



OPERATING AND SERVICE MANUAL

IC-RP2210

VHF REPEATER



ICOM INCORPORATED

INTRODUCTION

The advanced **IC-RP2210 VHF REPEATER** from **ICOM** is a highly reliable, heavy-duty repeater built for Amateur radio communications.

This manual contains information relative to the operational, theoretical, physical, mechanical, and electrical characteristics of the **IC-RP2210**.

ASSISTANCE

To thoroughly understand the capabilities of the **IC-RP2210**, please study this manual carefully before attempting operation.

If you have additional questions regarding maintenance or the operation of the **IC-RP2210**, feel free to contact your nearest authorized **ICOM Dealer** or **ICOM Service Center**.

ORDERING PARTS

For the fastest service, supply all of the following information when ordering parts from your dealer or **ICOM Service Center**:

1. Equipment model and serial number (e.g., **IC-RP2210**, No. 0001)
2. Printed circuit board name and number (e.g., **LOGIC UNIT B-1638B**)
3. Schematic part identifier (e.g., **IC1**)
4. Part number and name (e.g., μ **PD80C35C**, **IC**)
5. Quantity required (e.g., 2pcs.)

UNPACKING

Accessories included with the **IC-RP2210**:

	Qty.
① Microphone (HM-4)	1
② AC cord	1
③ Microphone hook	1
④ Spare fuses for AC line (5A)	2
⑤ Spare fuses for DC line (10A)	2

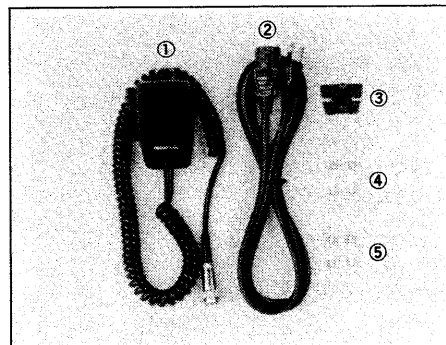
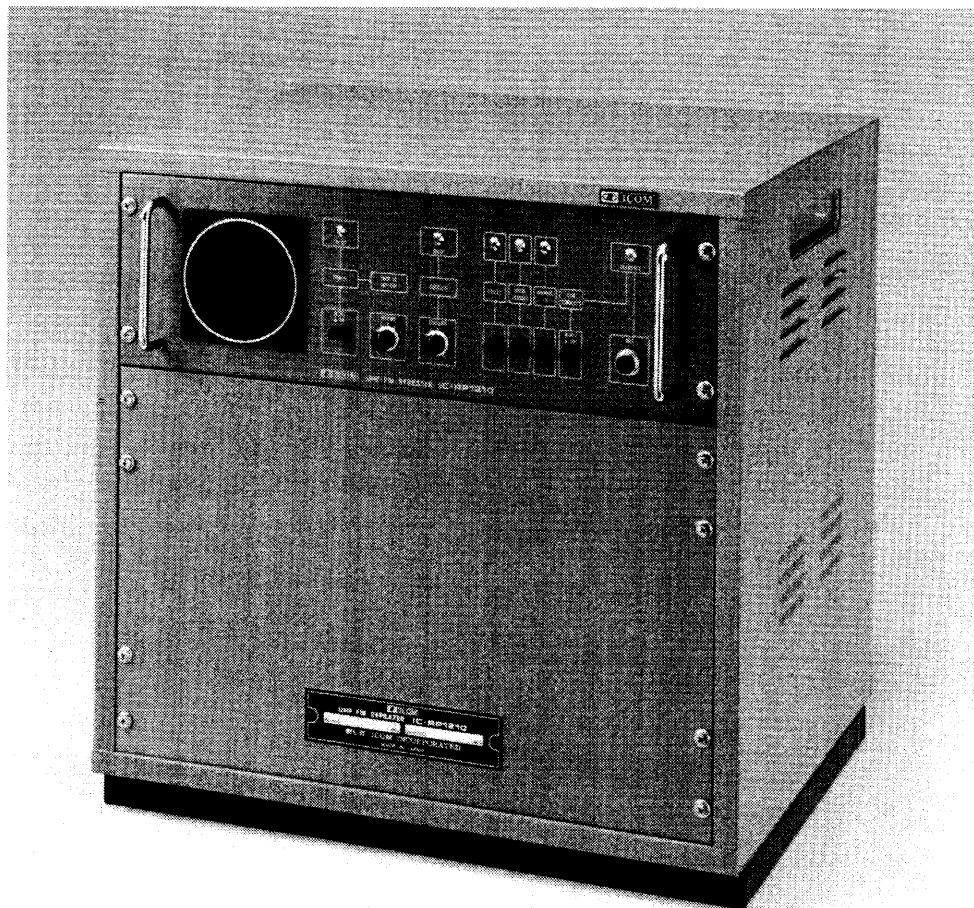


