



## INSTRUCTION MANUAL

VHF dPMR REPEATER

# IC-FR5000

UHF dPMR REPEATER

# IC-FR6000



---

## FORWARD

---

Thank you for purchasing this Icom repeater. The IC-FR5000/IC-FR6000 VHF/UHF dPMR REPEATERS is designed and built with Icom's state of the art technology and craftsmanship. With proper care, this product should provide you with years of trouble-free operation.

We appreciate you making the IC-FR5000/IC-FR6000 your repeater of choice, and hope you agree with Icom's philosophy of "technology first." Many hours of research and development went into the design of your IC-FR5000/IC-FR6000.

### ◆ FEATURES

#### ○ *Up to two operating channels*

You can install a channel extension module (optional UR-FR5000/UR-FR6000) into the repeater for two channel operation.

#### ○ *Built-in dPMR system operation*

The IC-FR5000/IC-FR6000 provide digital Private Mobile Radio (dPMR) operation that meets the 6.25 kHz bandwidth requirements for narrow band operation. This increases the efficiency of channel allocation and use of the spectrum.

#### ○ *Built-in 5-Tone, DTMF encoder & decoder*

Multiple signaling systems are standard equipment. These systems are fully compatible with Icom's F-series radios.

#### ○ *DTMF remote control capability*

You can control the repeater from a remote location over the air or over a phone line, with DTMF.

#### ○ *D-Sub 25 pin ACC port equipped*

You can use optional equipment through the D-sub 25 pin ACC port installed on the repeater's rear panel.

#### ○ *Other features*

- Wide frequency coverage  
(136 to 174 MHz, 400 to 470 MHz)
- PC programmable
- 19 inch rack mount
- Optional Voice Scrambler Unit (UT-109R/UT-110R) for using the repeater as the base station transceiver

---

## IMPORTANT

---


**READ THIS INSTRUCTION MANUAL CAREFULLY** before attempting to operate the repeater.

**SAVE THIS INSTRUCTION MANUAL**— This manual contains important safety and operating instructions for the IC-FR5000/IC-FR6000 VHF/UHF dPMR REPEATERS.

---

## EXPLICIT DEFINITIONS

---

WORD	DEFINITION
 <b>WARNING!</b>	Personal injury, fire hazard or electric shock may occur.
<b>CAUTION</b>	Equipment damage may occur.
<b>NOTE</b>	If disregarded, inconvenience only. No risk of personal injury, fire or electric shock.

---

## VOICE CODING TECHNOLOGY

---

The AMBE+2™ voice coding Technology embodied in this product is protected by intellectual property rights including patent rights, copyrights and trade secrets of Digital Voice Systems, Inc. This voice coding Technology is licensed solely for use within this Communications Equipment.

The user of this Technology is explicitly prohibited from attempting to extract, remove, decompile, reverse engineer, or disassemble the Object Code, or in any other way convert the Object Code into a human-readable form. U.S. Patent Nos. #8,595,002, #8,359,197, #8,315,860, #8,200,497, #7,970,606, and #6,912,495 B2.

Icom, Icom Inc. and the Icom logo are registered trademarks of Icom Incorporated (Japan) in Japan, the United States, the United Kingdom, Germany, France, Spain, Russia and/or other countries.

All other products or brands are registered trademarks or trademarks of their respective holders.

## PRECAUTIONS

⚠ **WARNING HIGH VOLTAGE! NEVER** attach an antenna or internal antenna connector during transmission. This may result in an electrical shock or burn.

⚠ **WARNING HIGH VOLTAGE! NEVER** install the antenna at any place that person touch the antenna easily during transmission. This may result in an electrical shock or burn.

⚠ **WARNING! NEVER** apply AC to the DC power receptacle on the repeater rear panel. This could cause a fire or damage the repeater.

⚠ **WARNING! NEVER** apply more than 16 V DC to the DC power receptacle on the repeater rear panel. This could cause a fire or damage the repeater.

⚠ **WARNING! NEVER** reverse the DC power cable polarity when connecting to a power source. This could cause a fire or damage the repeater.

**CAUTION: NEVER** let metal, wire or other objects touch any internal part or connectors on the rear panel of the repeater. This may result in an electric shock.

**CAUTION: NEVER** expose the repeater to rain, snow or any liquids.

**DO NOT** operate or place the repeater in areas with temperatures below  $-25^{\circ}\text{C}$  ( $-13^{\circ}\text{F}$ ) or above  $+55^{\circ}\text{C}$  ( $+131^{\circ}\text{F}$ ). Be aware that temperatures can exceed  $+80^{\circ}\text{C}$  ( $+176^{\circ}\text{F}$ ), resulting in permanent damage to the repeater if left there for extended periods.

