

IC-245E

2 METER FM

SSB-CW

Digital Synthesized
Transceiver

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ICOM



Congratulations on your purchase of the ICOM IC-245E. The IC-245E is unique in its mobility, flexibility and compact size. Outstanding performance capabilities are produced by the proprietary ICOM C-MOS LSI built into each IC-245E. By itself, the IC-245E gives full command of the 144 – 146 MHz 2 meter band. The IC-245E is a multimode 2MHz FM, USB, CW unit. Carefully reading this manual will help you get the most pleasure and effective use from your new transceiver.

SECTION I FEATURES

Multi-mode mobile transceiver

The IC-245E provides 144 – 146MHz FM, USB, CW coverage in the 144 – 146MHz frequency range. Thus the IC-245E can be used for DX, local calls, and satellite work.

Refined appearance and convenient layout

The knobs are easy to handle, the readout is large and easy on the eyes due to digit brightness during the day and automatic dimming in darkness, and the meter is easy to read. Again, ICOM has produced a set that is as attractive as it is functional.

A unique C-MOS LSI

The ICOM chip makes the IC-245E a revolutionary transceiver. This multi-function chip incorporates years of ICOM digital and PLL technology development. Compact size, dual VFO performance and an accurate, stable, digitalized frequency readout are possible due to the chip. Pulses generated by turning the dial are counted, thus controlling an up/down counter that controls a programmable divider in the PLL to change frequencies. Crystal-controlled oscillator-accurate levels are produced. SSB tuning is 100Hz per vernier increment and FM is 5KHz per vernier.

Dual VFO's

Two separate VFO's can be used either independently or together for simplex operation, and any desired frequency 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 representing MHz to KHz. 100Hz digits are represented by each vernier scale mark. Automatic recycling restarts tuning at the top of the band, i.e., 145.999MHz when the dial goes below 144.000MHz. Recycling changes 145.999MHz to 144.000MHz as well. Quick tuning in 5KHz steps is available, and fine tuning in 100Hz steps is provided for trouble free QSO operation. A click-stop mechanism prevents knob rotation due to vibration in mobile use.

Excellent performance in operation

Nearby strong signal interference is overcome by a MOSFET RF amplifier circuit, a specially designed 1st mixer circuit and the helical cavities used in the IC-245E. These same elements provide great selectivity for binary signals, and maintain a high, stable sensitivity. A system of cascaded filters gives exceptional FM performance, and SSB performance is insured by a monolithic crystal filter and a ceramic filter.

The transmitter uses a balanced mixer in a single conversion system, a band-pass filter and a high-performance low-pass filter. This system provides distortion-free signals with a minimum spurious radiation level.

SECTION II SPECIFICATIONS

General Specifications

Semiconductor complement	Transistors	111
	FET	21
	IC (includ. LSI)	50
	Diodes	131
Frequency range	144.0MHz – 146.0MHz	
Frequency stability	Within ± 1.5 KHz at temperature variation from -10°C to $+60^{\circ}\text{C}$.	
Mode	FM (F3)	
	SSB (A3J USB), CW (A1)	

Antenna impedance	50 ohms unbalanced
Power source voltage	DC 13.8V \pm 15%
Grounding polarity	Negative ground
Power consumption (with DC 13.8V supply) in reception	at minimum AF volume 0.6A at maximum AF volume 0.8A
in transmission	at SSB (PEP 10W) 2.8A at CW FM (10W output) 2.8A at FM (10W output) 2.8A
Outline dimensions (in m/m)	(H) 90 x (W) 155 x (D) 235 (protruding portions not included)
Weight	Approx. 2.7Kg

Transmitter unit

Frequency range	144.0MHz – 146.0MHz Continuously variable. Digital 2 VFO system.
RF output power	SSB 10W (PEP) CW 10W FM 10W
Type of modulation	FM variable reactance frequency modulation
Maximum frequency deviation (FM)	\pm 5KHz
Spurious level	Lower than -60dB
SSB carrier suppression ratio	More than 40dB
Microphone	500 ohms dynamic microphone with push-to-talk switch (IC-SM2 electric condenser microphone usable)

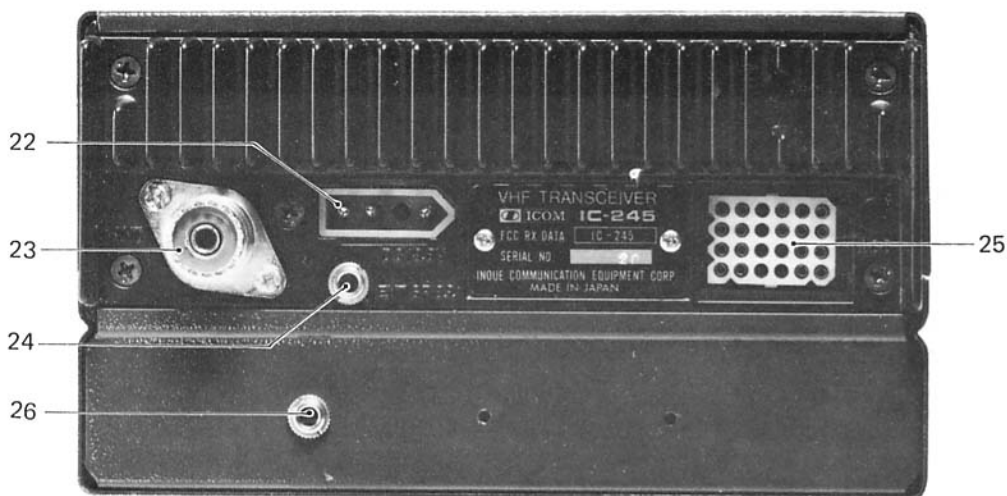
Receiver unit

Frequency Range	Same as transmitter
Receiving System	SSB, CW Single Super Heterodyne
Intermediate Frequency	FM Double Super Heterodyne SSB, CW 10.7MHz FM 10.7MHz, 455KHz
Sensitivity	SSB, CW 0.5 μ V at (S+N)/N 10dB or better Noise Suppression Sensitivity 20dB 0.6 μ V or less
Squelch Sensitivity (FM)	0.4 μ V or less
Suprious Sensitivity	-60dB or better
Selectivity	SSB, CW \pm 1.2KHz or better at -6dB \pm 2.4KHz or better at -60dB FM \pm 7.5KHz or better at -6dB \pm 15KHz or better at -60dB
Audio Output	More than 1.5W (into 8 Ω)
Audio Output Impedance	8 ohms

FRONT VIEW



BACK VIEW



Front Panel Configuration

The front panel controls are shown in Fig.

CONTROL or CONNECTION	DESCRIPTION
1 Frequency Display	<p>The operating frequency display of the set is shown by a 4-figure LED digital indicator with MHz to KHz digits. The frequency displayed is the carrier frequency of each communication mode (FM, SSB or CW), thus eliminating retuning when a mode is changed.</p>
2 Tuning Knob	<p>The tuning knob selects receiving and transmitting frequencies. Rotating, one vernier graduation shifts the frequency by 100Hz (5KHz by one complete rotation) in SSB and by 5 KHz steps (500KHz by one complete rotation) in FM. Push the TS switch (12) to change frequencies in 5KHz steps in SSB. For SSB operation frequencies are changed in 100KHz, and in FM, in 5KHz steps.</p>
3 RECEIVE LED	<p>Illuminated during reception. In FM operation, it is illuminated only when the squelch opens.</p>
4 TRANSMIT LED	<p>Illuminated during transmission.</p>
5 Photo Sensor	<p>A sensor used to detect the brightness of surroundings. When operating the set in the dark, the sensor actuates the dimmer circuit to furnish easier reading of meters and the frequency readout by reducing the light intensity level.</p>
6 VOL (Volume Control) Knob	<p>A knob used to control the audio-level of the received signals. Turning clockwise will increase the audio level. Set the volume to the proper audio level as desired.</p>
7 VFO Switch	<p>A selector switch used to either "A/Norm" or "B/Rev" VFO. When set to "A", both reception and transmission will operate with "A" VFO and when set to "B", they will operate with B-VFO. When changing from A to B VFO, the frequency used before change over of the selector switch is memorized in A VFO. Even after changing frequency with B-VFO, the memorized A-VFO frequency is still usable by restoring the switch to "A" position. (From B to A, the same function is provided.)</p>
8 Meter	<p>When receiving, this meter will operate as an S-meter to indicate signal strength and when transmitting, the meter shows relative RF-power output.</p>

