

FURUNO

OPERATOR'S MANUAL

150W SSB RADIOTELEPHONE

MODEL FS-1550

This manual is applicable to the sets
having new ITU frequencies.



FURUNO ELECTRIC CO., LTD.
NISHINOMIYA, JAPAN

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•Your Local Agent/Dealer

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Printed in Japan

FIRST EDITION : MAR. 1989
R : SEP. 4, 2001

(TENI)

PUB. No. OME-55100
FS-1550



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SAFETY INSTRUCTIONS

"DANGER", "WARNING" and "CAUTION" notices appear throughout this manual. It is the responsibility of the operator and installer of the equipment to read, understand and follow these notices. If you have any questions regarding these safety instructions, please contact a FURUNO agent or dealer.



DANGER

This notice indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.



WARNING

This notice indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

This notice indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury, or property damage.



SAFETY INFORMATION FOR THE OPERATOR

WARNING



Do not open the cover of the equipment.

This equipment uses high voltage electricity which can shock, burn, or cause death. Only qualified personnel should work inside the equipment.

Do not disassemble or modify the equipment.

Fire, electrical shock or serious injury can result.

Immediately turn off the power at the ship's mains switchboard if water or foreign object falls into the equipment or the equipment is emitting smoke or fire.

Continued use of the equipment can cause fire, electrical shock or serious injury.

CAUTION

Do not place liquid-filled containers on the top of the equipment.

Fire or electrical shock can result if a liquid spills into the equipment.

Do not place heater near the equipment.

Heat can melt the power cord, which can result in fire or electrical shock.

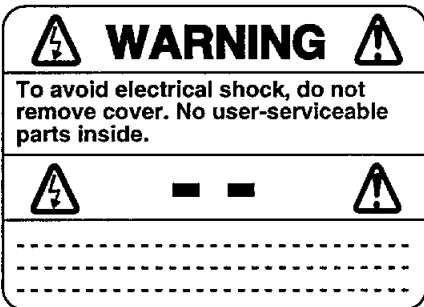
Do not operate the unit with wet hands.

Electrical shock can result.

Use the correct fuse.

Use of the wrong fuse can cause fire or equipment damage.

WARNING Label attached



Name : Warning Label (1)
Type : 86-003-1011-0
Code No. : 100-236-230

SAFETY INFORMATION FOR THE INSTALLER

WARNING



Only qualified personnel should work inside the equipment.

This equipment uses high voltage electricity which can shock, burn, or cause death.

Turn off the power at the ship's mains switchboard before beginning the installation. Post a warning sign near the switchboard to ensure that the power will not be applied while the equipment is being installed.

Serious injury or death can result if the power is not turned off, or is applied while the equipment is being installed.

CAUTION



Ground the equipment.

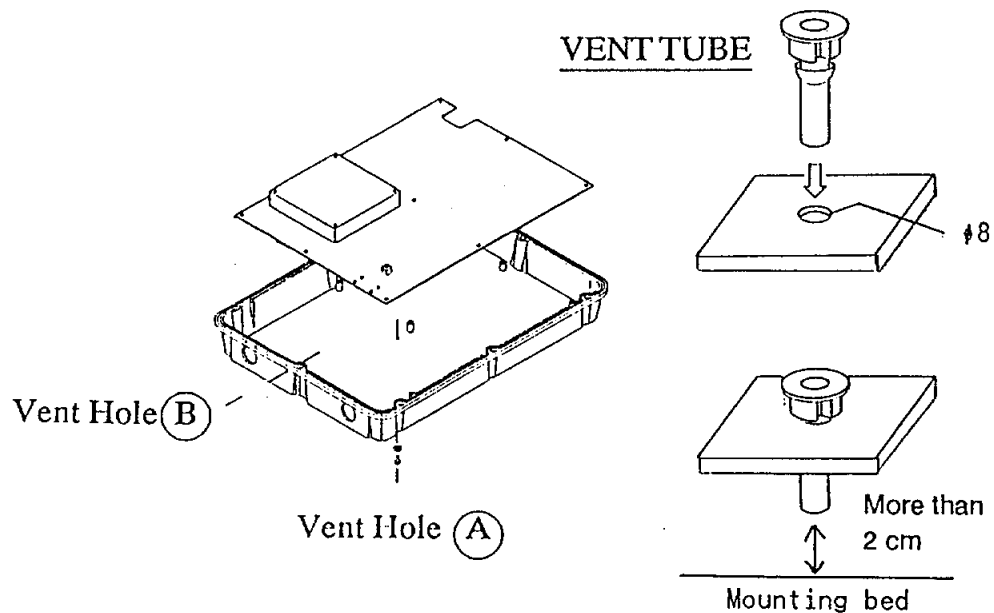
Ungrounded equipment can give off or receive electromagnetic interference or cause electrical shock.

Confirm that the power supply voltage is compatible with the voltage rating of the equipment.

Connection to the wrong power supply can cause fire or equipment damage. The voltage rating appears on the label at the rear of the equipment.

Anti-moisture measure

Ventilation must be provided to prevent moisture from being drawn into the enclosure during atmospheric pressure changes and to allow trapped humid air to escape. Vent tube should be mounted on either bottom (factory mount) or rear of the coupler. If the coupler is installed horizontally, remove screw A and mount the vent tube removed from vent hole B to vent hole A. The screw is remounted to vent hole B. These measures should be done before mounting the unit. Refer to page D-3 for the outline of the antenna coupler.



Location of vent holes and vent tube

■ **NOTE:** *How to fix vent tube.*

1. Dismount the p.c. board.
2. Insert the vent tube from inside of the coupler.
3. Mount the p.c. board.
4. Before fixing the coupler, confirm that the space between mounting bed of antenna coupler and the tip of the tube is at least 2 cm. If not, water may leak into the coupler.

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A WORD TO FS-1550 OWNERS

Congratulations on your choice of the FURUNO FS-1550 HF SSB RADIOTELEPHONE! We are confident that you will enjoy years of comfortable operation with this fine piece of equipment.

For over 40 years FURUNO ELECTRIC CO., LTD. has enjoyed an enviable reputation for quality and reliability throughout the world. This dedication to excellence is furnished by our sensitive global network of agents and dealers.

The FS-1550 is just one of the many Furuno developments in the field of radio communications. The compact, light-weight but rugged unit is easy to install and operate and is suitable for marine and point-to-point communications.

In addition to Furuno's proven seaworthiness, your FS-1550 is designed and constructed using the most advanced concepts and state-of-the-art engineering technology. Several custom chips are newly designed and incorporated to provide stable and reliable performance as a professional (yet affordable) communications equipment.

To obtain optimum performance from the unit, however, please read this operator's manual and follow the recommended procedures for installation, operation and maintenance. With proper care, your FS-1550 should provide many years of enjoyable and dependable communications.

SPECIFICATIONS OF FS-1550

GENERAL CHARACTERISTICS

- 1. Frequency Range**
1.6 to 23MHz in 10Hz steps
525 - 1605kHz (receive only, where permitted by authorities. Degraded sensitivity)
- 2. Frequency Accuracy**
After warmup: TX \pm 20Hz
Tuning Error: RX 20Hz (5Hz by clarifier)
Tuning Drift: RX 10Hz (15 min.)
- 3. Communication System**
Simplex or semi-duplex
- 4. Class of Emission**
J3E, H3E, R3E
(option: A1A, F1B; T/A spec not considered)
Automatic selection H3E on 2182kHz, manual override to other emission.
- 5. Number of Channels**
Separate TX, RX Frequencies:
TX: 64 factory programmed, recalled by CH No.
RX: 10Hz step free selection independent of TX frequency, user programmable with CH No. 1 - 64.
Paired TX/RX Frequencies: Factory programmed 64 TX/RX pairs selected by CH No. 1 - 64.
ITU HF: 192 ITU channels (Available in both Separate and Paired TX/RX frequency versions)
- 6. Power Supply**
13.6 VDC \pm 15%, 18A (TX), 1.2A (Std-by)
24 or 32VDC with extra DC-DC converter
110/220VAC with extra rectifier
- 7. Ambient Temperature**
-20 to +55 °C

TRANSMITTER CHARACTERISTICS

- 1. RF OUTPUT POWER**
J3E/R3E/H3E: 150 Wpеп at 50 ohm load (@13.6VDC, IEC rec.), reduction to 60 Wpеп or less
A1A(option)/F1B(100baud, option): 100W
- 2. Two-tone Alarm Generator**
Built in as standard.

RECEIVER CHARACTERISTICS

- 1. Receiving System**
Double-conversion superheterodyne
IF: 54.455MHz and 455kHz
- 2. Sensitivity**
Input level at 50 ohms to produce SINAD 20dB
J3E/R3E: 3dBuV (1.4uVemf)
H3E: 16dBuV (6.3uVemf)
- 3. Selectivity**
J3E/R3E: 350 to 2700Hz H3E: \pm 3kHz
A1A/F1B(option): \pm 150Hz
- 4. Scan**
8 groups (8 ch/group), All channels in selected band on ITU channels. Dwell time 1 - 9 sec where traffic is present.
- 5. Audio Output**
3W rated into internal speaker
5W max. into external 4-ohm speaker
- 6. Other Features**
AGC: ON/OFF; RF Gain: Adjustable;
Noise Blanker: always in circuit;
Squelch: ON/OFF;
Dimmer: OFF/Dark/Med/Bright;
Speaker: ON/OFF (Handset always alive)

ANTENNA COUPLER CHARACTERISTICS (AT-1500)

- 1. Tuning System**
CPU controlled fully automatic tuning system
- 2. Frequency Range**
1.6 to 25 MHz
- 3. Input Impedance**
50 ohms (Viewed from transceiver)
- 4. Antenna Required**
6 to 15 m wire or whip
- 5. Power Capability**
150 W_pep, 75 W continuous
- 6. Tuning Power**
10 W
- 7. VSWR**
Less than 1.5
- 8. Tune-up Time**
Within 2 to 15 sec.
Within 0.5 sec. in the pretuned bands
- 9. Switches/controls**
MANUAL 2182 kHz tuning facility
TEST switch (Self-test)
- 10. Dummy Load**
Internal (10 ohms + 250 pF), optional supply
- 11. Power Requirement**
15 VDC (supplied from transceiver),
0.6 A max.
- 12. Ambient Temperature**
- 30 °C + 60 °C at 95% RH
- 13. Construction**
Weather-proof plastic cabinet, stainless steel mount
- 14. Coating Color**
White
- 15. Dimensions**
267mm (W) x 390mm (H) x 90mm (D)
(10.5" x 15.4" x 3.5")
- 16. Weight**
Approx. 2.9kg (6.4lbs.)

EQUIPMENT LIST

(Standard)

Main Unit w/ Mounting Bracket	1set
Telephone Handset	1set
Antenna Coupler	1set

(Optional)

DC-DC Converter PC-220 for 24 or 32 VDC	
Rectifier PR-270 for 110/220VAC mains	
Flushmount Adapter for Main Unit	
Internal Dummy Load	

Complete Set

NO.	NAME	TYPE	CODE NO.	Q'TY	REMARKS
1	Transceiver Unit	FS-1550	000-055-206	1	
2	Antenna Coupler Unit	AT-1500	000-055-203	1	
3	Accessories				
	For Transceiver	FP05-02000	000-055-200	1 set	
		FP05-02010	000-055-201		
		FP05-02020	000-055-202		
	For Antenna Coupler	FP05-02100	000-055-205	1 set	
4	Installation materials				
	For Transceiver	CP05-02700	000-055-189	1 set	
	For Antenna Coupler	CP05-02800	000-055-204	1 set	
5	Spare Parts	SP05-02100	000-055-188	1 set	
6	Connector Cable	L-10M 05S0463- L-20M L-30M L-40M L-50M	000-113-355 000-113-356 000-113-357 000-113-358 000-113-359	1	Standard 10m. Specify length if a longer cable is required.
7	Coaxial Cable	L-10M 05S0462-1 L-20M L-30M L-40M L-50M	000-113-360 000-113-361 000-113-362 000-113-363 000-113-364	1	Standard 10m. Specify length if a longer cable is required.
(8)	Antenna materials			(1 set)	
(9)	AC Power Supply	PR-270	000-113-349	(1 set)	
(10)	DC-DC Converter	PC-220	000-113-350	(1 set)	
(11)	Telex Connection Kit	OP05-14	005-923-670	(1 set)	
(12)	External Speaker	SEM-21Q	000-144-917	(1)	
(13)	U-Bolt	OP05-12	005-923-680	(2sets)	For AT-1500
(14)	Artificial Antenna	OP05-36	005-931-230	(1)	SOLAS

* Items 8 to 14 are optional supply.

ACCESSORIES FOR TRANSCEIVER UNIT
FP05-02000

No.	NAME	TYPE	CODE No.	Q'TY	REMARKS
1	Hanger	FP05-02001	005-922-690	1	
2	Accessories	FP05-02002	005-922-700	1	
3	Microphone	DM1620FZ1	005-922-710	1	

FP05-02002 includes

- 1) Tapping Screws 6x20 SUS304 6pcs
- 2) Flat Washer M6 SUS304 6pcs
- 3) Fixing Knob 2pcs

ACCESSORIES FOR TRANSCEIVER UNIT
FP05-02010

No.	NAME	TYPE	CODE No.	Q'TY	REMARKS
1	Hanger	FP05-02001	005-922-690	1	
2	Accessories	FP05-02002	005-922-700	1	
3	Handset	HS-6000FZ5	000-112-623	1	
4	Handset Hanger	FP05-01311	005-011-950	1	

ACCESSORIES FOR TRANSCEIVER UNIT
FP05-02020

No.	NAME	TYPE	CODE No.	Q'TY	REMARKS
1	Hanger	FP05-02001	005-922-690	1	
2	Accessories	FP05-02002	005-922-700	1	
3	Microphone (Noise Canceller Type)	M112D4509910	000-116-487	1	

ACCESSORIES FOR ANTENNA COUPLER
FP05-02100

No.	NAME	TYPE	CODE No.	Q'TY	REMARKS
1	Pipe Seal	12W-R	000-113-354	1	

FURUNO

SPARE PARTS SP05-02100

No.	NAME	TYPE	CODE No.	Q'TY	REMARKS
1	Fuse	FGBO 30A 125V	000-549-017	2	

INSTALLATION MATERIALS FOR TRANSCEIVER UNIT CP05-02700

No.	NAME	TYPE	CODE No.	Q'TY	REMARKS
1	US Plug	PJ-2240-J	000-110-961	2	
2	Power Cable	05S0414-0	000-113-347	1	
3	Ground Cable	L-2M 05S0479-0	000-113-348	1	

INSTALLATION MATERIALS FOR ANTENNA COUPLER CP05-02800

No.	NAME	TYPE	CODE No.	Q'TY	REMARKS
1	Tapping Screw	6x20	000-800-414	4	
2	Flat Washer	M6 SUS304	000-864-129	4	
3	Ground Cable	L-2M 05S0479-0	000-113-348	1	

ANTENNA MATERIALS

No.	NAME	TYPE	CODE No.	Q'TY	REMARKS
1	Doublet Antenna	E-22	000-050-632	1 set	
2	Single Wire Antenna	E-24	000-050-634	1 set	
3	Double-span Antenna	E-25	000-050-635	1 set	
4	Whip Antenna Lead-in	E-26	000-050-636	1 set	
5	Whip Antenna Feeder	E-27	000-050-637	1 set	

GENERAL

This very small 150W SSB radiotelephone is constructed by the latest radio engineering and MPU control technology. It is very simple to operate and all the information that is needed for communication is shown on the large LCD (Liquid Crystal Display).

Transmit and receive frequencies can be selected separately or in pair depending on the requirements of Relevant Specifications.

The AT-1500 Antenna Coupler is designed specially for the FS-1500 series radiotelephone and it can

automatically tune to the antenna (Length nominal 6 to 15m) without any adjustment.

Special consideration is taken to minimize the level of radiated and conducted spurious emissions. Other electrical characteristics are of superb grade, too.

The supplied power should be 12 VDC and 30A at the maximum. You can operate the equipment on 24 or 32 VDC with via optional DC-DC converter, or on 110 or 220 VAC via the optional rectifier.

This radiotelephone equipment is designed to the following Standards.

1. **MPT1224 (UK)** Performance Specification for Single Sideband radiotelephone transmitters and receivers for the MF and HF bands for use in merchant ships

NOTE: CW and TELEX modes will not be available in the FS-1550 falling in this Standard. Noise Blanker not fitted

2. **MPT1227 (UK)** Performance Specification for Single Sideband radiotelephone transmitters and receivers for the MF and HF bands for voluntary fitting to small craft

NOTE: Noise Blanker always in circuit. Standard Broadcast band is accommodated.

3. **MPT 1225 (UK)** Performance Specification for radiotelephone alarm signal generating devices for use in merchant ships
4. **MPT 1204 (UK)** Specification Climatic and durability testing of maritime radio equipment

5. **KSR 144 (Netherlands)** Performance Specifications for Maritime Single Sideband radiotelephone transmitters and receivers for the MF and HF Bands

NOTE: CW and TELEX modes will not be available in the FS-1550 falling in this Standard. Noise Blanker not fitted

6. **KSR 141 (Netherlands)** Performance Specifications for Maritime Single Sideband radiotelephone transmitters and receivers for Small Craft used for Sport and Recreation

NOTE: Noise Blanker always in circuit. Standard Broadcast band is accommodated.

7. **CEPT Sub-Group T/R 15** Performance Specification for Single Sideband radiotelephone transmitters and receivers for the MF and HF bands

FEATURES

DURABLE MECHANICAL AND ELECTRICAL DESIGN

The compact and light-weight but solid and rugged cabinet permits installation most anywhere. Heavy duty transmitter allows continuous operation with minimum heat generation.

64 (semi-duplex) CHANNEL

Pre-programmed to maximum 64 transmitter frequencies, also capable of storing 64 TX/RX frequency pairs with required classes of emission. (Only authorized frequencies. Attempt to enter an unauthorized frequency is rejected and alerted by a flashing frequency indicator)

GENERAL COVERAGE IN 10Hz RESOLUTION

Capable of receiving on all MF/HF frequencies from 1.6 MHz to 23 MHz in 10 Hz resolution. It works as a general coverage receiver from 1.6 MHz to 23 MHz for news broadcasts, weather facsimile, navigational warnings, etc.

324 ITU SSB CHANNELS PRE-PROGRAMMED

Pre-programmed 324 ITU (International Telecommunications Union) SSB channels and 746 ITU TELEX channels.

USEFUL SCAN FUNCTION

Automatic scan function available on user channels.

LARGE EASY-TO-READ LCD DISPLAY

All necessary information is presented on large high-contrast LCD display. Adjustable back-light for the display and touchpad keys enables safe and comfortable operation for day and night.

FRIENDLY OPERATION

Allows frequency/channel selection in two ways; by direct touchpad input or by the rotary control.

SIMPLE EMERGENCY OPERATION

Independent [2182] key permits instantaneous selection of distress/calling frequency and on H3E. Also two-tone alarm generator is built in to meet SOLAS requirements.

BUILT-IN NOISE BLANKER AND SQUELCH

Incorporated as standard with quick response noise blanker, effective both for narrow and wide pulses such as ignition noise. Switchable squelch control for comfortable reception in quiet environment.

VARIETY OF OPTIONS

Convenient options include;

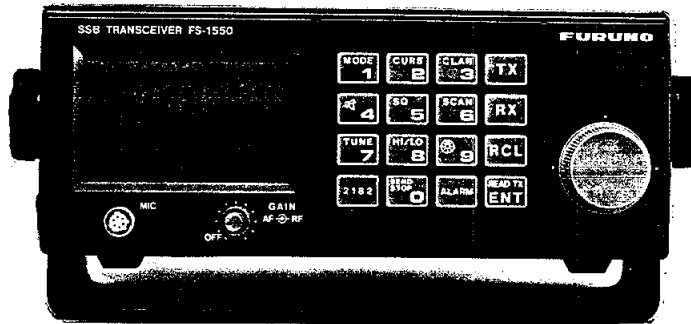
- * Power Supply Unit (Rectifier, DC-DC Converter)
- * Noise Canceller Microphone

OPERATING PRECAUTIONS

- 1) Prior to operating the equipment, a proper license and call sign must be released for the radio station.
- 2) This equipment must be operated only by a person holding a valid radio operator license or permit.
- 3) Although the equipment may be factory-programmed with any transmitting frequencies between 1.6 MHz and 23 MHz in 10 Hz steps, the station license is always necessary for the lawful and proper operation of his station.

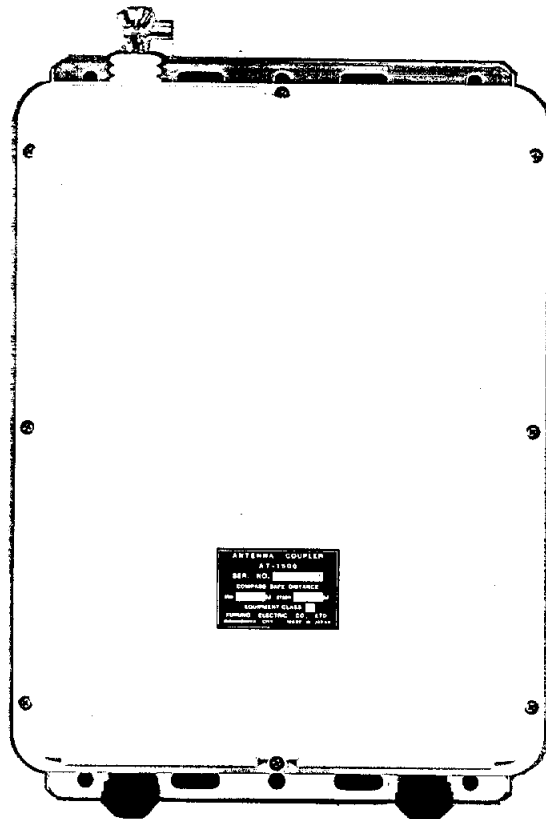
FURUNO will assume no responsibility for any communication disturbance or inconvenience incurred by illegal transmission on any unauthorized frequency.
- 4) The radiowave is public property and it should be used in accordance with appropriate regulations. Do not transmit with too much power or when unnecessary: it can interfere with other's communication.
- 5) The cabinet is also used as part of a heat sink, so it will get warm after a long period of transmission. Allow for enough air circulation around the unit and never put anything on top of the cabinet.
- 6) Large amount of electric current is required for voice transmission by SSB radiotelephone. If the battery becomes discharged then the radiotelephone can't transmit in enough power. Keep the battery fully charged.
- 7) The antenna and its ground are important. If these are not in good condition, you can't expect optimum performance from the unit then more you will damage your equipment than you can't have a good communication.
- 8) Each time you begin transmission, your radio is tuned automatically to the antenna by the antenna coupler. However it can not tune when the antenna is broken or its CPU control circuit does not function properly. If you hear "beeps" at the beginning of each transmission, there may be something wrong with the antenna or the control circuit. In this case select 2182 kHz, open the cover of the Coupler and turn the [MANUAL TUNE] switch to the "MANUAL 2182 kHz" position. Tell your radio is in trouble while it is not during silent time (0 to 3, 15 to 18, 30 to 33, 45 to 48 minutes of every hour). But never use the two-tone alarm.

Chapter 1 OPERATING INSTRUCTION



T Photo No 1012

Radiotelephone FS-1550 Transceiver Unit



T Photo No.975

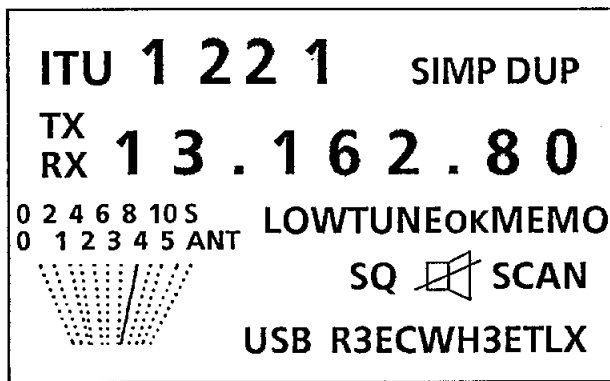
Antenna Coupler Type AT-1500

OPERATING INSTRUCTION

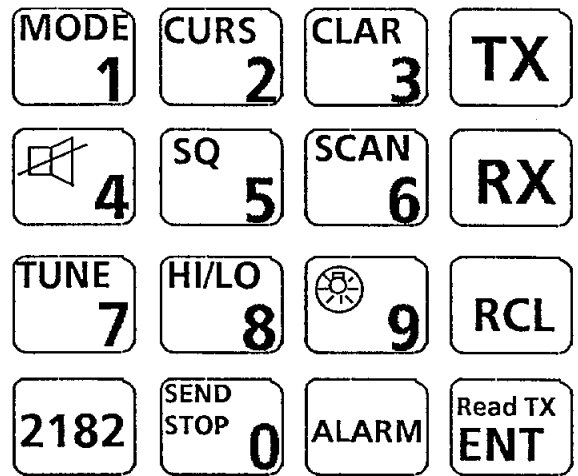
1.1 DESCRIPTION OF FRONT PANEL CONTROLS

All the operations of this radiotelephone can be done from the front panel. The touchpad keys are used to enter a channel number, frequency or scan

group number. To enter numeric data, press [RCL] before pressing the keys, and then finish by pressing [ENT] key after all the numbers are entered.



LCD DISPLAY PANEL showing all available indications for reference purpose



TOUCHPAD ARRANGEMENT



To turn on the equipment, rotate the AF GAIN control (inner control) clockwise. Further rotation will increase the audio level from the speaker (handset). The receiver sensitivity can be adjusted by turning the RF GAIN control (outer control).



