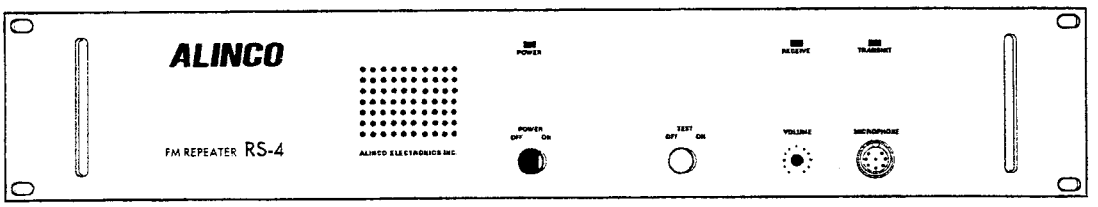
ALINCO

RS-4 VHF Repeater
RS-5 UHF Repeater

VHF: TE1/136 ~ 155MHz TE2*/150 ~ 174MHz
UHF: TE1/400 ~ 420MHz TE2/450 ~ 470MHz
CROSSBAND RS-5$_4$ Tx: 450 ~ 470MHz/Rx: 150 ~ 174MHz
CROSSBAND RS-4$_5$ Tx: 136 ~ 155MHz/Rx: 400 ~ 420MHz

*Serial No. 57051 ~



INSTRUCTION MANUAL

Thank you for purchasing this ALINCO RS-4/RS-5 Repeater. This instruction manual contains important safety and operating instructions. Please read it carefully before using the transceiver and conserve for future reference.

ALINCO ELECTRONICS INC.

TABLE OF CONTENTS

INTRODUCTION AND PRECAUTIONS

Thank you very much for purchasing the ALINCO repeater RS-4/5. ALINCO repeater and other products are ranked as some of the finest in the world. Your repeater RS-4/5 has been manufactured and tested very carefully at the factory and will give you satisfactory operation for many years. We are confident that you will be very satisfied with your choice of this fine ALINCO repeater.

In order to maintain the fine specifications of this repeater, please read the followings carefully:

1) Do not try to touch components inside unless this manual specifies. Eventual attempt may void the warranty and may cause serious damage to the repeater.

2) Do not expose the repeater to direct sun-light or to source of heat. Avoid installing the repeater in extremely dusty and/or humid environment.

3) Do not place anything which might spill over on top of the repeater.

4) For good ventilation allow at least 10 cm space behind the repeater from the wall.

5) Beware of moisture condensation. If condensation forms on the repeater, wipe and let dry. Do not turn on the repeater for a while.

6) If the unit ever emits smoke or strange smells, turn off the repeater immediately and contact an authorized ALINCO dealer.

1. GENERAL

1-1 SPECIFICATIONS

General

Frequency Range (Versions):	VHF: 136 ~ 155MHz (TE1), 150 ~ 174MHz (TE2) UHF: 400 ~ 420MHz (TE1), 450 ~ 470MHz (TE2)
Maximum Channel Spread:	VHF: 19MHz (TE1), 24MHz (TE2) UHF: 20MHz
Number of Channels:	1
Channel Spacing:	25kHz (12.5kHz as option)
Frequency Stability:	±5 ppm (VHF), ±3 ppm (UHF)
Voltage Requirement:	13.8VDC negative ground
Current Consumption:	10ADC TX / 500mADC standby
Operating Temperature Range:	−10°C ~ +60°C
Duty Cycle:	Continuous
Dimensions (approx.):	481(W) × 88(H) × 403(D) mm
Weight (approx.):	7kg
Panel:	19″ × 2U

Transmitter

RF Power Output:	35 Watts (VHF), 25 Watts (UHF) continuous-duty
FM Noise:	better than 40dB @1kHz
Modulations System:	Variable Reactance Modulation
Maximum Deviation:	±5kHz (25kHz spacing)
Transmit Activation System:	Carrier
Audio Response Characteristic:	6dB/octave pre-emphasis from 300Hz ~ 3kHz
Audio Distortion:	Less than 5% @1kHz
Spurious Emission:	better than 65dB (below carrier without duplexer)

Receiver

Circuit Type:	Double-Conversion Superheterodyne VHF: 17.2MHz & 455kHz UHF: 30.85MHz & 455kHz
Sensitivity:	0.35μV for 12dB SINAD
Spurious Rejection:	better than 75dB
Adjacent Channel Selectivity:	better than 70dB
Intermodulation Response:	better than 70dB
Receiver S/N Ratio:	better than 40dB

Control Unit

Tone Encoder (CTCSS):	50 tones
Tone Decoder (CTCSS):	50 tones (Option EJ-20U)
Response Time:	250msec. or less
Hang-Up Timer:	0 ~ 7 second. 1 sec. step
Time-Out-Timer:	Off or 30 ~ 450 sec. 30 sec. step
Number of Channel:	1

1-2 FEATURES

Standard 19-inches rack-in type × 2U dimensions with carry-handles on both sides of front-panel permit easy installation.

High 35 Watts output power for VHF RS-4 and 25 Watts for UHF RS-5.

Enough space is available inside for optional accessories such as duplexer and CTCSS decoder unit.

Features Time-Out-Timer, Hang-Up-Timer and 50 sub-tones CTCSS encoder as standard functions. A variety of optional accessories such as trunking controller and emergency power switch kit are also available to satisfy most-advanced users as well.

Volume control and microphone connector are provided on the front-panel for base-station use. Squelch level can be adjusted by VR inside with option to position it on the front-panel.

Frequency synthesized computer programmable.

1-3 ACCESSORIES — STANDARDS AND OPTIONS

A) STANDARD ACCESSORIES — Check if all below are packed.

