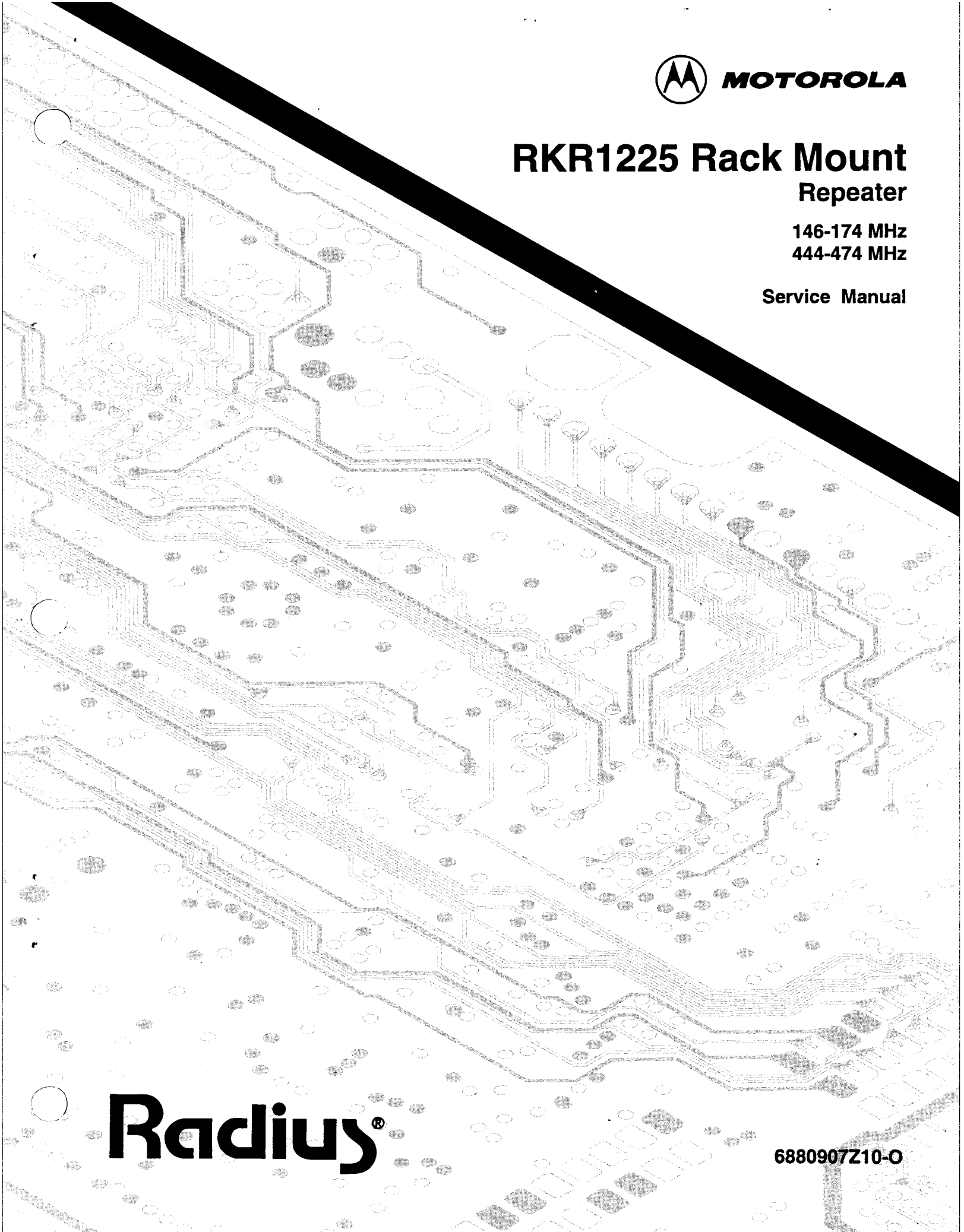
MOTOROLA

RKR1225 Rack Mount
Repeater

146-174 MHz
444-474 MHz

Service Manual



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Scope of Manual

This manual is intended for use by experienced technicians familiar with similar types of equipment. It contains all service information required for the equipment described and is current as of the printing date. Changes which occur after the printing date are incorporated by service manual revisions. These revisions are added to the manuals as the engineering changes are incorporated into the equipment.

How to Use This Manual

This manual contains introductory material such as model charts, accessories, and specifications, as well as sections that deal with specific service aspects of the RKR1225 Rack Mount Repeater. Refer to the Table of Contents for a general overview of the manual, or to the "Overview" paragraph in each section for a specific overview of the information in that section.

Other Documentation

Table 1 lists other documentation for the RKR1225 Rack Mount Repeater.

Table 1. Other Documentations

Information	Location
Basic Use of Transceiver	R1225 Operator Guide (6880904Z89)
Accessories	R1225 Accessory/Feature Sheet (6880905Z51)
Safety and Licensing	R1225 Safety/Licensing Guide (6880905Z34)
Programming	1225 Series RSS Getting Started (6880904Z93) p/o HVN9054
R1225 Service	R1225 Service Manual (6880905Z53)
i750R Operation/Maintenance	i750R Service Manual (6880904Z39)
i750R General Programming	i750R RSS Manual (6880904Z45)
i20R Operation Maintenance	i20R Service Manual (6880904Z40)
i20R General Programming	i20R RSS Manual (6880904Z55)
ZR310 Operation/ Maintenance/ Programming	ZR310 Service Manual (6880904Z64)
ZR340 Operation/ Maintenance/ Programming	ZR340 Service Manual (6880905Z90)
ST-853M SmarTrunk II Operation/Programming	ST-853M SmarTrunk II Service Manual (6880905Z59)

Table 1. Other Documentations (Cont'd.)

Information	Location
GR300/GR500 Operation/ Maintenance (includes ZR320, ZR330, ZR340, i50R, TRA100R, & Basic Controllers)	GR300/GR500 Service Manual (6880903Z42)
GR300/GR500 Programming Information (includes ZR320, ZR330, ZR340, i50R, TRA100R, & Basic Controllers)	GR300/GR500 Programming Guide (6880903Z43)

Technical Support

To obtain technical support, you may call Motorola's Radius Product Services. When you call, we ask that you have ready the model and serial numbers of the respective radio or its parts.

Service Policy

If malfunctions occur within 30 days that cannot be resolved over the phone with Radius Product Services, a defective "major" component (such as a repeater controller or the power supply) should be returned. You must obtain authorization from Radius Product Services before returning the component. After 30 days, you must return any defective component to the location shown in Table 1. Make sure that the component is shipped in its original packaging or use careful packing procedures, to eliminate the possibility of damage while en route. During the warranty period, we will either repair or replace the component as required. If the component is out of warranty, you must pay a service fee.

Table 1. Service After 30 Days

Major Component*	Repair Location
HPN9033_ (RKR1225 Power Supply)	DuraComm
HLN8388_ (ZR310)	Zetron
HLN9119_ (ZR340)	Zetron
HLN9121_ (TRA100R)	GAI-Tronics
HLN9120_ (i750R)	GAI-Tronics
HLN9447_ (i20R)	GAI-Tronics
HLN3104_ (ST-853M SmarTrunk II)	SmarTrunk Systems, Inc.

* Obtain authorization from the applicable repair location before returning the component

We do not generally recommend that you make repairs to the piece part level on the RKR1225 repeater components. However, we recommend that you keep spare station components (or a complete station) available at all times, so that once you have identified a defective component you can immediately replace it, getting the repeater back in service within a few minutes. If the transceiver should fail in the transmit or receive role, you can use a transceiver from your normal inventory.

Ordering Replacement Parts

You can order additional components and some piece parts directly through your Radius price pages. When ordering replacement parts, include the complete identification number for all chassis, kits, and components. If you do not know a part number, include with your order the number of the chassis or kit which contains the part, and a detailed description of the desired component. If a Motorola part number is identified on a parts list, you should be able to order the part through Motorola Parts. If only a generic part is listed, the part is not normally available through Motorola. If no parts list is shown, generally, no user serviceable parts are available for the kit.

Radius 30-Day Warranty
Technical Support
Radius Product Services
1000 W. Washington St.
Mt. Pleasant, IA 52641 USA

Motorola Radio Support Center
Attention: Warranty Return
3760 South Central Avenue
Rockford, IL 61102 USA
1-800-227-6772 (U.S. & Canada)

Radius Major Component Repair
Motorola Radio Support Center
3760 South Central Avenue
Rockford, IL 61102 USA

DuraComm Major Component Repair
(for RKR1225 Power Supply)
DuraComm Corporation
2119 Atlantic Avenue
North Kansas City, MO 64116
1-816-472-5544

Instrument Associates Major Component Repair
(for i20R, i750R, and TRA100R)
GAI-Tronics
2455 Harbor Ave.
P.O. Box 13127
Memphis, TN 38113-0127 USA
1-901-948-1490

Zetron Major Component Repair
(for ZR310, ZR320, and ZR340)
Zetron Inc.
12335 134th Court N.E.
Redmond, WA 98052-2433 USA
1-206-820-6363

SmarTrunk Systems, Inc.
(for SmarTrunk II)
23278 Bernhardt Street
Hayward, CA 94545-1621
1-510-887-1950

Motorola Parts
Aftermarket Products Division
Attention: Order Processing
1313 E. Algonquin Road
Schaumburg, IL 60196

Aftermarket Products Division
Attention: International Order Processing
1313 E. Algonquin Road
Schaumburg, IL 60196

Customer Service
1-800-422-4210
1-847-538-8198 (FAX)

Parts Identification
1-847-538-0021
1-847-538-8194 (FAX)

Regulatory Requirements

In the United States, the FCC regulates licensing of RF frequencies. The terms of the FCC radio license for a particular operation will determine the frequencies, output power, and antenna height(s) for a given situation. The applicable "Part" of the FCC Rules and Regulations must be consulted before a Radius RKR1225 Repeater Station is activated. In countries other than the United States, contact the local government for licensing rules.

Any telephone interconnect equipment sold in the U.S. must comply with Part 68 of the FCC rules. On the repeater controller housing there is a label that lists the FCC registration number and ringer equivalence number (REN) for this equipment. You must, on request, provide this information to your telephone company. In other countries additional compliance information or testing may be required. Contact Radius Product Services for further information.

The ringer equivalence number (REN) is useful in determining the quantity of devices you may connect to your telephone line and still have all of those devices ring when your telephone number is called. In most, but not all areas, the sum of the RENs of all devices connected to one line should not exceed five. Contact your local telephone company to determine the maximum REN for your calling area.

If your telephone equipment causes damage to the telephone, the telephone company may discontinue your service temporarily. If possible, they will notify you in advance, but, if advance notice is not practical, you will be notified as soon as possible. In such a case, you will be informed of your right to file a complaint with the FCC.

Your telephone company may make changes in facilities, equipment, operations, or procedures that could affect the proper functioning of your equipment. If it does, you will be notified in advance to give you an opportunity to maintain uninterrupted telephone service.

If any interconnect equipment malfunctions, the telephone company may ask you to disconnect it from the network until the problem has been corrected or until you are sure that the equipment is no longer malfunctioning.

Interconnect equipment cannot be used on coin service provided by the telephone company. Connection to party lines is subject to tariffs.

CAUTION

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manuals, can cause interference to radio communications. It has been tested and found to comply with the limits for a "Class A" computing device pursuant to Part 15 of FCC Rules which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user, at his own expense, will be required to take whatever measure is necessary to correct the interference.

DOC Requirements

The Canadian Department of Communications label identifies certified equipment. The certificate means that the equipment meets certain protective, operational, and safety requirements of the telecommunications network. The Department does not guarantee the equipment will operate to a user's satisfaction.

Before installing this equipment, make sure you are permitted to connect it to the facilities of the local telecommunications company. You must also install the equipment using an acceptable method of connection. In some cases you may extend the company's inside wiring for a single line individual service by means of a certified connector assembly (telephone extension cord). You should be aware, however, that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designed by the supplier. Any repairs or alterations made by a user to this equipment, or any equipment malfunctions may give the telephone communications company cause to request the user to disconnect the equipment.

WARNING

For your own protection, make sure that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas. Do not attempt to make electrical ground connections yourself. Contact an appropriate electrical inspection authority or electrician.

DOC Load Number (refer to the FCC label)

The load number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to the telephone loop used by the device to prevent overloading. The termination on a loop may consist of any combination of devices, subject to the requirement that the total of the load numbers of all devices cannot exceed 100.

DOC Compliance Notice

This digital apparatus does not exceed the Class A limits for radio noise emissions for digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications.

Avis De Conformation avec le Ministère des Communications du Canada (DOC)

Le présent appareil numerique n'emet pas de bruits radioélectriques dépassant les limites applicables aux appareils numeriques de la classe A, préscitées dans le règlement sur le brouillage radioélectrique edicté par le Ministère des Communications du Canada.

Accessories

Radius offers several accessories to increase communications efficiency. Many of the accessories available are listed below, but for a complete list, consult your Radius dealer.

Repeater Housing & Control Panel

HLN3254	RKR1225 Rack Mount Repeater Housing w/Transceiver Control Panel

Controller Modules

HLN9447	i20R Controller
HLN3104	SmarTrunk II Controller
HLN9119	ZR340 Controller
HLN8388	ZR310 Community Tone Panel
HLN9120	i750R Advanced Interconnect Signalling
HLN9121	TRA100R Tone Remote Adapter
CDN6010	Controller Rack Mount Dual Unit, 19 in.

Duplexer Modules

HFD8188	144-155 MHz, VHF Duplexer
HFD8465	150-160 MHz, VHF Duplexer (Tuned)
HFD8189	155-162 MHz, VHF Duplexer
HFD8190	162-174 MHz, VHF Duplexer
TDN7407	450-470 MHz, UHF Duplexer (Tuned)

Preselector Modules

HFD8461	144-160 MHz, VHF Preselector
HFD8462	160-174 MHz, VHF Preselector
HFE8459	440-474 MHz, UHF Preselector

C200 Desksets

L3144	Basic Extended Local Control Desk Set
L3146	Tone Remote Control Desk Set w/4-Freq., w/intercom
L4137	Extended Local Control Desk Set w/RapidCall
L3149	Tone Remote Control Desk Set w/16-Freq., w/RapidCall
L3145	Basic DC Remote Control Desk Set
L3148	DC Remote Control Desk Set w/4-Freq., w/RapidCall
L3150	DC Remote Adapter w/F1/F2 & Service Manual
L3151	Tone Remote Adapter w/16-Freq. & Service Manual

Microphones

HMN3175	Compact Touch Code Microphone w/ 7 ft. cord
HMN3000	Desk Microphone, black

16-Pin Accessory in Repeater

HLN9457	16-Pin Accessory Kit

Antennas

TDD7559	144-153 MHz, 3 dB Gain
TDD7544	150-158 MHz, 3 dB Gain
TDD7545	158-166 MHz, 3 dB Gain
TDD7546	166-174 MHz, 3 dB Gain
TDE7260	450-470 MHz, 3.8 dB Gain
TDE7760	470-488 MHz, 3.8 dB Gain

Cables

HKN9040	RKR1225 Add-On Controller Cable
HKN9035	RKR1225 Internal Duplexer RF Cables
HKN9034	RKR1225 External Duplexer RF Cables
HKN9033	RKR1225 Extended Accessory Cable

General Accessories

HLN9455	GR1225/GR400 X-Pand Battery Revert Kit
RRX4025	Type "N" Connector Coaxial In-line Arrestor
RRX4032	Tower Mount Hardware w/In-line Arrestor
ST788	1/2" Jacketed Heliax Coaxial Ground Clamps
ST853	7/8" Jacketed Heliax Coaxial Ground Clamps
RLN4264	120 V AC, 15 Amp Duplex Surge Protector

Manuals

6880905Z53	R1225 Service Manual
HLN9535	R1225 Operating Manual Kit
HVN9054	1225 Series Radio Service Software

Specifications

GENERAL

	VHF		UHF	
Model Series:	M03GRC	M43GRC	M04GRC	M44GRC
Frequency Range:	146-174 MHz		444-474 MHz	
RF Output:	1-10 W	25-50 W	1-10 W	25-45 W
Channel Spacing:	Switchable 12.5/20/25/30 kHz			
Duty Cycle:	Continuous @ 25 Watts, 50% @ 45/50 Watts (5 min. on / 5 min. standby)			
Dimensions:	H 8.0" x W 10.0" x D 14.0" (H 203mm x W 254mm x D 256mm)			
Weight:	35.0 lbs. (15.9 kg)			
Channel Capacity:	16 Channels			
Freq. Separation:	28 MHz		30 MHz	
Input Voltage: Repeater Transceiver	115/230 V ac ±10% 13.8 V dc ±10%			
Input Drain: Repeater	2.6 A ac (maximum @ 115 V ac 1.3 A ac (maximum) @ 115 V ac			
Transceiver (@13.8 V dc) Standby Receive @ 3 W or 7.5 W audio	0.45 A dc 1.5 A dc			
Transmit @ 50/45 W	14.0 A dc		12.5 A dc	
Squelch Code Capabilities:	TPL/DPL/CSQ			

TRANSMITTER

	VHF		UHF	
Frequency Stability:	±2.5 ppm		±1.5 ppm	
Spurs/Harmonics:	-23 dBm			
Audio Response:	+1/-3 dB, relative to 6 dB/octave pre-emphasis, 300-3000 Hz			
FCC Designation:	ABZ99FT3024	ABZ99FT3023	ABZ99FT4024	ABZ99FT4023
FCC Modulation: 25 kHz 12.5 kHz	16K0F3E 11K0F3E			
Output Impedance:	50 ohms			
Modulation Sensitivity:	80 mV rms for 60% deviation @ 1000 Hz			
FM Noise: 25 kHz 12.5 kHz	45 dB 40 dB		45 dB 40 dB	
Audio Distortion:	<3% EIA (60% of Rated Max. Deviation @1000 Hz)			

RECEIVER

	VHF		UHF	
	12.5 kHz	**25 kHz**	**12.5 kHz**	**25 kHz**
Freq. Stability (-30C to +60C):	±2.5 ppm		±1.5 ppm	
Sensitivity @ 12 dB SINAD*:	0.35 µV (-116.1 dBm)			
Internal Squelch (SINAD):	10 dB nominal setting; adjustable from off to 20 dB			
Selectivity*:	75 dB	85 dB	70 dB	80 dB
Intermodulation*:	80 dB		80 dB	
Spurious Rejection:	85 dB		85 dB	
Image / Half IF Rejection:	80 dB		80 dB	
Audio Output: 8 ohms (external) 22 ohms (internal)	7.5 W 3.0 W Nominal			
Input impedance:	50 ohms			
EIA Usable Bandwidth:	1.2 kHz	2.0 kHz	1.2 kHz	2.0 kHz
Audio Response:	+2/-8 dB, relative to 6 dB/octave de-emphasis, 300-3000 Hz			

* Typical measurements per EIA/TIA-603.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Service Aids

The following table lists service aids recommended for working on the RKR1225 Rack Mount Repeater.

Motorola Part No.	Description	Application
HLN9214	Radio Interface Box	Enables communication between the radio and the computer's serial communications adapter.
HSN9412	RIB Power supply	Used to supply power to the RIB.
HKN9216	Computer Interface cable	Connects the computer's serial communications adapter to the RIB.
HKN9217	Program Test Cable	RIB to Radio Cable
HVN9054	Radio Service Software	Software on 3-1/2 in. diskettes.

Test Equipment

The following table lists test equipment required to service the RKR1225 Rack Mount Repeater.

Motorola Model No.	Description	Characteristics	Application
R2200, R2400, or R2001	Service Monitor	This monitor will substitute for items with an asterisk *	Frequency/deviation meter and signal generator for wide-range troubleshooting and alignment
*R1049	Digital Multimeter		Two meters recommended for ac/dc voltage and current measurements
*S1100	Audio Oscillator	67 to 200 Hz tones	Used with service monitor for injection of PL tones
*S1053, *SKN6009, *SKN6001	AC Voltmeter, Power Cable for meter, Test leads for meter	1mV to 300V, 10-Megohm input impedance	Audio voltage measurements
R1053	Dual-trace Oscilloscope	20 MHz bandwidth, 5mV/cm - 20V/cm	Waveform measurements
*S1350, *ST1215 (VHF) *ST1223 (UHF) *T1013	Wattmeter, Plug-in Elements (VHF & UHF), RF Dummy Load	50 Ohm, ±5% accuracy, 1-0 Watts, maximum 0-1000 MHz, 300 Watts	Transmitter power output measurements
S1339	RF Millivolt Meter	100uV to 3V RF, 10 kHz to 1.2 GHz	RF level measurements
*R1013	SINAD Meter		Receiver sensitivity
S1347 or S1348 (prog)	DC Power Supply	0-20 Vdc, 0-5 Amps	Bench supply for 12.5 Vdc

Section 1
Introduction to the RKR1225 Rack Mount Repeater and Components

Overview

This section introduces you to the RKR1225 Rack Mount Repeater; outlines the major components; physical appearance; accessories; general information about duplexers, cables, and antenna spacing; and basic assembly of the repeater stations.

Repeater Stations

The RKR1225 Rack Mount Repeater provides low cost communications solutions. All of the necessary components are built into one cabinet. The repeater housing allows space for the R1225 transceiver module and the retrofit control panel; one optional repeater controller; and the power supply and a duplexer or preselector.

The transceiver and power supply in the repeater are forced air cooled with a 70 cfm 12 V dc fan.

A few features that distinguish the RKR1225 repeater:

- **Mounting**
  The RKR1225 repeater is designed for mounting in a standard 19 in. rack or cabinet.
- **Space for Duplexer or Preselector Options**
  The RKR1225 repeater housing has space for either an optional duplexer or preselector.
- **Space for Optional Battery Revert Module**
  The optional HLN9455 Battery Revert module can be installed inside the RKR1225 chassis.
- **Space for Internally Mounting One Repeater Controller**
  As a convenience to end users who do not require access to one of the GR-Series controllers, one of the controllers can be installed over the transceiver.

Repeater Controllers

Basic repeater interfacing circuitry and control are features of the R1225 Transceiver. For advanced features, such as Multiple Tone Encode/Decode or Telephone Interconnect, external controllers may be connected to the RKR1225 repeater housing via the DB-25 connector on the back panel.

The following optional repeater controllers are available for use with the RKR1225 repeater:

- Multiple Tone Community Repeater Controller (ZR310)
- On-Site Repeater Controller (i20R)
- RapidCall Interconnect Controller (i750R)
- Advanced Interconnect Controller (ZR340)
- Selective Calling Interconnect Controller (ZR320)
- Tone Remote Adapter (TRA100R)
- Digital Trunking Controller (SmarTrunk II ST-853M)
- LTR Trunking Controllers (Trident and Zetron)

Table 1-1 lists these components and the basic function of the RKR1225 repeater when combined with each component.

Table 1-1. Repeater Function w/ Controller Components

Component	Repeater Function
ZR310	Community Repeater (for up to 70 groups)
ZR320	Full-Featured Telephone Interconnect
ZR340	Advanced Interconnect
i750R	Full-Feature Telephone Interconnect
i20R	Multiple-Tone Panel (up to 10 groups)
TRA100R	Tone Remote Adapter
ST-853M SmarTrunk II	Digital Trunking with Interconnect

Each repeater interface component has its own manual. The manuals are listed in Table 1-2.

Table 1-2. Documentation for Controller Components

Component	Service Manual	Software Manual
ZR310	6880904Z64	
i750R	6880904Z39	6880904Z45
i20R	6880904Z40	6880904Z55
ZR340	6880905Z90	
ZR320	6880903Z42	6880903Z43
TRA100R	6880903Z42	6880903Z43
ST-853M SmarTrunk II	6880905Z59	

Physical Description

The following paragraphs describe the physical characteristics of the RKR1225 repeater:

- Repeater Housing
- Repeater Fan Assembly
- (Optional) Repeater Power Supply
- R1225 Transceiver
- (Optional) Repeater Controllers
- (Optional) Duplexer
- (Optional) Preselector

Table 1-9 shows the physical dimensions and weight of the RKR1225 repeater.

Repeater Housing

The RKR1225 repeater housing has an EIA 5-1/4" (3U) front panel is designed for mounting in an EIA 19" relay rack or cabinet. The RKR1225 repeater is shipped from the factory with the fan assembly already installed in the repeater housing. The HPN9033 power supply can be ordered as an option.

Repeater Fan Assembly

A fixed-speed 12 Vdc fan is provided for cooling the assembled RKR1225 repeater. The fan operates at an air flow rate of approximately 70 cfm. When used with the HPN9033 Power Supply, the fan is controlled by a thermal switch.

Repeater Power Supply

(Optional)

The RKR1225 repeater's power supply HPN9033 operates from a 115/230 V ac (switch selectable) power source. The power supply is a highly efficient switch mode unit. The power supply provides power to the fan assembly, the R1225 transceiver, and any optional repeater controller. A battery backup/revert, HLN9455, with trickle charging, is an optional accessory for the RKR1225 repeater's power supply. The power supply has three connectors and a thermal switch:

- A "Ford" type 2-prong connector, on a "pigtail", to provide power for the R1225 transceiver.
- A 6-position connector, on a "pigtail", to provide power for the fan and trickle charge current for the optional battery revert module.
- An IEC ac input receptacle for various line cords (U.S. standard, 3-prong 115 V ac cord provided).
- A thermal switch to sense the temperature of the heatsink of the R1225 transceiver.

R1225 Transceiver

The R1225 transceiver has mounting screw holes on each side in which to secure it to the RKR1225 repeater housing. Connectors for interconnecting the transceiver between the duplexer and the corresponding optional, external repeater controller(s) are located at the front and back. Controls, indicators, and the microphone connector are located on the control panel of the R1225 transceiver.

Repeater Controllers (Optional)

The repeater controllers appear almost identical. They each have mounting screw holes on each side with which to secure them into the accessory rack mount (CDN6010).

Connectors for cabling between the R1225 transceiver and the repeater controller(s) are located on the back of each component. Operating power for the interface components is obtained from the R1225 transceiver. LEDs, **Set-Up** controls, and a **Programming** modular jack (where applicable) are located on the front of the repeater controllers.

