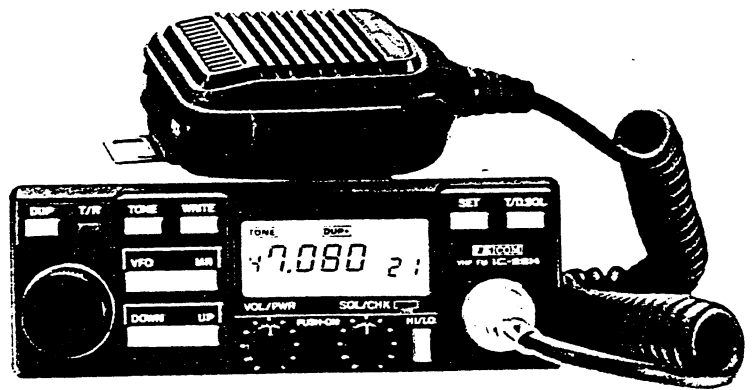


IC-28H

144MHz FM TRANSCEIVER

INSTRUCTION MANUAL



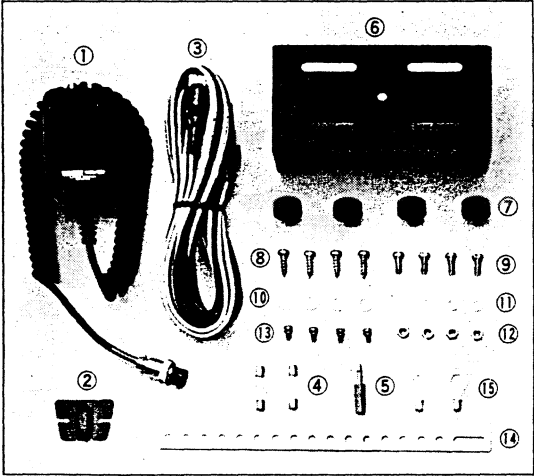
FOREWORD

Congratulations for choosing this technically-advanced ICOM product.

The IC-28H VHF FM transceiver is the latest addition to the ICOM system of Amateur radio equipment. Included in the IC-28H design is provision for use of the newly developed Digital Code Squelch method of communicating. Digital Code Squelch uses the latest digital techniques to create a communications system capable of dramatically reducing the inconvenience of heavily populated Amateur bands. In addition, a full 45 watts gives extra communication range in the IC-28H.

Use the IC-28H with the knowledge that this transceiver, and every ICOM product, is supported by a world-wide network of authorized service centers and dealers ready to provide assistance efficiently.

UNPACKING



IC-28H ACCESSORIES SUPPLIED	QTY.
1. *Microphone	1
2. Microphone hanger	1
3. Power cable	1
4. Fuses (15A)	2
5. External speaker plug.	1
6. Mounting bracket	1
7. Mounting bracket knobs	4
8. Mounting screws (self-tapping)	4
9. Mounting screws	4
10. Flat washers (large)	4
11. Flat washers (small).	4
12. Nuts	4
13. Screws/spring washers	4
14. Support bracket.	1
15. Cable lugs	2

* U.S.A. version : HM-12
 Europe, Italy and Spain versions : HM-15

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SECTION 1 SPECIFICATIONS

1-1 GENERAL

Frequency coverage	:	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: left;">MODEL</th> <th colspan="2">GUARANTEED RANGE</th> <th colspan="2">OPERATIONAL RANGE</th> </tr> <tr> <th>TRANSCEIVER</th> <th>RECEIVER</th> <th>TRANSMITTER</th> <th></th> </tr> </thead> <tbody> <tr> <td>U.S.A. version</td> <td>144.00 ~ 148.00</td> <td>138.00 ~ 174.00</td> <td>140.10 ~ 150.00</td> <td></td> </tr> <tr> <td>Australia version</td> <td>144.00 ~ 148.00</td> <td>144.00 ~ 148.00</td> <td>144.00 ~ 148.00</td> <td></td> </tr> <tr> <td>Europe version</td> <td>144.00 ~ 146.00</td> <td>144.00 ~ 146.00</td> <td>144.00 ~ 146.00</td> <td></td> </tr> <tr> <td>Italy, Spain versions</td> <td>144.00 ~ 148.00</td> <td>140.00 ~ 150.00</td> <td>140.00 ~ 150.00</td> <td></td> </tr> </tbody> </table>	MODEL	GUARANTEED RANGE		OPERATIONAL RANGE		TRANSCEIVER	RECEIVER	TRANSMITTER		U.S.A. version	144.00 ~ 148.00	138.00 ~ 174.00	140.10 ~ 150.00		Australia version	144.00 ~ 148.00	144.00 ~ 148.00	144.00 ~ 148.00		Europe version	144.00 ~ 146.00	144.00 ~ 146.00	144.00 ~ 146.00		Italy, Spain versions	144.00 ~ 148.00	140.00 ~ 150.00	140.00 ~ 150.00	
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Italy, Spain versions	144.00 ~ 148.00	140.00 ~ 150.00	140.00 ~ 150.00																												
Frequency resolution	:	U.S.A., Australia versions 5, 10, 15, 20 or 25kHz (programmable) Europe, Italy, Spain versions 12.5 or 25kHz (programmable)																													
Frequency control	:	CPU based 5kHz (or 6.25kHz) step digital PLL synthesizer Simplex and semi-duplex capability (programmable offset)																													
Memory channels	:	21 channels																													
Usable temperature range	:	-10°C ~ +60°C (+14°F ~ +140°F)																													
Power supply requirement	:	13.8V DC ±15% (negative ground) AC power supply is available for AC operation.																													
Current drain (at 13.8V DC)	:	Transmit <table style="margin-left: 20px;"> <tr> <td>HIGH (45W)</td> <td>Maximum</td> <td>9.5A</td> </tr> <tr> <td>LOW (5W)</td> <td>Approx.</td> <td>3.5A</td> </tr> </table> Receive <table style="margin-left: 20px;"> <tr> <td>Max. audio output</td> <td>Approx.</td> <td>800mA</td> </tr> <tr> <td>Squelched</td> <td>Approx.</td> <td>450mA</td> </tr> </table>	HIGH (45W)	Maximum	9.5A	LOW (5W)	Approx.	3.5A	Max. audio output	Approx.	800mA	Squelched	Approx.	450mA																	
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LOW (5W)	Approx.	3.5A																													
Max. audio output	Approx.	800mA																													
Squelched	Approx.	450mA																													
Antenna impedance	:	50 ohms unbalanced																													
Dimensions	:	140(140)mm(W) x 50(50)mm(H) x 155(171)mm(D) Bracketed values include projections																													
Weight	:	1.2kg																													

1-2 TRANSMITTER

Output power	:	HIGH 45W LOW 5W
Emission mode	:	16K0F3E (16K0F2D: When operating with an optional UT-28)
Modulation system	:	Variable reactance frequency modulation
Max. frequency deviation	:	±5.0kHz
Spurious emission	:	More than 60dB below carrier
Microphone	:	600 ohm electret condenser with push-to-talk and scanning switches (Europe, Italy, Spain versions 1750Hz tone burst switch)

1-3 RECEIVER

Receive system	:	Double-conversion superheterodyne
Modulation acceptance	:	16K0F3E
Intermediate frequencies	:	1st 17.2MHz 2nd 455kHz
Selectivity	:	More than 12.5kHz at -6dB Less than 25.0kHz at -60dB
Sensitivity	:	Less than 0.18µV for 12dB SINAD
Audio output	:	More than 2.4 watts at 10% distortion with 8 ohm load
Audio output impedance	:	4 ~ 8 ohms

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

SECTION 2 FEATURES

- **COMPACT AND HIGH OUTPUT POWER 144MHz MOBILE**

Smaller than many conventional automobile broadcast band receivers, the sophisticated IC-28H transceiver provides 45W of powerful output on any frequency in the 2 meter band and contains an internal speaker as well.
- **SIMPLE PANEL DESIGN**

Front panel layout is extremely simple in spite of the great number of functions available. The total number of controls on the front panel is significantly fewer than other models currently available while, at the same time, new features have been added resulting in a mobile unit that is safe and easy to use while driving without sacrificing performance.
- **HIGHLY VISIBLE LCD READOUT**

The LCD front panel readout features a particularly wide viewing angle designed to enable the driver to easily see the display, even in bright daylight, without changing position.
- **AUTOMATIC DIMMER CIRCUIT**

Variations in ambient light conditions pose no problems when using the IC-28H since the built-in light sensor automatically adjusts a dimmer circuit to control the backlighting of the display to suit the time of day or night that you are operating. This feature is particularly convenient for night operation to reduce eye fatigue caused by overly bright displays.
- **21 MEMORY CHANNELS**

The IC-28H introduces a large capacity memory with 21 fully programmable memory channels. These memory channels place a variety of communications functions at the fingertips of the driver.
- **DUAL SCANNING FUNCTIONS**
 - **FREQUENCY SCAN:**

The entire band is searched continuously with frequency increments specified by the operator.
 - **MEMORY SCAN:**

All memory channels are continuously checked.
- **SUBAUDIBLE TONE ENCODER STANDARD**

With 38 different subaudible tones standard on the IC-28H (U.S.A. version), maximum communications coverage is assured by allowing full access to all your local repeaters.
- **SQUELCH OPTIONS**

Two new optional units specially designed for the IC-28H are ideal for handling the crowded band conditions found on 2 meters in many locations. Either the UT-28 or the UT-29 may be installed.

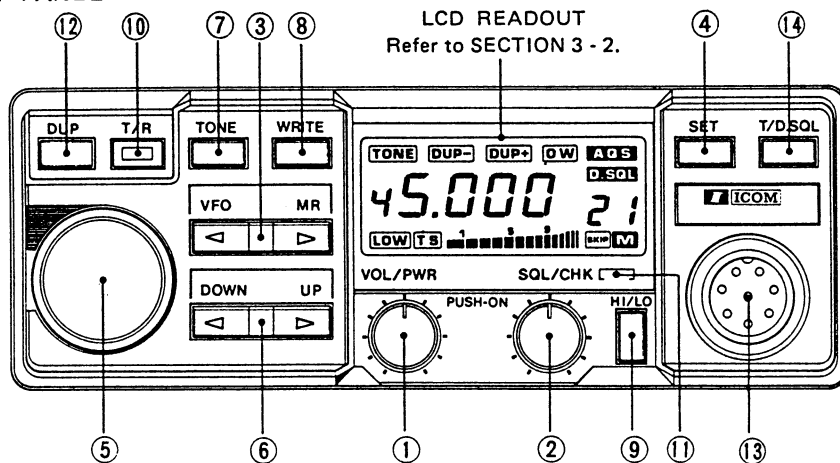
 - **UT-28 DIGITAL CODE SQUELCH UNIT:**

Incorporating a system of digital coding and decoding, the UT-28 option allows a "personalized" squelch to be programmed using 1 of 100,000 different code numbers.
 - **UT-29 TONE SQUELCH UNIT:**

The UT-29 is a subaudible tone encoder/decoder which may be installed as an alternative to the UT-28 Digital Code Squelch Unit.

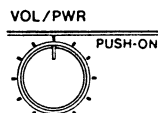
SECTION 3 CONTROL FUNCTIONS

3-1 FRONT PANEL



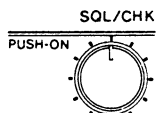
- ① VOLUME CONTROL/POWER SWITCH [VOL/PWR]

Push this control to turn the power ON and OFF. Turn the control clockwise to increase the audio level. Refer to SECTION 5 - 1 RECEIVING.



- ② SQUELCH CONTROL/CHECK SWITCH [SQL/CHK]

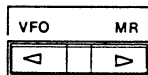
The squelch circuit quiets the noise from the receiver while no signals are being received. While monitoring a vacant channel, turn the control clockwise until the green T/R LED goes out. Refer to SECTION 5 - 1 RECEIVING.



A second function of this control is to allow the operator to monitor the transmit frequency when the duplex mode is selected. Push the control to use the CHECK function. The receive frequency is restored when the control is released. Refer to SECTION 5 - 4 DUPLEX PROGRAMMING.

- ③ VFO/MEMORY READ SWITCH [VFO/MR]

Push to select either the VFO mode or the MEMORY mode of operation. When the MEMORY mode is selected, the letter "M" appears under the memory channel number on the LCD readout. Refer to SECTIONS 5 - 1 RECEIVING and 5 - 2 MEMORY READING.



- ④ SET SWITCH [SET]

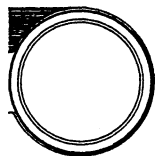
This is a multi-function switch which operates in different ways depending on which mode is currently selected with the IC-28H.



In the VFO mode, the SET SWITCH permits programming of the subaudible tone encoder on the IC-28H (U.S.A. version), the transmit offset frequency and the tuning step size of the TUNING CONTROL. Refer to SECTIONS 5 - 4 SUBAUDIBLE TONE ENCODER and DUPLEX PROGRAMMING, and 5 - 1 RECEIVING.

In the MEMORY mode, the SET SWITCH controls the skip function. The skip function allows memory channels to be deleted from the normal scanning sequence when memories are being scanned. Refer to SECTION 5-3 MEMORY CHANNEL SCANNING.

⑤ TUNING CONTROL

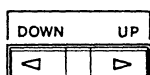


The function of this control is affected by the mode of operation being used.