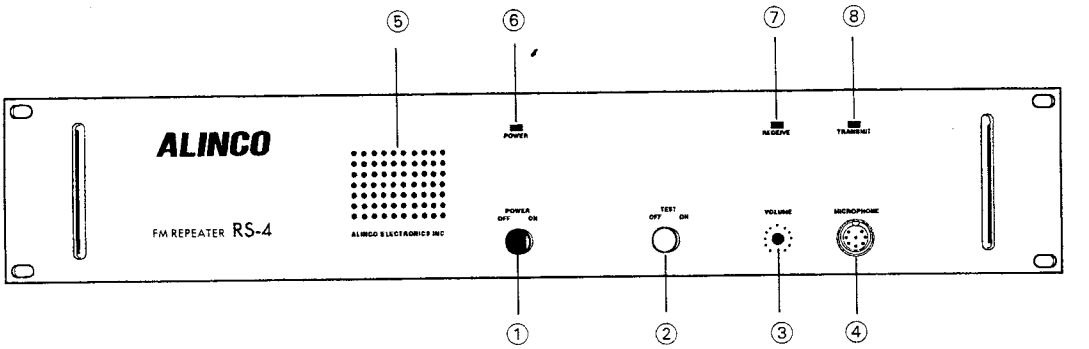
Instruction Manual (this leaflet) ..... 1 pc.
Fuse 4A and 15A ..... 1 pc. each
DC power cable (2 Mts.) ..... 1 pc.
BNC-P connector for co-ax cable equivalent to 3D2V..... 2 pcs.
Wire set for optional DP-2D ..... 1 set

B) OPTIONS

DP-2D ..... Radiotelephone Trunking Controller
EJ-29U..... Emergency Power Switch Kit
EJ-20U..... CTCSS Decoder Unit
EJ-30U..... External Squelch Volume
EMS-14..... Desktop Microphone (w/out DTMF Key-Pad)
EMS-12..... Handheld Microphone with DTMF Key-pad
EM0093 ..... Handheld Microphone Hanger
ERW-2B..... PC Programmable EEPROM Writer
RCS-3U..... 19″ Rack (accommodates one RS-4 or RS-5 and one DP-2D trunking controller)
SSQ-2A..... Duplexer (VHF: 138 ~ 170MHz offset 4 ~ 10MHz) (UHF: 400 ~ 470MHz offset 7 ~ 15MHz)
DM-1350Z..... Regulated DC Power Supply in: 220VAC/out: 13.8VDC
DM-1350T..... Regulated DC Power Supply in: 120VAC/out: 13.8VDC
EMP3401.24.A ..... Lightening Protector (Swiss made) (fuse not included) Max power 150W @VSWR < 1.2
73Z-0-0-47 ..... Fuse ("Capsule") for EMP3401.24.A

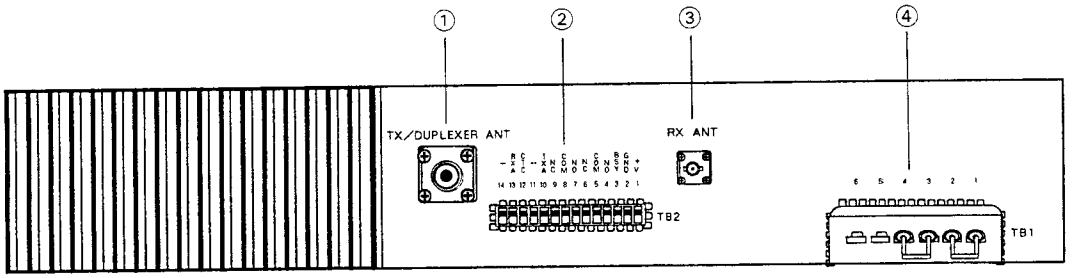
2. CONTROL

2-1 FRONT PANEL

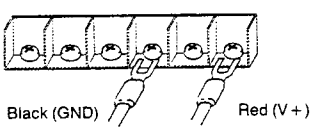


① Power Switch: Press to turn the power ON and OFF.
② Test Switch: Press to transmit (this position may be replaced with the squelch volume, see Section 4-5 Optional Accessories).
③ Volume Control: Adjust the audio output.
④ MIC connector: Connect optional microphone to operate as a base-station.
⑤ Speaker: Built-in speaker for monitoring.
⑥ Power Indicator: Lights when the repeater is turned ON.
⑦ RX Indicator: Lights when a signal is received.
⑧ TX Indicator: Lights during transmission.

2-2 REAR PANEL



① TX/Duplexer antenna connector: Connect TX antenna here.
② Accessory terminals: To connect optional control panels, DP-2D, etc.
③ RX antenna connector: Connect RX antenna here.
④ DC power supply terminals: For DC power supply input. Connect a 13.8VDC regulated source capable of 20A continuous duty. If the option EJ-29U is used, connect a 14.4VDC regulated source capable of 20A continuous duty, and a 12VDC battery as a back-up source (See Section 4-3).