**DO NOT** place the repeater in excessively dusty environments or in direct sunlight.

**DO NOT** put anything on top of the repeater. This will obstruct heat dissipation.

**BE CAREFUL!** The heatsink will become hot when operating the repeater continuously for long periods.

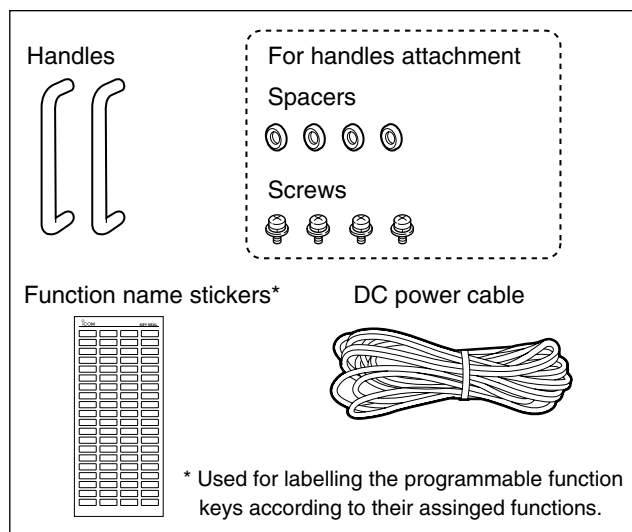
**BE CAREFUL!** If a linear amplifier is connected, set the repeater's RF output power to less than the linear amplifier's maximum input level, otherwise, the linear amplifier will be damaged.

**USE** only the specified microphone. Other microphones have different pin assignments and may damage the repeater.

Place the repeater in a secure place to avoid inadvertent access by children.

## SUPPLIED ACCESSORIES

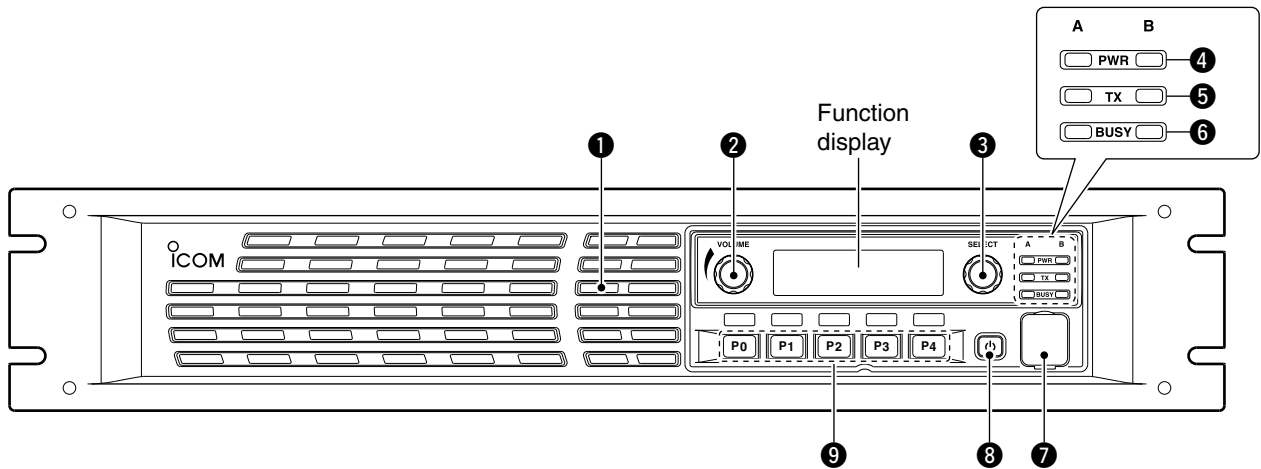
The following accessories are supplied.