TABLE OF CONTENTS

1. FEATURES	1-1	9. BOARD LAYOUTS	9-1 ~ 4
2. SPECIFICATIONS	2-1	9-1 RX UNIT	9-1
3. CONTROL FUNCTIONS	3-1 ~ 3	9-2 TX UNIT	9-2
3-1 FRONT PANEL	3-2	9-3 RX-VCO AND TX-VCO UNITS	9-3
3-2 REAR PANEL	3-2	9-4 N-CTRL UNIT	9-3
4. INSTALLATION	4-1	9-5 REGULATOR UNIT	9-3
4-1 PLANNING	4-1	9-6 AF UNIT	9-3
4-2 ANTENNA SYSTEM	4-1	9-7 PA UNIT	9-3
4-3 DUPLEXER	4-1	9-8 LOGIC UNIT	9-4
4-4 GROUNDING	4-1	10. UNIT INTERCONNECTIONS	
4-5 POWER SUPPLY	4-1	DIAGRAM	10-1
5. GENERAL OPERATION	5-1 ~ 3	11. BLOCK DIAGRAM	11-1
5-1 INITIAL SETTINGS	5-1	12. PARTS LIST	12-1 ~ 12
5-2 BASIC OPERATION	5-1	12-1 RX UNIT	12-1
5-3 FREQUENCY PROGRAMMING	5-2	12-2 TX UNIT	12-3
5-4 CTCSS FREQUENCY PROGRAMMING	5-3	12-3 RX-VCO UNIT	12-5
6. FUNCTIONS DESCRIPTION	6-1 ~ 4	12-4 TX-VCO UNIT	12-6
6-1 ID FUNCTION	6-1	12-5 LOGIC UNIT	12-6
6-2 TIME-OUT TIMER FUNCTION	6-1	12-6 N-CTRL UNIT	12-8
6-3 HANG-UP TIMER FUNCTION	6-1	12-7 PA UNIT	12-9
6-4 MANUAL TRANSMIT FUNCTION	6-1	12-8 FILTER UNIT	12-9
6-5 REMOTE CONTROL FUNCTION	6-1	12-9 AF UNIT	12-10
7. CIRCUIT DESCRIPTION	7-1 ~ 6	12-10 REGULATOR UNIT	12-10
7-1 SYSTEM CONFIGURATION	7-1	12-11 FRONT UNIT	12-11
7-2 RECEIVER CIRCUIT	7-1	12-12 MECHANICAL PARTS	12-12
7-3 TRANSMITTER CIRCUIT	7-2	13. SCHEMATIC AND VOLTAGE	
7-4 RECEIVER PLL CIRCUIT	7-3	DIAGRAM	13-1
7-5 TRANSMITTER PLL CIRCUIT	7-3		
7-6 CONTROL CIRCUIT	7-4		
7-7 CTCSS DECODER CIRCUIT	7-6		
7-8 N-CONTROL CIRCUIT	7-6		
7-9 DTMF DECODER CIRCUIT	7-6		
8. MAINTENANCE AND			
ADJUSTMENT	8-1 ~ 12		
8-1 MAINTENANCE	8-1		
8-2 PREPARATION BEFORE SERVICING	8-1		
8-3 INSIDE VIEWS	8-2		
8-4 RECEIVER PLL ADJUSTMENT	8-3		
8-5 TRANSMITTER PLL ADJUSTMENT	8-5		
8-6 RECEIVER ADJUSTMENT	8-7		
8-7 TRANSMITTER ADJUSTMENT	8-9		
8-8 LOGIC AND REGULATOR ADJUSTMENT	8-11		