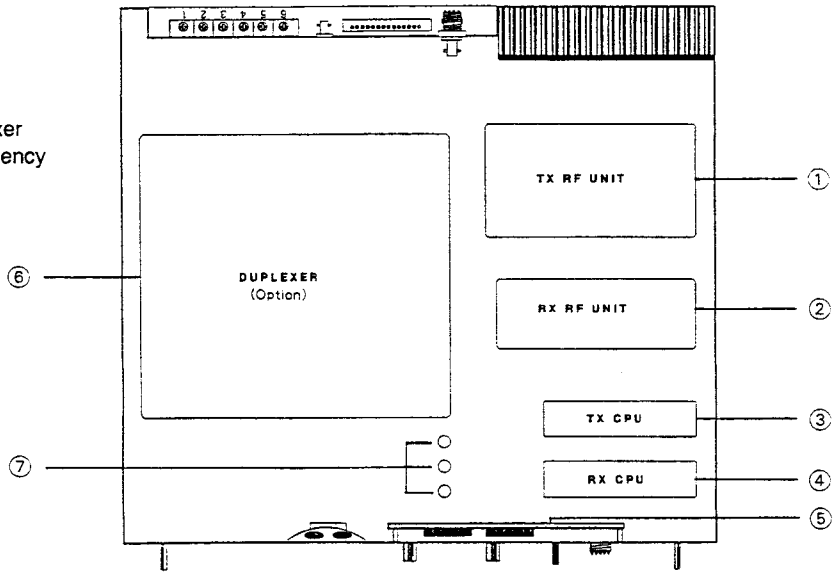
2-2-1 ACCESSORY TERMINAL BLOCK ASSIGNMENTS

No.	Title	Description
1	+V	13.8VDC output. Max. 3 Amps. (Connect with terminal No. 1 of DP-2D).
2	GND	Ground (Connect with terminal No. 2 of DP-2D).
3	BSY	NC
4	NO	Ground
5	COM	TX PTT input; normally 5VDC, pull down to ground to key transmitter (Connect with terminal No. 5 of DP-2D).
6	NC	NC
7	NO	NC
8	COM	NC
9	NC	NC
10	TXA	Audio input to transmitter microphone. Input level 600mVp-p (100kΩ. 5kHz Dev). (Connect with terminal No. 10 of DP-2D).
11	—	Ground (Can be used to connect with the shielding of the lines connected to No. 10 and No. 11).
12	CTC	CTCSS Tone Encoder input (Connect with terminal No. 12 of DP-2D).
13	RXA	Audio output from receiver discriminator, before de-emphasis. 600mVp-p (1.5kΩ. 5kHz Dev) (Connect with terminal No. 12 of DP-2D).
14	—	Ground (Can be used to connect with the shielding of the line connected to No. 13).

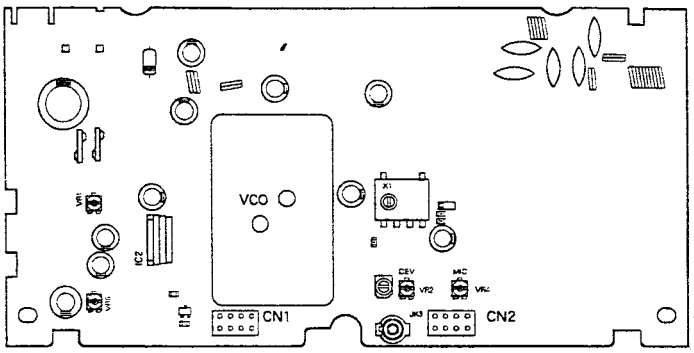
2-3 INSIDE — COMPONENTS LOCATION DIAGRAM

To remove the upper cover, remove 8 screws, three each are located on both sides and two in the rear.

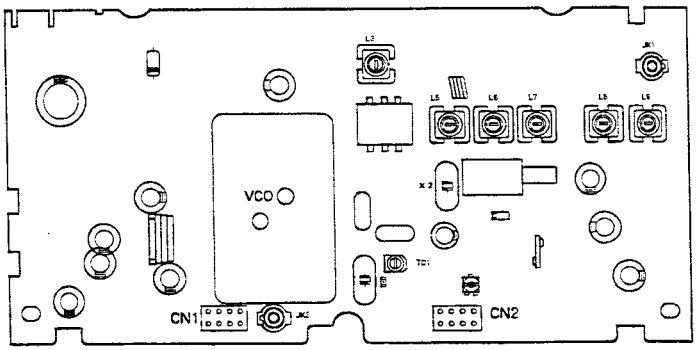
① TX RF Unit
② RX RF Unit
③ TX CPU Unit
④ RX CPU Unit
⑤ Operation Unit
⑥ Space to install an optional duplexer
⑦ Space to install an optional emergency power switch kit EJ-29U



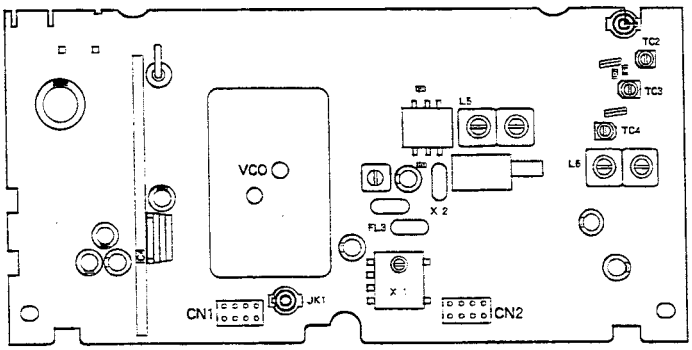
TX RF Unit (VHF/UHF)



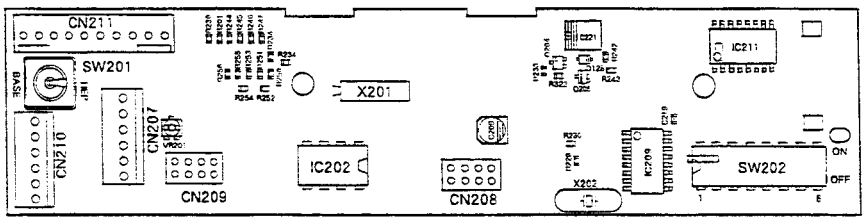
RX RF Unit (VHF)