## TABLE OF CONTENTS

<b>FORWARD</b> .....	i
<b>IMPORTANT</b> .....	i
<b>EXPLICIT DEFINITIONS</b> .....	i
<b>VOICE CODING TECHNOLOGY</b> .....	i
<b>PRECAUTIONS</b> .....	ii
<b>SUPPLIED ACCESSORIES</b> .....	ii
<b>TABLE OF CONTENTS</b> .....	ii
<b>1 PANEL DESCRIPTION</b> .....	1–3
■ Front panel .....	1
◇ Function display .....	2
■ Rear panel .....	2
◇ Accessory connector .....	3
<b>2 INSTALLATION AND CONNECTIONS</b> .....	4–6
■ Unpacking .....	4
■ Selecting a location .....	4
■ Antenna connection .....	4
■ Front panel connection .....	5
■ Rear panel connection .....	5
■ Power supply connection .....	6
■ Mounting the repeater .....	6
◇ Using the supplied handles .....	6
<b>3 OPERATION</b> .....	7
■ Receiving and transmitting .....	7
◇ Repeater operation .....	7
◇ Base station operation .....	7
<b>4 MAINTENANCE</b> .....	8
■ Troubleshooting .....	8
■ Fuse replacement .....	8
◇ Line fuse replacement .....	8
<b>5 OPTIONS</b> .....	9

## Front panel



### 1 INTERNAL SPEAKER

You can listen to received audio.

### 2 VOLUME CONTROL [VOLUME] (p. 7)

Rotate to adjust the audio output level.

### 3 SELECTOR DIAL [SELECT]

Rotate to adjust the squelch threshold level or select the operating channel. (Depending on the pre-programmed setting.)

### 4 POWER INDICATOR [POWER]

➔ Lights green on 'A' module's indicator while the repeater power is ON.

#### **When a channel extension module is installed:**

- ➔ Lights green on the selected module indicator ('A' or 'B') while the repeater power is ON.
- ➔ Lights orange on the un-selected module indicator ('A' or 'B') while the repeater power is ON.

### 5 TRANSMIT INDICATOR [TX]

Lights red while transmitting.

### 6 BUSY INDICATOR [BUSY]

Lights green while receiving a signal or while the noise squelch is open.

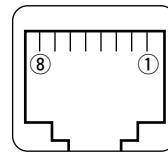
#### **About [PWR], [TX] and [BUSY] indicators:**

'A' and 'B' modules both have these. 'A' module's indicators correspond to the original module, and 'B' module's indicators correspond to the extended module.

### 7 MICROPHONE CONNECTOR [MIC]

This 8-pin modular jack accepts the optional microphone.

**KEEP** the [MIC] connector cover over the connector when the optional microphone is not connected.



- ① +8 V DC output (Maximum 15 mA)
- ② Output port for PC programming
- ③ No Connection
- ④ M PTT (Input port for TX control)
- ⑤ Microphone ground
- ⑥ Microphone input
- ⑦ Ground
- ⑧ Input port for PC programming

### 8 POWER SWITCH [POWER]

- ➔ Push to turn ON the repeater power.
- ➔ Hold down for 3 seconds to turn OFF the repeater power.

#### **When a channel extension module is installed:**

While the repeater power is ON, push to select the desired module to operate the repeater as the base station transceiver.

- The power indicator of the selected module lights green.

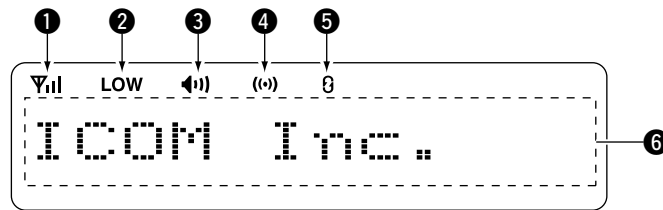
### 9 DEALER-PROGRAMMABLE KEYS

Desired functions can be programmed for each key by your dealer.

Ask your dealer for details.

- Because these keys are programmable, their functions are unique to each unit.

## ◇ Function display



### ❶ SIGNAL STRENGTH ICON

Indicates the relative signal strength level.

### ❷ LOW POWER ICON

Appears when low output power is selected.

### ❸ AUDIBLE ICON

Appears when the channel is in the 'audible' (unmute) mode.

### ❹ COMPANDER ICON

Appears when the compander function is activated.