9	Function Switch	A switch used to turn on and off the power source and to change from simplex to duplex operation.
10	SQL (Squelch) Knob	A knob used to adjust the squelch operation level in FM reception. When the set is adjusted to the noise shut-off point with no signal, a voice will be audible when signals are received.
11	MIC Connector	Use the microphone supplied with the set. An optional desk type ICOM microphone, IC-SM2, can also be used without modification. Other microphones of 500-600 ohms impedance can also be used.
12	Enter Switch	Used to enter or lock in a frequency, split for duplex operation.
13	Tone Switch	Activates tone circuit.
14	SSB/FM Switch	Push in for SSB, pop out for FM.
15	TS/Norm Speed Switch	Push in for 5KHz steps in SSB, or pop out for NORMAL 5KHz FM, 100Hz SSB operation.
16	Noise Blank Switch	Push in to activate Noise Blanker Circuit.
17	AGC/FAST Switch	Push in to activate fast AGC action.
18	CW-T/RECEIVE Switch	Push to transmit, pop out to receive CW signals.
19	RIT Control	Varies receiver frequency approximately \pm 1KHz.
20	RIT Switch	Place in RIT position to activate RIT circuit.
21	RIT LED	Is illuminated when RIT circuits is activated.

The following is a detailed description of the rear panel connections. Refer to Fig.

CONTROL or CONNECTION	FUNCTION
22 DC Power Connector	When using a DC power supply of 13.8V, connect the supplied DC power cable to this connector.
23 ANT(Antenna) Connector	A connector for antennas having an impedance of 50 ohms. Use an M-type coaxial connector.
24 External Speaker Jack	External speakers of 8 ohms impedance when used, are connected to this jack. When external speakers are connected, the built-in speaker is made inoperative.

25 ACC (Accessory)	Various adaptors can be used through terminals in this jack for frequency control input, modulation output, receiver output, T/R change-over control and so on. The table below shows terminal connections of this connector. Care should be taken not to apply voltage other than -0.5V to +5V to terminals between No.15 and No.24 as they are connected with the C-MOS IC. Optional connecting plugs are available.
26 Key Jack	Insert Key Plug for CW operation.

Terminal No. Connection

1. Output from discriminator.
2. DC 13.8V in conjunction with power switch operation.
3. Connected to push-to-talk T.R. change-over switch. When grounded, set operates in transmission mode.
4. Output from receiver detector stage. Fixed output regardless of AF output or AF gain control level.
5. TX shutdown terminal. When grounded, no RF power is transmitted.
6. DC 9V available when transmitted. (relay can not be directly actuated).
7. Input for external ALC voltage.
8. Ground.
9. NC (no connection)
10. NC (no connection)
11. NC (no connection)
12. NC (no connection)
13. NC (no connection)
14. NC (no connection)
15. LOCK Input to lock dial externally.
16. UDC Input to control up-down externally.
17. SCAN Input to scan frequency.
18. CL Input to clear frequency.
19. FCL Input to clear counter in specified digit and input for MSB date.
20. K0 Input for frequency control data.
21. K1 Input for frequency control data.
22. K2 Input for frequency control data.
23. K3 Input for frequency control data.
24. K4 Input for frequency control data.

SECTION IV INSTALLATION

Install the IC-245E with the following precautions.

Avoid a place subject to direct sunshine, high temperature, high humidity, excessive vibration, dust and other adverse influences.

Select a place where operation of controls, knobs and switches is easy and the meter and the dial are clearly readable.

Use the special mounting bracket supplied with the set.

Choose a place for installation with enough structural strength to bear the weight of the set.

Avoid placing the set near a heater or an air conditioner exhaust.

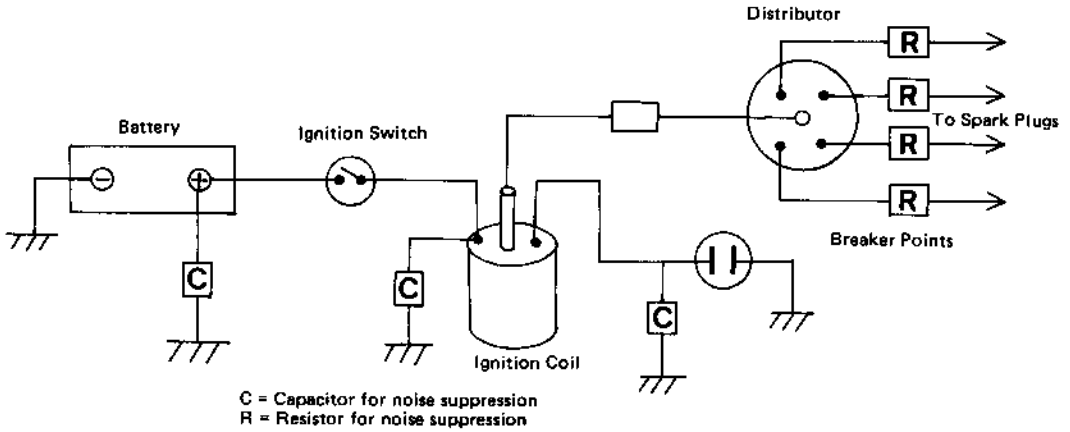
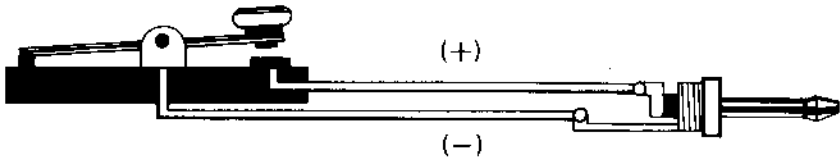
Be sure there is adequate space for ventilation around the set in the car.

Install the set in an easy-to-see location for driving safety.

Mobile Mounting

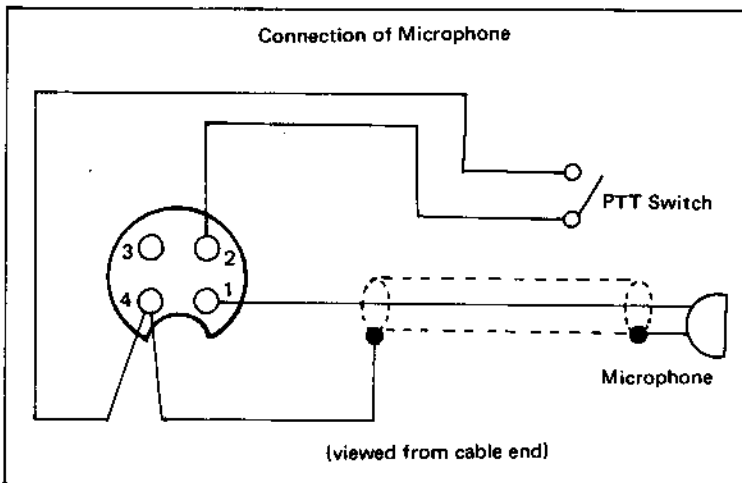
Install the set using the mobile mounting fixture supplied.

Key Connection



Ignition Noise

Care has been taken to suppress ignition noise within the set. However, in some kinds of auto-mobiles, excessive noise may occur. In that case, provide a filter circuit as shown in this figure. Remarkable noise suppression is furnished by this arrangement.



Installation

- (1) Fasten the mobile mounting angle bracket on the lip of the dash with the mounting bolts supplied.
- (2) Fasten the mobile mounting holder A to the angle bracket with the four ornamental screws.
- (3) Install the set in the mobile mounting holder A.
- (4) Hook up pawls of the mounting holder B into holes provided on the holder A.
- (5) Clamp the set by tightening the holder B and lock the quick fastener by pulling down the knob.