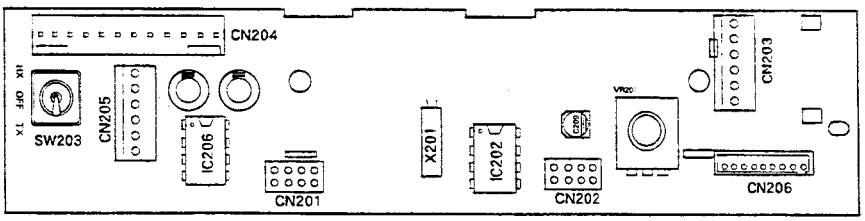
RX RF Unit (UHF)



TX CPU Unit



RX CPU Unit



3. PROGRAMMING AND MODE SET-UP

3-1 Programming EEPROM

Remove the upper case of the repeater by unscrewing 8 screws located around the unit. Connect Mic connector of ERW-2 with the Mic connector of the repeater. Connect ERW-2 and the PC with a printer cable. Run the "RS-***" software. In programming the receiver and transmitter of the repeater, always select Channel 00 on your computer screen. On your computer the software runs as follow:

To program the receiver data, press RETURN key to choose Channel 00.
Press TAB key to go to next field.
Press Shift & TAB keys to go back to previous field.
Input the RECEIVING frequency; Ignore "OFFSET".
To activate the tone squelch, select "Tone Squelch" in the CTCSS field, and choose the tone freq in the TONE field (Tone squelch unit EJ-20U is an option).

Now toggle the repeater's SW203 (RX CPU Unit) to position "RX". Then on your computer:
Press ALT + R to select the Radio pull-down menu;
Move the cursor on "WRITE" and press RETURN key: the data will be written into the repeater (RX).

Now, to program transmitter data, on your computer:
Press RETURN key to choose Channel 00.
Input the TRANSMITTING frequency;
Ignore "OFFSET": If any data is in the offset it should be 00.000MHz
To activate the CTCSS tone encoder, select "Tone" in the CTCSS field, and choose the tone frequency.
To activate the Time-Out-Timer, press ALT + O to select the Option pull-down menu, and select TOT;
This will let you scroll TOT timer in seconds. Note TOT = 0 means TOT = off.

Now toggle the repeater's SW203 to position "TX". Then on your computer:
Press ALT + R to select the Radio pull-down menu;
Move the cursor on "WRITE" and press RETURN key: the data will be written into the repeater (TX).

Upon completion, toggle the SW203 to position "OFF" (centre), and take out the ERW-2 cable from the Mic connector of the repeater. Test the repeater for the programmed settings before subjecting it to normal duty.

3-2 SET-UP

A) TO ADJUST SQUELCH LEVEL

The squelch VR can be found on the **RX CPU board**, **VR201**. Turn VR201 to set the squelch level. The optional EJ-30U (squelch kit) will let you have the squelch control on the repeater's front panel.

B) TO ADJUST HANG-UP-TIMER LEVEL

The Hang-Up-Timer can be set from 0 to 7 second with 1 second step.
The DIP switch on the **TX CPU Unit SW202** sets the Hang-Up time. Each DIP position correspond 0 to 7 second from right to left. For example, if Hang-Up time desired is 4 second, position the fifth switch from the right to "ON" position and all others remain at "OFF" position. If two or more switches are toggled "on", the repeater gives the priority to the shortest second selected and the others will be ignored. (**NOTE:** If Hang-Up time is 0, the far-right DIP SW must be ON.)

C) CABLE CONNECTION

Connect the supplied DC cable to the DC terminal on the rear-panel as shown below. Pay attention to the polarity and connect another end to the DC power supply. Regulated supply 13.8VDC with 20A continuous duty is required. ALINCO recommends DM-1350Z/1350T as a power source.

D) ANTENNA CABLE CONNECTION

***In case of using Two separate antennas for TX and RX**

Connect receiving antenna cable with BNC-P to the RX connector on the rear panel. Connect Transmission antenna cable with PL-259 to the TX connector on the rear panel.

***In case of using a duplexer**

Connect the antenna cable with PL-259 to the TX connector on the rear panel. See section 4-1 INSTALLATION OF OPTIONAL ACCESSORIES for the installation of a duplexer.

E) REPEATER MODE

Toggle the SW201 on the TX CPU Board towards "REP" side to operate the RS-4/5 as a repeater. Pressing PTT switch on an optional microphone connected with RS-4/5 will allow operator to transmit on the downlink frequency.

F) BASE MODE

Toggle the SW201 on the TX CPU Board towards "BASE" side to operate the RS-4/5 as a base transceiver with an optional microphone. When the RS-4/5 is used with the DP-2D Trunking Controller, the RS-4/5 must be operated in the BASE mode.