1. FEATURES

- Built-in high stability crystal unit for ± 5 ppm to obtain steady transmit and receive output signals.
- Uses an external EPROM for programming an independent ID call sign for control functions, etc., and is adapted to user requirements.
- Components in the repeater's RF system are completely shielded in the RF shield case to prevent interference from other units.
- A heavy-duty, large heatsink is installed on the rear panel to ensure steady, continuous 24 hour operation.
- Housed in a durable steel frame to ensure long-term reliability.
- Uses a high performance 8-bit CPU, μ PD80C35C, for controlling the repeater.
- The repeater has two-way, AC and DC power source capability. If AC power to the repeater is interrupted, DC power can be connected as a backup power source.
- The IC-RP2210 has convenient rack mounting adaptability. Just use the front panel screw holes and handles for easy installation in a cabinet or suitable location.



The product name shown in the picture differs from the actual repeater name.

The IC-RP2210 does not include the repeater metal cabinet as shown in the picture.

The cabinet is available as an option from ICOM. There is a space for installing a duplexer under the repeater body. The cabinet dimensions are 520mm(20.5")W x 520mm(20.5")H x 400mm(15.7")D.

2. SPECIFICATIONS

■GENERAL

- Frequency coverage:
220 ~ 225MHz
- Number of channels:
1
- Modes:
F3 (16K0F3E)
- Repeater control system:
Carrier or Tone squelch operating system
- Power supply voltage:
AC 117V DC 13.8V
- Power consumption:
125W
- Usable temperature range:
-10°C ~ +60°C (+14°F ~ +140°F)
- Antenna impedance:
50Ω
- Frequency stability:
Less than ±0.0005% (±5ppm)
- Dimensions:
480(W) x 150(H) x 400(D)mm
18.9"(W) x 5.9"(H) x 15.7"(D)
- Weight:
19.0kg (41.9lbs)

■TRANSMITTER

- RF output power:
25W
- Modulation system:
Variable reactance frequency modulation
- Max. frequency deviation:
±5kHz
- S/N ratio:
More than 40dB for 70% modulation at 1000Hz
- Spurious emissions:
Less than -60dB below carrier output power
- Occupied bandwidth:
Less than 16kHz

■RECEIVER

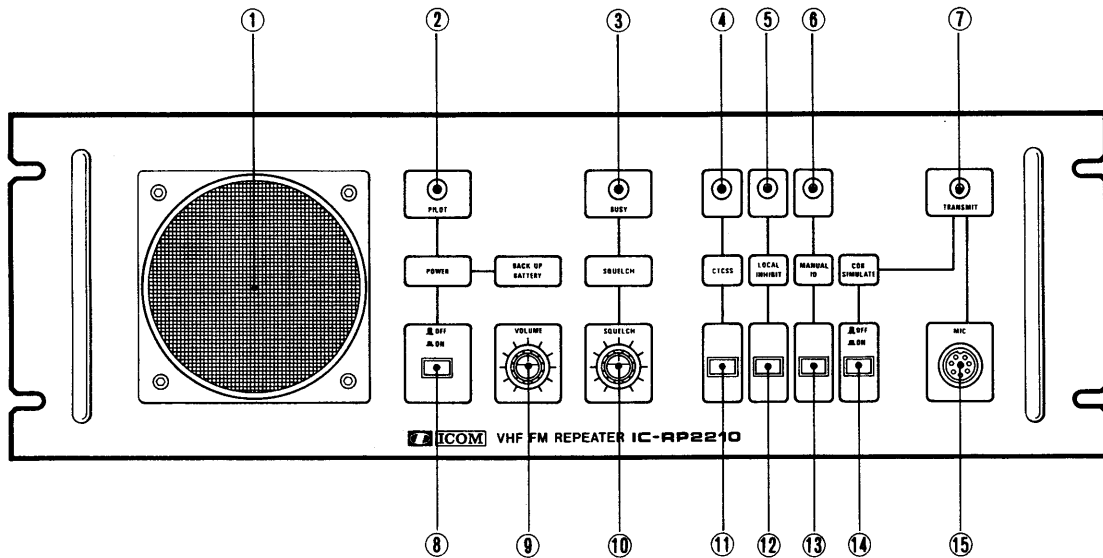
- Receiver system:
Double-conversion superheterodyne
- Intermediate frequencies:
1st IF 21.8MHz 2nd IF 455kHz
- Sensitivity:
Less than 0.32μV (-117dBm) for 12dB SINAD
- Squelch sensitivity:
Less than 0.2μV
- Selectivity:
Less than 25kHz at -60dB
- Spurious response rejection ratio:
More than 60dB
- Desensitization:
More than 70dB
- Intermodulation response:
More than 60dB
- AF output power:
1.7W at 10% distortion with an 8Ω load