Duplexer (Optional)

A duplexer allows the R1225 transceiver to operate simultaneously in the same frequency band with a single antenna and transmission line. Without the duplexer installed or connected to the RKR1225 repeater, it would be necessary to use two antennas spaced apart, with one connected to the receiver and the other to the transmitter. The duplexer mounts inside the repeater housing. The position of the mounting holes can vary, depending upon the type of duplexer used. RF connectors are on the rear of the duplexer, and tuning adjustments are on the front. The duplexer must be tuned before mounting into the RKR1225 repeater housing.

Preselector (Optional)

The preselector is a filter that allows a relatively narrow range of frequencies to pass through to the receiver while rejecting all other frequencies. In locations of high RF congestion, the preselector can reduce interference from intermodulation, desensitization and spurious responses. The preselector is placed in series with the input of the receiver in the R1225 transceiver from the duplexer or a separate receive antenna. The preselector must be tuned before mounting into the RKR1225 repeater housing.

NOTE

The internal space of the RKR1225 repeater allows mounting of a duplexer OR a preselector, but not both.

Accessories

Table 1-3 shows general compatibility for general accessories available for the RKR1225 repeater. Table 1-4 shows compatibility for the audio and DTMF accessories for each repeater controller. Additional accessories may be compatible if custom programming is done on the RSS and/or accessory cables are modified.

Duplexers, Preselectors, Cables, and Antenna Spacing

Duplexers

The duplexer "isolates" the receiver from the transmitter in the RKR1225 repeater. Without this isolation, the ability of the receiver to detect weak signals would be severely degraded by the output signal of the transmitter. Isolation may also be obtained by using separate antennas with proper spacing (distance) between the antennas. Less vertical spacing is needed for a given isolation of land mobile antennas than may be obtained easily with horizontal spacing.

There are two basic types of duplexers:

- bandpass
- bandreject

The bandpass duplexer has two filters connected together such that each filter will "pass" or appear transparent to, a narrow segment of frequencies; the filters are tuned to different frequencies. Any signal within the segment is transferred from or to the antenna while frequencies outside of the segment are "blocked."

The bandreject duplexer has two filters connected together such that each filter rejects, or "blocks," a narrow segment of frequencies. Again, the filters are tuned to different frequencies but any signal outside of the segment is transferred from or to the antenna while frequencies within the segment are "blocked."

The choice of which duplexer configuration to purchase may be dictated by the particular application. If several repeaters and an RKR1225 repeater are to operate at a given location, the bandpass duplexer might provide additional rejection to the signals from the other radios.

Basic Specifications

The basic specifications for a VHF or a UHF duplexer are:

- Impedance: 50 Ohms
- Isolation: 70 dB minimum

  Instead of the term "isolation," the manufacturer of the duplexer may use the terms "Receiver (or Rx) Isolation at the Transmitter Frequency" and "Transmitter (or Tx) Noise Suppression at the Receiver Frequency."
- Power handling: 50 Watts minimum

  Power handling may be called "Continuous Power Input" by the manufacturer.

Table 1-3. Accessory Compatibility with RKR1225 Repeater (General)

Part No.	Accessory
HSN8145	7.5 Watt External Speaker
HKN9035	RKR1225 Internal Duplexer RF Cables
HKN9034	RKR1225 External Duplexer RF Cables
HKN9040	RKR1225 Add-on Controller Cable

Table 1-4. Accessory Compatibility (Audio & DTMF)

Repeater Controller							
i20R	i750R	TRA100R	ZR310	ZR320	ZR340	Part No.	Accessory
X	X	X	X	X	X	L3134	Local Deskset
	X		X	X	X	L3150	DC Remote Adapter (2-Freq.)
	X		X	X	X	L3151	Tone Remote Adapter (16-Freq.)
						L3145	DC Remote Deskset (4-Freq.)
		X				L3146	Tone Remote Deskset (4-Freq.)
X	X	X	X	X	X	HMN3000_	Desk Microphone
X	X	X	X	X	X	HMN3175	DTMF LED Microphones

- Insertion loss: 3 dB maximum

  Less insertion loss of the duplexer means the receiver is able to discern weaker signals and the transmitter delivers more power output to the antenna. The 3 dB specification will result in coverage range being reduced approximately 30%. Typical insertion losses quoted in catalog sheets are 1.5 dB.

- Frequency spacing: Band dependent

  "Frequency spacing" is the frequency difference between the operating frequencies of the receiver and the transmitter. Frequency spacing less than 3 MHz can be achieved but the physical size of the duplexer increases dramatically. If a VHF repeater is being assembled, be aware of the minimum frequency spacing that a duplexer can provide when choosing the operating frequencies for the repeater. The VHF duplexers available from Motorola Radius stock are specified at 4.5 MHz minimum spacing. In the United States, the spacing in the 450 MHz to 470 MHz UHF band is 5 MHz.

If the proper equipment necessary to tune a duplexer is not available, then the duplexer must be pretuned by the manufacturer. Be ready to provide the exact receiver and transmitter frequencies at the time of purchase. Also indicate that the duplexer will be used in a GR1225 repeater.

- Connector Type-N

  The type BNC connector may be used on the receiver and transmitter inputs but must be avoided for the antenna. The BNC is prone to mechanical movement which can generate noise when the transmitter is operating. Type UHF connectors will suffice for VHF but should be avoided for UHF. The mini-UHF connector, if available for the duplexer, is very good. Other connectors, such as the SMA and the TNC, are very good but may be more expensive, fragile and rather difficult to assemble in the field. The best general performance comes from the type-N.

The cables purchased separately for the RKR1225 repeater mate with a type-N at the duplexer end. Any other type of connector will require you to assemble cables.

Preselectors

- Impedance: 50 Ohms

- Insertion loss: 3 dB maximum

  The 3 dB loss may cause a reduction in possible service coverage area of the repeater but the rejecting of interference may more than offset this coverage reduction. Be aware that insertion loss changes in an opposite way that pass bandwidth does. As the pass bandwidth decreases (narrower filter), the insertion loss increases.

- Pass bandwidth: band and interference dependent

  The pass bandwidth is defined as the difference between the highest frequency and the lowest frequency at which the insertion loss has increased an additional 0.5 dB. As the operating frequency increases, it is more difficult to maintain a "fixed" pass bandwidth. Therefore, VHF preselectors will tend to be narrower than UHF preselectors for equal insertion losses. The required pass bandwidth will be a function of the frequency spacing from the repeater receiver frequency and the interfering signal(s).

- Rejection: interference dependent

  The amount of rejection or attenuation of the interference varies between situations and the type of interference. In one case, 1 dB of attenuation will yield only 1 dB of interference reduction. In others, intermodulation or spurious responses, 1 dB of attenuation will yield 3 dB or more interference reduction. A typical rejection of 30 dB by the preselector at the closest interfering frequency should suffice.

Cables

The coaxial cables that connect the transceiver to the duplexer are fabricated from RG58A/U (the cable that is used with most of the mobile antenna kits). Since RG58A/U does not have a perfect shield, the routing of the cables should allow a physical separation of approximately 1 inch.

Do not use RG58A/U as the coaxial cable that connects the antenna connector of the repeater to the antenna. The rather small size of RG58A/U can introduce excessive losses in the system that will decrease the effective range of the repeater.

Substitute RG400/U for short lengths and RG214/U or 1/2-inch "hardline" for the longer lengths. If the "hardline" is used, connect the end of the "hardline" to the duplexer with a flexible jumper cable to avoid undue stress on the connectors of the cables and the duplexer.

In planning a system, make sure that the various connectors found on the duplexer, feedlines, feedline jumpers and antenna are the correct mating pairs. Avoid using several connectors and adapters, as they may generate interference (IM "hits").

Table 1-5 can be used to determine which feedline to choose for a given frequency band and line length to maintain 1.5 dB or less power loss. Table 1-6 is a list of

Motorola part numbers for the various connectors and cables.

Table 1-5. Maximum Feedline Length in Feet (Meters)

Band	RG400/U	RG214/U	Hardline
Low (50 MHz)	55 (17)	100 (30)	300 (90)
VHF (150 MHz)	25 (7.5)	50 (15)	150 (45)
UHF (450 MHz)	15 (4.5)	25 (7.5)	90 (27)
800 MHz	10 (3)	20 (6)	70 (21)

Table 1-6. Part Numbers for Connectors/Cables

Part	Motorola Part Number
mini-UHF male connector	2884606M01
UHF male connector	2884579F04
type-N male connector	2884476G01
type-N hardline male	RRX-4007A
type-N hardline female	RRX-4008A
RG58A/U coaxial cable	3000475378
RG400/U coaxial cable	3084173E01
RG214/U coaxial cable	3015068A17
1/2" hardline cable	3080329A22
8 foot jumper cable	TDN8406A*
type-N f-f adapter	5882764A01*

*Use of the type-N f-f adapter may be required to connect the jumper cable to the main feedline.

Antenna Spacing

Isolation between the output from the transmitter and the input to the receiver may be obtained with physical distance. Instead of using a duplexer, two antennas may be spaced apart and connected to the receiver and the transmitter with separate transmission lines. The separation necessary to yield the desired 70 dB of isolation is dependent upon the frequency band of operation. It is obvious from the following charts that, for all vertically polarized antennas in use for land mobile services, vertical spacing will get the 70 dB more easily than horizontal spacing. The horizontal spacing may be reduced if buildings, hills, or mountains are present between the antennas; the amount of reduction has to be determined by experiment. Table 1-7 shows the vertical spacing and Table 1-8 shows the horizontal spacing.

NOTE
The losses associated with long transmission lines have not been included in the calculations of the spacings. It is readily apparent that horizontal spacing of antennas is somewhat useless; the cost of the transmission lines to the two antennas would be greater than the cost of a duplexer.

NOTE
The two antennas will couple to a common metallic support; the position of one of the antennas may have to be varied to attain the desired isolation.

NOTE
The following tables contain spacing information about vertically polarized antennas used in land mobile services.

Table 1-7. Vertical Spacing

Frequency (MHz)	Spacing	
	feet	meters
150	59	18
170	52	16
400	22	7
470	20	6

Table 1-8. Horizontal Spacing

Frequency (MHz)	Spacing	
	feet	meters
150	2,600	780
400	960	293

Preventive Maintenance

Preventive maintenance of the RKR!225 Repeater Station consists of:

- visual inspection
- periodic cleaning

Visual Inspection

Check that external surfaces of the equipment are clean, that connecting cables are not damaged, and that connections are firm. A detailed inspection of the interior electronic circuitry is not needed or desired.

Periodic Cleaning

Periodically clean smudges and grime from the exterior housing. Use a soft, non-abrasive cloth moistened in a mild soap and water solution. Rinse the surface using a second cloth moistened in clean water, and clean any dirt or debris from the fan grill.

Table 1-9. RKR1225 Repeater Equipment Physical Characteristics

Major Component/Assembly	Height	Width	Depth	Weight
RKR1225 repeater station (includes the weights of chassis, mounting brackets, front panel, control head and cables, and fan assembly)	5.25 in. (1338mm)	19 in. (482mm)	13.5 in. (343mm)	22 lbs. (10kg)
R1225 Transceiver (high power models)	2.0 in. (51mm)	7.0 in. (178mm)	8.37 in. (213mm)	5.5 lbs. (2.50kg)
Repeater Controllers (maximum dimensions)	1.3 in. (34mm)	7.1 in. (180mm)	8.7 in. (221mm)	1.7 lbs. (0.77kg)
Preselector (maximum dimensions)	1.3 in. (33mm)	4.2 in. (105mm)	9.3 in. (235mm)	2.1 lbs. (0.9kg)
Duplexer (maximum dimensions)	1.3 in. (33mm)	6.3 in. (160mm)	9.5 in. (241mm)	3.5 lbs. (1.59kg)
Power Supply	2.0 in. (51mm)	7.0 in. (178mm)	7.5 in. (191mm)	3.1 lbs. (1.41kg)
Fan Assembly	4.8 in. (122mm)	4.8 in. (122mm)	1.5 in. (38mm)	0.5 lbs. (0.23kg)
Battery Revert Module	1.7 in. (43mm)	5.4 in (137mm)	2.9 in (74mm)	0.61 lbs. (0.27kg)

Section 2
Assembling the RKR1225 Repeater

Overview

This section contains information about the contents of your kit, assembly, mounting, and final assembly of your RKR1225 Repeater Station.

The RKR1225 repeater is designed to be mounted in a standard EIA 19" relay rack or cabinet. Please inspect your RKR1225 repeater for any obvious signs of damage. If you need to send the unit in for repairs, we recommend using the original packaging.

Performance

The RKR1225 repeater is not a high performance repeater, but is designed to withstand constant use. The RKR1225 repeater package is designed for fixed locations where protection from the elements (snow, rain, etc.) can be provided.

The fan is single speed, high airflow (70 cfm). It provides maximum cooling at elevated ambient temperatures or during heavy transmit duty cycles. The station is defined as intermittent transmit duty cycle, but it may have a surprisingly lower power slump when keyed for long periods in an office or shop environment.

Contents of the RKR1225 Repeater Kits

The following is a checklist of the contents of the kits used in assembling the RKR1225 repeater. Some of these kits are optional for assembling an internal duplexer, an external duplexer, or an optional controller into the RKR1225 repeater. The quantities are listed in [ ] brackets.

HLN9514 (control head)

- [1] R1225 Transceiver Retrofit Control Head

HHLN4077 (Hardware)

- [4] M5 Torx® Machine Screw, 8mm long (Blk)
- [5] Tie Wraps, Nylon, 3-5/8"
- [2] 1/4-20 Nut
- [2] 1/4-20 External Lockwashers
- [1] 1/4-20 x 1-1/2" Screw, Phillips Head

HKN9032 (Control Head Interface)

- [2] Flat Ribbon Cables
- [2] T20 Cap Head Screws

HKN9033 (Optional RKR1225 Extended Accessory Cable)

- [1] Cable (16-pin to DB-25F)
- [2] Tie Wraps, Nylon 3-5/8"

HKN9034 (Optional External Duplexer Cables)

- [2] Mini-UHF Plug to N Bulkhead RF Cables
- [1] 90-Degree Mini-U RF Adaptor
- [2] Vinyl Caps

HKN9035 (Optional Internal Duplexer Cables)

- [4] Tinnerman Nut Clips
- [4] 6 x 32 x 1/2 Machine Screw, Pan Head
- [2] Mini-UHF Plug to N Plug RF Cables
- [1] N Plug to N Bulkhead RF cable
- [4] Tie Wraps, Nylon
- [1] 90-Degree Mini-U RF Adaptor
- [1] Vinyl Cap

HKN9040 (Optional RKR1225 Add-on Internal Controller Cable)

- [1] Controller Cable (double 16-pin to single 16-pin)
- [2] Tee Knob M5 Screws
- [2] Tie Wraps, Nylon 3-5/8"

HKN9039 (Optional RKR1225 Add-on External Controller Cable

- [1] Controller Cable (double 16-pin to DB25M)

Additional Kits You May Require

In addition to the RKR125 repeater housing kit (HLN3254), you may need some of the following units or optional kits.

R1225 Transceiver

The RKR1225 is not useful without a R1225 transceiver just as an automobile is not drivable without an engine. As of this printing of the RKR1225 service manual, there are four models available:

M03GRC90C2AA	1-10 W, 146-174 MHz, VHF Transceiver
M43GRC90C2AA	25-50 W, 146-174 MHz, VHF Transceiver
M04GRC90C2AA	1-10 W, 444-474 MHz, UHF Transceiver
M44GRC90C2AA	25-45 W, 444-474 MHz, UHF Transceiver

HPN9033 Switchmode Power Supply

The HPN9033 power supply may be internally mounted in the RKR1225 repeater housing. This power supply is capable of continuous duty and supplying 13.8 V dc at 15 Amperes.

HKN9034 External Duplexer Cable Kit

The two (2) RF cables in this kit provide connection between the mini-UHF RF antenna connectors on the R1225 transceiver and type-N bulkhead female connectors that mount on the back panel of the RKR1225 repeater housing. Use this kit if the repeater has separate transmit and receive antennas, a transmit combiner/receiver multi-coupler system or a duplexer that is not capable of being mounted inside the RKR1225 repeater housing.

HKN9035 Internal Duplexer Cable Kit

Two (2) of the three (3) RF cable in this kit provide connection between the mini-UHF RF antenna connectors on the R1225 transceiver and type-N connectors on the receiver and transmitter ports of an internally mounted duplexer. The third cable provides the connections between the type-N antenna connector of the duplexer and a type-N bulkhead female on the back panel of the RKR1225 repeater housing.

Duplexer (internally mounted)

There are several duplexers available from Motorola that can be mounted inside the RKR1225 repeater housing. The power supply/duplexer bracket has the mounting hole pattern to accommodate these duplexers. Please note that the minimum transmit to receive frequency spacing is 4.5 MHz for VHF models and either 5 MHz (444-470 MHz) or 3 MHz (above 470 MHz) for the UHF models.

Preselector (internally mounted)

There are several preselectors available from Motorola that can be mounted inside the RKR1225 repeater housing. The power supply/duplexer bracket has the mounting hole pattern to accommodate these preselectors. Please note that the power supply/duplexer bracket allows mounting either a duplexer or a preselector, but not both simultaneously.

HKN9040 GR1225 Controller Cable

The RKR1225 repeater housing has provisions for internally mounting one (1) GR Series repeater controller (e.g. ZR310). The controller is NOT accessible after the RKR1225 repeater housing is assembled. The mounting is a convenience for "set and forget" controllers. The HKN9040 cable kit contains a cable that interfaces between the controller and the R1225 transceiver and also contains two Tee Knob screws for securing the controller to the transceiver/control head bracket.

HKN9033 Extended Accessory Cable

The HKN9033 cable provides connection between the 16-pin accessory connector on the back of the R1225 transceiver and a standard DB-25 type female connector that mounts on the back panel of the RKR1225. It is a convenient, readily available connector for interfacing externally mounted repeater controllers or accessories to the R1225. In some cases, cables are available from Motorola to connect between the DB-25 and the externally mounted unit. For other applications, you can construct your own cable. The wiring of the HN9033 is such that the pin numbers of the DB-25 line-up with the pin numbers of the 16-pin connector (i.e., pin 1 goes to pin 1, pin 2 goes to pin 2, etc.).

CDN6010 Dual Unit, 19" Rack Mount

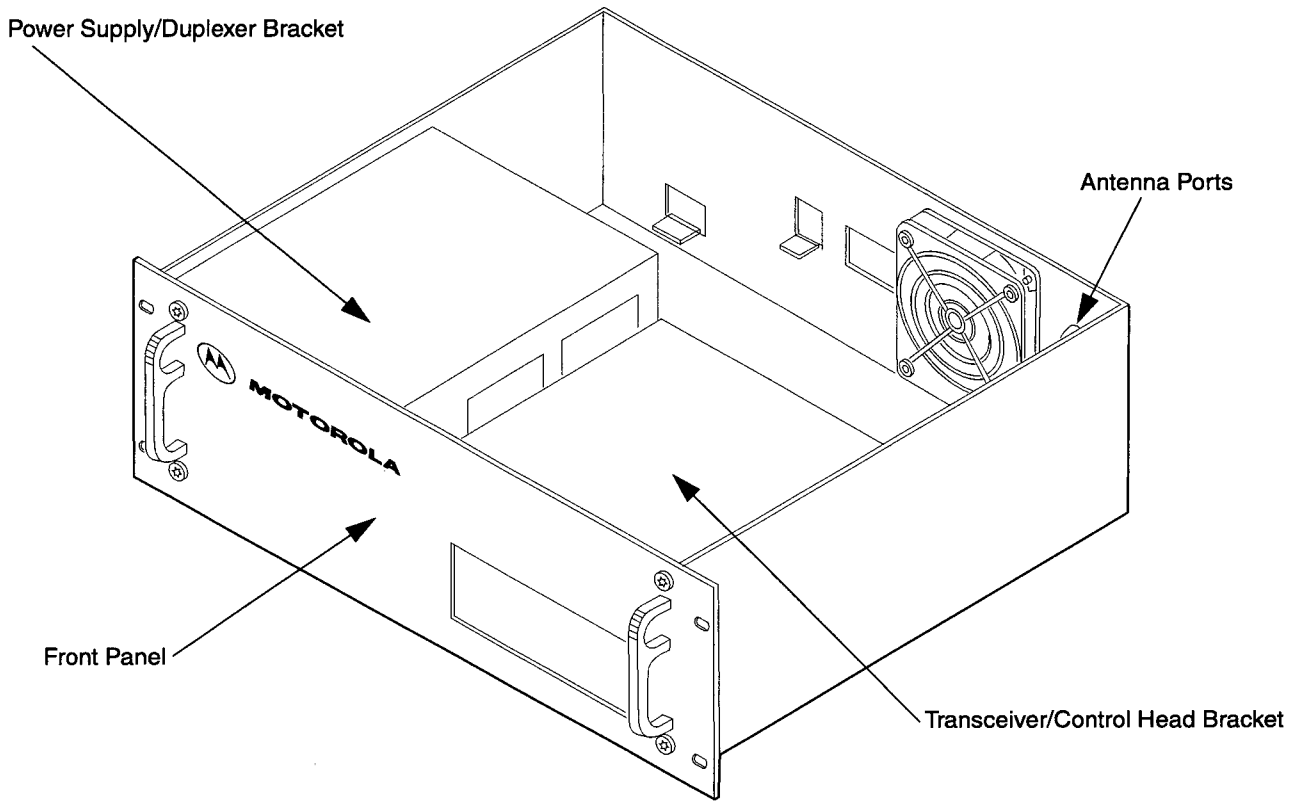
The CDN6010 allows one or two GR Series repeater controllers to be mounted externally to the RKR1225 housing.

HKN9039 Add-on Controller Cable

The HKN9039 interfaces with a GR Series controller, mounted in the CDN6010 rack mount, to the DB-25 accessory connector (part of the HKN9033 cable) on the back of the RKR1225 repeater housing.

HLN9455 Battery Revert Module

The HLN9455 battery revert module may be mounted in the RKR1225 repeater housing. It is placed at the rear of the housing, behind the power supply. Holes are provided in the chassis bottom for affixing the module to the RKR1225 repeater housing.



Basic RKR1225 Repeater Information

Weight	Height	Width	Depth
22 lbs. (10kg)	5-1/4 in. (133.4mm)	19 in. (482mm)	13.5 in. (343mm)

Figure 2-1. Assembled RKR1225 Repeater (before component installation)

Disassembling the Repeater Housing

When disassembling the housing, retain all screws for reuse. Figure 2-1 shows the repeater housing before component installation. Unless otherwise specified, directions are referenced to viewing from the front panel.

1. Remove the four (4) TT4.0 screws holding the top cover in place.
2. Remove the top cover.
3. Remove the four (4) TT6.0 screws from the front panel using a T30 Torx driver.
4. Remove the front panel.
5. Loosen the left side TT4.0 screws on the transceiver/control head bracket using a T20 Torx driver. One or two turns are sufficient.
6. Remove the right side TT4.0 screws on the transceiver/control head bracket using a T20 Torx driver.
7. Slide the transceiver/control head bracket slightly toward the right to clear the left side screws and remove the bracket from the repeater housing.

NOTE
If an external power supply is to be used, skip Steps 8 and 9. See "Connecting to an External Power Supply" on page 2-8 for wiring recommendations.

8. If an HPN9033 Power Supply is to be used, repeat Steps 5, 6, and 7 for the power supply/duplexer bracket.
9. Remove the power supply/duplexer bracket.

Installing the Ground Lug

(Located in kit HHLN4077)

CAUTION

If the RKR1225 repeater is to be reshipped to another location in this box, disregard steps 1 and 2 until the unit is at its final destination. *Do Not* reship with ground lug or antenna cable mounted to the unit.

1. Locate the 1/4-20 x 1-1/2" screw in kit HHLN4077.
2. Insert the screw, from the inside of the housing, through the small hole beneath the D-shaped holes in the back of the housing.
3. Locate the 1/4-20 lockwasher and 1/4-20 nut in kit HHLN4077.
4. Place the lockwasher and nut onto the screw and tighten to 2.25 N-m (20 in.-lbs.) torque.

NOTE

The remaining nut and external washer, in kit HHLN4077, are used to ground the repeater to an earth ground, as referenced in the Final Assembly of this section. These can be loosely assembled onto the screw to prevent loss.

Installing an Advantage™ Board into the R1225 Transceiver AdvantagePort™

The R1225 transceiver has been designed with an AdvantagePort interface that allows compatible Advantage Boards to be field installed. If an option board is desired, please install at this time. Refer to the R1225 Transceiver Service Manual (6880905Z53) for the proper installation of an Advantage Board.

Connecting the Control Head Cables to the R1225 Transceiver

1. Locate the two (2) flat ribbon cables in kit HKN9032.
2. Remove the flat ribbon cable cover screw on the transceiver using a T10 Torx driver.
3. Connect the 12-position flat ribbon connector from the control head assembly to the 12 pins on the right of the transceiver connector, making sure that the cable connector aligns properly with the missing #8 pin.
4. Connect the 15-position flat ribbon connector from the control head assembly to the 15 pins on the left of the transceiver connector, making sure that the cable connector aligns properly with the missing #3 pin.
5. Replace the flat ribbon cable cover and screw. Tighten to 0.68 N-m (6 in.-lbs.) torque.

Connecting the Optional HKN9040 Internal Controller Cable to the R1225 Transceiver

NOTE

If a GR Series repeater controller will be mounted inside the RKR1225 repeater housing, connect the cable from kit HKN9040 to the R1225 transceiver.

1. Locate the controller cable in kit HKN9040.
2. Attach the (single) 16-pin connector of the cable to the accessory connector on the back of the R1225 transceiver. The other end will be attached later to the controller or accessory.

Connecting the Optional HKN9033 Extended Accessory Cable to the R1225 Transceiver

NOTE

If the HKN9033 cable kit will be used, connect the 16-pin connector to the R1225 transceiver before the transceiver/control head bracket is mounted into the RKR1225 repeater housing.

The HKN9033 cable interfaces the R1225 transceiver to a rear panel mounted DB-25 socket on the RKR1225 repeater housing. Motorola supplied or dealer fabricated cables then connect between the DB-25 socket and any external (to the RKR1225 repeater housing) controller(s) or accessories.

1. Locate the 16-pin to DB-25 cable in the kit HKN9033.
2. Attach the 16-pin connector to the accessory connector on the back of the R1225 transceiver.