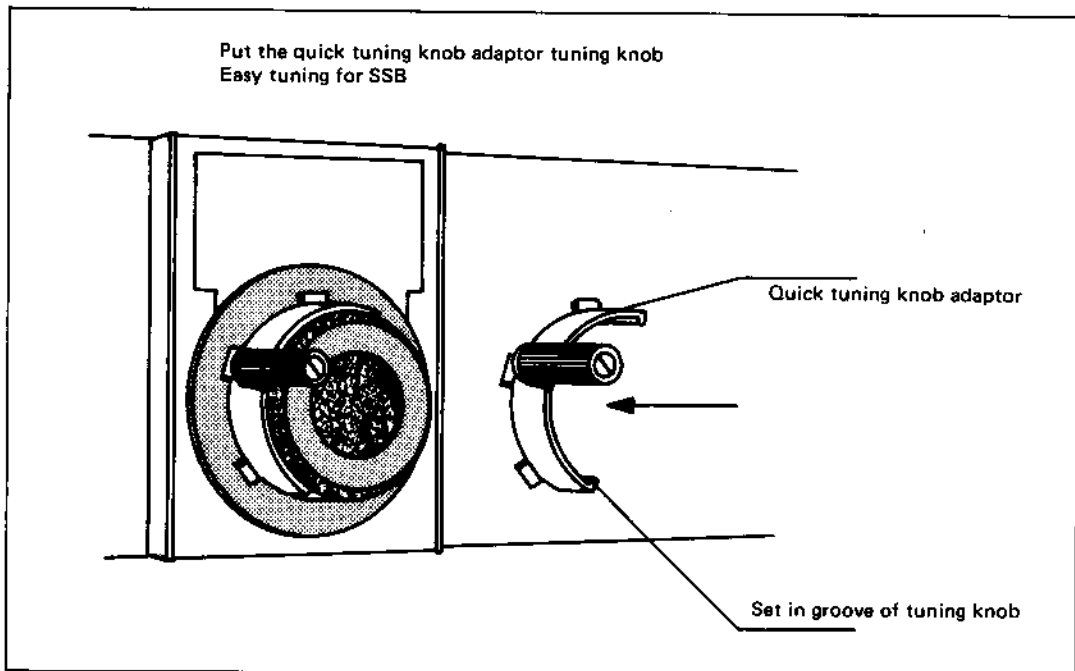
Removal

Unlock the quick fastener and loosen the holder B.

Adjustment of installation angle and position.

- (1) With the quick fastener, the unlocked set can be moved back and forth to select a suitable position. (Note that if the set is pulled out too far, the built-in speaker will be partially covered by the mounting bracket.)

● Installation of quick tuning knob adaptor



- (2) The installation angle can be adjusted over an 18° arc. Loosen screws at both sides and position the set at the most convenient angle for easy operation.

Fixed Station Use

When the set is used as a fixed station, use the supplied mobile mounting fixtures supplied with the IC-3PA power supply.

Power Supply for a Fixed Station

The rated power supply voltage of this set is $13.8V \pm 15\%$. Use a stabilized voltage power source of 13.8V with current capacity of more than 3A for a fixed station set. Reliable ICOM power supplies are ideal for this station use.

External Speaker

When used as a fixed station, the face of the speaker is placed downward. Therefore, we recommend the use of an external speaker. Be sure to use a speaker of 8 ohms impedance. An external speaker is an integral part of regulated ICOM power supplies.

The set is designed for use with an antenna having a matched impedance of 50 ohms.

Transmission power loss in VHF antenna systems tends to be greater. Select a low-loss VHF antenna for best performance.

Install a high performance antenna in an elevated position. Make sure the antenna connection to the coaxial cable is fixed to withstand vibration and sealed against moisture.

Grounded antennas for automobiles, such as whip antennas, should be grounded positively to the chassis.

Do not connect a whip antenna directly to the antenna connector. Use a coaxial cable between the antenna and the antenna connector. Keep the antenna more than 1 meter away from the set.

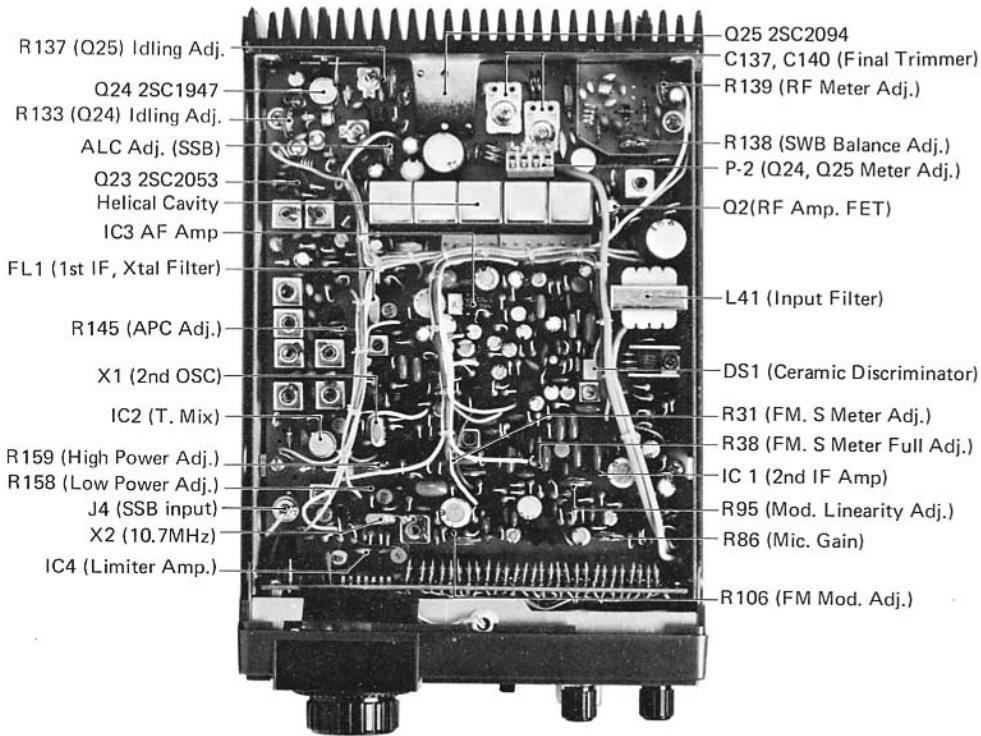
External Speakers

Although the IC-245E is provided with a built-in speaker, there is a jack located on the rear panel of the set for an external speaker of 8 ohms impedance. When the external speaker is used, the built-in speaker will not operate. Headphones of 8-16 ohms impedance can also be used.