- In the VFO mode, turn clockwise to increase the operating frequency and counterclockwise to decrease it. After pushing the SET SWITCH, the TUNING CONTROL is used to select the subaudible tone number on the IC-28H (U.S.A. version), to set the amount of transmit offset when using the duplex mode and to select the tuning step size for frequency changes with the TUNING CONTROL. Refer to SECTIONS 5-4 SUBAUDIBLE TONE ENCODER and DUPLEX PROGRAMMING, and 5-1 RECEIVING.

- In the MEMORY mode, turn clockwise to increase the selected memory channel and counterclockwise to decrease it. Refer to SECTION 5-2 MEMORY READING.

⑥ DOWN/UP SWITCH [DOWN/UP] This switch operates differently depending on the setting of the VFO/MR SWITCH.



In the VFO mode, push to change the selected operating frequency in 1MHz increments. In the MEMORY mode, push to change the selected memory channel in one channel increments. Refer to SECTIONS 5-1 RECEIVING and 5-2 MEMORY READING.

⑦ TONE SWITCH [TONE] (IC-28H U.S.A. version)



The name and function of this switch varies depending on the version of transceiver.

- TONE SWITCH: Push to turn ON and OFF the subaudible tone encoder when using the duplex mode. The word "TONE" appears when the tone encoder is turned ON. Refer to SECTION 5-4 SUBAUDIBLE TONE ENCODER.

CALL SWITCH [CALL] (except U.S.A. version)



- CALL SWITCH: Push to select the call channel which has been programmed in memory channel 21. The letter "C" appears in place of the memory channel number when the call function is activated. Refer to SECTION 5-5 CALL CHANNEL FUNCTION.

⑧ WRITE SWITCH [WRITE]



This switch works differently depending on the setting of the VFO/MR SWITCH.

- In the VFO mode, push to store the displayed frequency on the LCD readout in the memory channel represented by the memory channel number also displayed. Refer to SECTION 5-2 MEMORY PROGRAMMING.

28H

⑨ HIGH/LOW SWITCH [HI/LO]



• In the MEMORY mode, push to transfer the displayed frequency, which is the contents of the selected memory channel, to the VFO. After the transfer, the IC-28H changes to the VFO mode. Refer to SECTION 5 - 2 MEMORY CHANNEL TO VFO TRANSFERS.

Push to change between the HIGH (45W) and LOW (5W) transmit output power. The word "LOW" appears when LOW power is selected.

⑩ TRANSMIT/RECEIVE INDICATOR [T/R]



This two-color LED indicates whether the IC-28H is in the transmit or receive mode. The LED is red while transmitting and green while receiving with the squelch circuit open. The indicator is OFF when the squelch circuit is closed and the receiver is muted.

⑪ DISPLAY DIMMER SENSOR

This sensor measures the ambient light and controls the display dimmer circuit which varies the intensity of the LCD backlighting.

⑫ DUPLEX SWITCH [DUP]

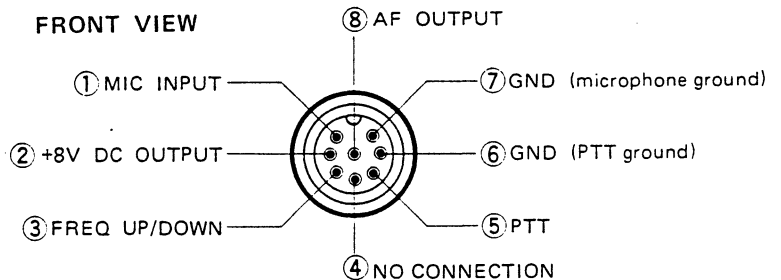


Push to select simplex or duplex operation:

- The transmit frequency is LOWER than the receive frequency by 600kHz or by the programmed offset amount when "DUP-" appears on the display.
- The transmit frequency is HIGHER than the receive frequency by 600kHz or by the programmed offset amount when "DUP+" appears on the display.
- When neither "DUP-" nor "DUP+" appear on the display, the IC-28H is in the simplex mode. The transmit and receive frequencies are equal at this time. Refer to SECTION 5 - 4 DUPLEX MODE.

⑬ MIC CONNECTOR

Connect the supplied microphone to this connector. Refer to SECTIONS 4 - 1 MOBILE INSTALLATION, 4 - 2 FIXED INSTALLATION and 5 - 6 MICROPHONE.



⑭ TONE SQUELCH SWITCH DIGITAL SQUELCH SWITCH [T/D.SQL]



This switch turns ON and OFF the optional squelch systems:

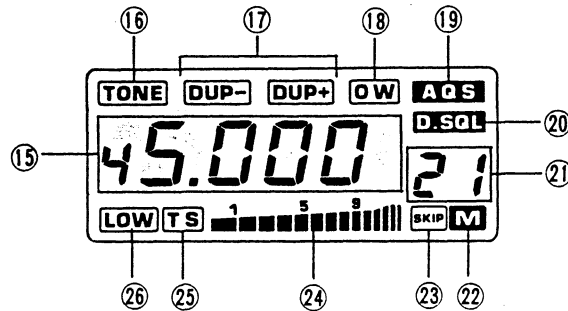
- TONE SQUELCH SYSTEM
When activated, "TONE" and "D.SQL" appear on the display. Push the SET SWITCH in order to program the desired subaudible tone numbers. Refer to SECTION 5 - 9 OPTIONAL UNITS.

This switch has no function when neither option is installed.

• DIGITAL CODE SQUELCH SYSTEM

When activated, "D.SQL" appears on the display. Push the SET SWITCH in order to program the desired group code. Refer to SECTION 5 - 9 OPTIONAL UNITS.

3 - 2 LCD READOUT



⑮ FREQUENCY

The operating frequency is displayed with digits representing the 10MHz, 1MHz, 100kHz, 10kHz and 1kHz positions. Additionally, the IC-28H Europe, Italy and Spain versions display the 100Hz digit.

The decimal point on the display flashes during scanning operations. Also, the subaudible tone number, the transmit offset, the tuning step size, and the group code for the optional digital code squelch are displayed on the LCD readout.

⑯ SUBAUDIBLE TONE INDICATOR "TONE"

Appears when the subaudible tone encoder is activated. Also, appears when the optional UT-29 Tone Squelch unit is activated. Refer to SECTIONS 5 - 4 SUBAUDIBLE TONE ENCODER and 5 - 9 OPTIONAL UNITS.

⑰ DUPLEX MODE INDICATORS "DUP-, DUP+"

Appear while the IC-28H is being operated in the duplex mode (transmit frequency different from the receive frequency). Both indicators disappear while operating in the simplex mode. Refer to SECTION 5 - 4 DUPLEX PROGRAMMING.

⑱ OFFSET WRITE INDICATOR "OW"

Flashes when the IC-28H is ready to have the transmit offset programmed for duplex operation. Refer to SECTION 5 - 4 DUPLEX PROGRAMMING.

⑲ GROUP CODE INDICATOR "AQS"

Flashes when the IC-28H is ready to have the group code programmed when using the optional UT-28 Digital Code Squelch unit. Refer to SECTION 5 - 9 OPTIONAL UNITS.

⑳ SQUELCH SYSTEM INDICATOR "D.SQL"

Appears when either the optional tone squelch or optional digital code squelch system is activated. Flashes with the TONE INDICATOR when the IC-28H is ready to have the subaudible tone number for the tone squelch programmed. Refer to SECTION 5 - 9 OPTIONAL UNITS.

②① MEMORY CHANNEL NUMBER

This area displays various symbols:

- Selected memory channels "1" to "21".
- Offset programming symbol "F" or "P".
- Call channel function "C".
IC-28H except U.S.A. version.
- Subaudible tone encoder memory number "1", "2" or "3".
IC-28H U.S.A. version.

②② MEMORY MODE INDICATOR "M"

Appears when the MEMORY mode is selected with the VFO/MR SWITCH. Refer to SECTION 5 - 2 MEMORY READING.

②③ MEMORY CHANNEL SKIP INDICATOR "SKIP"

Appears when a particular memory channel has been programmed with the SET SWITCH to be excluded from the memory scan operation. Refer to SECTION 5 - 3 MEMORY SKIP FUNCTION.

②④ S/R/F INDICATOR

- LOW power : 5 segments appear
- HIGH power : All segments appear

In the receive mode, this indicator operates as an S-meter showing the receive signal level. In the transmit mode, the relative output power of the transmitter is indicated as follows at left:

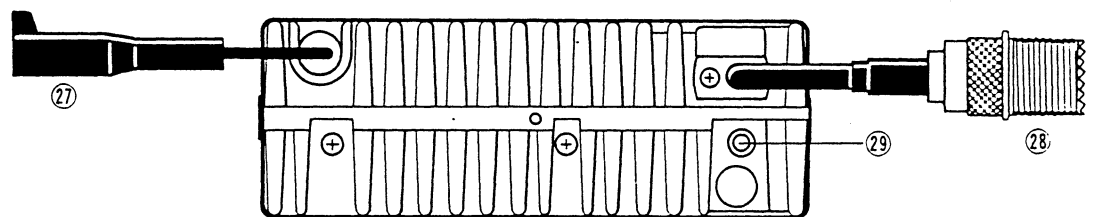
②⑤ TUNING STEP INDICATOR "TS"

Flashes when the IC-28H is ready for programming of the VFO step size. Use the TUNING CONTROL to select the desired step size. Refer to SECTION 5 - 1 SELECTING A FREQUENCY.

②⑥ OUTPUT POWER INDICATOR "LOW"

Appears when the transmitter LOW power is selected with the HI/LO SWITCH. The indicator does not appear when the transmitter HIGH power is used. Refer to SECTION 5 - 1 SELECTING OUTPUT POWER.

3 - 3 REAR PANEL



②⑦ POWER CONNECTOR

Connect 13.8V DC $\pm 15\%$ from a stable power source to this connector. Refer to SECTION 4 INSTALLATION.

②⑧ ANTENNA CONNECTOR

Connect a 50 ohm antenna with a PL-259 connector on the feedline to this connector. Refer to SECTION 4 INSTALLATION.

②⑨ EXTERNAL SPEAKER JACK

Connect a 4 ~ 8 ohm speaker to this jack, if required. Connecting the external speaker automatically disconnects the internal speaker. Refer to SECTION 4 INSTALLATION.

SECTION 4 INSTALLATION

4-1 MOBILE INSTALLATION

■ LOCATION

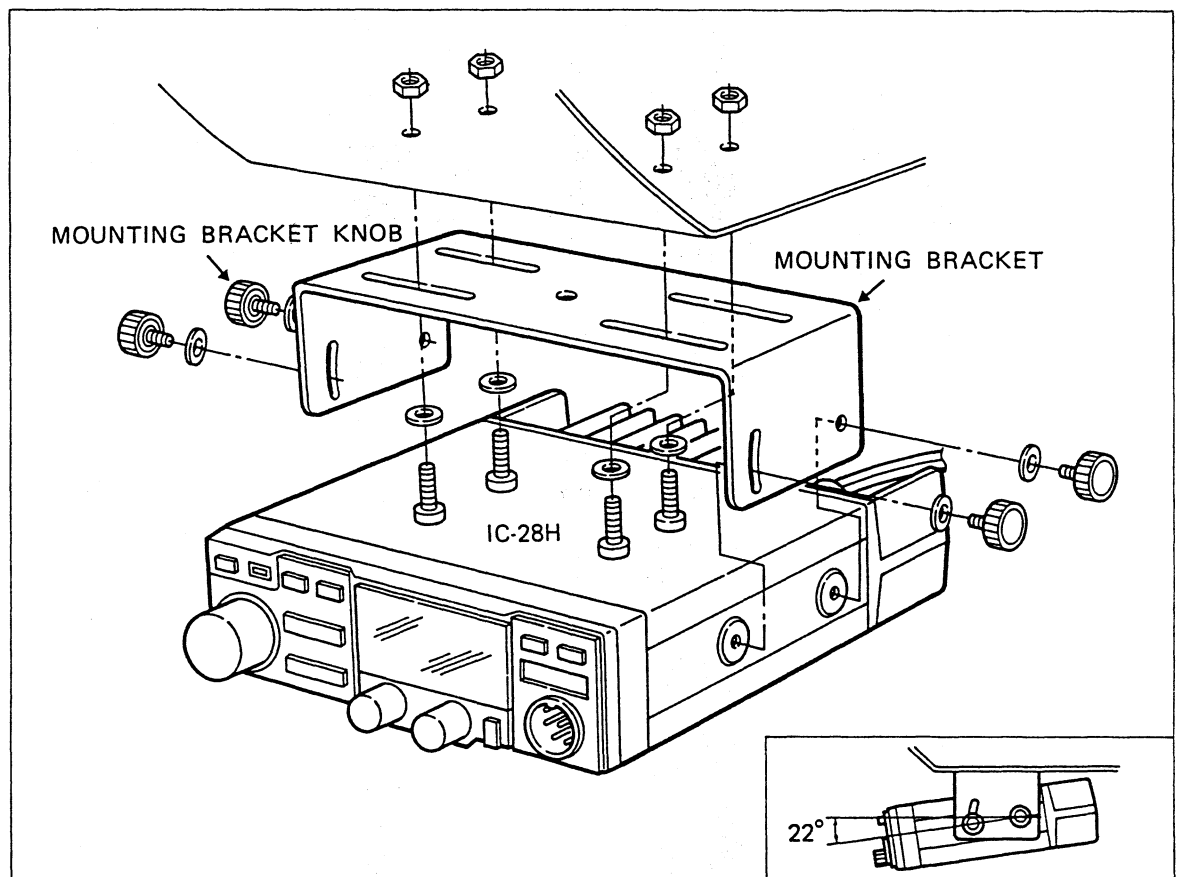
Where you place the IC-28H in your vehicle is not critical. The location should be accessible and convenient to reach from the driver's seat. There are numerous mounting possibilities since the transceiver is so compact. In general, the mounting bracket provides a guide for the installation location.