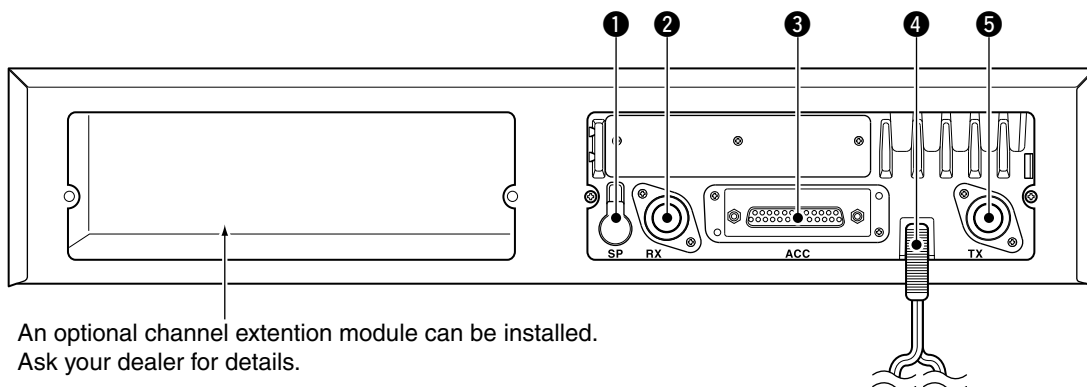
### ❺ SCRAMBLER ICON

Appears when the voice scrambler function is activated.

### ❻ ALPHANUMERIC DISPLAY

Shows a variety of text or code information.

## ■ Rear panel



### ❶ EXTERNAL SPEAKER CONNECTOR [SP]

Connect the optional SP-22.

### ❷ RECEIVE ANTENNA CONNECTOR [RX]

Connect a receive antenna (impedance: 50  $\Omega$ ) to receive signals.

### ❸ ACCESSORY CONNECTOR [ACC]

Connects to the accessory connector.

- See page 3 for accessory connector information.

### ❹ DC POWER RECEPTACLE

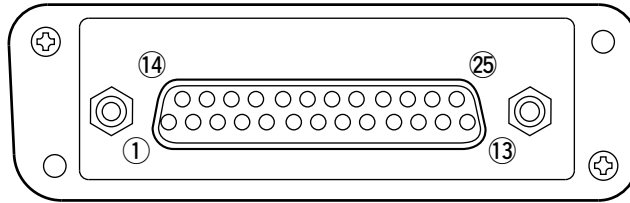
Connect the supplied DC power cable from this connector to an external 13.6 V DC power source.

### ❺ TRANSMIT ANTENNA CONNECTOR [TX]

Connect a transmit antenna (impedance: 50  $\Omega$ ) to transmit signals.

# 1 PANEL DESCRIPTION

## ◆ Accessory connector



Pin No.	Pin Name	Description	Specification
1	NC	No connection	—
2	TXD	Output terminal for serial communication data.	—
3	RXD	Input terminal for serial communication data.	—
4	RTS	Output terminal for request-to-send data.	—
5	CTS	Input terminal for clear-to-send data.	—
6	NC	No connection	—
7	GND	Serial/digital signal ground	—
8	MOD IN	Modulator input from an external terminal unit.	Input level: 300 mV rms
9	DISC OUT	Output terminal for AF signals from the AF detector circuit. Output level is fixed, regardless of [AF] control position.	Output level: 300 mV rms
10	EXT. D/A	A desired function can be assigned.* (Default: Null)	—
11	VCC	13.6 V DC output	Output current: Less than 1 A
12	EXT. A/D	Customize A/D input (Not used)	—
13	NC	No connection	—
14	GND	Ground	—
15	EXT.I/O 15	A desired function can be assigned.* (Default: Null)	+5 V pull up, Active=L
16	EXT.I/O 16	A desired function can be assigned.* (Default: P0 Monitor Output)	+5 V pull up, Active=L
17	EXT.I/O 17	A desired function can be assigned.* (Default: Busy Output)	+5 V pull up, Active=L
18	EXT.I/O 18	A desired function can be assigned.* (Default: Null)	+5 V pull up, Active=L
19	EXT.I/O 19	A desired function can be assigned.* (Default: EPTT Input)	+5 V pull up, Active=L
20	DATA IN	Input terminal for data.	—
21	EXT.I/O 21	A desired function can be assigned.* (Default: Analog Audible Output)	+5 V pull up, Active=L
22	AF OUT	The AF detector Output.	—
23	EXT.I/O 23	A desired function can be assigned.* (Default: Mic Mute Output)	+5 V pull up, Active=L
24	EXT.I/O 24	A desired function can be assigned.* (Default: Null)	+5 V pull up, Active=L
25	EXT.I/O 25	A desired function can be assigned.* (Default: Mic Hanger Output)	+5 V pull up, Active=L

\* A required function can be assigned using the optional CS-FR5000(dPMR) CLONING SOFTWARE. Ask your dealer for details.

## ■ Unpacking

After unpacking, immediately report any damage to the delivering carrier or dealer. Keep the shipping cartons.

