

# Icom America Systems

## INSTRUCTION MANUAL

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VHF FM REPEATER

**CY-F121S**

UHF FM REPEATER

**CY-F221S**

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## IMPORTANT

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**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 CY-F121S/F221S series.

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## PRECAUTION

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**⚠ 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 can touch the antenna easily during transmission. This may result in an electrical shock or burn.

**⚠ NEVER** apply AC to the [BATTERY] terminals on the repeater rear panel. This could cause a fire or damage the repeater.

**⚠ NEVER** apply more than 16 V DC, such as a 24 V battery, to the [BATTERY] terminals on the repeater rear panel. This could cause a fire or damage the repeater.

**⚠ 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.

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

**AVOID** using or placing the repeater in areas with temperatures below  $-30^{\circ}\text{C}$  ( $-22^{\circ}\text{F}$ ) or above  $+60^{\circ}\text{C}$  ( $+140^{\circ}\text{F}$ ). Be aware that temperatures on a vehicle's dashboard can exceed  $80^{\circ}\text{C}$  ( $+176^{\circ}\text{F}$ ), resulting in permanent damage to the repeater if left there for extended periods.

**AVOID** placing the repeater in excessively dusty environments or in direct sunlight.

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## EXPLICIT DEFINITIONS

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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.

**AVOID** putting anything on top of the repeater. This will obstruct heat dissipation. Place the repeater in a secure place to avoid inadvertent use by children.

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

**BE CAREFUL!** If a linear amplifier is connected, first 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 Icom microphones only (optional). Other manufacturer's microphones have different pin assignments, and connection to the CY-F121S/ CY-F221S series may damage the repeater.

### ***For U.S.A. only***

**CAUTION:** This repeater is intended for use as a fixed base station with the antenna located outdoors on the rooftop or on antenna tower, or indoors with the antenna located near the repeater.

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## FORWARD

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Thank you for purchasing this Icom America Systems CY-F121S/221S VHF/UHF FM REPEATER. With proper care, this product should provide you years of trouble-free operation.

### ☐ **FEATURES**

- *20 W continuous full duty cycle operation*  
This repeater looks as good as it performs.
- *Automatic battery backup system*  
A built-in backup system supports automatic switching to an external power supply (13.6 V DC) if the AC power supply fails.
- *Multiple CTCSS & DTCS tone memories*  
One CTCSS/DTCS tone (TX/RX tones respectively) can be programmed in a channel. Ideal for many different applications.
- *Other features*
  - PC programmable
  - 19 inch rack mount or desktop.

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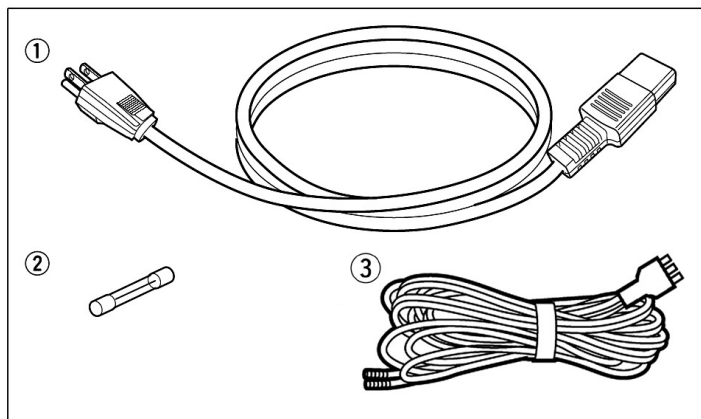
## SUPPLIED ACCESSORIES

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The following accessories are supplied with CY-F121S/221S series

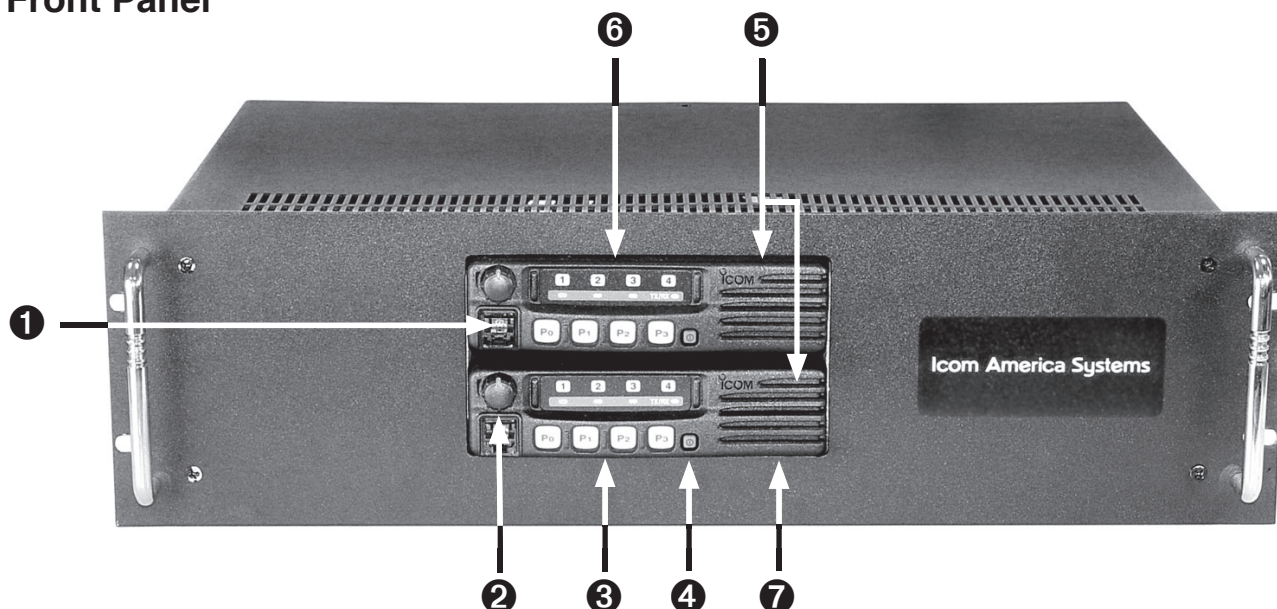
[AC120V version]

- ① AC power cable (OPC-510) ..... 1
- ② Spare fuses (FGB 20A) ..... 1
- ③ DC Power Cord ..... 1



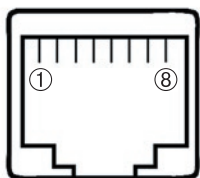
# PANEL DESCRIPTION

## ■ Front Panel



### ① MICROPHONE/SPEAKER CONNECTOR [MIC/SP]

This 8-pin modular jack accepts the optional microphone.



