

UHF SYNTHESIZED FM TWO-WAY PORTABLE RADIO

TK-330(F)/(EF)/(NF)

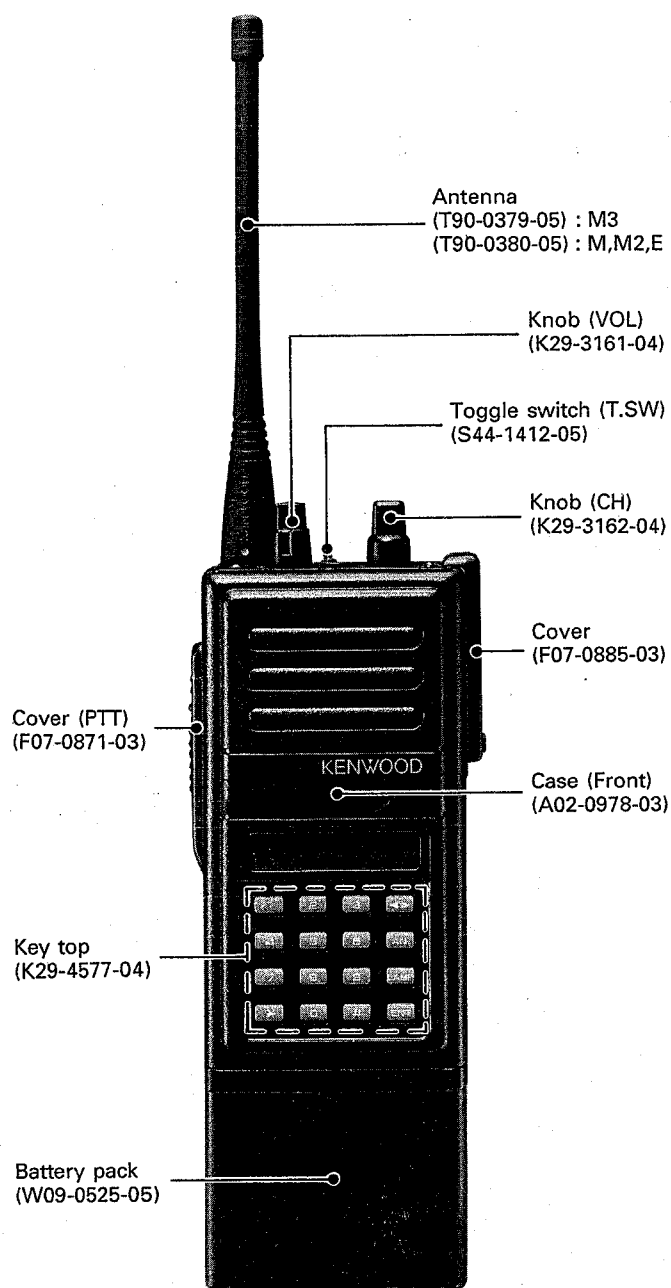
SERVICE MANUAL

KENWOOD

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5 TONE TYPE

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GENERAL

INTRODUCTION

SCOPE OF THIS MANUAL

This manual is intended for use by experienced technicians familiar with similar types of commercial grade communications equipment. It contains all required service information for the equipment and is current as of the publication data. Changes which may occur after publication are covered by either Service Bulletins or Manual Revisions. These are issued as required.

ORDERING REPLACEMENT PARTS

When ordering replacement parts or equipment information, the full part identification number should be included. This applies to all parts : components, kits, or chassis. If the part number is not known, include the chassis or kit number of which it is a part, and a sufficient description of the required component for proper identification.

PERSONNEL SAFETY

The following precautions are recommended for personnel safety :

- DO NOT transmit until all RF connectors are verified secure and any open connectors are properly terminated.
- SHUT OFF and DO NOT operate this equipment near electrical blasting caps or in an explosive atmosphere.
- This equipment should be serviced by a qualified technician only.

SERVICE

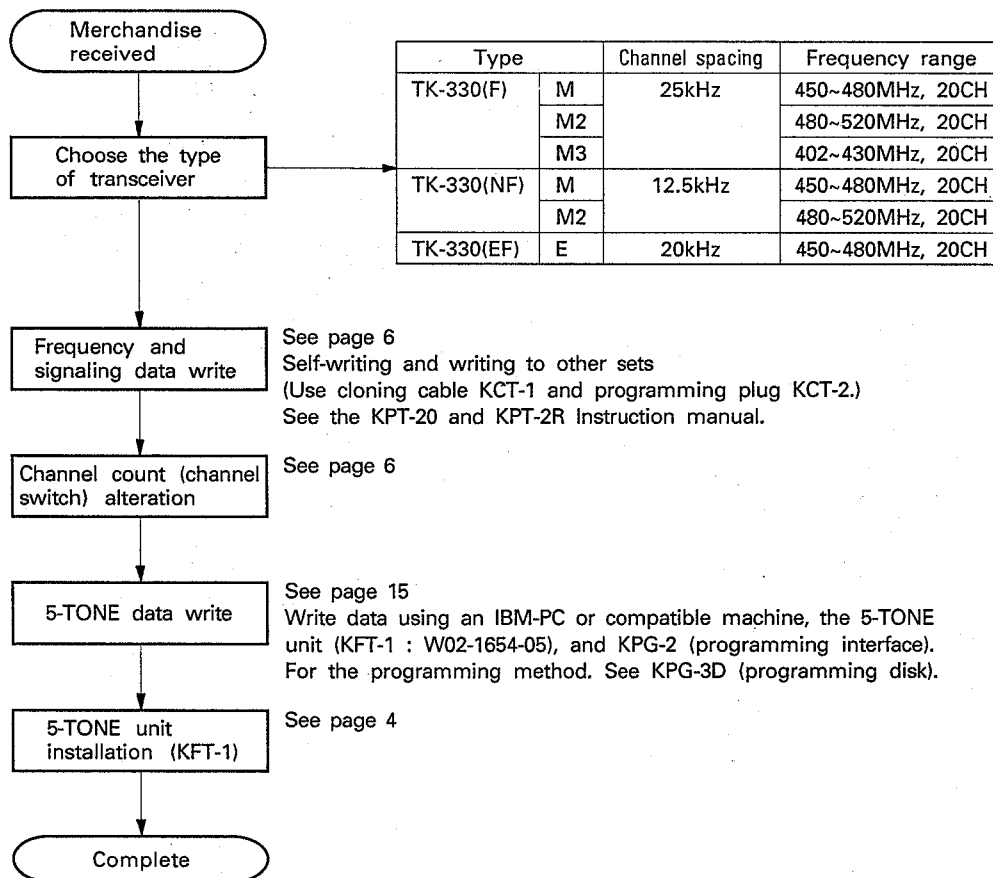
This radio is designed for easy servicing. Refer to the schematic diagrams, printed circuit board views, and alignment procedures contained within.

NOTE

WE CANNOT guarantee oscillator stability when using channel elements manufactured by other than KENWOOD or its authorized agents.

SYSTEM SET-UP / INSTALLATION

System Set-up



Installation

1. Installation of options

To install one of the following options, follow the instructions described below.

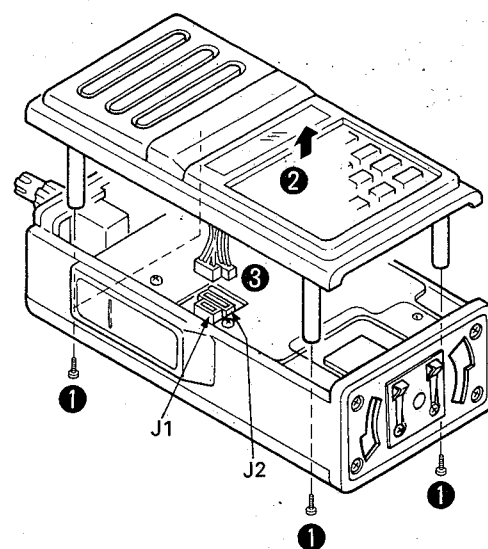
	Option	Procedure
1	KCT-1/2	See section on writing data. (See page 6)
2	KCT-3	See section on adjustment. (See page 61)

CAUTION : When disconnecting or connecting an external SP/MIC (KCM-11) and KCT-3 etc. to the universal connector, be sure to turn the radio POWER switch off.

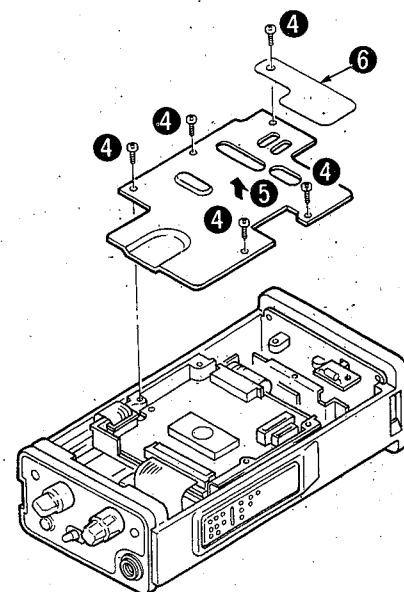
INSTALLATION

2. 5-TONE unit installation

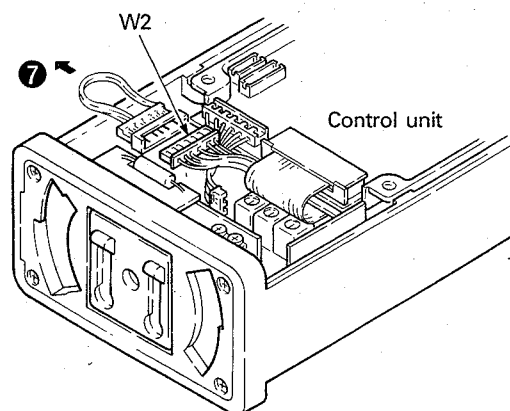
1. Remove the four screws (1) on the rear panel, raise the front panel (2), then remove the two connectors (3) from J1 and J2.



2. Remove the five screws (4) fixing the control unit, then remove the shielding plate (5) and the insulating plate (6).

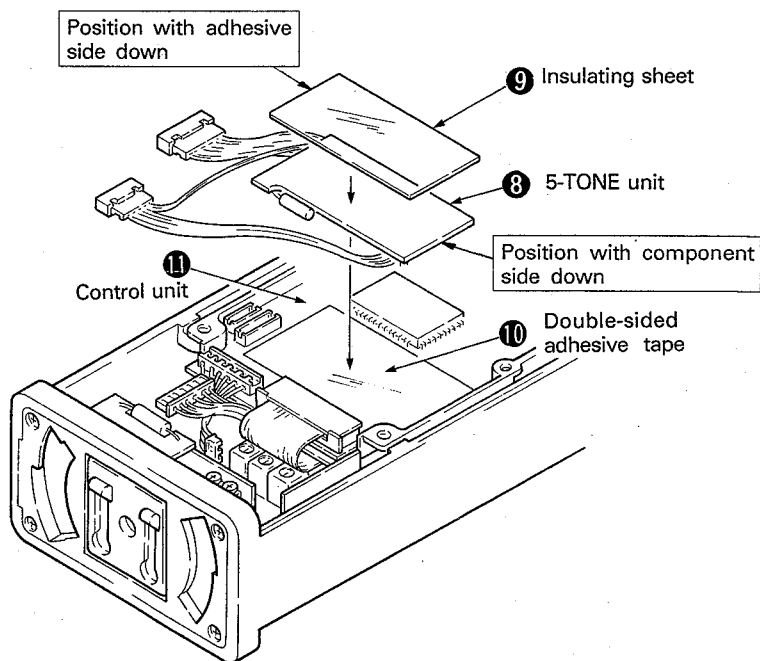


3. Remove the shorting plug (7) from connector cable W2, which leads wired from the control unit.

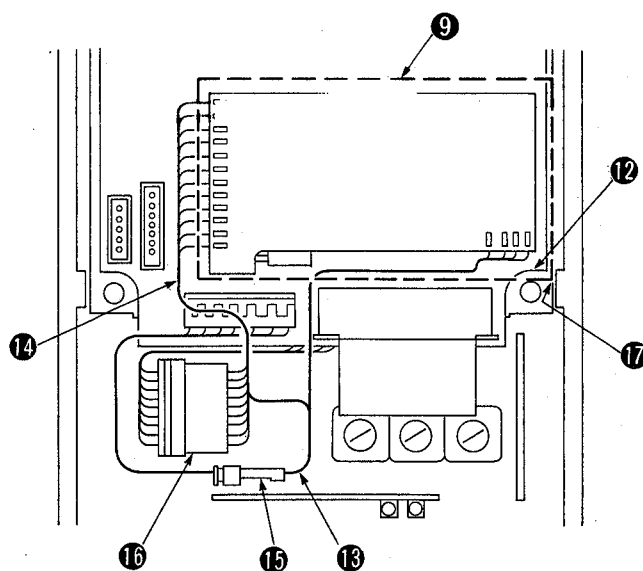


INSTALLATION

4. Take the 5-TONE unit (8) (KFT-1), insulating sheet (9) (J99-0319-04), and double-sided adhesive tape (10) (J99-0319-04) out of their box.
5. Attach the double-sided adhesive tape (10) to the top of the control unit (11).



6. Align the edge of the 5-TONE unit (component side down) in which data has been written with the lower-right corner of the shielding cover (12), put the unit on the double-sided adhesive tape, and press it down. Arrange the harnesses (13 and 14) as shown in the figure and connect the 7-pin and 9-pin connector lead wires (15 and 16) to the sockets from the control unit. Push the connectors into the case.
7. Put the insulating sheet (9) (adhesive side down) on the edge (17) of the shielding cover and attach the sheet so that the entire 5-TONE unit is covered.
8. Fix the shielding plate (5), insulating sheet (6), and front panel (2) with screws.
(Be careful not to pinch the lead wires.)



CONVERSION / WRITING METHOD

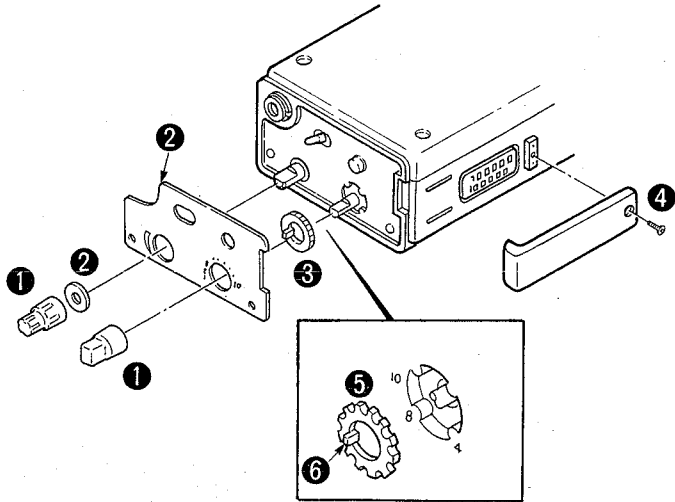
Conversion

1. How to set the channel switch stop position

The channel switch stop position can be changed freely by changing the mounting position of the channel stop.

1-1. Cosmetic panel removal

1. Remove the AF VOL and CHANNEL knobs (1).
2. Peel off the cosmetic panel with using a small thin $\ominus$ driver (2).
3. Remove the stopper (3).
4. Remove the screw (4).



1-2. Channel stopper adjustment

(How to use the channel stopper) (5)

1. For example :
If radio has just 8 channels, adjust stopper projection (6) to channel 8 position.

Writing Method

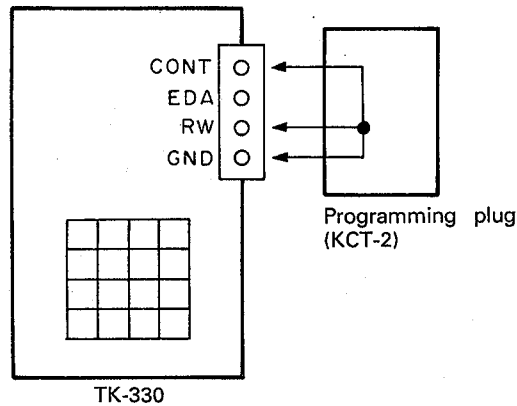
1. Overview

Self programming or cloning

- Write to self (Use programming plug KCT-2).
- Write to another set (Use cloning cable KCT-1).

1-1. Overview

The TK-330 has the ROM WRITER function. It writes T.SW data, system data (frequency set for each channel), and signaling data. The TK-330 can write data to itself. It can copy from radio with keyboard. Its write data and keyboard data to a radio without a keyboard (CLONE and COPY functions). In this case, radio will not action.



TK-330

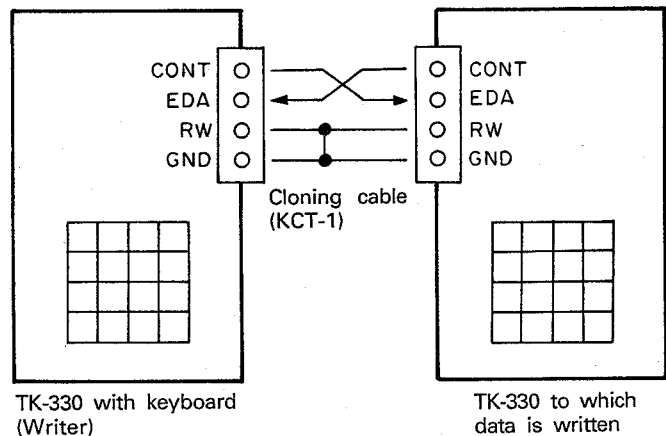
Self programming

1-2. Connection

When the TK-330 is used as a ROM writer, it is controlled through the CONT, EDA, and RW signal lines of the universal connector. The EDA is the main microcomputer data input. The TK-330 functions as a ROM writer when the CONT and RW signals are as follows :

CONT = 0, RW = 0 → Write to self

CONT = 1, RW = 0 → Write to another set



TK-330 with keyboard
(Writer)

TK-330 to which
data is written

Writing to another set (Cloning)

WRITING METHOD

1-3. Data to be written

The following three types of data are written into the EEPROM of the TK-330 :

- System-related data
 - Set variations (T.SW, DTMF DISABLE).
 - Basic set time (TOT, P.S).
- DTMF-related data
 - CONNECT ANI
 - DISCONNECT ANI
- Data set for each channel
 - Frequency data
 - Signaling data
 - Power H/L data

The power H/L is set independently of the frequency.

CAUTION

1. Before connecting an options (KMC-11, KCT-1, KCT-2 etc.) to the universal connector of the radio, be sure to turn the radio POWER switch off.
2. Alphanumeric data of the channel or repertory dial cannot be written by a set. Use KPT-20 + (2R).
3. The IF and PLL step cannot be modified by writing by a set. Therefore, set the IF and PLL step by using KPT-20 + (2R).
4. Each frequency data and tone data item is written into the ROM for each system. To modify system data, perform the operation until the modified system number appears, then perform the next operation.

1-4. System data

Data written by the ROM writer is classified into system data and CH data. Data associated with the basic specifications of the TK-330 is set. System data can be set for system 1 to 5. The contents of the data are as follows :

- | | |
|----------|---|
| SYSTEM 1 | · T.SW (●.○) function setting
· DTMF DISABLE |
| SYSTEM 2 | · Time-out-timer (TOT)
· Power save time |
| SYSTEM 3 | · CONNECT/DISCONNECT ANI |
| SYSTEM 4 | · Power H/L |
| SYSTEM 5 | · Not use |
| SYSTEM 6 | · CALL 1
· CALL 2
· GORUP |

1-5. Data for each channel

Data set for each channel includes :

- Frequency data
- Signaling data

Frequency data is the TK-330 operating TX or RX frequency. Signaling data is QT/DQT setting data (TX only).

1-6. Key functions and layout

When programming plug KCT-2 is used with the TK-330, the system enters the ROM WRITER mode.

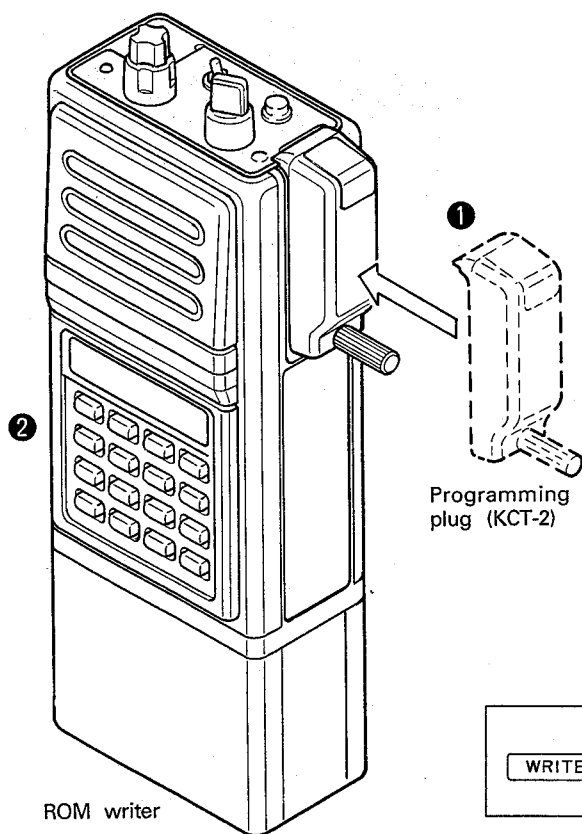
1	2	3	◀▶	◀▶	: Function key
4	5	6	AN	AN	: Data modify key
7	8	9	LAMP	LAMP	: Data delete key
✕	0	#	ENT	ENT	: Enter key

WRITING METHOD

2. Programming

2-1. Notes for writing

1. Before connecting an option to the universal connector of the radio, be sure to turn the radio POWER switch off.
2. Alphanumeric data of the channel or repertory dial cannot be written by the radio.
3. The IF and PLL step cannot be modified by writing by the radio. Therefore, write the data by using KPT-20 + (2R).
4. Each frequency data item and tone data item is written into the ROM for each system. To modify system data, perform the operation until the next number of the modified system number appears, then perform the next operation.



2-2. Setting

• Self programming

1. Turn OFF the power switch of the TK-330 and mount the KCT-2 on the universal connector (1).
2. The TK-330 has the ROM writer function (2).

• Cloning to another TK-330

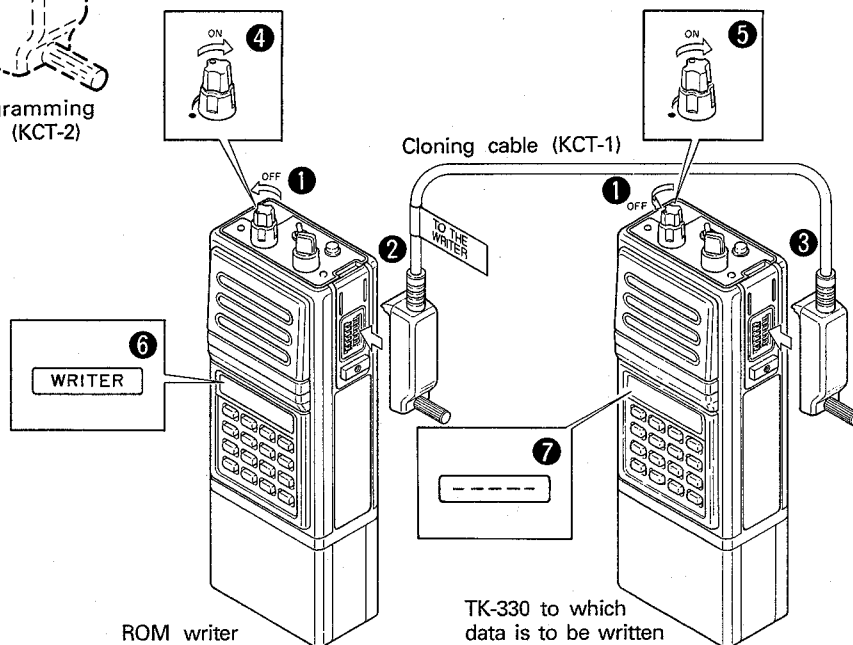
(All data, except 5-tone data, can be copied)

1. Turn off the power switch (1) of the set containing the TK-330 data (ROM writer).
2. Connect the red-tagged connector of cloning cable KCT-1 (option) to the universal connector (2) of the ROM writer, and the other connector to the universal connector (3) of the set to receive the data.
3. Turn on the power switch (4) of the ROM writer. Turn on the power switch (5) of the set to receive the data.
4. The messages "WRITER" (6) and "-----" (7) appear on the display of each set.

Now that, all data, except 5-tone data, can be copied in accordance with the ALL COPY operation on page.

Note : Be sure to use the cloning function between 5-tone models.

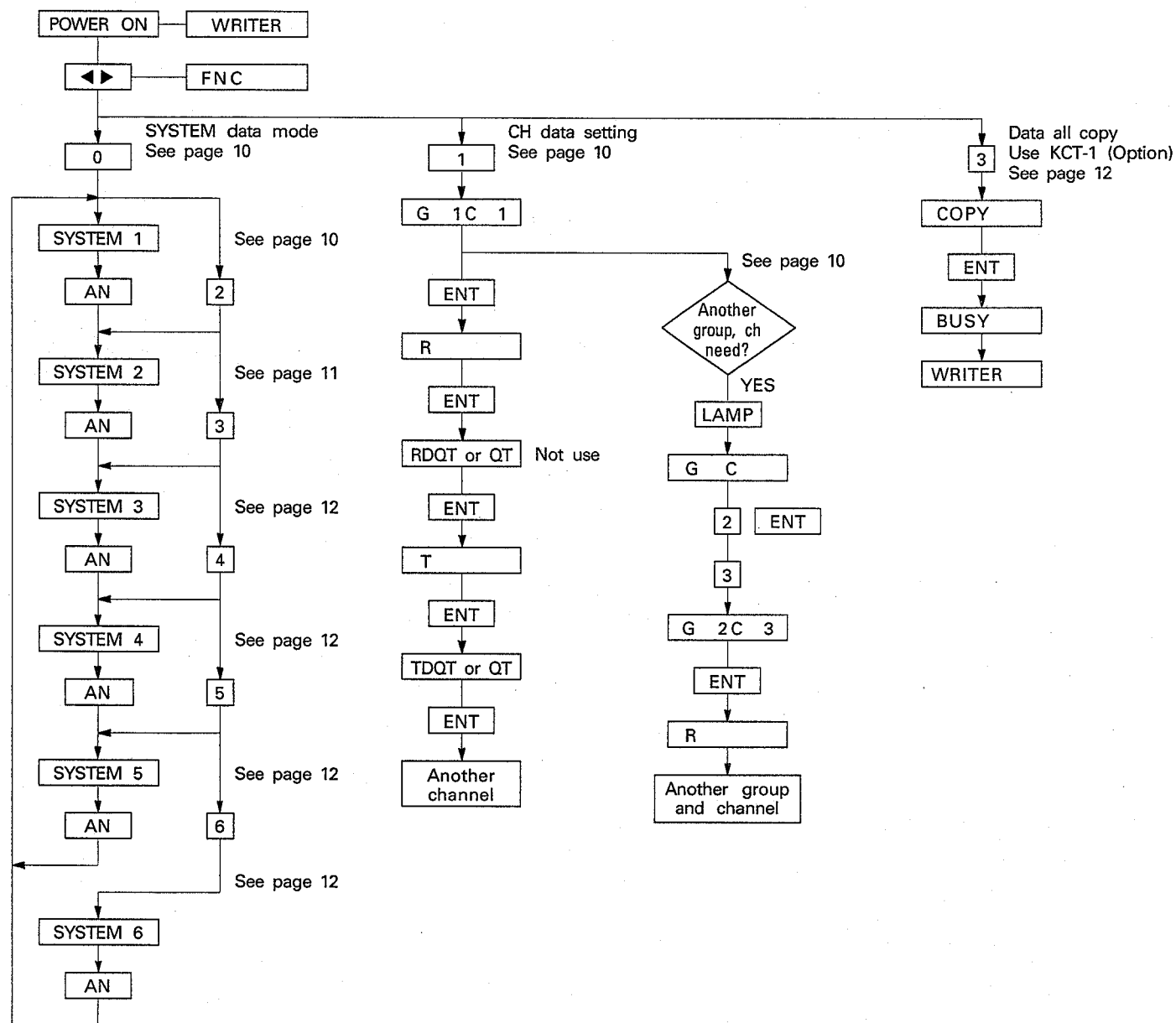
CAUTION : Before connecting programming plug KCT-2 or cable KCT-1 to the universal connector, be sure to turn the POWER switch of the set off.



WRITING METHOD

3. Write procedure

3-1. Write data selection



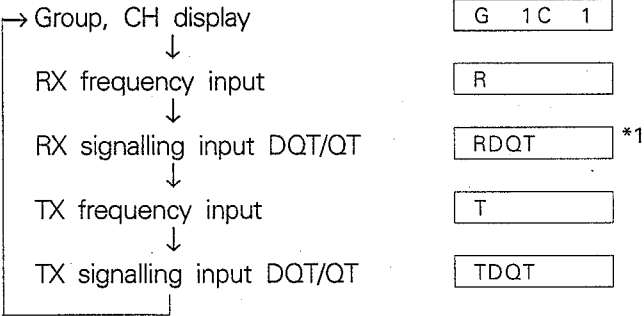
WRITING METHOD

3-2. CH data setting

The CH data setting mode is set by pressing the ◀▶ and 1 keys.

Enter data in the following order in the CH data setting mode.

• CH data setting order



• CH data setting

- 1. Power on [WRITER]
- 2. Press ◀▶ then 1 [G 1 C 1]

• RX frequency setting

- 3. Press ENT [R]
- 4. Press 460.1000 [R4601000]
- 5. Press ENT [RDQT N]

• TX frequency setting

- 6. Press ENT [T]
- 7. Press 460.0000 [T4600000]

• TX signalling setting

- 8. Press ENT *2 [TDQT N]

• DQT setting

- 9. Press 0, 2, 3 [TDQT023N]

• INVERT setting

- 10. Press S [TDQT023I]
- 11. Press ENT [G 1 C 2]

• Other CH data setting

- 12. Press ENT [R]

*1 : No function is possible even if RX signaling (DQT/QT) data is set.

*2 : Select of DQT/QT signalling mode

- 1. Press LAMP then AN if signalling data were programmed.
- 2. Press AN if signalling data were not programmed.

3-3. Group and CH setting

• CH setting (ex. Group 1 channel 2)

- 1. Power on [WRITER]
- 2. Press ◀▶ and 1 [G 1 C 1]
- 3. Press 2 [G 1 C 2]
- 4. Press ENT [R]

• Group setting (ex. Group 2 channel 3)

- 1. Power on [WRITER]
- 2. Press ◀▶ and 1 [G 1 C 1]
- 3. Press LAMP [G C]
- 4. Press 2 then ENT [G 2 C 1]
- 5. Press 3 [G 2 C 3]
- 6. Press ENT [R]

3-4. SYSTEM DATA operation procedure

SYSTEM 1

- 1. Press ◀▶ [FNC]
- 2. Press 0 [SYSTEM 1]

• Top panel switch setting

- 3. Press ENT [TSW 1/2]
- 4. Select the toggle switch setting code.
(For example 9 with the TK-330)

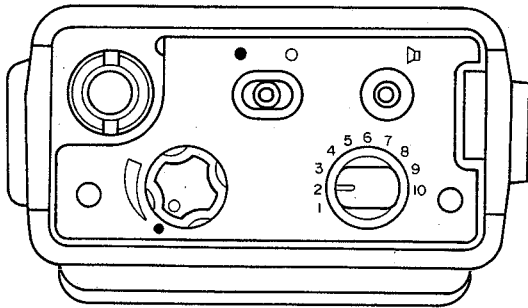
Code

TSW 1/2 9

- 5. Press ENT to go to next selection.
If you want to return to step SYSTEM 1, press ENT, ENT, ENT then press 1. [SCAN]

Code	Toggle switch setting list (●.○)	Number of channels (The number of channels for the radio varies depending on the code setting as shown below.)
1	Do not set, because the codes are not used in a 5-tone model.	
2		
3		
4		
5		
6		
7	POWER HI/LOW	10 ch
8	TALK AROUND	10 ch
9	GROUP 1/2	20 ch
10	Do not set in a 5-tone model.	
11	HOME/ROAM	10 ch
12	Do not set in a 5-tone model.	
13		

WRITING METHOD



TK-330 Front panel

• SCAN setting

6. Do not set, because the codes are not used in a 5-tone model.

SCAN

Press ENT to go to the next step

7. Press ENT to go to next section

• OTHERS setting

[DTMF function on/off setting]

The ANI and selection dial will not work when the DTMF function is off.

(For example 3)

OTHERS 3

8. Press ENT to go to next section

SYSTEM 2

If OTHERS setting is not necessary, press ENT to go to the next step.

Code	DTMF
1	ON
2	OFF
3	ON
4	OFF

SYSTEM 2

• TOT setting

9. Press ENT

TOT

10. Enter the desired Time-out-timer from 1 (= 15sec) to step 0 (= 9min).
(For example 1)

TOT 1

11. Press ENT to go to next section.

Code	TOT time	Code	TOT time (sec.)
1	15	9	135
2	30	10	150
3	45	11	165
4	60	12	180
5	75	13	195
6	90	14	210
7	105	15	225
8	120	9	9 (min.)

• POWER SAVE setting

P. S

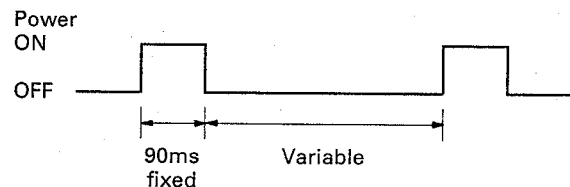
12. Enter the desired POWER SAVE time from 0 (= ∞) to step 7 (= 1200msec).
(For example 1)

P. S 1

13. Press ENT to go to next section.

SYSTEM 3

Code	Power save period
0	Disabled
1	150ms
2	200ms
3	300ms
4	400ms
5	600ms
6	800ms
7	1200ms



WRITING METHOD

SYSTEM 3

• ANI setting

Note :The DTMF function is not enabled, even if the ANI is written, when it is set to off.
Use 2 digits up to 16 digits.
Program A, B, C and D data from only ROM writer KPT-20 + (2R).

14. Press ENT

CONT

After 1sec.

15. Enter the desired CONNECT ANI NO.

(Up to 16 digits), use keys : 0 ~ 9, *, #
(For example *03755)

*03755

16. Press ENT to select DISCONNECT ANI entry.

DISCNT

After 1 sec.

17. Enter the desired DISCONNECT ANI NO.

(Up to 16 digits), use keys : 0 ~ 9, *, #
(For example #4358)

#4358

Press ENT to go to next section.

SYSTEM 4

SYSTEM 4

• DEL/ADD setting (A : ADD, D : DEL)

Do not set, because the codes are not used in a 5-tone model

18. Press ENT to go to next selection.

DEL/ADD

19. Press ENT to go to next selection.

G 1C 1 A

20. Press # to go to next section.

POWER

• POWER setting (H : HIGH, L : LOW)

21. Press ENT

G 1C 1 H

22. Press S

G 1C 1 L

23. Press ENT

G 1C 2 H

(To set all CH POWER to HI)

24. Press LAMP

G C

25. Press *

G 1C 1 H

26. Press #

SW 1/2

• SW 1/2 mode

(This key is not used for the TK-330)

27. Press ENT

G 1C 1 3

28. Press #

SYSTEM 5

SYSTEM 5

Do not set, because the codes are not used in a 5-tone model

29. Press 6

SYSTEM 6

SYSTEM 6

• CALL 1 setting

30. Press ENT

CALL 1

31. Set CALL 1 data (2-digit) (00 through 99)

(For example 25)

CALL 1 25

• CALL 2 setting

32. Press ENT

CALL 2

33. Set CALL 2 data (2-digit) (00 through 99)

(For example 45)

CALL 2 45

• GROUP setting

34. Press ENT

GROUP

35. Set an international group tone (decoding only).

(For example 4)

GROUP 4

36. Press ENT

SYSTEM 1

37. Complete

3-5. How to ALL COPY

Copy the contents of the writer into the ROM of the other set.

38. Press ◀▶

FNC

39. Press 3

COPY

40. Press ENT

-BUSY-

WRITER

41. Complete

WRITING METHOD

4. Beep sound

This set beeps a warning under the following conditions, but it does not indicate any failure.

	Beep type	Condition
1	Once when the power is switched on	For confirming the power is on. Since it is interlocked with AF VOL, the VOL position can also be confirmed.
2	Intermittent on BUSY CH LOCK OUT	A beep sounds when the PTT is pressed but transmission cannot be performed because of BUSY CH LOCK OUT.
3	Intermittent on PTT LOCK OUT	If the frequency is changed while the PTT is pressed, transmission is stopped, and a beep sounds. It stops sounding when the PTT is released.
4	Intermittent on TX UNLOCK	If the PTT is pressed for a channel to which no TX frequency is written or which has no frequency data during scanning, a beep sounds.

5. Programming with the KPT-20 (and KPT-2R)

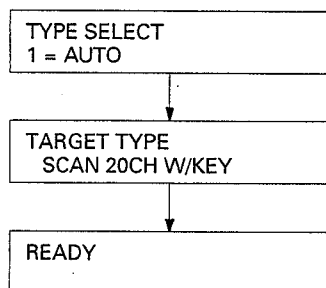
The TK-330 can write all frequencies and signaling data items (not including 5-tone data) themselves. To write with the KPT-20, use it in category 2 and mode 1.

For more information on the operation, see the Instruction Manual (I/M) for the KPT-2R. Note that different displays appear, or nonsetting or additional operation is required, in the items described below. Follow the Instruction Manual unless otherwise stated.

5-1. 3-4. CATEGORY 2-1 MODE 1 TYPE SELECTION

I/M page 27

Liquid crystal display (KPT-20)

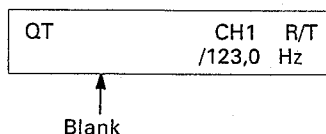


The scan type is displayed for the 5-tone model when the type selection is set to AUTO. For the operations when READY appears, see the Instruction Manual.

5-2. 3-4. CATEGORY 2-1 MODE 1 SIGNALING SELECTION

I/M page 29

Liquid crystal display



(ex. QT)

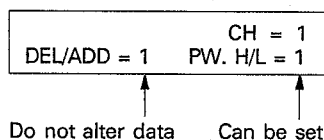
There is no reception QT/DQT function. So input only transmitted data and blank ; do not set the received data.

5-3. 3-4. CATEGORY 2-1 MODE 1 SIGNALING SELECTION

I/M page 31

1) The 1 key : DEL/ADD Power High/Low

Liquid crystal display



There is no DEL/ADD function on key 1. So never alter data. The DEL/ADD function does not work even if data is altered.

The power high/low function can be set.

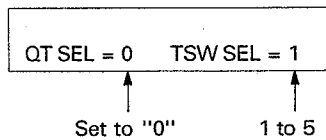
2) The 3 key : SCAN ON/OFF select Busy channel lockout

There is no scan function. The busy channel lockout function is controlled by the 5-tone unit, so mutual setting has no meaning. Do not select "3".

WRITING METHOD

3) The 4 key : QT selection T.SW. selection

Liquid crystal display (ex.)



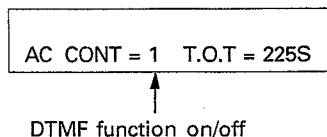
Always set the QT selection to "0". The T switch selection code is set as shown in table.

For the CALL 1/2 or STATUS GROUP (100 CH) selection, data is directly altered in the MODIFY mode of other items.

Code	Setting	Position	
		●	○
1	Power	HI	LO
2	Talk Around	OFF	ON
3	Group	1	2
4	Power	HI	LO
5	Home/Roam	R	H

4) The 5 key : AC control Time-out-timer selection

Liquid crystal display



The AC control function changes from the tone check function to DTMF function on/off for a priority channel during scanning.

1 : DTMF function off

0 : DTMF function on

For the time-out-timer selection function, see the Instruction Manual.

5) The 7 key : Scan type selection Resume Delay time selection

6) The 8 key : Priority Group/Channel selection

7) The 9 key : Priority Look Back time selection

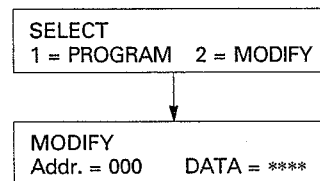
Keys 7 through 9 are not used. Do not use them.

5-4. Other Settings

To set the function used exclusively for the 5-tone unit, alter the address and data directly in the MODIFY mode of the KPT-20.

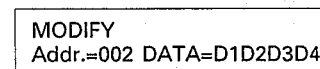
To alter the TG switch function, GROUP selection, and CALL 1/2 setting below, complete data write in steps 5-1 through 5-3 described previously. Do not alter the data for an item that is not used. (Keep the factory setting.)

Liquid crystal display



• TG Switch Function

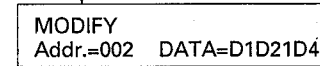
Liquid crystal display



Data **** or D1, D2, D3, and D4 includes values from 1 to 9 and from A to F, as determined by other item setting.

To select the TG switch function, alter only data D3, as shown in the table below.

Function	D3
CALL 1/2	2
STATUS	1
GROUP (100CH)	0



Data entry (For example, enter "1".)

Press the D1, D2, 1, D4, and ENT keys. Reenter data D1, D2, and D4, which are displayed on the liquid crystal display. The radio function may change when the data values are changed.

WRITING METHOD

• GROUP Selection

Liquid crystal display

MODIFY
Addr.=006 DATA=D1D2D3D4

Press the 6 key.
Press the ENT key. (Set the address to "006".)

To select the group, set only data D3 and D4, as shown in the table below.

	EEA	ZVEI-1	ZVEI-2	PZVEI	CCIR	NATEL	EIA	PZVEI
TONE A	00	01	02	03	04	05	06	07
TONE 0	08	09	0A	0B	0C	0D	0E	0F

MODIFY
Addr.=006 DATA=D1D2D4

Data entry (For example, CCIR TONE A)
Press the D1, D2, 0, 4, and ENT keys.

MODIFY
Addr.=007 DATA=D1D2D3D4

• CALL 1/2 Setting

Liquid crystal display

MODIFY
Addr.=007 DATA=D1D2D3D4

Press the ENT key.

Set data D1 through D4 as shown in the table below.

D1 = CALL 2 high-order digits
D2 = CALL 2 low-order digits
D3 = CALL 1 high-order digits
D4 = CALL 1 low-order digits

MODIFY
Addr. = 007 DATA = 4356

Data entry (For example, CALL 1=56, CALL 2=43)
Press the 4, 3, 5, 6, and ENT keys.

MODIFY
Addr. = 008 DATA = ****

END

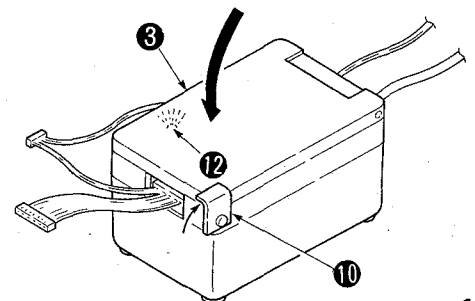
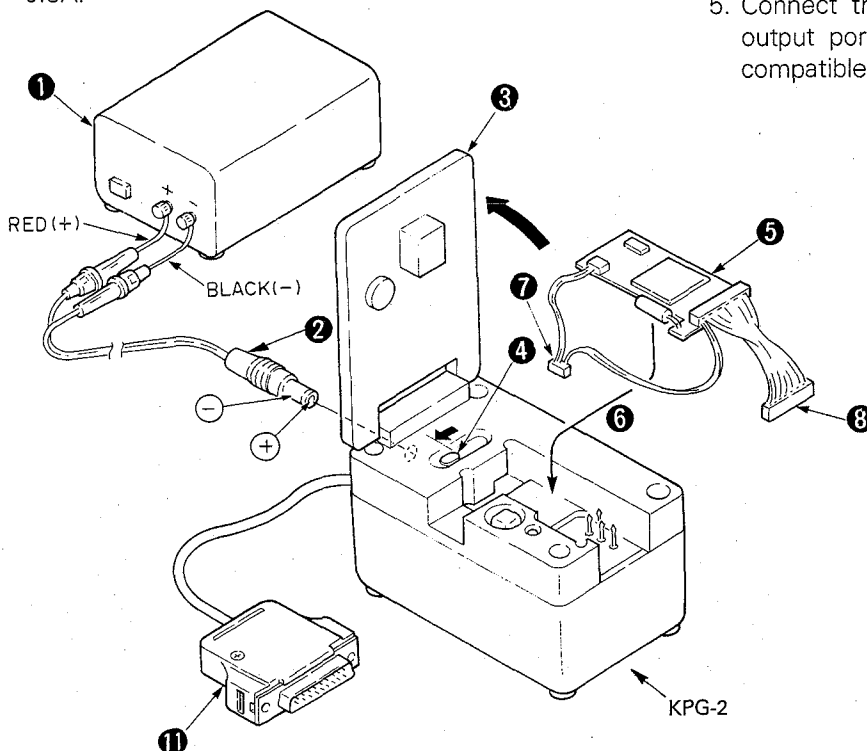
Setting is now complete. Press the PROG key and write. For subsequent operations, see the KPT-2R Instruction Manual.

6. 5-tone data write method

6-1. Setting

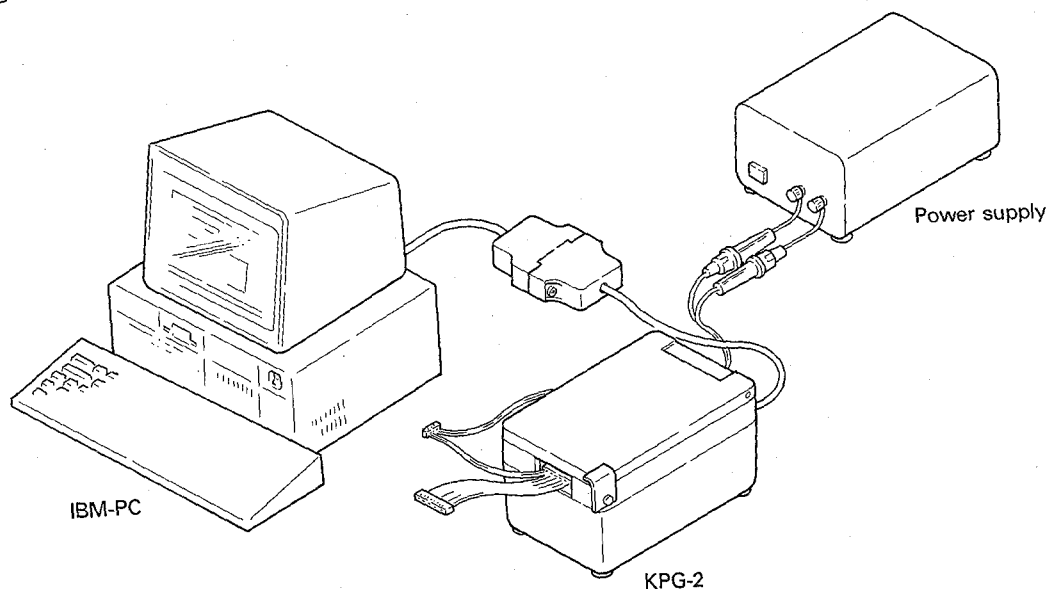
1. Connect the DC power supply to the connector on the rear of the KPG-2 (①). (Do not switch anything on yet.)
Use the cable (②) with a DC plug supplied with the KPG-2.
Use a DC power supply providing 12V DC (8 to 15V), 0.5A.