NOTE

The DB-25 socket will be attached to the rear panel of the RKR1225 repeater housing after the transceiver/control head bracket is mounted into the RKR1225 repeater housing.

Installing the Optional External Duplexer Cables

1. Locate the two (2) RF type cables and the 90-degree RF connector in kit HKN9034.
2. Attach the 90-degree RF connector to the receiver antenna connector on the front of the transceiver. Tighten 1/16 of a turn past finger tight using gas pliers. When viewed from the front of the R1225 transceiver, the 90-degree RF connector should be facing downward at a five o'clock position.
3. Attach the long (26") RF cable to the 90-degree RF connector on the front of the transceiver. Tighten 1/16 of a turn past finger tight using gas pliers.
4. Attach the short (15") RF cable to the transmitter antenna connector on the back of the transceiver. Tighten 1/16 of a turn past finger tight using gas pliers.

Installing the Optional Internal Duplexer Cables

1. Locate the three (3) RF type cables and the 90-degree RF connector in kit HKN9035.
2. Remove the nut and lockwasher from the bulkhead connector of the N plug to N bulkhead cable.
3. Align the flat side of the bulkhead connector, of the cable, with the straight side of the D-shaped hole in the back of the repeater housing and insert, from the inside to the outside, into the lower D-shaped hole (stamped "Rx/Duplex").
4. Secure the bulkhead connector to the repeater housing using the nut and lockwasher removed in Step 2 and tighten to 2.25 N-m (20 in.-lbs.) torque.
5. Attach the 90-degree RF connector to the receiver antenna connector on the front of the transceiver. Tighten 1/16 of a turn past finger tight using gas pliers. When viewed from the front of the R1225 transceiver, the 90-degree RF connector should be facing downward at a five o'clock position.
6. Attach the long (26") mini-UHF plug to N plug cable to the 90-degree RF connector on the front of the transceiver. Tighten 1/16 of a turn past finger tight using gas pliers
7. Attach the short (15") mini-UHF plug to N plug cable to the transmitter antenna connector on the back of the transceiver. Tighten 1/16 of a turn past finger tight using gas pliers

Installing the R1225 Transceiver

1. Place the transceiver/control head bracket on a flat surface with the open end down and the control head mounting tabs toward the front.
2. Slide the transceiver in from the rear of the bracket into the bottom position of the transceiver/control head bracket.
3. Align the holes of the transceiver with the M5 holes of the bracket.
4. Locate two (2) of the M5 x 8.0 machine screws in kit HHLN4077.
5. Secure the transceiver to the bracket with the two (2) M5 x 8 machine screws using a T25 Torx driver. Tighten to 3.16 N-m (28 in.-lbs.) torque.

Assembling the Control Head to the Transceiver/Control Head Bracket

1. Locate the control head in kit HLN9514.
2. Locate the two (2) T20 cap head screws and the two (2) flat ribbon cables in kit HKN9032.
3. Attach the 12-position flat ribbon cable from the R1225 transceiver to the 12 pins on the display board of the control head. Make sure that the cable connector aligns properly with the missing #8 pin.
4. Attach the 15-position flat ribbon cable from R1225 transceiver to the 15 pins on the volume/microphone board of the control head. Make sure that the cable connector aligns properly with the missing #3 pin.
5. Attach the control head to the transceiver/control head bracket using the locator tabs on the bracket.
6. Secure the control head to the bracket with the two (2) T20 cap head screws using a T15 Torx driver. Tighten to 1.69 N-m (15 in.-lbs.) torque.

Installing an Optional GR Series Controller

NOTE
A mounting area for a GR Series controller is provided on the top surface of the transceiver/control head bracket.

IMPORTANT
Once the RKR1225 repeater housing has been assembled, there is NO access to the front panel of the GR Series controller. The mounting is provided for those applications of a "set and forget" nature. All adjustments and programming of the controller must be completed before the front panel of the RKR1225 repeater housing is re-attached.

1. Locate the GR Series controller (e.g., ZR310 controller) that will be used.
2. Locate the two (2) M5 Tee Knob screws in kit HKN9040.
3. Thread the Tee Knob screws into the mounting holes on the sides of the controller.
4. Slide the controller fromthe back into the slots of the controller mounting tabs on top of the transceiver/control head bracket. The front of the controller should be at the control head end of the bracket.
5. Secure the controller to the two (2) mounting tabs of the bracket with the M5 Tee Knob screws. Hand tighten the screws.
6. Connect the "Rx" connector of the cable from kit HKN9040, or equivalent cable, to the "Receive" (or "RX-J5)" connector on the controller.
7. Connect the "Tx" connector of the cable from kit HKN9236, or equivalent cable, to the "Transmit" (or "TX-J3") connector on the controller.

Installing the Transceiver/Control Head Bracket Module

1. Place the assembled transceiver/control head bracket module into the right side position in the RKR1225 repeater housing. See Figure 2-3.
2. Tilt the bracket slightly upward at the right side and slide the left side notched mounting tabs on the bracket under the TT4.0 screws.
3. Replace the two (2) TT4.0 screws removed from the right side in Step 6 under "Disassembling the Repeater Housing" on page 2-3. Tighten all four (4) screws to 1.58 N-m (14 in.-lbs.) torque.

Mounting the Optional HKN9033 Controller Cable to the RKR1225 Repeater Housing

NOTE
Make a one turn "service loop" in the cable before installing the DB-25 socket.

1. If the HKN9033 controller cable is used, place the DB-25 socket of the cable in the cutout on the rear panel of the RKR1225 repeater housing.
2. Secure the socket to the housing with the supplied hardware.

Installing the Internal Power Supply (Optional HPN9033)

1. Place the power supply/duplexer bracket on a flat surface with the open end facing downward and the slotting mounting holes toward the left.
2. Locate two (2) M5 x 8.0 machine screws in kit HHLN4077.
3. Slide the power supply into the power supply/duplexer bracket with the slot ventilation holes of the power supply facing forward.
4. Secure the power supply with the two (2) M5 x 8.0 machine screws using a T25 Torx driver. Tighten to 3.16 N-m (28 in.-lbs.) torque.
5. If continuous fan operation is desired, move the slide switch, located at the rear of the power supply, to the "Fan Continuous On" position.

Installing an Optional Internal Duplexer or Preselector

If an optional internal duplexer or preselector is to be used with the repeater, space has been provided, for one or the other, above the power supply. Installation of a duplexer follows.

Installing an Internal Duplexer

NOTE
The duplexer (or preselector) should be tuned before mounting into the power supply/duplexer bracket module.

1. Examine the duplexer that was ordered for the RKR1225 repeater model being assembled. If four (4) of the mounting holes contain Pemnuts (threaded inserts), proceed to Step 3. If no Pemnuts are present, locate the four (4) Tinnerman clips in kit HKN9035 and continue with Step 2.

2. Using a pair of needle nose pliers, place Tinnerman clips over four of the mounting holes of the duplexer (refer to Figure 2-2).

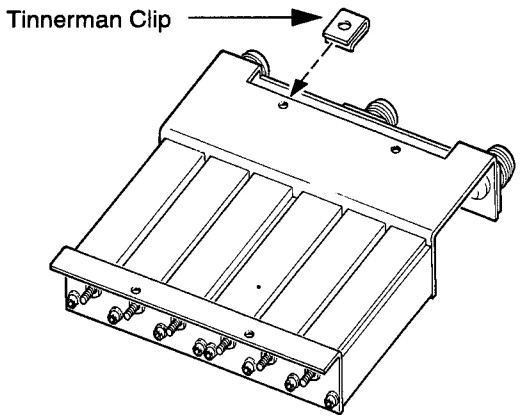


Figure 2-2. Duplexer, Bottom View

NOTE
The threaded side of each clip should be on the connector/tuning screw side of the duplexer mounting flange.

3. Place the duplexer into the power supply/duplexer bracket with the six tuning screws facing toward the front panel of the repeater housing. The mounting holes of the duplexer must face upward.

4. Locate the four (4) 6-32 x 1/2" T15 Torx, pan head screws in kit HKN9035.

5. Secure the duplexer to the mounting bracket with four (4) 6-32 x 1/2" T15 Torx, pan head screws. Tighten the screws to 0.68 N-m (6 in.-lbs.) torque for the Tinnerman clips or 1.35 to 1.58 N-m (12 to 14 in.-lbs.) torque for threaded inserts.

Installing the Power Supply/ Duplexer Bracket Module

1. Place the power supply/duplexer bracket module into the left side position of the RKR1225 repeater housing. See Figure 2-3

2. Tilt the module slightly upward at the right side and slide the left notched mounting tabs on the bracket under the TT4.0 screws.

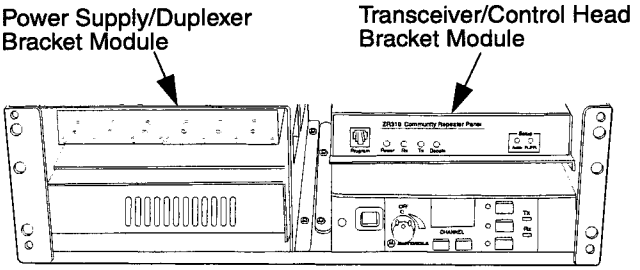


Figure 2-3. Bracket Module Positions

3. Replace the two (2) TT4.0 screws removed from the right side in Step 6 under "Disassembling the Repeater Housing" on page 2-3. Tighten all four (4) screws to 1.58 N-m (14 in.-lbs.) torque.

Connecting to the Internal Power Supply

1. Connect the power supply 6-position, fan connector to the fan power connector.

2. Connect the 2-prong "Ford" connector of the power supply output connector to the power supply connector on the back of the R1225 transceiver.

3. Locate the thermal switch mounting clip supplied with the HPN9033 power supply. Slip the mounting clip onto the thermal switch, from the power supply. Refer to Figure 2-4.

4. Place the thermal switch and mounting clip, in-between the last long fins of the R1225 transceiver's heatsink. These fins are nearest the DC connector. Refer to Figure 2-4

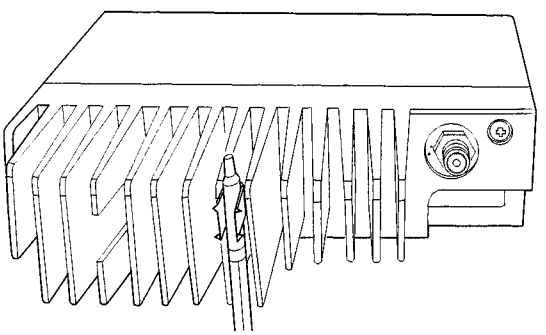


Figure 2-4. Insert thermal Switch into R1225 Heatsink

5. Use a regulator blade screwdriver to carefully push the thermal switch securely in the space between the fins.

6. Use the tie wraps supplied in kit HHLN4077 to bundle all cords and wires away from the fan.

Connecting to an External Power Supply

CAUTION

Any construction technique for connecting to an external power source must ensure that the leads from the transceiver dc extension cable, the fan cable and the power supply cable are properly insulated to prevent accidental shorting and the possibility of fire.

The following procedure is representative of methods to power the repeater assembly from your externally mounted power supply. This procedure uses a standard high power mobile radio cable kit, such as the HKN9402_R.

You will be required to supply insulated crimp butt splices or use equivalent construction to connect the dc power cables for the transceiver and the repeater fan to a power cable from your power supply.

1. Locate the cable attached to the fan of the housing.
2. Cut off the fan cable from the 6-pin connector as close to the connector as possible.
3. Strip approximately 13mm (1/2") of the insulation from the free ends of the red and black wires of the fan cable.
4. Locate the mobile power cable kit (e.g., HKN9402_R).
5. Cut the cable leads approximately 15cm (6") from the 2-prong "Ford" connector.
6. Strip approximately 13mm (1/2") of the insulation from the free end of the red ("positive") lead of the cable with the 2-prong "Ford" connector.
7. Twist together the red fan cable wire and the red lead of the mobile power cable.
8. Insert the twisted together red leads into a butt splice and crimp tightly.
9. Repeat Steps 6 through 8 for the remaining black ("negative") lead of the power cable with the 2-prong "Ford" connector and the black lead of the fan.
10. The remaining lengths of cable from the mobile power cable can be crimped to the above leads. Whether this cable or another cable is used, the positive power supply lead connects to the red leads. The negative power supply lead connects to the black leads.

Connecting the Duplexer Antenna Cables

Connecting External Duplexer Antenna Cables

1. Remove the nuts and lockwashers from both RF cables from the R1225 transceiver.
2. Locate the receiver antenna cable from the front of the R1225 transceiver.
3. Align the flat side of the bulkhead connector with the straight side of the D-shaped hole in the back of the RKR1225 repeater housing and insert, from the inside to the outside, into the bottom hole (stamped "Rx/Duplexer").
4. Locate the transmitter antenna cable from the back of the R1225 transceiver.
5. Align the flat side of the bulkhead connector with the straight side of the D-shaped hole in the back of the repeater housing and insert, from the inside to the outside, into the top hole (stamped "Tx").
6. Secure the bulkhead connectors to the RKR1225 repeater housing using the nuts and lockwashers removed in Step 1 and tighten to 2.25 N-m (20 in.-lbs.) torque.

Connecting Internal Duplexer Antenna Cables

1. Connect the type-N male connector from the bulkhead cable to the antenna connector of the duplexer.
2. Connect the type-N male connector of the receiver antenna cable, from the front of the transceiver, to the appropriate port of the duplexer.
3. Connect the type-N male connector of the transmitter antenna cable, from the back of the transceiver, to the empty port of the duplexer.

Replacing the Repeater Housing Front Panel

NOTE
Before replacing the repeater housing front panel, tuning of an optional internal duplexer or preselector or programming of an optional controller must be performed. Once the front panel is replaced, these components are NOT accessible.

1. Replace the front panel.
2. Secure the front panel to the housing with the four (4) TT6.0 screws removed earlier using a T30 Torx driver. Tighten to 3.16 N-m (28 in.-lbs.) torque.

Controller Connections

SmarTrunk II Controller Connections

1. Locate the SmarTrunk II cable previously attached to the transceiver.
2. Attach the DB-25 connector to the DB-25 connector on the back of the controller.
3. Tighten both screws using a small flat bladed screwdriver.

GR Series Controller Connections

NOTE
Disregard this section if the GR Series controller has been mounted internally.

1. Locate the GR Series cable previously attached to the transceiver or the HKN9039.
2. Connect the "Tx" plug of the controller cable from the transceiver to the transmitter connector of the repeater controller.
3. Connect the "Rx" plug of the controller cable from the transceiver to the receiver connector of the repeater controller.
4. If the cable is the HKN9039, connect the DB-25M end to the DB-25F connector, of the HKN9033 cable, on the RKR1225 housing's rear panel.

Installing the HLN9455 Battery Revert Module

If the optional HLN9455 Battery Revert Module will be used, follow these instructions to install the module into the RKR1225 housing. Orientation for the following steps is with respect to viewing the front panel from the outside of the RKR1225 housing.

Mounting the Module in the RKR1225 Housing

1. If necessary, unplug the ac line cord of the HPN9033 power supply unit from the ac mains.
2. Unplug the dc power cable to the R1225 transceiver.
3. Unplug the fan power cable to the fan.
4. Raise the right side of the RKR1225 housing and allow it to rest on the leftside of the chassis. The front panel will be close to you.
5. The module mounts near the center of the back on the inside (your left) of the RKR1225 chassis. Observe the hole pattern on the bottom (your right) of the RKR1225 chassis as shown in Figure 2-5.

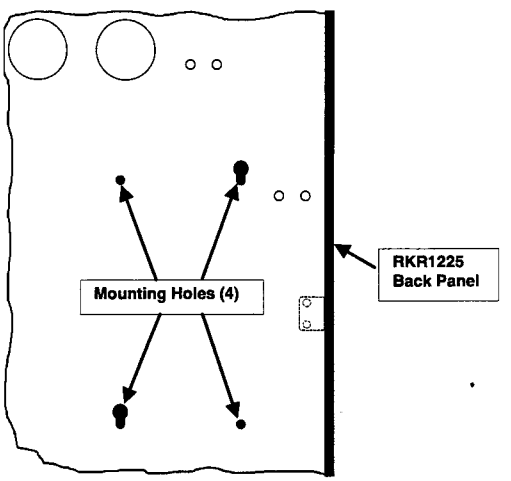


Figure 2-5. RKR1225 Battery Revert Mounting Hole Patttern (Bottom View)

6. Locate the Battery Revert module in kit HLN9455.
7. Locate two (2) of the M3.0 x 0.5 x 10 mm black, panhead, machine screws supplied in Battery Revert kit HLN9455.
8. Orient the module with plastic cover down and the cables exiting to the right.
9. Start the two (2) M3.0 screws into the upper righthand and lower lefthand corner threaded holes in the bottom of the chassis of the module. Two to three turns are sufficient.
10. Place the Battery Revert module into the inside (your left) of the RKR1225 housing. Ensure that the cables of the module extend

toward the back panel of the RKR1225 housing. The heads of the two (2) screws threaded into the module in Step 9 pass through the keyholes in the RKR1225 chassis bottom.

11. Slide the module down until it is snug against the bottom of the keyholes.

12. Locate the remaining two (2) of the M3.0 x 0.5 x 10 mm black, panhead, machine screws supplied in Battery Revert kit HLN9455.

13. Pass the screws through the two empty mounting holes in the RKR1225 chassis bottom. Turn the screws into the threaded holes of the chassis of the Battery Revert module.

14. Secure the module to the RKR1225 housing by tightening all four (4) M3.0 screws to 0.68-0.90 N-m (6-8 in-lbs).

Connecting the Battery Revert Cables

There are three (3) cables with 2-prong "Ford" connectors. One of the prongs of each connector is covered with insulation and the other is bare. Please note that the two (2) longest cables have opposite "polarities". Refer to Figure 2-6.

1. Locate the shortest 2-prong "Ford" cable from the module ("power supply input cable").

2. Connect the power supply input cable to the dc power cable from the HPN9033 power supply.

3. Locate the 6-position connector with the blue and black wires from the module ("charger supply cable").

4. Connect the charger supply cable to the 6-position fan cable connector from the HPN9033 power supply.

5. Locate the 6-position connector with the red and black wires from the module ("fan supply cable").

6. Connect the fan supply cable to the 6-position fan cable connector from the RKR1225 fan.

7. Examine the module and locate the longest 2-prong "Ford" cable with the red wire leading to the insulated prong ("transceiver power cable").

8. Connect the transceiver power cable to the dc power connector on the heatsink of the R1225 transceiver.

9. Examine the module and locate the longest 2-prong "Ford" cable with the black wire leading to the insulated prong ("battery cable").

10. Pass the battery cable through the centermost knockout above the module on the back panel of the RKR1225 housing. Two holes are provided on the tab from the knockout to allow strain relieving the battery cable with a tie wrap.

Refer to the instructions in the HLN9455 installation manual (6880905Z74) for properly connecting and fusing the cable to the battery and adjusting the float maintenance charger.

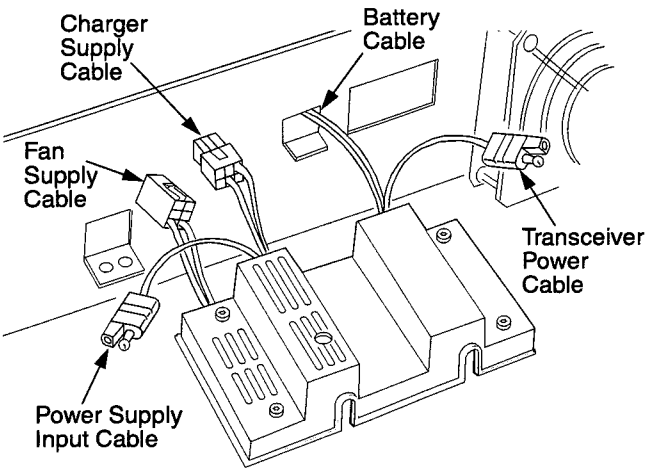


Figure 2-6. Battery Revert

Mounting the RKR1225 Repeater Station

Mount the RKR1225 repeater in a standard EIA 19" relay rack or cabinet. The repeater is front panel mountable.

CAUTION

A built-up RKR1225 repeater weighs approximately a maximum of 40 pounds (18.1 kg) when fully assembled. Lifting improperly can cause injury. Get help from a second person and use care when lifting the repeater.

CAUTION

The RKR1225 repeater weighs approximately 40 pounds (18.1 kg) when fully assembled, and can fall if not properly mounted. Use proper hardware to mount the repeater.

IMPORTANT

The RKR1225 repeater is designed for indoor use. Install in a location that is protected from the weather and outdoor environment, or use an outdoor cabinet.

IMPORTANT
To operate the RKR1225 repeater, the AC line cord (optional); antenna feed line, ground cable, phone lines (not supplied); and (optional) battery cables must exit from the rear of the unit.

Final Assembly

To operate the RKR1225 repeater, you must connect all of the necessary cables and accessories as follows:

1. If you are using a repeater controller with a grounding wire, connect the wire to the 1/4" threaded ground stud (stamped "Gnd") at the left side of the repeater housing (as viewed from the rear).
2. Attach a ground wire from an absolute earth ground to the 1/4" threaded ground stud on the left of the repeater housing, using the remaining external washer and nut provided in kit HHLN4077.
3. Connect lightning arrestors.

CAUTION
Lightning can damage the RKR1225 repeater and its components if the unit is not grounded properly. For lightning protection, ground the repeater to an absolute earth ground using at least #6 gauge copper wire, and use adequate lightning arrestors.

4. Connect the antenna lead(s) to the antenna connector(s) on the far left of the RKR1225 repeater housing.
5. Route the AC line cord through the right most knockout of the rear panel of the RKR1225 repeater housing.
6. Connect the AC line cord to the power supply unit.
7. Two holes are provided on the tab from the knockout to tie wrap the AC line cord for strain relief. Tie off the AC line cord.
8. Plug the AC line cord into an AC main outlet.
9. Replace the top cover that was removed during the disassembly procedure.
10. Secure the top cover with the four (4) TT4.0 screws removed in Step 1 of "HKN9034 External Duplexer Cable Kit".

Repackaging

The RKR1225 Repeater Station's shipping box is not intended, nor recommended for reshipping. If it is necessary to repackage the repeater as a built-up unit, follow these suggested steps to repackage the unit in its original box.

1. ***Do not*** connect the ground lug and antenna cable to the unit. Disconnect these if previously connected.
2. Discard the front panel filler and the chassis support packing pieces that were originally packed in the box. These are not needed for repackaging. Refer to Figure 2-7.

CAUTION
The RKR1225 repeater shipping box is not intended for reshipping a built-up unit. Please ship with extreme care.

CAUTION
Motorola, Inc. takes no responsibility for reshipping a built-up RKR1225 repeater.

CAUTION
Extreme caution should be taken when reshipping an RKR1225 repeater in its original box. A built-up RKR1225 repeater could weigh approximately a maximum of 40 pounds (18.1 kg) when fully assembled and in its original box. Lifting improperly can cause injury. Get help from a second person and use care when lifting the repeater.

CAUTION
If multiple RKR1225 repeater housings are mounted in a single rack, place a controller, accessory or blank 1-3/4" (1U) panel between the repeaters. The space is necessary for air flow.

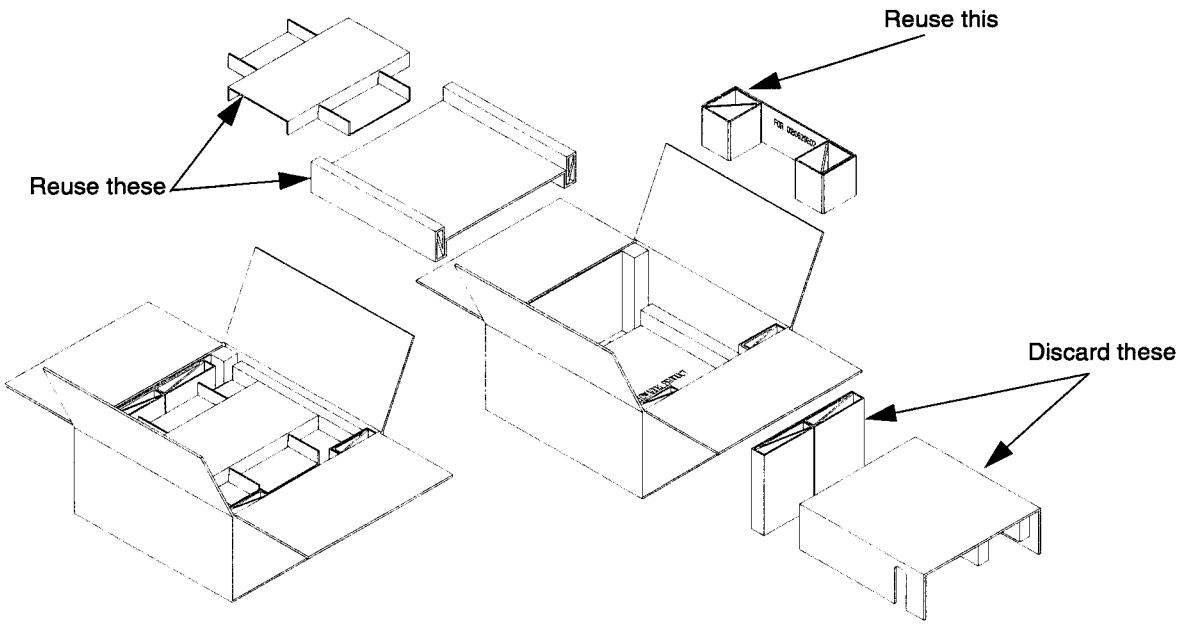


Figure 2-7. Repackaging a Built-up RKR1225 Repeater

Section 3
Tuning the Duplexer

Overview

Before using your repeater, you must tune the duplexer, using one of the following three methods for ensuring that the duplexer is tuned to the correct frequencies of operation:

- **Pre-Tuned Method (preferred method)**
  Order the duplexer from the manufacturer or supplier pre-tuned to the desired frequencies. This is not a "method" of tuning the duplexer but does not require any test equipment.

- **Visual Method**
  Use a tracking (sweep) generator and spectrum analyzer to adjust the tuning of the passbands and reject bands of the duplexer.