■LOGIC UNIT

- Tone decoder (CTCSS)
 - Frequency:
88.5Hz ±0.5% (other frequencies available)
 - Sensitivity:
Less than 6dB SINAD
 - Response time:
250msec. or less
- Control function
 - Hang-up time:
Within 5sec. (selectable)
 - ID sending speed:
3wpm to 20wpm with 800Hz tone
 - ID interval time:
First transmission after 2 to 3min. transmission
 - Remote control system:
DTMF control

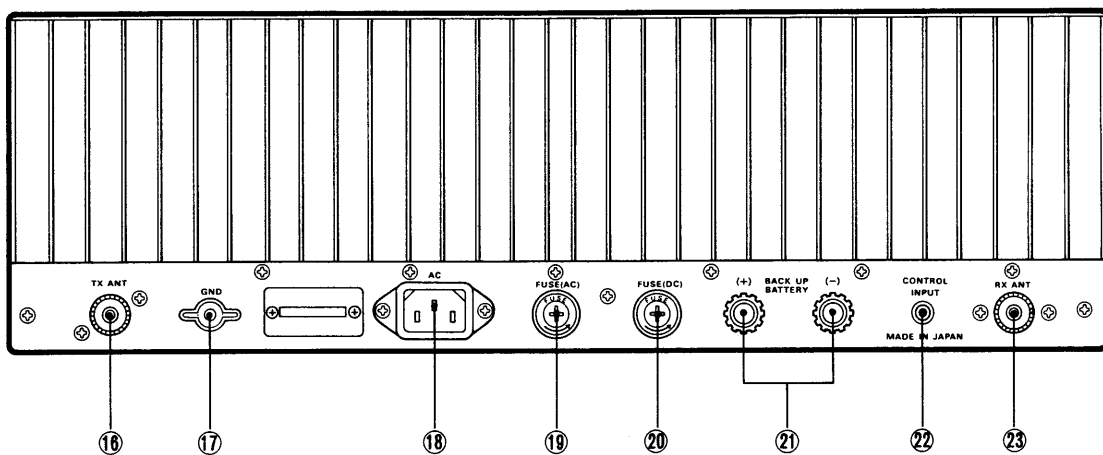
3. CONTROL FUNCTIONS

FRONT PANEL



- | | |
|---------------------------|------------------------|
| ① INTERNAL SPEAKER | ⑨ VOLUME CONTROL |
| ② PILOT INDICATOR | ⑩ SQUELCH CONTROL |
| ③ BUSY INDICATOR | ⑪ CTCSS SWITCH |
| ④ CTCSS INDICATOR | ⑫ LOCAL INHIBIT SWITCH |
| ⑤ LOCAL INHIBIT INDICATOR | ⑬ MANUAL ID SWITCH |
| ⑥ MANUAL ID INDICATOR | ⑭ COR SIMULATE SWITCH |
| ⑦ TRANSMIT INDICATOR | ⑮ MIC CONNECTOR |
| ⑧ POWER SWITCH | |

REAR PANEL



- | | |
|-------------------------------|-------------------------------|
| ①⑥ TRANSMIT ANTENNA CONNECTOR | ②⑩ DC LINE FUSE HOLDER |
| ①⑦ GROUND TERMINAL | ②① DC POWER INPUT TERMINALS |
| ①⑧ AC POWER SOCKET | ②② CONTROL SIGNAL INPUT JACK |
| ①⑨ AC LINE FUSE HOLDER | ②③ RECEIVER ANTENNA CONNECTOR |

3-1 FRONT PANEL

① INTERNAL SPEAKER

This speaker is used for monitoring received signals. (See item ⑨)

② PILOT INDICATOR

This indicator lights up when the POWER SWITCH is pushed IN.