- ① +8 V DC output (Max. 10 mA)
- ② CLO (output port for PC programming)
- ③ AFO
- ④ M PTT (Input port for TX control)
- ⑤ Microphone ground
- ⑥ Microphone input
- ⑦ Ground
- ⑧ CLI (Input port for PC programming and monitor control)

### ② VOLUME CONTROL [VOLUME]

Adjusts the audio output level.

### ③ DEALER PROGRAMMABLE KEYS

P0, P1, P2, P3

### ④ POWER SWITCH [POWER]

Push to turn the power ON and OFF.

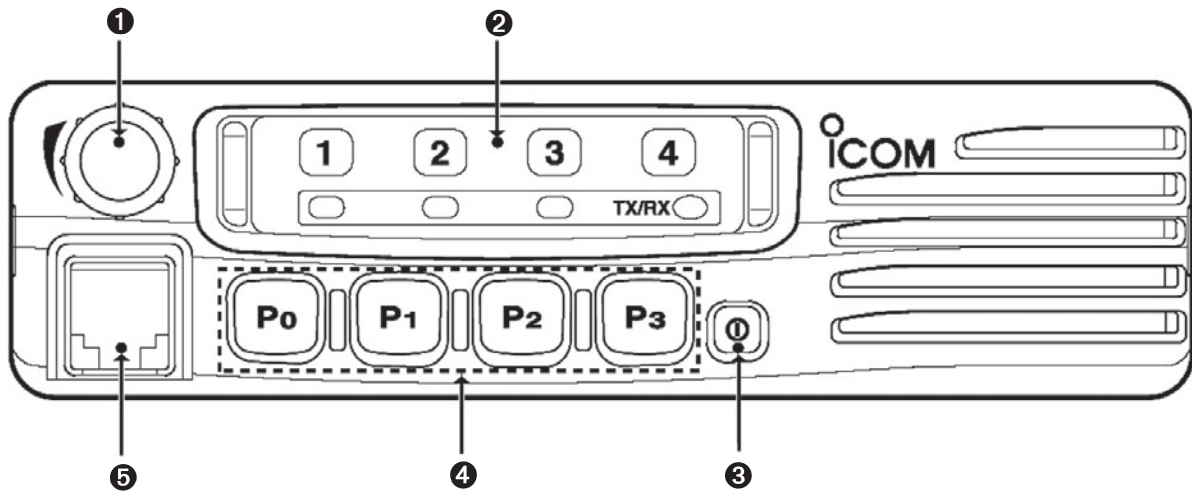
### ⑤ INTERNAL SPEAKER

Monitors received signals.

### ⑥ TRANSMITTER UNIT

### ⑦ RECEIVER UNIT

## ■ Front Panel



### ❶ AF VOLUME CONTROL KNOB

Rotate the knob to adjust the audio output level.

- Minimum audio level is pre-programmed.

### ❷ FUNCTION DISPLAY

Displays a variety of information, such as an operating channel number/name.

**NOTE:** The above functions depend on pre-programming.

### ❸ POWER SWITCH [POWER]

Push to turn the power ON and OFF.

- The following functions are available at power ON as options:
  - Automatic scan start
  - Password prompt
  - Set mode

### ❹ DEALER-PROGRAMMABLE KEYS [P0] to [P3]

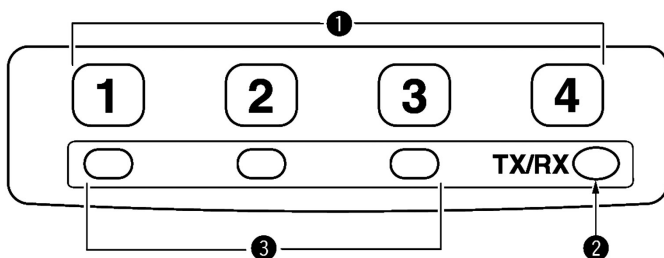
Desired functions can be programmed independently by your dealer.

### ❺ MICROPHONE CONNECTOR

Connect the supplied microphone or optional DTMF microphone for SmarTrunk II™ operation here.

**NEVER** connect non-specified microphones. The pin assignments may be different and the transceiver may be damaged.

## ■ Function LED



### ❶ CHANNEL INDICATORS

- Indicates the operating channel.
- Blinks when receiving a signal during scanning operation.
- All LEDs blink while entering the power ON password.