Keep the following items in mind when planning the mounting location:

- Avoid locations where hot or cold air can blow directly on the unit or where there are large temperature variations.
- Avoid mounting the transceiver where it will hinder the normal operation of the vehicle.
- Securely mount the transceiver with the supplied bracket to minimize vibration.

■ INSTALLATION

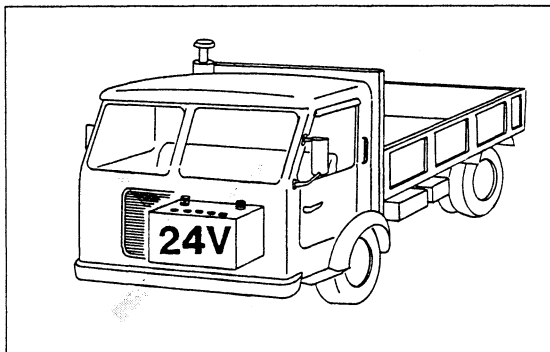
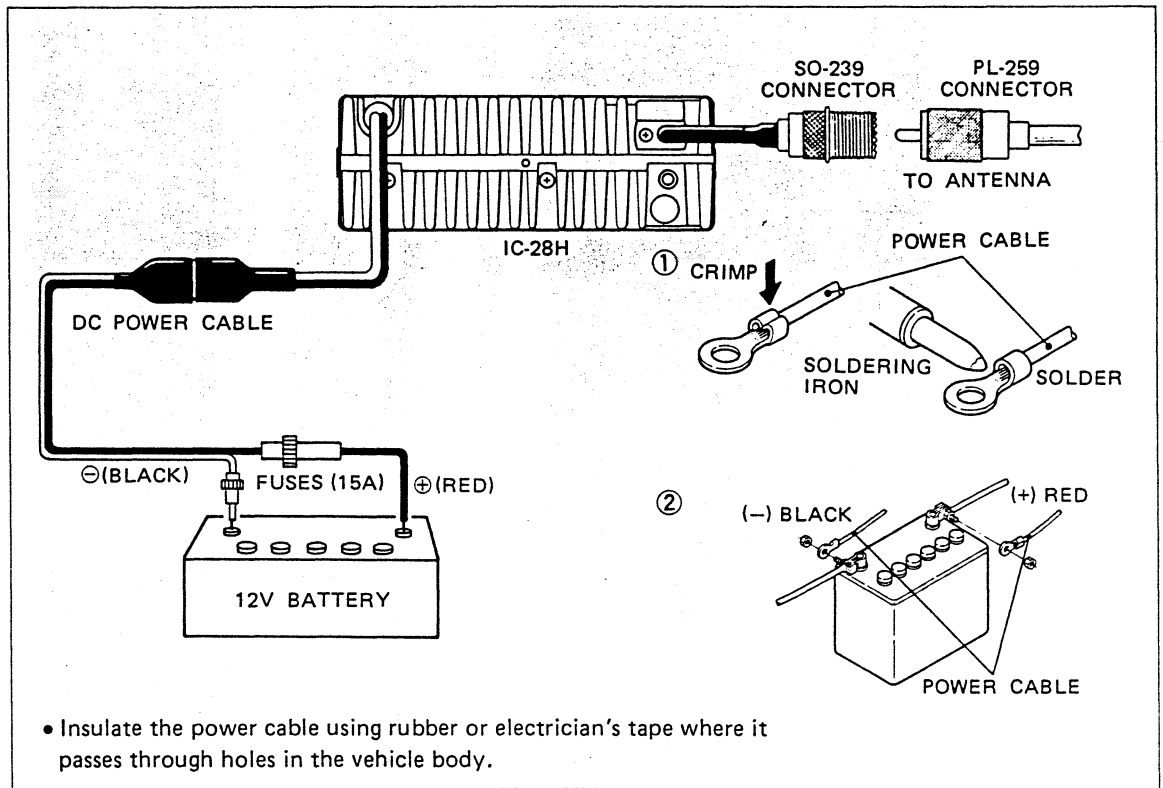
The installation angle of the IC-28H can be varied by approximately 22 degrees. Adjust the angle for the clearest view from the operating position.



■ CONNECTIONS

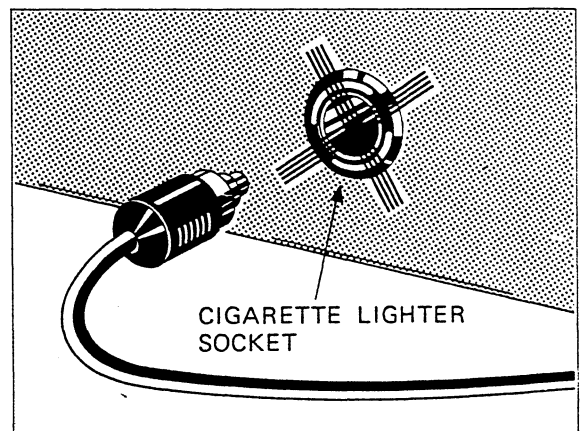
Connect the unit directly to a 12V battery using the supplied power cable. Note the polarity of the connections:

- RED cable : POSITIVE (+) terminal
- BLACK cable: NEGATIVE (-) terminal



- The IC-28H cannot be connected directly to a 24V battery.

- Do not use the cigarette lighter socket for a power connection.



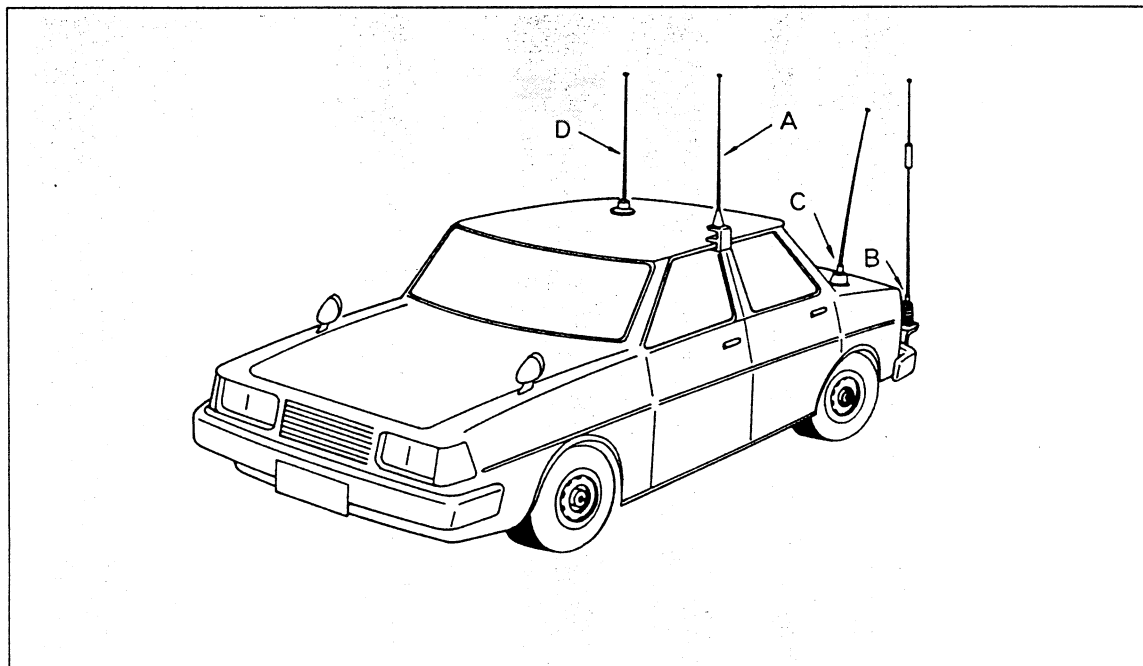
■ ANTENNA

Transceiver performance largely depends on the quality of the antenna used. Select a high-quality antenna and use it as recommended by the manufacturer.

■ COAXIAL CABLE

Use a large diameter 50 ohm coaxial cable. The added efficiency of the larger cable is important in the VHF spectrum to reduce cable loss.

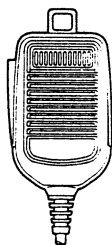
■ ANTENNA LOCATION



- A: Gutter-mount antenna
- B: Bumper-mount antenna
 - Best location for longer antennas.
- C: Trunk-mount antenna
- D: Roof-mount antenna
 - Best location for a good radiation pattern.
 - Drill a hole in the roof, or use a magnetic antenna base.

■ MICROPHONE

A high-quality electret condenser microphone is supplied with the IC-28H. Plug it directly into the jack on the front panel of the transceiver.



Optional microphones are available for mobile use with the IC-28H.

- IC-HM14: DTMF Microphone
- IC-HM16: Speaker-microphone (U.S.A. and Australia versions)
- IC-HM17: Speaker-microphone (Europe, Italy and Spain versions)
- HS-15 : Flexible Mobile Microphone
- HS-15SB: Switch Box for HS-15 Microphone

■ EXTERNAL SPEAKER

An external speaker plug is supplied with the IC-28H for use with an optional external speaker if you feel you require one. The external speaker impedance should be 4 ~ 8 ohms. The internal speaker is disconnected when the external speaker is connected.

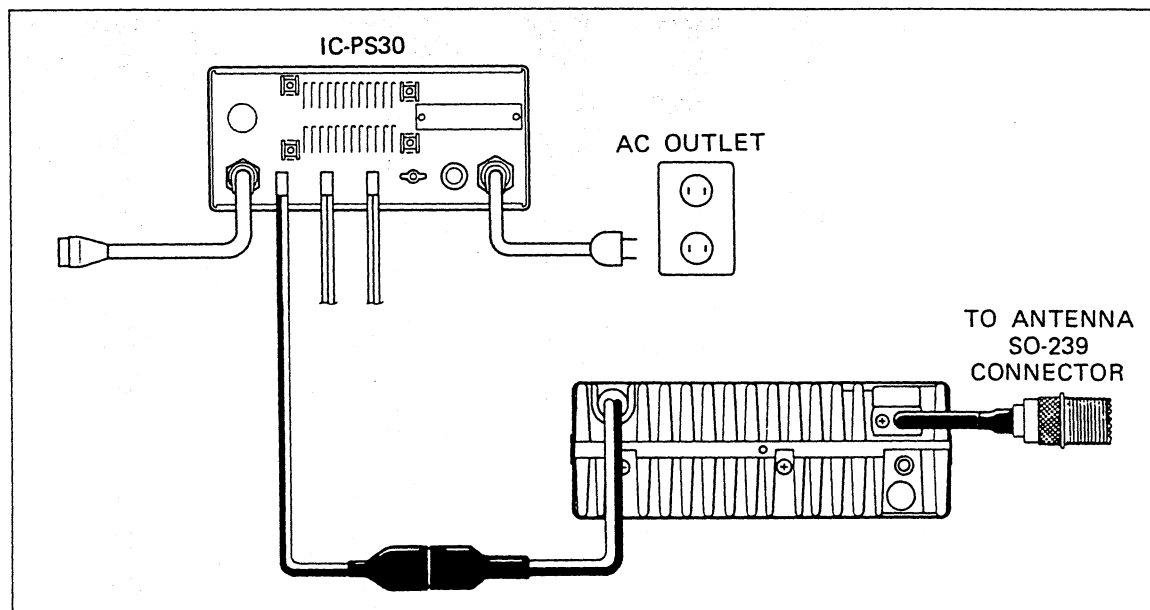
The SP-10 speaker is recommended for mobile use with the IC-28H.

4-2 FIXED INSTALLATION

■ CONNECTIONS

A stable AC power supply with a protective circuit is required for base station use.

CAUTION: Voltages greater than 16 volts DC will damage your transceiver. Check the source voltage before connecting the power cord.