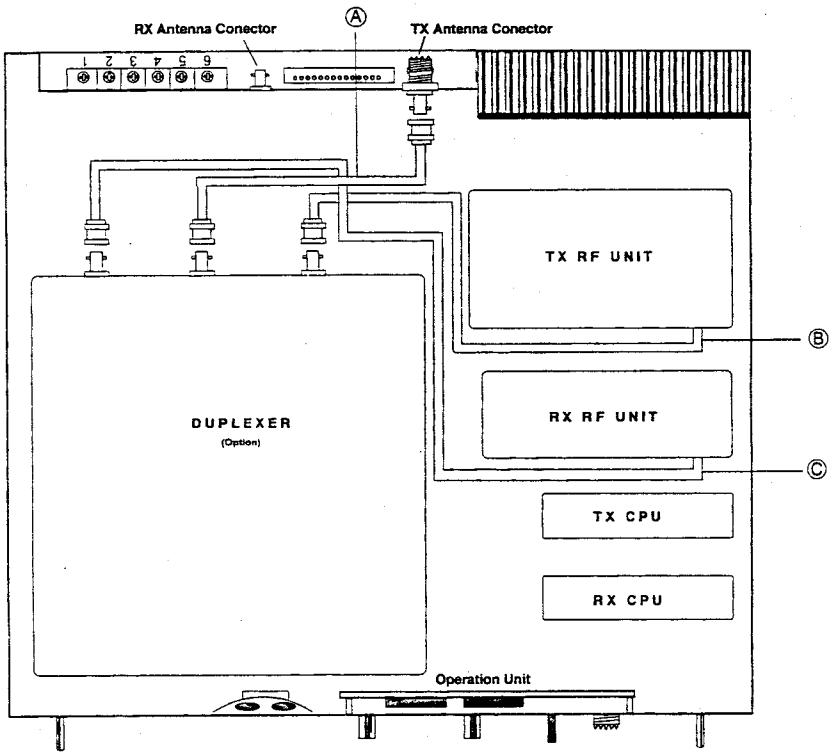
4. INSTALLATION OF OPTIONAL ACCESSORIES

4-1 DUPLEXER SSQ-2A

SSQ-2A must be preset to precise TX/RX frequencies.
Adjustable range: VHF/139 ~ 170MHz offset 4 ~ 10MHz
UHF/400 ~ 470MHz offset 7 ~ 15MHz

An optional SSQ-2A duplexer can be mounted inside the repeater.
Connect the co-ax cables as shown below in the diagram.

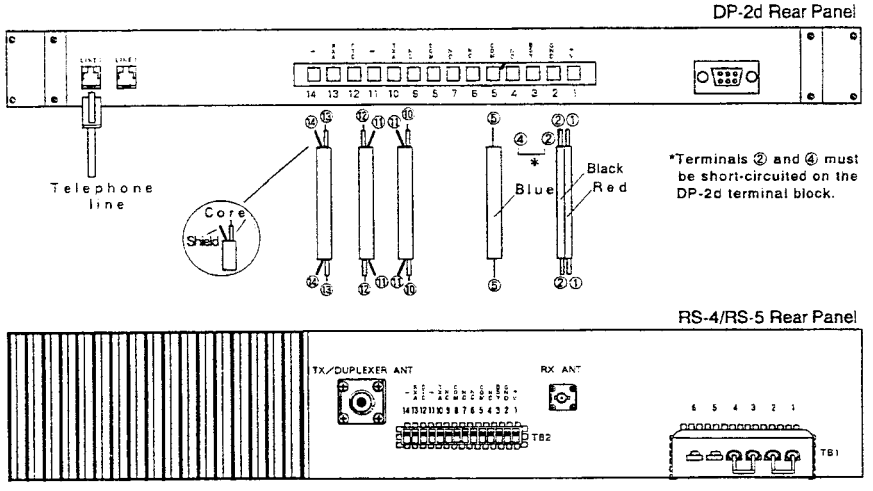
Ⓐ: Cable for Duplexer
Ⓑ: Cable for TX RF Unit
Ⓒ: Cable for RX RF Unit



4-2 TRUNKING CONTROLLER DP-2D

Toggle the SW201 of TX CPU Unit to "BASE" side. Set the hang-up-timer to 0.
Do not program CTCSS encoder or decoder.
Following the diagram shown below, make wire-connections.
Use cables provided with RS-4/5 as standard accessory.
For adjustments in the DP-2d, see the DP-2d manual.

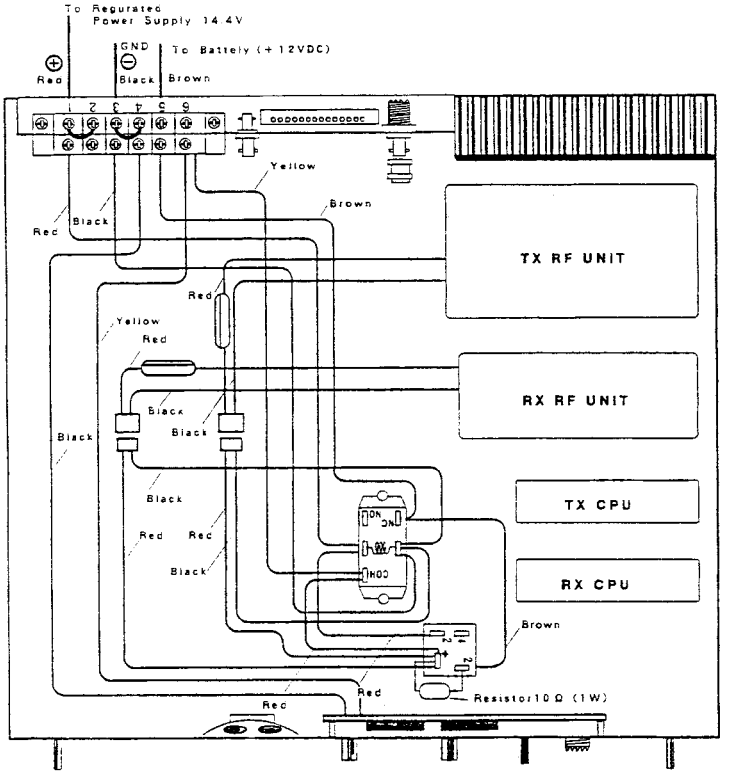
NOTE: In event of RF feed-back during the trunked operation, check ground loop effects caused by wirings; A use of RF-Choke on GND cable may be helpful to resolve the problem.



