

IC-45^{A/E}

430MHz FM TRANSCEIVER

INSTRUCTION MANUAL

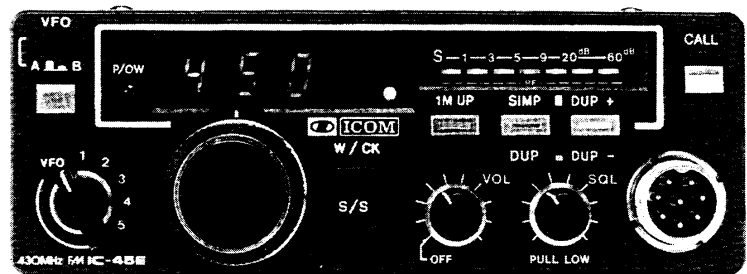


TABLE OF CONTENTS

I. SPECIFICATIONS	1
II. DESCRIPTION	2
III. INSTALLATION	3
IV. CONTROL FUNCTIONS.....	6
V. OPERATION	10
VI. INSIDE VIEW	19
VII. CIRCUIT DESCRIPTION	20
VIII. TROUBLESHOOTING.....	31
IX. BLOCK DIAGRAM.....	33
X. SCHEMATIC DIAGRAM.....	SEPARATE

SECTION I SPECIFICATIONS

GENERAL

Numbers of semiconductors	:	Transistor	47
		FET	8
		IC	20
		Diode	89 (IC-45A : 86)
Frequency coverage	:	430.000 ~ 439.995MHz (IC-45A : 440.000 ~ 449.995MHz)	
Frequency resolution	:	5KHz/25KHz steps	
Frequency control	:	Microcomputer based 5KHz step Digital PLL synthesizer Independent Dual VFO Capability.	
Frequency stability	:	Within $\pm 0.001\%$	
Memory channels	:	5 channels with any inband frequency programmable	
Usable conditions	:	Temperature: $-10^{\circ}\text{C} \sim 60^{\circ}\text{C}$ ($14^{\circ}\text{F} \sim 140^{\circ}\text{F}$) Operational time: Continuous	
Antenna impedance	:	50 ohms unbalanced	
Power supply requirement	:	13.8V DC $\pm 15\%$ (negative ground) 4A Max.	
Current drain (at 13.8V DC)	:	Transmitting	HIGH (10W) Approx. 3.5A
			LOW (1W) Approx. 1.7A
		Receiving	At max audio output Approx. 0.7A
			Squelched Approx. 0.5A
Dimensions	:	50mm(H) x 140mm(W) x 177mm(D)	
Weight	:	Approx. 1.5kg	

TRANSMITTER

Output power	:	10W (HIGH), 1W (LOW)	
Emission mode	:	16F ₃	
Modulation system	:	Variable reactance frequency modulation	
Max. frequency deviation	:	$\pm 5\text{KHz}$	
Spurious emission	:	More than 60dB below carrier	
Microphone	:	600 ohm electret condenser microphone with push-to-talk and frequency UP/DOWN switches. (IC-45A: with 16 key dual-tone pad.) (IC-45E: with 1750Hz tone burst unit.)	
Operating mode	:	Simplex, Duplex (Any offset in band in 100KHz increments)	

RECEIVER

Receiving system	:	Double-conversion superheterodyne	
Modulation acceptance	:	16F ₃	
Intermediate frequency	:	1st:	21.8MHz
		2nd:	455KHz
Sensitivity	:	Less than $0.3\mu\text{V}$ for 12dB SINAD	
		Less than $0.4\mu\text{V}$ for 20dB Noise quieting	
Squelch sensitivity	:	Less than $0.25\mu\text{V}$	
Spurious response rejection ratio	:	More than 60dB	
Selectivity	:	More than $\pm 7.5\text{KHz}$ at -6dB point	
		Less than $\pm 15\text{KHz}$ at -60dB point	
Audio output power	:	More than 2.0W	
Audio output impedance	:	4 ~ 8 ohms	

SECTION II DESCRIPTION

430MHz FM TRANSCEIVER INCORPORATING A MICROCOMPUTER

CPU control with ICOM's original programs provide various operating capabilities. No-backlash dial controlled by ICOM's unique rotary encoder circuit. The band-edge detector and Endless System provides out-of-band protection. There are no variable capacitors or dial gears, ensuring problem-free use. The IC-45A/E can accommodate FM, coverage in the 430 ~ 440MHz (IC-45A: 440 ~ 450MHz) frequency range.

MULTI-PURPOSE SCANNING

The Memory Scan allows you to monitor five different memory channels and two VFO frequencies, and the Program Scan provides scanning between two programmed frequencies. The scanning speed is adjustable, and the auto-stop terminates scanning when a signal is received or a channel is empty.

DUAL VFO'S

Two separate VFO's can be used independently either for simplex operation or for duplex operation, and any desired 100KHz steps frequency can be split in duplex operation.

CONTINUOUS TUNING SYSTEM

ICOM's new continuous tuning system features an LED display that follows the tuning knob movement and provides an extremely accurate readout. Frequencies are displayed in 4 LED digits with a resolution of 5KHz.

Automatic recycling restarts tuning at the top of the band, i.e., at 439.995MHz when the dial goes below 430.000MHz. Recycling changes 439.995MHz to 430.000MHz as well. Quick tuning in 25KHz steps is available with VFO "B", and is also provided for trouble free QSO (IC-45A : 439.995MHz and 430.000MHz should be read 449.995MHz and 440.000MHz.)

OUTSTANDING PERFORMANCE

The RF amplifier and the first mixer use high performance FET's, and with other circuits provide excellent cross modulation and two-signal selectivity characteristics. The IC-45A/E has excellent sensitivity, demanded especially for mobile operation, high stability, and with a pair of high quality monolithic crystal filters and ceramic filters, facilitates very stable receiving and excellent durability.

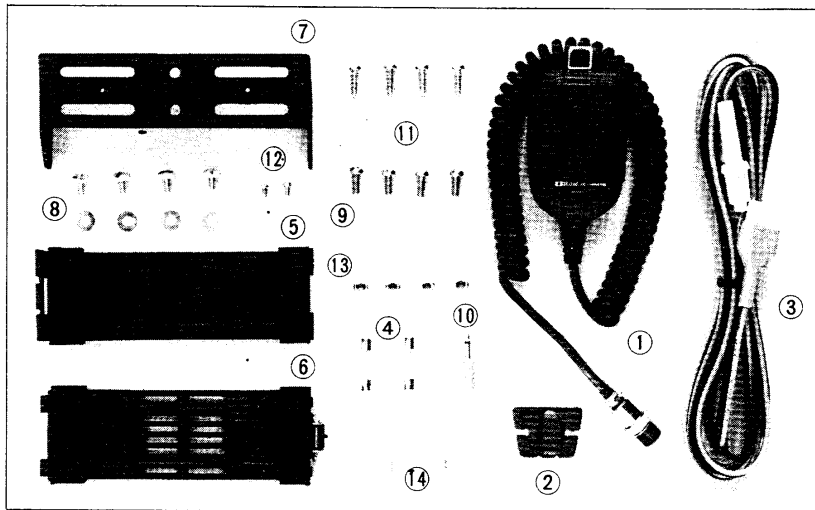
The transmitter uses the VCO signal which is locked at a half of the transmitting frequency and modulated with the microphone signals. This signal is doubled, amplified, and fed through band-pass filters and a high-performance low-pass filter. These systems provide distortion-free signals with a minimum spurious radiation level.

The IC-45A/E has everything you need to truly enjoy UHF FM operation, in an extremely compact, rugged transceiver, designed to ensure high quality, long term use.

SECTION III INSTALLATION

UNPACKING

Carefully remove your transceiver from the packing carton and examine it for signs of shipping damage. Should any be apparent, notify the delivering carrier or dealer immediately, stating the full extent of the damage. It is recommended you to keep the shipping cartons. In the event storage, moving, or reshipment becomes necessary, they come in handy. Accessory hardware, cables, etc., are packed with the transceiver. Make sure you have not overlooked anything.

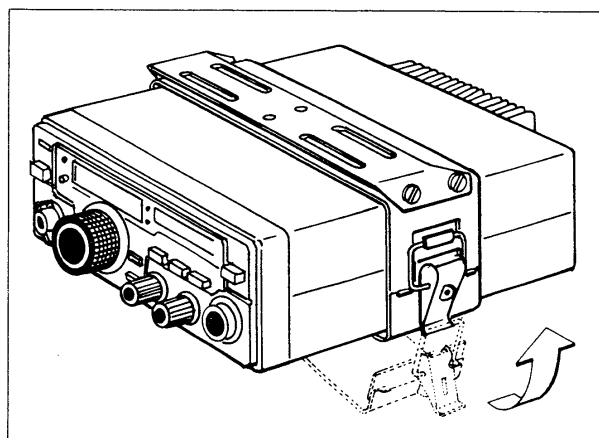
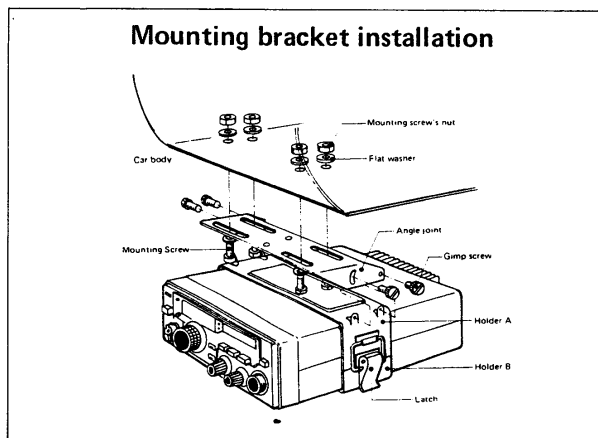


1. Microphone (IC-HM15)	1	8. Gimp screws.	4
2. Microphone hook	1	9. Flat washers.	12
3. Power cord.	1	10. Plug for speaker	1
4. Spare fuses (5A)	2	11. Mounting screws	8
5. Installing holder A.	1	12. Screws for additional bracket.	2
6. Installing holder B.	1	13. Mounting screw's nuts	4
7. Installing angle joint.	1	14. Battery terminal lugs	2

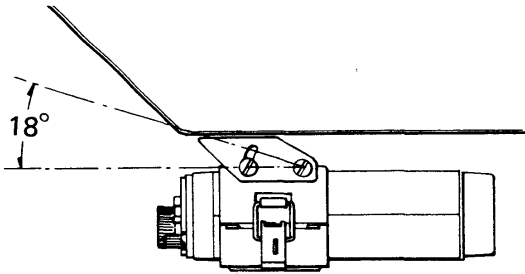
Note: Some versions supplied with IC-HM14 (dual-tone encoder mic) instead of IC-HM15.

LOCATION

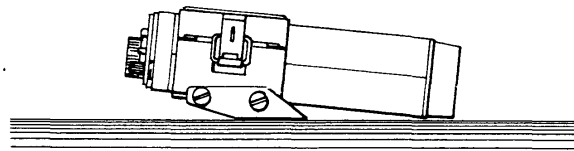
Where you place the transceiver in your automobile is not critical and should be governed by convenience and accessibility. Since the unit is so compact, many mobile possibilities present themselves. In general, the mobile mounting bracket will provide you with some guide as to placement. Any place where it can be mounted with metal screws, bolts, or pop-rivets will work. For fixed station use, a power supply should be designed to produce 4 amps for the transceiver.



Angle adjustment



Optional installation

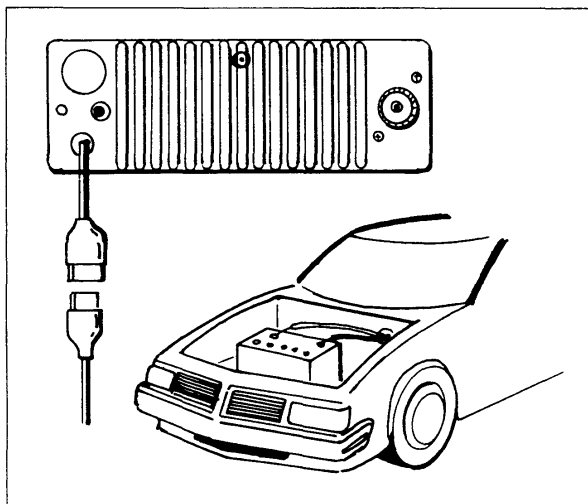


POWER REQUIREMENTS

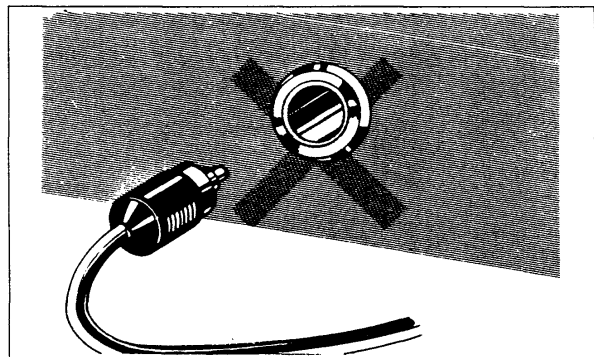
The transceiver is supplied ready to operate from any regulated 13.8V DC, 4 ampere negative ground source. An automobile 12 volt, negative ground, system is usually more than adequate. Some note must be taken, however, of the condition of the vehicle's electrical system. Items such as low battery, worn generator/alternator, poor voltage regulator, etc., will impair operation of your transceiver as well as the vehicle. High noise generation or low voltage delivery can be traced to these deficiencies. If an AC power supply is used with your transceiver, make certain it is adequately regulated for both voltage and current. Low voltage while under load will not produce satisfactory results from your transceiver. Receiver gain and transmitter output will be greatly impaired. Caution against catastrophic failure of the power supply should be observed.