- In AC operation : Lights up in yellow
- In DC operation : Lights up in red

③ BUSY INDICATOR

This indicator lights up when the repeater squelch is open. (See item ⑩)

④ CTCSS INDICATOR

This indicator lights up when the TONE SQUELCH FUNCTION is ON. (See item ⑪)

⑤ LOCAL INHIBIT INDICATOR

This indicator lights up when the LOCAL INHIBIT FUNCTION is ON. (See item ⑫)

⑥ MANUAL ID INDICATOR

This indicator lights up while the ID signal is being transmitted. (See item ⑬)

⑦ TRANSMIT INDICATOR

This indicator lights up when the repeater is transmitting. (See items ⑭ and ⑮)

⑧ POWER SWITCH

This switch turns the repeater ON and OFF. (See item ②)

⑨ VOLUME CONTROL

This control varies the audio output level from the INTERNAL SPEAKER. Clockwise rotation increases the level.

⑩ SQUELCH CONTROL

This control sets the squelch threshold level for receive signals. Clockwise rotation increases the squelch threshold level. (See item ③)

⑪ CTCSS (Continuous Tone Controlled Squelch System) SWITCH

This switch turns the TONE SQUELCH FUNCTION ON and OFF alternately and can be remote-controlled. (See item ④).

OFF condition:

The CTCSS INDICATOR does not light up. The repeater functions as an open repeater that transmits all received signals regardless of subaudible tones.

ON condition:

The CTCSS INDICATOR lights up. The repeater is set in CTCSS operation and opens when a signal with a specified subaudible tone superimposed on it is received, and transmits signals carrying the specified subaudible tone.

⑫ LOCAL INHIBIT SWITCH

This switch turns the repeater status alternately ON and OFF and can be remote-controlled. (See item ⑤)

OFF condition:

The LOCAL INHIBIT INDICATOR does not light up. The repeater functions as an ordinary repeater.

ON condition:

The LOCAL INHIBIT INDICATOR lights up. The repeater functions as an ordinary transceiver.

⑬ MANUAL ID (Identifier) SWITCH

This switch allows an identifier signal to be sent manually. Each push of the switch sends an ID signal. The MANUAL ID INDICATOR lights up while sending the ID out. (See item ⑥)

⑭ COR (Carrier Operated Relay) SIMULATE SWITCH

This switch sets the repeater in transmit mode continuously, and can be used for checking repeater functions such as hang-up time, time-out timer, etc. (See item ⑦)

⑮ MIC CONNECTOR

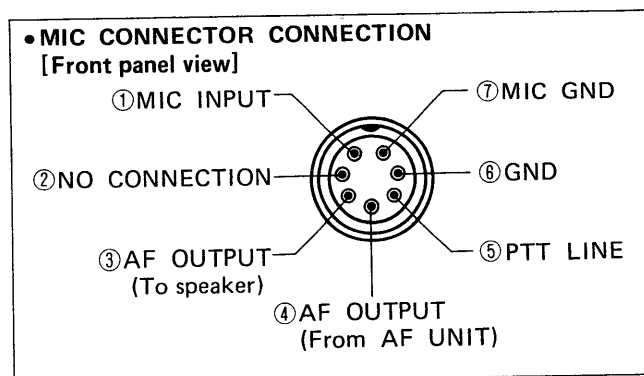
Connects the supplied HM-4 MICROPHONE.

When the [LOCAL INHIBIT] SWITCH is OFF:

Microphone signals are superimposed on receive signals when the PTT SWITCH is pushed.

When the [LOCAL INHIBIT] SWITCH is ON:

The PTT SWITCH on the microphone is pushed IN and the repeater functions as an ordinary transceiver when the microphone is used.



3-2 REAR PANEL

⑯ TRANSMIT ANTENNA CONNECTOR

This connector outputs RF output power. Connect a coaxial cable between the connector and the transmitter connector of the duplexer.

⑰ GROUND TERMINAL

Connect a ground cable to this terminal. Be sure to ground the repeater to a good earth point to protect the repeater and prevent electrical shocks.