For a description and a diagram of accessory equipment included with the repeater, see 'SUPPLIED ACCESSORIES' on page ii of this manual.

## ■ Selecting a location

Select a location for the repeater that allows adequate air circulation, free from extreme heat, cold, or vibrations, and away from TV sets, TV antenna elements, radios and other electromagnetic sources.

## ■ Antenna connection

For radio communications, the antenna is a critical component, along with output power and sensitivity. Select antenna(s), such as a well-matched 50  $\Omega$  antenna, and feedline. 1.5:1 or better of Voltage Standing Wave Ratio (VSWR) is recommended for desired band. Of course, the transmission line should be a coaxial cable.

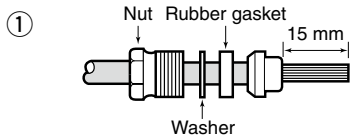
**CAUTION:** Protect repeater from lightning by using a lightning arrestor.

**NOTE:** There are many publications that describe proper antennas and their installation. Check with your local dealer for more information and recommendations.

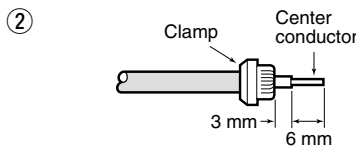
1

2

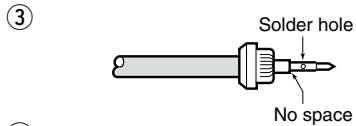
### TYPE-N CONNECTOR INSTALLATION EXAMPLE



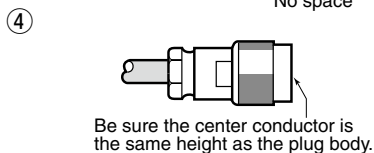
Slide the nut, flat washer, rubber gasket and clamp over the coaxial cable, then cut the end of the cable evenly.



Strip the cable and fold the braid back over the clamp.



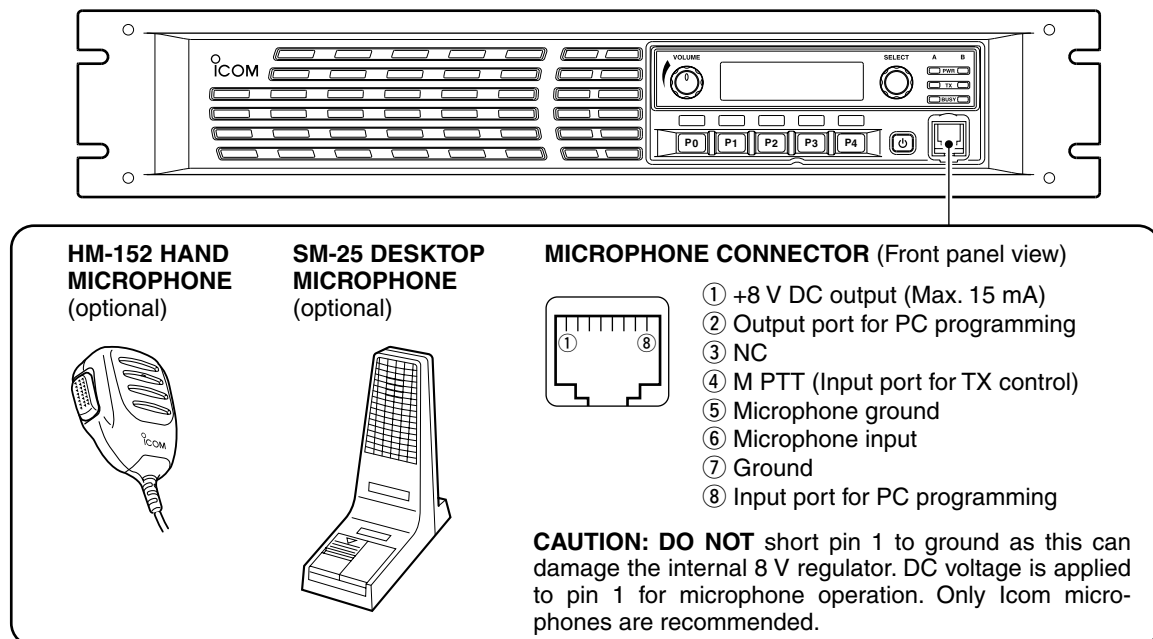
Soft solder the center conductor. Install the center conductor pin and solder it.



