

ICOM

INSTRUCTION MANUAL

VHF REPEATER
IC-VR8050
UHF REPEATER
IC-UR8050



Icom Inc.

IMPORTANT

READ THIS INSTRUCTION MANUAL carefully and completely before using the repeater.

SAVE THIS INSTRUCTION MANUAL. This instruction manual contains important safety and installation instructions for the IC-VR8050 and IC-UR8050.

EXPLICIT DEFINITIONS

WORD	DEFINITION
WARNING	Personal injury, fire hazard or electric shock may occur.
CAUTION	Equipment damage may occur.
NOTE	If disregarded, inconvenience only. No personal injury, fire hazard or electric shock will occur.

FOREWORD

Thank you for purchasing Icom's **IC-VR8050** or **IC-UR8050** repeater. This repeater is designed to meet professional communications requirements.

If you have any questions, contact your nearest authorized Icom Dealer or Service Center.

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PRECAUTIONS

NEVER connect the repeater to an AC outlet or to a power source of more than 16 V DC. These connections will damage the repeater.

NEVER connect the repeater to a power source using reverse polarity. This connection will damage the repeater.

DISCONNECT the DC power cable from the repeater before performing any internal work.

NEVER use non-rated fuses. Non-rated fuses could cause a fire or damage the repeater.

NEVER touch the antenna connector, ground terminal or antenna while transmitting.

NEVER touch internal parts while transmitting. Stop transmitting when internal adjustments are performed.

NEVER allow children to touch the repeater.

GROUND the repeater through the [GND] terminal to prevent electric shocks, TVI, BCI and other problems.

NEVER connect the [GND] terminal to a gas or electrical pipe, since the connection could cause an explosion or electric shock.

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

NEVER let metal, wire or other objects touch any internal parts. This could cause an electric shock.

DO NOT use or place the repeater in areas with temperatures below -20°C (-4°F) or above $+60^{\circ}\text{C}$ ($+140^{\circ}\text{F}$) or, in areas subject to direct sunlight.

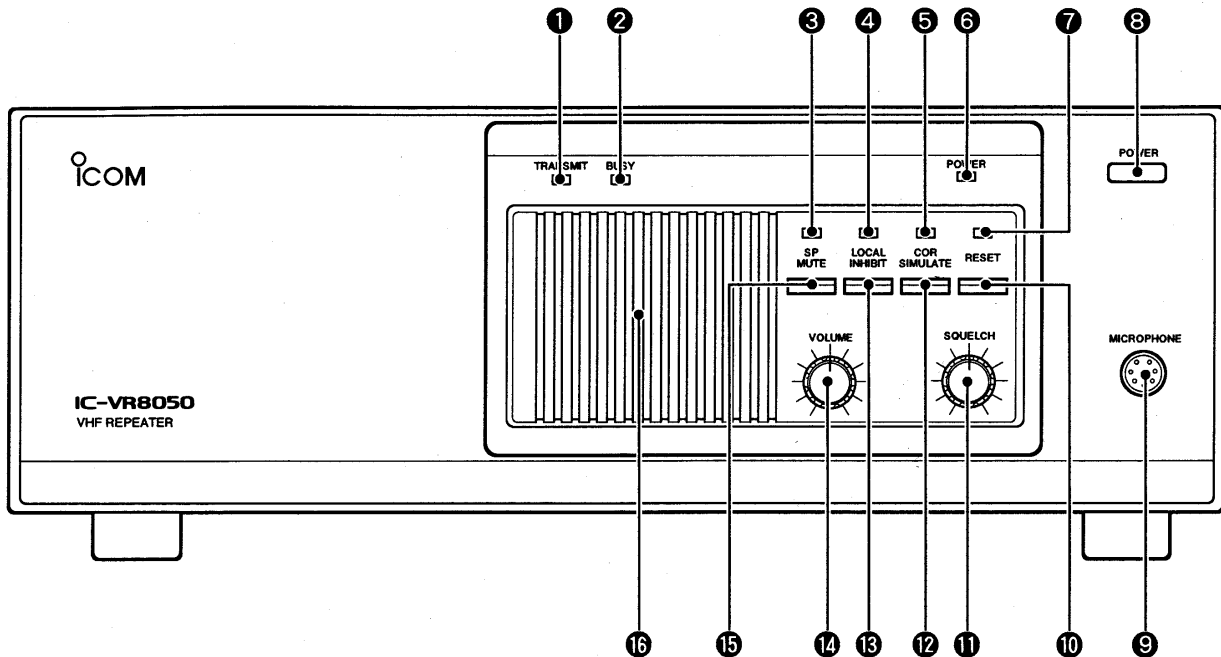
AVOID the use of chemical agents such as benzine or alcohol when cleaning, as they can damage the repeater surfaces.

AVOID placing the repeater against walls or putting anything on the top of the repeater. This could obstruct heat dissipation.