Selects the class of emission.

Each time the key is pressed the class of emission changes as shown below. The AGC (Automatic Gain Control) function is also switched on or off with this key.

USB (J3E with AGC) — USB (J3E w/o AGC) — R3E with AGC — R3E w/o AGC — H3E with AGC — H3E w/o AGC — CW with AGC — CW w/o AGC — TELEX with AGC — TELEX w/o AGC

(CW and TELEX modes are optional)
w/o = without



Together with this speech clarifier touchpad and the dial, the receiver is capable of reducing the frequency error to 5 Hz. The frequency range is ± 150 Hz in 10 Hz steps.



Turns internal or external speaker on or off.
A speaker icon with a diagonal line through it appears on the screen when the speaker is off. The headset if used is always active despite of speaker-off condition.



Turns the squelch function on or off.
SQ appears on the screen when the squelch is on.



Turns the scanning function on or off.
SCAN is indicated when scanning reception is selected.



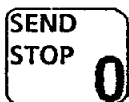
Tunes the transmitter output stage to the antenna by means of the automatic antenna coupler.
TUNE is displayed during tuning process.
TUNE OK is displayed when tuning is completed and 2 sec later it disappears.



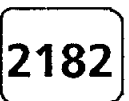
Changes output power high or low.
LOW is indicated on the screen when output power is reduced, disappears while operating in full power.



Pressing this key simultaneously with [SEND/STOP] key activates transmission of radiotelephone two-tone alarm signal.



Permits the test of the two-tone alarm signal required by SOLAS. If [SEND/STOP] key is pressed simultaneously (within 1 sec) with the [ALARM] key, the alarm signal is transmitted in air.



Emergency key to select "2182 kHz " by single action. The class of emission is automatically selected to H3E when the 2182 kHz is first selected, but manual override is possible to select other class of emission by the [MODE] key.



Shifts a marked digit of the frequency or channel number to ease adjustment by the rotary control.



Terminates data entry. Also relieves the operator from a confused status.

WARMING-UP

A crystal oven is used for the reference oscillator; it is switched on by the power switch associated with the **AF GAIN** control. However, no pre-heating is required and the equipment is operational within 30 seconds after switching on, meeting the specifications of Relevant Standards one minutes after switching on.


1.2 TURNING ON/OFF THE POWER


Turning the **[AF GAIN]** control clockwise supplies the power to the transceiver and the equipment is ready to receive a signal on the last used frequency.

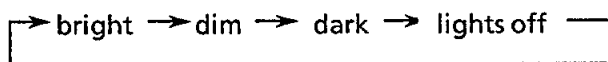
When the supply voltage is higher than 17 VDC the protector trips and the transceiver will be turned off automatically. If this happens, first switch off the equipment and check whether the battery charger is operating or not, then check transceiver input voltage. If the voltage is 12 to 15V, the unit may be turned on again.

To turn off the power, turn the **[AF GAIN]** fully counterclockwise till you feel a "click". All front panel settings and TX/RX frequencies at power off will be preserved in the back-up memory.

1.3 ADJUSTING THE DIMMER

Backlight for the LCD and the touchpad key panel may be adjusted by the  touchpad.

Each pressing of  will change the lighting intensity in four steps



1.4 TURNING ON/OFF THE LOUDSPEAKER

In case that you are using a handset and no need of the internal or external speaker then you can turn the loudspeaker off by pressing the **[4]** key.

Press **[4]** to turn off the speaker and the mark of a loudspeaker will appear on the LCD.

1.5 SELECTION OF FREQUENCY

There are three ways to select a frequency. (Para. 1.5.1, 1.5.2, 1.5.3)

1.5.1 Selection by CH NO. (factory programmed)

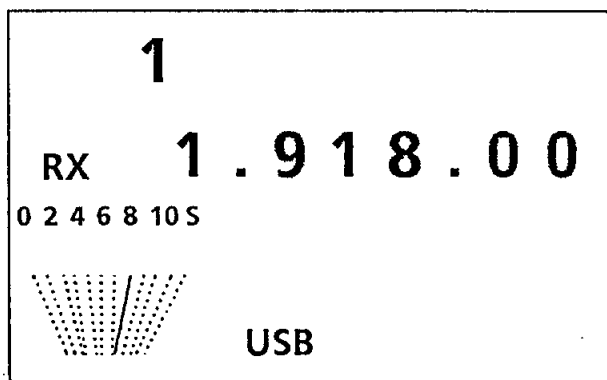
Separate selection for TX and RX frequencies.

For TX, press **[TX][RCL][CH NO][ENT]**

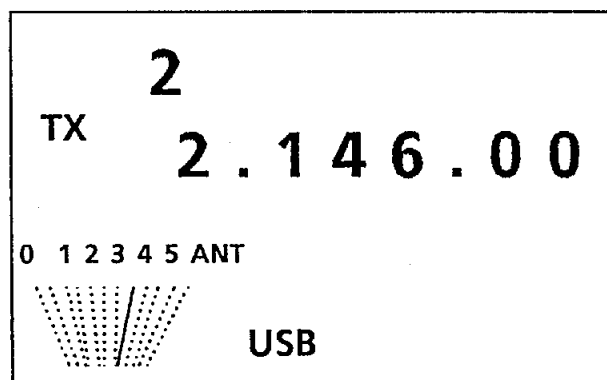
For RX, press **[RX][RCL][CH NO][ENT]**

No. 1 to 64, or
ITU NO.

For instance, if the Kiel Radio of 1918 kHz is factory programmed at CH NO.1, hit the keys in the order of **[RX][RCL][1][ENT]** to tune in it. The LCD panel will read as below:



To send the message to the Kiel Radio on 2146 kHz, when that frequency is factory programmed at CH NO.2, hit the keys in the order of **[TX][RCL][2][ENT]**. The LCD panel will read as below:



If the received signal is weak or distorted, press **[CLAR]** and adjust the tuning dial clockwise or counterclockwise.

1.5.2 Selection by paired TX/RX channel number (factory programmed)

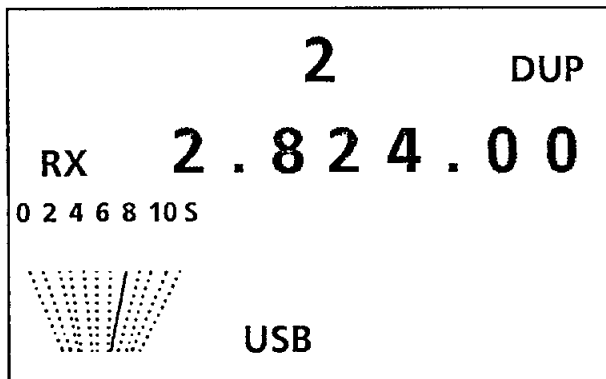
Press [RCL][CH NO][ENT]

No. 1 to 64(MF, HF)
ITU CH NO on HF

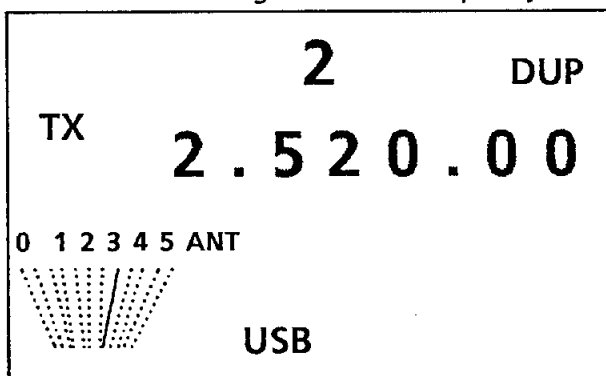
The channel number can be changed with the rotary control, too.

This equipment has only one LCD display which normally reads a receive frequency and when the [Read TX] key is pressed it reads a counterpart transmit frequency for 3 seconds. As far as the handset PTT button is pressed, the LCD displays the transmit frequency. The transmit frequency can be selected without operating the transmitter circuit.

If the channel No. 2 is factory programmed at 2,824 kHz for receiving coastal station call and at 2,520 kHz for transmitting vessel calling frequency, for instance, pressing the keys [RCL][2][ENT] will enable the transceiver to receive traffic on 2,824 kHz and the LCD panel reads as below:



When you press the PTT button on the handset, the transmit frequency is displayed with the LCD panel reading as below. Speak into the handset in normal tone to transmit your speech. Releasing the PTT button returns the transceiver to the receiving mode with the LCD indicating the receive frequency.



Under selection of paired TX/RX channels (1.5.2 above), a receive frequency and its channel NO are indicated normally. When the [ENT, READ TX] key is pressed, a transmit frequency is displayed for 3 seconds with the receiver listening to that channel. This design provides an advantage to determine whether the transmit frequency is vacant or occupied prior to transmission of speech.

DUPLEX or SIMPLEX Indication

When the channel selected is a two-frequency simplex, DUP is displayed to the upper right corner of the display. SIMP is indicated for channels of simplex operation (same frequency for TX and RX).

1.5.3 Selection by direct keying

For TX, press [TX][RCL][CH NO][ENT]

For RX, press [RX][Carrier Frequency][ENT]

Example: Selection of transmit frequency of 2023 kHz if programmed in CH NO.11. Press the keys [TX][RCL][1][1][ENT]. To select the receive frequency of 2614 kHz, press the keys [RX][2][6][1][4][ENT].

In any case, the transmit frequencies must be preprogrammed with corresponding channel numbers at factory. HF ITU frequencies are factory programmed according to ITU frequency tables in the RR in pairs of transmit and receive frequencies. MF frequency and HF frequency other than ITU lists are programmed by FURUNO or authorized agents. (Transmit frequencies are always selected by the channel numbers.)

This equipment has only one LCD display which normally reads a receive frequency and when the [READ TX] key is pressed it reads a transmit frequency that is stored in a certain channel paired with a receive frequency for 3 seconds. For the duration of 3 seconds after [READ TX] has been pressed, the transceiver will listen to traffic on the selected transmit frequency.

Another way to read a transmit frequency is to press the PTT button on the handset (or microphone). While it is kept pressed, the transceiver remains in the transmit condition with the LCD panel reading the transmit frequency. Do not press the PTT button more than necessary. Do not press the PTT while setting a receive or transmit frequency.

Tuning by Dial

The lower three digits of the receive frequency ($\times 0.01$ kHz, $\times 0.1$ kHz and $\times 1$ kHz) may be changed by turning the dial. To increase the frequency value, rotate the dial clockwise and to decrease, turn it counterclockwise. NOTE: This is not true in the paired TX/TR selection mode.

Frequency change is valid only at the digit marked by an underline. To select the digit, locate the cursor at " $\times 1$ kHz" or " $\times 0.1$ kHz" digit. The frequency can be changed in the digit where the cursor is located.

If changing the frequency by this method is inconvenient, press [RX] then enter a new frequency with the touchpad key, finishing by [ENT].

ITU Channel Receive Mode

ITU channel (paired TX and RX frequencies) are selected by pressing [RCL][CH NO][ENT]. Right two numbers show the "channel number" and the rest shows the "frequency band". 324 channels are factory programmed as per the list in Appendix.

1.6 SELECTING THE CLASS OF EMISSION

Press the [MODE] key repeatedly until you reach the desired class of emission. When the 2182 kHz is selected the class of emission is automatically selected to H3E. Manual override is possible to other class of emission by pressing the [MODE] key if necessary.


NOTE: Most coastal stations keep watch of 2182 kHz on H3E, and so do the shipboard stations.

Table 1-1 Class of Emission

Class of emission	Function	Main use	Power (pep)
USB	J3E (Upper Side Band)	Marine Mobile, General	150W
R3E	SSB (USB) with pilot carrier	Some Coastal Station Service	150W
H3E	SSB with full carrier	Distress, call on 2182 kHz	150W

Note: Select "USB" for voice communication on marine mobile operation. In some sets, the label "USB" will not appear when the class of emission, J3E, is selected.

1.7 ADJUSTING THE VOLUME

Adjust the AF GAIN control for the sound level desired. If  is present on the display, hit [4] key to activate the speaker. This key alternates on and off of the loudspeaker.

NOTE: In duplex channels, the loudspeaker is automatically cut off. To activate it, press the [4] key.

1.8 COMMENCING COMMUNICATIONS

Checking Desired Frequency

Watch the display. The LCD panel normally shows a receive frequency and channel number. Press the [Read TX] key to see if the counterpart transmit frequency is not busy.

Antenna Tuning

Press [TUNE] for tuning the transmitter output stage to the antenna through the Antenna Coupler. During the tuning (2 to 15 sec., "TUNE" is displayed on the LCD, and when tuning is completed "TUNE ok" is displayed. Tuning is also initiated by the first press of press-to-talk switch.

NOTE

- 1) The Automatic Antenna Coupler has a learning ability, that is, it memorizes the optimum tuning point for about one week. The tuning time within the same frequency band is fast, 0.2 to 1.5 sec. However, it is a good habit to wait for a short period after pressing the press-to-talk switch at the beginning of communication until TUNE ok is displayed.
- 2) If an antenna length is not within the tunable range of the coupler, it might take long to complete the tuning. If good tuning is not attained, the unit beeps and "TUNE ok" won't be displayed on LCD. In this case, the coupler is not matching with the antenna. Though the transceiver can transmit at a reduced power there is risk of damaging the equipment if it is used for a long period of time. Ensure the proper length of antenna (6 to 15 meter in total including the feeder line) is used.

Communication

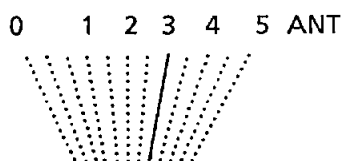
- 1) Confirm that "TUNE ok" is displayed.
- 2) Press the press-to-talk switch on the handset or microphone.
- 3) Keep a distance of about 5cm between the handset and your mouth.
- 4) Speak into the handset (or microphone) in a normal voice. There is no need to shout.
- 5) Speak out "OVER" and release the press-to-talk switch for reception.

Monitoring Antenna Current

The needlegraph provides a means of checking the antenna current in amperes on 2182 kHz as required by most Regulations including CEPT. Under speech transmission, the needle deflects depending on the radiation impedance of antenna. The following table shows rough values just for reference.

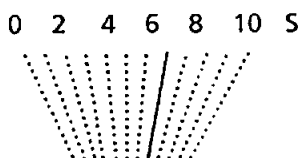
Antenna	2182kHz(H3E)	HF
6m Whip + 3m feeder	3 - 5A	1 - 2A
7m Wire + 4m feeder	2 - 4A	0.5-1.5A

NOTE: The meter resolution is 0.33A between 0 and 1A and 0.5A between 1 and 5A. The meter reading is the same in H3E and J3E under speech emission but under no-speech emission, the meter reads less in J3E mode because of lesser carrier component.



Monitoring Receiving Signal Strength

During reception, the needlegraph works as a sensitivity meter and indicates the "relative" strength of the incoming signal. The needle deflects rightward as the received signal gets stronger. The meter reading varies with the setting of the RF GAIN control. Note: The scale 0, 2, ... 10S will not appear when the AGC is turned off by the [MODE] key.



1.9 Receiver Fine Tuning by Speech Clarifier

The receiver is capable of reducing the frequency error to 5 Hz or less. Press [CLAR] key. Then you can change the frequency by the dial in step of 10 Hz. Set the dial at a position where the receiver gives the best articulation. Take the fine tuning each time the receiving frequency is changed.

1.10 TRANSMISSION OF TWO-TONE ALARM

In case of distress or an emergency, call for a help on 2182 kHz. Before transmitting the call, the two-tone alarm should usually be transmitted. This will call a 2182 kHz Watch Keeping Receiver's attention, since this frequency is watched 24 hours a day by other ships (SOLAS Convention ships) and coastal stations. Distress call may be made without emitting the two-tone alarm or interrupting the alarm in an utmost urgency.

- Note
- 1) Transmit 2182 kHz only in an emergency.
 - 2) Refer to "DISTRESS CALLING PROCEDURE" on page APC-1 of this manual.

Transmission

- 1) Press [2182] to set the frequency to 2182 kHz.
- 2) Press [ALM] and [SEND/STOP] simultaneously, or press these two in a second. Then alarm tone will be transmitted for about 45 seconds. This can be monitored through the built-in speaker.
- 3) To interrupt two-tone alarm for instant distress call, press the [SEND/STOP] key again.

Testing

- 1) Alarm-tone can be monitored by pressing [ALM] key alone.
- 2) To cease testing press [SEND/STOP] key. Sending or stopping the alarm may be repeated.

1.11 REDUCTION OF TRANSMISSION POWER

When using the transceiver in a harbor or near the shore you can normally transmit in low power, since you are close enough to a counterpart station. Transmission power is lowered as follows.

- 1) Press [HI/LOW], and "LOW" will be displayed on the LCD when the reduced output is attained. The output of the transceiver is reduced to 60W or less.
- 2) To return to high power output, press [HI/LOW] key again.

1.12 TURNING ON/OFF THE SQUELCH

When the noise is too annoying during stand-by condition, press [SQ] to activate the squelch function. "SQ" is displayed on the LCD. It mutes the audio output in the absence of incoming signal, but note that when the level of the receiving signal is very low it may extinguish both noise and the signal.

Note1: The squelch incorporated in this radio is an "Audio Frequency Detect Type Squelch" which means that, the squelch opens for 2 seconds when detecting an audio signal of 1kHz or lower. The squelch open state is maintained as long as the signal continually contains low frequency (below 1kHz) components.

- 2: Do not activate the squelch while operating in "CW" because actual reproduced audio output may be higher than "1kHz".

1.13 SCANNING RECEPTION

This function receives one by one the frequencies (maximum 8 frequencies) which are stored in memory. When a signal is detected, the receiver locks on that channel for a certain period (dwell time; presettable among 1 to 9 sec) The signal level to cause locking is also presettable in 1 to 9 levels of the S-meter reading. To quit scanning press [SCAN] or [ENT] key or the press-to-talk switch on the microphone.

Setting of "Dwell Time" and "Threshold Level"

- 1) Press [RCL][9][0].
- 2) Turn the dial to set the desired dwell time at 1 to 9 sec.
- 3) Press [SEND/STOP] to escape from this function.

Setting the Threshold Level

- 1) Press [RCL][9][1].
- 2) Turn the dial to set the desired level of Sensitivity meter among level 1 to 9. Default value is 3.
- 3) Press [SEND/STOP] to escape from this function.

Starting Scanning Reception

- 1) Press [SCAN] and turn the dial to select the channel number which corresponds to the scan group that you desire. Press [ENT] to commence scanning. Note that scanning is not available beyond the selected scan group.

Scan group number and corresponding channel number are as follows:

Table 1-2 Scan Group No. and Corresponding Channel

Scan Group Number	Channel Numbers to be scanned
1	1 to 8
2	9 to 16
3	17 to 24
4	25 to 32
5	33 to 40
6	41 to 48
7	49 to 56
8	57 to 64

- 2) To stop scanning, press [SCAN] or [ENT] key or press-to-talk switch on the microphone. The receiver will lock on a certain frequency (random depending on the timing of scan disable).

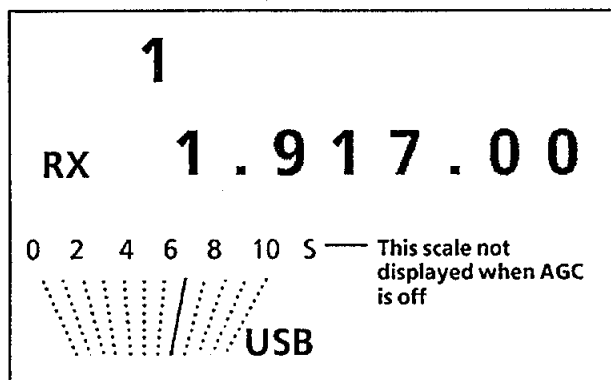
1.14 AGC (Automatic Gain Control)

AGC function can be switched on or off by pressing the [MODE] key. The [MODE] key changes the function as below. When the AGC function is off, the legend [0 2 4 6 8 10 S] will disappear from the LCD panel. The RF GAIN and VOLUME controls override the AGC function; therefore, normally put the AGC on. The AGC provides a means by which gain of the receiver is automatically adjusted to decrease variation of audio reproduction against

high and low signal input differentials. If you were to listen to a weak signal, you would cut off the AGC by pressing the [MODE] key and adjust the manual RF GAIN control as well as the VOLUME control.

USB (J3E with AGC) — USB (J3E w/o AGC) — R3E with AGC — R3E w/o AGC — H3E with AGC — H3E w/o AGC — CW with AGC — CW w/o AGC — TELEX with AGC — TELEX w/o AGC

(CW and TELEX modes are optional depending on authorization)
w/o = without



1.15 CHANNELIZING RECEIVE FREQUENCIES

The receive frequencies are set by the channel NO as para. 1.5.1, in TX/RX pair as para. 1.5.2 or by direct keypad entry as para. 1.5.3. If new receive frequencies are required to be assigned channel numbers, do the following. Note: Transmit frequencies can not be channelized outside factory.

- 1) Turn off the transceiver.
- 2) Keeping the [RCL] keypad pressed, turn on the transceiver. After MEMO appears on the LCD display release the [RCL] keypad.
- 3) Define the class of emission such as USB(J3E) through the [MODE] keypad. The class of emission determined here can be changed by the [MODE] key during normal operation.
- 4) Select the channel number with the tuning dial. Suppose you want an important receive frequency channelized at channel NO. 25. When you rotate the dial, you will first reach TX - 25, then turn it one step further to reach RX - 25.
- 5) Press the [RX] keypad to clear the previous frequency, if any.
- 6) Type a new receive frequency to the digit of 10 Hz (i.e., 2182.00 - the decimal is not necessary to enter, but do not neglect typing 00).
- 7) Press the [ENT] keypad. Do the steps 3 through 6 for other channels. 64 frequencies in total can

be channelized like this.

1.16 IN THE EVENT OF COUPLER FAILURE

The AT-1500 Antenna Coupler starts automatic antenna tuning the moment the PTT switch on the microphone is pressed or the [TUNE] key on the transceiver is pressed. After pressing the switch, tuning will be completed in 2 to 15 sec for a newly used frequency or in 0.5 s for a previously used frequency. A built-in memory stores capacitor and coil settings. This is why it can tune a previously used frequency so quickly.

When the control circuit in the Antenna Coupler does not function properly, you can not transmit effectively. In this case, you can transmit 2182 kHz by switching the Coupler to MANUAL mode. But for this operation, presetting should be done beforehand (Refer to Chapter 5 "MANUAL 2182 kHz SETTING") The following shows the way to switch over to "manual operation."

- 1) Open the cover of the Antenna Coupler.
- 2) Set the toggle switch S3 to "MANUAL 2182 kHz" position.
- 3) Close the cover.
- 4) Turn on the power and select 2182 kHz from the transceiver unit. (Coupler can be tuned to 2182 kHz only.)

See "CHAPTER 4 PARTS LOCATION" for locations of each component.

- CAUTION -

When closing the cover, fit the gasket properly and tighten each bolt with the same amount of torque. If the bolt is not tightened properly, water may leak inside the coupler.

1.17 BUZZER

The built-in buzzer sounds in the following cases.

- 1) When a key input sequence is completed successfully, a short beep is generated.
- 2) When the operator attempts to enter incorrect (illegal) frequency, three beeps will be generated. The input data is rejected and the previous data will be restored.
- 3) When the Antenna Coupler fails in antenna tuning, five beeps are generated without displaying the "TUNE ok" sign.

1.18 ARTIFICIAL ANTENNA

SOLAS

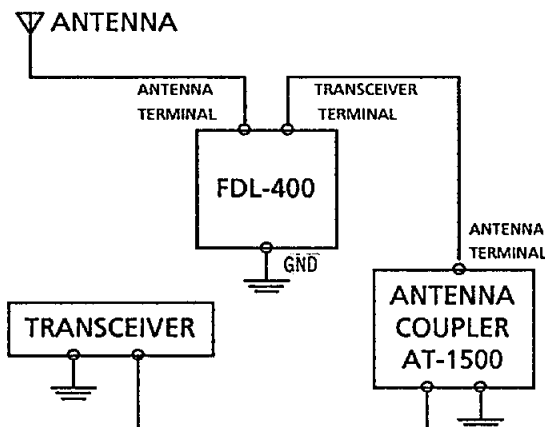
Chapter IV, Regulation 10 (h) (iv) (2):
Arrangements shall be made to check periodically the proper functioning of the automatic device for generating the radiotelephone alarm signal on frequencies other than the radiotelephone distress frequency using a suitable artificial antenna.

EXTERNAL ARTIFICIAL ANTENNA (Type FDL-400, Optional Supply)

The artificial antenna FDL-400 is designed to meet the SOLAS regulation as above. It contains a dummy aerial made up of $10\Omega + 250\text{pF}$ in series.

Connection

For periodic checks of the two-tone alarm generator built in the transceiver main unit, disconnect the antenna feeder from the antenna coupler AT-1500 (if used) and connect the feeder to the ANTENNA terminal on the artificial antenna FDL-400. Connect between the TRANSMITTER terminal of FDL-400 and the antenna terminal of the coupler AT-1500. Ground the FDL-400. See Figure below.



NOTE:

The artificial antenna FDL-400 may be permanently connected as illustrated for normal operation, but it should be noted that it is not waterproof and any proper shelter is required.