2. Open the lid (③) of the KPG-2 and slide lever (④) in the direction of the arrow.
3. Insert 5-TONE unit (W02-1654-05) (⑤) into the KPG-2 (⑥) as shown in the figure. (Free connectors 7 and 8.)
4. Close the lid (③) of the KPG-2 and secure the lock lever (⑩).
5. Connect the D sub-connector (⑪) to the printer output port of the personal computer (IBM-PC or compatible machine).



WRITING METHOD

6. The connection diagram is shown in figure.
7. Switch the DC power supply on and make sure that the LED (12) of the KPG-2 goes on.
8. The following section describes how to start the program.



6-2. To install onto another flexible or hard disk

The user may install the KPG-3D programming software onto another disk as follows :

1. Insert the KPG-3D disk into an appropriate drive if installing from a flexible disk.
2. Type : 'source-drive:' <ENTER>
e.g. A: <ENTER>
3. Type : CD \KENWOOD\KPG3D <ENTER>
4. Type : KPG3DINS 'target-drive:' <ENTER>
e.g. KPG3DINS_C: <ENTER>

The program and associated help files and handbook will be loaded into a new sub-directory structure starting at :

\KENWOOD\KPG3D\

The software may also be installed from a hard disk onto a flexible disk by following the same procedure as above.

6-3. To start the product support software

If operating the software from a flexible disk, insert the disk into an appropriate drive.

1. Type : 'drive:' <ENTER>
e.g. A: <ENTER>
2. Type : CD \ <ENTER>
3. Type : KPG3D <ENTER> to start the software

Note : _ is space

6-4. Cautions on 5-tone data programming

Set the TX CALL code as described below when data is written into the 5-tone unit with an IBM-PC.

1. To change the lower two digits of the TX CALL code with the TK-330 keyboard, enter H and I as follows :

TX CALL code *** H I ← IBM-PC display

- Enter 5-tone codes 0 through 9 where indicated by a *.
- The relationship between H and I, and the two-digit data entered with the keyboard is shown below. The two-digit data that is entered in H and I can be changed.

1 C 9 8 8 ← TK-330 LCD
 ↑ ↑
 H I

2. To fix the five digits of the TX CALL code, enter as follows :

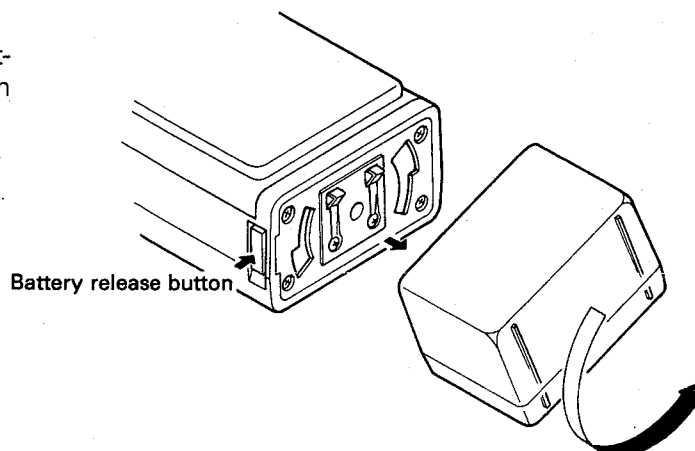
TX CALL code *****

- Enter 5-tone codes 0 through 9 where indicated by a *.
- Two-digit variable numerals can be entered with the TK-330 keyboard. The transferred 5-tone code does not change.

DISASSEMBLY FOR REPAIR

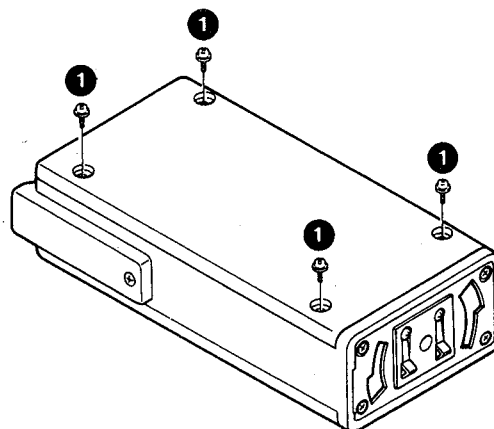
1. Battery release

1. While pressing the battery release button, the battery pack counterclockwise and pull the pack from the radio.



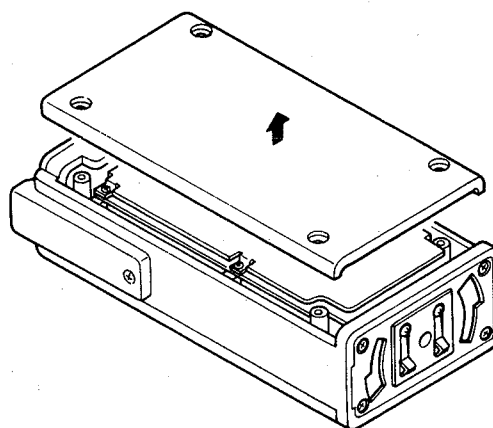
2. Case screw removal

1. Remove the 4 screws securing the rear case (1).



3. Rear case removal

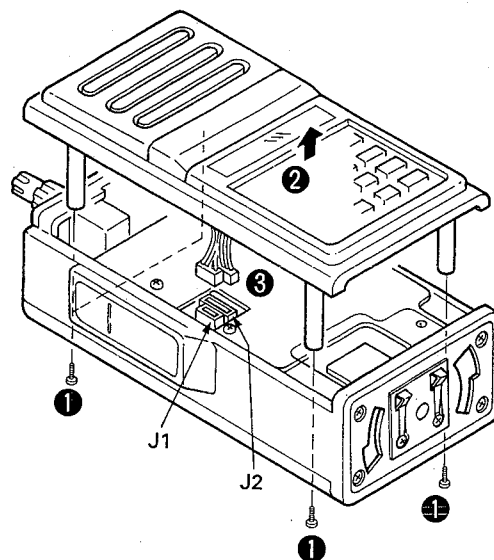
1. With the rear facing up carefully, lift away the rear case.



DISASSEMBLY FOR REPAIR

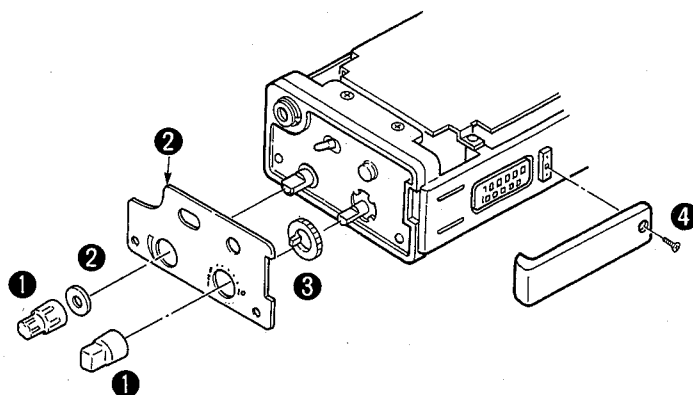
4. Front case removal

1. With the front facing up carefully, lift away the front case.
2. Disconnect the connectors from the control unit (1).



5. Cosmetic panel removal

1. Remove the AF VOL and CHANNEL knobs (1).
2. Peel off the cosmetic panel with using a small thin  driver (2).
3. Remove the stopper (3).
4. Remove the screw (4).

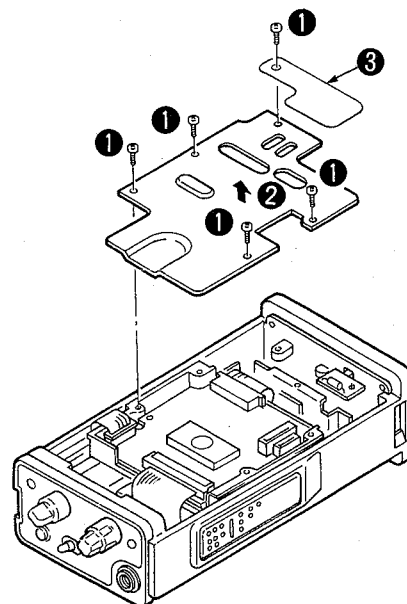


DISASSEMBLY FOR REPAIR

6. Shielding plate removal

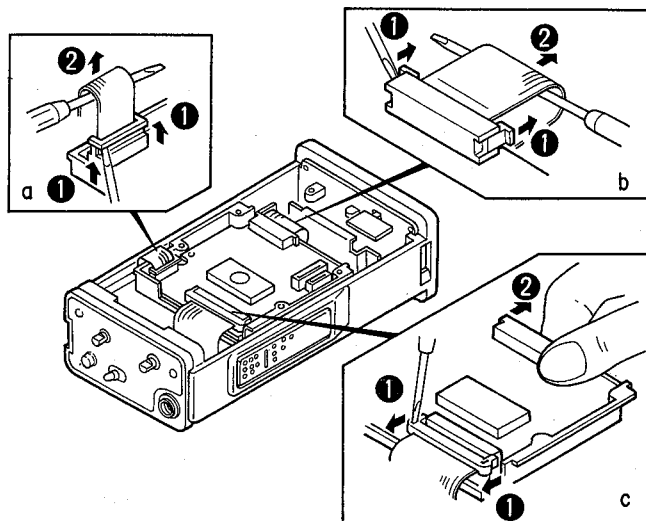
(Before 5-tone unit is installed)

1. Remove the 5 screws from the control unit (1).
2. Remove the shielding plate (2) and the insulating plate (3).



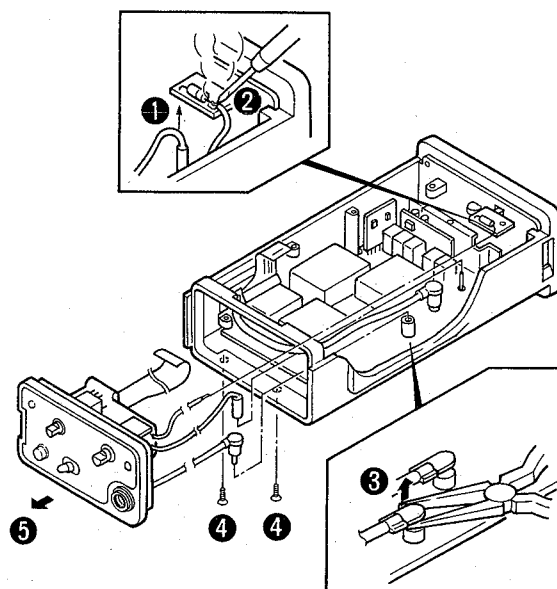
7. FPC connector housing removal

1. Release the lock as shown with using a small thin $\ominus$ driver (1), then slide the FPC connector housing (2).



8. Top panel removal

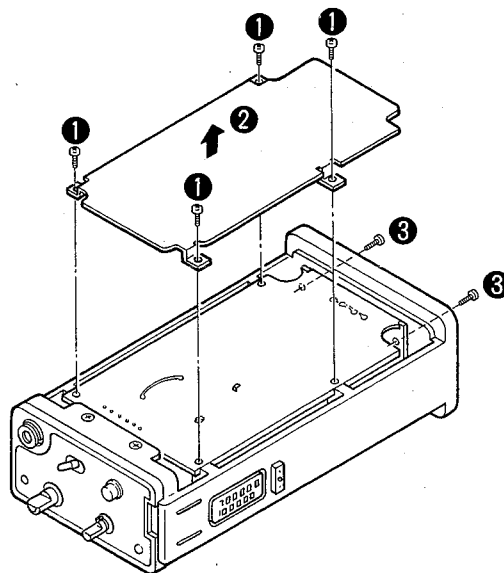
1. Remove the pin plug from the TX-RX unit (1).
2. Resolder the +B wiring from the fuse PCB (2).
3. Remove the RF pin plug from the TX-RX unit with using a small punch (3).
4. Remove the 2 screws from the frame (4).
5. Then remove the top panel slowly (5).



DISASSEMBLY FOR REPAIR

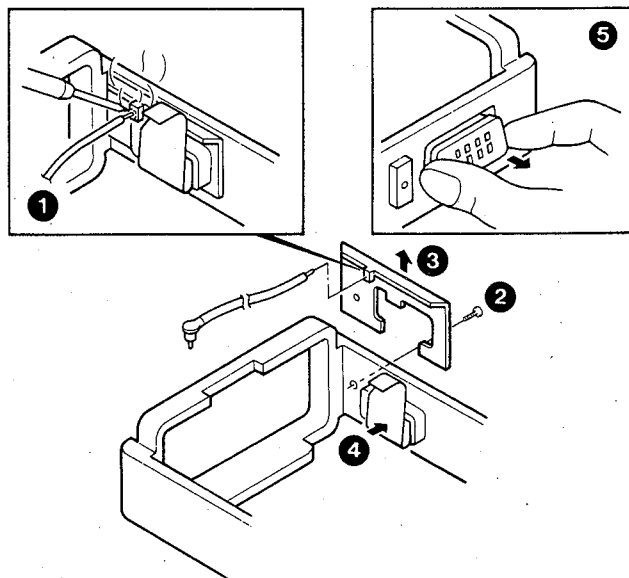
9. TX-RX unit removal

1. Remove the 4 screws from the shielding plate (❶).
2. Lift up the shielding plate (❷).
3. Remove the 2 screws from the bottom plate (❸).



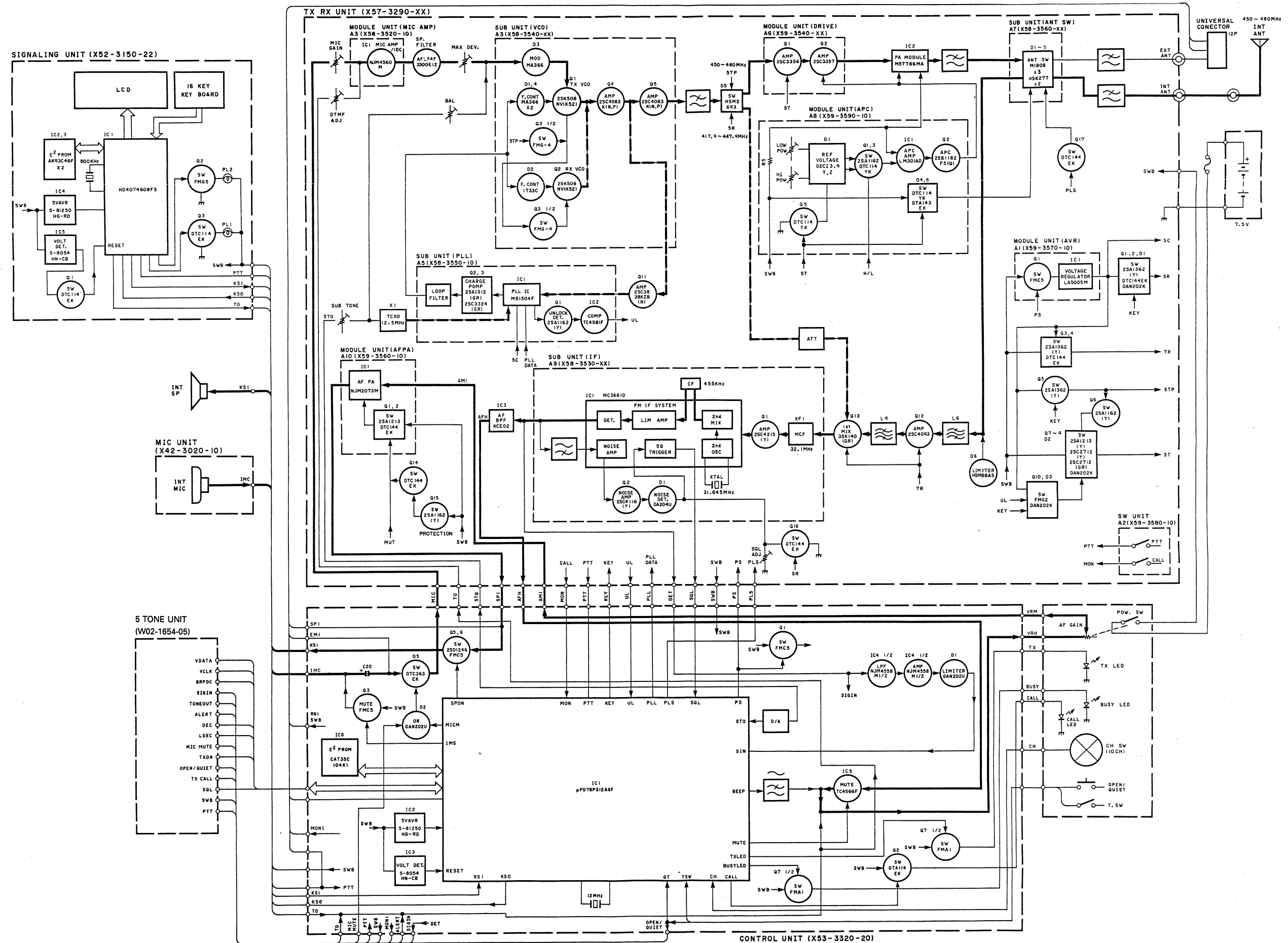
10. Universal connector removal

1. Resolder the shielding plate and RF coaxial ground wiring from the universal connector (❶).
2. Remove the screw from the frame (❷).
3. Lift the shielding plate as shown (❸).
4. Push out the universal connector from the inside (❹).
5. Lift the universal connector slowly as shown (❺).

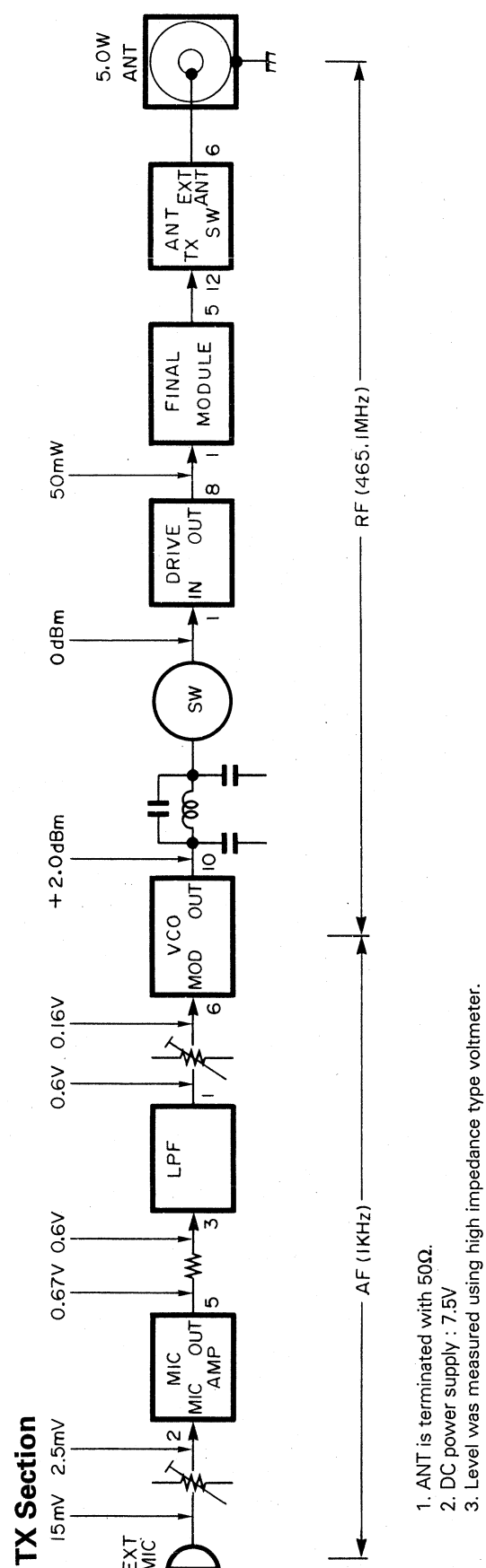
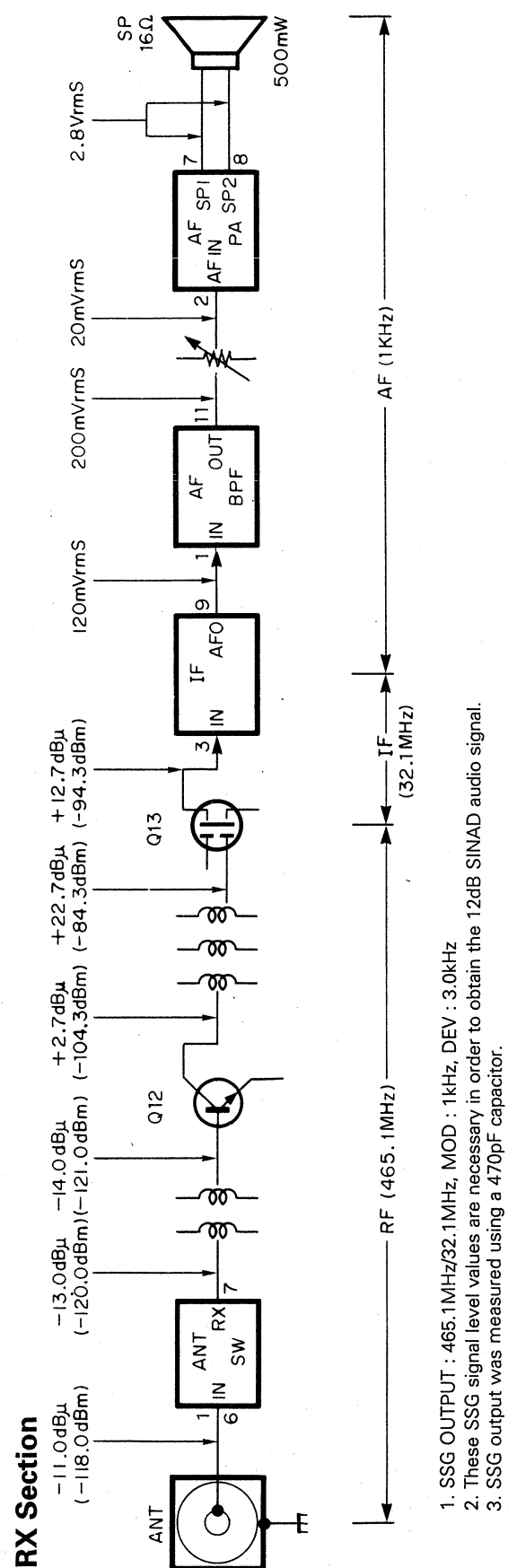


TK-330 TK-330

BLOCK DIAGRAM



LEVEL DIAGRAM



CIRCUIT DESCRIPTION

The model TK-330 consists of a TX-RX unit, a control unit and a microphone unit. The TX-RX unit has four sub-units and six module units.

1. FREQUENCY ORGANIZATION

TK-330 incorporates a phase locked loop (PLL) digital frequency synthesizer, operating with a 12.5kHz channel spacing.

The receiver is a double conversion superheterodyne with the first and second IF frequencies set at 32.1MHz and 455kHz. An incoming signal from the antenna is mixed with the first local oscillator (L.O.) signal to produce the 32.1MHz first IF signal. This is mixed again with the 31.645MHz second L.O. signal to produce the 455kHz second IF signal.

The transmit signal is generated by the PLL VCO and is routed to the antenna after being amplified by the power amplifier section. (Figure 1)

Range	f _R (L.O.)	f _T
F1 : 450 ~ 480MHz	417.9 ~ 447.9MHz	450.0 ~ 480.0MHz
F2 : 480 ~ 520MHz	447.9 ~ 487.9MHz	480.0 ~ 520.0MHz
F3 : 402 ~ 430MHz	369.9 ~ 397.9MHz	402.0 ~ 430.0MHz

Table 1 Frequencies

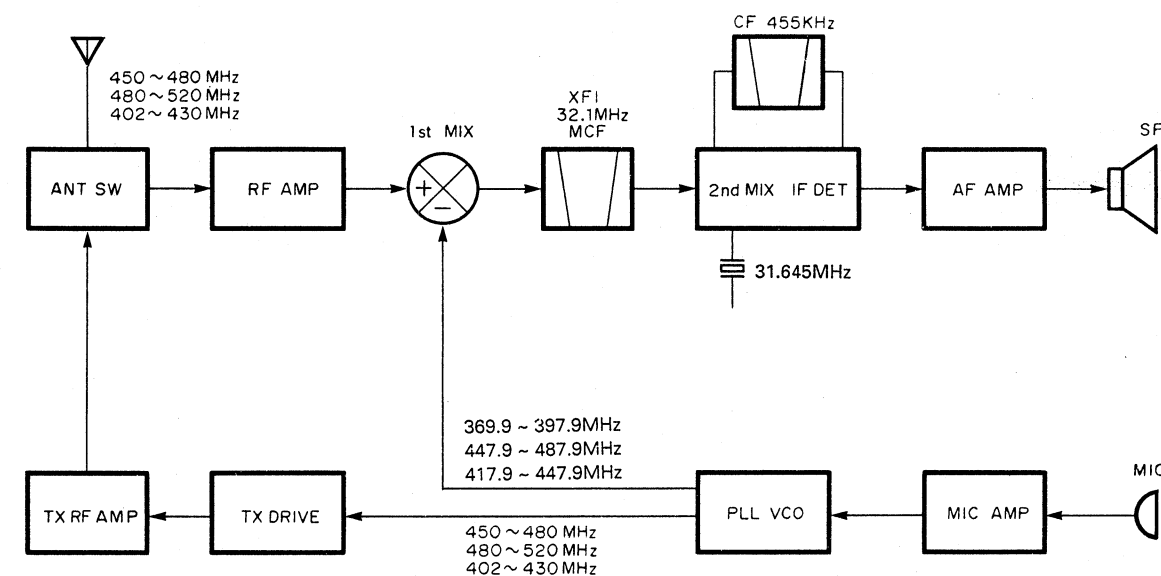


Fig.1 Frequency Organization

2. TX-RX UNIT

1. PLL Frequency Synthesizer

The frequency synthesizer is a dual modulus pre-scaled type, and it consists of a 12.5MHz temperature compensated crystal oscillator (TCXO, IC2), a PLL sub-unit and a voltage-controlled oscillator (VCO) sub-unit.

The frequency synthesizer phase locked loop is common for both the transmitter and the receiver sections except for the VCO, which contains dedicated oscillator sections for the transmitter and the receiver.

• Receiver PLL (RX PLL)

In the receive mode, the RX PLL is formed by the PLL sub-unit and Q1 in the VCO sub-unit with a reference signal supplied from the TCXO.

Q2 (2SK508), RF oscillator, in the VCO sub-unit generates a signal for the first local oscillator injection. This RF signal is amplified by buffer amplifiers Q3 and Q4 before it is routed to the TX-RX unit where the signal is switched by a switching diode (D5). D5 steers the RF

signal according to the mode of operation and when the transceiver is in the receive mode, the RF signal is fed through a 3dB attenuator before being applied to the RX first mixer (Q13).

A portion of the above VCO output signal is sampled and buffer amplified by Q11. The output signal of Q11 is applied to IC1 in the PLL sub-unit, where the signal is divided by a dual modulus type programmable counter to become a 12.5kHz signal. The 12.5kHz reference signal is obtained by dividing the 12.5MHz TCXO output signal, which has a frequency stability of ± 2 ppm from -30 degrees C to +60 degrees C, at the fixed counter section of IC1. Those two 12.5kHz signals are compared at the phase detector section of IC1 and any error in phase becomes the control signal for the VCO operating frequency after going through a charge pump circuit (Q2 and Q3) and a passive low-pass filter.

The VCO frequency is controlled by the voltage applied to varactor diodes (D1 and D3) in the VCO sub-unit.

- **Transmitter PLL (TX PLL)**

In the transmit mode, the oscillator (Q2) output signal is buffer amplified by Q3 and Q4 in the same manner as in the RX PLL operation. The signal is then steered to the driver sub-unit by D5. Other loop operations are the same as for the RX PLL.



CIRCUIT DESCRIPTION

• PLL Unlock Detection

The unlock control signal is derived from the signal provided by an unlock detector in IC1 (Pin 7). The unlock detector signal is processed by Q1 (2SA1162(Y)) and IC2 (TC4S81F) for controlling the automatic voltage regulator (AVR) to disable the transmitter by switching the transmitter 5V supply (5T) off, if an unlock condition occurs.

This unlock signal is also sent to the control unit for monitoring of the PLL condition, performed by the main micro-processor. If the transmission frequency is not defined or the unit is malfunctioning, a BEEP alarm will be emitted. (Figure 3)

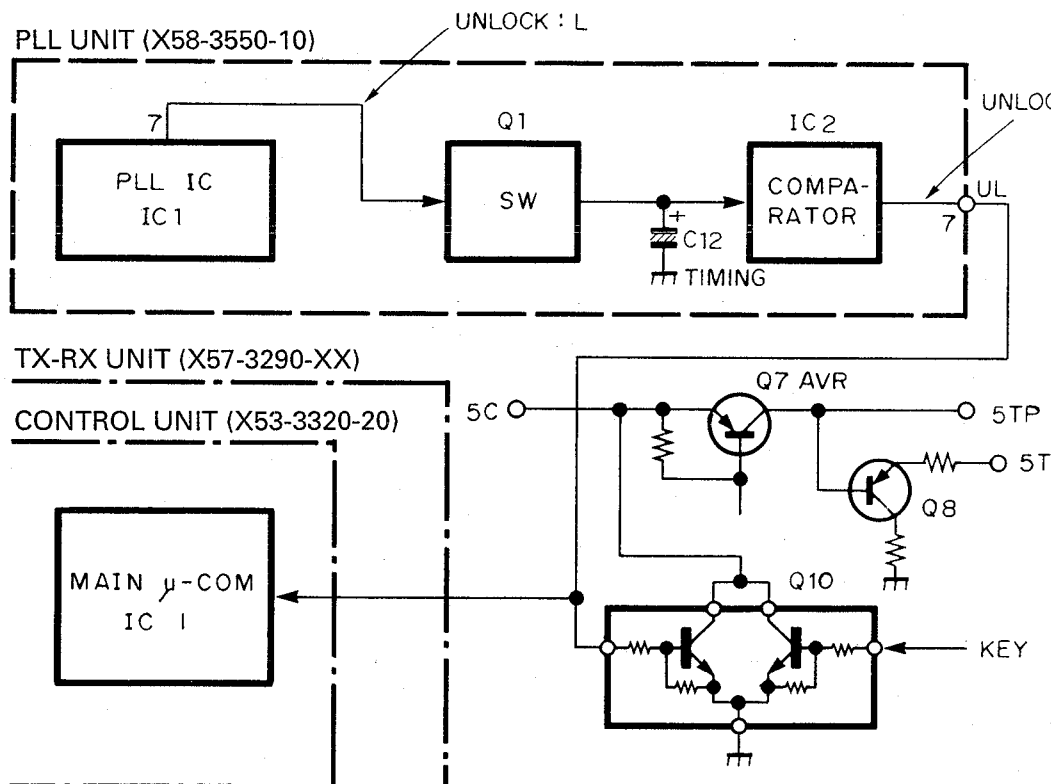


Fig. 3 Unlock detection circuit

2. Transmitter Modulator Circuit

The audio signal from the microphone or the optional DTMF encoder is applied to the microphone amplifier module unit through VR1 or VR2. The signal is pre-emphasized while being amplified by a 2-stage operational amplifier (IC1) in the module unit and routed to the modulator (MOD) terminal of the VCO sub-unit to generate an FM signal.

The microphone amplifier is a voltage saturation type, in which the signal level can not exceed the supply voltage of the amplifier, limiting its maximum output

level and this operation is temperature compensated by a thermister (TH1). The output signal from the amplifier is routed through a resistor divider network (VR3 and R25) in the TX-RX unit for the maximum deviation setting, and is then applied to the VCO unit for modulating the carrier.

When the sub-audible signalling (QT or DQT) encoder is enabled, the microcomputer generates the sub-audible signal and it is applied to the TCXO and the VCO. (Figure 4)

CIRCUIT DESCRIPTION

4. Transmitter Circuit

The output from the PLL frequency synthesizer is applied to a driver module unit, where the signal is amplified by RF amplifiers Q1 and Q2. The output signal of the driver unit is further amplified in a power hybrid module, IC1, and is routed to an antenna steering circuit for directing the transmit signal to either the built-in antenna (INT ANT) or an external antenna terminal (EXT ANT). The transmit signal is then routed to one of two antenna terminals after going through one of two 2-pole Pi type low-pass filters placed in each antenna circuit.

The automatic power control (APC) circuit is provided to keep transmitter output power constant, by controlling the power supply current to the final module. The APC operation is accomplished by monitoring the voltage drop across a 0.1Ω resistor, R5, in the APC module unit. The voltage across R5 is compared at a comparator, IC1 (LM301AD), with a reference voltage obtained from a 3.9V Zener diode, D1 (02CZ3.9YZ). The output of the comparator, IC1, is fed to Q2 (2SB1182) to control the supply voltage to the final module.

This operation limits any abnormal excess current in the final module to a pre-determined level, and insures stabilized transmitter output power at all time.

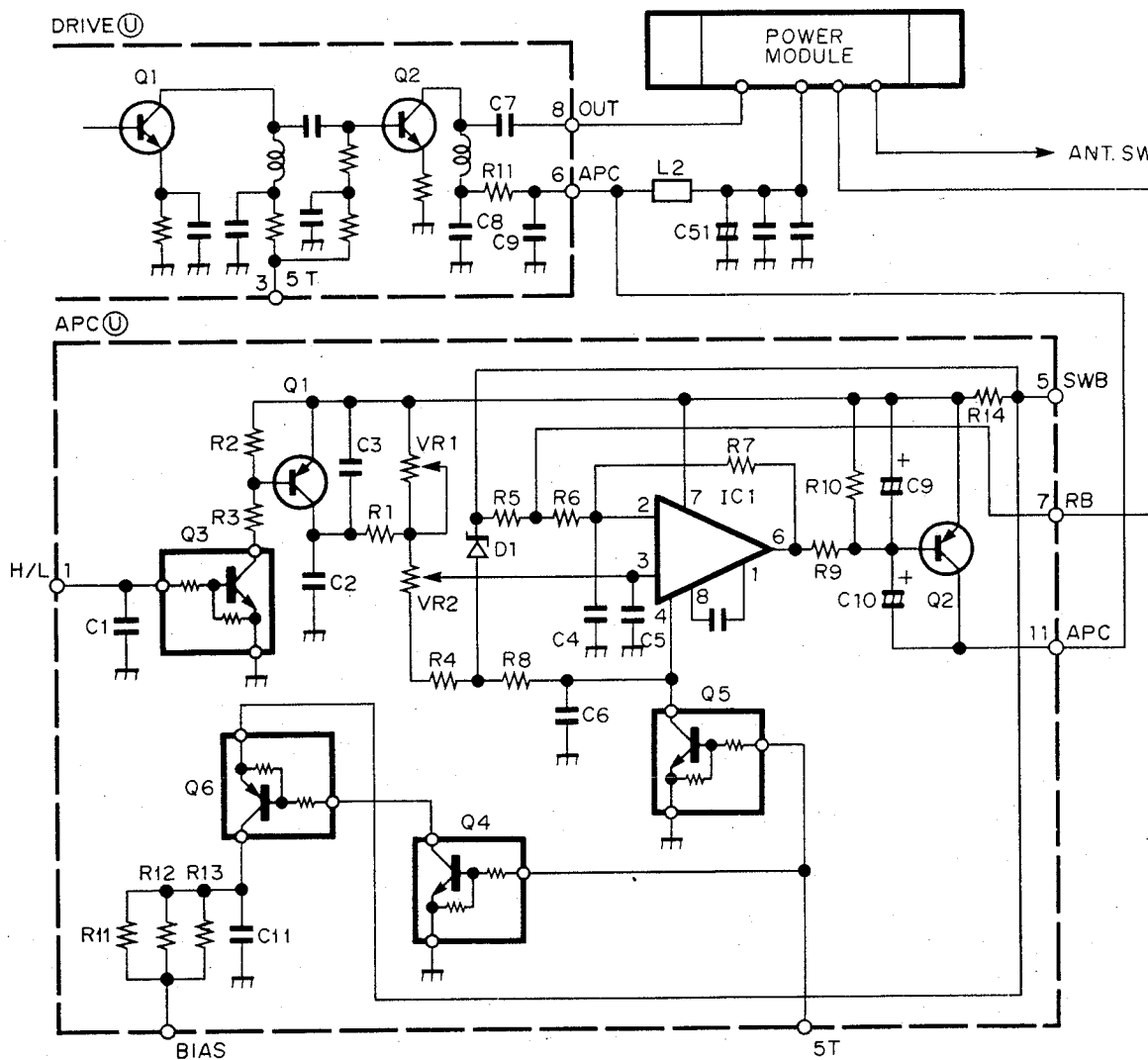


Fig. 5 APC, HI/LOW switching circuit

CIRCUIT DESCRIPTION

5. Power Supply Circuit

The power supply circuit is configured as shown in the figure 6. It provides 5C (Common 5V), 5R (RX 5V), 5TP (PLL, 5V for TX), 5T (5V for TX) and 7R (7V for the RX RF AMP first MIX). These supply outputs are controlled by KEY, UNLOCK or power save signals.

Power save timing (OFF duration) is set by the data contained in the EEPROM located in the control unit. The ON duration is fixed at 90 ms and the OFF duration is selectable from 150, 200, 300, 400, 600, 800 or 1200ms.

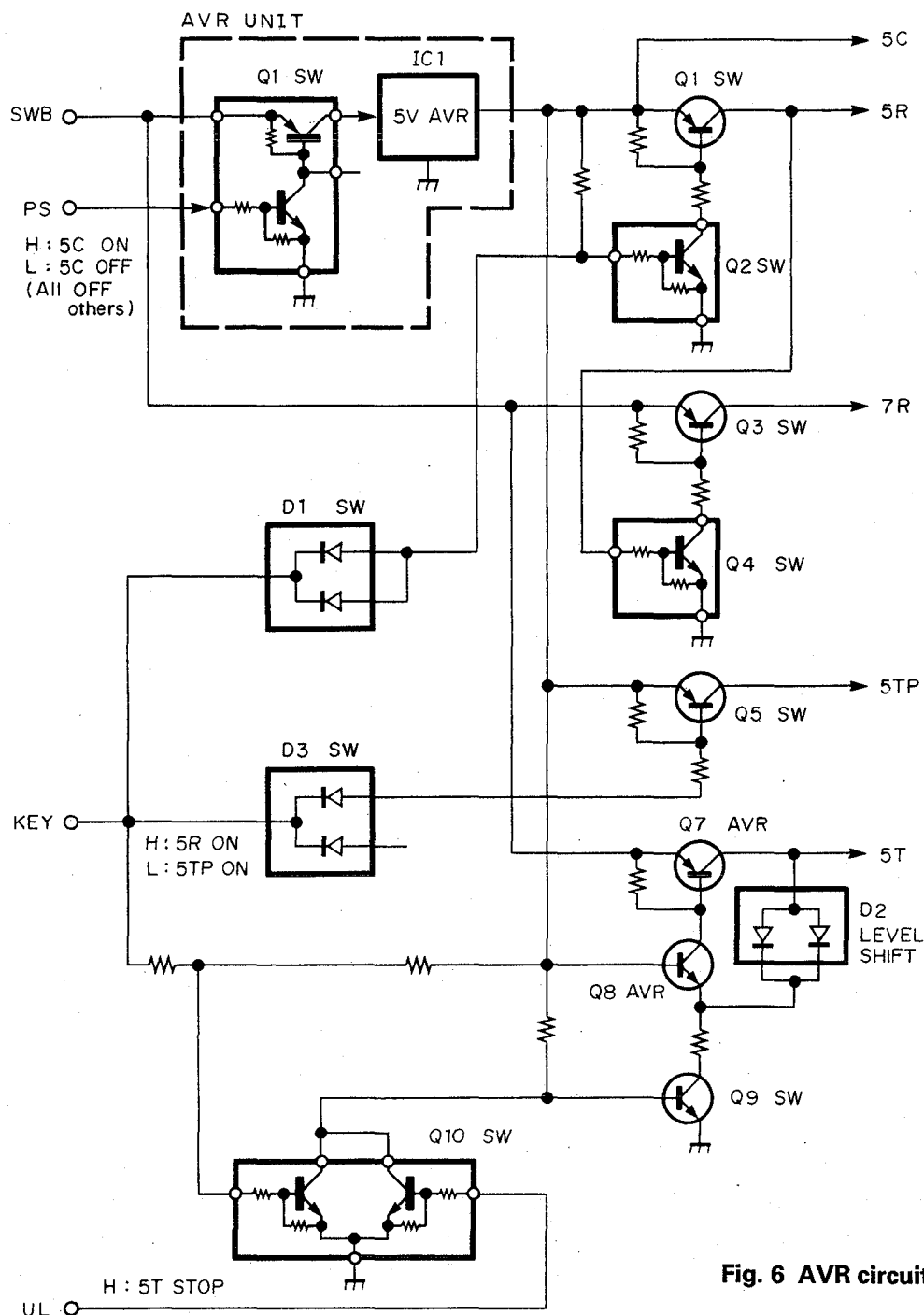


Fig. 6 AVR circuit

CIRCUIT DESCRIPTION

6. Antenna (ANT) Switching Circuit

The ANT switch sub-unit provides the function of the Transmit-Receive (TX-RX) antenna switching and the Internal-External (INT/EXT) antenna switching as shown in the figure 7. The TX-RX antenna switching is performed by D1 (MI808), D2 (HSK277) and L2. In the receive mode, D1 and D2 are turned off, causing an incoming signal from the ANT to be routed to the RX front end through L2. D1 and D2 are turned on during the transmit mode, and L2 is shunted to GND through D2. L2 is electronically equivalent to a $\lambda/4$ wave length which isolates the RX front end from the transmitter. The TX signal is, therefore, supplied to the ANT. The INT/EXT antenna switching is done by D3 (MI808), D4 (MI808) and D5 (HSK277). When the INT antenna is in use, D3, D4 and D5 are turned off, causing the RF signal to go through L3 to the INT ANT. If the EXT ANT is connected, D3, D4 and D5 are turned on. In this condition, the EXT ANT is connected through D3 and the INT ANT circuit is isolated since L3 and C6 form a parallel resonant circuit through D4 and D5.

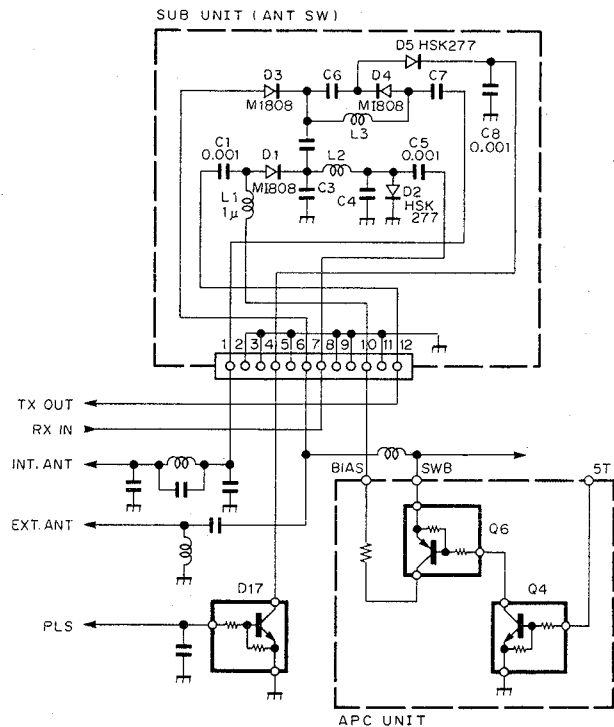


Fig. 7 ANT switching

3. CONTROL UNIT

The Control Unit has the following functions that are mostly processed in the Main MPU, IC1 (μ PD-78P312AGF) (Figure 8).

- Sending the RX/TX PLL DATA according to the stored Channel (CH)/Group (GR) information
- Power save control
- Various RX audio circuit switching
- INT/EXT switching of the SP/MIC
- QT/DQT Encode
- Data exchange between the signaling unit and MPU
- Radio programming function (with KCT-1 or KCT-2)
- 5-TONE signaling control
- Other control function

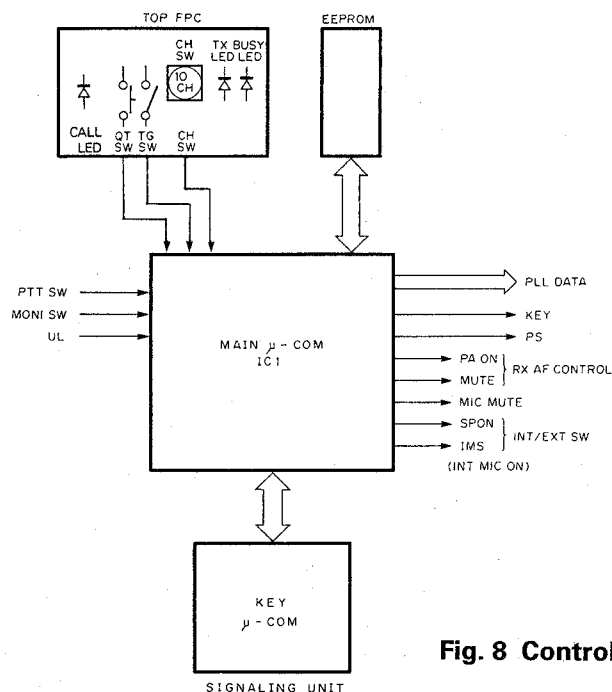


Fig. 8 Control unit

CIRCUIT DESCRIPTION

1. Rx Audio Switching On/Off

• Including 5-tone unit

Figure 9 shows the block diagram of a receiving control system. In the receive wait mode, the MUTE, PA ON, and SP ON signals are off. The BUSY and CALL LEDs are turned off by the main microprocessor.

The received signal is detected by the IF squelch circuit. The squelch is then made high, and the BUSY LED is turned on by the main microprocessor. No signal is output from the speaker.

The received 5-tone modulation signal is input through the output pin of the detector circuit (DET) to the 5-tone unit. The 5-tone unit then checks that the input signal coincides with the unit's own wait code. If they coincide, the 5-tone unit makes the DEC signal low and repeatedly toggles the LDEC signal. The ALERT signal is then output from the 5-tone unit. When the DEC signal is made low, the main microprocessor makes the PA ON and SP ON signals high and turns the SP signal on. (The SP ON signal remains low when an external speaker is used.)

The ALERT signal from the 5-tone unit goes through an audio frequency variable resistor (AF VR) to the PA amplifier. The received alert sound is then output from the speaker. The LDEC signal is passed through the main microprocessor to drive the CALL LED.

The CALL LED then blinks. The alert sound and CALL LED blinking can be canceled by pressing the OPEN/QUIET switch. If a signal is received when the CALL LED is lit, the main microprocessor makes the MUTE signal high and turns IC5 (TC4S66F) on. The received signal is then output from the speaker.

• International Group Tone Detection

An international group tone cannot be detected by the 5-tone unit, so the main microprocessor detects it.

A receiving detection output signal is input through low-pass filter IC4, an operational amplifier, to the main microprocessor. The main microprocessor digitally detects whether the group tone frequency set in ROM exists. The detection signal is output to a group decoder while the tone is output.