AVOID using the repeater in excessively dusty environments.

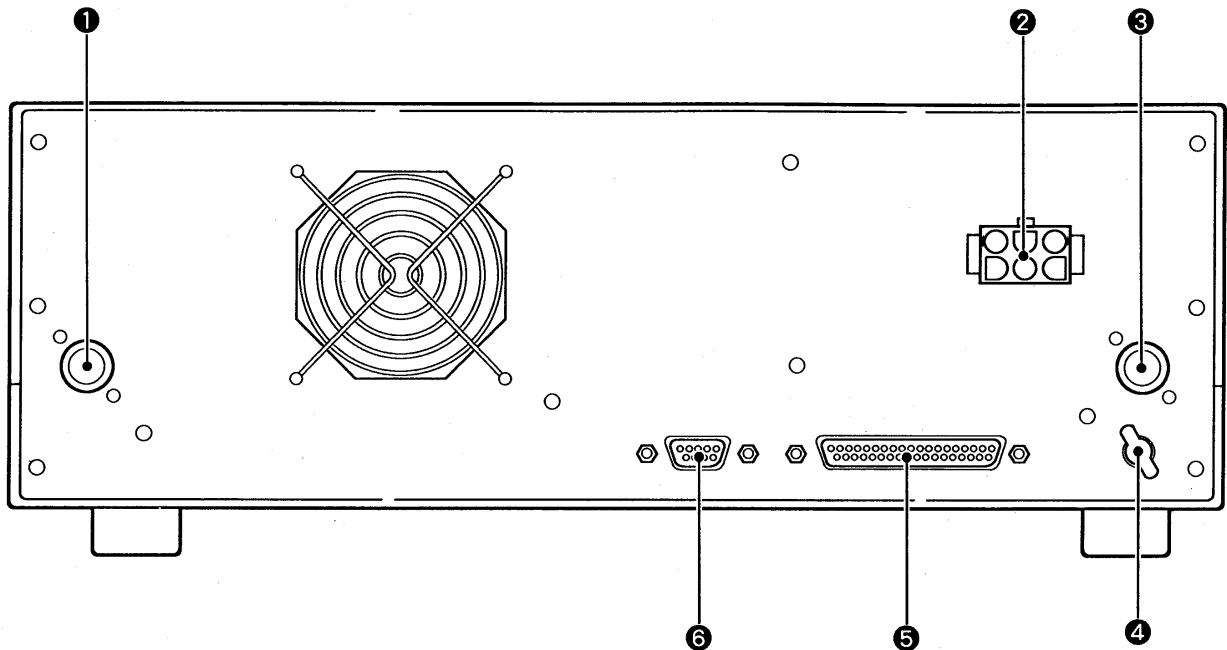
Protect your repeater from lightning using a lightning arrester.

■ Front panel



- ① TRANSMIT INDICATOR [TRANSMIT]**
Lights up in red when transmitting.
- ② BUSY INDICATOR [BUSY]**
Lights up in green when receiving with the squelch open.
- ③ SPEAKER MUTE INDICATOR [SP MUTE]**
Lights up in green when the speaker is muted.
- ④ LOCAL INHIBIT INDICATOR [LOCAL INHIBIT]**
Lights up in yellow when the repeater function is inhibited.
- ⑤ COR SIMULATE INDICATOR [COR SIMULATE]**
Lights up in red when the COR (Carrier-Operated Relay) simulate function is activated.
- ⑥ POWER INDICATOR [POWER]**
Lights up in green while the power is turned ON.
- ⑦ RESET INDICATOR [RESET]**
Lights up in yellow momentarily when the [RESET] switch is pushed.
- ⑧ POWER SWITCH [POWER]**
Turns the power ON and OFF.
- ⑨ MICROPHONE CONNECTOR [MICROPHONE]**
Connects an optional hand microphone. Refer to p. 3 for microphone operation.
- ⑩ RESET SWITCH [RESET]**
Resets the repeater when pushed. Clears the operating condition and sets the operating frequency to the dip switch settings. (p. 6)
- ⑪ SQUELCH CONTROL [SQUELCH]**
Functions while the local inhibit function is in use for setting the squelch threshold level. This setting is ignored for normal repeater operation.
- ⑫ COR SIMULATE SWITCH [COR SIMULATE]**
Sets the repeater to simulate continuous signal receiving and transmit a signal with FM noise modulation. Use the COR (Carrier-Operated Relay) simulate function for checking an operation such as the transmit frequency, time-out timer, etc.
- ⑬ LOCAL INHIBIT SWITCH [LOCAL INHIBIT]**
Inhibits the repeater function — sets no relation between receiver and transmitter. The repeater operates as a semi-duplex transceiver.
- ⑭ VOLUME CONTROL [VOLUME]**
Adjusts the audio output level from the speaker.
- ⑮ SPEAKER MUTE SWITCH [SP MUTE]**
Turns the speaker mute function ON and OFF without changing the [VOLUME] control.
- ⑯ SPEAKER**
Monitors the received signal.

