto isolator 4N35	544-2010-001
R 555	1.2k ohm $\pm 5\%$ 1206 SMD	569-0115-122	U 521	Transparent latch SOIC	544-3766-573
R 556	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	U 522	+12V regulator TO-92 78L12	544-2003-032
R 557	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	U 523	+8V regulator 78M08	544-2003-081
R 558	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	Z 500	EMI suppression filter	532-3003-002
R 559	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103	Z 501	EMI suppression filter	532-3003-002
R 560	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103			
R 561	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103			
R 562	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103			
R 563	3.9k ohm $\pm 5\%$ 1206 SMD	569-0115-392			
R 564	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102			
R 567	200 ohm $\pm 5\%$ 1206 SMD	569-0115-201			
R 568	200 ohm $\pm 5\%$ 1206 SMD	569-0115-201			
R 569	200 ohm $\pm 5\%$ 1206 SMD	569-0115-201			
R 570	1k ohm $\pm 5\%$ 1206 SMD	569-0115-102			
R 571	10k ohm $\pm 5\%$ 1206 SMD	569-0115-103			
R 572	16k ohm $\pm 5\%$ 1206 SMD	569-0115-163			

PARTS LIST

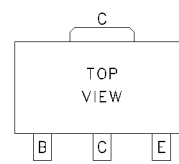
SECTION 10 SCHEMATICS AND COMPONENT LAYOUTS

TRANSISTORS

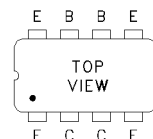
TRANSISTORS		
Part Number	Basing Diagram	Identification
576-0001-300	1	1R
576-0002-603	2	
576-0003-600	1	2X
576-0003-602	1	R2/R3
576-0003-604	3	3604
576-0003-612	1	2T
576-0003-636	1	R25
576-0003-657	1	2A
576-0003-658	1	1A
576-0004-098	3	
576-0004-820	4	
576-0004-821	4	
576-0006-109	5	
DIODES		
523-1504-002	6	5A
523-1504-012	6	2A
523-1504-015	6	4E
523-1504-016	6	5H
523-1504-023	-	A7
523-2016-180	6	Y7
523-2016-479	6	8E/Z1
523-2016-519	6	8F/Z2
523-2016-629	6	8J/Z4
523-2016-919	6	8P/Z8
523-5004-002		



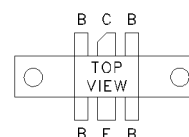
1



2



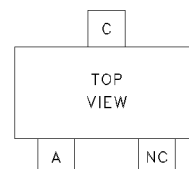
3



4

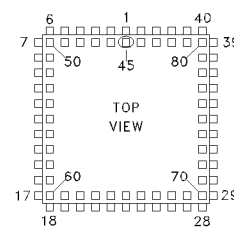
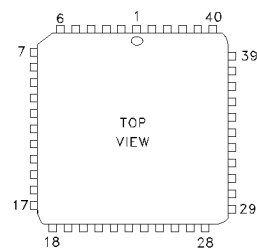
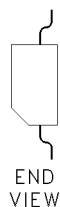
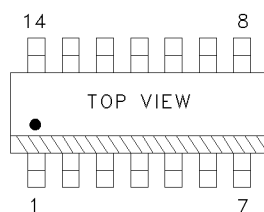
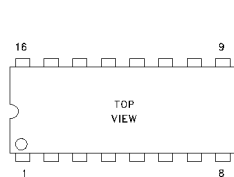


5



6

INTEGRATED CIRCUITS



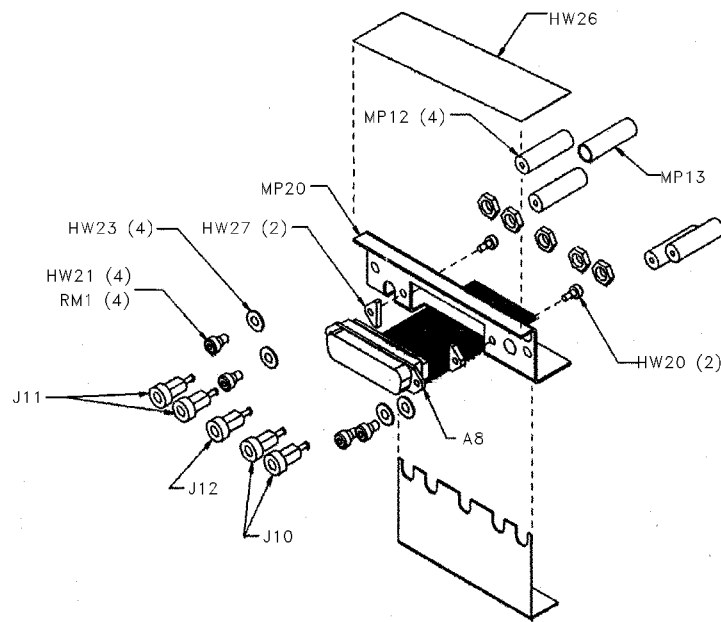


Figure 10-1 RF MODULE INTERFACE CONNECTOR

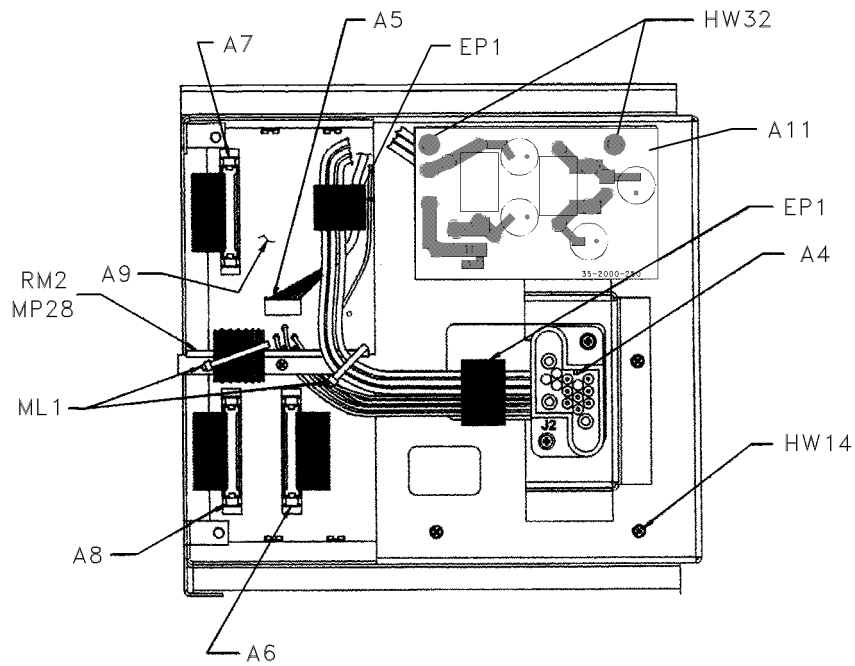
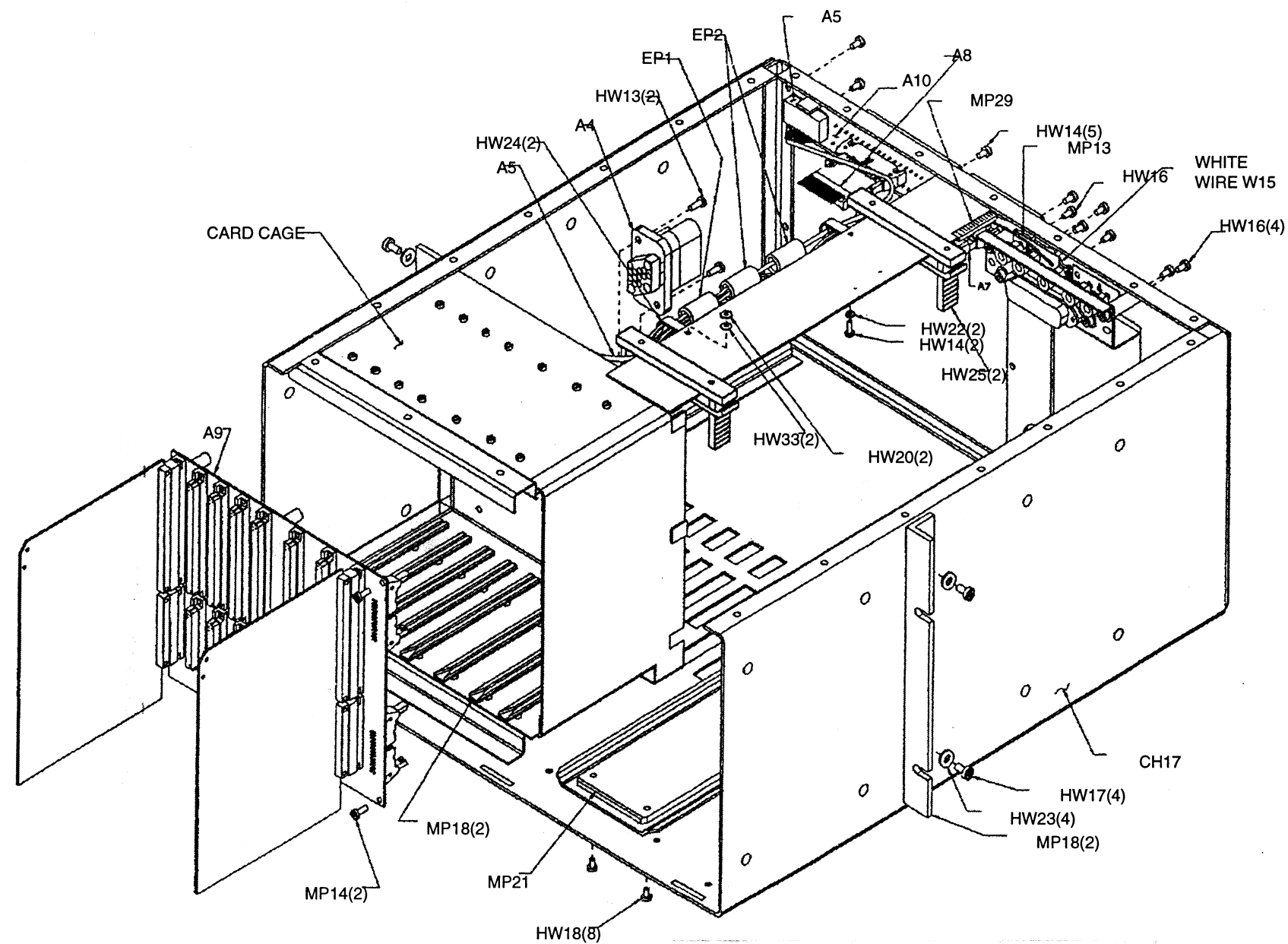
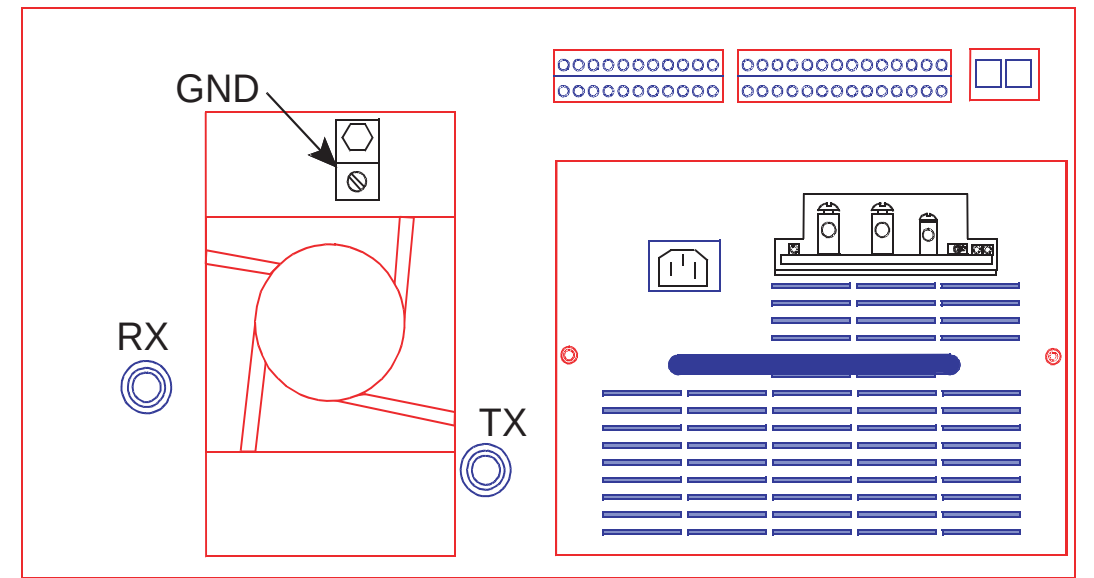