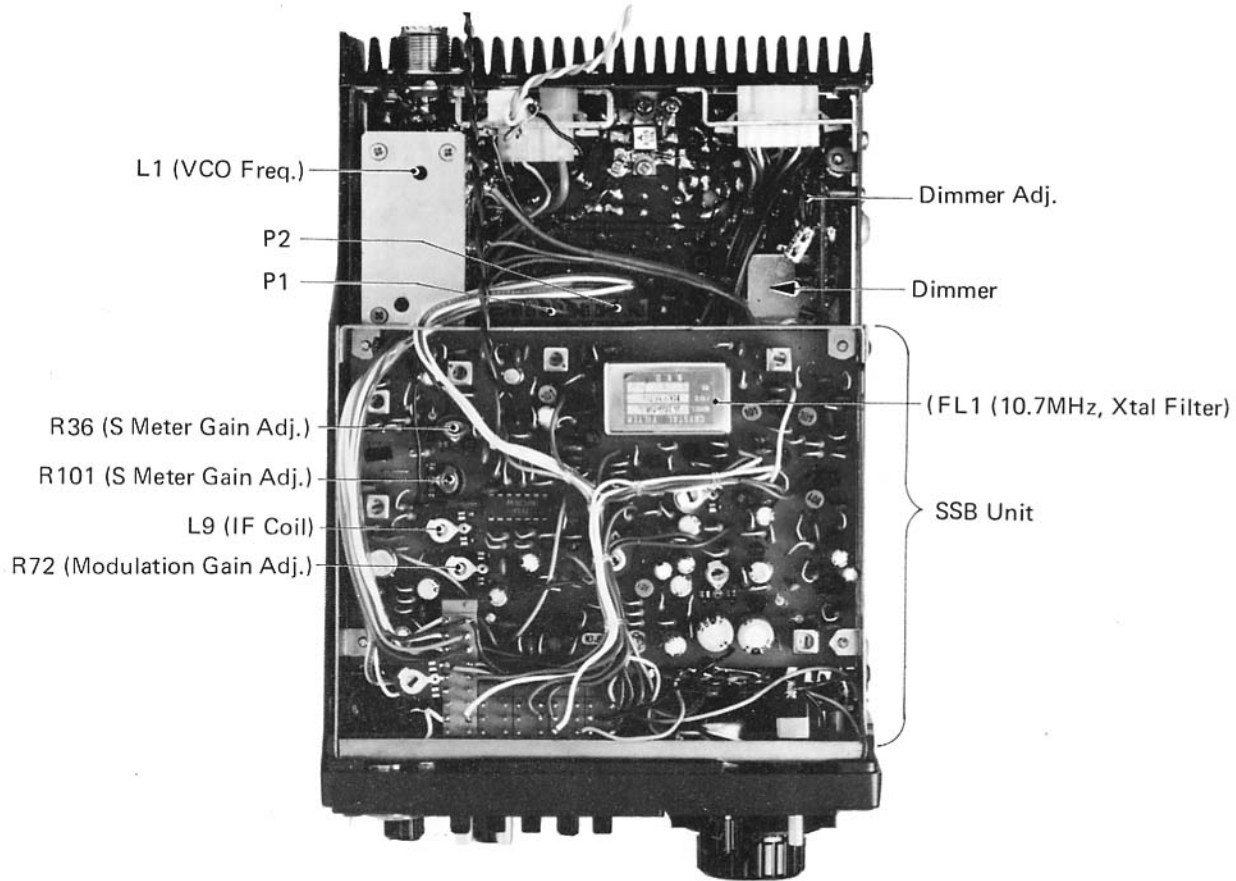
DC Power Cable

When using a DC power source such as a battery, connect the DC power cable to the battery before making the connection to the set. Connect the red cable to POSITIVE (+) and the black cable to the NEGATIVE (-) terminals of the battery after making certain of the polarity. Reversing polarity will blow out the fuse in the power cable due to actuation of the protective circuit. Make certain that the FUNCTION switch is at OFF before connecting the DC power cable to the DC power outlet. Verify that the DC power source voltage falls between 12 to 15V. Make certain that the power switch is at OFF, and connect the DC power cable to the DC outlet of the set.

(TOP)



(BOTTOM)



SECTION VI OTHER REMARKS

Do not attempt to connect or remove the power cable, antenna, external speaker or microphone while the power switch is ON. This may damage your set.

Do not transmit without connecting the antenna.

This set is made for the negative (–) ground system. The set can not be installed to a car having (+) positive ground without modification.

If fuses are blown, check the cause of trouble before replacing them with new ones.

If the power switch is turned on and off rapidly, the frequency display may indicate erroneous figures. If erroneous figures are shown, turn off the power switch and wait several seconds before turning the switch on again.

The set has been aligned very accurately with precision test instruments. Never try to alter the setting of variable resistors, coils and trimmers inside the set.

The PLL unit contains a C MOS LSI which is the heart of the set and requires extreme care and knowledge in handling. Therefore, the unit is sealed and when the seal is broken the warranty is voided. Repair of this unit can be expensive.
by qualified persons.

In addition to the PLL unit, the digital-driver unit also utilizes a C MOS IC. As the IC is very sensitive and will be damaged by excessive current or a large static potential, only a skillful technician familiar with handling the C MOS IC should check the circuitry. Even when a skillful technician checks the circuit, the following cautions must be taken.

The soldering iron tip, tools and measuring instruments must be properly grounded.

Do not plug in or unplug the C MOS IC or use a soldering iron while the unit is powered.

Do not apply signals to C MOS IC input terminals without the power being applied. Do not use a multimeter to measure resistance in the IC circuit unless power is applied.

Do not apply voltages other than 0.5 to +5V to the C-MOS IC circuit.

SECTION VII OPERATION

Reception

Preliminary procedures. After the antenna and the microphone have been connected, set knobs and switches as follows.

FUNCTION Switch	OFF (middle)
VFO Switch	A
VOL (Volume) Knob	fully counter-clockwise
SQL (Squelch) Knob	fully counter-clockwise

After setting, place the FUNCTION switch to "SIMPLEX" the power. The meter is illuminated, RECEIVE indicating lamp lights and a frequency of (4000) is shown on the frequency display window. This shows the set is now operating in (144,000MHz).

HOW TO TUNE

Tuning Knob

The tuning knob is provided with a click stop and it tunes smoothly even as a mobile station. Frequency drift due to vibration turning the tuning knob is prevented by the click stop. Transmitting and receiving frequencies are shown by four LED (Light Emitting Diodes) digits in the frequency display window in steps of 100Hz. Rotating the tuning dial clockwise will increase the frequency. In FM, each vernier movement is equivalent to a 5KHz frequency shift and one complete rotation equals a 250KHz change. Clockwise rotation increase the frequency. 100Hz digits are not shown at the frequency display window, but can be read on the vernier scale of the tuning knob.

If the tuning dial is rotated further to increase the frequency after reaching the upper end of the frequency band (145.995MHz), the frequency will return to the lower end of the frequency band (144.000) automatically and will continue to increase from that point. Conversely, further rotation of dial to decrease the lower end, 144.000MHz, will return the frequency to the upper end (145.995). Thus, no off-band tuning is given. The frequency shown at the frequency display window is the carrier frequency of each communication mode of FM, SSB (USB) and CW, thus eliminating a need for returning or recalibration of the dial when the mode is changed.

VFO Switch

This switch selects either the "A" or "B" VFO built into the set. When set on "A" or "B", both reception and transmission frequencies are controlled by that VFO and that is the frequency shown in the frequency display window. The frequency of "A" VFO is retained and memorized in the LSI before switching to "B" VFO, and "A" VFO will function at that same frequency when the switch is restored to "A". This capability allows effective communication using "A" VFO as a fixed calling frequency while searching for QSY frequencies with "B" VFO. It is also used for a temporary memory device. Rotation of the tuning dial will vary the frequency of the VFO functioning and change the corresponding frequency display window in any VFO operation mentioned above.

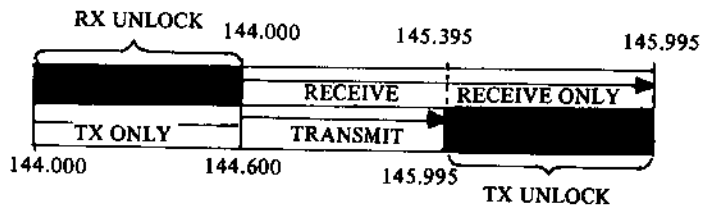
DUPLEX PROGRAM INSTRUCTIONS

1. Set VFO switch to "A/Norm" VFO.
2. Set FUNCTION switch to SIM(simplex).
3. Push in "ENTER" button so it locks in (ENTER).
4. Enter Transmit frequency (Example; 145.000MHz)
5. Set VFO switch to "B/Rev" position.
6. Enter receive frequency (Example; 145.000MHz)
7. Set VFO switch in a position and FUNCTION switch is Dup (Duplex) position.
8. Push in "Enter" button so it pops out.
9. Frequency DISPLAY will show receive frequency (145.000MHz) and when the PTT button is pressed, the TRANSMIT frequency (145.000MHz) is displayed. Rotating the tuning knob clockwise will increase the receive frequency and the TRANSMIT frequency will follow at the 600KHz difference.

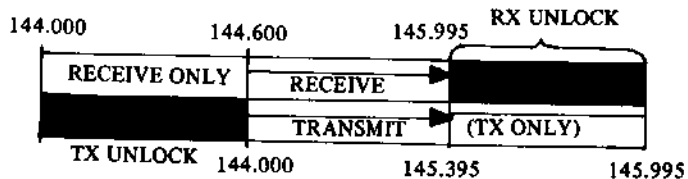
Duplex Program Instructions

In the European 2 meter FM duplex plan, the TRANSMIT frequency is generally 600KHz lower than the RECEIVE frequency.