■ ANTENNA

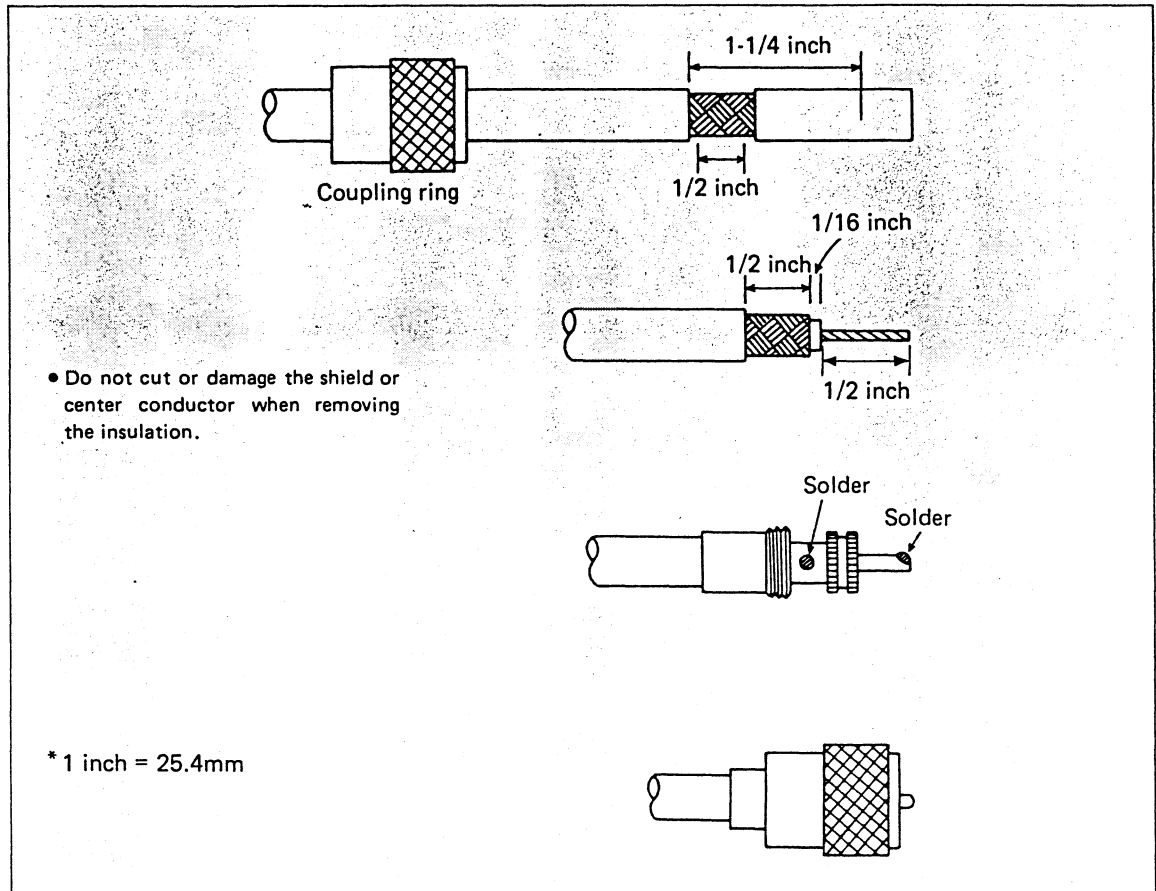
Antenna performance is crucial for reliable radio communications. For this reason, a 50 ohm directional antenna is well worth the extra investment. A tremendous variety of fixed location antennas are available from various manufacturers. Choose one most suited for your needs.

■ COAXIAL CABLE

Particularly in a fixed location installation where feedline lengths are often longer than in a mobile installation, it is best to use a coaxial cable with the lowest loss available.

At 144MHz, a 50 foot length of military grade RG-58A causes a loss of approximately 23 watts due to cable loss when using the IC-28H. An equal length of military grade RG-8A causes only approximately 12 watts loss due to cable loss. Therefore, simply by using a better quality cable, the power reaching the antenna will be about 33 watts instead of 22 watts.

■ INSTALLING PL-259 CONNECTORS



- 1) Slide the coupling ring over the coaxial cable.
- 2) Strip the cable as in the figure, and tin about 1/2" (13mm) of the shield conductor.
- 3) Remove the outer plastic casing and strip the center conductor insulation as in the figure. Tin the center conductor.
- 4) Slide the connector body onto the cable and solder.
- 5) Screw the coupling ring onto the connector body.

■ MICROPHONE

In addition to the microphones suggested in SECTION 4 - 1 MICROPHONE, also useful for base operation are the following:

- SM-8 : Desk Microphone
- SM-10: Compressor/Graphic Equalizer Microphone

■ EXTERNAL SPEAKER

In addition to the SP-10 mentioned in SECTION 4 - 1 EXTERNAL SPEAKER, the SP-7 Base Speaker is another optional speaker which is best for operation from a fixed location.

SECTION 5 OPERATION

5-1 BASIC OPERATION

■ RECEIVING

CONTROL	INITIAL SETTINGS
VOL/PWR	COUNTERCLOCKWISE
SQL/CHK	COUNTERCLOCKWISE

1) Push VOL/PWR CONTROL.

1) Push the VOL/PWR CONTROL to turn ON the power.

- The green T/R INDICATOR lights and the LCD READOUT displays the frequency and memory channel number last used.

- If the MEMORY mode was being used immediately prior to turning off the power to the IC-28H, the MEMORY mode is retained and the last used memory channel number and contents of that memory appear.

2) Adjust volume level.

2) Turn the VOL/PWR CONTROL clockwise until an adequate sound level is obtained.

3) Adjust squelch level.

3) Slowly turn the SQL/CHK CONTROL clockwise until the received noise is quieted.

- Perform this setting only on a vacant frequency (no received signal).

- The green T/R INDICATOR goes out.

- Setting the squelch in this manner mutes all sound from the speaker until a signal is received. On receiving a signal, it opens the squelch circuit and the signal is audible.

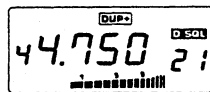
- Do not advance the SQL/CHK CONTROL beyond the point where the green T/R INDICATOR goes out or weak signals will not be heard.

4) Select operating frequency.

4) Select the desired operating frequency by using either the TUNING CONTROL, or the UP or DN SWITCH on the microphone.

- If the letter "M" appears on the display below the memory channel number, push the VFO side of the VFO/MR SWITCH to clear the MEMORY mode.

- When a signal is received, the green T/R INDICATOR lights, the S/RF INDICATOR displays the signal strength and the audio is heard from the speaker.



A strong signal being received at 144.750MHz. The duplex mode and optional digital code squelch are activated.

10-284

● **SELECTING A FREQUENCY**

Select the VFO mode by using the VFO/MR SWITCH. Select your desired frequency by the following procedure.

Ⓐ **USING THE TUNING CONTROL**

1) Use DOWN/UP SWITCH to set correct MHz digit.

1) Use the DOWN/UP SWITCH on the front panel to select the correct MHz range.

• Each time this switch is pushed, the frequency changes by 1MHz down or up.

2) Set tuning step size with SET SWITCH and TUNING CONTROL.

2) Push the SET SWITCH repeatedly until the TS INDICATOR appears flashing on the display.

• The currently programmed tuning step size also appears:
U.S.A. and Australia versions : 5, 10, 15, 20 or 25kHz
Europe, Italy and Spain versions : 12.5 or 25kHz

• To change the tuning step size, turn the TUNING CONTROL until the desired step size appears.

3) Select VFO mode.

3) Push the VFO side of the VFO/MR SWITCH to select the VFO mode.

4) Select frequency with TUNING CONTROL.

4) Use the TUNING CONTROL to select the exact frequency desired.

• As the TUNING CONTROL is turned, the frequency changes in increments as set in step 2).

Ⓑ **USING THE MICROPHONE**

1) Select correct MHz range and set tuning step size.

1) Follow steps 1) through 3) under Ⓐ USING THE TUNING CONTROL.

2) Push UP or DN SWITCH on microphone.

2) Push the UP SWITCH or DN SWITCH on the microphone until the correct frequency appears on the display.

NOTE: The microphone SCAN SWITCH must be ON.

• Each time the UP SWITCH or DN SWITCH is pushed, the frequency changes by one increment.

• If these switches are held down for longer than about 1/2 second, the frequency scan function begins. Refer to SECTION 5 - 3 FREQUENCY SCANNING.

■ **TRANSMITTING**

Before transmitting, ensure your transmit frequency is not being used by other stations.

1) Push PTT SWITCH on microphone.

1) Push and hold the PTT SWITCH on the microphone to activate the transmitter.

PTT SWITCH



• The red T/R INDICATOR lights and the S/RF INDICATOR shows the relative output power of the transmitter.

2) Speak into microphone.

2) Speak into the microphone using your normal voice level.

- Do not hold the microphone too closely to your mouth or speak too loudly. This may cause a distorted signal.

3) Release PTT SWITCH.

3) Release the PTT SWITCH to stop transmitting.

- The red T/R INDICATOR goes out.
- The receive mode is restored.

● SELECTING OUTPUT POWER

Push the HI/LO SWITCH to alternately change between the HIGH or LOW transmit power.

NOTE: When using HIGH power, the IC-28H may become warm. This is normal.

When the LOW power is selected, the LOW INDICATOR appears on the display.

HIGH POWER: 45W LOW POWER: 5W

5 - 2 MEMORY MODE

Memory channels 1 through 21 are useful for storing often-used frequencies. On all versions of the IC-28H except the U.S.A. version, channel 21 is reserved for the call function frequency. Refer to SECTION 5 - 5 CALL CHANNEL FUNCTION.

■ MEMORY READING

Push the MR side of the VFO/MR SWITCH to select the MEMORY mode.

● Select MEMORY mode.

- The letter "M" appears below the small memory channel number on the right side of the display to indicate the MEMORY mode is selected.

Ⓐ USING THE TUNING CONTROL

Turn the TUNING CONTROL clockwise or counterclockwise to select the desired memory channel.

- The selected memory channel number and contents of the memory appear on the display.
- This method is useful when a specific memory channel is desired.

Ⓑ USING THE DOWN/UP SWITCH

Push the DOWN or UP side of the front panel DOWN/UP SWITCH to individually step through the memory channels.

- Each memory channel number and contents of its memory appear on the display as the IC-28H steps through the memory channels.
- This method is useful when wishing to slowly check several or all of the programmed memory channels.

© USING THE MICROPHONE

NOTE: The microphone SCAN SWITCH must be ON.

Push the UP SWITCH or DN SWITCH on the microphone to step through the memory channels.

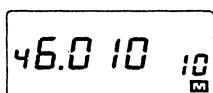
- Each memory channel number and contents of its memory appear on the display.
- This method is useful to monitor all channels since holding these switches down for longer than about 1/2 second causes the memory scan function to begin. Refer to SECTION 5 - 3 MEMORY CHANNEL SCANNING.

■ MEMORY PROGRAMMING

Example: Store 144.950MHz in memory channel 10.

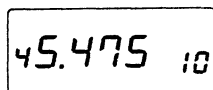
Use the following procedure to store operating frequencies plus duplex and memory skip information in memory channels. The duplex and memory skip functions are described in later sections.

- 1) Select memory channel 10.



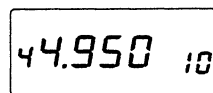
- 1) Select the memory channel to be programmed by using the MEMORY READING procedure described above.

- 2) Select VFO mode.



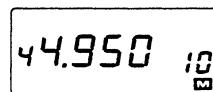
- 2) Push the VFO side of the VFO/MR SWITCH.

- 3) Select 144.950MHz.



- 3) While in the VFO mode, select the information you wish to write into a memory channel:
 - a) operating frequency (SECTION 5 - 1)
 - b) duplex and subaudible tone programming (SECTION 5 - 4)
 - c) memory skip programming (SECTION 5 - 3)

- 4) Push WRITE SWITCH.
Select MEMORY mode.



- 4) Push and hold the WRITE SWITCH for about 1/2 second.

- The 3 short tones indicate that the information selected in step 3) is now stored in the memory channel. Do not release the WRITE SWITCH until the 3 tones are heard.

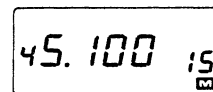
- Push the MR side of the VFO/MR SWITCH to confirm the memory channel has the correct information stored.

■ MEMORY CHANNEL TO VFO TRANSFERS

Example: Transfer the contents of memory channel 15 to the VFO.

At times it may be desirable to transfer the contents of a memory channel to the VFO. Perform the following steps.

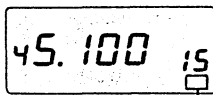
- 1) Select memory channel 15.



- 1) Select the memory channel containing the information to be transferred.

- Refer to the MEMORY READING section for information on selecting memory channels.

2) Push and hold WRITE SWITCH.



"M" disappears

2) Push and hold the WRITE SWITCH for about 1/2 second.

- The 3 short tones indicate that the information contained in the memory channel has been transferred to the VFO. Do not release the WRITE SWITCH until the 3 tones are heard.
- After the transfer is completed, the IC-28H changes to the VFO mode and the MEMORY mode "M" disappears from the display.
- This transfer function does not affect the contents of the memory channel.

5 - 3 SCAN FUNCTIONS

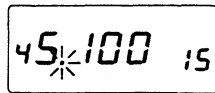
Both frequency and memory scanning on the IC-28H are controlled from the microphone. Before attempting to use either scan function, set the SQL/CHK CONTROL as below:

- SQL/CHK CONTROL : Speaker noise quieted
- T/R INDICATOR : OFF

■ FREQUENCY SCANNING

When using the frequency scan, the entire frequency range is automatically searched by the IC-28H using the programmed size of frequency steps (SECTION 5 - 1 SELECTING A FREQUENCY). The receiver only stops on frequencies where a signal is present.

- 1) Select VFO mode.
- 2) Push and hold UP SWITCH or DN SWITCH to start scan.



- 1) Push the VFO side of the VFO/MR SWITCH.
- 2) Push and hold the UP SWITCH or DN SWITCH on the microphone for about 1/2 second.