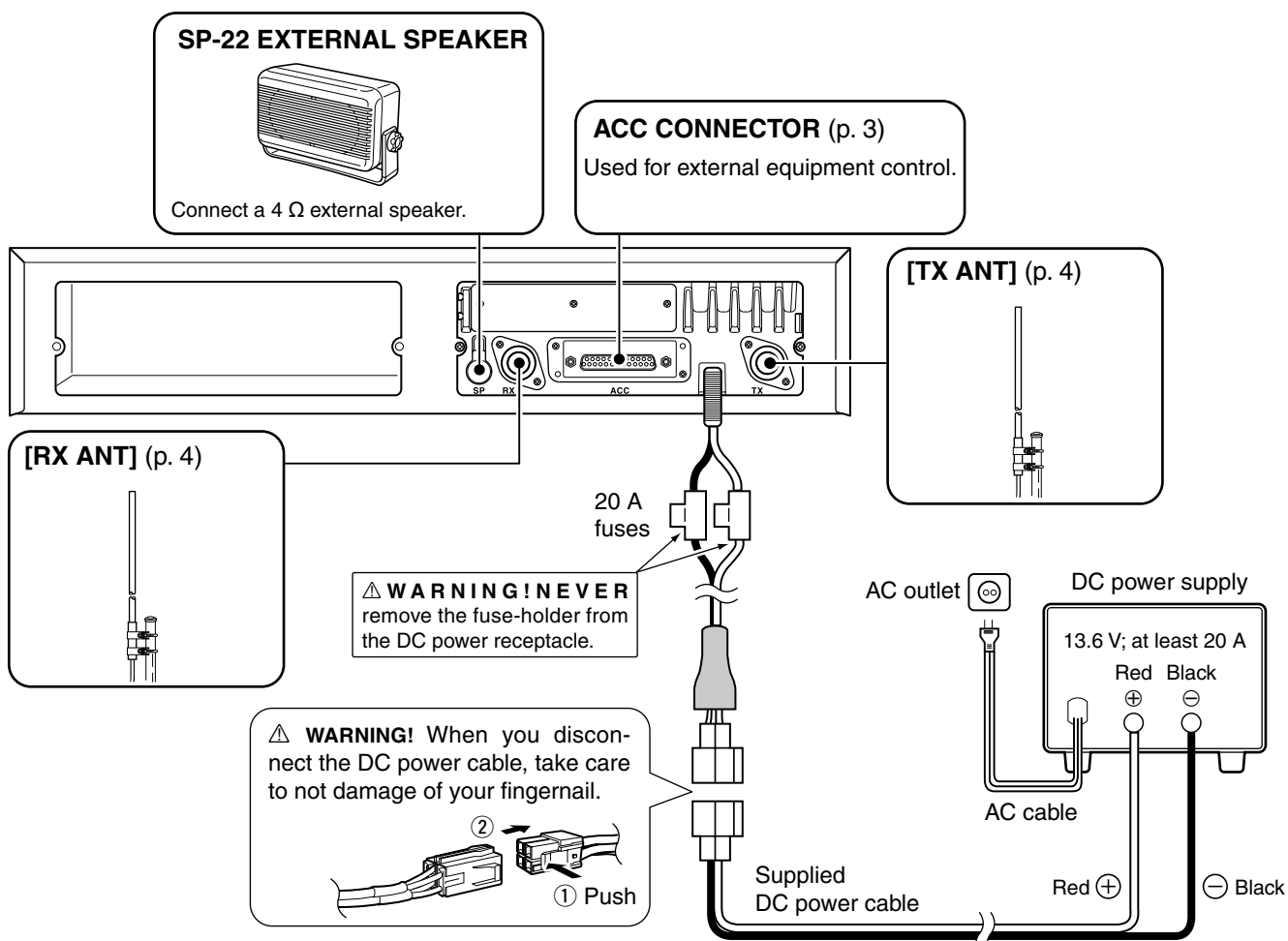
Carefully slide the plug body into place aligning the center conductor pin on the cable. Tighten the nut onto the plug body.

15 mm (0.59 in) 6 mm (0.24 in) 3 mm (0.12 in)

## ■ Front panel connection



## ■ Rear panel connection





## ■ Power supply connection

Make sure the repeater's power switch is turned OFF when connecting a DC power cable.