■ Rear panel



- ① **TRANSMIT ANTENNA CONNECTOR [TX ANT]** (p. 4)
Outputs the transmit power to an antenna via duplexer.
- ② **DC POWER SOCKET [DC 13.8V]** (p. 4)
Accepts 13.8 V DC through the supplied DC power cable (OPC-022).
- ③ **RECEIVE ANTENNA CONNECTOR [RX ANT]** (p. 4)
Inputs receive signals from an antenna via duplexer.

- ④ **GROUND TERMINAL [GND]** (p. 4)
Ground the repeater through this terminal to prevent electric shocks, TVI, BCI and other problems.
- ⑤ **ACCESSORY SOCKET 1 [ACC(1)]** (p. 5)
Inputs and outputs signals for external equipment.
- ⑥ **ACCESSORY SOCKET 2 [ACC(2)]** (p. 5)
Inputs and outputs signals for external equipment.

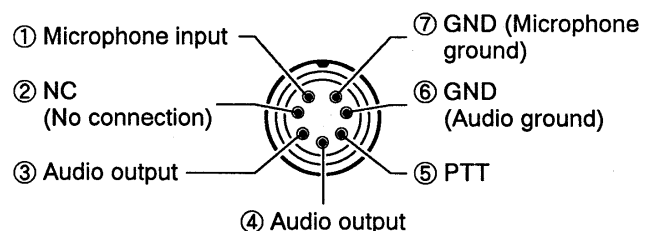
■ Microphone connector

Connect an optional HM-4 HAND MICROPHONE to the [MICROPHONE] connector.

- When [LOCAL INHIBIT] is OFF:
Pushing [PTT] on the microphone transmits manually and your voice is superimposed over the received signal.
- When [LOCAL INHIBIT] is ON:
Push [PTT] on the microphone to transmit your voice; release [PTT] to receive. The repeater functions as a semi-duplex transceiver.

DO NOT hold the microphone too close to your mouth or speak loudly. This may distort the signal.

Front panel view



Rear panel connections

[13.8V DC] socket

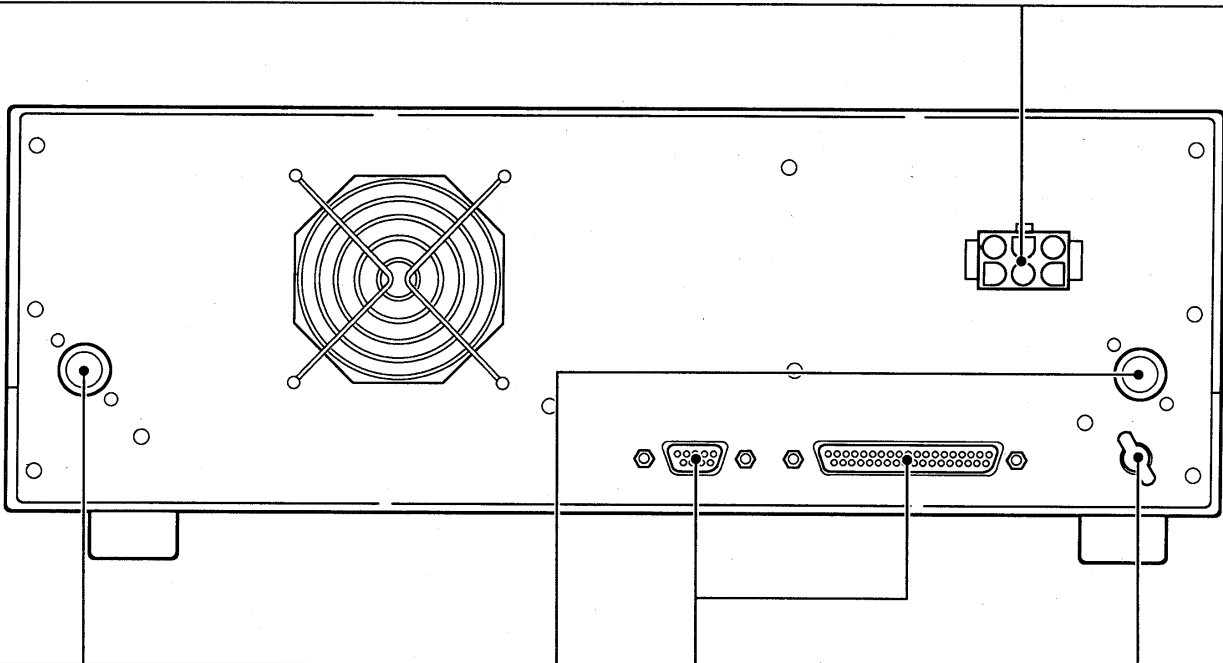
Use the supplied DC power cable and a DC power supply which has more than 17 A current capacity.