REVERSE DUPLEX



NORMAL DUPLEX



Memory

This set utilizes a C MOS LSI for setting the frequency. The memorized frequency remains as is when the power is off, however, the LSI is partially powered. In this set, the function switch need not remain ON (up) to keep the LSI memory working. However, the memory is lost when the power cable is disconnected from the power source or the AC power source is unplugged. If you wish to maintain frequency memory during periods when power is disconnected, connect batteries as shown in Fig. 10 to the DC power outlet to supply power when the power is off. The LSI will operate with battery voltage of 6-12V, but that of 9V is best. As current consumption is about 5mA, a dry cell battery can be used for a considerable period (2 months with a U-1 type dry cell battery).

FM Reception

Turn the VOL (volume) knob clockwise slowly until readable FM noise is heard. Search for an incoming signal with the tuning knob. When the signal is tuned in, the S meter pointer shows maximum deflection swings and voice signals are heard. Carefully tune a signal by rotating the tuning knob to obtain the widest swing of the S meter pointer and to hear distortion free voice signals tuned in without distortion.

SQL (Squelch) Knob

With the squelch knob turned fully counter clockwise and the set on a frequency where no signal is received, FM noise will be heard. Turn the SQUELCH knob clockwise slowly to the point where the noise is abruptly suppressed and the receive lamp turns off. With the SQUELCH knob at this setting, the set is silent until a signal is received or a station is tuned in. Then the set will receive signals and the RECEIVE lamp will light up. If in-coming signals are weak or the set is used as a mobile radio, where the SQUELCH operation is unstable, readjust the SQUELCH knob as required.

FM Transmission

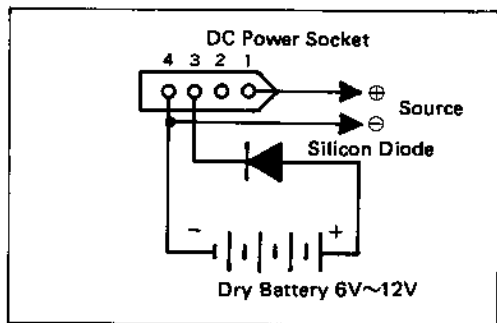
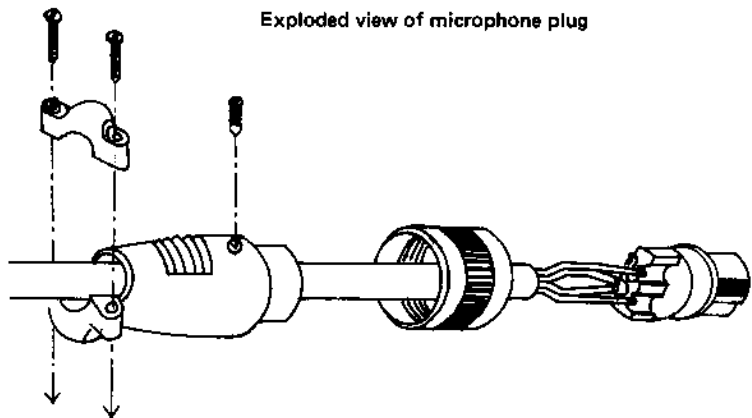
Depress the PTT switch on the microphone (press-to-talk). The TRANSMIT indicator lamp will light and the power meter will swing to the level of the power showing the set is ready to transmit. An FM signal will be transmitted when a voice activates the microphone. Releasing the PTT button will return the set to the reception operation and the TRANSMIT indicating lamp off. When transmitting the meter is automatically changed to the RF power level meter and is calibrated in terms of relative power output, not in absolute value (1, 2, 3W and so on). The meter is adjusted to make the pointer swing about 80% of the full RF scale with 10W output into a pure resistance load of 50 ohms (terminated type RF power meter). The meter deflection will vary according to antenna matching.

Other Facility

Auto Dimmer

The photosensor actuates the dimmer circuit by detecting darkness around the set such as at night. When actuated, the lamps for meters and the frequency display window are dimmed. This furnishes easier meter and frequency indicator reading by eliminating the dazzling effect of bright lamps in dark surroundings.

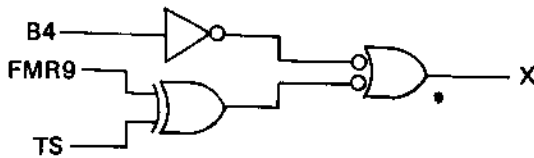
Exploded view of microphone plug



X-Control

B4	FM9	TS	X
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	*	*	1

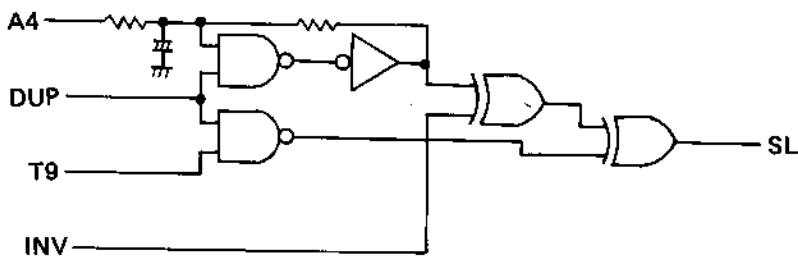
* = 0 or 1



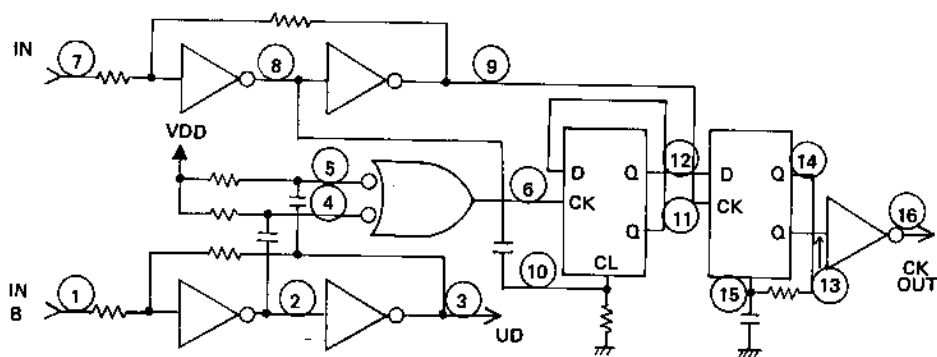
SL-Control

DUP	T9	A4	INV	SL
0	*	*	0	1
0	*	*	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