### ❷ TX/RX INDICATOR

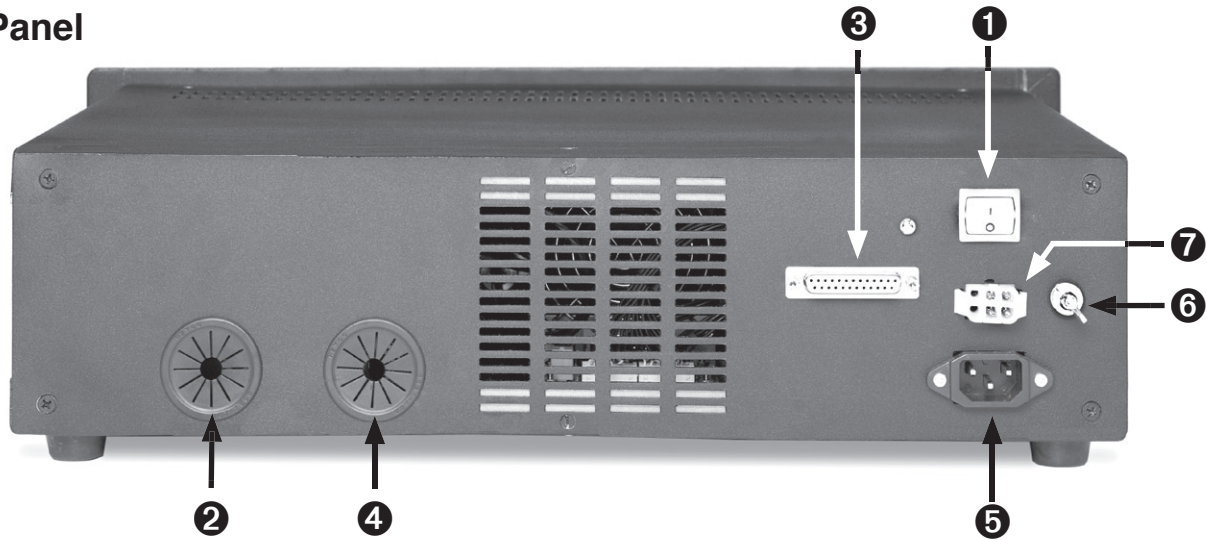
- Lights red: while transmitting
- Lights green: while the channel is busy
- Blinks orange (green and red blink simultaneously): when the specified 2-tone, 5-tone call is received.
- Green and red blink alternately: cloning error

### ❸ ACTIVATED KEY INDICATOR (LP 0/1/2)

Indicates relative receive signal strength level.

**NOTE:** When all function LEDs blink, check the DC battery voltage is not too high.

## ■ Rear Panel



### ❶ POWER SWITCH [POWER]

Toggles to turn the repeater power ON or OFF. Located on the back panel of the repeater.

### ❷ TRANSMIT ANTENNA CONNECTOR [TX/TX•RX]

- ➔ Connects a transmit antenna (impedance: 50  $\Omega$ ) and outputs transmit signals.
- ➔ When installing an optional internal duplexer (supplied by third party), this connects the transmit and receive to an antenna.

### ❸ ACCESSORY CONNECTOR [ACC]

Connects to a remote controller.

- See pgs. 3, 4 for accessory connector information.

### ❹ RECEIVE ANTENNA CONNECTOR [RX]

- ➔ Connects a receive antenna (impedance: 50  $\Omega$ ) and inputs receiving signals.
- ➔ When installing an internal duplexer (supplied by third party), do not use this connector.

### ❺ AC POWER SOCKET [AC]

Connects the supplied AC power cable to a domestic AC outlet.

### ❻ GROUND TERMINAL [GND]

Ground the repeater through this terminal to prevent electric shocks, TVI, BCI and other problems.

### ❼ DC POWER INPUT TERMINALS [BATTERY]

Connects a 12 V storage battery for repeater backup when AC power is interrupted. These terminals are also used for DC power operation.

**CAUTION: NEVER** short the (+) line of the DC power cable to repeater's chassis. There is danger of electric shock and/or equipment damage.



## ■ Repeater Controller

### Programming Mobile Radios

#### ① Transmitter:

- Go to LMR>Memory CH>Free, Program the TX and RX to the transmit frequency
- Set the CTCSS/CDCSS Tone
- Set RF Power to High
- Go to LMR>Common>Expert, Set EPTT/FTSW to EPTT (to allow ExtPTT)

\* Inside the TX radio, Short jumper D and solder TXData to F

#### ② Receiver:

- Go to LMR>Memory CH>Free, Program the RX frequency
- Set the CTCSS/CDCSS Tone
- Enable TX inhibit
- Set RF Power to LOW2
- Go to LMR>Common>Expert, set RX EXO to ON (to enable Signal HORN, CSQ, and PL/DPL)

### HANG ON TIME CONFIGURATION

JP7	JP6	JP5	JP4	T sec.
1	1	1	1	0
0	1	1	1	0.5
1	0	1	1	1
1	0	1	1	1.5
1	1	0	1	2
0	1	0	1	2.5
1	0	0	1	3
0	0	0	1	3.5
1	1	1	0	4
0	1	1	0	4.5
1	0	1	0	5
0	0	1	0	5.5
1	1	0	0	6
0	1	0	0	6.5
1	0	0	0	7
0	0	0	0	7.5