CAUTION: Excessive Voltage (above 15V DC) will cause damage to your transceiver. Be sure to check source voltage before plugging in the power cord.

Included with your transceiver is a DC power cable with plug attached. The Red Wire is positive (+), the Black, negative (-). If your mobile installation permits, it is best to connect these directly to the battery terminals. This arrangement eliminates random noise and transient spikes sometimes found in automotive accessory wiring. If such an arrangement is not possible, then any convenient B+ lead in the interior of the vehicle and the negative frame can be utilized. Remember, the unit operates on a negative ground system only; it cannot be used in a positive ground automobile. After making your connections, simply insert the plug into your transceiver.



Do not use a cigarette lighter socket.



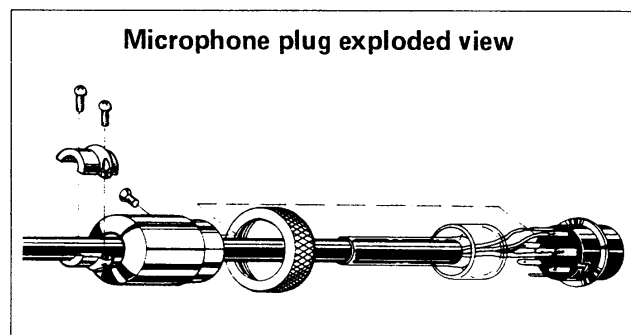
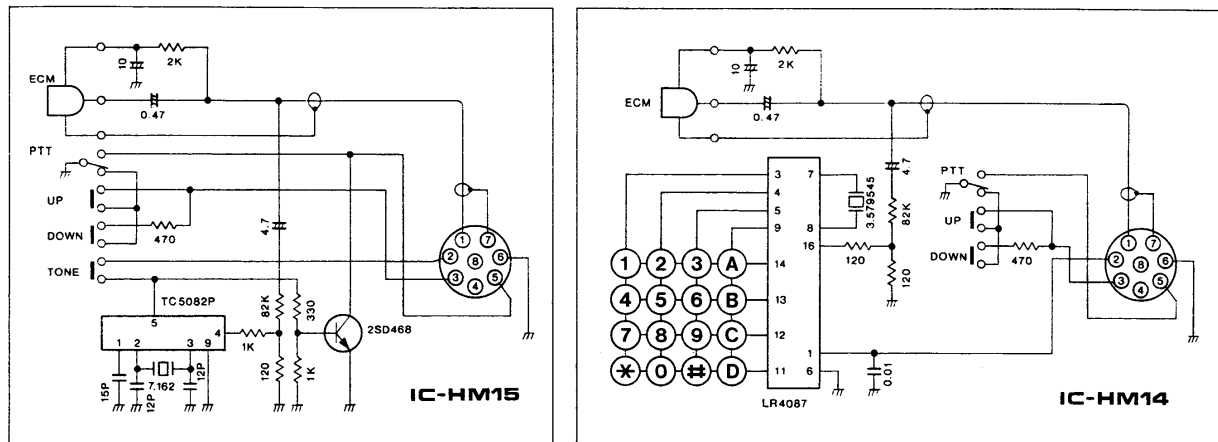
ANTENNA

The single most important item that will influence the performance of any communication system is the antenna. For that reason, a good, high-quality, gain antenna of 50 ohms impedance is recommended, fixed or mobile. In UHF as well as the low bands, every watt of ERP makes some difference. Therefore, 10 watts average output plus 3dB of gain antenna equals 20 watts ERP, presuming low VSWR of course. The few extra dollars invested in a gain type antenna is well worth it. When adjusting your antenna, whether mobile or fixed, by all means follow the manufacturer's instructions. There are however some pitfalls to be aware of. For example, do not attempt to adjust an antenna for lowest VSWR when using a diode VSWR meter not engineered for UHF applications. Such readings will invariably have an error of 40% or more. Instead, use an in line watt meter similar to the Bird Model 43 or Sierra Model 164B with UHF cartridge. Further, when adjusting a mobile antenna, do so with the engine running preferably above normal idling speed. This will insure proper voltage level to the transceiver.

The RF coaxial connector on the rear chassis mates with a standard N (UG-21/U) connector.

MICROPHONE

A high quality electret condenser microphone with built-in preamplifier is supplied with your transceiver. Merely plug it into the proper receptacle on the front panel. Should you wish to use a different microphone, make certain it has a proper output level. Particular care should be exercised in wiring also, as the internal electrical switching system is dependent upon it. See the schematic for the proper hookup.

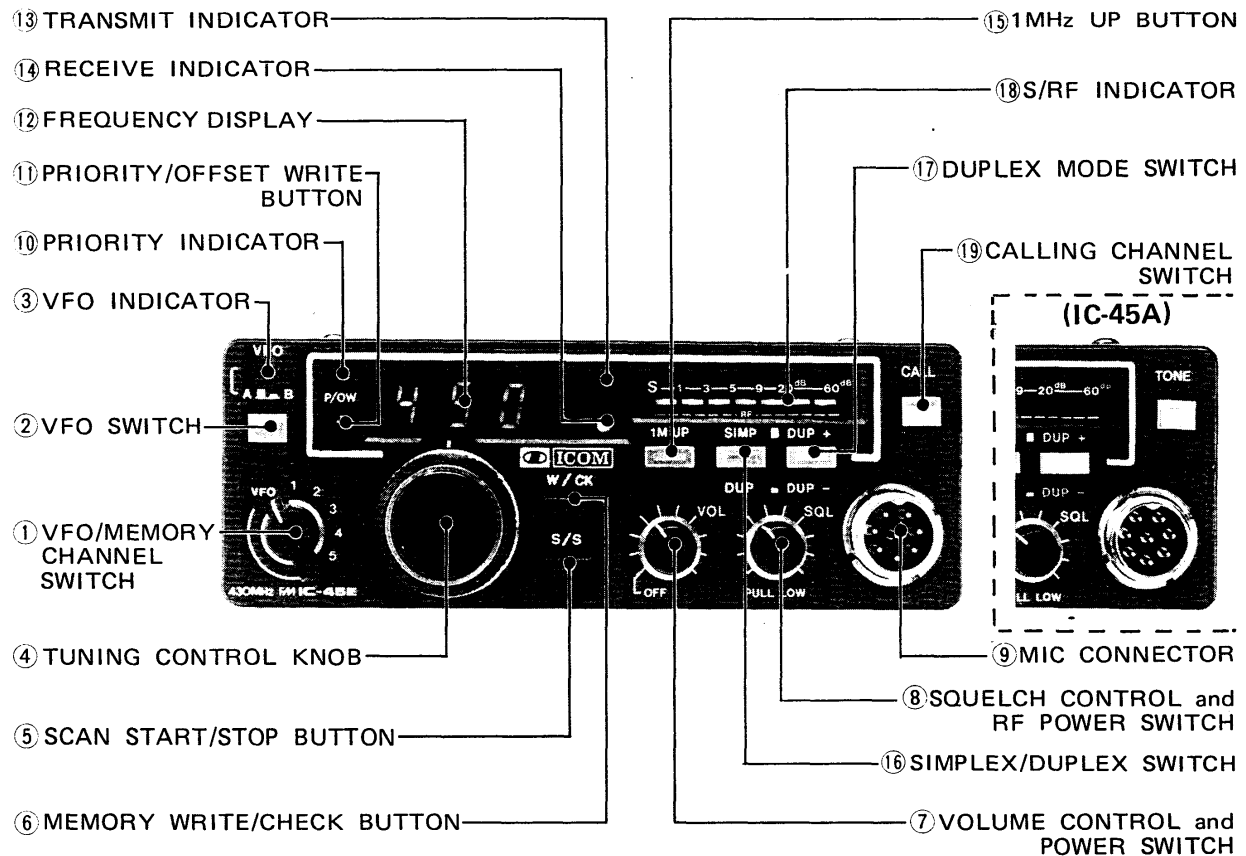


EXTERNAL SPEAKER

An external speaker jack and plug is supplied with your unit in the event another speaker is desirable. The external speaker impedance should be 4 ~ 8 ohms, and when used, will disable the internal speaker. A 4 ~ 16 ohm headset can be utilized as well.

SECTION IV CONTROL FUNCTIONS

FRONT PANEL



1. VFO/MEMORY CHANNEL SWITCH

Selects operation with the tuning control ("VFO" position) or operation with the memory channels (1 ~ 5). See "PROGRAMMING THE MEMORY CHANNELS" on page 13 for more details.

2. VFO SWITCH

Selects either VFO, "A" or "B", for tuning. In the "A" position, the VFO indicator is lit and the frequency changes 5KHz steps by turning the tuning control knob. In addition, this frequency can be memorized into any memory channel. In the "B" position, the frequency changes 25KHz steps by turning the tuning control knob.

3. VFO INDICATOR

When the VFO A is selected, this indicator illuminates.

4. TUNING CONTROL KNOB

Rotating the TUNING CONTROL KNOB clockwise increases the frequency, while rotating it counterclockwise decreases the frequency. The frequency is changed in 5KHz steps with the VFO "A", and 25KHz steps with the VFO "B", when tuning up past 439.995MHz (IC-45A : 449.995MHz), the frequency will automatically revert to 430.000MHz (IC-45A : 440.000 MHz). Likewise, when tuning down past 430.000MHz (440.000MHz), the frequency will automatically revert to 439.995MHz (449.995MHz).

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5. SCAN START/STOP BUTTON

Starts and stops any of the scan functions. When depressing it again to restart the scan, it will start from the stopped memory channel or frequency.

6. MEMORY WRITE/CHECK BUTTON

By pushing this button, VFO A's frequency is written into a memory channel, one VFO's frequency is transferred to the other VFO in the SIMPLEX mode, or the transmit frequency and receive frequency are exchanged with each other in the DUPLEX mode.

7. VOLUME CONTROL and POWER SWITCH

When the control is turned completely counterclockwise, the power is OFF. By turning the control clockwise beyond the "click", the unit is turned ON and the audio level increases by further rotating it clockwise.

8. SQUELCH CONTROL and RF POWER SWITCH

Turning this control clockwise sets the squelch threshold higher. To turn OFF the squelch function, turn this control completely counterclockwise.

By pulling the Squelch control knob, the RF output power is reduced to 1 watt. By depressing the knob to the normal position, the RF output power returns to 10 watts.

9. MIC CONNECTOR

Connect the supplied microphone to this jack. If you wish to use a different microphone, refer to the drawings on page 5.

10. PRIORITY INDICATOR

Illuminates when the priority function is turned ON.

11. PRIORITY/OFFSET WRITE BUTTON

Turns the priority function ON and OFF.

During the QSO or receiving with VFO, if you would like to monitor your favorite channel or a calling channel, set the memory channel switch to the favorite or calling channel which is memorized in a memory channel, and push the priority button. The receiving frequency will go to the channel for a moment every five seconds.

When the VFO/MEMORY CHANNEL switch is in the VFO position, while holding this button, the offset frequency is shown on the FREQUENCY DISPLAY and can be changed by turning the TUNING CONTROL knob. This allows you to program any 100KHz steps OFFSET frequency into the CPU.

12. FREQUENCY DISPLAY

The three large 7 segment LED's represent the digits between 1MHz and 10KHz and an LED for 5KHz of the operating frequency. The frequency indicated is the carrier frequency.

13. TRANSMIT INDICATOR

Illuminates in the transmit mode.

14. RECEIVE INDICATOR

Illuminates when the squelch is opened in the receive mode.

15. 1MHz UP BUTTON

Each push increases the frequency in 1MHz steps. The lower digits will not change.

16. SIMPLEX/DUPLEX SWITCH

Selects the SIMPLEX operation or the DUPLEX (repeater) operation.

17. DUPLEX MODE SWITCH

Selects the relationship of the receiving frequency and the transmitting frequency in the duplex mode.

18. S/RF INDICATOR

Indicates S-unit and RF output level with seven LED's in line. The numbers on the S-meter represent S1 through S9 and 20 and 60dB over S9. The RF output level meter functions only as a relative output meter and does not indicate the wattage. These functions are switched automatically when T/R switching is made.

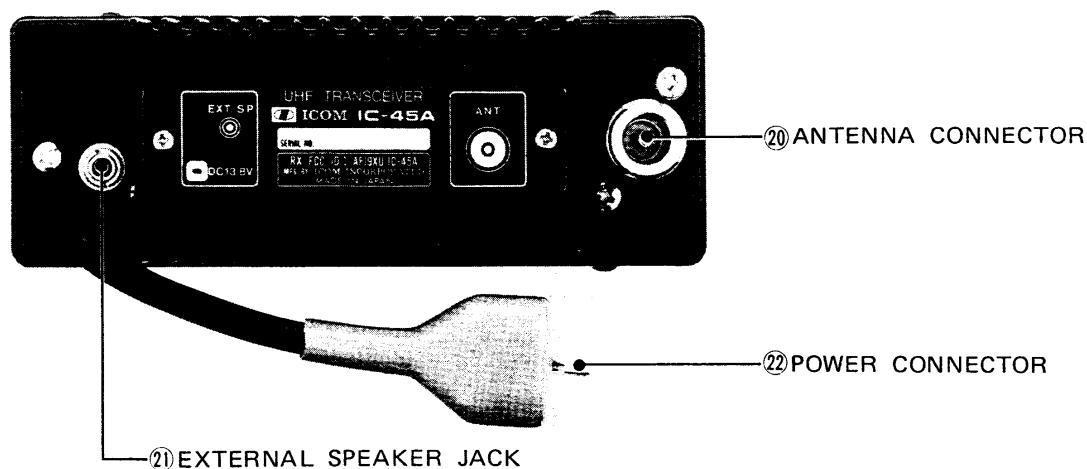
19. CALLING CHANNEL SWITCH

Selects the calling channel (Memory Channel 5), which can be programmed with any frequency, the same as the other memory channels, and has priority over the other VFO's and memory channels.