The 5-tone unit mixes the GROUP DEC signal and the five tones decoded by the 5-tone unit to detect the group call.

Note : The alert sound and status during the power-on sequence depends on the 5-tone unit setting. For more information, see the KPG-3D (Disk) Handbook.

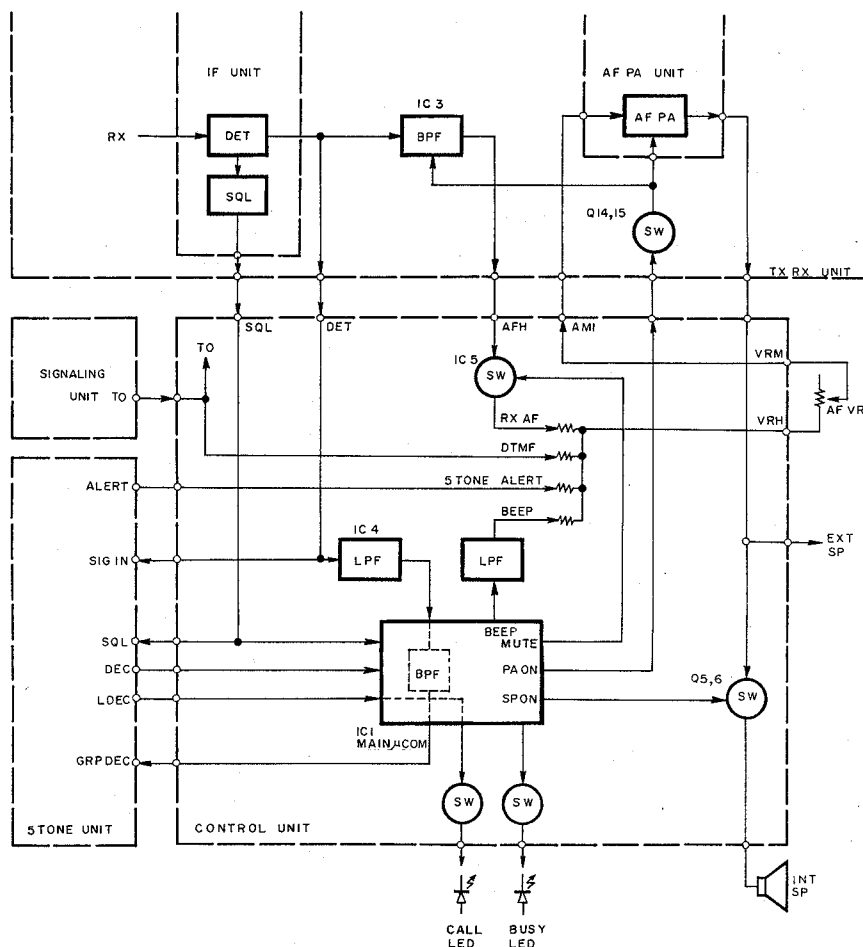


Fig. 9 RX audio switching ON/OFF

CIRCUIT DESCRIPTION

2. Transmit Signal Channel Processing

When the PTT switch is pressed, the corresponding information is sent to the 5-tone unit. If the transmission condition that the OPEN/QUIET switch is open and not busy is met, the 5-tone unit requests transmission with the TX ON line low. The main microprocessor turns the TX LED on and turns the KEY line on. The set then enters the transmission mode.

If there is QT/DQT data, eight-bit data is output and converted from digital to analog. The data is then modulated as a sub-tone signal.

Operation when the CALL switch is pressed is the same as for the PTT switch except that the MIC line is muted by Q4 when the five tones are sent.

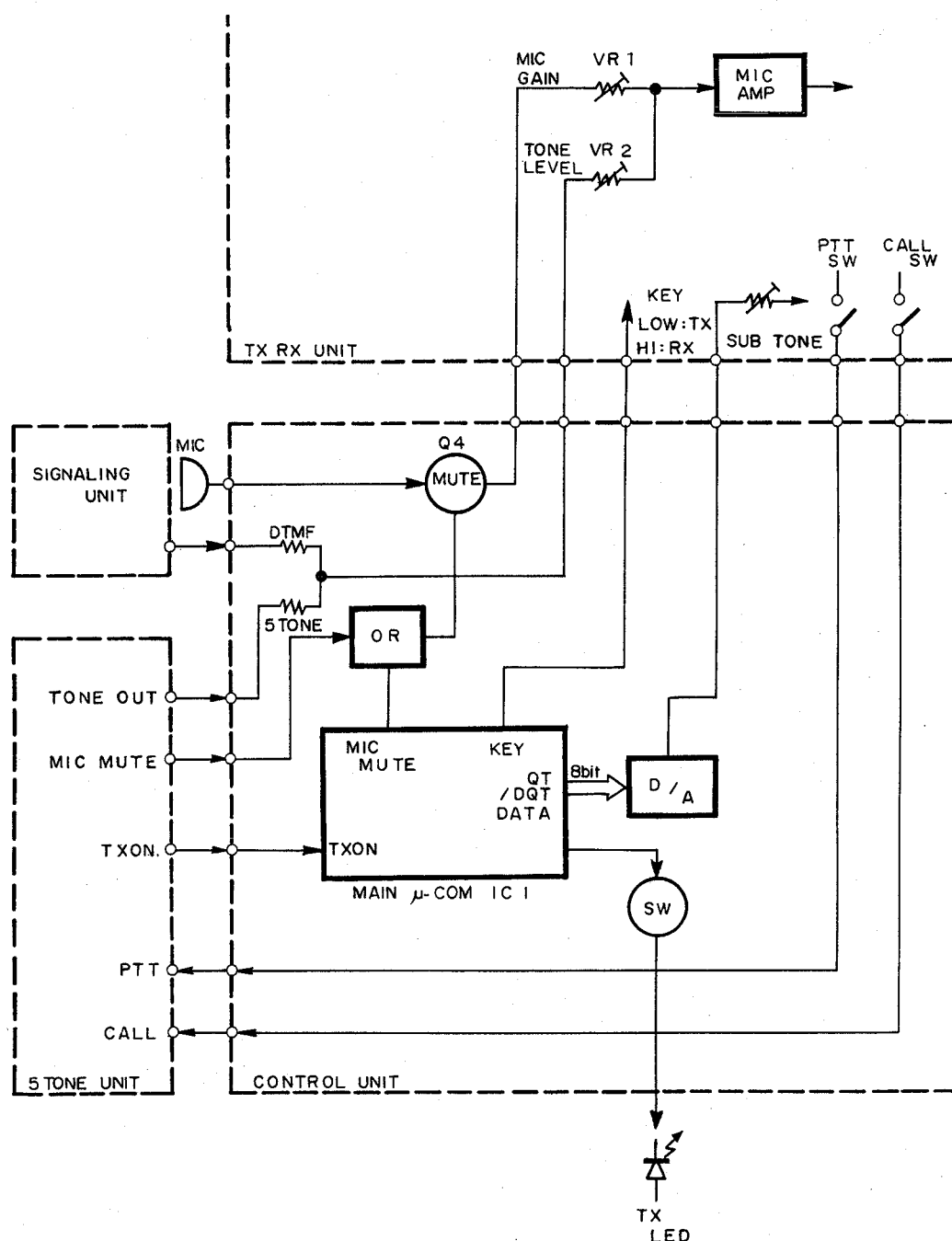


Fig. 10 Transmit signal channel processing

CIRCUIT DESCRIPTION

3. INT/EXT Switching

There are two kinds of INT/EXT (universal connector) switching:

1. Audio switching only (e.g. when the SP/MIC are connected)
2. Switching of the ANT for SP/MIC and measurement purposes

Identification between the two is done in the main MPU IC1 (M37450E4FP).

• Audio switching only

Connecting the CON line at the universal connector to GND causes the main MPU to switch the audio output routing to the EXT port while SP : ON and IMS are switched OFF.

• Switching of the ANT

Connect the universal connector EDA line to GND to create a low level that switches not only the audio but up to the ANT in the main MPU to EXT.

When EDA is low, the output of the PLS line is high and the ANT of the TX-RX unit is switched to EXT.

During DTMF output the MIC MUTE switch is set to ON so that sound and DTMF output do not interface.

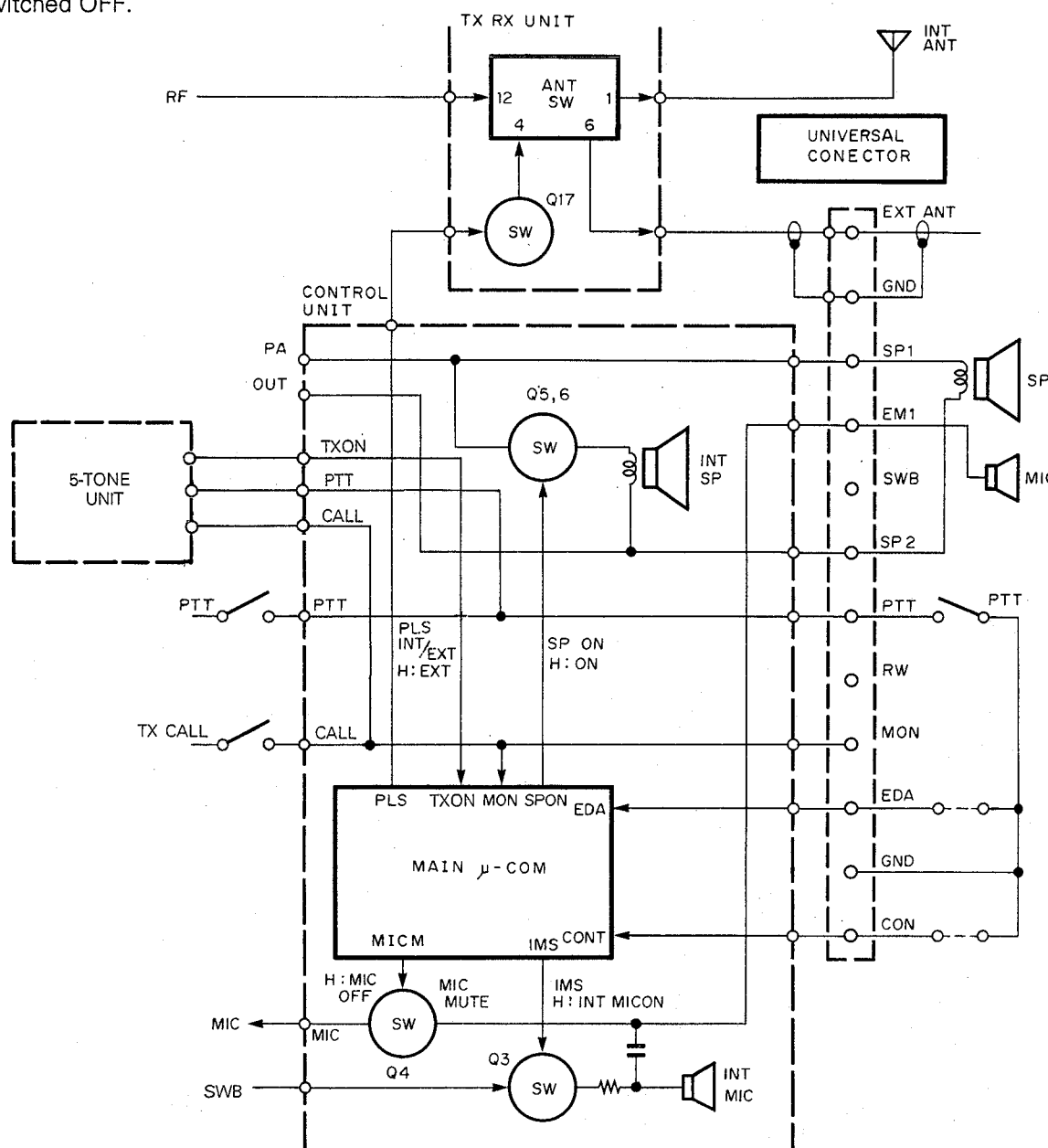


Fig. 11 INT/EXT switching

CIRCUIT DESCRIPTION

4. SIGNALING

1. Signaling Unit

The Signaling Unit consist of a 4 bit 1 chip MPU (HD4074608), a 1K bit EEPROM AK93C46F, a S-81250HG-RD power supply regulator, and a S-8054HN-CB reset circuit IC. According to the input data from the KEY MATRIX, the Signaling Unit encodes DTMF ANI, repertory dial or manual

DTMF tones. Each DTMF tone is generated individually in a sine wave form as TONER and TONEC. These tones are combined by a summing network and sent out from the TQ terminal on the control unit. The type of EEPROM used depends on the number of channels used. (Figure 12)

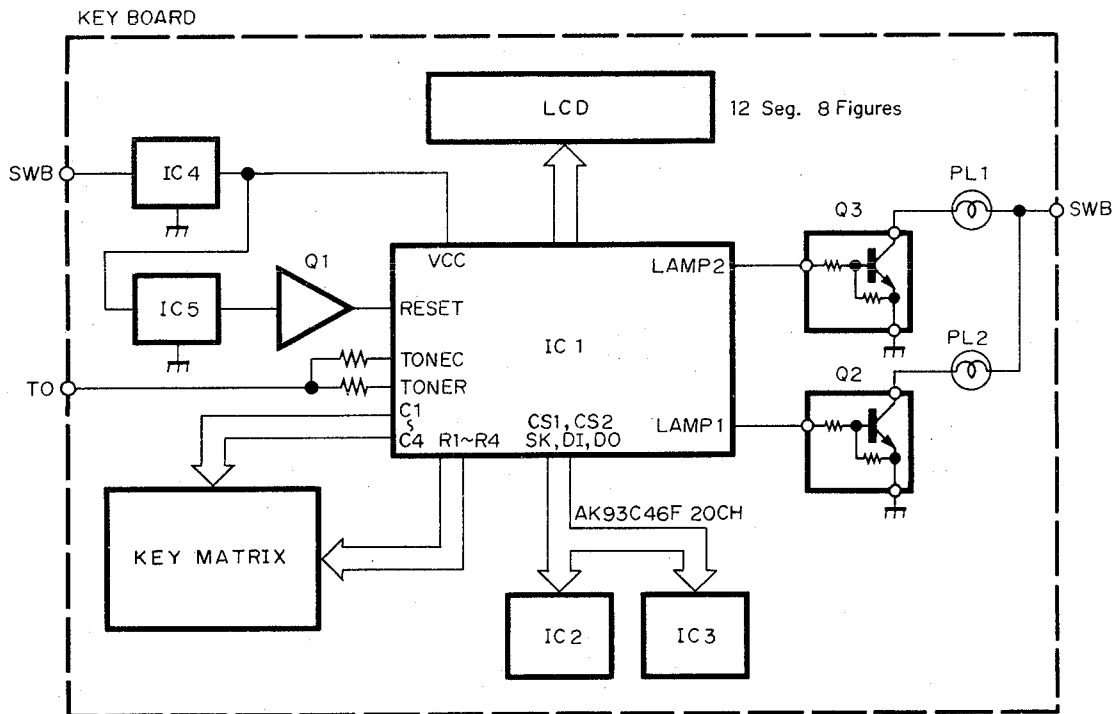


Fig. 12 Signaling system

• Data Communication between the Signal and Control Units

Data communication between the units is performed as shown in Figure 13. The unit, which is sending the data, will request transmission by setting the serial output port low. The receiving unit indicates "Clear to Send" by setting its output port low. The sending unit starts transmission of the data upon receipt of the "Clear to Send" signal at the data transfer speed of 1200bps (bits per second).

• Operation during POWER on

When the power is initially turned on, the Control Unit MPU sets KSQ low. It will then monitor KSI for 50mS. If KSI returns Low, the Control Unit determines that the Signaling Unit is connected. These units will then start data communication in the following order:

CHANNEL/GROUP
DTMF MONI/MIC MUTE CONTROL
5-TONE DATA

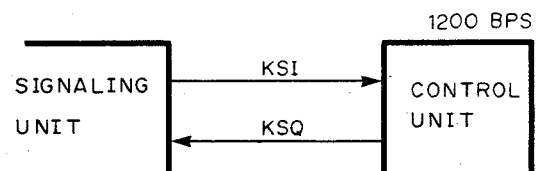
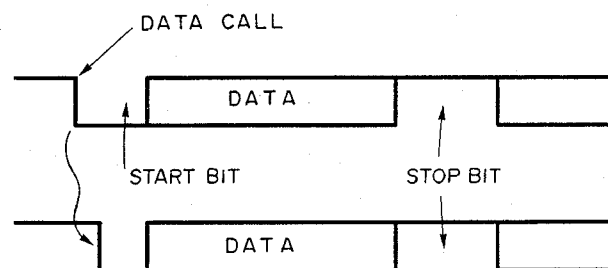


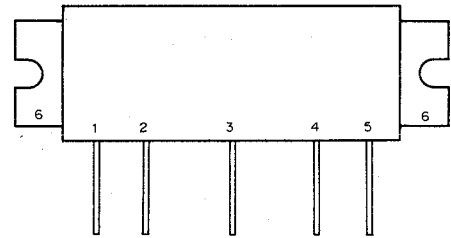
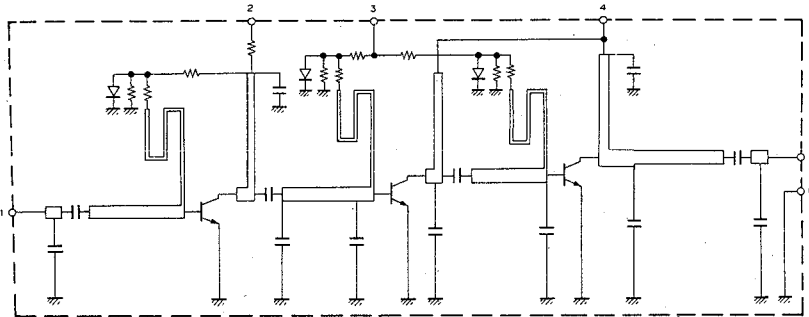
Fig. 13

SEMICONDUCTOR DATA

M57786LA, MA, HA : Power module (TX-RX unit IC2)

• Terminal connection diagram

• Equivalent circuit



- 1 : Input
 2 : Pre drive +B
 3 : Base bias +B
 4 : Final +B
 5 : Output
 6 : GND (Fin)

• Maximum rating (Tc = 25°C)

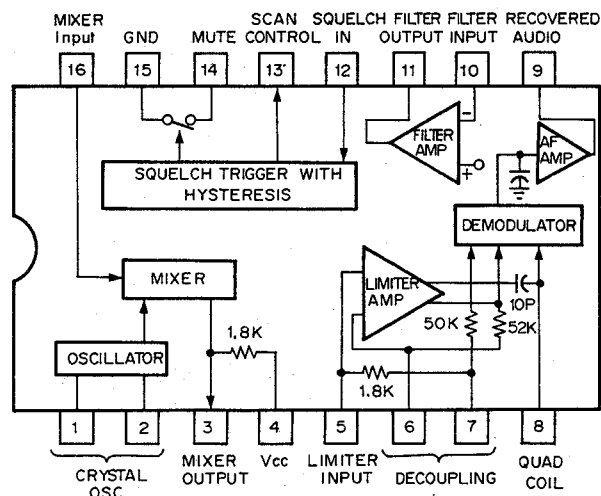
Item	Symbol	Condition	Rating	Unit
Power supply voltage	Vcc	—	10	V
Base bias voltage	Vbb	—	6	V
DC current	Icc	—	4	A
Input power	Pin	Zg = Zi = 50Ω	100	mW
Output power	Pout	Vcc1 ≤ 7.2V	10	W
Operation temperature	Tc(op)	—	−30 ~ +110	°C
Storage temperature	Tstg	—	−40 ~ +110	°C

• Electrical characteristics (Tc = 25°C)

Item	Symbol	Condition	M57786LA			M57786MA			M57786HA			Unit
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Frequency range			400	—	430	440	—	480	470	—	520	MHz
Output power	Po		7.8	—	—	7.8	—	—	7.8	—	—	W
Total efficiency	ηT	Vcc = 7.2V	45	48	—	45	48	—	45	48	—	%
2nd spurious		Vbb = 5V	—	—	−25	—	—	−25	—	—	−25	dB
3rd spurious		Pin = 50mW	—	—	−30	—	—	−30	—	—	−30	dB
Input SWR	pin	Zg = Zi = 50Ω	—	—	2.5	—	—	2.5	—	—	2.5	—
Output SWR	pout		—	1.5	—	—	1.5	—	—	1.5	—	—

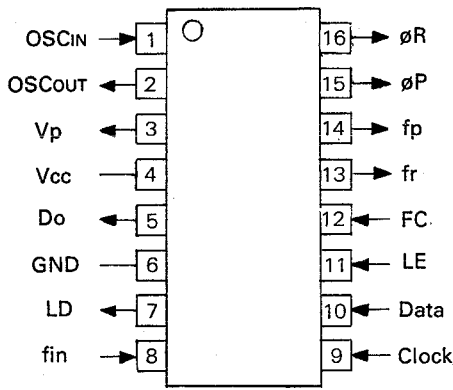
MC3361D : FM IF (IF unit IC1)

• Block diagram

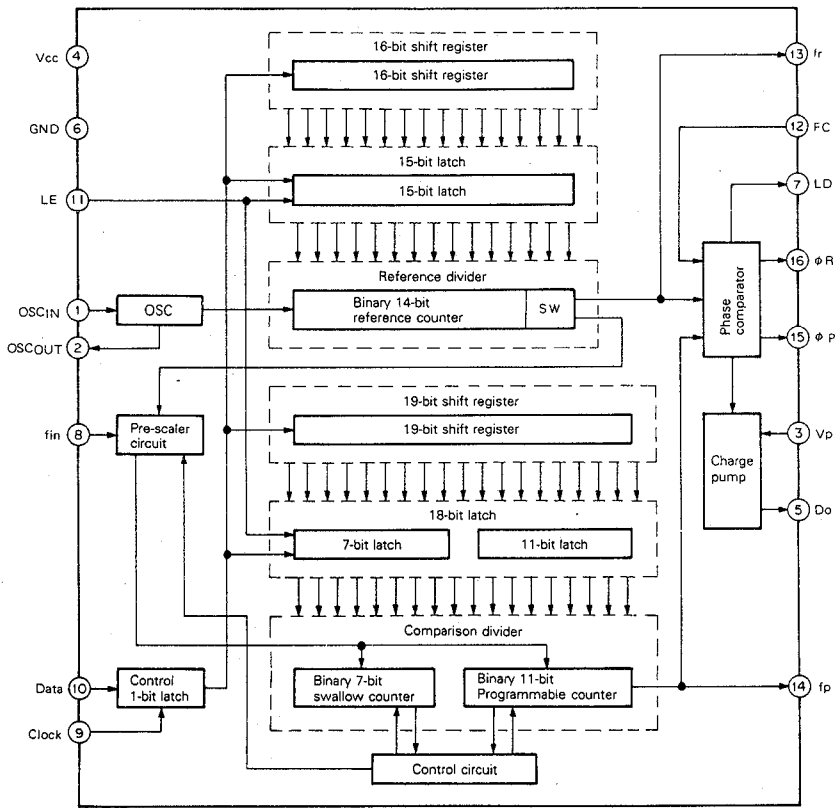


MB1504F : PLL IC (PLL unit IC1)

• Terminal connection diagram



• Block diagram



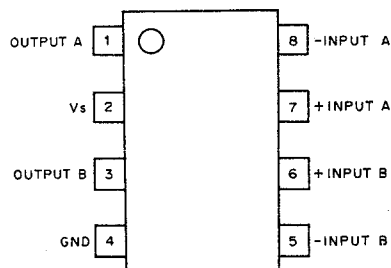
• Explanation of terminals

Pin No.	Name	I/O	Function
1	OSCIN	I	Terminal for crystal connection.
2	OSCOUT	O	(OSCIN = Oscillator circuit input terminal, OSCOUT = Oscillator circuit output terminal)
3	VP	O	Power supply terminal for charge pump output.
4	VCC	-	Power supply terminal.
5	DO	O	Charge pump output terminal. Phase characteristics are inverted according to the setting of the FC terminal.
6	GND	-	Ground terminal.
7	LD	O	Phase detector output terminal. Normally high. Low for the period of about the phase difference between fr and fp.
8	fin	I	Prescaler input terminal. Input with AC coupling.
9	Clock	I	Clock input input terminal for 19-bit and 16-bit shift register. Read data during rise of clock pulse.
10	Data	I	Serial data input terminal in binary code. When high, send data to 15-bit latch. When low, send data to 18-bit latch.
11	LE	I	Load enable signal input terminal. When high, send contents of shift register to latch (includes pull up resistor).
12	FC	I	Phase switch terminal of phase detector. When low, the charge pump and phase detector characteristics invert (includes pull up resistor).
13	fr	O	Monitor terminal of phase detector input. Output equivalent to reference divider.
14	fp	O	Monitor terminal of phase detector input. Output equivalent to programmable divider.
15	øP	O	Phase detector output terminal for external charge pump.
16	øR	O	Phase characteristics are inverted according to the setting of the FC terminal.

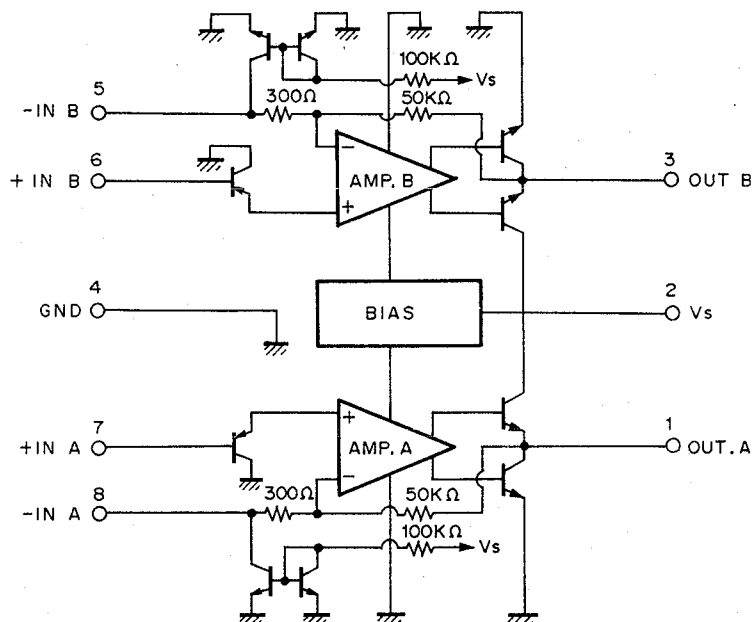
SEMICONDUCTOR DATA

NJM2073M : AF power amplifier (AF PA unit IC1)

• Terminal connection diagram



• Block diagram



• Electrical characteristics

Item	Symbol	Condition	MIN	TYP	MAX	Unit
Supply voltage	Vs		1.8		15	V
Output power	Po	THD = 10%, f = 1kHz				
		Vs = 6V, RL = 16Ω		0.8		W
		Vs = 4V, RL = 8Ω	350	460		mW
		Vs = 3V, RL = 4Ω	200	300		mW
		Vs = 2V, RL = 4Ω		80		mW
		THD = 1%, f = 40Hz ~ 15kHz, Vs = 4V, RL = 8Ω		380		mW
Distortion	THD	Vs = 4V, Po = 200mW, RL = 8Ω, f = 1kHz		0.2		%
Voltage gain	Gv	f = 1kHz	41	44	47	dB
Input impedance	ZIN	f = 1kHz	100			kΩ
Power bandwidth (-3dB)	P.B	RL = 16Ω, Po = 0.5W		130		kHz

L71-0413-05 : MCF (IF unit XF2) : TK-330(NF)

Item	Rating
Nominal center frequency (fo)	32,100kHz
Pass bandwidth	fo ± 3.75kHz or more at 3dB (-20°C ~ +60°C) fo ± 3.5kHz or more at 3dB (-30°C ~ +60°C)
Attenuation bandwidth	fo ± 14kHz or less at 40dB
Guaranteed attenuation	60dB or more within fo ± 1MHz spurious : 40dB or more
Ripple	1.0dB or less
Insertion loss	3.0dB or less
Terminal impedance	510Ω/4pF

L71-0289-05 : MCF (IF unit XF2) : TK-330(F)/(EF)

Item	Rating
Nominal center frequency (fo)	32,100kHz
Pass bandwidth	fo ± 7.5kHz or more at 3dB (-20°C ~ +60°C) fo ± 7.0kHz or more at 3dB (-30°C ~ +60°C)
Attenuation bandwidth	fo ± 28kHz or less at 40dB
Guaranteed attenuation	60dB or more within fo ± 1MHz Spurious : 40dB or more
Ripple	1.5dB or less
Insertion loss	3.0dB or less
Terminal impedance	1kΩ / 1pF

SEMICONDUCTOR DATA

L72-0373-05 : Ceramic filter (IF unit XF1) : TK-330(F)

Item	Rating
Nominal center frequency	455kHz
3dB bandwidth	$\pm 7.0\text{kHz}$ or more
6dB bandwidth	$\pm 10.0\text{kHz}$ or more
70dB bandwidth	$\pm 20.0\text{kHz}$ or less
Ripple	3dB or less ($455\text{kHz} \pm 7\text{kHz}$)
Guaranteed attenuation	70dB or more within $\pm 100\text{kHz}$
Spurious	40dB or more within 0.1 ~ 1MHz
Insertion loss	4dB or less
Terminal impedance	1.5k Ω

L72-0374-05 : Ceramic filter (IF unit XF1) : TK-330(EF)

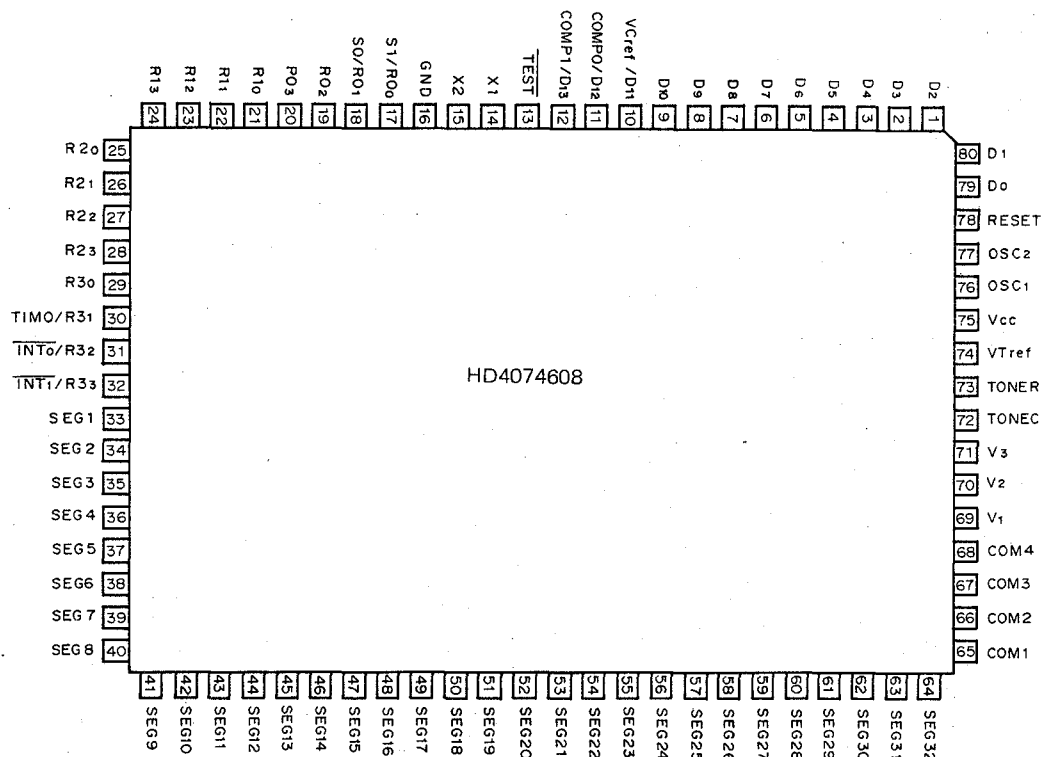
Item	Rating
Nominal center frequency	455kHz
3dB bandwidth	$\pm 5.5\text{kHz}$ or more
6dB bandwidth	$\pm 8.0\text{kHz}$ or more
70dB bandwidth	$\pm 16.0\text{kHz}$ or less
Ripple	3dB or less ($455\text{kHz} \pm 4\text{kHz}$)
Guaranteed attenuation	70dB or more within $f_o \pm 100\text{kHz}$
Spurious	40dB or more within $0.1 \sim 1\text{MHz}$
Insertion loss	3dB or less
Terminal impedance	$1.5\text{k}\Omega$

L72-0379-05 : Ceramic filter (IF unit XF1) : TK-330(NF)

Item	Rating
Nominal center frequency	455kHz
6dB bandwidth	$\pm 4\text{kHz}$ or more
70dB bandwidth	$\pm 10\text{kHz}$ or less
Ripple	3dB or less ($455\text{kHz} \pm 4\text{kHz}$)
Guaranteed attenuation	70dB or more within $f_o \pm 100\text{kHz}$
Spurious	50dB or more within $0.1 \sim 1\text{MHz}$
Insertion loss	6dB or less
Terminal impedance	$1.5\text{k}\Omega$

HD4074608FS : Micro controller (Signaling unit IC1)

- **Terminal connection diagram**



SEMICONDUCTOR DATA

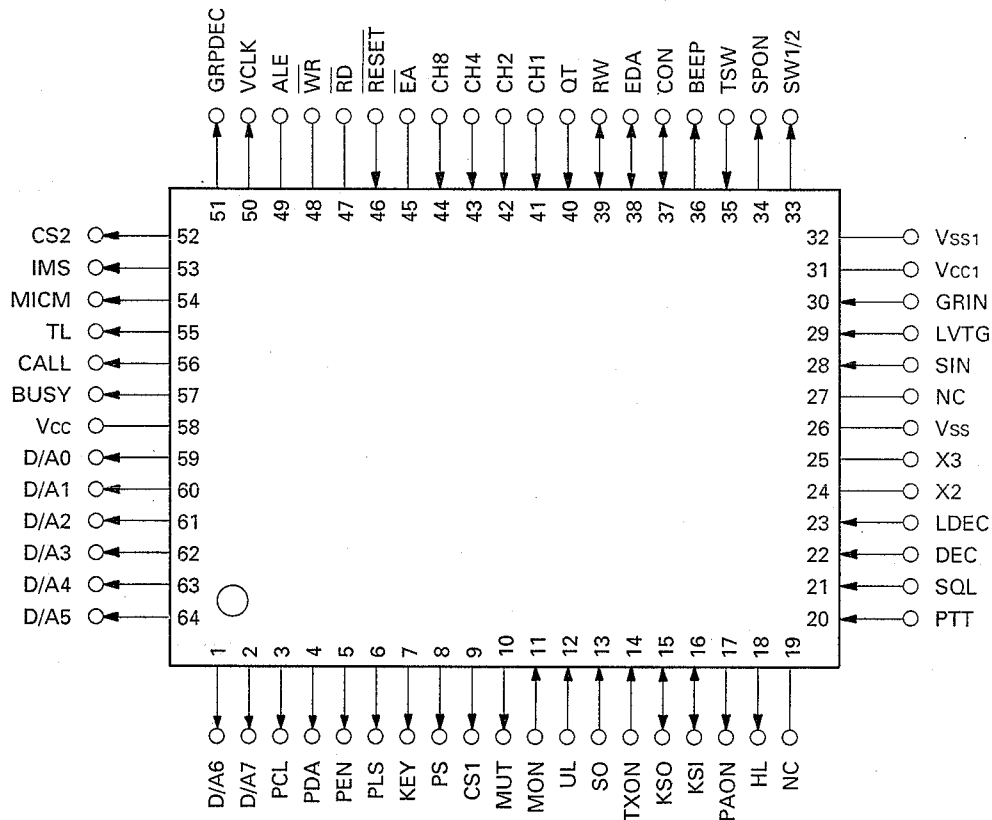
• Explanation of terminals

Pin No.	Symbol	I/O	Signal name	Description	During save
1	D2	O	SK	Serial clock for EEPROM.	H
2	D3	O	DI	Data output for EEPROM.	H
3	D4	I	DO	Data input for EEPROM.	H
4	D5	O	LAMP1	Lamp drive output.	H
5	D6	O	PTT	Request signal output (ANI, Repertory dial).	L
6	D7	I	KSO	Serial input from main microprocessor.	H
7	D8	O	KSI	Serial output to main microprocessor.	H
8	D9	I	DTMF16	12 key/16 key select. "L" : 12 key, "H" : 16 key	
9	D10	I			
10	D11/VCref	I			
11	D12/COMP0	I			
12	D13/COMP1	I	PTTI	Request signal input (Manual DTMF).	L
13	TEST	I			
14	X1	I			
15	X2	O			
16	GND	-			
17	R00/SCK	I/O			
18	R01/SI	I/O			
19	R02/SO	I/O			
20	R03	I/O			
21 ~ 24	R10 ~ R13	O	C1 ~ C4	Key matrix sense output. Usually "H"	H
25 ~ 28	R20 ~ R23	I	R1 ~ R4	Key matrix sense input. Usually "L" of pull-down resistor.	
29	R30	I/O			
30	R31/TIMO	I/O			
31	R32/INT0	O	LAMP2	Lamp drive output.	H
32	R33/INT1	I/O	EP46	1K/4K select. "L" : 1K EEPROM, "H" : 4K EEPROM	
33 ~ 36	SEG1 ~ SEG4	O		LCD segment drive output (1st figure).	
37 ~ 40	SEG5 ~ SEG8	O		LCD segment drive output (2nd figure).	
41 ~ 44	SEG9 ~ SEG12	O		LCD segment drive output (3rd figure).	
45 ~ 48	SEG13 ~ SEG16	O		LCD segment drive output (4th figure).	
49 ~ 52	SEG17 ~ SEG20	O		LCD segment drive output (5th figure).	
53 ~ 56	SEG21 ~ SEG24	O		LCD segment drive output (6th figure).	
57 ~ 60	SEG25 ~ SEG28	O		LCD segment drive output (7th figure).	
61 ~ 64	SEG29 ~ SEG32	O		LCD segment drive output (8th figure).	
65 ~ 68	COM1 ~ COM4	O		LCD common output.	
69 ~ 71	V1 ~ V3	-			
72	TONEC	O	DTMFC	DTMF column output (analog output).	
73	TONER	O	DTMFR	DTMF row output (analog output).	
74	VTref	-		Connect to Vcc.	
75	Vcc	-			
76	OSC1	I			
77	OSC2	O			
78	RESET	I		Reset input.	
79	D0	O	CS1	Chip selector for EEPROM.	H
80	D1	O	CS2	Chip selector for EEPROM.	H

SEMICONDUCTOR DATA

μPD78P312AGF : Micro controller (Control unit IC1)

• Terminal connection diagram



• Explanation of terminals

Pin No.	Symbol	I/O	Logic	Function	Pin No.	Symbol	I/O	Logic	Function
1, 2	D/A6, D/A7	O	D	8-bit D/A output	31	Vcc1	-	-	Power supply
3	PCL	O	D	PLL clock and serial clock	32	Vss1	-	-	GND
4	PDA	O	D	PLL data and serial data	33	SW1/2	O	-	PWM output
5	PEN	O	D	PLL enable signal	34	SPON	O	D	Speaker on signal
6	PLS	O	D	TX output internal/external selection	35	TSW	I	D	TSW switch input
7	KEY	O	D	Transmission control signal	36	BEEP	O	D	Beep output
8	PS	O	D	Power save signal	37	CON	I/O	D	AF internal/external selection signal
9	CS1	O	D	EEPROM chip select signal	38	EDA	I/O	D	External data line
10	MUT	O	D	Mute signal	39	RW	I/O	D	ROM writer mode signal
11	MON	I	D	CALL switch signal	40	QT	I	D	QT switch input
12	UL	I	D	Unlock signal	41	CH1	I	D	Channel switch input
13	SO	I	D	EEPROM data output	42	CH2	I	D	Channel switch input
14	TXON	I	D	Signaling transmission request signal	43	CH4	I	D	Channel switch input
15	KSO	I/O	D	Serial output to keyboard	44	CH8	I	D	Channel switch input
16	KSI	I/O	D	Serial input to keyboard	45	EA	-	-	Not used
17	PAON	O	D	Power amplifier on signal	46	RESET	I	D	Reset
18	HL	O	D	Transmission power selection signal	47	RD	-	-	Not used
19	NC	-	-	Not used	48	WR	-	-	Not used
20	PTT	I	D	Transmission request signal	49	ALE	-	-	Not used
21	SQL	I	A	Squelch signal input	50	VCLK	O	D	S1521 variable digital clock
22	DEC	I	D	Signaling coincidence detection signal	51	GRPDEC	O	D	Group tone detection signal
23	LDEC	I	D	CALL on instruction signal	52	CS2	O	D	EEPROM chip select signal
24	X2	-	-	12.000MHz crystal oscillator	53	IMS	O	D	Internal microphone selection signal
25	X3	-	-	12.000MHz crystal oscillator	54	MICM	O	D	Microphone mute output
26	Vss	-	-	GND	55	TL	O	D	TX LED output
27	NC	-	-	Not used	56	CALL	O	D	CALL LED output
28	SIN	I	A	Signal input terminal	57	BUSY	O	D	BUSY LED output
29	LVTG	I	A	Low voltage detection input	58	Vcc	-	-	Power supply
30	GRIN	I	A	Group status setting input	59~64	D/A0~D/A5	O	D	8-bit D/A output

DESCRIPTION OF COMPONENTS

TX-RX UNIT (X57-3290-XX)

Ref. No.	Parts No.	Description
Q1	2SC1362(Y)	Switch (RX)
Q2	DTC144EK	Switch
Q3	2SC1362(Y)	Switch (RX)
Q4	DTC144EK	Switch
Q5	2SA1362(Y)	Switch (TX PLL)
Q6	2SA1162(Y)	Switch (TX timing)
Q7	2SA1213(Y)	Voltage regulator
Q8	2SC2712(Y)	Voltage regulator
Q9	2SC2712(GR)	Switch
Q10	FMG2	Switch
Q11	2SC3838KZB(N)	RF amplifier
Q12	2SC4093	RX RF amplifier
Q13	3SK140(GR)	RX mixer
Q14	DTA144EK	Switch
Q15	2SA1162(Y)	Protection
Q16	DTC144EK	Switch
Q17	DTC144EK	Switch
D1	DAN202(K)	Switch
D2	DAP202(K)	Level shift
D3	DAN202(K)	Switch
D4	HSM88AS	
D5	HSM2693	RF switch
D6	HSM88AS	RX RF limiter
D7	HSM88AS	
IC1	AFL24F3300E12	Splatter filter
IC2	M57786MA,HA,LA	TX power module
IC3	KCE02	RX AF BPF

IF (X58-3530-XX)

Ref. No.	Parts No.	Description
Q1	2SC4215(Y)	IF amplifier
Q2	2SC4116(Y)	Noise amplifier
IC1	MC3361D	FM IF system
D1	DA204U	Noise detect
D2	MA110	

VCO (X58-3540-XX)

Ref. No.	Parts No.	Description
Q1	2SK508NV(K52)	RF oscillator (TX)
Q2	2SK508NV(K52)	RF oscillator (RX)
Q3	FMG4	Switch
Q4,5	2SC4083K(N,P)	RF amplifier
D1	MA366	Frequency control
D2	1T33C	Frequency control
D3	MA366	Modulation
D4	MA366	Frequency control

PLL (X58-3550-10)

Ref. no.	Parts No.	Description
Q1	2SA1162(Y)	Unlock detect
Q2	2SA1312(GR)	Charge pump
Q3	2SC3324(GR)	Charge pump
IC1	MB1540F	PLL IC
IC2	TC4S81F	Unlock comparator

ANT SW (X58-3560-XX)

Ref. No.	Parts No.	Description
D1	MI808	Antenna TX/RX switch
D2	HSK277	Antenna TX/RX switch
D3,4	MI808	Antenna I/E switch
D5	HSK277	Antenna I/E switch

MIC AMP (X59-3520-10)

Ref. No.	Parts No.	Description
IC1	NJM4560M	Mic amplifier IDC

DRIVE (X59-3540-XX)

Ref. No.	Parts No.	Description
Q1	2SC3356	RF amplifier
Q2	2SC3357	RF amplifier
D1	DA204K	Temperature compensation

AF PA (X59-3560-10)

Ref. No.	Parts No.	Description
Q1	2SC1213(Y)	Switch
Q2	DTC144EK	Switch
IC1	NJM2073M	AF power amplifier

AVR (X59-3570-10)

Ref. No.	Parts No.	Description
Q1	FMC5	Switch
IC1	LA5005M	Voltage regulator (5V)

APC (X59-3590-10)

Ref. No.	Parts No.	Description
Q1	2SA1162(Y)	Switch
Q2	2SB1182F5(Q)	APC
Q3~5	DTC114YK	Switch
Q6	DTA143EK	Switch
D1	02CZ3.9Y,Z	Voltage reference
IC1	LM301AD	APC amplifier

CONTROL UNIT (X53-3320-22)

Ref. No.	Parts No.	Description
Q1	FMC5	Switch
Q2	DTA114EK	Switch
Q3	FMC5	Switch
Q4	DTC363EK	Mic mute
Q5	2SD1246(S,T)	Internal speaker mute
Q6	FMC5	Switch
Q7	FMA1	Switch
D1,2	DAN202U	Limiter
D3~8	02CZ9.1(X,Y)	Protection
D9	02CZ10(X,Y)	Protection
IC1	μPD78P312AGF	Micro controller
IC2	S-81250HG-RD	Voltage regulator
IC3	S-8054HN-CB	Voltage detector
IC4	NJM4558M	Signaling LPF
IC5	TC4S66F	AF mute
IC6	CAT35C104	EEPROM

SIGNALLING UNIT (X52-3150-22)

Ref. No.	Parts No.	Description
Q1	DTC114YK	Switch
Q2	FMG5	Switch
Q3	DTC114YK	Switch
IC1	HD4074608FS	Micro controller
IC2,3	AK93C46F	EEPROM
IC4	S-81250HG-RD	Voltage regulator
IC5	S-8054HN-CB	Voltage regulator

PARTS LIST

* New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Teile ohne Parts No. werden nicht geliefert.