4-3 EMERGENCY POWER SWITCH KIT EJ-29U

The EJ-29U automatically switches the regular power source to a Back-Up power source in event of power failure.

Connect wires following as diagram shown below.

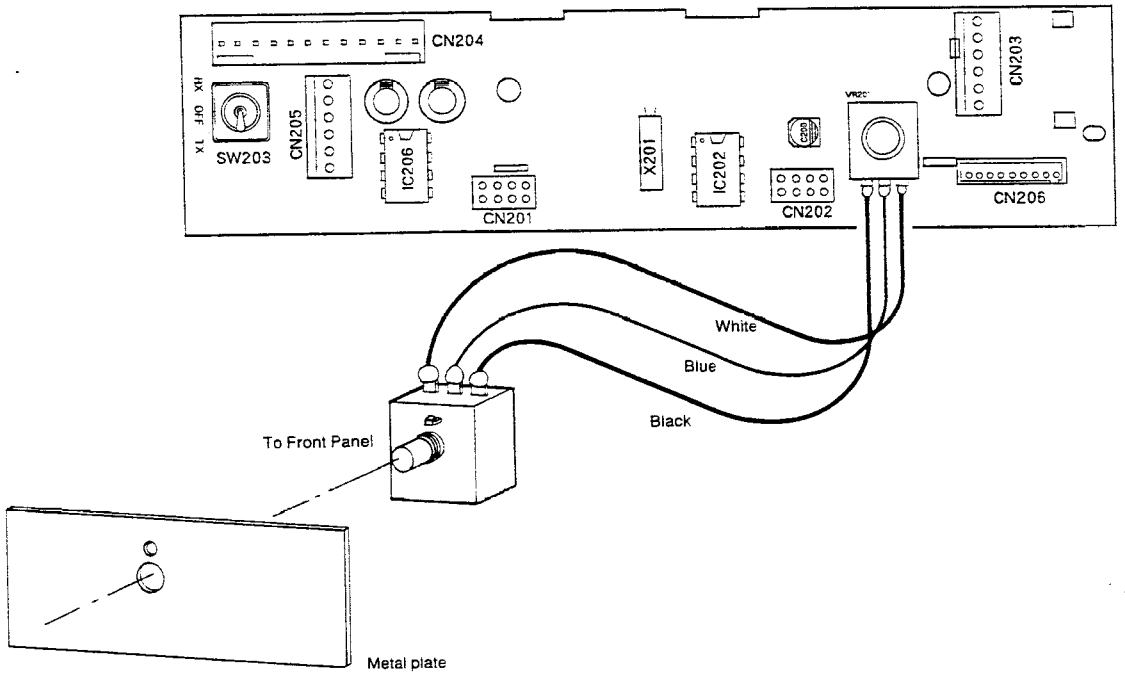


4-4 CTCSS DECODER UNIT EJ-20U

Connect EJ-20U's connector to **CN206** connector on **RX CPU Board**. Using the double-face adhesive tape provided, attach EJ-20U unit neatly on RX CPU Board.

4-5 EXTERNAL SQUELCH VOLUME

1. Take off the front panel and remove the operation unit.
2. Remove the "TEST" switch from the panel.
3. Insert the EJ-30U volume into the hole of metal plate provided with the EJ-30U, then attach to the front panel.
4. Free RX CPU Board from the repeater's chassis by disconnecting cables and unscrewing fixing-screws. Take **VR201** off the board (solder/disolder-iron required).
5. Solder EJ-30U's wires to RX CPU Board according to the diagram shown below.
6. Place RX CPU Board on the repeater's chassis. Replace EJ-30U's squelch volume with the TEST SWITCH located on the front-panel. Cut TEST SWITCH's wire and remove it from the OPERATION Board.



5. ALIGNMENT

CAUTION: Following alignments must be done by qualified personnel in adequate laboratory ONLY. Damages caused by unnecessary alignments void the warranty.

5-1 RX SENSITIVITY

Align L3, L5, L6, L7, L8 and L9 on VHF RX RF Board to obtain the best 12dB SINAD Value.

Align TC2, TC3, TC4, L5, and L6 on UHF RX RF Board to obtain the best 12dB SINAD Value.

5-2 TX DEVIATION

Using an audio-generator, feed to MIC at 1kHz $-30dB\mu$ and measuring on the desired TX frequency adjust VR2 to 4.8 ± 0.2kHz.

5-3 MIC GAIN

Using an audio-generator, feed to MIC at 1kHz $-45dB\mu$ and measuring on the desired TX frequency adjust VR4 to 3.5 ± 0.2kHz.