In addition, this switch can be used as a switch for the optional subaudible tone encoder, IC-EX270, or an external preamplifier such as the IC-AG1, by changing internal plug connection.

(IC-45A: Switches the power for optional subaudible tone encoder, IC-EX270.)

REAR PANEL



20. ANTENNA CONNECTOR

This is used to connect an antenna to the set. Its impedance is 50 ohms and connects with an N (UG-21/U) connector.

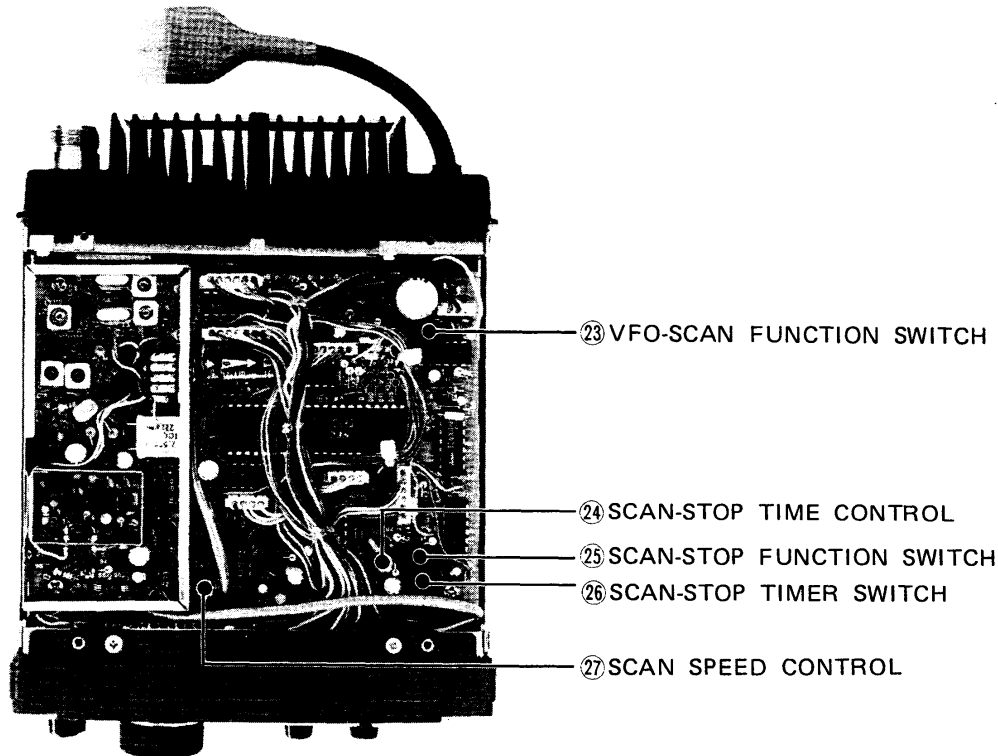
21. EXTERNAL SPEAKER JACK

When an external speaker is used, connect it to this jack. Use a speaker with an impedance of 4 ~ 8 ohms. When the external speaker is connected the built-in speaker does not function.

22. POWER CONNECTOR

Connect the supplied power cord to this connector.

UNDER THE TOP COVER



23. VFO-SCAN FUNCTION SWITCH

Switches the VFO-scan function to either the programmed scan or the full range scan.

24. SCAN-STOP TIME CONTROL

Controls the interval of the scan auto-stopping time. Adjust the control to desired interval. It can be adjusted from 5 to 20 seconds.

25. SCAN-STOP FUNCTION SWITCH

Switches the scan-stop function to either stop on a busy channel or stop on an empty channel.

26. SCAN-STOP TIMER SWITCH

Switches the scan-stop interval function ON and OFF.

27. SCAN SPEED CONTROL

Controls the scanning speed in any scan mode. Adjust the control to desired scanning speed.

SECTION V OPERATION

HOW TO TUNE

The following instructions are for tuning in any mode. Please read carefully and understand fully before turning ON your unit. Proper tuning is necessary for optimum operation.

PRESET FREQUENCIES

When the POWER Switch is turned ON, the frequency display will be "1.00" representing 431.000 MHz (IC-45A: representing 441.000MHz). The frequencies of the VFO's and the Memory Channels are preset so that they start from the frequencies shown above whenever the IC-45A/E is turned ON.

TUNING CONTROL

Rotating the Tuning Knob clockwise increase the frequency; turning it counterclockwise decreases the frequency in 5KHz steps when VFO "A" is used, or in 25KHz steps when VFO "B" is used.

The click stops of the knob change in 5KHz steps or 25KHz steps. One complete rotation of the tuning knob results frequency increases or decreases of a 250KHz or 1,250KHz.

When you reach 439.995MHz, turning the Tuning Control knob clockwise will bring the operating frequency to 430.000MHz, the lowest edge, and you can continue increasing the frequency from there by continuing to rotate the knob clockwise. The VFO endless system functions in the same way when decreasing the frequency from 430.000MHz, and will prevent you from inadvertently operating out of the amateur radio band. (IC-45A: 439.995MHz and 430.000MHz should be read as 449.995MHz and 440.000MHz.)

VFO/MEMORY CHANNEL SWITCH and VFO SWITCH

The CPU in the IC-45A/E contains two "VFO's" for both receiving and transmitting. The VFO's are labeled "A" VFO and "B" VFO and are selectable with the VFO Switch, when the VFO/MEMORY CHANNEL Switch is the VFO position. The dual VFO system gives the IC-45A/E many very convenient features. Please read this section very carefully and perform the operation several times until you are comfortable with the system. Try the example for practice!

1. "A" VFO is for both transmitting and receiving and is selected by placing the VFO Switch in the "A" (out) position. The transmit and receive frequency will be controlled by "A" VFO, displayed on the frequency display and stored in "A" memory.
2. "B" VFO is for both transmitting and receiving and is selected by placing the VFO Switch in the "B" (in) position. The transmit and receive frequency will be controlled by "B" VFO, displayed on the frequency display, and stored in "B" memory.

NOTE: The memory channel positions are described in the "MEMORY CHANNEL OPERATION" on page 13.

- When the IC-45A/E is first turned ON, 431.000MHz (IC-45A: 441.000MHz) is preset into the VFO "A" and VFO "B".

FOR EXAMPLE:

When the VFO Switch is set in the "A" position and the set is turned ON, "1.00" will be displayed on the readout representing 431.000MHz. (IC-45A: representing 441.000MHz). This will occur

whether the VFO switch is in either the "A" or "B" position. Rotating the tuning control knob clockwise will increase the frequency, and rotating the tuning knob counterclockwise will decrease the frequency in 5KHz steps with VFO "A", or in 25KHz steps with VFO "B".

- Switching from one VFO to the other VFO does not clear the first VFO. The frequency is retained in the VFO's memory.

FOR EXAMPLE:

If 431.125MHz is set with "A" VFO, and the VFO switch is set to "B" VFO, the frequency readout will show "B" VFO's frequency, but 431.125MHz is still stored in "A" VFO's memory. Return the VFO Switch to "A" VFO position, and "1.125" will be displayed on the readout. Accordingly, if the switch is placed in the "B" VFO position, the frequency that was set with the "B" VFO will appear. This allows you to set a certain frequency with one VFO, work up and down the band with the other VFO, and periodically check the set frequency simply by switching between "A" and "B" VFO. It also allows you to search for a clear frequency with one VFO, while keeping your operating frequency on the other VFO. When you have found a clear frequency, switch back to your operating frequency, inform the station you are in contact with of the new frequency, and switch back. It's that simple!

TRANSFERRING VFO FREQUENCY

The MEMORY WRITE/CHECK button allows either VFO's to be brought to the exact frequency of the other VFO without turning the tuning control knob.

FOR EXAMPLE:

When "A" VFO is 431.255MHz and "B" VFO is 431.355MHz, pushing the VFO Switch to select "B" VFO, then the MEMORY WRITE/CHECK button, "B" VFO's frequency becomes the same as "A" VFO's (431.255MHz). Now the "A" VFO's frequency is memorized in the "B" VFO, and you can operate anywhere with "A" VFO or "B" VFO. When you want to return to the previous frequency (431.255MHz), switch back to the other VFO. To reverse this (A the same as B), select "A" VFO first, then push the MEMORY WRITE/ CHECK button.

DUPLEX (REPEATER) OPERATION

The SIMPLEX/DUPLEX Switch and DUPLEX MODE Switch allow DUPLEX (repeater) operation. The offset frequency is preset for the standard separation; 7.6MHz (IC-45A: 5MHz), but this frequency can be reset for any 100KHz steps in-band frequency. So you can access to any repeater.

1. When the SIMPLEX/DUPLEX Switch is in the "SIMP" position, the set is in SIMPLEX mode; the receive frequency and transmit frequency are controlled a frequency which is by placing the VFO/MEMORY CHANNEL Switch and VFO Switch in any position of "A", "B" or Memory Channel 1 ~ 5.
2. When the SIMPLEX/DUPLEX Switch is in "DUP" position and the DUPLEX MODE Switch is in "-DUP" position, the set is in DUPLEX mode, and the transmit frequency is set 7.6MHz (or 5MHz, or reset offset frequency) below the receive frequency.
3. When the DUPLEX MODE Switch is in the "+DUP" position, the set is in DUPLEX mode, and the transmit frequency is set 7.6MHz (or 5MHz, or reset offset frequency) above the receive frequency.

4. When the SIMPLEX/DUPLEX Switch is in the "DUP" position, while the MEMORY WRITE/CHECK button is pushed, the receive frequency becomes the expecting transmit frequency, so you can receive the repeater's input frequency.

- "+DUP" or "-DUP" position will allow you to access a repeater that has a 7.6MHz input/output frequency separation.

FOR EXAMPLE:

Set "A" VFO to 438.725MHz. Then set the DUPLEX MODE Switch to-the "-DUP" position. 8.725 will be shown on the readout during receive and 1.125 during transmit. You are now receiving on 438.725MHz and transmitting on 431.125MHz, so you can access 431.125/438.725 repeater.

If you push the MEMORY WRITE/CHECK button, 1.125 will be shown on the readout and you can receive on 431.125MHz, i.e., repeater input frequency, while the button is pushed.

If you change the receiving ("A" VFO) frequency from 438.725MHz to 438.675MHz, the transmitting frequency will change from 431.125MHz to 431.075MHz, so now you can access a 431.075/438.675 repeater.

Setting the OFFSET Switch to "+DUP" position changes the transmitting frequency to 7.6MHz above the receiving frequency.

If you set "A" VFO to 431.250MHz, the transmitting frequency will be 438.850MHz.

These functions will be available also in "B" and Memory 1 ~ 5 positions of the VFO/MEMORY CHANNEL Switch, and the CALLING CHANNEL.

RESETTING THE OFFSET FREQUENCY

The offset frequency can be reset to any 100KHz steps in-band frequency other than 7.6MHz (or 5.0MHz).

Set the VFO/MEMORY CHANNEL Switch in the "VFO" position. By pushing the PRIORITY/OFFSET WRITE button, the FREQUENCY DISPLAY shows 1MHz digit and 100KHz digit of the offset frequency while the button is pushed. If no offset frequency has been reset since turning the power of the set ON, "7.6" (or "5.0") will be shown on the display.

Rotating the Tuning control knob clockwise increases the frequency; turning it counterclockwise decreases the frequency in 100KHz steps. Turn the tuning control knob to obtain desired offset frequency, and the desired offset frequency is written into the CPU and maintained as long as the power of the set is not turned OFF or a new offset frequency is reset.

- What to do if you want to operate repeaters that have a frequency difference other than $\pm 7.6\text{MHz}$ (or $\pm 5.0\text{MHz}$) (for example: 1.6MHz).

FOR EXAMPLE:

Set the VFO/MEMORY CHANNEL Switch in the "VFO" position, and by pushing the PRIORITY/OFFSET WRITE button, the FREQUENCY DISPLAY shows "7.6". Turn the tuning control

knob clockwise to show "1.6" on the display.

Set "A" VFO to 434.725MHz. Then set the DUPLEX MODE Switch to the "-DUP" position. 4.725 will be shown on the display during receive and 3.125 during transmit.

You are now receiving on 434.725MHz and transmitting on 433.125MHz, so you can access a 433.125/434.725 repeater.

If you change the receiving frequency from 434.725MHz to 434.675MHz, the transmitting frequency will change from 433.125MHz to 433.075MHz, so now you can access a 433.075/434.675 repeater.

MEMORY CHANNEL OPERATION

MEMORY-WRITE (PROGRAMMING THE MEMORY CHANNELS)

NOTE: Only "A" VFO can be used for memory-writing.