TK-330(F)/330(NF)/330(EF)

Ref. No.	Address	New Parts	Parts No.	Description	Destination	Remarks
参照番号	位置	新	部品番号	部品名 / 規格	仕向	備考
TK-330(F)/330(NF)/330(EF)						
1	2A, 1B	*	A02-0978-03	CASE (FRONT)		
2	3B	*	A02-0871-02	CASE (REAR)		
3	2B	*	A13-0685-11	FRAME		
4	2A		A20-2700-03	PANEL		
5	3A	*	A62-0026-03	DRESSING PANEL		
6	2A		A22-0761-04	SUB PANEL		
7	2B		A40-0618-05	BOTTOM PLATE		
10	3A		B30-0872-05	LED(TX/BUSY)		
11	2A	*	B30-0895-05	LED(CALL)		
12	-		B42-3343-04	S/NO LABEL (RADIO)		
14	-	*	B62-0037-00	INSTRUCTION MANUAL		
15	-	*	B72-0049-03	MODEL NAME PLATE	M	A
15	-	*	B72-0050-03	MODEL NAME PLATE	M2	A
15	-	*	B72-0051-03	MODEL NAME PLATE	M3	A
15	-	*	B72-0052-03	MODEL NAME PLATE	E	C
15	-	*	B72-0053-03	MODEL NAME PLATE	M	B
15	-	*	B72-0054-03	MODEL NAME PLATE	M2	B
-			B10-1116-04	FRONT GLASS		
C101			CC73FCH1H020C	CHIP C 2.0PF C		
17	2B		D10-0601-05	RELEASE LEVER		
18	2B		D10-0604-03	PTT LEVER		
19	2A		D32-0411-04	STOPPER(CH SW)		
21	2A		E06-0153-04	ANT RECEPTACLE		
22	2A		E08-1272-05	MIC RECEPTACLE		
23	2B		E23-0474-14	TERMINAL(POWER OUTSIDE)		
24	2B		E23-0617-04	TERMINAL(POWER INSIDE)		
25	2B		E23-0618-04	TERMINAL(SQUARE NUT)		
26	2A		E31-3484-15	CONNECTING WIRE(ANT-TX·RX)		
27	2B		E31-3486-05	FLEXIBLE PC BOARD(CONT-TX·RX)		
-			E23-0622-04	TERMINAL(CONTROL UNIT)		
-			E31-3483-15	CONNECTING WIRE(VOL-TX·RX)		
-			E31-3485-15	CONNECTING WIRE(MIC-TX·RX)		
-			E31-3489-05	CONNECTING WIRE(SP/MIC-CONT)		
-		*	E37-0053-05	SHORTING PLUG(9P)		
30	2B		F07-0871-03	COVER(PTT)		
31	2A		F07-0885-03	COVER		
32	3B		F10-1392-04	SHIELDING PLATE(TX·RX)		
33	1B		F10-1393-04	SHIELDING PLATE(CONT.)		
34	2B		F11-1125-13	SHIELDING COVER(CONT.)		
35	1A		F19-0650-04	BLIND PLATE(MIC)		
36	3B		F20-1018-04	INSULATING SHEET(TX·RX)		
37	1B		F20-1019-04	INSULATING SHEET(CONT.)		
38	1B		F20-1027-04	INSULATING SHEET(FUSE)		
39	1A		F20-1033-04	INSULATING SHEET(MIC UNIT)		
40	1B	*	F20-1058-04	INSULATING SHEET(CONT.)		
41	2B, 3B		F29-0438-05	INSULATOR(CASE, BOTTOM PLATE)		
42	3A		F29-0439-05	INSULATOR(VOL)		
-			F15-0662-04	SHADE (LCD)		
-			F20-1032-04	INSULATING SHEET		
45	2B		G01-0844-04	COIL SPRING(RELEASE LEVER)		

E: Scandinavia & Europe K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

A : TK-330(F) M, M2, M3

B : TK-330(NF) M, M2

C : TK-330(EF) E

⚠ indicates safety critical components.

PARTS LIST

* New Parts

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TK-330(F)/330(NF)/330(EF)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
46	3A		G02-0505-05	D SPLING(CH)	M3	A
47	3A		G02-0588-14	LEAF SPRING(VCO-FRAME)		
49	3A		G09-0418-05	D SPRING(VOL)		
50	1B		G10-0655-04	NON-WOVEN FABRIC(SHIELDING PLA		
51	3B		G10-0690-04	FELT		
52	2B		G11-0617-04	CUSHION(TERMINAL)		
53	2A		G13-0901-04	CUSHION(FPC)		
54	2A		G13-0938-04	CUSHION(COVER)		
55	3A		G53-0557-04	PACKING(TOGGLE SW)		
56	2B		G53-0558-04	PACKING(BOTTOM PLATE)		
57	2A		G53-0559-04	PACKING(MIC RECEPTACLE)		
58	1A		G53-0567-04	PACKING(CASE FRONT)		
59	3B		G53-0568-04	PACKING(CASE REAR)		
-		*	G02-0595-04	LEAF SPRING(FINAL MODULE)		
60	-		H01-8236-04	ITEM CARTON BOX(INSIDE)		
61	-		H10-2657-02	POLYSTYRENE FOAMED FIXTURE		
62	-		H11-0808-14	POLYSTYRENE PLATE		
63	-		H13-0828-04	PROTECTION BOARD		
64	-	*	H13-0848-04	PROTECTION BOARD(STONE UNIT)		
65	-		H25-0103-04	PROTECTION BAG(125X250)		
67	1A		J21-4188-14	MOUNTING HARDWARE(SPEAKER)		
68	2B		J21-4259-04	MOUNTING HARDWARE(FINAL MODULE)		
69	2B		J21-4260-04	MOUNTING HARDWARE		
70	2A		J21-4283-04	MOUNTING HARDWARE(MIC)		
71	2A		J25-6677-05	FLEXIBLE PC BOARD(PANEL-CONT.)		
72	2B		J25-6678-05	FLEXIBLE PC BOARD(MIC-CONT.)		
73	1A		J39-0434-04	SPACER(MIC)		
74	2B		J69-0313-05	O RING(POWER SUPPLY)		
75	2A, 3A		J69-0314-05	O RING(LED)		
76	2A		J69-0315-05	O RING(PANEL)		
77	2B		J69-0316-05	O RING(BOTTOM PLATE)		
78	-	*	J99-0319-04	ADHESIVE SHEET(STONE UNIT)		
-			J21-4135-04	LEAD HOLDER		
80	3A		K29-3161-04	KNOB(VOL)		
81	3A		K29-3162-04	KNOB(CH)		
82	1A		K29-4577-04	KEY TOP		
83	3A	*	K29-4578-03	RUBBER CAP(OPEN/QUIET SW)		
L101			L34-0895-05	COIL		
85	3A		N14-0533-04	NUT (VOL)		
86	3A		N14-0541-04	NUT (ANT)		
87	2A		N14-0542-04	NUT (CH)		
88	2A		N15-1050-41	FLAT WASHER(TOGGLE SW)		
A	3A, 3B		N09-2019-05	BINDING SCREW(02.6X10)		
B	2A		N09-2028-05	SCREW(02X3.5) COVER		
C	2B		N09-2049-05	SCREW(02.6X8) BOTTOM PLATE		
D	2B		N09-2053-05	SCREW(02X3) TERMINAL		
E	1B		N30-2604-41	PAN HEAD MACHINE SCREW(02.6X4		
F	1B, 3B		N30-2606-41	PAN HEAD MACHINE SCREW(02.6X6		
G	2A, 2B		N32-2606-41	FLAT HEAD MACHINE SCREW(2.6X6		
H	2A		N39-2035-45	PAN HEAD MACHINE SCREW(02X3.5		
I	1A		N89-2004-41	BINDING HEAD TAPTITE SCREW(02		
J	1A		N89-2005-41	BINDING HEAD TAPTITE SCREW(02		

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TK-330(F)/330(NF)/330(EF)

MIC UNIT (X42-3020-10)

SIGNALING UNIT (X52-3150-22)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
S4/VR1	2A		R05-3442-05	POTENTIOMETER(10K,SW+VOL/OFF)		
S1	2A		S40-2461-05	PUSH SW(OPEN/QUIET)		A
S2	2A		S44-1412-05	TOGGLE SWITCH(T.SW)		
S3	2A		S29-1440-05	ROTARY SWITCH(CHANNEL)		
90	1A		T07-0256-05	SPEAKER	M3	A
91	-		T90-0379-05	ANTENNA(400-450MHZ)	MM2E	
91	-		T90-0380-05	ANTENNA(450-520MHZ)		
92	1A		T91-0381-05	MICROPHONE(ECM)		
94	-	*	W02-1654-05	STONE UNIT(KFT-1)		
95	-		W09-0525-05	BATTERY PACK(7.2V 1000MAH)		
96	1A		X42-3020-10	MIC UNIT		
97	1A	*	X52-3150-22	SIGNALING UNIT		
98	1B	*	X53-3320-20	CONTROL UNIT		
99	2B,3B		X57-3290-10	TX-RX UNIT	M	A
99	2B,3B		X57-3290-11	TX-RX UNIT	M2	A
99	2B,3B		X57-3290-12	TX-RX UNIT	M3	A
99	2B,3B	*	X57-3290-21	TX-RX UNIT	M	B
99	2B,3B	*	X57-3290-22	TX-RX UNIT	M2	B
99	2B,3B	*	X57-3290-61	TX-RX UNIT	E	C
MIC UNIT (X42-3020-10)						
			T91-0381-05	MICROPHONE(ECM)		
C1			CC73FCH1H470J	CHIP C 47PF J		
C2			CK73FB1H102K	CHIP C 1000PF K		
R1			RK73FB2A123J	CHIP R 12K J 1/10W		
SIGNALING UNIT (X52-3150-22)						
A1			A33-0411-04	REFLECTOR (LCD)		
LCD1			B38-0315-05	LCD (FTD-8936)		
PL1 , 2			B30-0873-05	LAMP (5V 75MA)		
C1 , 2			CC73FCH1H101J	CHIP C 100PF J		
C3			C92-0004-05	CHIP-TAN 1.0UF 16WV		
C4			CK73FB1H102K	CHIP C 1000PF K		
C5			C92-0004-05	CHIP-TAN 1.0UF 16WV		
C6			CK73FB1H102K	CHIP C 1000PF K		
C7			C92-0501-05	CHIP-TAN 1.5UF 6.3WV		
C8 -10			CK73FB1H102K	CHIP C 1000PF K		
C11 -14			CC73FCH1H101J	CHIP C 100PF J		
C15			CK73FB1H471K	CHIP C 470PF K		
A2			E29-0480-04	CONNECTOR (LCD)		
W1			E31-6015-15	CONNECTING WIRE (6P)		
A3			J21-4258-04	MOUNTING HARDWARE (LCD)		
L1			L40-1001-48	SMALL FIXED INDUCTOR (10UH)		
X1			L78-0052-05	CERAMIC OSC (800KHZ)		
R1			RK73FB2A104J	CHIP R 100K J 1/10W		
R2			RK73FB2A124J	CHIP R 120K J 1/10W		
R3			RK73FB2A104J	CHIP R 100K J 1/10W		
R4			RK73FB2A471J	CHIP R 470 J 1/10W		
R5			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R6			RK73FB2A562J	CHIP R 5.6K J 1/10W		

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SIGNALING UNIT (X52-3150-22)

CONTROL UNIT (X53-3320-20)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
R7 R8 R9 R10 -12 R13			RK73FB2A104J RK73FB2A473J RK73EB2B470J RK73FB2A102J RK73FB2A101J	CHIP R 100K J 1/10W CHIP R 47K J 1/10W CHIP R 47 J 1/8W CHIP R 1.0K J 1/10W CHIP R 100 J 1/10W		
R14 -17 R18 R19			RK73FB2A473J RK73EB2B470J R92-0670-05	CHIP R 47K J 1/10W CHIP R 47 J 1/8W CHIP R 0 OHM		
IC1 IC2 ,3 IC4 IC5 Q1			HD4074608FS AK93C46F S-81250HG-RD S-8054HN-CB DTC114YK	IC(MICROPROCESSOR) IC(1K EEPROM) IC(VOLTAGE REGULATOR/ +5V) IC(VOLTAGE DETECTOR) DIGITAL TRANSISTOR		
Q2 Q3			FMG5 DTC114YK	DIGITAL TRANSISTOR DIGITAL TRANSISTOR		
CONTROL UNIT (X53-3320-20)						
C1 C2 C3 C4 C5			C92-0004-05 CK73GB1H102K C92-0004-05 CK73GB1H103K CK73GB1H102K	CHIP-TAN 1.0UF 16WV CHIP C 1000PF K CHIP-TAN 1.0UF 16WV CHIP C 0.01UF K CHIP C 1000PF K		
C6 C7 C8 C9 C10			CK73GB1H103K C92-0004-05 CK73GB1H102K C92-0004-05 CC73GCH1H101J	CHIP C 0.01UF K CHIP-TAN 1.0UF 16WV CHIP C 1000PF K CHIP-TAN 1.0UF 16WV CHIP C 100PF J		
C11 C12 ,13 C14 C15 C16			CK73GB1H222K CK73GB1H102K C92-0004-05 CK73GB1H102K CK73GB1H103K	CHIP C 2200PF K CHIP C 1000PF K CHIP-TAN 1.0UF 16WV CHIP C 1000PF K CHIP C 0.01UF K		
C17 C18 ,19 C20 C21 C22 ,23		*	CK73GB1H102K CC73GCH1H100D C92-0004-05 CK73GB1H102K CK73GB1H682K	CHIP C 1000PF K CHIP C 10PF D CHIP-TAN 1.0UF 16WV CHIP C 1000PF K CHIP C 6800PF K		
C24 C25 C26 C27 -31 C32			CK73GB1H102K CK73GB1H471K CK73GB1H103K CK73GB1H102K C92-0004-05	CHIP C 1000PF K CHIP C 470PF K CHIP C 0.01UF K CHIP C 1000PF K CHIP-TAN 1.0UF 16WV		
C33 C34 -38 C39 C40 C41			CK73GB1H102K CK73GB1H471K CK73GB1H102K CK73GB1H471K CK73GB1H102K	CHIP C 1000PF K CHIP C 470PF K CHIP C 1000PF K CHIP C 470PF K CHIP C 1000PF K		
C42 -46 C47			CK73GB1H471K CK73GB1H102K	CHIP C 470PF K CHIP C 1000PF K		
J1 J2 J3 J4 J5			E40-5181-05 E40-5183-05 E40-5237-05 E40-5255-05 E40-5285-05	PIN CONNECTOR(4P) PIN CONNECTOR(6P) FPC CONNECTOR(10P) FPC CONNECTOR(18P) FPC CONNECTOR(24P)		

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CONTROL UNIT (X53-3320-20)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
W1		*	E37-0012-05	CONNECTING WIRE(7P)		
W2		*	E37-0013-05	CONNECTING WIRE(9P)		
L1 ,2			L40-6882-48	SMALL FIXED INDUCTOR(.68UH)		
X1		*	L77-1435-05	CRYSTAL RESONATOR(12.000MHZ)		
R1 -13			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R14		*	R92-1252-05	CHIP R 0 OHM		
R15			RK73GB1J103J	CHIP R 10K J 1/16W		
R16			RK73GB1J105J	CHIP R 1.0M J 1/16W		
R17		*	R92-1252-05	CHIP R 0 OHM		
R18			RK73GB1J561J	CHIP R 560 J 1/16W		
R19			RK73GB1J103J	CHIP R 10K J 1/16W		
R20			RK73GB1J104J	CHIP R 100K J 1/16W		
R21			RK73GB1J103J	CHIP R 10K J 1/16W		
R22			RK73GB1J274J	CHIP R 270K J 1/16W		
R23			RK73FB2A473J	CHIP R 47K J 1/10W		
R24			RK73GB1J683J	CHIP R 68K J 1/16W		
R25			RK73GB1J104J	CHIP R 100K J 1/16W		
R26 -31			RK73GB1J103J	CHIP R 10K J 1/16W		
R32 -39		*	RK73GB1J203J	CHIP R 20K J 1/16W		
R40 -47			RK73GB1J103J	CHIP R 10K J 1/16W		
R48 -53			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R54			RK73FB2A473J	CHIP R 47K J 1/10W		
R55			RK73GB1J183J	CHIP R 18K J 1/16W		
R56 -58			RK73GB1J182J	CHIP R 1.8K J 1/16W		
R59			RK73FB2A473J	CHIP R 47K J 1/10W		
R60			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R61			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R62 ,63			RK73FB2A473J	CHIP R 47K J 1/10W		
R64		*	RK73GB1J203J	CHIP R 20K J 1/16W		
R65			RK73GB1J683J	CHIP R 68K J 1/16W		
R66			RK73GB1J103J	CHIP R 10K J 1/16W		
R67			RK73GB1J393J	CHIP R 39K J 1/16W		
R68 -70			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R71			RK73GB1J101J	CHIP R 100 J 1/16W		
R72			RK73FB2A473J	CHIP R 47K J 1/10W		
R73			RK73GB1J104J	CHIP R 100K J 1/16W		
R74			RK73GB1J224J	CHIP R 220K J 1/16W		
R75			RK73GB1J394J	CHIP R 390K J 1/16W		
R76			RK73GB1J824J	CHIP R 820K J 1/16W		
R77 ,78			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R79 -84			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R85			RK73FB2A473J	CHIP R 47K J 1/10W		
R86 -87			RK73GB1J103J	CHIP R 10K J 1/16W		
R88 ,89			RK73GB1J103J	CHIP R 10K J 1/16W		
R90 -94			RK73FB2A473J	CHIP R 47K J 1/10W		
R95			RK73GB1J103J	CHIP R 10K J 1/16W		
R96			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R97			RK73GB1J103J	CHIP R 10K J 1/16W		
R98 ,99			RK73GB1J182J	CHIP R 1.8K J 1/16W		
R100,101			RK73GB1J122J	CHIP R 1.2K J 1/16W		
R102-104		*	R92-1252-05	CHIP R 0 OHM		
R105			RK73FB2A473J	CHIP R 47K J 1/10W		
R106		*	R92-1252-05	CHIP R 0 OHM		
R107			RK73FB2A473J	CHIP R 47K J 1/10W		

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CONTROL UNIT (X53-3320-20)

TX-RX UNIT (X57-3290-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
R108-111 R112,113 R114 R115 R116		*	R92-1252-05 RK73GB1J473J R92-1252-05 RK73GB1J473J RK73GB1J102J	CHIP R 0 OHM CHIP R 47K J 1/16W CHIP R 0 OHM CHIP R 47K J 1/16W CHIP R 1.0K J 1/16W		
R117 R118 R119 R120 R121			RK73GB1J393J RK73GB1J183J RK73GB1J473J R92-1252-05 RK73GB1J104J	CHIP R 39K J 1/16W CHIP R 18K J 1/16W CHIP R 47K J 1/16W CHIP R 0 OHM CHIP R 100K J 1/16W		
R122-125			RK73GB1J473J	CHIP R 47K J 1/16W		
D1 ,2 D3 -8 D9 IC1 IC2		*	DAN202U 02CZ9.1(X,Y) 02CZ10(X,Y) UPD78P312AGF S-81250HG-RD	DIODE CHIP DIODE CHIP ZENER DIODE IC(MICROPROCESSOR) IC(VOLTAGE REGULATOR/ +5V)		
IC3 IC4 IC5 IC6 Q1			S-8054HN-CB NJM4558M TC4S66F CAT35C104K1 FMC5	IC(VOLTAGE DETECTOR) IC(OP AMP X2) IC(BILATERAL SWITCH) IC(4K EEPROM) DIGITAL TRANSISTOR		
Q2 Q3 Q4 Q5 Q6			DTA114EK FMC5 DTC363EK 2SD1246(S,T) FMC5	DIGITAL TRANSISTOR DIGITAL TRANSISTOR DIGITAL TRANSISTOR DIGITAL TRANSISTOR DIGITAL TRANSISTOR		
Q7			FMA1	DIGITAL TRANSISTOR		
TX-RX UNIT (X57-3290-XX) -10: TK-330(F) M -11: TK-330(F) M2 -12: TK-330(F) M3 -21: TK-330(NF) M -22: TK-330(NF) M2 -61: TK-330(EF) E						
C1 C2 C3 C4 ,5 C6			CK73FB1H102K C90-2048-05 CK73FB1H102K CK73FB1H103K C92-0002-05	CHIP C 1000PF K ELECTRO 6.8UF 6.3WV CHIP C 1000PF K CHIP C 0.010UF K CHIP-TAN 0.22UF 35WV		
C7 C8 C9 -13 C14 C15			CK73FB1H102K CK73FB1H103K CK73FB1H102K C92-0005-05 CK73FB1H102K	CHIP C 1000PF K CHIP C 0.010UF K CHIP C 1000PF K CHIP-TAN 2.2UF 6.3WV CHIP C 1000PF K		
C17 ,18 C19 ,20 C21 -23 C24 C25			CK73FB1H102K CK73FB1H103K CK73FB1H102K C92-0005-05 CK73FB1H102K	CHIP C 1000PF K CHIP C 0.010UF K CHIP C 1000PF K CHIP-TAN 2.2UF 6.3WV CHIP C 1000PF K		
C26 C27 C28 C29 C30			CE04NW0J220M CK73FB1H102K C92-0005-05 CK73FB1H102K C92-0005-05	ELECTRO 22UF 6.3WV CHIP C 1000PF K CHIP-TAN 2.2UF 6.3WV CHIP C 1000PF K CHIP-TAN 2.2UF 6.3WV		
C31 C32 C33 C34 -36 C37			CC73FCH1H030C CK73FB1H103K C92-0009-05 CK73FB1H102K CC73FCH1H100D	CHIP C 3PF C CHIP C 0.010UF K CHIP-TAN 4.7UF 10WV CHIP C 1000PF K CHIP C 10PF D		

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TX-RX UNIT (X57-3290-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
C38			CK73FB1H102K	CHIP C 1000PF K		
C39			C92-0509-05	TANTAL 10UF 6.3WV		
C40			CK73FB1H103K	CHIP C 0.010UF K	MM2E	
C40			CK73FF1E104Z	CHIP C 0.1UF Z	M3	
C41			CK73FB1H103K	CHIP C 0.010UF K		
C42			CK73FB1H102K	CHIP C 1000PF K		
C43			CC73FCH1H030C	CHIP C 3PF C	MM2E	
C43			CC73FCH1H050C	CHIP C 5PF C	M3	
C44 ,45			CK73FB1H102K	CHIP C 1000PF K		
C46 ,47			CK73FB1H103K	CHIP C 0.010UF K		
C48			C90-2041-05	ERECTRO 10UF 10WV		
C49			CK73FB1H103K	CHIP C 0.010UF K		
C50			CK73FB1H102K	CHIP C 1000PF K		
C51			C90-2041-05	ERECTRO 10UF 10WV		
C52			CK73FB1H103K	CHIP C 0.010UF K		
C53			CK73FB1H102K	CHIP C 1000PF K		
C54			C90-2041-05	ERECTRO 10UF 10WV		
C55			CK73FB1H103K	CHIP C 0.010UF K		
C56 -58			CK73FB1H102K	CHIP C 1000PF K		
C59			CC73FCH1H020C	CHIP C 2.0PF C	M2	
C59			CK73FCH1H040C	CHIP C 4.0PF C	M3	
C60			CC73FCH1H030C	CHIP C 3PF C	ME	
C60			CC73FCH1H040C	CHIP C 4PF C	M2	
C60			CC73FCH1H090D	CHIP C 9PF D	M3	
C61			CC73FCH1H151J	CHIP C 150PF J		
C62			CK73FB1H102K	CHIP C 1000PF K		
C63			CC73FCH1H020C	CHIP C 2.0PF C	MM2E	
C63			CC73FCH1H050C	CHIP C 5PF C	M3	
C64			CK73FB1H102K	CHIP C 1000PF K		
C65			CC73FCH1H010C	CHIP C 1PF C	M3	
C65			CC73FCH1H020C	CHIP C 2.0PF C	M2	
C65			CC73FCH1H030C	CHIP C 3PF C	ME	
C66			CC73FCH1H0R5C	CHIP C 0.5PF C	M2M3	
C67			CC73FCH1H040C	CHIP C 4PF C	M2	
C67			CC73FCH1H050C	CHIP C 5PF C	ME	
C67			CC73FCH1H060C	CHIP C 6.0PF C	M3	
C68			CC73FCH1H030C	CHIP C 3PF C	M2	
C68			CC73FCH1H040C	CHIP C 4PF C	ME	
C68			CC73FCH1H050C	CHIP C 5PF C	M3	
C69			CK73FB1H102K	CHIP C 1000PF K		
C70			CK73FB1H103K	CHIP C 0.010UF K		
C71			CK73FB1H102K	CHIP C 1000PF K		
C72			CC73FCH1H020C	CHIP C 2.0PF C	M3	
C72			CC73FCH1H100D	CHIP C 10PF D	MM2E	
C73			CC73FCH1H080D	CHIP C 8PF D	M3	
C73			CC73FCH1H220J	CHIP C 22PF J	ME	
C73			CC73FCH1H470J	CHIP C 47PF J	M2	
C74			CK73FB1H102K	CHIP C 1000PF K		
C75			CK73FB1H103K	CHIP C 0.010UF K		
C76			CK73FB1H102K	CHIP C 1000PF K		
C77 ,78			CK73FB1H103K	CHIP C 0.010UF K		
C79			C92-0005-05	CHIP-TAN 2.2UF 6.3WV		
C80			CK73FB1H103K	CHIP C 0.010UF K		
C81			C92-0002-05	CHIP-TAN 0.22UF 35WV		
C82 ,83			C90-2052-05	ELECTRO 68UF 10WV		

E: Scandinavia & Europe K: USA P: Canada W: Europe

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B : TK-330(NF) M,M2

C : TK-330(EF) E

⚠ indicates safety critical components.

PARTS LIST

× New Parts

Parts without Parts No. are not supplied.

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Teile ohne Parts No. werden nicht geliefert.

TX-RX UNIT (X57-3290-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
C84			CK73FB1H102K	CHIP C 1000PF K		
C85			CC73FCH1H010C	CHIP C 1PF C	M2	
C85			CC73FCH1H020C	CHIP C 2.0PF C	ME	
C85			CC73FCH1H030C	CHIP C 3PF C	M3	
C86			CK73FB1H102K	CHIP C 1000PF K		
C87			CC73FCH1H040C	CHIP C 4PF C	MM2E	
C87			CC73FCH1H050C	CHIP C 5PF C	M3	
C88			CC73FCH1H0R5C	CHIP C 0.5PF C	MM2E	
C89			CC73FCH1H070D	CHIP C 7PF D	MM2E	
C89			CC73FCH1H100D	CHIP C 10PF D	M3	
C90			CC73FCH1H020C	CHIP C 2.0PF C	M2	
C90			CC73FCH1H040C	CHIP C 4PF C	ME	
C90			CC73FCH1H060D	CHIP C 6PF D	M3	
C91			CC73FCH1H070D	CHIP C 7PF D	MM2E	
C91			CC73FCH1H100D	CHIP C 10PF D	M3	
C92 ,93			CK73EB1E104K	CHIP C 0.10UF K		
J1			E40-5244-05	FPC CONNECTOR(24P)		
J2 ,3			E04-0174-05	RF COAXIAL CABLE RECEPTACLE		
J4			E23-0621-05	TERMINAL(1P)		
F201			F10-1395-04	SHIELDING PLATE(FINAL MODULE)		
			F06-4025-05	FUSE(4A)		
			J30-0555-04	SPACER(POWER MODULE)		
L1			L40-4792-48	SMALL FIXED INDUCTOR(4.7UH)		
L2			L33-0680-05	CHOKER COIL		
L3			L40-1092-48	SMALL FIXED INDUCTOR(1UH)		
L4			L34-1183-05	COIL		
L5			L34-0895-05	COIL		
L6			L79-0863-05	FILTER (465MHZ)	ME	
L6			L79-0865-05	FILTER (500MHZ)	M2	
L6			L79-0867-05	FILTER (415MHZ)	M3	
L7			L40-1572-48	SMALL FIXED INDUCTOR	M2	
L7			L40-1872-48	SMALL FIXED INDUCTOR	ME	
L7			L40-4772-48	SMALL FIXED INDUCTOR	M3	
L8			L40-1072-48	SMALL FIXED INDUCTOR(10NH)	M3	
L8			L40-1572-48	SMALL FIXED INDUCTOR(15NH)	ME	
L8			L40-2272-48	SMALL FIXED INDUCTOR(22NH)	M2	
L9			L79-0862-05	FILTER (465MHZ)	ME	
L9			L79-0864-05	FILTER (500MHZ)	M2	
L9			L79-0866-05	FILTER (415MHZ)	M3	
L10			L40-2772-48	SMALL FIXED INDUCTOR(27NH)	M2	
L10			L40-4772-48	SMALL FIXED INDUCTOR(47NH)	ME	
L10			L40-8272-48	SMALL FIXED INDUCTOR(82NH)	M3	
L11			L40-2272-48	SMALL FIXED INDUCTOR	ME	
L11			L40-3372-48	SMALL FIXED INDUCTOR	M2	
L11			L40-8272-48	SMALL FIXED INDUCTOR	M3	
L12			L34-1264-05	COIL	M3	
L12			L34-1266-05	COIL	MM2E	
L13			L34-1266-05	COIL		
L14			L40-1072-48	COIL	MM2E	
L14			L40-1272-48	COIL	M3	
X1			L77-1404-05	TCXO (12.5MHZ)		
R1 -3			R92-0679-05	CHIP R 0 OHM		

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TX-RX UNIT (X57-3290-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
R4			RK73FB2A473J	CHIP R 47K J 1/10W		
R5			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R6			RK73FB2A103J	CHIP R 10K J 1/10W		
R7			R92-0679-05	CHIP R 0 OHM		
R8			R92-0670-05	CHIP R 0 OHM		
R9			R92-0679-05	CHIP R 0 OHM		
R10			RK73FB2A473J	CHIP R 47K J 1/10W		
R11			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R12 ,13			R92-0679-05	CHIP R 0 OHM		
R14			RK73FB2B100J	CHIP R 10 J 1/8W		
R15 ,16			RK73FB2A103J	CHIP R 10K J 1/10W		
R17			RK73FB2A471J	CHIP R 470 J 1/10W		
R18			R92-0670-05	CHIP R 0 OHM		
R19 ,20			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R21			RK73FB2A473J	CHIP R 47K J 1/10W		
R22 ,23			R92-0679-05	CHIP R 0 OHM		
R24			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R25			RK73FB2A103J	CHIP R 10K J 1/10W		
R26			RK73FB2A100J	CHIP R 10 J 1/10W		
R27			RK73FB2A101J	CHIP R 100 J 1/10W		
R28			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R29 -31			RK73FB2A103J	CHIP R 10K J 1/10W		
R32			R92-0670-05	CHIP R 0 OHM		
R33			RK73FB2A473J	CHIP R 47K J 1/10W		
R34 ,35			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R36			RK73FB2A473J	CHIP R 47K J 1/10W		
R37			RK73FB2A103J	CHIP R 10K J 1/10W		
R38			RK73FB2A273J	CHIP R 27K J 1/10W		
R39 ,40			R92-0679-05	CHIP R 0 OHM		
R41 -43			RK73FB2A821J	CHIP R 820 J 1/10W		
R44			RK73FB2A180J	CHIP R 18 J 1/10W		
R45 ,46			RK73FB2A271J	CHIP R 270 J 1/10W		
R47			RK73FB2A153J	CHIP R 15K J 1/10W		
R48			RK73FB2A273J	CHIP R 27K J 1/10W		
R49			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R50 ,51			RK73FB2A333J	CHIP R 33K J 1/10W		
R52			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R53 ,54			RK73FB2A101J	CHIP R 100 J 1/10W		
R56			R92-0679-05	CHIP R 0 OHM		
R57			RK73FB2A333J	CHIP R 33K J 1/10W		
R58			RK73FB2A183J	CHIP R 18K J 1/10W		B
R58			RK73FB2A822J	CHIP R 8.2K J 1/10W		A
R58			RK73FB2A822J	CHIP R 8.2K J 1/10W		C
R59 ,60			R92-1219-05	CHIP R 2.2 J 1/2W		
R61			R92-0670-05	CHIP R 0 OHM		
R62			R92-0679-05	CHIP R 0 OHM		
R63			R92-0670-05	CHIP R 0 OHM		
R64			R92-0679-05	CHIP R 0 OHM		
R65			RK73FB2A103J	CHIP R 10K J 1/10W		
R66			RK73FB2A560J	CHIP R 56 J 1/10W	M2	
VR1 ,2			R12-1442-05	TRIMMING POT.(2.2K)		
VR3 -6			R12-3445-05	TRIMMING POT.(47K)		
W1			R92-1061-05	JUMPER RES 0 OHM		
D1			DAN202(K)	CHIP DIODE		

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TX-RX UNIT (X57-3290-XX)
IF (X58-3530-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
D2 D3 D4 D5 D6 ,7			DAP202(K) DAN202(K) HSM88AS HSM2693 HSM88AS	CHIP DIODE CHIP DIODE CHIP DIODE CHIP DIODE CHIP DIODE	M2	
IC1 IC2 IC2 IC2 IC3			AFL24F3300E12 M57786HA M57786LA M57786MA KCE02	IC(SPLATER FILTER) IC(POWER MODULE) IC(POWER MODULE) IC(POWER MODULE) HYBRID IC(AF BPF)	M2 M3 ME	
Q1 Q2 Q3 Q4 Q5			2SA1362(Y) DTC144EK 2SA1362(Y) DTC144EK 2SA1362(Y)	CHIP TRANSISTOR DIGITAL TRANSISTOR CHIP TRANSISTOR DIGITAL TRANSISTOR CHIP TRANSISTOR		
Q6 Q7 Q8 Q9 Q10			2SA1162(Y) 2SA1213(Y) 2SC2712(Y) 2SC2712(GR) FMG2	CHIP TRANSISTOR CHIP TRANSISTOR CHIP TRANSISTOR CHIP TRANSISTOR DIGITAL TRANSISTOR		
Q11 Q12 Q13 Q14 Q15			2SC3838KZB(N) 2SC4093 3SK140(GR) DTA144EK 2SA1162(Y)	CHIP TRANSISTOR CHIP TRANSISTOR CHIP FET DIGITAL TRANSISTOR CHIP TRANSISTOR		
Q16 ,17 TH1			DTC144EK 157-101-53019	DIGITAL TRANSISTOR THERMISTER (100)		
A1 A2 A3 A4 A4			X59-3570-10 X59-3580-10 X59-3520-10 X58-3540-10 X58-3540-11	SUB UNIT (AVR) SUB UNIT (SW) SUB UNIT (MIC AMP) SUB UNIT(VCO F1) SUB UNIT(VCO F2)	ME M2	
A4 A5 A6 A6 A7			X58-3540-12 X58-3550-10 X59-3540-10 X59-3540-12 X58-3560-10	SUB UNIT(VCO F3) SUB UNIT(PLL) SUB UNIT(DRIVE) SUB UNIT(DRIVE) SUB UNIT(ANT SW)	M3 M3 ME	A
A7 A7 A8 A9 A9		*	X58-3560-11 X58-3560-12 X59-3590-10 X58-3530-10 X58-3530-21	SUB UNIT(ANT SW) SUB UNIT(ANT SW) SUB UNIT(APC) SUB UNIT(IF) SUB UNIT(IF:NARROW)	M2 M3	A B
A9 A10		*	X58-3530-61 X59-3560-10	SUB UNIT(IF) SUB UNIT(AF PA)		C
IF (X58-3530-XX) -10 : TK-330(F) -21 : TK-330(NF) -61 : TK-330(EF)						
C1 C1 C1 C2 C3			CC73GCH1H010C CC73GCH1H010C CC73GCH1H040C CC73GCH1H050C CC73FCH1H220J	CHIP C 1PF C CHIP C 1PF C CHIP C 4PF C CHIP C 5PF C CHIP C 22PF J		A C B
C4 C5 C5 C5			CC73GCH1H120J CC73GCH1H070D CC73GCH1H070D CC73GCH1H180J	CHIP C 12PF J CHIP C 7PF D CHIP C 7PF D CHIP C 18PF J		A C B

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IF (X58-3530-XX)

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C6			CC73GCH1H010C	CHIP C 1PF C		A
C6			CC73GCH1H010C	CHIP C 1PF C		C
C6			CC73GCH1H040C	CHIP C 4PF C		B
C7 , 8			CK73GB1H103K	CHIP C 0.01UF K		
C9			CK73GB1H472K	CHIP C 4700PF K		
C10 , 11			CK73EB1E104K	CHIP C 0.10UF K		
C12			CK73GB1H103K	CHIP C 0.01UF K		
C13			C92-0501-05	CHIP-TAN 1.5UF 6.3WV		
C14			CK73GB1H103K	CHIP C 0.01UF K		
C15			CC73GCH1H101J	CHIP C 100PF J		
C16 -19			CK73GB1H103K	CHIP C 0.01UF K		
C20			CK73EB1E104K	CHIP C 0.10UF K		
C21			CK73GB1H472K	CHIP C 4700PF K		
C22			C92-0003-05	CHIP-TAN 0.47UF 25WV		A
C22			C92-0003-05	CHIP-TAN 0.47UF 25WV		C
C22			C92-0004-05	CHIP-TAN 1.0UF 16WV		B
C23			CK73GB1H103K	CHIP C 0.01UF K		
C24 -26			CK73GB1H102K	CHIP C 1000PF K		
J1 , 2			E40-5337-05	PIN CONNECTOR (5P)		
A1			F11-1126-04	SHIELDING CASE		
L1			L34-4114-05	COIL (32.1MHZ)		
L2			L34-4015-05	COIL		
X1			L77-1399-05	CRYSTAL RESONATOR(31.645MHZ)		
XF1			L72-0373-05	CERAMIC FILTER(CFZM455D)		A
XF1			L72-0374-05	CERAMIC FILTER(CFZM455E)		C
XF1		*	L72-0379-05	CERAMIC FILTER(CFZM455G)		B
XF2			L71-0289-05	CRYSTAL FILTER(32.1MHZ/7.5KHZ)		A
XF2			L71-0289-05	CRYSTAL FILTER(32.1MHZ/7.5KHZ)		C
XF2		*	L71-0413-05	CRYSTAL FILTER(32.1MHZ/3.75KHZ)		B
R1			RK73GB1J122J	CHIP R 1.2K J 1/16W		A
R1			RK73GB1J122J	CHIP R 1.2K J 1/16W		C
R1			RK73GB1J471J	CHIP R 470 J 1/16W		B
R2			RK73GB1J101J	CHIP R 100 J 1/16W		
R3			RK73GB1J394J	CHIP R 390K J 1/16W		
R4			RK73GB1J121J	CHIP R 120 J 1/16W		
R5			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R6			RK73GB1J153J	CHIP R 15K J 1/16W		A
R6			RK73GB1J153J	CHIP R 15K J 1/16W		C
R6			RK73GB1J223J	CHIP R 22K J 1/16W		B
R7			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R8			RK73GB1J184J	CHIP R 180K J 1/16W		A
R8			RK73GB1J184J	CHIP R 180K J 1/16W		C
R8			RK73GB1J474J	CHIP R 470K J 1/16W		B
R9			RK73GB1J333J	CHIP R 33K J 1/16W		
R10			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R11			RK73GB1J561J	CHIP R 560 J 1/16W		
R12			RK73GB1J394J	CHIP R 390K J 1/16W		
R13			RK73GB1J823J	CHIP R 82K J 1/16W		
R14			RK73FB2A223J	CHIP R 22K J 1/10W		
R15			RK73FB2A473J	CHIP R 47K J 1/10W		
R16			RK73GB1J122J	CHIP R 1.2K J 1/16W		A
R16			RK73GB1J122J	CHIP R 1.2K J 1/16W		C
R16			RK73GB1J471J	CHIP R 470 J 1/16W		B

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IF (X58-3530-XX)

VCO (X58-3540-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
R17 R18			RK73GB1J184J RK73GB1J561J	CHIP R 180K J 1/16W CHIP R 560 J 1/16W		
D1 D2 IC1 Q1 Q2			DA204U MA110 MC3361D 2SC4215(Y) 2SC4116(Y)	CHIP DIODE CHIP DIODE IC(FM IF SYSTEM) CHIP TRANSISTOR CHIP TRANSISTOR		
TH1			157-153-45001	THERMISTOR(15K)		
VCO (X58-3540-XX) -10 : M,E -11 : M2 -12 : M3						
C1 C2 C3 C3 C3			CK73GB1H102M CC73GCH1H010C CC73GCH1H270J CC73GCH1H470J CC73GCH1H560J	CHIP C 1000PF M CHIP C 1PF C CHIP C 27PF J CHIP C 47PF J CHIP C 56PF J		
C4 C4 C4 C5 C5			CC73GCH1H080D CC73GCH1H100D CC73GCH1H120J CC73GCH1H100D CC73GCH1H120J	CHIP C 8PF D CHIP C 10PF D CHIP C 12PF J CHIP C 10PF D CHIP C 12PF J		M3 ME M2 MM2 M3
C6 ,7 C8 C9 C10 C10			CC73GCH1H220C CC73GCH1H030C CK73GB1H102M CC73GCH1H390J CC73GCH1H470J	CHIP C 22PF C CHIP C 3PF C CHIP C 1000PF M CHIP C 39PF J CHIP C 47PF J		MM2 M3
C11 C11 C11 C12 C12			CC73GCH1H070D CC73GCH1H080D CC73GCH1H120J CC73GCH1H060D CC73GCH1H100D	CHIP C 7PF D CHIP C 8PF D CHIP C 12PF J CHIP C 6PF D CHIP C 10PF D		ME M2 M3 M2 MM3E
C13 ,14 C13 ,14 C15 C16 ,17 C18			CC73GCH1H050C CC73GCH1H150J CC73GCH1H030C CK73GB1H102M CC73GCH1H010C	CHIP C 5PF C CHIP C 15PF J CHIP C 3PF C CHIP C 1000PF M CHIP C 1PF C		MM2E M3
C19 C20 ,21 C22 C23 C23			CC73GCH1H040C CK73GB1H102M CC73GCH1H040C CC73GCH1H030C CC73GCH1H040C	CHIP C 4PF C CHIP C 1000PF M CHIP C 4PF C CHIP C 3PF C CHIP C 4PF C		MM3E M2
CN1 ,2 A1			E40-5212-05 F11-1127-04	PIN CONNECTOR(5P) SHIELDING COVER		
L1 ,2 L3 ,4 L5 L6 L6			L40-8282-48 L40-1092-48 L34-2337-05 L34-2344-05 L34-2345-05	SMALL FIXED INDUCTOR(820NH) SMALL FIXED INDUCTOR(1.0UH) COIL COIL COIL		MM2E M3
L7 ,8 L9 ,10			L40-4782-48 L40-2272-48	SMALL FIXED INDUCTOR(470NH) SMALL FIXED INDUCTOR(22NH)		
R1 R2 R3 R4			RK73GB1J184J RK73GB1J104J RK73GB1J100J RK73GB1J101J	CHIP R 180K J 1/16W CHIP R 100K J 1/16W CHIP R 10 J 1/16W CHIP R 100 J 1/16W		MM3E

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VCO (X58-3540-XX)

PLL (X58-3550-10)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
R4 R5 R6 R7 R8			RK73GB1J560J RK73GB1J100J RK73GB1J472J RK73GB1J470J RK73GB1J103J	CHIP R 56 J 1/16W CHIP R 10 J 1/16W CHIP R 4.7K J 1/16W CHIP R 47 J 1/16W CHIP R 10K J 1/16W	M2	
R9 R10 R11 R12 R13			RK73GB1J104J RK73GB1J100J RK73GB1J101J RK73GB1J273J RK73GB1J103J	CHIP R 100K J 1/16W CHIP R 10 J 1/16W CHIP R 100 J 1/16W CHIP R 27K J 1/16W CHIP R 10K J 1/16W		
R14 R15 R16			RK73GB1J101J RK73GB1J103J RK73GB1J000J	CHIP R 100 J 1/16W CHIP R 10K J 1/16W CHIP R 0.0 J 1/16W		
D1 D2 D3 ,4 Q1 ,2 Q3			MA366 1T33C MA366 2SK508NV(K52) FMG4	CHIP DIODE CHIP DIODE CHIP DIODE CHIP FET DIGITAL TRANSISTOR		
Q4 ,5			2SC4083(N,P)	CHIP TRANSISTOR		
PLL (X58-3550-10)						
C1 C3 C4 C5 C6			CC73FCH1H100D CK73FB1H102K CK73FB1H103K CK73FB1H102K C92-0004-05	CHIP C 10PF D CHIP C 1000PF K CHIP C 0.010UF K CHIP C 1000PF K CHIP-TAN 1.0UF 16WV	M	
C7 C8 C9 C10 C11			C92-0001-05 C92-0004-05 CK73FB1H103K CK73FB1H102K C92-0005-05	CHIP-TAN 0.1UF 35WV CHIP-TAN 1.0UF 16WV CHIP C 0.010UF K CHIP C 1000PF K CHIP-TAN 2.2UF 6.3WV	M	
C12 C13 C15 C16			CK73EB1H223K CC73FCH1H101J CK73FB1H102K CC73FCH1H101J	CHIP C 0.022UF K CHIP C 100PF J CHIP C 1000PF K CHIP C 100PF J		
CN1 ,2			E40-5212-05	PIN CONNECTOR(5P)		
A1			F11-1128-04	SHIELDING COVER		
L1			L40-4792-48	SMALL FIXED INDUCTOR(4.7UH)		
R1 R2 -4 R5 -7 R8 R9			R92-0670-05 RK73FB2A102J RK73FB2A103J R92-0670-05 RK73FB2A100J	CHIP R 0 OHM CHIP R 1.0K J 1/10W CHIP R 10K J 1/10W CHIP R 0 OHM CHIP R 10 J 1/10W		
R10 R11 R12 R13 R14			RK73FB2A472J RK73FB2A103J RK73FB2A684J RK73FB2A102J RK73FB2A562J	CHIP R 4.7K J 1/10W CHIP R 10K J 1/10W CHIP R 680K J 1/10W CHIP R 1.0K J 1/10W CHIP R 5.6K J 1/10W		
R15 R16 R17 R18 R19			RK73FB2A472J RK73FB2A562J RK73FB2A472J RK73FB2A102J RK73GB1J561J	CHIP R 4.7K J 1/10W CHIP R 5.6K J 1/10W CHIP R 4.7K J 1/10W CHIP R 1.0K J 1/10W CHIP R 560 J 1/16W		

E: Scandinavia & Europe K: USA P: Canada W: Europe

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A: TK-330(F) M,M2,M3

B: TK-330(NF) M,M2

C: TK-330(EF) E

▲ indicates safety critical components.

PARTS LIST

× New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Teile ohne Parts No. werden nicht geliefert.