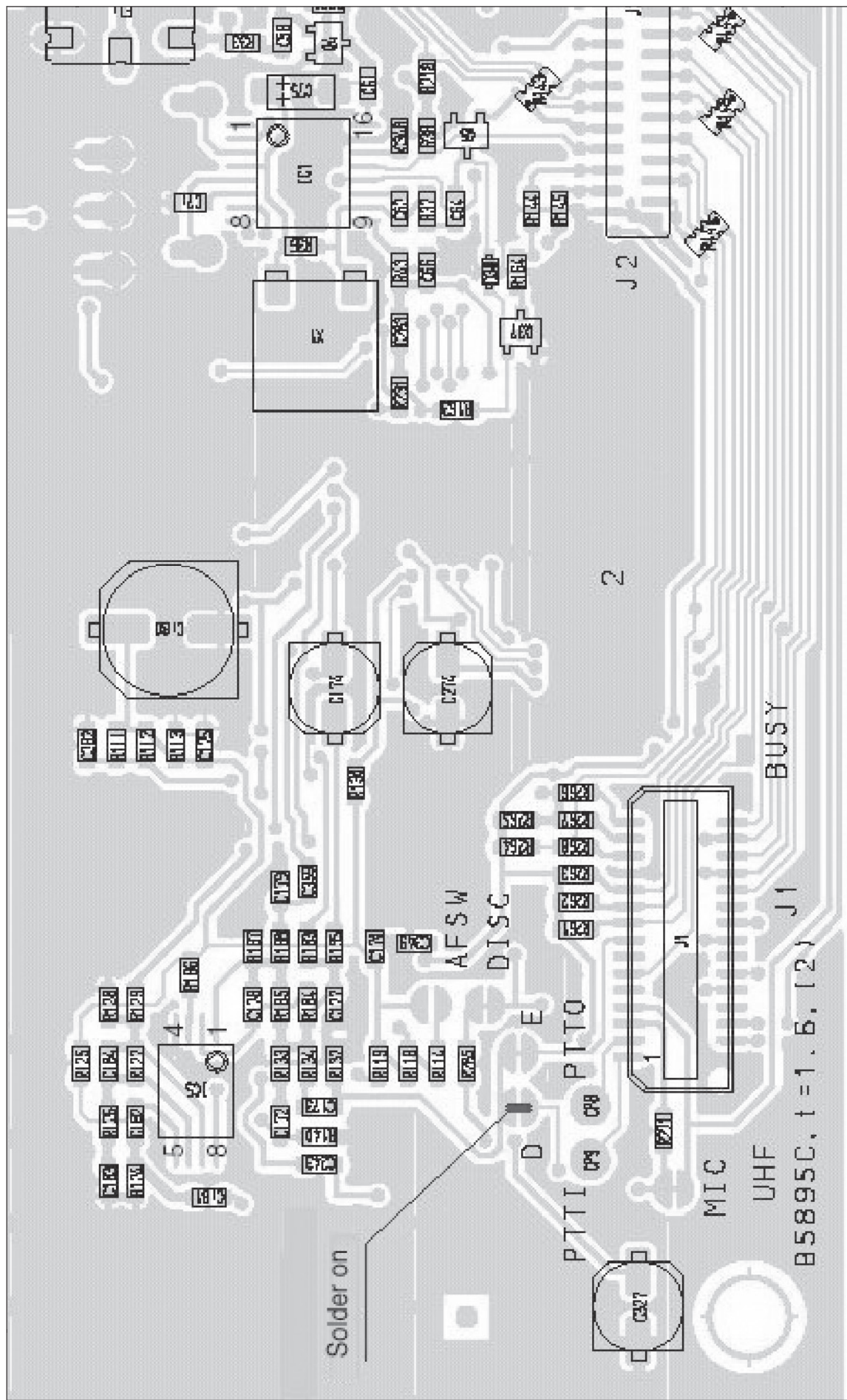
\*\* 1 = ON; 0 = OFF

### CABLE CONNECTORS

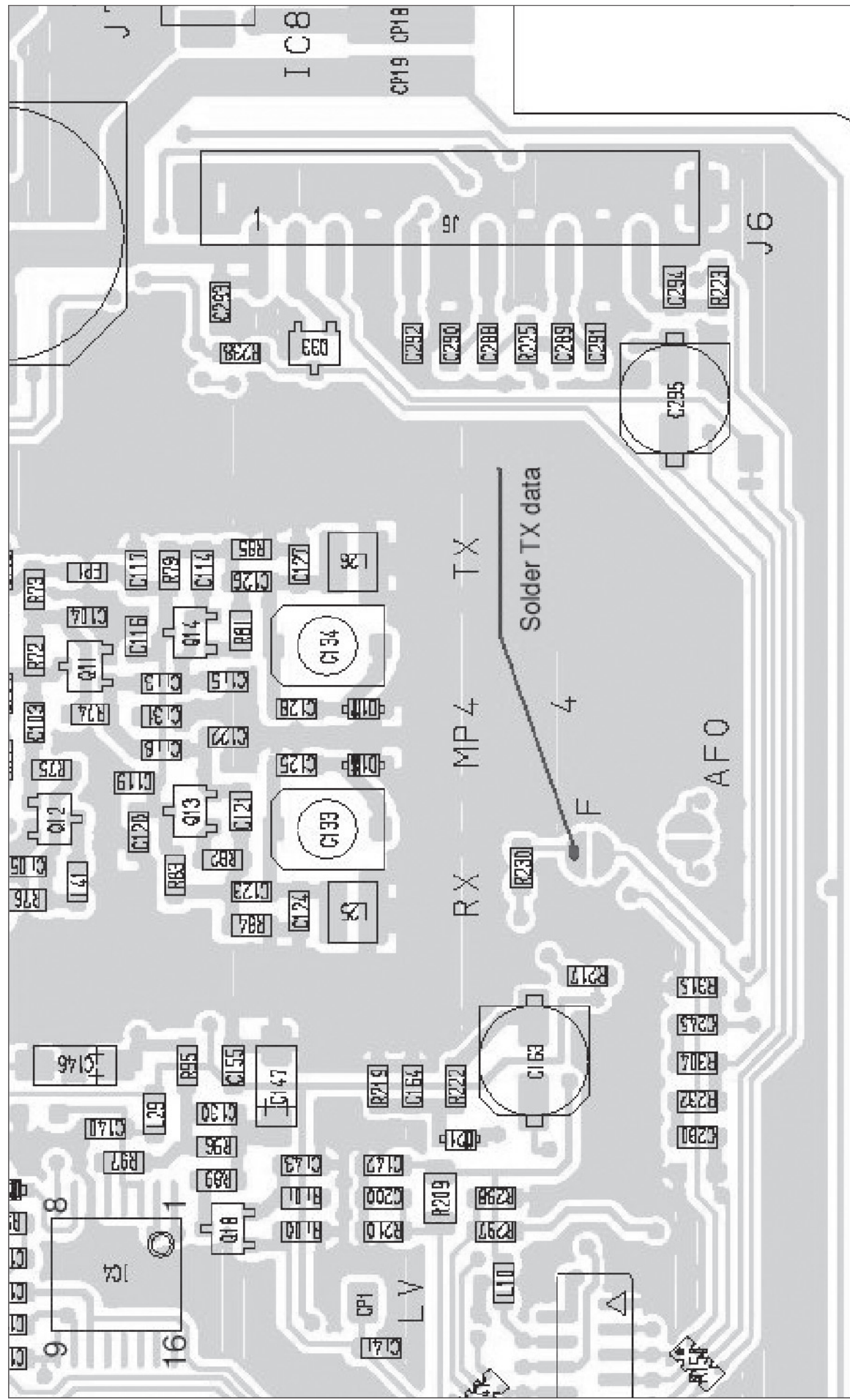
X1	Accessory Connector TX
X2	Accessory Connector RX
X3	FAN
X4	J6 Optional Connector RX
X5	J6 Optional Connector TX