- **"In a Pinch" Method**
  The following paragraphs address a simple method of tuning a "notch" (reject) duplexer such as the TDN7407 UHF duplexer. This is not as accurate a method of tuning as the visual method afforded by the tracking generator/spectrum analyzer sweep setup but it is much less costly. It may be sufficiently good for all but the most exacting applications. Use this method only when the operating frequencies of the receiver and transmitter satisfy the requirements of the duplexer. For example, the TDN7407 is designed for a transmitter/receiver frequency spacing of 5 MHz. If the operating frequencies for the repeater are appreciably different than that 5 MHz specification, degraded performance of the repeater will result.

The following procedure assumes that the repeater is fully assembled and the R1225 transceiver and duplexer are mounted in the brackets. The transceiver should be connected to the proper ports of the duplexer with the RF coaxial cables provided.

Programming the R1225 Transceiver

1. Use WINRSS to program the R1225 transceiver with an additional "receive only" mode for the normal transmit frequency of the R1225 transceiver.

2. Disconnect the transmitter RF cable from the duplexer

3. Terminate the transmitter port of the duplexer with a 50 ohm load.

4. Connect a Communications System Analyzer (CSA), such as the Motorola R2000 series, or an RF signal generator to the antenna port of the duplexer. The CSA should be operating in the "Generate" mode. Modulate the RF source with a 1 kHz tone at 60% system deviation to facilitate "hearing" the signal during the tune-up procedure.

NOTE
Disable the repeater before proceeding by momentarily pressing the RPT EN pushbutton. The "RPT EN" LED should not be illuminated.

Tuning the Receiver Section

NOTE
Tuning the receiver section of the duplexer begins with the tuning screw closest to the antenna port of the duplexer.

1. Adjust the CSA or generator to the normal transmit frequency of the R1225 transceiver.

2. Place the R1225 transceiver on the transmitter frequency mode defined in Step 1 under "Programming the R1225 Transceiver."

3. Adjust the level of the CSA or generator until a weak signal is heard from the receiver.

4. Increase the level of the CSA or the generator by approximately 20 dB.

5. Adjust the tuning screw of the duplexer for the greatest rejection of the signal. This will appear as a noisier signal. **If necessary:**

5A. Slightly loosen the locking nuts of the tuning screws to allow the tuning screws to turn more freely (but not "sloppy") **and**

5B. Increase the level of the CSA or the generator to maintain an audible 1 kHz tone.

6. Repeat Steps 4 thru 5B for each of the tuning screws on the receiver section of the duplexer. Begin with the tuning screw closest to the

antenna port and work in order toward the tuning screw closest to the receiver port.

7. Tighten the locking nuts of the tuning screws.

CAUTION
To avoid damage to the tuning screws and to allow fine tuning of the duplexer, do not overtighten the locking nuts.

8. Readjust the tuning screws of the duplexer for the greatest rejection of the signal. This will fine-tune the receiver section of the duplexer.

Tuning the TransmitterSection

NOTE
Tuning the transmitter section of the duplexer begins with the tuning screw closest to the antenna port of the duplexer.

1. Adjust the frequency of the CSA or generator to that of the receive frequency of the R1225 transceiver.
2. Place the R1225 transceiver on the normal repeater receive frequency mode.
3. Remove the 50 ohm load from the transmitter port of the duplexer.
4. Disconnect the receiver RF cable from the receiver port of the duplexer.
5. Connect the receiver RF cable to the transmitter port of the duplexer.
6. Connect the 50 ohm load to the receiver port of the duplexer.
7. Adjust the level of the CSA or generator until a weak signal is heard from the transmitter.
8. Increase the level of the CSA or the generator by approximately 20 dB.
9. Adjust the tuning screw of the duplexer for the greatest rejection of the signal. This will appear as a noisier signal. **If necessary:**

9A. Slightly loosen the locking nuts of the tuning screws to allow the tuning screws to turn more freely (but not "sloppy") **and**

9B. Increase the level of the CSA or the generator to maintain an audible 1 kHz tone.

10. Repeat Steps 8 thru 9B for each of the tuning screws on the duplexer. Begin with the tuning screw closest to the antenna port and move in order toward the tuning screw closest to the transmitter port.
11. Tighten the locking nuts of the tuning screws.

CAUTION
To avoid damage to the tuning screws and to allow fine tuning of the duplexer, do not overtighten the locking nuts.

12. Readjust the tuning screws of the duplexer for the greatest rejection of the signal. This will fine-tune the transmitter section of the duplexer.
13. Remove the 50 ohm load from the receiver port of the duplexer.
14. Disconnect the receiver RF cable from the transmitter port of the duplexer.
15. Reconnect the receiver RF cable to the receiver port of the duplexer.
16. Reconnect the transmitter RF cable to the transmitter port of the duplexer.
17. Use the WINRSS to remove the mode programmed in Step 1 under "Programming the R1225 Transceiver."

Operational Tests

Before reassembling the housing cover to the chassis, three operational tests should be performed.

A Communications System Analyzer (CSA) with a duplex generator capable of operating at an offset equal to the difference between the transmitter and receiver frequencies (T/R spacing) is the preferred piece of test equipment. Typical models are the Motorola R2000, R2550, and R2600 Series. Some means is required to reduce the output of the duplex generator to the usable sensitivity level. This may be designed into the CSA or accomplished with an external Step Attenuator.

Test Equipment Interconnection to the Repeater

1. If required, connect the output of the duplex generator of the CSA to the input of the Step Attenuator.
2. If required, connect the output of the Step Attenuator to a coupling tee in line with the "RF In/Out" of the CSA.
3. Connect the output of the coupling tee, if required, or the "RF In/Out" of the CSA to the antenna port of an external duplexer or the "RX/DPLX" connector for an internal duplexer.
4. If an external duplexer is being used, connect the "RX/DPLX" and the "TX" connectors at the chassis back panel of the repeater to the appropriate ports of the duplexer.

5. Connect the handset output of the transceiver (available through the front panel microphone connector on pin #8 and ground on pin #4) to the SINAD input of the CSA.

Initial Settings for the Test Equipment

1. Refer to your operating manual for the CSA to determine the correct control and switch settings.
2. Select the DUPLEX MONITOR mode (or equivalent) of the CSA and set the duplex generator for the appropriate T/R spacing ("DPLX OFFSET").
3. Adjust the modulation of a 1 kHz tone on the duplex generator for 60% of rated system deviation.

Channel Spacing	60% Deviation
12.5 kHz	1.5 kHz
25/30 kHz	3.0 kHz

Measure the Repeater Desensitization

1. Select the "DVM/DIST" (or equivalent) mode of operation to allow measuring SINAD.
2. Disable the repeater ("RPT EN" LED OFF). Adjust the level of the duplex generator until 12 dBS sensitivity is reached.
3. Increase the RF output of the duplex generator by 1 dB (this increases the SINAD).
4. Enable the repeater ("RPT EN" LED ON). The transmitter keys ("TX" LED ON).
5. Read the SINAD level. It should not drop below 12 dB. If the SINAD is less than 12 dB, check the tightness of connectors and the tuning of the duplexer.

Repeater Deviation

1. Select the "MONITOR" (or equivalent) mode of operation.
2. Disable the repeater ("RPT EN" LED OFF). Adjust the duplex generator level for a strong (full "quieting") signal into the receiver.
3. Enable the repeater ("RPT EN" LED ON). The transmitter keys ("TX" LED ON).
4. Read the transmitter deviation. It should be within ±10% of the deviation of the duplex generator.

Channel Spacing	Minimum	Maximum
25/30 kHz	2.70 kHz	3.30 kHz
12.5 kHz	1.35 kHz	1.65 kHz

Measure Repeater Transmitter Output Power

1. Follow steps 1 and 2 under "Repeater Deviation".
2. Enable the repeater ("RPT EN" LED ON). The transmitter keys "TX" LED ON).
3. Read the transmitter RF power output from the duplexer. Determine the maximum rated insertion loss for your duplexer and the loss of all cables. Use the following table as a guide.

Rated Power	1 dB Loss	2 dB Loss	3 dB Loss
45 W	35 W	28 W	22 W
50 W	39 W	31 W	25 W

Section 4
Controller Interconnections

Overview

This section describes the programming and setup of the optional external controllers for use with the R1225 transceiver module in the RKR1225 Rack Mount repeater.

The controllers discussed are the Zetron ZR310, ZR320 and ZR340; the Instrument Associates i20R, i750R and TRA100R; and the SmarTrunk Systems ST-853M.

The Radio Service Software (RSS) for the GM300/GR300 may be used to program most of the parameters for the Zetron ZR310 and ZR320. This RSS runs only under DOS and will not operate from the MS-DOS Prompt in Windows™. You **Must** exit Windows to start the GM300/GR300 RSS.

The ZR340 must be programmed from the DTMF pad on a mobile or portable radio. Some parameters in newer versions of the microprocessors and EEPROMs of the ZR310 and ZR320 controllers must be programmed with DTMF as the GM300/GR300 RSS does not provide support.

The i20R and i750R, and the SmarTrunk Systems ST-853M are programmed with special software provided by the manufacturer. Refer to the instructions contained in those software applications.

The TRA100R is programmed with DIP switch settings. Refer to the "Radius GR300/GR500 Repeater Stations and Controllers, Supplement to GM300 RSS Manual", 6880903Z43.

It assumed that the R1225 transceiver has already been "read" by the WINRSS (or an archive file for the transceiver has been read).

GR Series Controllers

ZR310 Community Repeater Panel

ZR310 Jumper Configurations

ZR310 Jumper Settings

Jumper	Setting
JP1	B (16)
JP3	A (8)

R1225 Transceiver Programming

From the opening WINRSS window, click the Radio Wide icon to open the Radio Wide Configuration windows. In the General Options window, for the Operation Mode select "Repeater w/Ext Controller".

Select the External Accessories tab. For the Acc External select the "ZR310". Verify or select these receive and transmit audios and the accessory connector pins.

R1225 Receive and Transmit Audios (ZR310)

Source/Muting	Value
Rx Audio Output	Flat
Rx Audio Muting	Unmuted
External Mic	External Mic Audio
Tx Flat Audio Input	Post

R1225 Accessory Connector Pins (ZR310)

Pin #	Function	Active Level
4	CSQ Detect	High

ZR310 Programming

The ZR310 can have most of the system and user parameters programmed with the GM300/GR300 RSS. However, DPL polarity must be programmed with DTMF commands. The VHF R1225 transceiver requires the ZR310 to be programmed for inverted polarity decode and normal polarity encode. The UHF R1225 transceiver requires the ZR310 to be programmed for normal polarity decode and encode. Enter the ZR310 DTMF programming mode (default programming access code is **12310#**). Then enter the following commands depending upon which band of operating for the R1225 transceiver.

ZR310 DTMF Command

Band	ZR310 Commands
VHF	215# and 218#
UHF	215# and 217#

ZR320 Selective Calling Interconnect

R1225 Transceiver Programming

From the opening WINRSS window, click the Radio Wide icon to open the Radio Wide Configuration windows. In the General Options window, for the Operation Mode select "Repeater w/Ext Controller".

Select the External Accessories tab. For the Acc External select the "ZR340". Verify or select these and the accessory connector pins.

R1225 Receive and Transmit Audios (ZR320)

Source/Muting	Value
Rx Audio Output	De-emphasized
Rx Audio Muting	Muted
External Mic	External Mic Audio
Tx Flat Audio Input	Post

R1225 Accessory Connector Pins (ZR320)

Pin #	Function	Active Level
4	CSQ Detect	High
12	PL/DPL-CSQ Detect	Low

As originally designed, the ZR320 will produce 50% transmitter peak system deviation for a receiver input signal with 60% peak system deviation. A normal repeater audio, 60% out for 60% in, can be obtained by bridging a 10kΩ-5%-1/4W composition resistor across resistor R9 (2.2kΩ) on the ZR320 Controller Board. This can be important in systems using the X-Pand feature.

ZR340 Telephone Interconnect

Jumper Configurations

ZR340 Jumper Settings

Jumper	Setting
JP7	B (16)
JP8	B (16)
JP9	A or B

R1225 Transceiver Programming

From the opening WINRSS window, click the Radio Wide icon to open the Radio Wide Configuration windows. In the General Options window, for the Operation Mode select "Repeater w/Ext Controller".

Select the External Accessories tab. For the Acc External select the "ZR340". Verify or select these receive and transmit audios and the accessory connector pins.

R1225 Receive and Transmit Audios (ZR340)

Source/Muting	Value
Rx Audio Output	De-emphasized
Rx Audio Muting	Muted
External Mic	External Mic Audio
Tx Flat Audio Input	Pre or Post

R1225 Accessory Connector Pins (ZR320)

Pin #	Function	Active Level
4	CSQ Detect	High
12	PL/DPL-CSQ Detect	Low

i20R On-Site Repeater

Jumper Configurations

i20R Jumper Settings

Jumper	Setting
JU20	Out

R1225 Transceiver Programming

From the opening WINRSS window, click the Radio Wide icon to open the Radio Wide Configuration windows. In the General Options window, for the Operation Mode select "Repeater w/Ext Controller".

Select the External Accessories tab. For the Acc External select the "I20R". Verify or select these receive and transmit audios and the accessory connector pins.

R1225 Receive and Transmit Audios (i20R)

Source/Muting	Value
Rx Audio Output	Flat
Rx Audio Muting	Unmuted
External Mic	External Mic Audio
Tx Flat Audio Input	Post

R1225 Accessory Connector Pins (i20R)

Pin #	Function	Active Level
8	CSQ Detect	Low

i750R Telephone Interconnect

R1225 Transceiver Programming

From the opening WINRSS window, click the Radio Wide icon to open the Radio Wide Configuration windows. In the General Options window, for the Operation Mode select "Repeater w/Ext Controller".

Select the External Accessories tab. For the Acc External select the "I750R". Verify or select these receive and transmit audios and the accessory connector pins.

R1225 Receive and Transmit Audios (i750R)

Source/Muting	Value
Rx Audio Output	De-emphasized
Rx Audio Muting	Muted
External Mic	External Mic Audio
Tx Flat Audio Input	Post

R1225 Accessory Connector Pins (i20R)

Pin #	Function	Active Level
6	PL/DPL Strip	Low
8	PL/DPL-CSQ Detect	Low
14	CSQ Detect	Low

TRA100R Tone Remote Adapter

Jumper Configurations

TRA100R Jumper Settings

Jumper	Setting
JU8	2
JU9	In
JU14	3-4
JU21	1

R1225 Transceiver Programming

From the opening WINRSS window, click the Radio Wide icon to open the Radio Wide Configuration windows. In the General Options window, for the Operation Mode select "Repeater w/Ext Controller".

Select the External Accessories tab. For the Acc External select the "TRA100R". Verify or select these receive and transmit audios and the accessory connector pins.

R1225 Receive and Transmit Audios (TRA100R)

Source/Muting	Value
Rx Audio Output	De-emphasized
Rx Audio Muting	Muted
External Mic	External Mic Audio
Tx Flat Audio Input	Pre

R1225 Accessory Connector Pins (TRA100)

Pin #	Function	Active Level
8	PL/DPL-CSQ Detect	Low
14	I/O Hook	Low

If channel steering is required, program pins 6, 9, and 12 as shown in the following table. NOTE: "Debounce" must be selected as "On" for the channel steering pins. An extra wire must be added to the cable to connect pin 9 of the R1225 connector to pin 9 of the "Tx" connector for the TRA100R.

R1225 Accessory Connector Pins for Channels Steering (TRA100R)

Pin #	Function	Debounce	Active Level
6	Channel Steering 0	On	Low
9	Channel Steering 1	On	Low
12	Channel Steering 2	On	Low

SmarTrunk Systems ST-853M

R1225 Transceiver Programming

From the opening WINRSS window, click the Radio Wide icon to open the Radio Wide Configuration windows. In the General Options window, for the Operation Mode select "Repeater w/Ext Controller".

Select the External Accessories tab. For the Acc External select the "SmarTrunk II". Verify or select these receive and transmit audios and the accessory connector pins..

R1225 Receive and Transmit Audios (ST-853M)

Source/Muting	Value
Rx Audio Output	Flat
Rx Audio Muting	Unmuted
External Mic	External Mic Audio
Tx Flat Audio Input	Post

R1225 Accessory Connector Pins (ST-853M)

Pin #	Function	Active Level
8	PL/DPL-CSQ Detect	High

R1225 Transceiver Audio and I/O Pins

The following table describes, in a compact format, the functions and programming of the audios and I/O pins of the R1225 transceiver for use with the controllers listed. Most of the I/O pins are automatically programmed by the Radio Service Software (WINRSS), but do not rely solely on the WINRSS. The transmit and receive audios will probably require you to set them manually.

Transceiver Pin #		ZR310	ZR340	i20R	i750R	TRA100R	ZR320	SmarTrunk II ST-853M
Pin 1 (Ext Spkr -)	:Function :Act Level :To pin #	N/U — —	N/U — —	N/U — —	N/U — —	N/U — —	N/U — —	N/U — —
Pin 2 (External Mic)	:Function :To pin #	Ext. Mic Audio N/A Tx - 2	Ext. Mic Audio N/A Tx - 2	Ext. Mic Audio N/A Tx - 2	Ext. Mic Audio N/A Tx - 2	Ext. Mic Audio N/A Tx - 2	Ext. Mic Audio N/A Tx - 2	Ext. Mic Audio N/A DB25-16
Pin 3 (PTT)	:Function :Act Level :To pin #	PTT Low Tx - 3	PTT Low Tx - 3	PTT Low Tx - 3	PTT Low Tx - 3	PTT Low Tx - 3	PTT Low Tx - 3	PTT Low DB25-19
Pin 4 (Prog Output)	:Function :Act Level :To pin #	CSQ Detect High Rx - 4	CSQ Detect High Rx - 4	Null/Output High Rx - 4	Null/Output High Rx - 4	CSQ Detect Low Rx - 4	CSQ Detect High Rx - 4	Null/Output High —
Pin 5 (Tx Flat Audio Input)	:Function :Act Level :To pin #	Tx PL/DPL Audio (Post-Limiter) Tx - 5	N/U (Pre or Post Tx - 5	Tx PL/DPL Audio (Post-Limiter) Tx - 5	Tx PL/DPL Audio (Post-Limiter) Tx - 5	N/U (Pre-Limiter) Tx - 5	Tx PL/DPL Audio (Post-Limiter) Tx - 5	Tx System Tone (Post Limiter) DB25-17
Pin 6 (Prog Input)	:Function :Act Level :To pin #	Null/Input Low Tx - 6	Null/Input Low Tx - 6	Null/Input Low Tx - 6	PL/DPL Strip Low Tx - 6	Channel Steer 0 Low Tx - 6	Null/Input Low Tx - 6	Null/Input Low —
Pin 7 (Gnd)	:Function :Act Level :To pin #	Gnd N/A Rx - 7	Gnd N/A Rx - 7	Gnd N/A Rx - 7	Gnd N/A Rx - 7	Gnd N/A Rx - 7	Gnd N/A Rx - 7	Gnd N/A DB25-2**
Pin 8 (Prog I/O)	:Function :Act Level :To pin #	Null/Input Low —	Null/Input Low —	CSQ Detect Low Rx - 8	PL/DPL-CSQ Det Low Rx - 8	PL/DPL-CSQ Det Low Rx - 8	Null/Input Low —	PL/DPL-CSQ Det High DB25-25
Pin 9 (Prog Input)	:Function :Act Level :To pin #	Null/Input Low —	Null/Input Low —	Null/Input Low —	Null/Input Low —	Channel Steer 1 Low Tx-9*	Null/Input Low —	Null/Input Low —
Pin 10 (Prog Input)	:Function :Act Level :To pin #	Null/Input Low —	Null/Input Low —	Null/Input Low —	Null/Input Low —	Null/Input Low —	Null/Input Low —	Null/Input Low —
Pin 11 (Rx Audio Output/ Muting)	:Function :Act Level :To pin #	Rx Audio (Flat/Unmuted) Rx - 11	Rx Audio (De-emph/Muted) Rx - 11	Rx Audio (Flat/Unmuted) Rx - 11	Rx Audio (De-emph/Muted) Rx - 11	Rx Audio (De-emph/Muted) Rx - 11	Rx Audio (De-emph/Muted) Rx - 11	Rx Audio (Flat/Unmuted) DB25-15
Pin 12 (Prog I/O)	:Function :Act Level :To pin #	Null/Input Low Rx - 12	PL/DPL-CSQ Det Low Rx - 12	Null/Input Low Rx - 12	Null/Input Low Rx - 12	Channel Steer 2 Low Rx - 12	PL/DPL-CSQ Det Low Rx - 12	Null/Input Low —
Pin 13 (SW A + Output)	:Function :Act Level :To pin #	SW A+ N/A Rx - 13	SW A+ N/A Rx - 13	SW A+ N/A Rx - 13	SW A+ N/A Tx - 13	SW A+ N/A Tx - 13	SW A+ N/A Rx - 13	SW A+ N/A DB25-13
Pin 14 (Prog I/O)	:Function :Act Level :To pin #	Null/Input Low Rx - 14	Null/Input Low Rx - 14	Null/Input Low Rx - 14	CSQ Detect Low Rx - 14	I/O Hook Low Rx - 14	Null/Input Low Rx - 14-	Null/Input Low —
Pin 15 (Int. Spkr +)	:Function :Act Level :To pin #	N/U — —	N/U — —	N/U — —	N/U — —	N/U — —	N/U — —	N/U — —
Pin 16 (Ext. Spkr +)	:Function :Act Level :To pin #	N/U — —	N/U — —	N/U — —	N/U — —	N/U — —	N/U — —	N/U — —

Note: "To pin #" refers to pin on connector of controller; transceiver pins are listed in bold in the first column.
"N/A" = Not Applicable
"N/U" = Not Used
If remote channel steering with the TRA100R is not required, program pins 6, 9, and 12 as "Null /Input".
* This wire must be added if channel steering is used.
**Jumper pins 2 an 18 together on the DB25.

Section 5
Controller Adjustments

Overview

This section is to confirm the proper operation of an external controller with your RKR1225 Rack Mount repeater prior to putting the system into operation with end users. It is assumed that the transceiver has already been programmed with its RF channel assignments.

The following steps should be performed with a Communications System Analyzer (CSA) or service monitor, such as the Motorola R2000 , R2550, or R2600, connected to the antenna jack of the duplexer (or the transmitter, if applicable). The CSA must be operating in the duplex mode. Set the CSA to monitor the frequency of the transmitter while generating the duplex signal at the frequency of the receiver. Refer to the operating instructions of your CSA manual. Adjust the deviation of the duplex generator for 60% of rated system peak deviation with a 1 kHz modulating tone.

For all of the controllers:

1. Connect the line cord from the repeater to a suitable 50/60 Hz ac power source.
2. Turn on the repeater. Any power indicating LED on the controller will illuminate.

IMPORTANT

The maximum deviation for "voice" audio from the R1225 transceiver module must not exceed the rated maximum system deviation minus any PL/DPL deviation generated by the external controller. For example: if a system with a maximum deviation of 5 kHz has its PL deviation set at 750 Hz, then the "voice" audio deviation would be set to 5000 Hz - 750 Hz = 4250 Hz, or 4.25 kHz or less. Use the 1225 Series RSS (version R02.00.00 or later) service mode to adjust the maximum "voice" deviation for this lower value.

ZR310 Controller Adjustments

It is not necessary for the ZR310 controller to have been programmed in order to complete these tests. If the ZR310 controller has been programmed, these tests should not effect any of that programming.

1. Use a DTMF equipped keypad radio to enter into the programming mode by keying up and sending the programming access code (default is "12310#"). Un-key the radio and listen for the acknowledgment prompt from the ZR310 controller in the CSA speaker. The transmitter will remain keyed.

Transmit TPL/DPL Encode Level

1. Key your portable or mobile radio and send "305# 27#" to the ZR310 controller. The repeater should key and transmit a PL tone of 159.8 Hz. Adjust the **PL/DPL** potentiometer on the front panel of the ZR310 controller for approximately 15% of full channel deviation (e.g. 750 Hz in a 5 kHz system or 375 Hz in a 2.5 kHz system). When you have finished checking/adjusting, key-up and send "305# 0#" to turn the encode off.

Transmit Audio Level

1. Key-up and send "304#" to open the repeat audio path in the ZR310 controller. Observe the deviation of the re-transmitted 1 kHz tone of the duplex generator on the CSA. Adjust the **Audio** potentiometer on the front of the ZR310 controller for "unity gain" in the repeat mode (60% out for 60% in). When you are finished, send "303#" to close the repeat audio path.

To Exit

1. Enter the DTMF command "99#" to exit the alignment mode.

This concludes the test and adjustments for the ZR310 controller and the repeater. You can now program the controller with its users (refer to the ZR310 controller service manual, 6880904Z64, for more information) or, if you have already programmed the unit, you are ready to place the system in service.

ZR320 Controller Adjustments

NOTE
At any time while programming these settings, if a time period of 60 seconds elapses without a DTMF key press, the ZR320 controller will exit the program mode automatically.

Receive Audio Level

1. Using a DVM or oscilloscope, adjust the **Audio** potentiometer on the ZR320 controller until 470 mV rms (1.33V p-p) is present at pin 8 of the ZR320 controller programming connector J2 on the front of the ZR320 controller (refer to Figure 5-1), or on either pin of JP5 inside the ZR320 controller.

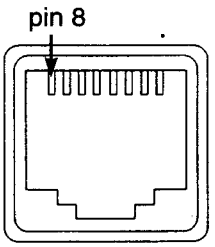


Figure 5-1. J2 Programming Connector, Front View

TPL/DPL Encode Level

1. Use either a DTMF equipped radio, or a DTMF equipped telephone calling the ZR320 controller to enter the ZR320 controller programming mode (default access code is "12320#").
2. Enter command "93#" to start TPL generation. The ZR320 controller will generate 134.4 Hz (the DPL turn-off tone).
3. Adjust the **PL/DPL** control for 15% of maximum rated system deviation (e.g., 750 Hz in a 5 kHz system or 375 Hz in a 2.5 kHz system).
4. Press any DTMF digit to end the test.

Hybrid Adjustment

If the ZR320 controller is to be used in the full-duplex mode, the hybrid must be adjusted. Perform the following steps to adjust the hybrid.

1. Enter the program mode of the ZR320 controller using a telephone so that the hybrid may be balanced into the central office to which the ZR320 controller is connected.