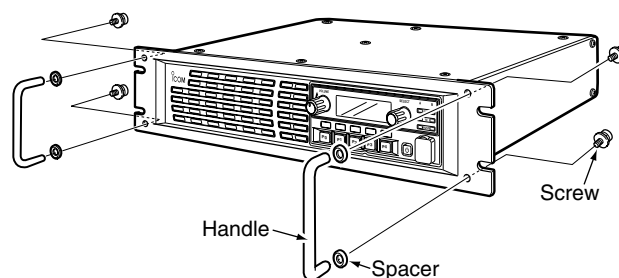
**⚠ WARNING!** Voltages greater than 16 V DC will damage the repeater. Check the source voltage before connecting the power cable.

## ■ Mounting the repeater

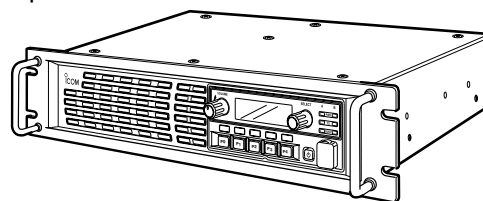
### ◇ Using the supplied handles

The handles are convenient for mounting the repeater into a 19 inch rack. The handles can be installed on the repeater's front panel.

- ① Attach the handles to both sides of the repeater's front panel with the spacers, then tighten the screws.



- ② The completed installation should look like this.



## ■ Receiving and transmitting

### ◇ Repeater operation

Ask your dealer for details of the repeater's programming.

- When the power is turned ON, the **[PWR]** indicator lights green. (p. 1)
- The **[TX]** and **[BUSY]** indicators light simultaneously while transmitting or receiving a signal.
  - The **[TX]** indicator lights red.
  - The **[BUSY]** indicator lights green.

**NOTE:** A power amplifier protector is built into the repeater. The protector is activated when the repeater's temperature becomes extremely high, to reduce the transmit output power level. The output power will return to its normal level when the repeater has cooled down.

### ◇ Base station operation

#### **Receiving**

- ① Push **[POWER]** to turn ON the power.
- ② Set the squelch and audio levels.
  - First, rotate **[SELECT]**\*<sup>1</sup> fully counterclockwise.
  - Rotate **[VOLUME]** to adjust the audio output level.
  - Rotate **[SELECT]**\*<sup>1</sup> clockwise until the noise just disappears.
- ③ Push **[CH Up]**\*<sup>2</sup> or **[CH Down]**\*<sup>2</sup> to select the desired channel.
  - When receiving a signal, the **[BUSY]** indicator lights green and audio is heard from the speaker.
  - Further adjustment of **[VOLUME]** to a comfortable listening level may be necessary at this point.

\*<sup>1</sup> When the [SQL Level Up/Down] key function is assigned to [SELECT].

\*<sup>2</sup> When the [CH Up]/[CH Down] key functions are assigned.

#### **Transmitting**

- ① Take the microphone off the hook.
- ② Wait for the channel to become clear.
- ③ Hold down **[PTT]** to transmit, then speak into the microphone at your normal voice level.
- ④ Release **[PTT]** to receive.

#### **IMPORTANT:**

To maximize the audio quality of the transmitted signal:

- (1) Pause briefly after pushing **[PTT]**.
- (2) Hold the microphone 5 to 10 cm (2 to 4 inch) from your mouth, then speak into the microphone at a normal voice level.

## ■ Troubleshooting

The following chart is designed to help correct problems which are not equipment malfunctions.

If you are unable to locate the cause of a problem or solve it through the use of this chart, contact the nearest Icom Dealer or Service Center.