### JUMPER SETTINGS

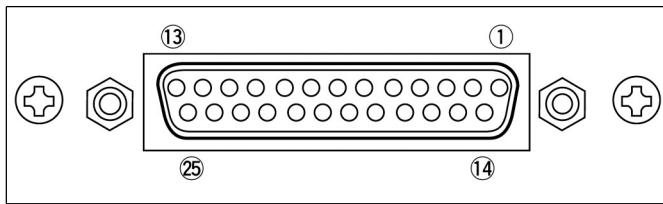
JP2	Repeater Disable
JP3	Transmit On
JP4	Hang On Time
JP5	Hang On Time
JP6	Hang On Time
JP7	Hang On Time
JP8	Audio On







## ■ Accessory connector



### DB25 Pin Outs Configuration

Pin No.	Pin Name	Description	Specification
6	Vcc TX	+15V DC Supply for External Controller, TX Unit	Maximum 1 A
7	GND TX	DC Ground, TX Unit	
8	Busy TX	Output Terminal for Busy Signal, TX Unit Open	Open Collector+OFF, 0V=ON
9	AFO TX	Audio Output, TX Unit	
10	DISC TX	Discriminator Output, TX Unit	
11	TXA TX	Transmit Audio, TX Unit	
12	PTT TX	External PTT, TX Unit	
13	TXD TX	Transmit Data Input, TX Unit	
18	Vcc RX	+15V DC Supply for External Controller, RX Unit	
19	GND RX	DC Ground, RX Unit	
20	Busy RX	Output Terminal for Busy Signal, RX Unit	
21	AFO RX	Audio Output, RX Unit	
22	DISC RX	Discriminator Output, RX Unit	
23	TXA RX	Transmit Audio, RX Unit	
24	PTT RX	External PTT, RX Unit	
25	TXD RX	Transmit Data Input, RX Unit	

## ■ 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 CY-F121S/221S series, see 'Supplied accessories' 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 of critical importance, 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 covering proper antennas and their installation. Check with your local dealer for more information and recommendations.

## ■ Duplexer

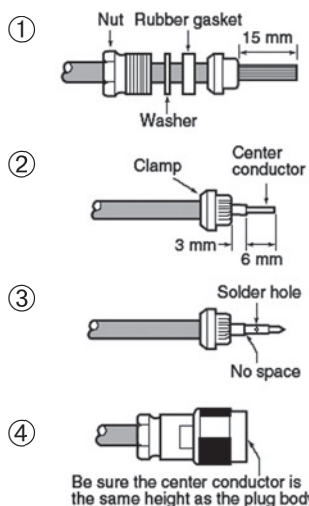
A duplexer is separately required when only one antenna is used for both transmitting and receiving. Select a duplexer according to the transmitting and receiving frequencies. Ask your Dealer for details.

## ■ Grounding

To prevent electrical shock, television interference (TVI), broadcast interference (BCI) and other problems, ground the transceiver through the [GND] terminal on the rear panel.

For best results, connect a heavy gauge wire or strap to a long earth-sunk copper rod. Make the distance between the [GND] terminal and ground 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.



### 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.

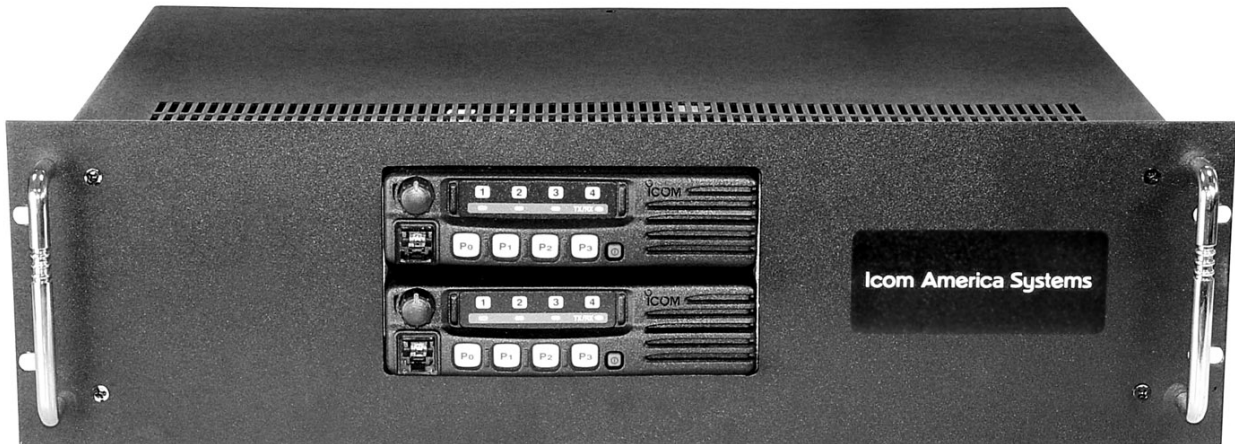
Strip the cable and fold the braid back over the clamp.

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

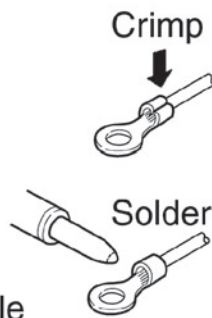
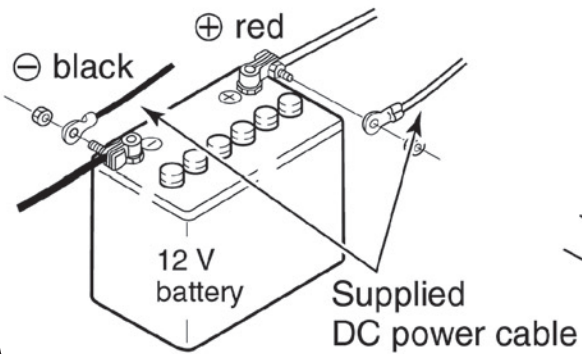
Carefully slide the plug body into place aligning the center conductor pin on the cable. Tighten the nut onto the plug body.