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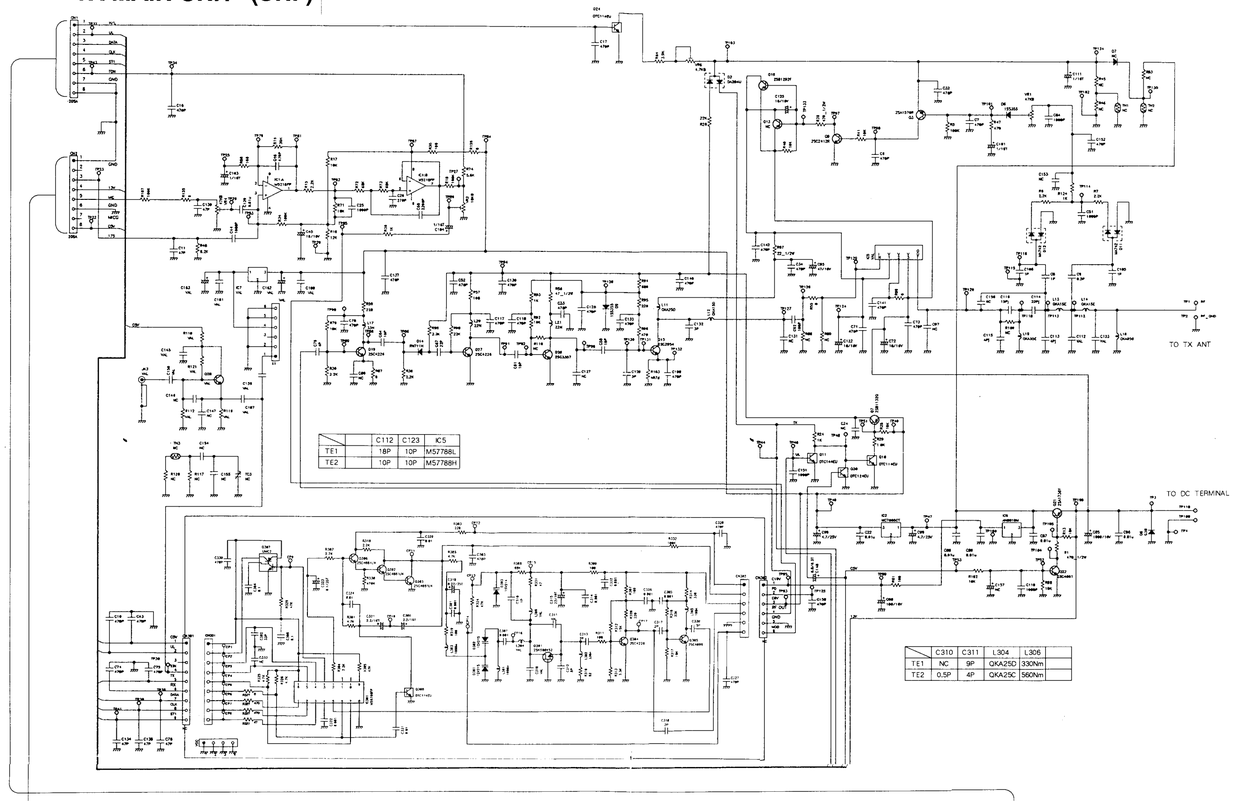
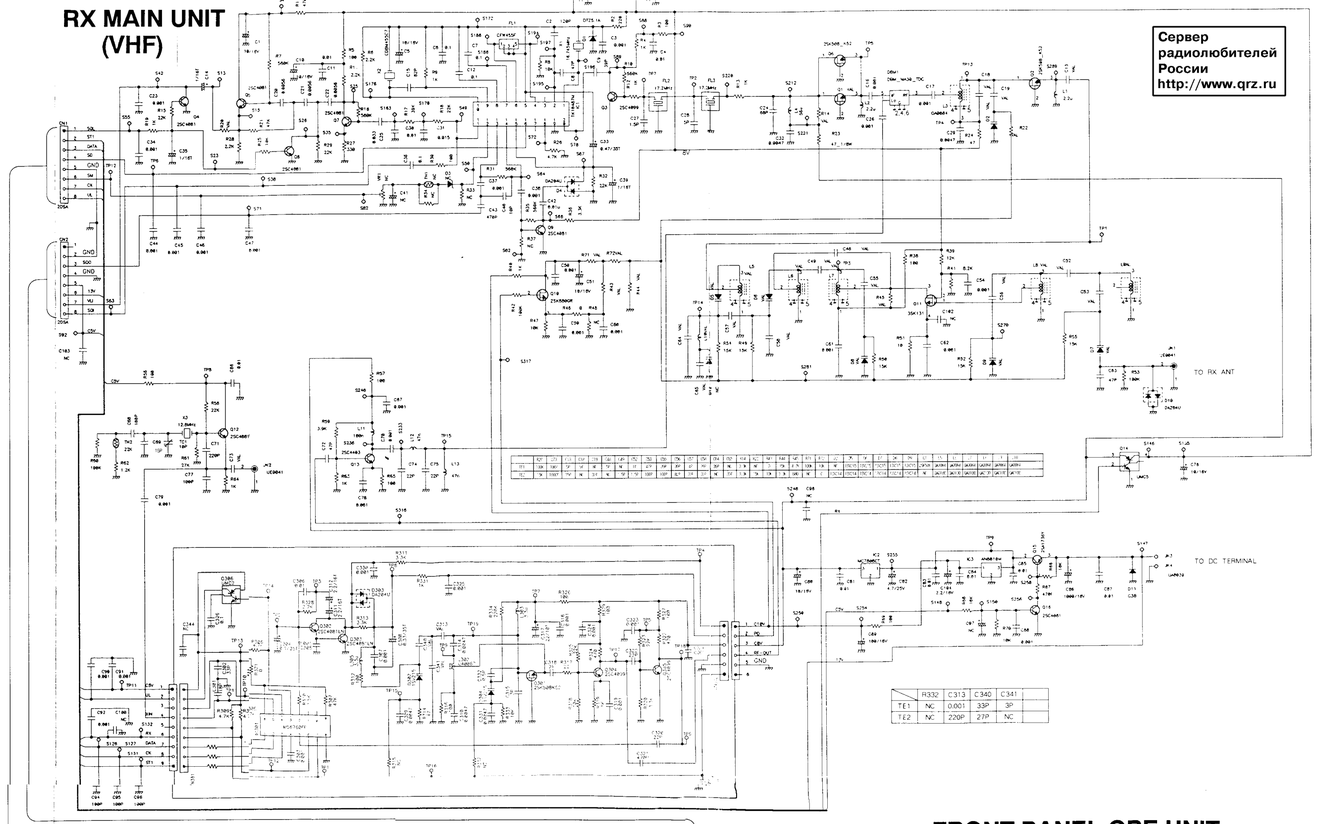
TX MAIN UNIT (UHF)