Make sure the DC power cable polarity is correct.

- Red : Positive ⊕ terminal
- Black : Negative ⊖ terminal

If a fuse blows or the repeater stops functioning, find the source of the problem if possible, and replace the damaged internal fuse with a new, rated fuse (FGB 20 A). (p. 6)

NOTE: The internal fuse also could be blown in this case. See p. 9 for fuse location.



[TX ANT] and [RX ANT] connectors

To obtain maximum performance from the repeater, select a high-quality antenna and mount it in a good location. Omnidirectional 50 Ω antenna(s) are recommended for ordinary conditions. VSWR should be less than 1.5:1. Use heavy-duty stainless steel mounting hardware to protect the antenna from bad weather.

Use 50 Ω coaxial cables as feedlines. The coaxial cables should be as short in length and as thick as possible.

A duplexer is separately required when only one antenna is used for both transmitting and receiving. Select a duplexer according to transmit and receive frequencies. Ask your Icom Dealer for details.

CAUTION: Protect your repeater from lightning using a lightning arrestor.

[GND] terminal

To prevent electric shocks, TVI, BCI and other problems, ground the repeater through the [GND] terminal.

For the best results, connect a heavy gauge cable to a long earth-sunk copper rod. Make the distance between the [GND] terminal and copper rod as short as possible.

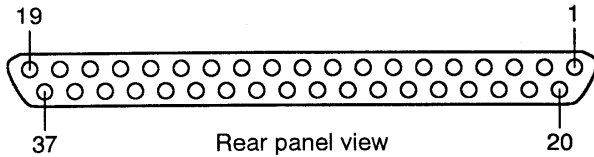
WARNING: NEVER connect the [GND] terminal to a gas or electric pipe, since the connection could cause an explosion or electric shock.

[ACC(1)] and [ACC(2)] sockets

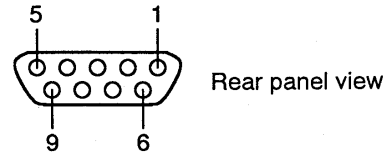
See the next page for details.

■ Accessory sockets

• ACC(1) socket



• ACC(2) socket