30 mm  $\approx$  9/8 in 10 mm  $\approx$  3/8 in 1–2 mm  $\approx$  1/16 in

## ■ Required Connections

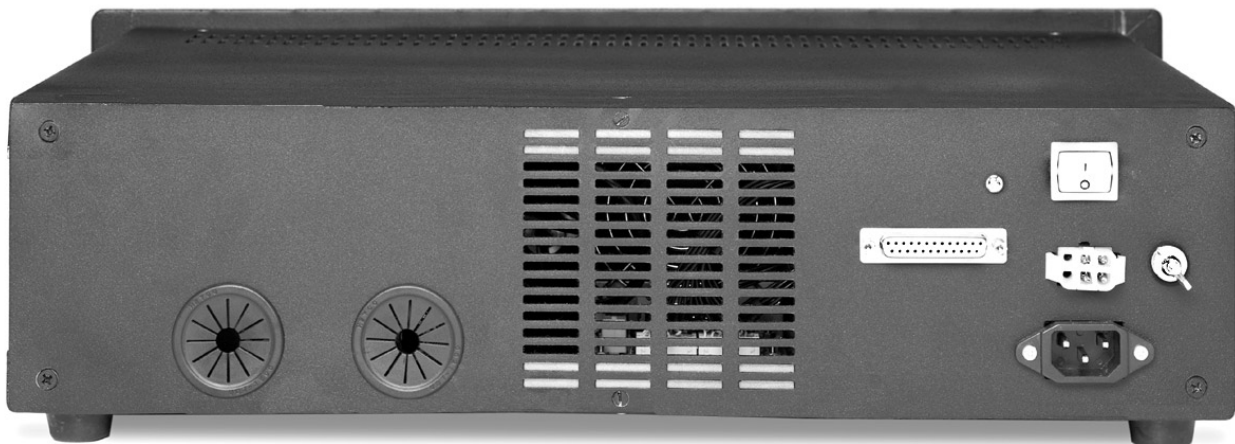


### [DC POWER INPUT TERMINAL]



Make sure the back up battery is correctly connected. Use a cable with following current capacity. Solder or clamp the cable plug when connecting the power cable to the backup battery to prevent voltage drops.

Power cable current capacity: 25 A or more

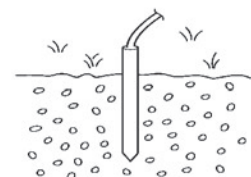


### [TX(TX·RX) ANT]

TX·RX antenna required for installing an internal duplexer.

### [RX ANT]

### GROUND






## ■ Power

Make sure the [POWER] switch is turned OFF when connecting an AC power cable or a backup battery (emergency power supply).


The CY-F121S/221S series can operate with an AC or DC power supply. If AC power is interrupted when operating the repeater with an AC power supply, power is automatically provided to the [BATTERY] terminals.

 **NOTE:** If turning the repeater OFF using the rear panel switch, wait a few seconds before turning it back ON. Otherwise, Logic circuits may not sense the transition and operate correctly.

### □ In AC operation

- Use the supplied AC power cable for connection to a domestic AC outlet.
- Extension cords should not be used unless absolutely necessary. Using improper extension cords could result in fire risk.

### □ In DC operation

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

- DO NOT place the backup battery on or near the repeater. Lead-acid batteries should be placed at least 5 m (16.4 ft.) away from the repeater. Use a heavy duty cable to make the connection and be sure both the positive (red) and negative (black) terminals are correctly connected.
- When connecting to the battery, connect the DC power cable to the repeater first, then the positive (red) terminal and negative (black) terminal to the battery. This is to prevent electric shock or circuit damage.

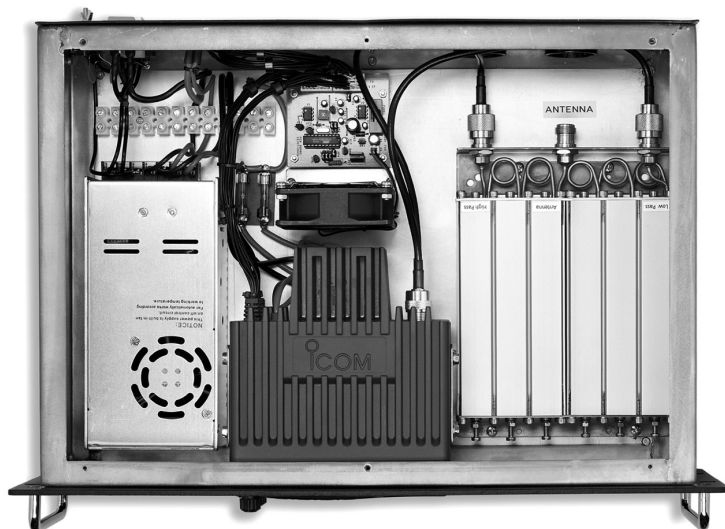


## ■ Opening the repeater's case

Follow the case and cover opening procedures shown here when an optional unit is installed or adjust the internal units, etc.

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

- ① Remove 7 screws from the top of the repeater and 4 screws from the sides, then lift up the top cover.
- ② Turn the repeater upside down.



## ■ Turning power ON

- ① On rear panel, push [POWER] to turn power ON.

## ■ Receiving and transmitting

### □ Receiving

- ① Push [POWER] to turn power ON.
- ② Rotate [VOLUME] to adjust the audio output level.
- ③ Push [1; 2; 3; 4] to select the desired channel.
  - When receiving a signal, BUSY indicator turns ON and audio is emitted from the speaker.
  - Further adjustment of [VOLUME] to a comfortable listening level may be necessary at this point.