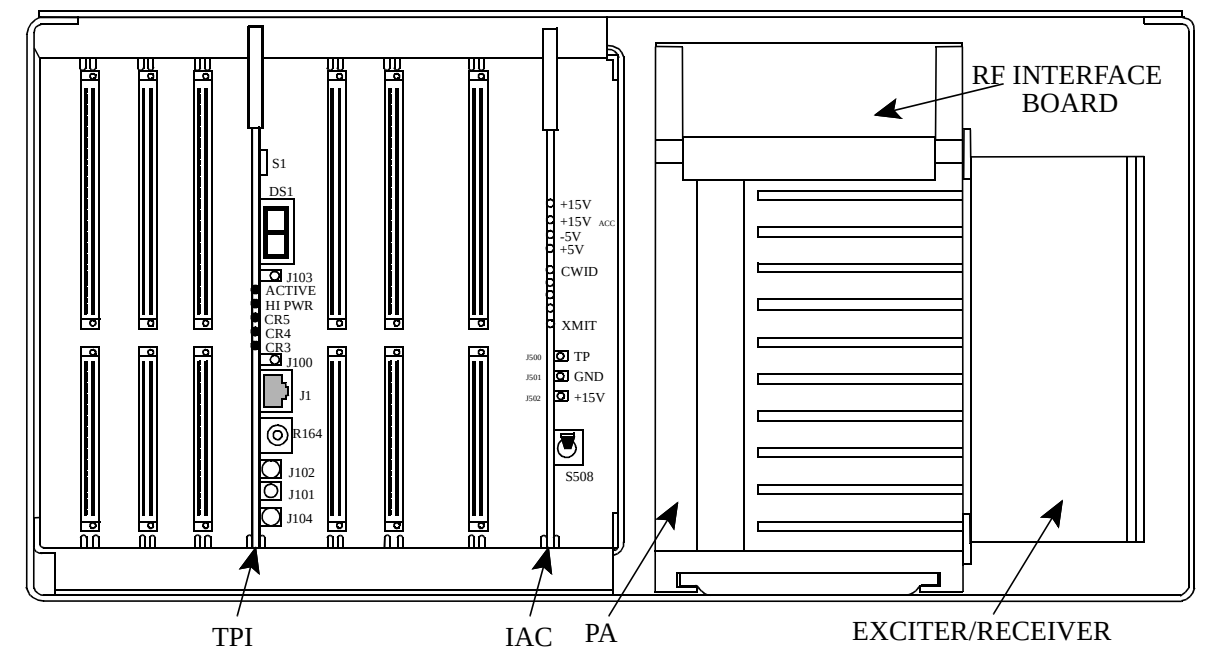
Figure 10-2 BACKPLANE CABLE CONNECTIONS



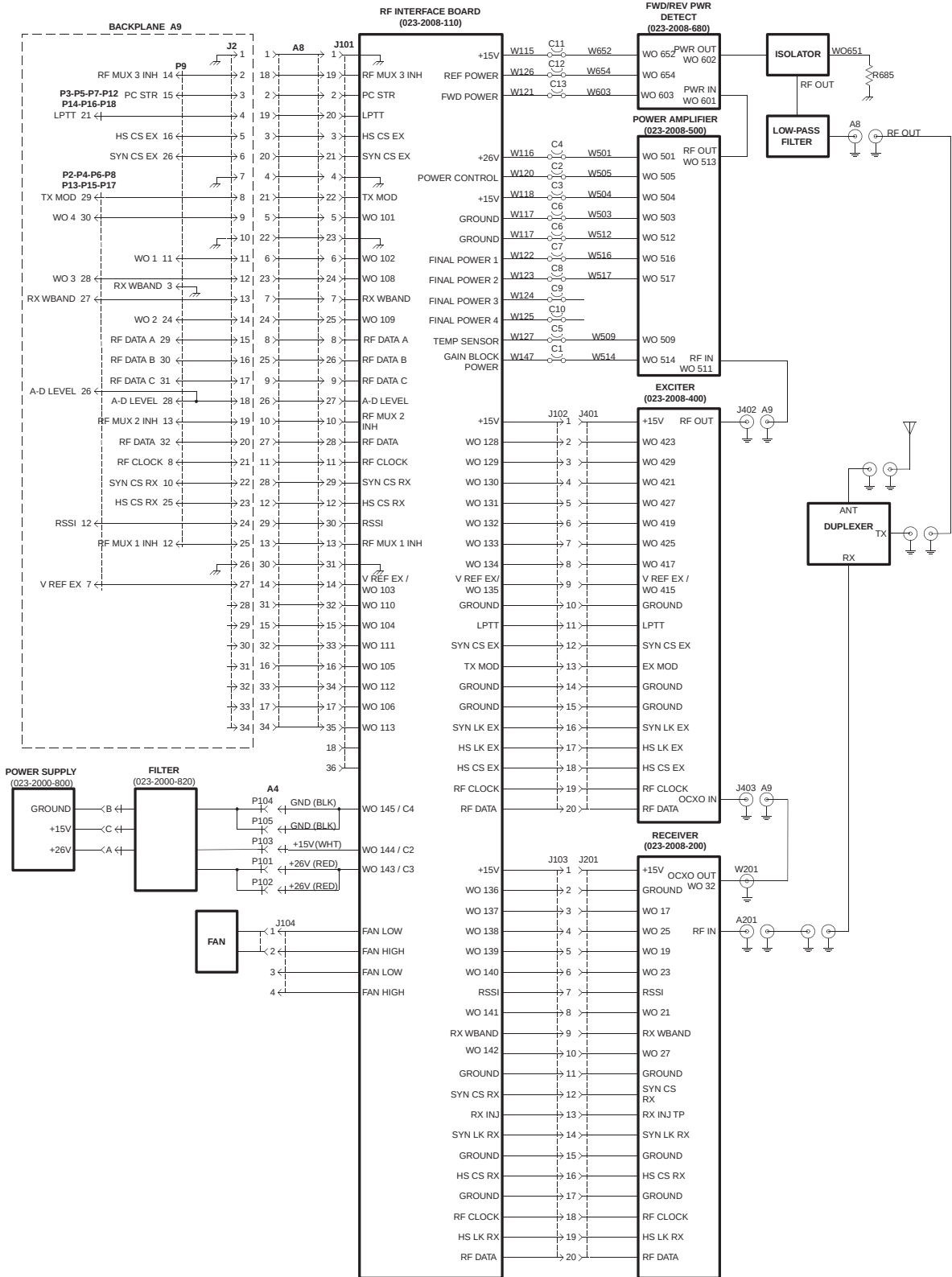
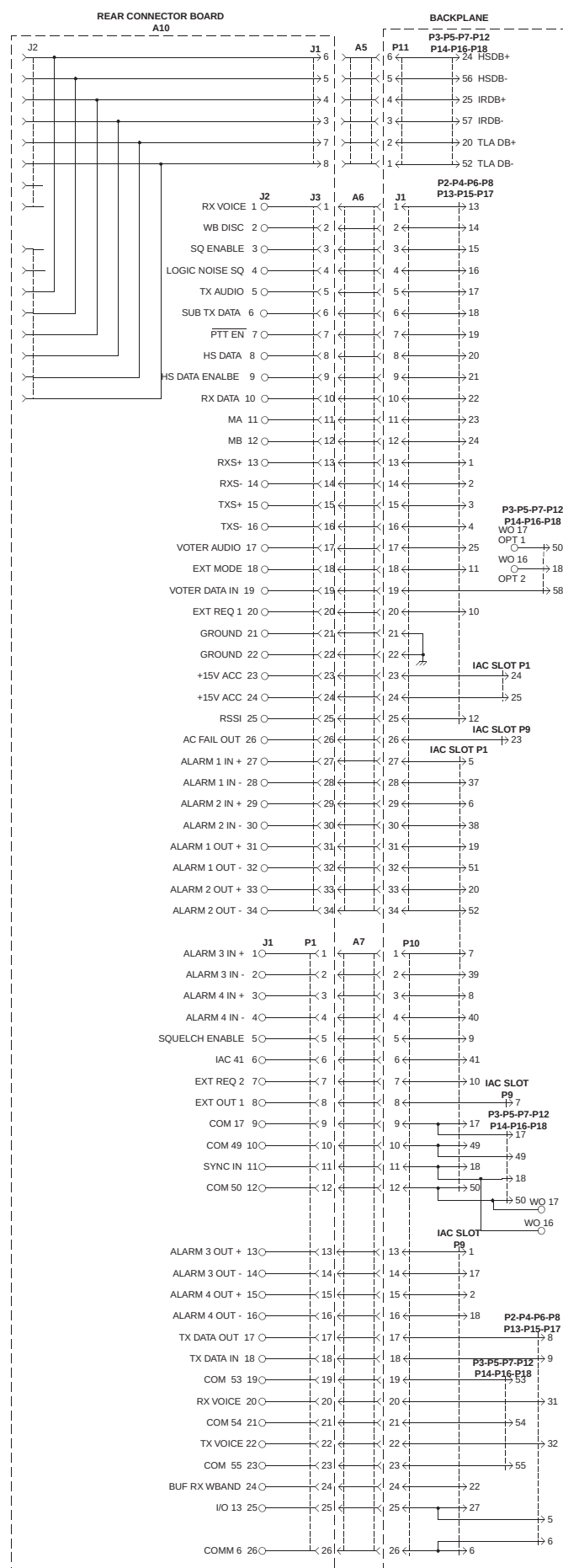
CABINET
FIGURE 10-3