• ACC(1) socket

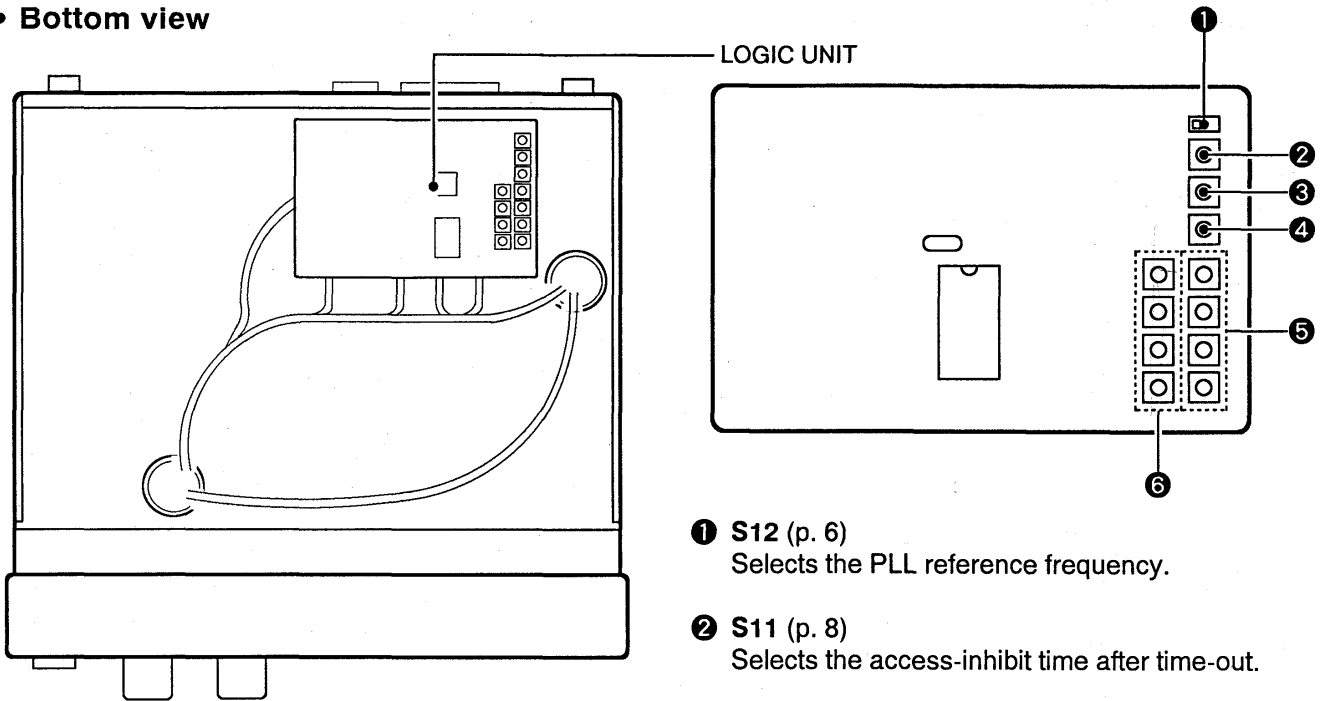
PIN No.	PIN NAME	DESCRIPTION	PIN No.	PIN NAME	DESCRIPTION
1–3	A0–A2	3-bit address data for the frequency setting switch (S1–S8 on the LOGIC unit).	17	NC	No connection.
4	STB	Strobe signal for frequency setting.	18, 19	GND	Ground for + 13.8 V DC output.
5	DO	Detected signal output with no de-emphasis. (0 dBm output with 600Ω load when a 1 kHz/±3 kHz deviation signal is received.)	20–23	D3–D0	4-bit data for the frequency setting switch position (0–9, A–F).
6	DI	Direct modulation signal input bypassing the emphasis circuit. (±3 kHz deviation with 1 kHz/100 mVrms input.)	24	GND	Ground for the “DO” signal (pin 5).
7	GND	Ground.	25	GND	Ground for the “DI” signal (pin 6).
8	TX EXT	Becomes “LOW” while transmitting.	26	S-METER	Outputs an S-meter signal.
9	BUSY	Becomes high impedance while receiving.	27	GND	Ground for the “S-METER” signal (pin 26).
10	GND	Ground.	28, 29	NC	No connection.
11, 12	NC	No connection.	30	AUX1	External [LOCAL] switch input. (more than 5 μsec. pulse input)
13	LO	Detected signal output with 300–3000 Hz 6 dB/oct. de-emphasis. (0 dBm output with 600Ω load when a 1 kHz/±3 kHz deviation signal is received.)	31	AUX2	External [RESET] switch input. (more than 5 μsec. pulse input)
14	GND	Ground for the “LI” signal (pin 33).	32	GND	Ground for the “LO” signal (pin 13).
15	EXT PTT	External PTT input. Connect to ground to transmit.	33	LI	Modulation signal input with 300–3000 Hz 6 dB/oct. emphasis. (±3 kHz deviation with 1 kHz/100 mVrms input.)
16	SP +	Amplified audio output for an external speaker.	34	GND	Ground.
			35	SP –	Amplified audio output for an external speaker.
			36, 37	+ 13.8V	Outputs 13.8 V DC and 2 A maximum for external equipment.