1. Set the Tuning Control to the desired frequency, using "A" VFO. For example, set it for 438.700MHz, the display shows "8.70".
2. Set the VFO/MEMORY CHANNEL Switch to the channel to be programmed (1 ~ 5). As an example, set it at Memory Channel 1. If no frequency has been programmed since turning the power of the unit ON, "1.00" will be shown on the display, and the unit will receive on 431.000MHz (IC-45A: 441.000MHz).
3. One push of the MEMORY WRITE/CHECK Button erases the previous programmed frequency (431.000) and programs the new frequency (438.700) into Memory Channel 1.
4. Program any desired frequencies in Memory Channels 2 ~ 5 in the same manner. Memory Channels 1 and 2 are used also for the Programmed Scan. For Programmed Scan operation, refer to "SCANNING OPERATION".

MEMORY READING

Set the VFO/MEMORY CHANNEL Switch to the desired memory channel 1, 2, or 5. At that frequency the "A" or "B" VFO was set, that previously programmed frequency is then recalled. When the VFO/MEMORY CHANNEL Switch is set back to "VFO", the previous operating frequency of that VFO will again be shown on the display.

The programmed frequencies in the five Memory Channels are maintained as long as the power, including MEMORY BACKUP power, of the IC-45A/E is not turned OFF or new frequencies reprogrammed. When the power cord is connected to a continuous operating power source, all the programmed frequencies on the Memory Channels and the operating frequencies of both "A" and "B" VFO's are retained even when the POWER Switch is turned OFF.

SCANNING OPERATION

The IC-45A/E provides various scanning operations. Please read the following instructions carefully to fully enjoy the IC-45A/E's many capabilities.

MEMORY SCAN

This is used to scan the five Memory Channels and two VFO's frequencies continuously.

1. Program five desired frequencies in Memory Channels 1 ~ 5.
2. Set the VFO/MEMORY CHANNEL Switch to any memory position.

3. Depress the S/S (Scan Start/ Stop) button, and the frequency starts scanning the programmed frequencies in the Memory Channels 1, 2, 3, 4, 5, then "A" VFO and "B" VFO, 1, 2, 3, 4, 5, "A" VFO, "B" VFO.
4. If the SQUELCH is engaged, the scan stops when the squelch is opened and receives a signal. To stop scanning without opening the squelch, depress the S/S Button. Depress it again to restart the scanning.
This function can be changed to stop when the squelch is closed, i.e., an empty channel, by setting the SCAN-STOP FUNCTION SWITCH located under the top cover to the EMPTY position.

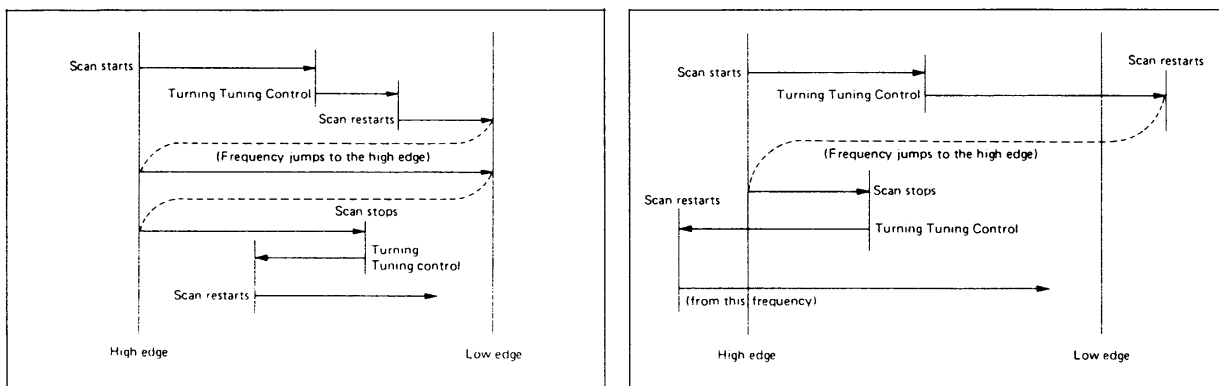
PROGRAMMED SCAN

This is used to scan between two desired frequencies, which are programmed in Memory Channels 1 and 2, by setting the VFO-SCAN FUNCTION Switch located under the top cover to "PROG-S" position.

1. Program the frequencies of the high edge of the desired scanning range into Memory Channel 2, and the low edge into Memory Channel 1.
For example, program 434.200MHz into Memory Channel 1 and 434.800MHz into Memory Channel 2.
2. Set the VFO/MEMORY CHANNEL Switch to VFO position. Depressing the S/S Button starts the scan from the high edge (434.800MHz) to the low edge. The scanning frequency increments depend on the VFO Switch setting.
3. When the scanning frequency reaches the lowest edge (434.200MHz), it automatically returns to the high edge (434.800MHz) and continues scanning down to provide endless scanning operation.
4. While the SQUELCH is engaged, the squelch opening as a signal is received will stop the scanning automatically to lock onto the frequency. If the RECEIVE indicator LED is lit because the SQUELCH is not engaged, the scan does not stop at any signal.
5. To stop the scan operation, depress the S/S Button. Depressing the S/S Button again restarts the scan from the frequency at which it stopped.
6. If this frequency is changed with turning the Tuning Control knob while the scan is stopped, the scanning will restart from the VFO frequency.

In this case, if the VFO frequency is below the low edge frequency, the frequency jumps to the high edge frequency (434.800MHz) and restarts from the high edge.

If the changed frequency is higher than the high edge frequency and the S/S Button is pushed, scanning will begin at the VFO frequency, scan down to the low edge but will return to the preprogrammed high edge frequency.



VFO FULL RANGE SCAN

This is to scan the entire band between 430.000MHz and 439.995MHz. (IC-45A : between 440.000MHz and 449.995MHz.)

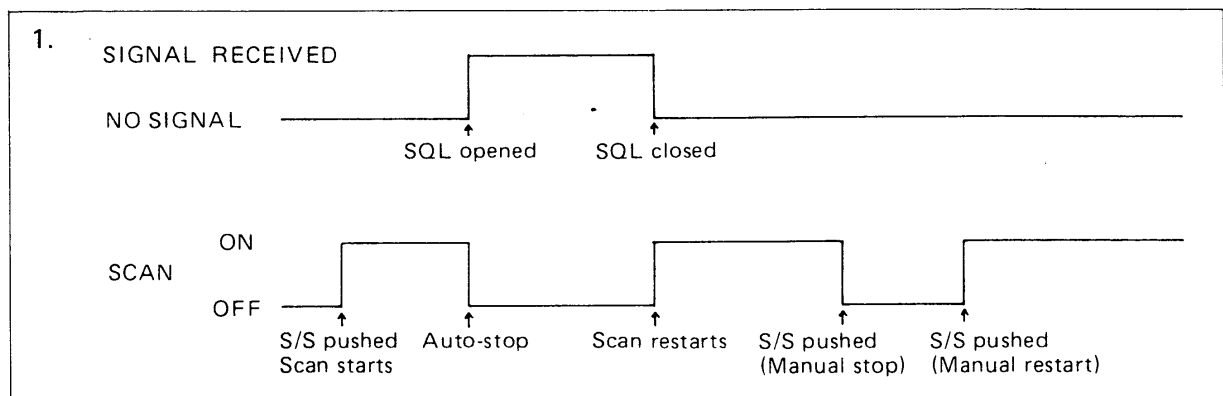
1. Set the VFO/MEMORY CHANNEL Switch to VFO position, and the internal VFO-SCAN FUNCTION Switch to "FULL-S" position. Depressing the S/S button starts the scan from the VFO frequency to the low edge. The scanning frequency increments depend on the VFO Switch setting.
2. When the scanning frequency reaches the low edge, it automatically returns to the high edge and continues scanning down to provide endless scanning operation.
3. Other operations are the same as the PROGRAMMED SCAN and MEMORY SCAN.

The scanning speed can be adjusted by the SCAN SPEED Control located under the top cover. Rotating the control counterclockwise makes the scanning speed faster.

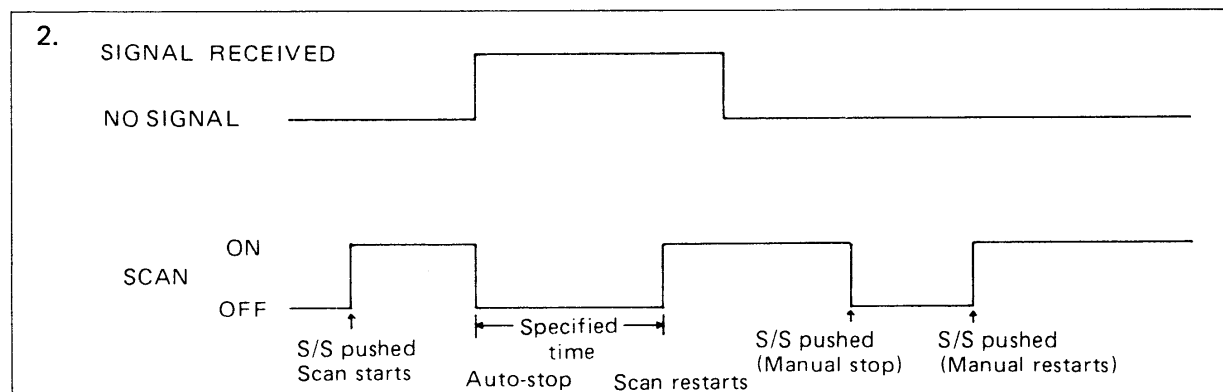
While the SCAN is operating even if the SCAN stops on a frequency, the decimal point of the frequency display will blink according to the scanning speed.

RESUMING SCAN

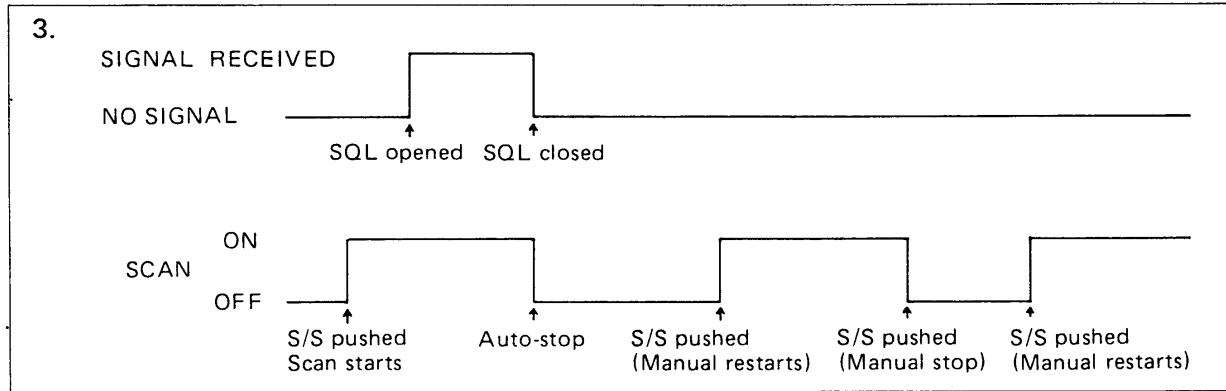
All scan modes are provided with the resume scan function. When the scan has been stopped by the auto-stop function, the scan will restart after the cause goes away, or after passing a specified time.



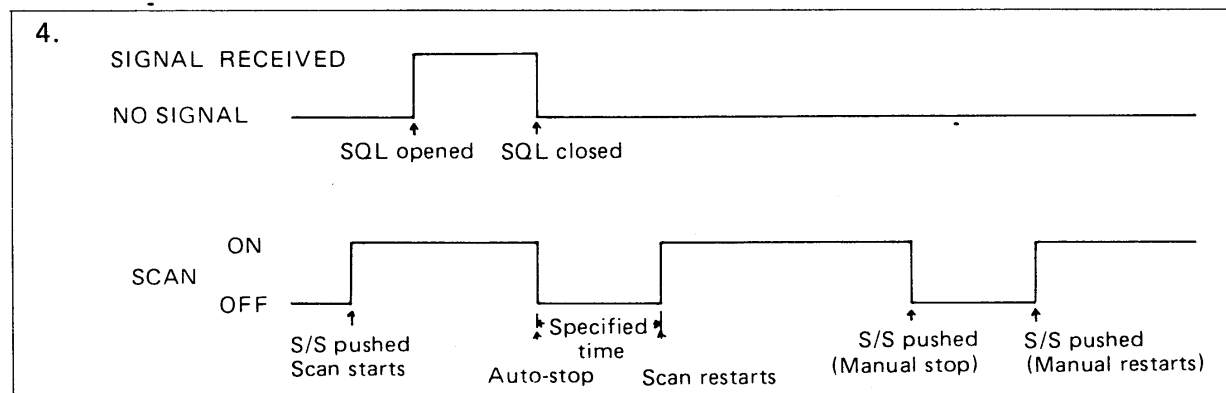
1. By setting the SCAN-STOP TIMER Switch in OFF position and the SCAN-STOP FUNCTION SWITCH in BUSY position (both located under the top cover), the scan will stop on a signal (by opening the squelch), then the scan will restart with disappearing the signal.



- By setting the SCAN-STOP TIMER Switch in ON position and the SCAN-STOP FUNCTION SWITCH in BUSY position, the scan will stop on a signal, and will restart after specified time is passed, whether a signal has been received or not. This scan stopping time is adjustable between 5 seconds and 25 seconds with the SCAN-STOP TIME CONTROL located under the top cover.



- By setting the SCAN-STOP FUNCTION SWITCH in EMPTY position and the SCAN-STOP TIMER Switch in OFF position, the scan will stop on an empty channel (by the closing of the squelch), then the scan will restart when a signal appears.



- By setting the SCAN-STOP FUNCTION SWITCH in EMPTY position and the SCAN-STOP TIMER Switch in ON position, the scan will stop on an empty channel, then will restart after specified time is passed, whether a signal has been received or not.