REAR VIEW
FIGURE 10-4



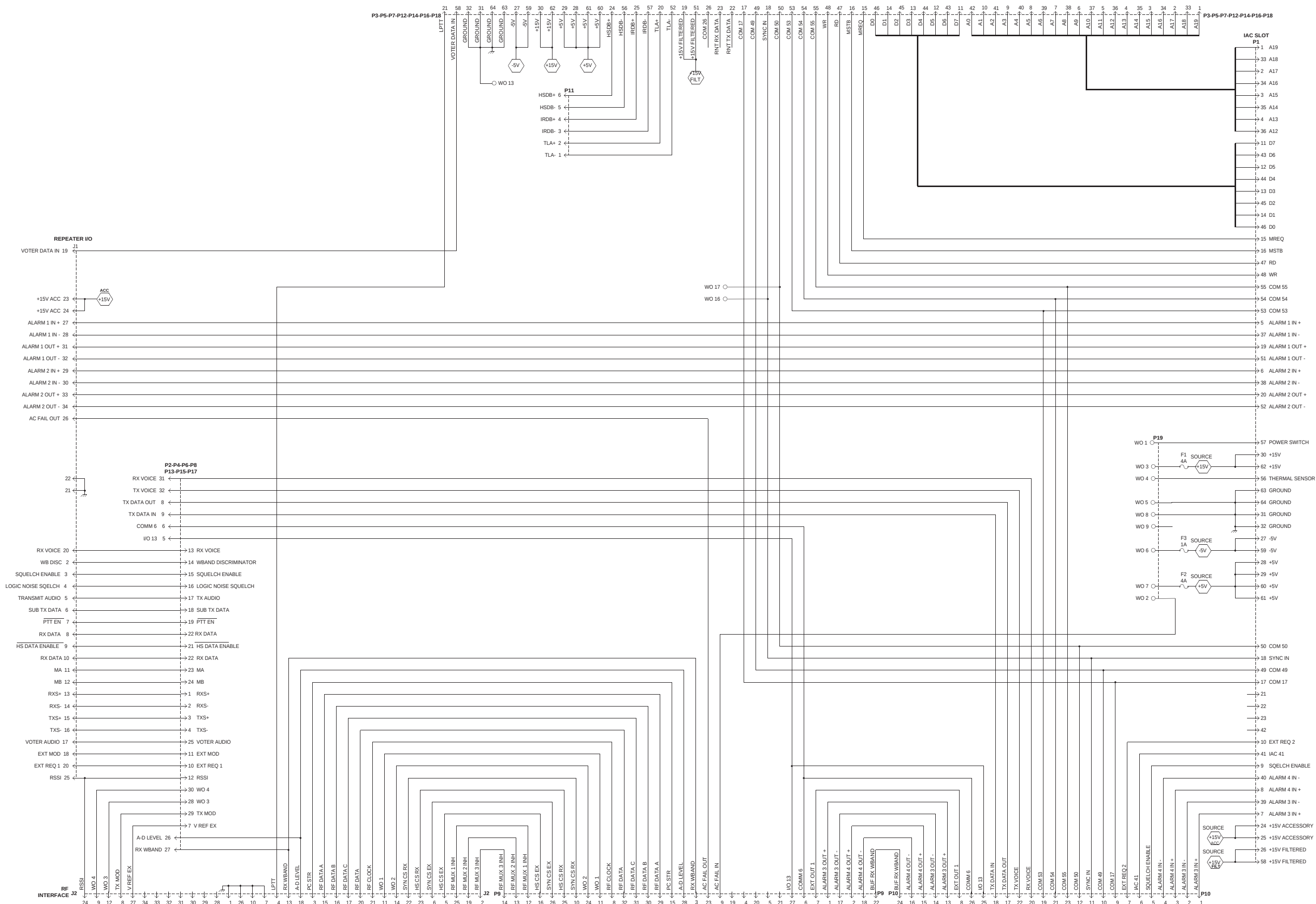
FRONT VIEW
FIGURE 10-5

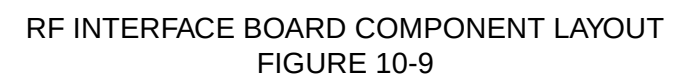


RF INTERCONNECT
FIGURE 10-7

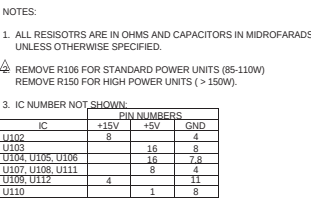
INPUT/OUTPUT ALARM INTERCONNECT

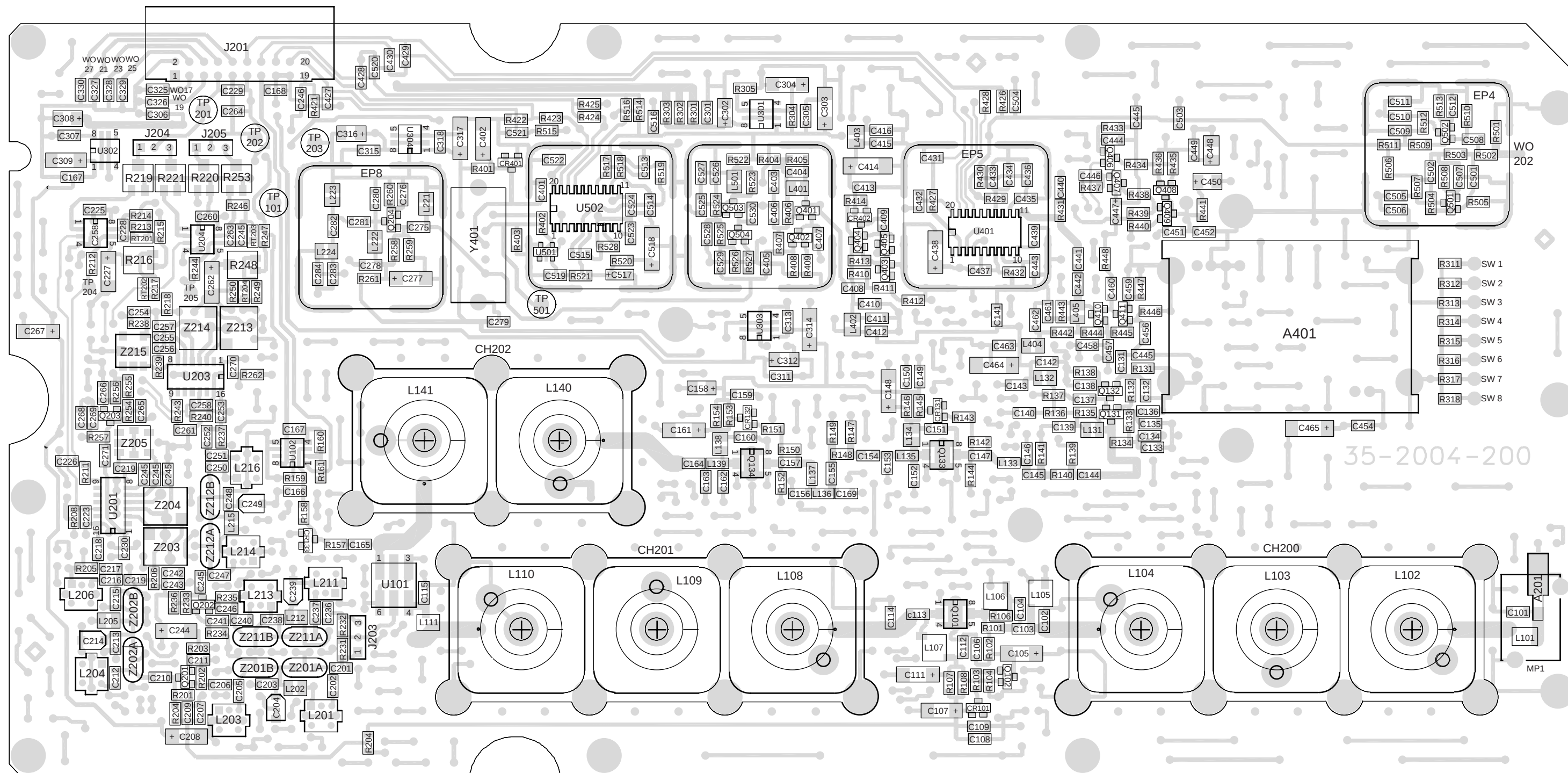
FIGURE 10-6





10-6





RECEIVER BOARD COMPONENT LAYOUT
(COMPONENT SIDE VIEW)
FIGURE 10-11

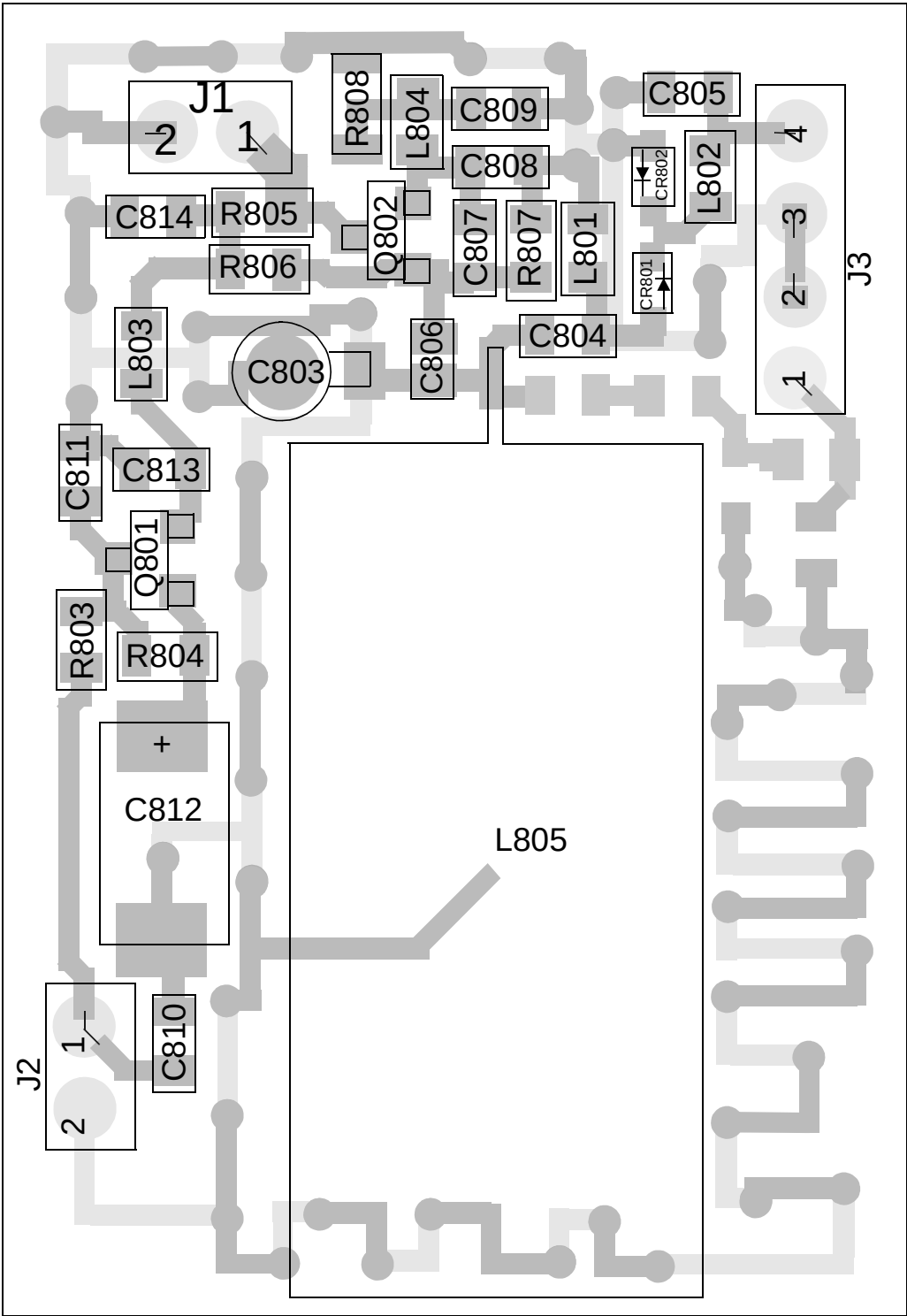


Figure 10-12 RECEIVER VCO COMPONENT LAYOUT

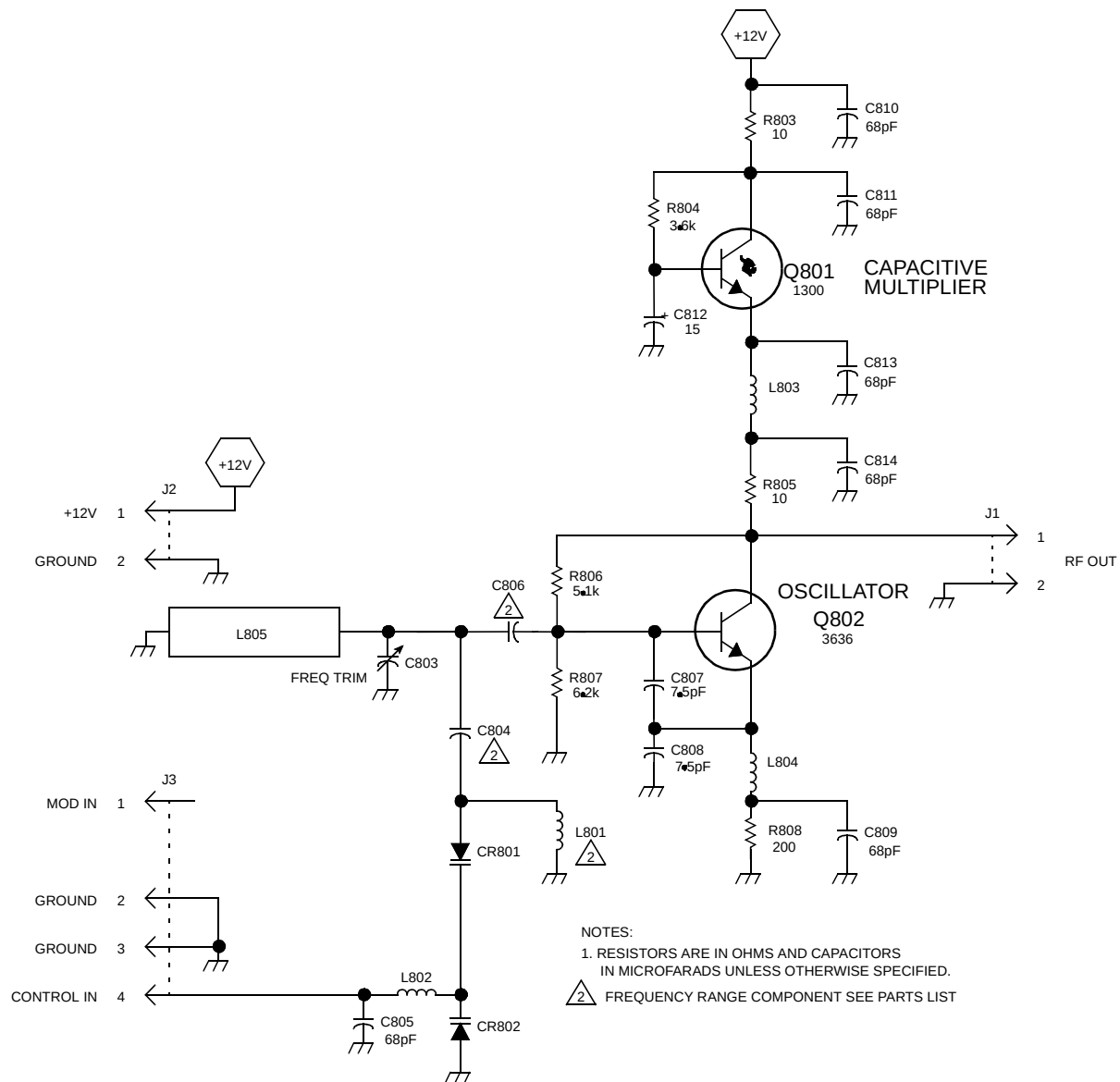
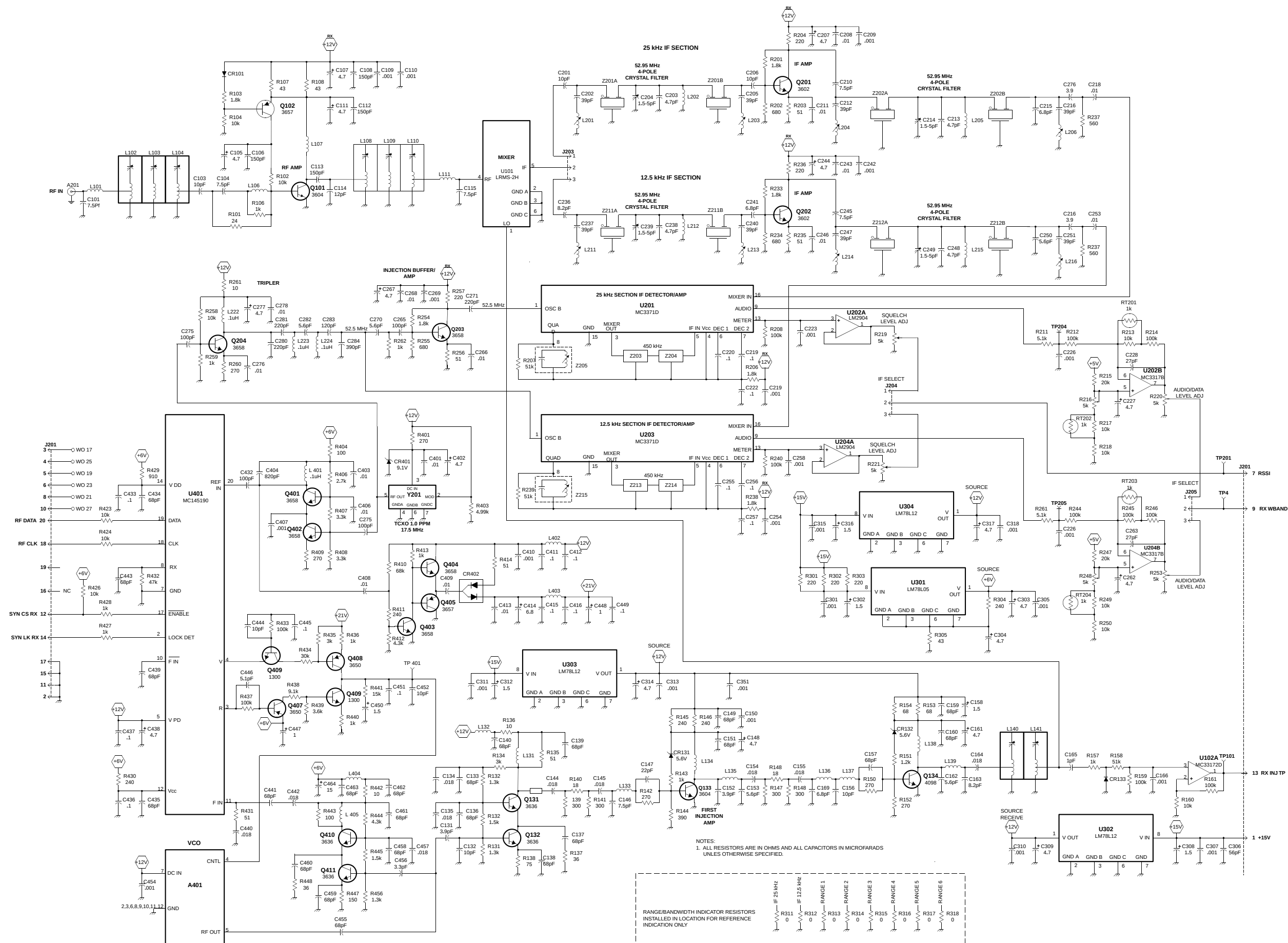
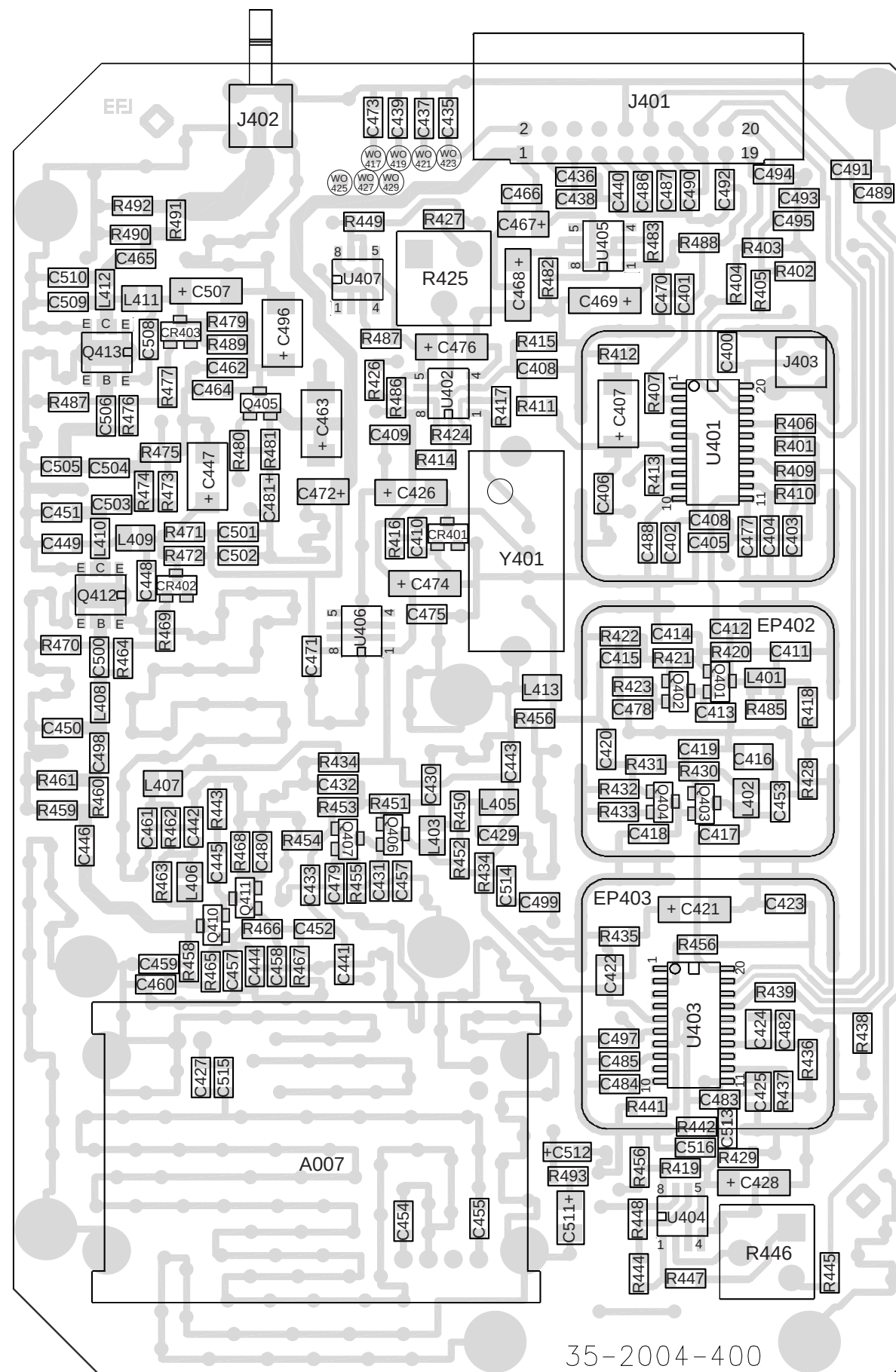