• ACC(2) socket

PIN No.	PIN NAME	DESCRIPTION	PIN No.	PIN NAME	DESCRIPTION
1	+ 13.8V	Outputs 13.8 V DC and 1 A maximum for external equipment.	5	EXT PTT	External PTT input. Connect to ground to transmit.
2	LI	Modulation signal input with 300–3000 Hz 6 dB/oct. emphasis. (±3 kHz deviation with 1 kHz/100 mVrms input.)	6	BUSY	Becomes high impedance while receiving.
3	GND	Ground for the “LI” and “LO” signals (pins 2, 4).	7	DI	Direct modulation signal input bypassing the emphasis circuit. (±3 kHz deviation with 1 kHz/100 mVrms input.)
4	LO	Detected signal output with 300–3000 Hz 6 dB/oct. de-emphasis. (0 dBm output with 600Ω load when a 1 kHz/±3 kHz deviation signal is received.)	8	GND	Ground for the “DI” and “DO” signals (pins 7, 9).
			9	DO	Detected signal output with no de-emphasis. (0 dBm output with 600Ω load when a 1 kHz/±3 kHz deviation signal is received.)

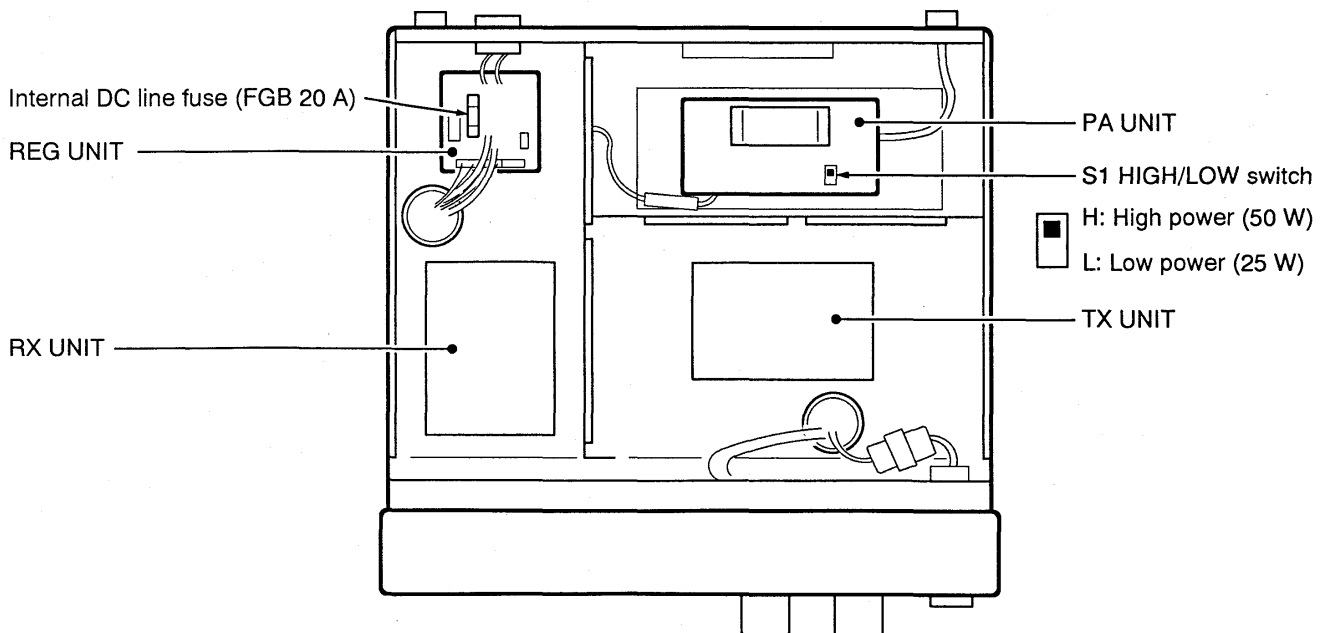
Internal views

• Bottom view



- ❶ **S12** (p. 6)
Selects the PLL reference frequency.
- ❷ **S11** (p. 8)
Selects the access-inhibit time after time-out.
- ❸ **S10** (p. 8)
Selects the hang-up time.
- ❹ **S9** (p. 8)
Selects the penalty timer.
- ❺ **S5 to S8** (p. 6)
Set the receive frequency.
- ❻ **S1 to S4** (p. 6)
Set the transmit frequency.

• Top view



3 INTERNAL SETTINGS

Rotary switches

Rotary switches for frequency setting or time-out timer setting, etc. are located on the LOGIC unit. To set these values, remove the bottom cover. Refer to p. 6 "Internal views" for the rotary switch locations.

IMPORTANT: After changing a rotary switch's position, turn power OFF then ON or push the [RESET] switch.

Frequency setting examples

Calculate the frequency data as shown below. Using the table on the next page, subtract the maximum possible value from the calculated value that does not result in a negative number.

Frequency setting

- ① Turn power OFF, then disconnect the DC power cable.
- ② Unscrew 12 screws, then remove the bottom cover.
- ③ According to the tuning step, select either the 12.5 kHz or 5 kHz PLL reference frequency using the PLL reference frequency switch, S12, on the LOGIC unit.
- ④ Calculate the frequency data as in the "Frequency setting examples" below.
- ⑤ Set the frequency data.
- ⑥ Replace the bottom cover and screws. Confirm that the set frequencies are correct.

CAUTION: Transmit and receive frequencies must be separated by more than 0.6 MHz (for the IC-VR8050) or 5 MHz (for the IC-UR8050).

Repeat this process until the calculation becomes 0. Then, set the rotary switches according to the obtained values (hexadecimal notation).

Frequency setting example (12.5 kHz tuning step)

Desired frequency : 150.0125 MHz
 PLL reference frequency : 0.0125 MHz (12.5 kHz)

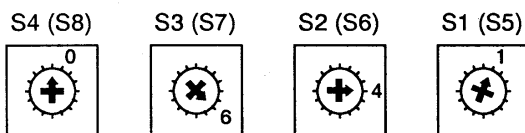
$$\begin{aligned} \text{Frequency data} &= \frac{\text{Desired frequency} - \text{Fixed frequency}^*}{\text{PLL reference frequency}} \\ &= \frac{150.0125 - 130.00}{0.0125} \\ &= 1601 (= 641_{\text{HEX}}) \end{aligned}$$

* IC-VR8050: 130 MHz, IC-UR8050: 390 MHz

Calculated value 1601 - 1536 (S3 position: 6) = 65
 65 - 64 (S2 position: 4) = 1
 1 - 1 (S1 position: 1) = 0

Rotary switch settings	S4	S3	S2	S1
	0	6	4	1

Transmit frequency setting



Bracketed values are receive frequency settings.

When the 12.5 kHz tuning step is selected, S4-S1 or S8-S5 change within the following range depending on versions.