Set the SCAN-STOP TIMER Switch, SCAN-STOP TIME Control, and SCAN-STOP FUNCTION SWITCH to the desired positions before the set is installed.

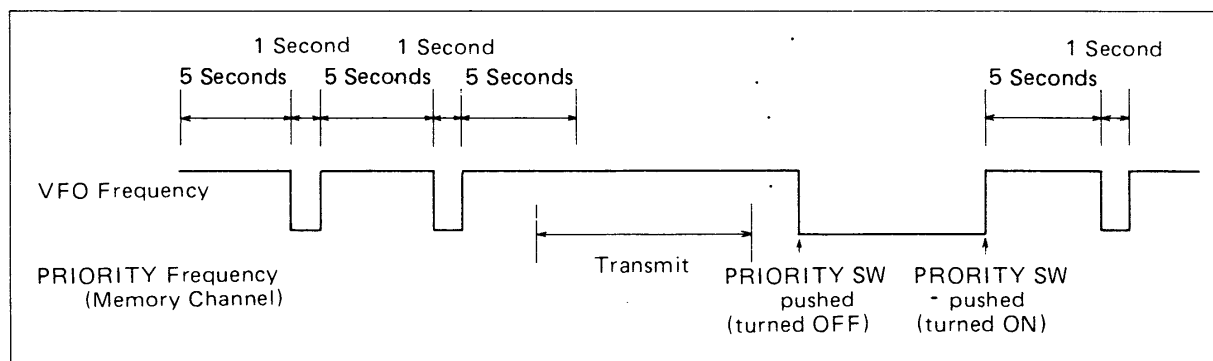
PRIORITY FUNCTION

This function is used to check your favorite channel, such as a local repeater or a calling channel stored in a memory channel while operating on a VFO frequency.

The following steps are taken to utilize the PRIORITY FUNCTION.

- Write your favorite frequency into a memory channel.

2. Set the VFO/MEMORY CHANNEL Switch in the position where your favorite frequency is stored. The set then receives on the memory channel.
3. By pushing the PRIORITY/OFFSET WRITE button, the PRIORITY INDICATOR is lit and the set receives on a VFO frequency for a period of five seconds and on the priority channel (written with your favorite frequency) one second, and then repeats this function until the PRIORITY button is pushed again.
4. If the set is turned to transmit mode during the priority function the transmit frequency will be the VFO frequency in SIMPLEX mode, or its OFFSET frequency in DUPLEX mode. When returned to receive mode the priority function will be continued.
5. If you wish to stop the priority function, push the PRIORITY/OFFSET WRITE button again, and the PRIORITY indicator is turned OFF and the operating frequency goes to the priority channel's frequency.
6. If you wish to continue the operation on the VFO frequency, set the VFO/MEMORY CHANNEL Switch to the VFO position.



OPERATION

1. RECEIVING

After connecting an antenna, microphone, etc., set knobs and switches as follows.

VFO/MEMORY CHANNEL SWITCH	"VFO"
VFO SWITCH	"A" (out)
VOLUME CONTROL and POWER SWITCH	Completely counterclockwise (OFF position)
SQUELCH CONTROL and RF POWER SWITCH	Completely counterclockwise (Pull switch is in normal position.)
SIMPLEX/DUPLEX SWITCH	"SIMP" (out)

The other switches are unrelated to receiving and need not be set at this time.

Now turn ON the POWER SWITCH. The RECEIVE indicator will be illuminated and "1.00" will be shown on the FREQUENCY DISPLAY. Slowly turn the VOLUME Control clockwise to a comfortable level. Rotate the tuning knob until a signal is received. The S/RF indicator will light according to the signal strength, so tune for the highest possible indicator reading and the clearest audio.

If no signal can be heard, turn the Squelch Control clockwise until the noise from the speaker stops and set it just below this threshold. (When adjusting the Squelch control setting, if some communication signals can be heard, turn the tuning control either direction and set it where

only noise can be heard.) The transceiver will now remain silent until an incoming signal is received which opens the squelch and lights the RECEIVE indicator. If the squelch is unstable due to the reception of weak signals or mobile stations, adjust the squelch control further until the proper threshold is obtained.

For tuning, Memory Channel operation and Scanning operation refer to "HOW TO TUNE" on page 10, "MEMORY CHANNEL OPERATION" on page 13, and "SCANNING OPERATION" on page 13.

2. TRANSMITTING

For simplex operation, set the SIMPLEX/DUPLEX Switch in the "SIMP" position.

For duplex operation set the SIMPLEX/DUPLEX Switch in the "DUP" position and the DUPLEX MODE Switch in the "-DUP" or "+DUP" position according to repeater's input/output frequencies.

When the IC-45A/E is first turned ON, the OFFSET frequency will be preset 7.6MHz (IC-45A: 5MHz). This OFFSET frequency is normal repeater input/output frequency separation.

If you desire to operate repeaters that have a frequency difference other than ± 7.6 MHz (or 5MHz), reset the OFFSET frequency to desired frequency. Refer to "RESETTING THE OFFSET FREQUENCY" on page 12.

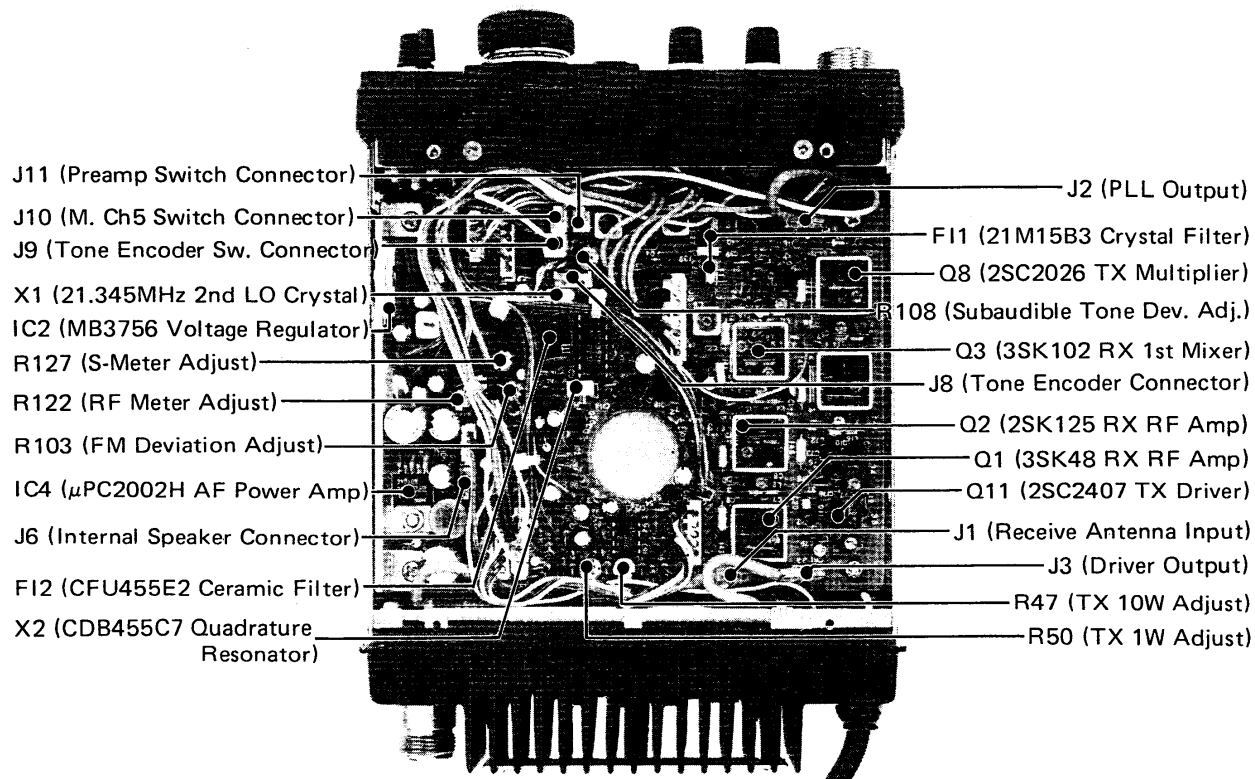
If the lower output power (1 watt) is sufficient, set the Squelch Control and RF Power Switch to the LOW (out) position.

Depress the PTT (push-to-talk) Switch on the microphone and the transceiver will transmit. At the same time the TRANSMIT indicator will illuminate red and the S/RF indicator will provide an indication of relative power output of the transmitter.

If you need a tone-burst for initial access of the repeater, depress the Tone Call Switch on the microphone for the required period. (Tone-burst periods vary individually from 100 milliseconds to 2 seconds.) (IC-45A: The 16 key Dual-Tone pad is provided on the microphone, and the optional subaudible tone encoder can be installed in the set.)

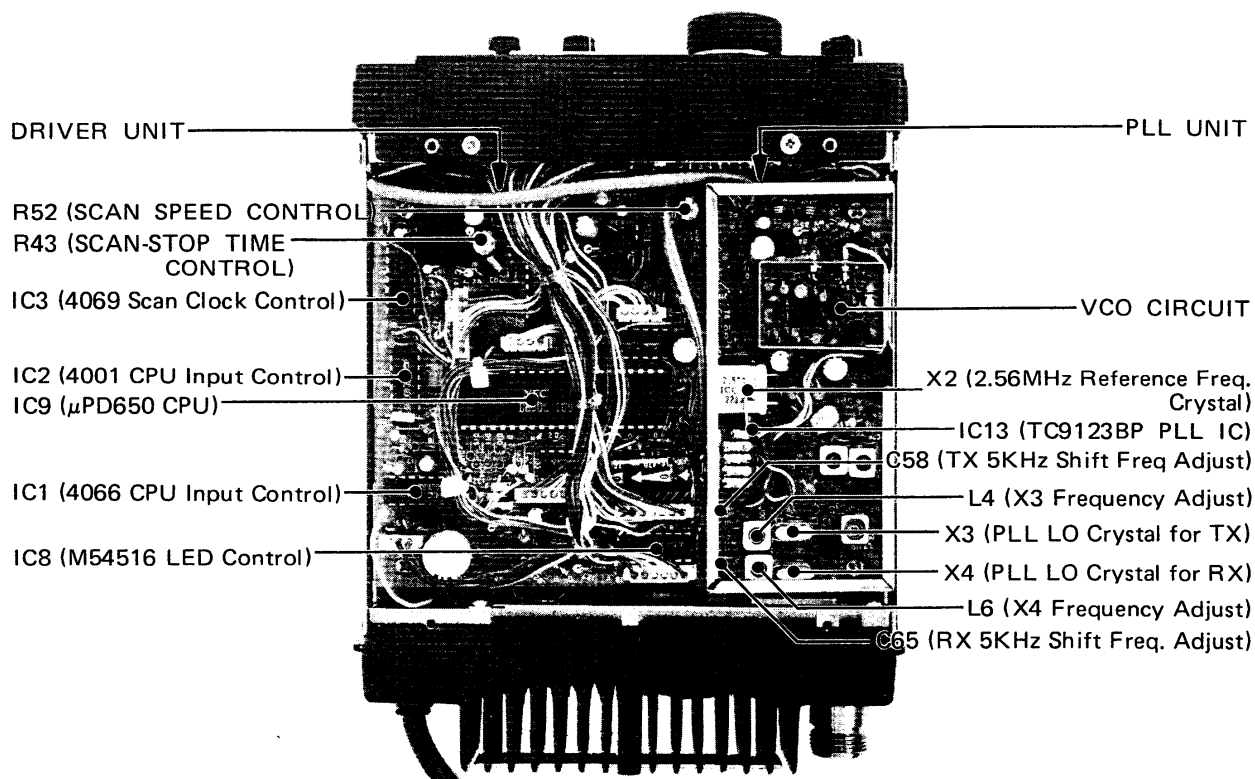
SECTION VI INSIDE VIEW

MAIN UNIT SIDE



PLL UNIT SIDE

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SECTION VII CIRCUIT DESCRIPTION

OUTLINE

The IC-45A/E employs a digital phase locked loop (PLL) circuit which generates a half of the desired frequency. This signal is multiplied to get the desired frequency.

This output signal is 21.8MHz below the receive frequency in the receive mode, and is exactly the transmit frequency in the transmit mode, thereby keeping spurious signal to a minimum.

The operating frequency is controlled by pulse signals, generated by the rotary encoder located at the tuning knob, being added to or subtracted from the preset frequencies in the microcomputer.

The microcomputer controls the PLL circuit which determines the output frequency of the VCO (Voltage Controlled Oscillator).

In the receiver section, signals from the antenna are mixed with the local oscillator output from the PLL circuit. The circuits function as a dual-conversion type with 21.8MHz 1st IF and 455KHz 2nd IF.

In the transmitter section, the VCO in the PLL circuit is used to produce the transmit signal which is direct-frequency modulated.

The FM signal is multiplied, amplified, filtered, and then sent to the antenna.

RECEIVER CIRCUITS

ANTENNA SWITCHING CIRCUIT

Signals from the antenna connector are fed to the RF amplifier Q1 in the MAIN unit through low-pass filters in the PA unit. The antenna switching relay in the PA unit, is turned OFF in the receive mode, and the signals are fed to the receiver circuit.

RF CIRCUIT

The signals from the PA unit, are amplified by the low-noise MOS FET Q1 and junction FET Q2, and sent to the band-pass filter, which reduces interference and intermodulation from other radio signals or nearby signals. The filtered signals are then fed to the 1st gate of the first mixer Q3.