Figure 10-13 RECEIVE VCO SCHEMATIC





March 1999
Part No. 001-2004-301

EXCITER COMPONENT LAYOUT
FIGURE 10-15
10-12

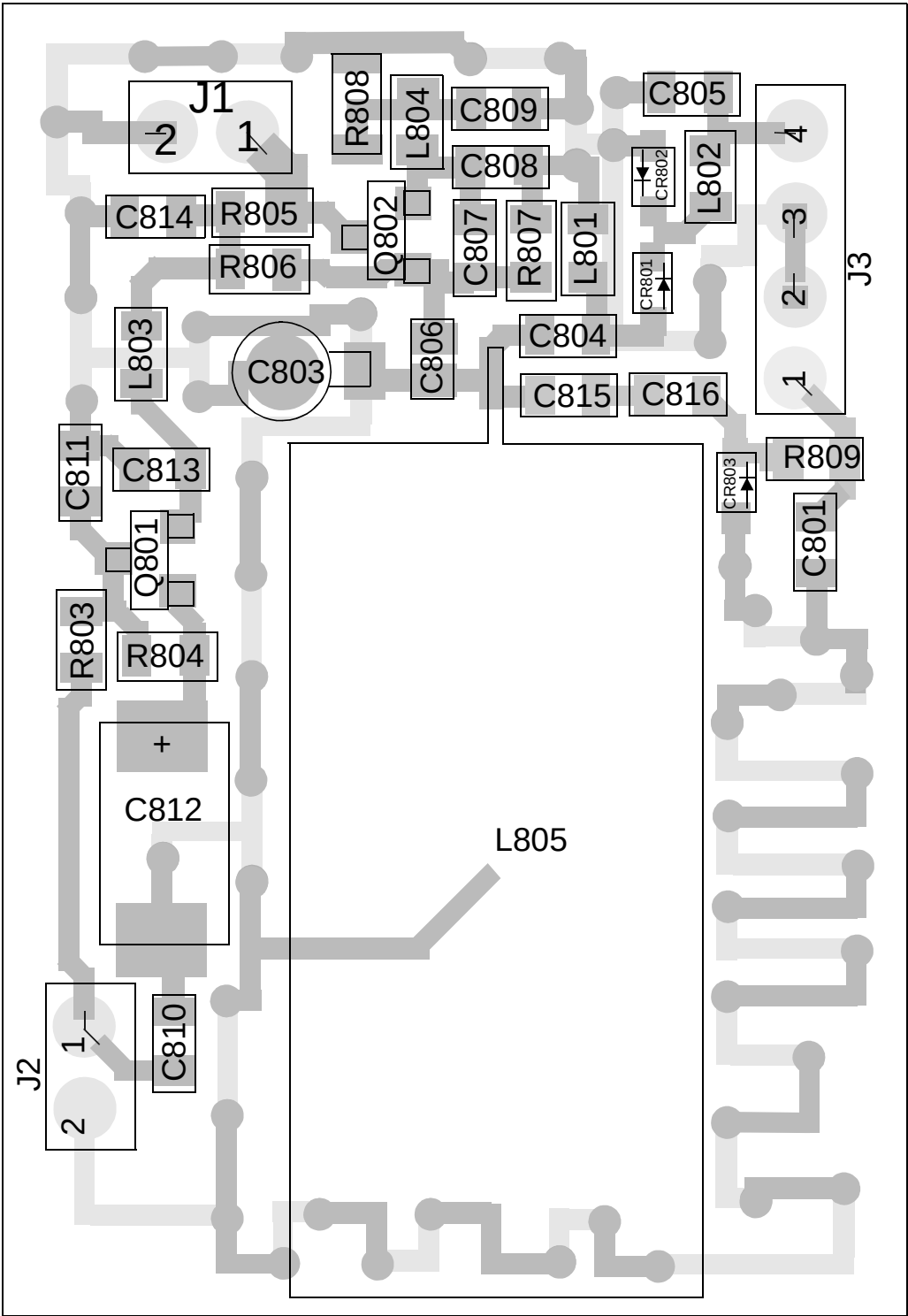


Figure 10-16 TRANSMIT VCO COMPONENT LAYOUT

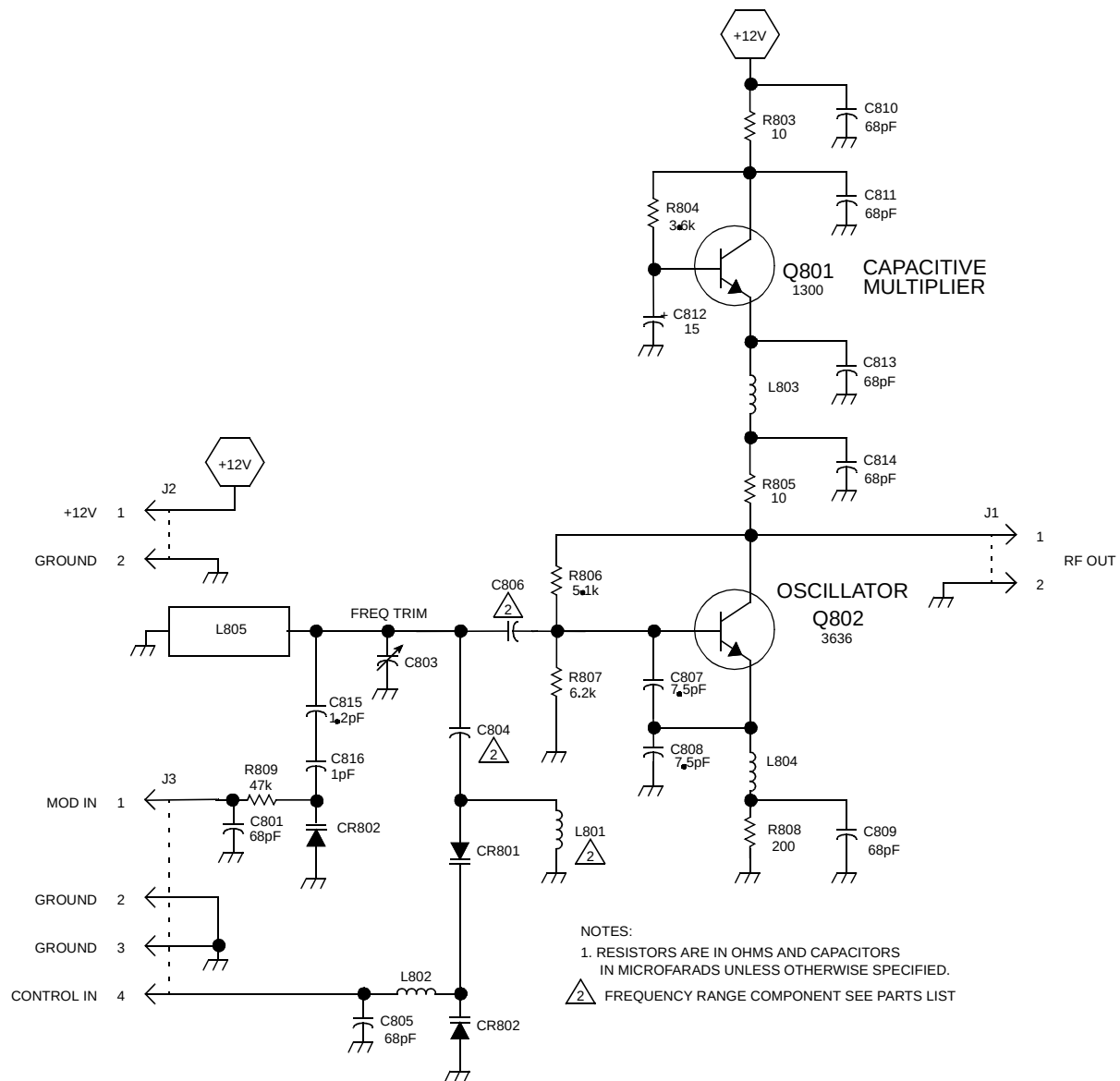
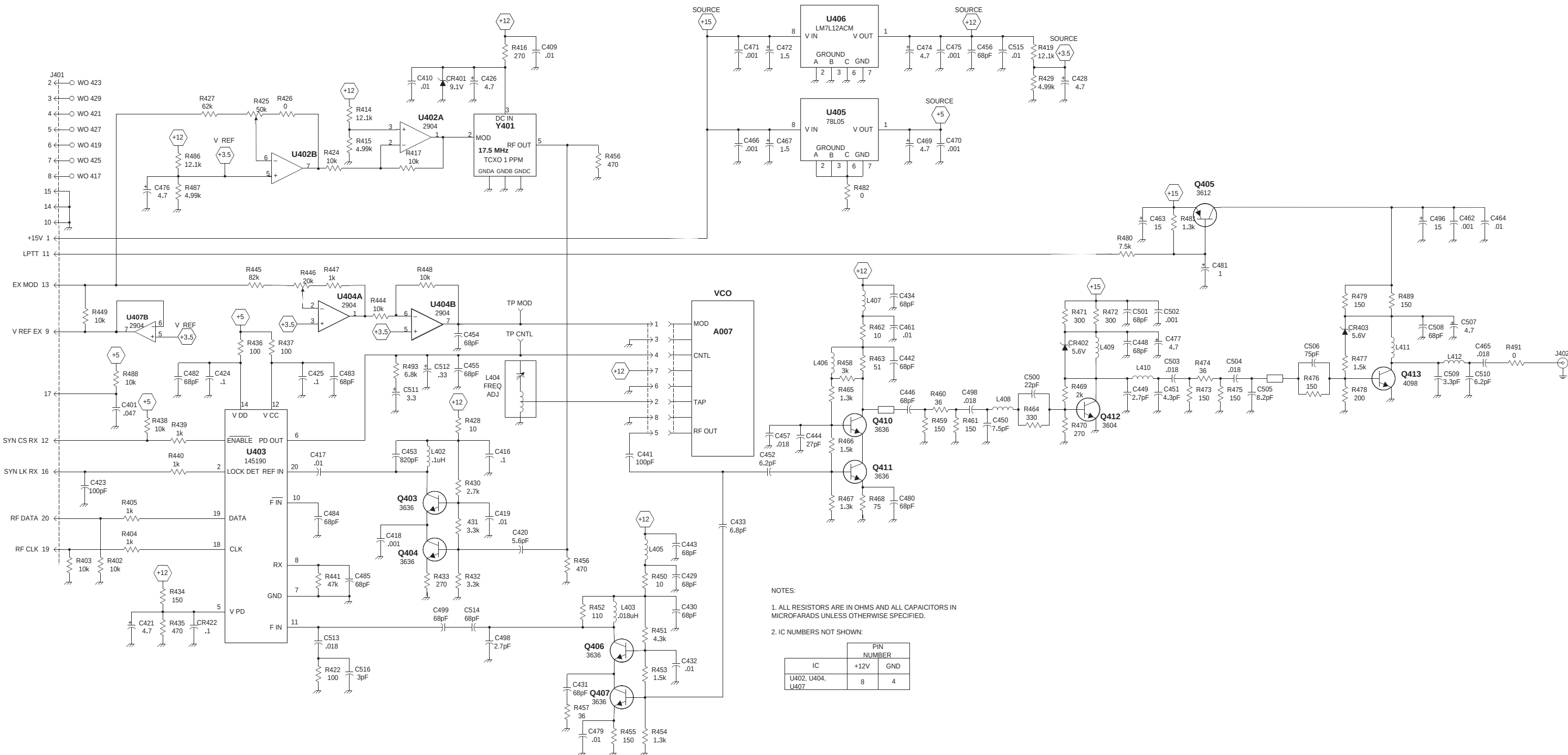
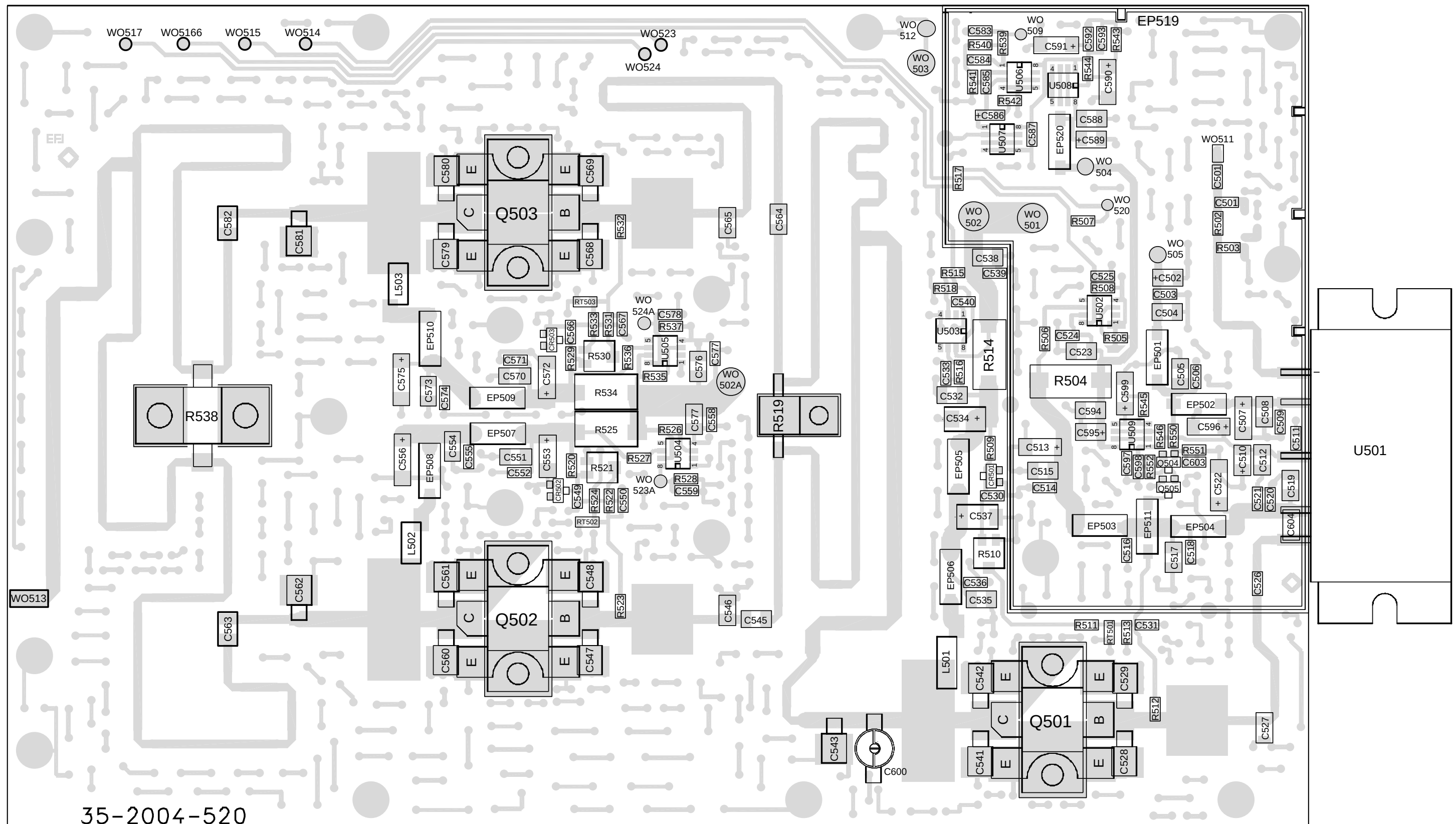
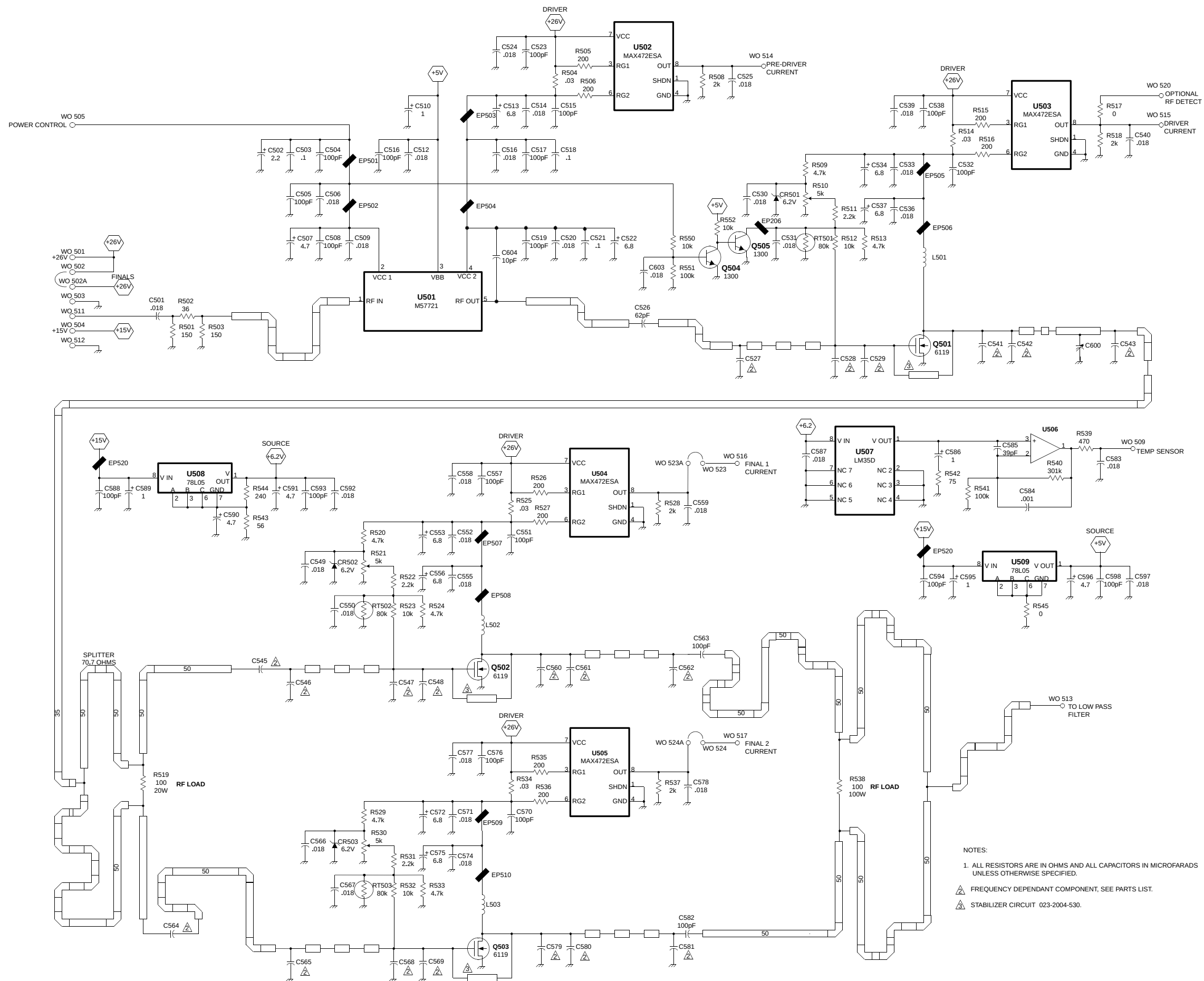
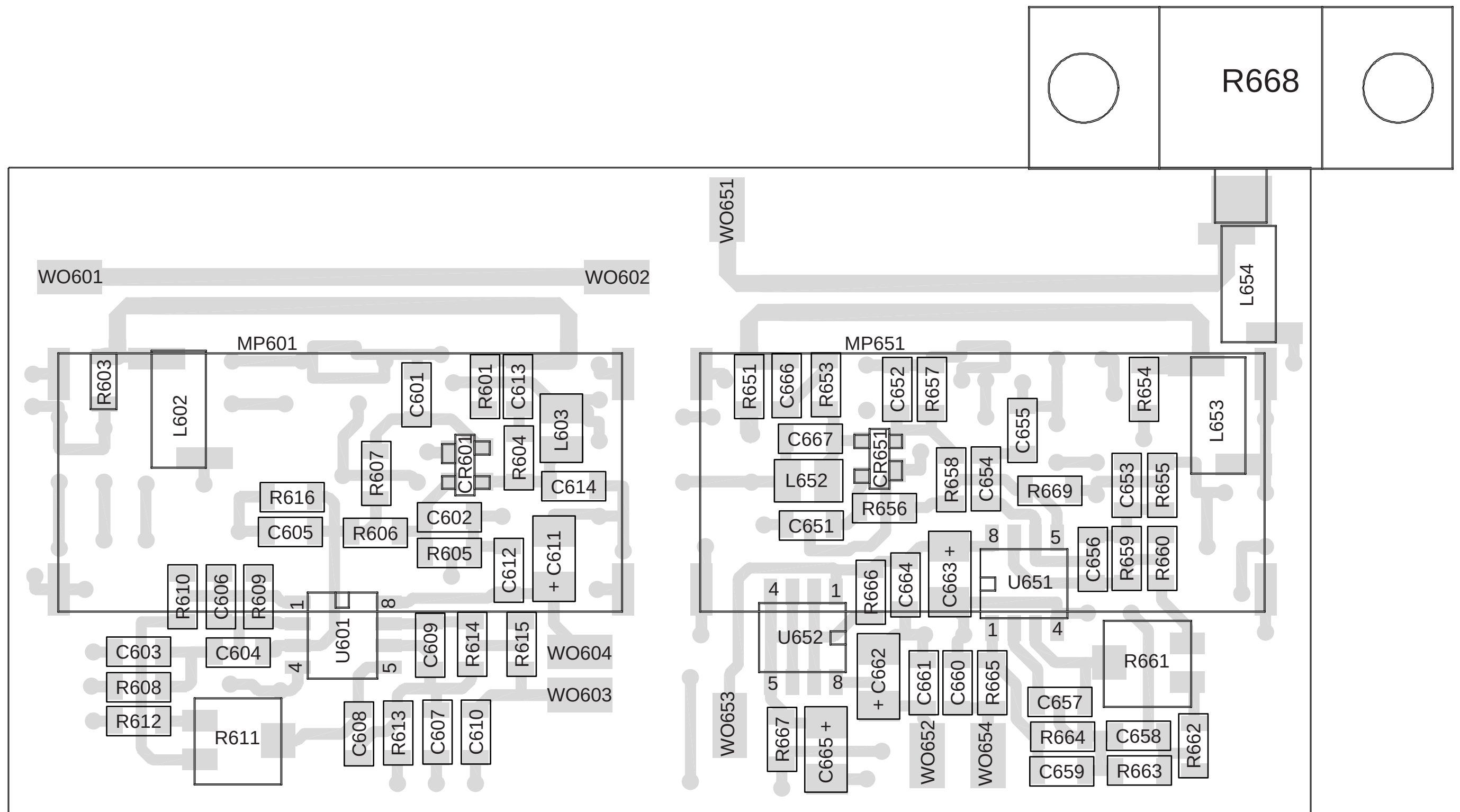