150-174 MHz (IC-VR8050) : 0640 to 0DC0_{HEX}
 450-470 MHz (IC-UR8050) : 82C0 to 8900_{HEX}

Frequency setting example (5 kHz tuning step)

Desired frequency : 450.100 MHz
 PLL reference frequency : 0.005 MHz (5 kHz)

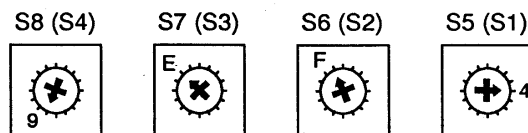
$$\begin{aligned} \text{Frequency data} &= \frac{\text{Desired freq.} - \text{Fixed freq.}^*}{\text{PLL reference frequency}} + 28672 \\ &= \frac{450.100 - 390.00}{0.005} + 28672 \\ &= 40692 (= 9EF4_{\text{HEX}}) \end{aligned}$$

* IC-VR8050: 130 MHz, IC-UR8050: 390 MHz

Calculated value 40692 - 36864 (S8 position: 9) = 3828
 3828 - 3584 (S7 position: E) = 244
 244 - 240 (S6 position: F) = 4
 4 - 4 (S5 position: 4) = 0

Rotary switch settings	S8	S7	S6	S5
	9	E	F	4

Receive frequency setting



Bracketed values are transmit frequency settings.

When the 5 kHz tuning step is selected, S4-S1 or S8-S5 change within the following range depending on versions.

150-174 MHz (IC-VR8050) : 0FA0 to 2260_{HEX}
 450-470 MHz (IC-UR8050) : 9EE0 to AE80_{HEX}

Frequency setting table

The following table shows the rotary switch values for frequency setting. Find your required values from the table.

ROTARY SWITCH POSITION	ROTARY SWITCHES			
	S1 or S5	S2 or S6	S3 or S7	S4 or S8
0	0	0	0	0 ^{*1}
1	1	16	256	4096 ^{*1}
2	2	32	512	8192 ^{*1}
3	3	48	768	12288 ^{*2}
4	4	64	1024	16384 ^{*2}
5	5	80	1280	20480 ^{*2}
6	6	96	1536	24576 ^{*2}
7	7	112	1792	28672 ^{*2}
8	8	128	2048	32768 ^{*3}
9	9	144	2304	36864 ^{*3}
A	10	160	2560	40960 ^{*3}
B	11	176	2816	45056 ^{*2}
C	12	192	3072	49152 ^{*2}
D	13	208	3328	53248 ^{*2}
E	14	224	3584	57344 ^{*2}
F	15	240	3840	61440 ^{*2}

^{*1} These values do not apply to the IC-UR8050.

^{*2} These values do not apply to the IC-VR8050/IC-UR8050.

^{*3} These values do not apply to the IC-VR8050.

Time-out timer setting

This function inhibits one station from monopolizing the repeater.

If a station accesses the repeater beyond the specified time-out time, the repeater automatically inhibits access for a specified penalty time.

The time-out time is selectable via the time-out-timer switch, S9.

S9 POSITION	TIME-OUT TIME	S9 POSITION	TIME-OUT TIME
0	1 min.	8	9 min.
1	2 min.	9	10 min.
2	3 min.	A	11 min.
3	4 min.	B	12 min.
4	5 min.	C	13 min.
5	6 min.	D	14 min.
6	7 min.	E	15 min.
7	8 min.	F	Unrestricted

Initial setting before shipping is 3 min.

Hang-up timer setting

When a receive signal from an accessing station disappears, the repeater continues transmitting for a specified hang-up time. If a signal is received within the hang-up time, the repeater transmits continuously with no interruption.

The hang-up time is selectable via the hang-up timer switch, S10.

S10 POSITION	HANG-UP TIME	S10 POSITION	HANG-UP TIME
0	0 sec.	8	8 sec.
1	1 sec.	9	9 sec.
2	2 sec.	A	10 sec.
3	3 sec.	B	11 sec.
4	4 sec.	C	12 sec.
5	5 sec.	D	13 sec.
6	6 sec.	E	14 sec.
7	7 sec.	F	15 sec.

Initial setting before shipping is 1 sec.

Penalty timer setting

This function allows you to set the time of the time-out timer penalty timer. This is the period from when the time-out timer is activated (re-transmit is automatically terminated) during which transmitting is further inhibited.

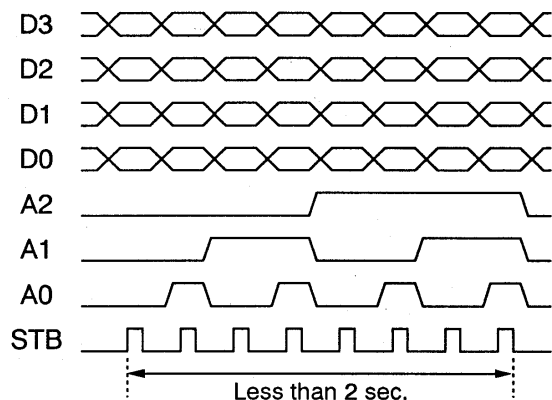
The penalty time is selectable via the penalty timer switch, S11.