PLL (X58-3550-10)

ANT SW (X58-3560-XX)

MIC AMP (X59-3520-10)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
R20 R21			RK73FB2A102J R92-0670-05	CHIP R 1.0K J 1/10W CHIP R 0 OHM		
IC1 IC2 Q1 Q2 Q3			MB1504 TC4S81F 2SA1162(Y) 2SA1312(GR) 2SC3324(GR)	IC(PLL FREQ SYNTHESIZER) IC(UNLOCK COMPALETER) CHIP TRANSISTOR CHIP TRANSISTOR CHIP TRANSISTOR		
ANT SW (X58-3560-XX) -10 : M,E -11 : M2 -12 : M3						
C1 ,2 C3 C4 C5 C6			CK73FB1H102K CK73FCH1H050C CC73FCH1H040C CK73FB1H102K CC73FCH1H050C	CHIP C 1000PF K CHIP C 5.0PF C CHIP C 4PF C CHIP C 1000PF K CHIP C 5PF C		M2
C6 C6 C7 C7 C7			CC73FCH1H060D CC73FCH1H070D CC73FCH1H070D CC73FCH1H090D CC73FCH1H120J	CHIP C 6PF D CHIP C 7PF D CHIP C 7PF D CHIP C 9PF D CHIP C 12PF J		ME M3 M2 ME M3
C8			CK73FB1H102K	CHIP C 1000PF K		
J1 -9 J11 -14			E23-0471-05 E23-0471-05 F11-1146-04 F20-1031-04 G13-0660-04	TERMINAL TERMINAL SHIELDING CASE INSULATING SHEET CUSHION		
L1 L2 L3			L40-1092-48 L34-1053-05 L34-1212-05	SMALL FIXED INDUCTOR(1UH) COIL COIL		
D1 D2 D3 ,4 D5			MI808 HSK277 MI808 HSK277	CHIP DIODE CHIP DIODE CHIP DIODE CHIP DIODE		
MIC AMP (X59-3520-10)						
C1 -2 C3 C4 ,5 C6 C7			CK73FB1H332K CC73FCH1H820J C92-0004-05 CC73FCH1H820J C92-0004-05	CHIP C 3300PF K CHIP C 82PF J CHIP-TAN 1.0UF 16WV CHIP C 82PF J CHIP-TAN 1.0UF 16WV		
C8 -10 C11			CK73FB1H102K C92-0004-05 E23-0471-05	CHIP C 1000PF K CHIP-TAN 1.0UF 16WV TERMINAL		
R1 R3 R4 R5 R6			RK73FB2A472J RK73FB2A222J RK73FB2A224J RK73FB2A222J RK73FB2A122J	CHIP R 4.7K J 1/10W CHIP R 2.2K J 1/10W CHIP R 220K J 1/10W CHIP R 2.2K J 1/10W CHIP R 1.2K J 1/10W		
R7 R8 R9 R10 R11			RK73FB2A152J RK73FB2A224J RK73FB2A102J RK73FB2A223J RK73FB2A820J	CHIP R 1.5K J 1/10W CHIP R 220K J 1/10W CHIP R 1.0K J 1/10W CHIP R 22K J 1/10W CHIP R 82 J 1/10W		

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C : TK-330(EF) E

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MIC AMP (X59-3520-10)

DRIVE (X59-3540-XX)

AF PA (X59-3560-10)

AVR (X59-3570-10)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
R12			R92-0670-05	CHIP R 0 OHM		
IC1			NJM4560M	IC(OP AMP X2)		
TH1			157-252-43001	THERMISTOR(25K)		
DRIVE (X59-3540-XX) -10 : M,M2,E -12 : M3						
C1			CC73FCH1H030C	CHIP C 3PF C	M3 MM2E	
C2 ,3			CK73FB1H102K	CHIP C 1000PF K		
C4			CC73FCH1H040C	CHIP C 4PF C		
C4			CC73FCH1H050C	CHIP C 5PF C		
C5 ,6			CK73FB1H102K	CHIP C 1000PF K		
C7			CC73FCH1H040C	CHIP C 4PF C	M3 MM2E	
C7			CC73FCH1H060D	CHIP C 6PF D		
C8 ,9			CK73FB1H102K	CHIP C 1000PF K		
			E23-0471-05	TERMINAL		
L1			L40-1072-48	SMALL FIXED INDUCTOR(10NH)		
L2 ,3			L40-1872-48	SMALL FIXED INDUCTOR(18NH)		
R1			RK73FB2A271J	CHIP R 270 J 1/10W		
R2			RK73FB2A180J	CHIP R 18 J 1/10W		
R3			RK73FB2A271J	CHIP R 270 J 1/10W		
R4			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R5			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R6			RK73FB2A560J	CHIP R 56 J 1/10W		
R7			R92-0670-05	CHIP R 0 OHM		
R8			RK73FB2A561J	CHIP R 560 J 1/10W		
R9			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R10			RK73FB2A270J	CHIP R 27 J 1/10W		
R11			RK73FB2A220J	CHIP R 22 J 1/10W		
D1			DA204K	CHIP DIODE		
Q1			2SC3356	CHIP TRANSISTOR		
Q2			2SC3357	CHIP TRANSISTOR		
AF PA (X59-3560-10)						
C1 ,2			CK73FB1H103K	CHIP C 0.010UF K		
C3 ,4			CK73EB1E104K	CHIP C 0.10UF K		
C5			CK73FB1H103K	CHIP C 0.010UF K		
C6			C92-0003-05	CHIP-TAN 0.47UF 25WV		
C7			CK73FB1H103K	CHIP C 0.010UF K		
			E23-0471-05	TERMINAL		
R1			RK73FB2A101J	CHIP R 100 J 1/10W		
R2			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R3			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R4			R92-0670-05	CHIP R 0 OHM		
R5			R92-1220-05	CHIP R 1 OHM		
IC1			NJM2073M	IC(AF POWER AMP)		
Q1			2SA1213(Y)	CHIP TRANSISTOR		
Q2			DTC144EK	DIGITAL TRANSISTOR		
AVR (X59-3570-10)						
C1 -3			CK73FB1H103K	CHIP C 0.010UF K		
C4			CK73FB1H102K	CHIP C 1000PF K		
			E23-0471-05	TERMINAL		
IC1			LA5005M	IC(VOLTAGE REGULATOR/ +5V)		

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B : TK-330(NF) M,M2

C : TK-330(EF) E

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PARTS LIST

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AVR (X59-3570-10)

SW (X59-3580-10)

APC (X59-3590-10)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
Q1			FMC5	DIGITAL TRANSISTOR		
SW (X59-3580-10)						
C1 ,2			CK73FB1H103K	CHIP C 0.010UF K		
			E23-0471-05	TERMINAL		
S1 ,2			S40-1420-05	TAKT SWITCH		
APC (X59-3590-10)						
C1 -7			CK73FB1H102K	CHIP C 1000PF K		
C8			CC73FCH1H151J	CHIP C 150PF J		
C9			C92-0004-05	CHIP-TAN 1.0UF 16WV		
C10			C92-0005-05	CHIP-TAN 2.2UF 6.3WV		
C11 ,12			CK73FB1H102K	CHIP C 1000PF K		
			E23-0471-05	TERMINAL		
R1			R92-0670-05	CHIP R 0 OHM		
R2			RK73FB2A103J	CHIP R 10K J 1/10W		
R3			RK73FB2A223J	CHIP R 22K J 1/10W		
R4			RK73FB2A683J	CHIP R 68K J 1/10W		
R5			R92-1218-05	CHIP R 0.1 J 1/2W		
R6			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R7			RK73FB2A124J	CHIP R 120K J 1/10W		
R8 ,9			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R10			RK73FB2A103J	CHIP R 10K J 1/10W		
R11 -13			RK73FB2A821J	CHIP R 820 J 1/10W		
R14			R92-0679-05	CHIP R 0 OHM		
VR1 ,2			R12-3461-05	TRIMMING POT.(10K)		
D1			O2CZ3.9Y,Z	CHIP ZENNER DIODE		
IC1			LM301AD	IC(OP AMP)		
Q1			2SA1162(Y)	CHIP TRANSISTOR		
Q2			2SB1182F5(Q)	CHIP TRANSISTOR		
Q3 -5			DTC114YK	DIGITAL TRANSISTOR		
Q6			DTA143EK	DIGITAL TRANSISTOR		

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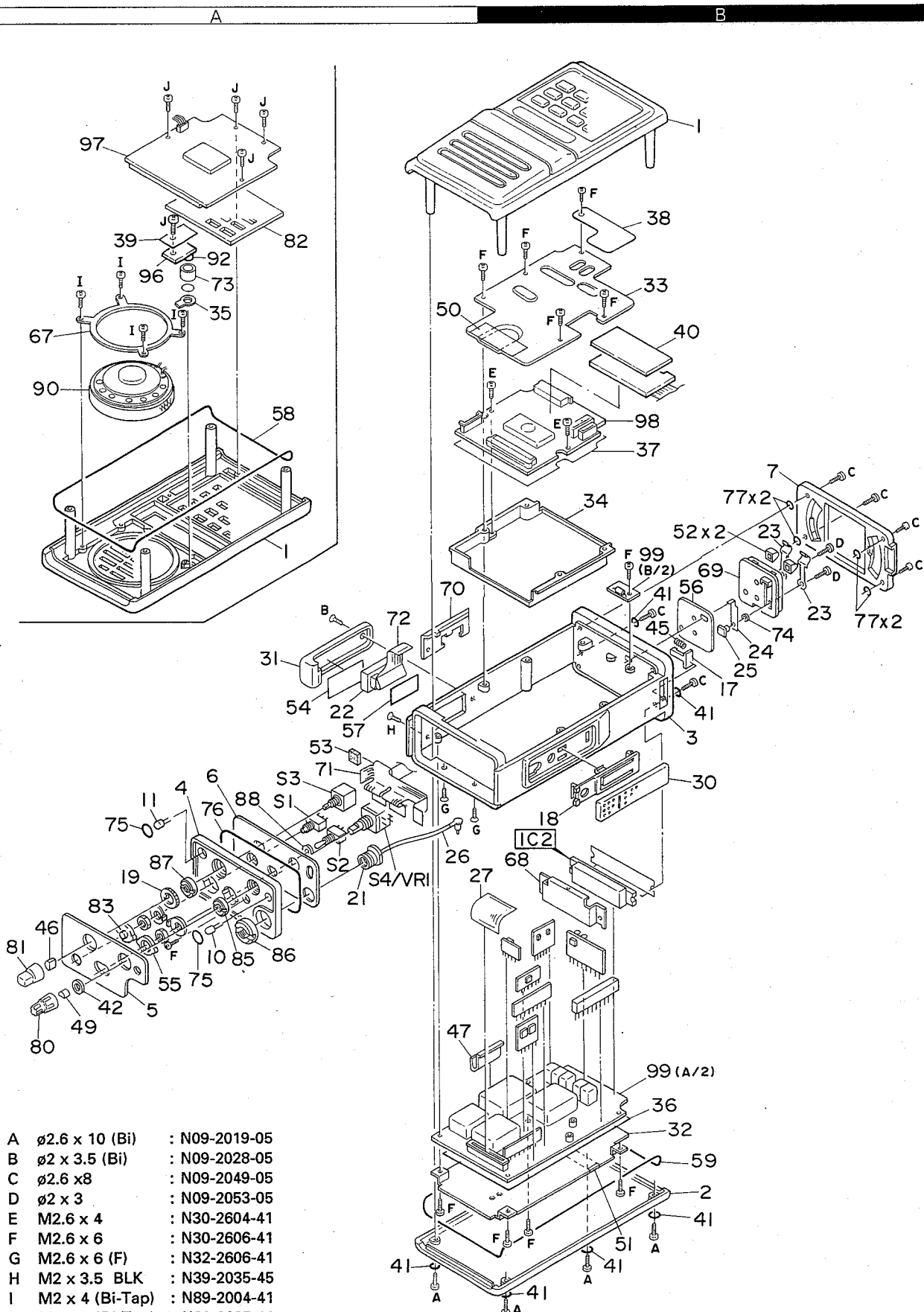
A: TK-330(F) M,M2,M3

B: TK-330(NF) M,M2

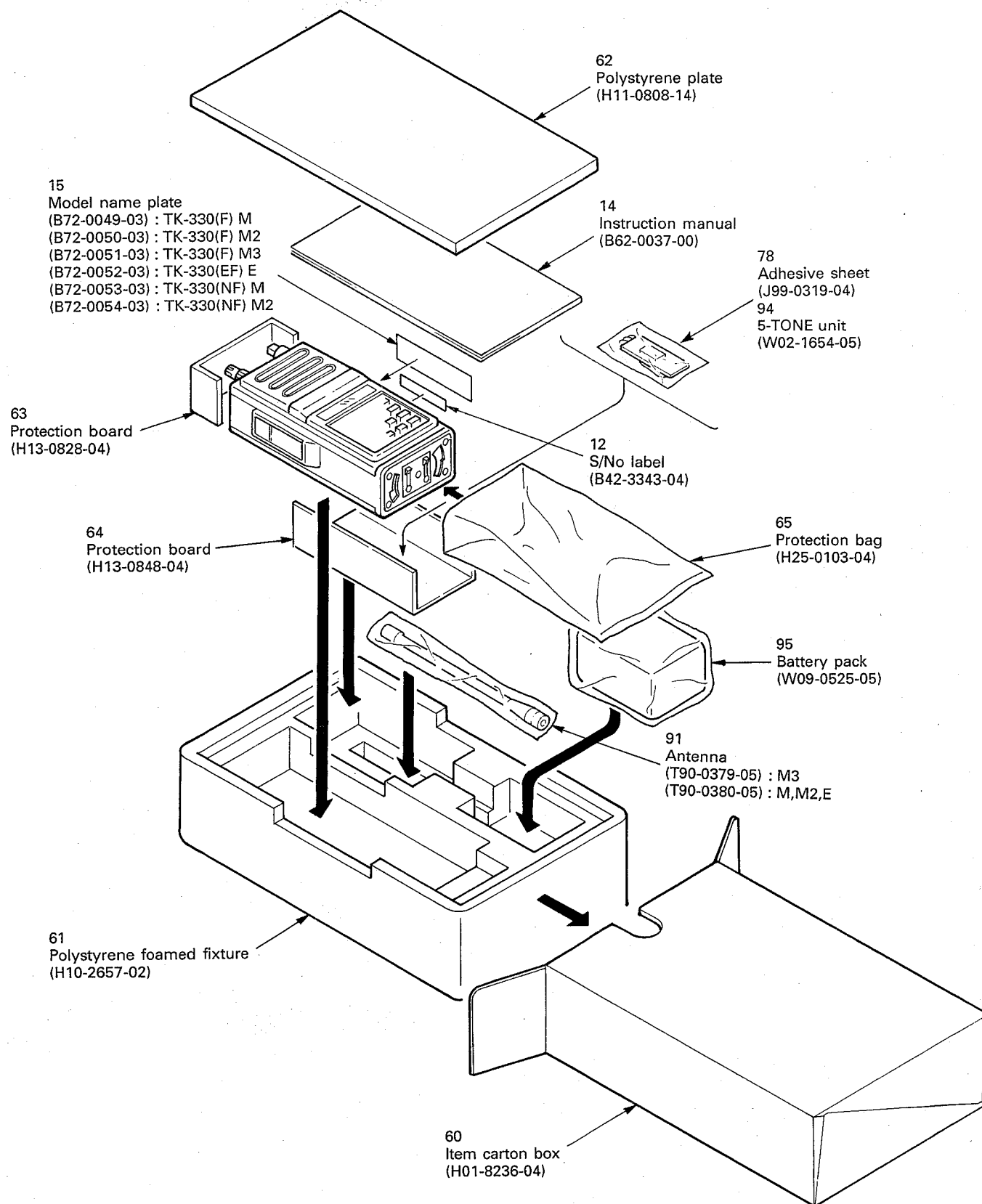
C: TK-330(EF) E

⚠ indicates safety critical components.

EXPLODED VIEW



PACKING

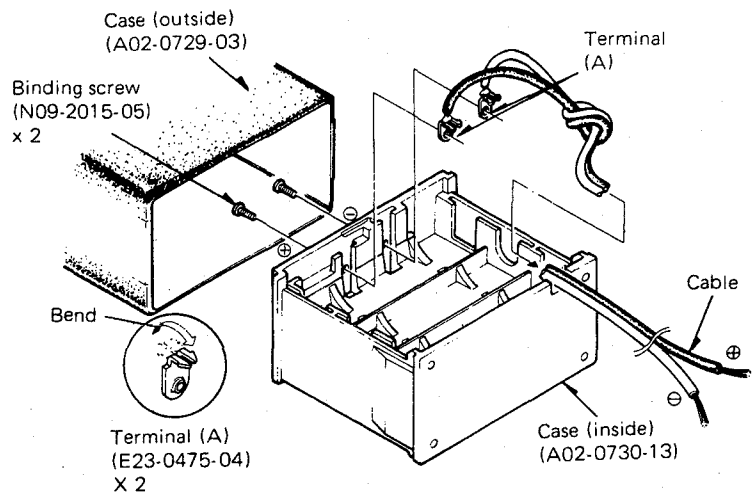


ADJUSTMENT

Test Equipment Required for Alignment

No.	Test Equipment	Major Specifications	
1	Standard Signal Generator (SSG)	Frequency Range Modulation Output	400 to 520MHz. Frequency modulation and external modulation. 0.1μV to greater than 1mV.
2	Power Meter	Input Impedance Operation Frequency Measurement Capability	50Ω. 400 to 520MHz or more. Vicinity of 10W and 3W.
3	Deviation Meter	Frequency Range	400 to 520MHz.
4	Digital Volt Meter (DVM)	Measuring Range Accuracy	1 to 10V DC. High input impedance for minimum circuit loading.
5	Oscilloscope		DC through 30MHz.
6	High Sensitivity Frequency Counter	Frequency Range Frequency Stability	10Hz to 600MHz. 0.2ppm or less.
7	Ammeter		3A.
8	AF Volt Meter (AFVTVM)	Frequency Range Voltage Range	50Hz to 10kHz. 3mV to 3V.
9	Audio Generator (AG)	Frequency Range Output	50Hz to 5kHz or more. 0 to 1V.
10	Distortion Meter	Capability Input Level	3% or less at 1kHz. 50mV to 10Vrms.
11	Voltmeter	Measuring Range Input Impedance	10 to 1.5V DC or less. 50kΩ/V or greater.
12	4Ω Dummy Load		Approx. 8 or 16Ω, 3W.
13	Regulated Power Supply		7.5V, approx. 5A (adjustable from 6 to 16 V). Useful if ammeter equipped.
14	5-TONE Analyzer	Frequency Range 5-TONE Code	400 to 520MHz EEA, ZVEI1, ZVEI2, DZVEI, CCIR, NATEL, EIA, etc.

- The following adaptor is recommended in connecting of the power supply.



- The set has been adjusted with frequency below chart.
- When other frequencies are requested, please write them following the instructions in the adjustment procedure.

		M, E	M2	M3
TX	H	469.975	499.975	421.975
	M	460.000	490.000	412.000
	L	450.000	480.000	402.000
RX	M	462.500	492.500	414.500
	L	450.100	480.100	402.100

L : Low freq' M : Mid freq' H : Hi freq'

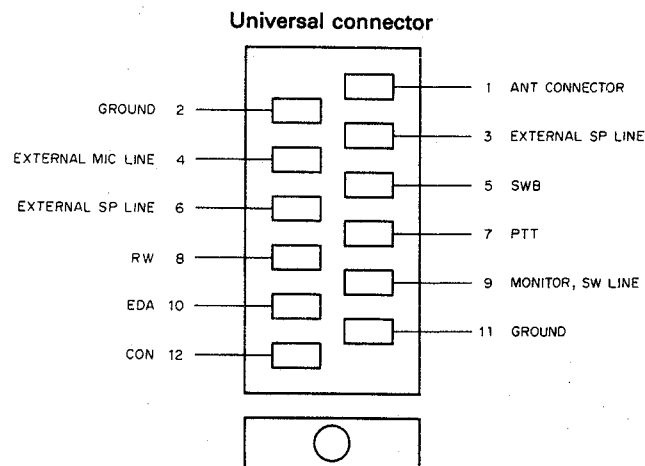
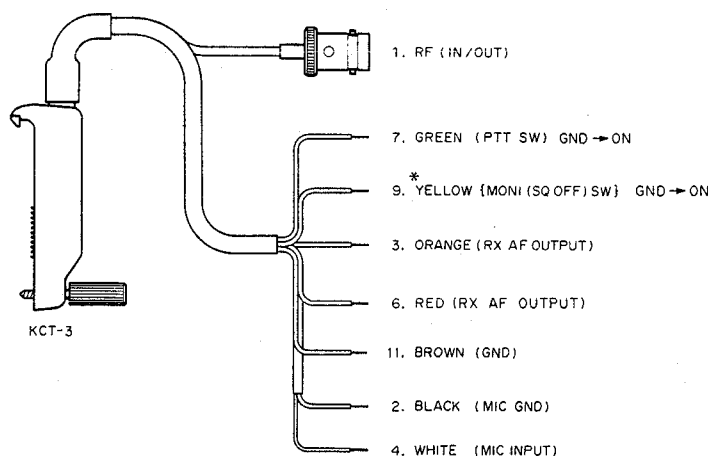
ADJUSTMENT

Universal Connector

Use the KCT-3 for adjustment. Connect the KCT-3 to the universal connector of the radio and tighten the screws.

• **The KCT-3 terminals are as follows**

Numbers are universal connector terminal numbers.



* **Radio operation when supplied shorting plug is connected**

The 5-tone unit is packed separately, so the shorting plug (E37-0053-05) is connected at the factory. The radio operation in that case is described below. (Page 4)

1. TX Press the PTT button to transmit. Ordinary operation then takes place, similar to the DTMF function.
2. RX When the power is turned on, a signal is input, but cannot be received. Sound can be heard when the signal is received while the CALL switch (MONI switch) is pressed.

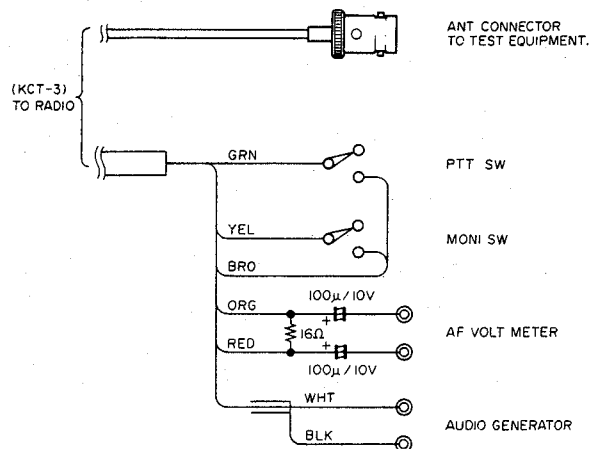
Hold down the OPEN/QUIET switch for more than two seconds while pressing the CALL switch to open the squelch. The squelch remains open until the CALL switch is released.

Note : If the CALL switch is pressed when the CALL LED is lit, with the 5-tone unit installed, the transmission mode is entered and the 5-tone unit is transferred. The CALL switch is the same as the MONI switch on the basic model. So note that the transmission mode may be entered when the MONI switch is pressed with a tool (KCT-3).

• **Connection**

CAUTION

1. When connecting the KCT-3 to the universal connector of the radio, a short circuit may occur. To prevent this, be sure to turn the radio POWER switch off.
2. Since the RX AF output is a BTL output, there is a DC component. Isolate this with a capacitor or transformer as shown in the figure.
3. Do not connect an instrument between red and orange and GND.



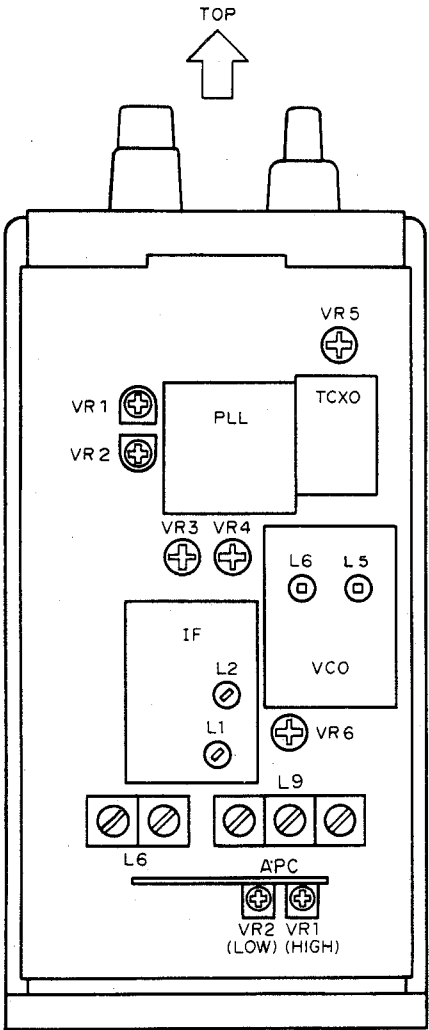
ADJUSTMENT

The radio has been factory pre programed for the data shown in the following table.
When required re-program them, you want in actual operation.

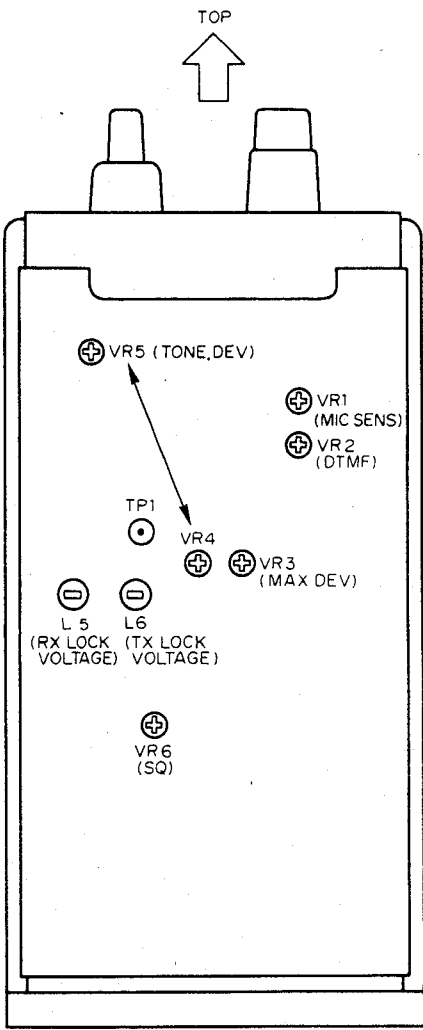
No.	Item	(F) M, (EF) E	(F) M2	(F) M3	(NF) M	(NF) M2
1	TX frequency	460.000	490.000	412.000	460.000	490.000
2	RX frequency	460.100	490.100	412.100	560.100	490.100
3	Power HI/LOW	HI	←	←	←	←
4	T.O.T	9min.	←	←	←	←
5	Power save	Disable	←	←	←	←
6	DTMF	OFF	←	←	←	←
7	DTMF 1st digit	80ms.	←	←	←	←
5-TONE						
1	Group tone	CCIR 2400Hz	←	←	←	←
2	Tone set	CCIR	←	←	←	←
3	Tone radio	20ms.	←	←	←	←
4	Lead in delay	500ms.	←	←	←	←
5	RX decode code	10000	←	←	←	←
6	TX call code	10000	←	←	←	←

Adjustment Points

• Component side

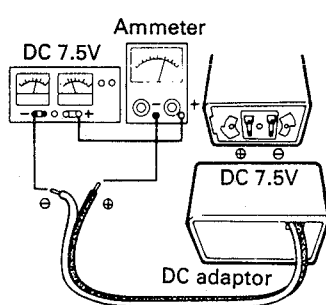
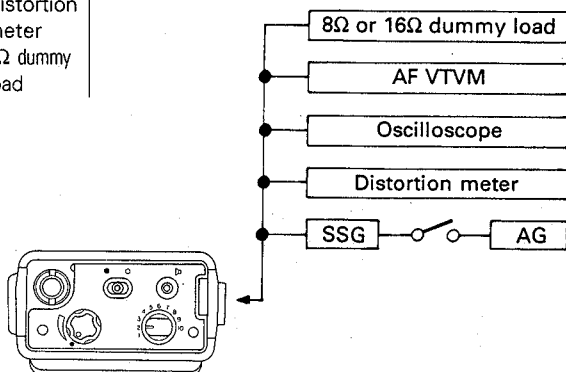


• Foil side



ADJUSTMENT

Alignment

Item	Condition	Measurement			Adjustment			Specifications/Remarks.	
		Test-equipment	Unit	Terminal	Unit	Parts	Method		
1. Setting	1) Write in freq' designed with EEPROM writer.								
	2) Connect DC 7.5V to the battery terminal. TX-RX unit VR6 : MAX CCW. Note 1. Measure voltage at battery terminal. 2. Adjust voltage of power supply to be 7.5V in transmitting.								
2. PLL lock voltage	1) CH : Channel with highest RX FREQ' (fRH).	Voltmeter	TX-RX	TP1	VCO	L5	3.8V ADJ.	±0.2V	
	2) PTT : ON					L6	3.8V ADJ.	±0.2V	
	3) CH : Channel with lowest RX FREQ' (fRL).						Check	1.2V or more.	
	4) CH : Channel with lowest TX FREQ' (fTL). PTT : ON							1.2V or more.	
3. Frequency adjustment	1) CH : Channel with lowest TX FREQ' (fTL). PTT : ON	Freq' counter Power meter		ANT			Check FREQ' of TX.	±1000Hz	
4. Sensitivity	1) CH : Channel with RX center FREQ' (fRM). SSG freq' : fRM SSG output : 500μV/54dBμ/-53dBm SSG MOD : 1kHz SSG DEV : 3kHz F : 1.5kHz NF : 2.4kHz EF OPEN/QUIET switch : OPEN	AF VTVM Oscilloscope Distortion meter 8Ω dummy load		SP	TX-RX	L6, 9	SINAD MAX.		
	2) SSG output : 0.35μV/-9dBμ/-116dBm								
	3) CH : Check other channel SSG output : 0.35μV/-9dBμ/-116dBm						Check	SINAD 12dB or more.	

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
5. Squelch adjustment	1) CH : Channel with RX center FREQ' (f _{RM}). SSG freq' : f _{RM} SSG output : Value when 3dB is subtracted from the sensitivity value of 12dB SINAD.	Oscilloscope Distortion meter AF VTVM		SP	TX-RX	VR6	Set to threshold point.	
	2) SSG output : Sensitivity value of 12dB SINAD.						Check	Squelch open.
	3) SSG output : OFF							Squelch close.
	Note Squelch adjust VR6 is adjusted at threshold point. If it is readjusted the VR6, the squelch sensitivity is changed. Do not touch it normally.							
3. Power (APC) adjustment	1) Connect the power meter to EXT. ANT. T. SW : Set to ● position. CH : Channel with highest TX FREQ' (f _{TH}). PTT : ON	Power meter Freq' counter DC ammeter		EXT. ANT	APC	VR1	Power MAX.	5.0W or more.
	2) CH : Channel with lowest TX FREQ' (f _{TL}). PTT : ON							
	3) CH : Channel with TX center FREQ' (f _{TM}). PTT : ON					VR2	Power MIN. 2.0W ADJ.	0.3W or less ±0.2W
	4) CH : Channel with TX center FREQ' (f _{TM}). PTT : ON					VR1	4.7W ADJ.	±0.2W 2.7A or less.
	5) CH : Check other channel PTT : ON						Check	4W or more. 2.7A or less.
7. DQT waveform correction	1) CH : Set the channel selector to the channel with which DQT is used. Deviation meter filter HPF : OFF LPF : 3kHz PTT : ON	Power meter Deviation meter Oscilloscope			TX-RX	VR4	Make the de-modulation waveform neat.	

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
8. QT	1) CH : Set the channel selector to the channel with which QT/CTCSS is used. Deviation meter filter HPF : 50Hz LPF : 3kHz De-emphasis : 750μs PTT : ON	Power meter Deviation meter Oscilloscope			TX-RX	VR5	±0.75kHz F ±0.37kHz NF ±0.6kHz EF	±100Hz F ±50Hz NF ±100Hz EF
9. Maximum deviation adjustment	1) AG : 1kHz/150mV at MIC in Deviation meter filter HPF : OFF LPF : 15kHz De-emphasis : OFF PTT : ON			MIC	TX-RX	VR3	±4.4kHz F ±2.2kHz NF ±3.5kHz ADJ. : EF (±4.9kHz ADJ. : F , ±2.45kHz ADJ. : NF , ±3.9kHz ADJ. : EF when using a QT/DQT) Adjust one more than the other by switching between -P and +P.	±100Hz
10. MIC sensitivity adjustment	1) AG : 1kHz/15mV at MIC in PTT : ON				TX-RX	VR1	±3kHz ADJ. : F ±1.5kHz ADJ. : NF ±2.4kHz ADJ. : EF , (±3.75kHz ADJ. : F , ±1.87kHz ADJ. : NF , ±3.0kHz ADJ. : EF when using a signaling)	±100Hz
11. DTMF	1) CH : Channel with TX center FREQ' (fTM). Connect the DTMF board. Keyboard : "1" push PTT : ON				TX-RX	VR2	±2.8kHz ADJ. : F ±1.4kHz ADJ. : NF ±2.3kHz ADJ. : EF	±100Hz
12. 5-TONE (Encode)	1) Set the channel selector to the channel with which 5-TONE is used. OPEN/QUIET switch : Push 2) CALL switch : Push	5-tone analyzer					Check	CALL LED goes on. (Make sure there is a beep.) Check a 5-tone code.
13. 5-TONE (Decode)	1) Put the radio into the ready mode. Send a 5-tone analyzer signal.						Check	CALL LED blinks. (Make sure there is a double beep.)

TERMINAL FUNCTIONS

Connector No.	Terminal No.	Terminal Name	Terminal Function
SIGNALING UNIT (X52-3150-22)			
J1	1	SWB	B line passing through the power sw.
	2	GND	GND.
	3	PTT	PTT line. "L" : TX
	4	KSI	Data line of main CPU and key CPU.
	5	KSO	Data line of main CPU and key CPU.
	6	TO	DTMF signal line.
CONTROL UNIT (X53-3320-20)			
J1	1	KS1	Internal speaker line.
	2	SP2	Internal speaker line.
	3	IMC	Internal microphone line.
	4	GND	Internal microphone GND line.
J2	1	SWB	B line passing through the power sw.
	2	GND	GND
	3	PTT	PTT line. "L" : TX
	4	KSI	Data line of main CPU and key CPU.
	5	KSO	Data line of main CPU and key CPU.
	6	TO	DTMF signal line.
J3	1	SP1	External speaker line.
	2	EMI	External microphone line.
	3	SWB	B line passing through the power sw.
	4	SP2	External speaker line.
	5	PTT	PTT line. "L" : TX
	6	RW	ROM.
	7	MON	CALL switch line. "L" : ON
	8	EDA	External data line and internal/external switching of antenna. "L" : External
	9	GND	GND.
	10	CON	Internal/external switching of microphone and speaker. "L" : External
J4	1	NC	Not connected.
	2	GND	GND.
	3	CH4	CH switch data.
	4	CH1	CH switch data.
	5	CH2	CH switch data.
	6	CH8	CH switch data.
	7	QT	OPEN/QUIET switch data.
	8	GR2	Group switch data.
	9	GR8	Group switch data.
	10	TSW	Toggle switch data.
	11	GR4	Group switch data.
	12	GR1	Group switch data.
	13	GND	GND.
	14	TL	TX LED.
	15	VRL	AF volume control low.
	16	VRM	AF volume control center.
	17	VRH	AF volume control high.
	18	BSY	BUSY LED.
J5	1	GND	GND.
	2	MUT	RX AF PA amplifier mute line. "H" (5V) : ON
	3	SP2	Speaker line 2.
	4	HL	TX power switching of HI/LOW.
	5	SP1	Speaker line 1.
	6	PTT	PTT line. "L" : TX
	7	DET	RX detector output.
	8	MON	CALL switch line.
	9	AMI	AF volume center.
	10	SWB	B line passing through the power sw.
	11	AFH	AF volume hot side.

Connector No.	Terminal No.	Terminal Name	Terminal Function
	12	TUN	Not connected.
	13	SQL	RX squelch line. "H" : Comes signal
	14	STO	Sub tone signal line.
	15	MIC	TX mic line.
	16	PCL	PLL data clock line.
	17	TO	DTMF signal line.
	18	PDA	PLL data line.
	19	PS	Power save. "H" : Radio on
	20	PEN	PLL enable line.
	21	KEY	On TX line from TX-RX unit. "L" : TX
	22	PLS	Internal/external switching of antenna. "H" : External
	23	UL	PLL unlock line. "H" (5V) : Unlock
	24	GND	GND.
W1	1	GND	GND.
	2	VDATA	5-TONE data line.
	3	VCCLK	5-TONE data clock line.
	4	GRPDEC	Group detect.
	5	SIGIN	RX DET signal.
	6	TONEOUT	TX 5-TONE.
	7	ALERT	Alert tone.
W2	1	DEC	5-TONE DET line.
	2	LDEC	CALL LED on line.
	3	MICMUTE	Mic mute line.
	4	TXON	TX ON line.
	5	OPEN/QUIET	OPEN/QUIET switch line.
	6	TXCALL	TX CALL switch line.
	7	SQL	RX squelch line.
	8	SWB	B line.
	9	PTT	PTT line.
TX-RX UNIT (X57-3290-XX)			
J1	1	GND	GND.
	2	MUT	RX AF PA amplifier mute line. "H" (5V) : ON
	3	SP2	Speaker line 2.
	4	HL	TX power switching of HI/LOW.
	5	SP1	Speaker line 1.
	6	PTT	PTT line. "L" : TX
	7	DET	RX detector output.
	8	MON	CALL switch.
	9	AMI	AF volume center.
	10	SWB	B line passing through the power sw.
	11	AFH	AF volume hot side.
	12	TUN	Not connected.
	13	SQL	RX squelch line. "H" : Comes signal.
	14	STO	Sub tone signal line.
	15	MIC	TX mic line.
	16	PCL	PLL data clock line.
	17	TO	DTMF signal line.
	18	PDA	PLL data line.
	19	PS	Power save. "H" : Radio on
	20	PEN	PLL enable line.
	21	KEY	On TX line from TX-R unit. "L" : TX
	22	PLS	Internal/external switching of antenna. "H" : External
	23	UL	PLL unlock line. "H" (5V) : Unlock
	24	GND	GND.
J2		INT ANT	Internal antenna connector.
J3		EXT ANT	External antenna connector.
J4		SWB	B line passing through the power sw.

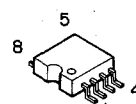
TK-330 CIRCUIT DIAGRAM

SIGNALING UNIT (X52-3150-22)
(X52-3150-22)

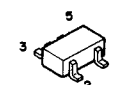
DTC114YK



AK93C46F



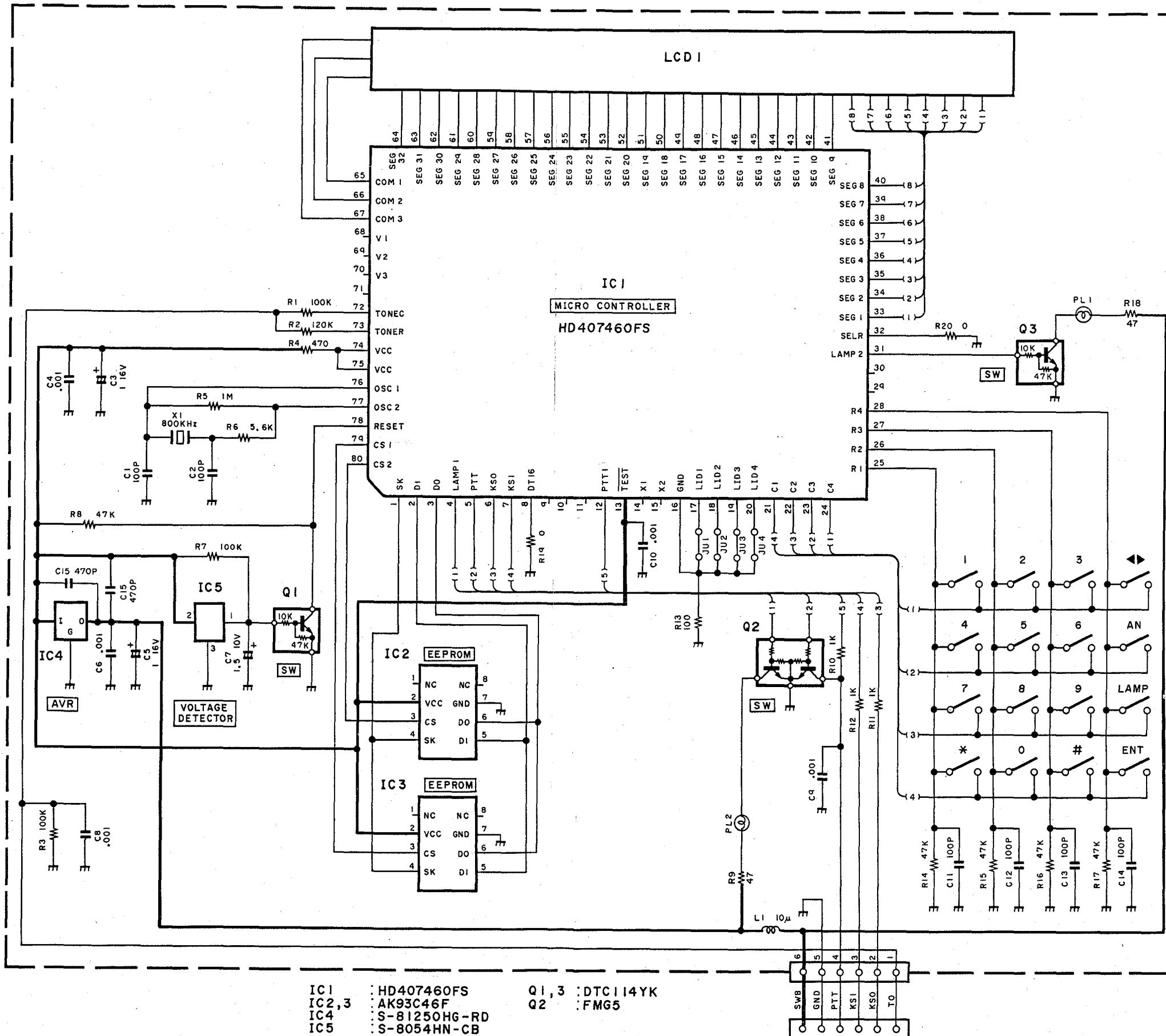
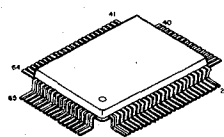
FMG5



S-81250H-RD
S-8054HN-CB



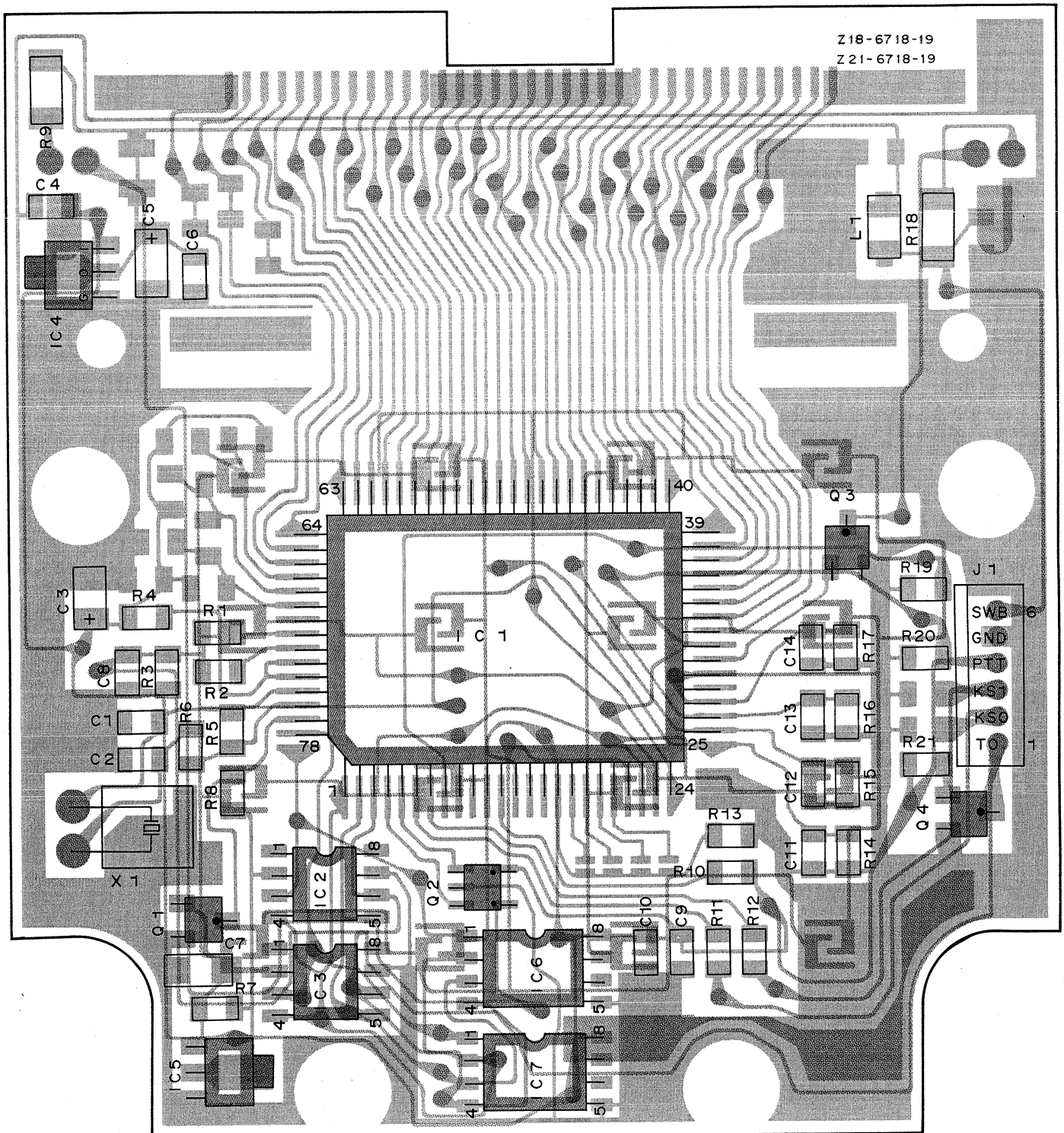
HD407460FS



IC1 : HD407460FS
IC2,3 : AK93C46F
IC4 : S-81250HG-RD
IC5 : S-8054HN-CB
Q1,3 : DTC114YK
Q2 : FMG5

PC BOARD VIEW TK-330

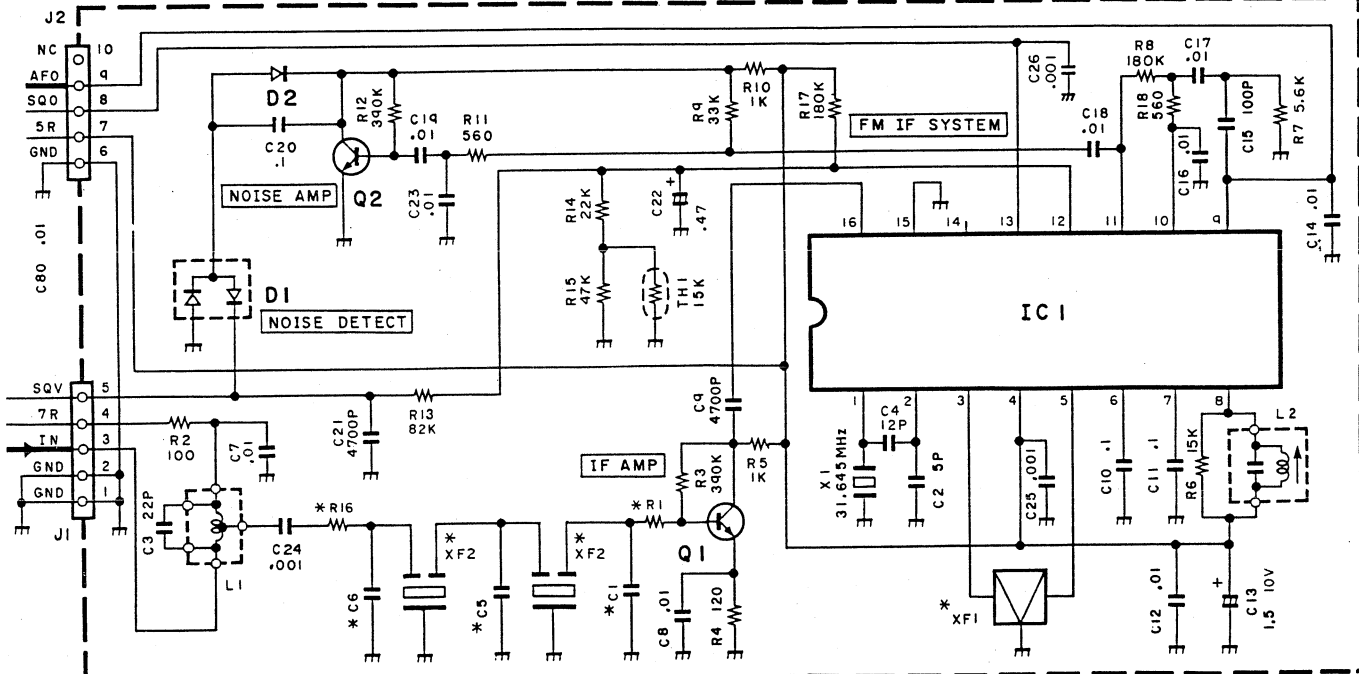
SIGNALING UNIT (X52-3150-22) Foil side view



