

VHF SYNTHESIZED FM TWO-WAY PORTABLE RADIO

TK-230/230(SC)

SERVICE MANUAL

KENWOOD

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Photo is TK-230.

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TK-230/230(SC)

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.

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.

FCC COMPLIANCE AND TYPE ACCEPTANCE NUMBERS

Type acceptance number	Frequency range	Compliance
ALHTK-230-1	150 ~ 174 MHz	Parts 15, 22, 74 and 90

PERSONNEL SAFETY

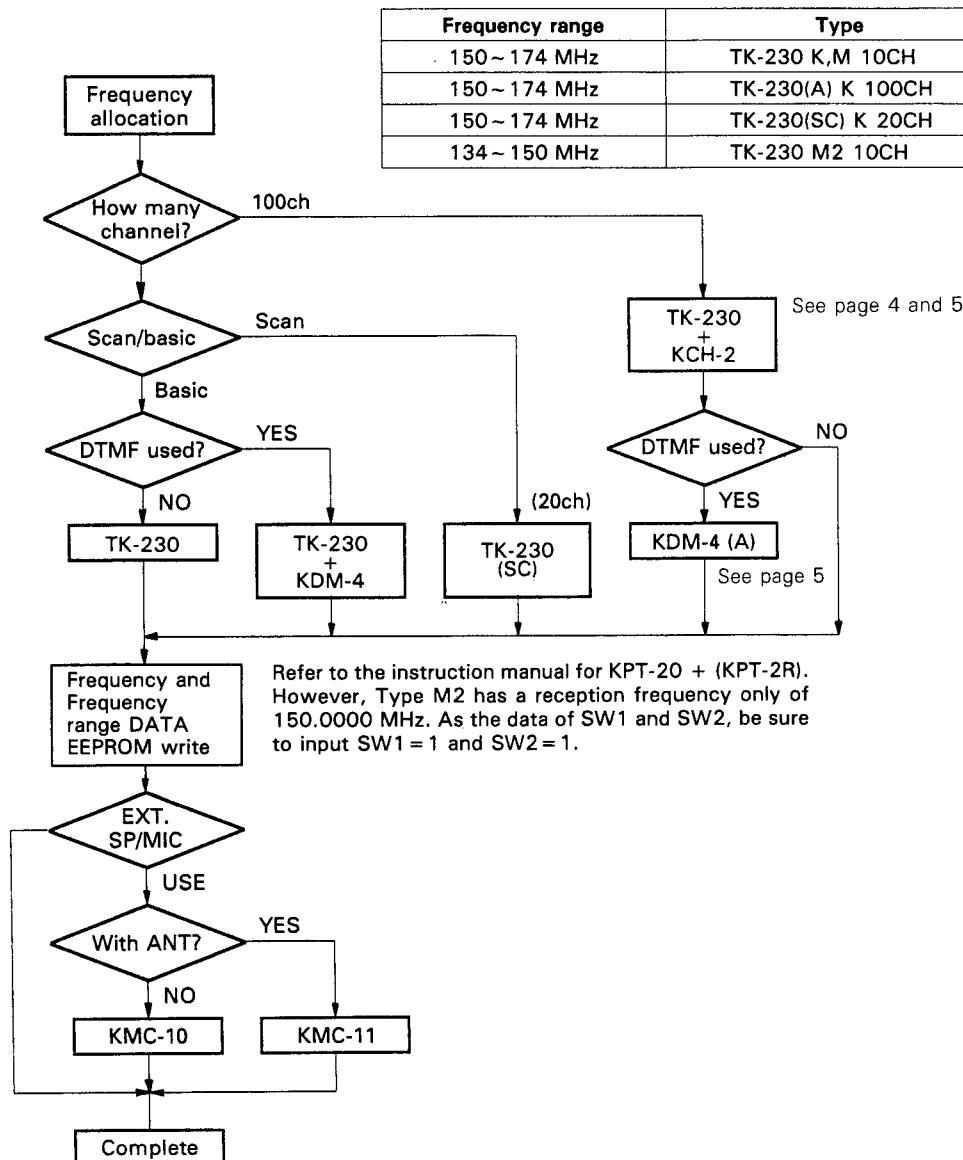
The following precautions are recommended for personnel safety:

- 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.

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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	Unit	Procedure
1	Top panel replacement	Control unit	Remove R107 to enter the 100CH mode. (See page 4) Insert the ROM supplied with KCH-2 into IC8, and solder it. Write data using the ROM writer.
2	KDM-4/KDM-4(A)	TX-RX unit	Replace the front panel. (See page 5) Adjust DTMF DEV with the variable resistor.
3	KCT-1/2		See section on writing data. (See page 7)
4	KCT-3		See section on adjustment. (See page 59)

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

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INSTALLATION

2. How to change the number of channels (10/20/100 channels max.)

1. Change the jumper resistors R106 and R107 of the control unit (X53-3210-XX) to select 10, 20, or 100 channels.

CH No.	R106	R107
10CH	○	○
20CH	X	○
100CH	X	X

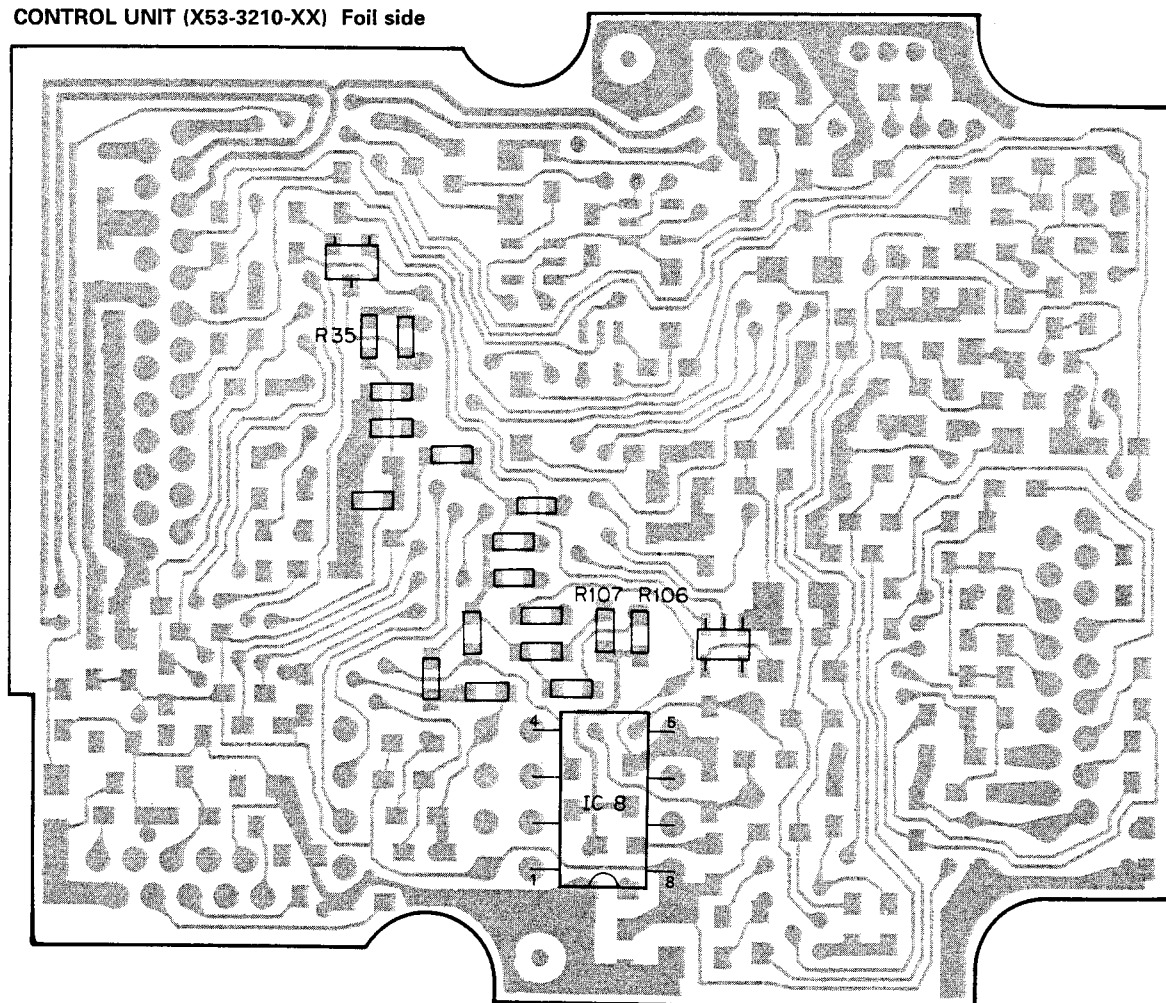
○ : Used X : Remove

2. How to mount the EEPROM (100 channels only)

Insert the EEPROM packaged with the KCH-2 (top panel for 100 channels) into the IC8 socket of the control unit (X53-3210-XX) of TK-230. Solder the EEPROM (NMC93CS66EN or NMC93CS66N*J).

Additional channel data can now be programmed.

CONTROL UNIT (X53-3210-XX) Foil side



IC8: Component side.

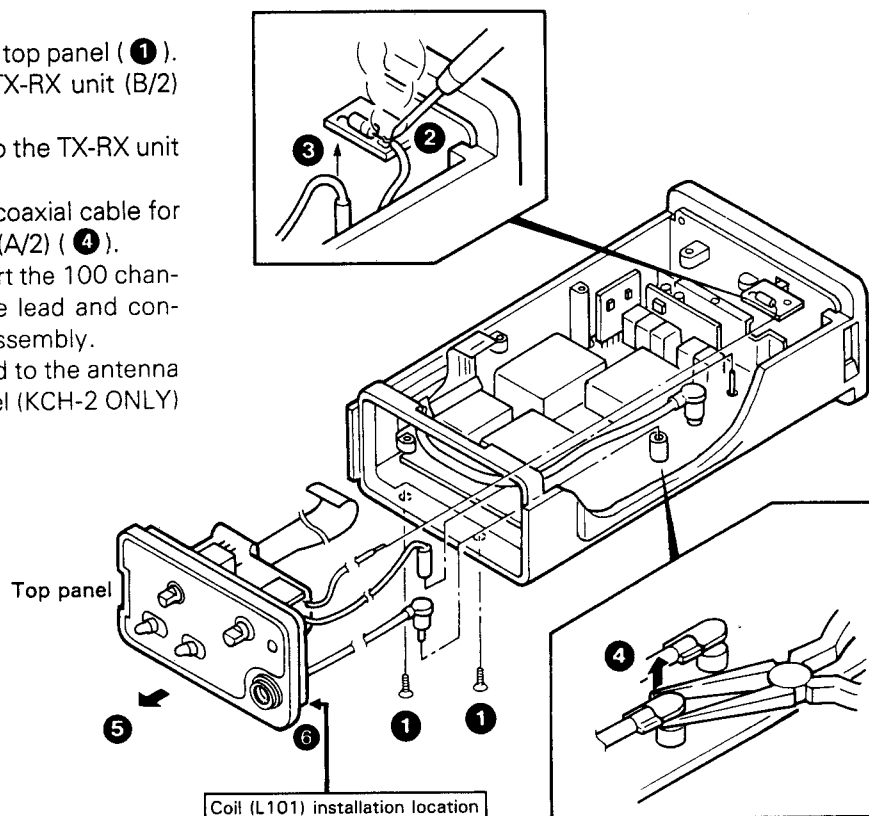
TK-230/230(SC)

INSTALLATION

3. How to replace the top panel

- 1) Remove the two screws holding the top panel (❶).
- 2) Desolder the red lead fixed to the TX-RX unit (B/2) (❷).
- 3) Pull out the red lead (J4) inserted into the TX-RX unit (A/2) (❸).
- 4) Pull out the connector (J2) with the coaxial cable for the pin inserted into the TX-RX unit (A/2) (❹).
- 5) Pull the top panel forward (❺). Insert the 100 channel top panel (KCH-2) and install the lead and connectors in the reverse order of disassembly.

Note: Cut away the coil (L101) soldered to the antenna connector section on the top panel (KCH-2 ONLY) using nippers or the like. (❻)



3. 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. (See disassembly for repair)

4. Scan capability enabling (See page 4)

The type can be changed to the SCAN type by removing R35 of the control unit (X53-3210-XX).

5. KDM-4/4A

5-1. How to install the KDM-4 (See page 9)

How to mount the KDM-4 on the basic radio.

- 1) Remove the TK-230 front panel.
Remove cable J1 with connectors from the microphone unit.
- 2) Insert the two cables with connectors for the front panel (KDM-4) with keyboard into connectors J1 and J2 on the TX-RX unit, and install the KDM-4 on the TK-230. (J1, J2: See page 18)

5-2. Outline

This unit is the key operation section and front panel assembly of the TK-230. It acts as the key operation section, DTMF keypad, and writing board. The KDM-4 is for 10 channels and the KDM-4A is for 100 channels.

5-3. Functions

• Key operation section

The functions of the keys as a set differ according to the type of main unit (BASIC/SCAN).

1) BASIC UNIT VERSION

1	2	3	F
4	5	6	S
7	8	9	LAMP
✳	0	#	ENT

The basic key functions are as follows :

- (F) No function
- (S) ALPA/NUM changover key: LCD display change over (character/number) key
- (LAMP) LAMP key: Lamp ON/OFF key
- (ENT) ENT Key: Repertory

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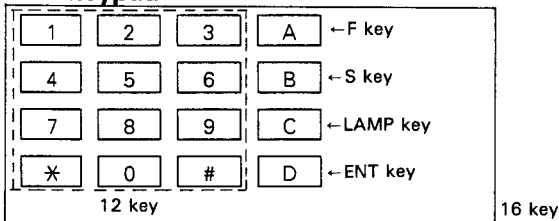
INSTALLATION

2) SCAN UNIT VERSION

The keys have a double function during scanning. The key functions are as follows :

- (1) Function select key: Back key function select key
- (2) S set key: Group set key
- (3) LAMP key: Lamp ON/OFF select key
- (4) ENT key: Repertory dial data input key
- (5) (F) + (S) SCAN key: SCAN ON/OFF select key
- (6) (F) + (LAMP) DEL/ADD key: Channel DEL/ADD set key
- (7) (F) + (ENT) SIN/MUL key: Single loop/multi-group scan change key

• DTMF keypad



Functions are assigned to the keys of the DTMF keypad as follows :

* key: Select repertory and ANI code, and output selected code.

key: Output DISCONNECT ANI code.

Note : The A, B, C and D keys are valid only when 16 keys are used.

The number of valid DTMF keys selected may be from 12 to 16.

Select of 12 key and 16 key performed a chip resistor R19 on SIGNALING UNIT.
(X52-3150-XX: See page 90)

	12 key	16 key
R19	○*	×

*: BASIC ○: used ×: Removed

• WRITING WITH THE KEYBOARD

By using the KDM-4, the main unit (TK-230), and the programming adapter (KCT-2, KCT-1) together, TK-230 frequency, signalling, and control data can be written.

The TK-230 can write data to itself or to another TK-230.

1) Power save data

Data code	0	1	2	3	4	5	6	7
Time								
ON time	∞	90	90	90	90	90	90	90
OFF time	0	150	200	300	400	600	800	1200

(msec)

2) Time-out timer

Data code	0	1	2	3	4	5	6	7
Time	540	15	30	45	60	75	90	105
Data code	8	9	10	11	12	13	14	15
Time	120	135	150	165	180	195	210	225

(sec)

3) Toggle switch function selection

- 1 : Power HI/LO changeover
- 2 : Talk/around
- 3 : Group 1/2 selection
- 4 : Scan ON/OFF (Basic + SCAN only)
- 5 : HOME/ROAM

4) Other control data setting

	No Pr AC CONT function	Pr AC CONT functions	Data code
No busy channel lockout			1
			2
Busy channel lockout			3
			4

5) Scan function setting data

	With priority	Variable priority	Stop at a priority channel	Programmable DEL/ADD	Preset DEL/ADD	Data code
						1
						2
			Stop at a channel to which a signal is input	Programmable DEL/ADD	Preset DEL/ADD	3
						4
		Fixed priority	Stop at a priority channel.	Programmable DEL/ADD	Preset DEL/ADD	5
						6
			Stop at a channel to which a signal is input.	Programmable DEL/ADD	Preset DEL/ADD	7
						8
With no priority			Stop at a channel set on the top panel.	Programmable DEL/ADD	Preset DEL/ADD	9
						10
			Stop at a channel to which a signal is input.	Programmable DEL/ADD	Preset DEL/ADD	11
						12

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WRITING METHOD

6) Lookback time

Lookback B

Data code	0	1	2	3	4	5	6	7
Time	0.75	0.875	1.00	1.125	1.25	1.375	1.50	1.625
Data code	8	9	10	11	12	13	14	15
Time	1.75	1.875	2.00	2.125	2.25	2.375	2.50	None

(sec)

Lookback A

Data code	0	1	2	3	4	5	6	7
Time	350	375	400	425	450	475	500	525
Data code	8	9	10	11	12	13	14	15
Time	550	575	600	625	650	675	700	*

(sec)

*: Same as Lookback B.

7) Scan resume time

Data code	0	1	2	3	4	5	6	7
Time	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
Data code	8	9	10	11	12	13	14	15
Time	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50

(sec)

8) Fixed priority

Group and channel setting.

9) ANI data setting

The ANI that can be set is the CONNECT/DISCONNECT ANI. The keys that can be used for input are 0 ~ 9, *, and #. The maximum number of digits is 16.

10) Transmit/receive frequency setting

11) Transmit/receive signalling setting

The types of signalling that can be set are QT and DQT. NORMAL can re-switched to INVERSE and viceversa for DQT.

Writing Data

1. Overview

- When the KPT-20 is used, refer to the KPT-2R manual.
- Self programming or cloning.
 - Write to self (Use programming plug KCT-2).
 - Write to another set (Use cloning cable KCT-1).

1-1. Overview

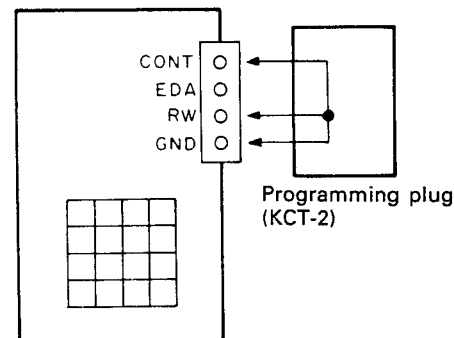
The TK-230 with keyboard has the ROM WRITER function. It writes T.SW data, system data (such as scan and frequency set for each channel), and signalling data. The TK-230 with keyboard can write data to itself. It can copy from radio with keyboard. Its write data and keyboard data to a radio without a keyboard (CLONE and COPY functions). In this case, radio will not action.

1-2. Connection

When the TK-230 with keyboard 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-230 functions as a ROM writer when the CONT and RW signals are as follows:

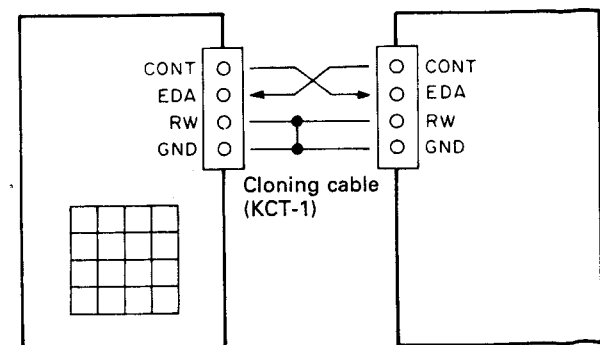
CONT = 0, RW = 0 → Write to self

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



TK-230 with keyboard

Self programming



TK-230 with keyboard
(Writer)

TK-230 to which
data is written

Writing to another set (Cloning)

TK-230/230(SC)

WRITING METHOD

1-3. Data to be written

The following three types of data are written into the EEPROM of the TK-230:

- System-related data
 - Set variations (T.SW 1/2), BUSY LOCKOUT, PRIORITY CH, DEL/ADD, AC CONT, SCAN).
 - Basic set time (TOT, BUSY LOCKOUT DELAY, P.S).
 - SCAN (LOOK BACK A/B, SCAN RESUME, etc.).
- DTMF-related data (only with keyboard)
 - CONNECT ANI
 - DISCONNECT ANI
- Data set for each channel
 - Frequency data
 - Signalling data
 - Power H/L data
 - Fixed DEL/ADD data.
 - SW1, SW2, data

The Power H/L, DEL/ADD, SW1 and SW2 are 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 POWERswitch off.
2. Alphanumeric data of the channel or repertory dial cannot be written by writing 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-230 is set. System data can be set for system 1 to 5. The contents of the data are as follows:

- | | |
|-----------------|---|
| SYSTEM 1 | · T.SW 1/2 (●.○/  ) function setting |
| | · Scan stop mode |
| | · Priority Yes/No |
| | · DEL/ADD |
| SYSTEM 2 | · Timeout timer (TOT) |
| | · Power save time |
| SYSTEM 3 | · CONNECT/DISCONNECT ANI
(With keyboard only) |
| SYSTEM 4 | · Fixed (programmable) DEL/ADD |
| | · Power H/L |
| | · SW1, SW2 |
| SYSTEM 5 | · Scan resume |
| | · Scan lookback (A) |
| | · Scan lookback (B) |
| | · Fixed priority CH |

1-5. Data for each channel

Data set for each channel includes :

- Frequency data
- Signalling data

Frequency data is the TK-230 operating frequency. Signalling data is QT/DQT setting data. Each data item is set for TX/RX.

1-6. Key functions and layout

When programming plug KCT-2 is used with the TK-230 with keyboard, the system enters the ROM WRITER mode.

1	2	3	F	F	: Function key
4	5	6	S	S	: Data modify key
7	8	9	LAMP	LAMP	: Data delete key
*	0	#	ENT	ENT	: Enter key

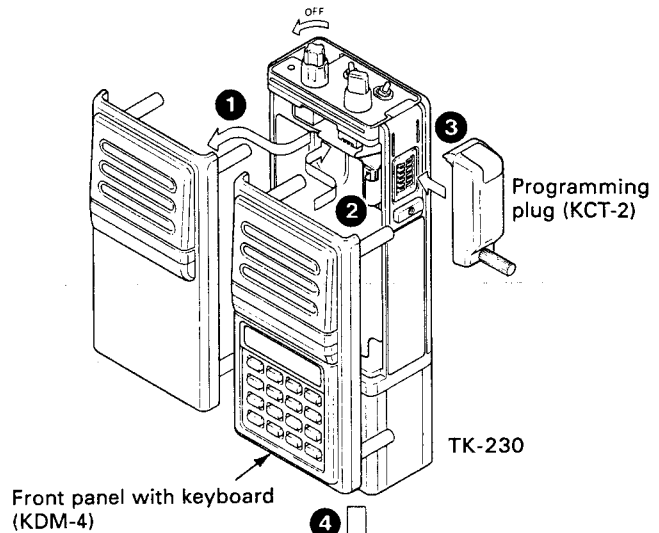
TK-230/230(SC)

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 writing 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

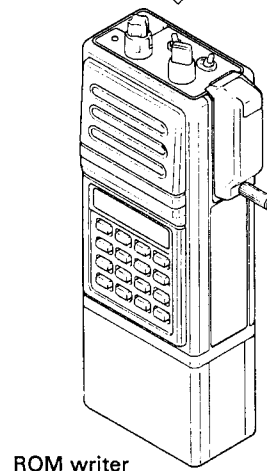
• Self programming

1. Remove the TK-230 front panel (①), and mount a keyboard on the front panel (②). (Or obtain a TK-230 with keyboard.)
2. Turn OFF the power switch of the TK-230 with keyboard off and mount the KCT-2 on the universal connector (③).

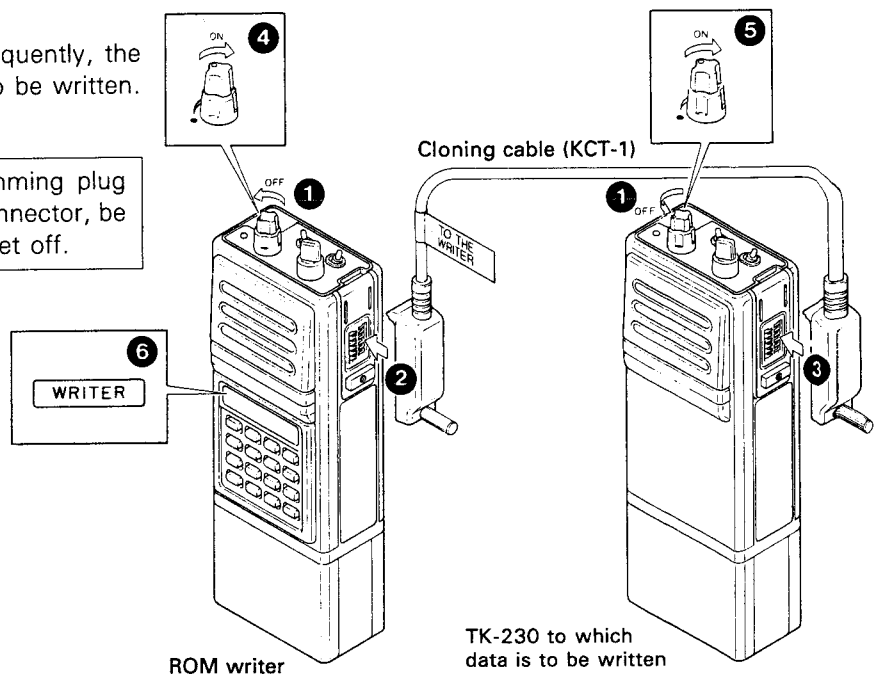
3. The TK-230 has the ROM writer function (④).

• Cloning to another TK-230 (all copy)

1. Turn the power switch of the TK-230 and another TK-230 with the ROM writer function off.
2. Connect the end of the KCT-1 cloning cable, which has a red tag, to the universal connector of the ROM writer, and connect the other end to the universal connector of the TK-230 to which the data is to be written.
3. Turn the writer POWER switch on, and then turn the POWER switch of the next set to which data is to be written on.
4. The set LCD indicates WRITER. Subsequently, the data is sent to the set to which data is to be written.



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.

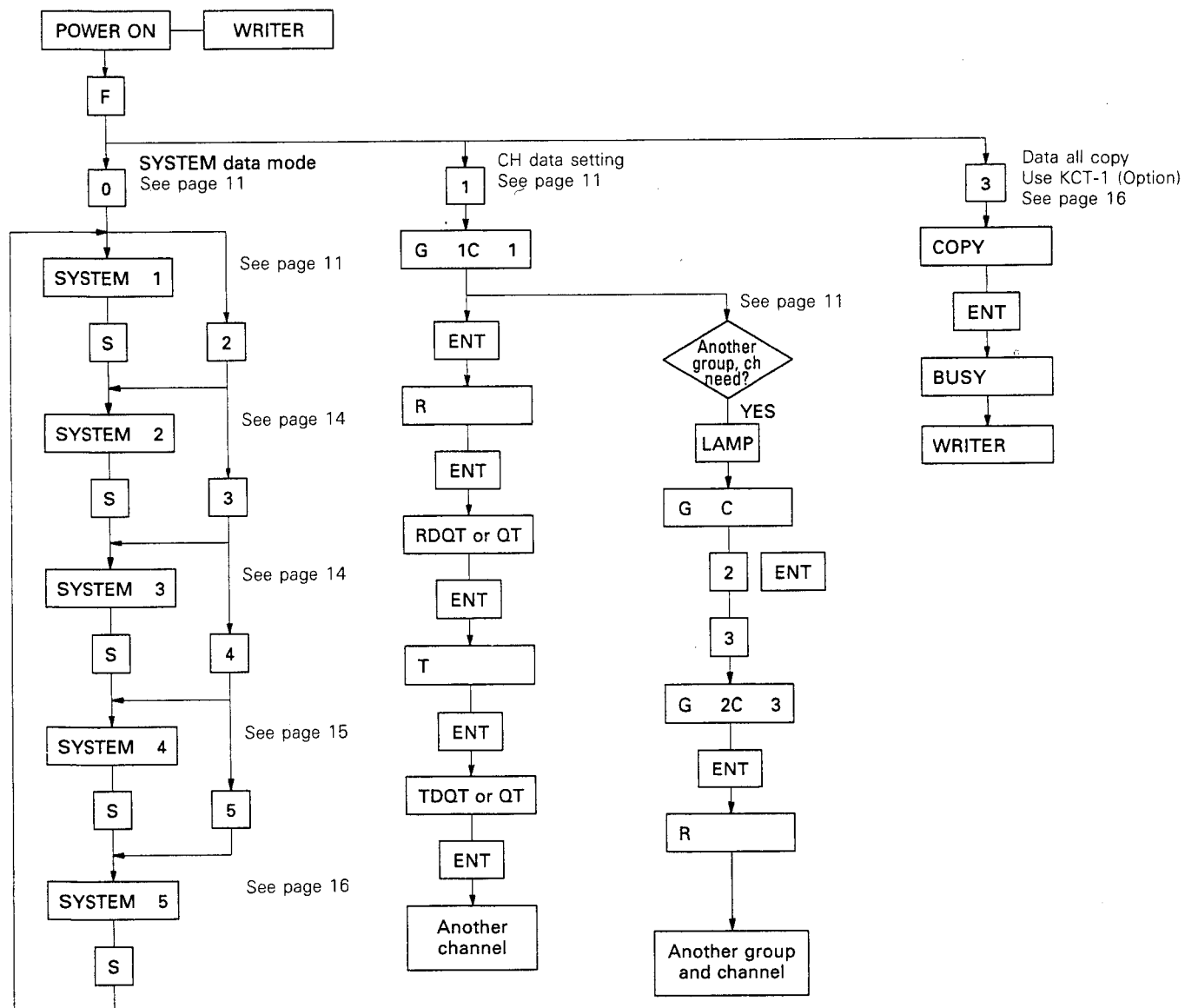


TK-230/230(SC)

WRITING METHOD

3. Write procedure

3-1. Write data selection



TK-230/230(SC)

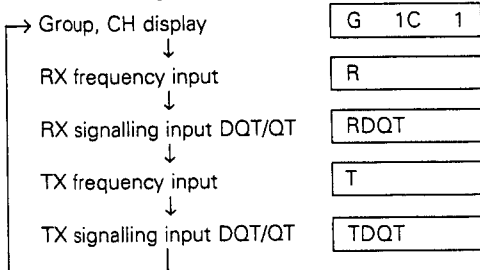
WRITING METHOD

3-2. CH data setting

The CH data setting mode is set by pressing the F 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 F then 1
G 1C 1

• RX frequency setting

3. Press ENT
R
4. Press 150.1000
R1501000

• RX signalling setting

5. Press ENT*
RDQT N
N (n) : NORMAL
I : INVERTED

• DQT setting

6. Press 0, 2, 3
RDQT023N

• TX frequency setting

7. Press ENT
T
8. Press 150.0000
T1500000

• TX signalling setting

9. Press ENT
TDQT N

• DQT setting

10. Press 0, 2, 3
TDQT023N

• INVERT setting

11. Press S
TDQT023I

12. Press ENT
G 1C 2

• Other CH data setting

13. Press ENT
R

* Select of DQT/QT signalling mode

1. Press LAMP then S if signalling data were programmed.
2. Press S 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 F and 1
G 1C 1
3. Press 2
G 1C 2
4. Press ENT
R

• Group setting (ex. Group 2 channel 3)

1. Power on
WRITER
2. Press F and 1
G 1C 1
3. Press LAMP
G C
4. Press 2 then ENT
G 2C 1
5. Press 3
G 2C 3
6. Press ENT
R

3-4. SYSTEM DATA operation procedure

SYSTEM 1

1. Press F
FNC
2. Press 0
SYSTEM 1

• Top panel switch setting

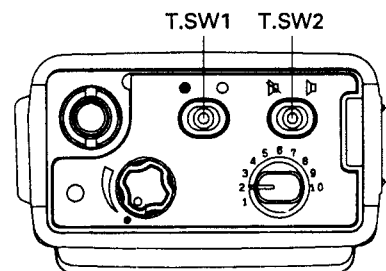
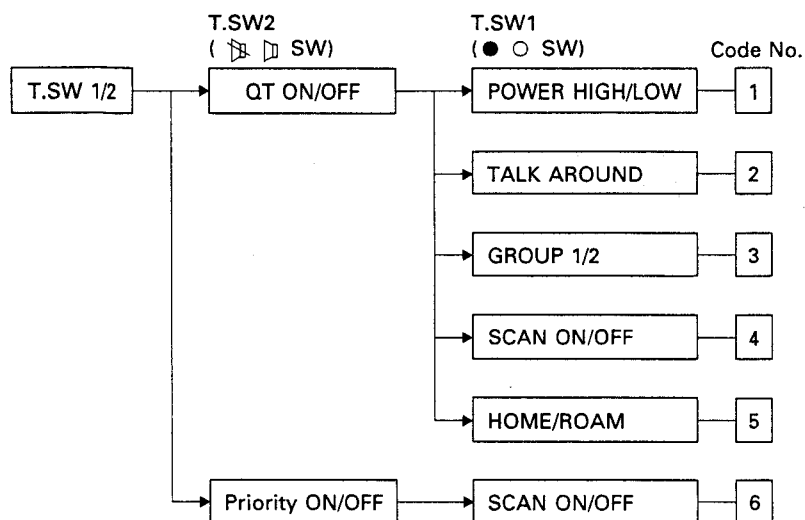
3. Press ENT
TSW 1/2
4. Select the toggle switch setting code.
(For example 2 with the TK-230).
Code
TSW 1/2 2
5. Press ENT to go to next selection.
If you want to return to step SYSTEM 1, press ENT, ENT, ENT then press 1.
SCAN

Code	T.SW 1	T.SW 2
	● ○ SW	⏏ ⏏ SW
1	POWER HI/LO	QT
2	TALK AROUND	QT
3	GROUP 1/2	QT
4	*SCAN	*QT
5	HOME/ROAM	QT
6	*SCAN	Priority

Note: *For a configuration with KDM-4 or in the case of TK-230 (SC), setting codes 4 or 6 provides Power Hi/Low switching rather than Scan On/Off switching. Also, the QT for code 4 changes to Priority.

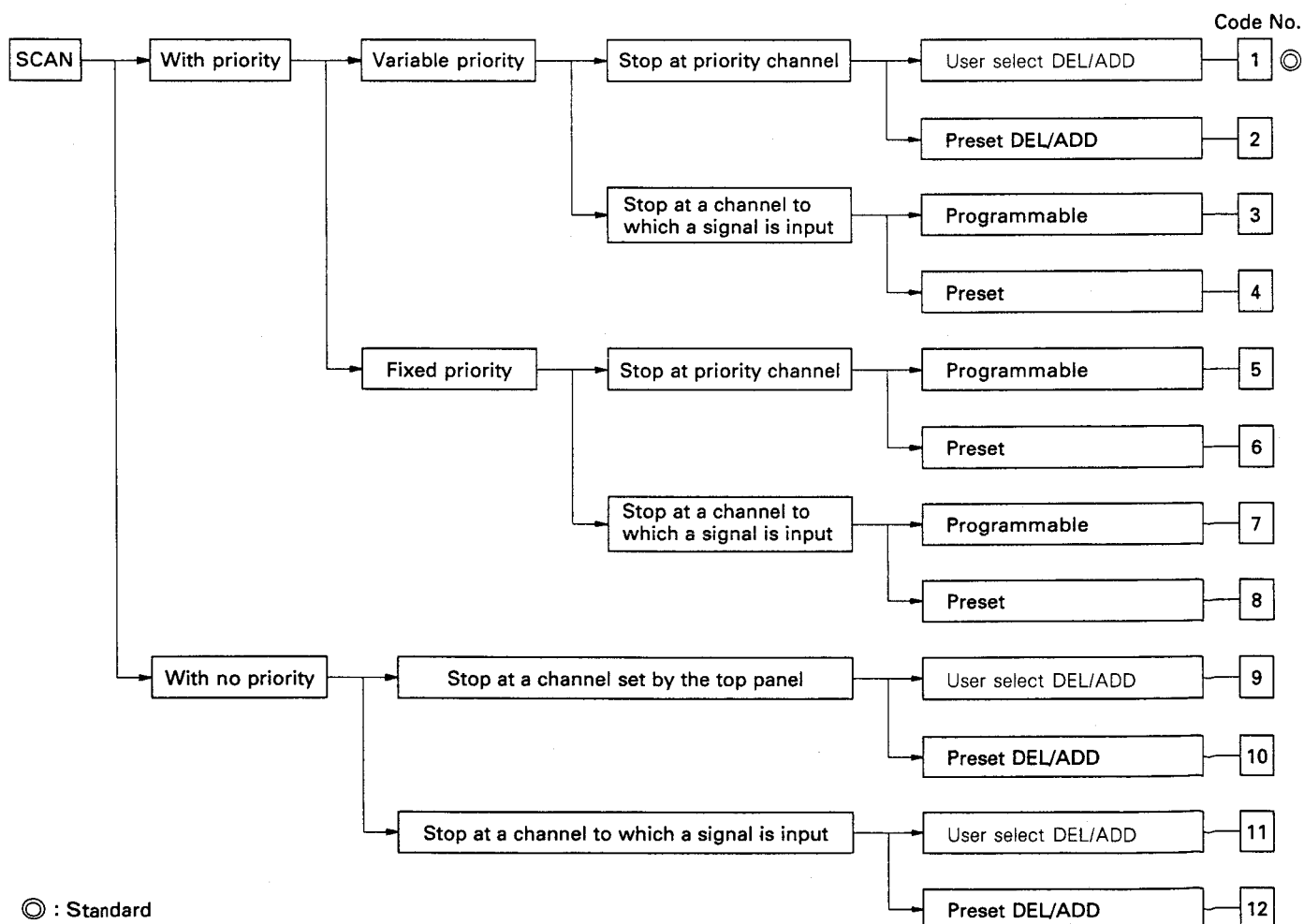
TK-230/230(SC)

WRITING METHOD



• SCAN stop mode setting

- Priority : Yes/No
- Priority CH : Variable/Fixed
- Scan stop CH : Priority CH/Normal CH
- DEL/ADD : User select/Fixed



◎ : Standard

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WRITING METHOD

• SCAN setting

6. Select SCAN type selection code 1 to 12 then ENT.
(For example press 1)

SCAN 1
↓
Code

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

7. Press ENT to go to next section

Code	Priority	SCAN STOP	DEL/ADD
1	User selectable priority	Priority channel	User selectable
2	Use selectable priority	Priority channel	Preset
3	User selectable priority	BUSY channel	User selectable
4	User selectable priority	BUSY channel	Preset
5	Fixed priority	Priority channel	User selectable
6	Fixed priority	Priority channel	Preset
7	Fixed priority	BUSY channel	User selectable
8	Fixed priority	BUSY channel	Preset
9	With no priority	Top panel channel	User selectable
10	With no priority	Top panel channel	Preset
11	With no priority	BUSY channel	User selectable
12	With no priority	BUSY channel	Preset

• OTHERS setting

(For example 3)

OTHERS 3

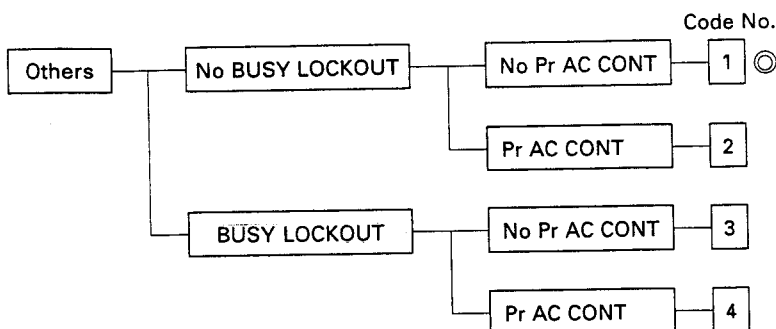
8. Press ENT to go to next section

SYSTEM 2

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

Code	BUSY lock out	Pr AC CONT
1	OFF	OFF
2	OFF	ON
3	ON	OFF
4	ON	ON

• OTHERS



⊙ : Standard

Note : Pr AC CONT : Deletion of the QT/DQT function of the priority CH (Only scan mode)

TK-230/230(SC)

WRITING METHOD

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.

(sec.)

Code	TOT time	Code	TOT time
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	0	9 (min.)

• POWER SAVE setting

P.S

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

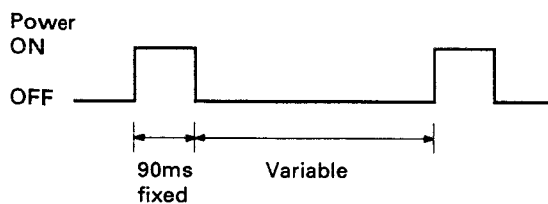
(For example 1)

P.S 1

13. Press ENT to go to next section.

SYSTEM 3

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



SYSTEM 3

• ANI setting

Note: Use 2 digits up to 16 digits.

Program A, B, C and D data from only ROM writer KPT-20 + (2R).

14. Press ENT

CNT

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

TK-230/230(SC)

WRITING METHOD

SYSTEM 4

• DEL/ADD setting (A : ADD, D : DEL)

18. Press ENT to go to next selection.

DEL/ADD

19. Press ENT to go to next selection.

G 1C 1 A

20. Press S

G 1C 1 D

21. Press ENT

G 1C 2 A

22. Press S

G 1C 2 D

If no setting is modified, press ENT.

The channels increment one channel at a time.

• Direct CH setting

1) Program only ADD for all channels

23. Press LAMP

G C

24. Press *

G 1C 1

25. Restore all channels

G 1C 1 A

26. Press S

G 1C 1 D

27. Press # to go to next section.

POWER

2) Required channel to program (ex. G2 C1 D)

28. Press LAMP

G C

29. Press 2

G 2C

30. Press ENT then 1

G 2C 1

31. Press ENT

G 2C 1 A

32. Press S

G 2C 1 D

33. Press # to go to next section

POWER

• POWER setting (H : HIGH, L : LOW)

34. Press ENT

G 1C 1 H

35. Press S

G 1C 1 L

36. Press ENT

G 1C 2 H

(To set all CH POWER to HI)

37. Press LAMP

G C

38. Press *

G 1C 1 H

39. Press #

SW 1/2

• SW1/2 mode

For the data of SW1 and SW2, select from the table according to the radio frequency version (K.M, M2) and input the selection. (Selection of varicap voltage of reception section)

1) Program only DATA2 for all channels (ex, Group 1, channel 1, DATA2)

40. Press ENT

G 1C 1 2

41. Press LAMP

G C

42. Press *

G C

43. Press 2

G C 2

44. Press ENT

G 1C 1 2

Note

45. Press #

SYSTEM 5

Note: Every channel is subject to scanning, and DATA2 is input, after which it stops at channel 1.

2) Required channel to program

(ex. Group 1, channel 1, DATA3)

46. Press ENT

G 1C 1 2

47. Press 3

G 1C 1 3

48. Press ENT

G 1C 2 2

49. Press #

SYSTEM 5

Frequency (MHz)		SW1/2 DATA
K,M	M2	
$150.0 \leq f < 155.5$	$134.0 \leq f < 137.5$	0
$155.5 \leq f < 161.5$	$137.5 \leq f < 141.5$	1
$161.5 \leq f < 167.5$	$141.5 \leq f < 145.5$	2
$167.5 \leq f \leq 174.0$	$145.5 \leq f \leq 150.0$	3

TK-230/230(SC)

WRITING METHOD

SYSTEM 5

Setting is necessary for SCAN set only.

• RESUME TIME setting

50. Press ENT

SR

51. Enter a desired Resume time defined as the following

(For example 2 (= 1.25sec.))