- The decimal point on the display begins to blink indicating the scan has started.
- The receiver scans in ascending order if the UP SWITCH is pushed, or in descending order if the DN SWITCH is pushed. The frequency on the display changes to indicate each frequency checked as the scan progresses.
- When a signal opens the receiver squelch circuit (i.e. the green T/R INDICATOR lights), the scan stops and the receiver monitors the signal. The scan begins again about 3 seconds after the frequency is clear of the signal, or about 15 seconds after the scan stops.

NOTE: The microphone SCAN SWITCH must be ON.

- 3) Push UP SWITCH or DN SWITCH to cancel scan.

- 3) Push either the UP SWITCH or DN SWITCH on the microphone in order to cancel the scan function.

■ MEMORY CHANNEL SCANNING

The memory channel scan is similar to the frequency scan except that all of the memory channels are checked repeatedly for signals.

- 1) Select MEMORY mode.
- 2) Push UP or DN SWITCH to start and stop scan.

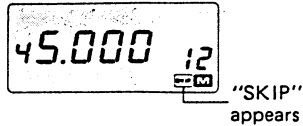
- 1) Push the MR side of the VFO/MR SWITCH.
- 2) Follow steps 2) and 3) for FREQUENCY SCANNING.

● MEMORY SKIP FUNCTION

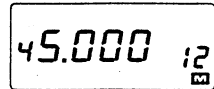
- 1) Select MEMORY mode.
- 2) Select channel to be skipped.



- 3) Push SET SWITCH.



- 4) Push SET SWITCH to cancel skip function.

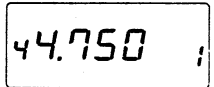


5 - 4 DUPLEX MODE

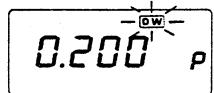
■ DUPLEX PROGRAMMING

Example: Program the following frequencies.
 Receive : 144.75MHz
 Transmit: 145.35MHz

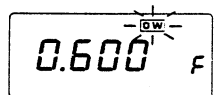
- 1) Select the receive frequency.



- 2) Push the SET SWITCH to select offset write mode.



- 3) Select 600kHz transmit offset.



Memory channels which are not required to be scanned may be eliminated from the memory channel scan by the following procedure.

- 1) Push the MR side of the VFO/MR SWITCH.
- 2) Select the channel which is not required in the memory channel scan.

- Refer to SECTION 5 - 2 MEMORY READING.

- 3) Push the SET SWITCH.

- The SKIP INDICATOR appears on the display.
- The selected channel will now be skipped when using the memory channel scan.

- 4) Push the SET SWITCH again to cancel the skip function on this channel.

NOTE: The memory channel scan will not operate if all memory channels are programmed to be skipped.

The duplex mode allows operation with a transmit frequency which is different from the receive frequency. This is necessary when operating through repeaters. When the receive and transmit frequencies are identical, this is referred to as the simplex mode.

NOTE: Transmit offset refers to the frequency difference between the receive and transmit frequencies when using the duplex mode.

- 1) Push the VFO side of the VFO/MR SWITCH.
- 2) Push the SET SWITCH repeatedly until the OW INDICATOR appears flashing on the display.

- The current transmit offset and the offset programming symbol ("F" or "P") also appear.

DISPLAYED SYMBOL	SYMBOL MEANING	OFFSET VALUE
F	FIXED Offset	600kHz
P	PROGRAMMABLE Offset	Variable (0 ~ 7.99MHz)

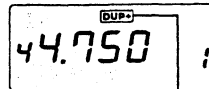
- 3) Push the front panel DOWN/UP SWITCH to select one of the two methods for programming the transmit offset.

- The usual position is "F" since most repeaters operate with a 600kHz split between the receive and transmit frequencies.
- If the "P" position is selected, use the TUNING CONTROL to choose your required transmit offset value.

4) Select VFO mode.

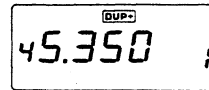


5) Push DUP SWITCH to select DUPLEX (+).



"DUP+" appears

6) Push SQL/CHK CONTROL to check transmit frequency.



4) Push the VFO side of the VFO/MR SWITCH.

5) Push the DUP SWITCH to select either the DUPLEX (-) or DUPLEX (+) condition.

- DUP (-): The transmit frequency is lower than the receive frequency by the offset amount.
- DUP (+): The transmit frequency is higher than the receive frequency by the offset amount.

• Neither DUP (-) nor DUP (+) displayed:
The IC-28H is in the simplex mode with both receive and transmit frequencies equal.

6) Push the SQL/CHK CONTROL in order to monitor the transmit frequency when operating with the duplex mode.

- This allows checking of the signal strength of your contacted station directly without going through a repeater. If the signal is received strongly enough directly, both stations should move to a simplex frequency.

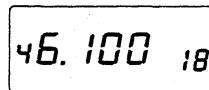
■ **SUBAUDIBLE TONE ENCODER**
(IC-28H U.S.A. version)

The supplied tone encoder allows access to repeaters which require a subaudible tone superimposed on the transmit signal in order to open the squelch circuit of the receiver at the repeater station. Without this tone being present, the repeater cannot be used.

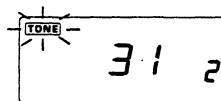
● **PROGRAMMING THE SUBAUDIBLE TONE ENCODER**

Example: Program 88.5Hz in subaudible tone memory 3.

1) Select VFO mode.



2) Push SET SWITCH to select subaudible tone programming mode.

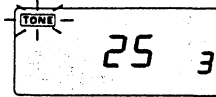


1) Push the VFO side of the VFO/MR SWITCH.

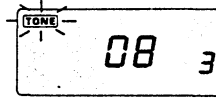
2) Push the SET SWITCH repeatedly until the TONE INDICATOR appears flashing on the display.

NOTE: In this mode, the IC-28H U.S.A. version can store a total of three tone numbers in the three tone memories. The tone memories are named "1", "2" and "3" and are designated with small numbers on the right side of the display.

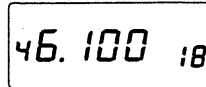
- 3) Push DOWN/UP SWITCH to select tone memory 3.



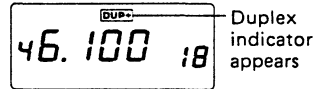
- 4) Turn TUNING CONTROL to select tone number 08 (88.5Hz).



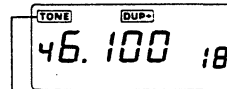
- 5) Select the VFO mode.



- 6) Select the duplex mode.



- 7) Activate tone encoder.



"TONE" appears

- 3) Push the front panel DOWN/UP SWITCH to select one of the tone memories.

- 4) Use the TUNING CONTROL to select a subaudible tone number.

- Refer to the SUBAUDIBLE TONE FREQUENCY CHART to determine the number to select for your required tone frequency.

- 5) Push the VFO side of the VFO/MR SWITCH.

- 6) Push the DUP SWITCH to select DUPLEX (-) or DUPLEX (+).

- 7) Push the TONE SWITCH to turn the subaudible tone encoder ON or OFF.

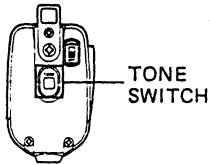
- The TONE INDICATOR appears when the tone encoder is activated.
- The subaudible tone will be transmitted each time a transmission is made.
- The tone encoder does not function when the simplex mode is used.

● SUBAUDIBLE TONE ENCODER FREQUENCY CHART
(For using IC-28H U.S.A. version with repeaters)

TONE NUMBER	FREQUENCY (Hz)	TONE NUMBER	FREQUENCY (Hz)	TONE NUMBER	FREQUENCY (Hz)
01	67.0	15	110.9	29	179.9
02	71.9	16	114.8	30	186.2
03	74.4	17	118.8	31	192.8
04	77.0	18	123.0	32	203.5
05	79.7	19	125.3	33	210.7
06	82.5	20	131.8	34	218.1
07	85.4	21	136.5	35	225.7
08	88.5	22	141.3	36	233.6
09	91.5	23	146.2	37	241.8
10	94.8	24	151.4	38	250.3
11	97.4	25	156.7	39
12	100.0	26	162.2	40
13	103.5	27	167.9	41
14	107.2	28	173.8	42

■ **1750Hz TONE BURST FUNCTION (Europe, Italy and Spain version)**

- 1) Select duplex mode.
- 2) Push and release microphone TONE SWITCH.



- 3) Transmit.

An audible tone burst may be generated for the purpose of accessing repeaters by the following method.

- 1) Adjust the IC-28H for operation in the duplex mode as described in SECTION 5 - 4 DUPLEX PROGRAMMING.
- 2) Push the TONE SWITCH on the back of the supplied microphone to generate the tone. Release the TONE SWITCH.

- It is usually best to transmit the tone at the beginning of each transmission for a duration of approximately 300 milliseconds.

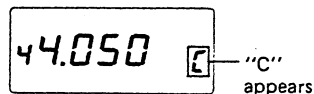
- 3) Push the PTT SWITCH on the microphone and transmit in the usual manner.

5 - 5 **CALL CHANNEL FUNCTION (except U.S.A. version)**

Your highest priority or most frequently used channel should be stored as the call channel. The contents of memory channel 21 are reserved for the call channel function.

■ **USING THE CALL FUNCTION**

- 1) Push CALL SWITCH to select call function.



- 2) Push CALL SWITCH again to release call function.

- 1) Push the CALL SWITCH while in either the VFO or MEMORY mode.

- The IC-28H immediately selects the frequency stored in memory channel 21.
- The call channel symbol "C" also appears on the display.

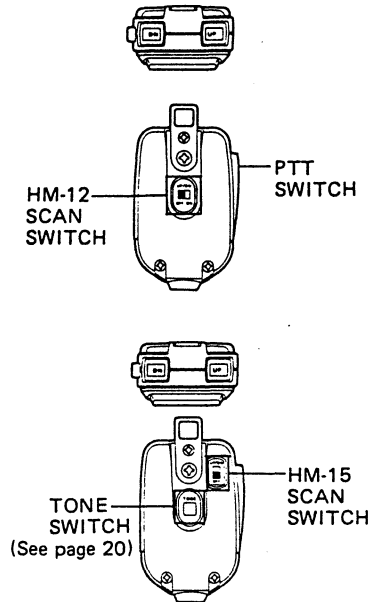
- 2) Push the CALL SWITCH again when finished with the call function.

- The IC-28H returns to the function in use before the call function was selected.
- The "C" disappears from the display.
- The VFO/MR SWITCH may also be used to return directly to either the VFO or MR mode.

■ **PROGRAMMING THE CALL CHANNEL**

To program the call channel, follow the same procedure as for programming memory channel 21. Refer to SECTION 5 - 2 MEMORY PROGRAMMING.

5 - 6 MICROPHONE



NOTE: When scanning, the SCAN SWITCH must remain ON at all times.

5 - 7 BACKUP BATTERY

NOTE: Battery replacement should be done by your nearest ICOM authorized dealer or ICOM service center.

5 - 8 RESETTING INTERNAL MICROCOMPUTER (CPU)

NOTE: After resetting the CPU, all memory channels must be re-programmed.

PTT SWITCH:

Push this switch to turn the transmitter ON and OFF.

UP SWITCH and DN (down) SWITCH:

In the VFO mode, pushing either of these switches changes the operating frequency in the direction indicated on the switch by one step. Holding either switch down starts the frequency scan (SECTION 5 - 3 FREQUENCY SCANNING).

In the MEMORY mode, the switches change the selected memory channel one channel at a time. Holding either switch down starts the memory channel scan (SECTION 5 - 3 MEMORY CHANNEL SCANNING).

SCAN SWITCH:

- OFF: The UP SWITCH and DN SWITCH on the microphone are disabled to eliminate the chance of accidental frequency or memory channel changes.
- ON: The SCAN SWITCH must be ON for the UP SWITCH and DN SWITCH to function as described above.

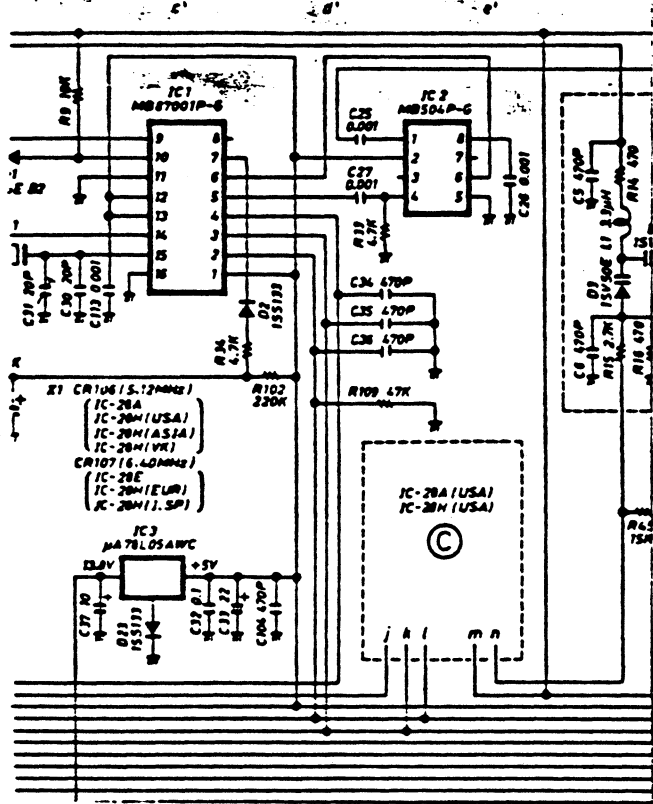
The IC-28H contains a lithium battery as a backup for the internal microcomputer memory in the transceiver for times when the external power source is removed or interrupted. The lithium battery is a reliable backup device which has been proven to last for more than five years under actual operating conditions.