IF (X58-3530-XX) -10 : TK-330(F) -21 : TK-330(NF) -61 : TK-330(EF)

SUB UNIT (IF) (X58-3530-XX)

*A9



(X58-3530-XX)
IC 1 : MC3361D

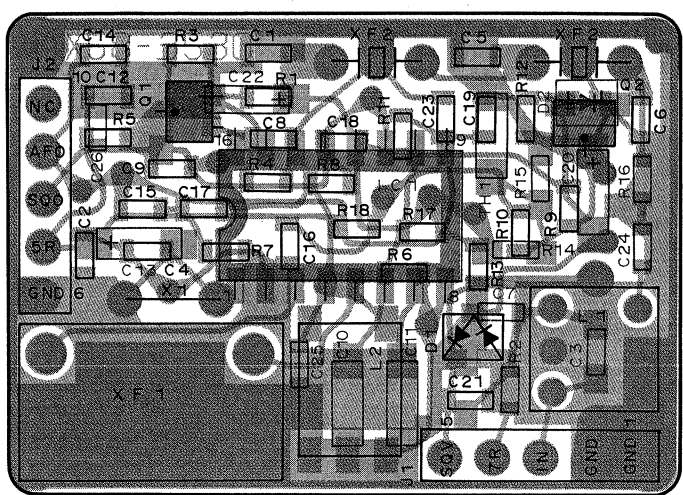
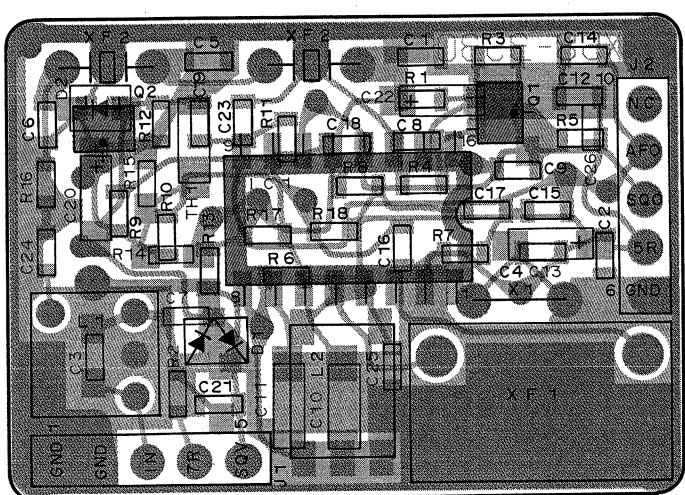
Q1 : 2SC4215(Y)
Q2 : 2SC4116(Y)

D1 : DA204U
D2 : MA110

		XF1	XF2	C1	C5	C6	R1	R16
TK-330F	X58-3530-10	L72-0373-05	L71-0289-05	1P	7P	1P	1.2K	1.2K
TK-330NF	X58-3530-21	L72-0379-05	L71-0413-05	4P	18P	4P	470	470
TK-330EF	X58-3530-61	L72-0374-05	L71-0289-05	1P	7P	1P	1.2K	1.2K

IF (X58-3530-XX) Component side view

IF (X58-3530-XX) Foil side view



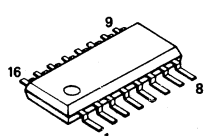
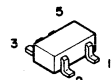
■ : Component side
■ : Foil side

2SC4083
2SC4116
2SC4215

2SK508NV

FMG4

MC3361D

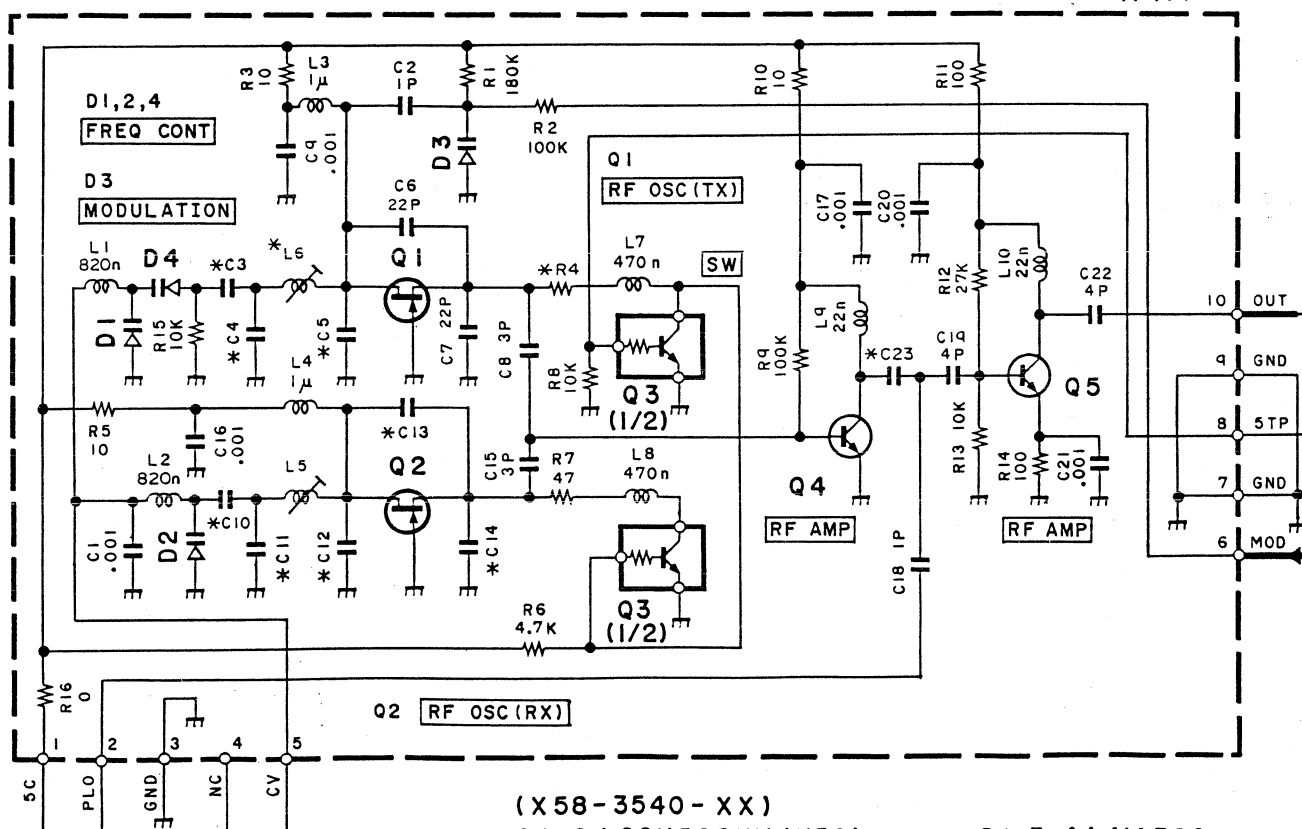


CIRCUIT DIAGRAM / PC BOARD VIEWS TK-330

VCO (X58-3540-XX) -10 : M,E -11 : M2 -12 : M3

SUB UNIT (VCO) (X58-3540-XX)

* A4



(X58-3540-XX)

Q1,2 : 2SK508NV (K52)

Q3 : FMG4

Q4,5 : 2SC4083(N,P)

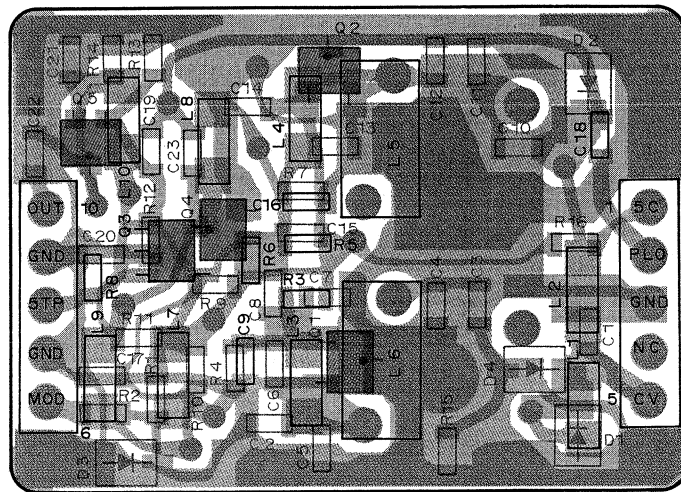
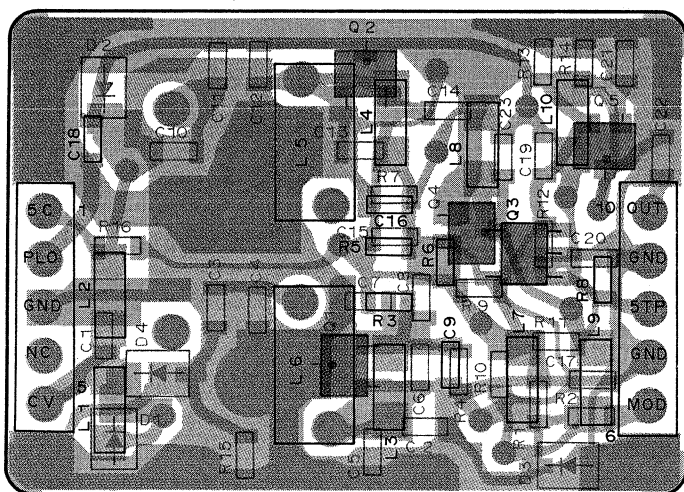
D1,3,4 : MA366

D2 : 1T33C

		C3	C4	C5	C10	C11	C12	C13,14	L6	R4	C23
TK-330F/EF/NF	X58-3540-10	47P	12P	10P	34P	7P	10P	5P	L34-2344-05	100	3P
	X58-3540-11	56P	10P	10P	34P	8P	6P	5P	L34-2344-05	56	4P
TK-330F	X58-3540-12	27P	8P	12P	47P	12P	10P	15P	L34-2345-05	100	3P

VCO (X58-3540-XX) Component side view

VCO (X58-3540-XX) Foil side view



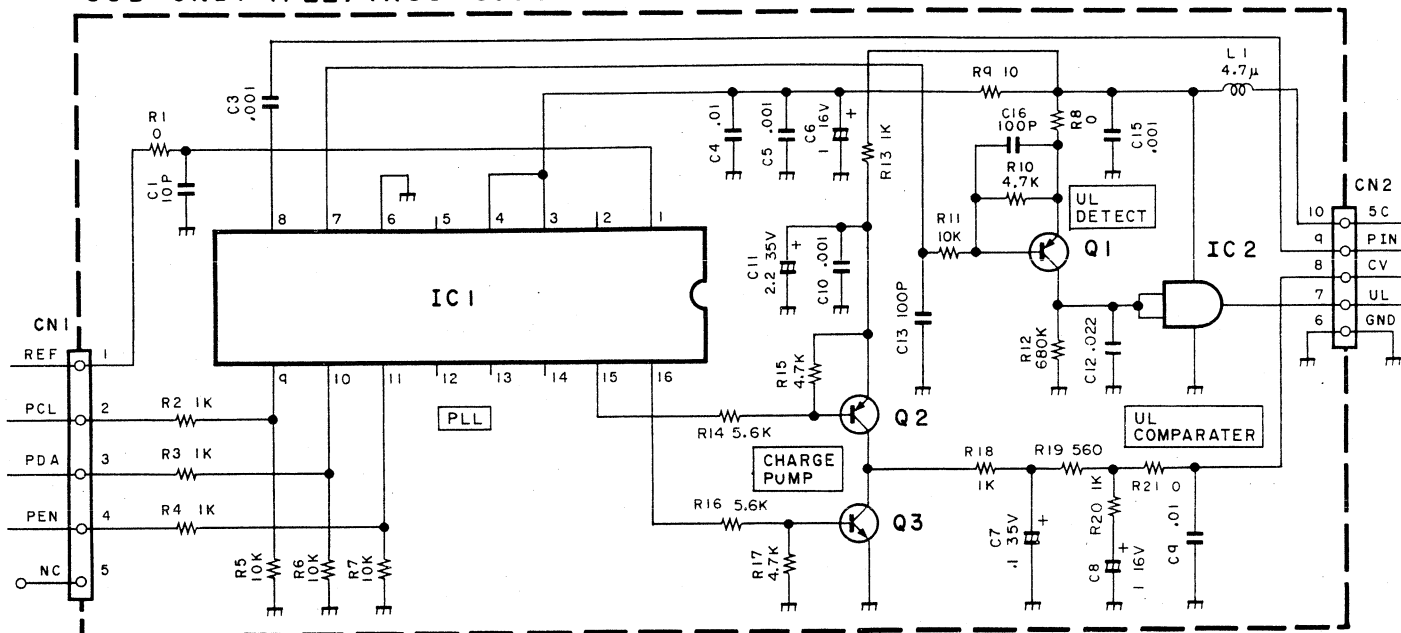
■ : Component side

■ : Foil side

TK-330 CIRCUIT DIAGRAM / PC BOARD VIEWS

PLL (X58-3550-10)

SUB UNIT (PLL) (X58-3550-10)



IC1 : MB1504

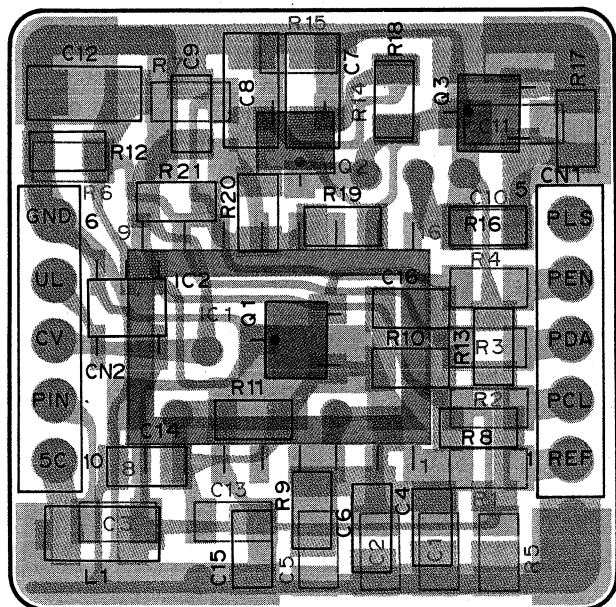
Q2 : 2SA1312 (GR)

IC2 : TC4581F

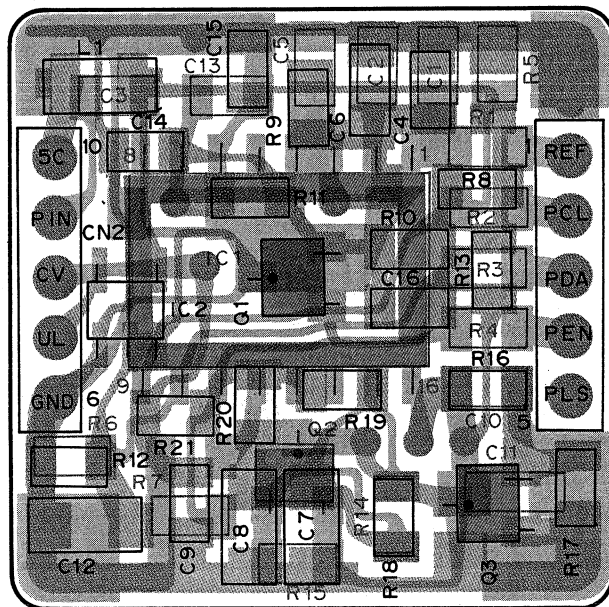
Q3 : 2SC3324 (GR)

Q1 : 2SA1162 (Y)

PLL (X58-3550-10) Component side view



PLL (X58-3550-10) Foil side view



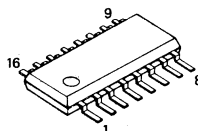
: Component side

: Foil side

2SA1162
2SA1312
2SC3324

TC4581F

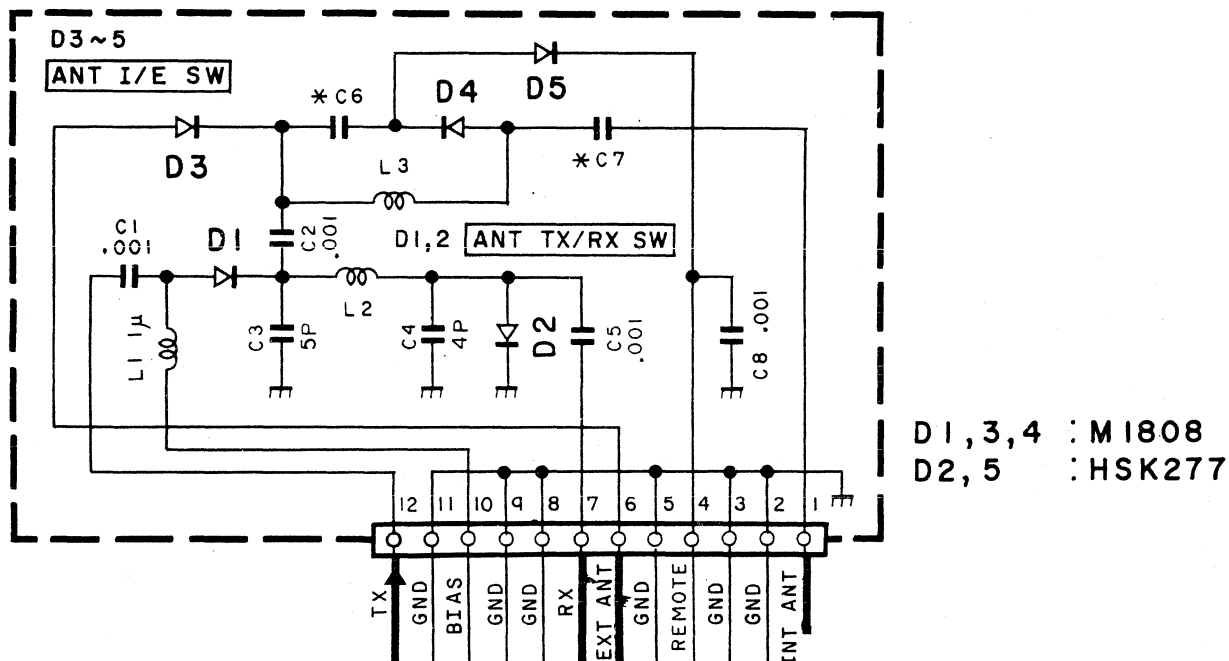
MB1504



CIRCUIT DIAGRAM / PC BOARD VIEW TK-330

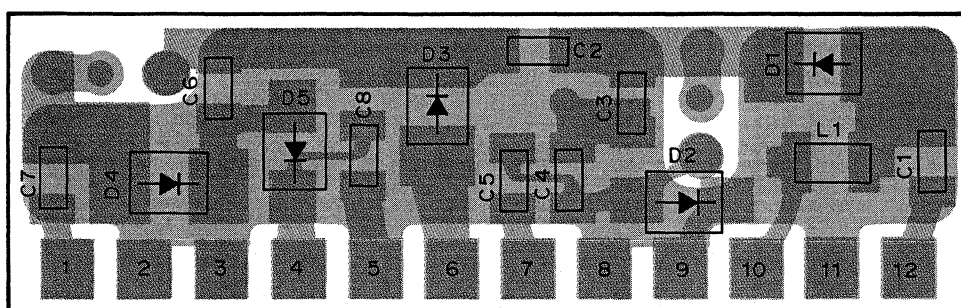
ANT SW (X58-3560-XX) -10 : M,E -11 : M2 -12 : M3

SUB UNIT (ANT SW) (X58-3560-XX)



		C6	C7
TK-330 M,E	X58-3560-10	6P	9P
TK-330 M2	X58-3560-11	5P	7P
TK-330 M3	X58-3560-12	7P	12P

ANT SW (X58-3650-XX) Component side view

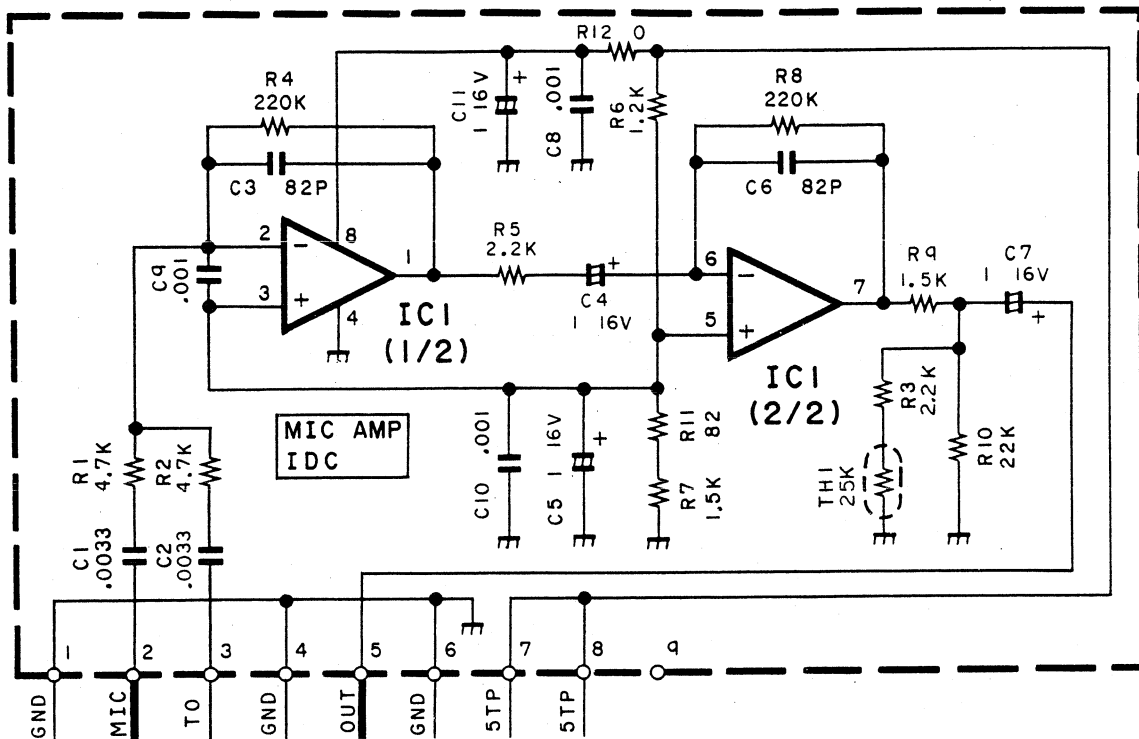


■ : Component side
■ : Foil side

TK-330 CIRCUIT DIAGRAM / PC BOARD VIEWS

MIC AMP (X59-3520-10)

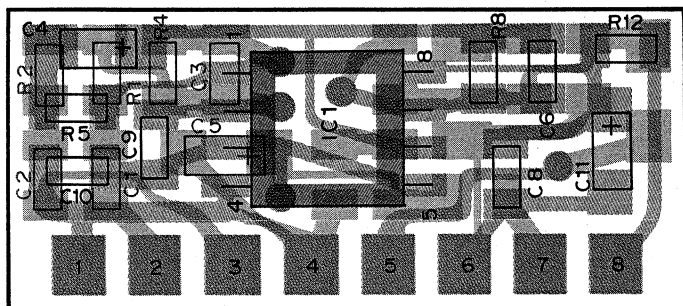
MODULE UNIT (MIC AMP) (X59-3520-10)



IC1 : NJM4560M

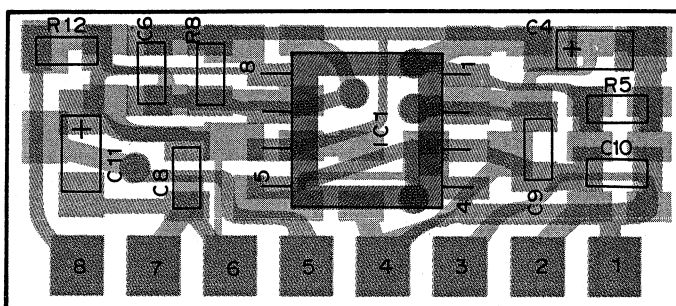
MIC AMP (X59-3520-10)

Component side view



MIC AMP (X59-3520-10)

Foil side view

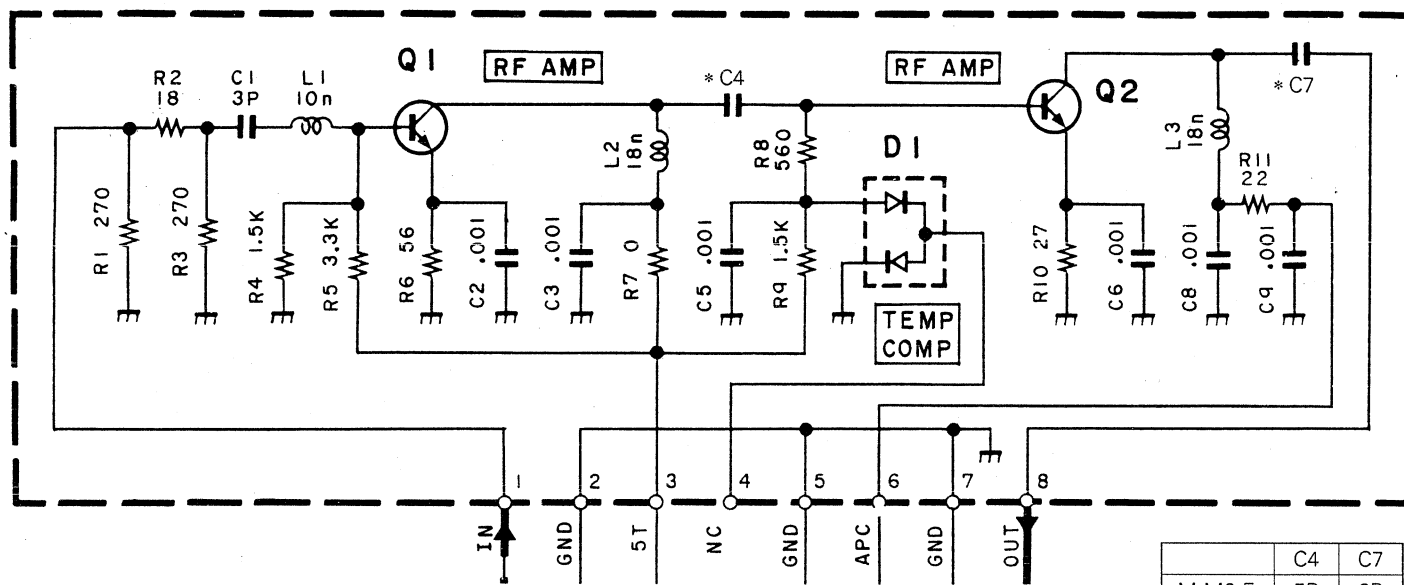


■ : Component side
■ : Foil side

CIRCUIT DIAGRAM / PC BOARD VIEW TK-330

DRIVE (X59-3540-XX) -10 : M,M2,E -12 : M3.

MODULE UNIT (DRIVE) (X59-3540-10)

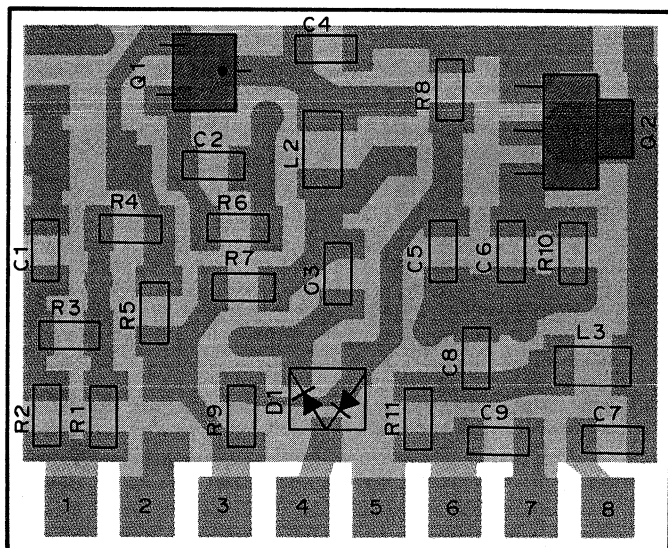


Q1 : 2SC3356

D1 : DA204K

Q2 : 2SC3357

DRIVE (X59-3540-XX) Component side view



■ : Component side

■ : Foil side

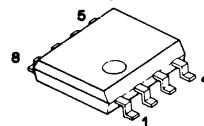
2SC3357



2SC3356



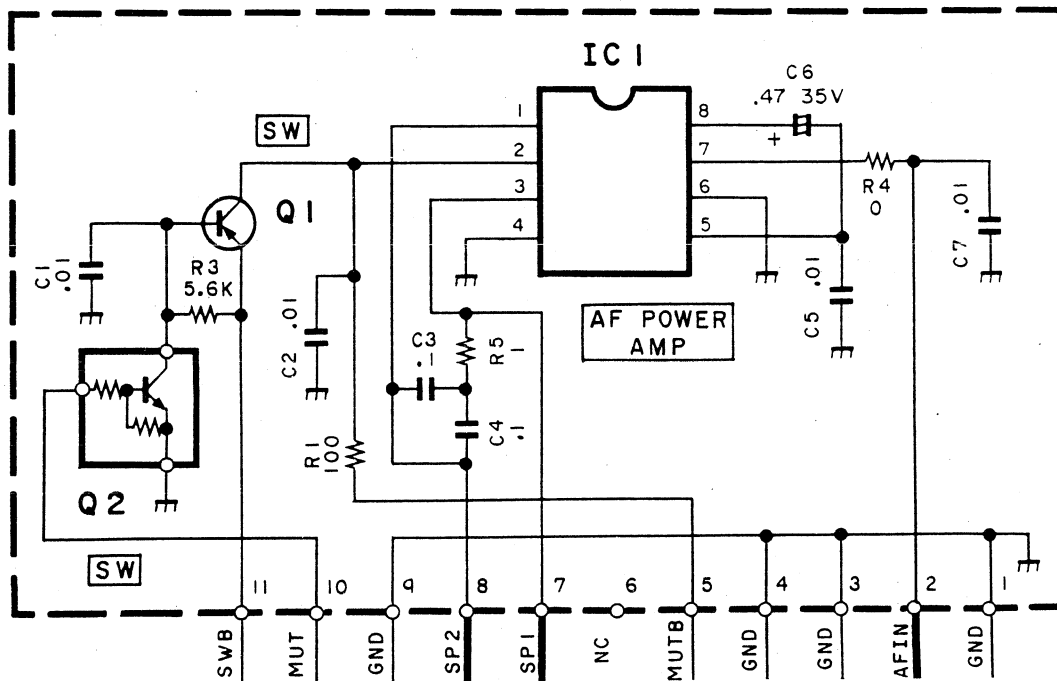
NJM4560M



TK-330 CIRCUIT DIAGRAM / PC BOARD VIEW

AF PA (X59-3560-10)

MODULE UNIT (AF PA) (X59-3560-10)

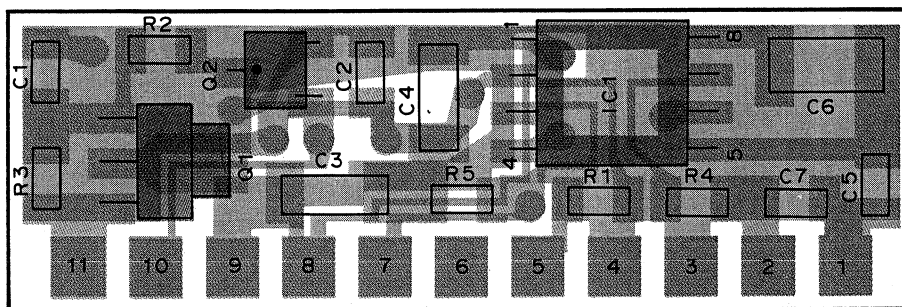


IC 1 : NJM2073M

Q 1 : 2SC1213(Y)

Q 2 : DTC144EK

AF PA (X59-3560-10) Component side view

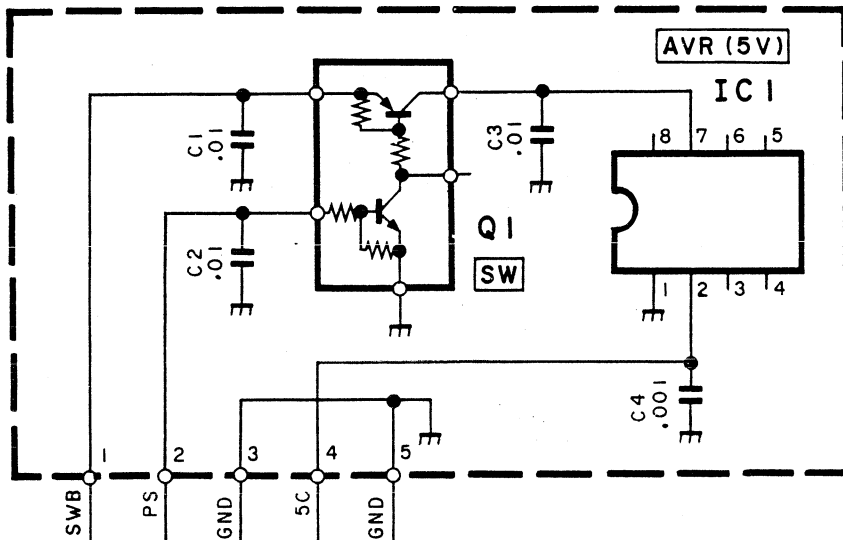


■ : Component side
■ : Foil side

CIRCUIT DIAGRAM / PC BOARD VIEWS TK-330

AVR (X59-3570-10)

MODULE UNIT (AVR) (X59-3570-10)

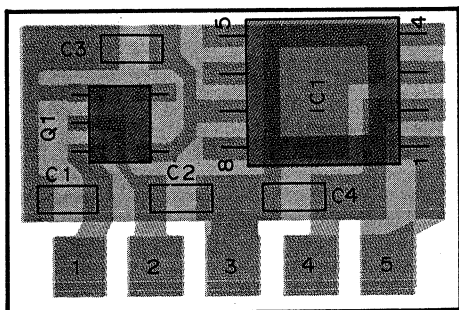


IC 1 : LA5005

Q 1 : FMC5

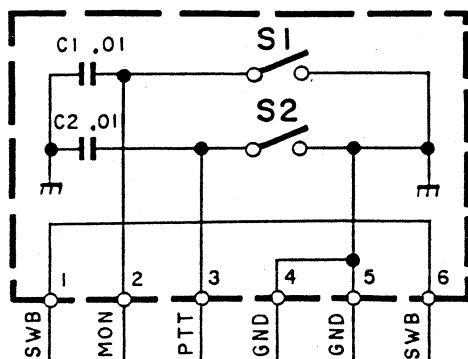
AVR (X59-3570-10)

Component side view



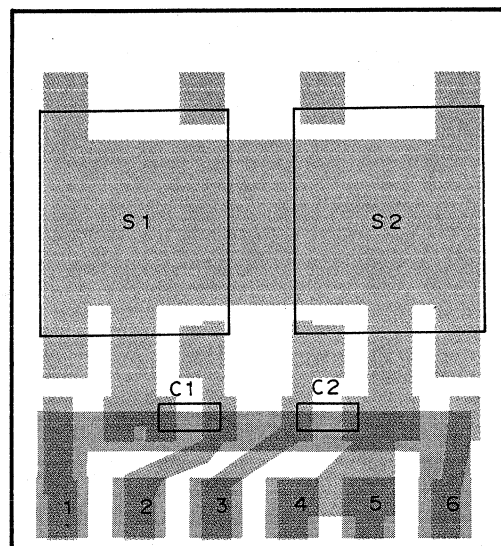
SW (X59-3580-10)

MODULE UNIT (SW)
(X59-3580-10) A2



SW (X59-3580-10)

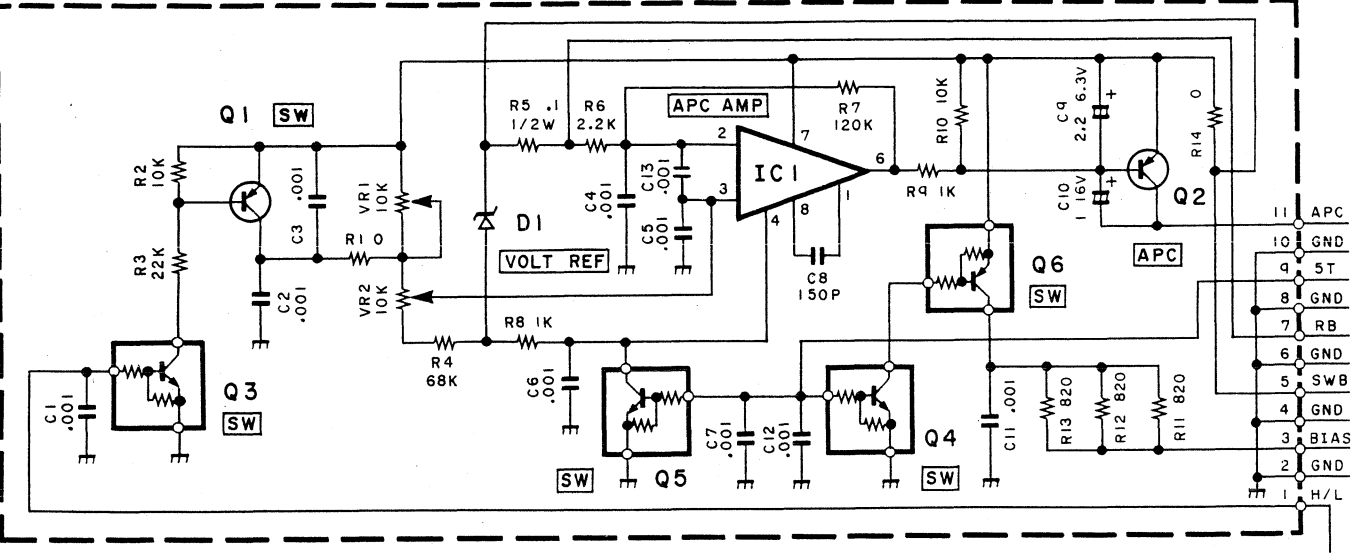
Component side view



■ : Component side
■ : Foil side

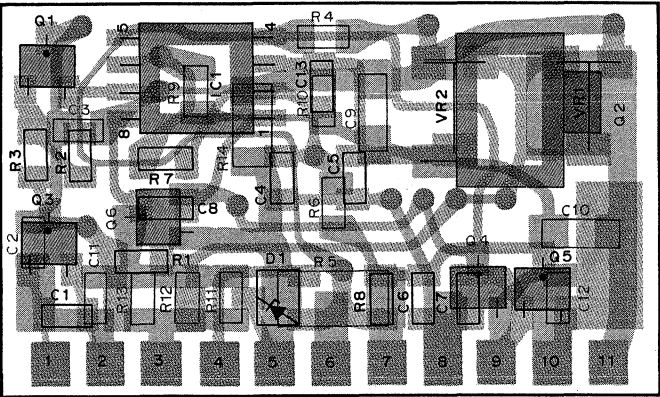
APC (X59-3590-10)

MODULE UNIT (APC) (X59-3590-10)

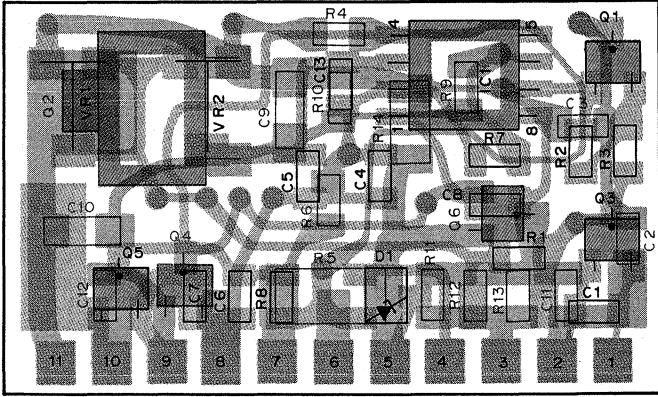


- IC1 : LM301AD
D1 : 02CZ3.9YZ
- Q1 : 2SA1162(Y)
Q2 : 2SB1182F5(Q)
Q3~5 : DTC114YK
Q6 : DTA143EK

APC (X59-3590-10) Component side view



APC (X59-3590-10) Foil side view



■ : Component side
■ : Foil side

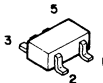
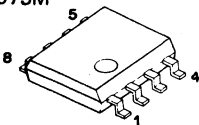
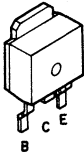
2SA1162
2SC1212
DTA143EK

DTC114YK
DTC144EK

2SB1182F5

LA5005
LM301AD
NJM2073M

FMC5



KSC-4 (RAPID CHARGER)

External view



Specifications

Source voltage	120V/60Hz (M2 type) 220V/50Hz (M type)
Charging current	Approx. 1.1A (KNB-3) Approx. 1.6A (KNB-4)
Charge time	Approx. 1~1.3 hours (at 25°C)
Ambient temperature	5°C~40°C (41°F~104°F)
Dimensions (Body only)	7.87" (200mm) W x 5.28" (134mm) D x 3.35" (85mm) H
Weight	3.57 lbs (1620g) (M2 type) 3.86 lbs (1750g) (M type)

Circuit description

The KSC-4 is a rapid charger for the KNB-3A and KNB-4 Ni-Cd batteries for the TK-330.

Theory of operation

The operation of each block is explained below.

1) + 11V AVR circuit

This AVR circuit, consisting of a 2SD600F transistor (Q1) and DZA11Y Zener diode (DZ1) provides an output of approximately +11V as the reference voltage for the charging circuit consisting of IC2 to IC5.

2) Battery Pack Detect Circuit

This circuit detects whether a battery pack is inserted in the charger. Outputs from this circuit are routed to the reset circuit and the battery recognition circuit.

When a KNB-3A or KNB-4 is inserted in the charger, a small amount of current flows from Q2 : 2SA608E through R9 to the charging terminal B1 and Q2 turns on. As a result, an output of approximately 11V appears at (A) in Figure 1. Similarly when a KNB-4 is inserted Q3 : 2SA608E turns on and approximately 11V is provided at output (B). When a KNB-3A or KNB-4 is charged, Q4 is off and 0V is provided output (C).

TK-330 TK-330

KSC-4 (RAPID CHARGER)

4) Battery Recognition Circuit

The battery recognition circuit uses NAND logic to recognize the battery type from the outputs from the battery pack detect circuit. Outputs from this circuit are sent to the charging current limiting circuit and sensor level switching circuit.

	INPUT							OUTPUT						
BATT.	A	B	C	D	E	F	G							
None	L	L	L	H	H	L	L							
KNB-3A	H	L	L	H	H	L	H							
KNB-4	H	H	L	L	H	L	H							

Table 3

5) Charging Current Limiting Circuit

This circuit receives the output of the battery recognition circuit and limits the charging current according to the type (current capacity) of battery.

The charging current ICR is detected as a voltage drop across R1 (0.15Ω), which is provided to pin 3 of the operational amplifier IC4(1/2) : LA6393A. Pin 4 receives a reference voltage (VREF) used as a comparison standard for limiting the charging current. The VREF is changed by ON and OFF by Q5 and Q6. (See Table 4.)

When a KNB-3A or KNB-4 is charged, Q6 is off. Pin 2 of IC4 provides "L" output when VREF < VCR, stopping the operation of the chopper regulator (IC1 : STK772B) and reducing the charging current. The charging current is limited by the formula:

$$ICR \text{ MAX (A)} = VREF (V) / 0.15(\Omega)$$

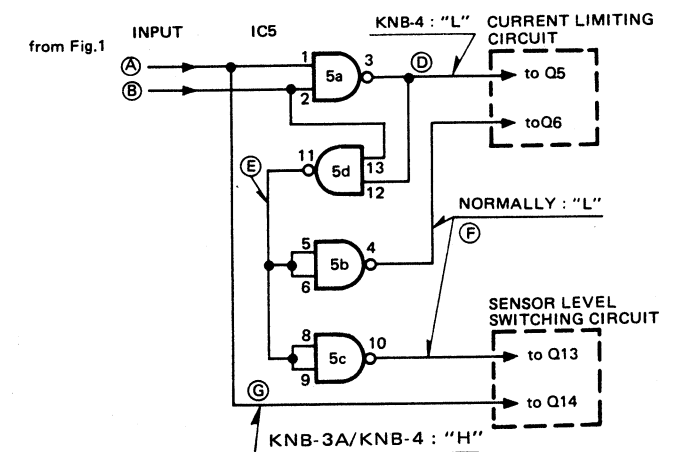


Fig. 3 Battery Recognition Circuit Block Diagram

BATT.	Q5	Q6	VREF	ICR MAX
KNB-3A	OFF	OFF	0.28V	1.8A
KNB-4	ON	OFF	0.36V	2.4A

Table 4

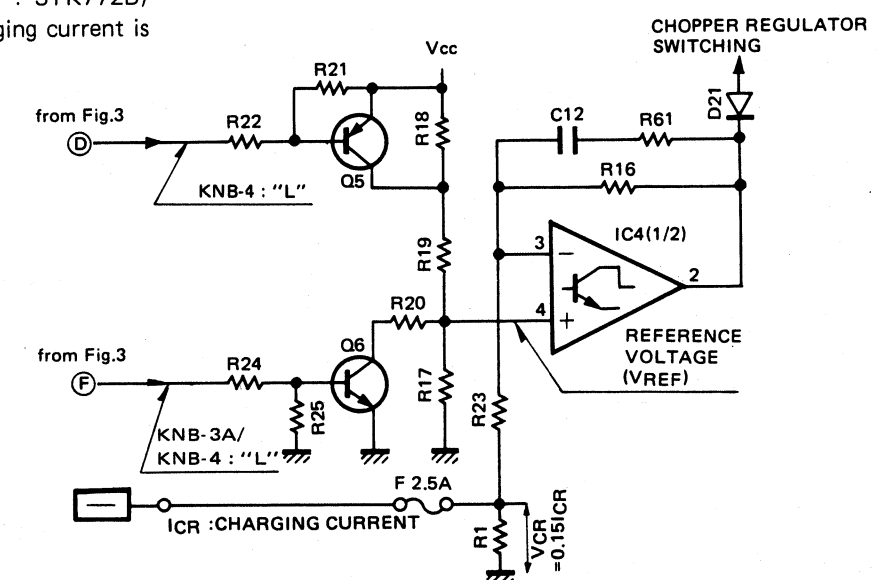


Fig. 4 Charging Current Limiting Circuit Block Diagram

TK-330

KCT-1 (CLONING CABLE) / KCT-2 (PROGRAMMING PLUG) /
KCT-3 (METERING CABLE) / KRA-5A, 5B, 5C (UHF STUBBY ANTENNA)

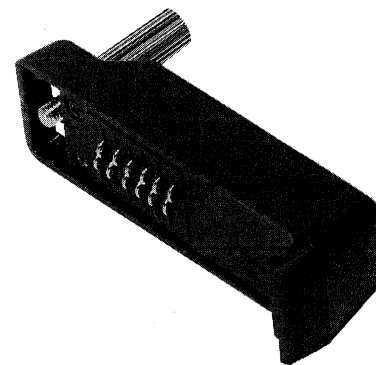
KCT-1 External view

Method of use : See page 8.