To the 2nd gate of the MOS FET mixer Q3, a 410MHz signal is supplied from the PLL unit through the multiplier Q6 and buffer amplifier Q7.

The 21.8MHz, first IF signals are taken from the drain of the mixer Q3 through the matched pair monolithic crystal filter F11, then fed to the IF circuit.

IF CIRCUIT

The 21.8MHz 1st IF signals from the crystal filter, F11, are fed to the amplifiers Q4 and Q5, then IC3 which is composed of the second local oscillator, second mixer, limiter amplifier, quadrature detector and active filter circuits.

The second local oscillator oscillates 21.345MHz with X1, and is fed to the second mixer with the first IF signals to convert into 455KHz second IF signals. The second IF signals are put out from Pin 3, and fed to external ceramic filter F12 which has excellent selectivity, then fed to IC3 (Pin 5) again to amplify and detect.

The detected AF signals are put out from Pin 9.

Audio signals from Pin 9 are divided into audio signals and noise component signals to operate the squelch circuit.

AUDIO CIRCUIT

In the audio amplifier, the audio signals are passed through the de-emphasis circuit consisting of R74 and C112, and amplified by Q18. High frequency components are cut by a low-pass filter Q16, in order to improve the signal-to-noise ratio. Then the audio signals are adjusted to a suitable level by volume control R1, amplified by AF power amplifier IC4 to 2W or more, and fed to the speaker.

SQUELCH CIRCUIT

This is a noise circuit that suppresses noise when signals enter the set. To avoid erroneous operation due to audio signals, noise components of about 20KHz are selectively amplified.

Noise components put out from Pin 9 of IC3 are fed to IC3 (Pin 10) again through the SQUELCH control R2, which controls the squelch threshold level, filtered about 20KHz signal (noise) and put out from Pin 11.

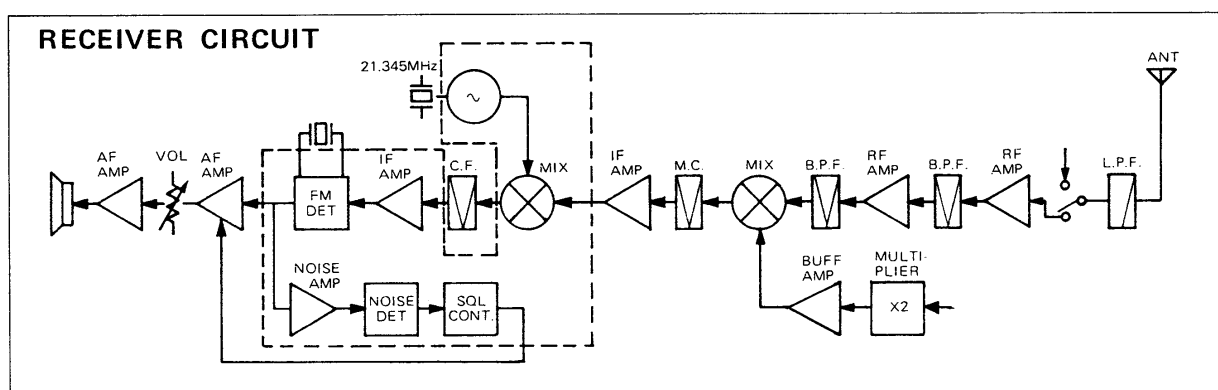
This signal (noise) is rectified by D4 and D5, integrated by R76, R77 and C105, and turns Q17 ON and turns OFF the Q18 AF amplifier.

When there are no signals, rectified DC voltage from D4 and D5 is applied to the base of Q17, turning it on. Since the collector of Q17 is connected to the base bias network of AF amplifier Q18, base voltage of Q18 falls and Q18 is turned off, thus squelch action is applied, and no audio is amplified by IC4. At this time, signal lamp control IC, IC8 of LOGIC unit, does not conduct, and so the RECEIVE lamp goes off.

When incoming signals are received, noise is suppressed, the base voltage of Q17 falls, and Q17 is turned off. Therefore, normal voltage is applied to the base of Q18, the squelch circuit is opened, and audio signals are heard from the speaker. IC8 also is turned on, and the RECEIVE lamp lights up.

The point at which squelch becomes operative (squelch threshold) is adjusted by R2.

During transmit, Q17's collector is grounded through D13 and PTT switch, and the squelch circuit is operative, so squelch action is started the moment there is switchover from transmit to receive, and no loud crackling or similar noise is heard.



TRANSMITTER CIRCUITS

MIC AMPLIFIER CIRCUIT

Audio signals from the microphone are fed to the differential circuit, C169 and R87, then to Pin 3 of IC1, which is a limiter amplifier and has 6dB/Octave response between 300Hz and 3KHz.

The output of the limiter amplifier is similar to rectangular waves and includes harmonics. These harmonics are eliminated by the low-pass filter Q20, which cuts 3KHz or higher.

Filtered signals are fed to the VCO in the PLL board to make modulation through level adjust trimmer R103.

MULTIPLIER AND DRIVER CIRCUITS

The VCO oscillates a half of a transmitting frequency, thus the multiplier Q8, multiplies it two times to obtain 430MHz transmitting frequency.

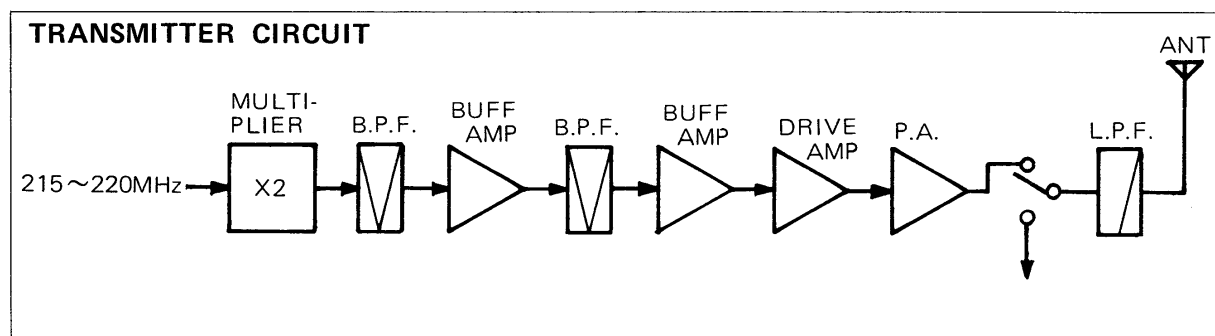
This 430MHz signal is fed to amplifiers Q9, Q10 and Q11 through band-pass filters L13, L14 and L15, L16 to obtain 200 milliwatts pure 430MHz signal.

POWER AMPLIFIER CIRCUIT

The signals from Q11 in the MAIN unit are amplified by IC1 in the PA unit to obtain 10W output. The heat from IC1 is transmitted to the diecast heat sink which radiates the heat very efficiently. IC1 is a hybrid IC consisting of a three-stage RF power amplifier. The output signals of IC1 are fed to the antenna terminal through the T/R switching relay and low-pass filter, which suppress harmonics by more than 60dB.

ALC CIRCUIT

This circuit stabilizes the output power when the supply voltage or the antenna load is fluctuating, and switches the output power between 1 watt and 10 watts. The variation in the current of IC1 is detected at R1 in the PA unit and amplified by differential amplifier IC1 in the MAIN unit. The output voltage from Pin 7 of IC1 is fed to Q12 then Q14. This lowers voltage of Pin 2 of IC1 and input excitation level and reduces input power to the final stage, thus preventing damage to the module due to high current. Normal power (10W) can be adjusted with R47. Low power (1W) is adjusted with R50.



METERING CIRCUIT

In the receive mode, the S/Rf indicator functions as an S-meter. A part of the second IF signal from Pin 5 of IC3 is amplified by IC5, then rectified by D9 and D10. The rectified signal is fed to the indicator driver IC which provides a wide dynamic range meter function.

In the transmit mode, the S/RF indicator functions as a relative RF power meter. A part of the RF power output is fed to D1 in the PA unit and rectified, then fed to the indicator drive IC through the level adjust trimmer R122.

POWER SUPPLY CIRCUIT

This circuit employs a multipurpose voltage regulator, IC2. It puts out a constantly active 8V, R8V which is operative during receive, and T8V which is operative during transmit. R8V is put out from Pin 6, and T8V is put out from Pin 8 of IC2. By grounding Pin 5 through R61 and Q15, R8V goes to 0V and T8V is actuated, thus the set will be turned to transmit mode.

PLL (PHASE LOCKED LOOP) UNIT

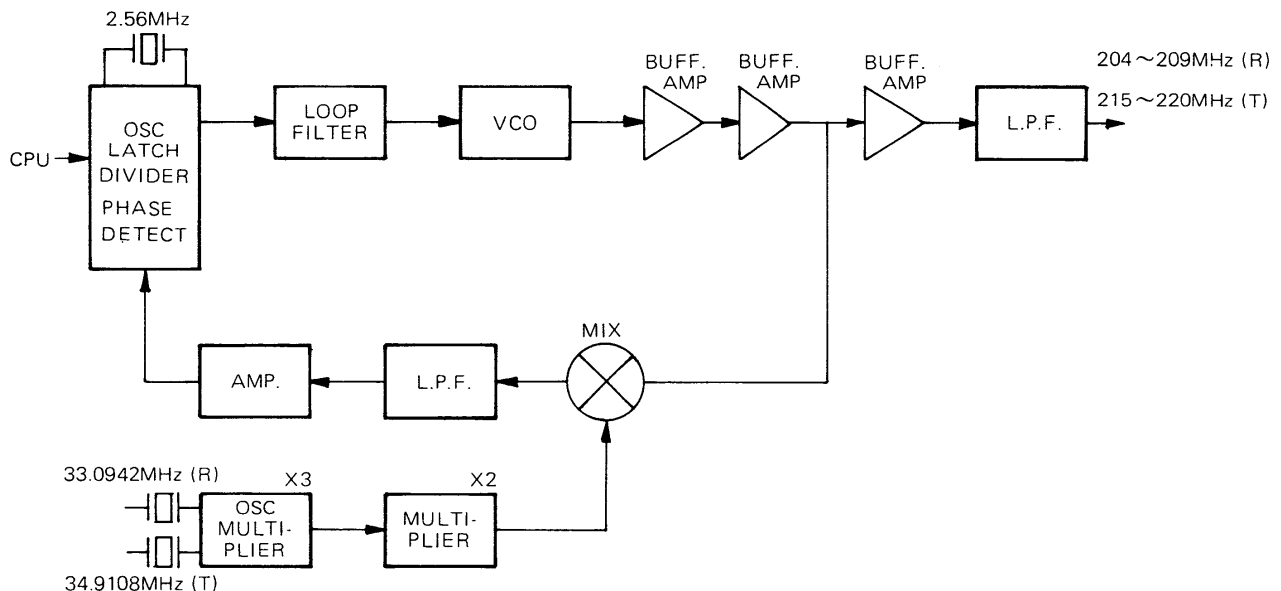
LOCAL OSCILLATOR CIRCUIT

The circuit produces 33.09417MHz (IC-45A: 33.9275MHz) signal in the receive mode and 34.9108 MHz (IC-45A: 35.74417MHz) signal in the transmit mode, with Q19.

The signal at 3 times this frequency is taken from the collector of Q19. This signal is then multiplied two times by Q20, and Q20 puts out 198.565MHz (IC-45A: 203.565MHz) in the receive mode, and 209.465MHz (IC-45A: 214.465MHz) in the transmit mode.

When the operating frequency KHz digit equals 5, D43 is turned OFF and C65 is inserted in series into the serial capacitor of the crystal in the receive mode, D41 is turned OFF and C58 is inserted in the transmit mode. Thus the output frequency of the local oscillator is shifted 2.5KHz (5KHz divided by 2).

PLL CIRCUIT



MIXER, LOW PASS FILTER, AND AMPLIFIER CIRCUIT

The output signals from the local oscillator circuit and the VCO signals are mixed by the MOS FET mixer Q21. The output signals are fed to the low-pass filters to filter out only the signals

below 15MHz. The output signals from the filter are amplified to the proper drive level (more than 3Vp-p) of the programmable divider IC13 by Q13. Then the signals are fed to Pin 12 of IC13 through C33.

PROGRAMMABLE DIVIDER CIRCUIT

The input signal at Pin 12 of the PLL IC, IC13, which consists of a programmable divider, reference frequency generator and phase detector, is divided by the BCD data sent from the upmultiplexed format. Pins 6 ~ 9 receive BCD while Pins 2 ~ 5 address each divide by N digit.

The programmable divider is also called the 1/N counter and the BCD input is N. The relationship between the display frequency and the divide number N is as follows:

DISPLAY FREQUENCY	CPU OUTPUT	DIVIDE NUMBER (N)
430.000MHz	1000	1107
430.010MHz	1001	1108
}	}	}
431.000MHz	1100	1207
}	}	}
432.000MHz	1200	1307
}	}	}
438.000MHz	1800	1907
}	}	}
439.000MHz	1900	2007
}	}	}
439.990MHz	1999	2106

(IC-45A: 440.000MHz ~ 449.990MHz)

REFERENCE FREQUENCY GENERATOR CIRCUIT

The reference frequency generator consists of a crystal oscillator and a highspeed divider. X2 oscillates at 2.56MHz, which is divided by 512. The 5KHz reference frequency is fed to phase detector. This 5KHz reference frequency decides the variation step of the PLL output frequency and the divide number N decides the PLL output frequency.

$$\text{PLL unit output freq.} = \text{local oscillator freq. (MHz)} + 0.005\text{MHz (the reference freq.)} \times \text{N (divide number of programmable divider)}$$

PHASE DETECTOR AND LOOP FILTER CIRCUIT

Digital phase detector detects the phase difference of the pulse signals of the 5KHz reference frequency, and the output signal of the programmable divider, and proportionately puts out positive/negative pulse signals at Pin 16. Pin 18 is for detecting the lock failures and changes to ground level according to the phase difference of the two pulse signals.