Test Transmission

1. Select a proper MF transmitter frequency near 2182 kHz, but not on 2182 kHz.

2. Press [ALM] and [SEND/STOP] keys on the transceiver unit. The transceiver emits an alarm tone for 45 seconds.
3. Keep the push button pressed on the artificial antenna FDL-400 and read the antenna current on the transceiver unit.
4. Antenna current should be approximately 3.5 - 4.0 A with full output power. If out of range, consult the service representative.
5. After test, remove the artificial antenna FDL-400 unless it is installed in a weatherproof arrangement.

DANGER

HIGH TENSION VOLTAGE AT ANTENNA TERMINALS ON THE COUPLER AT-1500 AND ARTIFICIAL ANTENNA FDL-400 DURING TRANSMISSION.

NEVER FAIL TO WEAR GLOVES. CHECK IS EASILY MADE BY TWO PERSONS IF THE ANTENNA COUPLER IS INSTALLED AWAY FROM THE TRANSCIEVER UNIT. ESTABLISH GOOD COMMUNICATIONS BETWEEN THE TWO PERSONS USING A HANDHELD TRANSCIEVER OR OTHER.

INTERNAL ARTIFICIAL ANTENNA (Type OP05-36, Optional Supply)

To conduct two-tone signal test on 2191kHz, an internal artificial antenna kit is optionally available. If local regulation requires two-tone signal test with artificial antenna, install the artificial antenna in the antenna coupler referring to the instruction on pages APE-1 and -2.

Test Transmission

1. Press the [ALARM] and [ENT] key simultaneously. (Relay on the dummy load assy. is energized and dummy load is connected in lieu of the antenna.)
2. Frequency is set to 2191kHz and two-tone signal test starts.
3. Confirm that two-tone signal ceases after approx. 45 seconds and the equipment restores the settings in effect before the check began.

Chapter 2 MAINTENANCE

2.1 GENERAL

This radio is designed and constructed to provide years of trouble-free operations. However, no radio equipment can perform its intended functions without periodic checks and inspections.

The following table shows the items to be checked from time to time. (It is ideal to have a licensed radio technician check the transceiver annually.)

Check Item	Check Points/Methods	Remedy/Remarks
Power supply Power Cable Battery	<ol style="list-style-type: none">1. Check that the supply voltage is within the rated range.2. Check that there is no loose or corroded connection at power terminals.3. Check that the battery is fully charged.	<ol style="list-style-type: none">1. If the voltage is out of rated range, consult an electrician or call for service. Low voltage may cause erratic operation of the equipment.2. If the battery is discharged, recharge the battery.
Feeder (coax. cable), control cable	<ol style="list-style-type: none">1. Check that there is no damage to the cables, which may cause water to leak into them.	<ol style="list-style-type: none">1. If damaged, replace it.
P.C. Board connection	<ol style="list-style-type: none">1. Check that jumper cables between boards are connected firmly.	<ol style="list-style-type: none">1. Reinstall loose connector.
Air Vents	<ol style="list-style-type: none">1. Ensure that air vents are not obstructed.	<ol style="list-style-type: none">1. Remove any objects inhibiting air circulation.
Microphone	<ol style="list-style-type: none">1. Check that microphone connector is fastened tightly.	<ol style="list-style-type: none">1. Move plug connector in and out to check for good contact.

2.2 FUSE REPLACEMENT

To protect the transceiver from serious damage, two 30A fuses are provided in the snap-in fuse holders on the power cable. The fuse protects against over voltage/reverse polarity of the mains supply or

internal fault of the equipment. If the fuse has been blown, first find out the cause of the problem before replacing it.

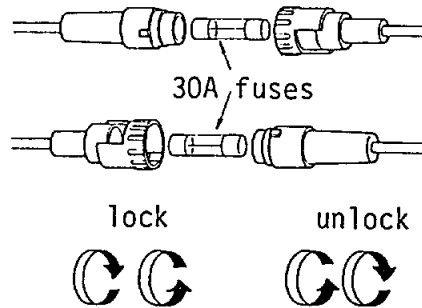


Fig. 2.1 Fuse Replacement

Do not use a fuse rated more than 30A, since it can cause more serious damage to the equipment.

2.3 CLEANING

The units must be kept clean and dry all the time. Wipe off dirt, dust and moisture with a soft dry cloth. For persistent dirt, use diluted detergent on a soft cloth. **DO NOT USE PLASTIC SOLVENT FOR**

CLEANING.

If the transceiver unit is not used for a long period, protect it with a dust cover.

Chapter 3 TROUBLESHOOTING

3.1 TROUBLE FINDING LIST

Various protection facilities are incorporated in this unit to minimize malfunctioning. However, if any unusual symptom is encountered during operation of the equipment, first check the connections of connectors and terminal boards. Find the symptom on the following list and perform the specified remedy. In some cases, the problem will be alleviated by rechecking the operating methods, for example, data entry sequence. Do not attempt

further check inside the unit. It is best to leave to a qualified technician. Careless handling or adjustment may cause serious damage to the equipment.

CAUTION: There are some HIGH TENSION points inside the Transceiver, Antenna Coupler and Antenna Feeder system. Be careful not to touch these points with bare hand.

Tabel 3-1 Trouble Finding List

Symptom	Possible Cause	Remedy
Unit does not work at all. (No frequency display nor light.)	<ol style="list-style-type: none"> 1. Switch at mains switch board is turned off. 2. Battery is flat or poor contact at terminals. 3. Rectifier (if installed) is faulty. 	<ol style="list-style-type: none"> 1. Turn on the mains switch. 2. Recharge battery and tighten terminal connections. 3. Check fuse on the rectifier.
Frequency displayed but no lamp lights.	<ol style="list-style-type: none"> 1. DIMMER switch is in OFF state. 	<ol style="list-style-type: none"> 1. Press [DIM] key.
Power is on but no sound.	<ol style="list-style-type: none"> 1. SP OFF switch is activated. 2. VOLUME control is set too low. 3. SQ is on. 	<ol style="list-style-type: none"> 1. Press the SP OFF switch. 2. Turn VOLUME control clockwise. 3. Press [SQ] if "SQ" is displayed.
Power is on but no sound.	<ol style="list-style-type: none"> 1. Wrong emission mode is used. (ex. receiving USB signal in H3E mode.) 2. Receiver is detuned. 	<ol style="list-style-type: none"> 1. Select the same emission mode as incoming signal. 2. Adjust frequency by dial after pressing [CLAR] key. In Free Frequency Receiving Mode, adjust by dial for fine tuning.
Can't store frequency into memory. (Receive only)	<ol style="list-style-type: none"> 1. Attempting to store into wrong channel number. 	<ol style="list-style-type: none"> 1. Store it into the proper channel number. <p>NOTE: You can't store transmit frequencies at will. They must be factory programmed.</p>

Tabel 3-1 Trouble Finding List

Symptom	Possible Cause	Remedy
Ant. Coupler won't tune to antenna.	<ol style="list-style-type: none"> 1. Antenna is disconnected or shorted to ground. 2. Antenna is out of tunable length. 3. Coupler ground is insufficient. 4. Toggle switch (S1) in the coupler is set to "MANUAL 2182 kHz" position. 5. Breaker has tripped. 6. Cable is loose or disconnected. 	<ol style="list-style-type: none"> 1. Check the antenna connections. 2. Antenna should be 6 to 15 meter long. 3. Check the coupler ground connections. 4. Set the switch to "AUTO" position. 5. Check main voltage and polarity, then replace breaker to the normal position. 6. Secure cable connection.
Two-tone alarm generator does not work.	<ol style="list-style-type: none"> 1. Only [SEND/STOP] key is pressed. 	<ol style="list-style-type: none"> 1. Press [ALM] key and [SEND/STOP] key simultaneously.

3.2 CHECK OF RELAY

The function of the relays selecting capacitors and coils are checked with the procedure below.

- 1) Open the shield cover inside the coupler. There you will see DIP switch S2.
- 2) Set No.2 segment switch of S2 to "ON" position.
- 3) Press "TUNE" switch S1 right below.
- 4) Then 20 LEDs (CR33 to CR52) will light one by one for 1 sec each as the relays are energized, and then they blink all at once when the test is over.

- 6) Ensure that all segment switches of DIP switch S2 are set to "OFF" position before you close the cover.

LEDs and corresponding relays are as follows.

CR33 - K3 CR38 - K8 CR43 - K14 CR48 - K19
 CR34 - K4 CR39 - K9 CR44 - K15 CR49 - K20
 CR35 - K5 CR40 - K10 CR45 - K16 CR50 - K21
 CR36 - K6 CR41 - K11 CR46 - K17 CR51 - K13
 CR37 - K7 CR42 - K12 CR47 - K18 CR52 - K22

NOTE: See "CHAPTER 4 PARTS LOCATION" for locations of each part.

- 5) Never fail to re-set No.2 segment switch of DIP S2 to "OFF" position, or you will be unable to transmit.

Chapter 4 PARTS LOCATION

4.1 TRANSCEIVER UNIT

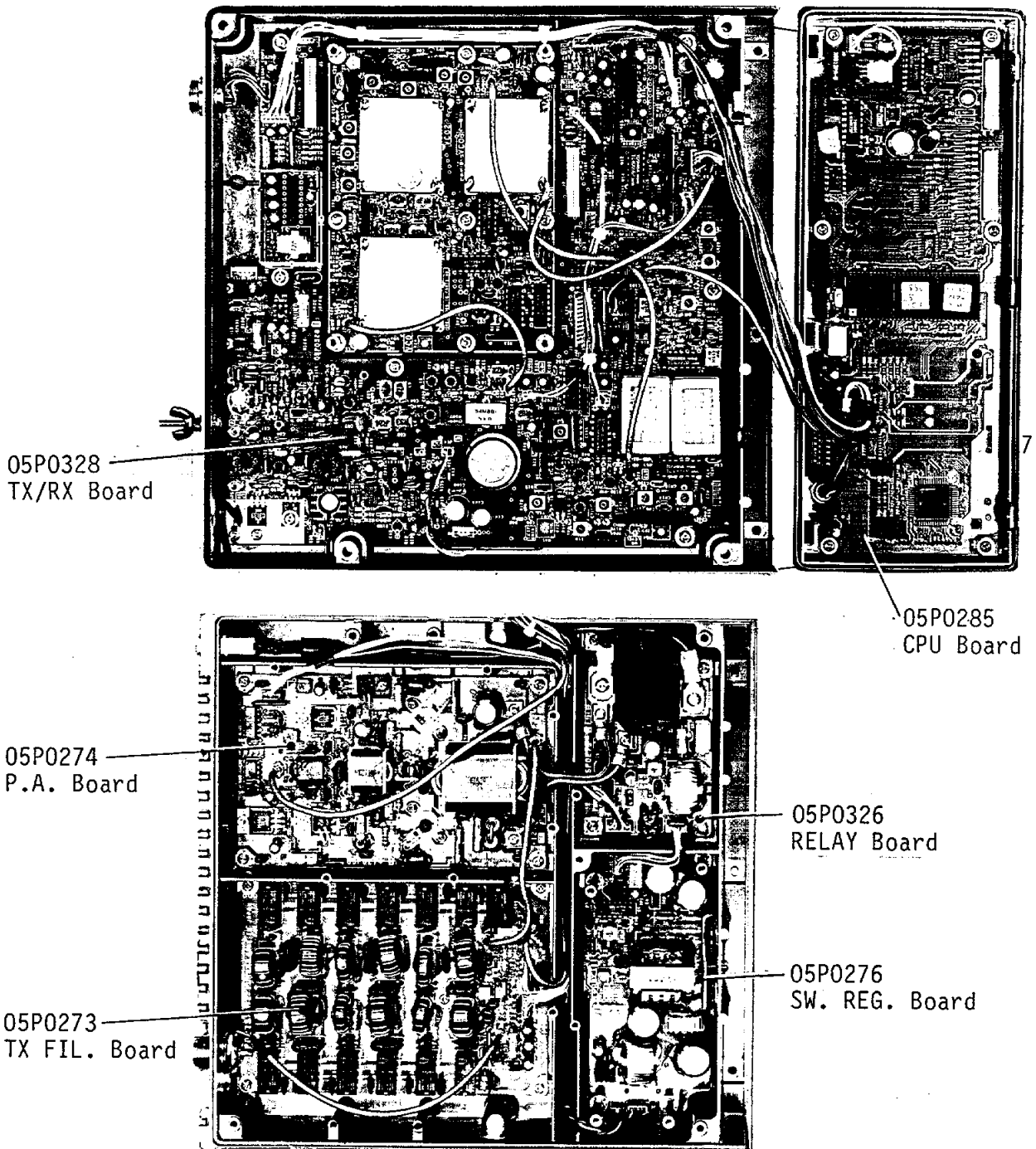


Fig. 4-1 Inside View of Transceiver Unit

4.2 ANTENNA COUPLER UNIT

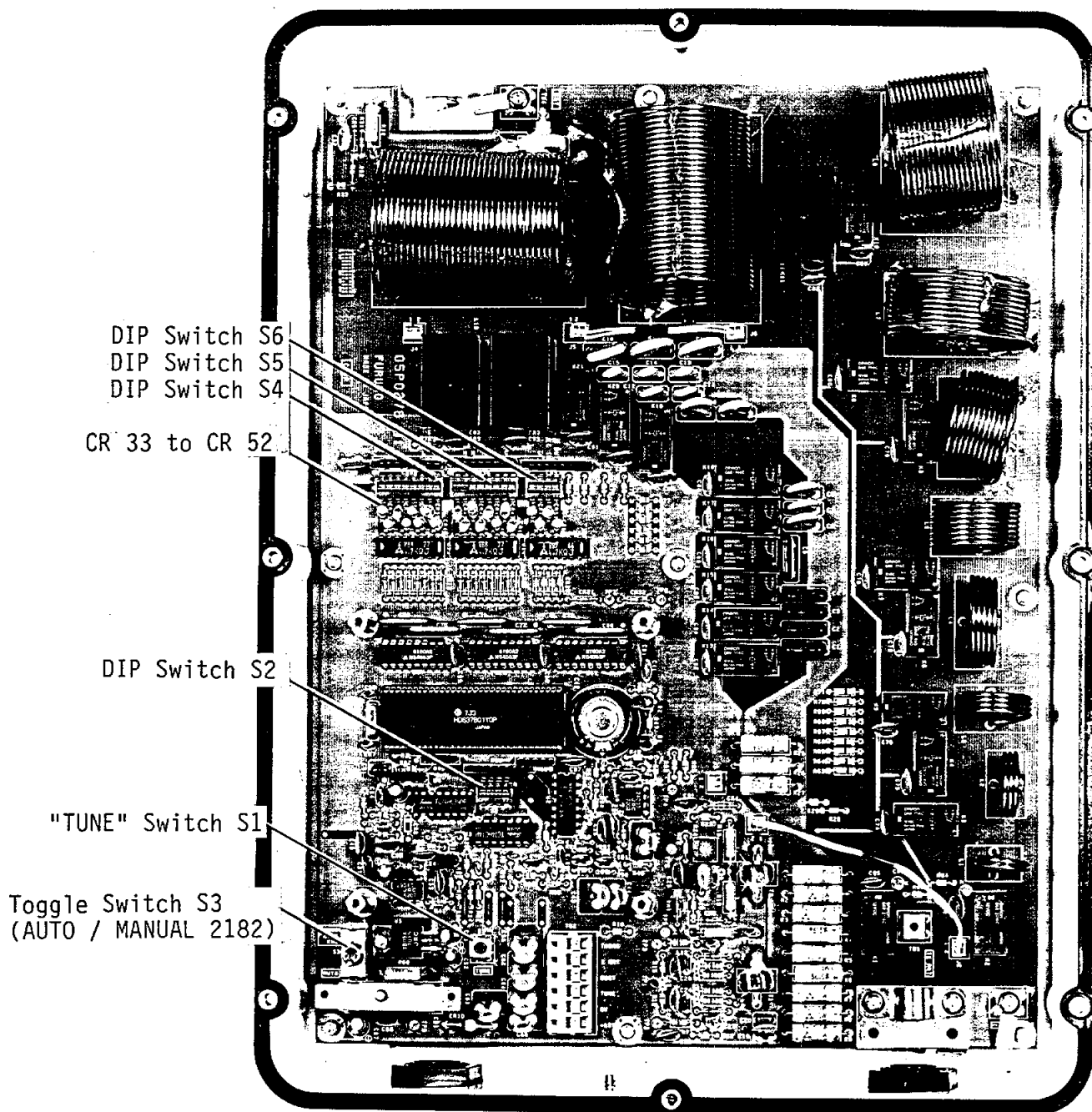


Fig. 4-2 Inside View of Antenna Coupler

Chapter 5 INSTALLATION

5.1 GENERAL NOTES ON INSTALLATION

No machine can perform to the utmost of its ability unless it is installed properly. On installation work, note the following precautions.

AVOID WATER SPLASH

The transceiver unit should be located on the bridge, in the cabin or other suitable place where it is readily accessible and reasonably protected from water splash. The Antenna Coupler can be installed outside the cabin; however, select a place where it is not continuously exposed to salt water spray. Salt water on the antenna insulator may cause unstable operation of the Coupler and may result in transmission loss.

CAUTION: Furuno will assume no responsibility for the damage caused by exposure to salt water spray.

AVOID SHOCK OR VIBRATION

This equipment is designed to withstand possible shocks and vibrations normally experienced onboard the vessel or on the vehicle. However, excessive and continued shock and vibration can shorten the life of equipment. Where necessary, appropriate shock absorption measures should be taken.

AVOID HOT ENVIRONMENT

It is recommended to keep the transceiver unit out of direct sunlight or at least shaded because of the heat that can build up inside the unit. It is also important to provide clearance behind and above the transceiver unit for sufficient air circulation.

AVOID ONBOARD NOISE

Though this radio is well shielded from onboard noise by using the aluminium diecast cabinet, it is recommended to install the transceiver unit away from pulse generating equipment, computer-controlled equipment or motor operated equipment, such as radar, echo sounder,

gyrocompass, loran, sat-nav, other electronic navigation equipment.

REQUIREMENT FOR POWER SUPPLY AND CABLE

Use the power cable of proper size conductors. This equipment draws a large amount of current (Peak 30A) from the battery. Use the battery having a capacity of 130AH or more. A small amount of corrosion at the connection to the power cable can markedly reduce transmission power. Use heavy wire (see table below) and keep the length as short as possible.

Table 5.1 Recommended Cable Specification

Cable length to 12VDC power supply	Conductor area (mm ²)	AWG #	British S.W. Gauge
10m	8mm ²	#8	#10
15m	12mm ²	#8	#10
20m	16mm ²	#5	#6

5.2 THE ANTENNA

The antenna plays a very important role in radio communications. Several points should be considered when selecting an antenna.

Requirement for Antenna

The antenna coupler will automatically tune on any frequency in the range 1.6 to 23 MHz to a wire or a whip antenna having a length of 6 to 15 meters. Though a longer antenna is preferable when the radio is operated only on low frequencies, it is recommended to use this size of antenna to ensure stable automatic tuning on all bands.

The antenna should be erected as high as possible, well clear of or away from any object which may affect its performance, such as back stays, metallic masts, derricks, etc.

Insulators should be of the highest quality to prevent leakage in wet condition. Stays, metallic masts, etc. should be either effectively grounded or insulated.

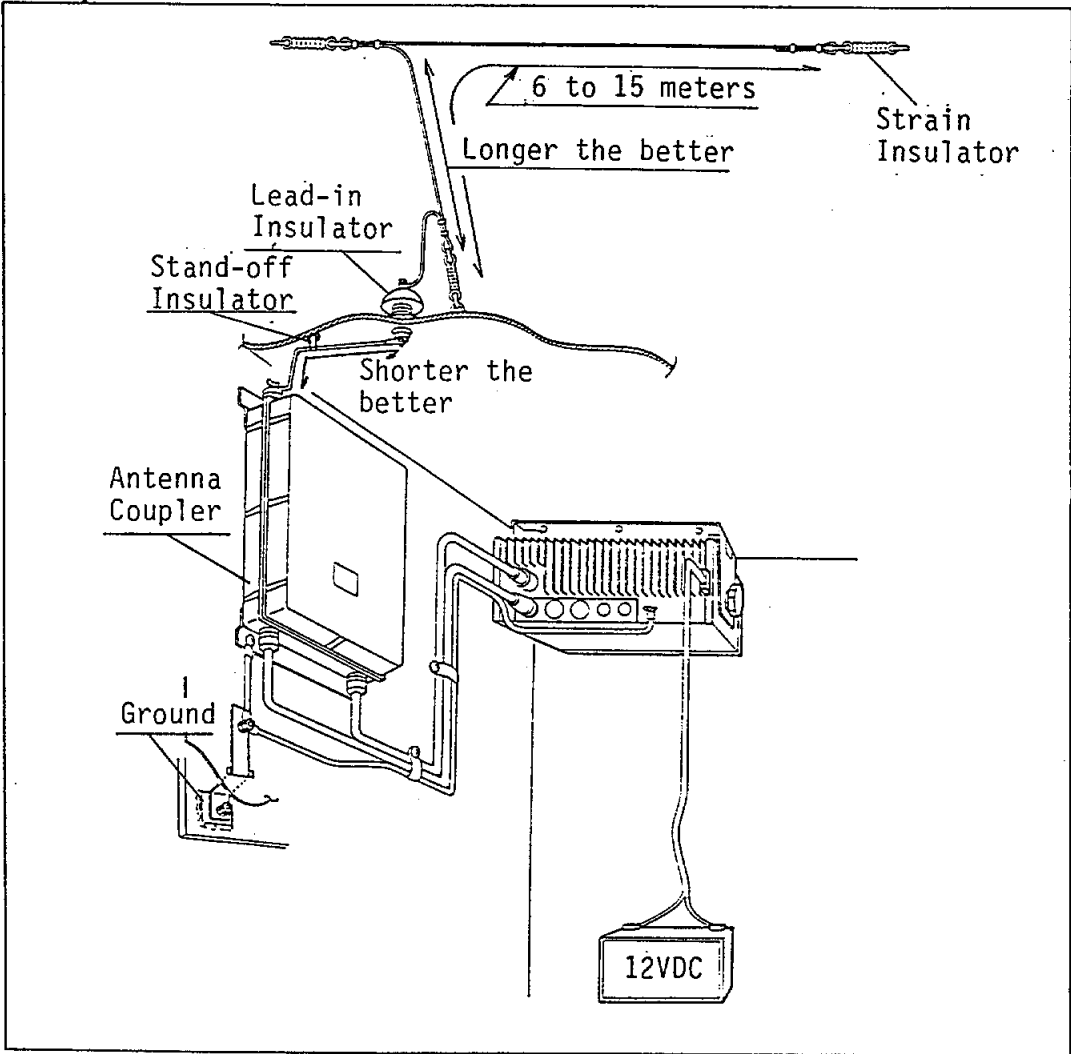
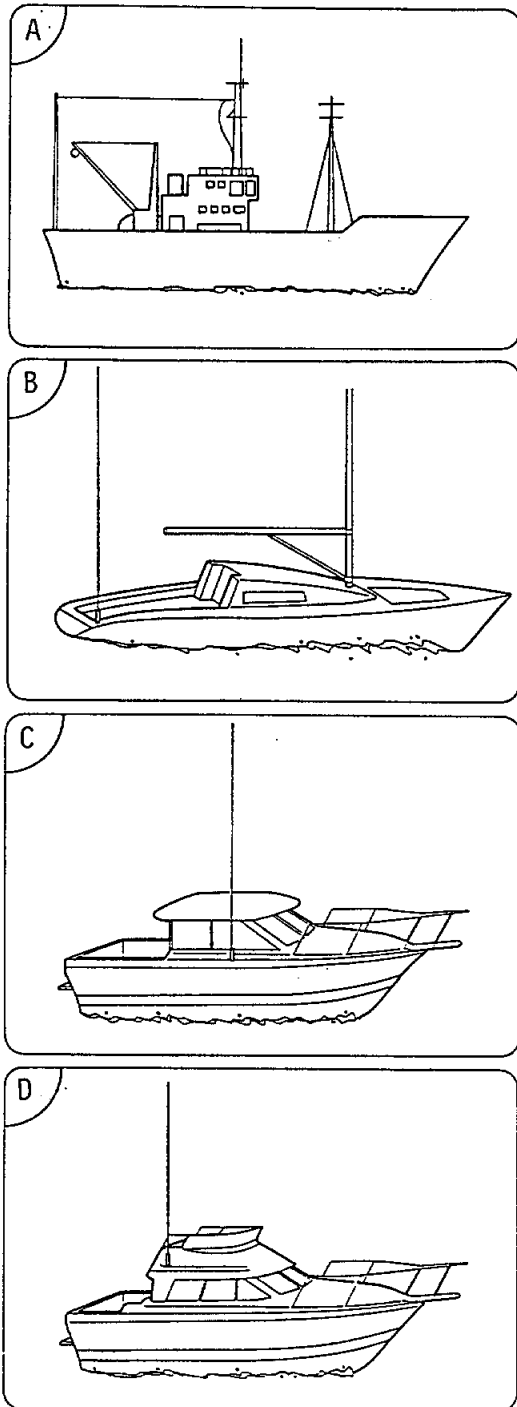


Fig. 5.1 Typical Installation

General Idea for Selecting Antenna



[SHIP STATION]

Fig. 5.2 (A) shows an example of shipboard installation using a horizontal wire antenna. The length of the horizontal part should be between 6 and 12 meters. And the length of the vertical part (feeder) should be no less than 4m; the longer the better for effective transmission.

For sailboats and power boats, a whip antenna is preferable since it does not require much space.