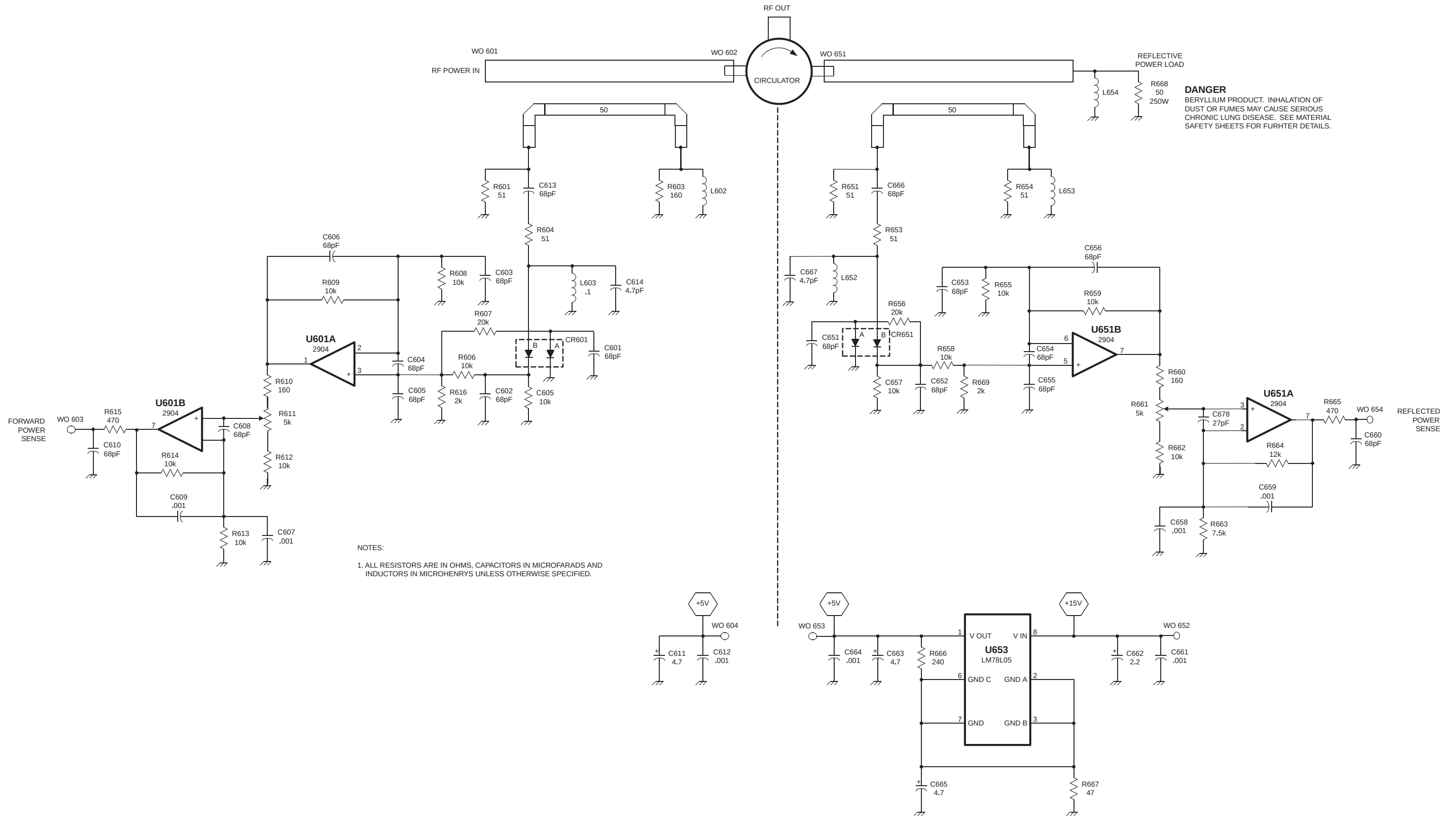
Figure 10-17 TRANSMIT VCO SCHEMATIC

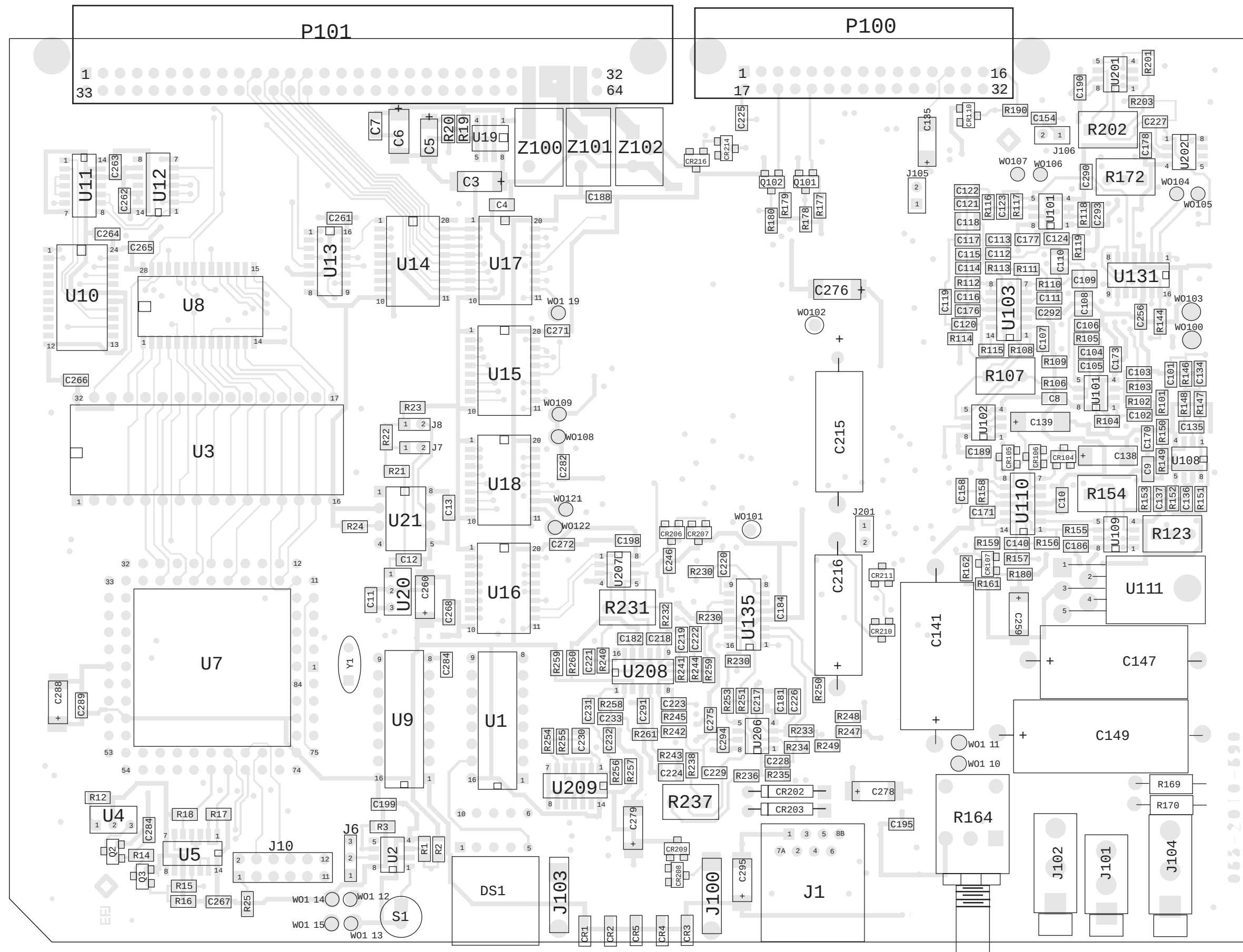




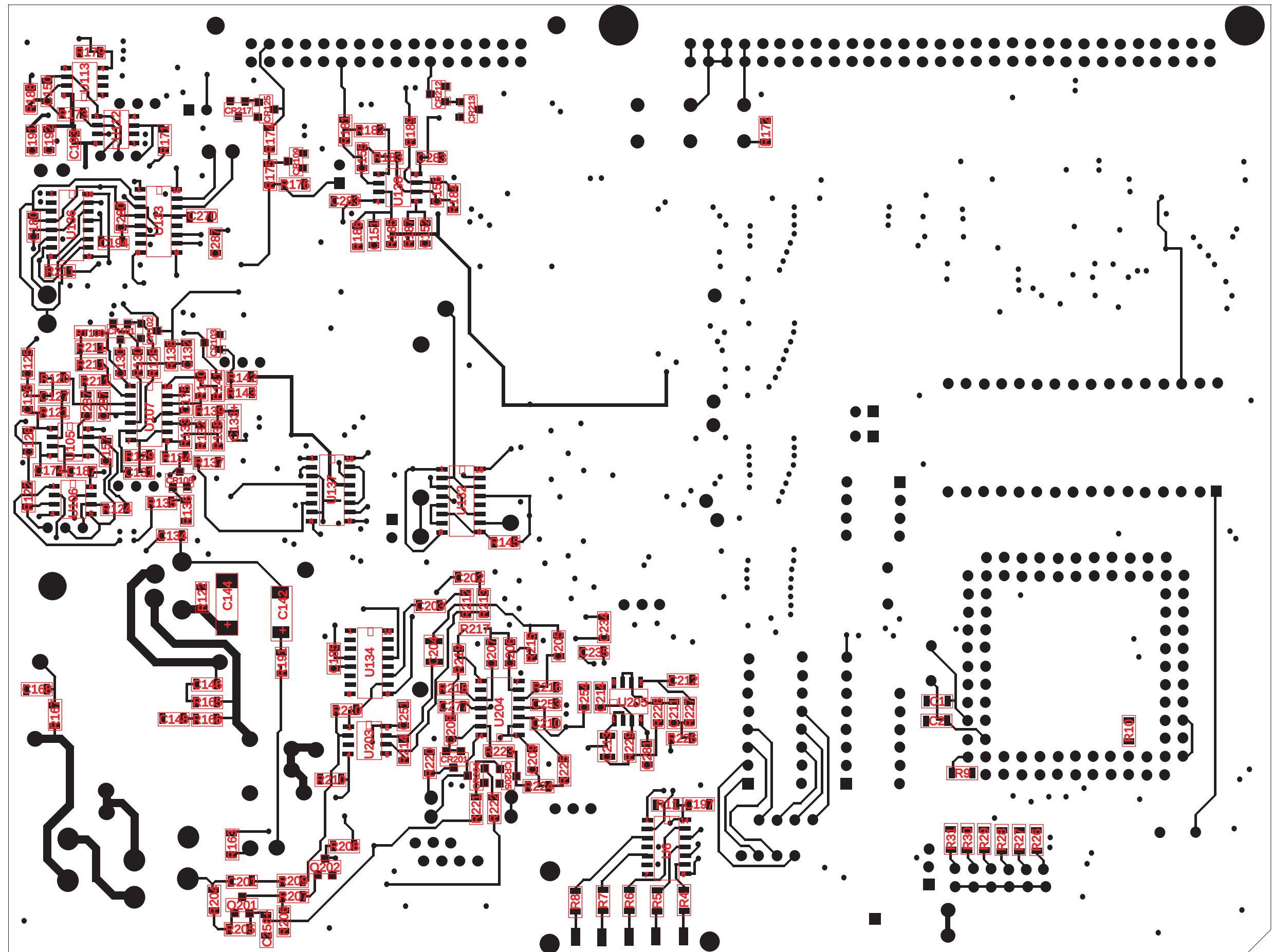


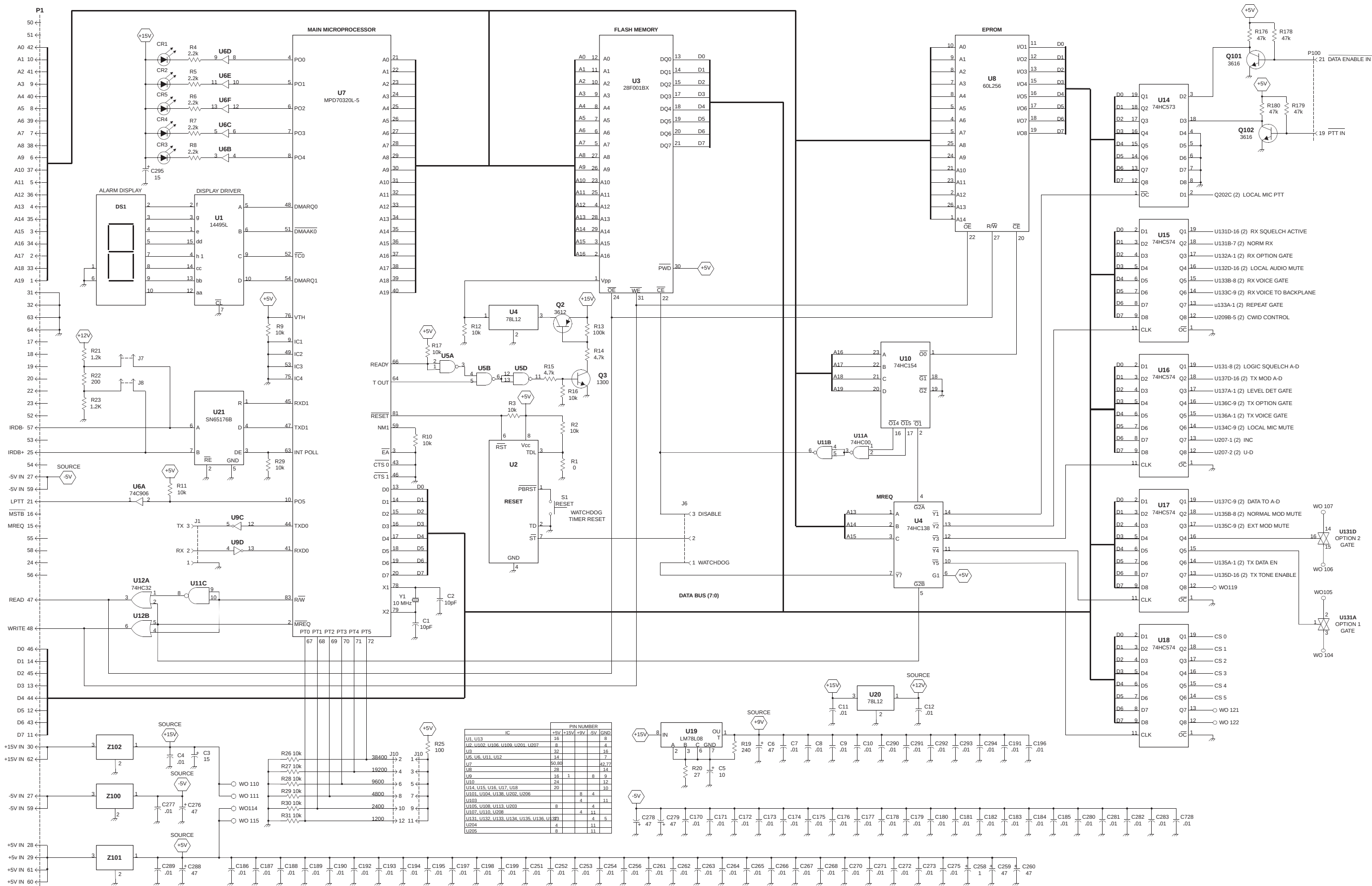




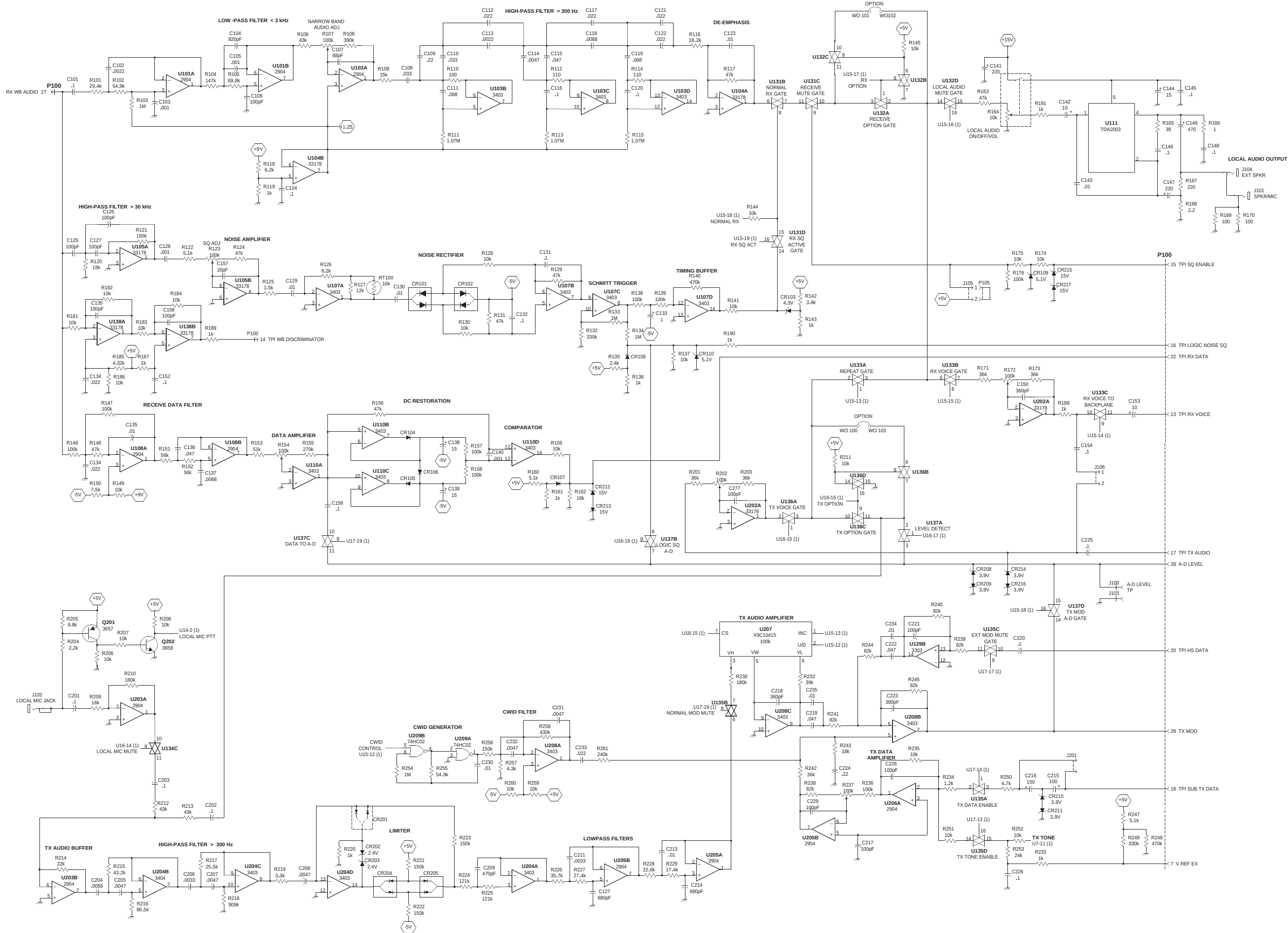


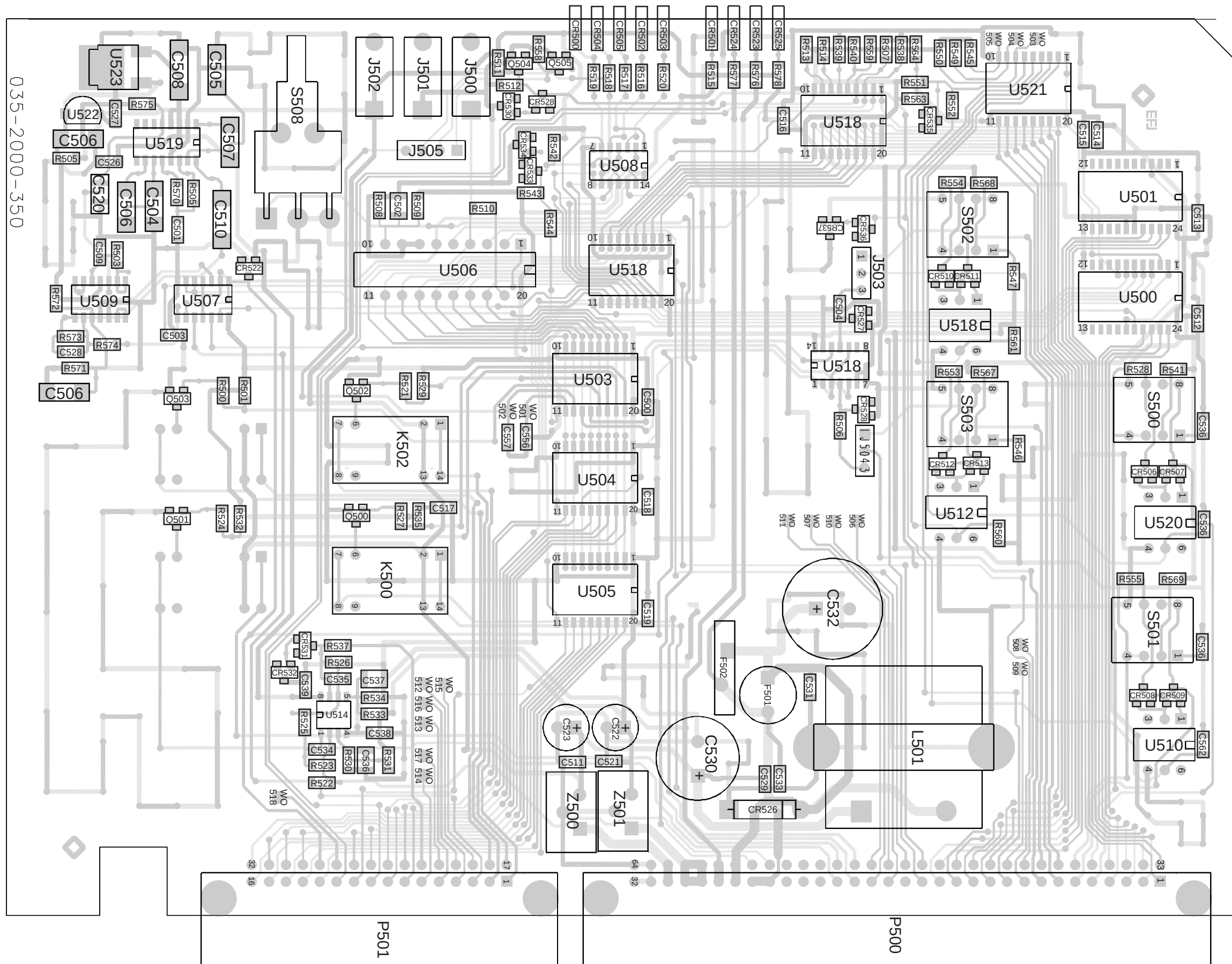
**TPI CARD COOMPONENT LAYOUT
(COMPONENT SIDE VIEW)