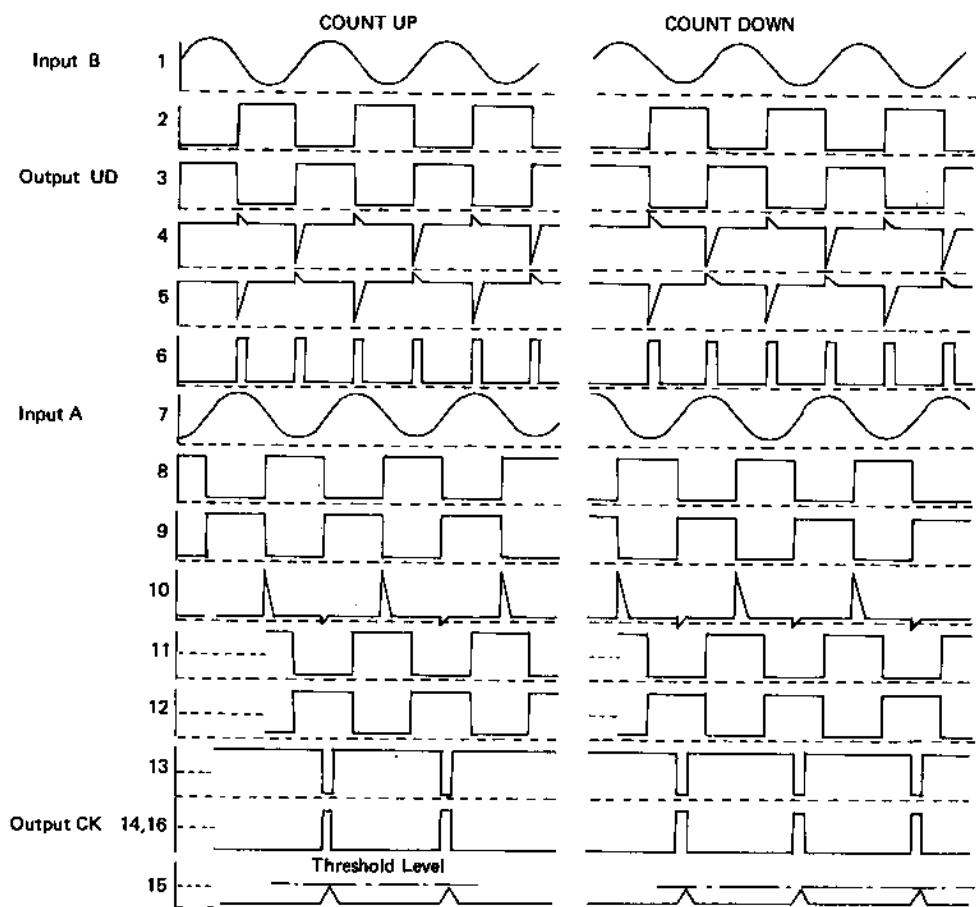
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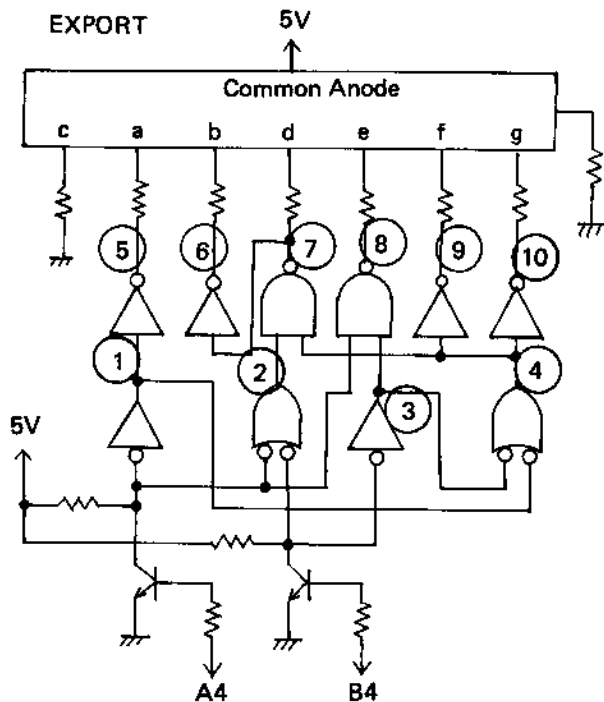


DIAL PHASE CLOCK



TIMING CHART

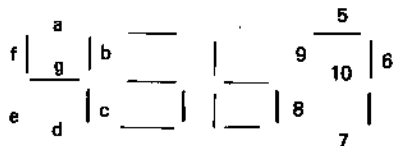




TRUTH TABLE

EXPORT

Input		Output									
B4	A4	5	6	7	8	9	10	1	2	3	4
0	0	1	0	1	1	0	0	0	0	0	1
0	1	0	1	0	1	0	0	1	1	0	1
1	0	1	1	0	0	0	0	0	1	1	1
1	1	0	0	1	1	1	1	1	1	1	0



SECTION IX PARTS LIST

EF UNIT		
R-1	Variable	PR-15K B10K
R-2	Variable	PR-15K A10K
R-5	Sensor	MPY 54C69
S-1	Switch	S2023-48C
S-2	Switch	S2012-48C
S-3	Switch	M02-6102
D-1	LED	303E
D-2	LED	103S
D-3	Diode	1SS53
D-5	Diode	GP08A
D-6	Diode	GP08A
C-1	Ceramic	20P 50V
C-2	Ceramic	.01 50V
L-1	Coil	LA-115
PL-1	Lamp	White 5 ϕ 50mA 14V
M-1	Meter	YN-40A-2
SP-1	Speaker	66-52UT
DRIVER		
IC1	IC	M53247P
IC2	IC	M53247P
IC3	IC	M53247P
IC4	IC	M53204P
IC5	IC	M53200P
IC6	IC	μ PD4011C
IC7	IC	μ PD4011C
IC8	IC	μ PD4013C
Q1	Transistor	JA1600G
Q2	Transistor	2SC945R
Q3	Transistor	2SC945R
Q4	Photo Transistor	PH101
Q5	Photo Transistor	PH101
D1	LED	SR106C
D2	LED	SR106C
C1	Milar	0.0047 μ 50V
C2	Ceramic	470P 50V
C3	Ceramic	470P 50V
C4	Ceramic	0.0022 μ 50V
C5	Ceramic	0.01 μ 50V
DRIVER (DISPLAY)		
IC9	7-Seg LED	TLR313
IC10	7-Seg LED	TLR313

IC11	7-Seg LED	TLR313
IC12	7-Seg LED	TLR313
MAIN UNIT		
R31	Trimmer	3K ohm FR-10
R38	Trimmer	10K FR-10
R55	Thermistor	33D28
R86	Trimmer	10K ohm FR-10
R95	Trimmer	3K ohm FR-10
R105	Thermistor	33D28
R106	Trimmer	1K ohm FR-10
R113	Thermistor	23D29
R133	Trimmer	1K ohm FR-10
R135	Trimmer	5K ohm FR-10
R137	Trimmer	100 ohm FR-10
R138	Trimmer	100 ohm FR-10
R139	Trimmer	30K ohm FR-10
R145	Trimmer	100K ohm FR-10
R158	Trimmer	3K FR-10
R159	Trimmer	3K FR-10
C1	Ceramic	0.001 μ F 50V
C2	Ceramic	0.001 μ F 50V
C3	Dip Mica	10pF 50V
C4	Ceramic	0.01 μ F 50V
C5	Ceramic	0.01 μ F 50V
C6	Ceramic	0.01 μ F 50V
C7	Ceramic	0.01 μ F 50V
C8	Ceramic	0.01 μ F 50V
C9	Ceramic	0.01 μ F 50V
C10	Ceramic	0.01 μ F 50V
C11	Ceramic	30 pF 50V
C12	Ceramic	0.01 μ F 50V
C13	Stycon	100 pF 50V
C14	Stycon	200 pF 50V
C15	Ceramic	0.01 μ F 50V
C16	Ceramic	2 pF 50V
C17	Milar	0.039 μ F 50V
C18	Milar	0.039 μ F 50V
C19	Milar	0.01 μ F 50V
C20	Milar	0.039 μ F 50V
C21	Milar	0.039 μ F 50V
C22	Milar	0.039 μ F 50V
C23	Milar	0.01 μ F 50V
C24	Milar	0.056 μ F 50V
C25	Milar	0.01 μ F 50V
C26	Milar	0.001 μ F 50V
C27	Milar	0.056 μ F 50V
C28	Milar	0.01 μ F 50V

C29	Electrolytic	10 μ F	16V
C30	Milar	0.01 μ F	50V
C31	Milar	0.01 μ F	50V
C32	Milar	0.001 μ F	50V
C33	Electrolytic	10 μ F	16V
C34	Milar	0.056 μ F	50V
C35	Milar	0.056 μ F	50V
C36	Milar	0.056 μ F	50V
C37	Milar	0.056 μ F	50V
C38	Milar	0.056	50V
C39	Electrolytic	4.7	16V
C40	Milar	0.0022	50V
C41	Milar	0.001	50V
C42	Milar	0.0047	50V
C43	Milar	.022	50V
C44	Milar	.0047	50V
C45	Electrolytic	1 μ	50V
C46	Milar	0.01	50V
C47	Milar	0.01	50V
C48	Milar	0.039	50V
C49	Milar	0.0022	50V
C50	Milar	0.1 μ	50V
C51	Milar	0.039	50V
C52	Electrolytic	1.	50V
C53	Electrolytic	10	16V
C54	Electrolytic	10	16V
C55	Electrolytic	3.3	25V
C56	Electrolytic	3.3	25V
C57	Electrolytic	3.3	25V
C58	Milar	0.01	50V
C59	Electrolytic	33	10V
C60	Electrolytic	0.47	50V
C61	Milar	0.01	50V
C62	Milar	0.01	50V
C63	Ceramic	100p	50V
C64	Milar	0.001	50V
C65	Milar	0.001	50V
C66	Electrolytic	10	16V
C67	Electrolytic	4.7	16V
C68	Milar	0.001	50V
C69	Electrolytic	47	10V
C70	Electrolytic	4.7	16V
C71	Electrolytic	220	10V
C72	Milar	0.01	50V
C73	Ceramic	100p	50V
C74	Electrolytic	33	10V
C75	Milar	0.001	50V
C76	Electrolytic	100	10V
C77	Electrolytic	4.7	16V