18 AC POWER SOCKET

The AC POWER SOCKET connects the repeater to an AC outlet via the supplied AC cord.

19 AC LINE FUSE HOLDER

This holder contains the 5A fuse for the AC power supply. Use the spare fuses provided to replace an old or damaged fuse.

20 DC LINE FUSE HOLDER

This holder contains the 10A fuse for the DC power supply. Use the spare fuses provided to replace an old or damaged fuse.

21 DC POWER INPUT TERMINALS

Connects a DC power source such as a 12V-type storage battery for DC operation. This battery is used for the repeater backup battery when power is interrupted during AC operation. See p. 4 - 1 for information regarding use of these terminals.

22 CONTROL SIGNAL INPUT JACK

This jack is used for controlling repeater functions such as CTCSS or LOCAL INHIBIT by DTMF tones from external equipment.

23 RECEIVER ANTENNA CONNECTOR

This connector receives incoming signals from the antenna sent through the duplexer. Connect a coaxial cable between this connector and the receive connector on the duplexer.

4. INSTALLATION

4-1 PLANNING

This repeater should be installed in a cabinet to protect it from dust, moisture, etc. The repeater has four screw holes and two handles on each side of the front panel for this installation purpose.

- **AVOID** using the IC-RP2210 in the following situations:
 - Where temperatures under -10°C or over $+60^{\circ}\text{C}$ are encountered. **DO NOT** use the repeater in areas exposed to direct sunlight for long periods.
 - In places subject to rain, humidity, strong winds, or excessive dust and moisture.
- To facilitate good ventilation and emergency maintenance, allow sufficient access between the repeater and the surrounding walls.

4-2 ANTENNA SYSTEM

CAUTION: Transmitting without an antenna may damage the transmitter of the repeater.

(1) ANTENNA

Antenna performance is important for reliable radio communications. For this reason, a 50Ω directional antenna is well worth the extra investment. Many high quality fixed location antennas are available from various manufacturers. Choose one most suited to your needs.

- Use heavy-duty stainless steel mounting hardware to protect the antenna from bad weather and preserve it for longer periods of time.

(2) COAXIAL CABLE

We recommend using a coaxial cable as follows, particularly in a fixed location installation of a repeater where feed lengths are very long:

- Use a thick, low loss, all weather-type coaxial cable, and for best results make the connection between the antenna and repeater as short as possible.

4-3 DUPLEXER

This repeater does not include a duplexer. The duplexer must be purchased separately.

- The cables between the repeater and duplexer should be as short and thick as possible to reduce insertion loss.

4-4 GROUNDING

To prevent electrical shocks, interference to other stations, and other problems, be sure to ground the repeater through the **GROUND TERMINAL**.

- To ensure safety, use the heaviest gauge wire or strap available and make the connection as short as possible.
- **NEVER** use a gas pipe or electrical conduit pipe for grounding.

4-5 POWER SUPPLY

The IC-RP2210 can function with either an AC or DC power source. If AC power is interrupted when operating the repeater with an AC power source, power is automatically provided to the repeater when a 12V-type storage battery is connected to the **DC POWER INPUT TERMINALS** on the rear panel.

(1) IN AC OPERATION

- Extension cords should not be used unless absolutely necessary. Use of improper extension cords could result in fire risk.
- Use a proper power source from an AC outlet.

(2) IN DC OPERATION

CAUTION: Voltages greater than 16V DC will damage your repeater. Check the source voltage before connecting the power cable.

- Connect a battery with sufficient capacity such as a lead-acid battery. The current drain is approx. 8A while transmitting.
- Place the battery in a spot away from the repeater as gas leakage from the battery could cause corrosion when a lead-acid battery is used. Keep the battery cable long and install the battery more than 5 meters away from the repeater. Provide good ventilation.
- Charge the battery completely before connecting it to the repeater. Note the polarity: positive wire to the **RED** terminal; negative wire to the **BLACK** terminal.
- During AC operation a current of 100mA is fed from the repeater to recharge the battery as long as the repeater **POWER SWITCH** is **ON**. This is enough current to compensate for the battery's natural discharge. However, recharge the battery using an external charger.