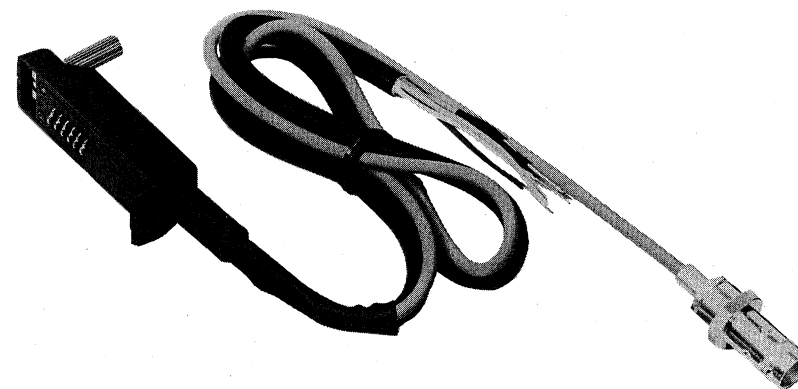
KCT-2 External view

Method of use : See page 8.



KCT-3 External view

Method of use : See page 61.



Note : Before connecting an option to the universal connector, be sure to turn the radio POWER switch off because there is a possibility of a short circuit.

KRA-5A /5B / 5C External view

KRA-5A : 450 ~ 480MHz
KRA-5B : 480 ~ 520MHz
KRA-5C : 400 ~ 430MHz



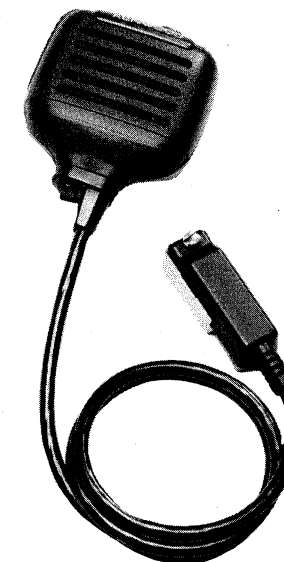
TK-330

KMC-10 (SPEAKER MICROPHONE) /
KMC-11 (SPEAKER MICROPHONE WITH STUBBY ANTENNA)

KMC-10 External view



KMC-11 External view



Note : STUBBY ANTENNA are options (KRA-5A/5B/5C).

Note : Before connecting an option to the universal connector, be sure to turn the radio POWER switch off because there is a possibility of a short circuit.

Specifications

Electrical characteristics

- **Speaker**
 - Diameter 45mm
 - Impedance 16Ω
 - Rated input power 0.5W
 - Max. input power 1.0W
- **Microphone**
 - Sensitivity -65dB ± 4dB at 1000Hz*
 - Output impedance 680Ω ± 30% at 1000Hz*

* : RL 680Ω, 4.5V

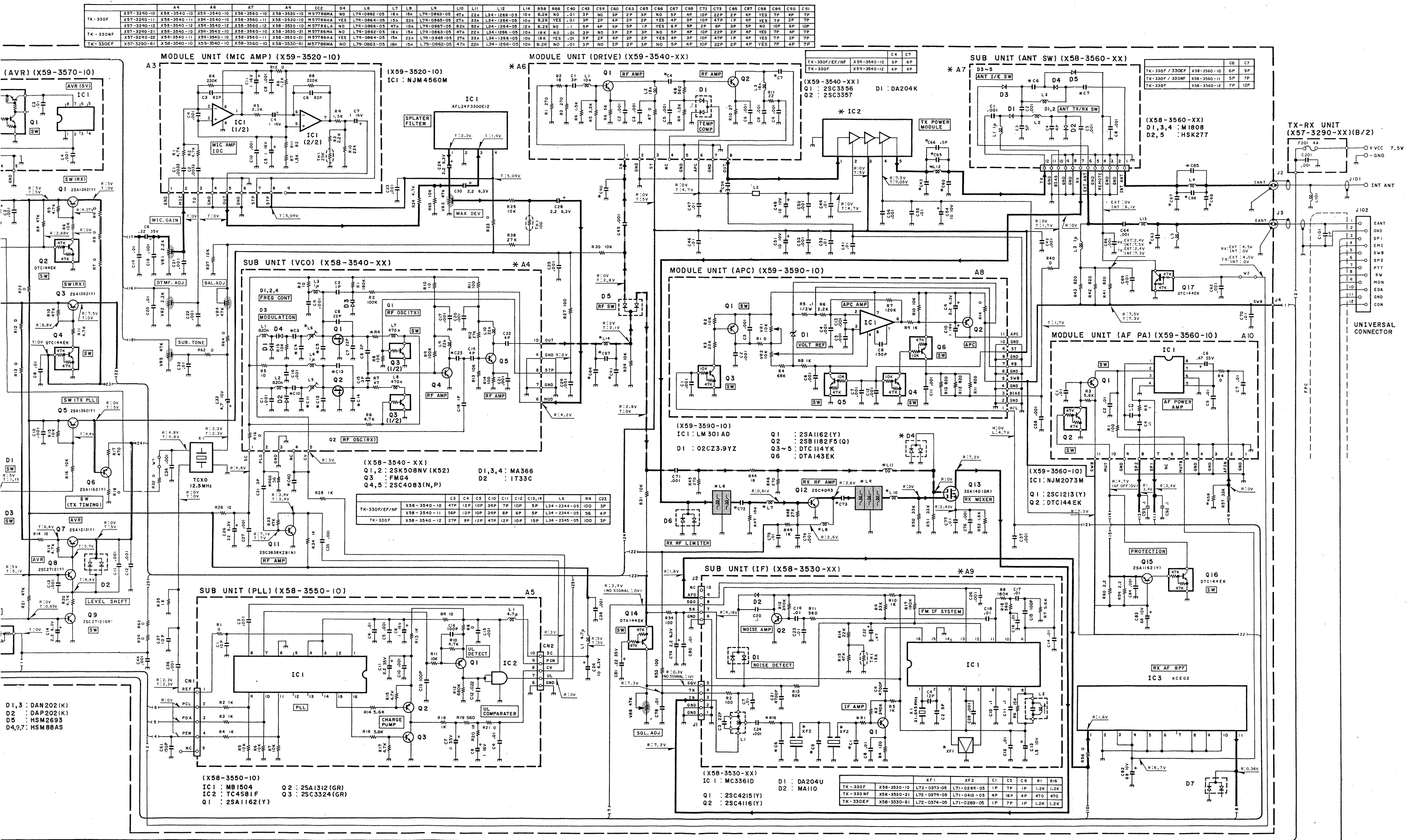
Parts list

* : New parts

Ref. No.	New parts	Parts No.	Description	Re-marks
	*	A02-0904-13	Case (Rectangular plug)	
	*	A02-0907-08	Case (Front)	A
	*	A02-0908-08	Case (Rear)	A
	*	A02-0909-08	Case (Front)	B
	*	A02-0910-08	Case (Rear)	B
	*	B09-0316-08	Cap (ANT)	A
	*	B50-8307-08	Instruction manual	
	*	D10-0606-08	Lever (PTT)	
	*	E06-0154-08	ANT receptacle	B
	*	E09-1273-05	Rectangular plug	
	*	E11-0436-08	Phono jack	
	*	E30-2163-08	Curlicode assy	A
	*	E30-2164-08	Cord assy	B
	*	F07-0888-04	Cover (Rectangular plug)	
	*	F07-0889-08	Silicon rubber (PTT)	
	*	G02-0585-04	Flat spring	
	*	G53-0569-08	Packing (MIC case)	
	*	J29-0440-08	Clip assy	
	*	J31-0532-08	Packing (MIC)	
	*	J42-0457-04	Bushing (Rectangular plug)	
	*	J42-0458-08	Bushing (MIC case)	
	*	N08-0518-08	Decorated screw (Rectangular plug)	
	*	N09-2058-05	Screw	
	*	S50-1415-05	Tact switch	
	*	T07-0258-08	Loudspeaker	
	*	T91-0385-08	Condenser mic	

A : KMC-10
B : KMC-11

SCHEMATIC DIAGRAM TK-330

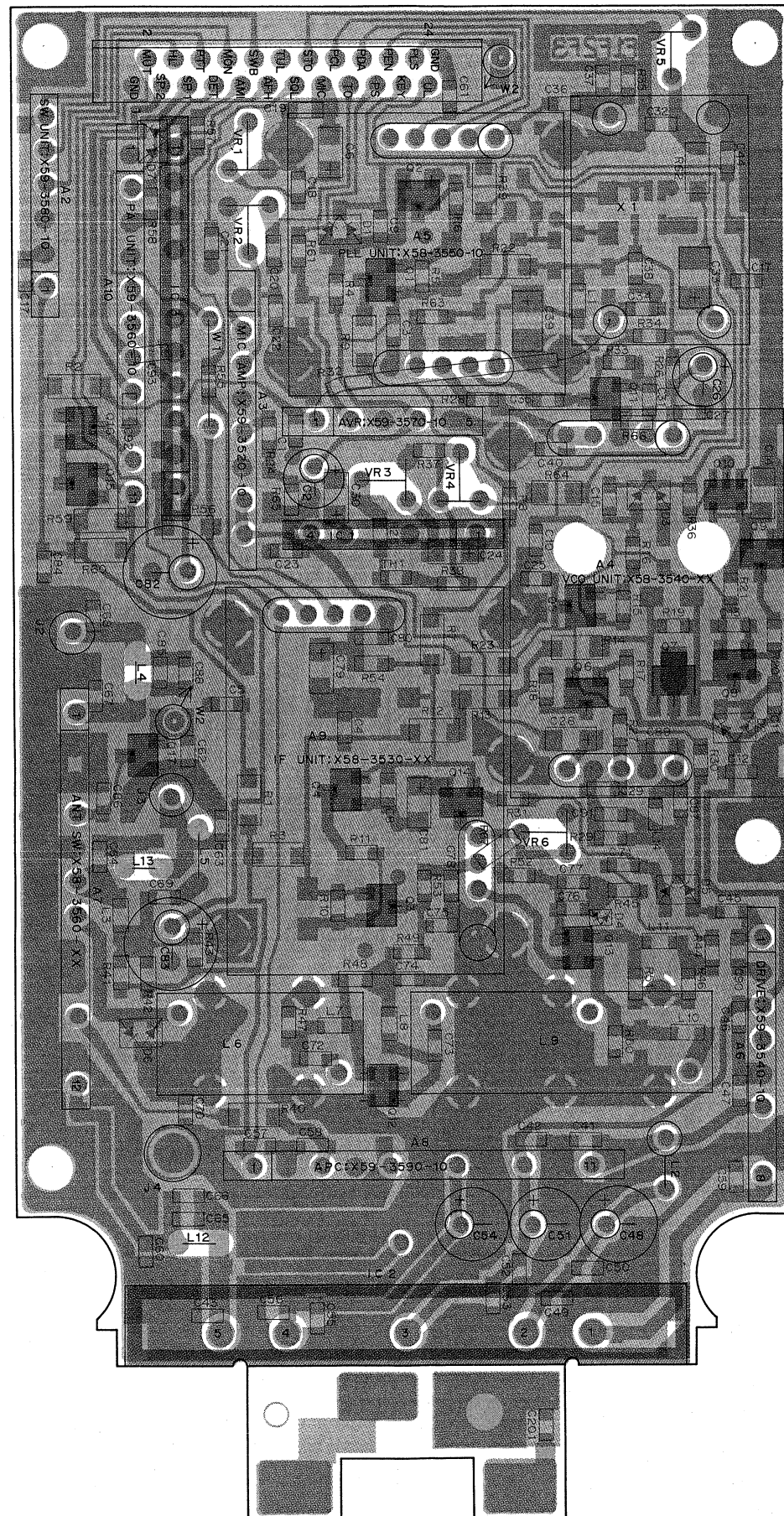




TK-330 PC BOARD VIEWS

TX-RX UNIT (X57-3290-XX) Foil side view

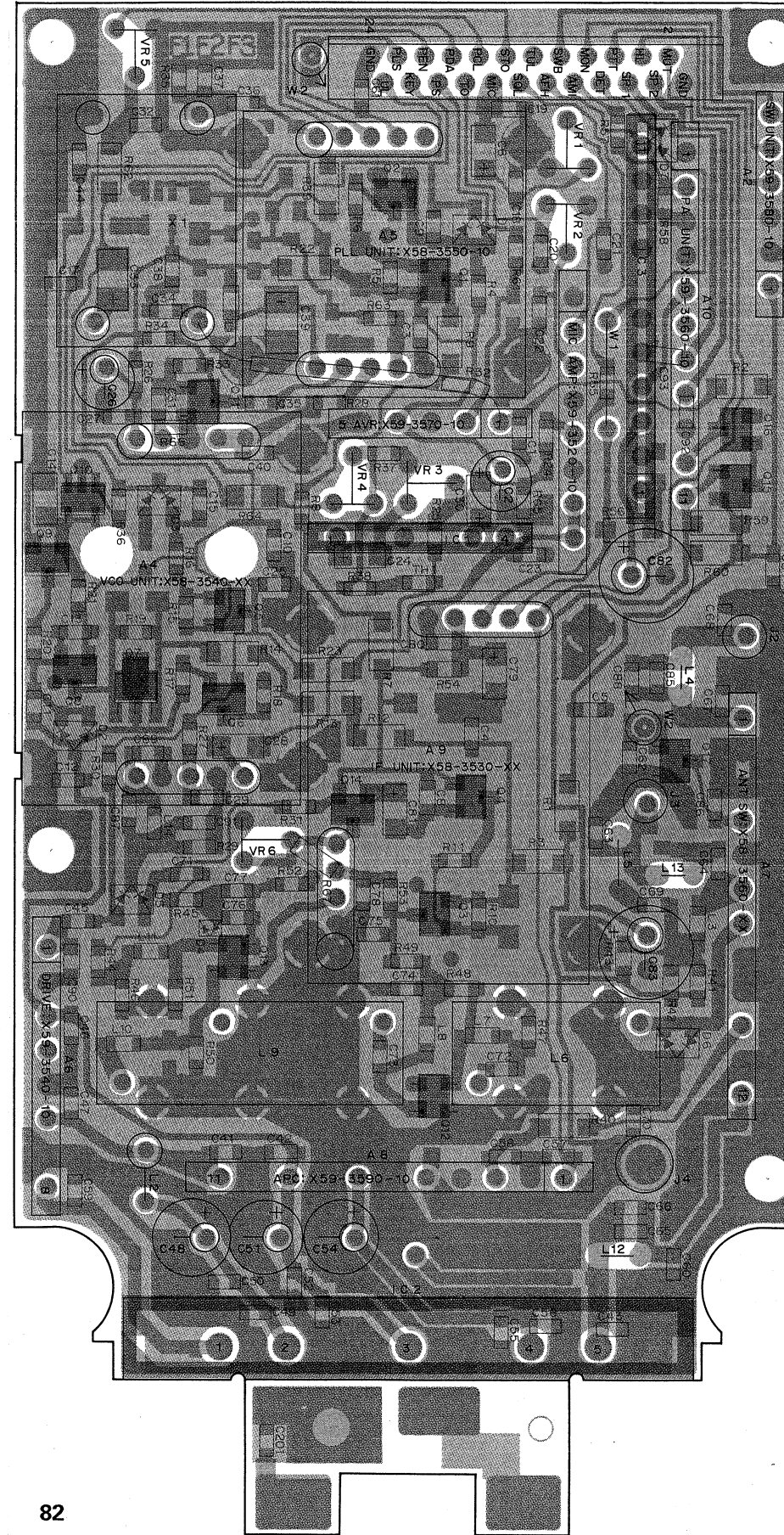
-10 : TK-330(F) M -11 : TK-330(F) M2 -12 : TK-330(F) M3 -21 : TK-330(NF) M -22 : TK-330(NF) M2 -61 : TK-330(EF) E



IC1 : AFL24F3300E12 IC2 : M57786MA or M57786HA or M57786LA IC3 : KCE02
Q1, 3, 5 : 2SA1362(Y) Q2, 4, 16, 17 : DTC144EK Q6, 15 : 2SA1162(Y) Q7 : 2SA1213(Y) Q8 : 2SC2712(Y) Q9 : 2SC2712(GR) Q10 : FMG2 Q11 : 2SC3838KZB(N)
Q12 : 2SC4093 Q13 : 3SK140(GR) Q14 : DTA144EK
D1, 3 : DAN202K D2 : DAP202K D4, 6, 7 : HSM88AS D5 : HSM2693

TX-RX UNIT (X57-3290-XX) Component side view

-10 : TK-330(F) M -11 : TK-330(F) M2 -12 : TK-330(F) M3 -21 : TK-330(NF) M -22 : TK-330(NF) M2 -61 : TK-330(EF) E



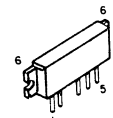
2SA1162
2SA1362
2SC2712
2SC3838KZB
DTA144EK
DTC144EK



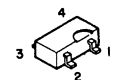
2SA1213



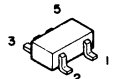
M57786MA
M57786LA
M57786HA



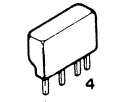
2SC4093
3SK140



FMG2

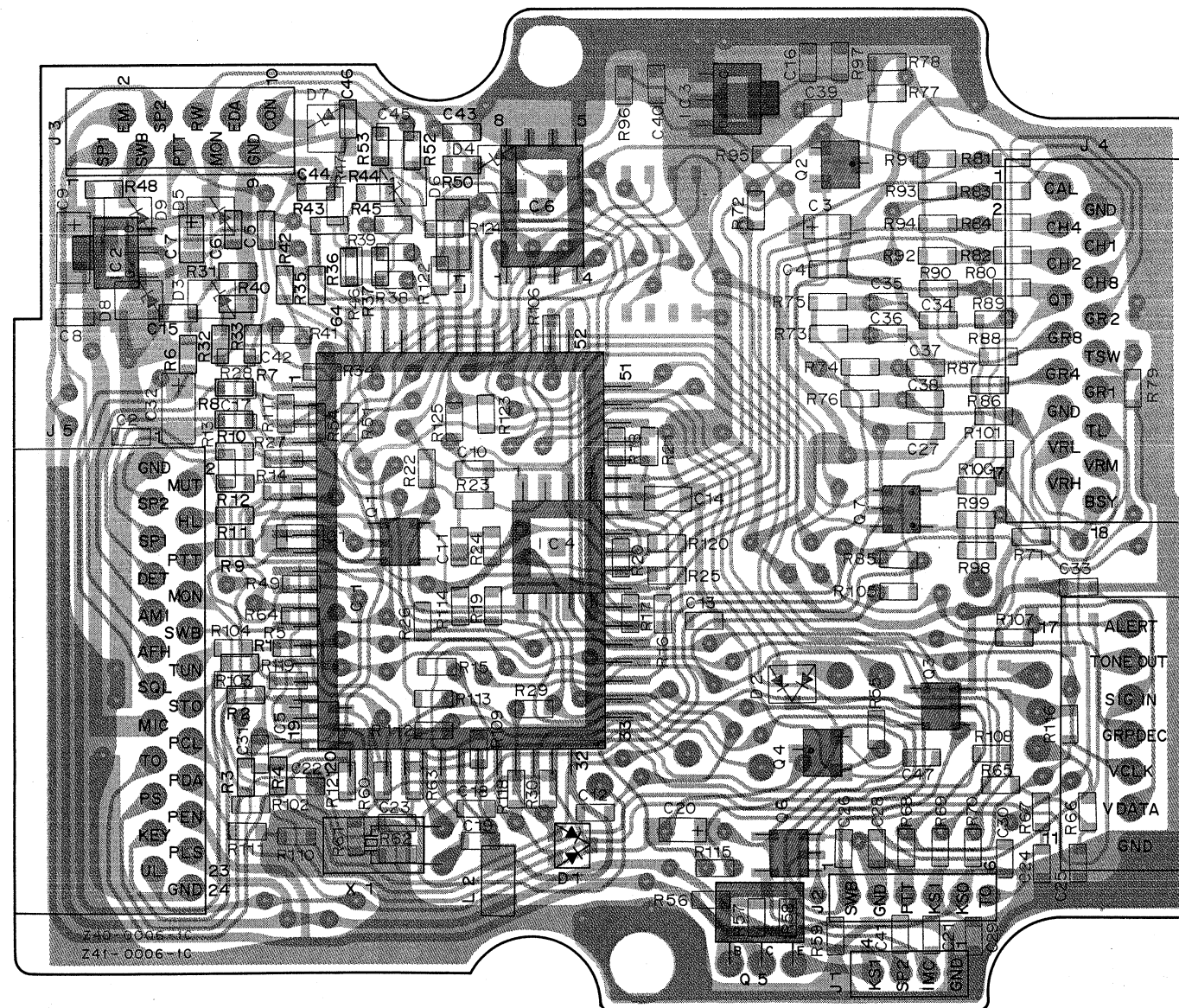


AFL24F3300E12

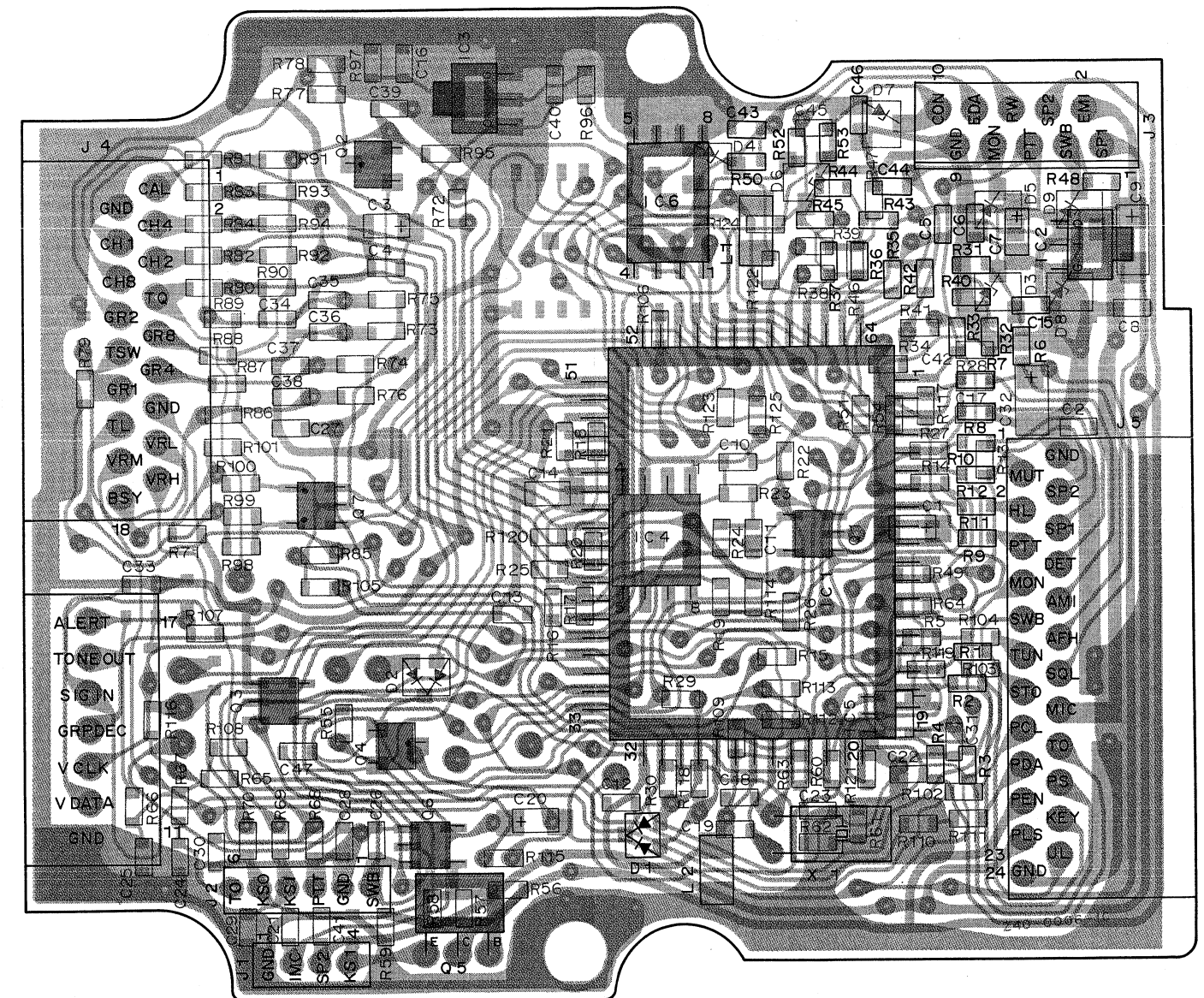


■ : Component side
■ : Foil side

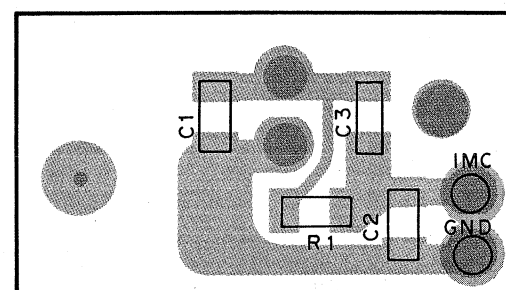
CONTROL UNIT (X53-3320-20) Component side view



CONTROL UNIT (X53-3320-20) Foil side view

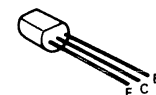


MIC UNIT (X42-3020-10)
Component side view



■ : Component side
■ : Foil side

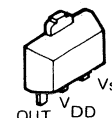
2SD1246



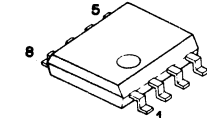
DTC363EK
DTA114EK



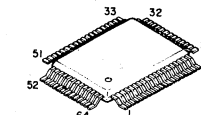
S-8054HN-CB
S-81250HG-RD



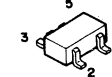
NJM4558M
CAT35C104KI



μPD78P312AGF



FMA1
FMC5



TC4S66F



IC1 : μPD78P312AGF IC2 : S-81250HG-RG IC3 : S-8054HN-CB IC4 : NJM4558M IC5 : TC4S66F
IC6 : CAT35C104KI
Q1,3,6 : FMC5 Q2 : DTA114EK Q4 : DTC363EK Q5 : 2SD1246(S,T) Q7 : FMA1
D1,2 : DAN202U D3~8 : 02CZ9.1(X,Y) or RD9.1M-B2 D9 : 02CZ10(X,Y) or RD10M-B1

KSC-4 (RAPID CHARGER)

4) Battery Recognition Circuit

The battery recognition circuit uses NAND logic to recognize the battery type from the outputs from the battery pack detect circuit. Outputs from this circuit are sent to the charging current limiting circuit and sensor level switching circuit.

	INPUT			OUTPUT			
BATT.	A	B	C	D	E	F	G
None	L	L	L	H	H	L	L
KNB-3A	H	L	L	H	H	L	H
KNB-4	H	H	L	L	H	L	H

Table 3

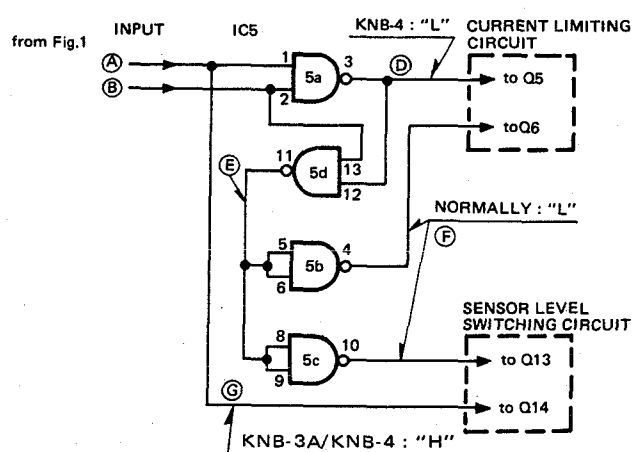


Fig. 3 Battery Recognition Circuit Block Diagram

5) Charging Current Limiting Circuit

This circuit receives the output of the battery recognition circuit and limits the charging current according to the type (current capacity) of battery.

The charging current ICR is detected as a voltage drop across R1 (0.15Ω), which is provided to pin 3 of the operational amplifier IC4(1/2) : LA6393A. Pin 4 receives a reference voltage (VREF) used as a comparison standard for limiting the charging current. The VREF is changed by ON and OFF by Q5 and Q6. (See Table 4.)

When a KNB-3A or KNB-4 is charged, Q6 is off. Pin 2 of IC4 provides "L" output when VREF < VCR, stopping the operation of the chopper regulator (IC1 : STK772B) and reducing the charging current. The charging current is limited by the formula:

$$ICR \text{ MAX (A)} = VREF(V)/0.15(\Omega)$$

BATT.	Q5	Q6	VREF	ICR MAX
KNB-3A	OFF	OFF	0.28V	1.8A
KNB-4	ON	OFF	0.36V	2.4A

Table 4

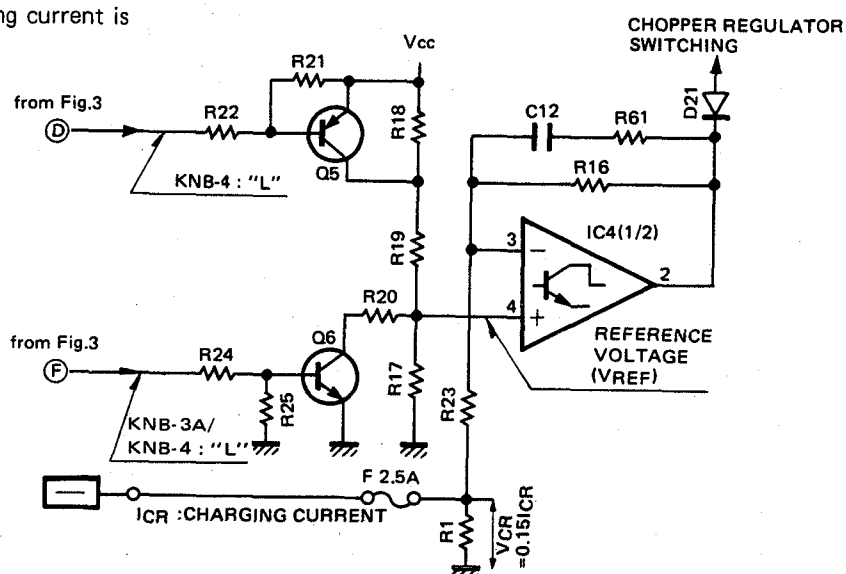


Fig. 4 Charging Current Limiting Circuit Block Diagram

KSC-4 (RAPID CHARGER)

6) Sensor Level Switching Circuit

This circuit receives the output of the battery recognition circuit and aligns the voltages supplied to the charging status detect circuit according to the battery type (voltage) so that they are nearly equal at completion of charging.

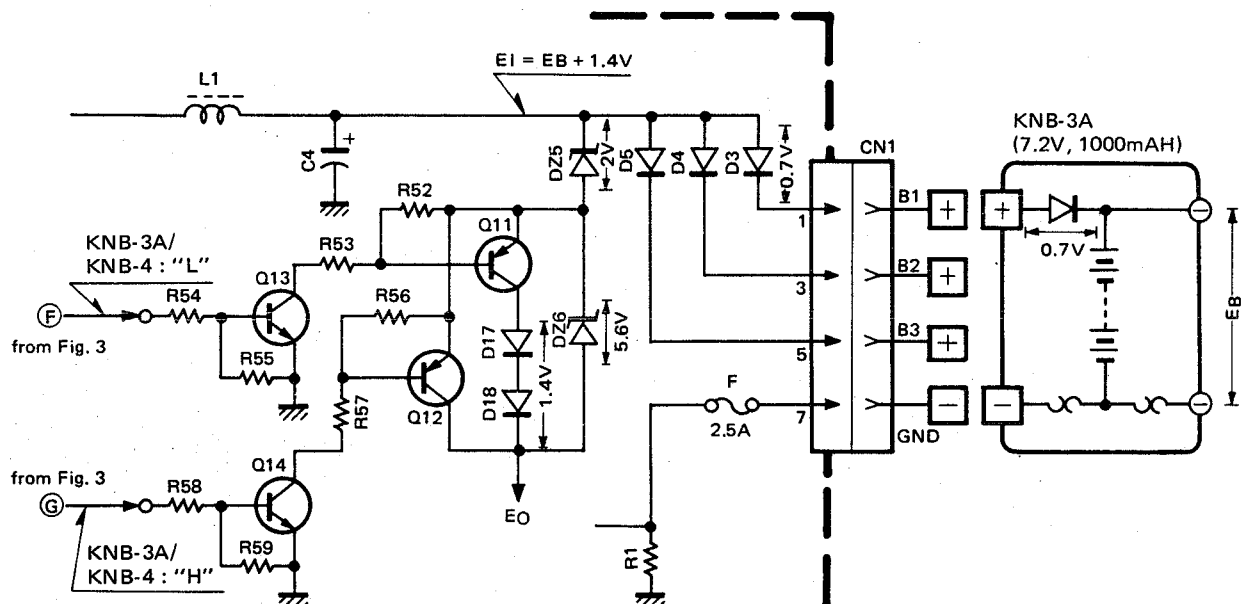


Fig. 5 Sensor Level Switching Circuit Block Diagram

The pin voltages while the Ni-Cd battery is charging are approximately 1.2 times the voltages at the completion of charging. (See **Figure 6**.) The battery terminal voltage EB is as follows:

Approximately 8.6V for the KNB-3A (7.2V, 1000mAh)
 Approximately 8.6V for the KNB-4 (7.2V, 1600mAh)

The charging line voltage EI is the EB voltage plus a 1.4V voltage drop added by a diode.

$$EI = EB + 1.4V \dots (1)$$

The EI voltage is output with a level shift as the voltage E0 to the charging status detect circuit via Zener diode DZ6 and diodes D17 and D18. The amount of the shift is controlled by switching Q11 and Q12 on and off. When a KNB-3A or KNB-4 is charged, Q11 is off and Q12 is on. E0 is required by the following formula:

$$\text{KNB-3A or KNB-4: } E0 = EB - 0.6V = 8.6V - 0.6V = 8V$$

At the completion of charging the value is approximately 8V.

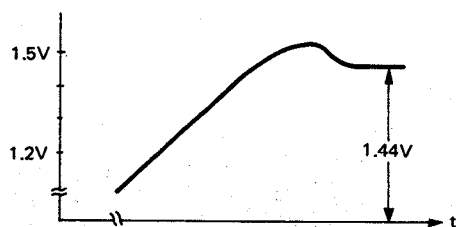


Fig. 6 The pin voltages while the Ni-CD Battery is charging

KSC-4 (RAPID CHARGER)

7) Charging Status Detect Circuit

This circuit detects the completion of charging and outputs a signal to stop charging. When no battery pack is inserted or charging is completed, a High ("H") Reset signal is applied to D15. When a battery is inserted the Reset signal applied to D15 is cleared. When the Reset signal is cleared, pin 4 of IC2 holds the reset state due to the charge in C8 for the duration of the R46-C8 time constant, then goes "L" to clear the reset state. Pins 8 and 9 of IC2 receive divided portions of the battery voltage. These inputs are tracked as the charging is performed in the long-term memory capacitor "MD". As the Ni-Cd battery charges, the battery voltage reaches a peak, then declines. (See Figure 6.)

The "MD" stores the peak voltage, which is compared with the divided voltages at pins 8 and 9. When the difference ΔV is the same, a "L" signal is output from pin 11 to indicate that charging is complete. The signal indicating completion of charging is applied to the charging status memory circuit.

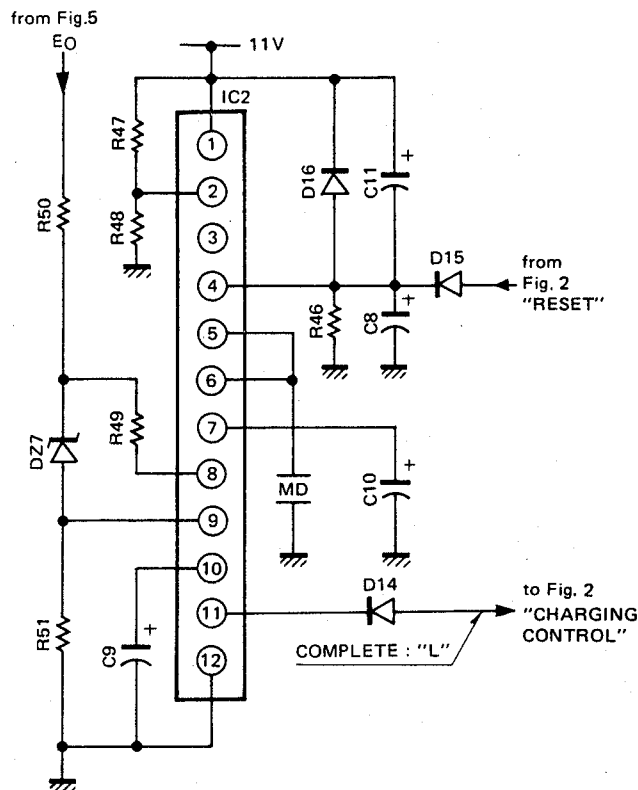


Fig. 7 Charging Status Detect Circuit Block Diagram

8) Timer Circuit

Battery defects may result in charging continuing indefinitely without completion, so this timer outputs a signal that stops charging approximately 1.7 hours after charging begins. When charging begins and the Reset signal is cleared at pin 3, IC3 : AN6780 begins counting. At the first count of 16384 pin 6 goes from "H" to "L". The output from pin 6 is connected to the Stop input (pin 2), so the output of IC3 is held in the "L" state until IC3 receives another Reset signal (for example, when the battery is removed).

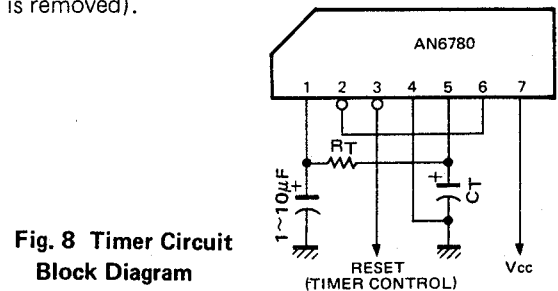
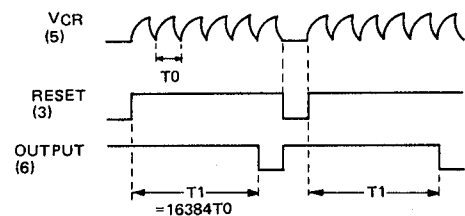


Fig. 8 Timer Circuit Block Diagram

Fig. 9
TIMER TIME $T_1(s) \approx 11R_T(K\Omega) \cdot CT(\mu F)$
TIMER TIME $T_1(s) \approx 11 \times 56(K\Omega) \cdot 10(\mu F) = 6160(s)$

9) Voltage Comparator Circuit

This circuit monitors the output (EO) of the sensor level switching circuit and indirectly detects abnormal conditions in the battery pack connected to the charging terminal. When the EO voltage falls to 5.2V or lower, the charging control line goes "L" to halt charging.

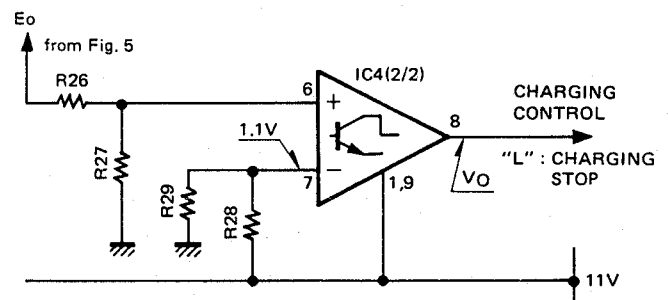


Fig. 10 Voltage Comparator Circuit Block Diagram

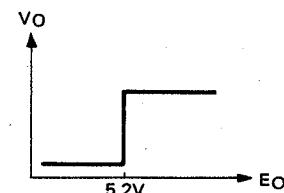


Fig. 11

KSC-4 (RAPID CHARGER)

* New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Teile ohne Parts No. werden nicht geliefert.

Parts list

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
KSC-4						
1	1A	*	A02-0775-08	CASE		
2	1A,1B	*	A02-0778-05	BATTERY POCKET		
3	1B		B46-0418-00	WARRANTY CARD		
4	1B	*	B50-8133-08	INSTRUCTION MANUAL (KSC-4/5)		
5	1B	*	E23-0488-05	TERMINAL		
6	2A		E30-2038-08	AC CORD		
8	2B	*	H01-8061-08	ITEM CARTON CASE		
9	2B		H10-2584-02	POLYSTYRENE FOAMED FIXTURE (L)		
10	2B		H10-2585-02	POLYSTYRENE FOAMED FIXTURE (R)		
11	3A		J02-0439-05	FOOT		
12	3A	*	J39-0424-05	SPACER		
T1	2A	*	L01-8081-08	POWER TRANSFORMER (AC120V)	M2	
T1	2A	*	L01-8112-08	POWER TRANSFORMER (AC220V)	M	
A	3A		N30-3006-41	MACHINE SCREW (M3 X 6)		
B	2A,1B		N34-4006-46	MACHINE SCREW (M4 X 6 Tr)		
C	2A,1B		N35-4006-45	MACHINE SCREW (M4 X 6 Bi) BLK		
D	2A		N87-3008-46	TAPTITE SCREW (φ3 X 8 Br)		
E	1A		N89-3008-45	TAPTITE SCREW (φ3 X 8 Bi) BLK		
7	3B	*	W02-0389-05	CHARGE CONTROL UNIT		
CHARGE CONTROL UNIT (W02-0389-05)						
C1			CE04EW1V222M	ELECTRO 2200μF 35WV		
C2			CE04EW1C470M	ELECTRO 47μF 16WV		
C3			CE04EW1H010M	ELECTRO 1μF 50WV		
C4			CE04EW1E471M	ELECTRO 470μF 25WV		
C5,6			CE04EW1C100M	ELECTRO 10μF 16WV		
C7			CE04EW1A101M	ELECTRO 100μF 10WV		
C8			CE04EW1C100M	ELECTRO 10μF 16WV		
C9,10			CE04EW0J101M	ELECTRO 100μF 6.3WV		
C11			CE04EW1C330M	ELECTRO 33μF 16WV		
C12			CK45B1H102K	CERAMIC 0.001μF 50WV		
C14			CE04EW1H010M	ELECTRO 1μF 50WV		
MD			C91-1038-08	ELECTRO		
F1		*	F06-2522-05	FUSE (2.5A)	M,M2	

E: Scandinavia & Europe H: Audio Club K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe)

X: Australia

⚠ indicates safety critical components.

KSC-4 (RAPID CHARGER)

× New Parts

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Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
L1		*	L33-0694-08	CHOKE COIL (470 μ H)		
R1		*	R92-0683-08	FL-PROOF 0.15 Ω 4W		
R2			RD14CB2E202J	RD 2K 1/4W		
R3			RD14BB2E302J	RD 3K 1/4W		
R4,5			RD14CB2E103J	RD 10K 1/4W		
R6-9			RD14BB2E103J	RD 10K 1/4W		
R10-12			RD14BB2E202J	RD 2K 1/4W		
R13			RD14BB2E303J	RD 30K 1/4W		
R14,15			RD14CB2E303J	RD 30K 1/4W		
R16			RD14CB2E204J	RD 200K 1/4W		
R17			RD14CB2E391J	RD 390 1/4W		
R18			RD14CB2E362J	RD 3.6K 1/4W		
R19			RD14CB2E113J	RD 11K 1/4W		
R20			RD14BB2E102J	RD 1K 1/4W		
R21			RD14CB2E203J	RD 20K 1/4W		
R22			RD14BB2E203J	RD 20K 1/4W		
R23			RD14BB2E512J	RD 5.1K 1/4W		
R24			RD14BB2E203J	RD 20K 1/4W		
R25			RD14CB2E103J	RD 10K 1/4W		
R26			RD14BB2E103J	RD 10K 1/4W		
R27			RD14CB2E272J	RD 2.7K 1/4W		
R28			RD14CB2E912J	RD 9.1K 1/4W		
R29			RD14CB2E102J	RD 1K 1/4W		
R30			RD14BB2E563J	RD 56K 1/4W		
R31			RD14BB2E202J	RD 2K 1/4W		
R32			RD14CB2E204J	RD 200K 1/4W		
R33			RD14BB2E103J	RD 10K 1/4W		
R34			RD14BB2E682J	RD 6.8K 1/4W		
R35			RD14CB2E203J	RD 20K 1/4W		
R36			RD14BB2E303J	RD 30K 1/4W		
R37			RD14CB2E203J	RD 20K 1/4W		
R38			RD14CB2E103J	RD 10K 1/4W		
R39			RD14BB2E103J	RD 10K 1/4W		
R40			RD14BB2E162J	RD 1.6K 1/4W		
R42			RD14CB2E103J	RD 10K 1/4W		
R43			RD14BB2E203J	RD 20K 1/4W		
R44,45			RD14CB2E103J	RD 10K 1/4W		
R46			RD14CB2E825J	RD 8.2M 1/4W		
R47			RD14CB2E104J	RD 100K 1/4W		
R48			RD14CB2E122J	RD 1.2K 1/4W		
R49			RD14BB2E563J	RD 56K 1/4W		

E: Scandinavia & Europe H: Audio Club K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

⚠ indicates safety critical components.