### □ Transmitting

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

### IMPORTANT:

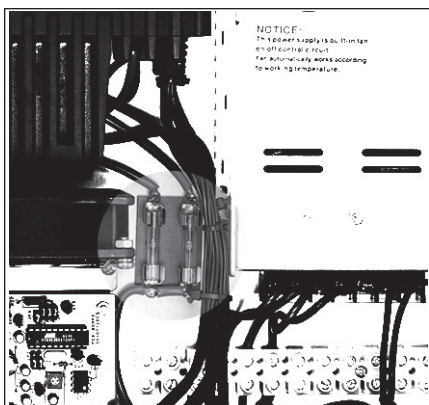
To maximize the readability of the transmitted signal:

- (1) Pause briefly after pushing [PTT].
- (2) Hold the microphone 1 to 2 inch (2.5 to 5 cm) from your mouth, then speak into the microphone at a normal voice level.

## ■ Fuse replacement

If a fuse blows or the repeater stops functioning, try to find the source of the problem, and replace the damaged fuse with a new, rated fuse.

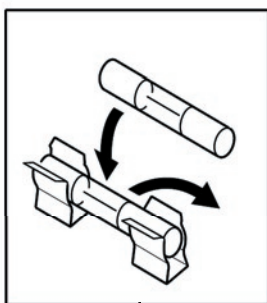
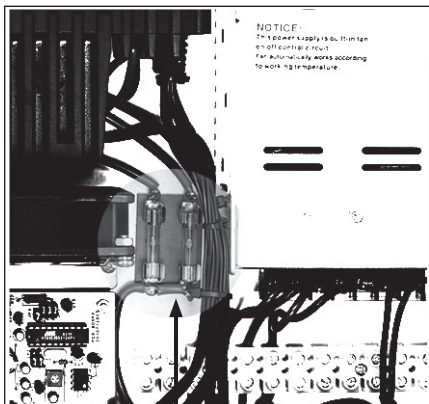
Replace the circuitry fuse as shown below.



“There are two fuses:

The left fuse, as pictured, is for repeater TX

The right fuse is for repeater RX”



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

## ■ Specifications

### ◆ CY-F121S

#### General

- Frequency coverage : 136.000-174.000 MHz\*
- Channel spacing : 12.5/25 kHz (Narrow/Wide)
- Number of channels : Max 8 channels
- Antenna connector : SO-293 (50Ω)
- Power supply voltage : 13.2 V DC nominal [25W]  
(Negative ground) 13.6 V DC nominal [50W]
- Current drain (apporx.) : TX (25W) 7.0 A  
(50W) 13.0 A  
Max. Audio 1.2 A  
Stand-by 0.3 A
- Operating temp. range : -30 °C to +60 °C  
(-22 °F to +140 °F)
- Dimensions (Projections not included)

[25W]: 480 (W) x 133 (H) x  
364 (D) mm; 18.90 (W) x  
5.24 (H) x 14.33 (D) inches

[50W]: 480 (W) x 133 (H) x  
364 (D) mm; 18.90 (W) x  
5.24 (H) x 14.33 (D) inches

- Weight: 8.6 kg; 18 lb [25W]  
8.6 kg; 18 lb [50W]
- RF output power: 25W/10W/2.5W [25W]  
(High/Low2/Low1) 50W/25W/5W [50W]
- Modulation system: Variable reactance freq.  
modulation
- Max. frequency deviation: ±2.5 kHz [Narrow]  
±5.0 kHz [Wide]
- Frequency Error: ±5.0 ppm
- Spurious emission: 70 dB typical
- Adjacent channel power: 60 dB [Narrow]  
70 dB [Wide]
- Audio frequency response: +2 dB to -8 dB of  
6 dB/octave range from:  
300 Hz to 2550 Hz [Narrow]  
300 Hz to 3000 Hz [Wide]
- Audio harmonic distortion : 3% typical at 1 kHz , 40%  
deviation
- FM Hum and noise: 40 dB [Narrow]  
(typical, with CCIT filter) 46 dB [Wide]
- Limiting character of: 70-100% of max deviation  
modulation
- Microphone connector: 8-pin modular (600Ω)

#### Receiver

- Receive system: Double-conversion  
superheterodyne system
- Intermediate frequency: 1<sup>st</sup>: 46.35 MHz, 2<sup>nd</sup>: 450 kHz
- Sensitivity: 0.25 μV at 12 dB SINAD
- Squelch sensitivity: 0.25 μV
- Adjacent channel: 65 dB [Narrow]  
Selectivity (typical) 75 dB [Wide]
- Spurious response: 75 dB
- Intermodulation (typical): 74 dB
- Hum and Noise (typical): 40 dB [Narrow]  
45 dB [Wide]
- Audio output power: 4W typical at 10% distortion  
with a 4Ω load
- External SP connector: 2-conductor 3.5 (d) mm  
(1/8")/4Ω

### ◆ CY-F221S

#### General

- Frequency coverage: 400.000-430.000 MHz\*  
440.000-490.000 MHz\*
- Channel spacing: 12.5/25 kHz (Narrow/Wide)
- Number of channels: Max 8 channels
- Antenna connector: SO-293 (50Ω)
- Power supply voltage: 13.6 V DC nominal  
(negative ground)
- Current drain (apporx.): TX (25W) 7.0 A  
(45W) 13.0 A  
Max. Audio 1.2 A  
Stand-by 0.3 A
- Operating temp. range: -30 °C to +60 °C  
(-22 °F to +140 °F)
- Dimensions (Projections not included)  
[25W]: 480 (W) x 133 (H) x  
364 (D) mm; 18.90 (W) x  
5.24 (H) x 14.33 (D) inches  
[45W]: 480 (W) x 133 (H) x  
364 (D) mm; 18.90 (W) x  
5.24 (H) x 14.33 (D) inches
- Weight: 8.6 kg; 18 lb [25W]  
8.6 kg; 18 lb [45W]