For installation on a sailboat, the mounting location must be chosen carefully so as not to disturb deck fixtures. Keep the antenna clear of the spinnaker, jib, and of course the boom. Especially leave clear of the back stay. The taffrail is a good location in the event of dismasting, since the antenna won't be carried away. The best location, however, is atop the mast; the higher the better. It is always a good idea to keep a spare antenna onboard in the event of dismasting.

On power boats, since there is no mast or deck fixture to worry about, selection of a mounting location is much easier. A whip antenna can be installed almost anywhere, again the higher the better. If your boat has flybridge, install it there. And if it does not, install it atop the cabin.

Fig. 5.2

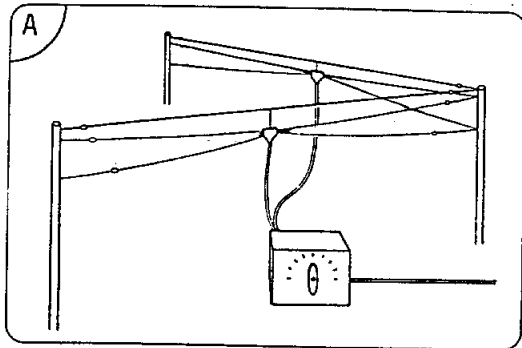


Fig. 5.3

[FIXED STATION]

If the unit is to be operated as fixed station, and if you do not need a multiple of frequencies, then you can use a doublet antenna. (In this case, the antenna coupler is not necessary.) This antenna is simple to extend and very effective, but note that a plurality of antennas may not be practical if you convert for multifrequency operation in future.

5.3 THE GROUND

The RF ground is an important factor for satisfactory operation of the radio. The overall efficiency of the radio can be related almost directly on one-to-one basis to the efficiency of the grounding system. It is of the utmost importance to ground the antenna coupler unit. Keep in mind that without a good ground an SSB radio cannot work satisfactorily. For the AT-1500, 2m of 3.5mm² cable is

supplied as a ground wire. Do not use a wire longer than this: it is the maximum length of the grounding wire to ensure good grounding. To extend the length, use a copper strap.

NOTE: If the antenna current is very low (refer to para.1.8), suspect the poor grounding.

For Metallic Hulled Boats

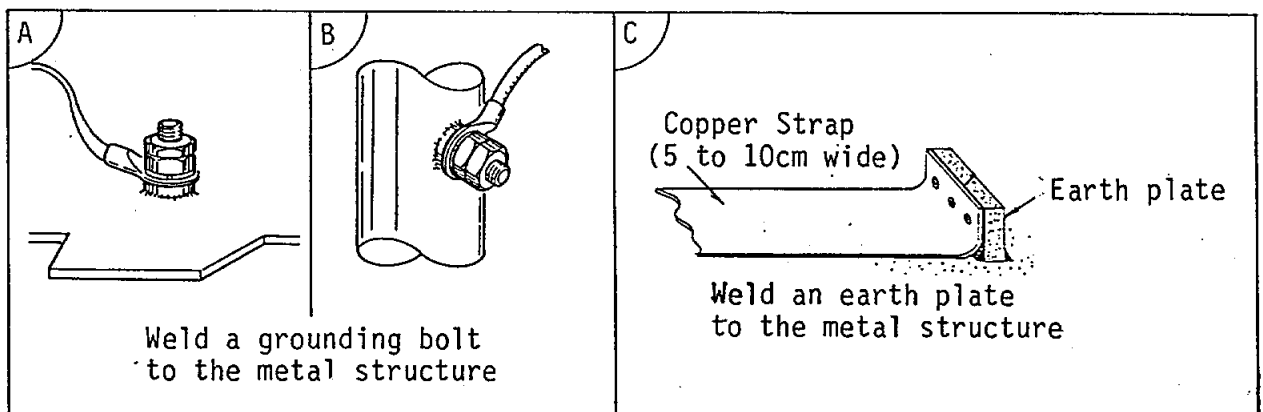


Fig. 5-4 Recommended Ground for Steel-hulled Boat

For Non-metallic Hulled Boats

When good RF ground is not available, it is recommended to run more than 20cm wide copper

plate from the outside of the boat to the ground terminal of the antenna coupler. See Fig. 5-5A.

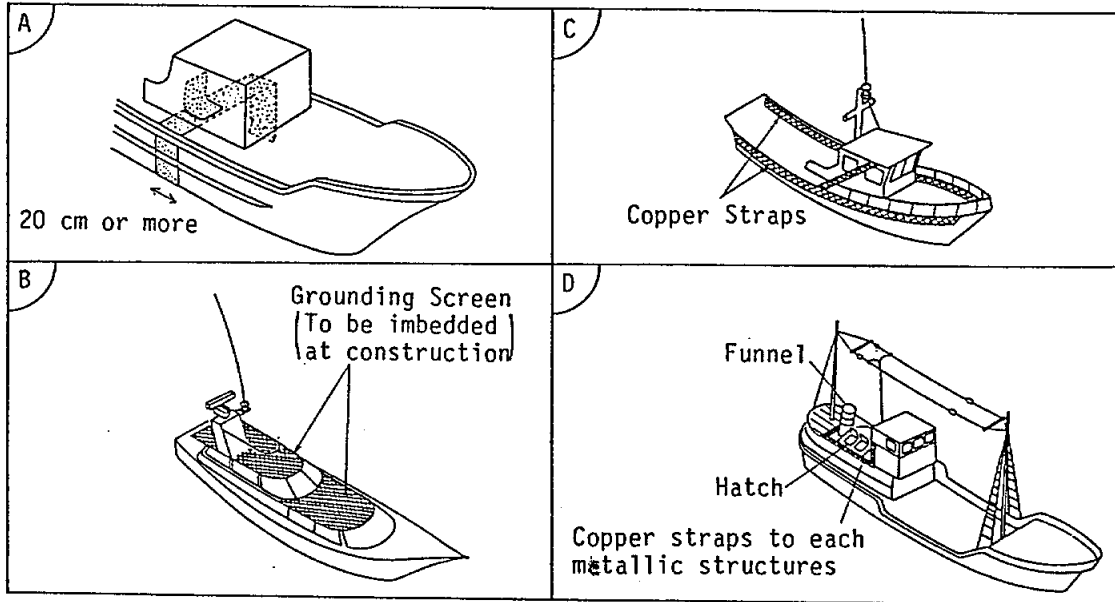


Fig. 5-5 Recommended Ground for Non-metallic-hulled Boat

If there is no copper ground plate from the outside, then secure more than 3 square meters of copper foil or copper mesh, or connect metal structures with a 5cm wide copper strap. Copper strap will work quite well but never use ordinary wire; good ground can not be ensured. The structures listed below, when connected radially by copper straps,

create an effective ground below the waterline.

- Lead keel
- Metal fuel tank
- Metal water tank
- Hydraulic steering system
- Engine block
- Rigging
- Hand rails
- Metal oil-catch tank

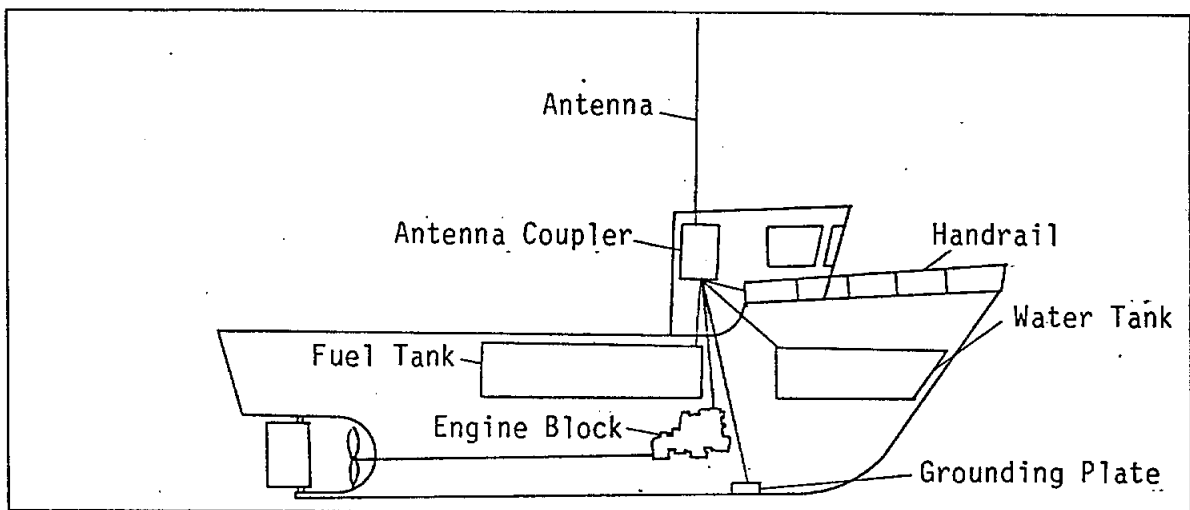


Fig. 5-6 Radial Grounding Using copper Straps

5.4 ANTENNA COUPLER INSTALLATION

The waterproof construction of the AT-1500 Antenna Coupler permits indoor or outdoor installation. It should be installed within 50 meters from the transceiver unit, as near as possible to the electrical ground. The Antenna Coupler is fixed horizontally or vertically with eight bolts (M6) and nuts, woodscrews, or U-bolts (option). When deciding the mounting place, the following points should be taken into account.

- 1) Select a place close to the antenna base.
- 2) Select a place where the efficient ground is easily taken.
- 3) Select a place where the antenna terminal is away from metallic structures or stays.
- 4) Select a place where water will not penetrate inside the coupler.
- 5) Select a place where the coupler is not exposed to direct water spray.
- 6) Select a place where it is easy to maintain, but avoid the place where it may interfere with crew or passengers.

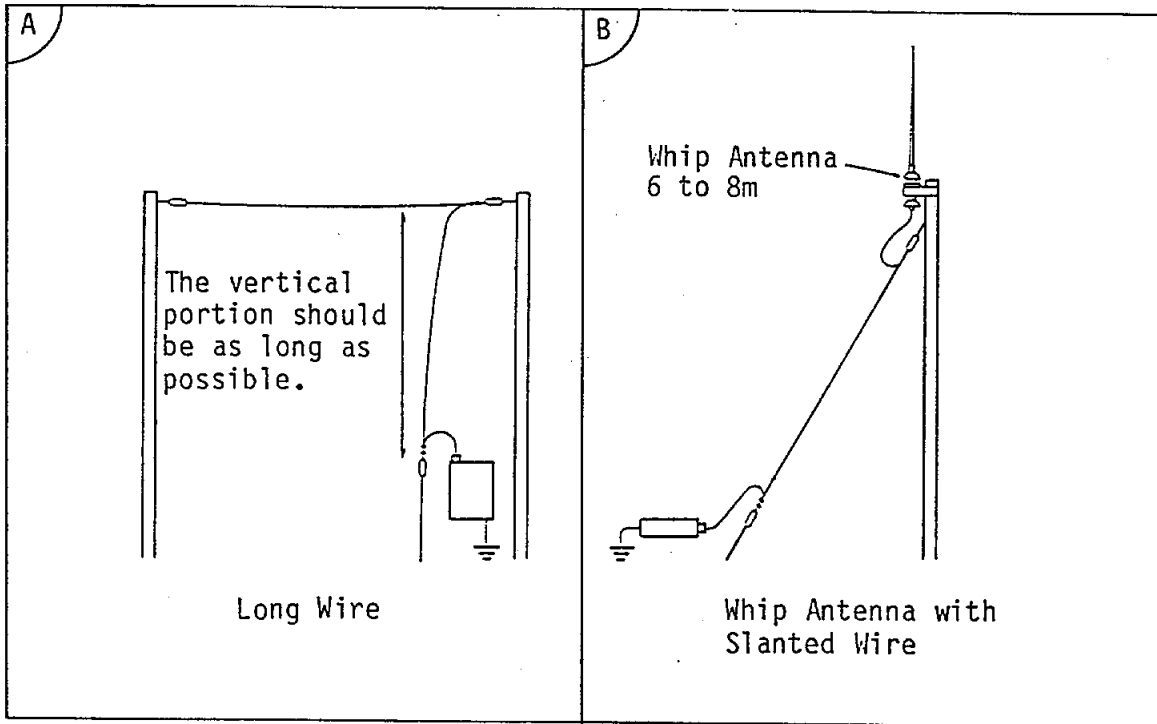


Fig. 5-7 Typical Installation of Antenna and Antenna Coupler

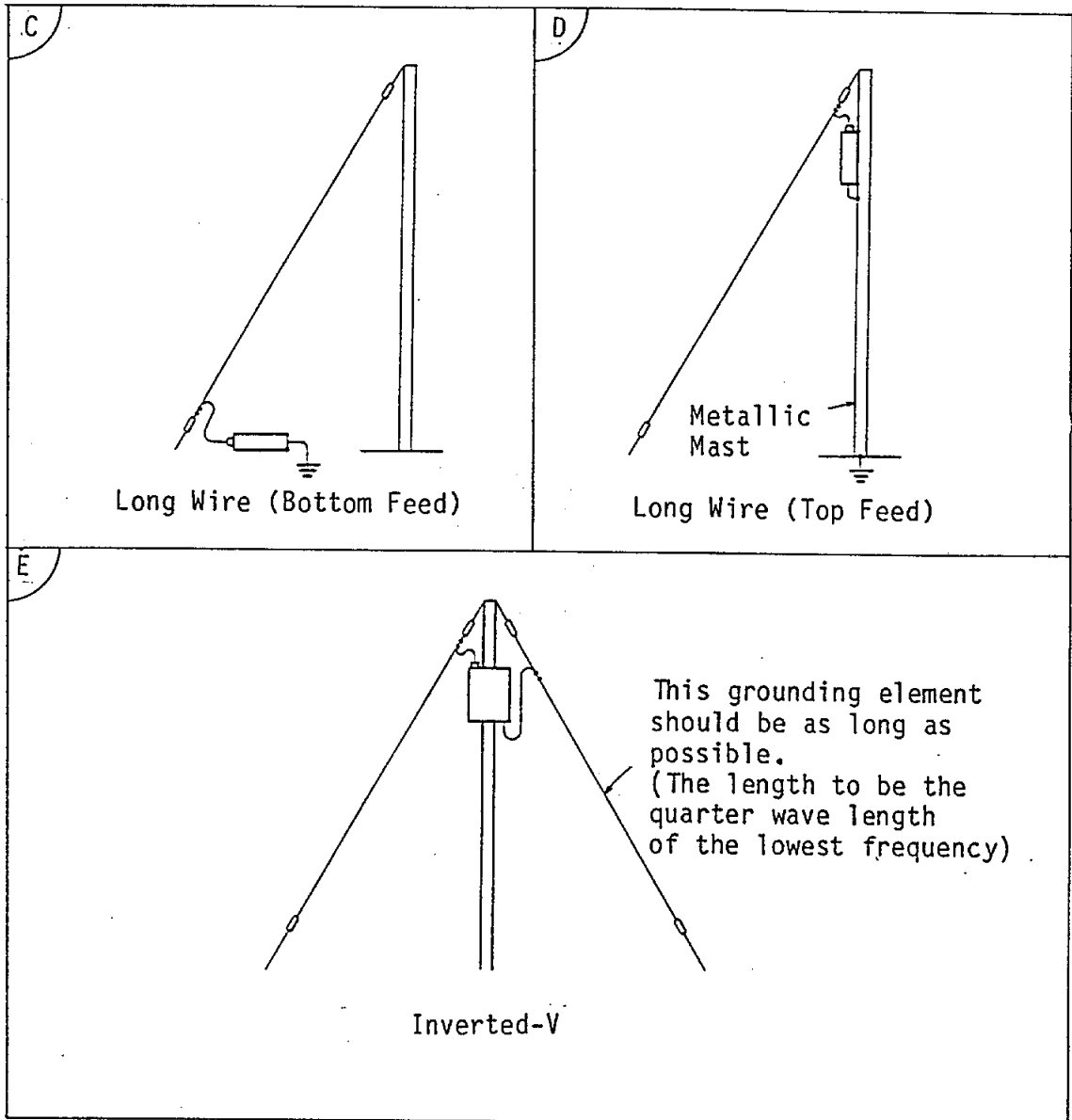


Fig. 5-8 Typical Installation of Antenna and Antenna Coupler

Mounting the Antenna Coupler

This coupler can be installed either on the floor, on the bulkhead, on the ceiling or to the mast.

It can be fixed with tapping screws to thick boards or walls, with nuts and bolts to the thin boards and with U-bolts, supplied as option, to masts. But never install the coupler where you can not easily open the top cover for service.

You have to preset the coupler for 2182 kHz after all the antenna, ground, and other cables are installed. When closing the cover, fit the gasket properly and tighten each bolt to the same amount of torque. If the bolt is not tightened properly, water may leak inside the coupler.

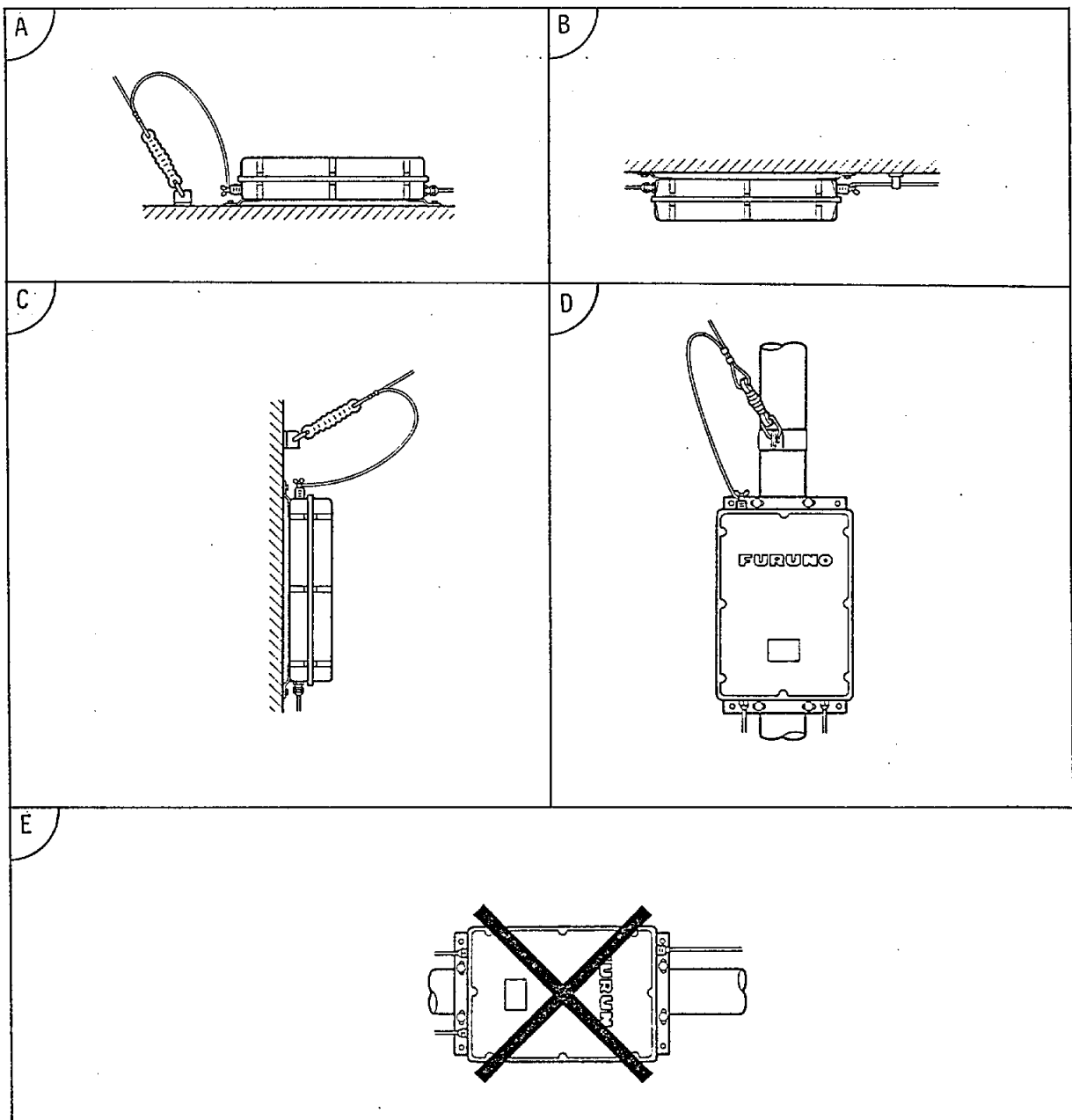


Fig. 5-9 Mounting the Antenna Coupler

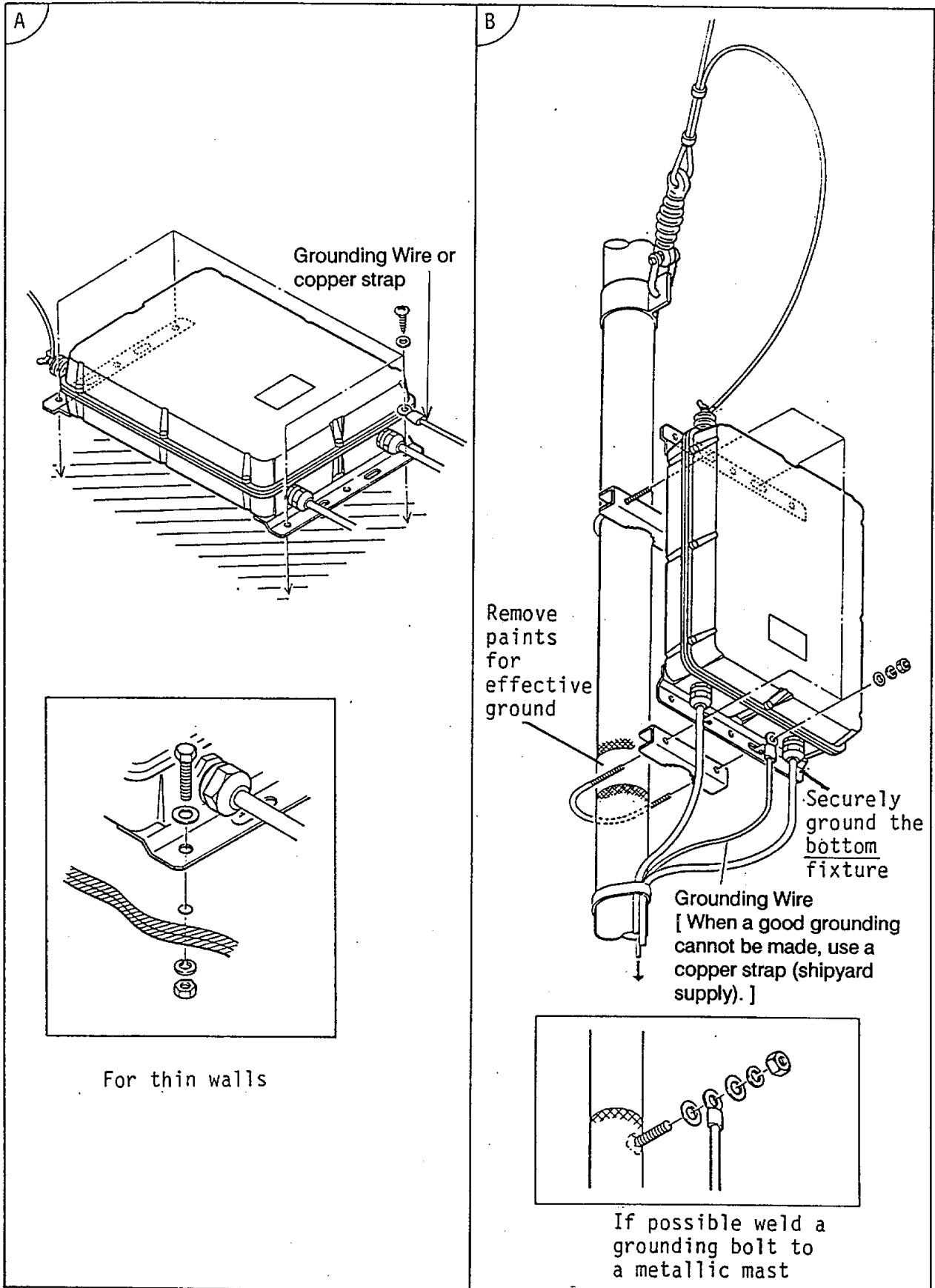


Fig. 5-10 Installing the Antenna Coupler

Anti-moisture Measure

When the coupler is installed outdoors, ventilation must be provided to allow trapped moisture to escape. Two drain holes are provided, one at the rear and the other at the bottom, and either should

be opened according to coupler installation method. If the coupler is installed horizontally; remove screw A and if installed vertically, remove screw B. This should be done before fixing the unit.

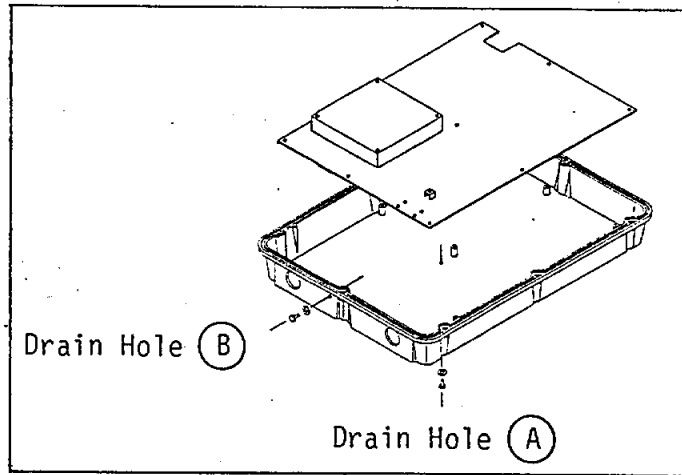


Fig. 5-11 Drain Hole

Connection of Antenna Wire to the Coupler

The antenna is connected to the antenna terminal of the Antenna Coupler. The insulator must be relieved from mechanical stress by using a short flexible wire between the insulator and a support. See Fig. 5-13.