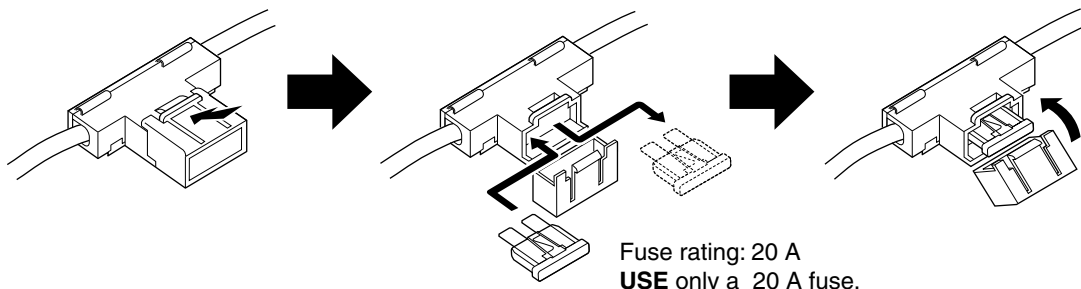
PROBLEM	POSSIBLE CAUSE	SOLUTION	REF.
Power does not come ON when <b>[POWER]</b> is pushed.	<ul style="list-style-type: none"> <li>The power supply is turned OFF.</li> <li>DC power cable is improperly connected.</li> <li>Fuse is blown.</li> </ul>	<ul style="list-style-type: none"> <li>Turn ON the power supply.</li> <li>Re-connect the DC power cable correctly.</li> <li>Check the cause, then replace the fuse with a spare one.</li> </ul>	<p>–</p> <p>pp. 5, 6 p. 8</p>
No sound comes from the speaker.	<ul style="list-style-type: none"> <li>Volume level is too low.</li> <li>The squelch is closed.</li> <li>The audio mute function is activated.</li> <li>A selective call or squelch function is activated such as 5-tone call or tone squelch.</li> <li>The front speaker is set to OFF.</li> </ul>	<ul style="list-style-type: none"> <li>Rotate <b>[VOLUME]</b> clockwise to obtain a suitable listening level.</li> <li>While in base operating mode, rotate <b>[SELECT]</b> to counterclockwise to open the squelch. (When the [SQL Level Up/Down] key function is assigned to <b>[SELECT]</b>.)</li> <li>Push <b>[MONI]</b> (if assigned) to turn OFF the audio mute function.</li> <li>Turn OFF the appropriate function.</li> <li>Turn ON the front speaker using the optional CS-FR5000(dPMR) CLONING SOFTWARE. Ask your dealer for details.</li> </ul>	<p>p. 7</p> <p>p. 7</p> <p>–</p> <p>–</p> <p>–</p>
Sensitivity is low and only strong signals are audible.	<ul style="list-style-type: none"> <li>Antenna feedline or the antenna connector has a poor contact or is short-circuited.</li> </ul>	<ul style="list-style-type: none"> <li>Check and re-connect (or replace if necessary) the antenna feedline or antenna connector.</li> </ul>	p. 5
Received signal cannot be understood.	<ul style="list-style-type: none"> <li>Optional voice scrambler is turned OFF.</li> <li>Scrambler code is not set correctly.</li> </ul>	<ul style="list-style-type: none"> <li>Turn ON the optional voice scrambler.</li> <li>Reset the scrambler code.</li> </ul>	<p>–</p> <p>–</p>
Output power is too low.	<ul style="list-style-type: none"> <li>Output power is set to Low.</li> <li>Power amplifier protection circuit is activated.</li> </ul>	<ul style="list-style-type: none"> <li>Push <b>[HIGH/LOW]</b> (if assigned) to select the High power.</li> <li>Cool down the repeater or stop accessing to the repeater until it has cooled down.</li> </ul>	<p>–</p> <p>–</p>
No contact possible with another station.	<ul style="list-style-type: none"> <li>The other station is using tone squelch.</li> <li>While in base operating mode, the repeater is set to duplex.</li> </ul>	<ul style="list-style-type: none"> <li>Turn ON the tone squelch function.</li> <li>Set the repeater to simplex, when other transceiver is set to simplex.</li> </ul>	<p>–</p> <p>–</p>

## ■ Fuse replacement

If a fuse blows, or the repeater stops functioning, track down the source of the problem, have it repaired, and replace the damaged fuse with a new rated one.

**CAUTION:** DISCONNECT the DC power cable from the repeater. Otherwise, there is danger of electric shock and/or equipment damage.

### ◇ Line fuse replacement



- **SP-22** EXTERNAL SPEAKER  
Compact and easy-to-install.  
Input impedance : 4  $\Omega$   
Maximum input power : 7 W
- **HM-152** HAND MICROPHONE
- **SM-25** DESKTOP MICROPHONE
- **UR-FR5000/UR-FR6000** CHANNEL EXTENSION MODULES
- **UC-FR5000** dPMR CONTROLLER
- **UT-109R** VOICE SCRAMBLER UNIT  
Non-rolling type (maximum 32 codes).
- **UT-110R** VOICE SCRAMBLER UNIT  
Rolling type (maximum 1020 codes).

\* The scrambler systems of the UT-109R and UT-110R are not compatible with each other.

Approved Icom optional equipment is designed for optimal performance when used with an Icom repeater. Icom is not responsible for the destruction or damage to an Icom repeater in the event the Icom repeater is used with equipment that is not manufactured or approved by Icom.

Some options may not be available in some countries. Please ask your dealer for details.



## MEMO



Count on us!



---

---

---

---

---

---