#### Transmitter

- RF output power: 25W/10W/2.5W [25W]  
(High/Low2/Low1) 50W/25W/4.5W [45W]

- Modulation system: Variable reactance freq. modulation
- Max. frequency deviation:  $\pm 2.5$  kHz [Narrow]  
 $\pm 5.0$  kHz [Wide]
- Frequency Error:  $\pm 2.5$  ppm
- Spurious emission: 70 dB typical
- Adjacent channel power: 60 dB [Narrow]  
70 dB [Wide]
- Audio frequency response: +2 dB to -8 dB of  
6 dB/octave range from:  
300 Hz to 2550 Hz [Narrow]  
300 Hz to 3000 Hz [Wide]
- Audio harmonic distortion: 3% typical at 1 kHz , 40% deviation
- FM Hum and noise: 40 dB [Narrow]  
(typical, with CCIT filter) 46 dB [Wide]
- Limiting character of: 70-100% of max deviation modulation
- Microphone connector: 8-pin modular (600 $\Omega$ )

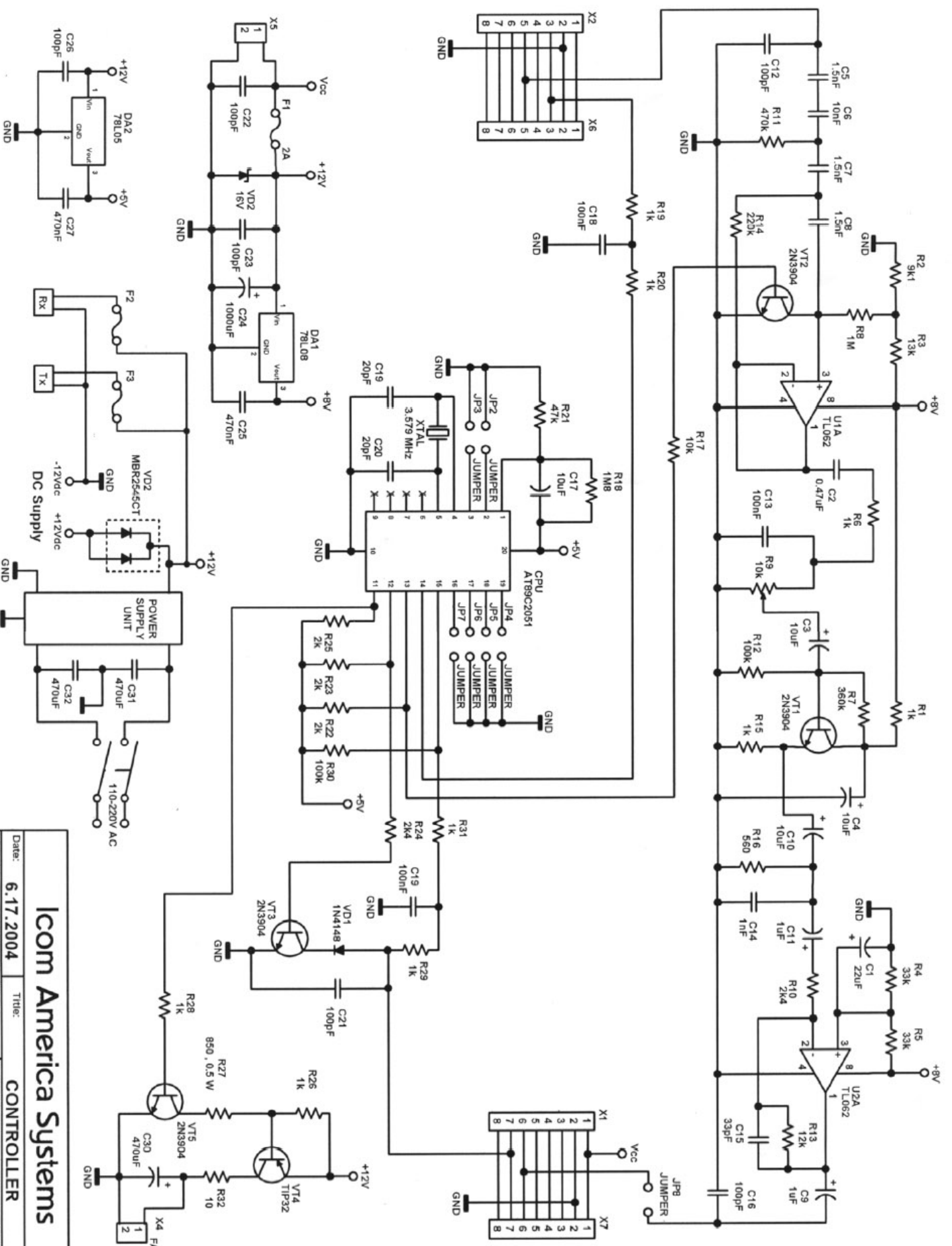
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- Sensitivity: 0.25  $\mu$ V at 12 dB SINAD
- Squelch sensitivity: 0.25  $\mu$ V
- Adjacent channel: 65 dB [Narrow]  
Selectivity (typical) 75 dB [Wide]
- Spurious response: 75 dB
- Intermodulation (typical): 74 dB
- Hum and Noise (typical): 40 dB [Narrow]  
45 dB [Wide]
- Audio output power: 4W typical at 10% distortion  
with a 4 $\Omega$  load
- External SP connector: 2-conductor 3.5 (d) mm  
( $\frac{1}{8}$ " )/4 $\Omega$

## Options

- HM-100 HAND MICROPHONE
- HM-100TN DTMF MICROPHONE  
Hand microphone with a DTMF keypad
- SM-25 DESKTOP MICROPHONE
- IAS VHF DUP KIT VHF duplexer kit with RF jumpers
- IAS UHF DUP KIT UHF duplexer kit with RF jumpers





Icom America Systems

Date: 6.17.2004 Title: CONTROLLER

Model No.: CY.F121/221 Manufacturer: CYCLONE

MEMO

Count on us!