When the Antenna Coupler is installed in the cabin on the boat, keep the length of the feeder as short as possible. A lead-in insulator should be used to pass the bulkhead, and it should be able to withstand high voltage. See Fig. 5-14.

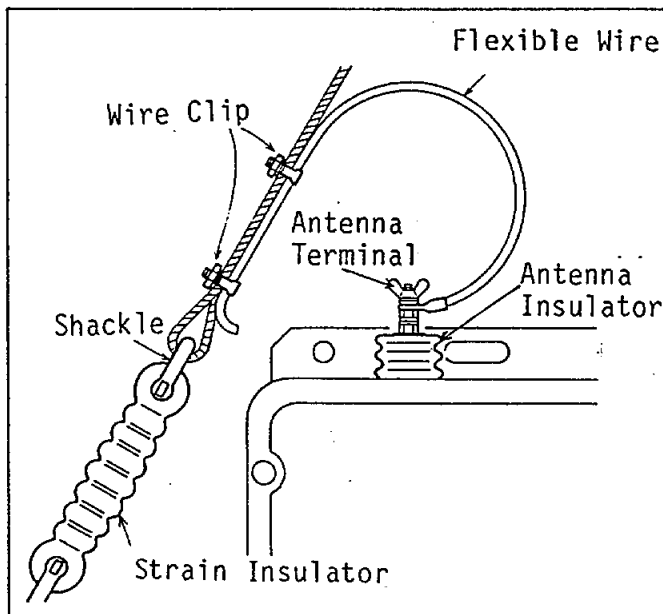


Fig. 5-12 connection of Antenna Terminal

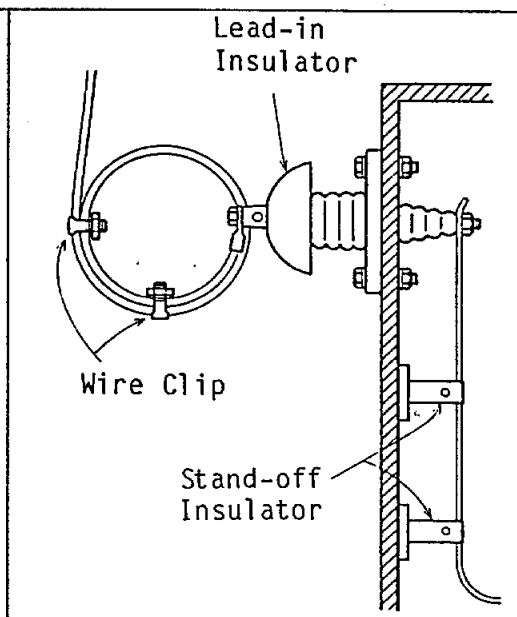


Fig. 5-13 Antenna Feed-thru Using A Lead-in insulator

5.5 MOUNTING TRANSCEIVER

The hanger bracket supplied with the FS-1500 Series allows mounting overhead, on a tabletop, or on the bulkhead. Make sure the selected location is strong enough to carry the unit under the conditions of

continued vibration and shock normally encountered on the vehicle or boat. Where necessary, reinforce the mounting location by lining block or doubling plate.

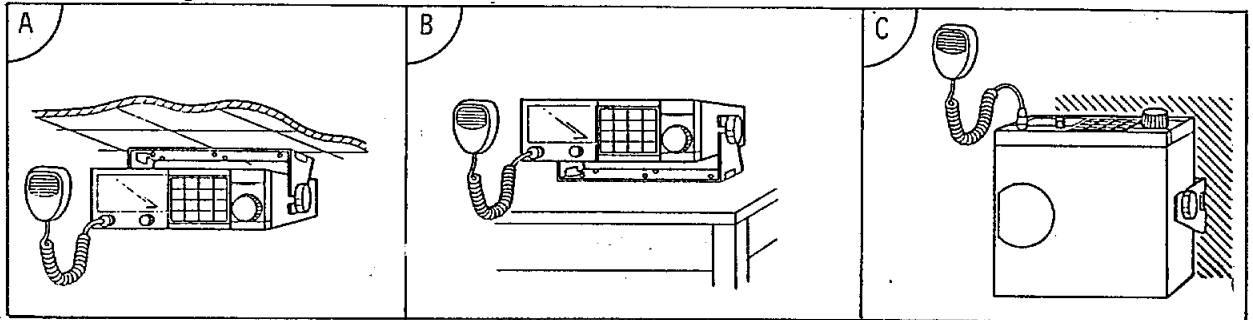


Fig. 5-14 Mounting Transceiver

Mounting Procedure

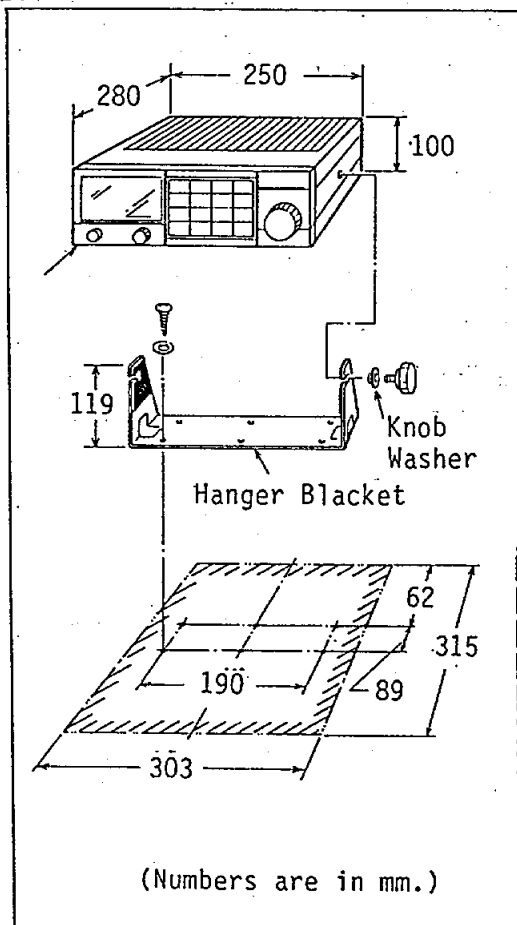


Fig. 5-15 Installing Transceiver

- 1) Drill six pilot holes for the hanger bracket.
- 2) Fix the hanger with the self-tapping screws supplied.
For thin walls, use bolts and nuts instead of the tapping screws.
- 3) Mount the transceiver unit on the hanger and tighten the knob screws at an adequate viewing angle.

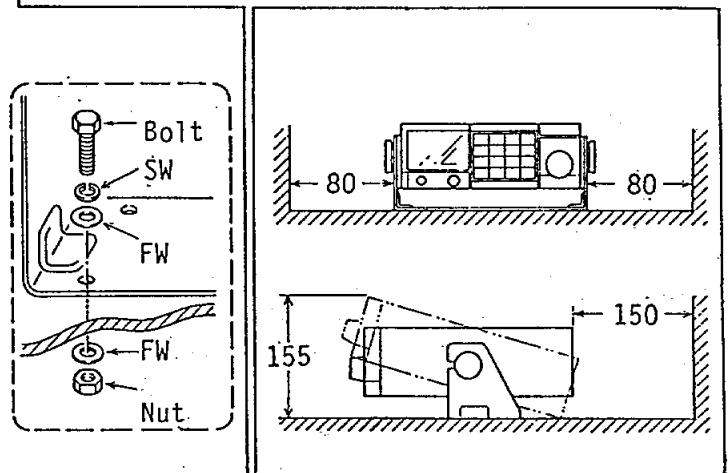


Fig. 5-16 Service Clearance

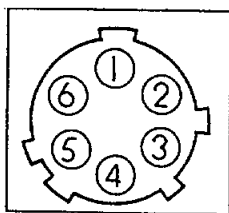
5.6 CABLE CONNECTION

Refer to the page 5.15 and wiring diagram on page S-1.

Description of Connectors

On the front panel of the transceiver, you can see a connector jack at the left lower side. This is for microphone connection. Each pin acts as follows.

The numbers are read from the solder side of the connector plug.



1. 0V Connected to the ground.
2. PTT Gets the transceiver ready to transmit.
3. MIC (+) A path for microphone
4. MIC (-) Connected to the ground.
5. PHONE Received audio frequency output for handset.
6. +15V Not used

Fig. 5-17 Pin Layout of the Microphone Connector Plug

Fig. 5.19 is the rear view of the transceiver. You can see eight terminals (connectors). The roles of each terminal are as follows. The pin numbers shown

here are also read from the solder side of the connector plug.

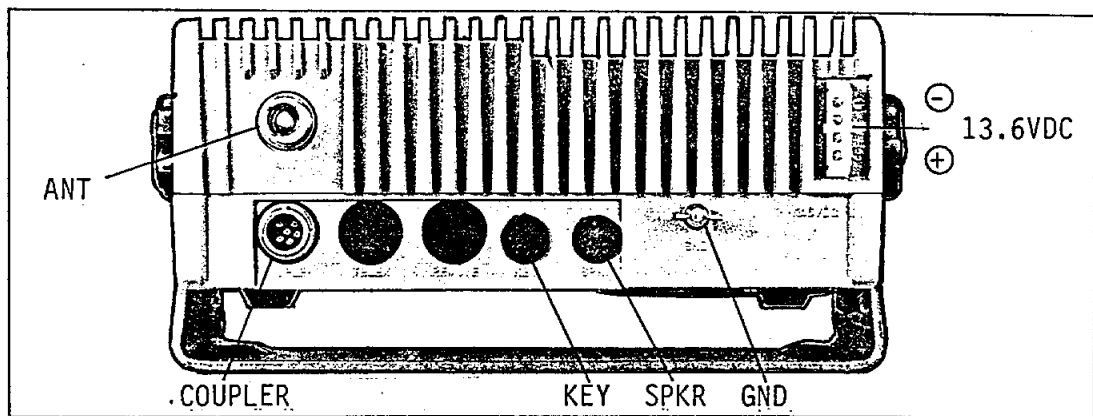


Fig. 5-18 Rear View

ANT is for antenna cable.

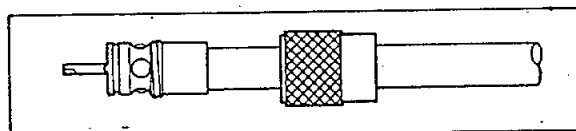
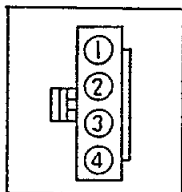


Fig. 5-19 Coaxial Cable

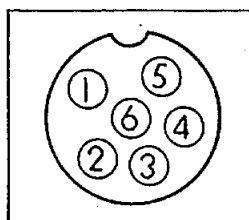
13.6 VDC for power supply



- 1. RED (+)
- 2. RED (+)
- 3. BLK (-)
- 4. BLK (-)

Fig. 5.20

COUPLER is for antenna coupler.



- | | |
|--|---|
| <ul style="list-style-type: none"> 1. RED + 15V 2. BLK 0V 3. ORG TUNE 4. YLW BUSY 5. GRN ANT 6. BLU THRU | <ul style="list-style-type: none"> + 15V is supply for Antenna Coupler. Return line of + 15V. Signal to start tuning. Signal to tell it is in tuning sequence. Transfers antenna current to transceiver. Signal to shortcut the coupler for reception. (Shortcut" can be selected only on 1.6 to 3.9 MHz) |
|--|---|

Fig. 5.21

NOTE: While using a resonant antenna like doublet antenna, and Antenna coupler is no use, then turn DIP S17 No.6 (on the CPU Board, see page 4-1) to OFF position.

SKPR is for external speaker

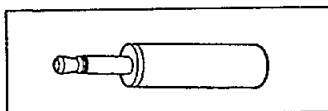


Fig. 5-22 Pin Jack

GND is for grounding.

5.7 WIRING

A control cable and 50 ohm coaxial cable are used to connect the transceiver unit with the antenna coupler unit. 10m control cables are supplied as standard, however longer cables are optionally supplied. Not only the supplied cable but any other cable that satisfies the specifications (See page APA-1) may be used.

NOTE

- 1) To reduce the possibility of picking up noise, locate the cable as far as possible away from the following cables.
 - a) Separate 450 mm or more from the cables of pulse generating equipment, i.e., radar, echo sounder, SCR controlled equipment.
 - b) Separate 50 mm or more from other general power cables, e.g., cables of electric lights.

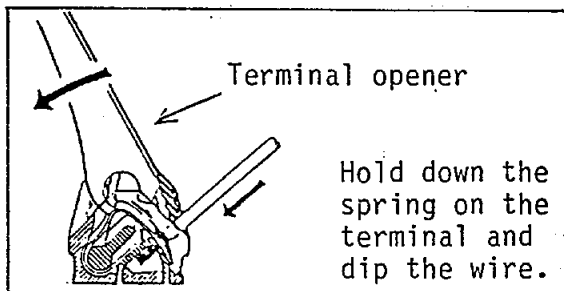


Fig. 5-23 Opening the Terminal

- 2) The length of the cable should be determined considering future maintenance ease.
- 3) Connection of wire to the clipper terminal in the antenna coupler should be made using the tool provided inside the antenna coupler.

5.8 POST INSTALLATION CHECK

After wiring is completed, proceed (in order) to the following checks. These checks will ascertain whether the equipment is installed correctly or not and will prevent unexpected accidents. This includes the checks for Antenna Coupler.

Visual Check

Before turning on the radiotelephone, visually check the unit as follows.

Antenna

- 1) Are fixing bolts, wire clips, shackles securely tightened?
- 2) Are the antenna and/or coax. lead-in waterproof?
- 3) Is antenna wire securely connected to coupler?
- 4) Be sure that mechanical stress from the antenna is not applied to the terminal of antenna coupler.

Antenna Coupler Unit

- 1) Is the unit perfectly grounded using a copper wire?
- 2) Is the ground connection short enough?
- 3) Are all wirings made correctly?

Transceiver Unit

- 1) Is the unit grounded with 3.5 sq grounding wire?
- 2) Is the ground connection short enough?
- 3) Are all wirings made correctly?

Rectifier

- 1) Is the rated voltage specified on the rectifier unit coincident with the mains supply?

Supply Voltage Check

Make sure the power switch of the control unit is off and check that the voltage of the transceiver unit is within $13.6 \text{ VDC} \pm 15\%$.

Performance Check

If no problem was found in the checks above, turn on the transceiver unit and check performance.

NOTE: Antenna tuning may be difficult if the antenna length is too long or too short. Adjust the length, if necessary.

- a) Check by self-test
Check the antenna coupler unit by the self-test described in 3.2 SELF-TEST "RELAY Test."

- b) Receiver check
Set the transceiver as follows and check that all the frequency bands are received clearly.

Speaker ----- ON
Squelch ----- OFF

If the receiving signal is too weak or noisy, carry out "Visual Check". Double check the antenna and ground. If there is no trouble proceed to the next step.

- c) Transmitter check
Check if "TUNE ok" mark is displayed and automatic tuning is executed when the [TUNE] key or the press-to-talk switch is pressed on each band.

It is designed not to take more than 15 sec. for automatic tuning. So if you find a frequency which takes more than 15 sec. then check the length of the antenna. It might be too long or too short. "good length" may be found if the antenna is shortened or lengthened by about 2 meters.

5.9 MANUAL 2182 kHz SETTING

Regulation require that 2182 kHz be tunable manually if automatic tuning facility is damaged. The setup to enable manual tuning is made with DIP switches in the antenna coupler. (See "Chapter 4 PARTS LOCATION" for the location of components.)

- 1) Turn on the power of the transceiver unit.
- 2) Open the cover of the Antenna Coupler Unit.
- 3) Set toggle switch S3 to "AUTO" position.
- 4) Tune the coupler by hitting the [2182] key on the transceiver unit.
The relays should chatter for a short while and then become silent.
- 5) Record the on/off status of the light emitting diodes (LEDs) CR33 thru CR52.
- 6) Set toggle switch S3 to "MANUAL (2182)" position.
- 7) Set the DIP switches S4, S5 and S6 so that the LEDs are lit or extinguished in the same pattern as recorded in step 5) above.

DIP Switch S4 DIP Switch S5 DIP Switch S6

No. 1 - CR 33	No. 1 - CR 41	No. 1 - CR 49
No. 2 - CR 34	No. 2 - CR 42	No. 2 - CR 50
No. 3 - CR 35	No. 3 - CR 43	No. 3 - CR 51
No. 4 - CR 36	No. 4 - CR 44	No. 4 - CR 52
No. 5 - CR 37	No. 5 - CR 45	
No. 6 - CR 38	No. 6 - CR 46	
No. 7 - CR 39	No. 7 - CR 47	
No. 8 - CR 40	No. 8 - CR 48	

- 9) Set S3 to "AUTO" position, and then replace the cover of the Antenna Coupler Unit.

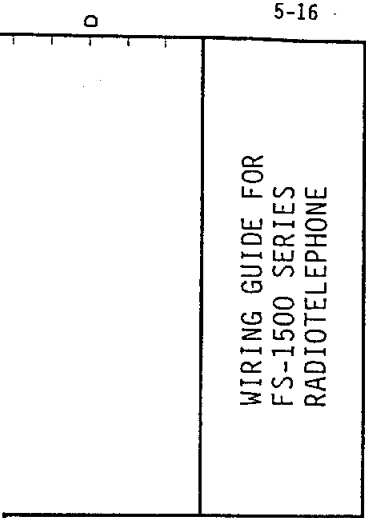
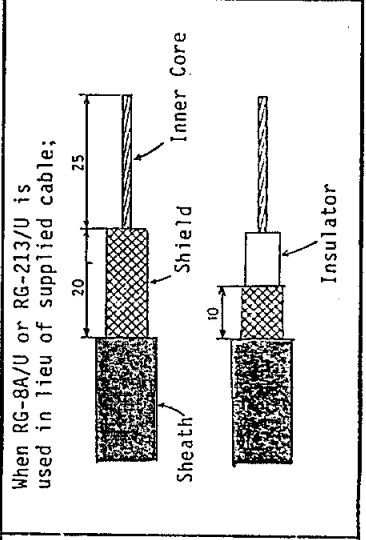
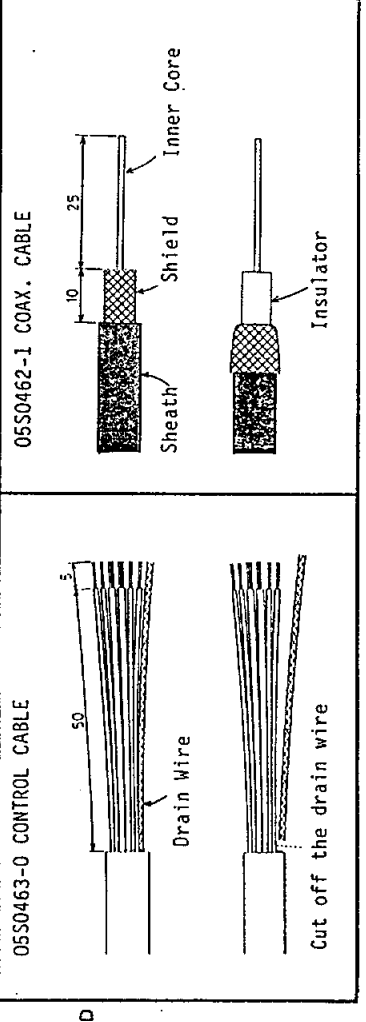
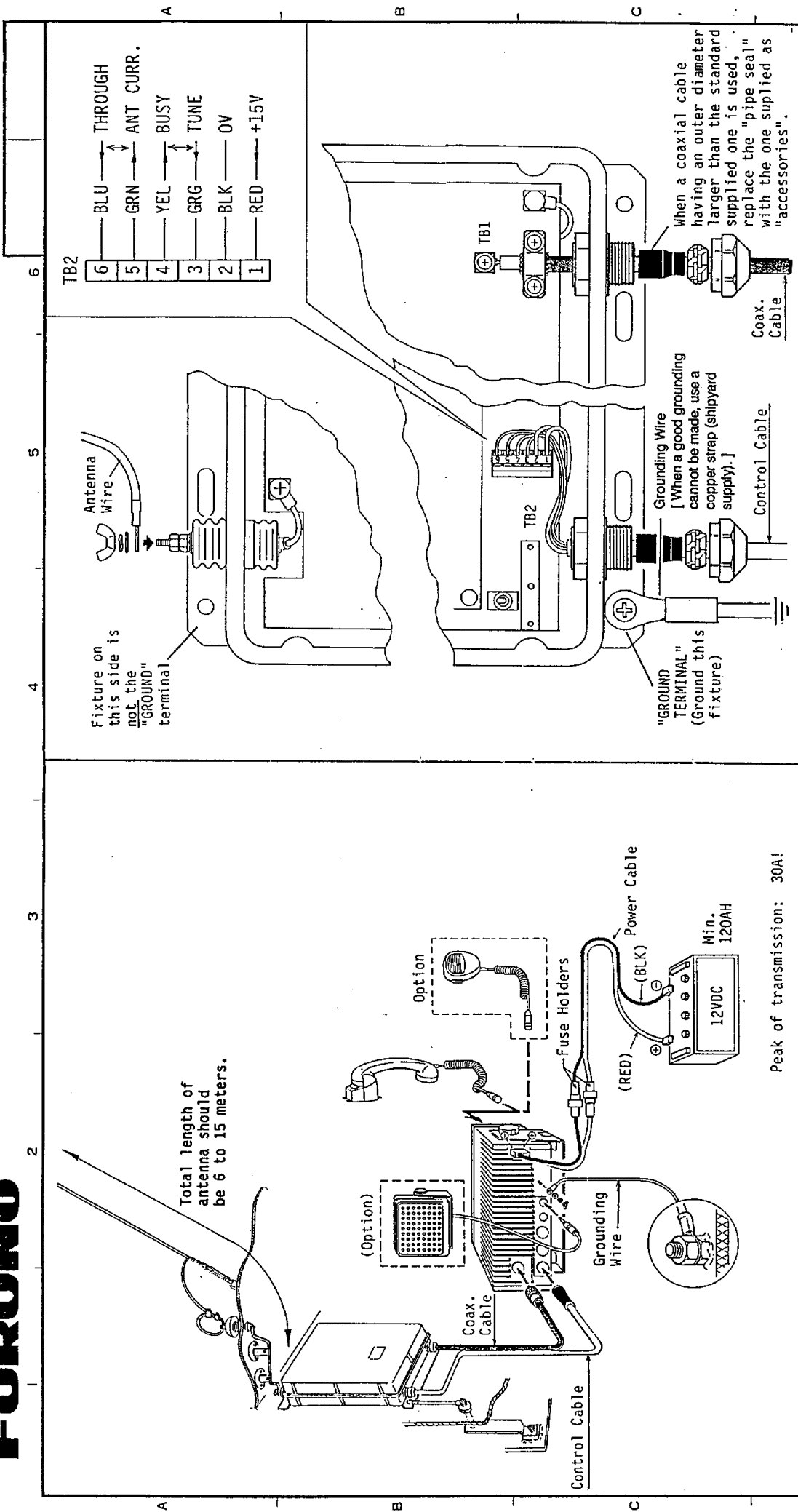
5.10 DC-DC Converter Input Setting

The DC-DC converter type PC-220 is required to operate the transceiver from mains supply of 24 or 32 VDC. The converter is factory set for 24 VDC. To use it for 32 VDC, cut off the jumper on resistor R24 (27 ohms, 5W) in the fan drive line.