FIGURE 10-23**





TPI SCHEMATIC (1 OF 2)
FIGURE10-25



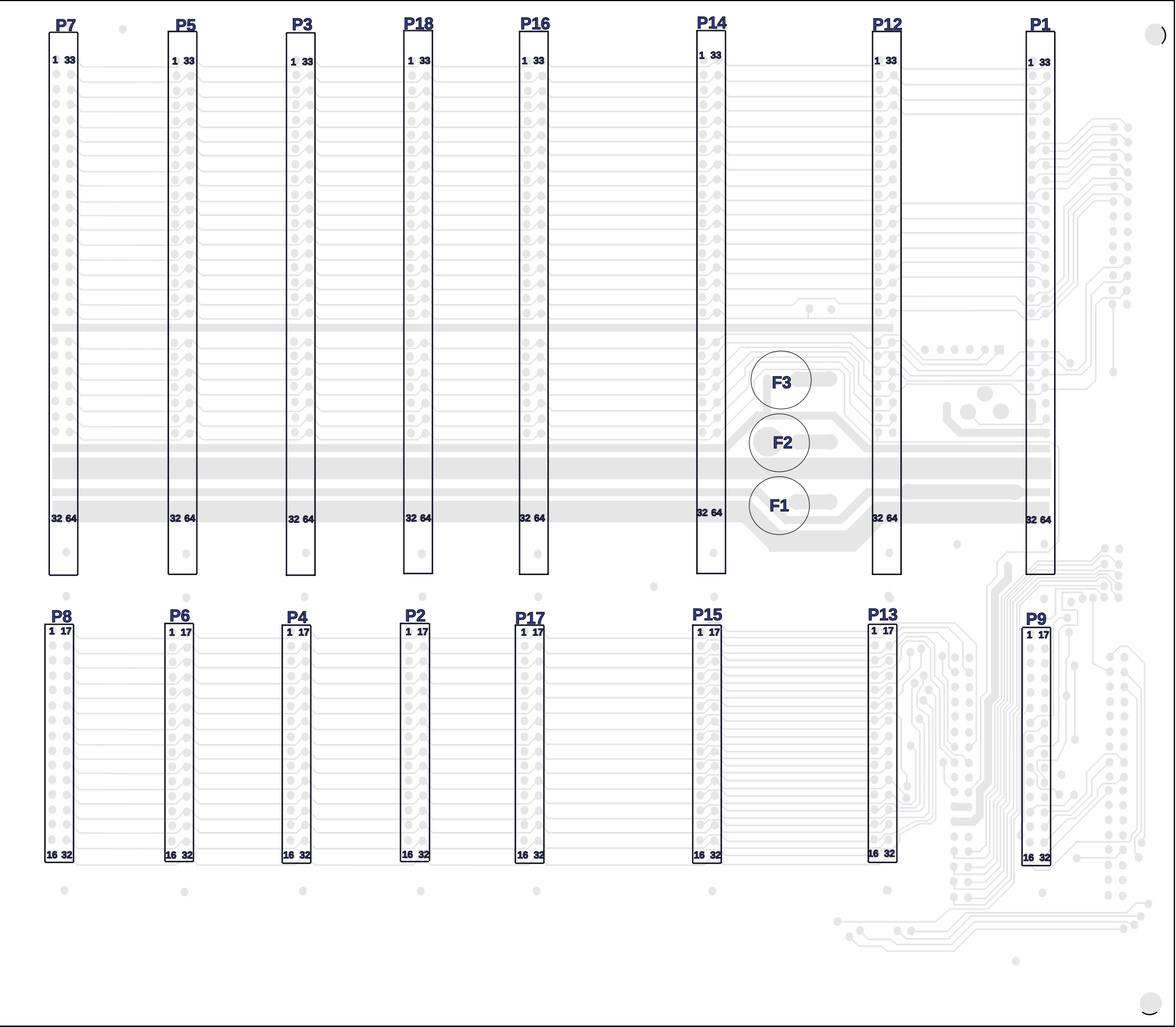


INTERFACE ALARM CARD COMPONENT LAYOUT
FIGURE 10-27

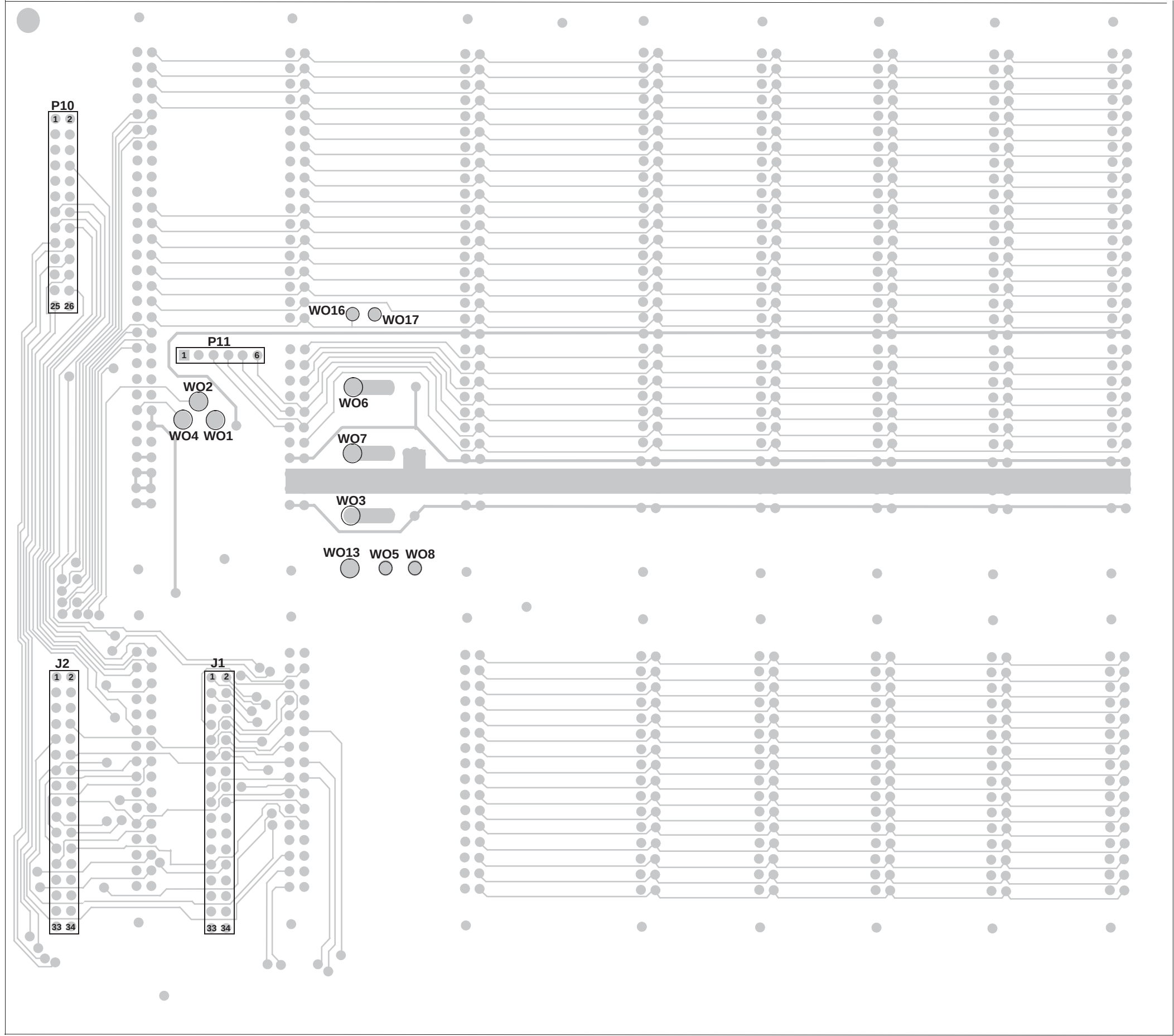


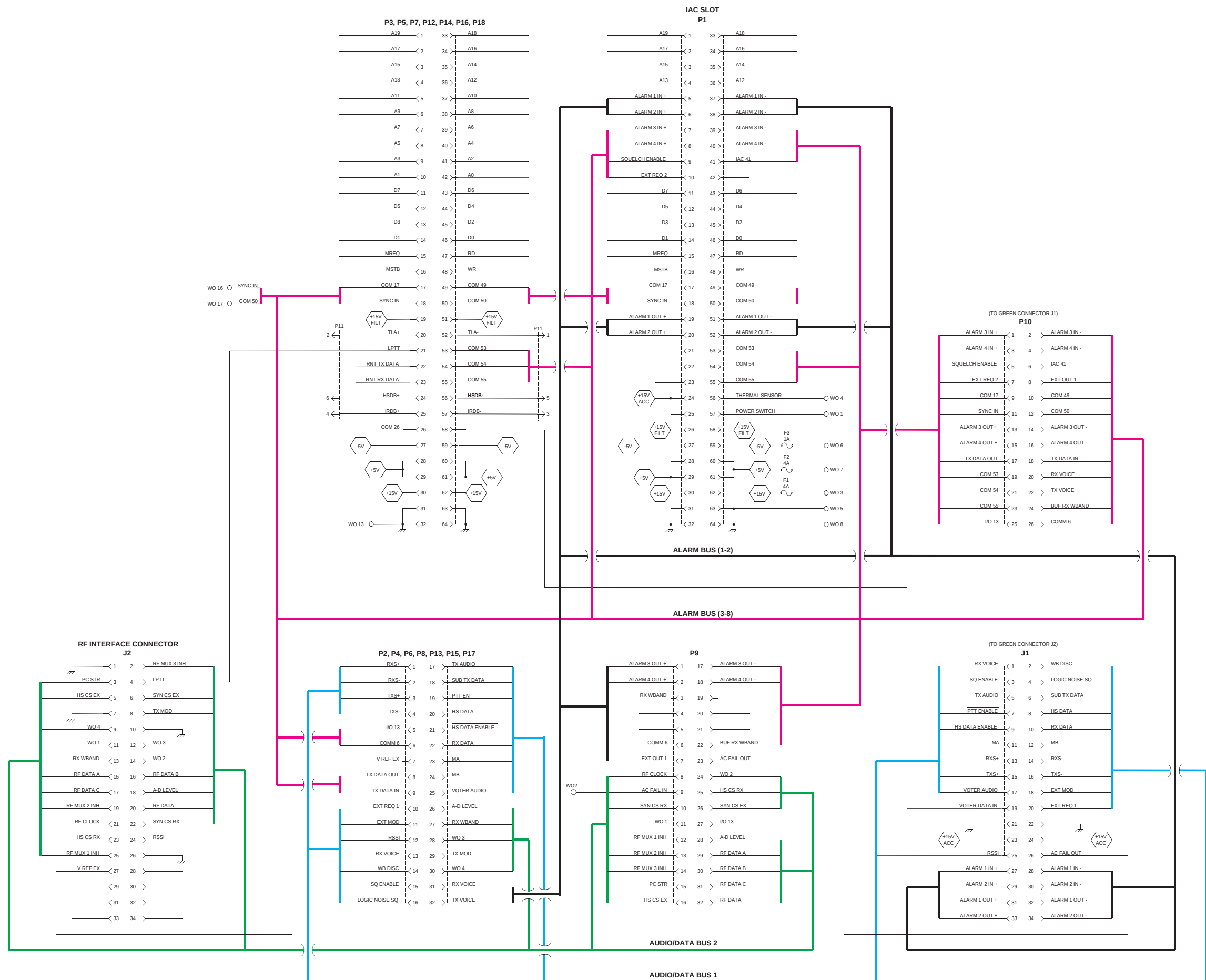
Part No. 001-2004-301

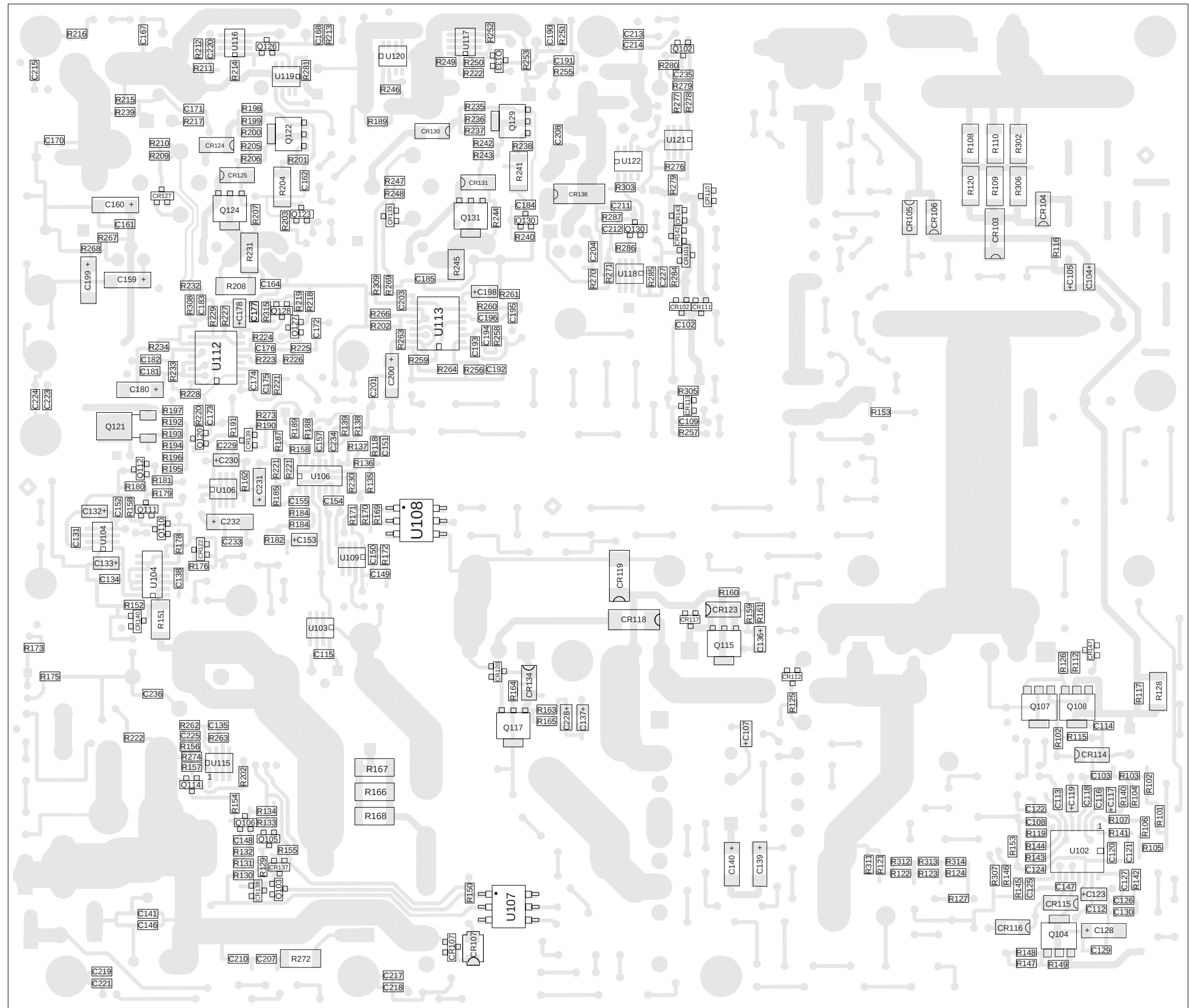
10-25