SR 2

(sec.)			
Code	Resume time	Code	Resume time
0	0.75	8	2.75
1	1.00	9	3.00
2	1.25	10	3.25
3	1.50	11	3.50
4	1.75	12	3.75
5	2.00	13	4.00
6	2.25	14	4.25
7	2.50	15	4.50

• LOOKBACK (A) setting

52. Press ENT

A 0

53. Enter a desired Resume time defined as the following

(For example 3)

A 3

(sec.)			
Code	LOOKBACK(A)	Code	LOOKBACK(A)
0	0.750	8	1.750
1	0.875	9	1.875
2	1.000	10	2.000
3	1.125	11	2.125
4	1.250	12	2.250
5	1.375	13	2.375
6	1.500	14	2.500
7	1.625		

• LOOKBACK (B) setting

54. Press ENT

B 0

55. Enter a desired Resume time defined as the following

(For example 1)

B 1

(msec.)			
Code	LOOKBACK(B)	Code	LOOKBACK(B)
0	350	8	550
1	375	9	575
2	400	10	600
3	425	11	625
4	450	12	650
5	475	13	675
6	500	14	700
7	525	15	Same as LOOKBACK(A)

• CH setting in the fixed priority mode

(ex. group 1, channel 2)

56. Press ENT

PR

57. Press 1

PR 1

58. Press ENT

PR

59. Press 2

PR 2

60. Then press ENT

SYSTEM 1

61. Complete

3-5. How to ALL COPY

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

62. Press F

FNC

63. Press 3

COPY

64. Press ENT

- BUSY -

WRITER

65. Complete

Beep Sound

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

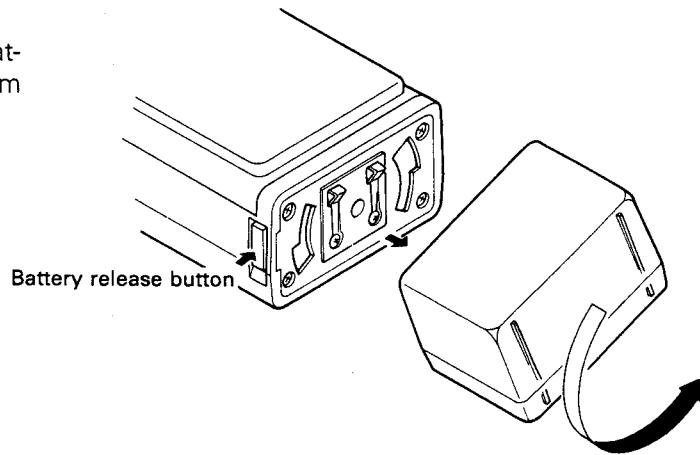
	Beep type	Condition
1	Once when the power is switched on	For confirming the power is on. Since it is interlocked with AF VOL, the VOL position can also be confirmed.
2	Intermittent on BUSY CH LOCK OUT	A beep sounds when the PTT is pressed but transmission cannot be performed because of BUSY CH LOCK OUT.
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	Intermittent on PRIORITY	When the Priority channel is changed to a channel that has no frequency data during scanning, a beep sounds until the channel is changed or the scan is turned off.

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DISASSEMBLY FOR REPAIR

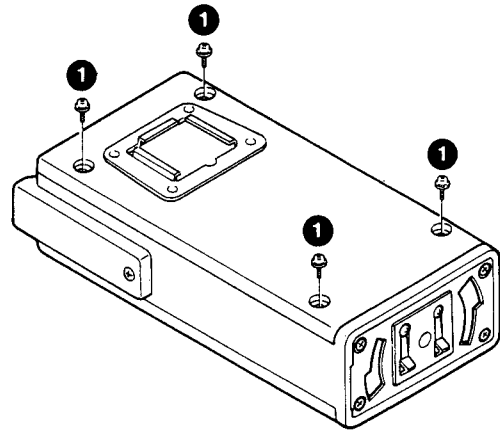
1. Battery release

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



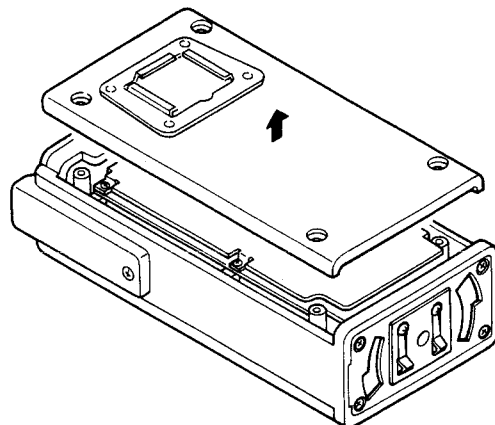
2. Case screw removal

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



3. Rear case removal

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

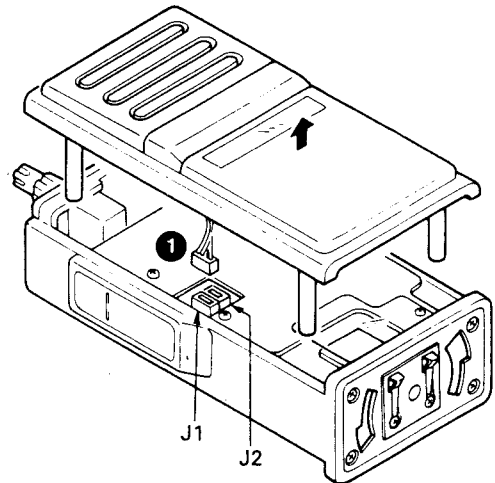


TK-230/230(SC)

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).

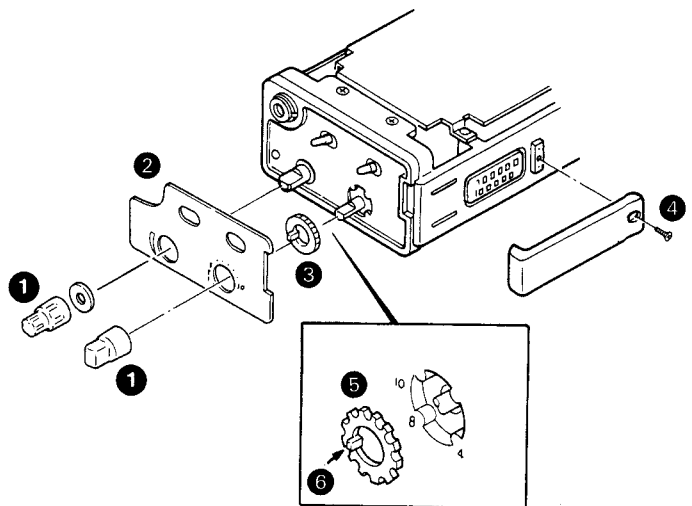


5. Cosmetic panel removal

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

6. 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.

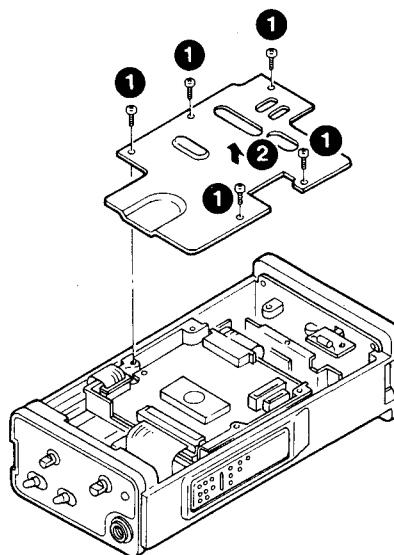


TK-230/230(SC)

DISASSEMBLY FOR REPAIR

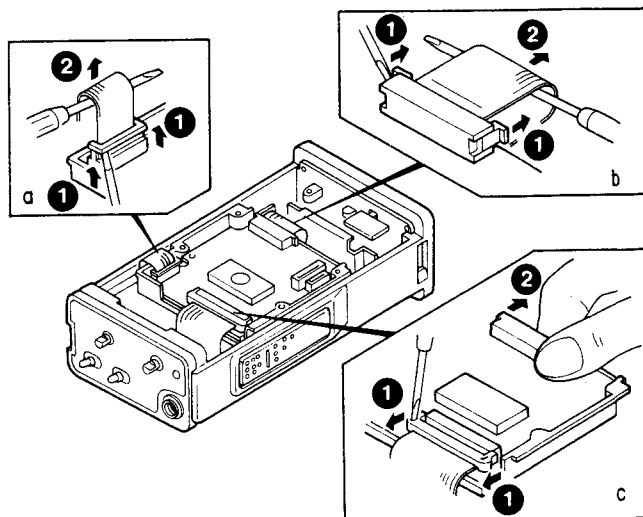
7. Shielding plate removal

1. Remove the 5 screws from the control unit (❶).
2. Lift up the shielding plate (❷).



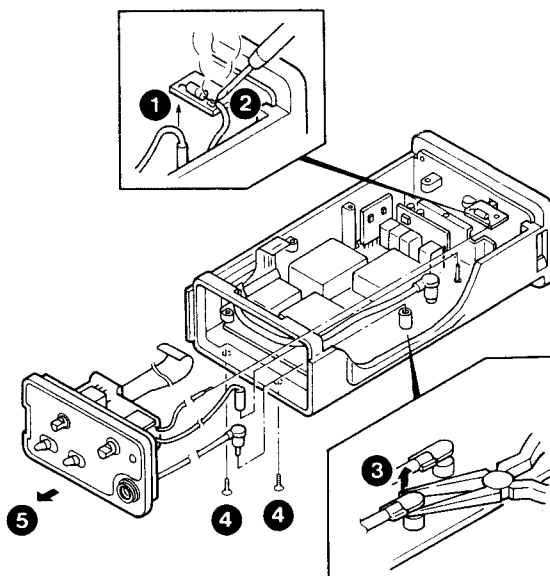
8. FPC connector housing removal

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



9. Top panel removal

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

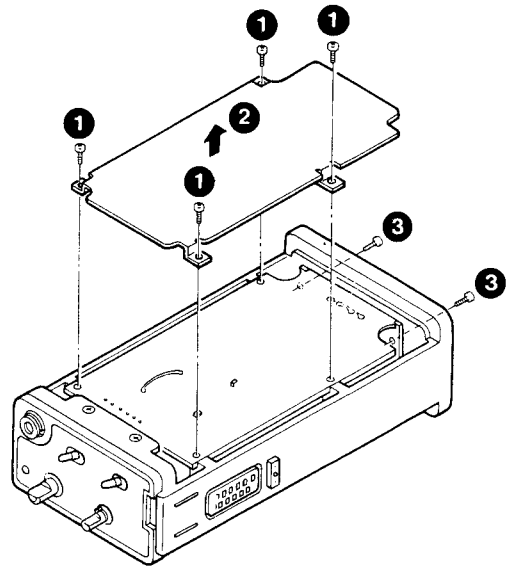


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DISASSEMBLY FOR REPAIR

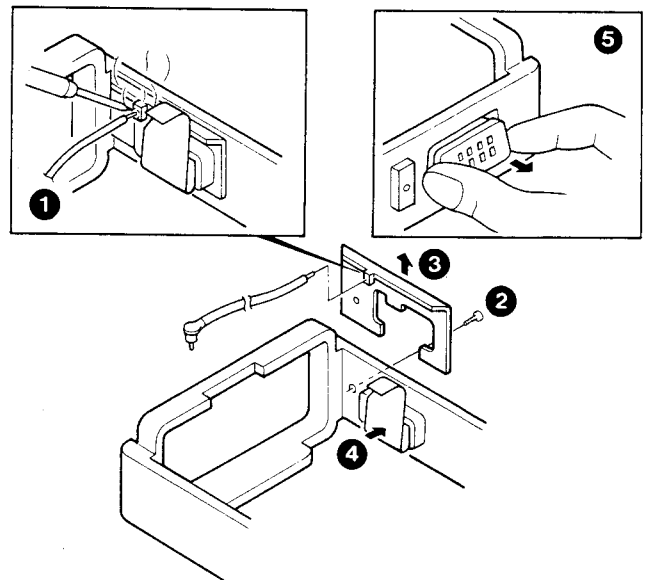
10. TX-RX unit removal

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).



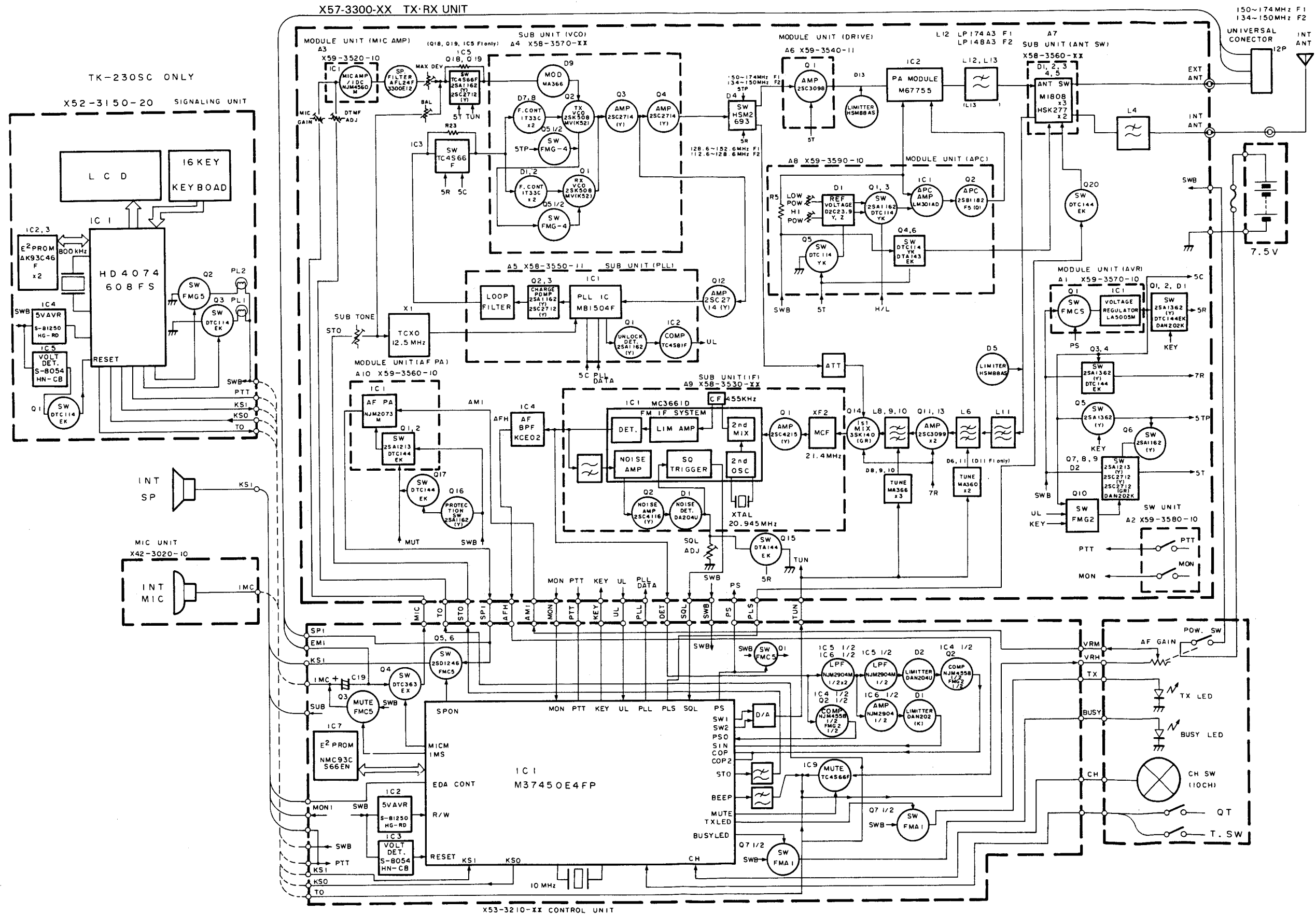
11. Universal connector removal

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).



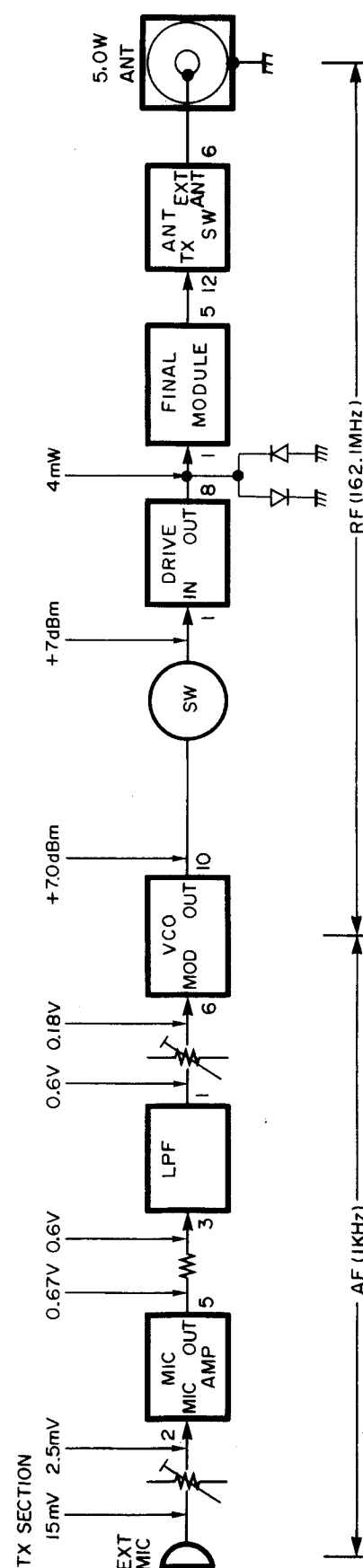
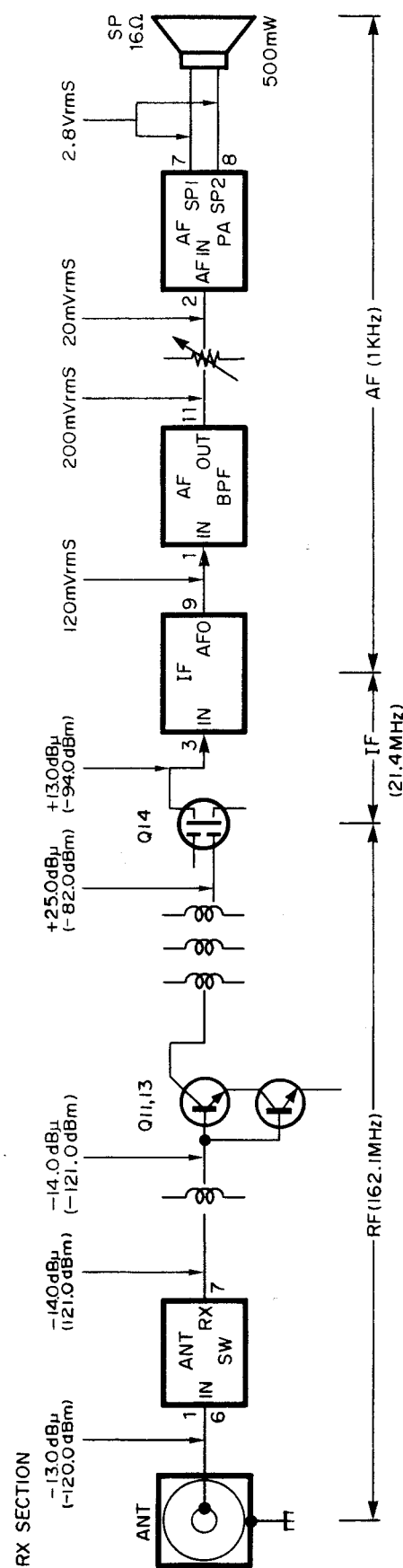
TK-230/230(SC) TK-230/230(SC)

BLOCK DIAGRAM



TK-230/230(SC)

LEVEL DIAGRAM



TK-230/230(SC)

CIRCUIT DESCRIPTION

The model TK-230 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. In addition, the optional KDM-4 signaling unit may be added to TK-230.

1. FREQUENCY ORGANIZATION

TK-230 incorporates a phase locked loop (PLL) digital frequency synthesizer, operating with a 5kHz channel spacing.

The receiver is a double conversion superheterodyne with the first and second IF frequencies set at 21.4MHz and 455kHz. An incoming signal from the antenna is mixed with the first local oscillator (L.O.) signal to produce the 21.4MHz first IF signal. This is mixed again with the 20.945MHz 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)

fr = fr - 21.4MHz		
Range	fr (L.O.)	fr
F1: 150 ~ 174MHz	128.6 ~ 152.6MHz	150 ~ 174MHz
F2: 134 ~ 150MHz	112.6 ~ 128.6MHz	134 ~ 150MHz

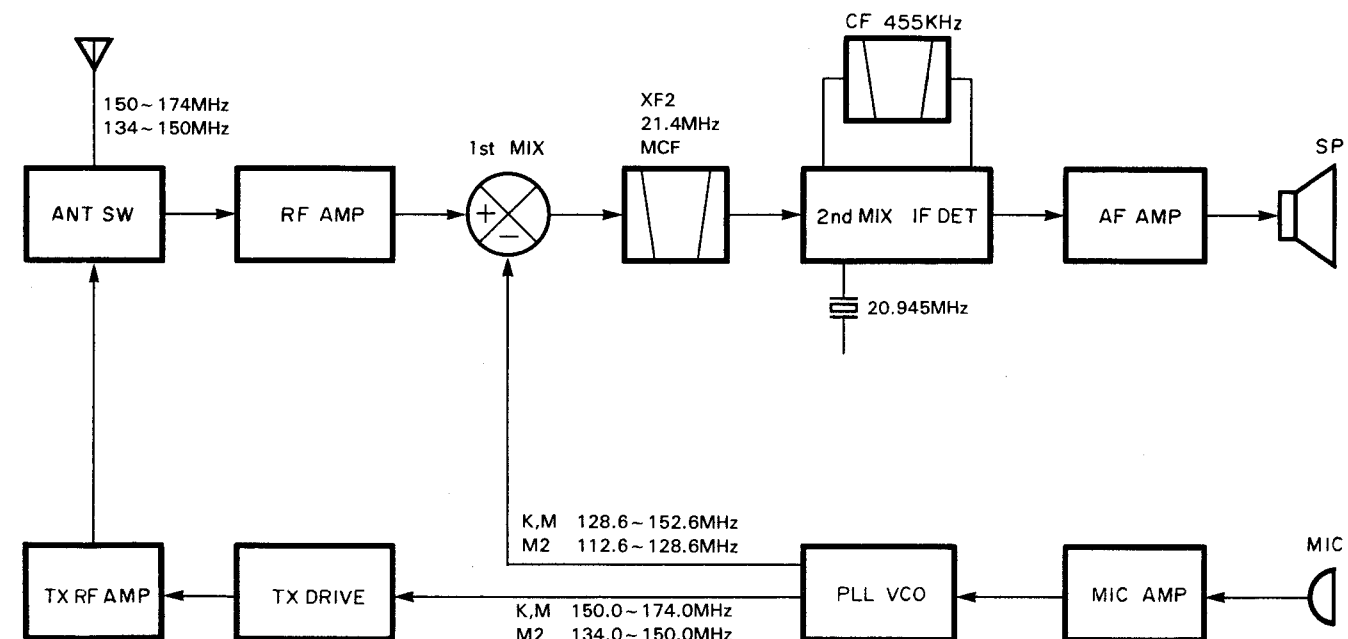


Fig. 1 Frequency Organization

2. TX-RX UNIT

1. PLL Frequency Synthesizer

The frequency synthesizer is a dual modulus prescaled type, and it consists of a 12.5MHz temperature compensated crystal oscillator (TCXO), 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.

Q1 (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 (D4). D4 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 (Q14).

A portion of the above VCO output signal is sampled and buffer amplified by Q12. The output signal of Q12 is applied to IC1 in the PLL sub-unit, where the signal is divided by a dual modulus type programmable counter to become a 5.0kHz signal. The 5.0kHz 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 5.0kHz signals are compared at the phase detector section of IC1 and any error in

TK-230/230(SC)

CIRCUIT DESCRIPTION

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 D2) in the VCO sub-unit.

The operating frequency is set according to the contents (programmed frequency) of the EEPROMs (Electrically Erasable Programmable Read Only Memory, IC7 and IC8 in the control unit) and the channel selected by the channel selector switch. The channel selector position is recognized by the microcomputer (IC1 in the control unit) and whenever the receiver circuit is turned on (initial power on and/or revert to the receive mode from the transmit mode), the microcomputer retrieves the frequency information (16-bit serial data) from the EEPROMs. This frequency information is sent to IC1 in the PLL unit, by the microcomputer, to set the programmable counter.

• Transmitter PLL (TX PLL)

The transmitter PLL (TX PLL) shares major components with the RX PLL. However, Q2 in the VCO sub-unit is used for generating the TX RF signal. The programmable counter in IC1 of the PLL unit is re-programmed, every time the transmitter is activated, for the proper operating frequency according to the channel selector position.

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 D4. Other loop operations are the same as for the RX PLL.

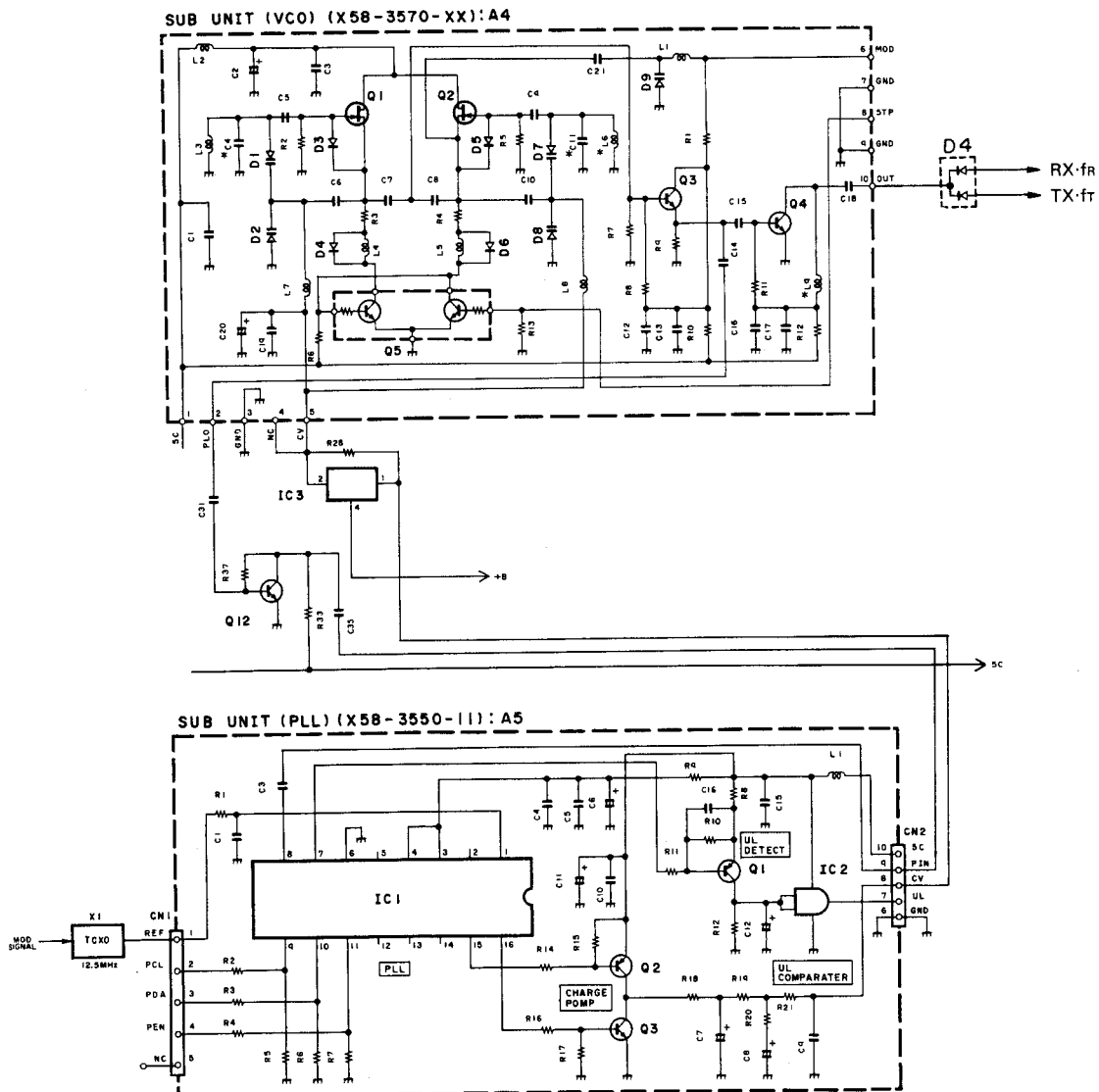


Fig. 2 PLL Circuit

TK-230/230(SC)

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)

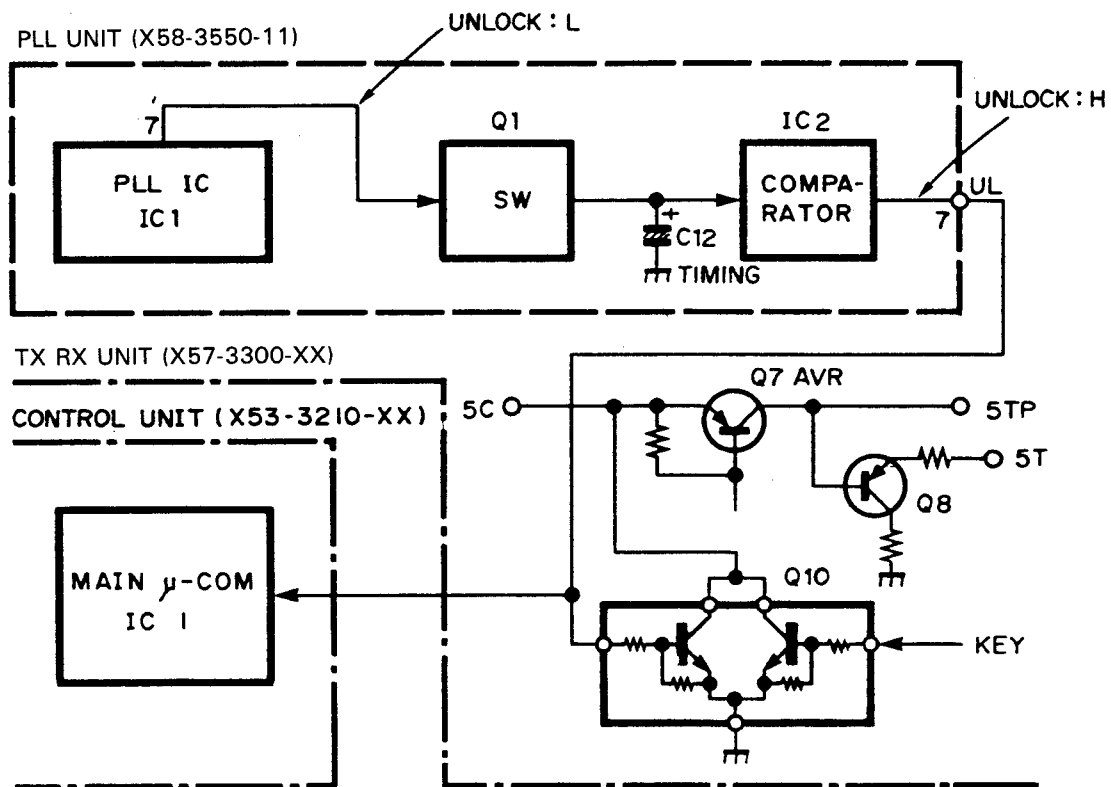


Fig. 3 Unlock detection circuit

2. Transmitter Modulator Circuit

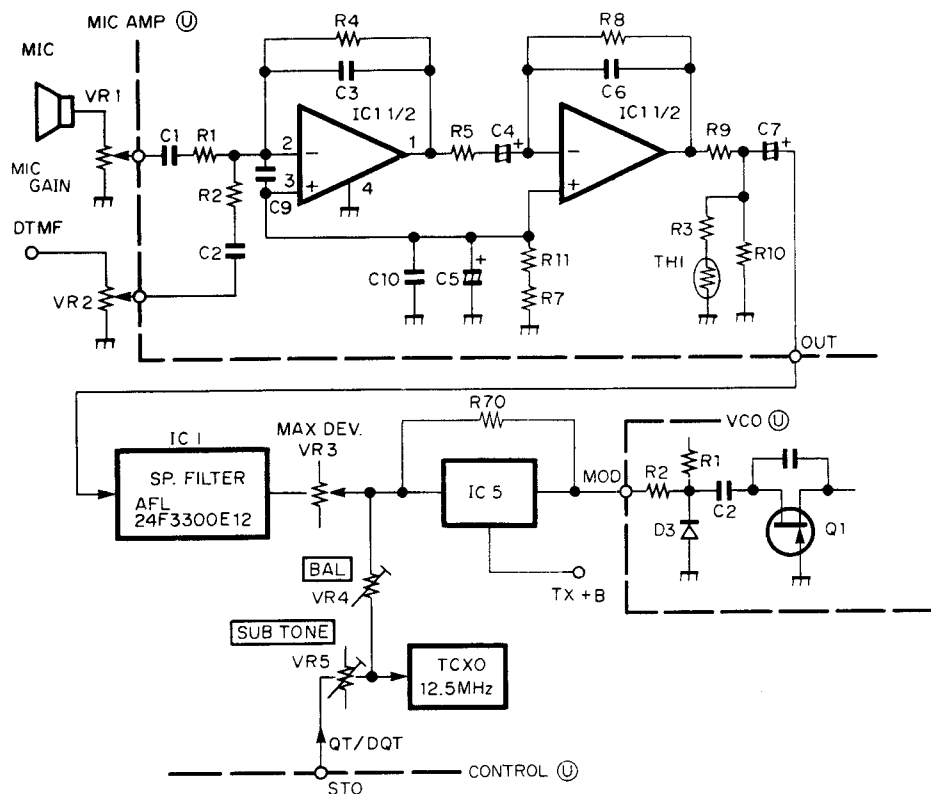
The audio signal from the microphone or the optional DTMF encoder is applied to the microphone amplifier module unit through VR1 or VR2. The signal is pre-emphasized while being amplified by a 2-stage operational amplifier (IC1) in the module unit and routed to the modulator (MOD) terminal of the VCO 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 thermistor (TH1). The output signal from the amplifier is routed through a resistor divider network (VR3 and R34) 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



3. Receiver Circuit

An incoming signal from the antenna (ANT terminal) passes through a Pi type low-pass filter (LPF) in the TX-RX unit, and then through D3 in the antenna switch (ANT SW) sub-unit if the external antenna terminal is used, and is routed to an RF amplifier, Q11 and Q13, in the TX-RX unit for filtered amplification.

Band-pass filters are placed before and after Q11 and Q13, to eliminate unwanted signals, which have varactor diodes D6, D8, D9 and D10 for automatic tracking of the front end band-pass filter tuning based on the programmed receive frequency.

The signal that has been amplified by Q11 and Q13 is heterodyned down to a 21.4MHz first IF signal by mixing it with a first L.O. signal from the PLL unit in an active mixer, Q14. It is then fed to the IF sub-unit.

The recovered audio signal from IC1 is de-emphasized at IC4 (audio band-pass filter) and it is applied to the audio power amplifier module (AF PA) unit after going through a volume control on the top panel. The audio signal is further amplified, by IC1 (NJM2073M) in the PA unit, up to a level of 0.5W (Bridged Transformer-Less configuration) for driving a speaker.

In the IF sub-unit, the noise component in the recovered audio signal from the IF IC is amplified by a noise amplifier, consists of an operational amplifier in the IF IC, and Q2 in the IF sub-unit. The signal is then detected by a noise detector (half-wave rectifier) circuit, and is passed through a ripple filter and a temperature compensation circuit before being returned to the squelch switching circuit in IC1.

The squelch switch information obtained above is sent to IC1 (microcomputer) in the control unit to indicate the presence of an incoming signal. IC1 controls the audio signal line in the control unit with Q5, and the power supply lines for IC1 and the audio band-pass filter, both in the AF PA module unit, with Q1.

Q15 in the TX-RX unit is provided for eliminating a misoperation of the microcomputer. By monitoring the squelch switch line, when the common 5V power supply is turned on, Q16 and Q17 prevent the AF PA from being damaged by an overload.

TK-230/230(SC)

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. The output signal of the driver unit is further amplified in a power hybrid module, IC12, 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.

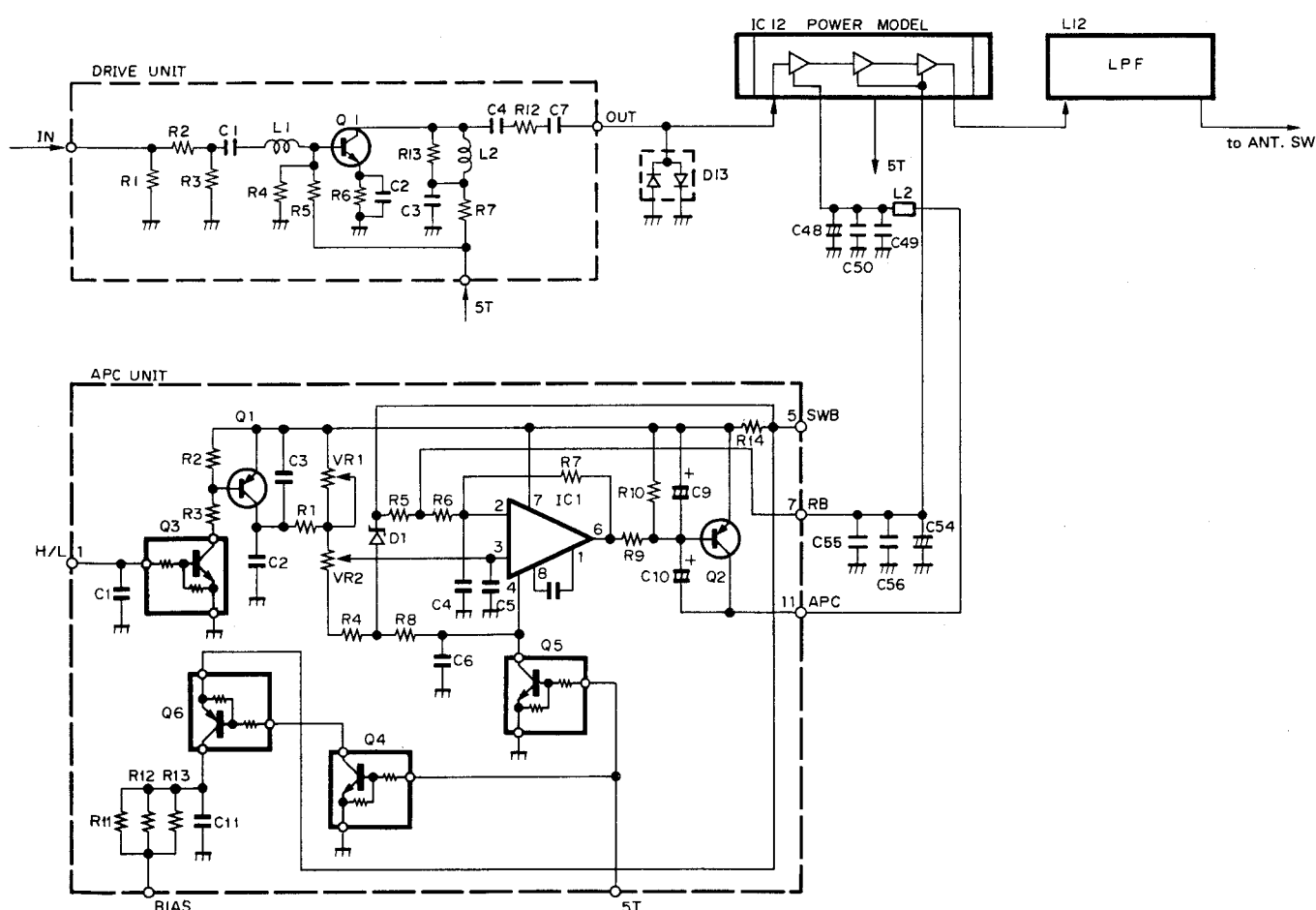


Fig. 5 APC, HI/LOW switching circuit

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.

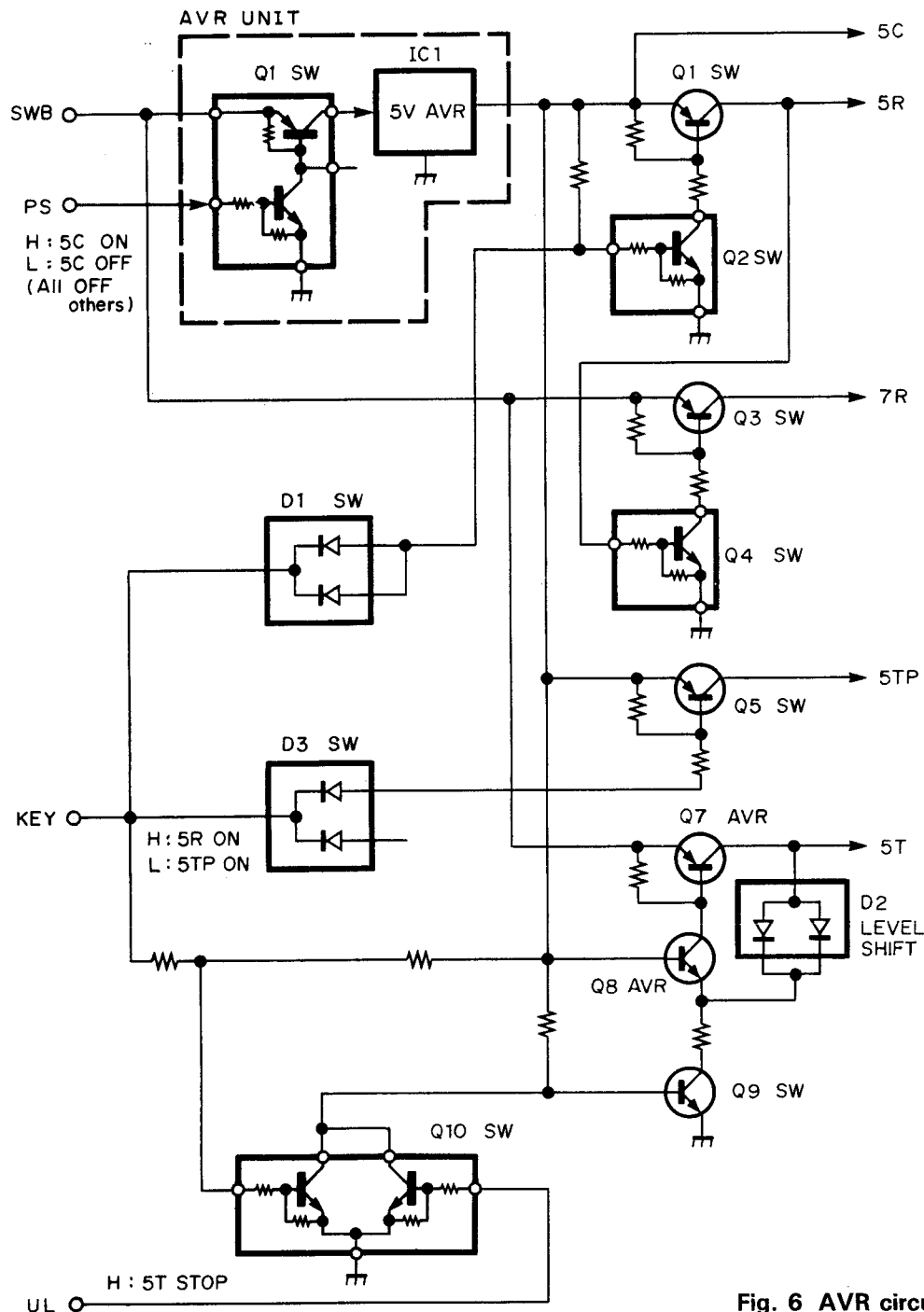


Fig. 6 AVR circuit

TK-230/230(SC)

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 $1/4$ 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 goes 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.