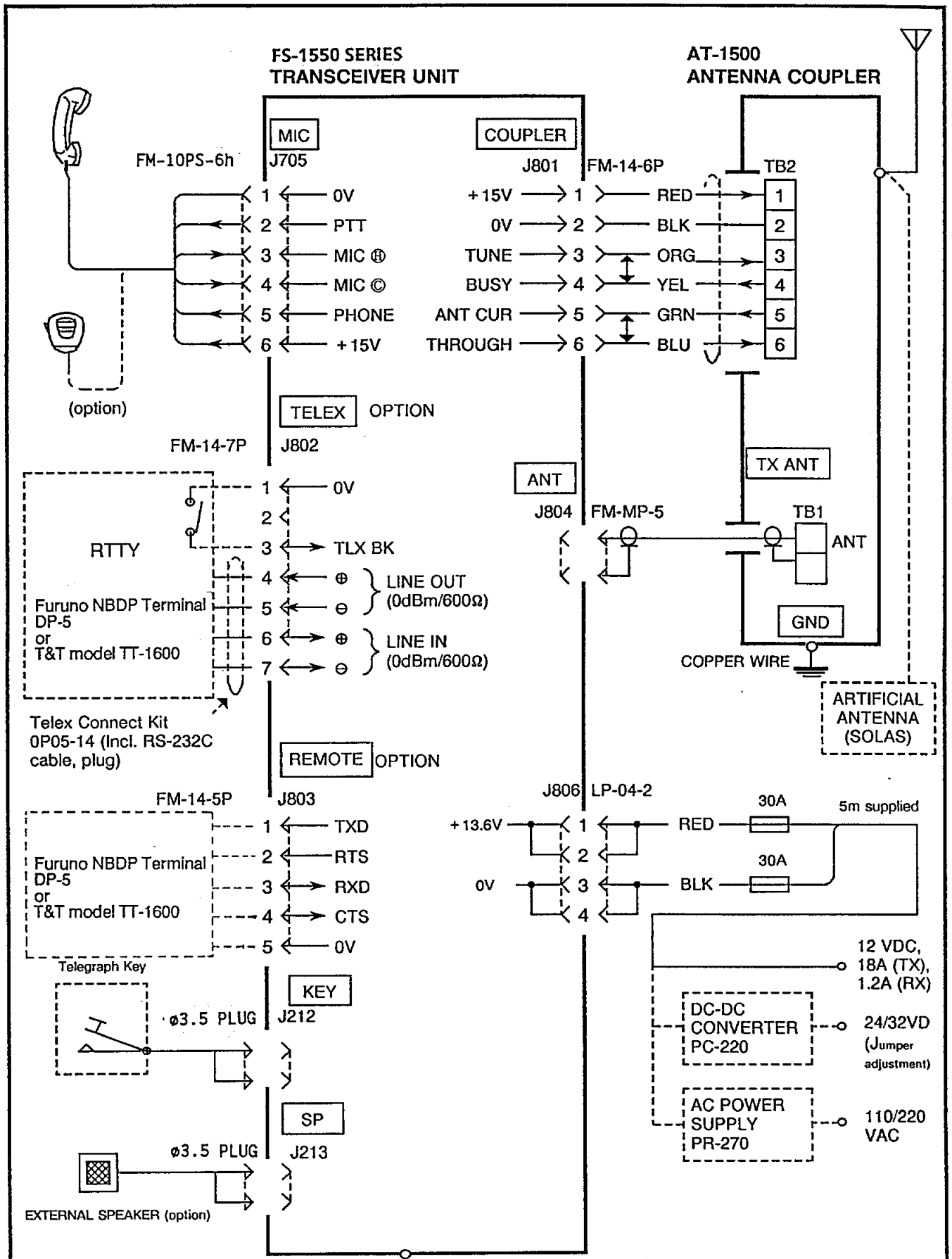
5.11 CHANGE OF SYSTEM SETTING

CH NO	FUNCTION	SETTING	DEFAULT
90	Scan dwell time	1 to 9 sec.	5
91	Scan threthold level	1 to 9 Smeter level	3
92	-	-	-
93	Scan enable/disable	1:disable 0:enable	0
94	Clarifier variable range	1:±100Hz 0:±150Hz	0

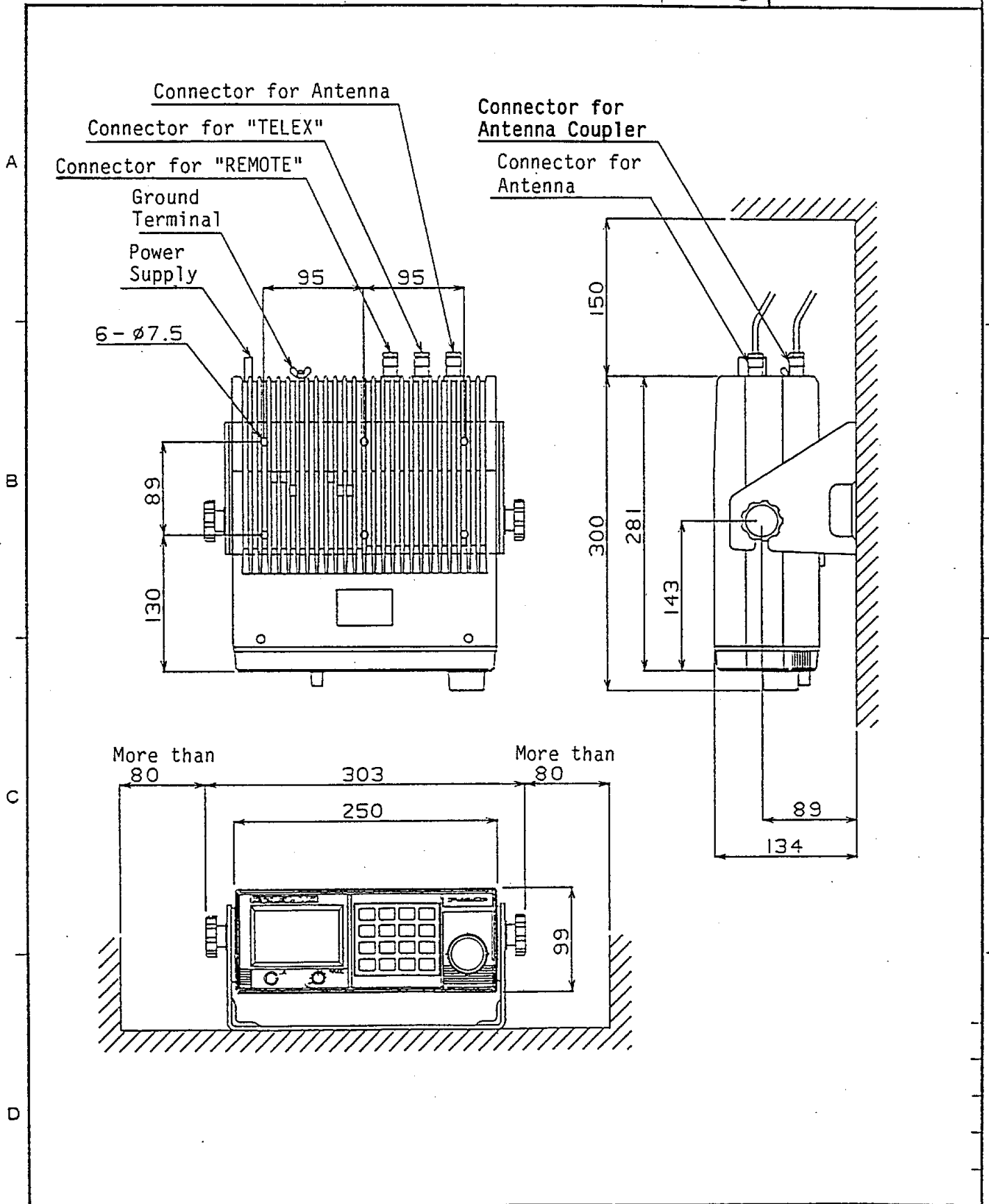
- 1) Press [RCL] and then [(your desired channel)].
- 2) Turn the dial to set the desired setting number.
- 3) Press [SEND/STOP] to escape from this function.



WIRING GUIDE FOR
FS-1500 SERIES
RADIOTELEPHONE

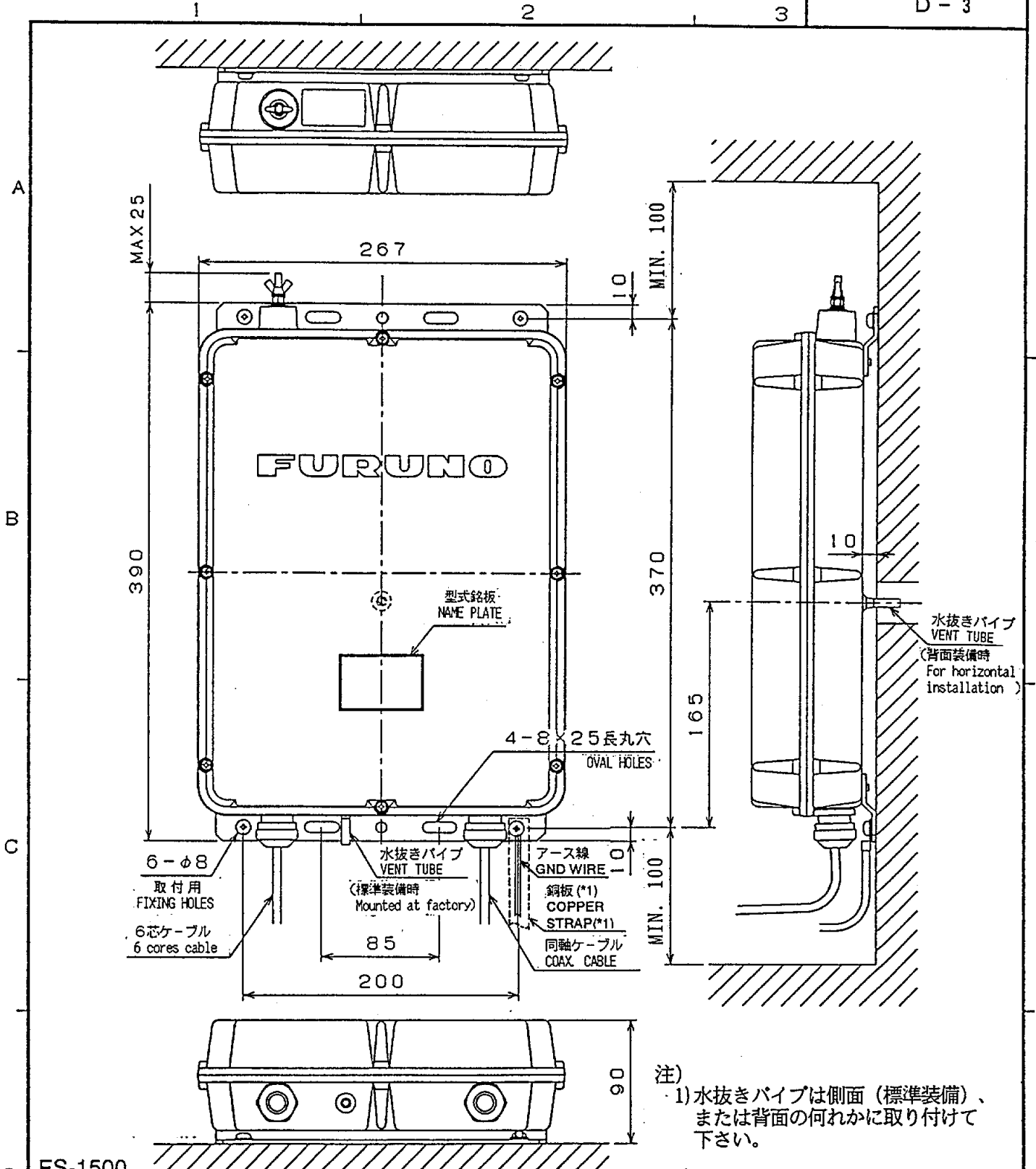


APPROVED	TITLE FS-1550 SERIES SSB RADIOTELEPHONE INTERCONNECTION DIAGRAM
CHECKED	
DRAWN	DWG. NO.



FS-1550

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
承認 APPROVED	DEC. 25. '87 T. NAKANO	三角法 THIRD ANGLE PROJECTION		名称 TITLE	FS-1550 TRANSCEIVER UNIT
検図 CHECKED	Dec. 25. '87 M. IKEDA	尺度 SCALE	1/5	図番 DWG.NO.	
製図 DRAWN	Dec. 25. '87 S. NISHI	重量 WEIGHT	5.8 kg	図番 DWG.NO.	C5510-G01-A



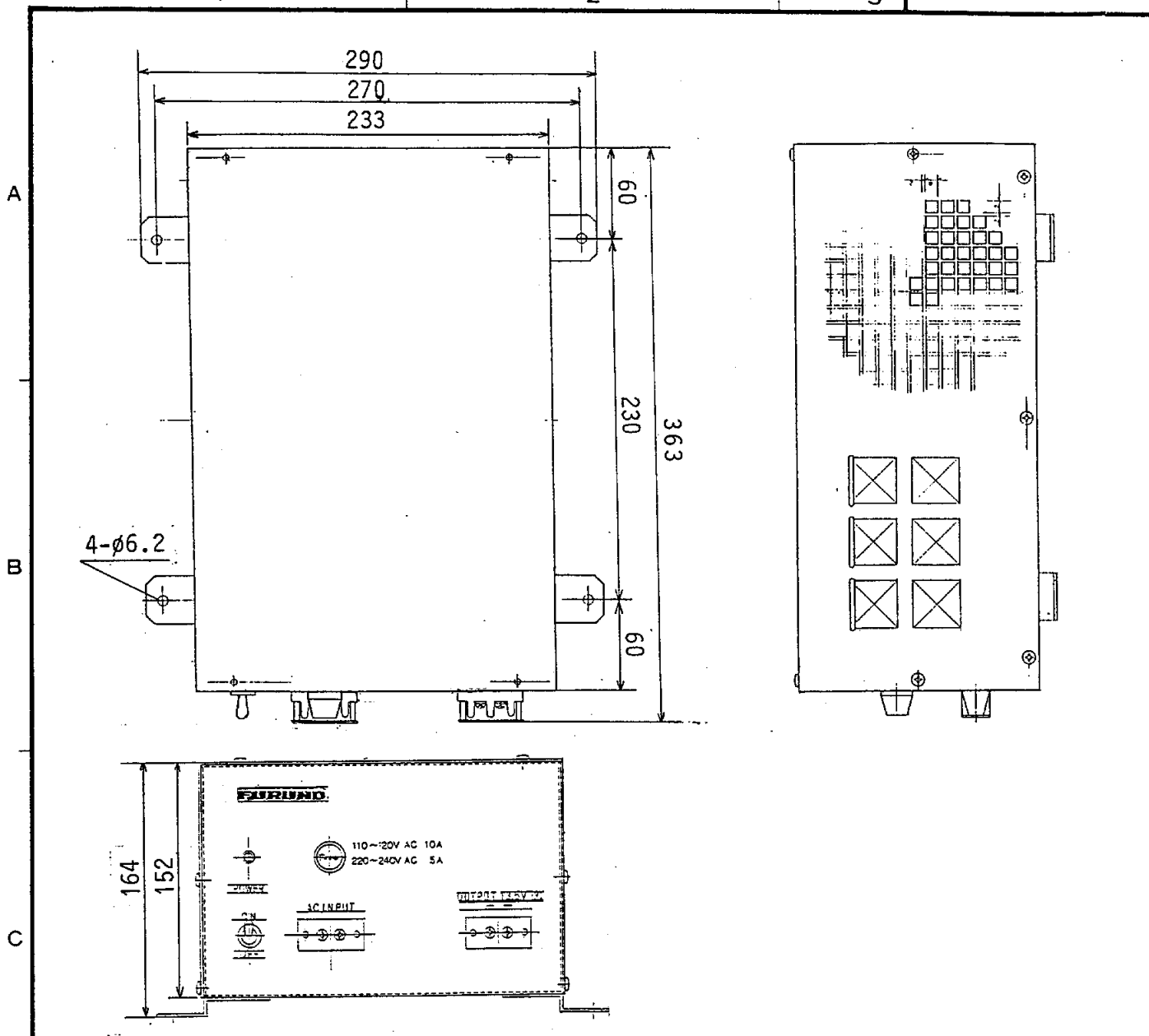
注) 1) 水抜きパイプは側面 (標準装備)、または背面の何れかに取り付けて下さい。

1) Vent tube should be mounted on either bottom (factory mount) or rear of the coupler, depending on installation methods.

*1: ノイズが多い船は銅板を使用すること
Use copper strap for ships having lots of noise.

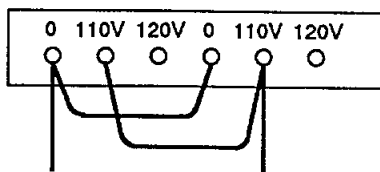
- FS-1500
- FS-1501
- FS-1502
- FS-1550
- FS-1552

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
承認 APPROVED	NOV. 22 '91 T. NAKANO	三角法 THIRD ANGLE PROJECTION			
検図 CHECKED	NOV 20 '91 M. IKEDA	名称 TITLE	アンテナカップラ外寸図 AT-1500/AT-1502		
製図 DRAWN	SEP. 3 '91 J. ISHIHARA	R 度 SCALE	1 / 4	ANTENNA COUPLER	
	重量 WEIGHT	2.9 kg	図番 DWG.NO.	C5485-010-F	

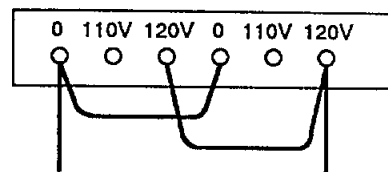


内部結線
Internal Connection

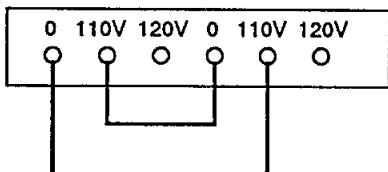
110VAC



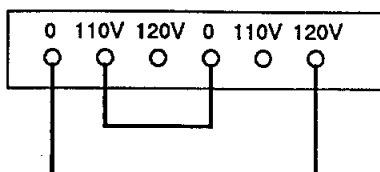
120VAC



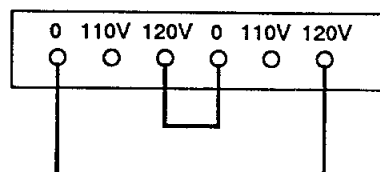
220VAC



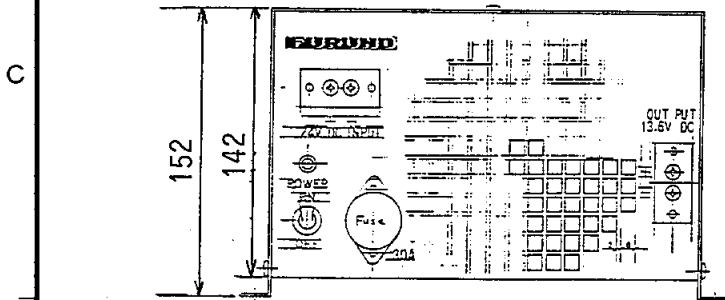
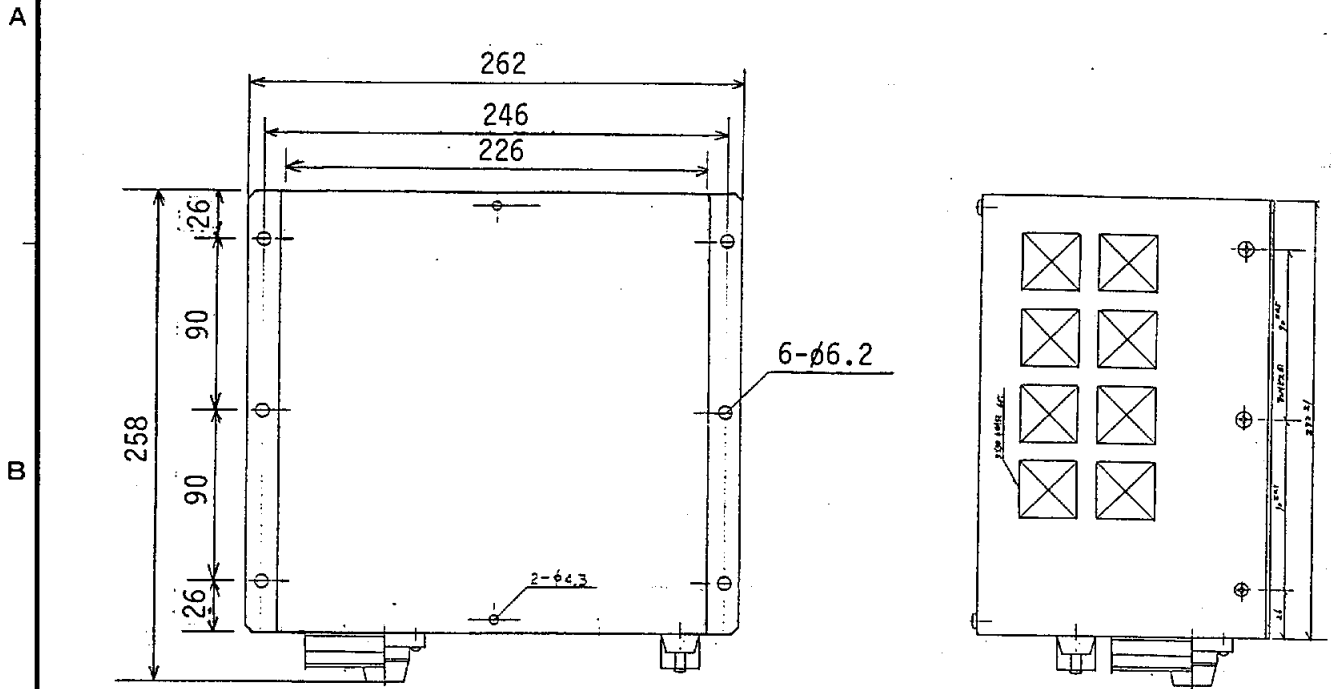
230VAC



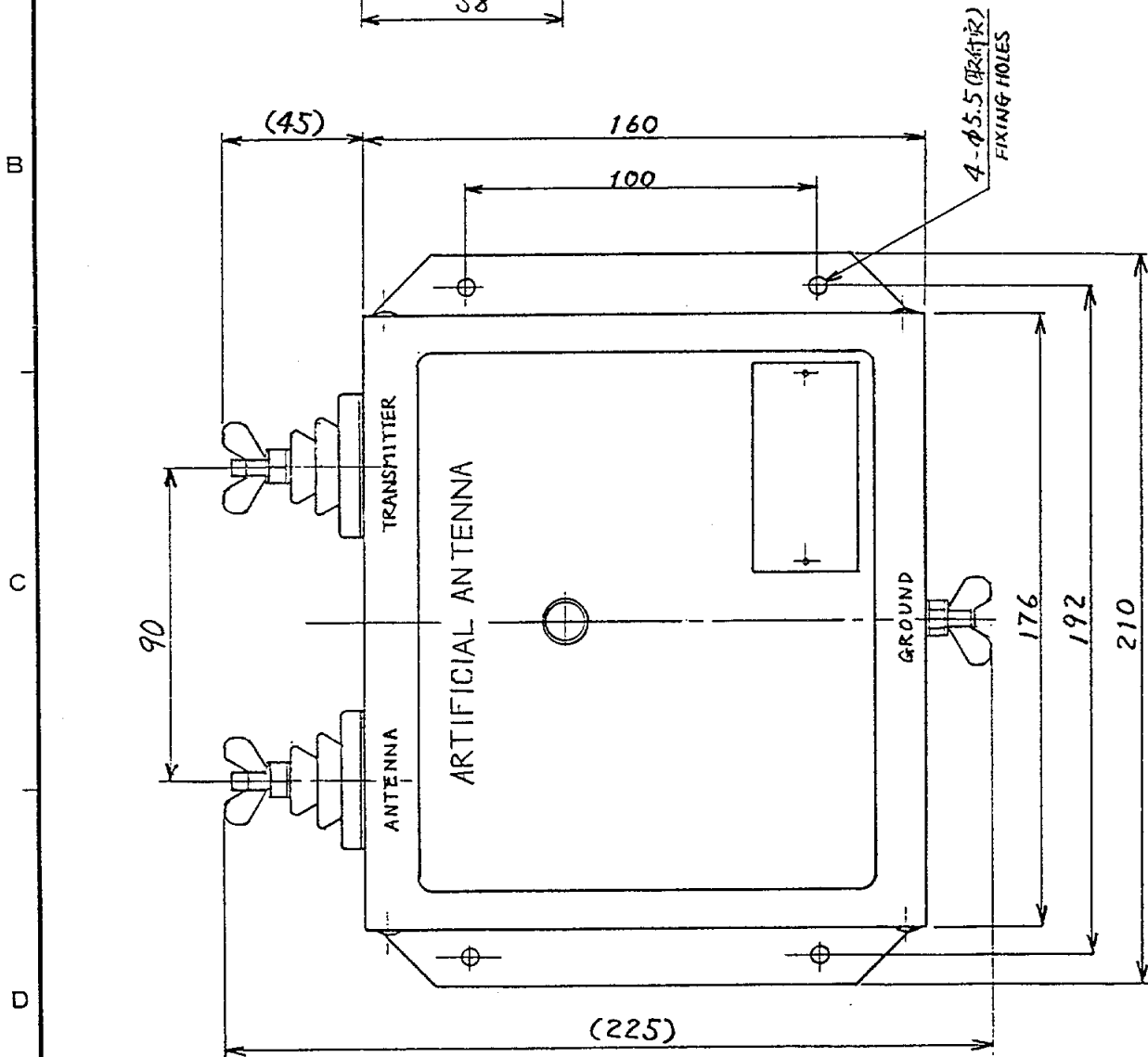
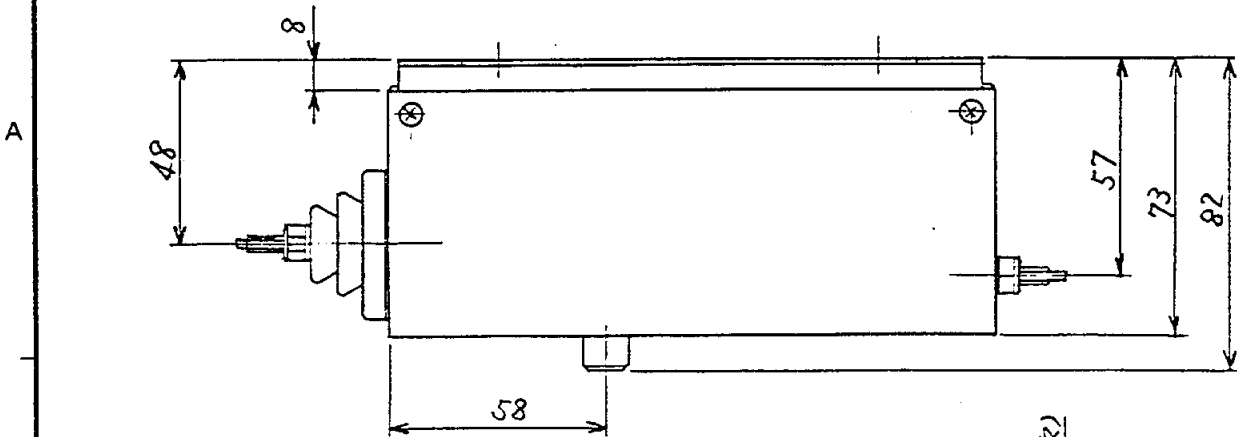
240VAC