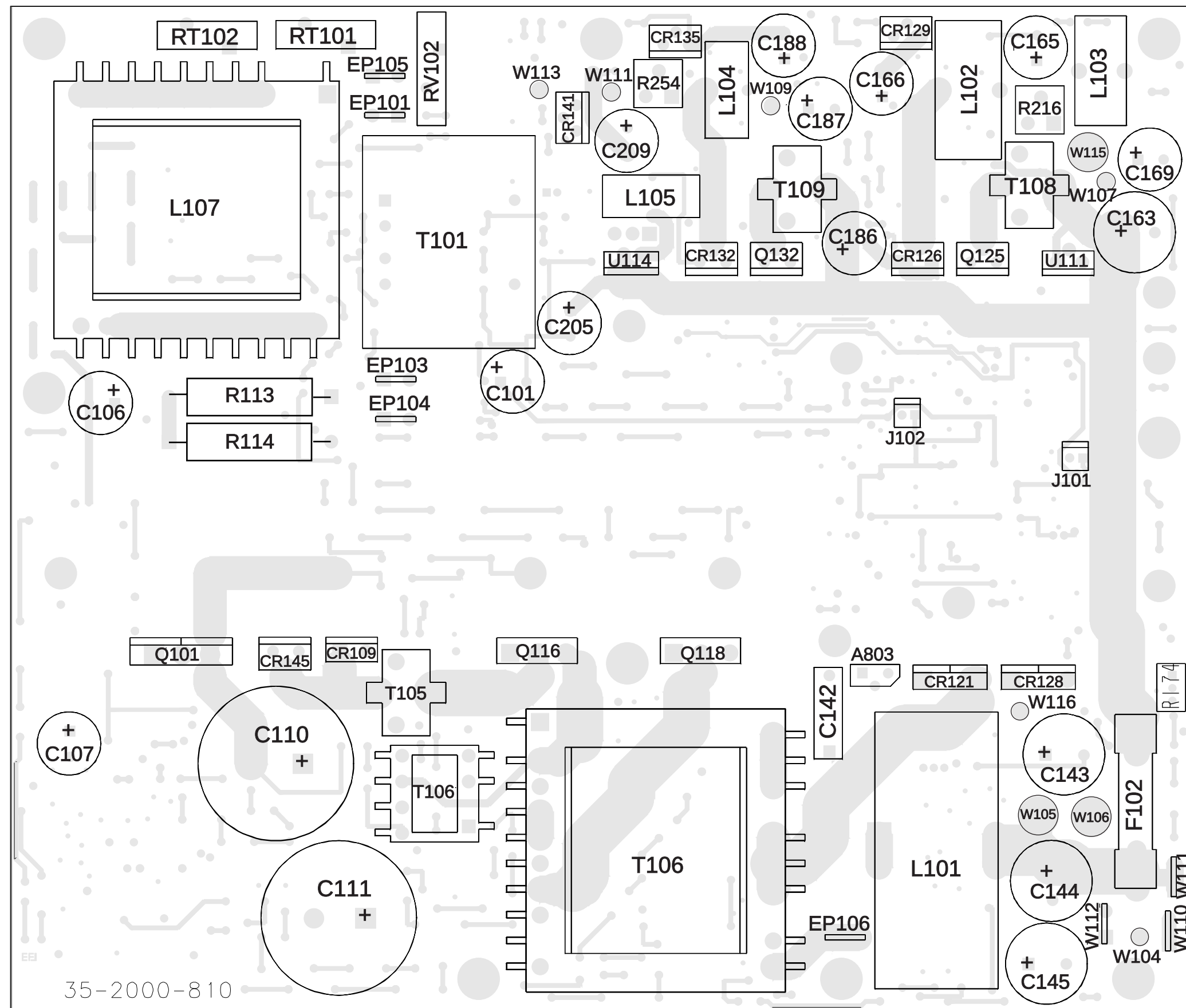
BACKPLANE COMPONENT LAYOUT (CARD SIDE)
FIGURE 10-29





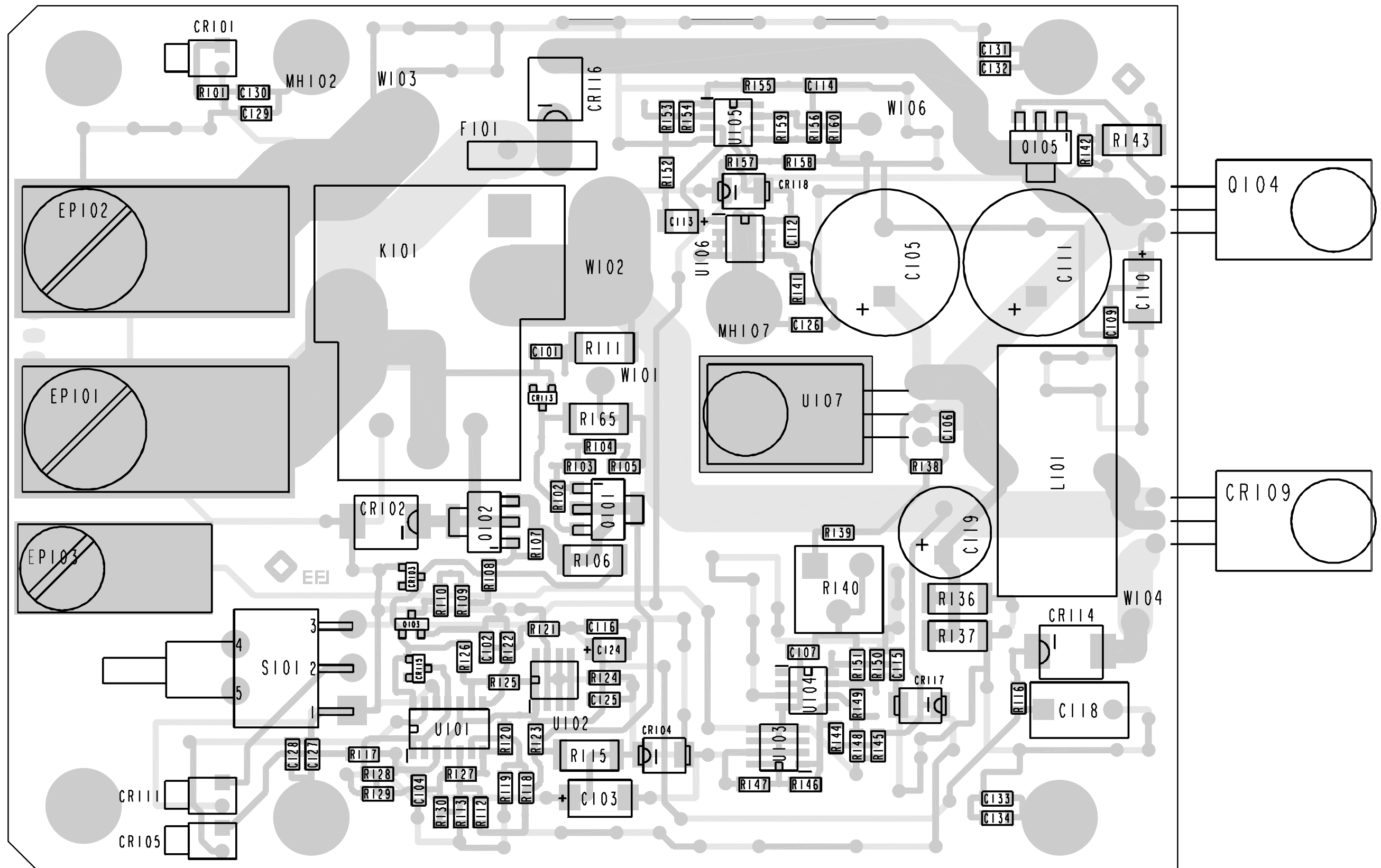


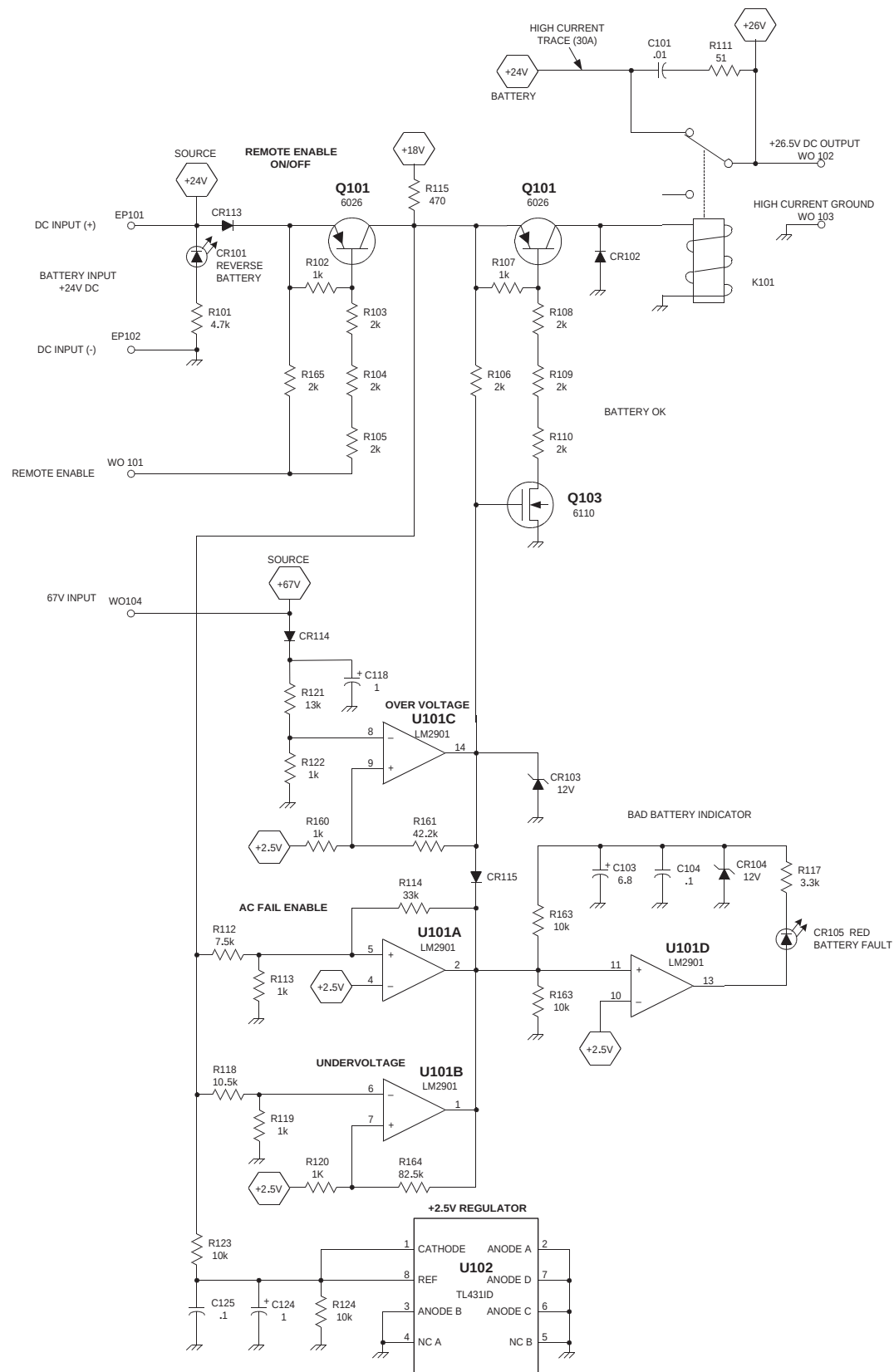
800W POWER SUPPLY COMPONENT LAYOUT
(OPPOSITE COMPONENT SIDE VIEW)
FIGURE 10-32



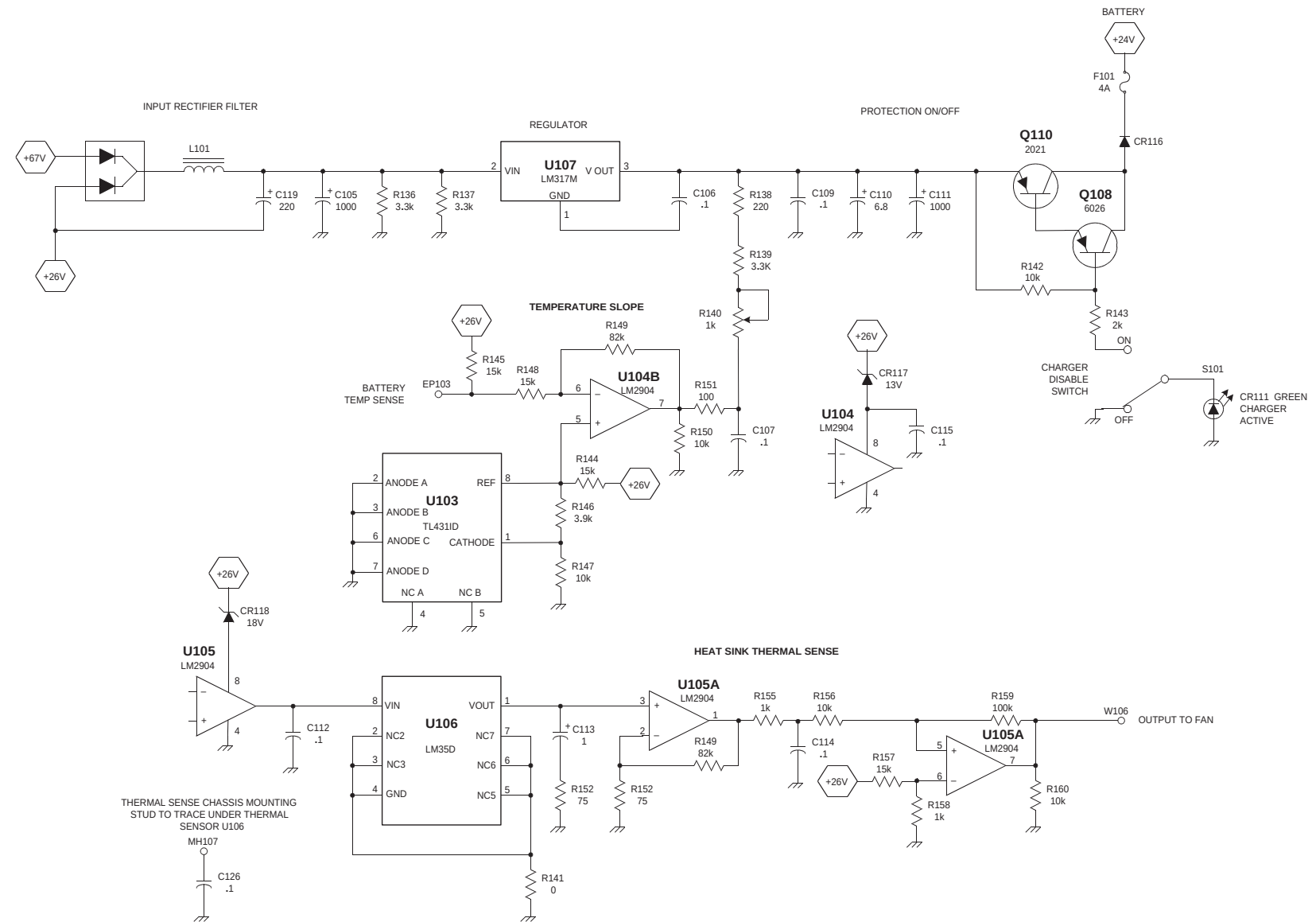


10-32



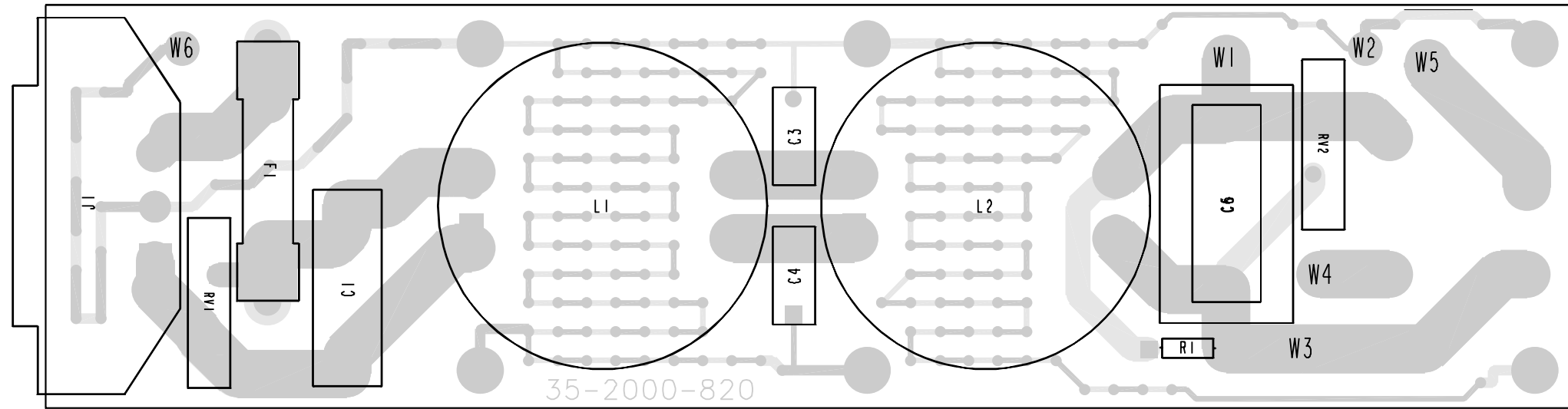