The loop filter, consisting of R76, R78, R79, C30 and C29 converts the pulse signal from Pin 16 into a DC voltage and decides the response time of the whole loop. The output signals are fed to tuning diode D1 of the VCO unit as the control voltage for the VCO frequency set.

When the operating frequency is changed over a great frequency range, the PLL becomes unlocked condition, and Pin 18 of IC13 goes to ground level.

This turns Q10 OFF, and its collector becomes H-level. Thus Q11 and Q12 are turned ON, shunt R78, and the response time of the loop becomes faster.

This makes it possible, to both modulate the VCO with a subaudible tone, and to lock up the operating frequency quickly.

VCO CIRCUIT

The VCO (Voltage-Controlled Oscillator) is a Clapp circuit using junction FET, Q1, and oscillates between 204.1 ~ 209.1MHz (IC-45A: 209.1 ~ 214.1MHz) in the receive mode, and 215 ~ 220 MHz (IC-45A: 220 ~ 225MHz) in the transmit mode.

In the receive mode, R+5V is applied to D2's anode through Q22 and D38, and D2 is turned ON and grounds C7 and C8 through C9. Thus the free-run frequency of the VCO is lowered.

In the transmit mode, D2 is turned OFF, and C7 and C8 are isolated from the ground. Thus the free-run frequency of the VCO is increased.

At the same time, the VCO signal is frequency-modulated by the audio signals from the microphone which are applied to the gate of Q1 and varies Q1's mutual conductance.

BUFFER AMPLIFIER CIRCUIT

The VCO output signals are fed to buffer amplifier Q2. A part of the output signal is then fed to the first gate of the mixer Q21 through isolation buffer amplifiers Q17 and Q18, to get a DC-voltage to control the frequency of the VCO. The other part of the output signal is fed to the receiver and the transmitter sections through the buffer amplifier Q15.

DRIVER UNIT

CLOCK PULSE GENERATE CIRCUIT

The input data for the microcomputer, is controlled by a custom-made LS type TTL IC, IC10.

The clock pulses are generated by a mechanical rotary-encoder which is connected directly to the shaft of the tuning control knob. The rotary-encoder puts out two signals which are 90 degree out of phase. Clock pulse signals and UP/DOWN signals are generated by the UP/DOWN control circuit consisting of IC4. These signals are fed to Pins 3 and 4 of IC10 through level converter Q5.

SCAN and MIC UP/DOWN CONTROL CIRCUIT

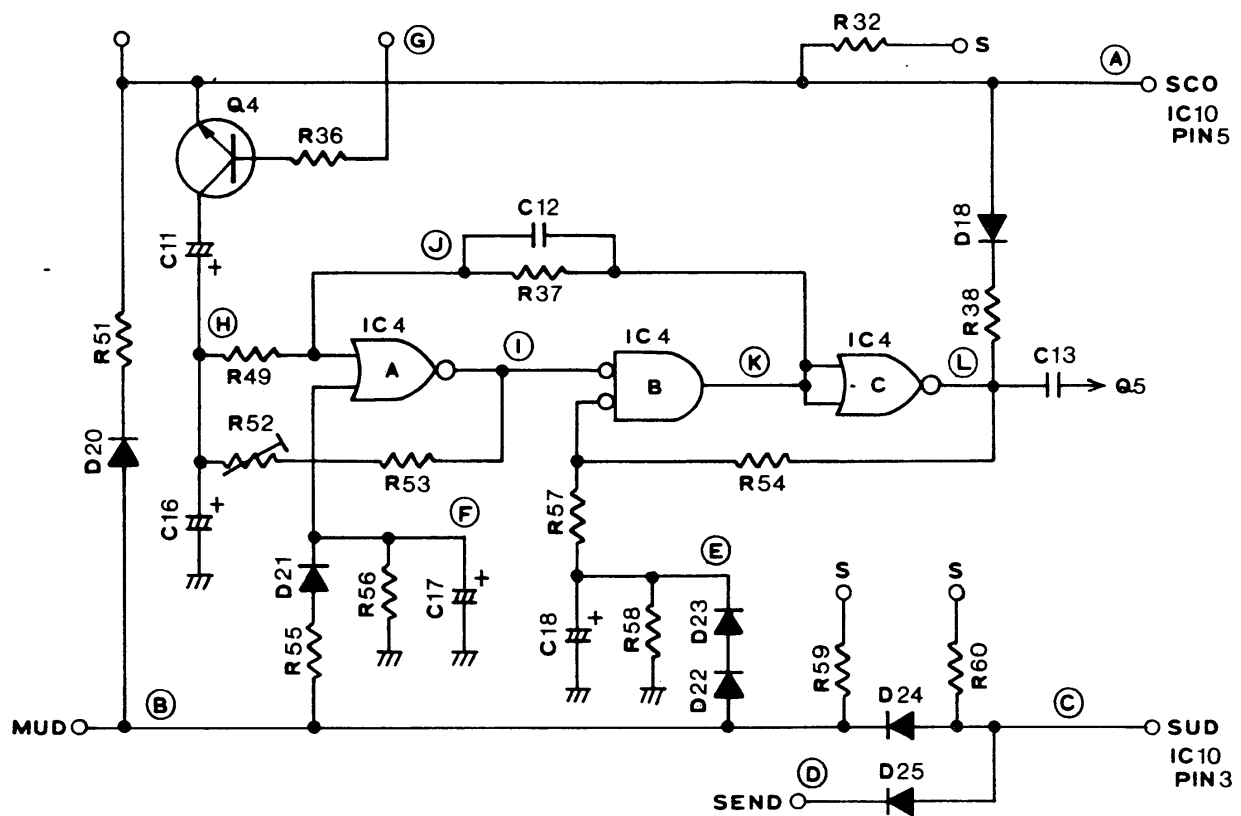
The scan function is provided by pushing the scan Start/Stop (S/S) button. When pushed the S/S button, Pin 5 of IC10 is lowered to ground level, the voltage at Ⓔ and Ⓕ are also lowered, and the multivibrator, consisting of IC4, starts oscillation for scanning, and the decimal point of the frequency display will blink. When Pin 5 of IC10 is lowered, Pin 3 (UP/DOWN control terminal) is also lowered, but its voltage is still 1V ~ 2V, so the downward scanning is selected.

The oscillation frequency (scan speed) can be adjusted by R52. When a VFO is selected (in the

programmed scan or full range scan function), the voltage at (G) is ground level, and Q4 is turned OFF. So the oscillation frequency is decided by C16 only and the frequency is higher and the scan speed is fast. When a memory channel is selected (in the memory scan function), a voltage is applied to (G), Q4 is turned ON and C11 is paralleled to C16. Thus the oscillation frequency is lowered and the scan speed is slow.

In the MIC UP/DOWN function, as the UP button on the microphone is depressed, the (B) point is grounded and the multivibrator starts oscillation. In this case, Pin 3 is grounded through D24 only and near ground level. Thus the upward scanning is selected. When the DOWN button is depressed the (B) point is grounded through a 470 ohms resistor installed inside the microphone. So the voltage divided by R60 and the 470 ohms resistor, is applied to Pin 3 and the downward scanning is selected.

SCAN CONTROL CIRCUIT

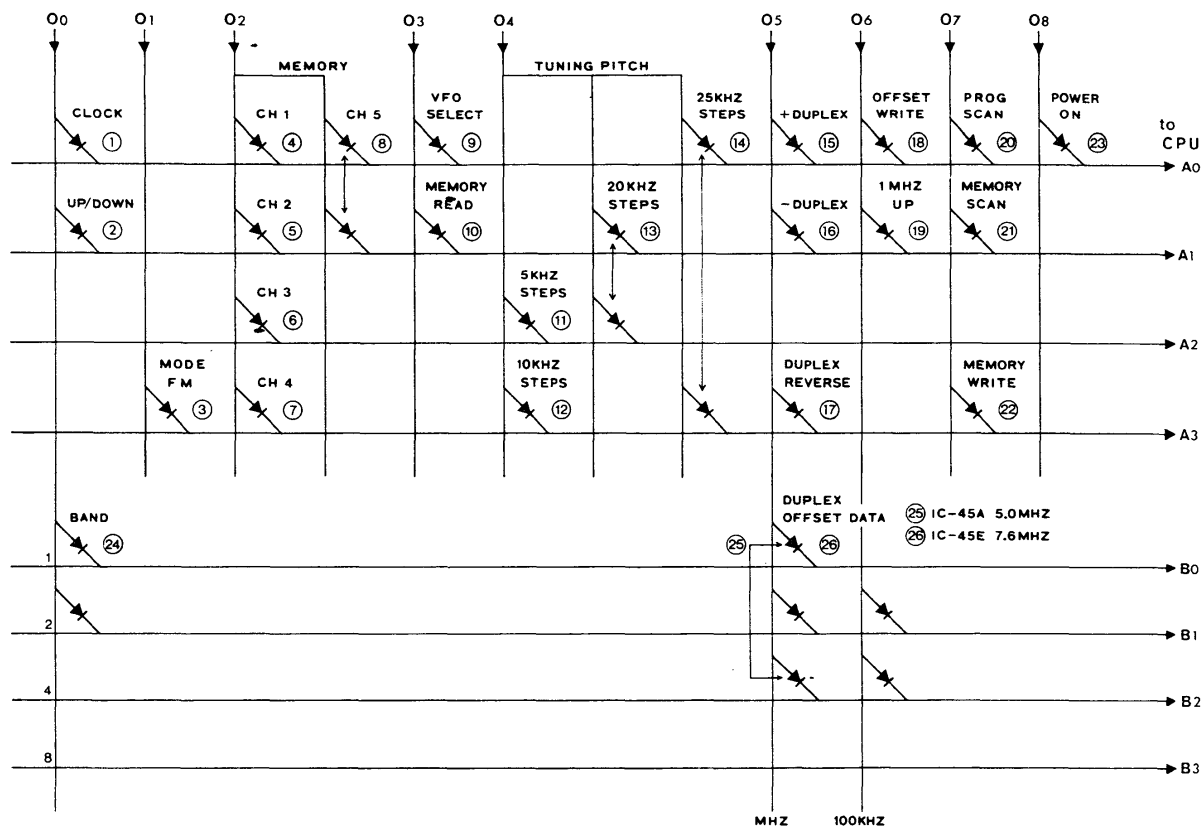


CPU CONTROL CIRCUIT

The CPU in the unit is a 4-bit CPU and the input terminals are A0 ~ A3 and B0 ~ B3.

The CPU cannot have many functions with the small number of A and B input signals. To increase the functions of the CPU, scanning E output signals and decoded O0 ~ O8 signals by IC6, and are fed to A and B input terminals through the matrix circuit. The CPU reads the relationship of E output, and A and B input signals to decide the function as follows:

CPU INPUT MATRIX



- ① **O0 → A0 (Clock)**
This flow occurs when the frequency is moved up or down with each pulse input by turning the tuning control knob or scanning.
- ② **O0 → A1 (Up/Down)**
This flow occurs when the frequency is moved up. When the frequency is moved down, the O0 signal is not fed to A1.
- ③ **O1 → A3 (FM)**
This flow occurs when the MODE is set for FM. The display shows the carrier frequency.
- ④ **O2 → A0 (Memory Channel 1)**
This flow occurs when the VFO/MEMORY CHANNEL Switch is set at "1".
- ⑤ **O2 → A1 (Memory Channel 2)**
This flow occurs when the VFO/MEMORY CHANNEL Switch is set at "2".
- ⑥ **O2 → A2 (Memory Channel 3)**
This flow occurs when the VFO/MEMORY CHANNEL Switch is set at "3".
- ⑦ **O2 → A3 (Memory Channel 4)**
This flow occurs when the VFO/MEMORY CHANNEL Switch is set at "4".

- ⑧ **O2 → A0, A1 (Memory Channel 5)**
This flow occurs when the VFO/MEMORY CHANNEL Switch is set at "5", or CALLING CHANNEL Switch is pushed.
- ⑨ **O3 → A0 (VFO Select)**
This flow occurs when the VFO Switch is set in "B", and the unit operates at the frequency set by "B" VFO. When the VFO Switch is set in "A", the O3 signal is not fed to A0, and the unit operates at the frequency set by "A" VFO.
- ⑩ **O3 → A1 (Memory Read)**
This flow occurs when the VFO/MEMORY CHANNEL Switch is set at a memory channel, and the set operates on the channel. This function is prior to the function ⑨
- ⑪ **O4 → A2 (5KHz Steps)**
This flow occurs when the VFO Switch is set at "A", and the operating frequency is moved up or down with 5KHz steps.
- ⑫ **O4 → A3 (10KHz Steps)**
When this flow occurs, the operating frequency is moved up or down with 10KHz steps. (This mode is not used for IC-45A/E.)
- ⑬ **O4 → A1, A2 (20KHz Steps)**
When this flow occurs, the operating frequency is moved up or down with 20KHz steps. (This mode is not used for IC-45A/E.)
- ⑭ **O4 → A0, A3 (25KHz Steps)**
This flow occurs when the VFO Switch is set at "B", and the operating frequency is moved up or down with 25KHz steps.
- ⑮ **O5 → A0 (+Duplex)**
This flow occurs when the DUPLEX MODE Switch is set at "+DUP", and the transmit frequency becomes a frequency which is added the specified offset frequency to the receive frequency.
- ⑯ **O5 → A1 (-Duplex)**
This flow occurs when the DUPLEX MODE Switch is set at "-DUP", and the transmit frequency becomes a frequency which is subtracted the specified offset frequency from the receive frequency.
- ⑰ **O5 → A3 (Duplex Check)**
This flow occurs when the SIMPLEX/DUPLEX Switch is set at "DUP" and during the MEMORY WRITE/CHECK button is pushed, the receive frequency becomes a frequency which is added to the specified offset frequency or subtracted it from the original receive frequency.
- ⑱ **O6 → A0 (Offset Write)**
This flow occurs when the VFO/MEMORY CHANNEL Switch is set at "VFO" position and the PRIORITY button is pushed, and the offset frequency can be reset by turning the tuning control knob.