承認 APPROVED	DEC. 14. '88 T. NAKAUO	三角法 THIRD ANGLE PROJECTION		名称 TITLE PR-270 AC 電源 POWER SUPPLY
検図 CHECKED	Dec. 14. '88 M. IKEDA	尺 度 SCALE	/	
製 図 DRAWN	Dec. 14. '88 S. NISHI	重 量 WEIGHT	14 kg	図 番 DWG. NO. C5485 - 031 - C



承認 APPROVED	品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
DEC. 14. 88 T. UAKAWO		三角法 THIRD ANGLE PROJECTION				
検図 CHECKED	Dec. 14. '88 M. IICEDA	尺度 SCALE				名称 TITLE PC-220
製図 DRAWN	Dec. 14. '88 S. Nishi	重量 WEIGHT		5 kg	図番 DWG.NO.	DC-DC コンバータ DC-DC CONVERTER C5485-029-B



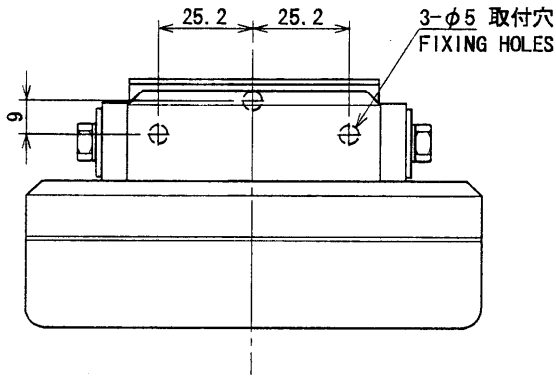
FS-4000

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
承認 APPROVED	JULY. 13. '87 T. NAKANO	三角法 THIRD ANGLE PROJECTION	名称 TITLE	ARTIFICIAL ANTENNA UNIT OUTLINE	
検図 CHECKED	July 13. '87 M. IKEDA	尺度 SCALE	1/2	FOL-400. アンテナダミー外観図	
製図 DRAWN	JULY. 13. '87 S. Nishi	重量 WEIGHT	1.5 kg	図番 DWG.NO.	C5453-006-A

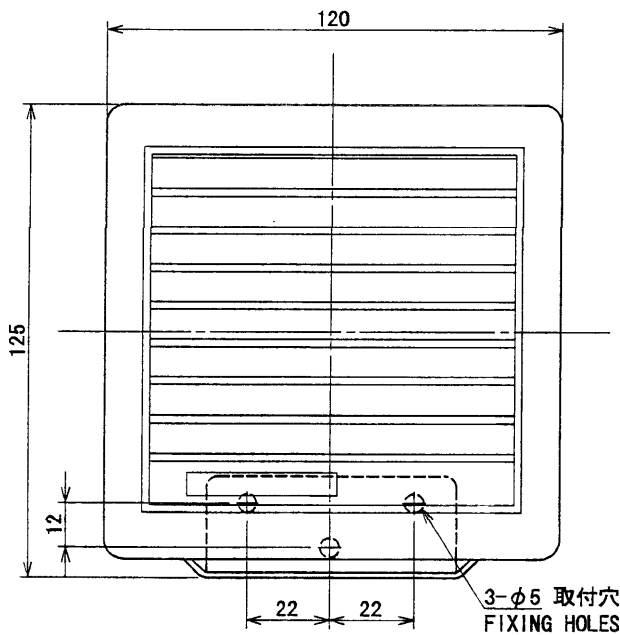
表 1 TABLE 1

寸法区分 (mm) DIMENSION	公差 (mm) TOLERANCE
$0 < L \leq 50$	± 1.5
$50 < L \leq 100$	± 2.5
$100 < L \leq 500$	± 3

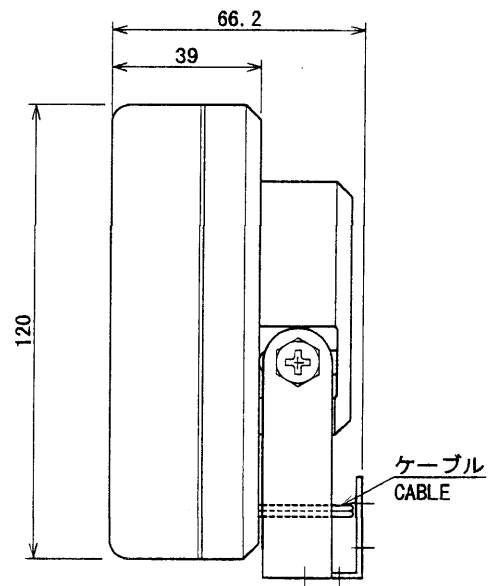
A



B



C



D

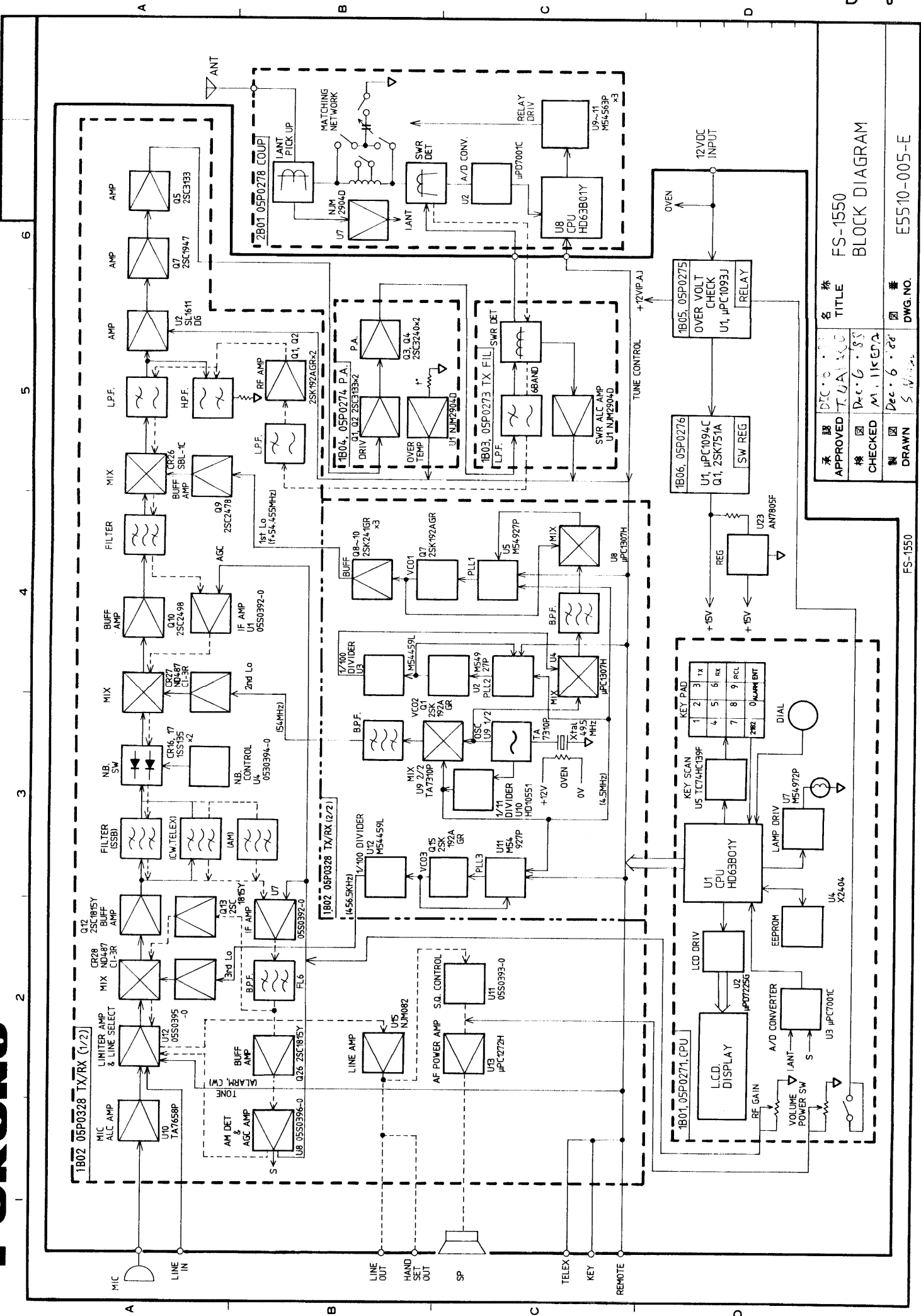
注記

1) 指定なき寸法公差は表 1 による。

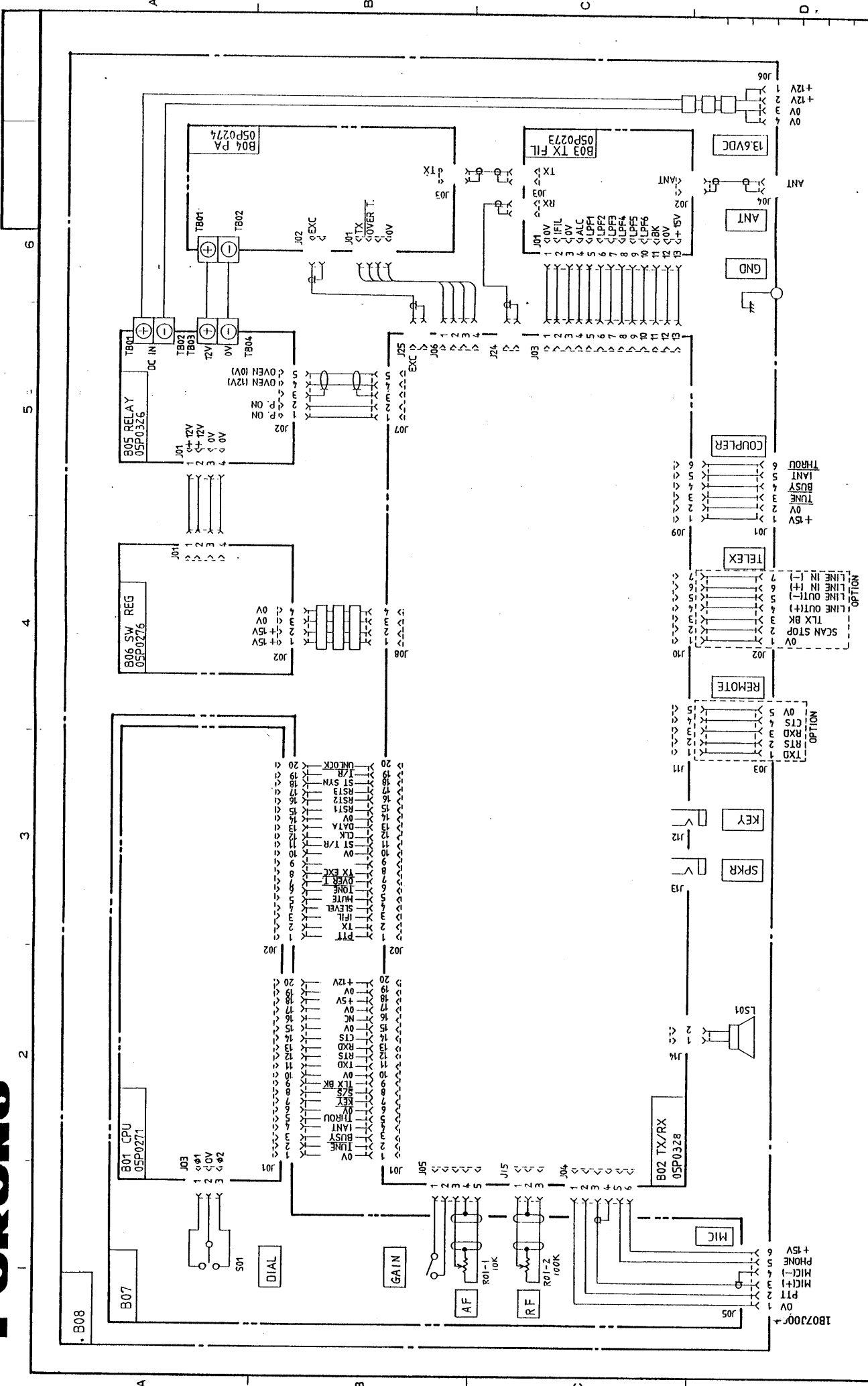
NOTE

1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS.

DRAWN May 23 '01 T. YAMASAKI		TITLE SEM-21Q	
CHECKED May 24 '01 T. Kimi		名称 スピーカ	
APPROVED May 24 '01 T. Kimi		外寸図	
SCALE 1/2	MASS $\pm 10\%$ 0.54 kg	質量は2.8mケーブルを含む MASS W/ 2.8m CABLE	NAME LOUDSPEAKER
DWG. No. C5016-G07- A		OUTLINE DRAWING	

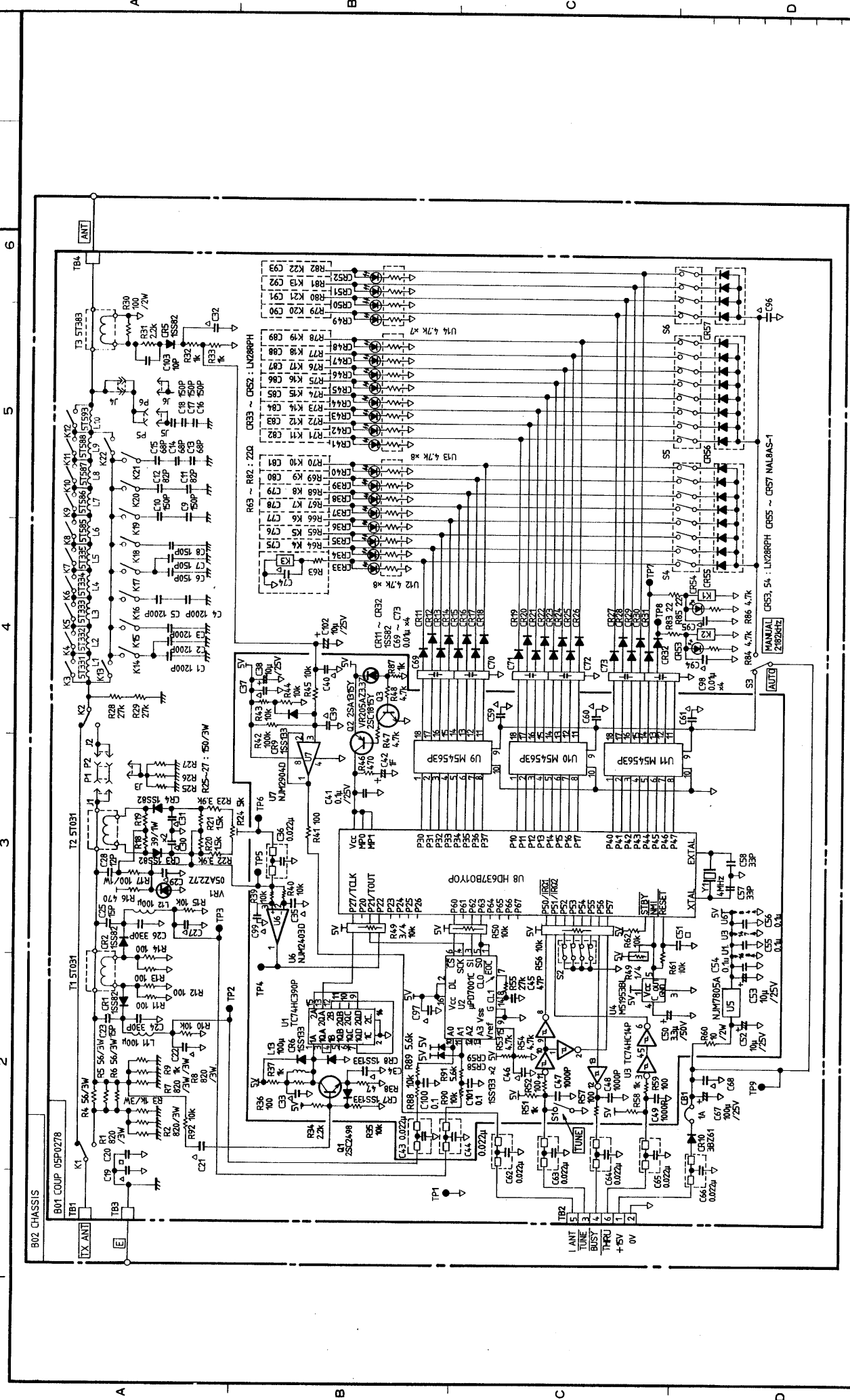


承認	DISC. 6. 88	名称	FS-1550
APPROVED	T. UAI	TITLE	BLOCK DIAGRAM
検図	Dec. 6. 88	製図	M. I. K. G. A.
CHECKED		図番	5. 28
製図	Dec. 6. 88	DWG. NO.	E5510-005-E
DRAWN			



承認 APPROVED	名 称 TITLE
検 査 CHECKED	FS-1550 SSB TRANSCEIVER
製 図 DRAWN	図 番 DWG. NO.
	FS-1550

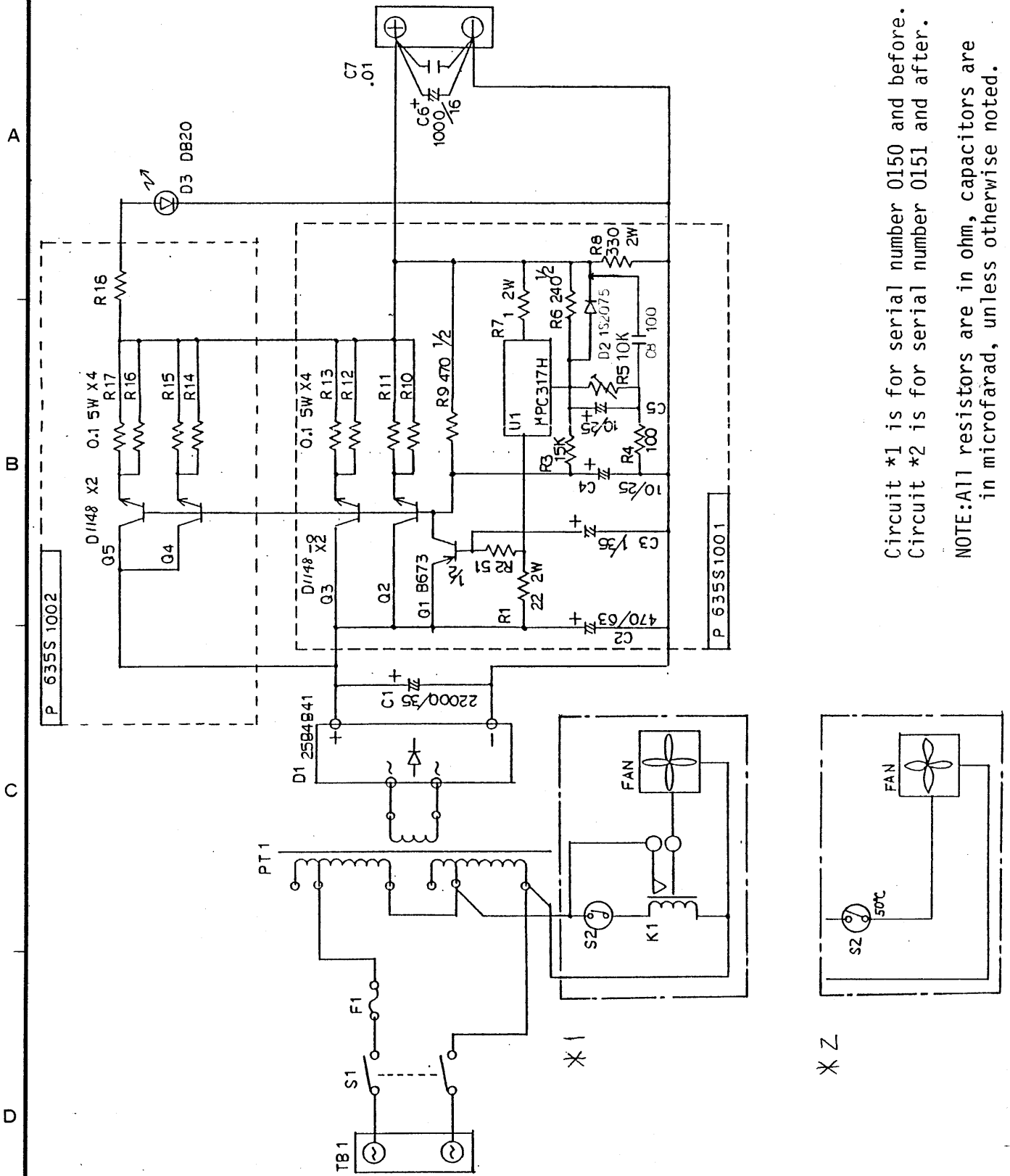
承認 APPROVED	名 称 TITLE
検 査 CHECKED	FS-1550 SSB TRANSCEIVER
製 図 DRAWN	図 番 DWG. NO.
	FS-1550



NOTE : (1) RESISTORS ARE IN Ω (1/6W) CAPACITORS ARE IN F,
INDUCTORS ARE IN H, UNLESS OTHERWISE NOTED.
(2) MARKS ○ ARE 1000PF/50WV CAPACITORS
△ ARE 0.01μF/50WV CAPACITORS AND
□ ARE 0.1μF/25WV CAPACITORS.

承認 MAY 31 1988	名称 TITLE
検図 MAY 27 1988	AT-1500 ANTENNA COUPLER
製図 MAY 28 1988	圖番 E5485-020-C
DRAWN S. Iijima	DWG. NO.

FS-1500 SERIES



Circuit #1 is for serial number 0150 and before.
 Circuit #2 is for serial number 0151 and after.
 NOTE: All resistors are in ohm, capacitors are in microfarad, unless otherwise noted.