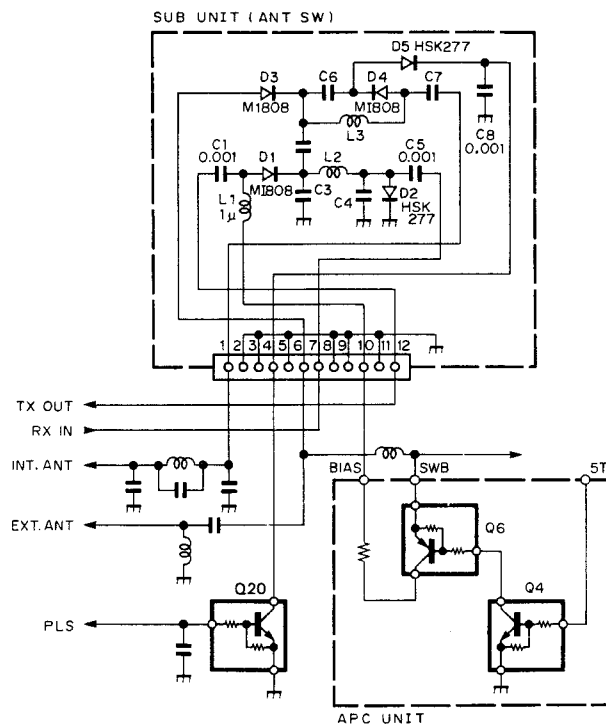


Fig. 7 ANT switching

3. CONTROL UNIT

The Control Unit has the following functions that are mostly processed in the Main MPU, IC1 (H37450M4-235FP) (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/Decode
- Data exchange between the signaling unit and MPU
- Radio programming function (with KDM-4 and KCT-1 or KCT-2)
- Control functions such as, SCAN BUSY LOCK OUT, PTT LOCK OUT, etc.
- A voltage corresponding to the frequency is supplied to the varactor diode in the receiver.

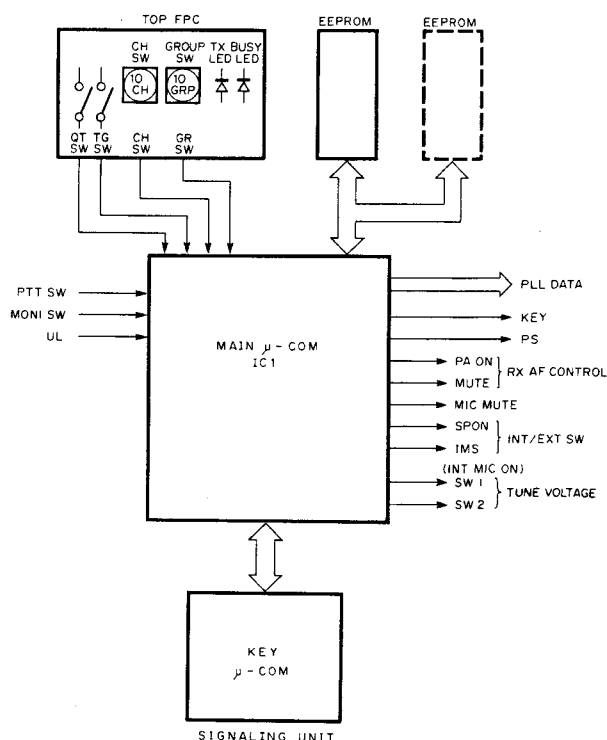


Fig. 8 Control unit

CIRCUIT DESCRIPTION

1. RX Audio Switching ON/OFF

The receive audio, beep tones, and DTMF side tone are routed to the speaker. Signal line MUTE function is controlled by the MPU through IC9 (TC4S66F) depending on the conditions set by the control unit.

If no selective signaling option is employed, the receive audio muting is done by controlling the power supply for the AF power amplifier IC in the PA sub-unit of the TX-RX unit and IC9 and Q5 (audio signal line) in the control unit.

When the selective signaling (CTCSS or Digitally Controlled Squelch) is enabled, audio muting is performed by monitoring the detector (DET) output signal.

The recovered audio signal from the incoming signal is filtered by a low-pass filter, which has a sharp cut-off characteristic at 230Hz, to eliminate the audible frequency range. The filtered signal is fed to IC1 in the control unit for CTCSS or Digitally Controlled Squelch decode after going through the appropriate waveform shaping circuits.

Audio muting is performed by controlling the power supply for the audio amplifier, the same as for the noise squelch.

For driving the speaker with the BEEP alarm during PA: ON, T.O.T. and LOCK OUT, PA: ON and SP: ON are set to high. The BEEP signal from the MPU passes through a LPF before being amplified and applied to the speaker.

During DTMF output, part of the DTMF signal from the signaling unit is routed to the audio amplifier. Only PA: ON and SP: ON are set to high and DTMF side tone is applied to the speaker.

All three signal output levels are adjustable by using the volume control and the level compensation of each signal is done with a summing resistor.

When switched to EXT, the SP: ON signal is set to low and the INT SP signal is turned off. (Figure 9)

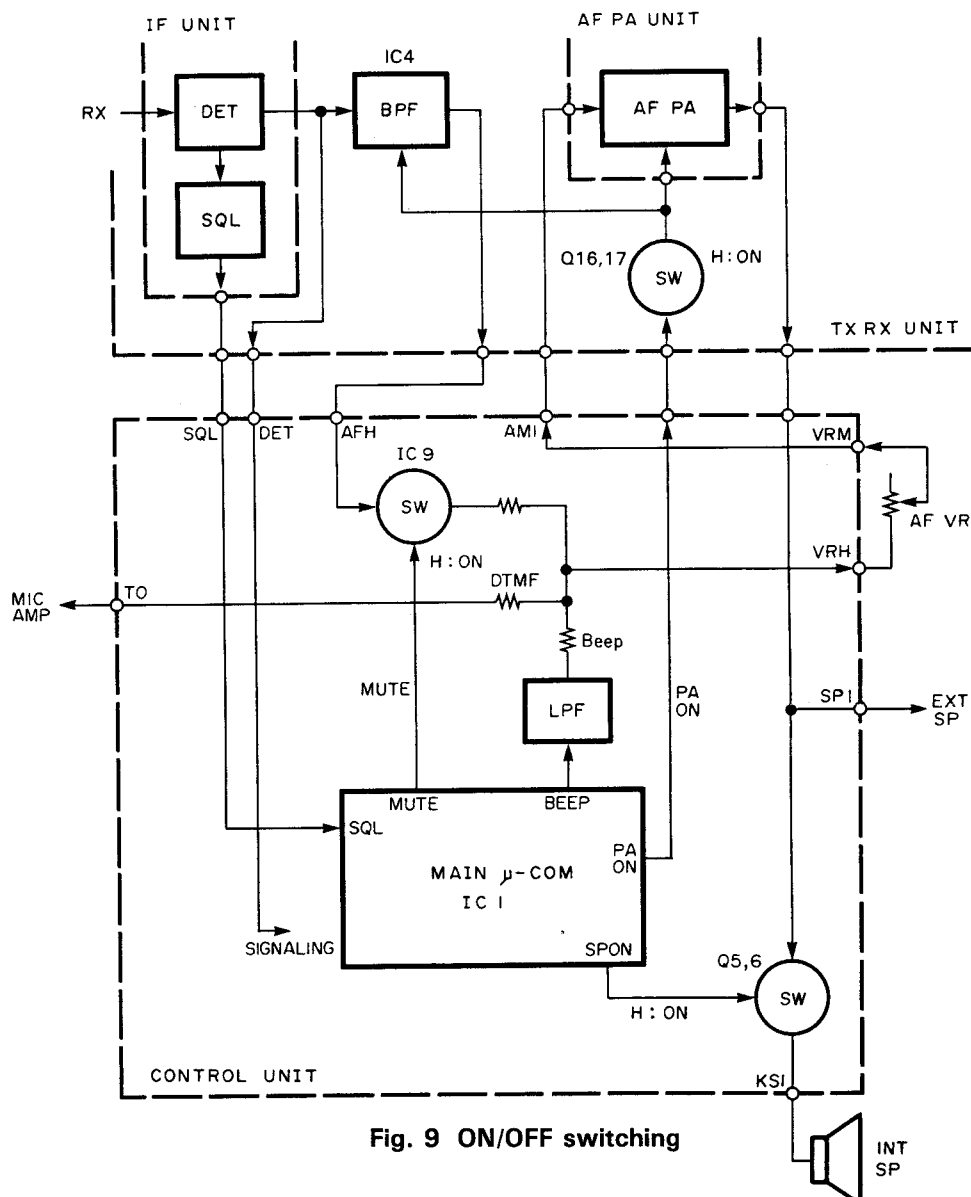


Fig. 9 ON/OFF switching

TK-230/230(SC)

CIRCUIT DESCRIPTION

2. 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

Connecting the EDA line at the universal connector to GND causes not only the audio but also the ANT is to be routed to the EXT port by the main MPU.

When the EDA line is low, the PLS line is set high resulting the ANT port is switched to EXT.

The MIC MUTE line is set true during the DTMF tones are encoded, causing the MIC input is disabled to avoid the speaker output signal is getting into the transmit modulation.

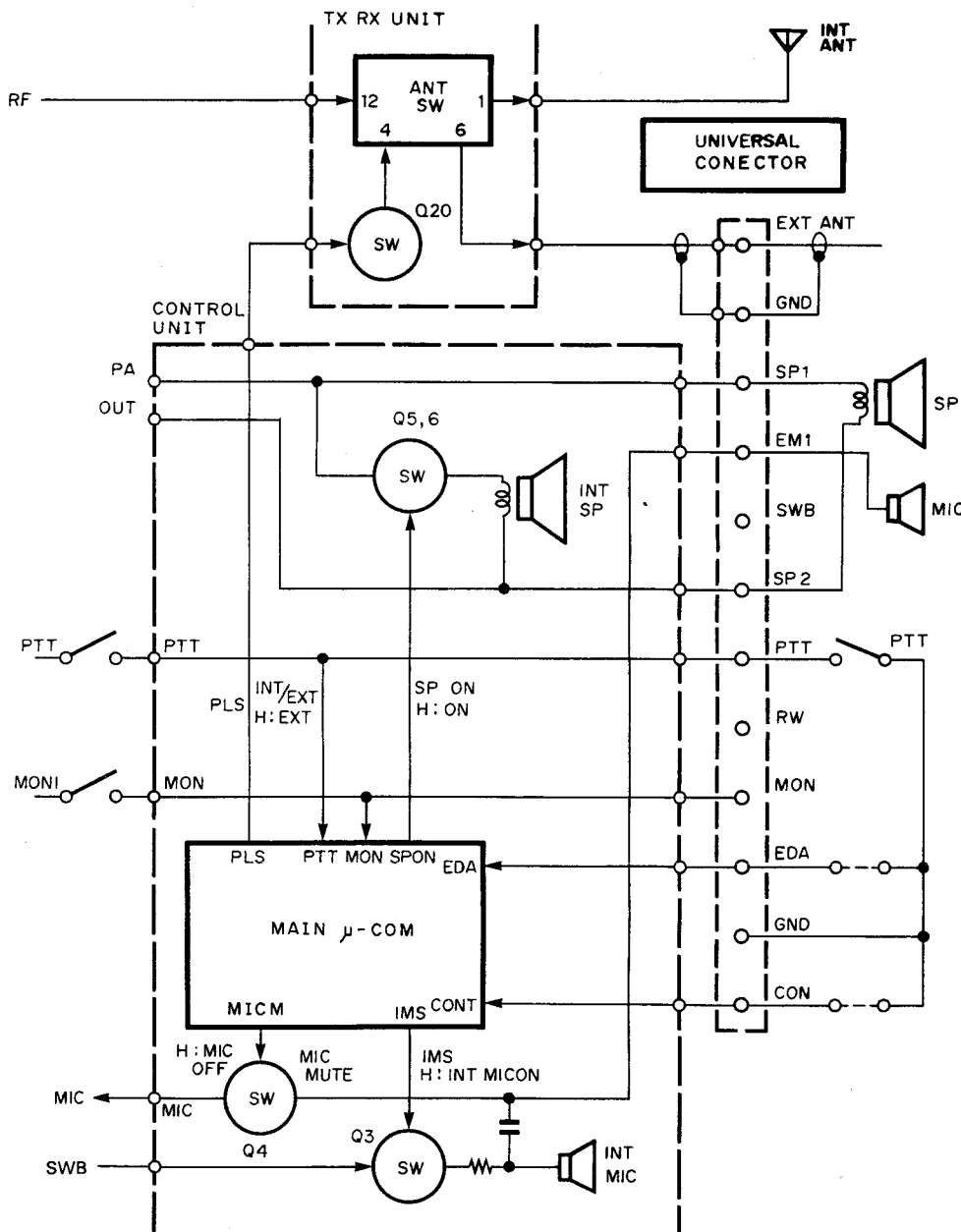


Fig. 10 INT/EXT switching

TK-230/230(SC)

CIRCUIT DESCRIPTION

3. Vari-cap tuning Circuit

- A tuning voltage is supplied to the varactor diode in the receiver according to the HI/LO state at the IC1 output port (SW1, SW2) of the main CPU.
- SW1 and SW2 (frequency range tuning switches) are automatically set when the frequency is written using a combination of KPT-20 and KPT-2R. Note however, that, only if the frequency received by the radio type M2 is 150,000MHz, enter SW1 = 1 and SW2 = 1.
- The SW1 and SW2 settings are also held effective during transmission. On the F1 version, they are used for switching of modulation factor.

	Frequency (MHz)	SW1	SW2
F1	$150.0 \leq f < 155.5$	L	L
	$155.5 \leq f < 161.5$	L	H
	$161.5 \leq f < 167.5$	H	L
	$167.5 \leq f < 174.0$	H	H
F2	$134.0 \leq f < 137.5$	L	L
	$137.5 \leq f < 141.5$	L	H
	$141.5 \leq f < 145.5$	H	L
	$145.5 \leq f < 150.0$	H	H

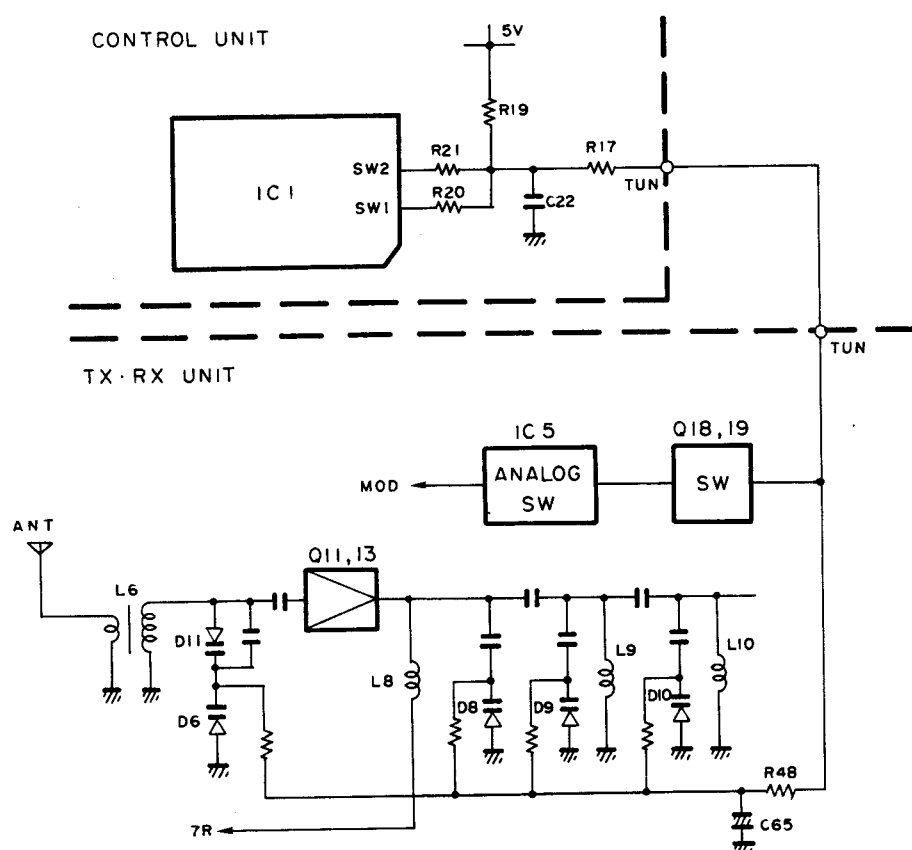


Fig. 11

TK-230/230(SC)

CIRCUIT DESCRIPTION

4. SIGNALING

The DET output signal is filtered by a 300Hz Low-Pass filter (LPF) consisting of 1/2 of IC5 (NJM2904M) and 1/2 of IC6 (NJM2904M) to eliminate the audible frequency signals from the recovered audio. The filtered signal is then amplified to approximately 3V p-p in 1/2 of IC6 and is applied to the analog signal input terminal of the main MPU. D1 (DAN202K) is provided to limit the maximum input level applied to the MPU. The output signal from 1/2 of IC5 above is further processed by the other 1/2 of IC5, waveform shaped by 1/2 of IC4 (NJM4588M) and level translated by 1/2 of Q2 (FMG2) to a 0 to 5V square wave format for DQT decoding at the MPU. The MPU controls the receiver audio circuit according to the presence or absence of the QT or DQT signal.

The DET output signal is also sampled by the control unit through 1/2 of IC4 and 1/2 of Q2. This signal determines the presence of an incoming signal during SCAN operation.

In the transmit mode, the QT or DQT signals are sent out from the D/A (Digital to Analog) converter output pin of the MPU. A post Low-Pass filter is provided to remove the quantizing noise from the generated signal. (Figure 12)

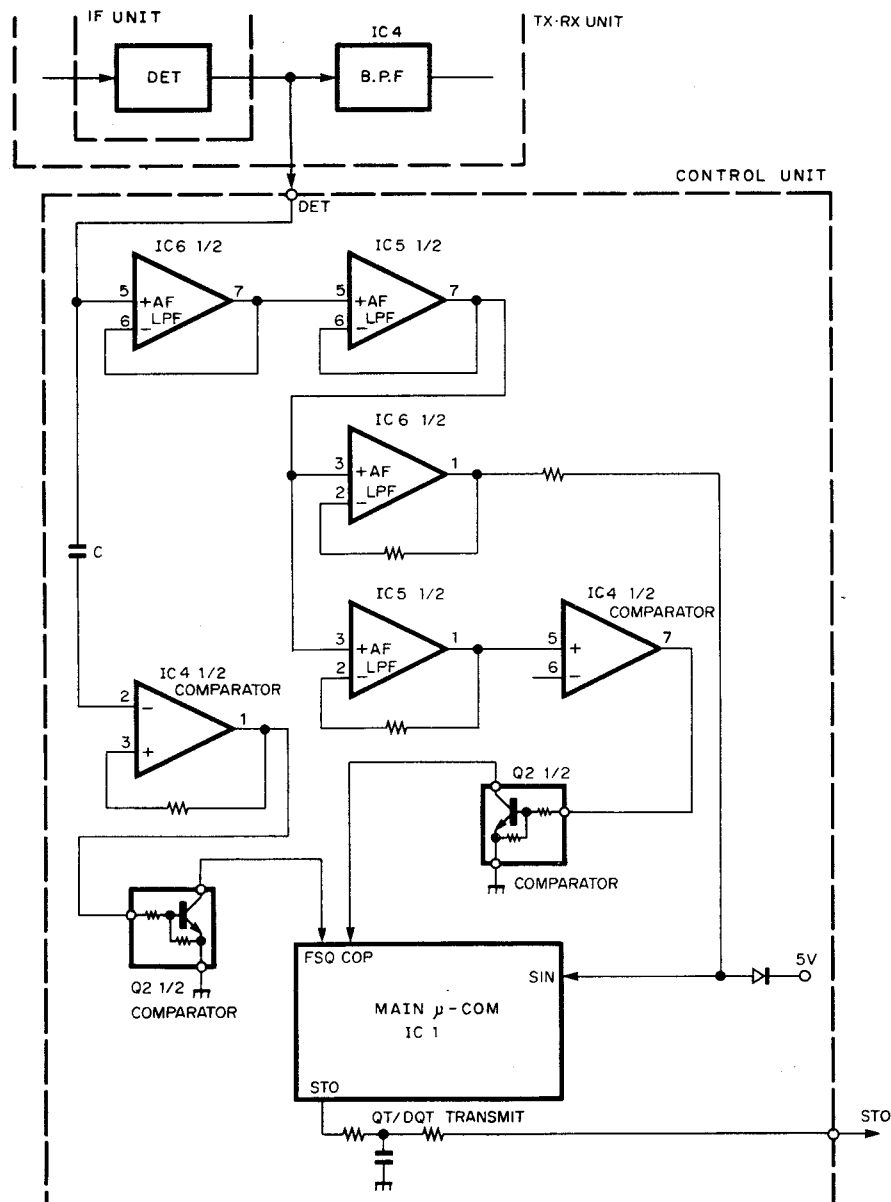


Fig. 12 Signaling

CIRCUIT DESCRIPTION

1. Signaling Unit

The Signaling Unit consist of a 4 bit 1 chip MPU (HD4074608), a 1K bit EEPROM AK93C46F (The 100CH version transceiver uses a CAT35C104PI), 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 Signalling 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 13)

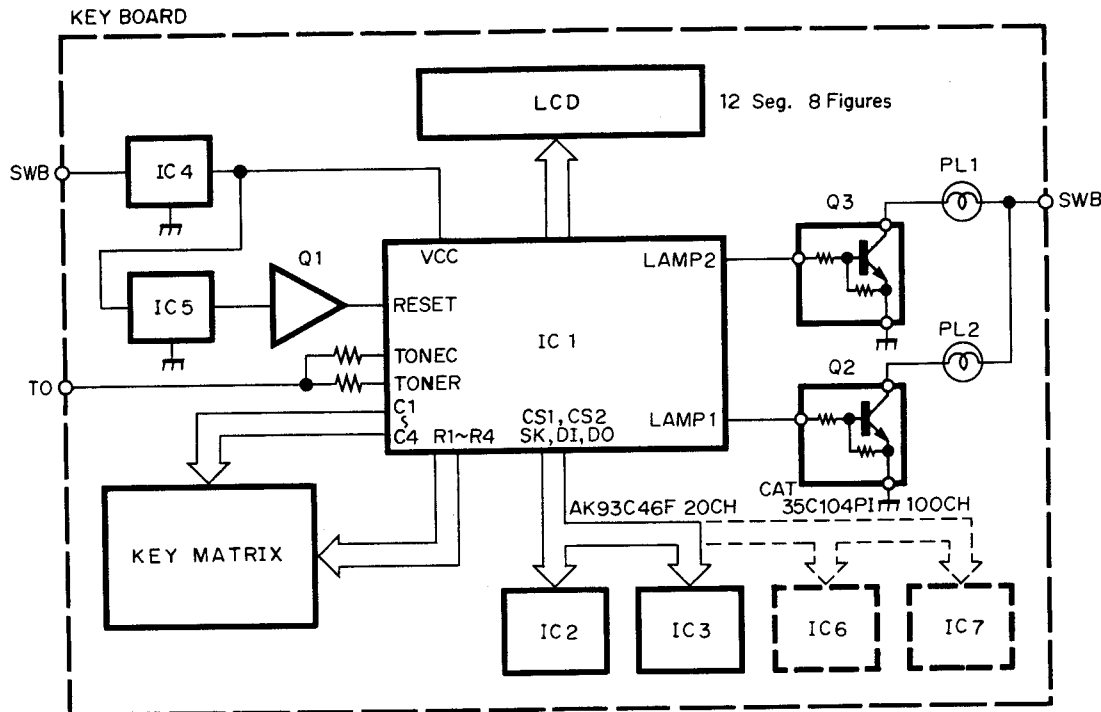
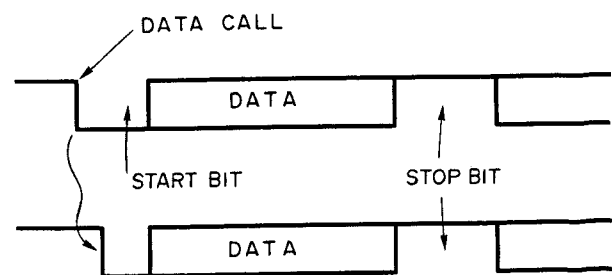


Fig. 13 Signaling system

• Data Communication between the Signal and Control Units

Data communication between the units is performed as shown in Figure 14. 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
PRIORITY DISPLAY
DTMF MONI/MIC MUTE CONTROL
DEL/ADD CONTROL DISPLAY

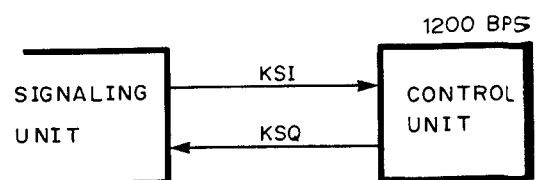


Fig. 14

TK-230/230(SC)

SEMICONDUCTOR DATA

L71-0244-05: MCF (IF unit XF2)

Item	Rating
Nominal center frequency (fo)	21.400MHz
Pass bandwidth	fo $\pm$ 7.5kHz or more at 3dB (-20°C ~ +60°C)
Attenuation bandwidth	fo $\pm$ 25kHz or less at 40dB
Guaranteed attenuation	85dB or more within fo $\pm$ 1MHz Spurious: 40dB or more
Ripple	1.0dB or less
Insertion loss	2.5dB or less
Terminal impedance	1.6k Ω /1pF

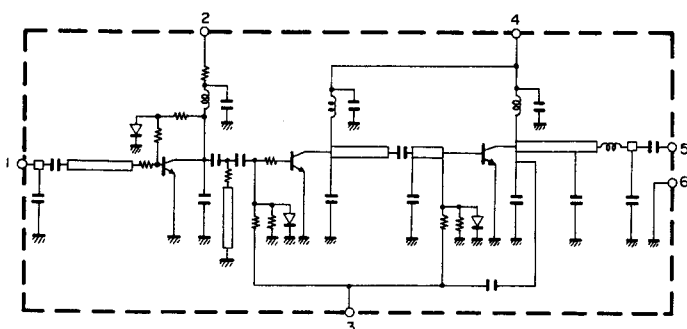
L72-0373-05: Ceramic filter (IF unit XF1)

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

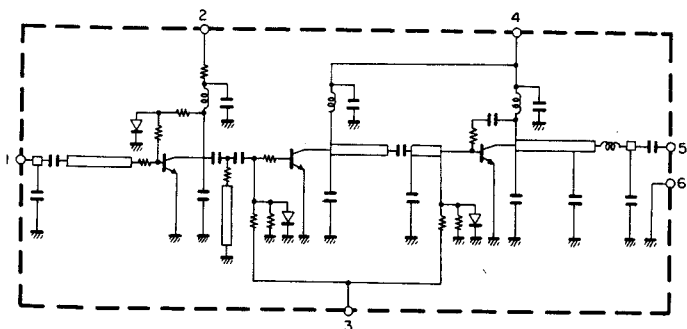
M67755L/H: Power module (TX-RX unit IC2)

• Equivalent circuit

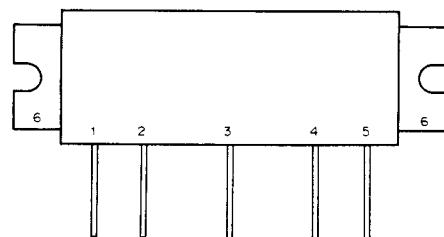
M67755H



M67755L



• Terminal connection diagram



- 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
Bass bias voltage	Vbb	—	7	V
DC current	Icc	—	4	A
Input power	Pin	Zg = Zi = 50 Ω	4	mW
Output power	Pout	Vcc1 $\leq$ 7.2V	10	W
Operation temperature	Tc (op)	—	-30 ~ +110	°C
Storage temperature	Tstg	—	-40 ~ +110	°C

• Electrical characteristics (Tc = 25°C)

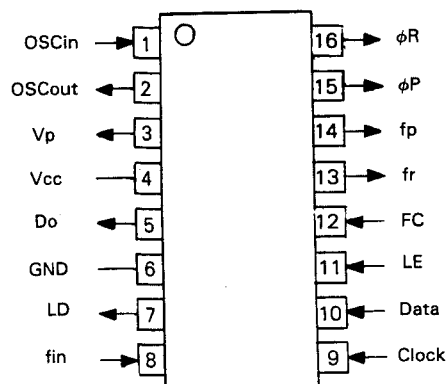
Item	Symbol	Condition	M67755L			M67755H			Unit
			Min	Typ	Max	Min	Typ	Max	
Frequency range			134	—	150	150	—	174	MHz
Output power	Po		7.5	7.8	—	7.5	7.8	—	W
Total efficiency	n	Vcc = 7.2V	45	48	—	45	48	—	%
2nd spurious		Vbb = 5V	—	—	-25	—	—	-25	dB
3rd spurious		Pin = 2mW	—	—	-30	—	—	-30	dB
Input SWR	pin	Zg = Zi = 50 Ω	—	—	2.5	—	—	2.5	—
Output SWR	pout		—	1.5	—	—	1.5	—	—

TK-230/230(SC)

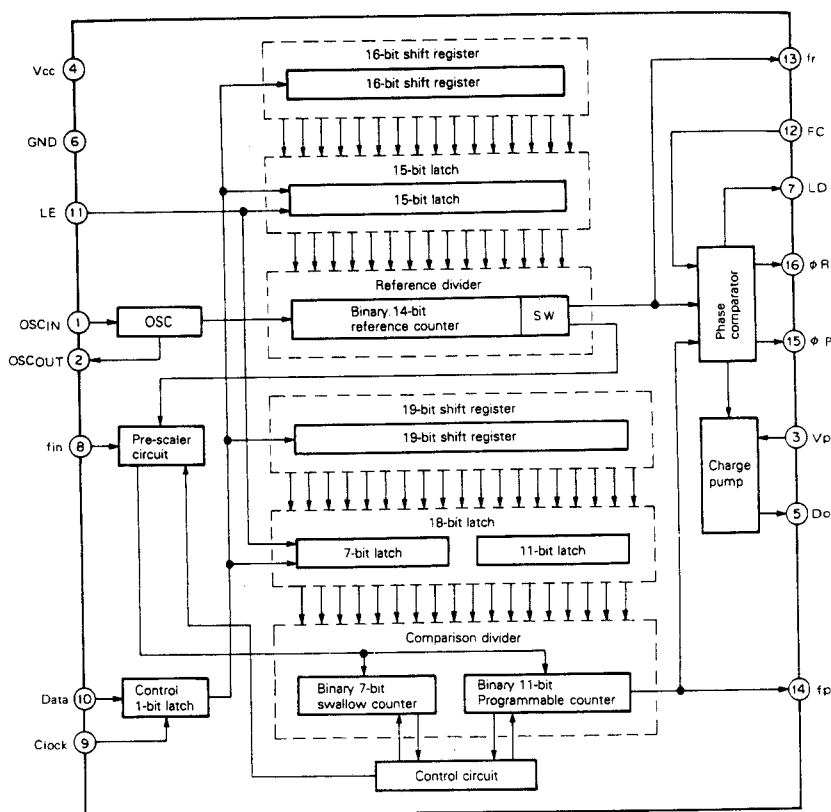
SEMICONDUCTOR DATA

MB1504F: PLL IC (PLL unit IC1)

• Terminal connection diagram



• Block diagram



• Explanation of terminals

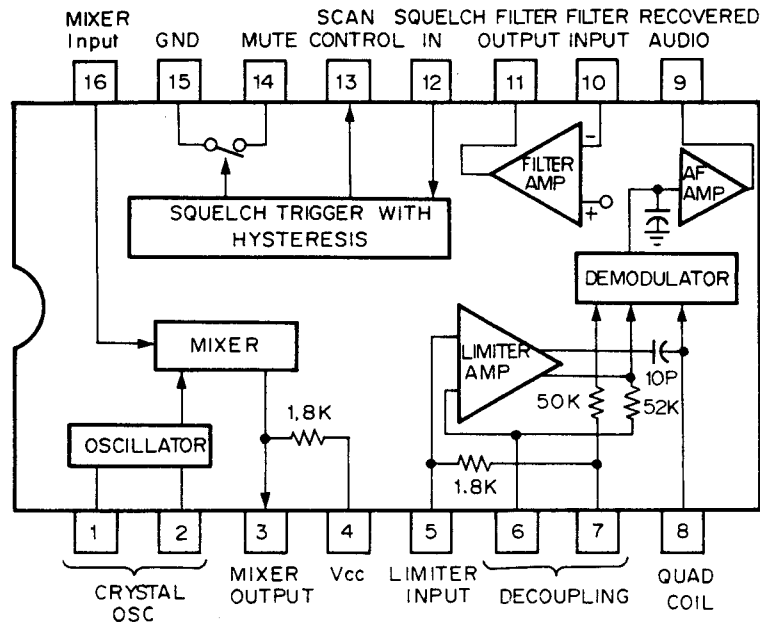
Pin No.	Name	I/O	Function
1	OSCIN	I	Terminal for crystal connection.
2	OSCOUT	O	(OSCIN = Oscillator circuit input terminal, OSCOUT = Oscillator circuit output terminal)
3	Vp	O	Power supply terminal for charge pump output.
4	Vcc	-	Power supply terminal.
5	Do	O	Charge pump output terminal. Phase characteristics 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	φP	O	Phase detector output terminal for external charge pump.
16	φR	O	Phase characteristics are inverted according to the setting of the FC terminal.

TK-230/230(SC)

SEMICONDUCTOR DATA

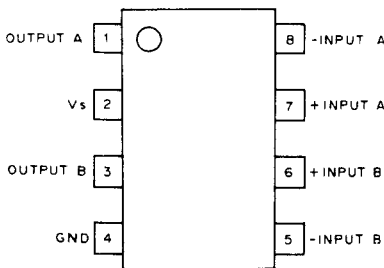
MC3361D : FM IF (IF unit IC1)

• Block diagram

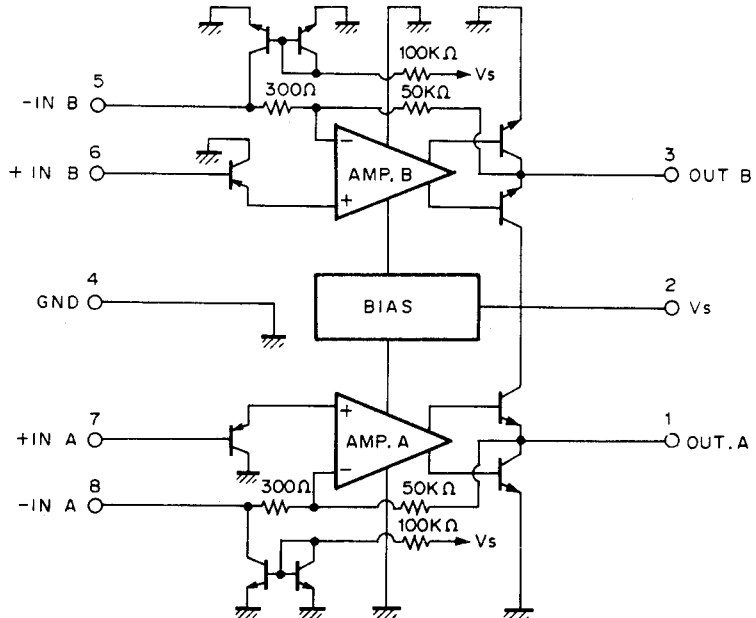


NJM2073M : AF power amplifier (AF PA unit IC1)

• Terminal connection diagram



• Block diagram



• Electrical characteristics

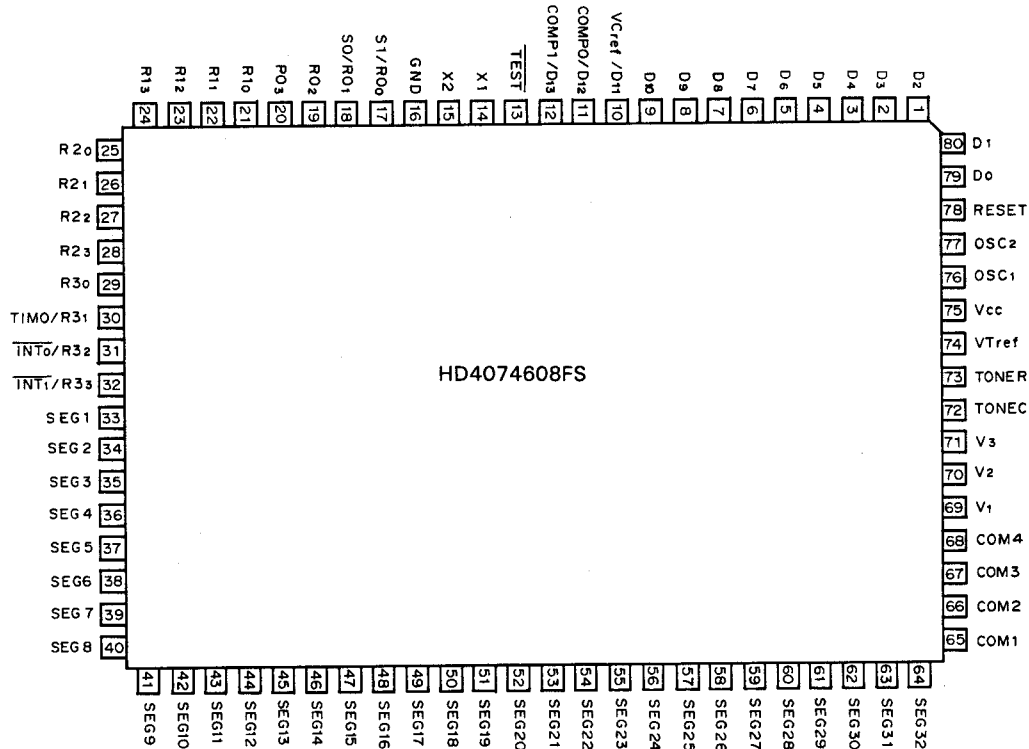
Item	Symbol	Condition	MIN	TYP	MAX	Unit
Supply voltage	Vs		1.8		15	V
Output power	Po	THD = 10%, f = 1kHz				
		Vs = 6V, RL = 16Ω		0.8		W
		Vs = 4V, RL = 8Ω	350	460		mW
		Vs = 3V, RL = 4Ω	200	300		mW
		Vs = 2V, RL = 4Ω		80		mW
		THD = 1%, f = 40Hz ~ 15kHz, Vs = 4V, RL = 8Ω		380		mW
Distortion	THD	Vs = 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

TK-230/230(SC)

SEMICONDUCTOR DATA

HD4074608FS: Micro controller (Signaling unit IC1)

• Terminal connection diagram



H37450M4-235FP: Micro controller (Control unit IC1)

• Terminal connection diagram



TK-230/230(SC)

SEMICONDUCTOR DATA

• HD4074608FS 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/Vc _{ref}	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 colum output (analog output).	
73	TONER	O	DTMFR	DTMF row output (analog output).	
74	VT _{ref}	-		Connect to V _{cc} .	
75	V _{cc}	-			
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

TK-230/230(SC)

SEMICONDUCTOR DATA

• H37450M4-235FP explanation of terminals

Pin No.	Symbol	I/O	Name	Function	Pin No.	Symbol	I/O	Name	Function
1	NC	–	NC	Non connect	41	NC	–	NC	Non connect
2	P31/EV2	I	COP	Event	42	P17/A15	I	SO	
3	P30/EV1	I	FSQ	Fast squelch. Event.	43	P16/A14	O	PR	
4	P57/DB7	I	Bit3	Group SW	44	P15/A15	O	PRE	
5	P56/DB6	I	Bit2	Group SW	45	P14/A12	O	CS2	
6	P55/DB5	I	Bit1	Group SW	46	P13/A11	O	CS1	
7	P54/DB4	I	Bit0	Group SW	47	P12/A10	O	MUT	
8	P53/DB3	I	Bit3	CH SW	48	P11/A9	O	PLS	
9	P52/DB2	I	Bit2	CH SW	49	P10/A8	O	KEY	
10	P51/DB1	I	Bit1	CH SW	50	P07/A7	O	PS	
11	P50/DB0	I	Bit0	CH SW	51	P06/A6	O	PEN	
12	P67/W	I	QT		52	P05/A5	O	PDA	
13	P66/R	I	TSW		53	P04/A4	O	PCL	
14	P65/CS	O	BSY	Busy LED	54	P03/A3	O	SW2	
15	P64	O	TL	TX LED	55	P02/A2	O	SW1	
16	P63/Prdv	O	NNC		56	P01/A1	O	HL	
17	P62/INT3	I	COP2	External interruption	57	P00/A0	O	PA ON	
18	P61/INT2	I	ROMS	External interruption	58	P47/AN7	I	UL	PLL unlock. Analog input
19	P60/INT1	I	ROMN	External interruption	59	P46/AN6	I	SQL	Squelch. Analog input
20	WR	O		Open	60	P45/AN5	I	MONI	Monitor SW input. Analog input
21	RD	O		Open	61	P44/AN4	I	PTT	PTT SW input. Analog input
22	R/W	O		Open	62	P43/AN3	I	S/B	Scan/Basic SW. Analog input
23	SYNC	O		Open. SYNC signal output	63	P42/AN2	I		Analog input
24	RESETout	O		Open. Reset signal output	64	P41/AN1	I	SIN	Analog input
25	CNVss	I	Vss	GND. Mode selection	65	P40/AN0	I	LVTG	Low voltage. Analog input
26	RESET	I		Reset signal input	66	DA2	O	STO	Subtone output. Analog output
27	NC	–	NC	Non connect	67	DA1	O	LPFO	Low pass filter output. Analog output
28	Xin	I			68	DAVREF	–		5V. D/A reference
29	Xout	O			69	ADVREF	–		5V. A/D reference
30	NC	–	NC	Non connect	70	AVss	–		GND. Analog ground
31	ø	O		Open. Timing output.	71	AVcc	–		5V.
32	Vss	–		GND	72	Vcc	–		5V
33	P27/D7	I/O	CONT		73	Vss	–		GND
34	P26/D6		EDA		74	P37/SRDV	I		
35	P25/D5		IMS		75	P36/SCLK	O	SPON	
36	P24/D4		ROMW		76	P35/TXD	O	KSO	Serial output
37	P23/D3	I	POLT		77	P34/RXD	I	KSI	Serial input
38	P22/D2	I	POLR		78	P33/PWMOUT	O	BEEP	PWM output
39	P21/D1	I	TST1		79	P32/EV3	O		MIC mute. Event
40	P20/D0	I	TST2		80	NC	–	NC	Non connect

TK-230/230(SC)

DESCRIPTION OF COMPONENTS

TX-RX UNIT (X57-3300-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	2SC3099	RF amplifier
Q12	2SC2714(Y)	RX RF amplifier
Q13	2SC3099	RF amplifier
Q14	3SK140(GR)	1st Mixer
Q15	DTC144EK	Switch
Q16	2SA1162(Y)	Protection
Q17	DTC144EK	Switch
Q18	2SC2712(Y)	Switch
Q19	2SC1162(Y)	Switch
Q20	DTC144EK	Switch
D1	DAN202(K)	Switch
D2	DAP202(K)	Level shift
D3	DAN202(K)	Switch
D4	HSM2693	Switch
D5	HSM88AS	RF Limiter
D6	MA360	RX Tuning
D7	DAP202(K)	Level Shift
D8	MA366	RX Tuning
D9	MA366	RX Tuning
D10	MA366	RX Tuning
D11	MA360	RX Tuning
D13	HSM88AS	Limiter
IC1	AFL24F3300E12	Splatter filter
IC2	M67755L.H	TX power module
IC3	TC4S66F	Switch
IC4	KCE02	RX AF BPF
IC5	TC4S66F	Switch

IF (X58-3530-11)

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	Switch

VCO (X58-3570-XX)

Ref. No.	Parts No.	Description
Q1	2SK508NV(K52)	RF oscillator (TX)
Q2	2SK508NV(K52)	RF oscillator (RX)
Q3,4	2SC2714(Y)	RF amplifier
Q5	FMG4	Switch
D1,2	1T33C	Frequency control
D3	HSM2693	RX Temp. Compensation
D4	MA110	RX Temp. Compensation
D5	HSM2693	TX Temp. Compensation
D6	MA110	TX Temp. Compensation
D7	1T33C	Freq. Control
D8	1T33C	Freq. Control
D9	MA366	TX Modulator

PLL (X58-3550-11)

Ref. No.	Parts No.	Description
Q1	2SA1162(Y)	Unlock detect
Q2	2SA1162(Y)	Charge pump
Q3	2SC2712(Y)	Charge pump
IC1	MB1504F	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 (X59-3540-11)

Ref. No.	Parts No.	Description
Q1	2SC3098	RF amplifier

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 (X53-3210-XX)

Ref. No.	Parts No.	Description
Q1	FMC5	Switch
Q2	FMG2	Comparator
Q3	FMC5	Switch
Q4	DTC363EK	Mic mute
Q5	2SD1246(S,T)	Internal speaker mute
Q6	FMC5	Switch
Q7	FMA1	Switch
D1	DAN202(K)	Limiter
D2	HSM88AS	Limiter
D3~8	02CZ9.1(X,Y)	
D9	02CX10(X,Y)	
IC1	H37450M4-235FP	Micro controller
IC2	S-81250HG-RD	Voltage regulator
IC3	S-8054HN-CB	Voltage detector
IC4	NJM4558M	Comparator
IC5,6	NJM2904M	AF (signalling) LPF
IC7,8	NMC93CS66EN	EEPROM
IC9	TC4S66F	AF mute

SIGNALLING UNIT (X52-3150-20): TK-230SC ONLY

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

TK-230/230(SC)

PARTS LIST

CAPACITORS

CC 45 TH 1H 220 J
1 2 3 4 5 6

CC45

Color*

Capacitor value

1 0 3 = 0.01 μ F

- 1 = Type ceramic, electrolytic, etc.
2 = Shape round, square, etc.
3 = Temp. coefficient

- 4 = Voltage rating
5 = Value
6 = Tolerance

Temperature Coefficient

1st Word	C	L	P	R	S	T	U
Color*	Black	Red	Orange	Yellow	Green	Blue	Violet
ppm/°C	0	-80	-150	-220	-330	-470	-750

2nd Word	G	H	J	K	L
ppm/°C	± 30	± 60	± 120	± 250	± 500

Example CC45TH = -470 ± 60 ppm/°C

Tolerance

Code	C	D	G	J	K	M	X	Z	P	No code
(%)	± 0.25	± 0.5	± 2	± 5	± 10	± 20	+40 -20	+80 -20	+100 -0	10 μ F -10 ~ +50 4.7 μ F -10 ~ +75

Code	B	C	D	F	G
(pF)	± 0.1	± 0.25	± 0.5	± 1	± 2

Less than 10 pF

Rating voltage

2nd word 1st word	A	B	C	D	E	F	G	H	J	K	V
0	1.0	1.25	1.6	2.0	2.5	3.15	4.0	5.0	6.3	8.0	-
1	10	12.5	16	20	25	31.5	40	50	63	80	35
2	100	125	160	200	250	315	400	500	630	800	-
3	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	-

Chip capacitors

(EX) CC 73 F SL 1H 000 J
1 2 3 4 5 6 7
(Chip) (CH, RH, UJ, SL)
(EX) CK 73 F F 1H 000 Z
1 2 3 4 5 6 7
(Chip) (B, F)

RESISTORS

Chip resistor (Carbon)

(EX) RD 73 E B 28 000 J
1 2 3 4 5 6 7
(Chip) (B, F)

Carbon resistor (Normal type)

RD 73 E B 28 000 J
1 2 3 4 5 6 7

- 1 = Type ceramic, electrolytic, etc.
2 = Shape round, square, etc.
3 = Dimension
4 = Temp. coefficient
5 = Voltage rating
6 = Value
7 = Tolerance.

Dimension

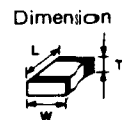
Dimension code	L	W	T
Empty	5.6 ± 0.5	5.0 ± 0.5	Less than 2.0
E	3.2 ± 0.2	1.6 ± 0.2	Less than 1.25
F	2.0 ± 0.3	1.25 ± 0.2	Less than 1.25

Dimension

Dimension code	L	W	T	Wattage
E	3.2 ± 0.2	1.6 ± 0.2	0.57	2B
F	2.0 ± 0.3	1.25 ± 0.2	0.45	2A

Rating wattage

Cord	Wattage	Cord	Wattage	Cord	Wattage
2A	1/10W	2E	1/4W	3A	1W
2B	1/8W	2H	1/2W	3D	2W
2C	1/6W				



TK-230/230(SC)

PARTS LIST

SEMICONDUCTOR

N : New parts

Item	Remarks	Parts NO.
Diode	N	DAN202 (K)
		DAP202 (K)
		DA204U
		HSK277
		HSM88AS
		HSM2693
		M1808
		MA110
		MA360
		MA366
		1T33C
Zenner diode		RD10M-B1
		RD9.1M-B2
		02CZ3.9 (Y,Z)
		02CZ9.1 (X,Y)
		02CZ10 (X,Y)
Transistor		2SA1162 (Y)
		2SA1213 (Y)
		2SA1362 (Y)
		2SB1182F5 (Q)
		2SC2712 (Y), (GR)
		2SC1213 (Y)
		2SC2714 (Y)
		2SC3098
		2SC3099
		2SC4215 (Y)
		2SC4116 (Y)
		2SD1246 (S,T)
Digital transistor		DTA143EK
		DTA144EK
		DTC114YK
		DTC144YK
		DTC144EK
		DTC363EK
		FMA1
		FMC5
		FMG2
		FMG4
		FMG5

Item	Remarks	Parts NO.
FET		2SK508NV (K52)
		3SK140 (GR)
IC		AFL24F3300E12
		AK93C46F
		CAT35C104KI
		H37450M4-124FP
		HD4074608FS
		KCE02
		LA5005M
		LM301AD
		H37450M4-235FP
		M67755H
		M67755L
		MB1504F
		MC3361D
		NJM2073M
		NJM2904M
		NJM4558M
		NJM4560M
		NMC93CS66EN
		NMC93CS66N*J
		S-8054HN-CB
		S-81250HG
		S-81250HG-RD
		TC4S66F
		TC4S81F

TK-230/230(SC)

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TK-230/230 (SC)						
1	2A		A02-0865-03	CASE ASSY (FRONT)		B
1	2A	*	A02-0868-13	CASE ASSY (FRONT)		A
1	2A	*	A02-0868-13	CASE ASSY (FRONT)		C
2	3B		A02-0871-02	CASE (REAR)		
4	2B		A13-0685-11	FRAME		
5	2A		A20-2700-03	PANEL		
6	3A		A21-1531-03	DRESSING PANEL		A
6	3A		A21-1531-03	DRESSING PANEL		B
6	3A		A21-1533-03	DRESSING PANEL		C
7	2A		A22-0761-04	SUB PANEL		
8	2B		A40-0618-05	BOTTOM PLATE		
10	3A		B30-0872-05	LED (TX/BUSY)		
-		*	B40-3894-13	MODEL NAME PLATE	KM	
-		*	B40-3895-03	MODEL NAME PLATE	M2	
-			B42-2454-04	S/NO LABEL (CARTON)		
-			B42-3343-04	S/NO LABEL (RADIO)		
-			B44-2163-04	UPC LABEL		
-			B44-2165-04	UPC LABEL		
-			B46-0409-20	WARRANTY CARD	K	
-			B50-8323-00	INSTRUCTION MANUAL		A
-			B50-8270-00	INSTRUCTION MANUAL		B
C101			CC73FCH1H060D	CHIP C 6.0PF D	KM	
13	2B		D10-0601-05	RELEASE LEVER		
-			D10-0603-04	PTT LEVER ASSY		
15	2B		D10-0604-03	PTT LEVER		
16	2A		D32-0411-04	STOPPER (CH,GRP SW)		
18	2A		E06-0153-04	ANT RECEPTACLE		
19	2A		E08-1272-05	MIC RECEPTACLE		
20	2B		E23-0474-14	TERMINAL (POWER OUTSIDE)		
21	2B		E23-0617-04	TERMINAL (POWER INSIDE)		
22	2B		E23-0618-04	TERMINAL (SQUARE UNIT)		
-			E23-0622-04	TERMINAL (CONT.)		
-		*	E31-3483-15	CONNECTING WIRE (VOL-TX-RX)		
24	2A		E31-3484-05	CONNECTING WIRE (ANT-TX-RX)		
-			E31-3485-05	CONNECTING WIRE (MIC-TX-RX)		
25	2B		E31-3486-05	FLEXIBLE PC BOARD (CONT-TX-RX)		
-			E31-3489-05	CONNECTING WIRE (SP/MIC-CONT)		
27	2B		F07-0871-03	COVER (PTT)		
28	2B		F07-0885-03	COVER		
29	3B		F10-1392-04	SHIELDING PLATE (TX-RX)		
30	1B		F10-1393-04	SHIELDING PLATE (CONT.)		
31	2B	*	F11-1125-13	SHIELDING COVER (CONT.)		
-		*	F12-0417-04	SHEET (IF,PLL)		
-			F15-0662-04	SHADE (LCD)		B
32	1A		F19-0650-04	BLIND PLATE (MIC)		
33	3B		F20-1018-04	INSULATING SHEET (TX-RX)		
34	1B		F20-1019-04	INSULATING SHEET (CONT.)		
-			F20-1027-04	INSULATING SHEET (FUSE)		
-			F20-1032-04	INSULATING BOARD		
35	1A		F20-1033-04	INSULATING SHEET (MIC UNIT)		
36	2B, 3B		F29-0438-05	INSULATOR		

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TK-230/230(SC)

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37	3A		F29-0439-05	INSULATOR (VOL)		
40	2B		G01-0844-04	COIL SPRING (RELEASE LEVER)		
41	3A		G02-0505-05	D SPRING (CH,GRP)		
43	3A		G09-0418-05	D SPRING (VOL)		
-			G10-0655-04	NON-WOVEN FABRIC		
46	2B		G11-0617-04	CUSHION (TERMINAL)		
47	2A		G13-0901-04	CUSHION (FPC)		
-			G13-0938-04	CUSHION		
-		*	G13-0946-04	CUSHION (IF)		
-		*	G13-0947-04	CUSHION (PLL)		
49	3A		G53-0557-04	PACKING (TOGGLE SW)		
50	2B		G53-0558-04	PACKING (BOTTOM PLATE)		
51	2A		G53-0559-04	PACKING (MIC RECEPTACLE)		
52	1A		G53-0567-04	PACKING (CASE,FRONT)		
53	3B		G53-0568-04	PACKING (CASE,REAR)		
-			H11-0808-14	POLYSTURENE FOAMED FIXTURE(UP)		
-			H11-0820-04	POLYSTURENE FOAMED FIXTURE(UP)		
-			H13-0828-04	PROTECTION BOARD		
-		*	H01-8238-04	ITEM CARTON BOX (INSIDE)		
-			H10-2657-02	POLYSTYRENE FOAMED FIXTURE(LO)		
-			H25-0103-04	PROTECTION BAG (125X250)		
-			J21-4135-04	LEAD HOLDER		
55	1A		J21-4188-14	MOUNTING HARDWARE (SP)		
56	2B		J21-4259-04	MOUNTING HARDWARE (POWER MODUL		
57	2B		J21-4260-04	MOUNTING HARDWARE		
58	2A		J21-4283-04	MOUNTING HARDWARE		
59	2A		J25-6677-05	FLEXIBLE PC BOARD (PANEL-CONT)		
-			J25-6678-05	FLEXIBLE PC BOARD (MIC-CONT)		
61	1A		J39-0434-04	SPACER (MIC)		
62	2B		J69-0313-05	O RING (POWER SUPPLY)		
63	3A		J69-0314-05	O RING (LED)		
64	2A		J69-0315-05	O RING (PANEL)		
65	2B		J69-0316-05	O RING (BOTTOM PLATE)		
-			K29-3160-04	KEY TOP		
67	3A		K29-3161-04	KNOB (VOL)		
68	3A		K29-3162-04	KNOB (CH,GRP)		
A	3A, 3B		N09-2019-05	BINDING SCREW (CASE F,R) 2.6X10		
B	2A		N09-2028-05	SCREW (COVER) 2X3.5		
C	2B		N09-2049-05	SCREW (BOTTM PLATE) 2.6X8		
D	2B		N09-2053-05	SCREW (TERMINAL) 2X3		
70	3A		N14-0533-04	NUT (VOL)		
71	3A		N14-0541-04	NUT (ANT)		
72	2A		N14-0542-04	NUT (CH,GRP)		
73	2A		N15-1050-41	FLAT WASHER (TOGGLE SW)		
E	1B		N30-2604-41	PAN HEAD MACHINE SCREW(2.6X4)		
F	1B, 3B		N30-2606-41	PAN HEAD MACHINE SCREW(2.6X4)		
G	2A, 2B		N32-2606-41	FLAT HEAD MACHINE SCREW(2.6X6)		
H	2A		N39-2035-45	PAN HEAD MACHINE SCREW(2X3.5)		
I	1A		N89-2004-41	BINDING HEAD TAPTITE SCREW		
J	1A		N89-2005-41	BINDING HEAD TAPTITE SCREW		
S4	2A		R05-3442-05	POTENTIOMETER (10K, SW+VOL/OFF)		

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S3 S1,2	2A 2A		S29-1440-05 S44-1412-05	ROTARY SWITCH (CHANNEL, GROUP) TOGGLE SWITCH (QT, T SW)		
77	1A	*	T07-0256-05 T90-0381-05 T90-0382-05 T91-0381-05	LOUDSPEAKER ANTENNA (134-150MHZ) ANTENNA (150-162MHZ) MICROPHONE	M2 M	A A
78	1A		W09-0525-05	BATTERY PACK (7.2V 1000MAH)		
-						
80	1A		X42-3020-10 X52-3150-20	CONDENSERMIC UNIT SIGNALING UNIT		B A B C
82	1B		X53-3210-10	CONTROL UNIT		
82	1B		X53-3210-11	CONTROL UNIT		
82	1B		X53-3210-12	CONTROL UNIT		
83	2B, 3B	*	X57-3300-10	TX-RX UNIT	KM	
83	2B, 3B	*	X57-3300-11	TX-RX UNIT	M2	
CONDENSER MIC UNIT (X42-3020-10)						
C1			CC73FCH1H470J	CHIP C 47PF J		
C2			CK73FB1H102K	CHIP C 1000PF K		
C3			CK73FB1H103K	CHIP C 0.010UF K		
R1			RK73FB2A123J	CHIP R 12K J 1/10W		
SIGNALING UNIT (X52-3150-20)						
LCD1 PL1,2			A33-0411-04 B38-0315-05 B30-0873-05	REFLECTOR (LCD) LCD (FTD-8936) LAMP (5V 75MA)		
C1,2 C3 C4 C5 C6			CC73FCH1H101J C92-0004-05 CK73FB1H102K C92-0004-05 CK73FB1H102K	CHIP C 100PF J CHIP-TAN 1UF 16WV CHIP C 1000PF K CHIP-TAN 1UF 16WV CHIP C 1000PF K		
C7 C8 -10 C11 -14			C92-0501-05 CK73FB1H102K CC73FCH1H101J	CHIP TAN 1.5UF 6.3WV CHIP C 1000PF K CHIP C 100PF J		
A2 W1			E29-0480-04 E31-6015-15	CONNECTOR (LCD) CONNECTING WIRE (6P)		
A3			J21-4258-04	MOUNTING HARDWARE (LCD)		
L1 X1			L40-1001-48 L78-0052-05	SMALL FIXED INDUCTOR (10UH) CERAMIC OSC (800KHZ)		
R1 R2 R3 R4 R5			RK73FB2A104J RK73FB2A124J RK73FB2A104J RK73FB2A471J RK73FB2A105J	CHIP R 100K J 1/10W CHIP R 120K J 1/10W CHIP R 100K J 1/10W CHIP R 470 J 1/10W CHIP R 1.0M J 1/10W		
R6 R7 R8 R9 R10 -12			RK73FB2A562J RK73FB2A104J RK73FB2A473J RK73EB2B470J RK73FB2A102J	CHIP R 5.6K J 1/10W 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		
R13 R14 -17 R18 R19			RK73FB2A471J RK73FB2A473J RK73EB2B470J R92-0670-05	CHIP R 470 J 1/10W CHIP R 47K J 1/10W CHIP R 47 J 1/8W CHIP R 0 OHM	M	

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R19 ,20			R92-0670-05	CHIP R 0 OHM	M2	
IC1			HD4074608FS	IC(MICROPROCESSOR)		
IC2 ,3			AK93C46F	IC(1K EEPROM)	M	
IC4			S-81250HG-RD	IC(VOLTAGE REGULATOR/ +5V)		
IC5			S-8054HN-CB	IC(VOLTAGE DETECTOR)		
IC6 ,7			CAT35C104KI	IC(4K EEPROM)	M2	
Q1			DTC114YK	DIGITAL TRANSISTOR		
Q2			FMG5	DIGITAL TRANSISTOR		
Q3			DTC114YK	DIGITAL TRANSISTOR		
CONTROL UNIT (X53-3210-XX: -10: K, M, M2, -11: K2M, -12: K3)						
C1			C92-0004-05	CHIP-TAN 1UF 16WV		
C2			C92-0002-05	CHIP-TAN 0.22UF 35WV		
C3			CK73FB1H103K	CHIP C 0.010UF K		
C4			CK73EB1H683K	CHIP C 0.068UF K		
C5			CK73EB1E104K	CHIP C 0.10UF K		
C6			CK73FB1H682K	CHIP C 6800PF K		
C7			CK73FB1H332K	CHIP C 3300PF K		
C8			CK73FB1H333K	CHIP C 0.033UF K		
C9			C92-0004-05	CHIP-TAN 1UF 16WV		
C10			CK73FB1H103K	CHIP C 0.010UF K		
C11			CK73FB1H223K	CHIP C 0.022UF K		
C13			C92-0004-05	CHIP-TAN 1UF 16WV		
C14 ,15			CK73FB1H183K	CHIP C 0.018UF K		
C16			CK73FB1H103K	CHIP C 0.010UF K		
C17 ,18			CK73FB1H682K	CHIP C 6800PF K		
C19			C92-0004-05	CHIP-TAN 1UF 16WV		
C20			CK73FB1H102K	CHIP C 1000PF K		
C21 ,22			CK73FB1H103K	CHIP C 0.010UF K		
C23			CK73FB1H102K	CHIP C 1000PF K		
C24			CK73FB1H103K	CHIP C 0.010UF K		
C25			CK73FB1H102K	CHIP C 1000PF K		
C26			CK73FB1H103K	CHIP C 0.010UF K		
C27 ,28			CC73FCH1H330J	CHIP C 33PF J		
C29			CK73FB1H223K	CHIP C 0.022UF K		
C30			CK73FB1H103K	CHIP C 0.010UF K		
C31			C92-0511-05	CHIP TAN 0.15UF 35WV		
C32			C92-0004-05	CHIP-TAN 1UF 16WV		
C33			CK73FB1H103K	CHIP C 0.010UF K		
C34 ,35			CK73FB1H102K	CHIP C 1000PF K		
C36			CC73FSL1H471J	CHIP C 470PF J		
C37			C92-0004-05	CHIP-TAN 1UF 16WV		
C38 -41			CC73FSL1H471J	CHIP C 470PF J		
C50 ,51			CC73FSL1H471J	CHIP C 470PF J		
C53			CC73FSL1H471J	CHIP C 470PF J		
C54			C92-0507-05	TANTAL 4.7UF 6.3WV		
C55 -56			C91-0757-05	CERAMIC 1000PF K		
C58			CK73FB1H152K	CHIP C 1500PF K		
C59			CK73FB1H102K	CHIP C 1000PF K		
C60 ,61			CC73FCH1H101J	CHIP C 100PF J		
C63			CK73FB1H102K	CHIP C 1000PF K		
J1			E40-5181-05	PIN CONNECTOR (4P)		
J2			E40-5183-05	PIN CONNECTOR (6P)		
J3			E40-5237-05	PIN CONNECTOR (10P)		
J4			E40-5255-05	PIN CONNECTOR (18P)		

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J5			E40-5285-05	PIN CONNECTOR (24P)		
X1			L77-1403-05	CRYSTAL RESONATOR (10MHZ)		
R1 ,2			R92-0679-05	CHIP R 0 OHM		
R3 ,4			R92-0670-05	CHIP R 0 OHM		
R5 -16			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R17			RK73FB2A103J	CHIP R 10K J 1/10W		
R19			RK73FB2A682J	CHIP R 6.8K J 1/10W		
R20			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R21			RK73FB2A123J	CHIP R 12K J 1/10W		
R22			RK73FB2A185J	CHIP R 1.8M J 1/10W		
R23			RK73FB2A684J	CHIP R 680K J 1/10W		
R24			RK73FB2A103J	CHIP R 10K J 1/10W		
R25			RK73FB2A273J	CHIP R 27K J 1/10W		
R26			RK73FB2A104J	CHIP R 100K J 1/10W		
R27			RK73FB2A623J	CHIP R 62K J 1/10W		
R28			RK73FB2A683J	CHIP R 68K J 1/10W		
R29			RK73FB2A433J	CHIP R 43K J 1/10W		
R30			RK73FB2A104J	CHIP R 100K J 1/10W		
R31 ,32			RK73FB2A623J	CHIP R 62K J 1/10W		
R33			RK73FB2A103J	CHIP R 10K J 1/10W		
R34			R92-0670-05	CHIP R 0 OHM		
R35			R92-0670-05	CHIP R 0 OHM		
R35			R92-0670-05	CHIP R 0 OHM		
R35			R92-0670-05	CHIP R 0 OHM		
R36 ,37			RK73FB2A124J	CHIP R 120K J 1/10W		
R38			RK73FB2A183J	CHIP R 18K J 1/10W		
R39 ,40			RK73FB2A623J	CHIP R 62K J 1/10W		
R41			RK73FB2A473J	CHIP R 47K J 1/10W		
R42			RK73FB2A563J	CHIP R 56K J 1/10W		
R43			RK73FB2A473J	CHIP R 47K J 1/10W		
R44			RK73FB2A333J	CHIP R 33K J 1/10W		
R45 ,46			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R47			RK73FB2A333J	CHIP R 33K J 1/10W		
R48 -52			RK73FB2A473J	CHIP R 47K J 1/10W		
R53			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R54			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R55			RK73FB2A683J	CHIP R 68K J 1/10W		
R56			R92-0679-05	CHIP R 0 OHM		
R57			RK73FB2A683J	CHIP R 68K J 1/10W		
R58 ,59			RK73FB2A122J	CHIP R 1.2K J 1/10W		
R60			RK73FB2A473J	CHIP R 47K J 1/10W		
R61			RK73FB2A183J	CHIP R 18K J 1/10W		
R62 -64			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R65			RK73FB2A101J	CHIP R 100 J 1/10W		
R66			RK73FB2A681J	CHIP R 680 J 1/10W		
R67			RK73FB2A821J	CHIP R 820 J 1/10W		
R68 -72			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R73 -77			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R78			R90-0710-05	MULTI-COMP		
R79 -83			RK73FB2A473J	CHIP R 47K J 1/10W		
R84			R90-0708-05	MULTI-COMP		
R85 -91			RK73FB2A473J	CHIP R 47K J 1/10W		
R92			RK73FB2A104J	CHIP R 100K J 1/10W		

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TK-230 K, M, M2 :A

TK-230(SC) K, M :B

TK-230A K :C

⚠ indicates safety critical components.

TK-230/230(SC)

PARTS LIST

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R93 R94 R95 R96 R97			RK73FB2A225J RK73FB2A100J RK73FB2A102J RK73FB2A222J RK73FB2A103J	CHIP R 2.2M J 1/10W CHIP R 10 J 1/10W CHIP R 1.0K J 1/10W CHIP R 2.2K J 1/10W CHIP R 10K J 1/10W		
R98 ,99 R100-102 R103 R104 R105			RK73FB2A473J R92-0670-05 RK73FB2A102J RK73FB2A100J R92-0670-05	CHIP R 47K J 1/10W CHIP R 0 OHM CHIP R 1.0K J 1/10W CHIP R 10 J 1/10W CHIP R 0 OHM		
R106,107 R107 R109-111 R112 R114			R92-0670-05 R92-0670-05 R92-0670-05 R92-0679-05 R92-0670-05	CHIP R 0 OHM CHIP R 0 OHM CHIP R 0 OHM CHIP R 0 OHM CHIP R 0 OHM	K K2	
D1 D2 D3 ,4 D3 ,4 D5 -8			DAN202(K) HSM88AS RD9.1M-B2 02CZ9.1(X,Y) 02CZ9.1(X,Y)	DIODE DIODE ZENER DIODE ZENER DIODE ZENER DIODE		
D9 D9 IC1 IC2 IC3			RD10M-B1 02CZ10(X,Y) H37450M4-235FP S-81250HG S-8054HN-CB	ZENER DIODE ZENER DIODE IC(MICROPROCESSOR) IC(VOLTAGE REGULATOR/ +5V) IC(VOLTAGE DETECTOR)		
IC4 IC5 ,6 IC7 IC7 IC7 ,8			NJM4558M NJM2904M NMC93CS66EN NMC93CS66N*J NMC93CS66EN	IC(OP AMP X2) IC(OP AMP X2) IC(EEPROM) IC(EEPROM) IC(EEPROM)		
IC9 Q1 Q2 Q3 Q4			TC4S66F FMC5 FMG2 FMC5 DTC363EK	IC(BILATERAL SWITCH) DIGITAL TRANSISTOR DIGITAL TRANSISTOR TRANSISTOR DIGITAL TRANSISTOR		
Q5 Q6 Q7			2SD1246(S,T) FMC5 FMA1	DIGITAL TRANSISTOR DIGITAL TRANSISTOR DIGITAL TRANSISTOR		
TX-RX UNIT (X57-3300-XX: -10: K, M, -11: M2)						
C1 C2 C3 C4 C5			CK73FB1H102K C90-2048-05 CK73FB1H102K CK73FB1H103K CC73FCH1H330J	CHIP C 1000PF K ELECTRO 6.8UF 6.3WV CHIP C 1000PF K CHIP C 0.010UF K CHIP C 33PF J		
C6 C7 C8 C9 -15 C17 ,18			CC73FCH1H020C CC73FCH1H070D CK73FB1H103K CK73FB1H102K CK73FB1H102K	CHIP C 2.0PF C CHIP C 7.0PF D CHIP C 0.010UF K CHIP C 1000PF K CHIP C 1000PF K	K2 K2	
C19 ,20 C21 -23 C24 C25 C26			CK73FB1H103K CK73FB1H102K C92-0005-05 CC73FCH1H030C CE04NW0J220M	CHIP C 0.010UF K CHIP C 1000PF K CHIP-TAN 2.2UF 6.3WV CHIP C 3.0PF C ELECTRO 22UF 6.3WV		

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C27			CK73FB1H102K	CHIP C 1000PF K		
C28			C92-0005-05	CHIP-TAN 2.2UF 6.3WV		
C29 -30			CK73FB1H102K	CHIP C 1000PF K		
C31			CK73FB1H102K	CHIP C 1000PF K		
C32			CK73FB1H103K	CHIP C 0.010UF K		
C33			C92-0507-05	CHIP TAN 4.7UF 6.3WV		
C34 -36			CK73FB1H102K	CHIP C 1000PF K		
C37			CC73FCH1H100D	CHIP C 10PF D		
C38			CK73FB1H102K	CHIP C 1000PF K		
C39			C92-0509-05	TANTAL 10UF 6.3WV		
C40			CC73FRH1H270J	CHIP C 27PF J	K2	
C41			CC73FCH1H010C	CHIP C 1.0PF C	K	
C41			CC73FCH1H010C	CHIP C 1.0PF C		
C42			CC73FRH1H270J	CHIP C 27PF J	K2	
C43			CC73FCH1H010C	CHIP C 1.0PF C	K	
C43			CC73FCH1H010C	CHIP C 1.0PF C		
C44 ,45			CK73FB1H102K	CHIP C 1000PF K		
C46			CC73FRH1H270J	CHIP C 27PF J		
C47			CK73FB1H102K	CHIP C 1000PF K		
C48			C90-2041-05	TANTAL 10UF 10WV		
C49			CK73FB1H103K	CHIP C 0.010UF K		
C50			CK73FB1H102K	CHIP C 1000PF K		
C51			C90-2041-05	TANTAL 10UF 10WV		
C52			CK73FB1H103K	CHIP C 0.010UF K		
C53			CK73FB1H102K	CHIP C 1000PF K		
C54			C90-2041-05	TANTAL 10UF 10WV		
C55			CK73FB1H103K	CHIP C 0.010UF K		
C56 -61			CK73FB1H102K	CHIP C 1000PF K		
C62 ,63			CK73EB1E104K	CHIP C 0.10UF K		
C64			CK73FB1H102K	CHIP C 1000PF K		
C65			C92-0005-05	CHIP-TAN 2.2UF 6.3WV		
C66			CK73FB1H102K	CHIP C 1000PF K	K2	
C67			CC73FCH1H060D	CHIP C 6.0PF D	K	
C67			CC73FCH1H130J	CHIP C 13PF J		
C68			CC73FCH1H130J	CHIP C 13PF J		
C69			CK73FB1H102K	CHIP C 1000PF K		
C70			CK73FB1H103K	CHIP C 0.010UF K		
C71 ,72			CK73FB1H102K	CHIP C 1000PF K		
C73 -75			CC73FRH1H050C	CHIP C 5.0PF C	K2	
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		
C84			CK73FB1H102K	CHIP C 1000PF K		
C85			CC73FCH1H070D	CHIP C 7.0PF D	K	
C85			CC73FCH1H090D	CHIP C 9.0PF D	K2	
C86			CC73FCH1H180J	CHIP C 18PF J	K	
C86			CC73FRH1H270J	CHIP C 27PF J	K2	
C87			CC73FCH1H150J	CHIP C 15PF J	K	
C87			CC73FCH1H200J	CHIP C 20PF J	K2	
C88			CK73FB1H102K	CHIP C 1000PF K		
C89			CC73FCH1H151J	CHIP C 150PF J		
C90 ,91			CC73FCH1H010C	CHIP C 1.0PF C	K	

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C90 ,91			CC73FCH1H1R5C	CHIP C 1.5PF C	K2	
C92 ,93			CC73FCH1H050C	CHIP C 5.0PF C	K	
C94			CK73FB1H102K	CHIP C 1000PF K	K2	
C96			CK73FB1H102K	CHIP C 1000PF K		
C98			CK73FB1H102K	CHIP C 1000PF K		
C99			CC73FCH1H090D	CHIP C 9.0PF D	K2	
C99			CC73FCH1H120J	CHIP C 12PF J	K	
C100			CC73FCH1H020C	CHIP C 2.0PF C	K	
C101			CC73FCH1H120J	CHIP C 12PF J	K	
C101			CC73FCH1H150J	CHIP C 15PF J	K2	
C102			CK73FB1H102K	CHIP C 1000PF K	K	
C201			CK73FB1H102K	CHIP C 1000PF K		
J1			E40-5244-05	FPC CONNECTOR		
J2 ,3			E04-0174-05	RF COAXIAL CABLE RECEPTACLE		
J4			E23-0621-05	TERMINAL (1P)		
W2			E33-1905-05	FINISHED WIRE SET		
F201			F10-1395-04	SHIELDING PLATE		
			F06-4025-05	FUSE		
			J30-0555-04	SPACER		
L1			L40-4792-48	SMALL FIXED INDUCTOR(4.7UH)		
L2			L33-0680-05	CHOKE COIL		
L3			L40-1092-48	SMALL FIXED INDUCTOR(1UH)		
L4		*	L34-1289-05	COIL		
L6			L34-4018-05	COIL		
L7			L40-3372-48	SMALL FIXED INDUCTOR(33UH)		
L8 -10			L34-4019-05	COIL		
L11			L40-1082-48	SMALL FIXED INDUCTOR(100UH)		
L12		*	L79-0868-05	LPF	K	
L12		*	L79-0869-05	LPF	K2	
L13			L34-1263-05	COIL	K	
L18 ,19			L34-0892-05	COIL		
X1		*	L77-1404-15	TCXO (12.5MHZ)		
R1 ,2			R92-0679-05	CHIP R 0 OHM		
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			RK73EB2B100J	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 ,22			RK73FB2A473J	CHIP R 47K J 1/10W		
R23			R92-0679-05	CHIP R 0 OHM		
R24			R92-0670-05	CHIP R 0 OHM		
R25			RK73EB2B273J	CHIP R 27K J 1/8W		
R26			RK73FB2A100J	CHIP R 10 J 1/10W		

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TK-230A K :C

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TK-230/230(SC)

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R27			RK73FB2A101J	CHIP R 100 J 1/10W		
R28			R92-0670-05	CHIP R 0 OHM		
R29 -31			RK73FB2A103J	CHIP R 10K J 1/10W		
R32			RD14BB2C561J	CHIP R 560 J		
R33			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R34			RK73FB2A103J	CHIP R 10K J 1/10W		
R35			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R36			RK73FB2A103J	CHIP R 10K J 1/10W		
R37			RK73FB2A104J	CHIP R 100K J 1/10W		
R38			RK73EB2B273J	CHIP R 27K J 1/8W		
R39			R92-1219-05	FIXED RESISTOR(2.2 OHM)		
R40			R92-0670-05	CHIP R 0 OHM		
R41 -43			RK73FB2A821J	CHIP R 820 J 1/10W		
R44			RK73FB2A270J	CHIP R 27 J 1/10W		
R45 ,46			RK73FB2A181J	CHIP R 180 J 1/10W		
R47			RK73FB2A104J	CHIP R 100K J 1/10W		
R48			RK73FB2A103J	CHIP R 10K J 1/10W		
R50 ,51			R92-0679-05	CHIP R 0 OHM		
R52			RK73FB2A102J	CHIP R 1.0K J 1/10W	K2	
R52			RK73FB2A332J	CHIP R 3.3K J 1/10W	K	
R53			RK73FB2A101J	CHIP R 100 J 1/10W		
R54			RK73EB2B101J	CHIP R 100 J 1/8W		
R55			R92-0670-05	CHIP R 0 OHM		
R56			R92-0679-05	CHIP R 0 OHM		
R57			RK73FB2A333J	CHIP R 33K J 1/10W		
R58			RK73FB2A103J	CHIP R 10K J 1/10W		
R59			R92-1219-05	FIXED RESISTOR		
R60			R92-0670-05	CHIP R 0 OHM		
R61			R92-0670-05	CHIP R 0 OHM		
R62			RK73FB2A104J	CHIP R 100K J 1/10W		
R63			RK73FB2A822J	CHIP R 8.2K J 1/10W		
R64			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R65			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R66			RK73FB2A471J	CHIP R 470 J 1/10W		
R67			RK73FB2A331J	CHIP R 330 J 1/10W		
R68 ,69			RK73FB2A104J	CHIP R 100K J 1/10W		
R70			RK73FB2A153J	CHIP R 15K J 1/10W		
R71 ,72			RK73FB2A473J	CHIP R 47K J 1/10W	K	
R73			RK73FB2A104J	CHIP R 100K J 1/10W	K	
R75			R92-0679-05	CHIP R 0 OHM		
R76			RK73FB2A334J	CHIP R 330K J 1/10W		
R77 ,78			R92-0670-05	CHIP R 0 OHM		
VR1 ,2			R12-1442-05	TRIMMING POT.(2.2K)		
VR3 -6			R12-3445-05	TRIMMING POT.(47K)		
W1			R92-1061-05	JUMPER REST 0 OHM		
D1			DAN202(K)	DIODE		
D2			DAP202(K)	DIODE		
D3			DAN202(K)	DIODE		
D4			HSM2693	DIODE		
D5			HSM88AS	DIODE		
D6			MA360	DIODE		
D7			DAP202(K)	DIODE		
D8 -10		*	MA366	DIODE		
D11			MA360	DIODE	K	
D12 ,13			HSM88AS	DIODE		

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IC1			AFL24F3300E12	IC(ACTIVE L.P.F/FC3.6KHZ)		
IC2		*	M67755H	IC(POWER MODULE)	K	
IC2		*	M67755L	IC(POWER MODULE)	K2	
IC3			TC4S66F	IC(BILATERAL SWITCH)		
IC4			KCE02	IC(AF BPF)		
IC5			TC4S66F	IC(BILATERAL SWITCH)	K	
Q1			2SA1362(Y)	TRANSISTOR		
Q2			DTC144EK	DIGITAL TRANSISTOR		
Q3			2SA1362(Y)	TRANSISTOR		
Q4			DTC144EK	DIGITAL TRANSISTOR		
Q5			2SA1362(Y)	TRANSISTOR		
Q6			2SA1162(Y)	TRANSISTOR		
Q7			2SA1213(Y)	TRANSISTOR		
Q8			2SC2712(Y)	TRANSISTOR		
Q9			2SC2712(GR)	TRANSISTOR		
Q10			FMG2	DIGITAL TRANSISTOR		
Q11			2SC3099	TRANSISTOR		
Q12			2SC2714(Y)	TRANSISTOR		
Q13			2SC3099	TRANSISTOR		
Q14			3SK140(GR)	FET		
Q15			DTA144EK	DIGITAL TRANSISTOR		
Q16			2SA1162(Y)	TRANSISTOR		
Q17			DTC144EK	DIGITAL TRANSISTOR		
Q18			2SC2712(Y)	TRANSISTOR	K	
Q19			2SA1162(Y)	TRANSISTOR	K	
Q20			DTC144EK	DIGITAL TRANSISTOR		
A1			X59-3570-10	MODULE UNIT(AVR)		
A2			X59-3580-10	MODULE UNIT(SW)		
A3		*	X59-3520-10	MODULE UNIT(MIC AMP)		
A4		*	X58-3570-10	MODULE UNIT(VCO)	K	
A4		*	X58-3570-11	MODULE UNIT(VCO)	K2	
A5		*	X58-3550-11	MODULE UNIT(PLL)		
A6		*	X59-3540-11	MODULE UNIT(DRIVE)		
A7		*	X58-3560-13	MODULE UNIT(ANT SW)	K	
A7		*	X58-3560-14	MODULE UNIT(ANT SW)	K2	
A8			X59-3590-10	MODULE UNIT(APC)		
A9		*	X58-3530-11	MODULE UNIT(IF)		
A10			X59-3560-10	MODULE UNIT(AF PA)		
MODULE UNIT (VCO) (X58-3570-XX: -10: K, -11: K2)						
C1			CK73FB1H102K	CHIP C 1000PF K		
C2			CE04CW1A101M	ELECTRO 100UF 10WV		
C3			CK73FB1H102K	CHIP C 1000PF K		
C4			CC73FCH1H020C	CHIP C 2.0PF C	K	
C4			CC73FCH1H090D	CHIP D 9.0PF C	K2	
C5			CC73FCH1H330J	CHIP C 33PF J		
C6			CC73FCH1H180J	CHIP C 18PF J		
C7 ,8			CC73FCH1H030C	CHIP C 3.0PF C		
C9			CC73FCH1H330J	CHIP C 33PF J		
C10			CC73FCH1H050C	CHIP C 5.0PF C		
C11			CC73FCH1H060D	CHIP C 6.0PF D	K	
C11			CC73FCH1H090D	CHIP C 9.0PF D	K2	
C12			CK73FB1H103K	CHIP C 0.010UF K		
C13			CK73FB1H102K	CHIP C 1000PF K		
C14 ,15			CC73FCH1H100D	CHIP C 10PF D		

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C16			CK73FB1H103K	CHIP C 0.010UF K		
C17			CK73FB1H102K	CHIP C 1000PF K		
C18			CC73FCH1H100D	CHIP C 10PF D		
C19			CK73FB1H103K	CHIP C 0.010UF K		
C20			C92-0003-05	CHIP TAN 0.47UF 25WV		
C21			CC73FCH1H1R5C	CHIP C 1.5PF C		
CN1 ,2		*	E40-5337-05	PIN CONNECTOR		
A1		*	F11-1127-04	SHIELDING CASE		
L1			L40-4791-19	SMALL FIXED INDUCTOR		
L2			L40-1021-14	SMALL FIXED INDUCTOR		
L3			L34-4084-05	COIL		
L4 ,5			L40-4792-48	SMALL FIXED INDUCTOR		
L6			L34-4086-05	COIL	K2	
L6			L34-4095-05	COIL	K	
L7 ,8			L40-3391-19	SMALL FIXED INDUCTOR		
L9		*	L40-1082-19	SMALL FIXED INDUCTOR	K	
L9			L40-1582-19	COIL	K2	
R1 ,2			RK73FB2A104J	CHIP R 100K J 1/10W		
R3 ,4			RK73FB2A121J	CHIP R 120 J 1/10W		
R5			RK73FB2A104J	CHIP R 100K J 1/10W		
R6			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R7			RK73FB2A273J	CHIP R 27K J 1/10W		
R8			RK73FB2A153J	CHIP R 15K J 1/10W		
R9			RK73FB2A331J	CHIP R 330 J 1/10W		
R10			RK73FB2A560J	CHIP R 56 J 1/10W		
R11			RK73FB2A823J	CHIP R 82K J 1/10W		
R12			RK73FB2A101J	CHIP R 100 J 1/10W		
R13			RK73FB2A223J	CHIP R 22K J 1/10W		
D1 ,2			1T33C	DIODE		
D3			HSM2693	DIODE		
D4			MA110	DIODE		
D5			HSM2693	DIODE		
D6			MA110	DIODE		
D7 ,8			1T33C	DIODE		
D9		*	MA366	DIODE		
Q1 ,2			2SK508NV(K52)	FET		
Q3 ,4			2SC2714(Y)	TRANSISTOR		
Q5			FMG4	DIGITAL TRANSISTOR		

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

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

UE: AAFES(Europe) X: Australia

TK-230 K, M, M2 :A

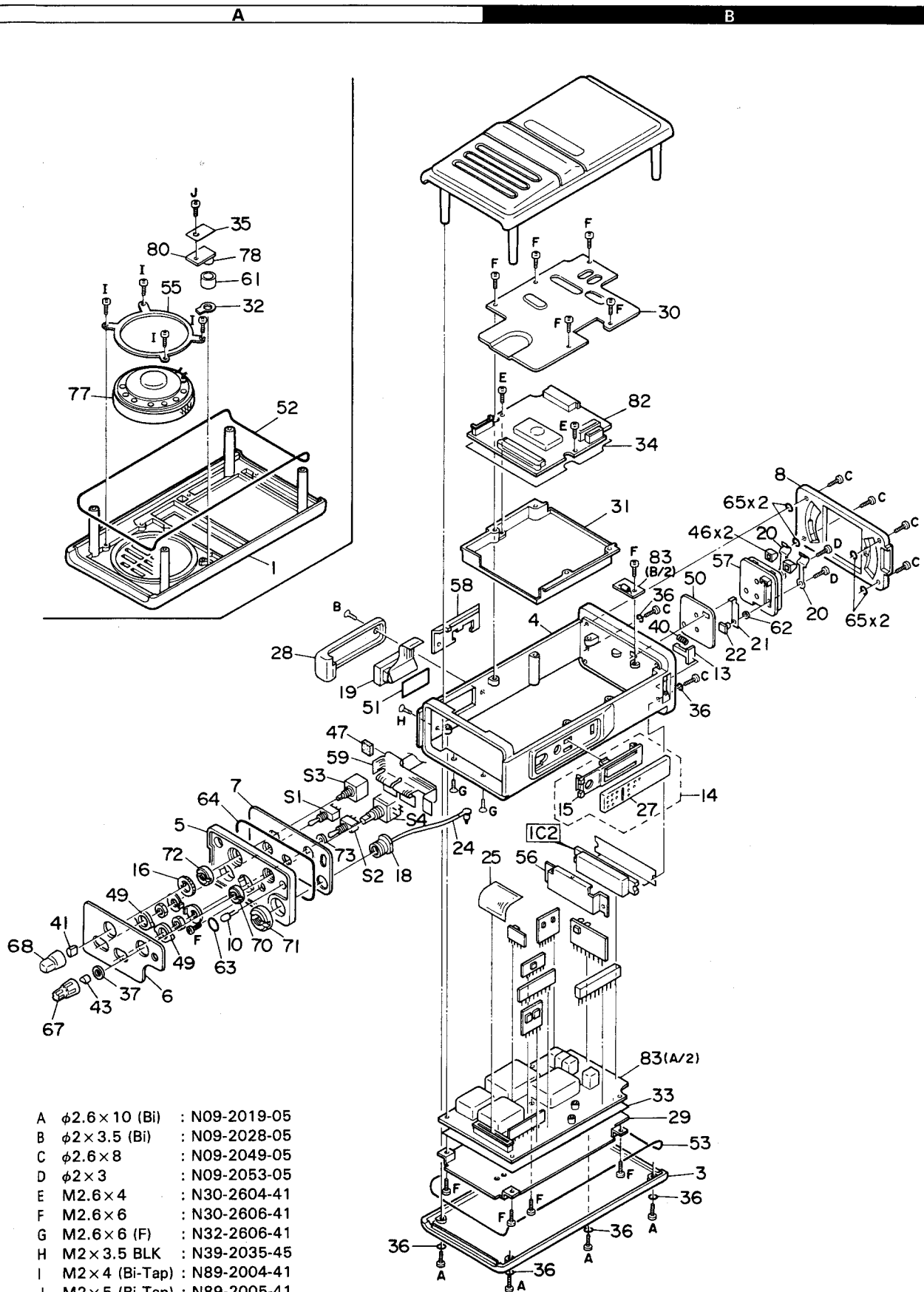
TK-230(SC) K, M :B

TK-230A K :C

 indicates safety critical components.

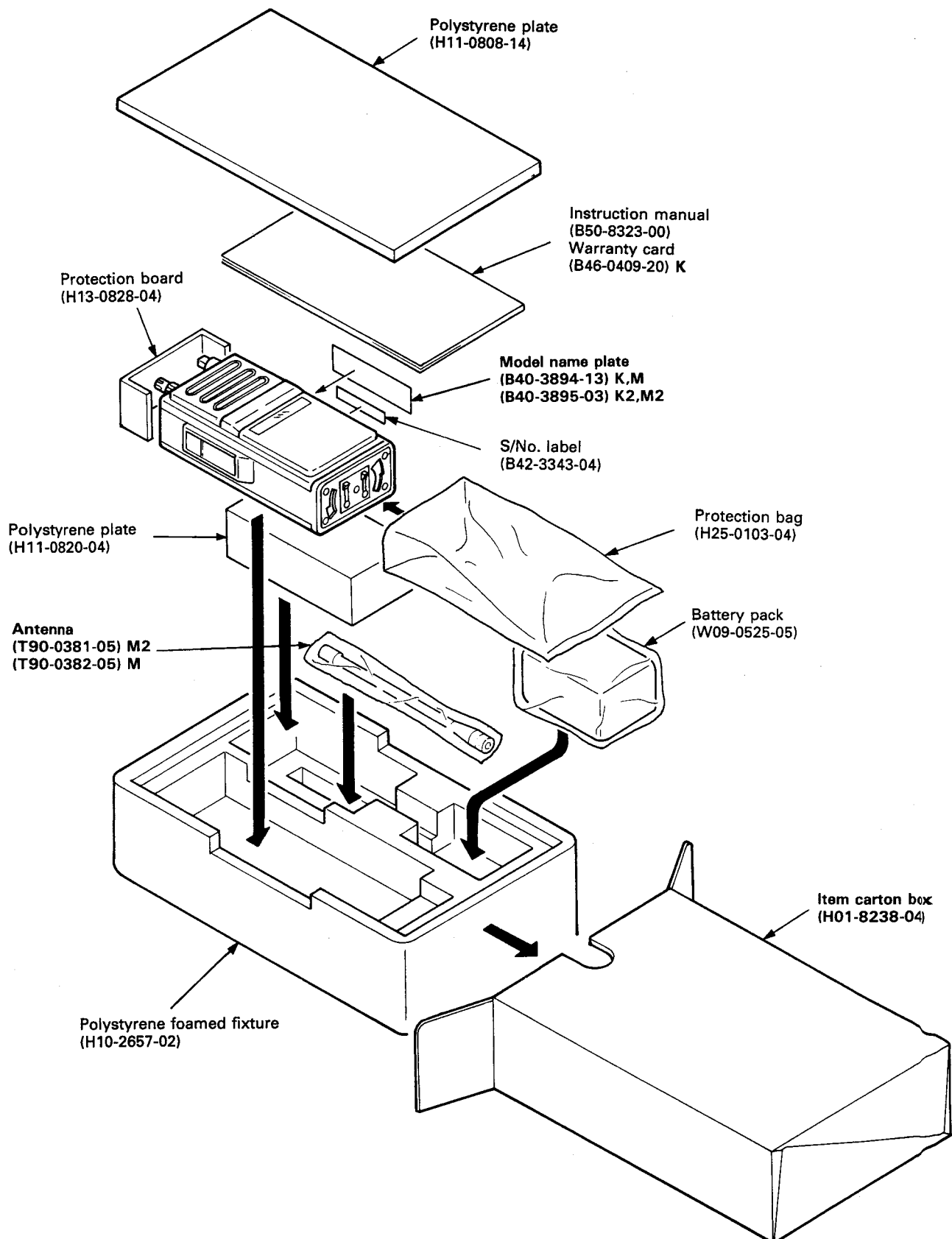
TK-230/230(SC)

DISASSEMBLY



TK-230/230(SC)

PACKING



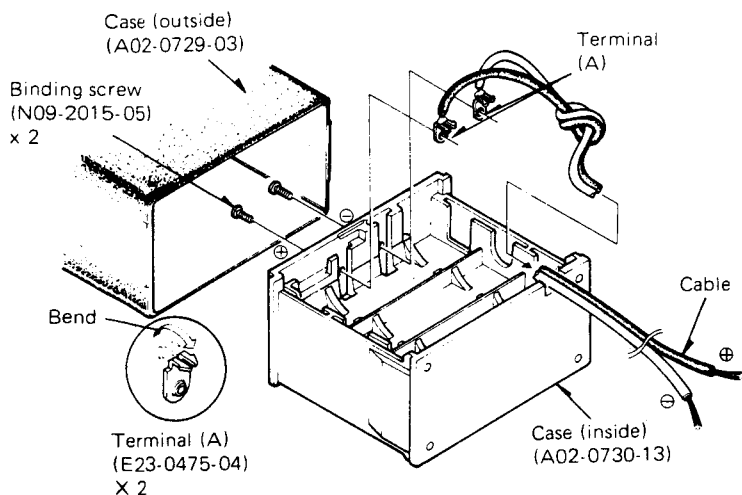
TK-230/230(SC)

ADJUSTMENT

Test Equipment Required for Alignment

No.	Test Equipment	Major Specifications	
1	Standard Signal Generator (SSG)	Frequency Range Modulation Output	134 to 174MHz. Frequency modulation and external modulation. 0.1μV to greater than 1mV.
2	Power Meter	Input Impedance Operation Frequency Measurement Capability	50Ω. 134 to 174MHz or more. Vicinity of 10W and 3W.
3	Deviation Meter	Frequency Range	100 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		5A.
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 and 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	8 or 16Ω Dummy Load		Approx. 8 or 16Ω, 3W.
13	Regulated Power Supply		7.5V, approx. 5A (adjustable from 6 to 16V). Useful if ammeter equipped.

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



- The frequencies shown in the table have been written when the set leaves the factory.

		K,M	M2
CH1	TX	162.000	142.000
	RX	162.100	142.000

(MHz)

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

		K,M	M2
TX	H	173.970	149.970
	M	162.000	142.000
	L	150.000	134.000
RX	H	173.870	149.870
	M	162.100	142.100
	L	150.100	134.100

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

(MHz)

TK-230/230(SC)

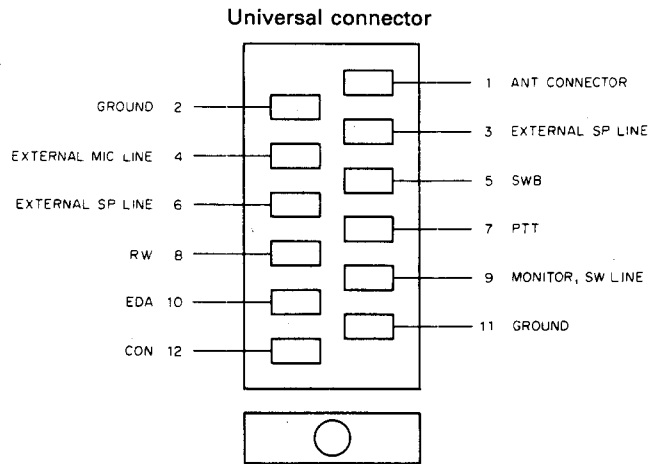
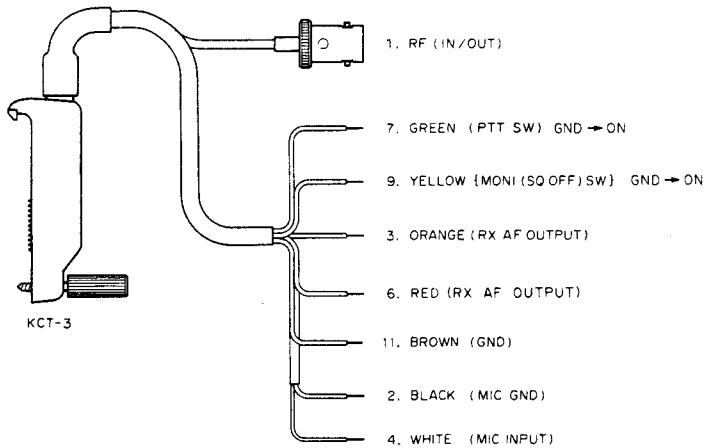
ADJUSTMENT

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**

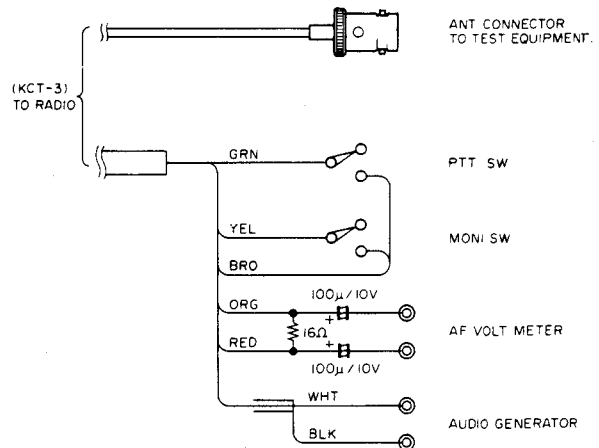
Numbers are universal connector terminal numbers.



- **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 or orange and GND.



The radio has been factory pre programmed for the data shown in the following table at channel "G 1C 1". When required re-program them, you want in actual operation.

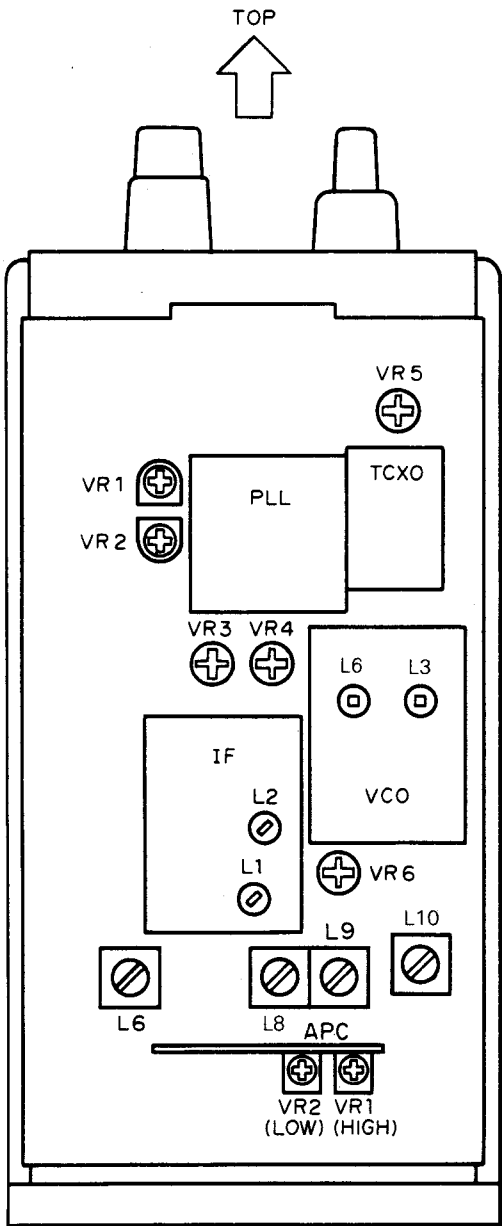
No.	Item	K, M	K2, M2	(A) K	(SC) K, M
1	Frequency TX RX	162.000 162.100	142.000 142.100	162.000 162.100	162.000 162.100
2	DEL/ADD	ADD	←	←	←
3	POWER HI/LOW	HIGH	←	←	←
4	SCAN ON/OFF	ON (ENABLE)	←	←	←
5	BUSY CH LOCK OUT	ON	←	←	←
6	QT SEL ON/OFF	ON, OFF	←	←	ON, OFF
7	TALK AROUND ON/OFF	OFF, ON	←	←	OFF, ON
8	AC CONT ON/OFF	OFF	←	←	←
9	T.O.T	9min.	←	←	←
10	POWER SAVE	DISABLE	←	←	←
11	DTMF 1st DIGIT TIME				80msec.

TK-230/230(SC)

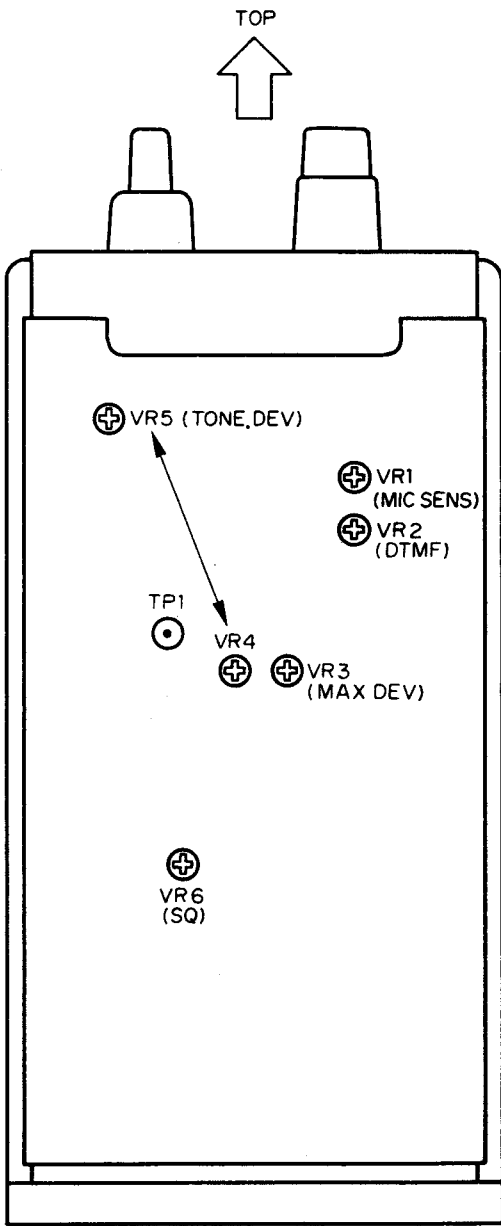
ADJUSTMENT

Adjustment Points

• Component side

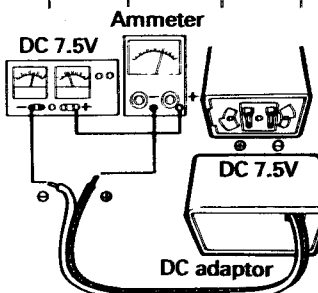
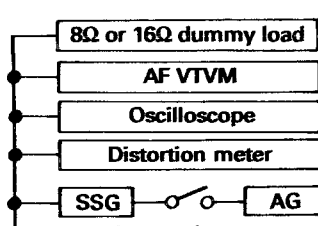
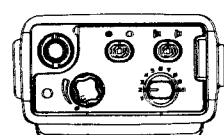


• Foil side



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. 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' (f _{RH})	Voltmeter	TX-RX	TP1	VCO	L3	K,M 3.7V ADJ M2 3.5V ADJ	+0.2 V, -0.4 V ±0.2 V
	2) PTT : ON					L6	K,M 3.7V ADJ M2 3.5V ADJ	+0.2 V, -0.4 V ±0.2 V
	3) CH : Channel with lowest RX FREQ' (f _{RL}).						Check	1.1V or more.
	4) CH : Channel with lowest TX FREQ' (f _{TL}). PTT : ON							1.1V or more.
3. Frequency adjustment	1) CH : Channel with lowest TX FREQ' (f _{TL}). PTT : ON	Freq' counter Power meter		ANT			Check FREQ' of TX.	±400Hz
4. Sensitivity	1) CH : Channel with RX center FREQ' (f _{RM}). SSG freq' : f _{RM} SSG output : 500μV/54dBμ/-53dBm SSG MOD : 1kHz SSG DEV : 3kHz	AFVTVM Oscilloscope Distortion meter 8Ω dummy load		SP	TX-RX	L6, 8, 9, 10	SINAD MAX.	
	2) SSG output : 0.28μV/-11dBμ/-118dBm						Check	SINAD 12dB or more.
	3) CH : Chaeck other channel SSG output : 0.28μV/-11dBμ/-118dBm							
5. Squelch adjustment	1) CH : Channel with RX center FREQ' (f _{RM}). SSG freq' : f _{RM} SSG output : 0.35μV/-9dBμ/-116dBm at 12dB SINAD MONI : OFF	Oscilloscope Distortion meter AFVTVM		SP	TX-RX	VR6	Set to threshold point.	
	2) SSG output : 12dB SINAD : 0.45μV/-114dBm at 12DB SINAD						Check	Squelch open.
	3) SSG output : OFF							Squelch close.
	4) MONI : ON 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.							Sound appear. Close when MONI : OFF.

TK-230/230(SC)

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
6. Power (APC) adjustment	1) Connect the power meter to EXT. ANT. T.SW : Set to ● position. CH : Channel with highest TX FREQ' (fTH). PTT : ON	Power meter Freq' counter DC ammeter		EXT. ANT	APC	VR1	Power MAX.	5.5W or more.
	2) CH : Channel with lowest TX FREQ' (fTL). PTT : ON					VR2	Power MIN.	±0.3W
	3) CH : Channel with TX center FREQ' (fTM). PTT : ON						1.0W ADJ.	±0.2W
	4) CH : Channel with TX center FREQ' (fTM). PTT : ON						VR1	5.0W ADJ.
	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.	
8. QT	1) CH : Set the channel selector to the channel with which QT/CTCSS is used. Deviation meter filter HPF : OFF LPF : 3kHz De-emphasis : 750µs PTT : ON				TX-RX	VR5	±0.75kHz	±100Hz
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 (±4.9kHz ADJ. 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. (±3.75kHz ADJ. when using a signaling)	±100Hz
11. DTMF (KDM-4/4A installed)	1) CH : Channel with TX center FREQ' (fTM). Connect the DTMF board. Keyboard : [1] push PTT : ON				TX-RX	VR2	±2.8kHz ADJ.	±100Hz

TK-230/230(SC)

TERMINAL FUNCTIONS

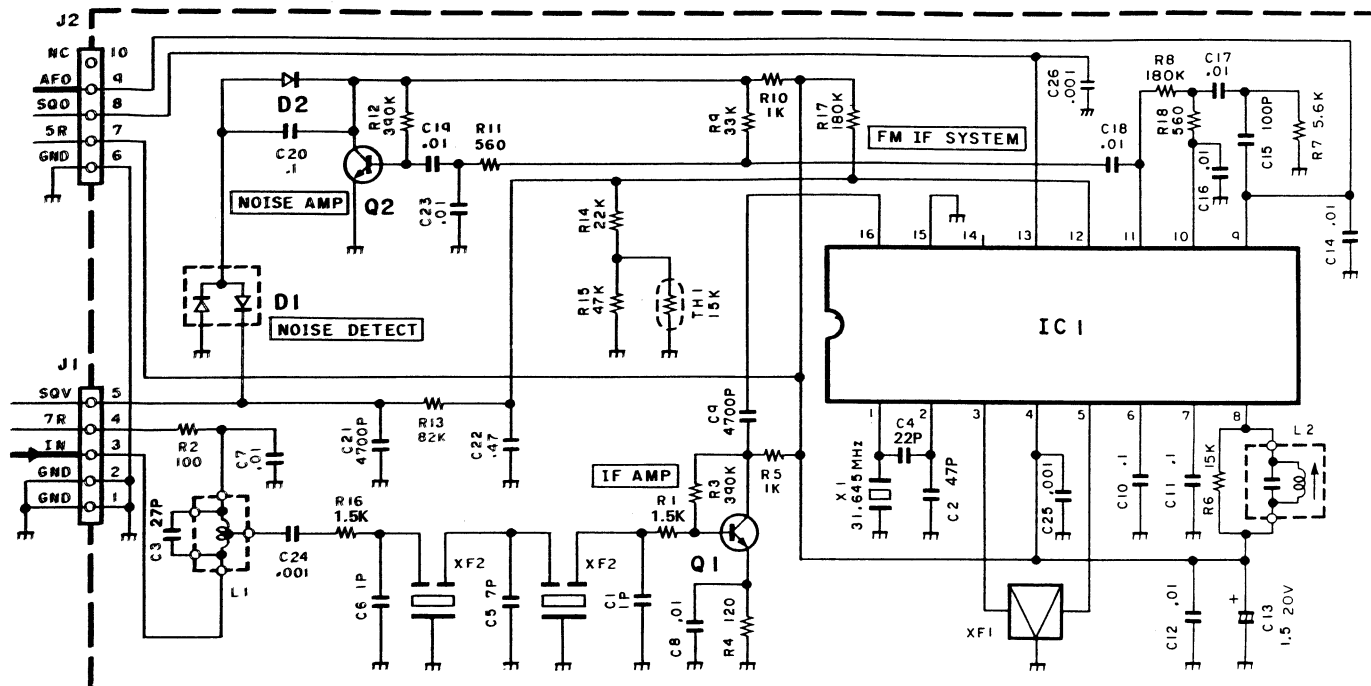
Connector No.	Terminal No.	Terminal Name	Terminal Function
SIGNALING UNIT (X52-3150-20): TK-230 (SC)			
J1	1	SWB	B line passing through the power sw.
	2	GND	GND.
	3	PTT	PTT line. "L" : TX
	4	KSI	Data line of main CPU and key CPU.
	5	KSO	Data line of main CPU and key CPU.
	6	TO	DTMF signal line.
CONTROL UNIT (X53-3210-XX)			
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	Monitor 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	QT 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.

Connector No.	Terminal No.	Terminal Name	Terminal Function
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	Monitor switch line. "L" (0V) : ON
	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-TR unit. "L" : TX
	22	PLS	Internal/ external switching of antenna. "H" : External
J2	23	UL	PLL unlock line. "H" (5V) : Unlock
	24	GND	GND.
TX-RX UNIT (X57-3300-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	Monitor switch line. "L" (0V) : ON
	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-TR unit. "L" : TX
	22	PLS	Internal/ external switching of antenna. "H" : External
J3	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-230/230(SC) CIRCUIT DIAGRAM / PC BOARD VIEWS

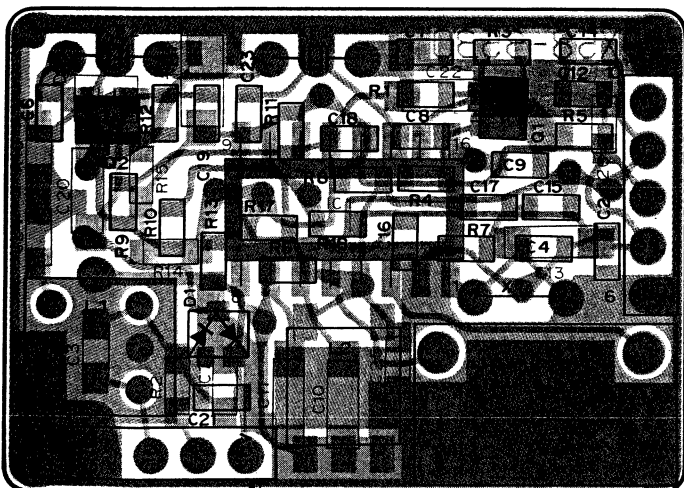
IF (X58-3530-11)

SUB UNIT (IF) (X58-3530-11)

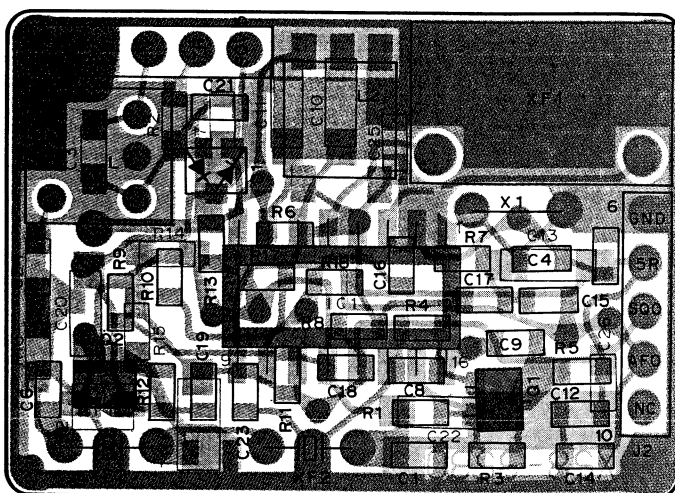


IC1: MC3361D, Q1: 2SC4215, Q2: 2SC4116, D1: DA204U,
D2: MA110

IF (X58-3530-11) Component side view



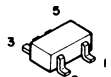
IF (X58-3530-11) Foil side view



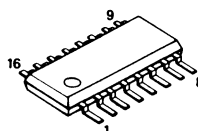
2SC4083
2SC4116
2SC4215



FMG4



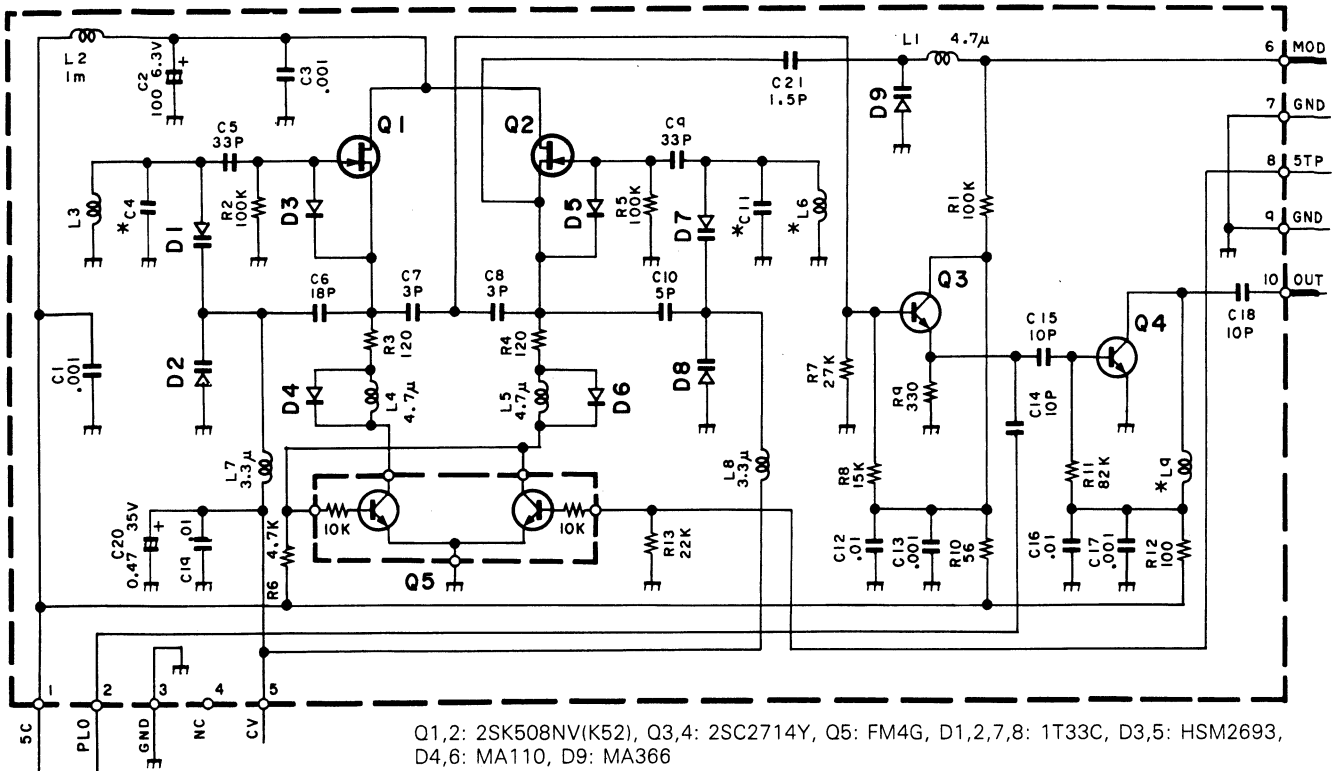
MC3361D



CIRCUIT DIAGRAM / PC BOARD VIEWS TK-230/230(SC)

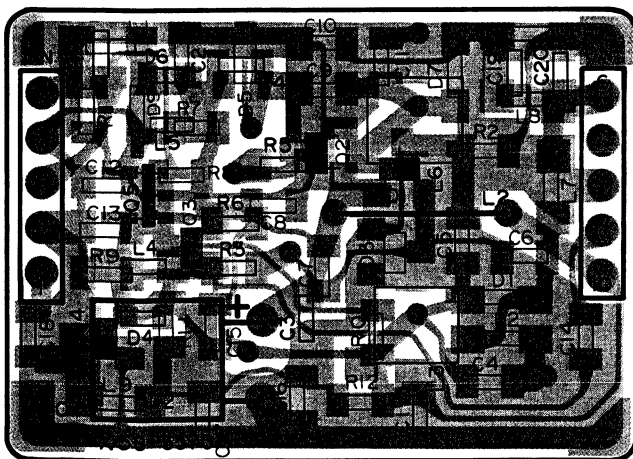
VCO (X58-3570-XX) -10: K,M -11: M2

SUB UNIT (VCO) (X58-3570-XX)

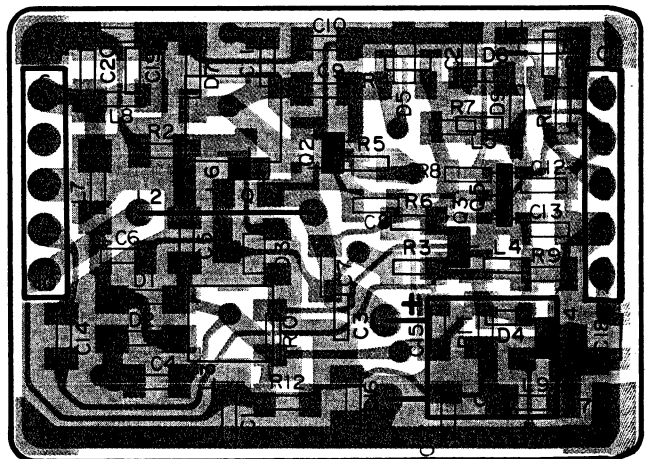


	L6	L9	C4	C11
X58-3570-10	L34-4095-05	L40-1082-19	—	5P
X58-3570-11	L34-4086-05	L40-1582-19	7P	9P

VCO (X58-3570-XX) Component side view



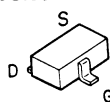
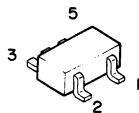
VCO (X58-3570-XX) Foil side view



2SK2714

FM4G

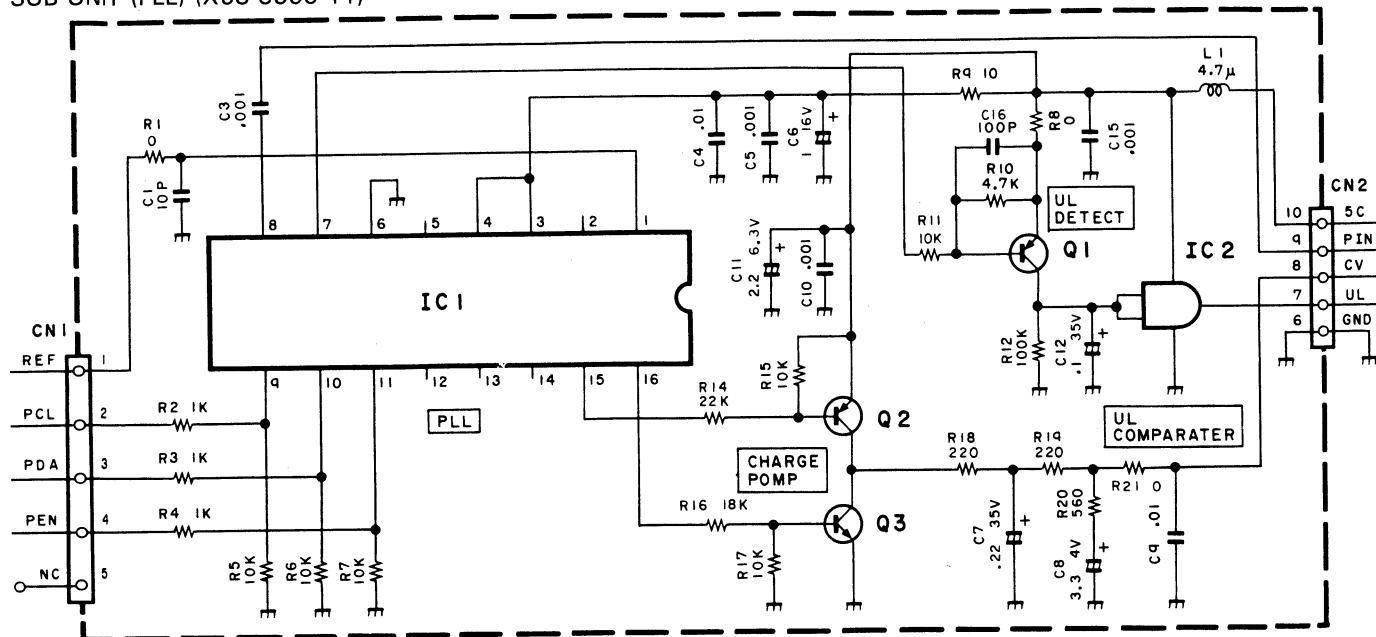
2SK508NV



TK-230/230(SC) CIRCUIT DIAGRAM / PC BOARD VIEWS

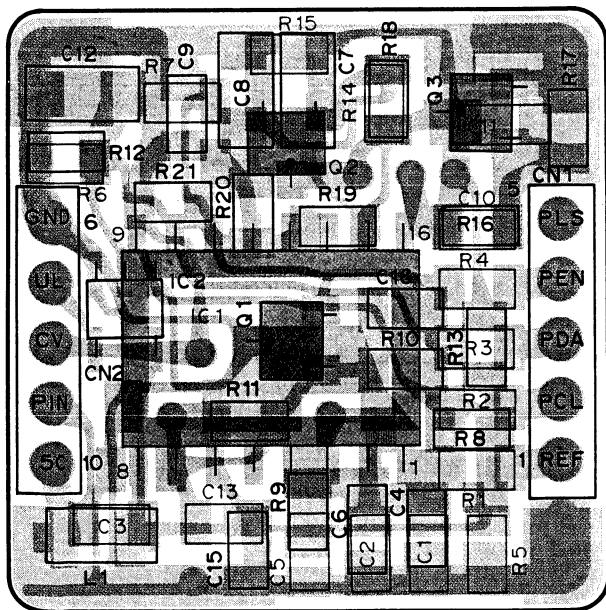
PLL (X58-3550-11)

SUB UNIT (PLL) (X58-3550-11)

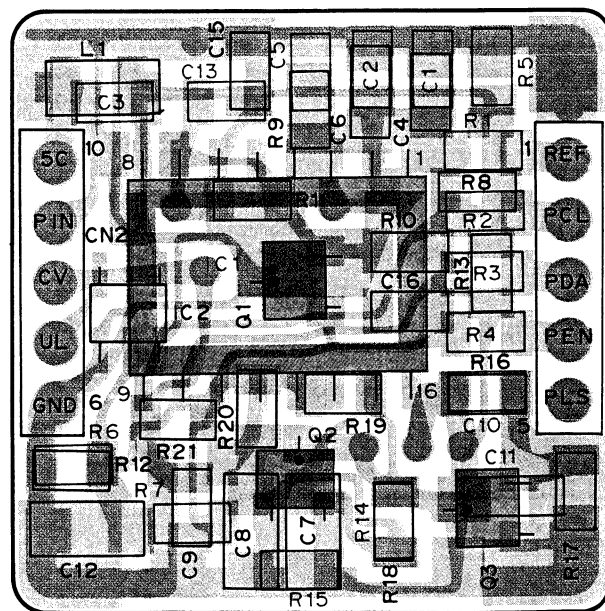


IC1: MB1504F, IC2: TC4S81F, Q1,2: 2SA1162(Y), Q3: 2SC2712(Y)

PLL (X58-3550-11) Component side view



PLL (X58-3550-11) Foil side view



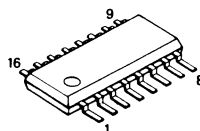
2SA1162
2SA1312
2SC3324



TC4S81F



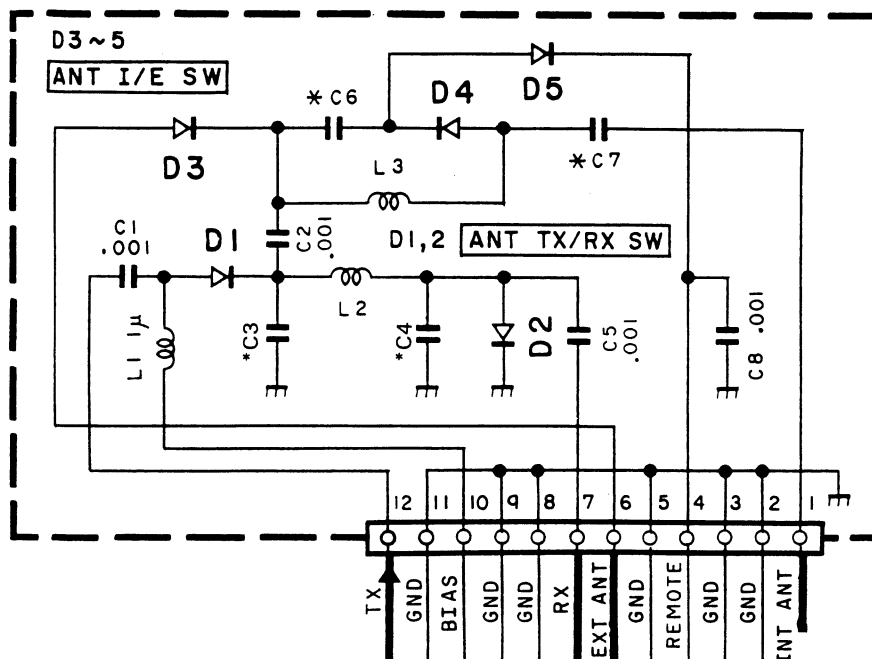
MB1504



CIRCUIT DIAGRAM / PC BOARD VIEW TK-230/230(SC)

ANT SW (X58-3560-XX) -13: K,M -14: M2

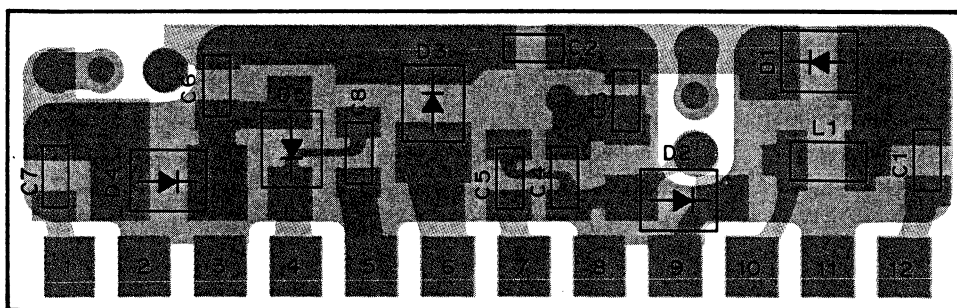
SUB UNIT (ANT SW) (X58-3560-XX)



D1,3,4: μ 1808, D2,5: HSK277

		C6	C7	C3	C4
TK-230 F1	X58-3560-13	11P	13P	22P	20P
TK-230 F2	X58-3560-14	16P	15P	24P	22P

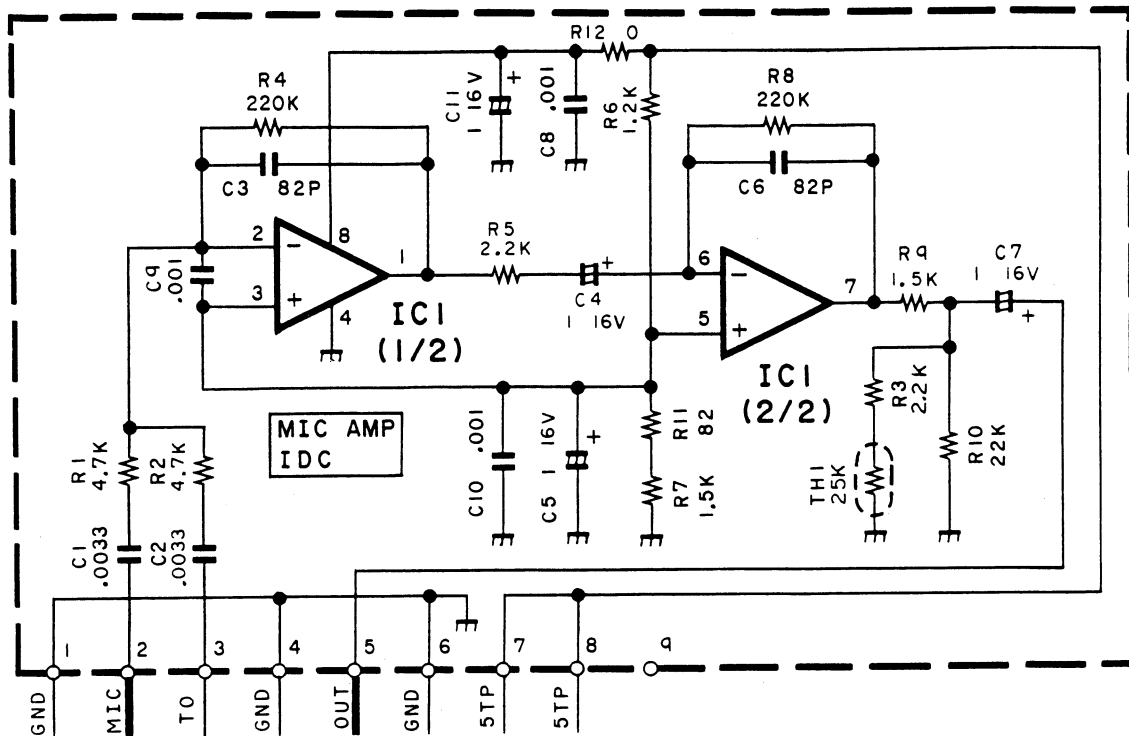
ANT SW (X58-3650-XX) Component side view



TK-230/230(SC) CIRCUIT DIAGRAMS / PC BOARD VIEWS

MIC AMP (X59-3520-10)

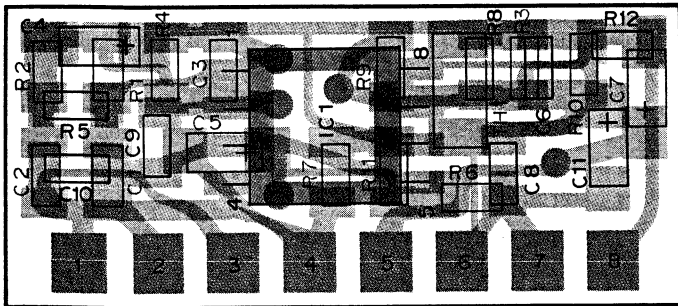
MODULE UNIT (MIC AMP) (X59-3520-10)



IC1: NJM4560M

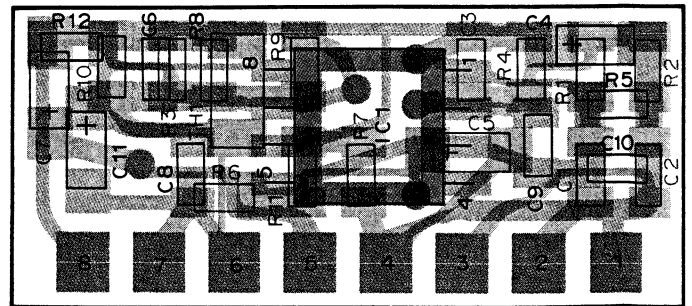
MIC AMP (X59-3520-10)

Component side view

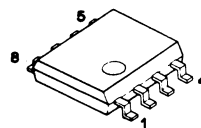


MIC AMP (X59-3520-10)

Foil side view



NJM4560M

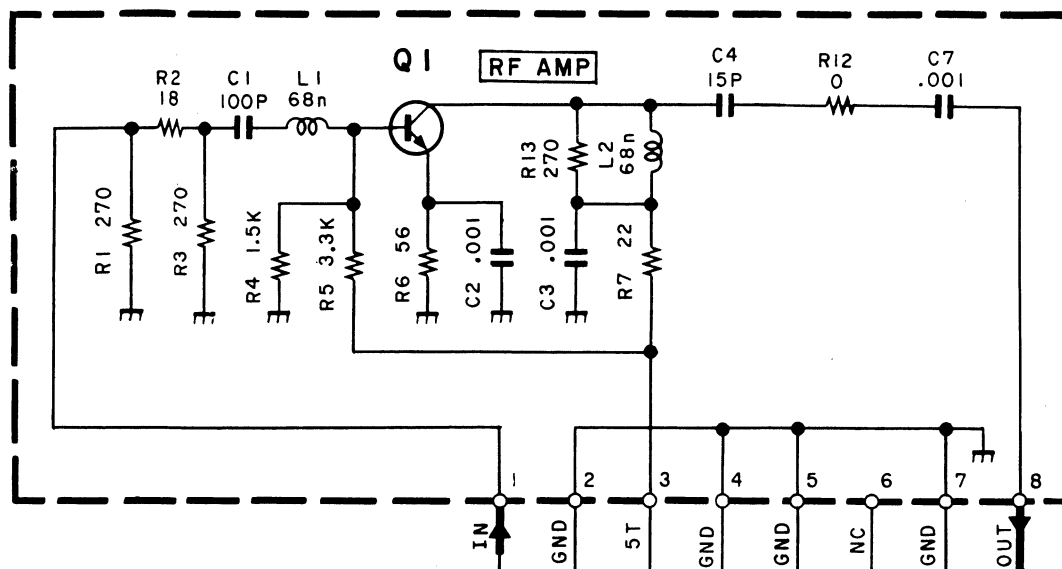


CIRCUIT DIAGRAM / PC BOARD VIEW

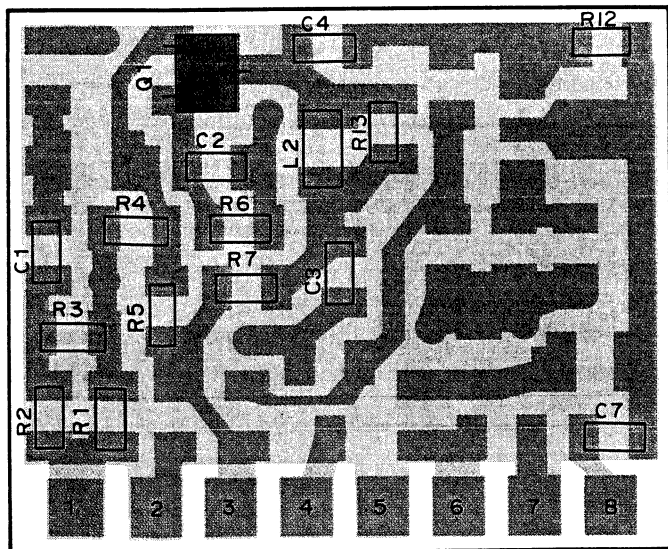
TK-230/230(SC)

DRIVE (X59-3540-11)

MODULE UNIT (DRIVE) (X59-3540-11)



DRIVE (X59-3540-11) Component side view



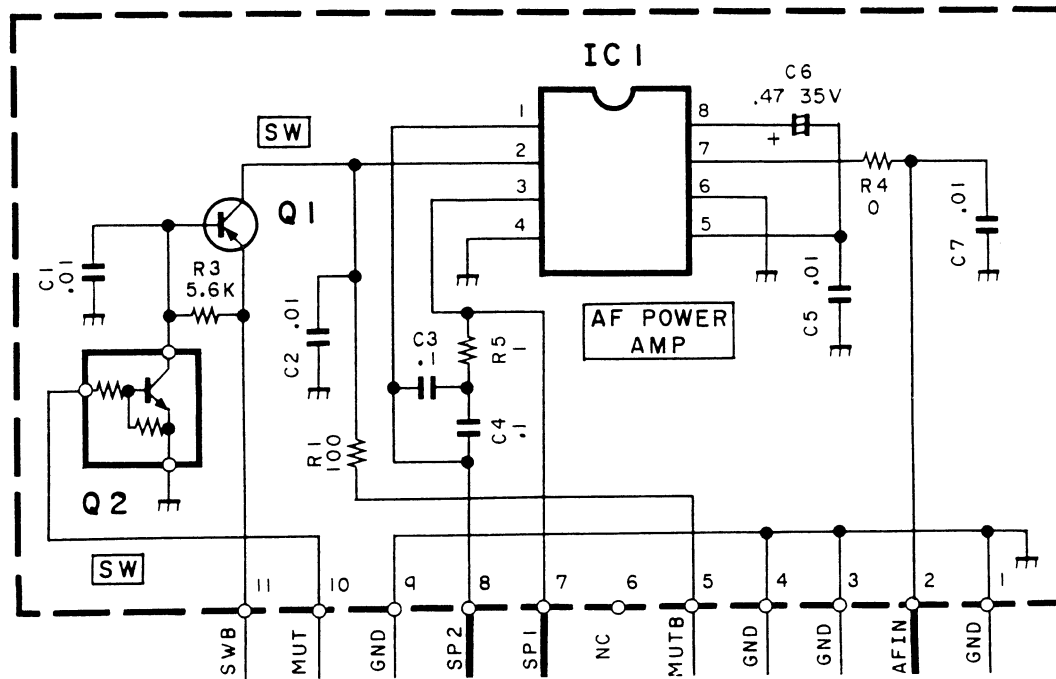
2SC3098



TK-230/230(SC) CIRCUIT DIAGRAM / PC BOARD VIEW

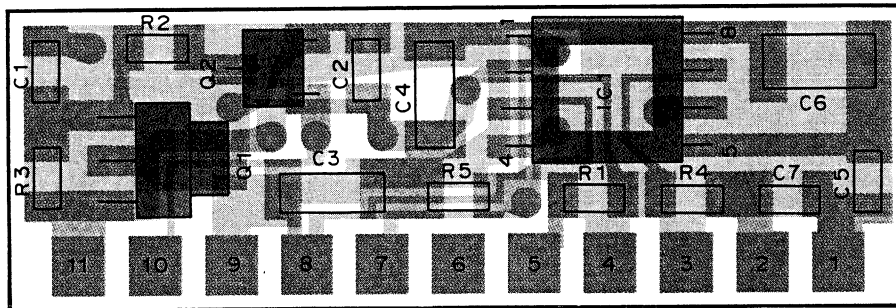
AF PA (X59-3560-10)

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

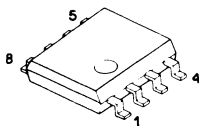


IC1: NJM2073M, Q1: 2SC1213(Y), Q2: DTC144EK

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



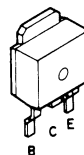
NJM2073M



2SC1213



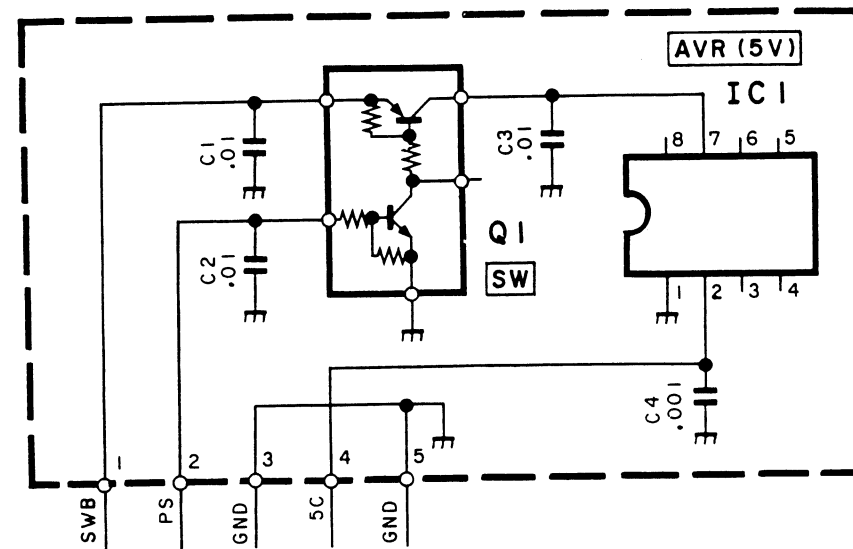
DTC144EK



CIRCUIT DIAGRAM / PC BOARD VIEWS TK-330/330(SC)

AVR (X59-3570-10)

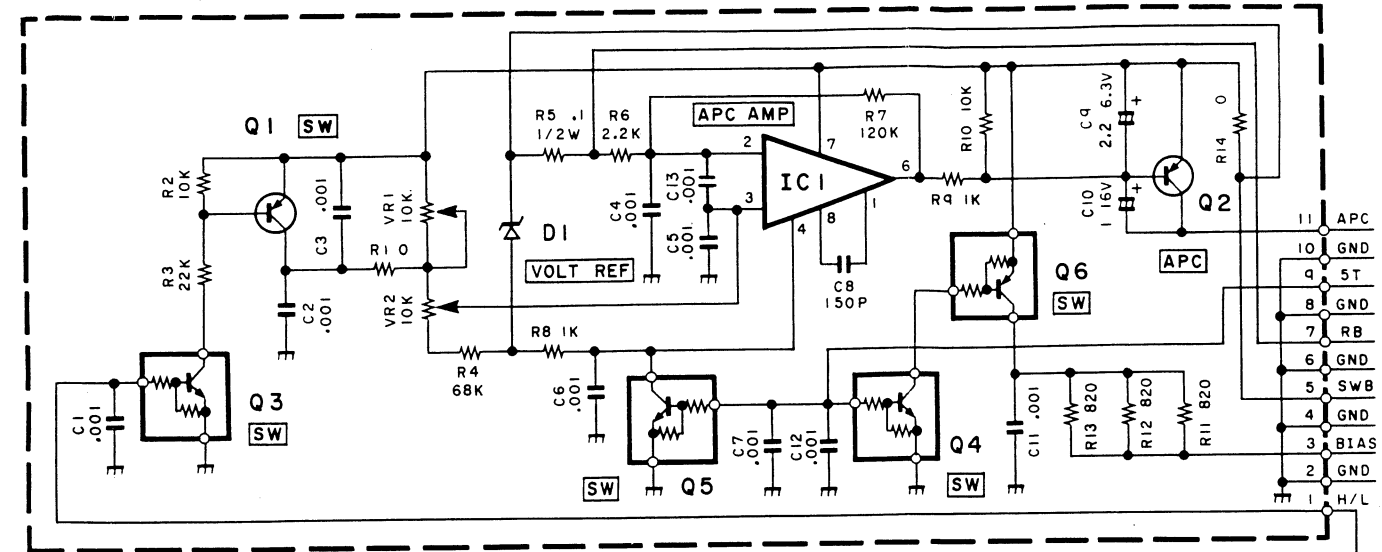
MODULE UNIT (AVR) (X59-3570-10)



IC1: LA5005, Q1: FMC5

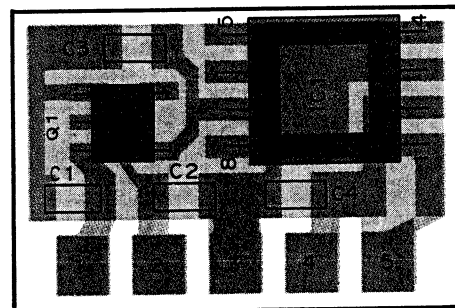
APC (X59-3590-10)

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

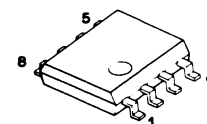


IC1: LM301AD, Q1: 2SA1162(Y), Q2: 2SB1182FS(Q), Q3~5: DTC114YK, Q6: DTA143EK

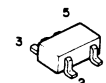
AVR (X59-3570-10) Component side view



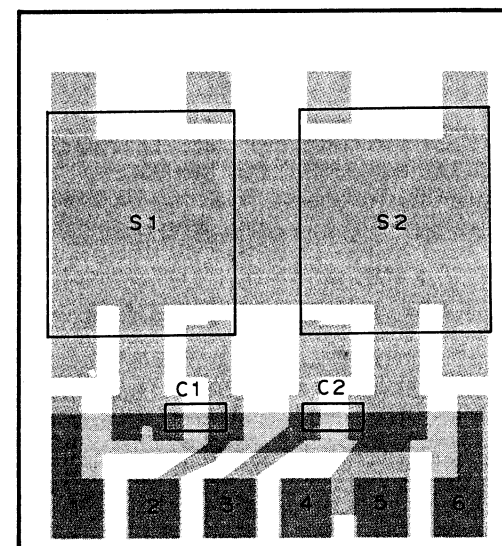
LA5005



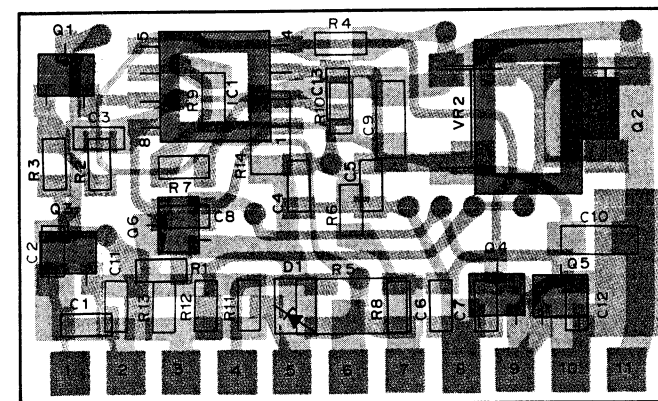
FMC5



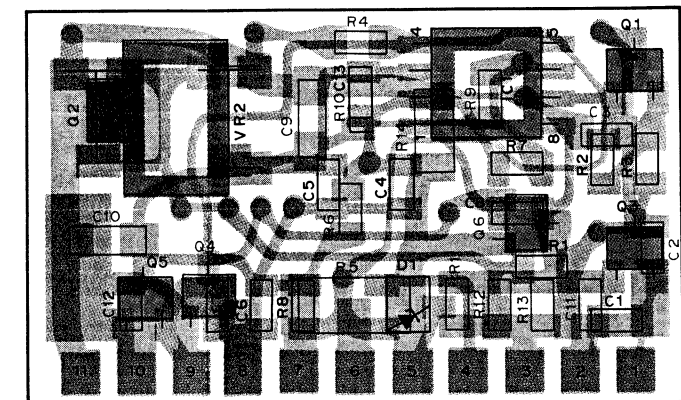
SW (X59-3580-10) Component side view



APC (X59-3590-10) Component side view



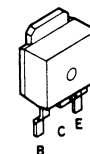
APC (X59-3590-10) Foil side view



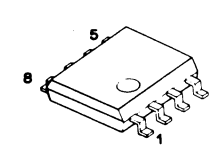
2SA1162
DTA143EK
DTC114YK



2SB1182F5



LM301AD



A

B

C

D

E

F

G

H

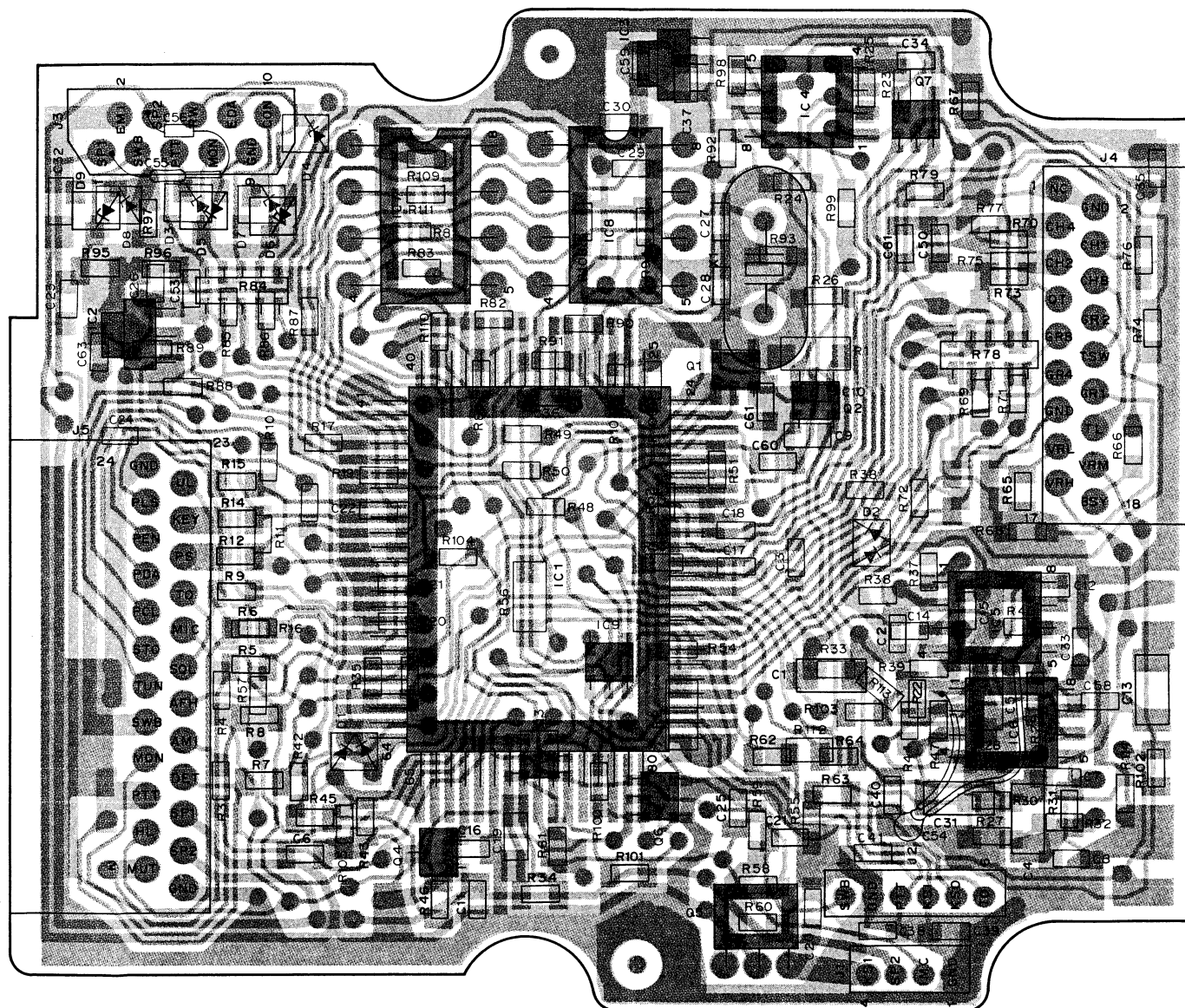
I

TK-230/230(SC)

PC BOARD VIEW

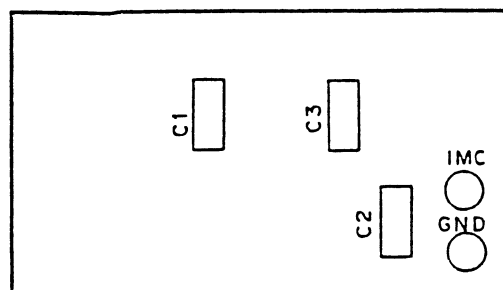
CONTROL UNIT (X53-3210-XX) Component side view

-10: TK-230 -11: TK-230(SC) -12: TK-230A (S/No. 0080050 ~ 0080425)



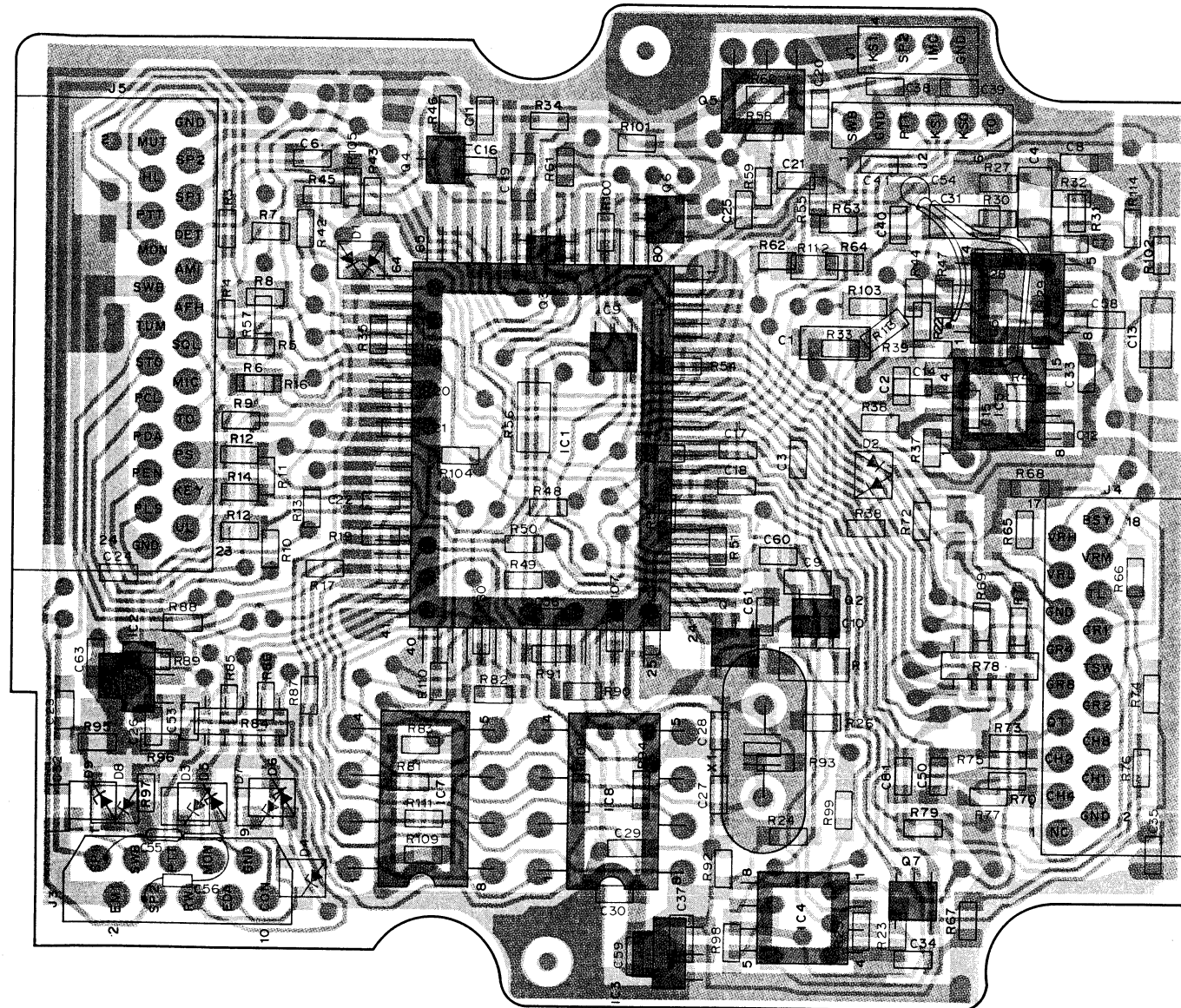
MIC UNIT (X42-3020-10)

Component side view



CONTROL UNIT (X53-3210-XX) Foil side view

-10: TK-230 -11: TK-230(SC) -12: TK-230A (S/No. 0080050 ~ 0080425)



IC1: H37450M4-235FP IC2: S-81250HG-RD IC3: S-8054HN-CB IC4: NJM4558M IC5,6: NJM2904M
 IC7,8: NMC93CS66EN or NMC93CS66N*J IC9: TC4S66F
 Q1,3,6: FMC5 Q2: FMC2 Q4: DTC363EK Q5: 2SD1246(S,T) Q7: FMA1
 D1: DAN202K D2: HSM88AS D3~8: 02CZ9.1(X,Y) or RD9.1M-B2 D9: 02CZ10(X,Y) or RD10M-B1

PC BOARD VIEW

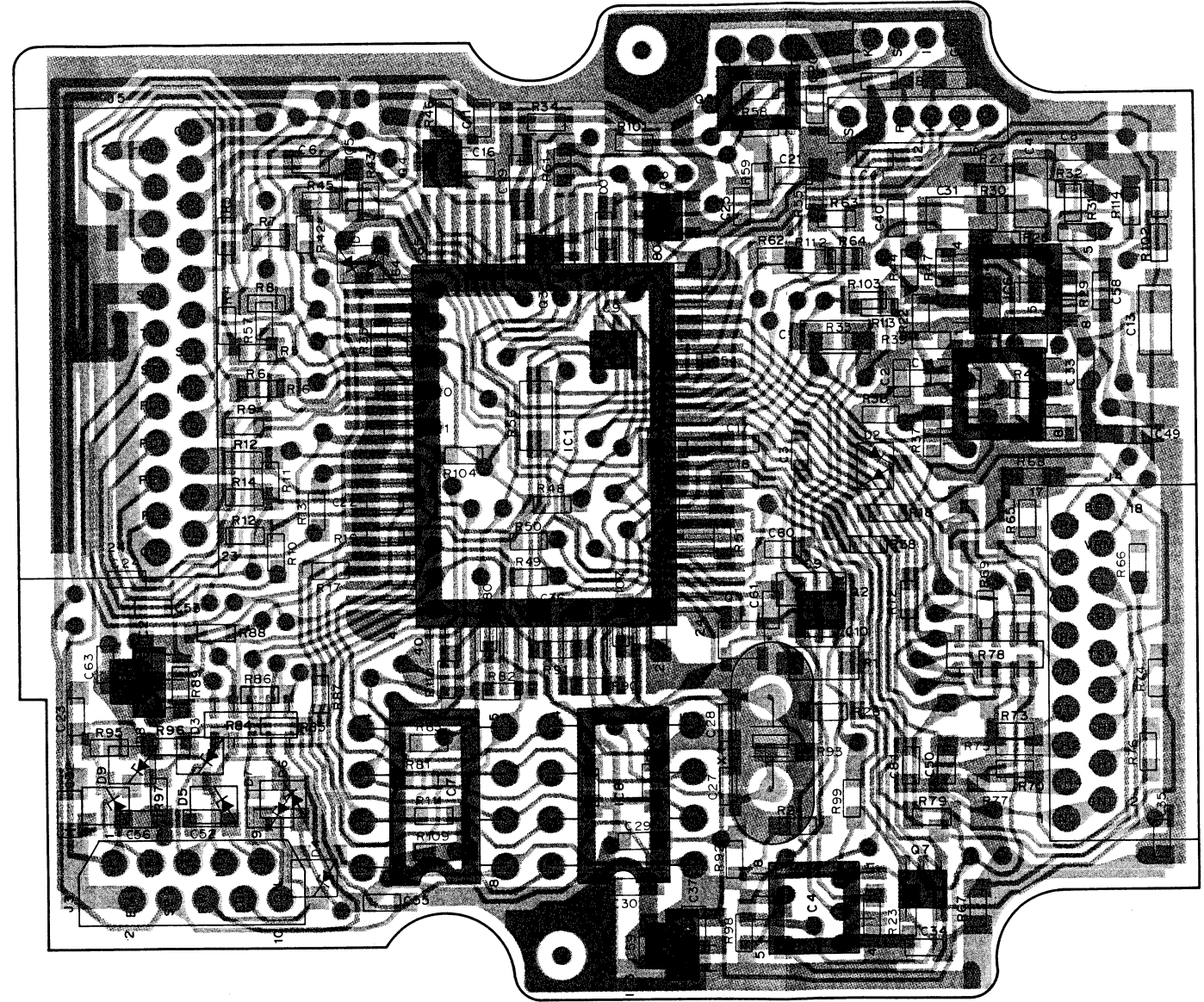
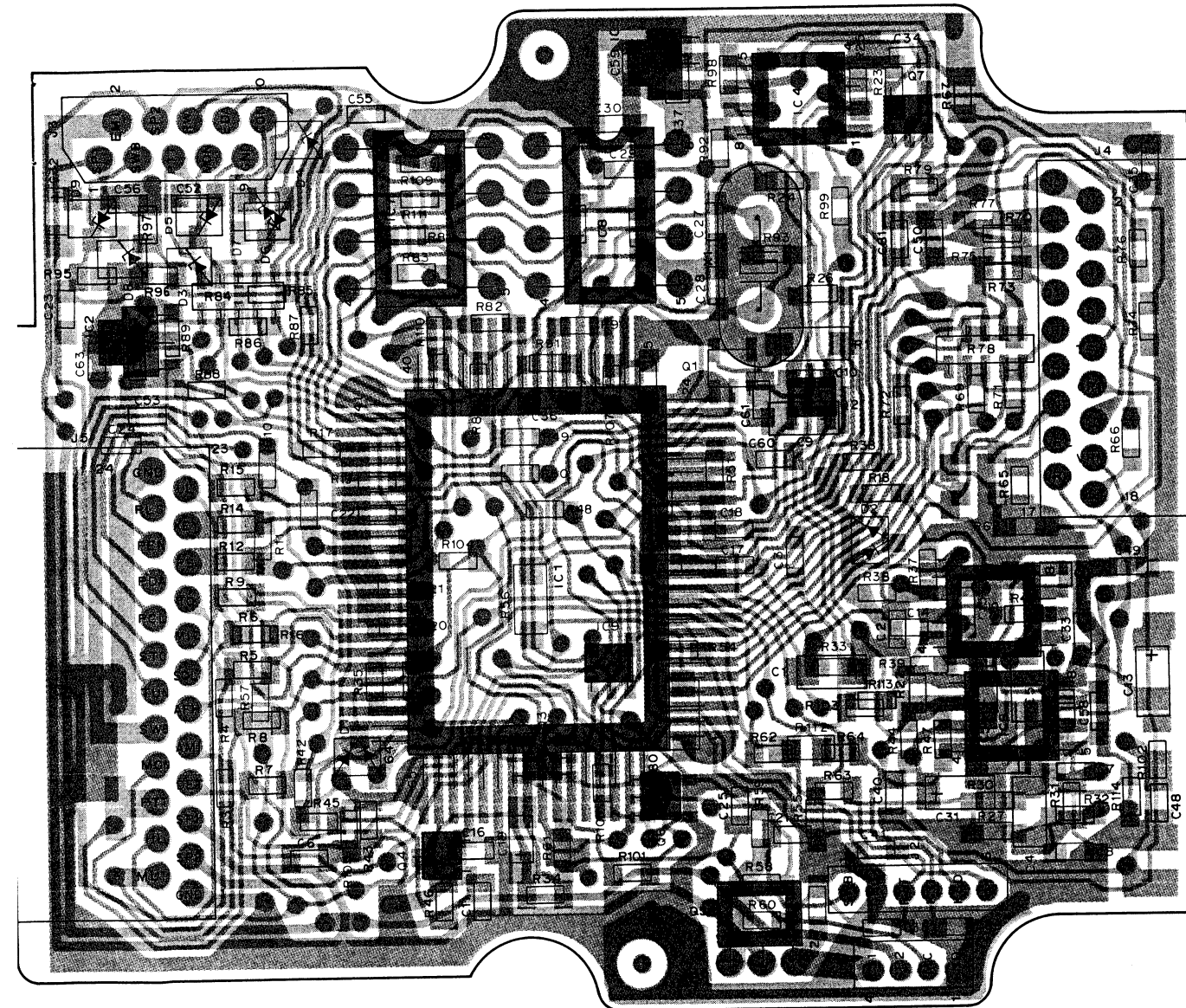
TK-230/230(SC)

CONTROL UNIT (X53-3210-XX) Component side view

-10: TK-230 -11: TK-230(SC) -12: TK-230A (S/No. 0090061 ~)

CONTROL UNIT (X53-3210-XX) Foil side view

-10: TK-230 -11: TK-230(SC) -12: TK-230A (S/No. 0090061 ~)



IC1: H37450M4-235FP IC2: S-81250HG-RD IC3: S-8054HN-CB IC4: NJM4558M IC5,6: NJM2904M
IC7,8: NMC93CS66EN or NMC93CS66N*J IC9: TC4S66F
Q1,3,6: FMC5 Q2: FMG2 Q4: DTC363EK Q5: 2SD1246(S,T) Q7: FMA1
D1: DAN202K D2: HSM88AS D3~8: 02CZ9.1(X,Y) or RD9.1M-B2 D9: 02CZ10(X,Y) or RD10M-B1

2SD1246

DTC363EK

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

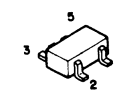
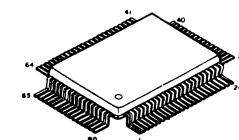
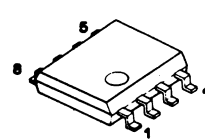
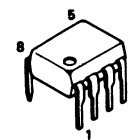
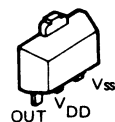
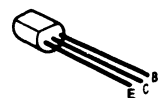
NMC93CS66N*J
NMC93CS66EN

NJM2904M
NJM4558M

H37450M4-235FP

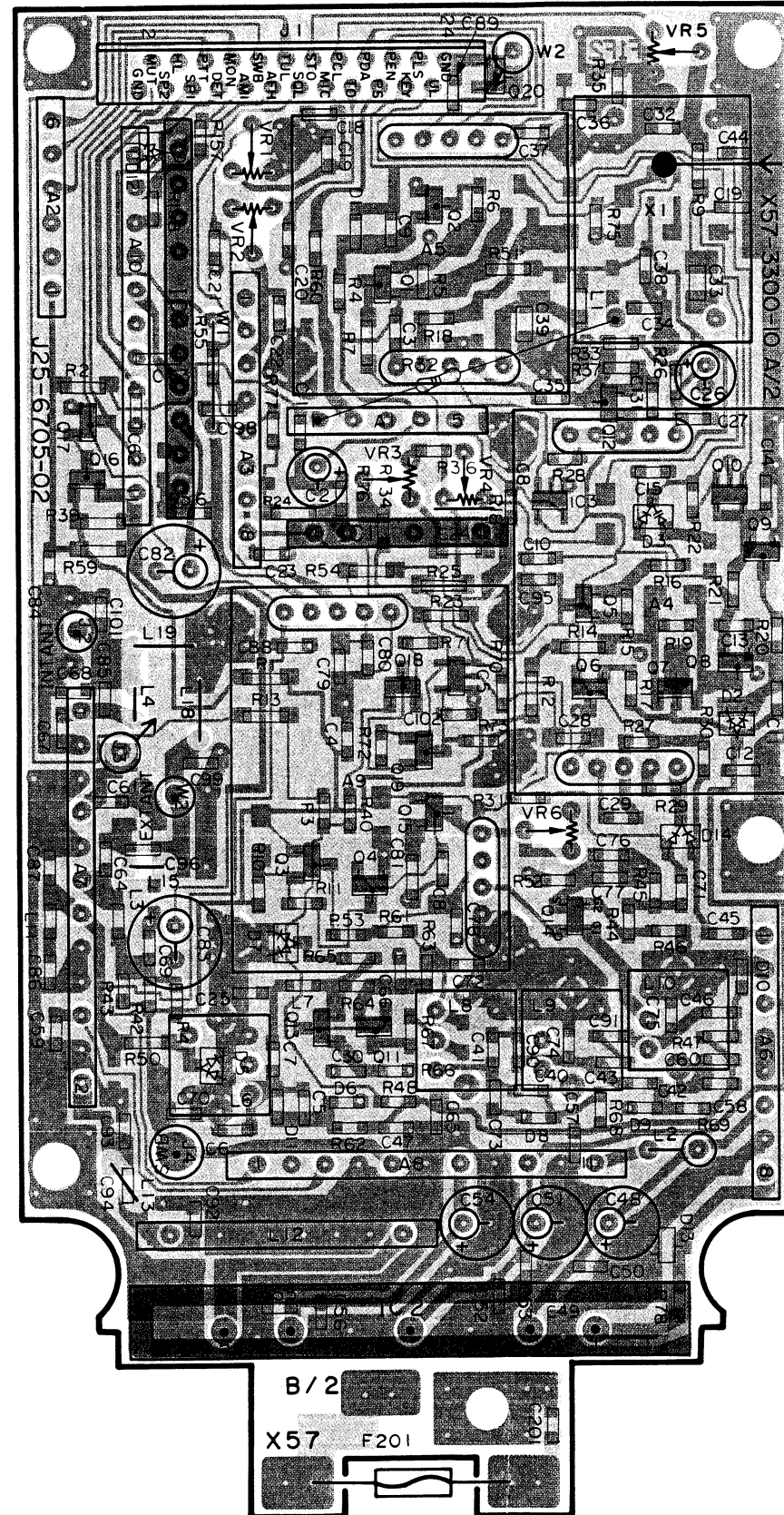
FMA1
FMC5
FMG2

TC4S66F



TK-230/230(SC)

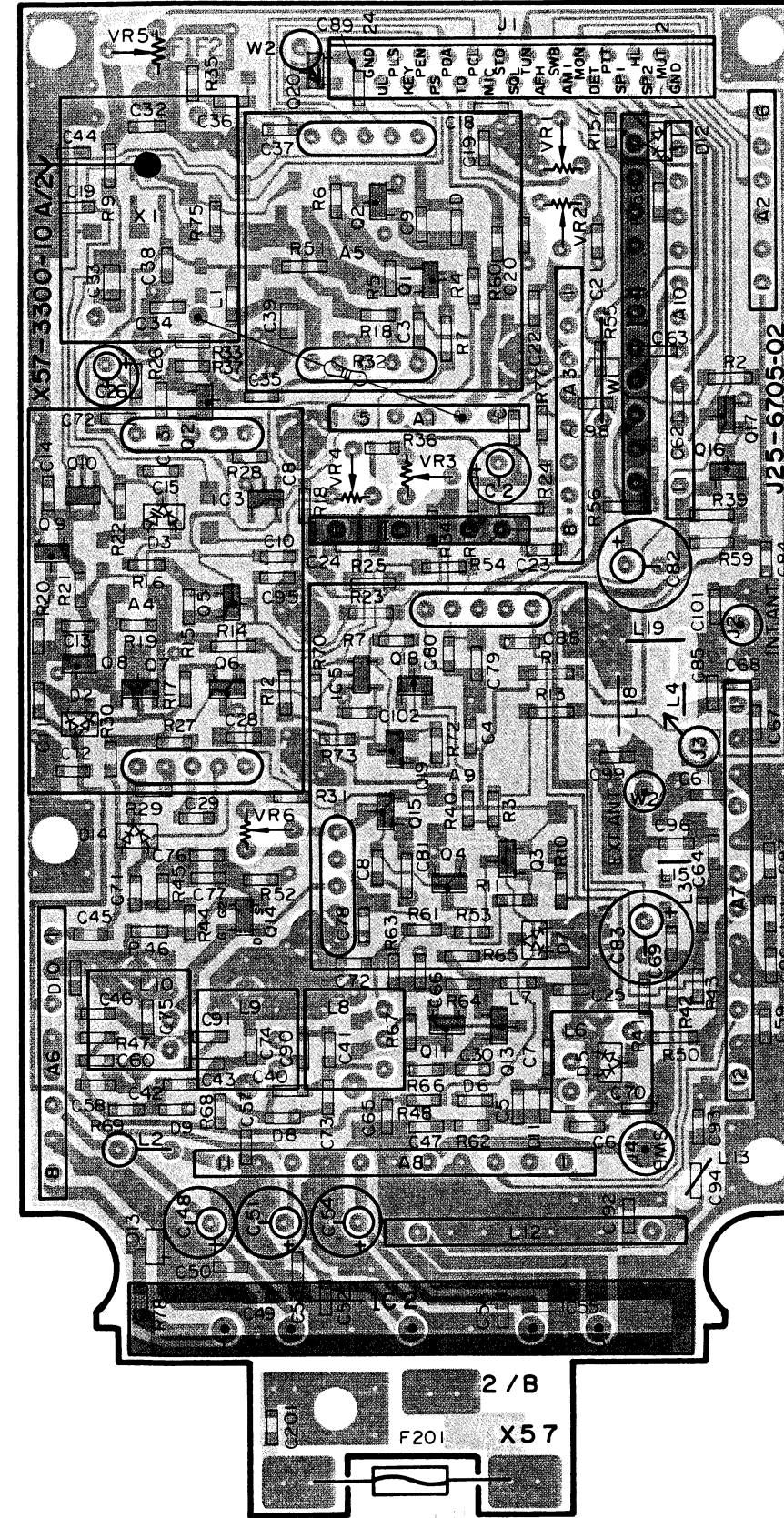
TX-RX UNIT (X57-3300-XX) Component side view
-10: TK-230 -11: TK-230(SC)



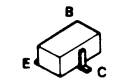
IC1: AFL24F3300E12, IC2: M67755H or M67755L, IC3: TC4S66F, IC4: KCE02, Q1,3,5: 2SA1162(Y), Q2,4,17,20: DTC144EK, Q6,16,19: 2SA1162(Y), Q7: 2SA1162(Y), Q8: 2SC2712(Y), Q9,18: 2SC2712(Y), Q10: FMG2, Q11,13: 2SC2712(Y), Q12: 2SC2712(Y), Q14: 3SK140(GR), Q15: DTA144EK, D1,3: DAN202K, D2,7: DAP202K, D4: HSM2693, D5,12,13: HSM88AS, D6,11: MA360, D8~10: MA366

PC BOARD VIEW

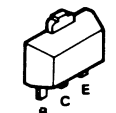
TX-RX UNIT (X57-3300-XX) Foil side view
-10: TK-230 -11: TK-230(SC)



2SA1162
2SA1362
2SC2712
DTA144EK
DTC144EK
2SC3099
2SC2714



2SA1213



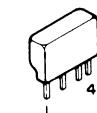
3SKK140



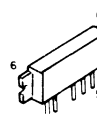
FMG2



AFL24F3300E12



M67755H
M67755L



TC4S66F



TK-230/230(SC)

KDM-4 (FOR 20-CH ALPHA-NUMERIC DISPLAY) / KDM-4(A) (FOR 100-CH ALPHA-NUMERIC DISPLAY)

• Time-out timer

Data code	0	1	2	3	4	5	6	7
Time	540	15	30	45	60	75	90	105
Data code	8	9	10	11	12	13	14	15
Time	120	135	150	165	180	195	210	225

(sec)

• Toggle switch function selection

- 1 : Power HI/LO changeover
- 2 : Talk/around
- 3 : Group 1/2 selection
- 4 : Scan ON/OFF (BASIC + SCAN only)
- 5 : HOME/ROAM

• Other control data setting

No busy channel lockout	No Pr AC CONT function	Data code	1
	Pr AC CONT functions		2
Busy channel lockout	No Pr AC CONT function		3
	Pr AC CONT functions		4

• Scan function setting data

With priority	Variable priority	Stop at a priority channel	Programmable DEL/ADD	Data code	1
			Preset DEL/ADD		2
		Stop at a channel to which a signal is input	Programmable DEL/ADD		3
			Preset DEL/ADD		4
	Fixed priority	Stop at a priority channel.	Programmable DEL/ADD		5
			Preset DEL/ADD		6
		Stop at a channel to which a signal is input.	Programmable DEL/ADD		7
			Preset DEL/ADD		8
With no priority	Stop at a channel set on the top panel.		Programmable DEL/ADD		9
			Preset DEL/ADD		10
	Stop at a channel to which a signal is input.		Programmable DEL/ADD		11
			Preset DEL/ADD		12

• Lookback time

1) Lookback B

Data code	0	1	2	3	4	5	6	7
Time	0.75	0.875	1.00	1.125	1.25	1.375	1.50	1.625
Data code	8	9	10	11	12	13	14	15
Time	1.75	1.875	2.00	2.125	2.25	2.375	2.50	None

(sec)

2) Lookback A

Data code	0	1	2	3	4	5	6	7
Time	350	375	400	425	450	475	500	525
Data code	8	9	10	11	12	13	14	15
Time	550	575	600	625	650	675	700	*

* : Same as Lookback B.

(sec)

• Scan resume time

Data code	0	1	2	3	4	5	6	7
Time	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
Data code	8	9	10	11	12	13	14	15
Time	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50

(sec)

• Fixed priority

Group and channel setting.

• ANI data setting

The ANI that can be set is the CONNECT/DISCONNECT ANI. The keys that can be used for input are 0 ~ 9, *, and #. The maximum number of digits is 16.

• Transmit/receive frequency setting

• Transmit/receive signalling setting

The types of signalling that can be set are QT and DQT. NORMAL can re-switched to INVERSE and vice-versa for DQT.

TK-230/230(SC)

KDM-4 (FOR 20-CH ALPHA-NUMERIC DISPLAY) / KDM-4(A) (FOR 100-CH ALPHA-NUMERIC DISPLAY)

× 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
KDM-4/4 (A)						
		*	A02-0865-03	CASE ASSY		
		*	E31-3489-05	CONNECTING WIRE(SP-CONT) 4P		
		*	F15-0662-04 F19-0650-04	BLIND PLATE BLIND PLATE		
		*	G53-0567-04	PACKING(CASE)		
			J21-4188-14 J31-0526-14	MOUNTING HARDWARE(SP) SPACER(MIC)		
		*	K29-3160-14	KEY TOP		
			N89-2004-46	TAPPING SCREW(MIC,SIGNALING U.		
		*	T07-0256-05 T91-0381-05	SPEAKER MICROPHONE		
			X42-3020-10 X52-3150-20	MIC UNIT SIGNALING UNIT	M	A
		*	X52-3150-21	SIGNALING UNIT	M2	B
SIGNALING UNIT (X52-3150-20)						
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 1UF 16WV		
C4			CK73FB1H102K	CHIP C 1000PF K		
C5			C92-0004-05	CHIP-TAN 1UF 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		
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		*	L73-0052-05	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		
R7			RK73FB2A104J	CHIP R 100K J 1/10W		
R8			RK73FB2A473J	CHIP R 47K J 1/10W		
R9			RK73EB2B470J	CHIP R 47 J 1/8W		
R10 -12			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R13			RK73FB2A471J	CHIP R 470 J 1/10W		
R14 -17			RK73FB2A473J	CHIP R 47K J 1/10W		
R18			RK73EB2B470J	CHIP R 47 J 1/8W		
R19			R92-0670-05	CHIP R 0 OHM	M	

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: 10CH
B: 100CH

△ indicates safety critical components.

TK-230/230(SC)

KDM-4 (FOR 20-CH ALPHA-NUMERIC DISPLAY) / KDM-4(A) (FOR 100-CH ALPHA-NUMERIC DISPLAY)

× 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.

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
R19 ,20			R92-0670-05	CHIP R 0 0HM	M2	
IC1		*	HD4074608A34FS	IC(MICROPROCESSOR)		
IC2 ,3		*	AK93C46F	IC(1K EEPROM)	M	
IC4			S-81250HG-RD	IC(VOLTAGE REGULATOR/ +5V)		
IC5			S-8054HN-CB	IC(VOLTAGE DETECTOR)		
IC6 ,7			CAT35C104KI	IC(4K EEPROM)	M2	
Q1			DTC114YK	DIGITAL TRANSISTOR		
Q2		*	FMG5	DIGITAL TRANSISTOR		
Q3			DTC114YK	DIGITAL TRANSISTOR		

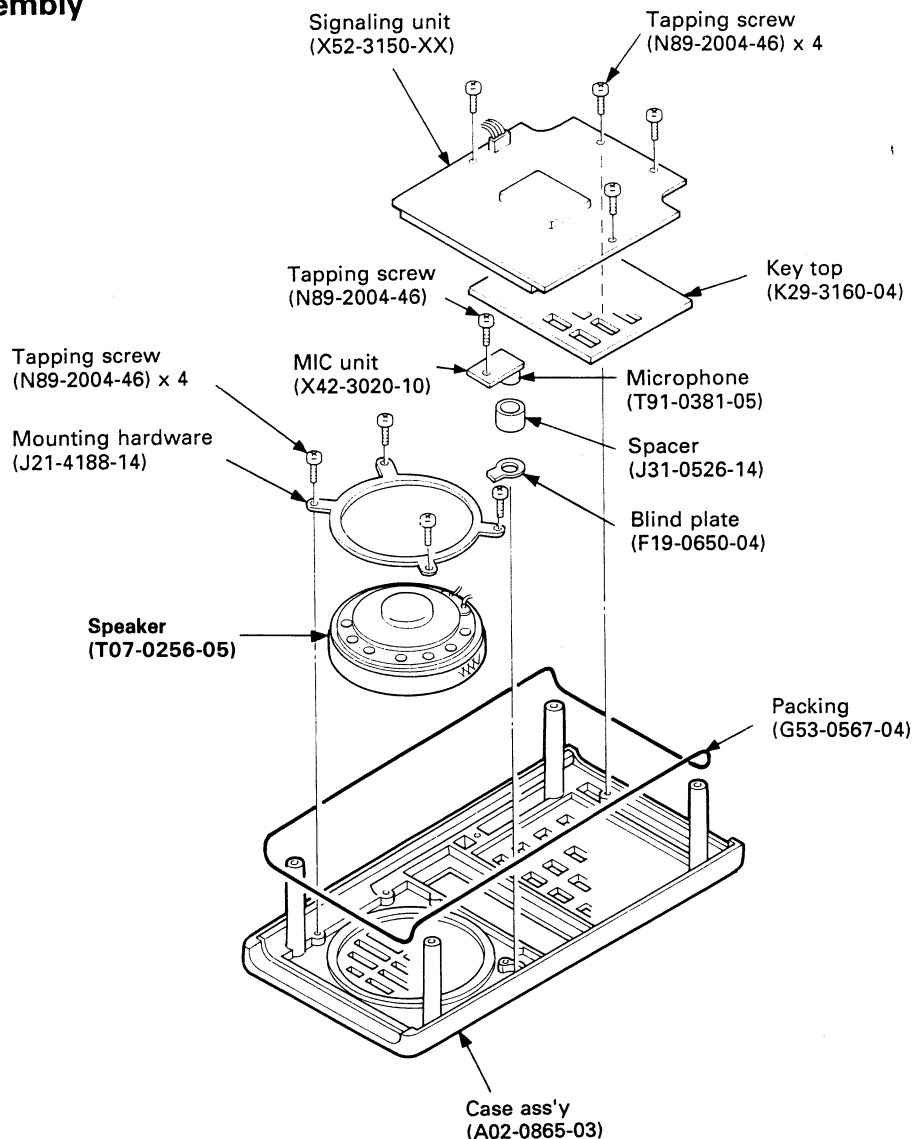
E: Scandinavia & Europe K: USA P: Canada W: Europe

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

UE: AAFES(Europe) X: Australia

⚠ indicates safety critical components.

Disassembly



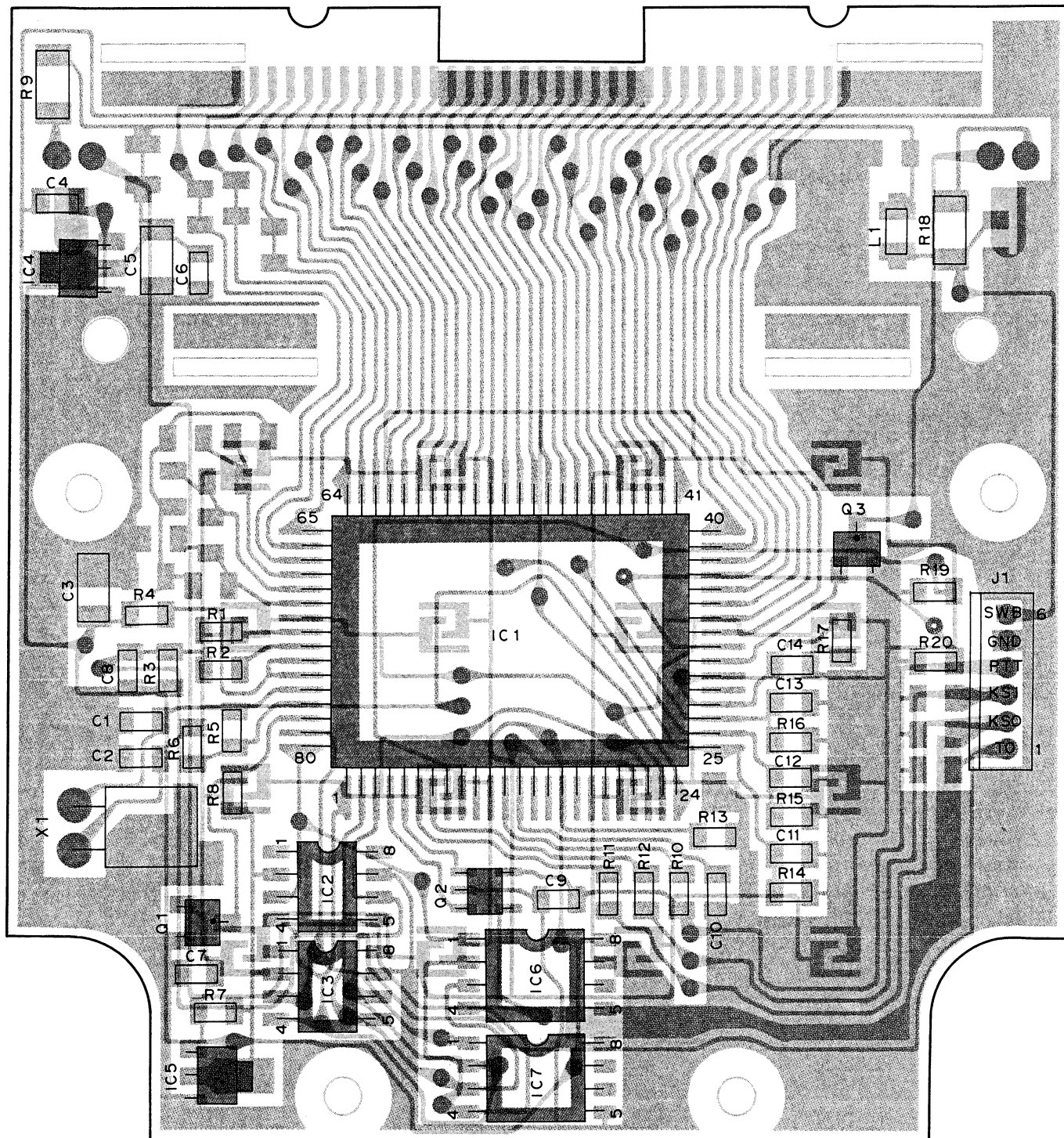
TK-230/230(SC)

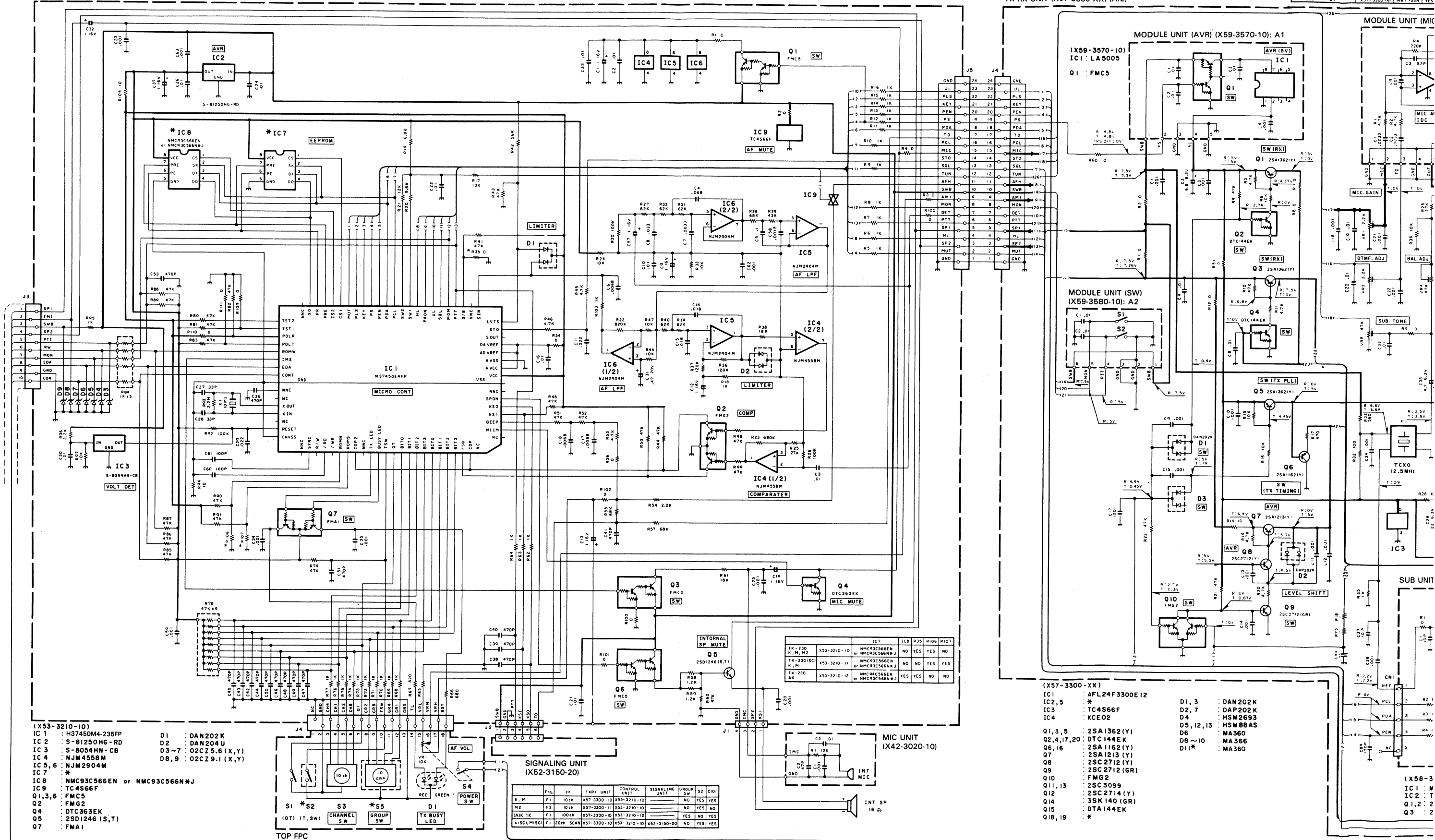
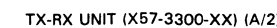
**KDM-4 (FOR 20-CH ALPHA-NUMERIC DISPLAY) /
KDM-4(A) (FOR 100-CH ALPHA-NUMERIC DISPLAY)**

PC board view

SIGNALING UNIT (X52-3150-XX) Component side view

-20 : KDM-4 -21 : KDM-4(A)

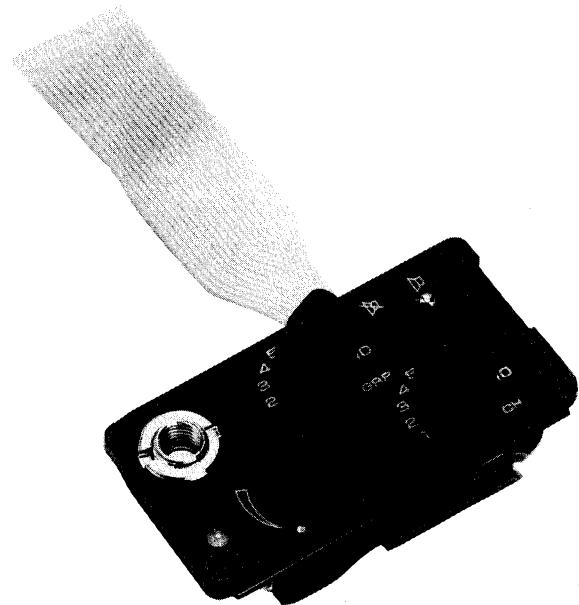




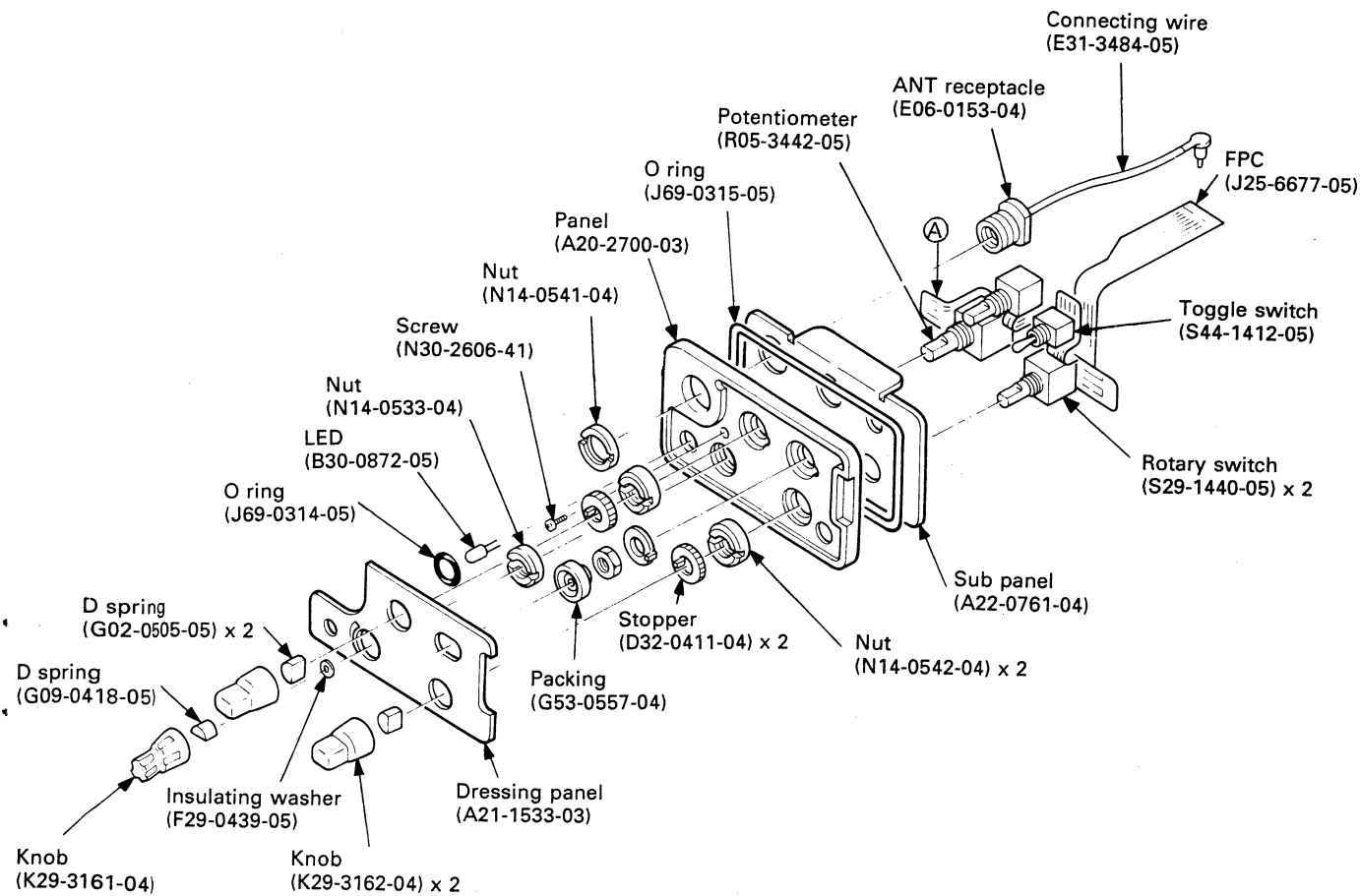
TK-230/230(SC)

KCH-2 (MULTI-CHANNEL TOP PANEL)

External view



Disassembly



Differences from the top panel for 10CH

	Toggle switch (S44-1412-05)	Rotary switch (S29-1440-05)	Face panel
KCH-2 (100CH)	One	Two	For 100 channels (A21-1533-03)
10CH	Two	One	For 10 channels (A21-1531-03)

Accessory

IC : NMC93C66E x 2

Note

- To remove and install the top panel : see page 5
1. When soldering +B (red lead), be sure to remove the battery from the radio.
 2. Mount it so that FPC (A) does not bite into the panel.

TK-230/230(SC)

KCH-2 (MULTI-CHANNEL TOP PANEL)

× 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.	Address	New Parts	Parts No.	Description	Desti- nation	Re- marks
参照番号	位置	新	部品番号	部品名 / 規格	仕向	備考
KCH-2						
		*	A20-2700-03	PANEL		
		*	A21-1533-03	DRESSING PANEL		
		*	A22-0761-04	SUB PANEL		
		*	B30-0872-05	LED (TX/BUSY)		
		*	D32-0411-04	STOPPER (CHANNEL)		
		*	E06-0153-04	ANT RECEPTACLE		
		*	E31-3483-05	CONNECTING WIRE (VOL-TX-RX)		
		*	E31-3484-05	CONNECTING WIRE (ANT-TX-RX)		
		*	E33-1884-05	WIRE (RED)		
		*	F29-0439-05	INSULATING WASHER (VOL)		
			G02-0505-05	D SPRING (CH, GRP.)		
			G09-0418-05	D SPRING (VOL)		
			G13-0682-04	CUSHION		
			G13-0901-04	CUSHION (FPC)		
		*	G53-0557-04	PACKNG (TOGGLE SW)		
		*	J25-6677-05	FPC		
		*	J69-0314-05	O RING (LED)		
		*	J69-0315-05	O RING (PANEL)		
		*	K29-3161-04	KNØB (VOL)		
		*	K29-3162-04	KNØB (CHANNEL, GROUP)		
			N14-0533-04	NUT (VOL)		
			N14-0541-04	NUT (ANT)		
		*	N14-0542-04	NUT (CH, GRP.)		
			N30-2606-41	SCREW		
			R05-3442-05	POTENTIOMETER (VOL)		
		*	S29-1440-05	ROTARY SWITCH (CHANNEL, GROUP)		
			S44-1412-05	TOGGLE SW		
		*	NMC93C66EN	IC (EEPROM)		

E: Scandinavia & Europe 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.

KCT-1 KCT-3

KCT-1 Exter
Method of use:

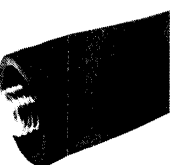


KRA-6A/6B/6C

KRA-6A: 150~

KRA-6B: 162~

KRA-6C: 134~

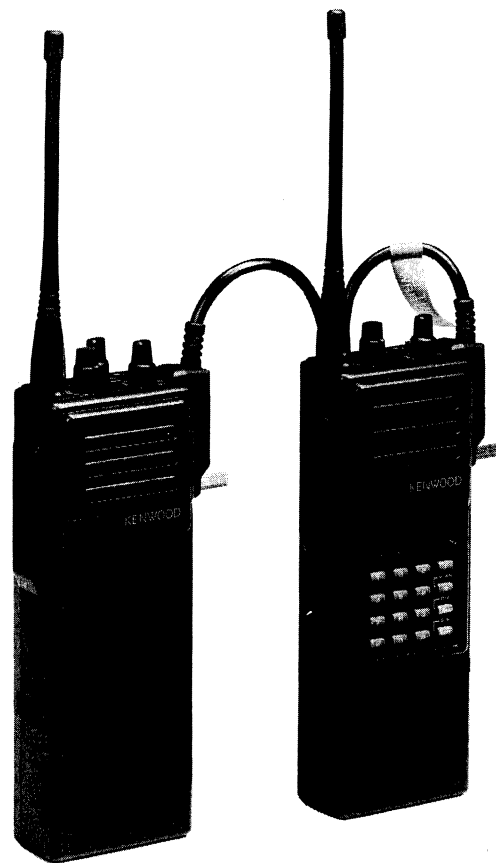


TK-230/230(SC)

KCT-1 (CLONING CABLE)/KCT-2 (PROGRAMMING PLUG)/ KCT-3 (METERING CABLE)/KRA-6A, 6B, 6C (VHF STUBBY ANTENNA)

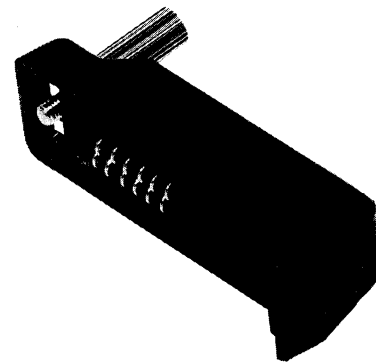
KCT-1 External view

Method of use: See page 7



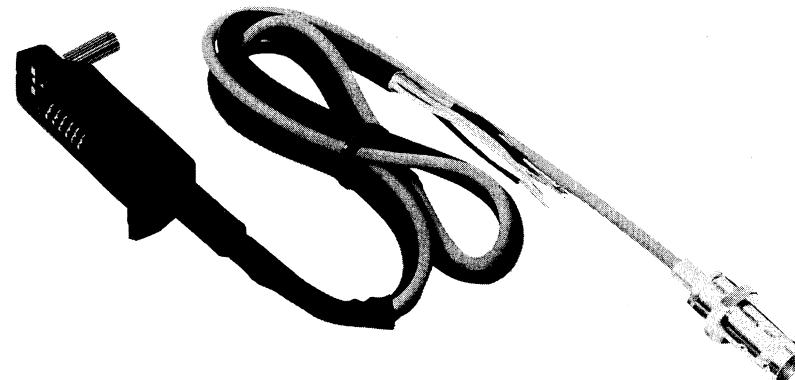
KCT-2 External view

Method of use: See page 7



KCT-3 External view

Method of use: See page 59



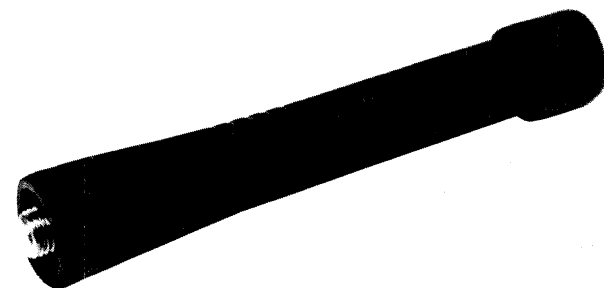
Note: Before connecting an option to the universal connector, be sure to turn the radio POWER switch off because there is a possibility of a short circuit.

KRA-6A/6B/6C External view

KRA-6A: 150 ~ 162 MHz

KRA-6B: 162 ~ 174 MHz

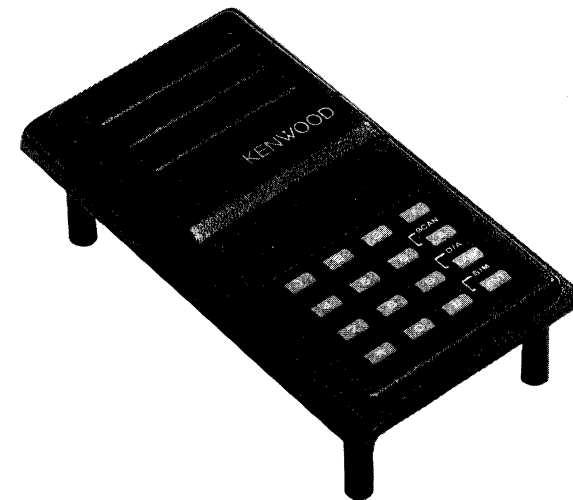
KRA-6C: 134 ~ 150 MHz



TK-230/230(SC)

KDM-4 (FOR 20-CH ALPHA-NUMERIC DISPLAY) / KDM-4(A) (FOR 100-CH ALPHA-NUMERIC DISPLAY)

External view



Specifications

Reference voltage SWB 7.2V
Voltage range SWB 6 to 9V
Current consumption 130mA or less (LAMP ON)
2mA or less (LAMP OFF)

Outline

This unit is the key operation section and front panel assembly of the TK-230. It acts as the key operation section, DTMF keypad, and writing board. The KDM-4 is for 10 channels and the KDM-4A is for 100 channels.

Functions

1. Key operation section

The functions of the keys as a set differ according to the type of main unit (BASIC/SCAN).

• BASIC unit version

1	2	3	F
4	5	6	S
7	8	9	LAMP
*	0	#	ENT

The basic key functions are as follows :

(F) No function
(S) ALPA/NUM changover key : LCD display changover (character/number) key
(LAMP) LAMP key : Lamp ON/OFF key
(ENT) ENT key : Repertory

• SCAN unit version

The keys have a double function during scanning. The key functions are as follows :

- (1) Function select key : Back key function select key
- (2) S set key : Group set key
- (3) LAMP key : Lamp ON/OFF select key
- (4) ENT key : Repertory dial data input key
- (5) (F) + (S) SCAN key : SCAN ON/OFF select key
- (6) (F) + (LAMP) DEL/ADD key : Channel DEL/ADD set key
- (7) (F) + (ENT) SIN/MUL key : Single loop/multi-group scan change key

2. DTMF keypad

1	2	3	A	← F key
4	5	6	B	← S key
7	8	9	C	← LAMP key
*	0	#	D	← ENT key
12 key			16 key	

Functions are assigned to the keys of the DTMF keypad as follows :

* key : Select repertory and ANI code, and output selected code.

key : Output DISCONNECT ANI code.

Note : The A, B, C and D keys are valid only when 16 keys are used.

The number of valid DTMF keys selected may be from 12 to 16.

Select of 12 key and 16 key performed a chip resistor R19 on Singling unit (X52-3150-20 : See page 90.).

	12 key	16 key
R19	○*	X

* : BASIC
○ : Used
X : Removed

3. Writing with the keyboard

By using the KDM-4, the main unit (TK-230), and the programming adapter (KCT-2, KCT-1) together, TK-230 frequency, signalling, and control data can be written.

The TK-230 can write data to itself or to another TK-230.

• Power save data

Data code Time	0	1	2	3	4	5	6	7
ON time	∞	90	90	90	90	90	90	90
OFF time	0	150	200	300	400	600	800	1200

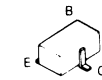
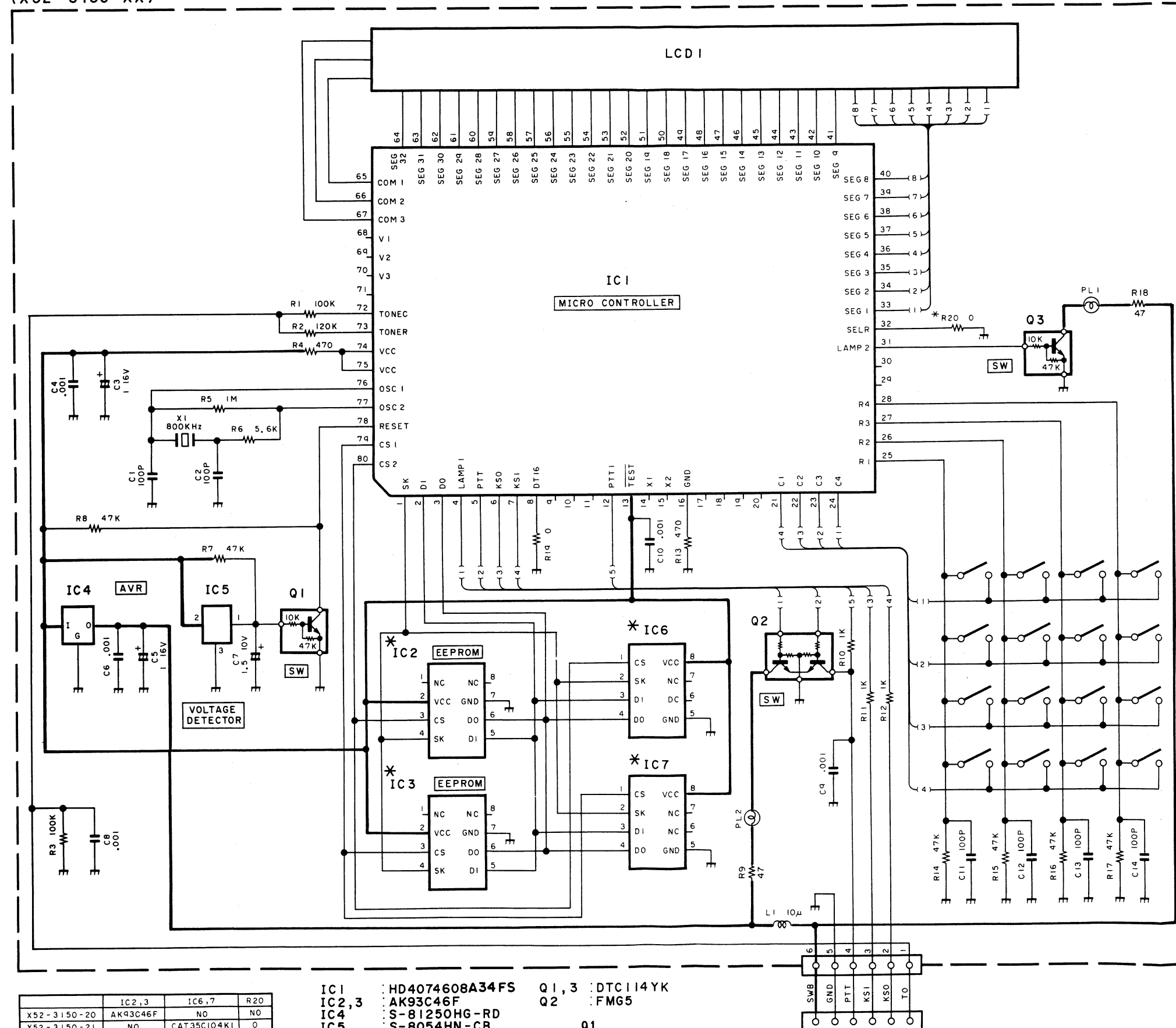
(msec)

TK-230/230(SC) TK-230/230(SC)

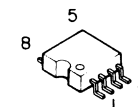
KDM-4 (FOR 20-CH ALPHA-NUMERIC DISPLAY) /
KDM-4(A) (FOR 100-CH ALPHA-NUMERIC DISPLAY)

Schematic diagram

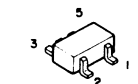
(X52-3150-XX)



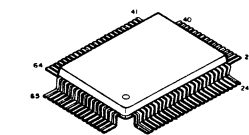
AK93C46F
CAT35C104KI



FMG5



HD4074608A34FS



TK-230/230(SC)

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-6A/6B/6C).

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

TK-230/230(SC)

KSC-4 (RAPID CHARGER)

External view



Specifications

Source voltage	120V/60Hz (K,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) (K,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-230.

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.

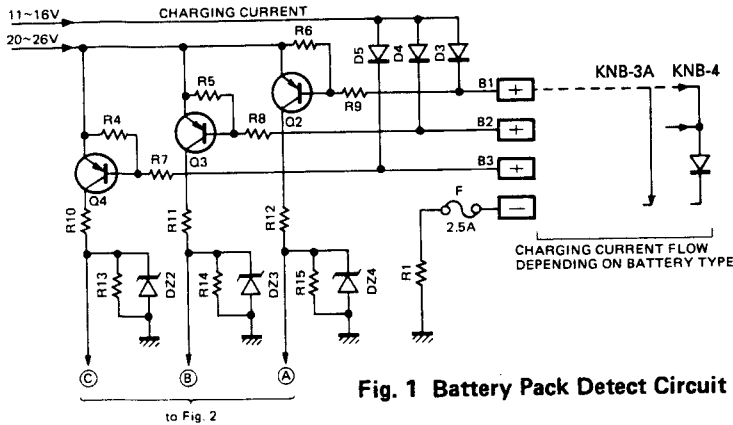
2) Battery Pack Detect Circuit

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 ① in **Figure 1**. Similarly when a KNB-4 is inserted Q3 : 2SA608E turns on and approximately 11V is provided at output ②. When a KNB-3A or KNB-4 is charged, Q4 is off and 0V is provided output ③.

TK-230/230(SC)

KSC-4 (RAPID CHARGER)



Battery	Q2	Q3	Q4
None	OFF	OFF	OFF
KNB-3A	ON	OFF	OFF
KNB-4	ON	ON	OFF

Table 1

Fig. 1 Battery Pack Detect Circuit Block Diagram

3) Reset Circuit/Charge Status Memory Circuit/Display Circuit

The reset circuit initializes the charging status memory circuit.

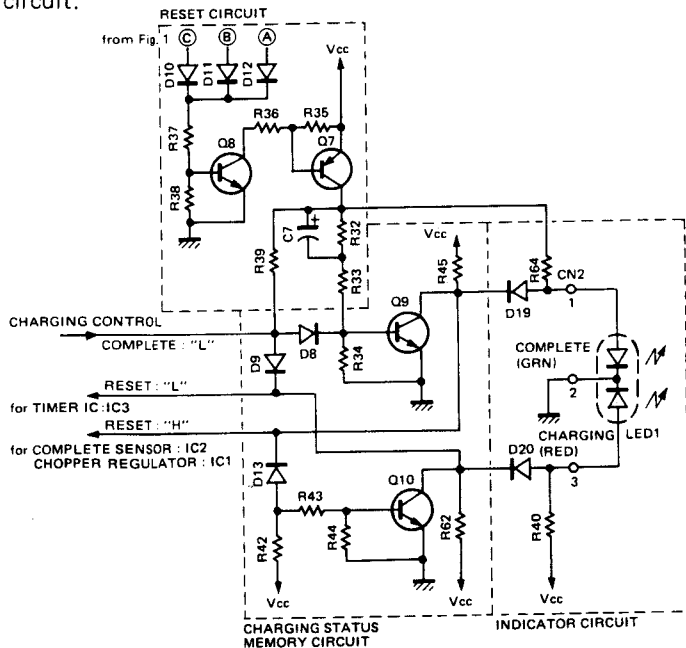


Fig. 2 Reset Circuit/Charge Status Memory Circuit/Display Circuit Block Diagram

	Q8,Q7	Q9	Q10	LED1
PACK OUT	OFF	OFF	ON	—
PACK IN				
• CHARGING	ON	ON	OFF	RED
• COMPLETE	ON	OFF	ON	GRN

Table 2

The charge status memory circuit is an R-S flip-flop configured from transistors and resistors. The two states of the flip-flop are called COMPLETE and CHARGING. Outputs from the flip-flop drive the LED in the indicator circuit and reset the timer, complete sensor, and chopper regulator. In the COMPLETE state Q9 : 2SC536E is off and Q10 : 2SC536E is on. In the CHARGING state Q9 is on and Q10 is off.

When a battery pack is not inserted, Q8 : 2SC536E and Q7 : 2SC536E turn off. As there is no base voltage to Q9, Q9 also turns off. The base of Q10 receives enough bias from Vcc to turn on, resulting in 0V at the collector.

When the battery pack is inserted Q8 and Q7 turn on. As soon as Q7 turns on, charging current flows through R33, R34, and Q9 to C7 and Q9 turns on. The base voltage of Q10, which is connected to Q9 through diode D13, then drops and Q10 turns off. Since Q10 is off, current flows through R40 to the CHARGING indicator in LED1, which glows red to indicate that the battery is charging. When charging of C7 is completed, on-current continues to flow to the base of Q9 through R39 and D8.

When charging is completed, the complete sensor (IC2 : KCH-1003) outputs a Low ("L") signal that ends the flow of current to the base of Q9, turning Q9 off. As a result current flows through R64 to the COMPLETE indicator in LED1, which glows green to indicate that charging is complete.

TK-230/230(SC)

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

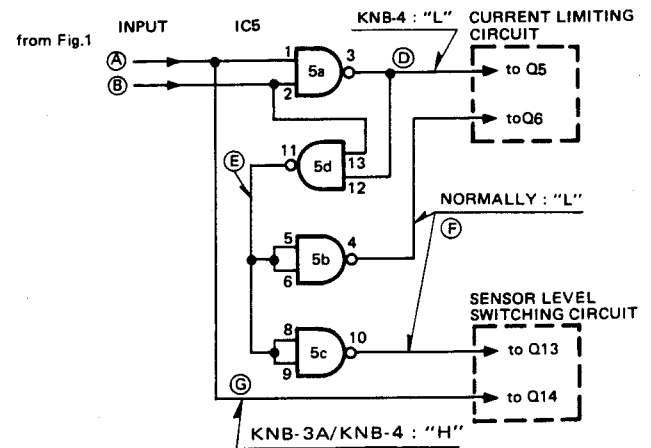


Fig. 3 Battery Recognition Circuit Block Diagram

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 $V_{REF} < V_{CR}$, stopping the operation of the chopper regulator (IC1 : STK772B) and reducing the charging current. The charging current is limited by the formula:

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

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

Table 4

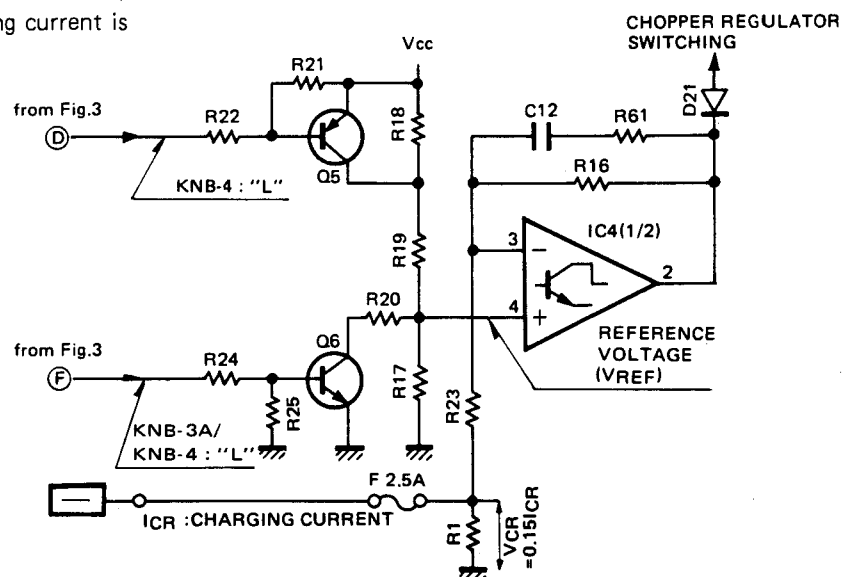


Fig. 4 Charging Current Limiting Circuit Block Diagram

TK-230/230(SC)

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.

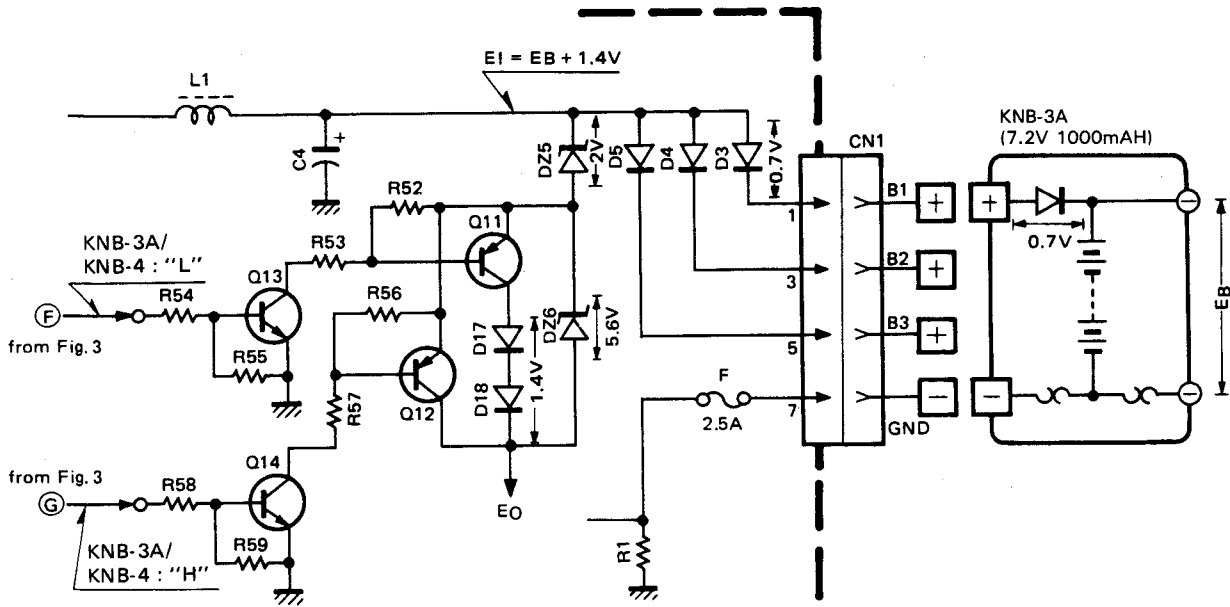


Fig. 5 Sensor Level Switching Circuit Block Diagram

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.

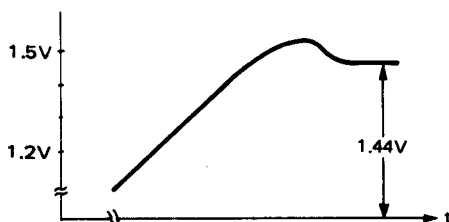


Fig. 6 The pin voltages while the Ni-CD Battery is charging

TK-230/230(SC)

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.

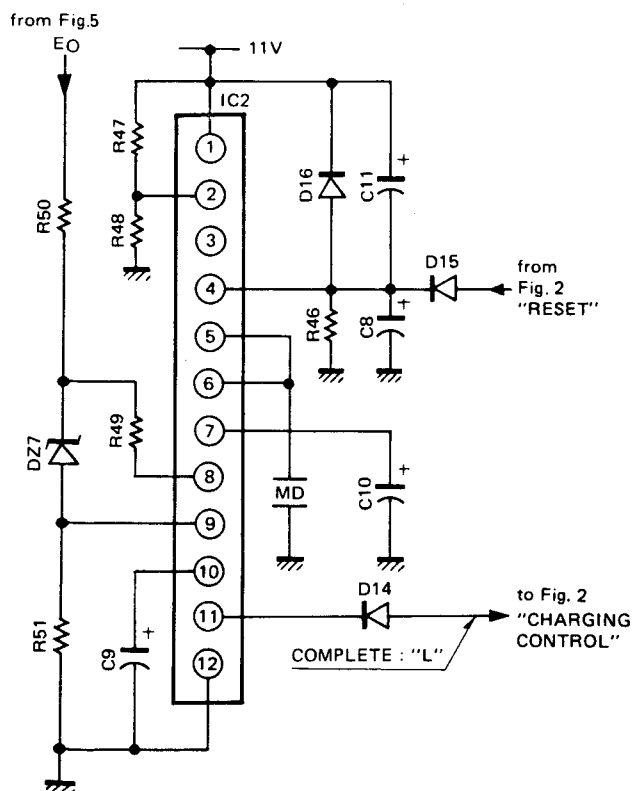


Fig. 7 Charging Status Detect Circuit Block Diagram

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).

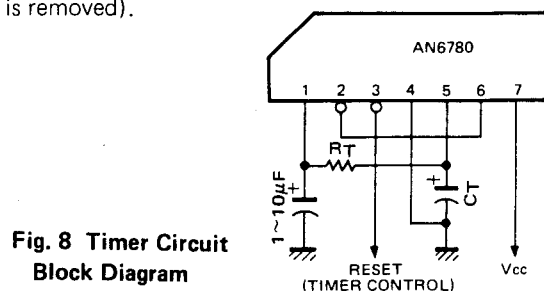


Fig. 8 Timer Circuit Block Diagram

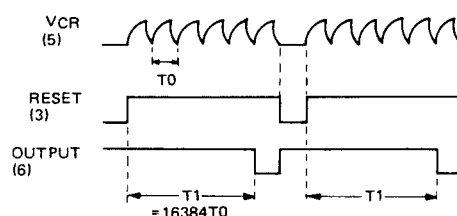


Fig. 9
TIMER TIME $T_1(s) \approx 11RT(K\Omega) \cdot C_T(\mu F)$
TIMER TIME $T_1(s) \approx 11 \times 56(K\Omega) \cdot 10(\mu F) = 6160(s)$

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.

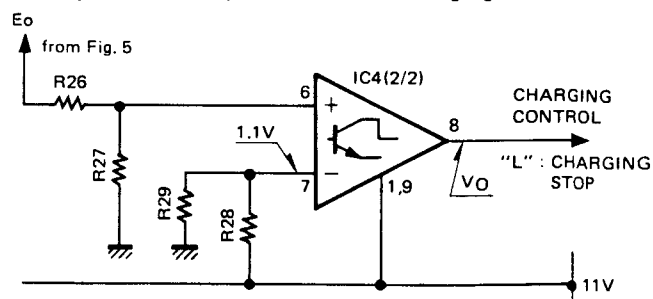


Fig. 10 Voltage Comparator Circuit Block Diagram

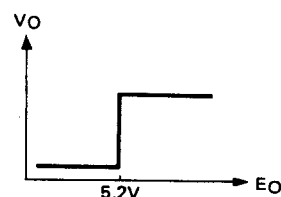


Fig. 11

TK-230/230(SC)

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)	K,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	
F1		*	F06-2523-05	FUSE (2.5A)	K	

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.

TK-230/230(SC)

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.

Telle 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 (470μH)		
R1		*	R92-0683-08	FL-PROOF 0.15Ω 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.

TK-230/230(SC)

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.

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

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

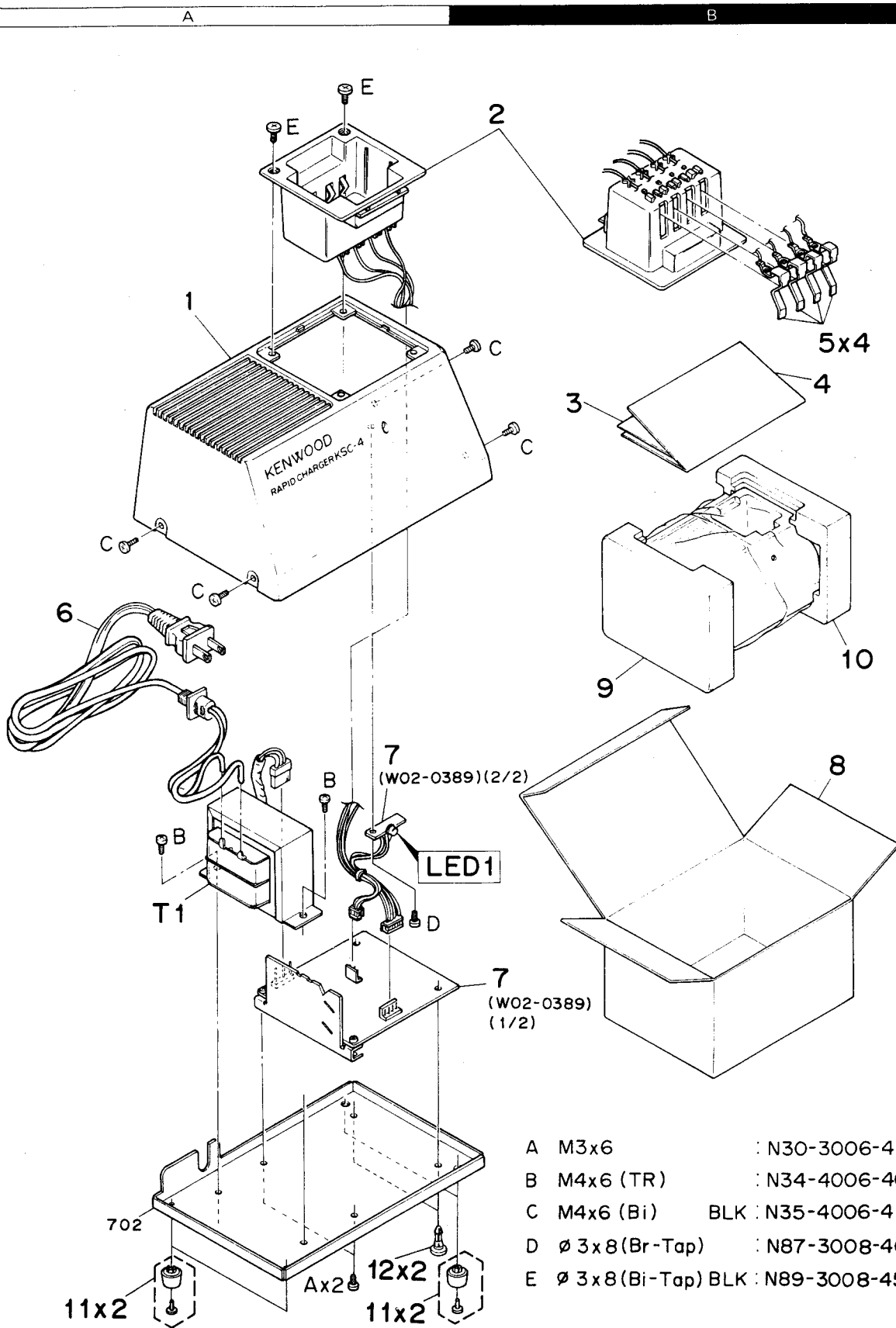
UE: AAFES(Europe) X: Australia

 indicates safety critical components.

TK-230/230(SC)

KSC-4 (RAPID CHARGER)

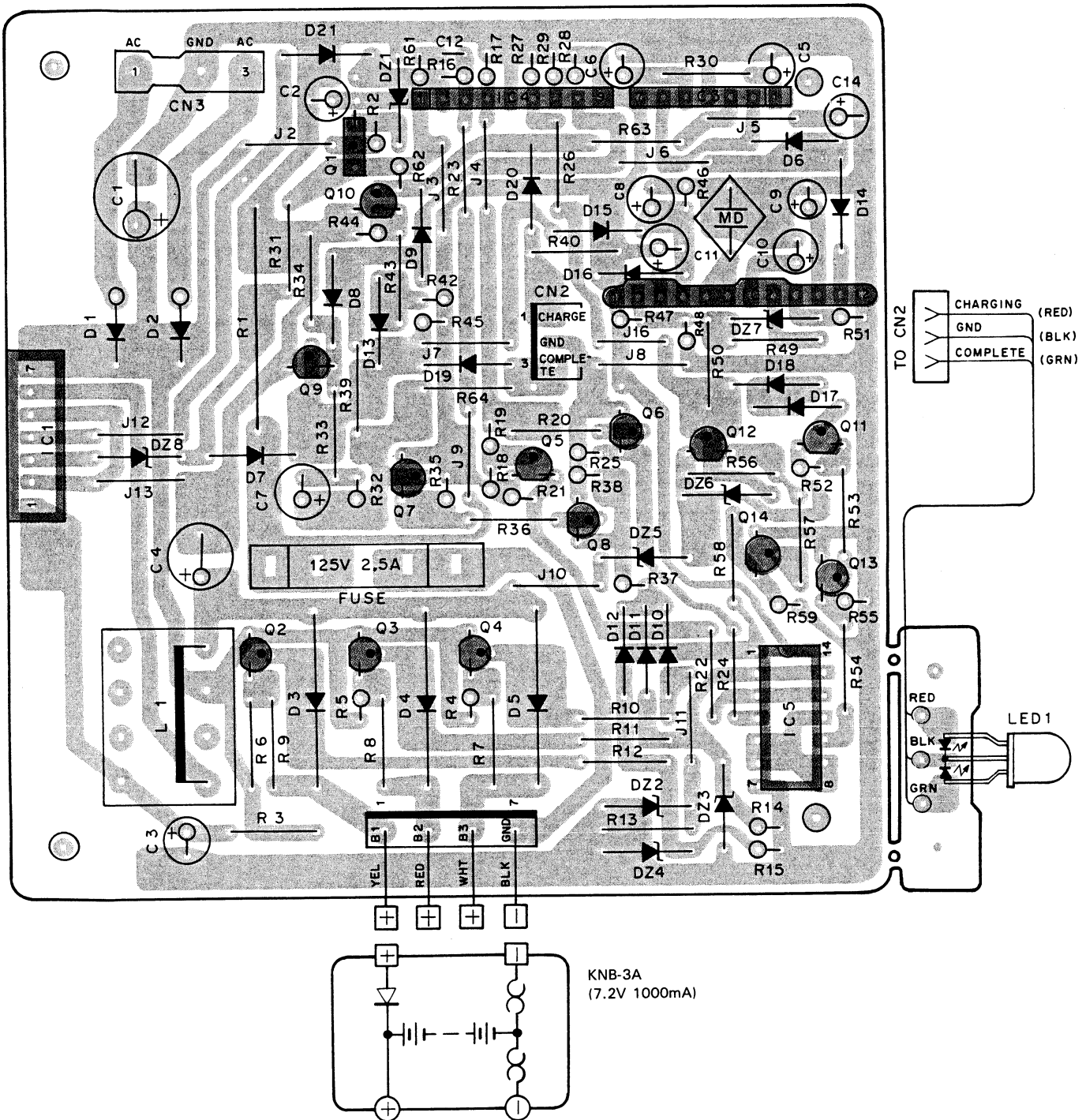
Exploded view



TK-230/230(SC)

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

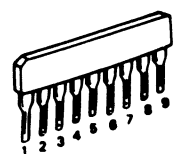
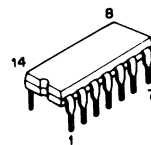
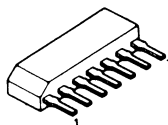
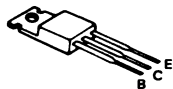
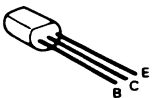
2SA608E,F

2SD600F,KF
2SC536E,F

AN6780

LC4011B

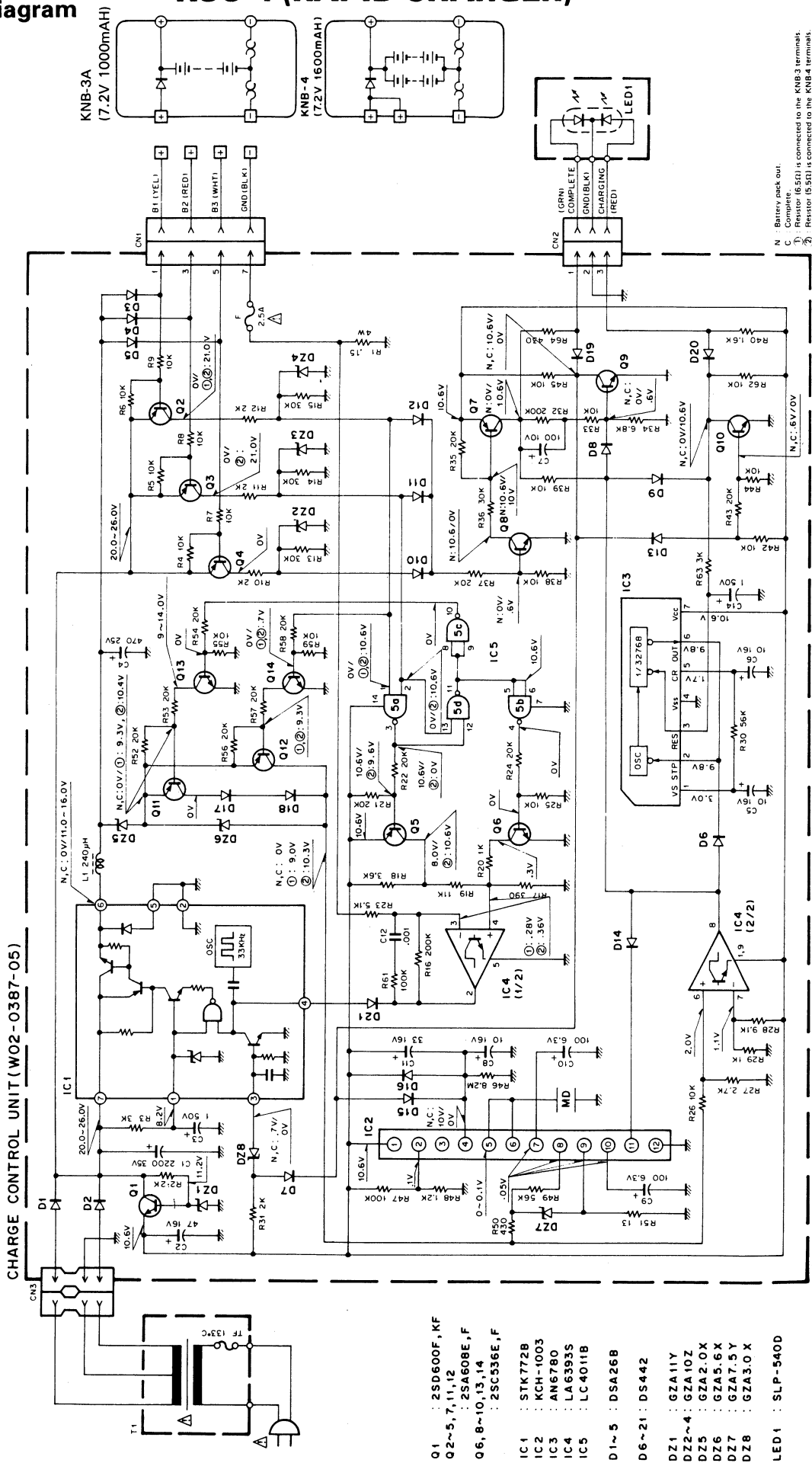
LA6393S



TK-230/230(SC)

KSC-4 (RAPID CHARGER)

Schematic diagram



TK-230/230(SC)

KSC-5 (REGULAR RATE CHARGER)

External view



Specifications

Source voltage	120V/60Hz (K,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) (K,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:

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

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.

TK-230/230(SC)

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.	Address	New Parts	Parts No.	Description	Desti-nation	Re-marks
参照番号	位 置	新	部 品 番 号	部 品 名 / 規 格	仕 向	備 考
KSC-5						
1	1A	*	A02-0774-08	CASE	K	
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	*	H01-8064-08	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)	K,M2 M	
T1	2A	*	L01-8102-08	POWER TRANSFORMER (AC220V)		
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

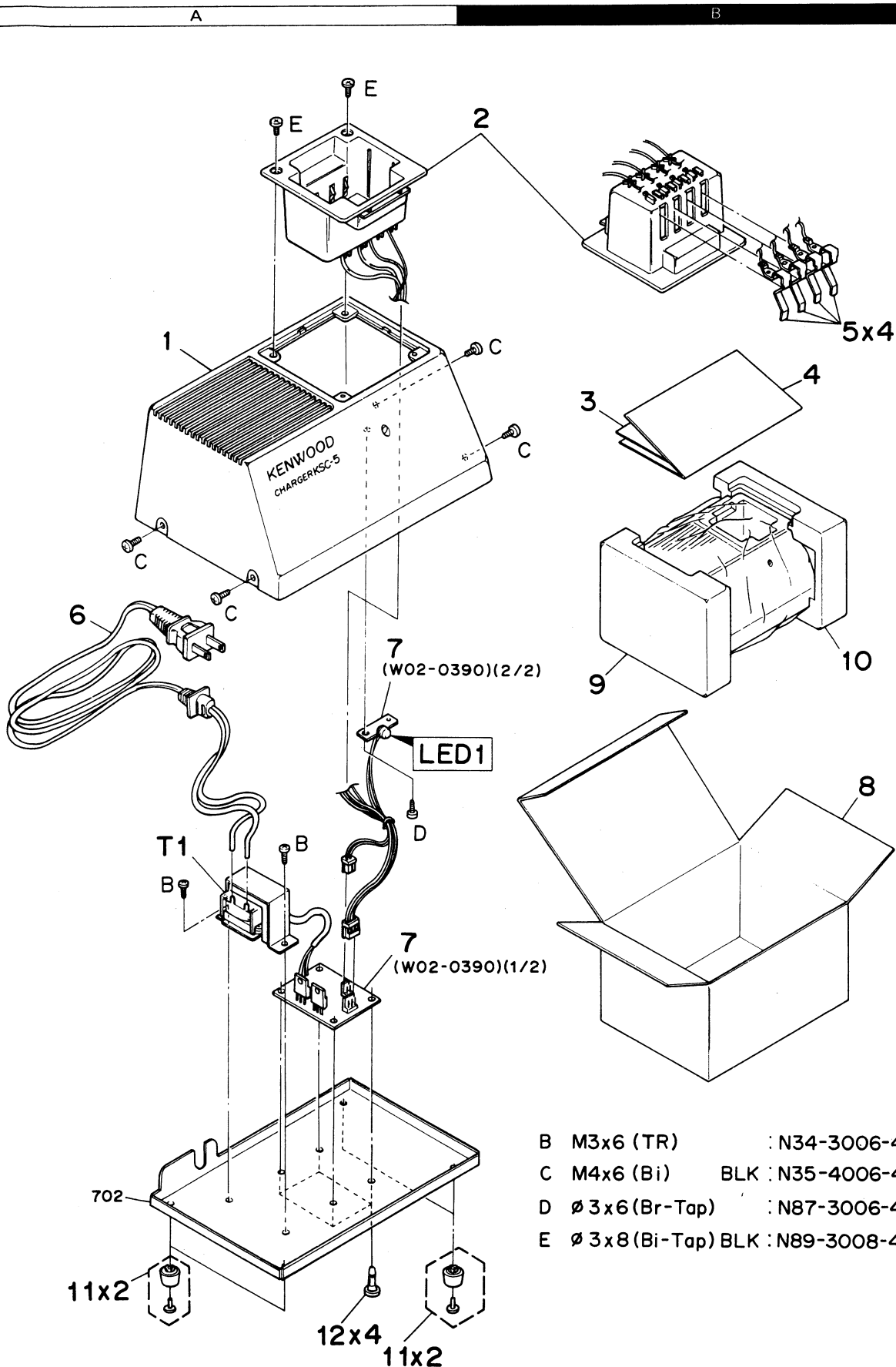
UE: AAFES(Europe) X: Australia

△ indicates safety critical components.

TK-230/230(SC)

KSC-5 (REGULAR RATE CHARGER)

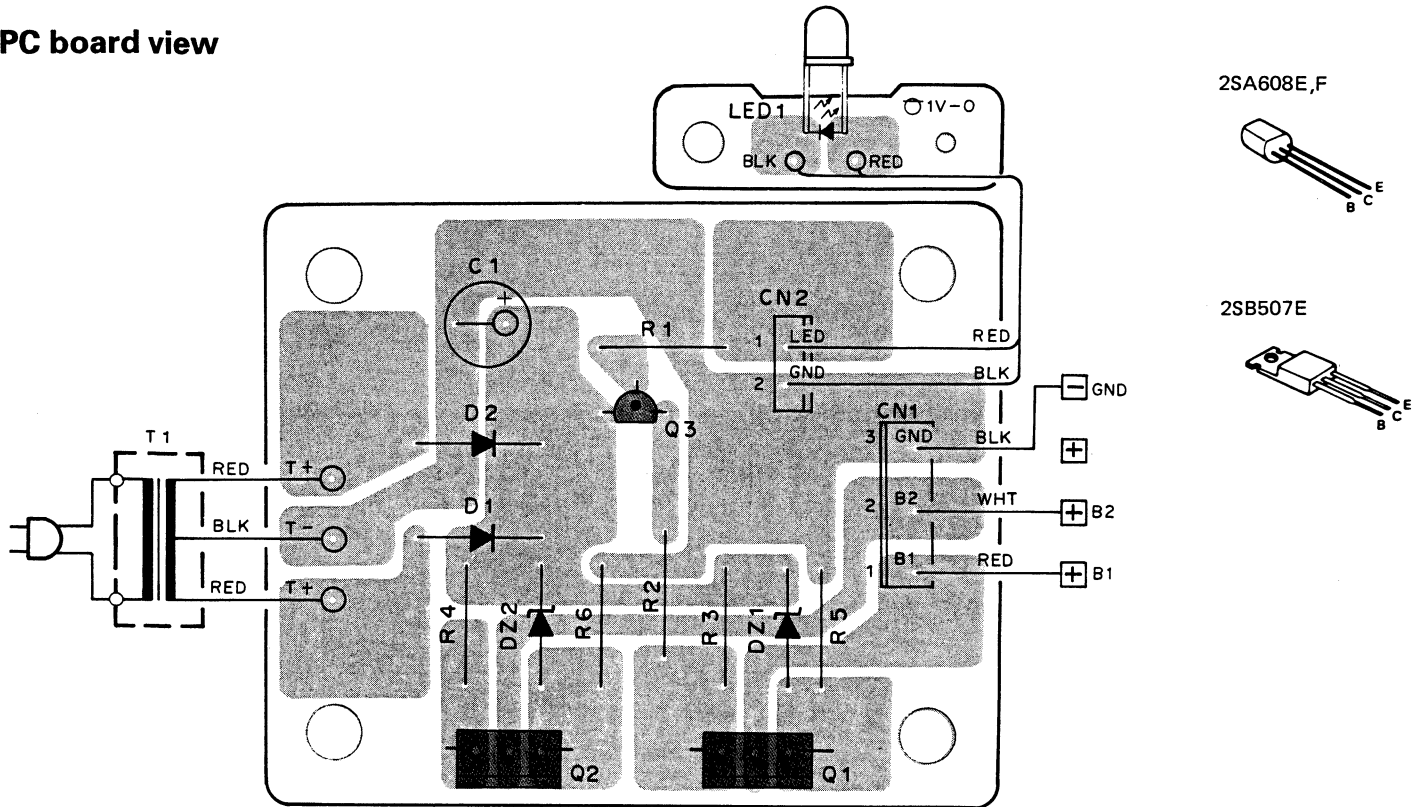
Exploded view



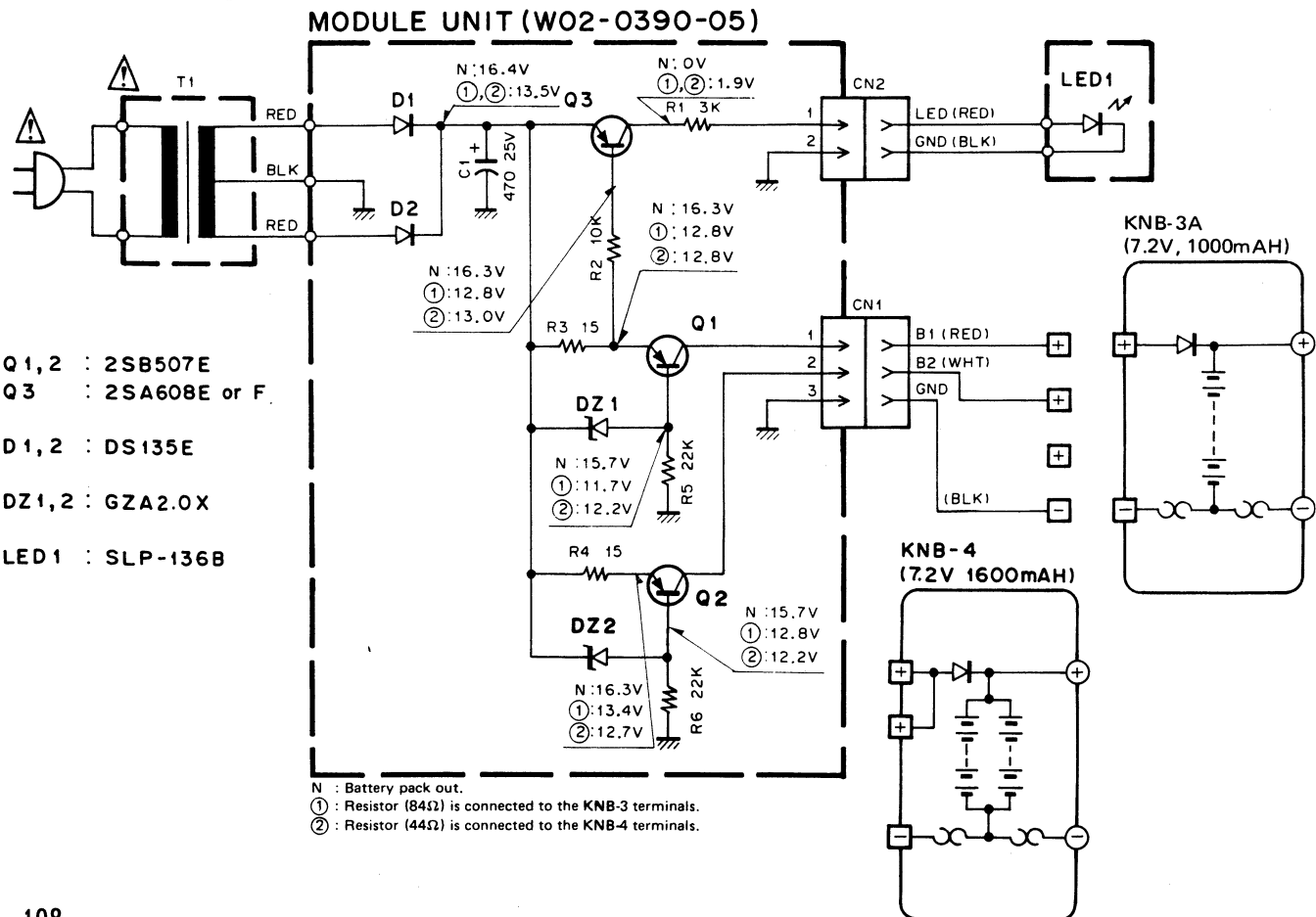
TK-230/230(SC)

KSC-5 (REGULAR RATE CHARGER)

PC board view



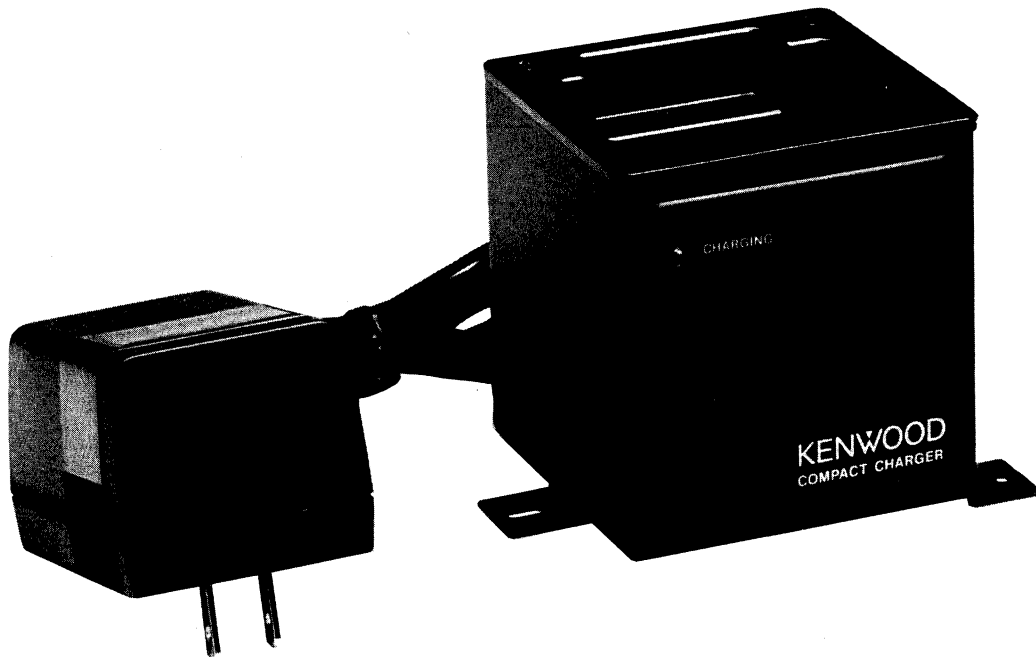
Schematic diagram



TK-230/230(SC)

KSC-6 (COMPACT CHARGER)

External view



Specifications

Source voltage	120V/60Hz (K type) 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 R8 (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:

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

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

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.

TK-230/230(SC)

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	K	
2	1A,1B		A02-0778-05	BATTERY POCKET		
3	1C		B46-0418-00	WARRANTY CARD		
4	1C	*	B50-8136-08	INSTRUCTION MANUAL		
J1	2A	*	E03-0168-05	DC JACK	K M M2	
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	*	W09-0372-08	AC ADAPTOR (AC120V,60HZ)		
10	1C	*	W09-0373-08	AC ADAPTOR (AC220V,50/60HZ)		
10	1C	*	W09-0374-08	AC ADAPTOR (AC120V,50/60HZ)		
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

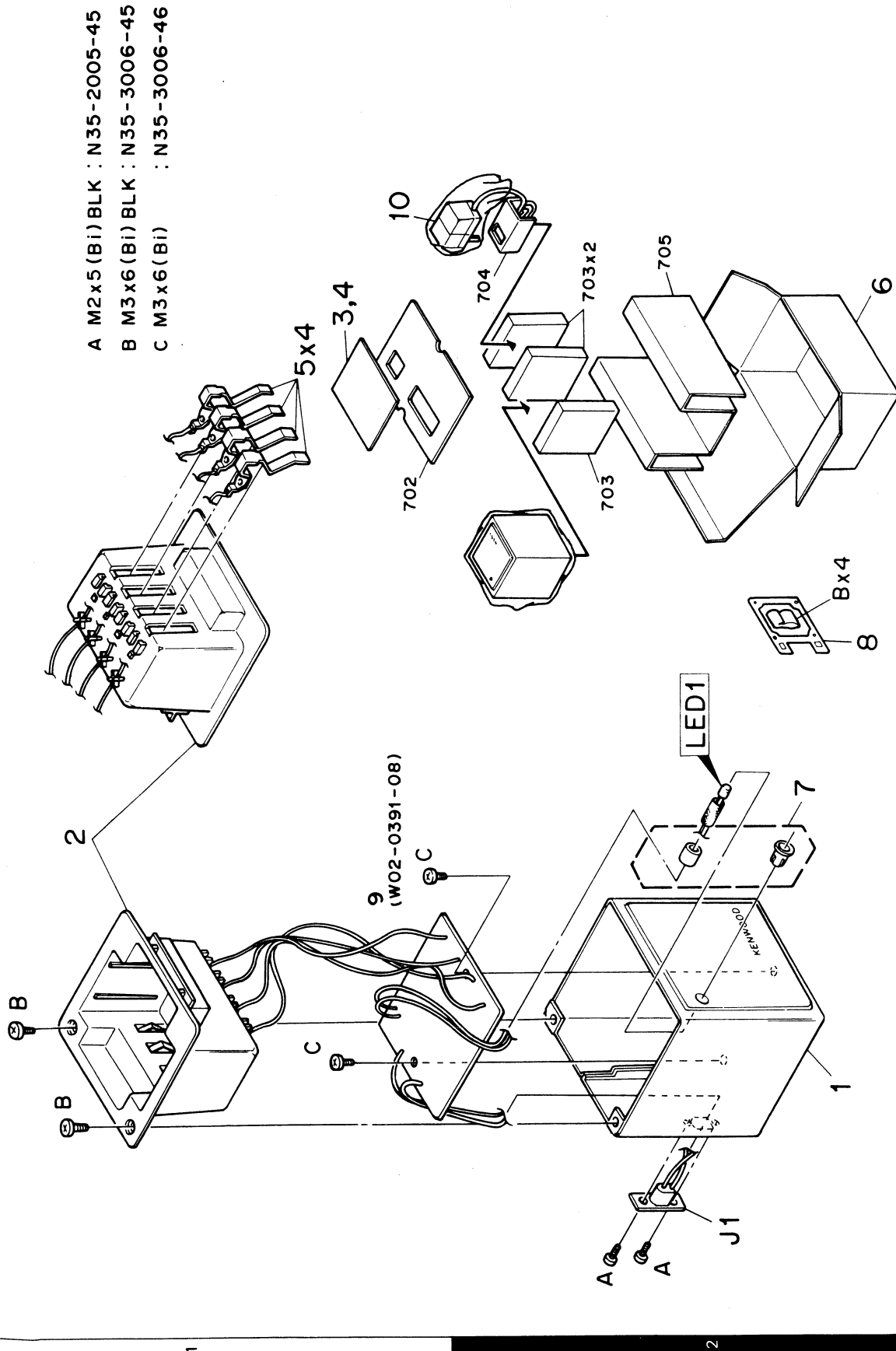
UE: AAFES(Europe) X: Australia

△ indicates safety critical components.

TK-230/230(SC)

KSC-6 (COMPACT CHARGER)

Exploded view



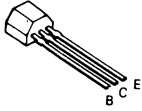
Parts with the exploded numbers larger than 700 are not supplied.

TK-230/230(SC)

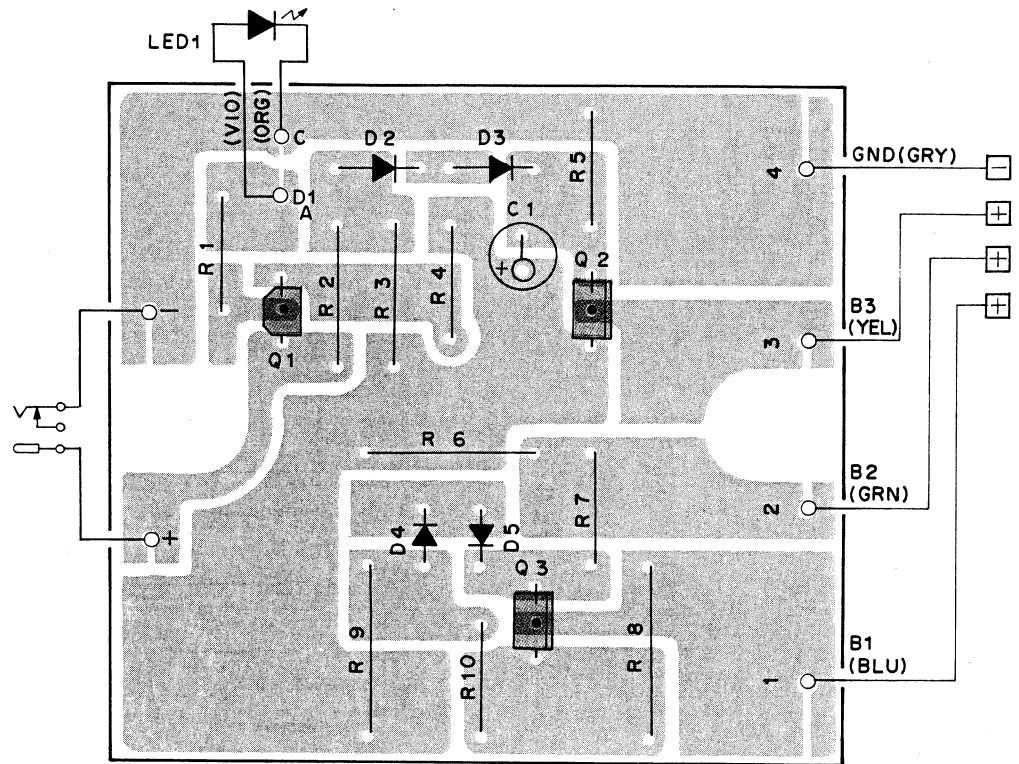
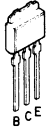
KSC-6 (COMPACT CHARGER)

PC board view

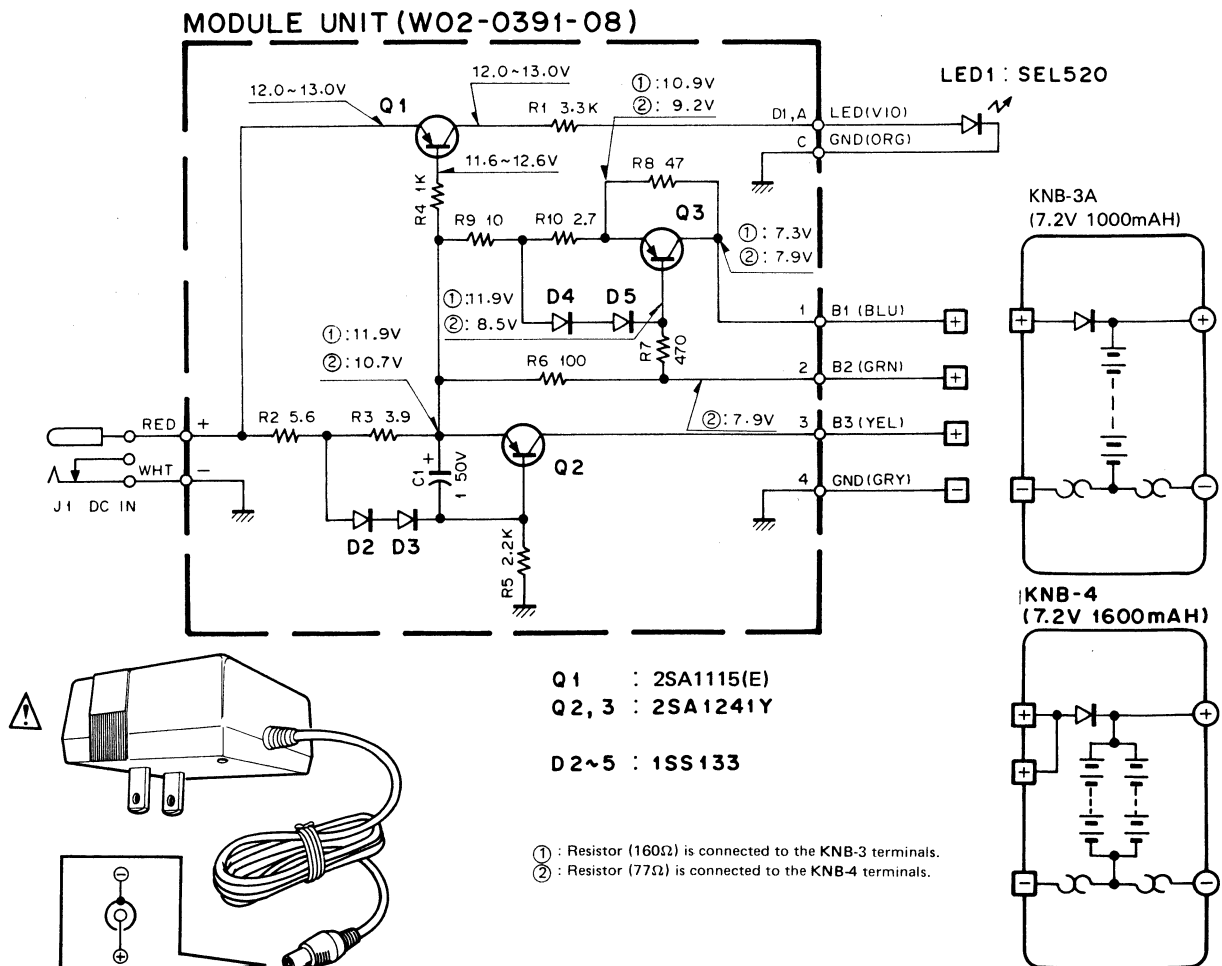
2SA1115(E)



2SA1241Y



Schematic diagram



TK-230/230(SC)

TK-230/230(SC)

SPECIFICATIONS

GENERAL

Frequency Range	134 ~ 150MHz (M2 Type) 150 ~ 174MHz (K,M, Type)
Number of Channels	20 or 100 semi-duplex channels
Channel Spacing	30kHz (PLL channel step 5kHz)
Battery Voltage	7.5V DC
Battery Life	More than 8 hours at 5watts (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	0.25 μ V
20dB Quieting	0.30 μ V
Squelch Sensitivity	0.20 μ V threshold
Modulation Acceptance	$\pm$ 7kHz
Selectivity	-75dB
Intermodulation	-70dB
Spurious and Image Rejection	-75dB
Audio Power Output	600mW at less than 5% distortion
Frequency Stability	$\pm$ 0.0003% from -30°C to +60°C
Channel Frequency Spread	24MHz

TRANSMITTER

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

RF Power Output	HI : 5 watts, adjustable to 2 watts LO : 2 watts, adjustable to 0.3 watts
Spurious and Harmonics	-65dB
Modulation	F3E, $\pm$ 5kHz for 100% at 1000Hz
FM Noise	-50dB
Audio Distortion	1.0% at 1000Hz
Frequency Stability	$\pm$ 0.0003% from -30°C to +60°C
Channel Frequency Spread	24MHz

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