S11 POSITION	PENALTY TIME	S11 POSITION	PENALTY TIME
0	0 sec.	8	30 sec.
1	1 sec.	9	40 sec.
2	2 sec.	A	50 sec.
3	3 sec.	B	1 min.
4	5 sec.	C	2 min.
5	10 sec.	D	3 min.
6	15 sec.	E	5 min.
7	20 sec.	F	10 min.

Initial setting before shipping is 5 sec.

■ Frequency setting from the [ACC(1)] socket

The operating frequency can be remotely set by serial data from external equipment. The frequency data must be sent within 2 sec. The operating frequency changes 2 sec. after the 1st strobe signal (STB) is received. One or more rotary switches' data can be changed. The following chart shows the timing.



The following table shows the rotary switch which the repeater assigns the 4-bit data to.

ROTARY SWITCH	ADDRESS DATA		
	A2	A1	A0
S1	HIGH	HIGH	HIGH
S2	HIGH	HIGH	—
S3	HIGH	—	HIGH
S4	HIGH	—	—
S5	—	HIGH	HIGH
S6	—	HIGH	—
S7	—	—	HIGH
S8	—	—	—

— : LOW

The following table shows the specified switch position which the repeater electronically sets.

ROTARY SWITCH VALUE	4-BIT DATA			
	D3	D2	D1	D0
0	—	—	—	—
1	—	—	—	HIGH
2	—	—	HIGH	—
3	—	—	HIGH	HIGH
4	—	HIGH	—	—
5	—	HIGH	—	HIGH
6	—	HIGH	HIGH	—
7	—	HIGH	HIGH	HIGH
8	HIGH	—	—	—
9	HIGH	—	—	HIGH
A	HIGH	—	HIGH	—
B	HIGH	—	HIGH	HIGH
C	HIGH	HIGH	—	—
D	HIGH	HIGH	—	HIGH
E	HIGH	HIGH	HIGH	—
F	HIGH	HIGH	HIGH	HIGH

— : LOW

■ GENERAL

- Frequency coverage : IC-VR8050 150–174 MHz
IC-UR8050 450–470 MHz
- Mode : 16K0F3E
- Antenna impedance : 50 Ω (nominal)
- Power supply requirement : 13.8 V DC \pm 15% (negative ground)
- Current drain :
 - Repeated 15.0 A (at 50 W), 12.0 A (at 25 W)
 - Rated audio output Less than 1.2 A
 - Squelched Less than 0.7 A
- Offset frequency width : IC-VR8050 More than 0.6 MHz
IC-UR8050 More than 5 MHz
- Channel spacing : IC-VR8050 30 kHz
IC-UR8050 25 kHz
- Selectable tuning steps : 5 or 12.5 kHz
- Usable temperature range : -20°C to $+60^{\circ}\text{C}$; -4°F to $+140^{\circ}\text{F}$
- Frequency stability : \pm 2.5 ppm
- Dimensions : 425(W) \times 149(H) \times 368(D) mm; 16^{23/32}(W) \times 5^{7/8}(H) \times 14^{1/2}(D) in
(projections not included)
480(W) \times 171(H) \times 417(D) mm; 18^{29/32}(W) \times 6^{23/32}(H) \times 16^{13/32}(D) in
(projections included with an optional MB-19 RACK MOUNTING HANDLES attached.)
- Weight : 12 kg; 26 lb 7 oz

■ TRANSMITTER

- Output power : 50 W/25 W (switchable)
- Modulation system : Variable reactance and reference frequency modulation
- Maximum frequency deviation : \pm 5.0 kHz
- Spurious emissions : Less than -70 dB
- Transmit noise ratio : Less than -40 dB
- Transmit distortion : Less than 5%
- Microphone impedance : 600 Ω

■ RECEIVER

- Receive system : Double-conversion superheterodyne
- Intermediate frequencies : 1st 30.875 MHz
2nd 455 kHz
- Sensitivity (for 12 dB SINAD) : Less than 0.32 μV
- Squelch sensitivity (at threshold) : IC-VR8050 Less than 0.1 μV
IC-UR8050 Less than 0.22 μV
- Tight squelch sensitivity : IC-VR8050 Less than 1.0 μV
IC-UR8050 Less than 1.0 μV
- Selectivity : More than 15 kHz/ -6 dB
Less than 30 kHz/ -60 dB
- Adjacent channel selectivity : More than 70 dB
- Spurious response rejection ratio : More than 70 dB
- Intermodulation rejection ratio : More than 70 dB
- Receive noise ratio : Less than -40 dB
- Receive distortion : Less than 3%
- Audio output power : More than 1.7 W at 10% distortion with the 8 Ω internal speaker.
- Audio output impedance : 8 Ω

All stated specifications are subject to change without notice or obligation.

Count on us!