After using the IC-28H for five years, monitor the transceiver operation carefully and replace the battery if there are repeated cases of display malfunction.

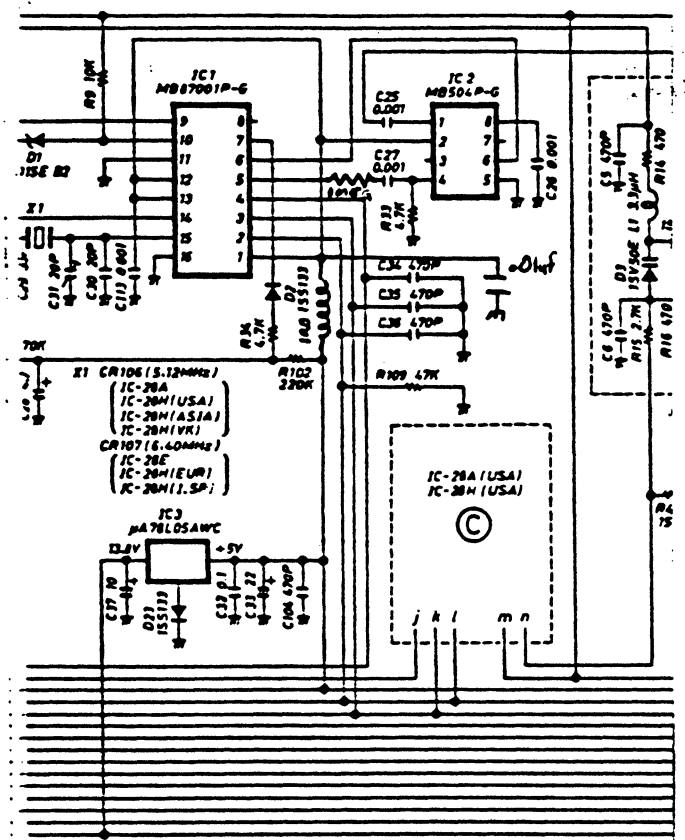
Occasionally, the LCD READOUT may display erroneous information either during operation or when first applying power. This may, for example, be caused by an external cause such as static electricity.

When this sort of problem is encountered, turn OFF the power to the IC-28H, wait for a few seconds and turn the power ON again. If the problem persists, perform the following procedure.

- 1) Turn ON the power to the IC-28H.
- 2) Locate the RESET HOLE in the bottom cover of the transceiver.
- 3) Insert a non-metallic probe through the hole and push the RESET SWITCH.
- 4) The microcomputer in the IC-28H is now reset and the following parameters are automatically set as shown.



ORIGINAL



MODIFIED

Item For Adjustment	Conditions	Points for Measurement			Adjustment Location			Instruments Reading
		Measuring Instruments Required	Unit	Test Point	Unit	Parts	How to Adjust	
PLL	Display: 146.01MHz Connect oscilloscope to pin 1 of J7 on the PLL unit.	Oscilloscope	MAIN	Pin 1 of J7	MAIN	L2	Adjust L2 for 6.0V P-P.	6.0V
	Display: 146.01MHz Connect frequency counter to cathode of D8 on PLL unit.	Frequency Counter	MAIN	D8 cathode	MAIN	C31	Adjust C31 for 128.810MHz.	128.810MHz
Transmit	Display: 146.01MHz Connect RF power meter to antenna connector. Hi/Low Switch: Hi Set R71 on MAIN board to counter clockwise. Transmit.	RF Power Meter					No adjustment is required.	28A: more than 30W 28H: more than 47.5W
	Display: 146.01MHz Connect RF power meter to antenna connector. Hi/Low Switch: Hi Transmit.				MAIN	R71	28A: Adjust R71 for 27W. 28H: Adjust R71 for 46W.	28A: 27W 28H: 46W
	Display: 146.01MHz Connect RF power meter to antenna connector. Hi/Low Switch: Low Transmit.					R72	28A: Adjust R72 for 5W. 28H: Adjust R72 for 5W.	28A: 5W 28H: 5W
	Display: 146.01MHz Connect RF power meter to antenna connector. Hi/Low Switch: Low Transmit.						No adjustment is required.	5 dot on S-meter scale.
Deviation	Display: 146.01MHz Connect deviation meter to antenna connector. Connect audio generator to mic connector. Transmit.	Deviation meter Audio Generator						
	Apply 1KHz/65mVrms to mic connector.				MAIN	R100	Adjust R100 for 4.8KHz.	4.8KHz
	Apply 1KHz/6.5mVrms to mic connector.					R89	Adjust R89 for 3.5KHz.	3.5KHz
	Disconnect the audio generator. Set the PL tone to #38. Transmit.	Deviation meter			MAIN	R48	Adjust R48 for 0.75KHz.	0.75KHz
	Set the PL tone to #01.						No adjustment is required.	0.5 - 1KHz
	Display: 146.01MHz Remain in the above condition. Put the counter cable with loose couple to X2 on the main board.	Frequency Counter	MAIN	X2			No adjustment is required.	3.565024-3.5944502 MHz
Receive	Display: 146.01MHz Connect standard signal generator to antenna connector. Connect AF multimeter with speaker to EXT speaker jack.	Signal Generator AF Multi-Meter						
	Apply 146.01MHz/2.5uV with 3.5 deviation to antenna connector. Receive.				Rx	L7 L6 L5 L3 L2 L1	Adjust L7, L6, L5, L3, L2, L1 for maximum level.	Maximum Level
	Apply 146.01MHz/odBu to antenna connector.					R41	Adjust R41 for S3 on the S-Meter scale.	S3 on S-Meter Scale.

Item For Adjustment	Conditions	Points for Measurement			Adjustment Location			Instruments Reading
		Measuring Instruments Required	Unit	Test Point	Unit	Parts	How to Adjust	
PLL	Display: 146.01MHz Connect oscilloscope to pin 1 of J7 on the PLL unit.	Oscilloscope	MAIN	Pin 1 of J7	MAIN	L2	Adjust L2 for 6.0V P-P.	6.0V
	Display: 146.01MHz Connect frequency counter to cathode of D8 on PLL unit.	Frequency Counter	MAIN	D8 cathode	MAIN	C31	Adjust C31 for 128.810MHz.	128.810MHz
Transmit	Display: 146.01MHz Connect RF power meter to antenna connector. Hi/Low Switch: Hi Set R71 on MAIN board to counter clockwise. Transmit.	RF Power Meter					No adjustment is required.	28A: more than 30W 28H: more than 47.5W
	Display: 146.01MHz Connect RF power meter to antenna connector. Hi/Low Switch: Hi Transmit.				MAIN	R71	28A: Adjust R71 for 27W. 28H: Adjust R71 for 46W.	28A: 27W 28H: 46W
	Display: 146.01MHz Connect RF power meter to antenna connector. Hi/Low Switch: Low Transmit.					R72	28A: Adjust R72 for 5W. 28H: Adjust R72 for 5W.	28A: 5W 28H: 5W
	Display: 146.01MHz Connect RF power meter to antenna connector. Hi/Low Switch: Low Transmit.						No adjustment is required.	5 dot on S-meter scale.
Deviation	Display: 146.01MHz Connect deviation meter to antenna connector. Connect audio generator to mic connector. Transmit.	Deviation meter Audio Generator						
	Apply 1KHz/65mVrms to mic connector.				MAIN	R100	Adjust R100 for 4.8KHz.	4.8KHz
	Apply 1KHz/6.5mVrms to mic connector.					R89	Adjust R89 for 3.5KHz.	3.5KHz
	Disconnect the audio generator. Set the PL tone to #38. Transmit.	Deviation meter			MAIN	R48	Adjust R48 for 0.75KHz.	0.75KHz
	Set the PL tone to #01.						No adjustment is required.	0.5 - 1KHz
	Display: 146.01MHz Remain in the above condition. Put the counter cable with loose couple to X2 on the main board.	Frequency Counter	MAIN	X2			No adjustment is required.	3.565024-3.5944502 MHz
Receive	Display: 146.01MHz Connect standard signal generator to antenna connector. Connect AF Multi-meter with speaker to EXT speaker jack.	Signal Generator AF Multi-Meter						
	Apply 146.01MHz/2.5uV with 3.5 deviation to antenna connector. Receive.				Rx	L7 L6 L5 L3 L2 L1	Adjust L7, L6, L5, L3, L2, L1 for maximum level.	Maximum Level
	Apply 146.01MHz/odBu to antenna connector.					R41	Adjust R41 for S3 on the S-Meter scale.	S3 on S-Meter Scale.

ICOM UT-29 Encoder/Decoder Modification

The UT-29 Encoder/Decoder board is an accessory for the IC-29/IC-38/IC-48 transceivers. As supplied from the manufacturer, the UT-29 will only decode in the simplex mode of operation. This modification will allow the operator to add PL decode to duplex (repeater) operation. The modification I performed was on an IC-38A with an HM-14 microphone.

First, locate D2 on the circuit board, a dual diode package, and follow its left leg to a plated-through hole. Turn the circuit board over and follow the trace from the hole to IC2 pin 12. Cut through the trace between the hole and IC2 pin 12 with an exacto knife. Next solder a 1K ohm 1/8w resistor into the plated-through hole leading to the D2 diode package. Solder the other side of the resistor to IC2 pins 15 and 16, the 5.0V supply (use the plated-through hole next to these pins). Solder a wire to the end of the resistor going into the hole leading to the D2 diode package. The other end of the wire goes to the microphone socket inside the radio. I choose to sacrifice the "frequency up/down" feature of my HM-14 microphone and use mic socket pin 3 to carry ground from the mic button to diode D2. Replace the UT-29 board inside the radio. Proceed by carefully cutting the trace between mic socket pin 3 and the junction including R28, R30 and R44. Include the bypass capacitor, C12, with pin 3. Solder the wire from D2 to mic socket pin 3.

Open the HM-14 microphone. (Be careful not to let the PTT lever spring fly away!) The pin 3 wire color in my HM-14 is black. Verify your wire color with an ohmmeter. Unsolder this wire. Find the brown wire from the mic hang-up button and unsolder it from the circuit board next to the blue wire (PTT ground return). Verify continuity in the wire to the mic button. Remove the wires to the freq up/down switch and solder the black wire to the trace going to the center contact of the switch. Solder a 1N914 (or equivalent) diode (anode side) to the upper contact of the switch. Solder the cathode side of the diode to the brown wire from the mic button. Use insulating sleeving over the diode. Carefully close the microphone.

The microphone clip must be at ground potential. You must use a wire from a mic clip mounted on a plastic dashboard to chassis ground.

The operation is as follows: Program the tone and frequency, simplex or duplex, into memory as usual. Place the mic into the mic clip with the freq up/down switch in the "up/dn" position. Now only received signals, simplex or duplex, with the programmed tone will be heard through the speaker. Lifting the mic from the mic clip or putting the freq. up/down switch in the "off" position will allow you to monitor any signals on frequency.

It is recommended to notify repeater control operators of

your intended tone squelch operation on their repeater in order to avoid possibly interfering with control functions.

(Thanks, Bill Rourke, W7ERH, 1119 Fairview Ave, South Pasadena, CA 91030)

FEB. 6, 1989

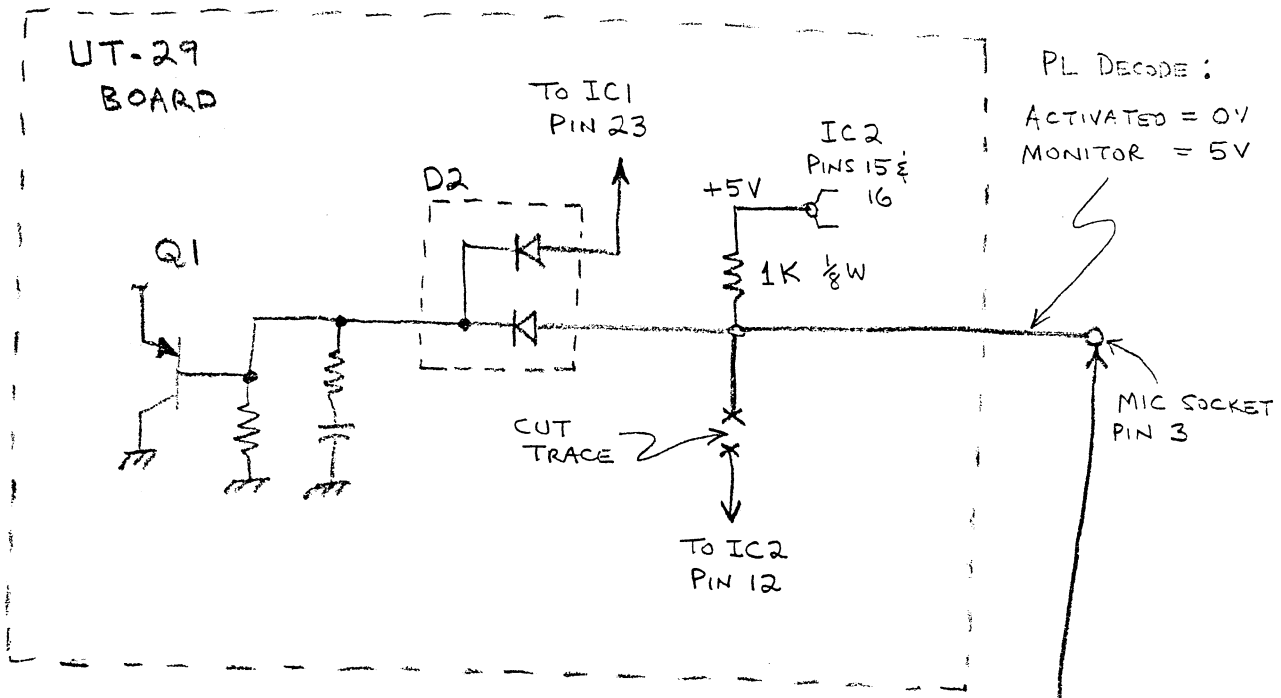
Dear Tom;

Thank you for your letter of October 3, 1988, and the schematic & layout of the UT-29 tone squelch unit. With your help I have solved my problem of no PL decode in the duplex mode of operation with my IC-38A. I thought you and your staff would be interested; I have enclosed my solution.