KSC-4 (RAPID CHARGER)

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Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
R50			RD14BB2E431J	RD 430 1/4W		
R51			RD14CB2E130J	RD 13 1/4W		
R52			RD14CB2E203J	RD 20K 1/4W		
R53,54			RD14BB2E203J	RD 20K 1/4W		
R55			RD14CB2E103J	RD 10K 1/4W		
R56-58			RD14BB2E203J	RD 20K 1/4W		
R59			RD14CB2E103J	RD 10K 1/4W		
R61			RD14CB2E104J	RD 100K 1/4W		
R62			RD14CB2E103J	RD 10K 1/4W		
R63			RD14BB2E302J	RD 3K 1/4W		
R64			RD14BB2E431J	RD 430 1/4W		
D1-5			DSA26B	DIODE		
D6-21			DS442	DIODE		
DZ1		*	GZA11Y	ZENER DIODE (11V)		
DZ2-4		*	GZA10Z	ZENER DIODE (10V)		
DZ5		*	GZA2.0X	ZENER DIODE (2V)		
DZ6		*	GZA5.6X	ZENER DIODE (5.6V)		
DZ7		*	GZA7.5Y	ZENER DIODE (7.5V)		
DZ8		*	GZA3.0X	ZENER DIODE (3V)		
IC1		*	STK772B	IC (CHOPPER REGULATOR)		
IC2		*	KCH-1003	IC (VOLTAGE SENSOR)		
IC3			AN6780	IC (TIMER)		
IC4			LA6393S	IC (DUAL OP IC)		
IC5			LC4011B	IC (QUADRUPLE NAND GATE)		
Q1		*	2SD600F,KF	TRANSISTOR		
Q2-5		*	2SA608E,F	TRANSISTOR		
Q6		*	2SC536E,F	TRANSISTOR		
Q7		*	2SA608E,F	TRANSISTOR		
Q8-10			2SC536E,F	TRANSISTOR		
Q11,12			2SA608E,F	TRANSISTOR		
Q13,14			2SC536E,F	TRANSISTOR		
LED1	2A		SLP-540D	LED (RED/GRN)		

E: Scandinavia & Europe H: Audio Club K: USA P: Canada W: Europe

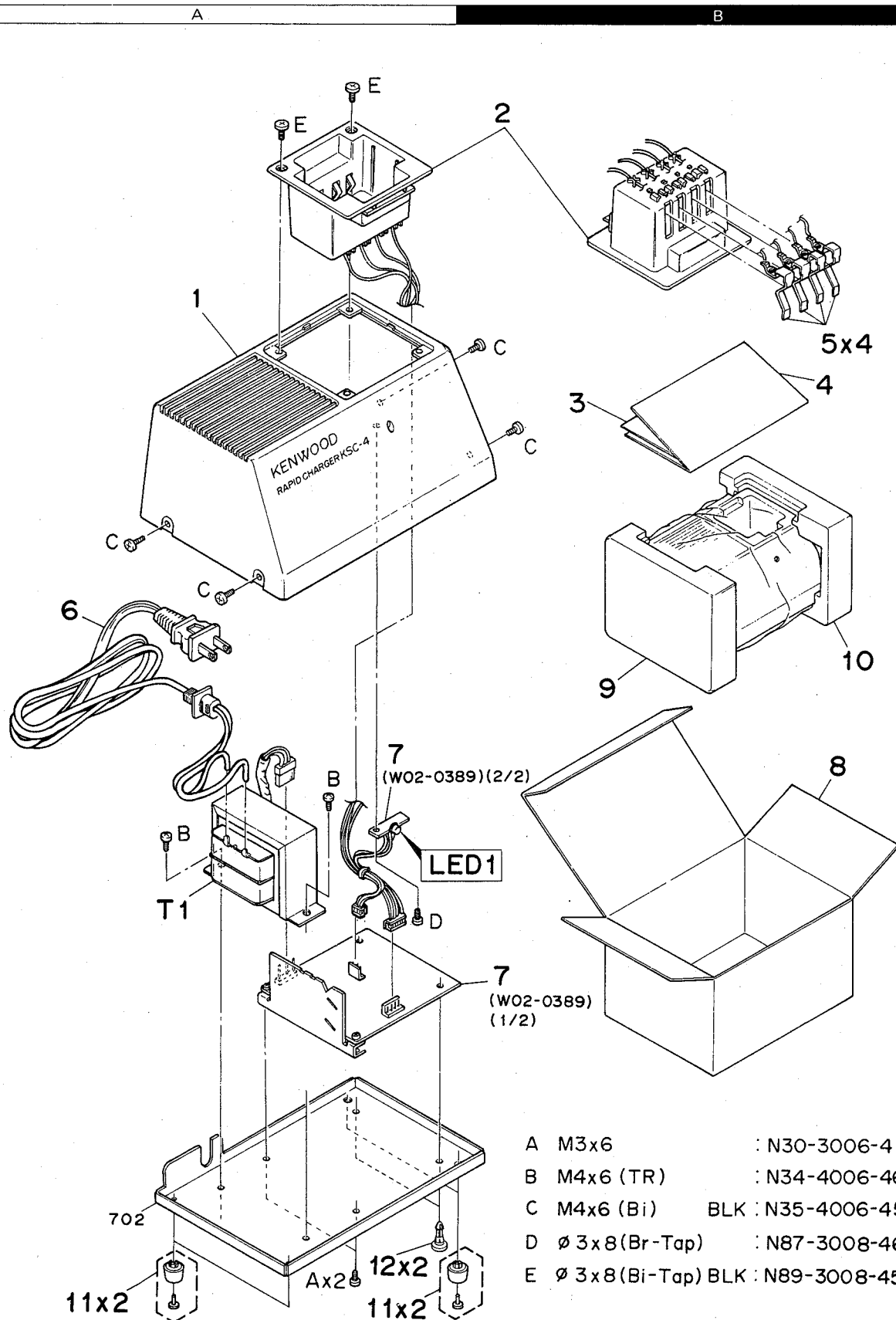
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UE: AAFES(Europe) X: Australia

⚠ indicates safety critical components.

Exploded view

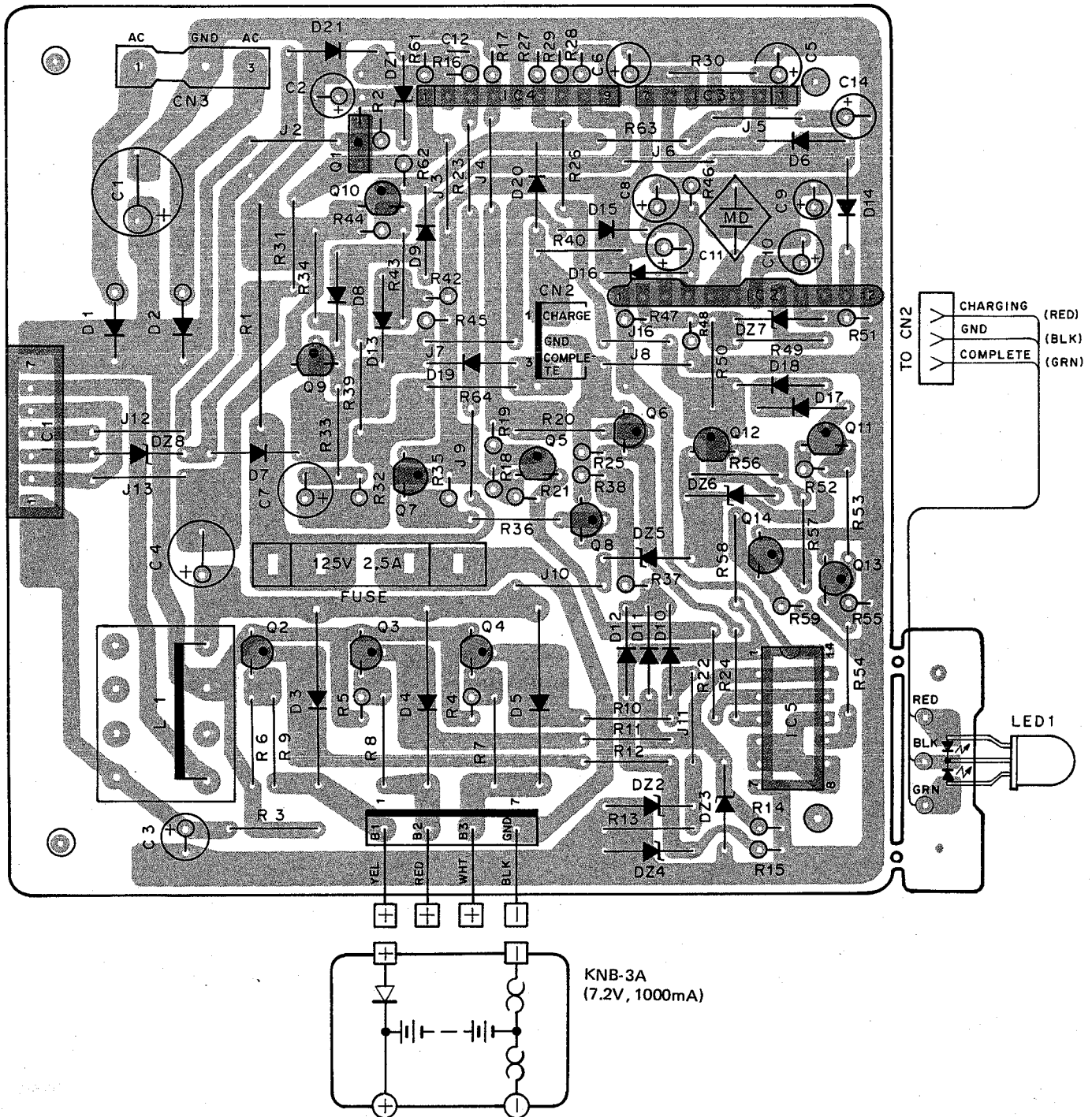
KSC-4 (RAPID CHARGER)



Parts with the exploded numbers larger than 700 are not supplied.

KSC-4 (RAPID CHARGER)

PC board view



IC1 : STK772B IC2 : KCH-1003 IC3 : AN6780 IC4 : LA6393S IC5 : LC4011B

Q1 : 2SD600F,KF Q2-5 : 2SA608E,F Q6 : 2SC536E,F Q7 : 2SA608E,F Q8-10 : 2SC536E,F Q11,12 : 2SA608E,F Q13,14 : 2SC536E,F

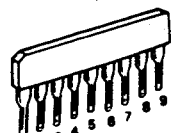
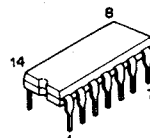
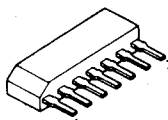
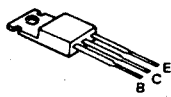
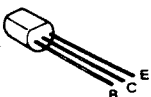
2SA608E,F

2SD600F,KF
2SC536E,F

AN6780

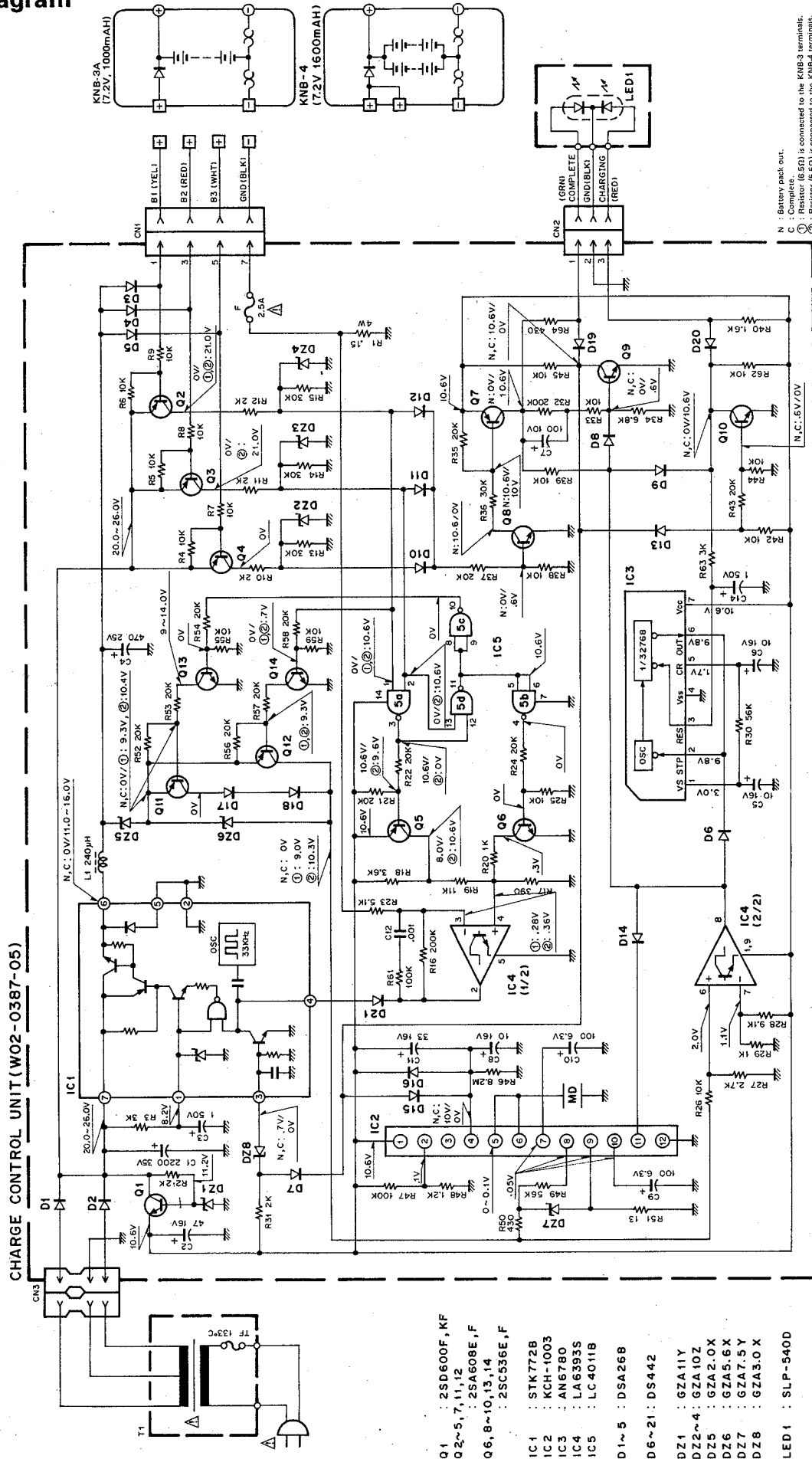
LC4011B

LA6393S



Schematic diagram

KSC-4 (RAPID CHARGER)



KSC-5 (REGULAR RATE CHARGER)

External view



Specifications

Source voltage	120V/60Hz (M2 type) 220V/50Hz (M type)
Charging current	Approx. 80mA (KNB-3) Approx. 160mA (KNB-4)
Charge time	Approx. 15 hours (at 25°C)
Ambient temperature	5°C~40°C (41°F~104°F)
Dimensions (Body only)	7.87" (200mm) W x 5.28" (134mm) D x 3.35" (85mm) H
Weight	1.81 lbs (820g) (M2 type) 1.9 lbs (860g) (M type)

Circuit description

The KSC-5 is a trickle charger for the KNB-3A and KNB-4 Ni-Cd batteries.

Charging Circuit

When a KNB-3A is connected, charging current flows through Q1 : 2SB507E. The current flow to Q1 is limited to a value determined by the voltage drop across R3, Zener diode DZ1, and the base-to-emitter voltage VBE of Q1, given by the following formula:

$$I = \frac{(DZ1 \text{ voltage} - VBE \text{ of } Q1)}{R3} = \frac{(2V - 0.7V)}{15\Omega} = \frac{1.3}{15} \approx 87mA \text{ (Approx.)}$$

The equations above indicate that the KNB-3A charges at a maximum 87mA. As charging progresses, this value becomes lower.

When a KNB-4 is connected, charging current flows through Q1 and Q2 : 2SB507E. The maximum current through Q1 is 87mA as above. The current through Q2 is limited in the same way as the current through Q1, resulting in the same maximum 87mA. The KNB-4 is charged by the sum of the Q1 and Q2 currents (maximum 174mA). As charging progresses, the value becomes lower.

Indicator Circuit

The voltage drop across the emitter resistor R3 of Q1 turns on Q3 : 2SA608E, supplying current to the CHARGING indicator in LED1.

KSC-5 (REGULAR RATE CHARGER)

* New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Teile ohne Parts No. werden nicht geliefert.

Parts list

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
KSC-5						
1	1A	*	A02-0774-08	CASE		
2	1A,1B		A02-0778-05	BATTERY POCKET		
4	1B		B50-8133-08	INSTRUCTION MANUAL (KSC-4/5)		
5	1B		E23-0488-05	TERMINAL		
6	2A		E30-2038-08	AC CORD		
8	2B	*	H01-8064-08	ITEM CARTON CASE		
9	2B		H10-2584-02	POLYSTYRENE FOAMED FIXTURE (L)		
10	2B		H10-2585-02	POLYSTYRENE FOAMED FIXTURE (R)		
11	3A		J02-0439-05	FOOT		
12	3A		J39-0424-05	SPACER		
T1	2A	*	L01-8071-08	POWER TRANSFORMER (AC120V)	M2	
T1	2A	*	L01-8102-08	POWER TRANSFORMER (AC220V)	M	
B	2A	*	N34-3006-46	MACHINE SCREW (M3 X 6 Tr)		
C	2A,1B		N35-4006-45	MACHINE SCREW (M4 X 6 Bi) BLK		
D	2A		N87-3006-46	TAPTITE SCREW (φ 3 X 6 Br)		
E	1A		N89-3008-45	TAPTITE SCREW (φ 3 X 8 Bi) BLK		
7	3A	*	W02-0390-05	MODULE UNIT		
MODULE UNIT (W02-0390-05)						
C1			CE04EW1E471M	ELECTRO 470μF 25WV		
R1			RD14BB2E302J	RD 3K 1/4W		
R2			RD14BB2E103J	RD 10K 1/4W		
R3,4			RD14BB2E150J	RD 15 1/4W		
R5,6			RD14BB2E223J	RD 22K 1/4W		
D1,2		*	DS135E	DIODE		
DZ1,2			GZA2.0X	ZENER DIODE (2V)		
Q1, 2			2SB507E	TRANSISTOR		
Q3			2SA608E,F	TRANSISTOR		
LED1		*	SLP-136B	LED (RED)		

E: Scandinavia & Europe H: Audio Club K: USA P: Canada W: Europe

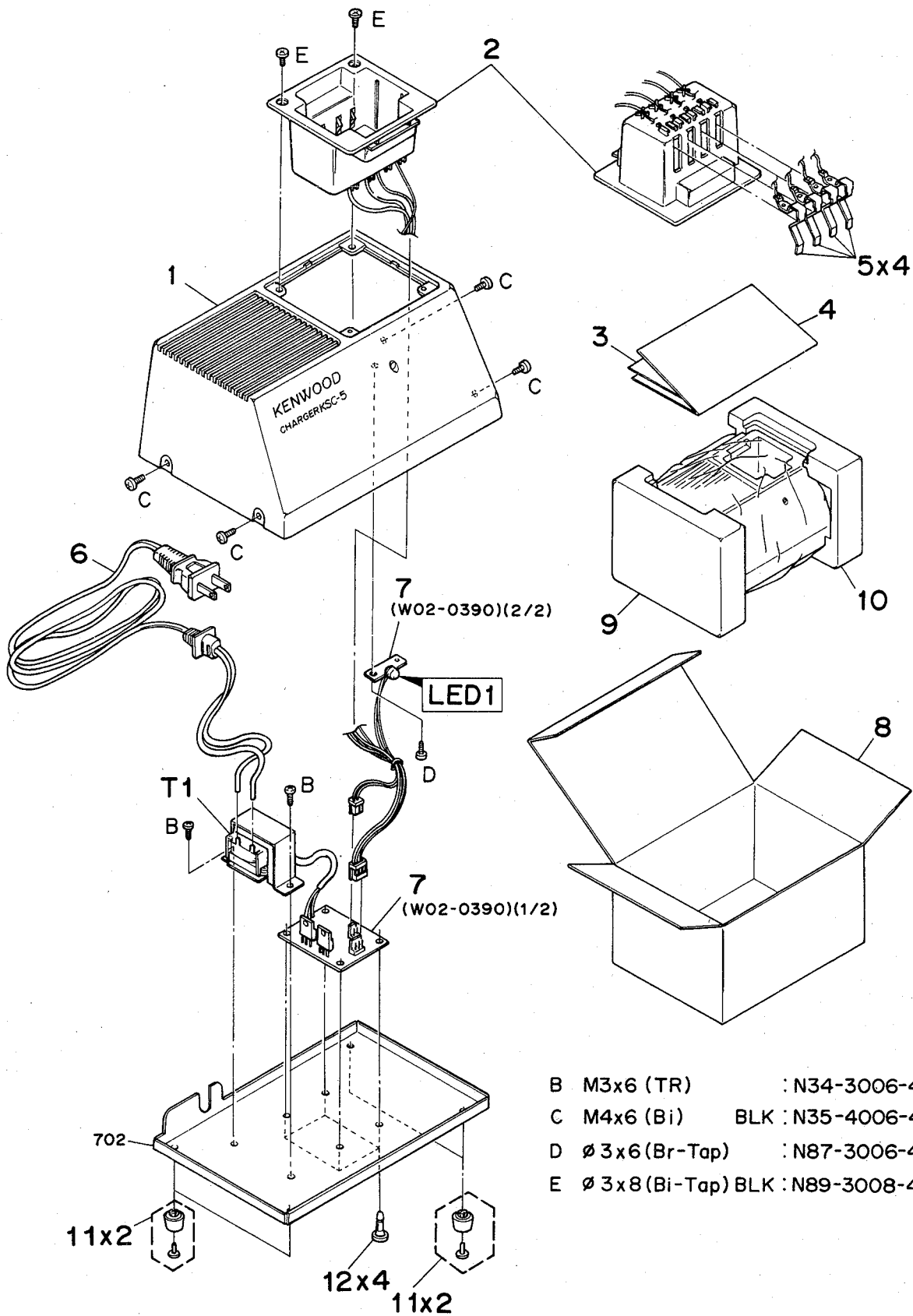
U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

⚠ indicates safety critical components.

KSC-5 (REGULAR RATE CHARGER)

Exploded view

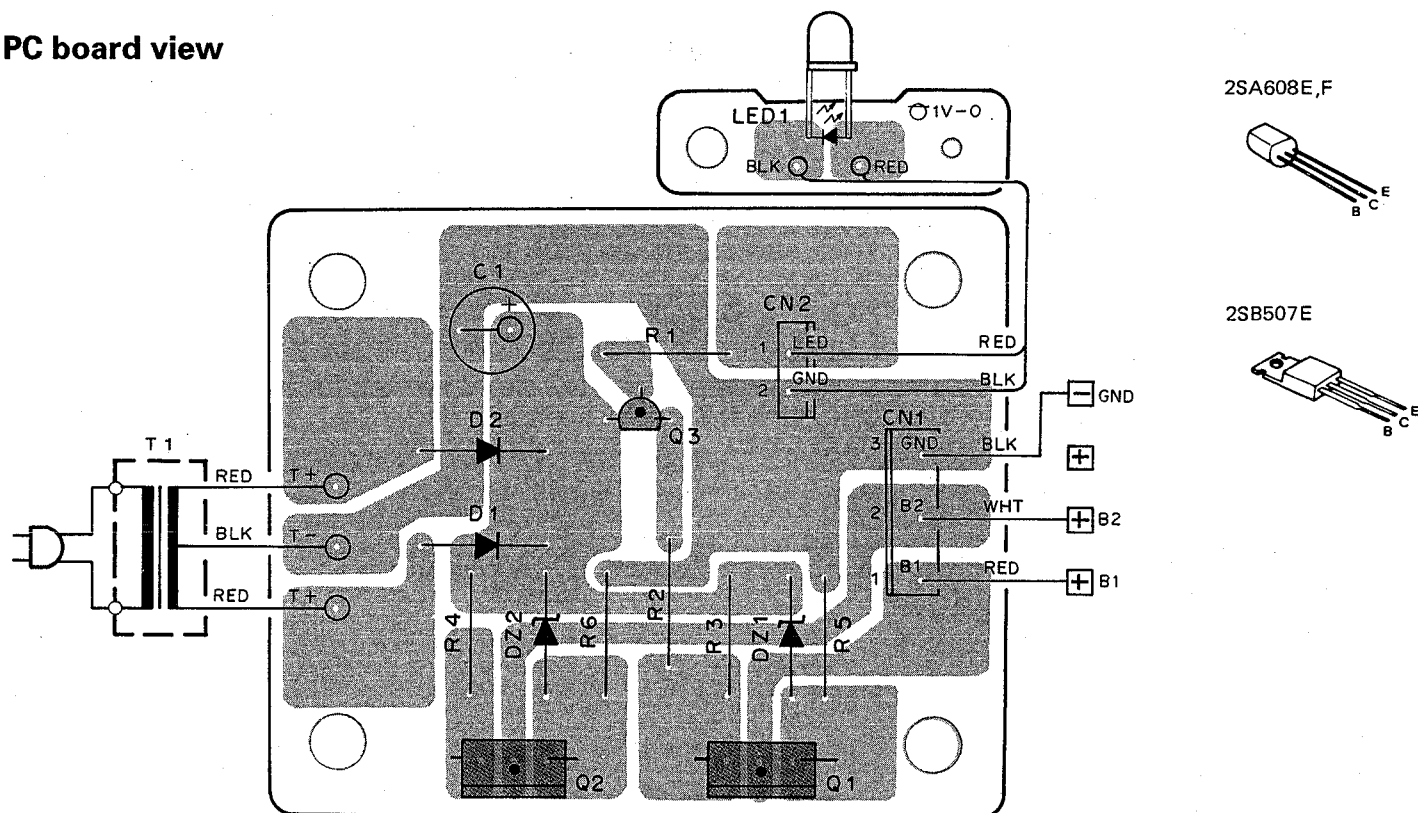


B M3x6 (TR) : N34-3006-46
C M4x6 (Bi) BLK : N35-4006-45
D Ø 3x6 (Br-Tap) : N87-3006-46
E Ø 3x8 (Bi-Tap) BLK : N89-3008-45

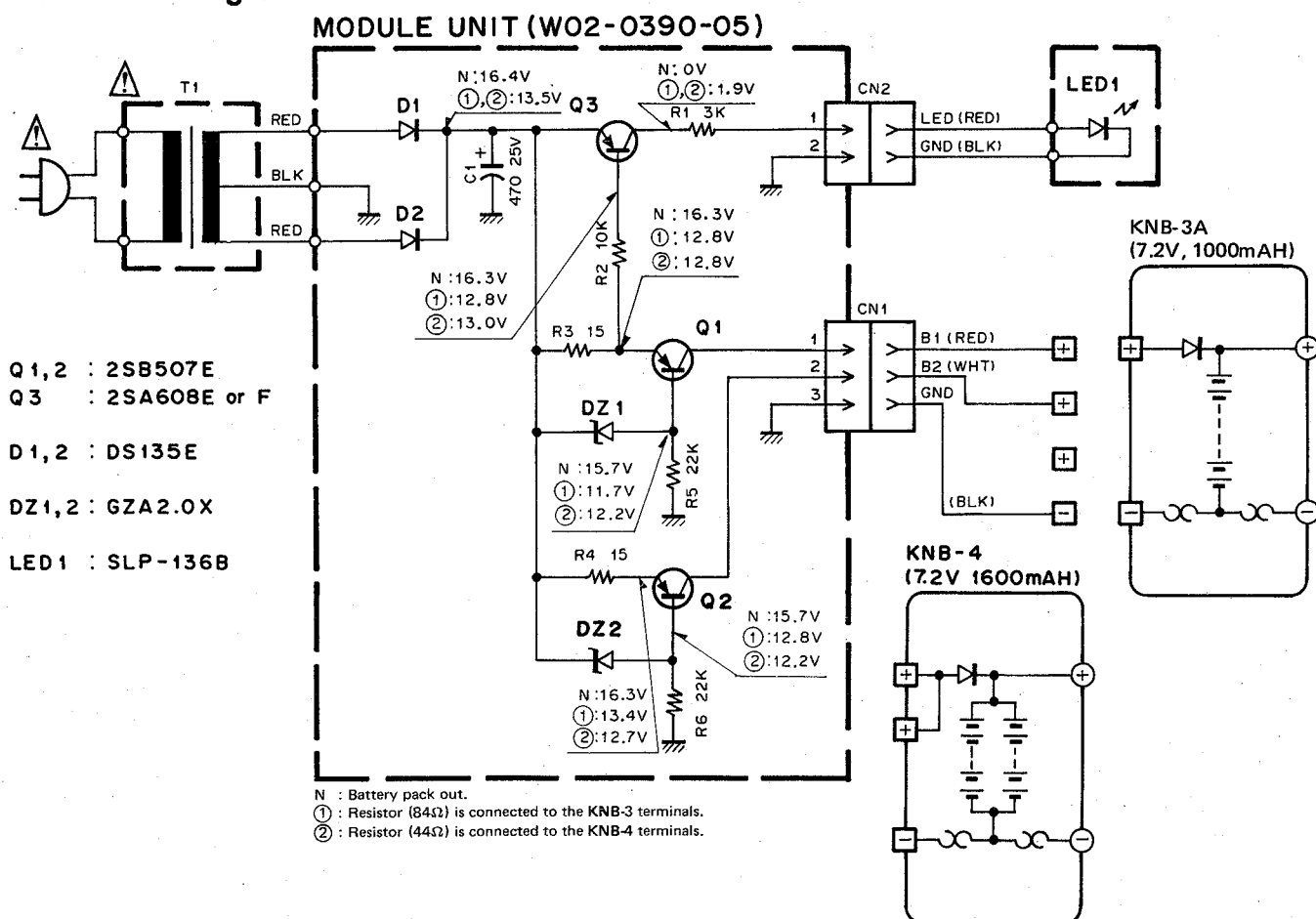
Parts with the exploded numbers larger than 700 are not supplied.

KSC-5 (REGULAR RATE CHARGER)

PC board view

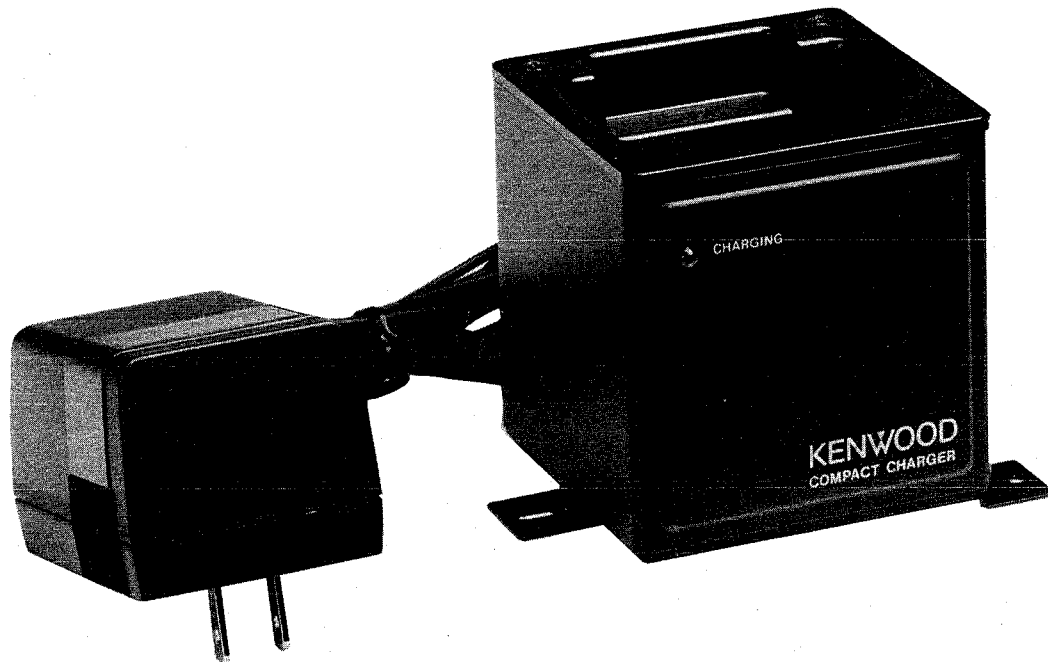


Schematic diagram



KSC-6 (COMPACT CHARGER)

External view



Specifications

Source voltage	220V/50,60Hz (M type) 120V/50,60Hz (M2 type)
Charging current	Approx. 80mA (KNB-3) Approx. 160mA (KNB-4)
Charge time	Approx. 15 hours (at 25°C)
Ambient temperature	5°C~40°C (41°F~104°F)
Dimensions (Body only)	2.05" (52mm) W x 1.65" (42mm) D x 3.31" (84mm) H : AC Adaptor 3.31" (84mm) W x 3.15" (80mm) D x 3.43" (87mm) H : Charger
Weight	0.75 lbs (340g) : AC Adaptor 0.79 lbs (360g) : Charger

Design and specifications subject to change without notice.

Circuit description

The KSC-6 is a compact trickle charger for charging KNB-3A and KNB-4 batteries.

Charging Circuit

When a KNB-3A is connected, current flows through R8 (47Ω). The maximum charging current is approx. 160mA.

When a KNB-4 is connected, current flows through R6 (100Ω) and Q3 : 2SA1241Y. The current flow through R6 to the battery is maximum approx. 100mA. The current flow to Q3 is limited by the voltage drop across R10, the forward voltage of diodes D4 and D5, and the base-to-emitter voltage V_{BE} of Q3, as given by the following formula:

$$I = \frac{(\text{Voltage across D4 and D5} - V_{BE} \text{ of Q3})}{R10} =$$

$$\frac{(1.2V - 0.6V)}{2.7\Omega} = \frac{0.6}{2.7} \approx 220mA \text{ Approx.}$$

Thus current flow to the KNB-4 in the completely discharged state is approximately 320mA. As charging progresses, the value becomes lower. When KNB-3A or KNB-4 is charged, the current limiting circuit, consisting of Q2 : 2SA1241Y, D2 and D3 (output current approx. 160mA) is not working.

Indicator Circuit

The voltage drop across R2 and R3 turns on Q1 so that current flows to the red CHARGING indicator in LED1.

KSC-6 (COMPACT CHARGER)

* New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Teile ohne Parts No. werden nicht geliefert.

Parts list

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
KSC-6						
1	2A	*	A01-1027-08	CASE		
2	1A,1B		A02-0778-05	BATTERY POCKET		
4	1C	*	B50-8136-08	INSTRUCTION MANUAL		
J1	2A	*	E03-0168-05	DC JACK		
5	1C		E23-0488-05	TERMINAL		
6	2C	*	H01-8067-08	ITEM CARTON CASE		
7	2B	*	J19-1423-08	LED HOLDER		
8	2B	*	J21-4198-08	MOUNTING HARDWARE		
A	2A		N35-2005-45	MACHINE SCREW (M2 X 5 Bi) BLK		
B	1A,2B		N35-3006-45	MACHINE SCREW (M3 X 6 Bi) BLK		
C	1A,1B		N35-3006-46	MACHINE SCREW (M3 X 6 Bi)		
9	1A	*	W02-0391-08	MODULE UNIT		
△ 10	1C	*	W09-0373-08	AC ADAPTOR (AC220V,50/60HZ)	M	
△ 10	1C	*	W09-0374-08	AC ADAPTOR (AC120V,50/60HZ)	M2	
MODULE UNIT (W02-0391-08)						
C1			CE04EW1H010M	ELECTRO 1μF 50WV		
R1			RD14BB2E332J	RD 3.3K 1/4W		
R2			RD14BB2E5R6J	RD 5.6 1/4W		
R3			RD14BB2E3R9J	RD 3.9 1/4W		
R4			RD14BB2E102J	RD 1K 1/4W		
R5			RD14BB2E222J	RD 2.2K 1/4W		
R6			RD14BB2H101J	RD 100 1/2W		
R7			RD14BB2E471J	RD 470 1/4W		
R8			RD14BB2H471J	RD 47 1/2W		
R9			RD14BB2H100J	RD 10 1/2W		
R10			RD14BB2E2R7J	RD 2.7 1/4W		
D2-5			1SS133	DIODE		
Q1			2SA1115(E)	TRANSISTOR		
Q2,3			2SA1241Y	TRANSISTOR		
LED1	2B	*	SEL520	LED (RED)		

E: Scandinavia & Europe H: Audio Club K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

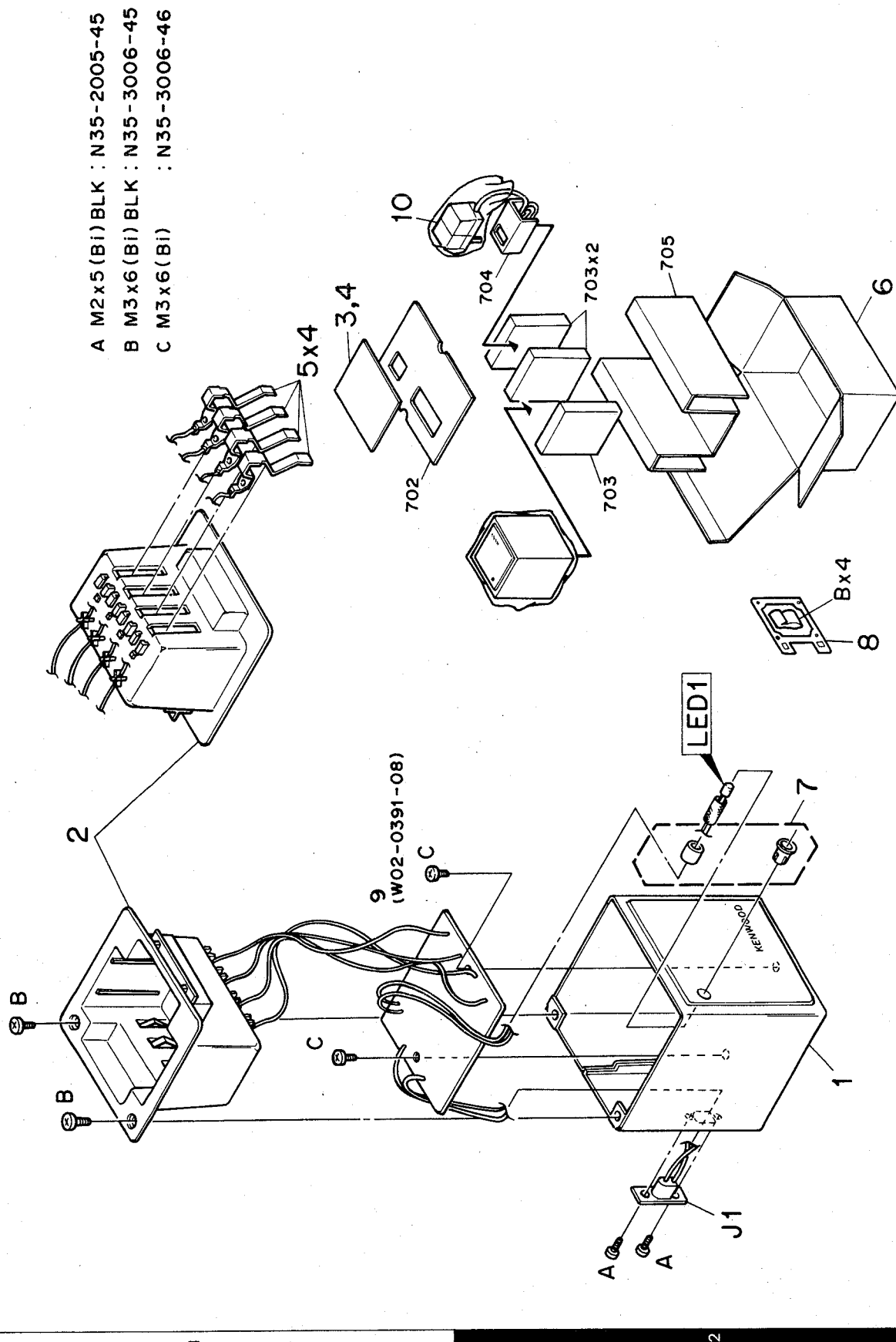
UE: AAFES(Europe)

X: Australia

△ indicates safety critical components.

KSC-6 (COMPACT CHARGER)

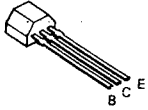
Exploded view



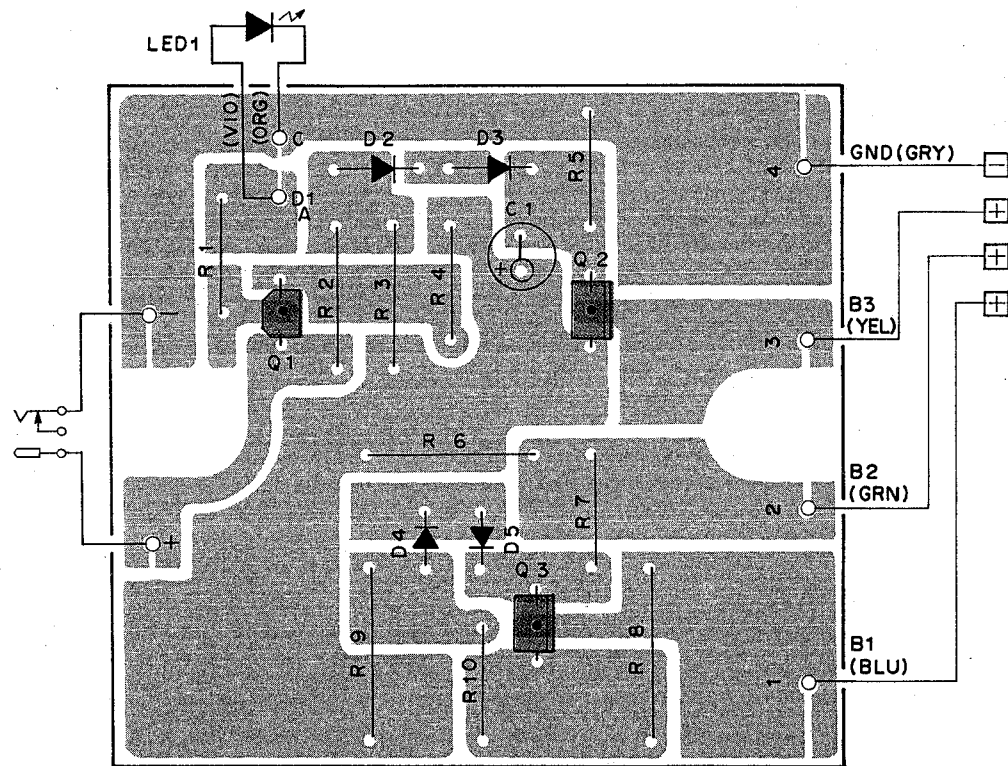
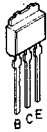
KSC-6 (COMPACT CHARGER)

PC board view

2SA1115(E)

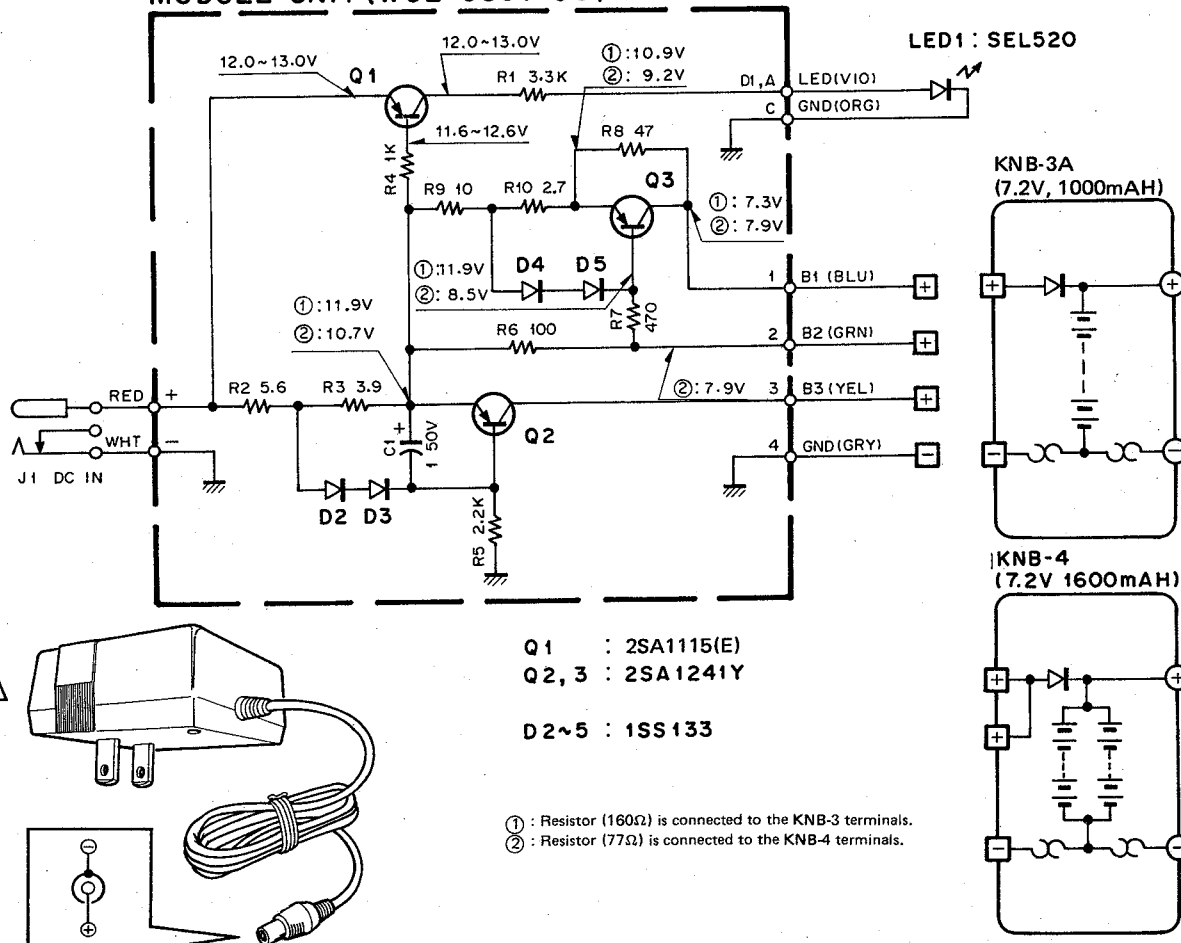


2SA1241Y



Schematic diagram

MODULE UNIT (W02-0391-08)



TK-330

SPECIFICATIONS

GENERAL

Frequency Range	402 to 430MHz : M3 450 to 480MHz : M, E 480 to 520MHz : M2
Number of Channels	20 semi-duplex channels
Channel Spacing	12.5kHz : NF (PLL channel step 12.5kHz) 20kHz : EF (PLL channel step 10kHz) 25kHz : F (PLL channel step 12.5kHz)
Selective Calling	5-tone encode, decode for (F) model only ZVEI (ZVEI-1, ZVEI-2, DZVEI, PZVEI), EEA, CCIR, NATEL, EIA
Battery Voltage	7.5V DC
Battery Life	More than 8 hours at 5W (5-5-90 duty cycle with KNB-4 battery)
Temperature Range	-30°C to +60°C (-22°F to +140°F)
Dimensions and Weight	
With KNB-3A (1000mAh battery)	7.13" (181mm) H x 2.64" (67mm) W x 1.46" (37mm) D, 26.63ozs. (750g)
With KNB-4 (1600mAh battery)	8.86" (225mm) H x 2.64" (67mm) W x 1.46" (37mm) D, 33.51ozs. (950g)

RECEIVER (Measurements made per EIA standard EIA-316-B)

Sensitivity	
EIA 12dB SINAD	0.25µV
20dB Quieting	0.30µV
Squelch Sensitivity	0.20µV threshold
Modulation Acceptance	±7kHz
Selectivity	-70dB
Intermodulation	-70dB
Spurious and Image Rejection	-75dB
Audio Power Output	600mW at less than 5% distortion
Frequency Stability	±0.0003% from -30°C to +60°C
Channel Frequency Spread	20MHz (20MHz at 0.35µV, 16MHz at 0.25µV sensitivity)

TRANSMITTER (Measurements made per EIA standard EIA-316-B)

RF Power Output	HI : 5W, adjustable to 2W LO : 2W, adjustable to 0.3W
Spurious and Harmonics	-70dB
Modulation	F3E, ±5kHz for 100% at 1000Hz
FM Noise	-45dB
Audio Distortion	1.0% at 1000Hz
Frequency Stability	±0.0003% from -30°C to +60°C
Channel Frequency Spread	20MHz

Radio specifications may vary in accordance with the type accepted local national regulations (including 12.5kHz narrow channel spacing).

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