NOTE
The telephone must have a telephone number (or extension) different from the the ZR320 controller.

2. Once in the programming mode, enter command "95#". The ZR320 controller will generate two tones that are sent to the telephone. Audio coming from the telephone is then presented to the transmit radio so that any hybrid imbalance will appear as transmitted audio.
3. Alternately adjust the **R** and **C** controls on the ZR320 controller for minimum transmitted audio (lowest deviation measured on the CSA).
4. Repeat Step 3 until no further minimizing of the transmitted audio can be attained. The hybrid is now balanced.
5. Press any DTMF digit to terminate the test.

Dial Click Decode Level

If you are installing a ZR320 controller and you are planning on using rotary telephones for over-dialing user numbers into the ZR320 controller, perform the following steps.

1. Enter command "96#" to enable the dial click decode test.
2. For each rotary digit you enter, the ZR320 controller will send "beeps" back.
3. Adjust the **Click** control until the number of beeps matches the digit dialed.

To Exit

1. Enter the DTMF command "99#" to exit the alignment mode.

Refer to the ZR320 controller service manual (6880903Z42) or programming manual (6880903Z43) for more information.

ZR340 Controller Adjustments

1. Use a DTMF equipped radio to enter into the ZR340 controller programming mode (default programming access code is "12123").

Transmit Audio Level

1. Key in the DTMF command "92#" (Tx test). The ZR340 controller will generate a 1 kHz tone.
2. Adjust the **TX Setup** potentiometer on the ZR340 controller for 70% of full rated system

deviation (3.5 kHz for a 5 kHz system or 1.75 kHz for a 2.5 kHz system).

3. Press any DTMF digit to end the test.

Repeated Audio Level

1. Complete the "Transmit Audio Level" adjustment, described above, before continuing.
2. Key in the DTMF command "93#" (repeated audio test).
3. Adjust the **RX Setup** potentiometer on the ZR340 controller for 60% of full rated system deviation of the transmit radio.
4. Press any DTMF digit to end the test.

To Exit

1. Enter the DTMF command "99#" to exit the alignment mode.

Refer to the ZR340 controller operation/maintenance/programming manual (6880905Z02) for more information.

i750R Controller Adjustments

1. Place the i750R controller into the diagnostic/test mode by simultaneously pressing the **Up** and **Down** buttons. (The i750R controller will be in Test #1.)

Transmit Audio Level

1. In Test #1, the i750R controller generates a 1 kHz tone. use the UP or DOWN button to adjust the deviation by the tone to 70% of peak rated system deviation (3.5 kHz in a 5 kHz system or 1.75 kHz in a 2.5 kHz system).

MDC/TPL/DPL Encode Level

1. Select Test #11 (Tx Audio Port).
2. In Test #11, the i750R generates an 1800 Hz tone, TPL or DPL. The 1800 Hz tone is generated upon entry to the test.
3. Use the **Up** or **Down** button to adjust the deviation of the 1800 Hz tone to 70% of peak rated system deviation.
4. Press the **Up** and **Down** buttons simultaneously to go to the TPL generation.
5. Use the **Up** or **Down** button to adjust the deviation of the TPL tone to 15% of peak rated system deviation.
6. Press the **Up** and **Down** buttons simultaneously to go to the DPL generation.
7. Use the **Up** or **Down** button to adjust the deviation of the DPL data to 15% of peak rated system deviation.

To Exit

1. Press the **Up** and **Patch On/Off** buttons simultaneously to exit the alignment mode.

Refer to the i750R controller operation maintenance manual (6880904Z39) or programming manual (6880904Z45) for more information.

i20R Controller Adjustments

1. Place the i20R controller into test/setup mode #1 by pressing once the **Test** push-button on the front panel.

Repeated Audio Level

1. Adjust the **FWD** Audio Level on the i20R controller for 60% peak deviation of the transmit radio.

TPL/DPL Encode Level

1. Turn off the 1 kHz tone modulation of the duplex generator.
2. Press the **Test** push-button twice to place the i20R controller into test/setup mode #3.
3. Adjust the **SIG** Audio Level potentiometer for 15% of peak rated system deviation of the test TPL tone.

To Exit

1. Simultaneously press the **Test** and **RPTR** push-buttons to end the test/setup modes.

Refer to the i20R controller operation maintenance manual (6880904Z40) or programming manual (6880904Z55) for more information.

TRA100R Controller Adjustments

To gain access to the controls and programming DIP switches of the TRA100R controller, it is necessary to remove the 4 small Phillips head screws that retain the protective front cover.

1. If the **Rptr** LED of the TRA100R controller is not on, press the **Repeater Enable** switch.

Repeated Audio Level

1. Apply the proper TPL/DPL, if required for a coded squelch repeater.

2. Adjust the **Rptr** control on the TRA100R controller for 60% of full rated system deviation of the transmitter by the 1 kHz tone. Take into account any deviation by TPL/DPL on the transmitted signal.

Transmit Level

1. Enter the diagnostic test mode of the TRA100R controller by simultaneously pressing the **Repeater Enable/Test** and **Line Disable/Reset** buttons.

2. Select test mode #4 by pressing the **Repeater/ Enable/Test** button. Test #4 is indicated when the **COR** led illuminates.

3. Disconnect the remote control line from the **Phone Line** modular connector on the back of the TRA100R controller.

4. Connect an audio generator with a 600 Ω output impedance between pins 2 and 3 of the **Phone Line** connector. Set the frequency to 1 kHz at a level of 0 dBm (775 mV rms at 600 Ω).

5. Adjust the **TX Level** control on the TRA100R controller for 60% of full rated system deviation by the 1 kHz tone. Take into account any deviation by TPL/DPL on the transmitted signal.

Line Audio Level

1. Select test mode #5 by pressing the **Repeater Enable/Test** button. Test #5 is indicated when the **COR** and **PTT** LEDs illuminate.

2. Reconnect the remote control line to the TRA100R controller.

3. Adjust the **Line Level** control on the TRA100R controller for the desired line audio level (typically 0 dBm or 775 mVrms at 600 Ω).

To Exit

1. Press the **Line Disable/Reset** button to end the alignment and test mode.

Control Line Level

The TRA100R controller provides automatic level compensation within a range of 20 dB. The unit uses the level of the high level guard tone burst to establish the transmit level. By convention, this high level guard tone is 3 dB above the maximum audio level. The TRA100R controller will operate outside this 20 dB range, but the output level of the transmitter will vary. The only requirement during installation is to make sure that the level at the TRA100R controller from each remote desk set is between 0 dBm and -20 dBm.

Refer to the TRA100R controller service manual (6880903Z42) or programming manual (6880903Z43) for more information.

ST-583M SmarTrunk II Adjustments

Refer to the ST-583M SmarTrunk II controller service manual (6880905Z59) for adjustment instructions.

Section 6
Troubleshooting

Table 6-1. Troubleshooting for R1225 Transceiver (General)

Symptom	Problem(s)	Possible Solution(s)
1. RKR1225 repeater is dead (7-segment LED display does not light).	1a. AC line cord not plugged into the power supply or AC mains outlet. 1b. Repeater not turned ON. 1c. Loose or bad cable from the control head to the transceiver. 1d. DC cord not plugged into the R1225 transceiver. 1e. Open fuse in power supply.	1a. Plug the power supply cord into the power supply CEE receptacle or AC mains outlet. 1b. Turn on the repeater. 1c. Check the cable connections to the control head and the transceiver or replace the cable, if necessary. 1d. Plug the DC cable into the connector at the rear of the R1225 transceiver. 1e. Check the fuse in the power supply and replace as necessary.
2. No field radios can access system.	2a. Repeater programmed with wrong TPL/DPL code. 2b. Loose or bad coaxial cable from the receiver antenna connector to the duplexer or receiver antenna. 2c. Incorrect programming of field radios. 2d. Repeater not enabled or set up (if applicable).	2a. Check TPL/DPL code of the repeater and reprogram, if necessary. 2b. Check the repeater cable connections to the receiver antenna connector and replace the cable if necessary. 2c. Check programming on field radios and reprogram, if necessary. 2d. Check the repeater enable and setup condition(s).
3. First part of message not repeated.	3. User speaking too soon after pressing PTT.	3. Delay conversation to allow for delays in system due to: • TPL/DPL decoding. • Requirements of signalling systems.
4. Loss of receiver sensitivity when the repeater is keyed (repeater toggles from transmit to receive repeatedly when attempting to communicate through it).	4a. Leaky or defective coaxial cable(s). 4b. Loose antenna connector(s). 4c. Faulty antenna connector(s). 4d. Duplexer not tuned correctly (if applicable). 4e. Inadequate distance between the receiver and transmitter antennas (if applicable). 4f. Improper or faulty coaxial cable(s) to antenna(s).	4a. Check the coaxial cables and replace if necessary. 4b. Check the antenna connector(s) and replace, if necessary. 4c. Replace the antenna connector(s). 4d. Re-tune the duplexer. 4e. Read "Antenna Spacing" on page 1-5 of this manual and adjust the distance between the antennas. 4f. Read "Cables" on page 1-4 of this manual to determine the types of cables required or replace the cable(s), if necessary.

Table 6-1. Troubleshooting for R1225 Transceiver (General) (Cont'd.)

Symptom	Problem(s)	Possible Solution(s)
5. Partial (RapidCall) PTT ID message repeated.	5a. Pre-time too short. 5b. "Pre" PTT ID used.	5a. Increase the pre-time in field radio. 5b. Use "Post" PTT ID.
6. Fan in the repeater runs all the time.	6a. Fan switch of HPN9033 power supply in "continuous" position. 6b. Repeater environment is hot (>50°C). 6c. Defective thermal switch from HPN9033 power supply 6d. Only happens if a battery revert module is installed.	6a. Move switch to "thermo control" position". 6b. Normal operation at elevated ambient temperatures or extended repeater keying. 6c. Replace the power supply. 6d. Normal operation with the battery revert.
7. Fan still runs with repeater power switch turned OFF.	7a. Normal operation if repeater was transmitting prior to turning OFF. 7b. Repeater environment is hot (>50°C). 7c. Battery revert module is installed	7a. Wait until repeater cools. Have an "807" while waiting. 7b. Move repeater to cooler environment. 7c. Normal operation with the battery revert module. 7d. Disconnect AC cord from AC mains outlet.
8. Power supply stays ON with repeater power switch OFF.	8. Normal operation.	8. Power switch on front panel turns OFF B+ only to transceiver.
9. Repeater constantly keyed.	9a. Accessory connector of transceiver not programmed correctly or not operating correctly. 9b. Transceiver PTT pin pulled LOW by an accessory.	9a. Check programming of accessory connector and reprogram, if necessary. 9b. Remove or correct accessory.
10. Control head display does not light but repeater is warm.	10a. 12-conductor cable is not plugged into the display board. 10b. Power supply is in overcurrent protection.	10a. Check the installation of the 12-conductor cable and correct if necessary. 10b. Transceiver or external controller may have a short circuit
11. Repeater will not enable with "RPT EN" pushbutton.	11a. Repeater programmed as Base Station only. 11b. Pin 10 of accessory connector programmed for "Repeater Knockdown" and is activated.	11a. Use RSS to reprogram for repeater operation. 11b. Check wiring from pin 10 to an external controller or accessory and correct, if necessary.
12. "RPT EN" pushbutton will not disable the repeater.	12a. "RPT EN" pushbutton programmed as "Null".	12a. Use the RSS to program "RPT EN" as "Repeater Enable".
13. Remote "Repeater Knockdown" (pin 10 of accessory connector) not functioning.	13. Pin 10 programmed with "Null" default.	13. Use RSS to reprogram pin 10 as "Repeater Knockdown".
14. CWID stops and starts many times.	14. CWID programmed as interruptible.	14. Use RSS to reprogram CWID as non-interruptible.
15. Desk Mic does not put station in monitor mode when monitor button is pushed.	15. "Permanent On-Hook" enabled.	15. Use RSS to reprogram "Permanent On-Hook" as disabled.
16. Local microphone (front panel jack) overrides repeat audio.	16. None.	16. Normal operation. PTT priorities are (low to high): COR, External, Local, Page.
17. I hear voices coming from my repeater mounted in a closet.	17a. "PA Mute" not enabled. 17b. Ghosts/spirits.	17a. Use RSS to program "PA Mute" as enabled. 17a. Exorcism.

Table 6-2. Troubleshooting for Transceiver Receiver

Symptom	Problem	Solution
1. No speaker audio heard.	1a. None.	1a. Normal operation. No speaker is supplied with the RKR1225 repeater. Use handset for servicing.
	1b. External speaker (if applicable) not connected between pins 1 and 16 of accessory connector on controller.	1b. Connect external speaker between pins 1 and 16.
	1c. Defective external speaker (if applicable).	1c. Check speaker and replace if necessary.
	1d. Volume control turned down.	1d. Turn up volume.
	1e. "PA Mute" enabled.	1e. Momentarily press the "MON" pushbutton (for brief listening periods). Use the RSS to reprogram "PA Mute" as disabled (for continuous listening).

Table 6-3. Troubleshooting for Transceiver Transmitter

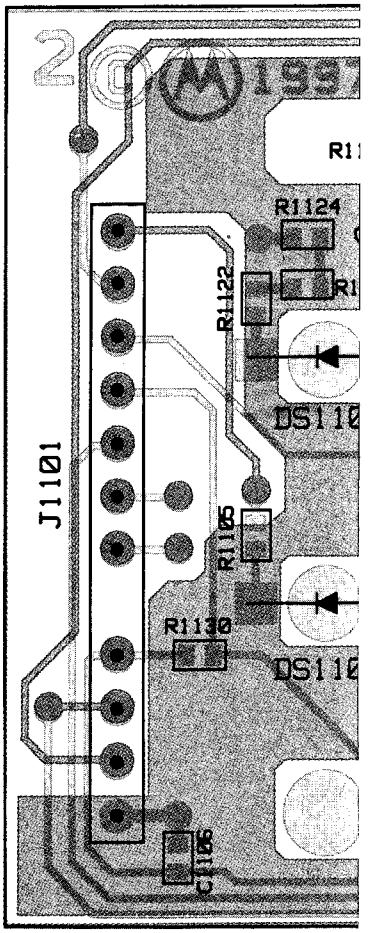
Symptom	Problem	Solution
1. Transmitter not keying when a properly identified signal is presented to receiver.	1a. Repeater not enabled. 1b. Repeater on wrong channel (mode). 1c. No transmit frequency programmed. 1d. Incorrect receive frequency or TPL/DPL programmed. 1e. Accessory connector pin 10 (remote knockdown) activated or not operating correctly.	1a. Enable repeater. 1b. Set repeater to correct channel (mode). 1c. Program transmit frequency. 1d. Check receive frequency and TPL/DPL and reprogram, if necessary. 1e. Check connections to pin 10 of accessory connector and correct, if necessary.
2. Transmitter keying continuously or keying without a properly identified signal presented to the receiver.	2a. Repeater on wrong channel (mode). 2b. Wrong TPL/DPL programmed. 2c. Pin 3 of accessory connector pulled LOW by an accessory. 2d. Accessory connector not programmed correctly or not operating correctly.	2a. Set repeater to correct channel (mode). 2b. Check TPL/DPL and reprogram, if necessary. 2c. Remove accessory and correct LOW condition. 2d. Check programming of accessory connector and reprogram, if necessary.
3. Low or erratic output power level, or no output power level from the transmitter.	3a. Loose RF cable connector(s). 3b. Faulty antenna or feedline. 3c. Faulty duplexer (if applicable). 3d. Output voltage from power supply drops during transmit. 3e. Excessive power supply current drain.	3a. Tighten RF cable connectors to • transmitter output • duplexer • antenna 3b. Replace faulty component. 3c. Check: • Tuning of duplexer • Tightness of locking nuts on tuning screws. • Replace duplexer if duplexer is correctly tuned and nuts are properly tightened. 3d. Check: • Correct position of "115/230" switch on power supply. • High output power from transmitter; do not set greater than 10% over rated RF output power (measured at transmitter output, NOT at duplexer antenna connector). 3e. Disconnect components, one at a time, to locate faulty piece. Replace faulty piece.
4. Transmitter keys but no or low audio is transmitted.	4a. Repeater gain improperly set. 4b. Incorrect "Operation Mode" programmed.	4a. Use RSS to set repeater gain. 4b. Use RSS to reprogram "Operation Mode."

Table 6-4. Troubleshooting for External Controllers (General)

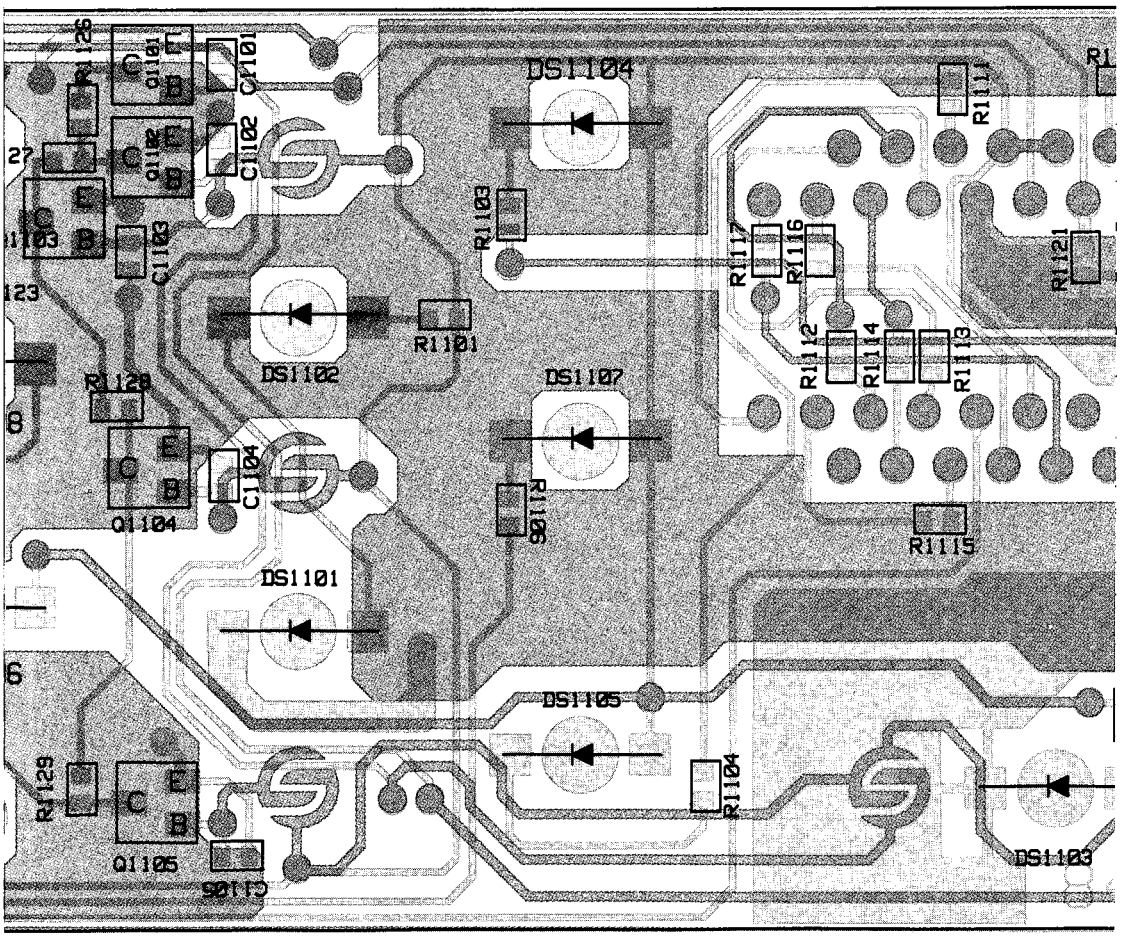
Symptom	Problem	Solution
1. Controller dead, no LED indications.	1a. Loose or bad cable from transceiver. 1b. Blown fuse in controller (if applicable).	1a. Check cable from transceiver and replace if necessary. 1b. Replace fuse in controller (if applicable) and check for short or open circuit(s).
2. Transmitter not keying when a properly identified signal is presented to receiver.	2a. Controller not enabled, if applicable. 2b. R1225 transceiver not enabled. 2c. Loose or bad repeater cable. 2d. Accessory connector of transceiver not programmed correctly or not operating correctly. 2e. Incorrect receive frequency or TPL/DPL programmed. 2f. Repeater on wrong channel (mode). 2g. Pin 10 programmed as "repeater knockdown" and activated by a controller or accessory. 2h. No transmit frequency programmed into transceiver.	2a. Enable controller. 2b. Press front panel "RPT EN" pushbutton. 2c. Check repeater cable connection(s) and replace cable, if necessary. 2d. Check programming of accessory connector and reprogram, if necessary. 2e. Check frequency and TPL/DPL code and reprogram, if necessary. 2f. Change repeater channel (mode). 2g. Check wiring to pin 10 and correct, if necessary. 2h. Program transmit frequency.
3. Transmitter keying continuously or keying without a properly identified signal presented to receiver.	3. Pin 3 of accessory connector on controller pulled LOW by an accessory.	3. Remove accessory and correct LOW condition.
4. R1225 transceiver keys, however only a short burst of audio is heard in field radios.	4. R1225 transceiver is not programmed for correct operating mode.	4. Use the RSS to reprogram as "Repeater w/Ext. Controller".
5. First part of message not repeated.	5. User speaking too soon after pressing PTT.	5. Delay conversation to allow for delays in repeater and field radios from: • TPL/DPL decoding. • Requirements of signalling systems.
6. Transmitter keys, but low or no audio is transmitted.	6a. "External Mic" input (pin 2) of accessory connector not enabled. 6b. Controller not adjusted correctly.	6a. Use RSS to enable "External Mic Audio". 6b. Adjust controller. Perform alignment procedures.
7. "Tinny" repeated audio (lacks low frequencies).	7. Flat receive audio selected with microphone transmit audio.	7. Use RSS to check "Rx Audio Output" and reprogram, if necessary.
8. "Bassy" repeated audio (lacks high frequencies).	8. EIA de-emphasized receive audio selected with flat transmit audio.	8. Use RSS to check "Rx Audio Output" and reprogram, if necessary.
9. TPL/DPL signalling "passing through" controller.	9. Flat repeat audio selected.	9. Use RSS to reprogram repeat audio as "EIA."
10. TPL/DPL signalling not "passing through" controller.	10. EIA de-emphasized repeat selected.	10. Use RSS to reprogram repeat audio as "Flat."
11. DPL sense inverted in "pass through" mode (flat audios).	11. Inversion caused by processing of signal in receiver circuits.	11. Use RSS to change "Flat Tx DPL Polarity".
12. Undesirable squelch tails and noise transmitted during drop-out delay.	12. Unmuted receive audio selected	12. Use RSS to reprogram for "Muted" audio.

Table 6-4. Troubleshooting for External Controllers (General) (Cont'd.)

Symptom	Problem	Solution
13. Cannot remotely setup repeater with Call Alert.	13a. No option board installed into the R1225 transceiver. 13b. Both external controller and R1225 transceiver are programmed for remote setup/knockdown and are operating out of sequence.	13a. Install an option board into the R1225 transceiver. 13b. Disable remote setup/knockdown function in the external controller or R1225 transceiver.
14. TRA100R will not channel steer or will not channel steer to channels (modes) 2, 3, 6 or 7.	14a. R1225 transceiver accessory connector pins are not programmed. 14b. Wire missing in cable from pin 9 of R1225 transceiver connector to pin 9 of "Tx" connector. 14c. R1225 transceiver channel steering pins are programmed with debounce "Off."	14a. Program R1225 transceiver accessory connector: Pin 6 - Chan Steer 0 Pin 9 - Chan Steer 1 Pin 12 - Chan Steer 2 All active Low, Debounce On. 14b. Add wire from pin 9 of R1225 transceiver connector to pin 9 of "Tx" connector. 14c. Use RSS to reprogram channel steer pins with debounce "On."
15. External accessory is not a repeater controller and repeater does not function.	15. Incorrect operation mode selected (such as "Repeater w/External Controller".	15. Use the RSS to program "Linked Repeater" operation mode.



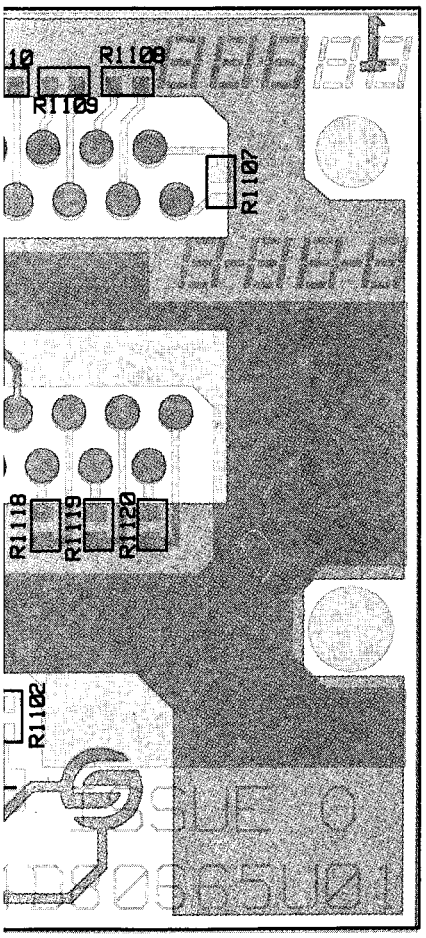
SOLDE



ER SIDE 84-80665U01 I

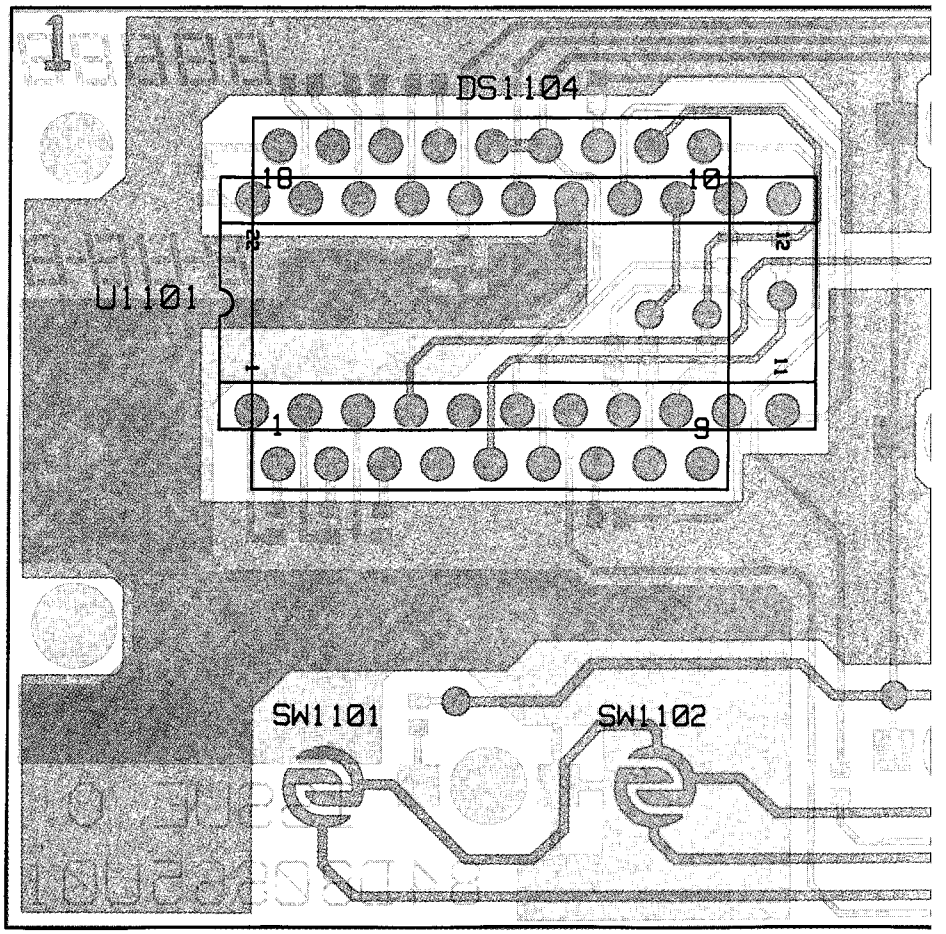
COMPONENT SIDE (GRAY) RCB-97187-O (REV)
SOLDER SIDE (PINK) RCB-97188-O (REV)
OVERLAY ----- RCB-97190-O

SOLDER SIDE VIEW



SSUE O

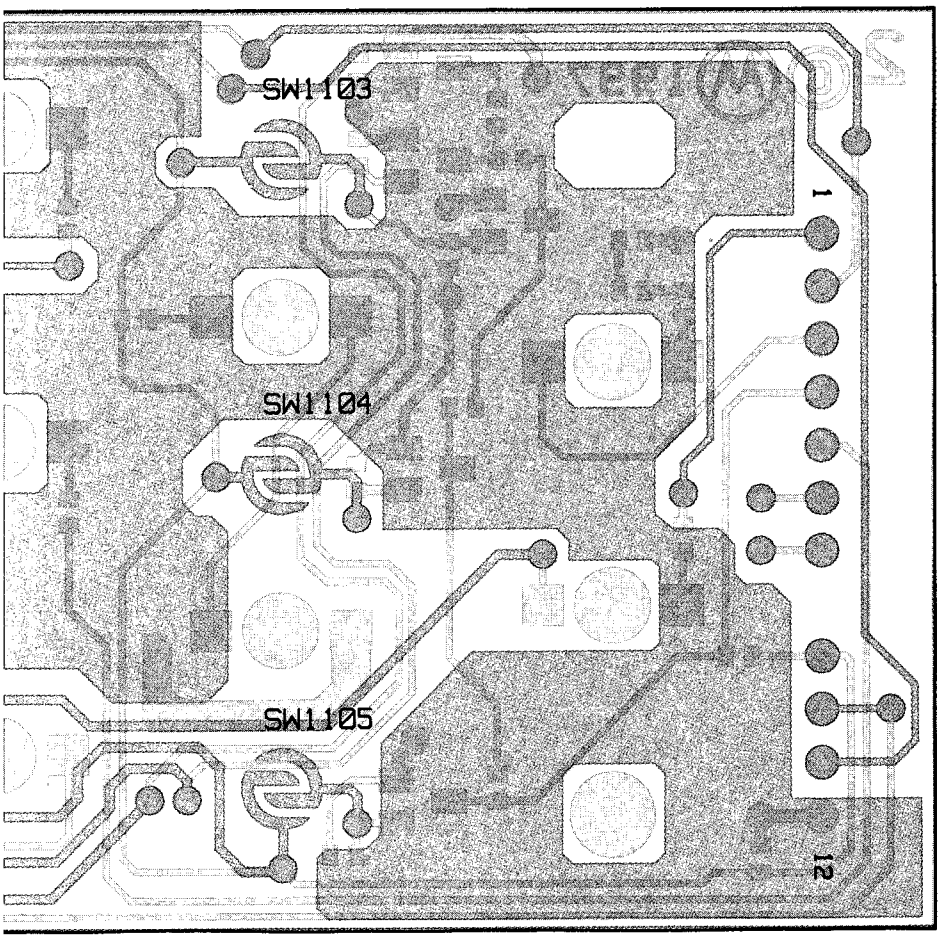
Circuit Board Details for Display Board



COMPONENT SIDE 84

**COMPONENT SIDE (
SOLDER SIDE (PINK
OVERLAY -----**

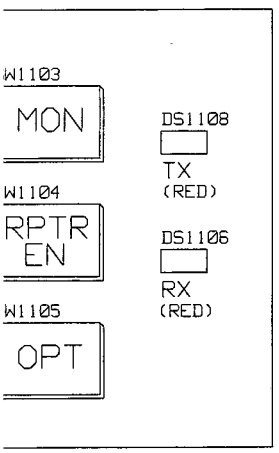
COMPONEN



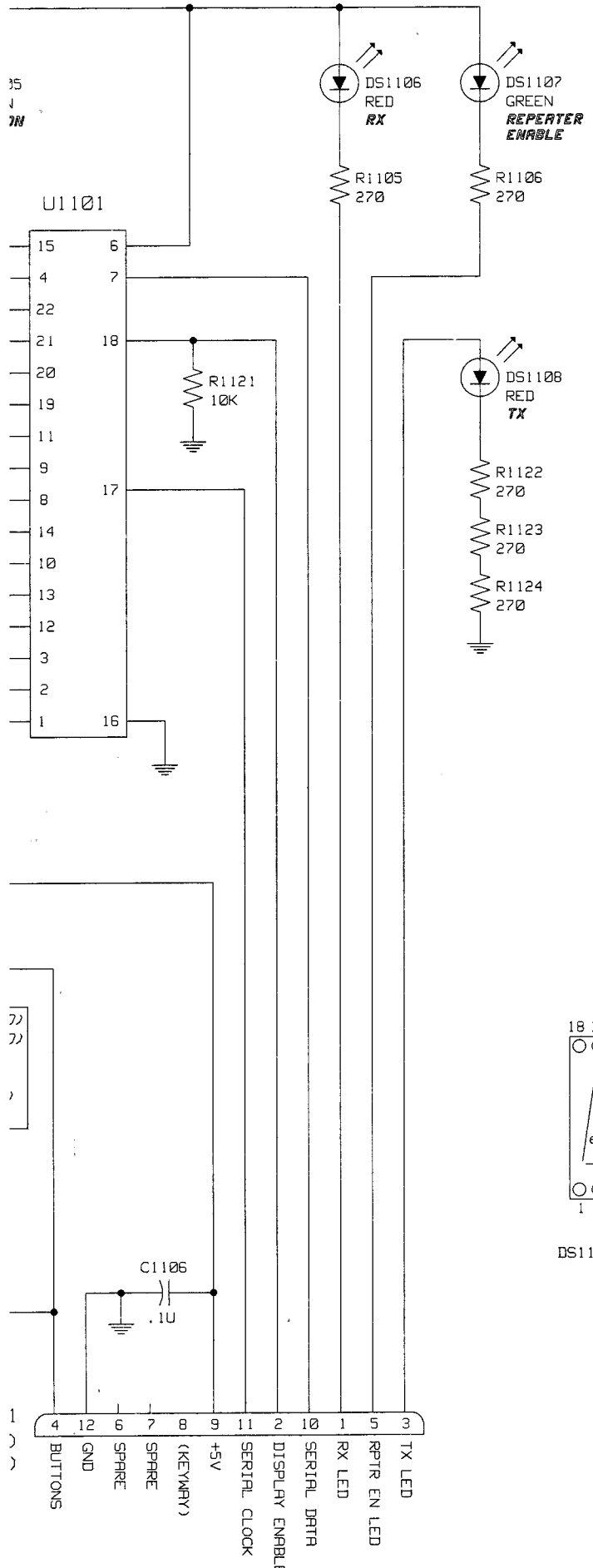
-80665U01 ISSUE O

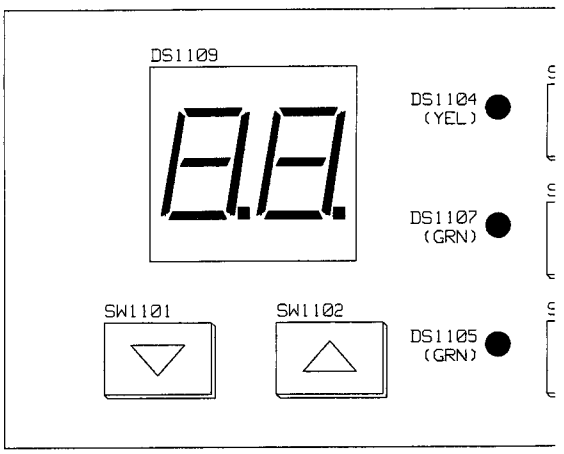
RAY) RCB-97187-O
RCB-97188-O
RCB-97189-O

SIDE VIEW

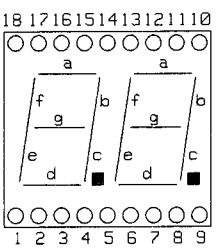


? LAYOUT





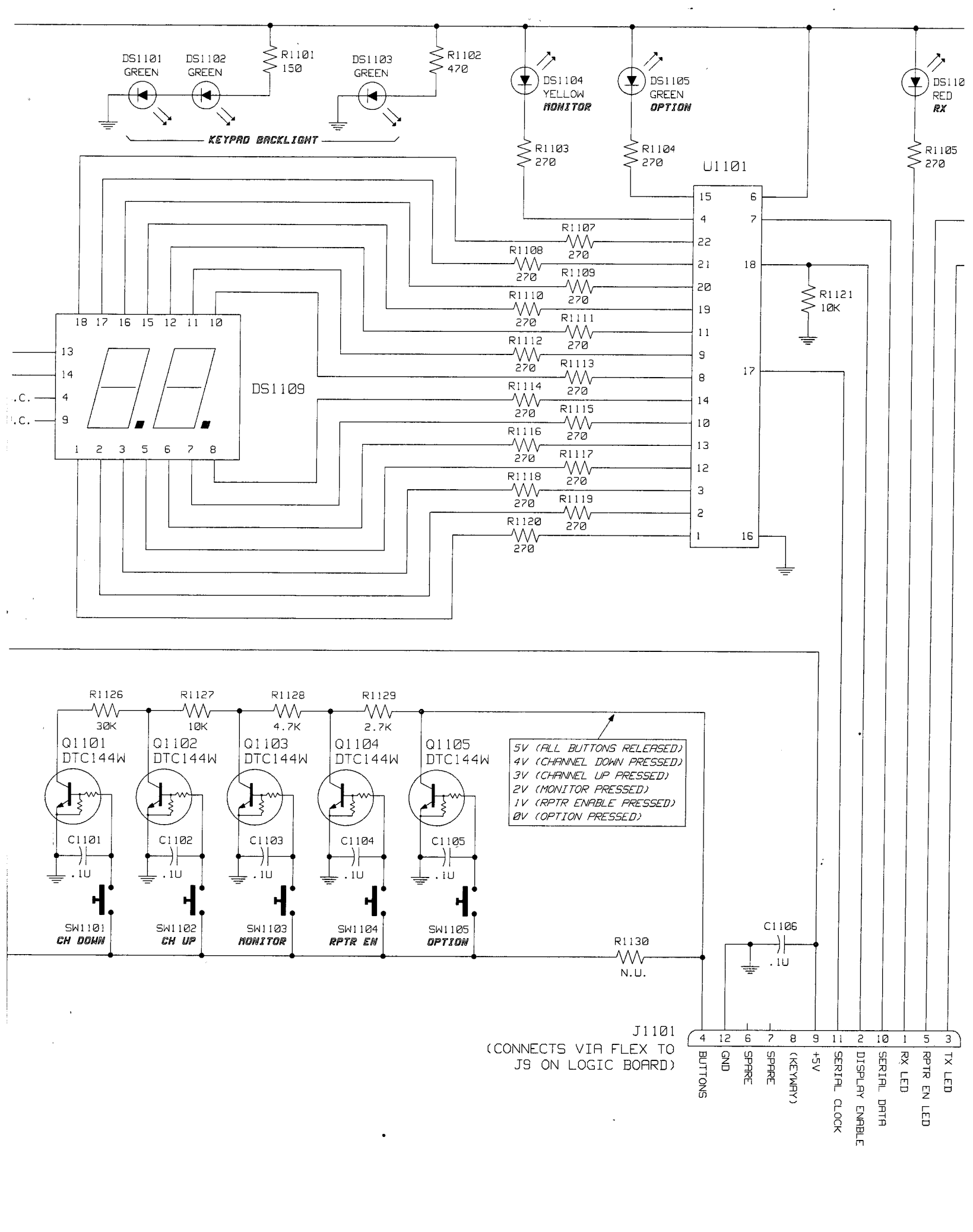
PUSHBUTTON AND INDICATOR



DS1104 PIN ASSIGNMENTS

PIN	ASSIGNMENT
1	CATHODE e1
2	CATHODE d1
3	CATHODE c1
4	CATHODE dp1
5	CATHODE e2
6	CATHODE d2
7	CATHODE g2
8	CATHODE c2
9	CATHODE dp2
10	CATHODE b2
11	CATHODE a2
12	CATHODE f2
13	ANODE digit 2
14	ANODE digit 1
15	CATHODE b1
16	CATHODE a1
17	CATHODE g1
18	CATHODE f1

7/1/97

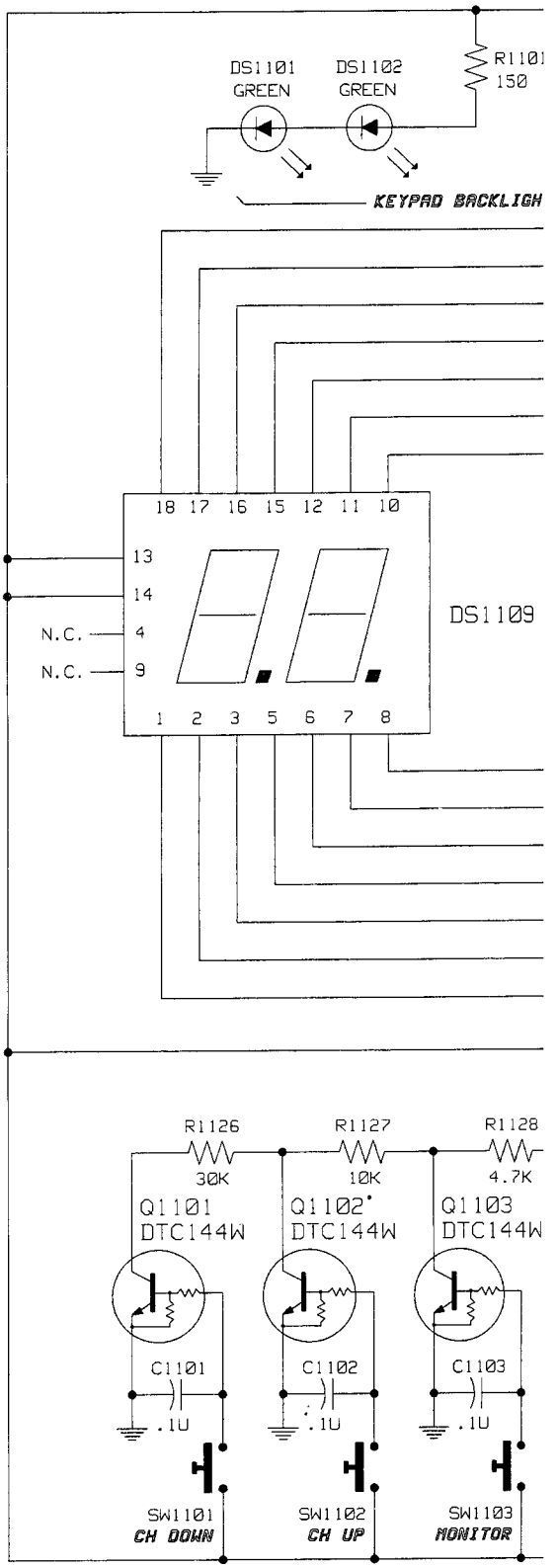

DS1101 GREEN
DS1102 GREEN
R1101 150
DS1103 GREEN
R1102 470
KEYPAD BACKLIGHT
DS1104 YELLOW MONITOR
DS1105 GREEN OPTION
DS110 RED RX
R1103 270
R1104 270
R1105 270
U1101
R1107 270
R1108 270
R1109 270
R1110 270
R1111 270
R1112 270
R1113 270
R1114 270
R1115 270
R1116 270
R1117 270
R1118 270
R1119 270
R1120 270
R1121 10K
DS1109
18 17 16 15 12 11 10
13
14
.C. 4
.C. 9
1 2 3 5 6 7 8
15 4 22 21 20 19 11 9 8 14 10 13 12 3 2 1
6 7 18 17 16
R1126 30K
R1127 10K
R1128 4.7K
R1129 2.7K
Q1101 DTC144W
Q1102 DTC144W
Q1103 DTC144W
Q1104 DTC144W
Q1105 DTC144W
5V (ALL BUTTONS RELEASED)
4V (CHANNEL DOWN PRESSED)
3V (CHANNEL UP PRESSED)
2V (MONITOR PRESSED)
1V (RPTR ENABLE PRESSED)
0V (OPTION PRESSED)
C1101 .1U
C1102 .1U
C1103 .1U
C1104 .1U
C1105 .1U
SW1101 CH DOWN
SW1102 CH UP
SW1103 MONITOR
SW1104 RPTR EN
SW1105 OPTION
R1130 N.U.
C1106 .1U
J1101
(CONNECTS VIA FLEX TO J9 ON LOGIC BOARD)
4 12 6 7 8 9 11 2 10 1 5 3
BUTTONS
GND
SPARE
SPARE
(KEYWAY)
+5V
SERIAL CLOCK
DISPLAY ENABLE
SERIAL DATA
RX LED
RPTR EN LED
TX LED

Parts List

HLN9502A Display Board PL-971043-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, chip: unless otherwise stated
C1101 thru 1106	21-13743E20	0.1 uF 10%; 16 V
		displays and indicators:
DS1101 thru 1103	48-82565T07	diode LED GRN
DS1104	48-82565T06	diode LED YEL
DS1105	48-82565T07	diode LED GRN
DS1106	48-82565T05	diode LED RED
DS1107	48-82565T07	diode LED GRN
DS1108	48-82565T05	diode LED RED
DS1109	48-80055M01	dual 7 segment LED
		connector, receptacle:
J1101	28-80129R05	12-pin (pin 8 removed)
		transistor: (see note)
Q1101 thru 1105	48-80947V01	digital NPN; type DTC144W
		resistor, chip: +/-5%; 1/16 W: unless otherwise stated
R1101	06-62057A29	150
R1102	06-62057A41	470
R1103 thru 1120	06-62057A35	270
R1121	06-62057A73	10k
R1122 thru 1124	06-62057A35	270
R1126	06-62057A84	30k
R1127	06-62057A73	10k
R1128	06-62057A65	4.7k
R1129	06-62057A59	2.7k
R1130	---	Not Used
		integrated circuit: (see note)
U1101	51-84437N25	driver, serial to parallel

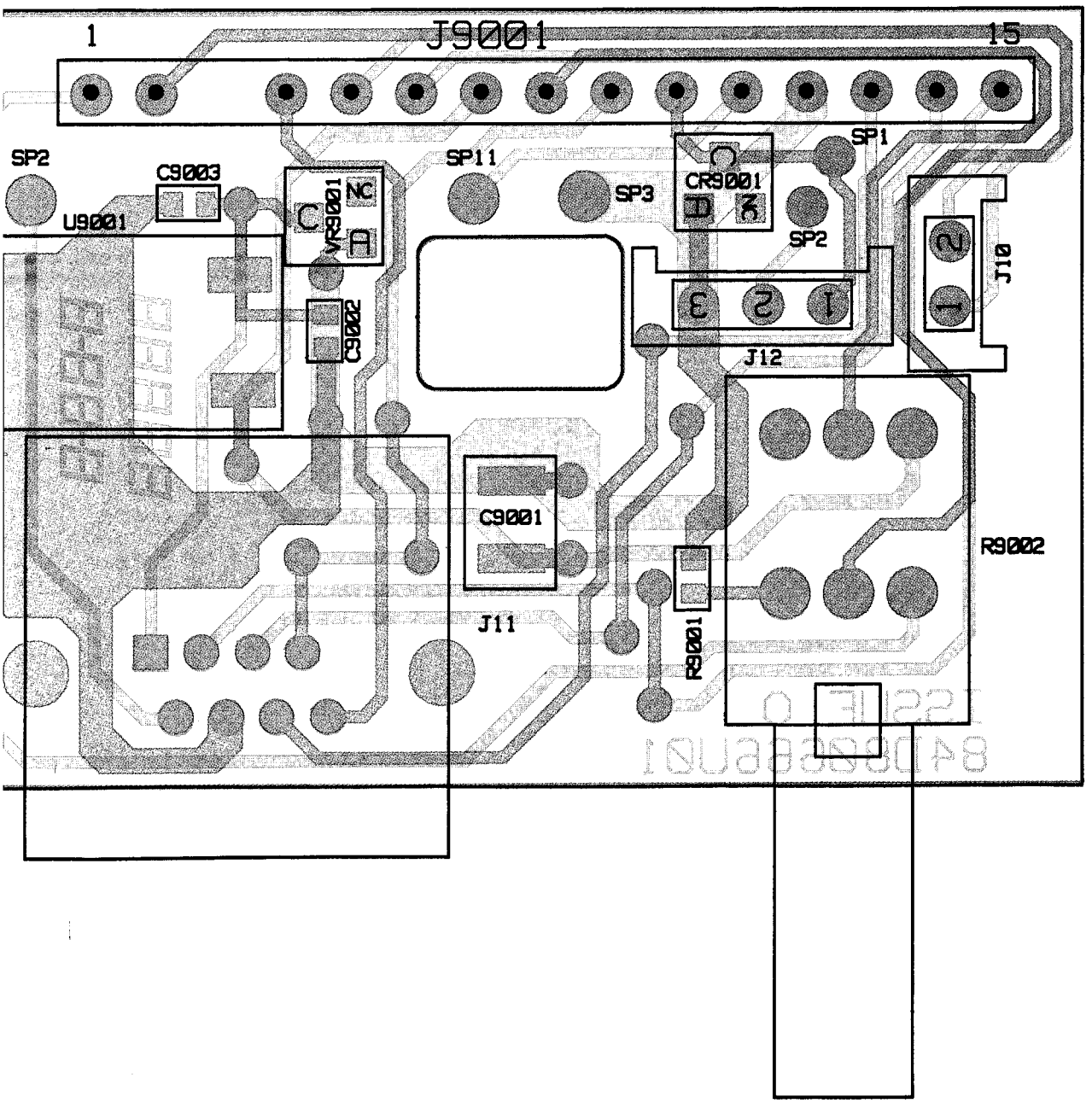
note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.