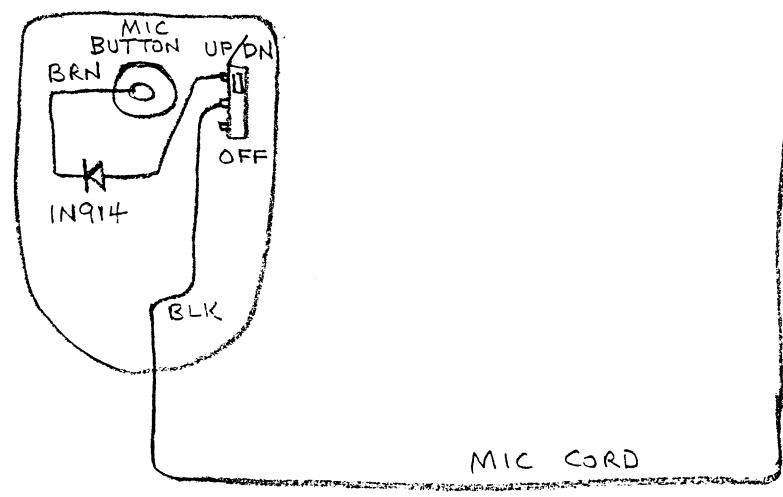
Best regards,

Bill Rourke

W7ERH



HMI4 MICROPHONE





ICOM

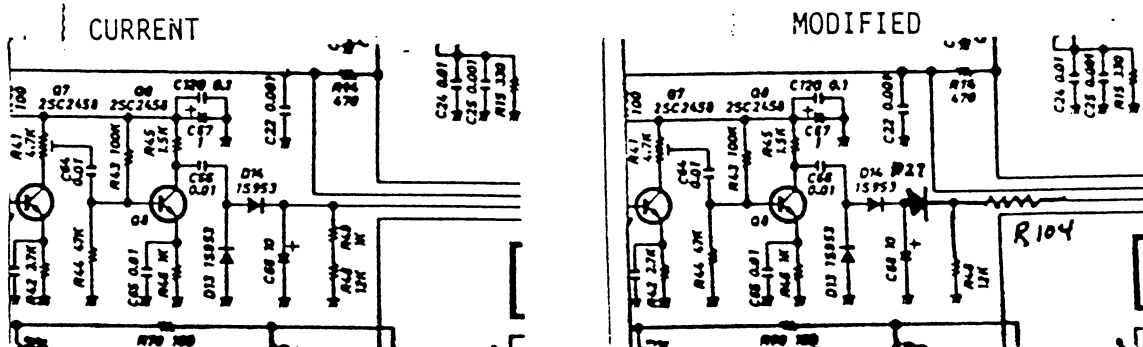
SERVICE BULLETIN

MODEL: IC-28A/H SN AFFECTED: _____ BULLETIN # 280CT86-013
 DIVISION: AMATEUR X MARINE _____ LAND MOBILE _____ AVIONICS _____
 SUBJECT: IMPROVE RF METER ATTACK/DELAY TIME
 FILE ONLY NOT FOR DISTRIBUTION

PARTS EFFECTED	COMPONENT IDENTIFIER	BOARD OR UNIT	CHANGE TO
1K	D27	RX	155133
	R49	RX	DELETE
	R10A	RX	1K

PROCEDURE:

1. ADD D27 AND 155133 DIODES IN SERIES WITH D14
2. REMOVE R49 AND INSTALL JUMPER IN IT'S PLACE
3. ADD 1K RESISTOR AND R104 IN SERIES WITH D27



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ICOM

SERVICE BULLETIN

MODEL: IC-28H SN AFFECTED: _____ BULLETIN # 280CT86-014

DIVISION: AMATEUR X MARINE _____ LAND MOBILE _____ AVIONICS _____

SUBJECT: IMPROVE RF OUTPUT POWER

PARTS EFFECTED	COMPONENT IDENTIFIER	BOARD OR UNIT	CHANGE TO
LA-233	L22	MAIN	LA-235
12pf 50 VOLT	C46	MAIN	47pf 50 VOLT
33pf 50 VOLT	C52	MAIN	22pf 50 VOLT
22pf 50 VOLT	C109	MAIN	10pf 50 VOLT
	R113	MAIN	150 OHM

PROCEDURE:

1. ADD R113 BETWEEN PIN 1 OF IC-6 AND GROUND ON THE MAIN BOARD
2. INSTALL REMAINDER OF PARTS AS LISTED

Ray
Bill

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ICOM

SERVICE BULLETIN

MODEL: IC-28A/H SN AFFECTED: _____ BULLETIN # 280ct86-012

DIVISION: AMATEUR X MARINE _____ LAND MOBILE _____ AVIONICS _____

SUBJECT: Improved Rx sensitivity.

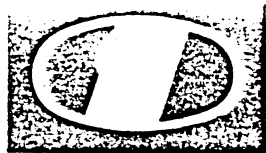
PARTS EFFECTED	COMPONENT IDENTIFIER	BOARD OR UNIT	CHANGE TO
18pf 50 volt	C21	Rx Board	12pf 50 volt
8pf 50 volt	C23	Rx Board	9pf 50 volt
39pf 50 volt	C108	Rx Board	56pf 50 volt
Jumper	W5	Rx Board	Remove

PROCEDURE:

1. The Above Procedure Should Improve Sensitivity by 1 db

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ICOM

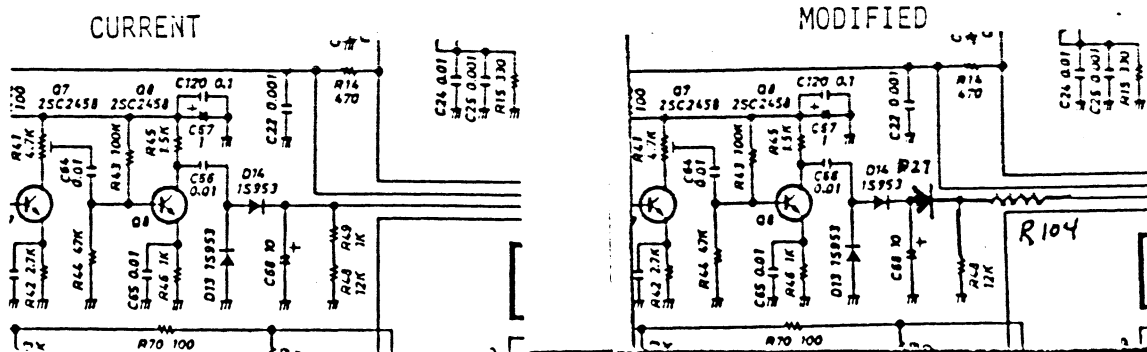
SERVICE BULLETIN

MODEL: IC-28A/H SN AFFECTED: _____ BULLETIN # 280CT86-013
 DIVISION: AMATEUR x MARINE _____ LAND MOBILE _____ AVIONICS _____
 SUBJECT: Improve PTT Speed

PARTS EFFECTED	COMPONENT IDENTIFIER	BOARD OR UNIT	CHANGE TO
1K	D27	Rx	155133
	R49	Rx	Delete
	R10A	Rx	1K

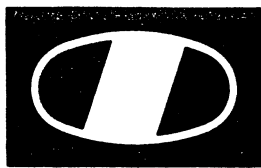
PROCEDURE:

1. Add D27, 155133, Diode in series with D14
2. Remove R49, Install Jumper in its Place
3. Add 1K Resistor, R104 in Series with D27



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ICOM

SERVICE BULLETIN

MODEL: IC-28A/H SN AFFECTED: N/A BULLETIN # 22987-005

DIVISION: AMATEUR X MARINE _____ LAND MOBILE _____ AVIONICS _____

SUBJECT: CHANGE IN CPU SOFTWARE

FILE ONLY NOT FOR DEALER / DISTRIBUTOR

PARTS EFFECTED	COMPONENT IDENTIFIER	BOARD OR UNIT	CHANGE TO
UPD 7514G-191-12	IC-1	EF UNIT	UPD7514G-148-12

PROCEDURE:

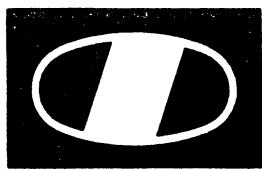
EARLY CPU, STAYED IN LOW POWER WHEN UNIT WAS TURNED OFF

NEW CPU, RF POWER REVERTS TO HIGH POWER. IF RADIO IS TURNED OFF IN LOW POWER, NO OTHER FUNCTIONS CHANGED

Bill

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ICOM

SERVICE BULLETIN

MODEL: IC-28A/H SN AFFECTED: _____ BULLETIN # 3Nov86-003
DIVISION: AMATEUR X MARINE _____ LAND MOBILE _____ AVIONICS _____
SUBJECT: To prevent birdies at 154.755MHz and 154.810MHz

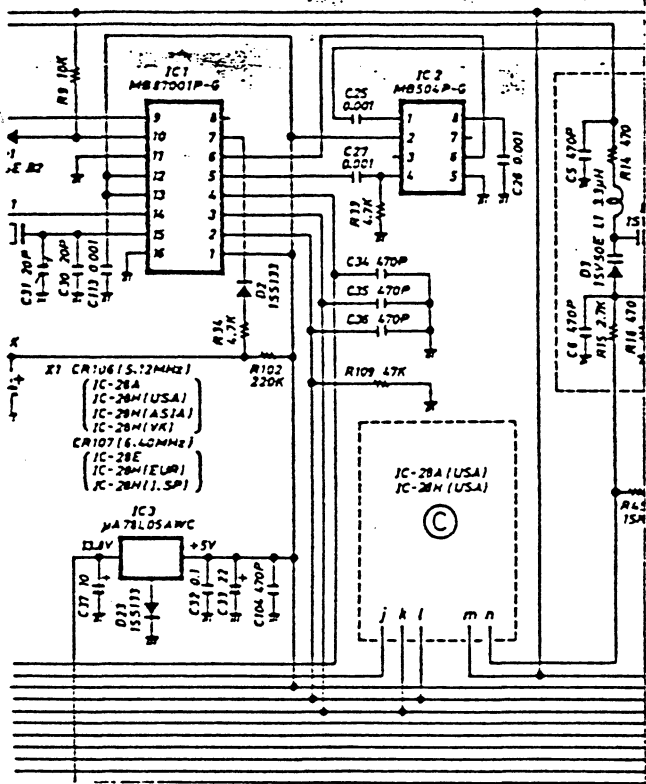
PARTS EFFECTED	COMPONENT IDENTIFIER	BOARD OR UNIT	CHANGE TO

PROCEDURE:

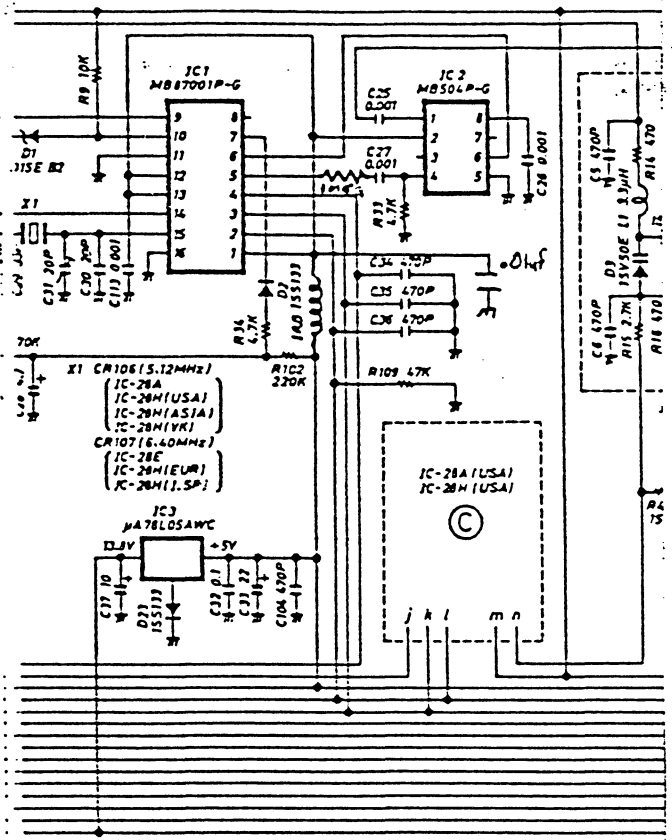
1. Cut Land Between Pin 1 of IC-1 and (MB87001P-G) and R102 on Main Board.
2. Install 1 MicroHenry Coil (1R0) Between Pin 1 of IC-1 and R102.
3. Install 0.01 ufd Capacitor Between Pin 1 of IC-1 and Ground.
4. Cut Land Between Pin 5 of IC-1 and C27.
5. Install 1 megohm Resistor Between Pin 5 of IC-1 and C-27.