REVERT SECTION

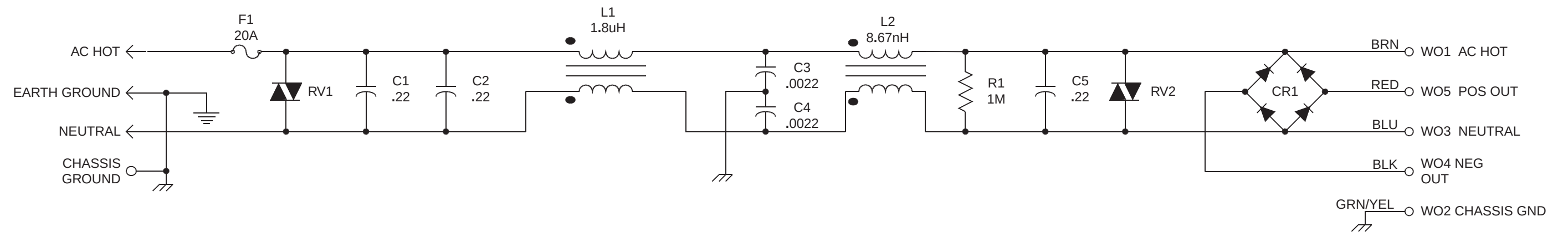


CHARGER SECTION

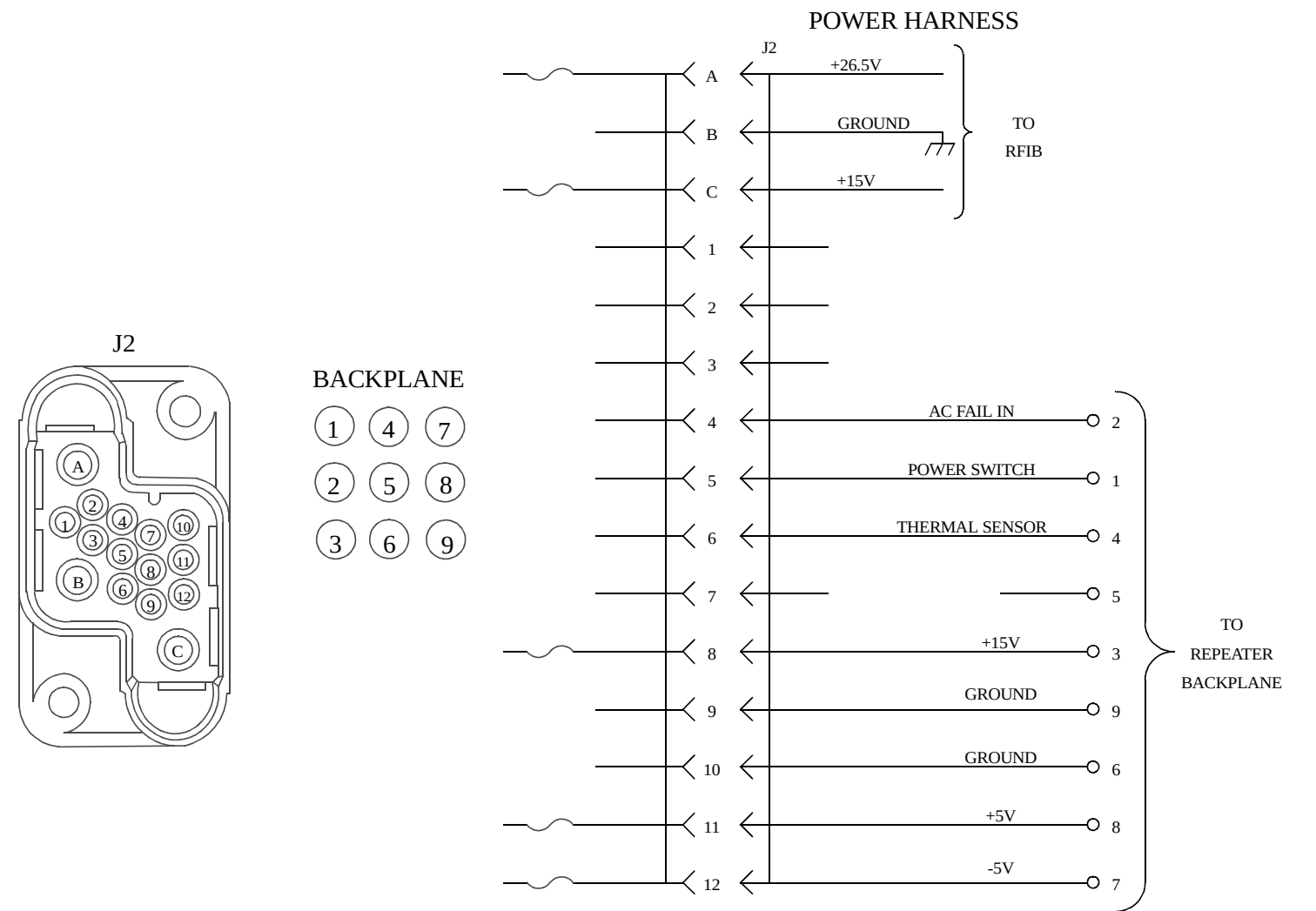
BATTERY BACK-UP SCHEMATIC
FIGURE 10-37



POWER SUPPLY FILTER BOARD COMPONENT LAYOUT
FIGURE 10-40



POWER SUPPLY FILTER BOARD SCHEMATIC
FIGURE 10-41



**POWER CABLE CONNECTOR AND SCHEMATIC
FIGURE 10-42**