	C112	C123	IC6
TE1	18P	10P	M57788L
TE2		10P	M57788H

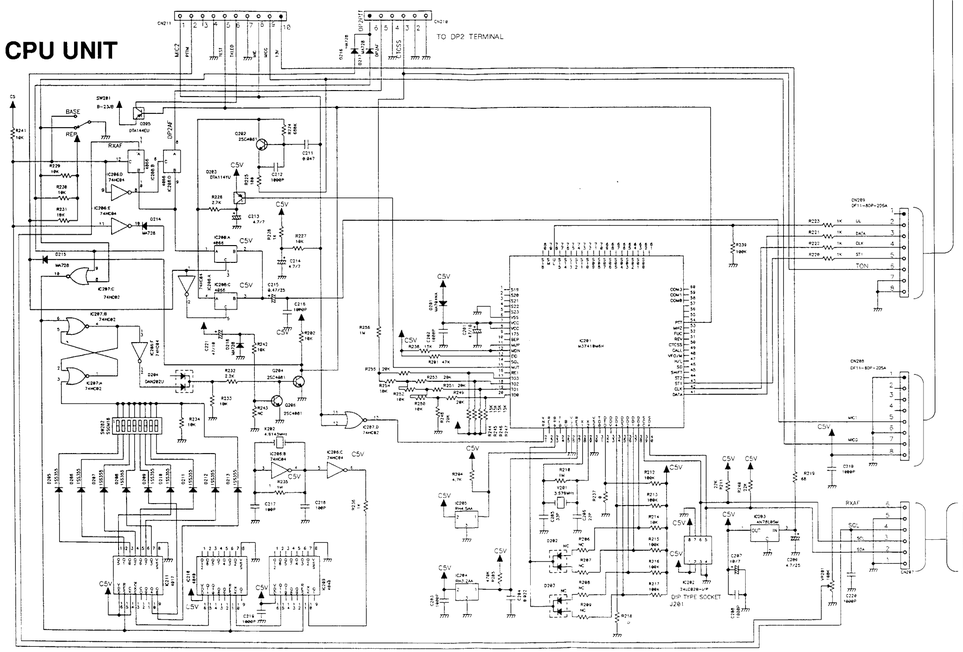
	C310	C311	L304	L305
TE1	NC	9P	QKA25D	330Nm
TE2	0.5P	4P	QKA25C	560Nm

RX MAIN UNIT (VHF)

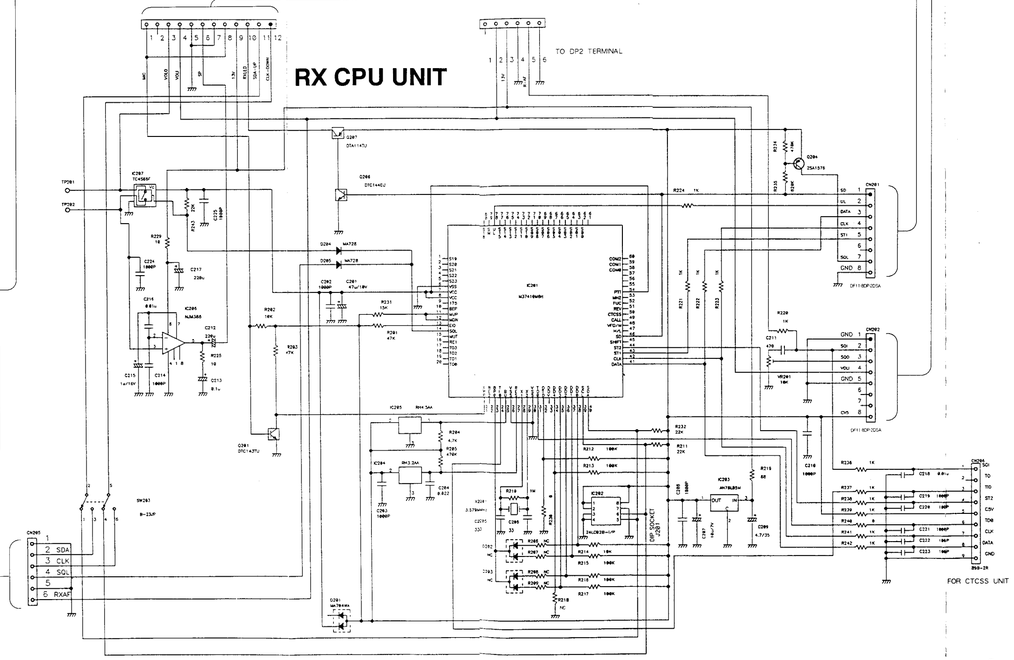


	R332	C313	C340	C341
TE1	NC	0.001	33P	3P
TE2	NC	220P	27P	NC

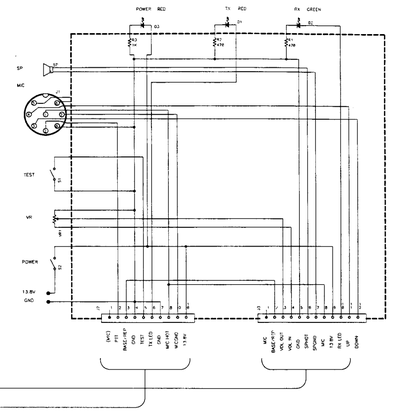
TX CPU UNIT



RX CPU UNIT



FRONT PANEL OPE UNIT



SCHEMATIC DIAGRAM

RS-514

PK0063