C78	Milar	0.01	50V
C79	Ceramic	100p	50V
C80	Milar	0.01	50V
C81	Electrolytic	220	10V
C82	Milar	0.0033	50V
C83	Milar	0.1	50V
C84	Milar	0.0047	50V
C85	Milar	0.01	50V
C86	Ceramic	10p	50V
C87	Ceramic	0.01	50V
C88	Ceramic	200p	50V
C89	Ceramic	100p	50V
C90	Ceramic	10p	50V
C91	Ceramic	0.01	50V
C92	Ceramic	0.01	50V
C93	Ceramic	0.01	50V
C94	Ceramic	0.01	50V
C95	Ceramic	6p	50V
C96	Ceramic	10p	50V
C97	Ceramic	0.35p	50V
C98	Ceramic	0.35p	50V
C99	Ceramic	0.35p	50V
C100	Ceramic	0.35p	50V
C101	Ceramic	6p	50V
C102	Ceramic	6p	50V
C103	Ceramic	6p	50V
C104	Ceramic	6p	50V
C105	Ceramic	4p	50V
C106	Ceramic	0.001	50V
C107	Ceramic	0.01	50V
C108	Ceramic	0.01	50V
C109	Ceramic	0.01	50V
C110	Electrolytic	4.7	16V
C111	Ceramic	0.001	50V
C112	Ceramic	0.5p	50V
C113	Ceramic	7p	50V
C114	Ceramic	30p	50V
C115	Ceramic	0.01	50V
C116	Ceramic	0.01	50V
C117	Ceramic	0.001	50V
C118	Ceramic	0.001	50V
C119	Trimmer	CVO5C120	
C120	Ceramic	15P	50V
C121	Trimmer	CVO5C120	
C122	Electrolytic	10	16V
C123	Ceramic	0.01	50V
C124	Electrolytic	47	16V
C125	Ceramic	0.01	50V
C126	Ceramic	0.001	50V

C127	Electrolytic	47 μ	10V
C128	Ceramic	0.01	50V
C129	Trimmer	CVC20-11	
C130	Ceramic	15P	50V
C131	Ceramic	0.001	50V
C132	Trimmer	CVE50-11	
C133	Ceramic	68p	50V
C134	Electrolytic	330	16V
C135	Ceramic	0.01	50V
C136	Ceramic	0.001	50V
C137	Trimmer	70p type-C	
C138	Ceramic	20p	50V
C139	Ceramic	50p	50V
C140	Trimmer	70p type-C	
C141	Ceramic	20p	50V
C142	Ceramic	2p	50V
C143	Ceramic	30p	50V
C144	Ceramic	6p	50V
C145	Ceramic	15p	50V
C146	Ceramic	0.01	50V
C147	Ceramic	1p	50V
C148	Ceramic	0.01	50V
C149	Ceramic	20p	50V
C150	-	-	-
C151	Electrolytic	1	50V
C152	Electrolytic	3.3	25V
C153	Ceramic C	0.01	50V
C154	Electrolytic	3.3	35V
C155	Electrolytic	33	10V
C156	Electrolytic	0.47	50V
C157	Ceramic	0.001	50V
C158	Electrolytic	10	16V
C159	Electrolytic	47	16V
C160	Electrolytic	220	10V
C161	Milar	0.0033	50V
V162	Electrolytic	47	16V
V163	Milar	0.1	50V
C164	Electrolytic	470	16V
C163	Electrolytic	47	10V
C166	Electrolytic	10	16V
C167	Ceramic	0.01	50V
C168	Ceramic	0.04	50V
C169	Ceramic	0.001	50V
C170	Ceramic	0.01	50V
C171	Electrolytic	0.47	50V
C172	Ceramic	6P	50V
C173	Ceramic	0.01	50V
C174	Ceramic	0.01	50V
C175	Ceramic	0.01	50V

C176	Ceramic	100p	50V
C177	Ceramic	0.01	50V
C178	Ceramic	0.001	50V
C179	Ceramic	0.001	50V
C180	Ceramic	20p	50V
C181	Ceramic	0.01	50V
C182	Ceramic	0.02	50V

MAIN UNIT

IC1	IC	μ pc577H
IC2	IC	TA7045M
IC3	IC	μ pc575C2
IC4	IC	BA-401
Q1	Transistor	2SA639 Q
Q2	F E T	3SK40 K
Q3	F E T	3SK40 M
Q4	Transistor	2SC945 P
Q5	F E T	2SK49 H2
Q6	Transistor	2SC945 R
Q7	Transistor	2SC945 P
Q8	Transistor	2SC945 P
Q9	Transistor	2SC1571 G
Q10	Transistor	2SC945 P
Q11	Transistor	2SC945 P
Q12	Transistor	2SC945 P
Q13	Transistor	2SC945 P
Q14	Transistor	2SC1571 G
Q15	Transistor	2SC1571 G
Q16	Transistor	JA1050 G
Q17	Transistor	2SC1571 G
Q18	Transistor	2SC945 R
Q19	Transistor	2SC945 R
Q20	Transistor	2SC945 P
Q21	Transistor	2SC945 P
Q22	F E T	3SK40 M
Q23	Transistor	2SC2053
Q24	Transistor	2SC1947
Q25	Transistor	2SC2094
Q26	Transistor	JA1050 G
Q27	F E T	2SK44 D
Q28	Transistor	JA1050 G
Q29	Transistor	2SC945 P
Q30	Transistor	JA1600 G
Q32	Transistor	2SC945 P
Q33	Transistor	2SD359 D
D1	Diode	1SS55
D2	Diode	1SS55
D3	Diode	1SS53

D4	Diode	1SS53
D5	Diode	1SS53
D6	Diode	1N60
D7	Diode	1N60
D8	Diode	1N60
D9	Diode	1N60
D10	Diode	1N60
D11	Diode	1S1555
D12	Diode	1SS53
D13	Diode	1N60
D14	Diode	1N60
D15	Vari Cap	1S2688C
D16	Diode	1SS53
D17	Diode	1SS53
D18	Diode	1SS53
D19	Diode	1SS53
D20	Diode	1SS53
D21	Diode	1SS53
D22	Diode	1S1555
D23	Diode	1S1555
D24	Diode	1S2473
D25	Diode	1S2473
D26	Diode	1N60
D27	Diode	1N60
D28	Diode	1SS53
D29	Diode	1SS53
D30	Diode	1SS53
D31	Diode	1SS53
D32	Diode	1SS53
D33	Diode	1SS53
D34	Diode	1SS53
D35	Diode	1SS53
D36	Diode	XZ096
D37	Diode	SR10N-2R
L1	Coil	LS-4
L2	Coil	LB-1-3A
L3	Coil	LB-1-1
L4	Coil	LB-1-1
L5	Coil	LB-1-1
L6	Coil	LB-1-3A
L7	Coil	LR-17
L8	Coil	LS-81
L9	Coil	101
L10	Coil	LS-79
L11	Coil	LS-20
L12	Coil	102
L13	Coil	LS-16
L14	Coil	102
L15	Coil	LS-80