Schematic Diagram and Parts List for Display Board

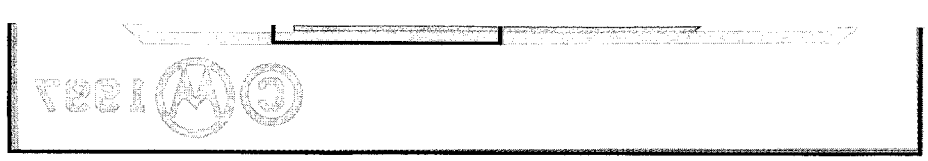
84D80666U01 ISSUE O

COMPONENT SIDE



COMPONENT SIDE (GRAY) RCB-97191-O
SOLDER SIDE (PINK) RCB-97192-O
OVERLAY ----- RCB-97193-O

COMPONENT SIDE VIEW



Parts List

HLN9509A Volume/Microphone Board PL-971044-O

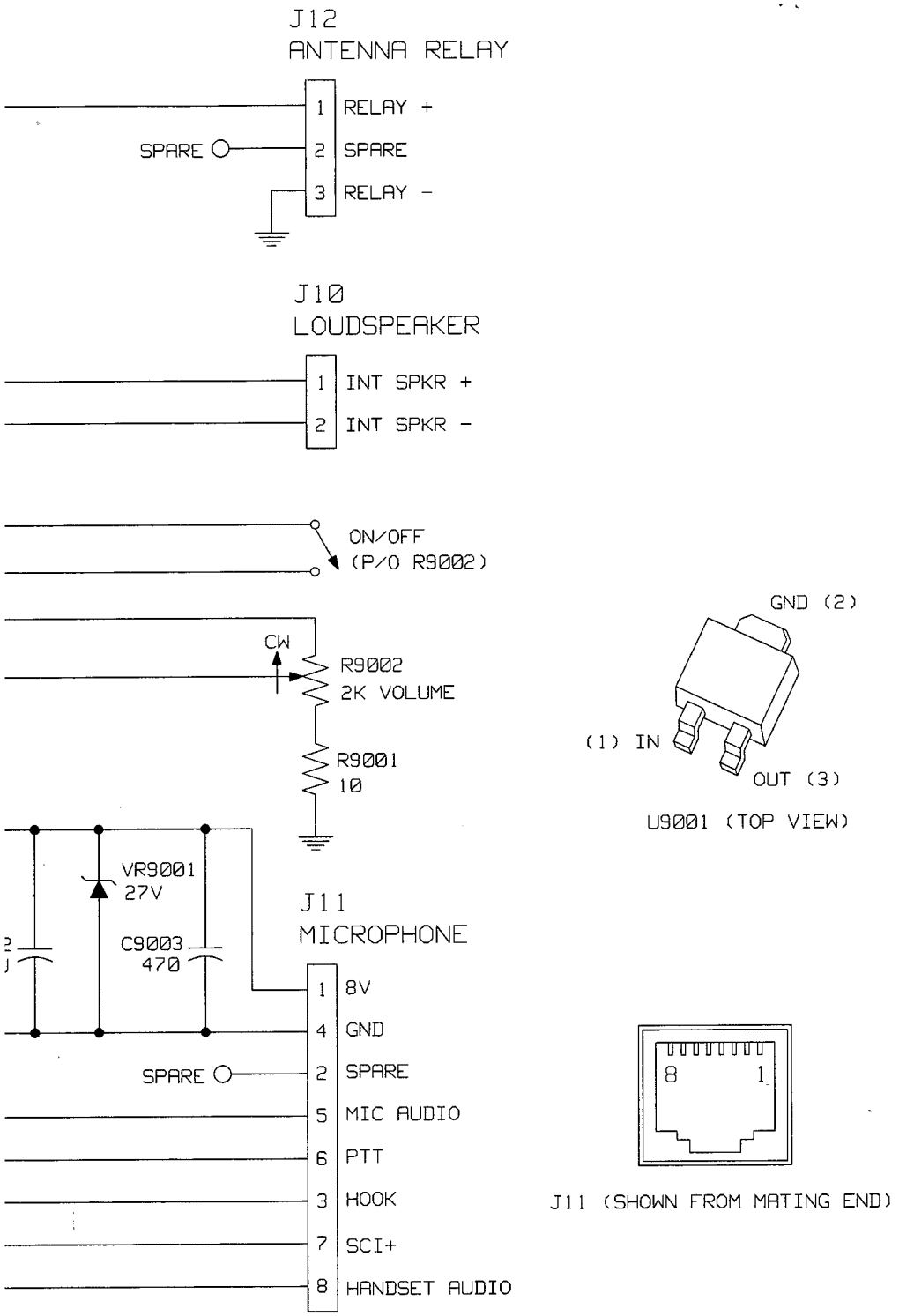
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: uF +/-5%; 50 V: unless otherwise stated
C9001	21-13741W01	1 uF 10%; 25 V
C9002	21-13743E20	0.1 uF 10%; 16 V
C9003	21-13741F17	470 pF
		diode: (see note)
CR9001	48-05129M76	silicon SOT
		connector, receptacle:
J10	28-80128M02	2-pin, internal speaker
J11	09-80132M01	telephone type, 8 contact, microphone
J12	28-80128M07	3-pin, antenna relay
J9001	28-80129R06	15-pin (pin 3 removed)
		resistor, fixed: +/-5%; 1/16 W: unless otherwise stated
R9001	06-62057A01	10
R9002	18-04405J01	variable 2k with switch
		integrated circuit: (see note)
U9001	51-13816A08	8 V regulator MC78M08BDT
		voltage regulator: (see note)
VR9001	48-80948V01	zener diode 27V SOT

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

Circuit Board Details, Schematic Diagram, and Parts List for Volume Microphone Board

97151-O

CR9001
8V REGULATOR
MC78M08
U9001
1
2
3
C9001
1U
SPARE
11 SPARE
10 RELAY
6 INT SPKR +
5 INT SPKR -
8 B+
7 SW B+
1 VOL CONT TOP
2 VOL CONT WIPER
12 GND
14 MIC AUDIO
13 PTT
15 HOOK
9 SCI+



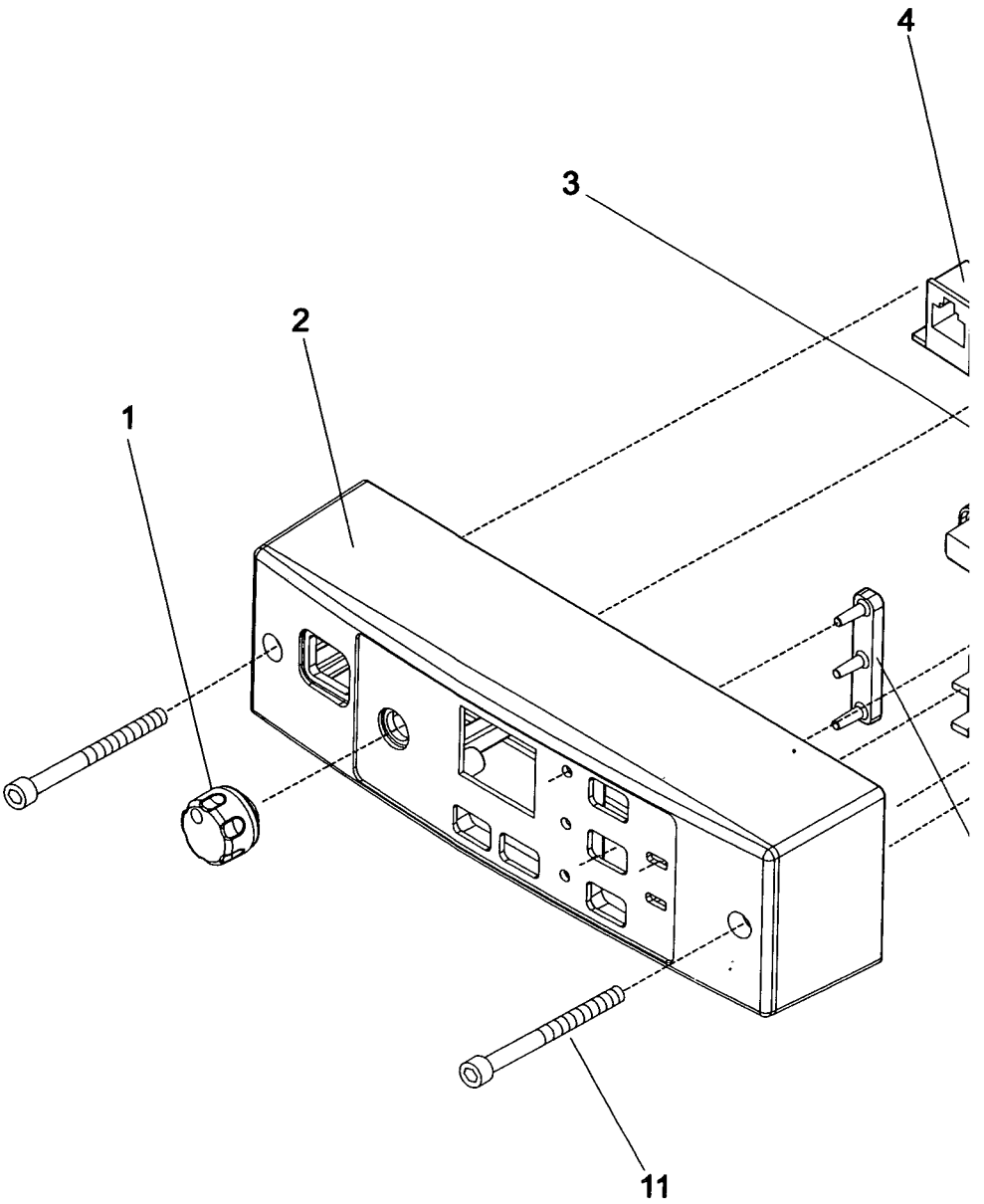
U9001 (TOP VIEW)

J11 (SHOWN FROM MATING END)

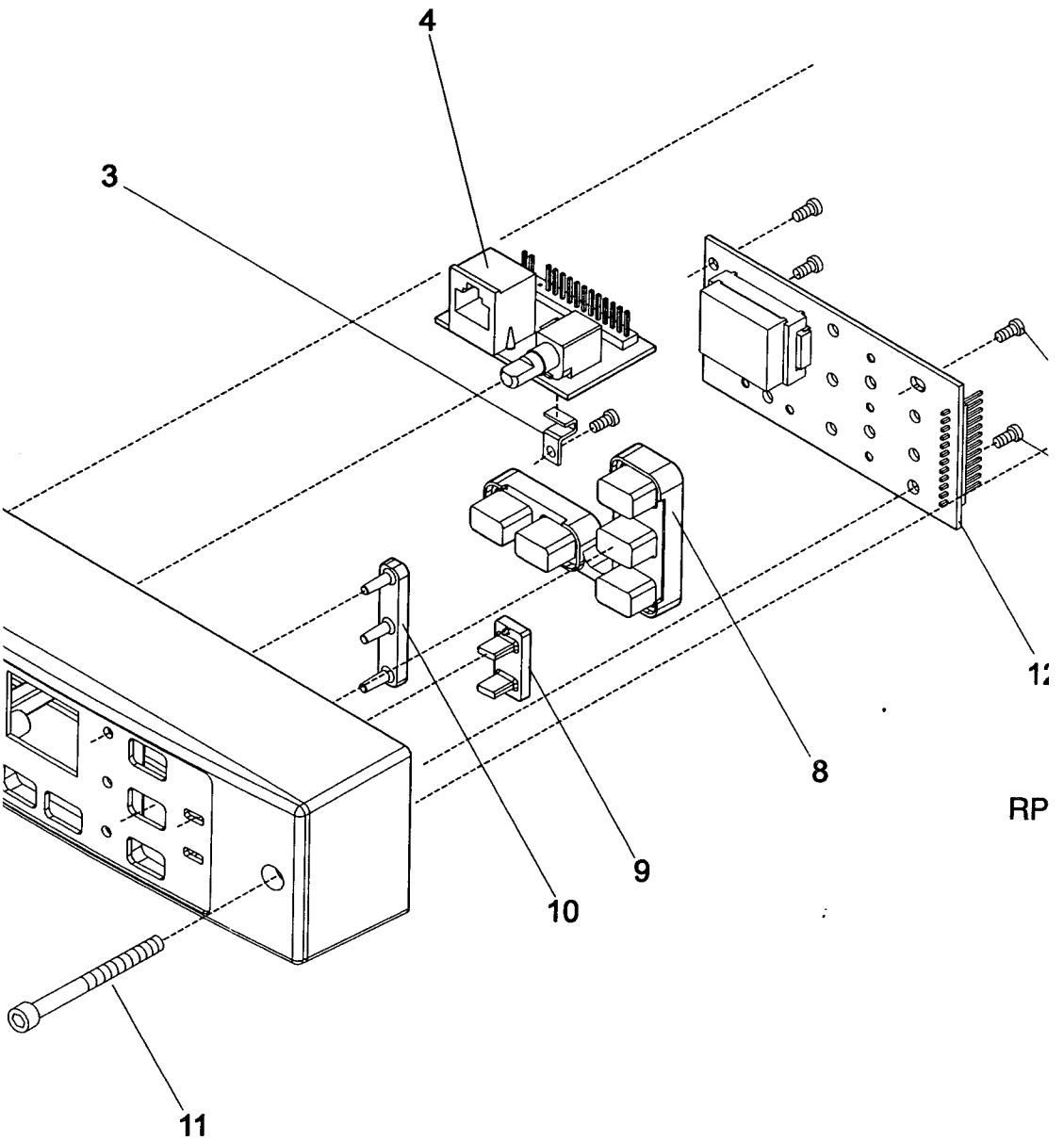
Parts List

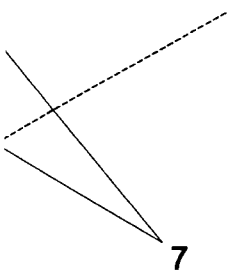
R1225 Control Head Assembly, Mechanical PL-991010-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	3680106M03	KNOB
2	1580668U01	HOUSING, control head
3	0780037M01	BRACKET, PC board retainer
4	HLN9509	BOARD, volume
8	7580471U01	KEYPAD
9	6180491U01	LIGHTPIPE
10	6180491U02	LIGHTPIPE
11	0380270L01	SCREW, cap; 2 used
12	HLN9502	BOARD, display
	non-referenced items	
	1380670U01	ESCUTCHEON
	3080519U03	CABLE, ribbon, 12-pin
	3080519U04	CABLE, ribbon, 15-pin



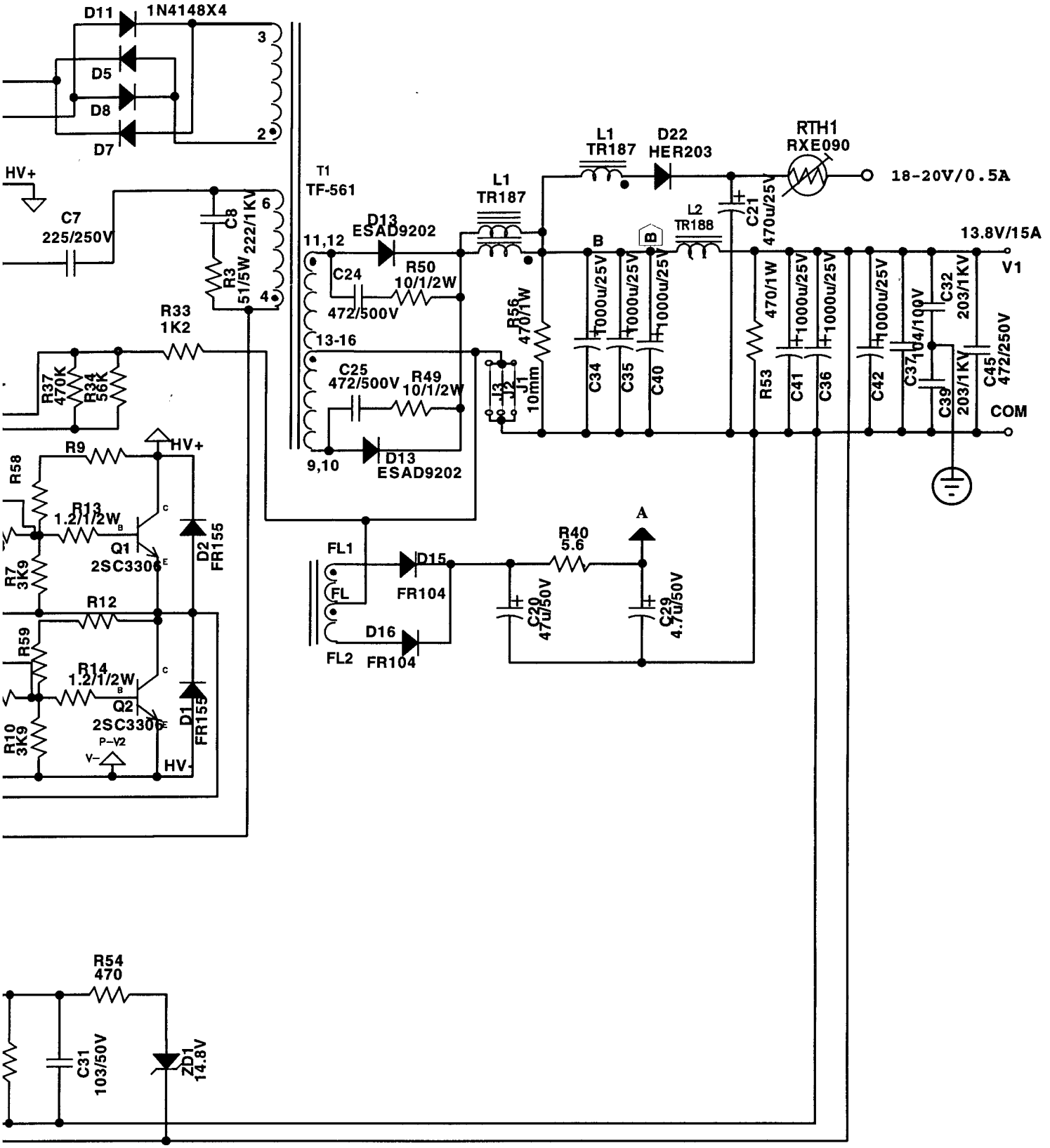
Exploded View and Parts Lists for Control Head Assembly


4
3
8
9
10
11
12

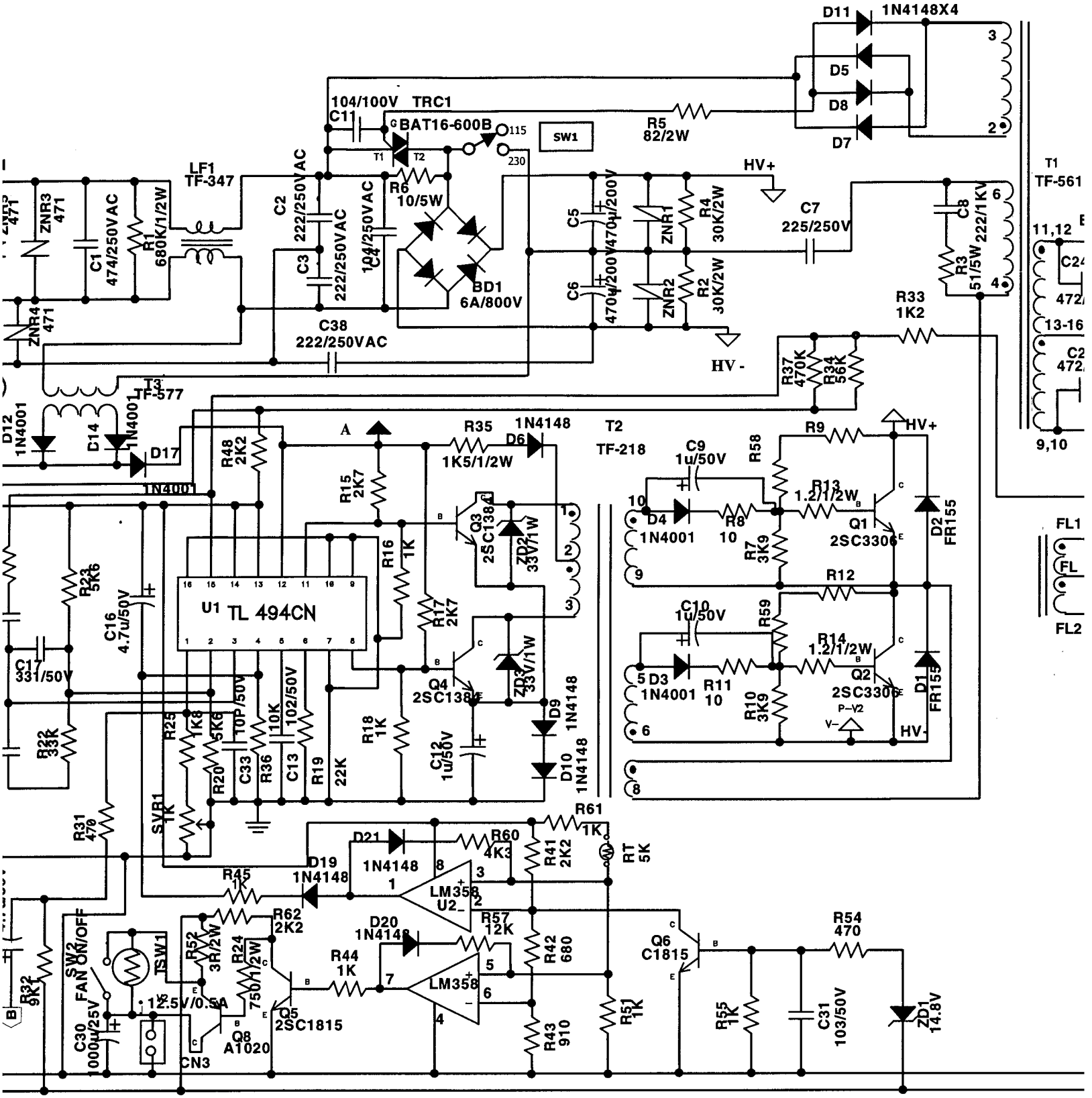


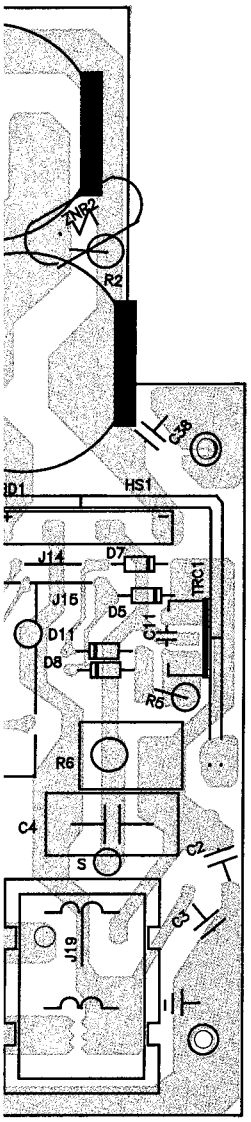
2

D-99117-O

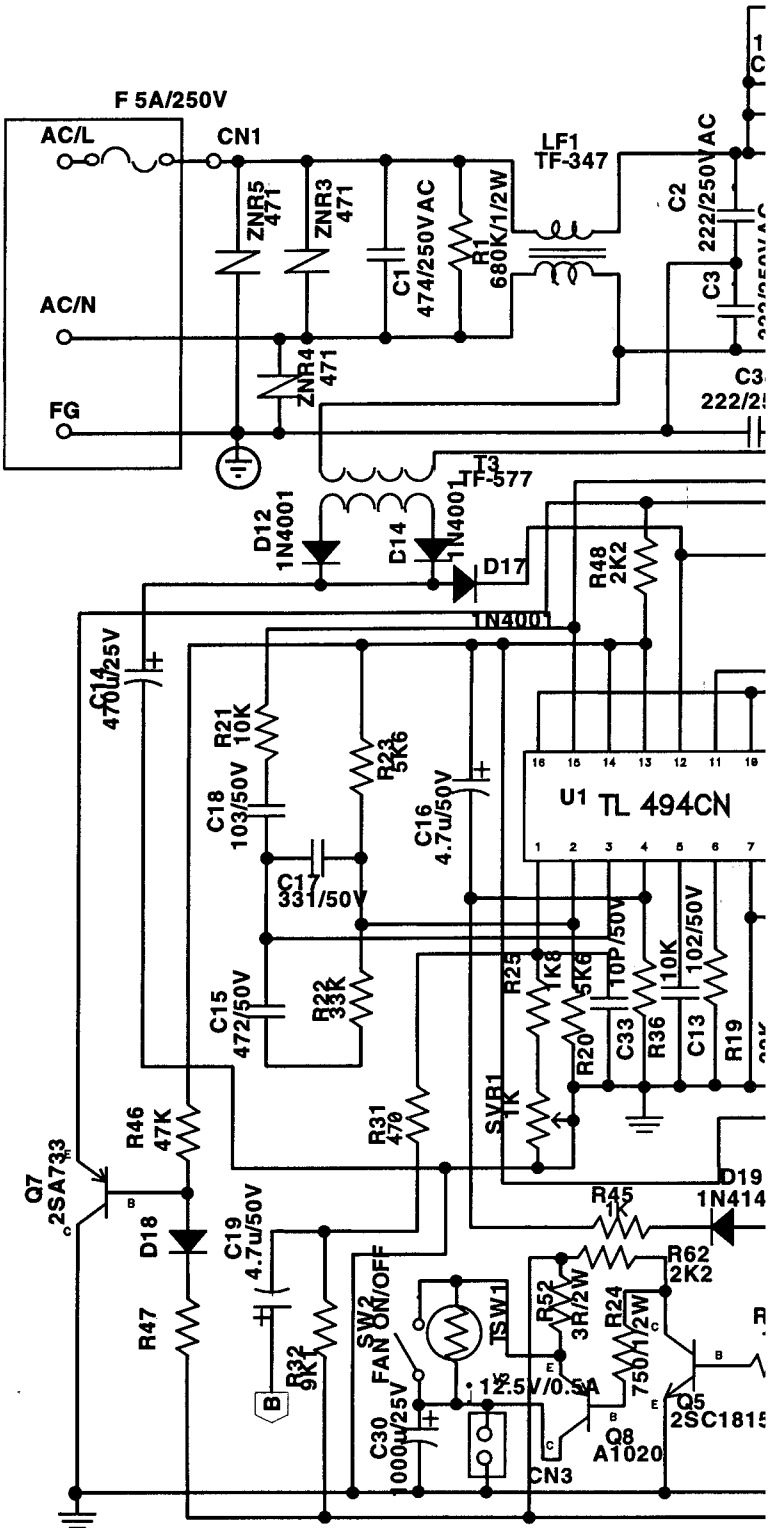


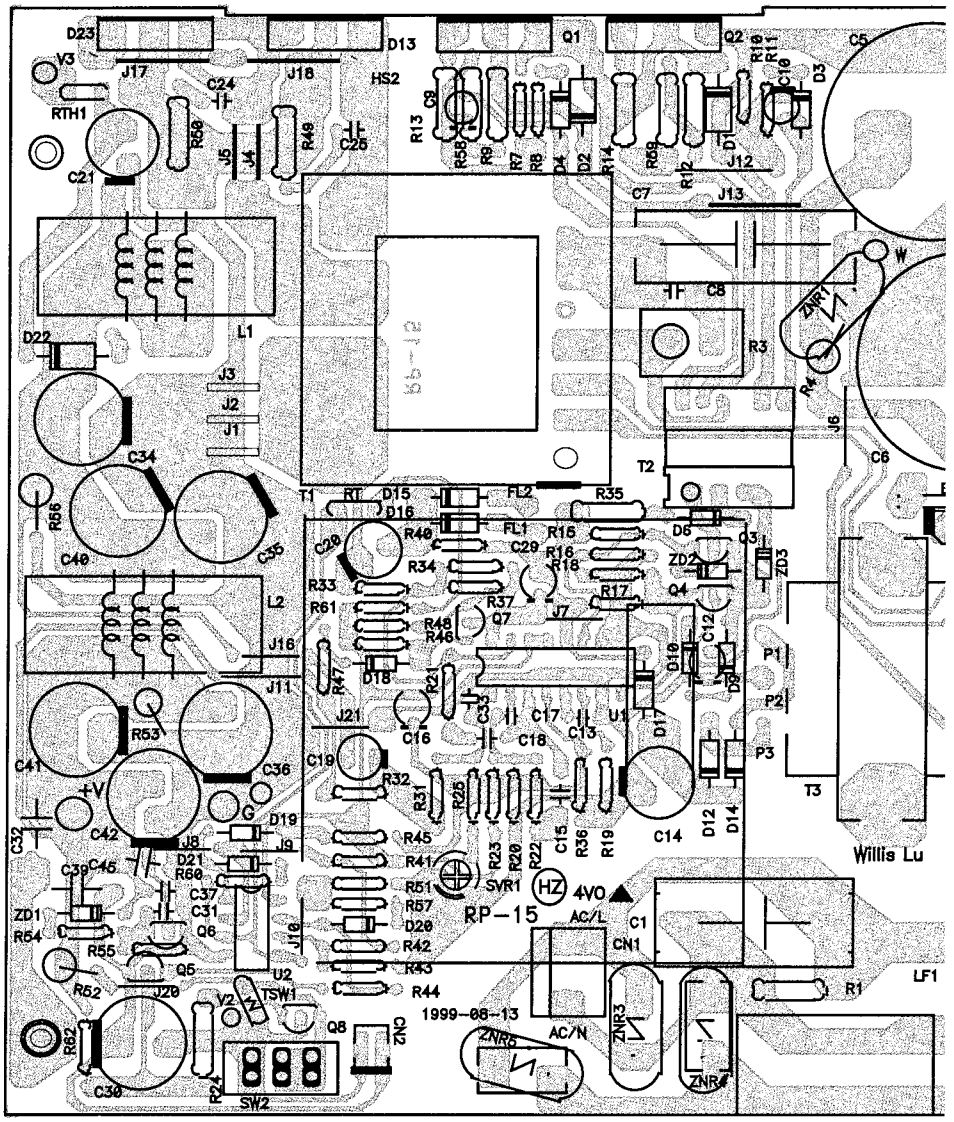
Circuit Board Detials, Schematic Diagram, and Parts List for HPN9033 Power Supply