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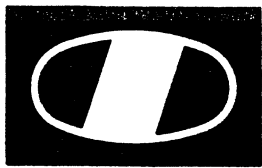
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ORIGINAL



MODIFIED



ICOM

SERVICE BULLETIN

MODEL: IC-28A/H SN AFFECTED: _____ BULLETIN # 280ct86-015

DIVISION: AMATEUR X MARINE _____ LAND MOBILE _____ AVIONICS _____

SUBJECT: To improve S-Meter gain.

PARTS EFFECTED	COMPONENT IDENTIFIER	BOARD OR UNIT	CHANGE TO
33K	R37	Rx Board	27K
1.5K	R45	Rx Board	2.7K
47pf	C62	Rx Board	100pf

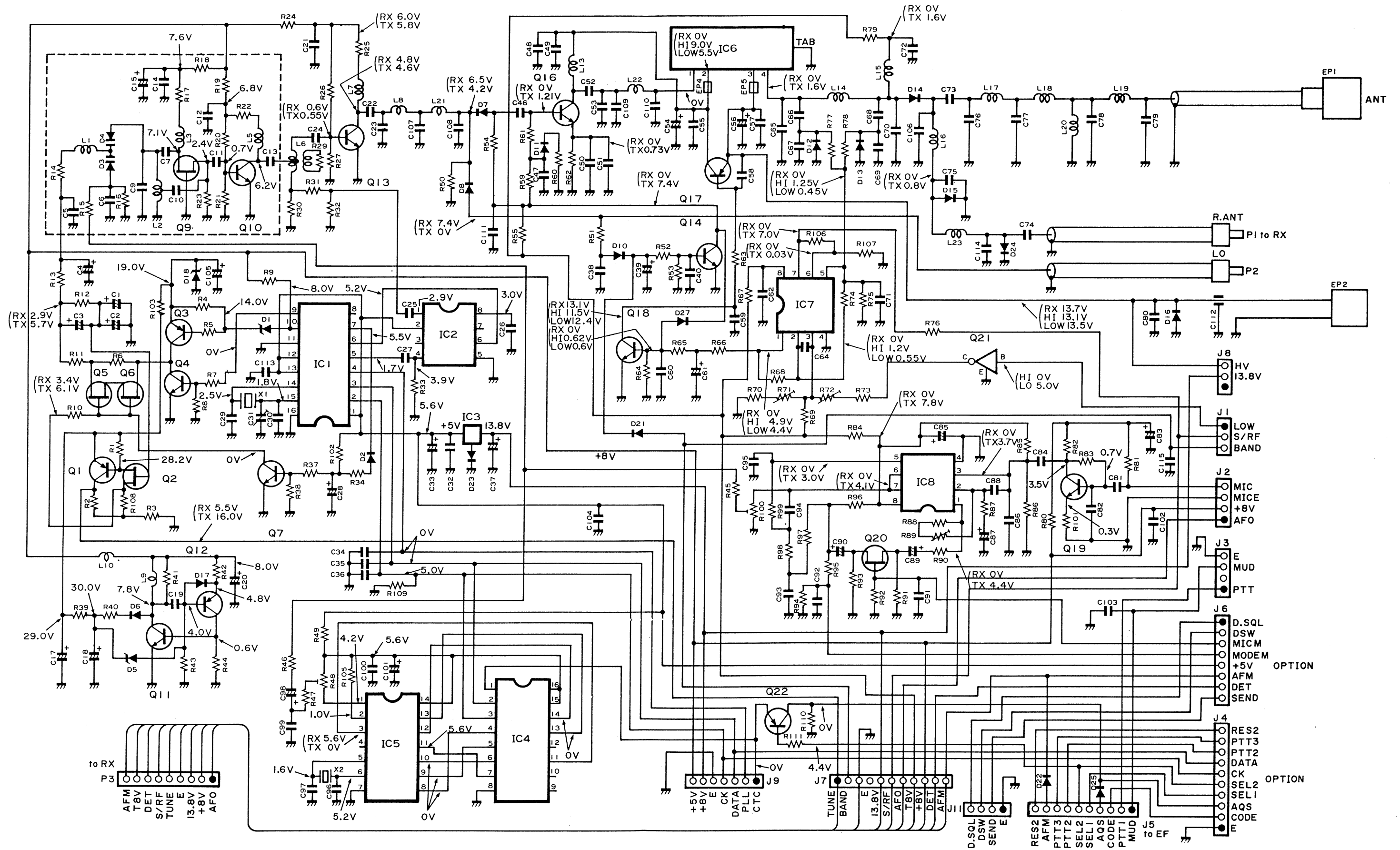
PROCEDURE:

1. Modification Will Increase S-Meter Gain by 5 db

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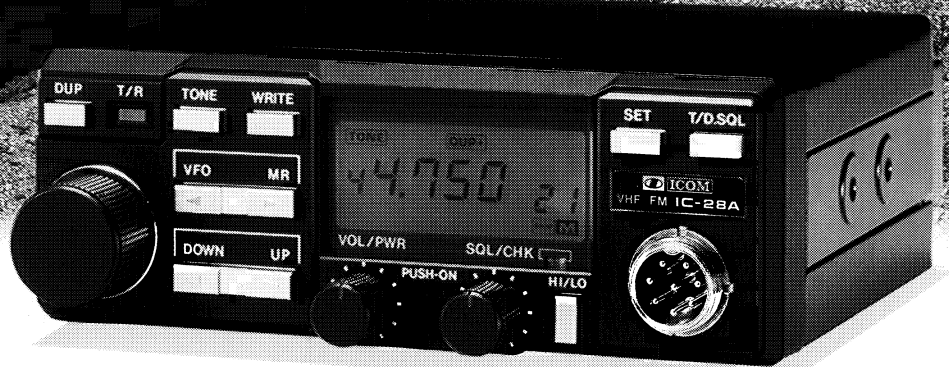
THIS SERVICE BULLETIN IS TO PROVIDE INFORMATION ON CHANGES/IMPROVEMENTS TO EXISTING EQUIPMENT. ICOM ASSUMES NO LIABILITY OR RESPONSIBILITY FOR THE IMPROPER INSTALLATION OF THIS PROCEDURE.

8 - 3 MAIN UNIT (IC-28A/E VERSIONS)



ICOM IC-28A

On the road, less



- 25 Watts Output Power
- Large LCD Readout
- Automatic Dimmer Circuit
- Compact Size
- 21 Memory Channels
- Dual Scanning Capability
- Simple Panel Design
- Options Available

Smaller than many conventional compact mobile transceivers, the sophisticated IC-28A provides 25 watts of output power on any frequency in the 2-meter band and also allows you to operate using a selectable 5-watt low output power feature.

Large LCD Readout. The highly visible front panel LCD readout is designed with wide angle viewing capability, making transceiver operation safe and easy while you are at the wheel.

Automatic Dimmer Circuit. Variations in ambient light conditions pose no problems when using the IC-28A since the built-in light sensor automatically adjusts an internal dimmer control circuit to control backlighting of the display at anytime, day or night.

Compact Size. Light and compact at just 140mm(W)×50mm(H)×133mm(D), the IC-28A will fit nearly anywhere in your vehicle, making it ideal for travel in all environments.

21 Memory Channels. The IC-28A contains a total of 21 fully-programmable large-capacity memories, placing a variety of communications functions at your fingertips.

Dual Scanning Capability. All memory channels and frequencies can be continuously scanned and checked by using the provided HM-12 Microphone.

Simple Panel Design. Even with tremendous versatility and a wide variety of functions, the IC-28A is easy to use because of its simple front panel layout. All the controls are easy to find and reach, making driving safe and comfortable.

Options Available. IC-HM16 Speaker-Microphone, PS-45 13.8V 8A Power Supply, UT-28 Digital Code Squelch Unit, UT-29 Tone Squelch Unit, SP-10 External Speaker, HS-15 Flexible Mobile Microphone and PTT Switchbox.

(Specifications on reverse side)

HF/VHF/UHF AMATEUR, MARINE AND BUSINESS USE COMMUNICATION EQUIPMENT



ICOM

ICOM INCORPORATED

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6-9-16, Kamihigashi, Hirano-ku, Osaka 547, Japan

FAX:(06)793-0013 TELEX:05277822 ICOM TR J

144MHz FM TRANSCEIVER

IC-28A

SPECIFICATIONS

GENERAL

Frequency coverage

MODEL	GUARANTEED RANGE	OPERATIONAL RANGE	
	TRANSCEIVER	RECEIVER	TRANSMITTER
IC-28A	144.00~148.00	138.00~174.00	140.10~150.00
IC-28A Australia version	144.00~148.00	144.00~148.00	144.00~148.00

Frequency resolution 5, 10, 15, 20 or 25kHz(programmable)
 Frequency control CPU based 5kHz(or 6.25kHz)step digital PLL synthesizer
 Simplex and semi-duplex capability (programmable offset)
 Memory channels 21 channels
 Usable temperature range $-10^{\circ}\text{C}\sim+60^{\circ}\text{C}(+14^{\circ}\text{F}\sim+140^{\circ}\text{F})$
 Power supply requirement 13.8V DC $\pm 15\%$ (negative ground)
 AC power supply is available for AC operation.
 Current drain (at 13.8V DC)
 Transmit
 HIGH(25W) Approx. 6.0A
 LOW(5W) Approx. 3.0A
 Receive
 Max. audio output Approx. 800mA
 Squelched Approx. 450mA
 Antenna impedance 50 ohms unbalanced
 Dimensions 140(140)mm(W) \times 50(50)mm(H) \times 133(148.5)mm(D)
 Bracketed values include projections
 Weight 0.95kg

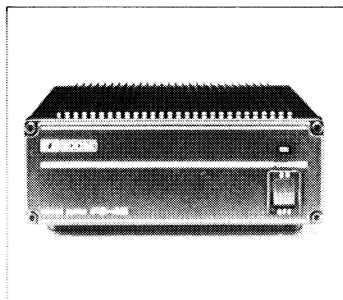
TRANSMITTER

Output power HIGH 25W LOW 5W
 Emission mode 16K0F3E
 Modulation system Variable reactance frequency modulation.
 Max. frequency deviation $\pm 5.0\text{kHz}$
 Spurious emissions More than 60dB below carrier
 Microphone 600 ohm electret condenser with push-to-talk and scanning switches

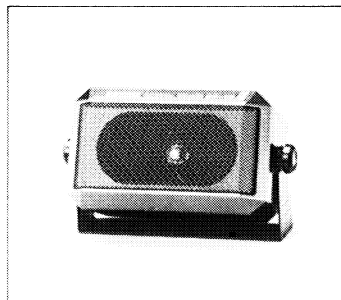
RECEIVER

Receive system Double-conversion superheterodyne
 Modulation acceptance 16K0F3E
 Intermediate frequencies 1st:17.2MHz 2nd:455kHz
 Selectivity More than 12.5kHz at -6dB
 Less than 25.0kHz at -60dB
 Sensitivity Less than $0.18\mu\text{V}$ for 12dB SINAD
 Audio output More than 2.4 watts at 10% distortion with 8 ohm load
 Audio output impedance 4~8 ohms

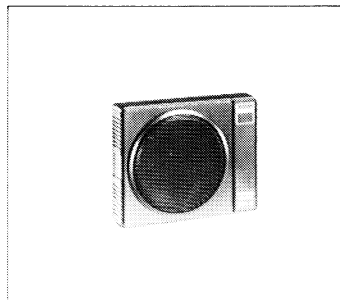
ACCESSORIES



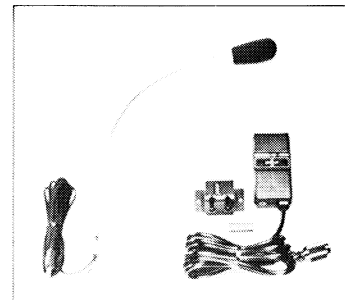
PS-45
 AC POWER SUPPLY
 (13.8V DC, 8A max.)
 The OPC-102 interface cable to connect the PS-45 to the IC-28A must be purchased separately.



SP-10
 MOBILE SPEAKER



SP-8
 EXTERNAL SPEAKER



HS-15
 FLEXIBLE MOBILE MICROPHONE
 HS-15SB
 SWITCHBOX FOR HS-15

SM-8	ELECTRET CONDENSER DESK MICROPHONE
SM-10	COMPRESSOR/GRAPHIC EQUALIZER MICROPHONE
UT-28	DIGITAL CODE SQUELCH UNIT
UT-29	TONE SQUELCH UNIT

IC-HM14	DTMF MICROPHONE
SP-7	BASE SPEAKER
IC-HM16	SPEAKER-MICROPHONE



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 Telex: 965179 ICOM G

Your local agent/dealer: