



FURUNO®

Complying with GMDSS carriage requirements

MARINE VHF RADIOTELEPHONE with built-in DSC MODEL FM-8500

General features

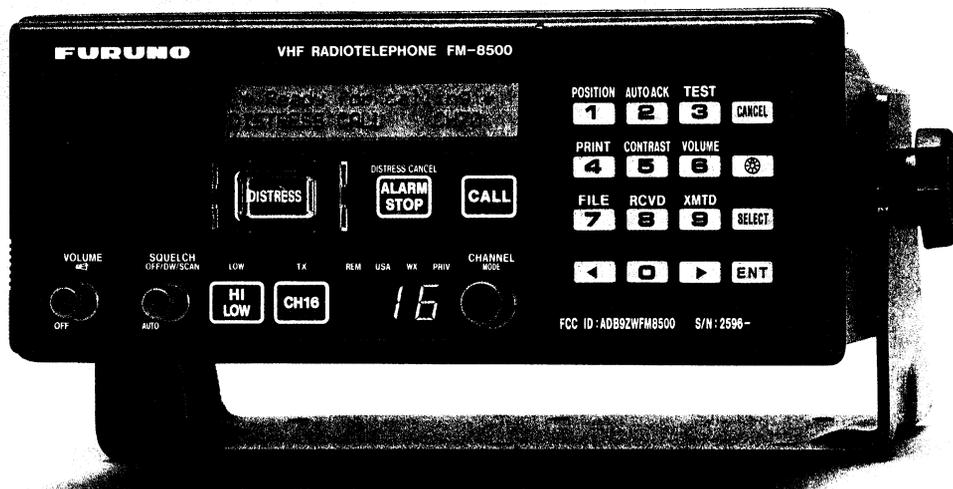
- All-in-one unit design including radiotelephone, DSC facility and watch keeping receiver
- Fully meets ITU, IEC, ETSI, IMO for GMDSS and other related standards
- Compact cabinet for ease of installation

VHF features

- Precision PLL frequency synthesizer for high frequency stability as required for DSC operation
- Output power 25 W, reducible to 1 W
- Dual watch and multiple watch

DSC features

- Continuous DSC watch on CH70
- Prevention of accidental distress alert
- File editing for emergency readiness
- Automatic entry of own ship position with manual override



The FURUNO FM-8500 is a cost-effective all-in-one marine VHF radio system consisting of a 25 W VHF radiotelephone, a DSC modem and a CH 70 Watch Receiver. It complies with GMDSS carriage requirements for safety and general communications.

The FM-8500 offers simplex/semi-duplex voice communications on all ITU channels in the 156-174 MHz VHF band. Other standard features are Dual Watch and Multiple Watch functions which allow a watch on CH 16 and another selected frequency.

Full Class A DSC functions are provided for distress

alert transmission and reception, as well as the general call formats: Individual Telephone, All Ships, Group and Area Call. Distress alert can be readily transmitted but an arrangement is provided to prevent an accidental activation. The FM-8500 maintains a continual watch on CH 70 even while you are using another VHF channel. Upon receiving an incoming DSC message the FM-8500 gives aural and visual alarms.

The compact cabinet allows a flexible and space-saving installation on a navigation console or at the conning position.



The future today with FURUNO's electronics technology.

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Catalogue No. V-022b

TRADE MARK REGISTERED
MARCA REGISTRADA

SPECIFICATIONS OF FM-8500

VHF Section

GENERAL CHARACTERISTICS

1. **Class of Emission** G3E (voice), G2B (DSC)
2. **Communication System** Simplex/Semi-duplex
3. **Channel Program**
 General version: 55 channels (RR Appendix 18)
 U.S.A. version: General, US channels,
 Weather channels
 Nordic version: General, Fish/Pleasure private
4. **Power Supply** 24 VDC, +30%, -10%
5. **Display** 24 characters x 2 lines,
 character 5 x 7 dots, backlit
 LCD (dimnable)

TRANSMITTER

1. **Frequency Range** 155.00 - 161.475 MHz
2. **RF Output Power** 25 W, reducible to 1 W
 US version: CH67, CH13 at 1 W, manual override for FULL
3. **Frequency Stability** 1.5 kHz (-20°C to +55°C)
4. **Time-out Timer**
 Deactivates the transmitter after an uninterrupted transmission of more than 5 minutes

RECEIVER

1. **Frequency Range** 155.00 - 166.075 MHz
2. **Receiving System**
 Double-conversion superheterodyne
 IF: 21.4 MHz and 455 kHz
3. **AF Output Power** 3 W (internal 8 Ω loud speaker)
 2 mW (200 Ω handset)
4. **Audio Response** De-emphasis of 6 dB/oct +1/-3 dB
5. **Sensitivity** -5 dBμV at SINAD 20 dB
6. **Adjacent Channel Selectivity** 70 dB (+15°C to +35°C)

DSC Section

1. **Distress Call and Message**
 Distress call attempt is transmitted as five consecutive calls. It is repeated after a random delay of between 3.5 and 4.5 min from the beginning of initial call.
2. **Message Storage**
 Receive: 50 distress messages plus 50 non-distress messages
 Transmit: 50 non-distress messages plus 99 files containing station ID, telephone No.
3. **Interface** Nav data: NMEA 0183 V2.0
 Printer: FURUNO MIF w/Interface box
4. **Alarm** Aural and visual on receipt of a DSC call
5. **Receiver Characteristics**
 DSC frequency: CH70
 Calling sensitivity: Symbol error rate 10⁻², input -3 dBμV
 Watch keeping: Continuous watch on CH70

EQUIPMENT LIST

Standard

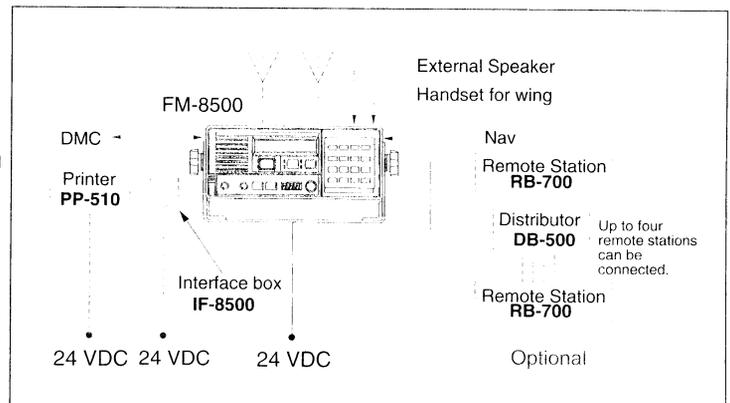
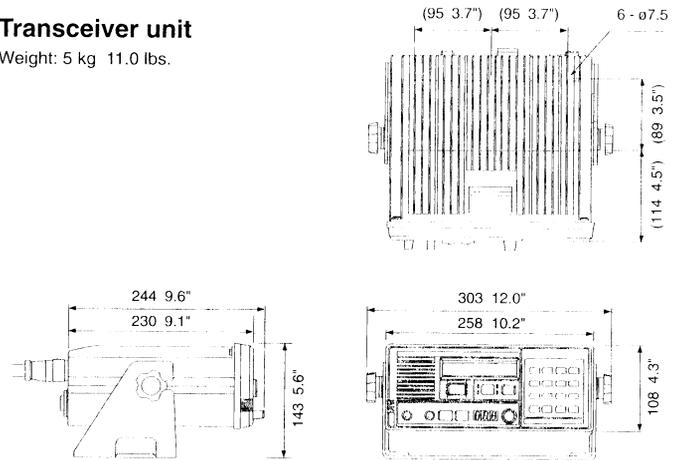
- | | |
|---------------------------|--------|
| 1. Transceiver unit | 1 unit |
| 2. Handset | 1 set |
| 3. Installation materials | 1 set |

Optional

1. Whip antennas for VHF and DSC
2. Coaxial antenna cable
3. Remote Station RB-700
4. Distributor DB-500 (Required to connect 2 or more sets of the RB-700. Extension kit is required in DB-500 to connect 3 sets of RB-700 or more)
5. Extension handset
6. Mic receptacle box
7. Printer PP-510
8. Interface box IF-8500 for PP-510
9. AC-DC changeover unit

Transceiver unit

Weight: 5 kg 11.0 lbs.

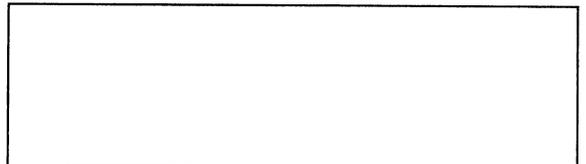


SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

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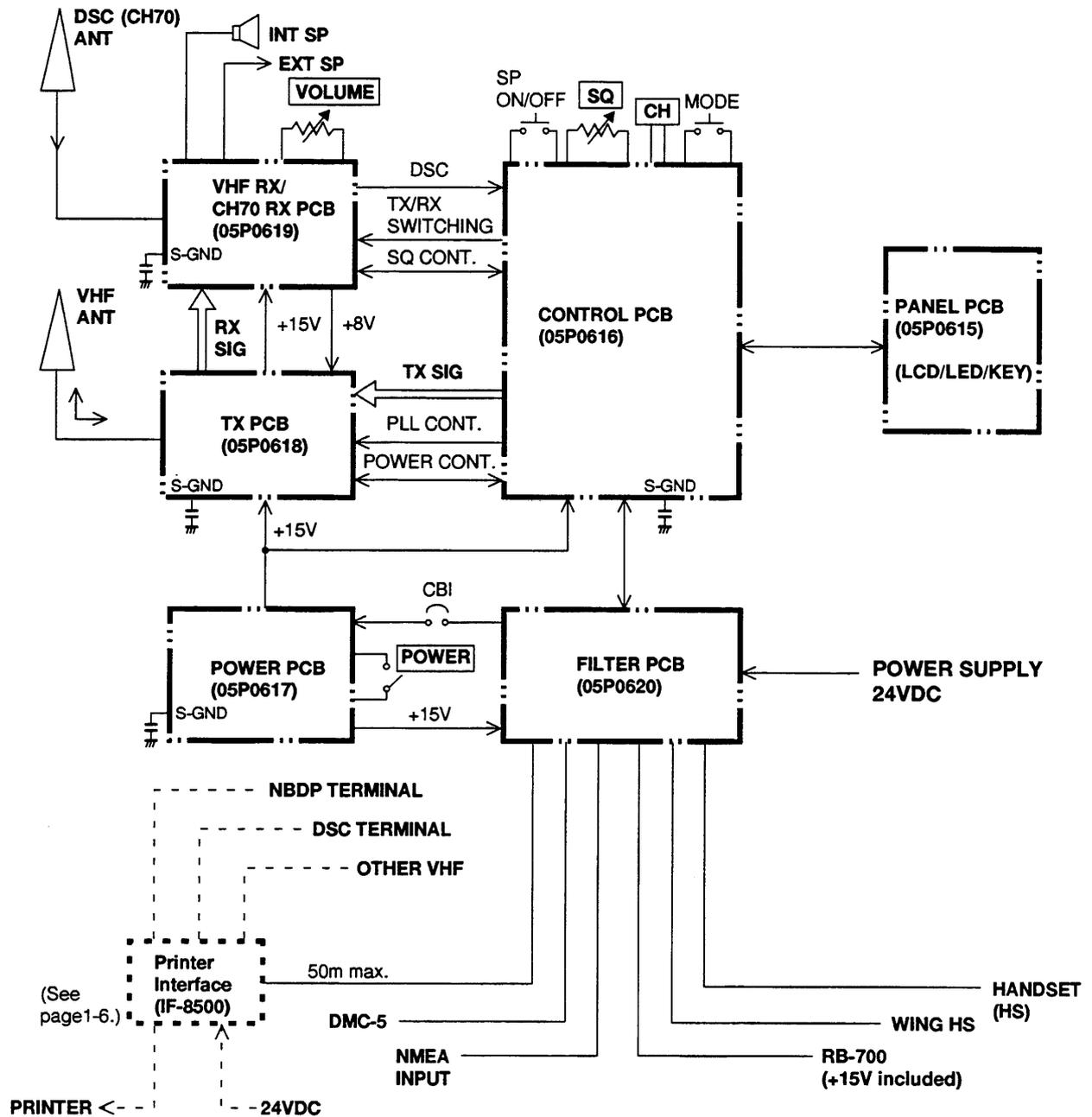
9609XN Printed in Japan



Chapter 1 Block Description

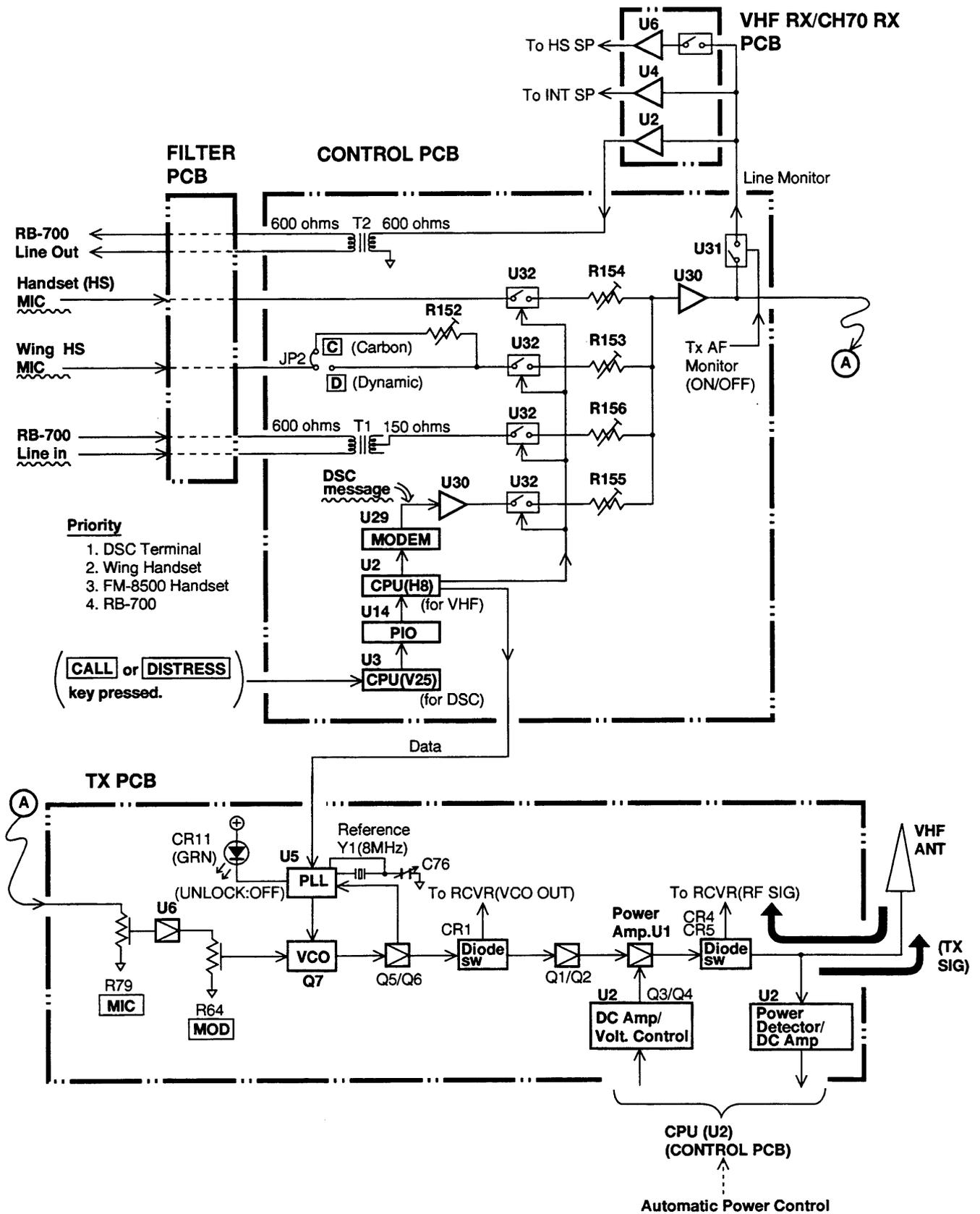
1.1 General

The FM-8500 operates from 24VDC power supply and consists of six boards as show blow. It can be combined with the RB-700, DMC-5, wing handset, navigation equipment (NMEA input) and printer (optional printer interface IF-8500 necessary).



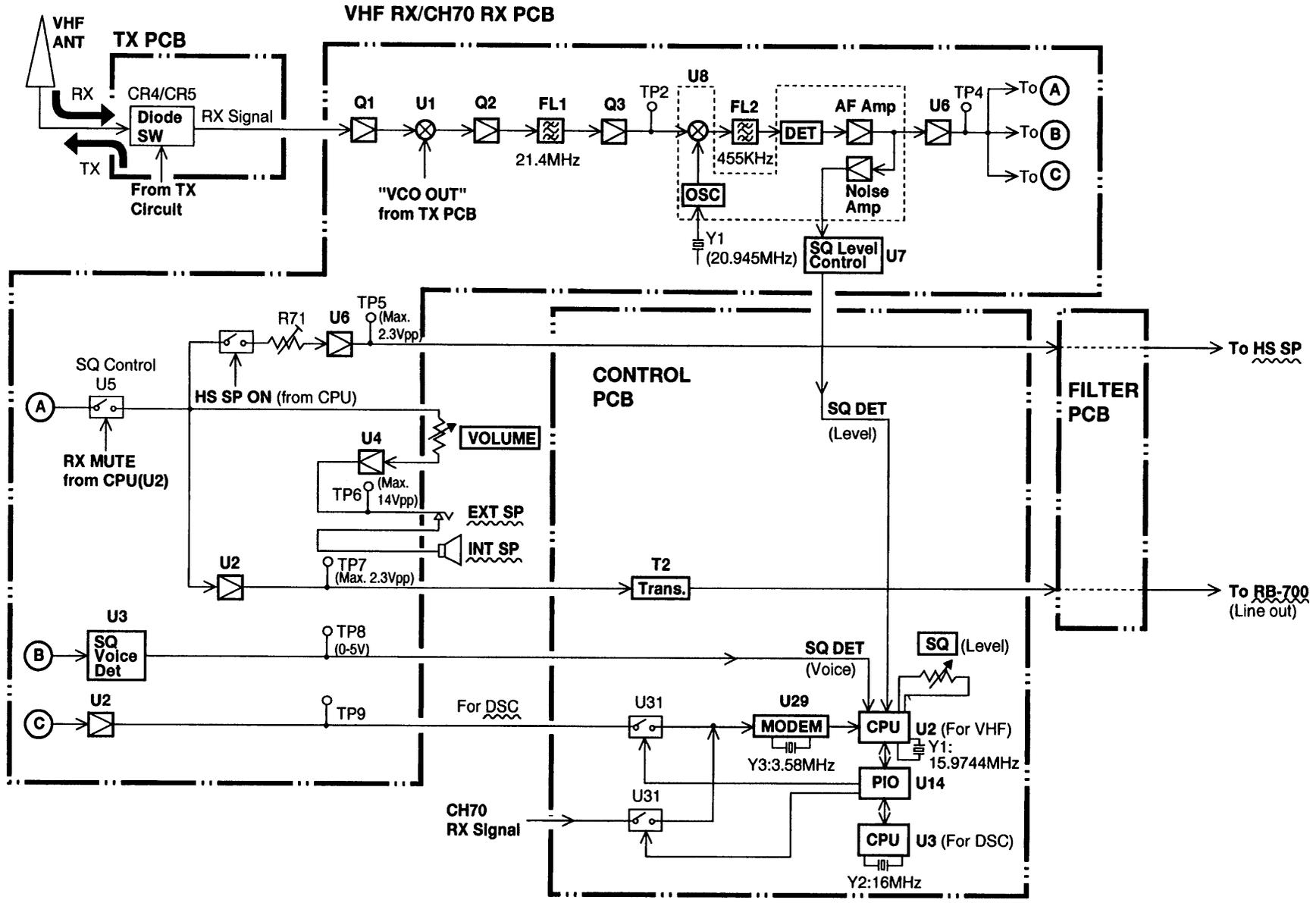
GENERAL BLOCK DIAGRAM

1.2 Transmission Signal Flow



TRANSMISSION SIGNAL FLOW

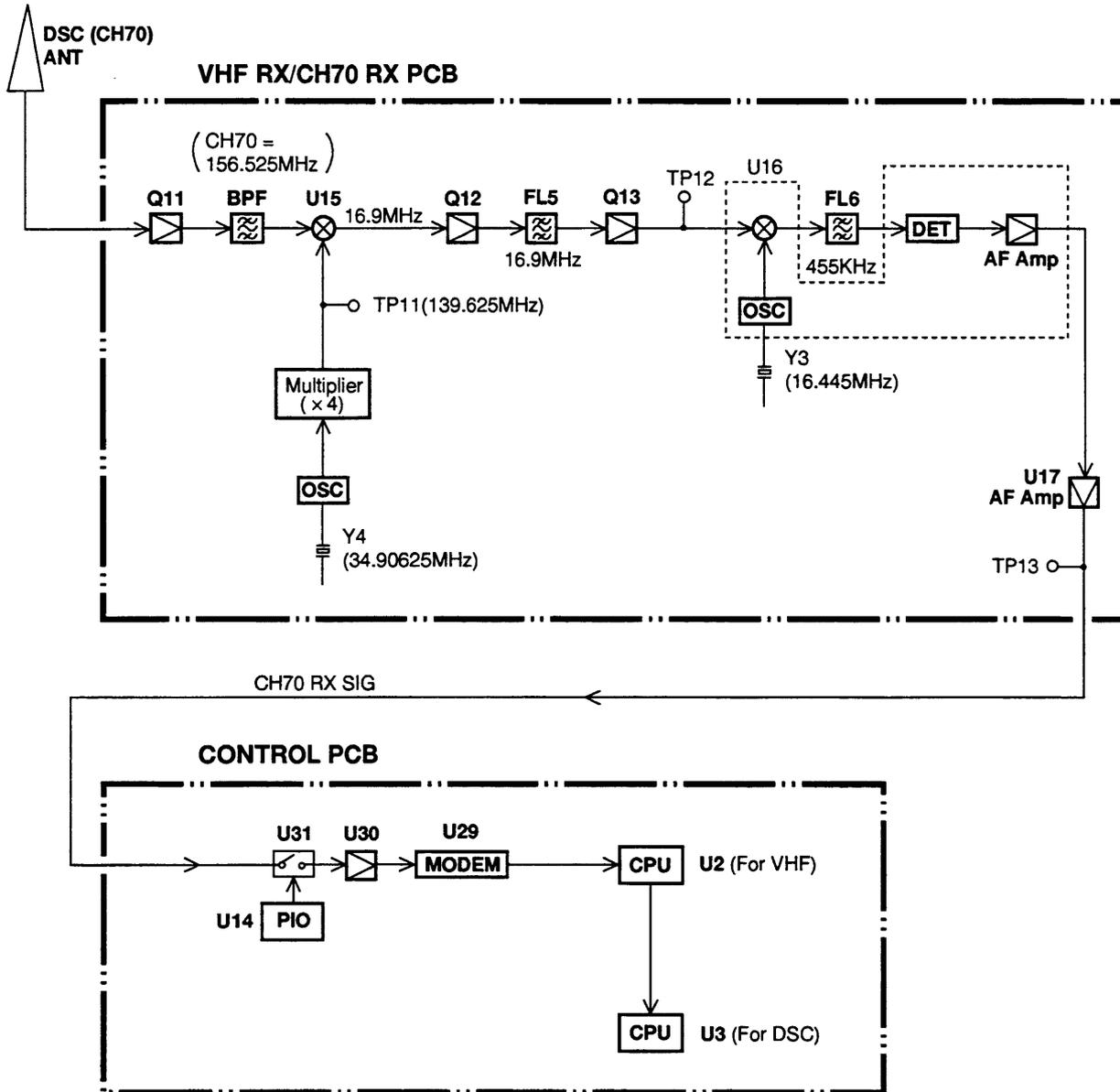
1.3 VHF Reception Signal Flow



VHF RECEPTION SIGNAL FLOW

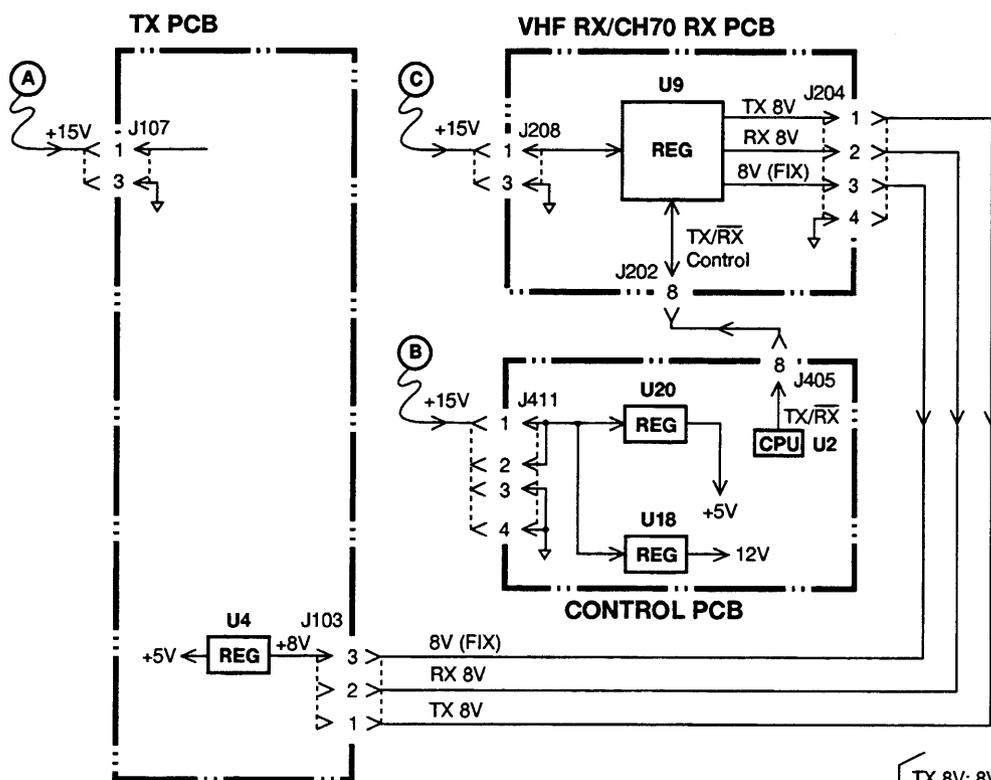
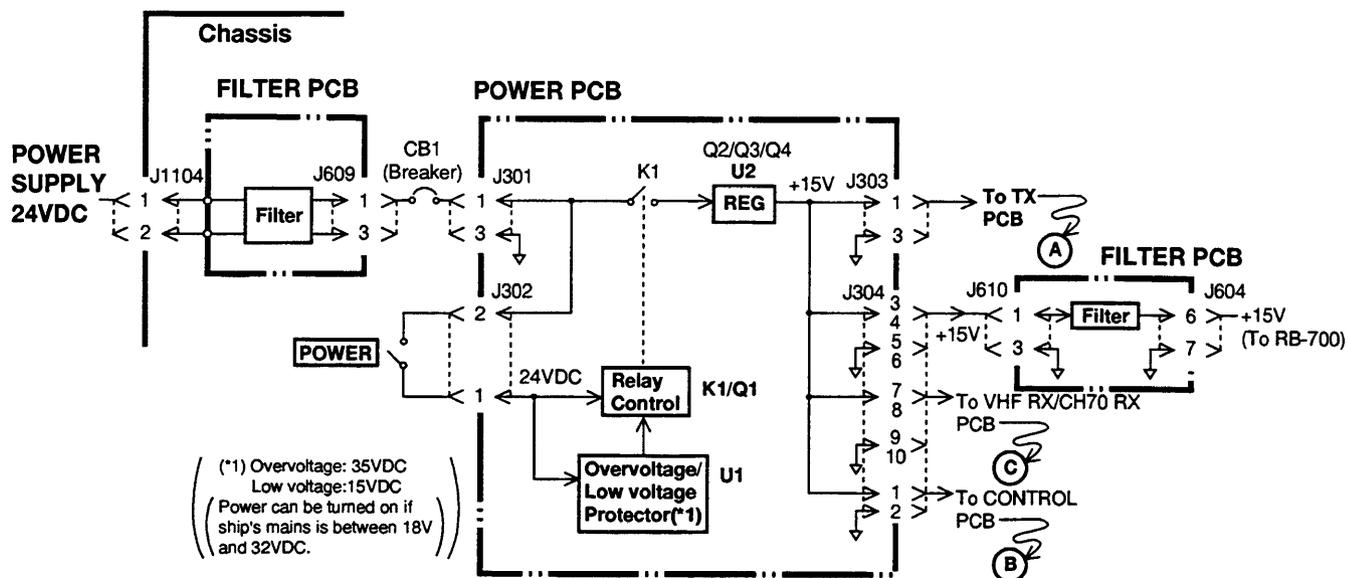
1-3

1.4 CH70 RX Signal Flow



CH70 RX SIGNAL FLOW

1.5 Power Supply Circuit



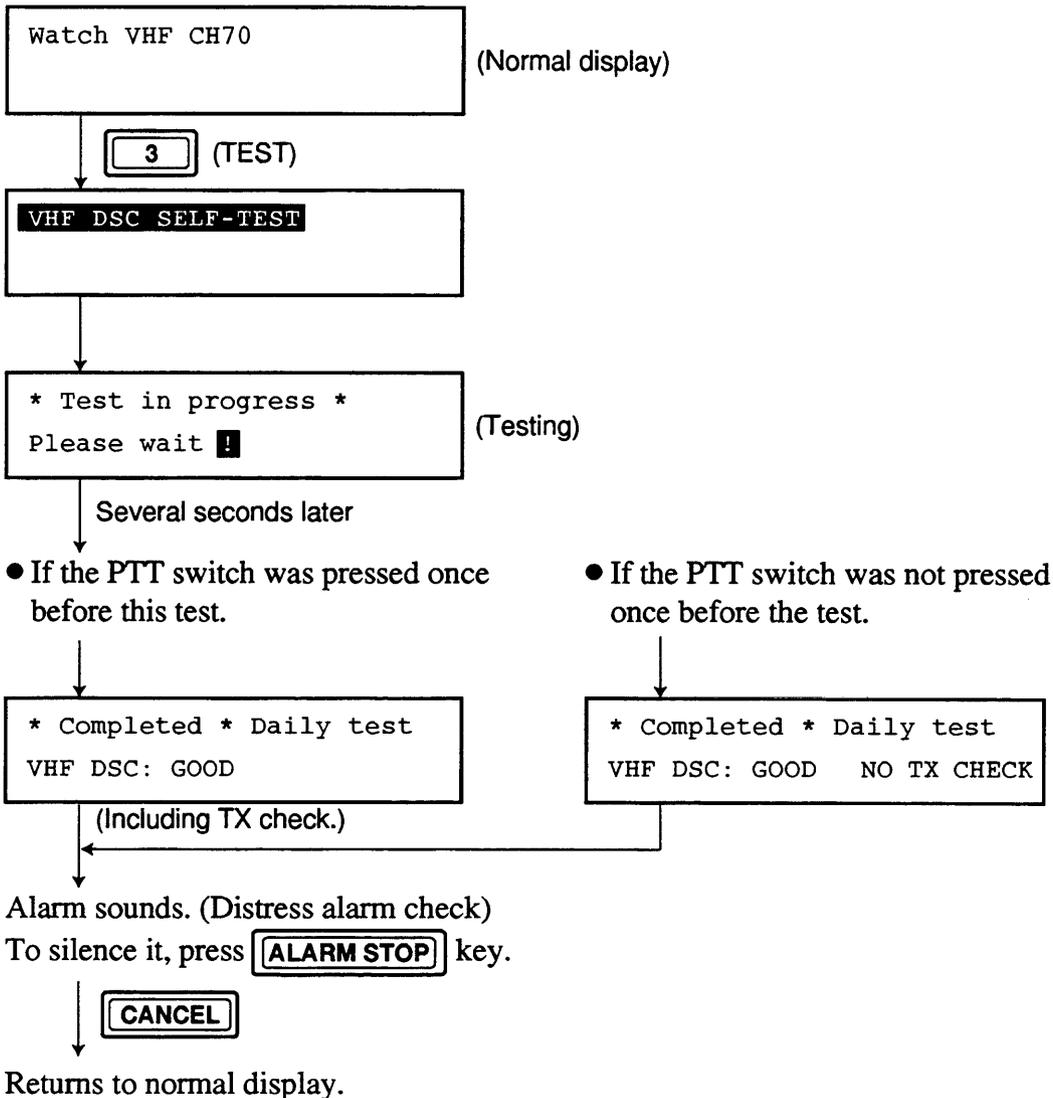
POWER SUPPLY CIRCUIT

TX 8V: 8V is supplied at TX only.
RX 8V: 8V is supplied at RX only.
TX/RX: At RX, the line goes low level.

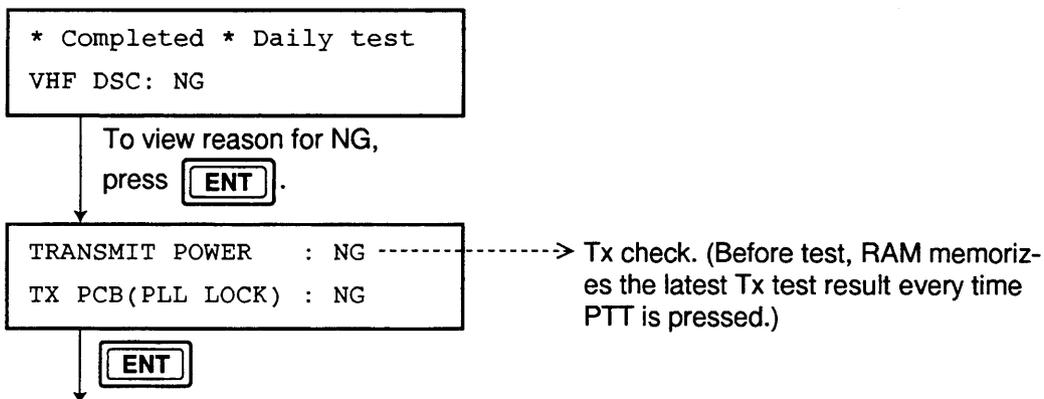
3.2 Daily Diagnosis Test

We recommend daily execution of the diagnosis test to ensure proper transmission in case of distress.

Press the **3** key at the normal display.

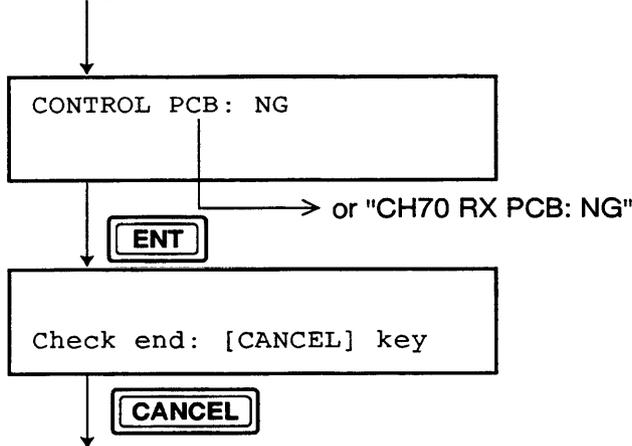


If "NG" appears instead of "GOOD"



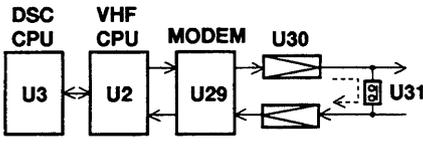
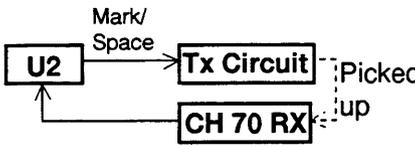
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Returns to normal display.

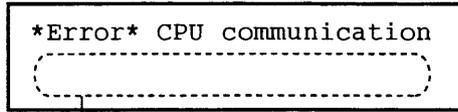
There are four kinds of "NG" in the test. For error, up to three NGs may be displayed by pressing the **ENT** key (once or twice) after the test is completed.

NG display	Meaning	Remedy
TRANSMIT POWER: NG	Tx output power is less than about 15W.	Check TX board (Power Amp. U1) or antenna.
TX PCB (PLL LOCK): NG	VHF CPU (U2) detects PLL unlock in TX board.	Check PLL (U5) and associated components in TX board.
CONTROL PCB: NG  (AF Loop back test)	VHF CPU (U2) sends mark/space signals by a command from DSC CPU (U2) and receives them through <u>MODEM (U29)</u> in CONTROL board. VHF CPU (U2) judges that transmitted and received mark/space signals are not the same.	Check MODEM (U29) in CONTROL board.
CH70 RX PCB: NG  (RF Loop back test)	VHF CPU (U2) sends mark/space signals to Tx circuit (except for power amp). CH70 RCVR picks them up and sends back to U2. VHF CPU (U2) judges that transmitted and received mark/space signals are not the same.	Check CH70 RX circuit. Replace VHF RX/CH70 RX board.

Either appears.

Chapter 7 Error Messages

1. CPU Communications Error

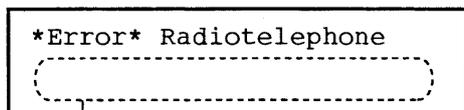


Communications error between U2 (for VHF CPU) and U3 (for DSC CPU)

One of three shown below appears.

Indication	Meaning	Remedy
TYPE : 1 (no change to in)	Ports of U2 are not changed to input ports.	Press the CANCEL key, then retry operation. If that does not clear the symptom, turn the power off and on. If the symptom is still not cleared, clear contents of RAM or EPROM referring to page 3-7.
TYPE : 2 (no ack/time out)	Tx completion command is not fed from U2 to U3 within five seconds after pressing the CALL key.	
	Reply of DSC daily test is not fed from U2 to U3 within five seconds after receiving test requirement from U3.	
TYPE : 3 (no initialize)	When power is turned on or system settings are changed, U2 can not read (or receive) system data from U3.	

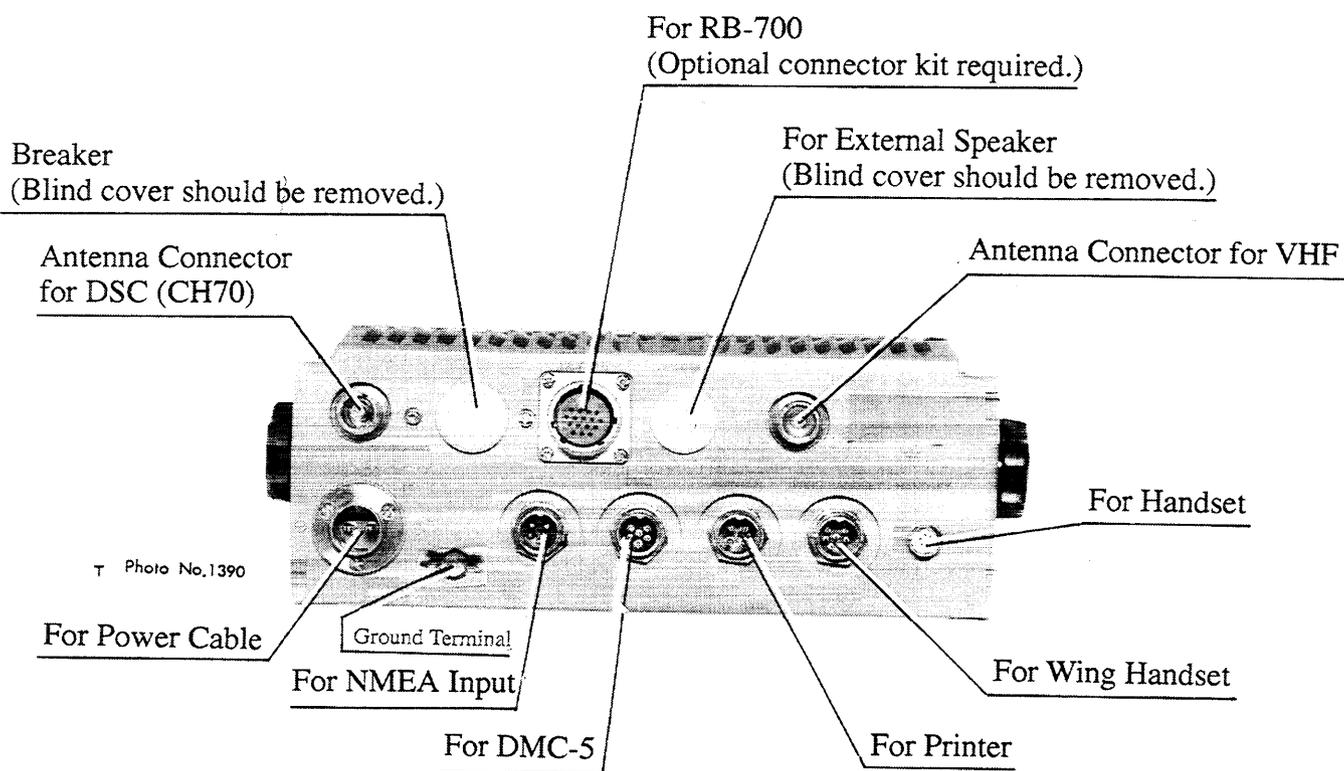
2. PLL unlock and/or reduced output power



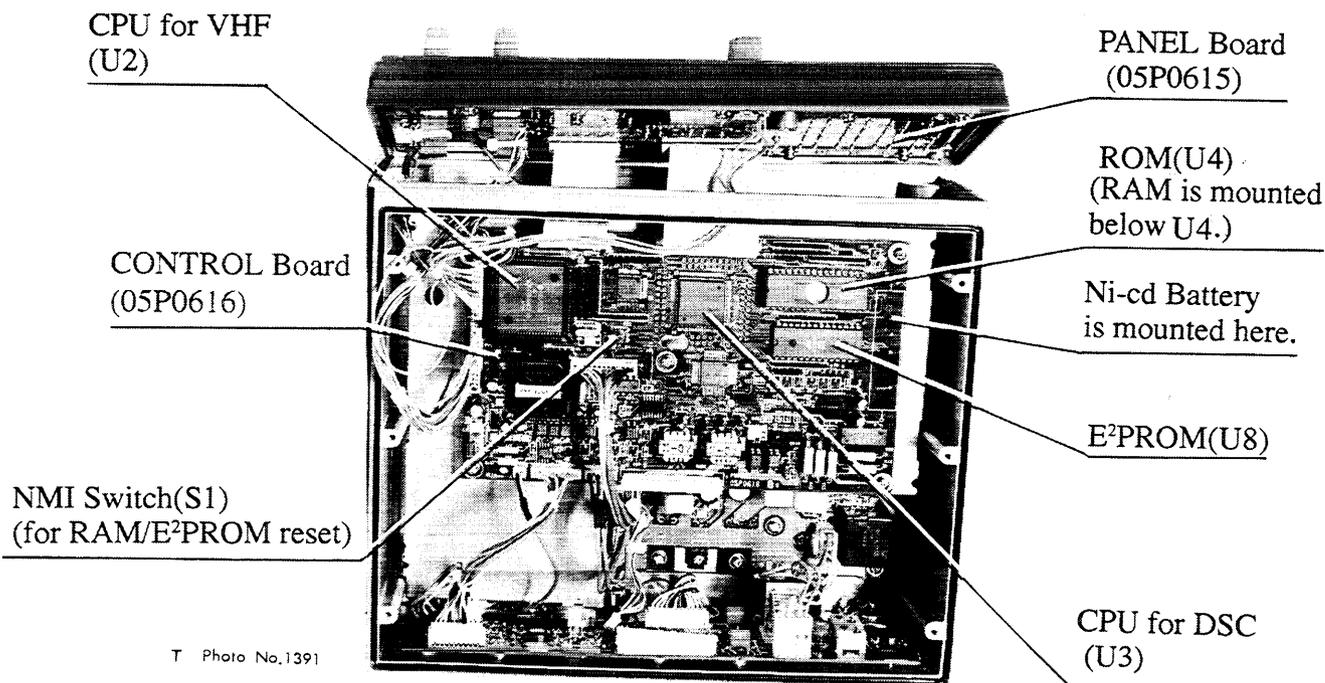
One of three shown below appears.

Indication	Meaning	Remedy
TX PCB : PLL LOCK	PLL (U5) in TX board unlocks. (No transmission possible except distress call)	Check TX board.
TRANSMIT POWER	Output power is less than about 15W. (Transmission possible)	Check TX board (Power Amp U1) or antenna.
TX PCB : PLL LOCK, TX POWER	Two symptoms mentioned above occur simultaneously.	Check TX board and antenna.

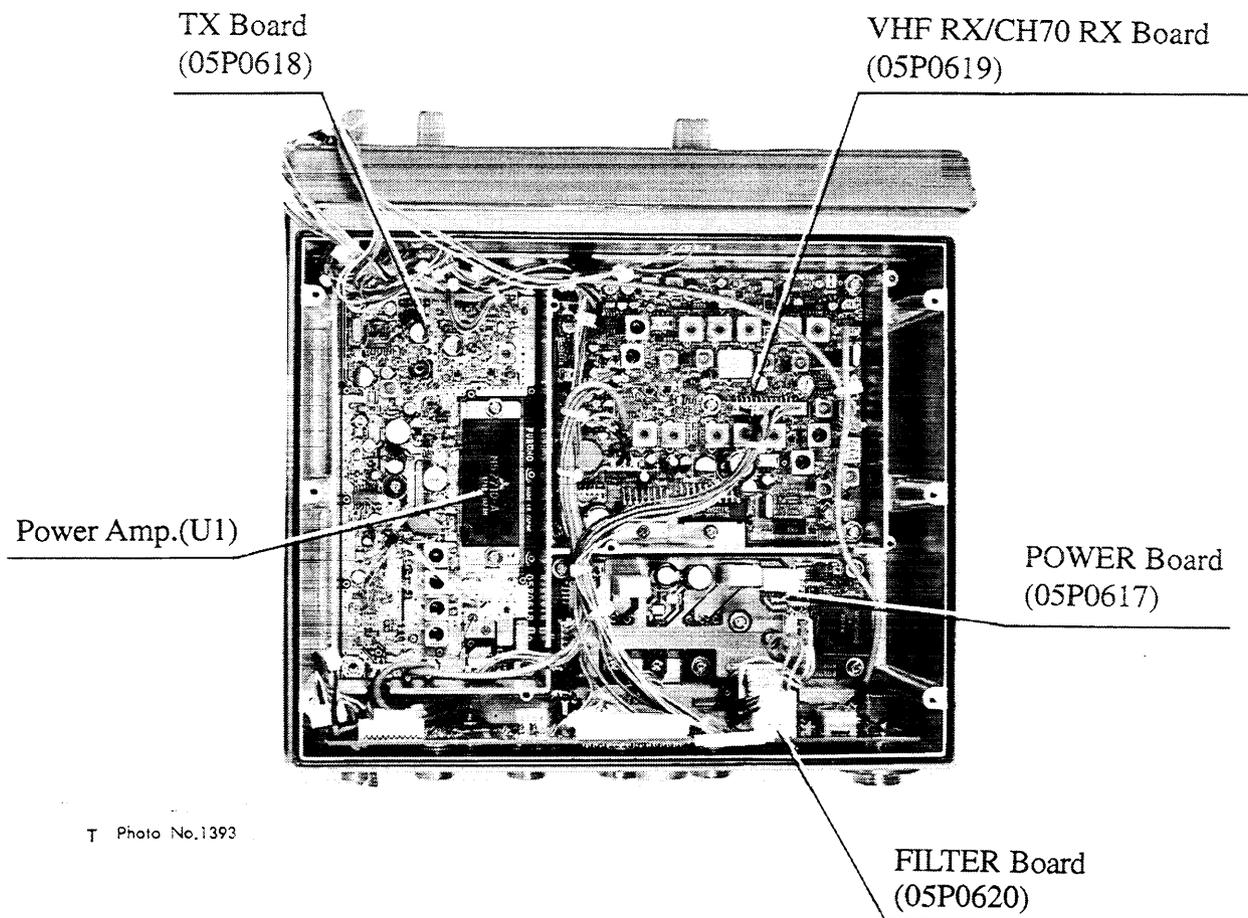
Chapter 5 Parts Location



Rear View



Bottom View Without Cover



Bottom View With CONTROL Board Removed

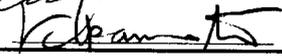
FM-8500 Software History

Version	DSC
Ver. 1.09	Current Version
Ver. 1.07	Corrected compatibility problem with Ross DSC
Ver.1.05	Corrected Ver 1.03 problem of responding to incorrect individual call. Also NMEA sentences GLL, ZDA, and RMC now accepted.
Ver.1.03	Process on MMSI reset is changed.
Ver.1.02	Initial production version

Version	RT
Ver. 1.06	New Procedure to select CH mode.
Ver.1.05	DSC call from FM-7000 and FM-8000 cannot be received. Revert to Ver 1.02. Version 1.05 was not released in the US.
Ver.1.02	Initial production version

Information

Issued by: FURUNO ELECTRIC CO., LTD
 SERVICE MANAGEMENT & COMMANDING DEPARTMENT

No. : FQ5-1999-009Date: 1999-06APPROVED BY WRITTEN BY **New Software, -06**FM-8500

New Procedure to select CH Mode

To protect against inadvertent change of channel mode, the software for the VHF CPU has been changed from the production in May 1999. Two actions are necessary to change the channel mode on the set having a new program: While pressing the mode selector, press the CH16 key.

The software was changed from Ver. 02 to Ver.06. Version numbers -03 to -05 are not used.

The new software has other minor changes:

- 1) Deleted was channel free detection on other channels than CH70 before commencing DSC call,
- 2) Unwanted 5 letters in the DSC message was eliminated, and
- 3) The main unit has priority over the remote station RB-700 after DSC transmission when both stations have the handset off-hooked, etc.

Field modification

If necessary, change U2 on the CONT board, 05P0616 with -06.

Necessary Parts:

Parts Name	Type	Code No.
Program ROM	PROM0550183106	005-389-200

⑤

SSB

Factory-modified sets

From the production in May 1999

FM-8500

Changing the MMSI and System Settings

****This procedure will revert all System Settings to Factory Default****

1. Turn on the power and press the NMI switch, located on the CONT PCB, which is accessed by opening the bottom plate of the FM-8500.
2. Turn the power off, then back on again. The next screen appears.

```
Clear < >
NO RAM EEROM ALL
```

3. Select **EEROM** and press **ENT**. After about 15 seconds, “**Turn off the power**” appears on the screen.
4. Turn the power off, then back on. The next screen appears.

```
TEST VHF CH70
AUTO
```

4. Press the **SELECT** key. The setup menu appears.

```
Setup menu < >
1 2 3 4 6 9 ALM
```

5. Press the **9** key to display the system menu.

```
System menu < >
V P ID DSC RT CH PO
```

6. Select **ID** press **ENT**.

```
System < >
V P ID DSC RT CH PO
```

7. Enters the ship’s MMSI number, press **CANCEL** if incorrect. Press **ENT** to accept. Press **ENT** to return to the system menu.

FM-8500

Changing the MMSI and System Settings (Continued)

```
System < >
V P ID DSC RT CH PO
```

8. Select **RT** and press **ENT**.

```
RT 1-Mode: USA/ WX < >
OFF[1] ON[2]
```

9. Press **2** to select USA mode. Press **CANCEL** to exit to the system menu.
10. The next procedure is for the second VHF only. This will block the CH 70 DSC receiver from responding to DSC calls. Only one VHF onboard should be set for automatic DSC.
11. Select **DSC** from the system menu press **ENT**.

```
DSC: receiver<>
CH70[1]VHF[2]
```

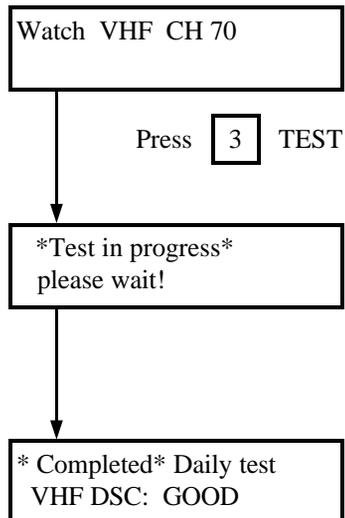
12. Press the **2** key to select VHF.
13. All other settings are to be at default (see Pgs 20 thru 26 of the Installation Manual).
14. Press **ENT**.
15. Select **P** at the system menu.

```
System <>
V P ID DSC RT CH PO
```

16. Select **ON** then press **ENT**. Press **Cancel** until the main screen returns.
17. Next perform the self test procedure.
18. Select a channel not in use. Press and hold down the PTT switch for more than one second before starting the self test.
19. Follow the procedure on the next page.

FM-8500

Changing the MMSI and System Settings (Continued)



20. If you did not press the PTT switch, **except VSWR** will appear instead of **GOOD**.
21. The Distress Alarm will sound and the red LED near the **DISTRESS** key light. Press **ALARM STOP** to silence the alarm.
22. Record any errors (see Operator's and Installation Manuals).
23. Press **CANCEL** to end the test.

Chapter 4 Change of Initial Settings

4.1 System Setting

CAUTION

These instructions are intended for use by authorized Furuno agents and dealers to preset this equipment. Under no circumstances should these instructions be released to the operator for owner of the equipment.

The system is usually set up at installation. If change of system setting is required, however, follow the procedure shown below.

Contents of System Setting

DSC Section

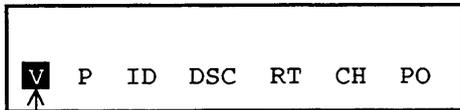
- ① Entry of ship's ID number
- ② Selection of receiver (VHF or CH70 RX)

VHF Section

- ③ Preset of VHF
 - (1) USA/WX mode selection
 - (2) Private mode selection
 - (3) Auto revert function
 - (4) Automatic setting of internal SP
 - (5) Continuous transmission time limit
 - (6) Transmit voice monitoring
 - (7) Auto 1W function
 - (8) Dual watch operation
 - (9) Scan operation
 - (10) Auto squelch (voice detecting type SQ) range setting
- ④ Channel preset on each mode
- ⑤ Power adjustment (High power and low power)

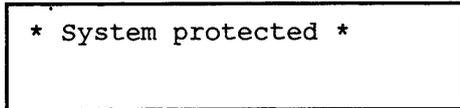
Procedure

1. At the normal display, press the **SELECT** and **9** keys in this order. The following display appears.



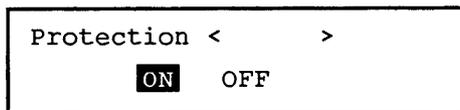
Blinking

2. Select "P" by pressing the **▶** key, then press the **ENT** key.

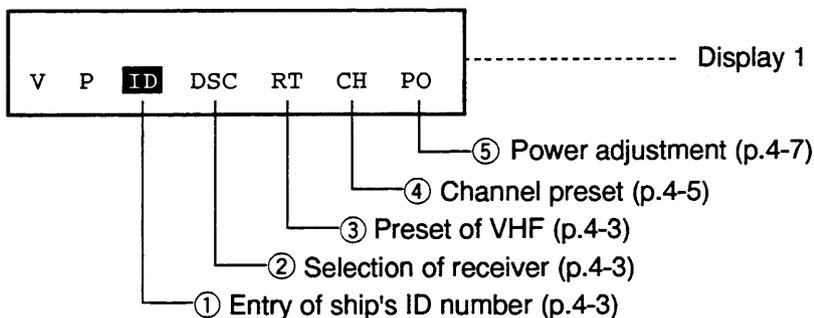


3. Type password.

6 **5** **2** **1** **1** **1**



4. Select "OFF" by pressing the **▶** key, then press the **ENT** key.



[Operation Rule]

There are two ways to choose menu item on selection menu : by using the arrow keys and the **ENT** key, or by pressing the corresponding numeric key.

(Example)

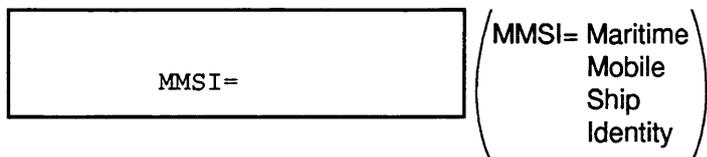


Selection Method

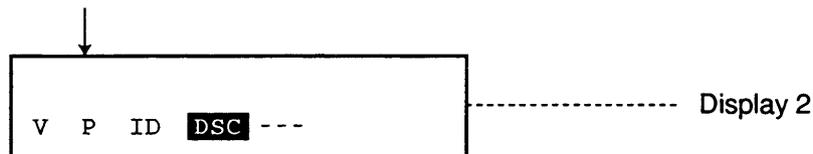
- Place cursor on desired item with arrow key, then press **ENT**.
- or
- Press corresponding numeric key (1 or 2).

① Entry of ship's ID number

At the display 1 (see page 4-2), press the **ENT** key.

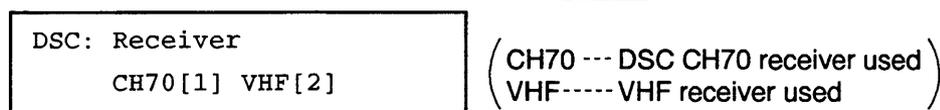


Then, enter your ship's ID number in nine digits followed by the **ENT** key.



② Selection of receiver

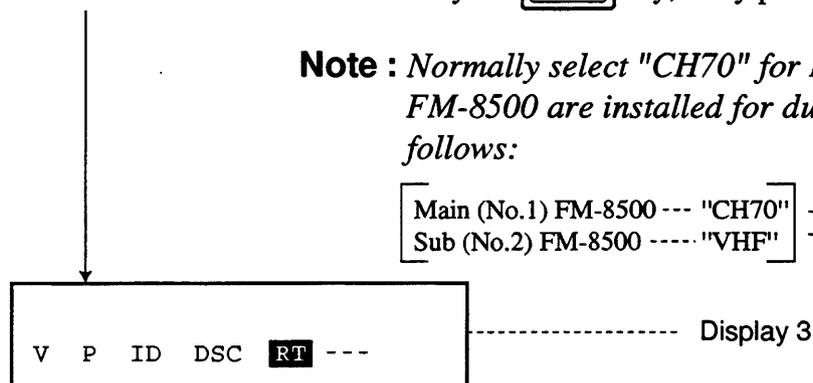
At the display 2 (shown above), press the **ENT** key.



Select either one with the arrow keys & **ENT** key, or by pressing the corresponding numeric key.

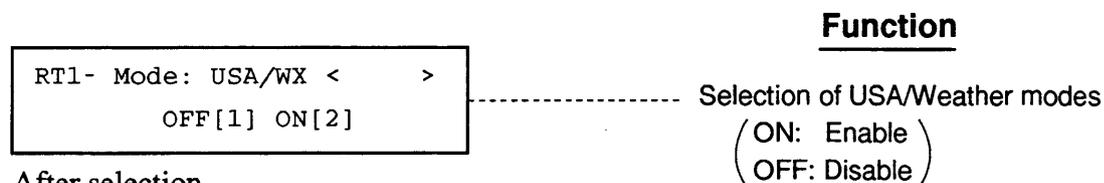
Note : Normally select "CH70" for DSC continuous watch. If two FM-8500 are installed for duplication, select this setting as follows:

Main (No.1) FM-8500 --- "CH70"	⇒	When No.1 FM-8500 fails, use No.2 FM-8500 after interchanging these settings.
Sub (No.2) FM-8500 ----- "VHF"		



③ Preset of VHF (For default setting, see the next page.)

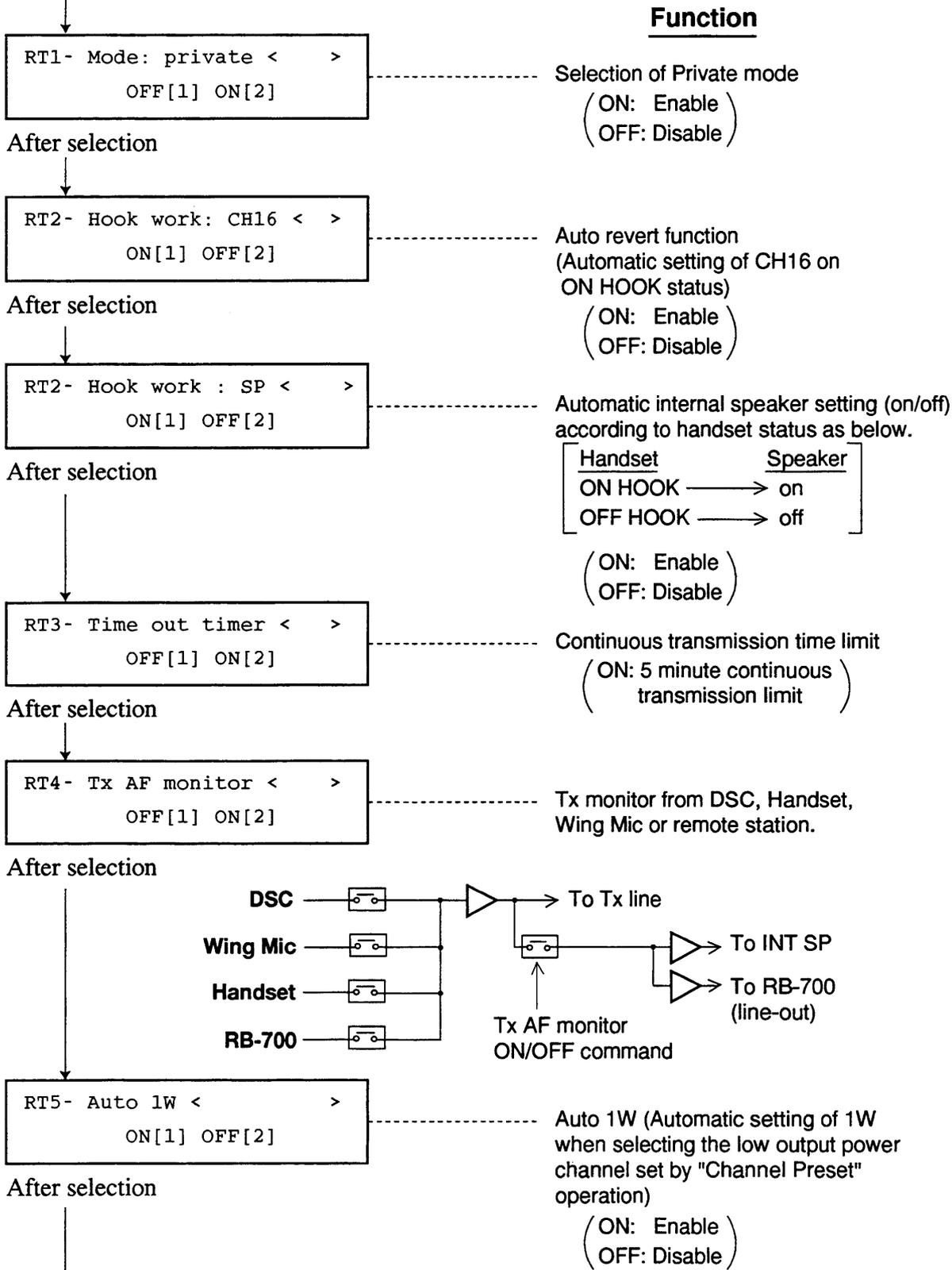
At the display 3 (shown above), press the **ENT** key.



After selection

↓
(Continued on next page)

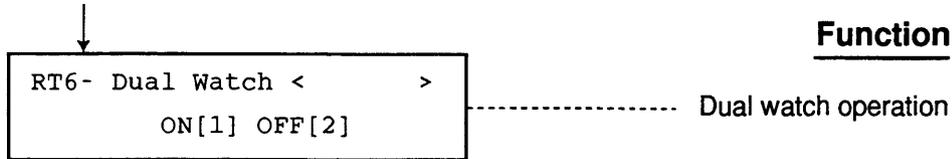
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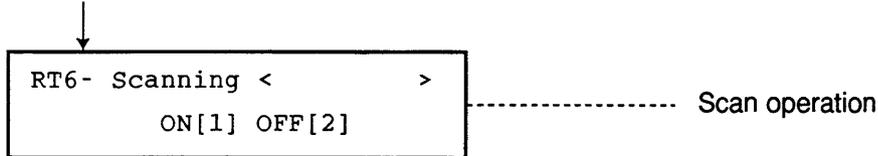
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Delivery	RT1 Mode: USA/WX	RT1 Mode: PRIV	RT2 Hook work: CH16	RT2 Hook work: SP	RT3	RT4	RT5	RT6 DW	RT6 SCAN
Standard	OFF	OFF	ON	ON	OFF	OFF	ON	ON	ON
USA	ON	OFF	ON	ON	ON	OFF	ON	ON	ON

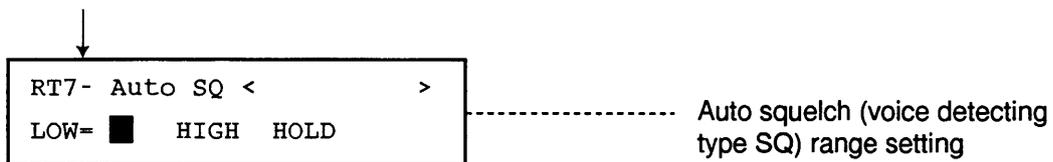
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After selection

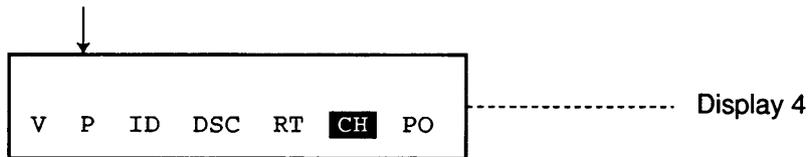


After selection



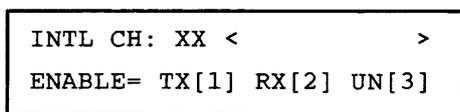
LOW: Lower limit of voice freq. } (Setting value) x 50 = □ Hz
HIGH: Upper limit of voice freq. }
HOLD: SQ hold time } (Setting value) x 20 = □ ms
(SQ open time after signal goes away.) }

Enter 2-digit data for lower limit followed by the **ENT** key. Then enter "HIGH" and "HOLD" data in the same manner as "LOW".



④ Channel preset... (Selections of TX/RX operation, communication mode and output power)

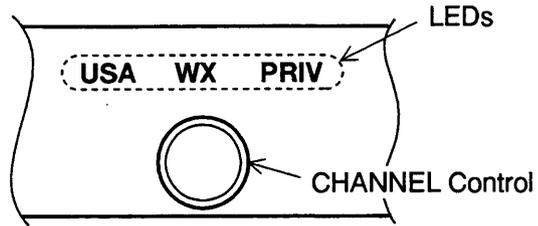
At the display 4, press the **ENT** key.



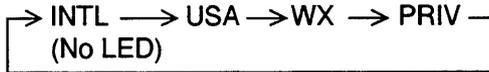
(Continued on next page)

(From previous page)

Select the desired mode and channel with the CHANNEL control.
(See the right.)

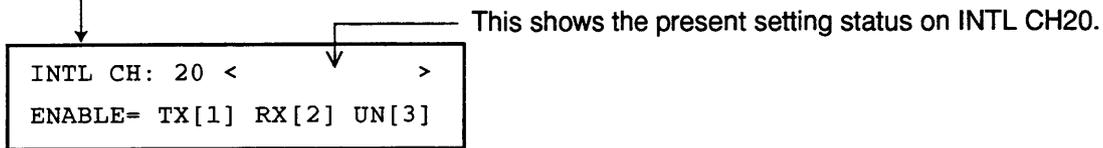


Every press of the CHANNEL control changes the mode as follows:



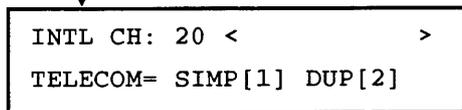
Then select the deseired channel by rotating the control.

(Example) INTL CH20 is selected. (If PRIV mode is selected, see the next page.)



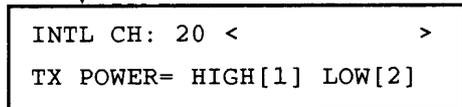
- TX: Both transmission and reception available
- RX: Reception only available
- UN: Unable (Neither transmission nor reception available)

After selection



- Communication mode selection
- SIMP: Simplex
 - DUP: Semi-duplex

After selection

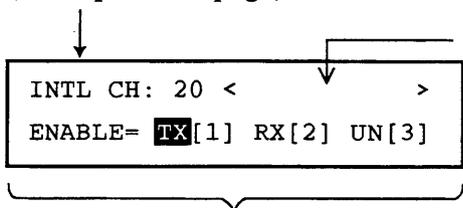


- Output power selection
- HIGH: 25W
 - LOW: 1W

After selection

(Continued on next page)

(From previous page)

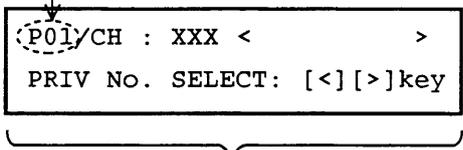


You can confirm the setting status on INTL CH20.

Now INTL CH20 has been preset.

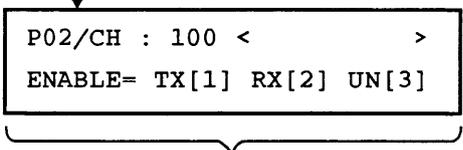
(Example) Private mode is selected.

Memory No.



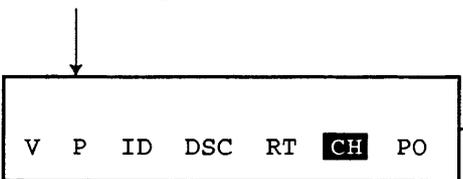
Select the desired memory number (max. 20) with the arrow keys followed by the **ENT** key. Then, rotate the CHANNEL control to select channel to preset. For private channel list, refer to Appendix 2.

(Example) Memory No: 02, CH: 100



Follow the procedure as shown on the previous page.

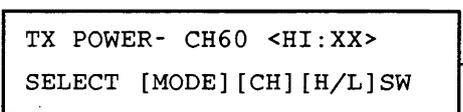
After presetting all channels in the respective modes, press the **CANCEL** key to escape from the channel preset menu.



Display 5

⑤ Power adjustment

At the display 5, press the **▶** key followed by the **ENT** key for Tx power adjustment.



High power adjustment on INTL CH60

(Continued on next page)

(From previous page)



Adjust high power and low power on INTL CH14, CH60 and CH88 as follows.

● For CH60

While pressing the PTT switch, rotate the CHANNEL control to set high power data. Release the PTT switch when the desired value (power data) appears on the channel display. (Power data: 700 ± 100 ----> Output power: About 25W) ---- For power data, refer to the next page.

Then, press **HIGH/LOW** the key. The following display appears.

```
TX POWER- CH60 <low:XX>
SELECT [MODE] [CH] [H/L] SW
```

----- Low power adjustment on INTL CH60

Adjust low power by following the same manner as above.

● For CH14/CH88

Change the channel to CH14 (or CH88) with the CHANNEL control.

```
TX POWER- CH14 <HI:XX>
SELECT [MODE] [CH] [H/L] SW
```

----- High power adjustment on INTL CH14
(or CH88)

Adjust high power and low power in the same manner as mentioned above.



After completion of power adjustment on INTL mode, adjust the output power for PRIV mode in the same procedure as for INTL power adjustment. Note that for PRIV mode, you can adjust power for each channel.

Note : *Power adjustment for USA mode is not necessary, since it is automatically done by carrying out power adjustment on INTL mode. This means power data for INTL and USA modes are the same.*

After completion of power adjustment on all modes, press the **CANCEL** key.

```
V P ----- P0
```

Select "P", then press the **ENT** key.

```
Protection < >
ON OFF
```

Select "ON", then press the **ENT** key.

To return to the normal display, press the **CANCEL** key several times.

Relationship between output power and power data

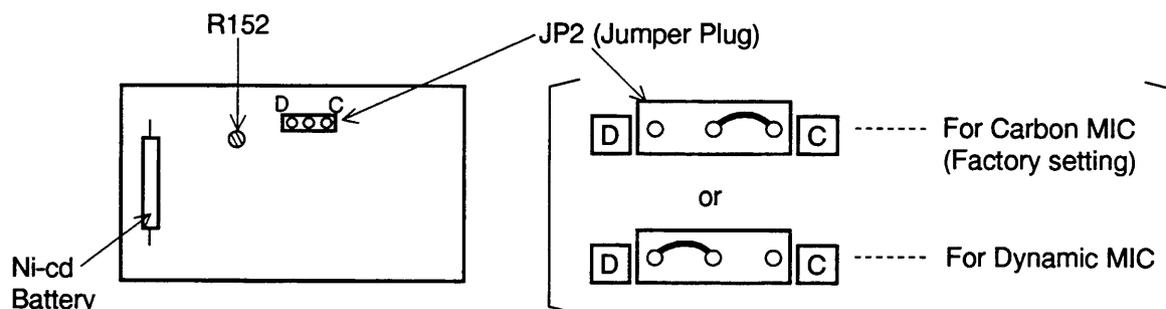
Output Power	25W	20W	15W	10W	5W
Power Data	Po	Po x 90%	Po x 75%	Po x 60%	Po x 40%

Note : Power data are restored to default settings as below when clearing all contents of E²PROM (see page 3-5).

{ High power data : 750
Low power data : 100 }

4.2 Jumper Setting

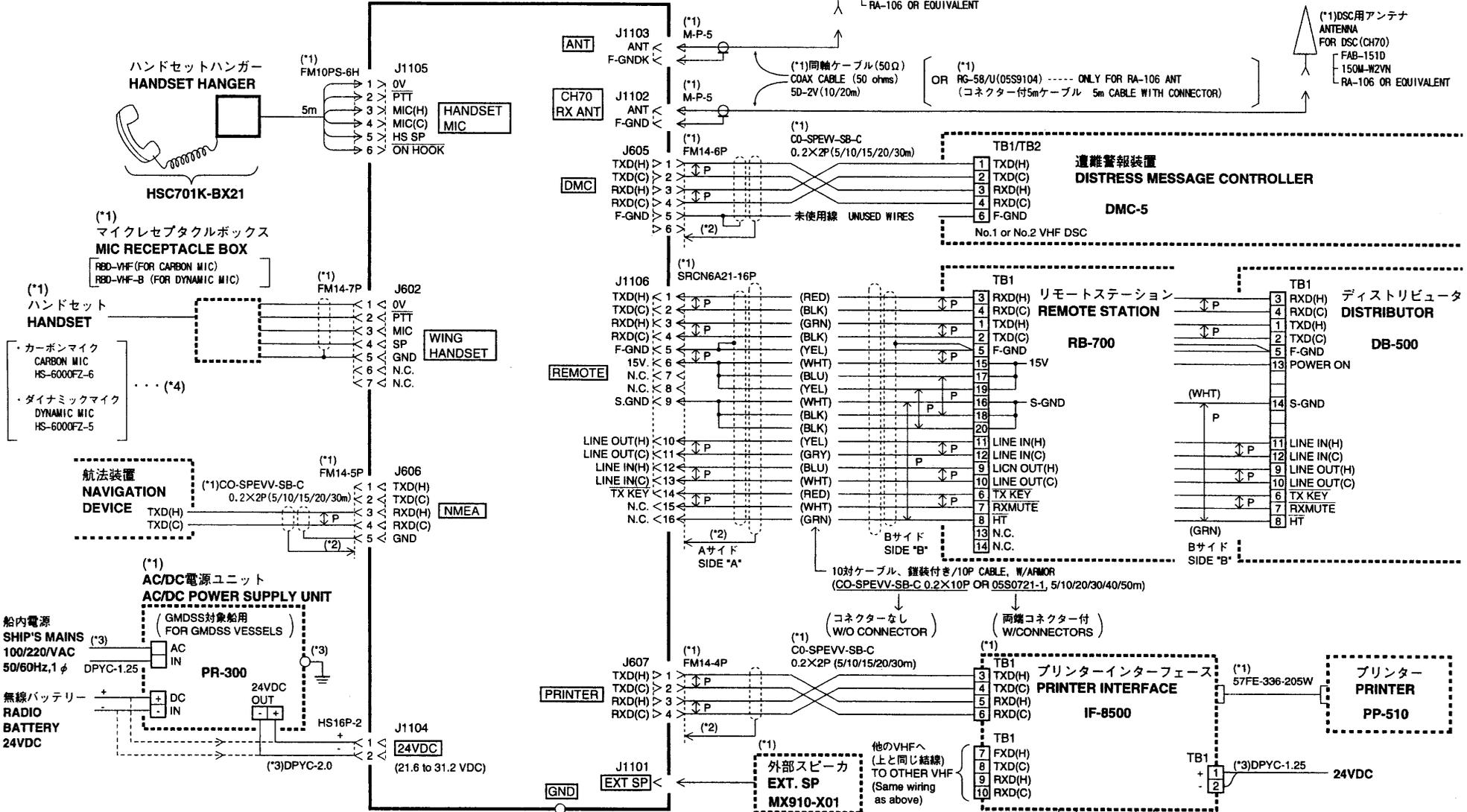
Change the jumper plug setting (JP2) on the CONTROL Board according to the type of the wing microphone : Carbon MIC or Dynamic MIC.



Top View of CONTROL PCB

For dynamic MIC, turn R152 on the CONTROL Board fully counterclockwise (max). No adjustment is required for carbon MIC.

FM-8500
本体 TRANSCEIVER UNIT

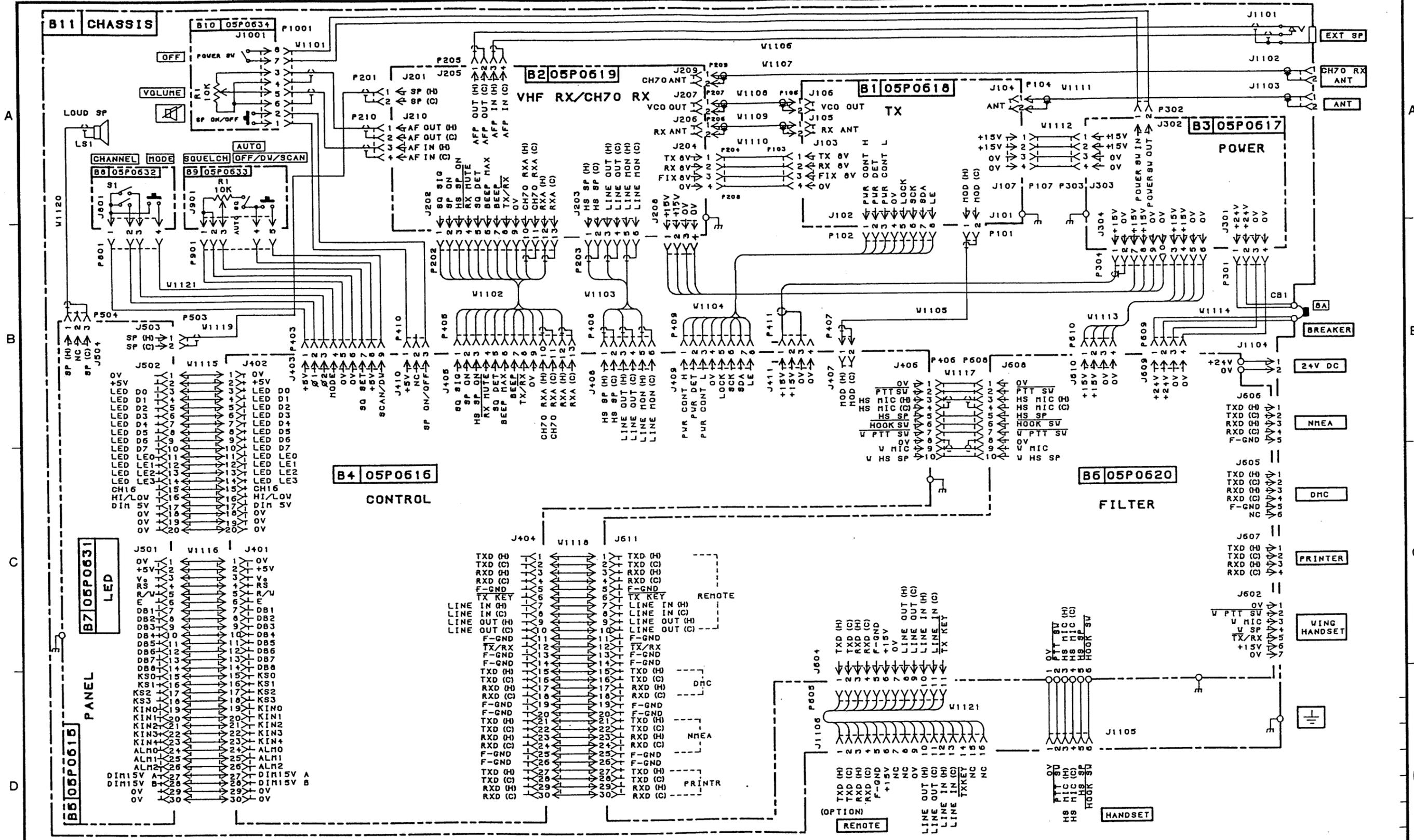


(*)1: オプション支給。
 (*)2: 鍍装ケーブルの場合は、鍍装をコネクタのクランプ経由でアースに落とす。
 (*)3: 造船所支給
 (*)4: マイクのタイプに応じてFM-8500コントローラ基板上のジャンパを設定を変更。

(*)1) OPTION.
 (*)2) WHEN ARMORED CABLE IS USED, GROUND CABLE ARMOR THRU CONNECTOR CLAMP.
 (*)3) SHIPYARD SUPPLY.
 (*)4) CHANGE JUMPER CONNECTIONS ON CONTROLLER PCB OF FM-8500 DEPENDING ON MIC TYPE.

DRAWN MAY 25 '90 T. YAMASAKI		TYPE FM-8500	
CHECKED MAY 25 '90 TAKAHASHI		名称 国際VHF無線電話装置	
APPROVED MAY 30 '90 T. SAITO		相互結線図	
SCALE 1/2	MASS — kg	APPLICABLE TO: FM-8500 (MODEL)	BLOCK NO. NAME VHF RADIOTELEPHONE
DWG NO. C5603-C01-E		INTERCONNECTION DIAGRAM	

A
B
C



DRAWN May 29 '96 T. YAMASAKI		TYPE FM-8500
CHECKED MAY 29 '96 TAKAMASHI		名称 総合
APPROVED May 30 '96 T. SAITO	FM-8500 1B11	回路図
SCALE X	MASS - kg	APPLICABLE TO: (MODEL)
DWG NO. C5603-K01- D	05-001-3677- 1	BLOCK NO. NAME GENERAL
SCHEMATIC DIAGRAM		