L16	Coil	100
L17	Coil	101
L18	Coil	LS-66 A
L19	Coil	101
L20	Coil	LS-73
L21	Coil	LS-73
L22	Coil	LS-73
L23	Coil	LS-73
L24	Coil	LS-73
L25	Coil	LS-73
L26	Coil	LS-73
L27	Coil	LA-71
L28	Coil	LA-97
L29	Coil	LA-97
L30	Coil	LW-1
L31	Coil	LA-96
L32	Coil	LA-31
L33	Coil	LW-1
L34	Coil	LA-74
L35	Coil	LA-73
L36	Coil	LW-5
L37	Coil	LA-71
L38	Coil	LA-71
L39	Coil	LR-13
L40	--	--
L41	Choke Trans	TC-1B
L42	Coil	LS-73
L43	Choke Coil	101
FL1	Filter	10M20A
FL2	Filter	CFU-455E
FL3	Filter	CFU-455E
DS 1	Ceramic Discr	455D
X-1	Xtal	HC/18 μ 10.245MHz
X-2	Xtal	HC/18 μ 10.703MHz
L44	Choke Coil	100

PLL

R17	Trimmer	RGP102 B30K
R18	Trimmer	RGP102 B3.3K
R20	Thermistor	33D28
R64	Trimmer	FR-10 10K
C1	Chemical	4.7 μ 25V
C2	Ceramic	.01 μ 50V
C3	Chemical	47 μ 10V

C4	Chemical	22 μ 16V
C5	Chemical	47 μ 10V
C6	Chemical	4.7 μ 50V
C7	Dip-mica	39p 50V
C8	Dip-mica	39p 50V
C9	Trimmer	CVO5D180
C10	Milar	.1 μ 50V
C11	Chemical	10 μ 16V
C12	Milar	.0047 50V
C13	Chemical	47 μ 10V
C14	Ceramic	0.01 μ 50V
C15	Chemical	33 μ 25V
C16	Milar	.0022 μ 50V
C17	Milar	.0047 μ 50V
C18	Chemical	10 μ 16V
C19	Ceramic	.01 μ 50V
C20	Ceramic	.01 μ 50V
C21	Ceramic	.01 μ 50V
C22	Ceramic	40p 50V
C23	Dip-mica	15p 50V
C24	Ceramic	40p 50V
C25	Ceramic	.01 μ 50V
C26	Ceramic	.01 μ 50V
C27	Ceramic	.01 μ 50V
C28	Ceramic	.01 μ 50V
C29	Ceramic	.01 μ 50V
C30	Ceramic	.01 μ 50V
C31	Ceramic	.01 μ 50V
C32	Ceramic	.01 μ 50V
C33	Ceramic	.01 μ 50V
C34	Trimmer	CVO5D180
C35	Trimmer	CVO5D120
C36	Chemical	3.3 μ 25V
C37	Ceramic	.001 50V
C38	Sticon	820P 50V
C39	Sticon	200P 50V
C40	Ceramic	.01 μ 50V
C41	Sticon	100P 50V
C42	Sticon	820P 50V
C43	Ceramic	.01 μ 50V
C44	Dip-mica	39P 50V
C45	Ceramic	.01 μ 50V
C46	Ceramic	10P 50V
C47	Ceramic	.01 μ 50V
C48	Ceramic	.01 μ 50V
C49	Ceramic	8P 50V
C50	Ceramic	.5P 50V
C51	Ceramic	10P 50V
C52	Ceramic	0.01 μ 50V

C53	Milar	.1 μ 50V
C54	Ceramic	.01 μ 50V
C55	Chemical	22 μ 16V
C56	Ceramic	.01 μ 50V
C57	Chemical	22 μ 16V
C58	Ceramic	.01 μ 50V
Feed Through		C60 ~ C100
C100	Kantsu-con	B363YN820M
C101	Ceramic	470 pF 50V
C102	Ceramic	470 pF 50V
C103	Ceramic	470 pF 50V
C104	Ceramic	0.01 μ 50V
C105	Ceramic	NPO 20p 50V

Q1	Transistor	2SC945
Q2	FET	2SK44
Q3	Transistor	2SC945
Q4	Transistor	2SC1312-G
Q5	-	-
Q6	Transistor	2SC1312-G
Q7	Transistor	2SC945
Q8	Transistor	JA1050-G
Q9	Transistor	2SC385
Q10	Transistor	2SC763-C
Q11	Transistor	2SC763-C
Q12	Transistor	2SC945

IC1	LSI	SC3062
IC2	IC	μ PD4011
IC3	IC	μ PD4030
IC4	IC	TA7045M
IC5	IC	μ PC577H
IC6	IC	MC7805CP
IC7	DC Converter	DP-1
IC8	IC	MC78L08

X1	Xtal	HC-18/U 5.000MHz
X2	Xtal	HC-18/U 14.700MHz
X3	Xtal	HC-18/U 14.922MHz

D2	Diode	1SS53
D3	Diode	1SS53
D4	Diode	1SS53
D5	Diode	1SS53
D6	Diode	1SS53
D7	Varicap	MV-201
D8	Varicap	MV-201

D9	Diode	1SS53
D10	Diode	1SS53
D11	Diode	1SS53
D12	Diode	1SS53
D13	Varicap	ITT410
D14	Varicap	ITT410
L1	Trans	LR-11B
L2	Choke	100
L3	Coil	LS-93
L4	Coil	LS-2
L5	Coil	LS-3A
L6	Coil	LS-3A
L7	Choke	101
L8	Choke	102

DIMMER

Q201	Transistor	2SC945-F
Q202	Transistor	2SC945-P
Q203	Transistor	JA1050-G
Q204	Transistor	JA1600-G
D201	Diode	1SS53
R201	Trimmer	100K FR-10
R202	Trimmer	1K ohm R25J
R203	Trimmer	1K R25J
R204	Trimmer	4.7K R25J
R205	Trimmer	1K R25J
R206	Trimmer	470 R25J
R207	Trimmer	100 R25J
R208	Trimmer	1K R25J
R209	Trimmer	10K R25J
R210	Trimmer	220 R25J
R211	Trimmer	22K R25J
R212	Trimmer	1K R25J
C201	Electrolytic	4.7 16V
C202	Electrolytic	10 μ 16V

SECTION X VOLTAGE CHARTS

Unit	No.	Transmit				Receive				Notes
		Base or Gate 1	Gate 2	Collector or Drain	Emitter or Source	Base or Gate 1	Gate 2	Collector or Drain	Emitter or Source	
U-116 PLL	Q1	8.5		8.6	7.8					
"	Q2	0		8.6	3.9					
"	Q3	0		0.9	0					
"	Q4	0		7.8	0					
"	Q6	0		7.8	0.3					
"	Q7	7.5		7.6	7.0					
"	Q8	4.5		5.0	5.0					
"	Q9	1.8		8.3	1.0					
"	Q10	1.4		8.4	0.8					
"	Q11	1.4		8.4	0.8					

Unit	No.	Transmit							Pin No.							Notes
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
U-116 PLL	IC-1	(see below)														
	IC-2	0	0	5	0	0	5	0	0	5	5	5	0~5	0	5	
	IC-3	5~0	0	0	0	5	5	0	5	0	5	0~5	5	5	5	
	IC-4	5	2.6	E	1.9	5	6.7	7.5	7.5							
	IC-5	5.1	1.9	E	E	5.4	3	6								
	IC-6	10.6	E	5.0												

1=B
2=C
3=E

Unit	No.	Receive							Pin No.							Notes
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
U-116 PLL	IC-7	5	9.3													
"	IC-8	13.8	0	8.4												
U-116 PLL	IC-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
		5	1.5	0.8	1.4	5	0	0	0	0	0	0	0	0	0	
		15	16	17	18	19	20	21	22	23	24	25	26	27	28	
		0	0	0	0	0~5	0	0~5	0~5	0~5	0~5	0~5	0~5	0~5	0~5	
		29	30	31	32	33	34	35	36	37	38	39	40			
		0~5	0~5	0~5	0~5	0~5	0	5	0	0	0	0	2.8			

1=Output
2=Input
1=B
2=C
3=E

21~28
D.LSW.ON-5V
T.S SW.ON-0

29~33
D.L SW ON-5V

SECTION XI BLOCK DIAGRAMS