D11 1N4148X4
D5
D8
D7
104/100V TRC1
C11
BAT16-600B
115
230
SW1
R5 82/2W
T1
T2
LF1 TF-347
C2 222/250VAC
C3 222/250VAC
104/250VAC C4
R6 10/5W
BD1 6A/800V
HV+
C5 470u/200V
C6 470u/200V
ZNR1
ZNR2
R4 30K/2W
R2 30K/2W
C7 225/250V
HV -
T1 TF-561
C8 222/1KV
R3 51/5W
11,12
9,10
13-16
R33 1K2
R37 470K
R34 56K
C38 222/250VAC
ZNR3 471
ZNR4 471
C1 474/250VAC
R1 680K/1/2W
T3 TF-577
D12 1N4001
D14 1N4001
D17 1N4001
1N4001
R48 2K2
A
R35 1K5/1/2W
D6 1N4148
T2 TF-218
R9
C9 1u/50V
R58
R13 1.2/1/2W
D4 1N4001
R8 10
R7 3K9
Q1 2SC3306
D2 FR155
R12
C10 1u/50V
R59
R14 1.2/1/2W
D3 1N4001
R11 10
R10 3K9
Q2 2SC3306
D1 FR155
P-V2
V-
HV-
FL1
FL
FL2
R15 2K7
R16 1K
Q3 2SC1384
ZD2 33V/1W
R17 2K7
Q4 2SC1384
ZD3 33V/1W
D9 1N4148
D10 1N4148
U1 TL 494CN
R23 5K6
C16 4.7u/50V
C17 331/50V
R22 33K
R25 1K8
R20 5K6
C33 10P/50V
R36 10K
C13 102/50V
R19 22K
R18 1K
C12 1u/50V
SVR1 1K
R31 470
R61 1K
D21 1N4148
R60 4K3
R41 2K2
RT 5K
D19 1N4148
R45 1K
LM358 U2
D20 1N4148
R62 2K2
R57 12K
R42 680
R44 1K
R43 910
R51 1K
R54 470
Q6 C1815
R55 1K
C31 103/50V
ZD1 14.8V
SW2 FAN ON/OFF
TSW1
12.5V/0.5A
R52 3R/2W
R24 750/1/2W
Q5 2SC1815
Q8 A1020
CN3
C30 1000u/25V
R32 9K1



DC	AC
1.61 V	---
1.47 V	---
21.95 V	---
10.9 V	---
22.9 V	---
19.1 V	---
22.7 V	---
11.83 V	---
13.91 V	---
13.85 V	---
13.99 V	14.6 V





HPN9033 Test Voltages

	DC	AC	
Q1 pinC (+) to Q1 pinE (-)	151 V	108 V	C10 + (+) to C10 - (-)
Q1 pinB (+) to Q1 pinE (-)	-1.71 V	2.39 V	C12 + (+) to C12 - (-)
Q2 pinC (+) to Q2 pinE (-)	154 V	108 V	C14 + (+) to C14 - (-)
Q2 pinB (+) to Q2 pinE (-)	-1.76 V	2.4 V	C19 + (+) to C19 - (-)
Q4 pinC (+) to Q4 pinE (-)	7.3 V	13 V	C20 + (+) to C20 - (-)
Q4 pinB (+) to Q4 pinE (-)	0.3 V	0.63 V	C21 + (+) to C21 - (-)
Q5 pinC (+) to Q5 pinE (-)	7.3 V	13 V	C29 + (+) to C29 - (-)
Q5 pinB (+) to Q5 pinE (-)	0.3 V	0.63 V	C30 + (+) to C30 - (-)
Q7 pinE (+) to Q7 pinC (-)	4.73 V	---	C40 + (+) to C40 - (-)
Q7 pinB (+) to Q7 pinC (-)	4.93 V	---	C42 + (+) to C42 - (-)
C5 + (+) to C6 - (-)	310 V	---	L1 and D13 (+) to COM (-)
C9 + (+) to C9 - (-)	1.57 V	---	

Test Conditions Input: 230 V ac / 115 V ac
Output: V1 13.8 V dc 15A
V2 12.5 V dc 0.5A
V3 19 V dc 0.5A

Parts List

REFERENCE SYMBOL	DURACOMM PART NO.	DESCRIPTION
		bridge rectifier:
BD1	1CD1A6R0C801-XS	6A/800V Silicon Bridge Rectifier
		capacitor, fixed: uF +/-10%; 100 V: unless otherwise stated
C1	1BC1F474C251K-J	0.47 uF 250 V ac, 20%
C2, 3	1BC1D222C251K-7	2.2 nF 250 V ac, 20%
C4	1BC1F104C251K-F	0.1 uF 250 V ac, 20%
C5, 6	1BCAC471C201M22	470 uF 200 V 85°C electrolytic
C7	1BC2G225C251K-L	2.2 uF 250 V
C8	1BC3D222D102M-5	2.2 nF 1K V, 20% Z5U
C9, 10	1BCDA1R0B500M05	1 uF 50 V, 20% 105°C electrolytic
C11	1BC2F104C101K-5	0.1 uF
C12	1BCDA1R0B500M05	1 uF 50 V, 20% 105°C electrolytic
C13	1BC4D102C101J-2	1 nF, 5%
C14	1BCGC471B250M10	470 uF 25 V, 20% electrolytic
C15	1BC4D472C101J-2	4.7 nF, 5%
C16	1BCDA4R7B500M05	4.7 uF 50 V, 20% 105°C electrolytic
C17	1BC3C331C101K-5	330 pF Y5P
C18	1BC4E103C101J-2	10 nF, 5%
C19	1BCDA4R7B500M05	4.7 uF 50 V, 20% 105°C electrolytic
C20	1BCEB470B500M08	47 uF 50 V, 20% electrolytic
C21	1BCGC471B250M10	470 uF 25 V, 20% electrolytic
C24, 25	1BC3D472C501M-5	4.7 nF 500 V, 20% Z5U
C29	1BCDA4R7B500M05	4.7 uF 50 V, 20% 105°C electrolytic
C30	1BCGD102B250M12	1000 uF 25 V, 20% electrolytic
C31	1BC3E103C101M-5	10 nF, 20% Z5U
C32	1BC6E203D102M-9	20 nF 1K V, 20% Z5U EPOXY
C33	1BC3B100B500K-5	10 pF 50 V, NPO
C34 thru 36	1BCGD102B250M12	1000 uF 25 V, 20% electrolytic
C37	1BC2F104C101K-5	0.1 uF
C38	1BC1D222C251K-7	2.2 nF 250 V ac, 20%
C39	1BC6E203D102M-9	20 nF 1K V, 20% Z5U EPOXY
C40 thru 42	1BCGD102B250M12	1000 uF 25 V, 20% electrolytic
C45	1BC1D472C251K-7	4.7 nF 250 V ac, 20%
		connector:
CN3	1FF12022-02	8812-02, 2-position fan
		diode: (see note)
D1, 2	1CD3A1R5C601-H	FR155, 1.5A/600 V
D3, 4	1CD2A1R0B500-H	1N4001, 1A/50 V
D5 thru 11	1CDA1N4148-T	1N4148, switching diode
D12	1CD2A1R0B500-H	1N4001, 1A/50 V
D13A, B	1CD5ESAD92-02	ESAD9202, 20A/200 V fullwave rectifier
D14	1CD2A1R0B500-H	1N4001, 1A/50 V
D15, 16	1CD3A1R0C401-H	FR104, 1A/400 V
D17	1CD2A1R0B500-H	1N4001, 1A/50 V
D18	---	Not Used
D19 thru 21	1CDA1N4148-T	1N4148, switching diode
D22	1CD5HER203	HER203, 2A/200 V
		fuse:
F	1EE2A5R0C251F1I	5A, 250 V, GFE/GMA
		fan:
FAN	1EE6B120A6R0BBM	KD1206PHB2, 12 V dc, 1.9 W DC
		filter choke:
L1	1DL3TR187	TR187, Toroidal
L2	1DL3TR188	TR188 3.2 uH, Toroidal
LF1	1DL5TF347	TF347 1.9 mH Line
		transistor: (see note)
Q1, 2	1CQ12SC3306	2SC3306 10A/400 V NPN
Q3, 4	1CQ12SC1384	2SC1384 1A/50 V NPN
Q5, 6	1CQ12SC1815GR	2SC1815 0.1A/40 V NPN
Q7	1CQ12SA733	2SA733 -0.1A/-50 V PNP
Q8	1CQ12SA1020	2SA1020 -2A/50 V PNP
		resistor, fixed: +/-5%; 1/4 W: unless otherwise stated
R1	1AR1-R50F684JH	680k, 1/2 W
R2	1AR2A2R0E303JH	30k, 2 W metal oxide
R3	1AR6A5R0B510JH5	51, 5 W R/CE
R4	1AR2A2R0E303JH	30k, 2 W metal oxide
R5	1AR2A2R0B820JH	82, 2 W metal oxide
R6	1AR7A5R0B100K	10, 5 W R/FS
R7	1AR1-R25D392JH9	3.9k
R8	1AR1-R25B100JH9	10
R9	---	Not Used
R10	1AR1-R25D392JH9	3.9k

REFERENCE SYMBOL	DURACOMM PART NO.	DESCRIPTION
R11	1AR1-R25B100JH9	10
R12	---	Not Used
R13, 14	1AR1-R50A1R2JH	1.2, 1/2 W
R15	1AR1-R25D272JH9	2.7k
R16	1AR1-R25D102JH9	1k
R17	1AR1-R25D272JH9	2.7k
R18	1AR1-R25D102JH9	1k
R19	1AR1-R25E223JH9	22k
R20	1AR1-R25D562JH9	5.6k
R21	1AR1-R25E103JH9	10k
R22	1AR1-R25E333JH9	33k
R23	1AR1-R25D562JH9	5.6k
R24	1AR1-R50C751JH	750, 1/2W
R25	1AR1-R25D182JH9	1.8k
R31	1AR1-R25C471JH9	470
R32	1AR1-R25D912JH9	9.1k
R33	1AR1-R25D122JH9	1.2k
R34	1AR1-R25E563JH9	56k
R35	1AR1-R50D152JH	1.5k, 1/2W
R36	1AR1-R25E103JH9	10k
R37	1AR1-R25F474JH9	470k
R40	1AR1-R25A5R6JH9	5.6
R41	1AR1-R25D222JH9	2.2k
R42	1AR1-R25C681JH9	680
R43	1AR1-R25C911JH9	910
R44, 45	1AR1-R25D102JH9	1k
R46	1AR1-R25E473JH9	47k
R47	---	Not Used
R48	1AR1-R25D222JH9	2.2k
R49, 50	1AR1-R50B100JH	10, 1/2 W
R51	1AR1-R25D102JH9	1k
R52	1AR2A2R0A3R0JH	3, 2 W metal oxide
R52	1HH3104C	3 W, 2 W metal oxide
R53	1AR2A1R0C471JH	470, 1 W metal oxide
R54	1AR1-R25C471JH9	470
R55	1AR1-R25D102JH9	1k
R56	1AR2A1R0C471JH	470, 1 W metal oxide
R57	1AR1-R25E123JH9	12k
R58, 59	---	Not Used
R60	1AR1-R25D432JH9	4.3k
R61	1AR1-R25D102JH9	1k
R62	1AR1-R25D222JH9	2.2k
		thermistor:
RT	1ARC-TDC05C250L	TDC05C250L 5kΩ
RTH1	1ARCRXE090	RXE090 0.9A/60 V PSW
		variable resistor:
SVR1	1ARB-R30D102S2S	1k, 0.3 W, 10%
		switch:
SW1	1EE1L21-22A1	Slide (115/230 V ac)
SW2	1EE1SSFZC22-062	Slide (Fan Continuous On)
		transformer:
T1	1DL5TF561	TF-561, output power
T2	1DL5TF218	TF-218-R2, driver
T3	1DL5TF577	TF-57, low voltage supply
		Triac:
TRC1	1CQ3BTA16-600B	BTA16-600B
		thermal switch:
TSW1	1ARENR	50°C 2.6A
		integrated circuit: (see n
U1	1CU4TL494TI	TL494CN, pulse width mod
U2	1CU5LM358	LM358, dual operational a
		voltage regulator: (see n
ZD1	1CDB-R50B14R8G	14.8 V 1/2 W, 2% Zener di
ZD2, 3	1CDBA1R0B33R0G	1N4752, 33 V, 1 W, 2% Ze
		metal oxide varistor:
ZNR1, 2	---	Not Used
ZNR3 thru 5	1ARD-R60C471K97	TNR15G471K, 470 V, 0.6

note: For optimum performance, diodes, transistors, and integrat must be ordered by DuraComm part numbers.

Glossary

Base Station:
Simple receive then transmit functions of the R1225 transceiver module. The two functions occur one at a time (simplex operation). Also see Full Duplex Base Station.

Bi-directional Repeater:
A repeater configuration in which two R1225 transceiver modules or two radios are interconnected. The audio and COR signals from the receiver of the first radio are routed to the transmitter of the second radio. Unlike the unidirectional case, though, the audio and COR signals of the receiver of the second radio are also routed to the transmitter of the first radio. Example: the first radio receives a signal on 456.550 MHz which is re-transmitted by the second radio on 451.550 MHz. The second radio then receives a signal on 451.550 MHz which is re-transmitted by the first radio on 456.550 MHz.

Console radio:
A fixed (base station) or a mobile radio installation that has been designated as the controlling radio for the repeater or as the "hub" for communications. The console radio is not part of the repeater hardware.

Courtesy "Over" Beep:
An alert tone ("beep") transmitted by the repeater to denote reset of the Time-Out Timer of the repeater. Used to indicate when the next field radio can transmit.

COR ("Carrier Operated Relay"):
A carry-over term from the early days of repeater operation. COR is used in its generic sense and does not necessarily mean only Carrier Squelch operation. For the R1225 transceiver, the COR signal may be programmed on pin 4, pin 8, pin 12, or pin 14 of the 16-pin accessory jack (J3). Whenever a "properly" identified signal is received, a dc level change occurs on pin 4, pin 8, pin 12, or pin 14.

COR PTT:
An internal PTT to the R1225 transceiver generated by the presence of a properly identified signal to the receiver of the R1225 transceiver.

CSQ:
Carrier SQuelch.

Cross band Repeater:
A repeater in which the receiver operates in a different frequency band than the transmitter. The R1225 transceiver module cannot operate crossband by itself. A second R1225 transceiver or a radio must be used. Example: the receiver operates on 159.420 MHz in the highband VHF and the transmitter operates on 451.650 MHz in the 450-470 MHz UHF band. Crossband repeaters may be either unidirectional or bi-directional.

CWID:
Morse code station identification. Sometimes called SID (Station Identification).

Drop Out Delay:
The time, in seconds, that the transmitter remains keyed, or on the air, after the input signal to the receiver ceases. Also known as "transmit (tx) hang time."

EIA De-emphasized Audio:
The audio frequency response of the receiver that is measured at the speaker and at pin 11 of the accessory connector when "Rx Audio Output" is "EIA."

EIA Pre-emphasized Audio:
The audio frequency response of the transmitter for an audio input to the microphone, front panel jack, or pin 2 of the accessory connector on the R1225 transceiver module.

External PTT:
The PTT signal on pin 3 of the accessory connector on the R1225 transceiver module.

External Repeater Controller:
An optional repeater interface component providing enhanced features that processes receiver audio and COR signals, and generates transmitter audio and PTT signals and is external to the R1225 transceiver. Depending upon the model, the external controller may be mounted inside or outside of the GR400 & GR500 X-Pand repeater housing. Also see Internal Repeater Controller.

Field Radio:
A mobile or portable radio that is neither a part of the repeater hardware nor a console radio. Field radios may intercommunicate via the repeater or directly.

Flat Audio:
Receiver or transmitter audio level that does not change appreciably in amplitude as the frequency of that audio is varied from 1 Hz to 3 kHz. The receiver audio response from pin 11 of the radio accessory connector when "Rx Audio Output" is "Flat" and the

transmitter audio response for input to pin 5 of the radio accessory connector are "flat."

Full Duplex Base Station:
A base station with which a dispatcher can hear receiver activity (if any occurs) while transmitting. An advantage of this mode is the ability of field radios to interrupt the dispatcher for "instantaneous" repeating of information without the need to wait until the dispatcher terminates transmission. Requires two operating frequencies and a duplexer or separate receive and transmit antennas.

i20R:
A repeater controller that provides service for up to 10 different user groups (TPL/DPL).

i750R:
A repeater controller that provides telephone interconnect and revertive, selective calling. TPL, DPL, Quik-Call II and MDC-1200 signalling formats are supported.

Internal Repeater Controller:
The repeater controller functions of the R1225 transceiver module. Also see R1225 Transceiver.

Linked Repeater:
A uni-directional repeater that sends receiver audio and COR signals to an external "link" radio (or another repeater such as a GR1225) for the purpose of relaying repeated information to another location. Receiver audio and COR signals from the "link" radio are applied to the R1225 transceiver as transmit audio and PTT signals. For example, VHF coverage can be extended between two cities with a UHF link between the two VHF, uni-directional repeaters.

Local PTT:
The PTT signal from a microphone plugged into the front panel of the repeater.

Normal Receiver Audio:
See EIA de-emphasized audio.

Normal Transmitter Audio:
See EIA pre-emphasized audio.

"On Battery" Alert Tone:
An alert tone ("beep") transmitted periodically to indicate to field radio operators that the repeater is operating on a battery backup power source and they should limit their transmissions (number and duration). Requires external switching source such as battery revert module. The R1225 transceiver "On Battery" alert is a 100 millisecond long, 1400 Hz tone transmitted every 5 seconds.

PAC*RT:
Portable Area Communications RepeaTer; a specialized cross band, bi-directional repeater configuration. Example: paramedics at an accident scene may use 450-470 MHz UHF portable radios to communicate with a highband VHF dispatcher.

Page PTT:
A PTT signal that is a programmable function on an input or input/output pin of the accessory connector. May be used to gate either EIA transmit audio (microphone on pin 2) or flat transmit audio (on pin 5) of the accessory connector of the R1225 transceiver. "Debounce" of page PTT may be eliminated to reduce transmitter turn on/turn off times.

PTT Priority:
Defines which PTT signal will override or be overridden by other PTT signals. The highest priority (overrides all other PTT's) in the R1225 transceiver module is Page PTT, followed by Local PTT, then External PTT, and, finally, COR PTT.

Post Limter:
Flat transmit audio from pin 5 of the R1225 accessory connector that is combined with the microphone or repeater audio after the transmitter audio limiter. This is the preferred method for externally generated TPL, DPL and other subaudible signalling.

Power-up:
The initial application of operating potential (voltage) to the R1225 transceiver and any optional, external repeater controller.

Pre-Limiter:
Flat transmit audio from pin 5 of the R1225 accessory connector that is combined with the microphone or repeater audio before application to the transmitter audio limiter.

"Properly" Identified Signal:
All signals being received on a CSQ receiver or those signals with the correct TPL tone or DPL code being received on a coded squelch receiver.

R1225 Transceiver:
A specialized transceiver module capable of full duplex operation. Basic and a few advanced repeater controller features are standard in the hardware and software of the module.

Repeater Controller:
A module or option card that fits into the GR400 & GR500 X-Pand repeater station and provides advanced features beyond the basic repeater operation of the R1225 transceiver module.

Repeater Knockdown:
To deactivate a repeater or to remove it from service.

Repeater Setup:
To activate a repeater or to place it into service.

Revertive Signalling (paging):
Accessing a repeater with one signalling format (e.g., DTMF) and selective signalling with a different format (e.g., QCII).

Selective Signalling (calling):
A method of signalling with TPL, DPL, multiple tones or digital words to alert an individual radio user in a group.

Single Band Repeater:
A repeater in which both the receiver and the transmitter operate in the same frequency band. *Example:* receive at 456.650 MHz and transmit at 451.650 MHz in the 450-470 MHz UHF band.

ST-853M SmarTrunk II:
A repeater controller that allows trunking operation of the R1225 transceiver module. Up to 4096 subscriber units (field radios) with individual identification can be serviced. Telephone interconnect, individual and group selective calling are supported.

TRA100R:
A repeater controller that provides tone remote control capability to the repeater.

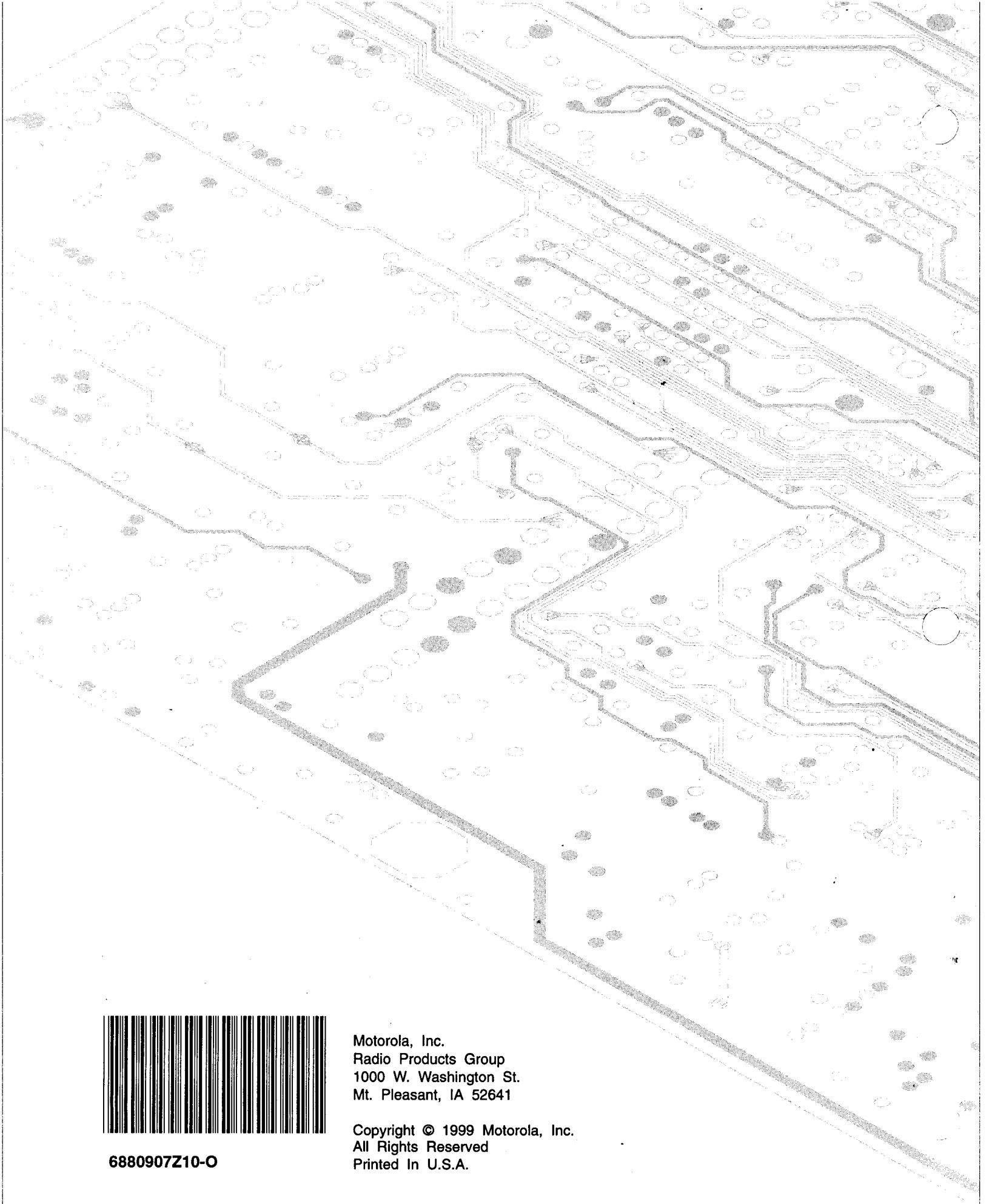
Unidirectional Repeater:
The basic repeater function of the R1225 transceiver module.

VOX:
Voice controlled transmission; the transmitter is keyed by a circuit that detects the presence of voice output from the receiver or from a telephone line.

ZR310:
A repeater controller that provides individualized repeater service for up to 70 different customer groups (TPL/DPL).

ZR320:
A repeater controller that acts as an interface to the telephone line, providing selective calling telephone interconnect features and repeater operation. TPL, DPL, and Quik-Call II signalling formats are supported.

ZR340:
A repeater controller that provides telephone interconnect with expanded sign-on/sign-off code features and CWID for the single user repeater.



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Motorola, Inc.
Radio Products Group
1000 W. Washington St.
Mt. Pleasant, IA 52641