⑲ **O6 → A1 (1MHz Up)**

When this flow occurs, the 1MHz digit of operating frequency is moved up with 1MHz steps.

⑳ **O7 → A0 (Programmed Scan)**

When this flow occurs, and the S/S button is depressed, the operating frequency scans between frequencies written into the Memory Channels 1 and 2. (Memory Channel 2 should be written higher frequency than Memory Channel 1, if not the scan function does not actuate.)

When this flow does not occur and the S/S button is depressed, the operating frequency scans the entire band.

㉑ **O7 → A1 (Memory Scan)**

When this flow occurs, the operating frequency scans on the memory channels and the VFO's A and B.

㉒ **O7 → A3 (Memory Write)**

When a memory channel is selected and this flow occurs, a frequency of the VFO A is written into the selected memory channel.

When a VFO is selected and this flow occurs, a frequency of the other VFO is written into the selected VFO.

㉓ **O8 → A0 (Power ON)**

This flow occurs when the POWER Switch is turned ON. When this flow does not occur, the CPU is in stand by condition.

NOTE: The port B is used to initialize the CPU when the power is turned ON.

㉔ **O0 → B0, B1**

When this flow occurs, the operating frequency range is selected between 430.000MHz and 439.995MHz (IC-45A: 440.000MHz and 449.995MHz).

㉕ **O5 → (B0, B1, B2, B3)**

When this flow occurs, the 1MHz digit of the offset frequency is preset. The digit is decided by a BCD code consisting of B0 ~ B3 (B0 = 1, B1 = 2, B2 = 4, B3 = 8).

㉖ **O6 → (B0, B1, B2, B3)**

When this flow occurs, the 100KHz digit of the offset frequency is preset. The digit is decided by a BCD code consisting of B0 ~ B3.

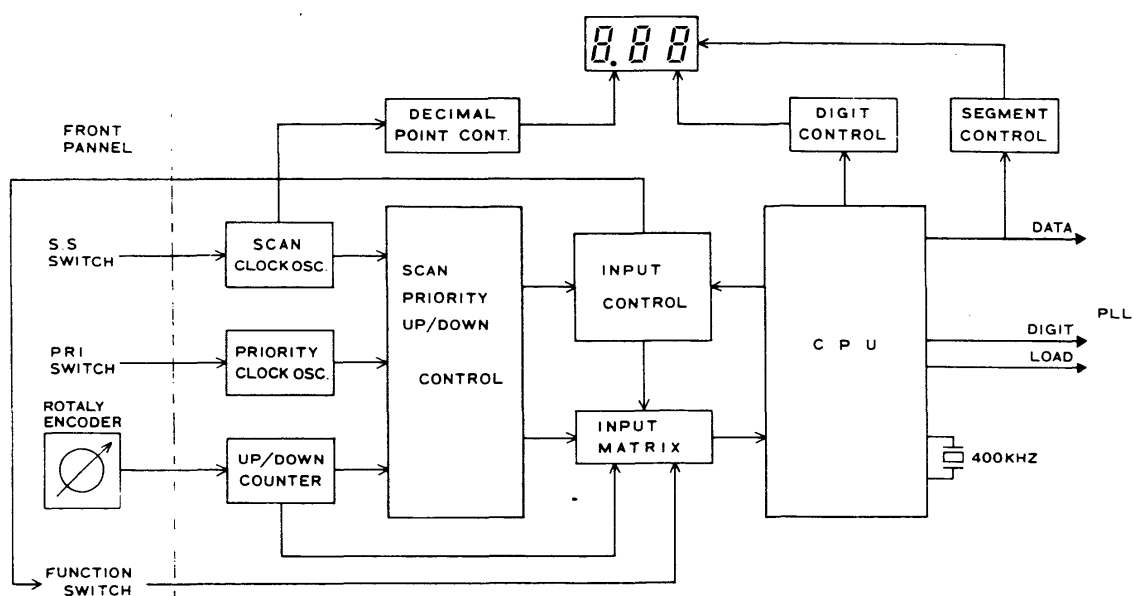
FREQUENCY CONTROL, DISPLAY AND I/O CIRCUIT

The dynamic lighting display functions with the 7-segment data output which are decoded by IC7 from BCD output at the E0 ~ E3 terminals of the CPU and the digit designation output signals at the F0 ~ F3 terminals. The decimal point is illuminated with the current through scan blinking transistor Q7, only when the digit designation signals for 1MHz is sent. The E0 ~ E3 terminals are timeshared for the other data output. The E0 ~ E3 terminals also put out the divide number (N) for the PLL divider, and are supplied to the CPU control circuit through IC6.

When the power is turned ON, the CPU is initialized and then reads the mode setting and memorizes it. Then the CPU reads the control data from the external controller in the order of the numbers of the matrix and controls the various necessary operations. The data of the display, "A" VFO, "B" VFO, the frequency shift, step pitch, Memories 1 ~ 5, and the divide number (N) are programmed in each RAM area for the initial presetting.

Then, at the CPU output terminals E0 ~ E3, the divide number and the 5KHz shift data are put out in the BCD code. The data to designate the latch position (digit-position) are output at the CPU output D0 ~ D3.

DRIVER CIRCUIT



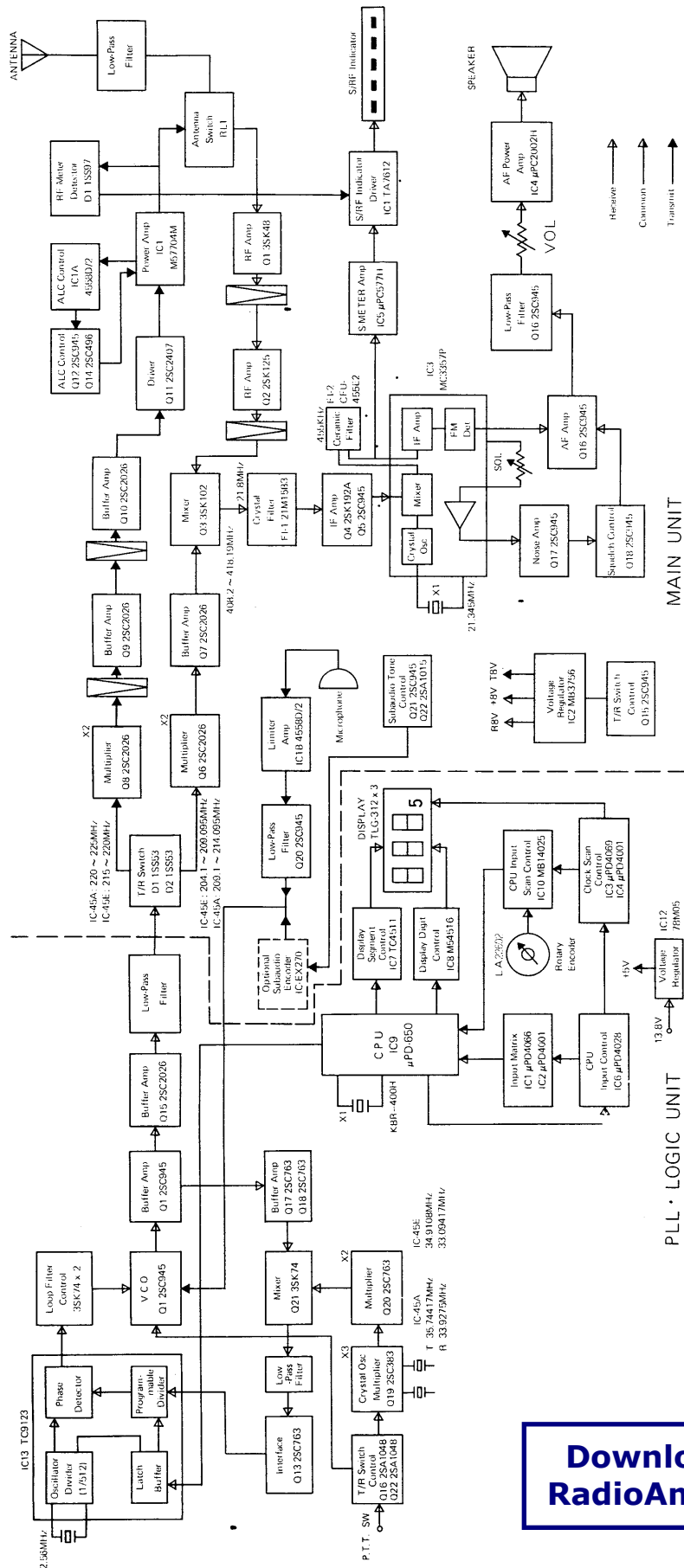
SECTION VIII TROUBLESHOOTING

Your IC-45A/E has been tested very carefully at the factory before shipping. The chart below has been designed to help you correct any problems which are not equipment malfunctions. If you are not able to locate the problem and/or solve it through use of this chart, please contact your dealer or ICOM distributor for assistance.

Problem	Possible Cause	Solution
1. Power does not come ON when the switch is turned.	Power cord is improperly connected. Power cord is connected with the polarity reversed. Blown fuse.	Carefully reconnect power cord. Disconnect the power cord, replace the blown fuse, then reconnect the power cord observing proper polarity. Check for the cause, then replace the fuse with a new one.
2. No sound comes from the speaker.	VOLUME Control knob is completely counterclockwise, but not "clicked OFF". The unit is in the transmit mode, by the PTT Switch on the microphone. SQUELCH setting is turned too far clockwise. External speaker is in use. The internal speaker cable is not connected.	Turn the knob clockwise to a suitable level. Put the unit in the receive mode. Turn the SQUELCH control counterclockwise until noise can be heard and reset it just below the threshold. Check if the external speaker plug is inserted properly or if the external speaker cable is cut. Connect the speaker connection.
3. Sensitivity is low and only strong signals are audible.	The antenna feed line is cut or shorted.	Check the feed line and correct any improper condition.
4. No or low RF output.	RF Power Switch is set at the Low position. PTT Switch is not functioning due to bad connection of the MIC connector. The antenna feeder is cut or shorted.	Set the RF Power Switch to the High (normal) position. Check the connection of the MIC connector and correct any problems. Check the antenna feeder and correct any problems.
5. No modulation.	Bad connection of the MIC connector. The MIC cable is cut.	Check the connection of the MIC connector and correct any problems. Repair the disconnected or cut wire.

Problem	Possible Cause	Solution
<p>6. The receive mode functions properly and your signals are transmitted, but you are unable to make contact with another station.</p>	<p>The SIMPLEX/DUPLEX Switch is in "DUP" position. (When desiring SIMPLEX mode.)</p> <p>The SIMPLEX/DUPLEX Switch is in "SIMP" position. (When desiring DUPLEX mode.)</p> <p>Improper frequency split or input/output frequency of the repeater.</p>	<p>Set the SIMPLEX/DUPLEX Switch to the "SIMP" position.</p> <p>Set the SIMPLEX/DUPLEX Switch to the "DUP" position.</p> <p>Set the proper frequency split and set the DUPLEX MODE Switch to the "+DUP" or "-DUP" position according to repeater input/output frequency.</p>
<p>7. The memorized frequencies are lost and the display shows 1.00 when power switch is turned ON.</p>	<p>The main switch of the power source was turned OFF or the power plug was unplugged.</p> <p>The power failed (when using the AC power source).</p>	<p>Use the continuous operating power source or optional memory power source.</p>
<p>8. The memory scan operation does not function when the S/S Switch is pushed.</p>	<p>No frequency is programmed in the memory channels or the same frequency is programmed in all the memory channels.</p> <p>The VFO/MEMORY CHANNEL Switch is not in a Memory Channel position.</p>	<p>Program the required frequencies in the memory channels following the instructions for "MEMORY CHANNEL OPERATION" on page 13.</p> <p>Set the VFO/MEMORY CHANNEL Switch in a Memory Channel position.</p>
<p>9. The programmed scan operation does not function when the S/S Switch is pushed.</p>	<p>The same frequency is programmed in the memory channel 1 and 2, or the programmed frequency in the memory channel 1 is higher than the one in the channel 2.</p> <p>The VFO/MEMORY CHANNEL Switch is not in the VFO position.</p>	<p>Program the low edge frequency into the memory channel 1, and the high edge frequency into the memory channel 2.</p> <p>Set the VFO/MEMORY CHANNEL Switch in the VFO position.</p>
<p>10. The scan does not stop even if a signal is received.</p>	<p>The squelch has opened when the scan started.</p>	<p>Engage the squelch on a no signal frequency, then start the scan by pushing the S/S Switch.</p>

SECTION IX BLOCK DIAGRAM



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