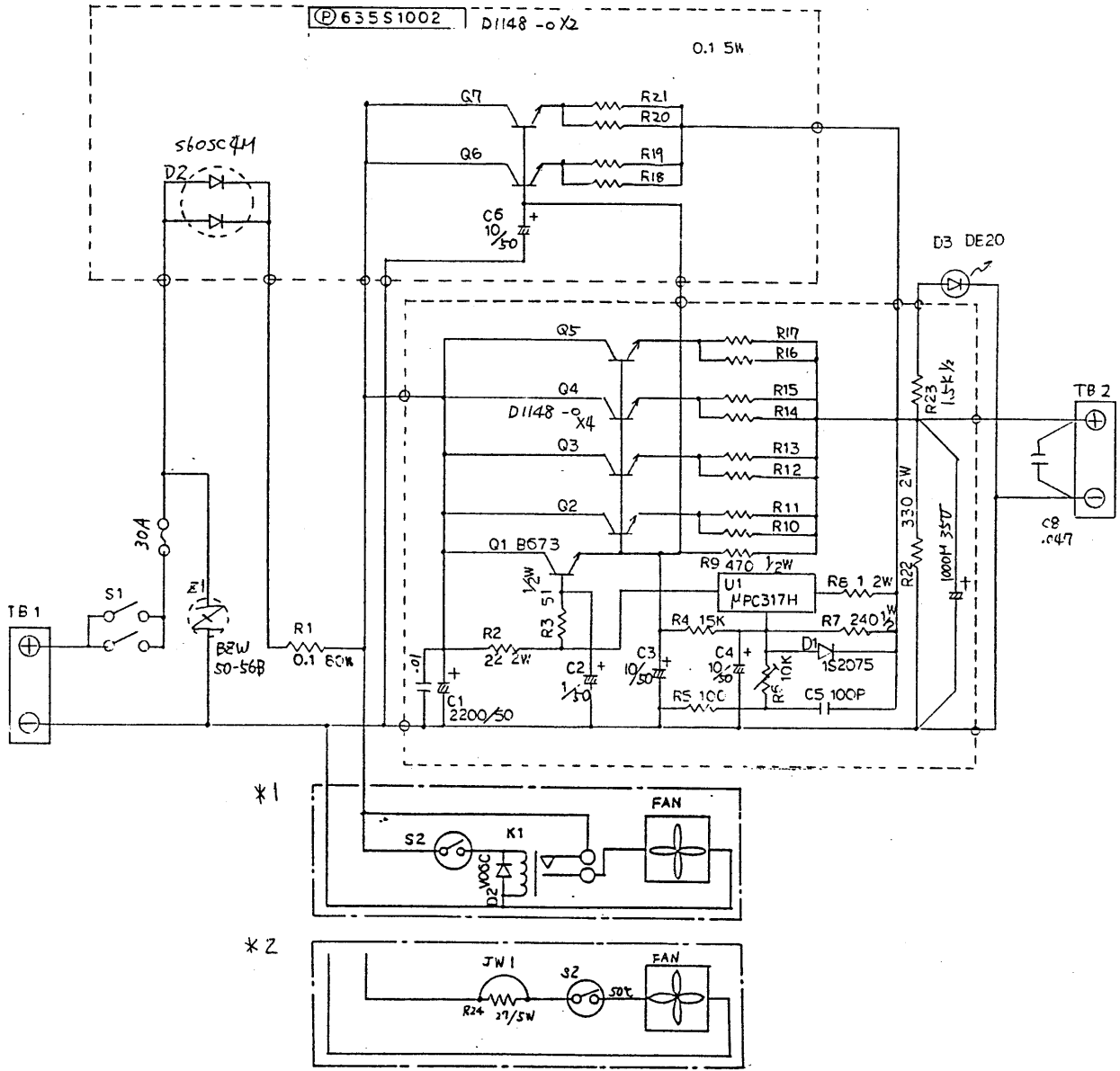
品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
承認 APPROVED	DEC. 14. '88 T. NAKANO	三角法 THIRD ANGLE PROJECTION	名称 TITLE	AC 電源 POWER SUPPLY	
検図 CHECKED	Dec. 14. '88 M. IKEDA	尺度 SCALE	PR-270		
製図 DRAWN	Dec. 14. '88 S. NISHI	重量 WEIGHT	kg	図番 DWG.NO.	C5485-032-C

A

B

C

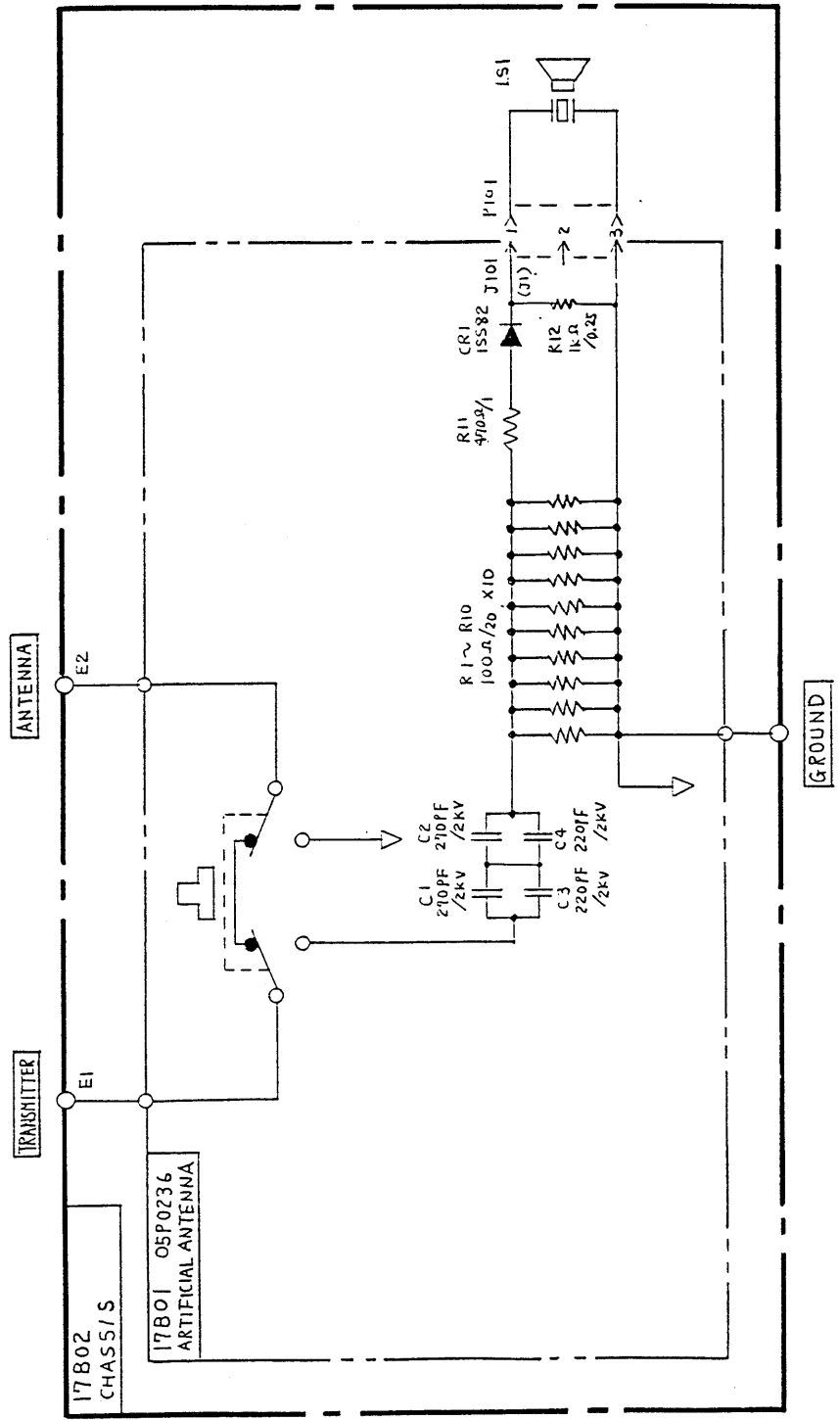
D



Circuit *1 is for serial number 0150 and before.
 Circuit *2 is for serial number 0151 and after.
 NOTE: All resistors are in ohm, capacitors are in microfarad, unless otherwise noted.

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
承認 APPROVED	DEC. 14. '88 T. KAKAO	三角法 THIRD ANGLE PROJECTION	名称 TITLE	DC-DC コンバータ DC-DC CONVERTER	
検図 CHECKED	DEC. 14. '88 M. IKEDA	尺度 SCALE	PC-220		
製図 DRAWN	DEC. 14. '88 S. NISHI	重量 WEIGHT	kg	図番 DWG.NO.	C5485-030-C

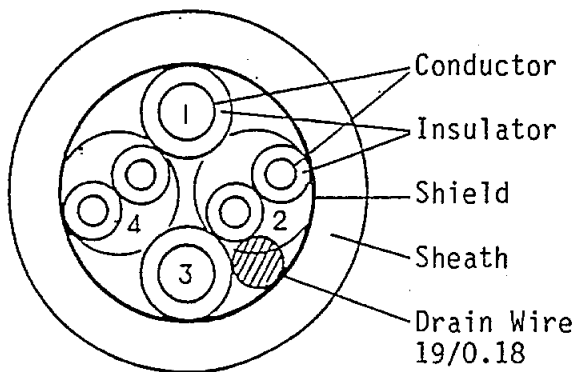
A
B
C
D



承認 APPROVED	品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
Aug. 31. '87 T. NAKANO	17B02 CHASSIS	三角法 THIRD ANGLE PROJECTION				
檢 CHECKED	Aug. 27. '87 M. IKEBA	尺度 SCALE			FDL-400	ARTIFICIAL ANTENNA UNIT
製 DRAWN	Aug. 27. '87 S. NISHI	重量 WEIGHT	kg		図番 DWG.NO.	E5453-028-A

SPECIFICATION OF CONTROL CABLE

		2 Pairs	2 Cores
A. Conductor	Nominal Sect. Area (mm)	0.18	0.5
	Construction	7/0.18	20/0.18
	Outer Dia. (mm)	0.54	1.0
B. Insulator	Thickness (mm)	0.25	0.5
	Outer Dia (mm)	1.05	2.0
	Material	PVC	PVC
	Color	See color table below.	
C. Twist	Direction	CCW (pair)	-
	Pitch	25	60
	Outer Dia (mm)	2.1	4.85
D. Shield	Construction	Aluminum laminated tape plus drain wire (7/0.18)	
E. Sheath	Thickness	0.7	
	Finish Dia (mm)	6.5	
	Material	PVC	
	Color	White-gray	



No.	Color		Size
1	RED		0.5
2	ORG	YEL	0.18
3	BLK		0.5
4	GRN	BLU	0.18

USER CHANNEL LIST (MEMORY CHANNEL LIST)

(Frequency in kHz)

GROUP No. (for SCAN)	CH No.	Receiving Frequency	Transmitting Frequency	PURPOSE / REMARKS
1	1	.	.	
	2	.	.	
	3	.	.	
	4	.	.	
	5	.	.	
	6	.	.	
	7	.	.	
	8	.	.	
2	9	.	.	
	10	.	.	
	11	.	.	
	12	.	.	
	13	.	.	
	14	.	.	
	15	.	.	
	16	.	.	
3	17	.	.	
	18	.	.	
	19	.	.	
	20	.	.	
	21	.	.	
	22	.	.	
	23	.	.	
	24	.	.	
4	25	.	.	
	26	.	.	
	27	.	.	
	28	.	.	
	29	.	.	
	30	.	.	
	31	.	.	
	32	.	.	

USER CHANNEL LIST (MEMORY CHANNEL LIST)

(Frequency in kHz)

GROUP No. (for SCAN)	CH No.	Receiving Frequency	Transmitting Frequency	PURPOSE / REMARKS
5	33	.	.	
	34	.	.	
	35	.	.	
	36	.	.	
	37	.	.	
	38	.	.	
	39	.	.	
	40	.	.	
6	41	.	.	
	42	.	.	
	43	.	.	
	44	.	.	
	45	.	.	
	46	.	.	
	47	.	.	
	48	.	.	
7	49	.	.	
	50	.	.	
	51	.	.	
	52	.	.	
	53	.	.	
	54	.	.	
	55	.	.	
	56	.	.	
8	57	.	.	
	58	.	.	
	59	.	.	
	60	.	.	
	61	.	.	
	62	.	.	
	63	.	.	
	64	.	.	

DISTRESS CALLING PROCEDURE

Introductions : Fill in the blanks and post near your radiotelephone.

1. Turn on the power switch.
2. Press [2182]
3. Press [ALM] and [SEND] together.
4. Press PTT switch and send the distress message.

Speak SLOWLY CLEARLY CALMLY

a) Say: "MAYDAY--MAYDAY--MAYDAY"

b) Say: "This is _____, _____, _____,
your boat's name your boat's name your boat's name
_____."
your call sign

c) Say: "MAYDAY _____,"
your boat's name

d) TELL WHERE YOU ARE (What navigational aids or land marks are near?)

e) STATE THE NATURE OF YOUR DISTRESS.

f) GIVE NUMBER OF ADULTS AND CHILDREN ABOARD, AND CONDITIONS OF ANY INJURED.

g) ESTIMATE PRESENT SEAWORTHINESS OF YOUR BOAT.

h) BRIEFLY DESCRIBE YOUR BOAT:

_____ ; _____ FEET; _____ FEET;
State Registration No. Length Draft

_____ ; _____ HULL; _____ TRIM; _____ MASTS; _____ POWER
Type Color Color Number Horse Power

Construction Material

Anything else you think will help rescuers to find you.

i) Say: "I WILL BE LISTENING ON 2182kHz"

j) End message by saying: "THIS IS _____ .OVER"
Your boat name and call sign

k) Release PTT switch and listen: Someone should answer.
Follow his directions afterwards.
IF THEY DO NOT, REPEAT CALL, BEGINNING AT ITEM 4.

FURUMO ITU SSB FREQUENCY TABLE

No.	4 MHz BAND		5 MHz BAND		8 MHz BAND		12 MHz BAND		16 MHz BAND		18/19 MHz BAND		22 MHz BAND		25/26 MHz BAND	
	Tx	Rx	No.	Rx	No.	Rx	No.	Rx	No.	Rx	No.	Rx	No.	Rx	No.	Rx
401	4065	4357	601	6501	801	8195	1201	12300	1601	16360	1801	18742	2201	22000	2601	26896
402	4068	4360	602	6203	802	8198	1202	12333	1602	16363	1802	18745	2202	22003	2602	26899
403	4071	4363	603	6206	803	8201	1203	12366	1603	16366	1803	18748	2203	22006	2603	26902
404	4074	4366	604	6209	804	8204	1204	12399	1604	16369	1804	18751	2204	22009	2604	26905
405	4077	4369	605	6212	805	8207	1205	12432	1605	16372	1805	18754	2205	22012	2605	26908
406	4080	4372	606	6215	806	8210	1206	12465	1606	16375	1806	18757	2206	22015	2606	26911
407	4083	4375	607	6218	807	8213	1207	12498	1607	16378	1807	18760	2207	22018	2607	26914
408	4086	4378	608	6221	808	8216	1208	12531	1608	16381	1808	18763	2208	22021	2608	26917
409	4089	4381	609	6224	809	8219	1209	12564	1609	16384	1809	18766	2209	22024	2609	26920
410	4092	4384	610	6227	810	8222	1210	12597	1610	16387	1810	18769	2210	22027	2610	26923
411	4095	4387	611	6230	811	8225	1211	12630	1611	16390	1811	18772	2211	22030	2611	26926
412	4098	4390			812	8228	1212	12663	1612	16393	1812	18775	2212	22033	2612	26929
413	4101	4393			813	8231	1213	12696	1613	16396	1813	18778	2213	22036	2613	26932
414	4104	4396			814	8234	1214	12729	1614	16399	1814	18781	2214	22039	2614	26935
415	4107	4399			815	8237	1215	12762	1615	16402	1815	18784	2215	22042	2615	26938
416	4110	4402			816	8240	1216	12795	1616	16405	1816	18787	2216	22045	2616	26941
417	4113	4405			817	8243	1217	12828	1617	16408	1817	18790	2217	22048	2617	26944
418	4116	4408			818	8246	1218	12861	1618	16411	1818	18793	2218	22051	2618	26947
419	4119	4411			819	8249	1219	12894	1619	16414	1819	18796	2219	22054	2619	26950
420	4122	4414			820	8252	1220	12927	1620	16417	1820	18799	2220	22057	2620	26953
421	4125	4417			821	8255	1221	12960	1621	16420	1821	18802	2221	22060	2621	26956
422	4128	4420			822	8258	1222	12993	1622	16423	1822	18805	2222	22063	2622	26959
423	4131	4423			823	8261	1223	13026	1623	16426	1823	18808	2223	22066	2623	26962
424	4134	4426			824	8264	1224	13059	1624	16429	1824	18811	2224	22069	2624	26965
425	4137	4429			825	8267	1225	13092	1625	16432	1825	18814	2225	22072	2625	26968
426	4140	4432			826	8270	1226	13125	1626	16435	1826	18817	2226	22075	2626	26971
427	4143	4435			827	8273	1227	13158	1627	16438	1827	18820	2227	22078	2627	26974
428	4146	4438			828	8276	1228	13191	1628	16441	1828	18823	2228	22081	2628	26977
429	4149	4441			829	8279	1229	13224	1629	16444	1829	18826	2229	22084	2629	26980
430	4152	4444			830	8282	1230	13257	1630	16447	1830	18829	2230	22087	2630	26983
431	4155	4447			831	8285	1231	13290	1631	16450	1831	18832	2231	22090	2631	26986
432	4158	4450			832	8288	1232	13323	1632	16453	1832	18835	2232	22093	2632	26989
433	4161	4453			833	8291	1233	13356	1633	16456	1833	18838	2233	22096	2633	26992
434	4164	4456			834	8294	1234	13389	1634	16459	1834	18841	2234	22099	2634	26995
435	4167	4459			835	8297	1235	13422	1635	16462	1835	18844	2235	22102	2635	26998
436	4170	4462			836	8300	1236	13455	1636	16465	1836	18847	2236	22105	2636	27001
437	4173	4465			837	8303	1237	13488	1637	16468	1837	18850	2237	22108	2637	27004
438	4176	4468			838	8306	1238	13521	1638	16471	1838	18853	2238	22111	2638	27007
439	4179	4471			839	8309	1239	13554	1639	16474	1839	18856	2239	22114	2639	27010
440	4182	4474			840	8312	1240	13587	1640	16477	1840	18859	2240	22117	2640	27013
441	4185	4477			841	8315	1241	13620	1641	16480	1841	18862	2241	22120	2641	27016
442	4188	4480			842	8318	1242	13653	1642	16483	1842	18865	2242	22123	2642	27019
443	4191	4483			843	8321	1243	13686	1643	16486	1843	18868	2243	22126	2643	27022
444	4194	4486			844	8324	1244	13719	1644	16489	1844	18871	2244	22129	2644	27025
445	4197	4489			845	8327	1245	13752	1645	16492	1845	18874	2245	22132	2645	27028
446	4200	4492			846	8330	1246	13785	1646	16495	1846	18877	2246	22135	2646	27031
447	4203	4495			847	8333	1247	13818	1647	16498	1847	18880	2247	22138	2647	27034
448	4206	4498			848	8336	1248	13851	1648	16501	1848	18883	2248	22141	2648	27037
449	4209	4501			849	8339	1249	13884	1649	16504	1849	18886	2249	22144	2649	27040
450	4212	4504			850	8342	1250	13917	1650	16507	1850	18889	2250	22147	2650	27043
451	4215	4507			851	8345	1251	13950	1651	16510	1851	18892	2251	22150	2651	27046
452	4218	4510			852	8348	1252	13983	1652	16513	1852	18895	2252	22153	2652	27049
					853	8351	1253	14016	1653	16516	1853	18898	2253	22156	2653	27052
					854	8354	1254	14049	1654	16519	1854	18901	2254	22159	2654	27055
					855	8357	1255	14082	1655	16522	1855	18904	2255	22162	2655	27058
					856	8360	1256	14115	1656	16525	1856	18907	2256	22165	2656	27061
					857	8363	1257	14148	1657	16528	1857	18910	2257	22168	2657	27064
					858	8366	1258	14181	1658	16531	1858	18913	2258	22171	2658	27067
					859	8369	1259	14214	1659	16534	1859	18916	2259	22174	2659	27070
					860	8372	1260	14247	1660	16537	1860	18919	2260	22177	2660	27073
					861	8375	1261	14280	1661	16540	1861	18922				
					862	8378	1262	14313	1662	16543	1862	18925				
					863	8381	1263	14346	1663	16546	1863	18928				
					864	8384	1264	14379								
					865	8387	1265	14412								
					866	8390	1266	14445								
					867	8393	1267	14478								
					868	8396	1268	14511								
					869	8399	1269	14544								
					870	8402	1270	14577								

APPENDIX-E

How To Install The Dummy Load Assembly In The Antenna Coupler

To conduct two-tone signal test on 2191kHz (not 2182kHz), a microprocessor-controlled dummy load is available. Below is the procedure for mounting the dummy load.

CONTENTS OF DUMMY LOAD INSTALLATION KIT (TYPE OP05-36, Code No. 005-931-230)

INTERFACE Board	×1	M3 Screw	×4
Dummy Load with Heat Sink	×1	M3 Nut	×4
Spacer	×4	Cable Clamp	×5

NECESSARY TOOLS

Screwdriver / Longnose Pliers / Vinyl Tape

PROCEDURE

1. Turn off the power. Detach the cover of the antenna coupler.
2. Loosen the four screws fixing the shield case to the COUPLER board
3. Dismount the INTERFACE board from the heat sink by loosening four screws.
4. Fix the heat sink onto the shield case with spacers.
5. Mount the INTERFACE board onto the heat sink using the screws loosened in step 3.
6. Arrange the cable clamps inside the antenna coupler as shown in Fig.1.

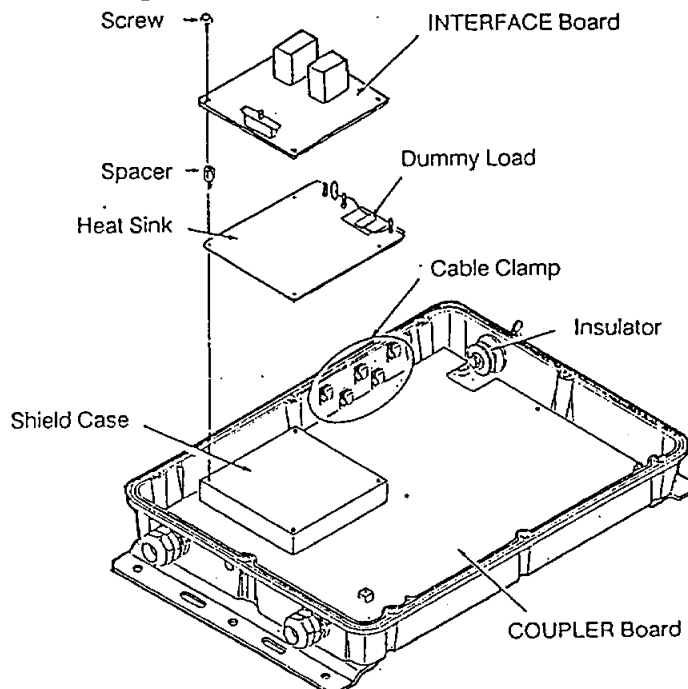


Fig. 1

7. Connect the wires of the dummy load assembly to the connectors in the antenna coupler, referring to Fig. 2 and the table below.

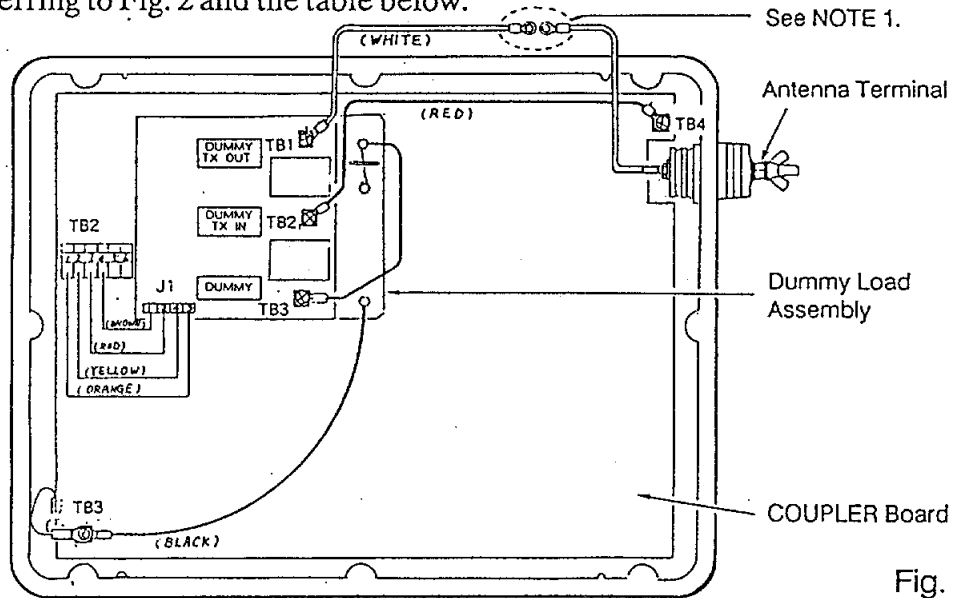


Fig. 2

DUMMY LOAD ASSEMBLY		COUPLER BOARD		REMARKS
From	Wire Color	Connected to		
TB1	White	Antenna Terminal (Insulator)		See NOTE 1.
TB2	Red	TB4		
—	Black	TB3		See NOTE 2.
J1	1 Brown	TB2	4	See NOTE 2.
	2 Red		3	
	3 Orange		1	
	4 Yellow		2	

NOTE 1. Disconnect the wire connected to TB4 on the COUPLER board and connect it to the "white wire" with screw and nut (M3). Tape the junction and fix the wires with the cable clamps.

NOTE 2. Do not remove the wires previously connected to TB2, TB3 on the COUPLER board.

TRANSMITTER CHECKING WITH TWO-TONE SIGNAL

1. Press the [ALARM] and [ENT] key simultaneously. (Relay on the dummy load assy. is energized and dummy load is connected in lieu of the antenna.)
2. Frequency is set to 2191kHz and two-tone signal test starts.
3. Confirm that two-tone signal ceases after approx. 45 seconds and the equipment restores the settings in effect before the check began.

APPENDIX F

CONNECTION OF TELEX TERMINAL

1. GENERAL

When automatic telex communication is required, it is recommended to use Furuno Model DP-5 NBDP Terminal or Thrane-Thrane Model 1600 system comprising Radiotelex Modem TT-1585, Keyboardprocessor TT-1601A, Video Monitor TT-1602A. The maximum communication distance on the ARQ mode is about 7500km.

2. Modification of FS-1550 series Transceiver Unit

Prepare the "Telex Connection Kit(Code No.005-923-670)" for modification.

Table 1. Contents of Telex Connection Kit

No.	NAME	TYPE	CODE No.	Q'ty	REMARKS
1	5-pin Jack	FM214-5SM	000-113-464	1	
2	5-pin Plug Assy.	05S4487-0	000-113-471	1	
3	7-pin Jack	FM214-7SM	000-113-463	1	
4	7-pin Plug Assy.	05S4488-0	000-113-472	1	
5	Connector Cover	05S4426-0	000-113-346	2	
6	7-pin Plug	FM14-7P	000-113-345	1	
7	5-pin Plug	FM14-5P	000-111-537	1	
8	IC	LT1080CN	000-111-479	1	
9	Gasket	05-029-0122-2	100-087-842	2	

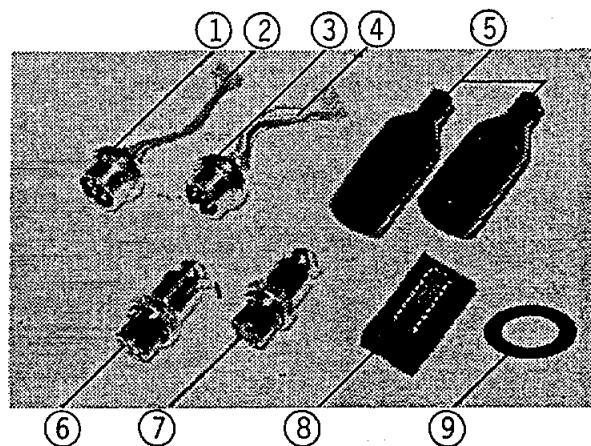


Fig 1. Telex Connection Kit

Installing the connector jacks

- 1) Peel off the seal on the back side of the transceiver.
- 2) Solder 5-pin Plug Assy. (2) to 5-pin Jack (1) and solder 7-pin Plug Assy. (4) to 7-pin Jack (3). Refer to page APF-2 or APF-3.

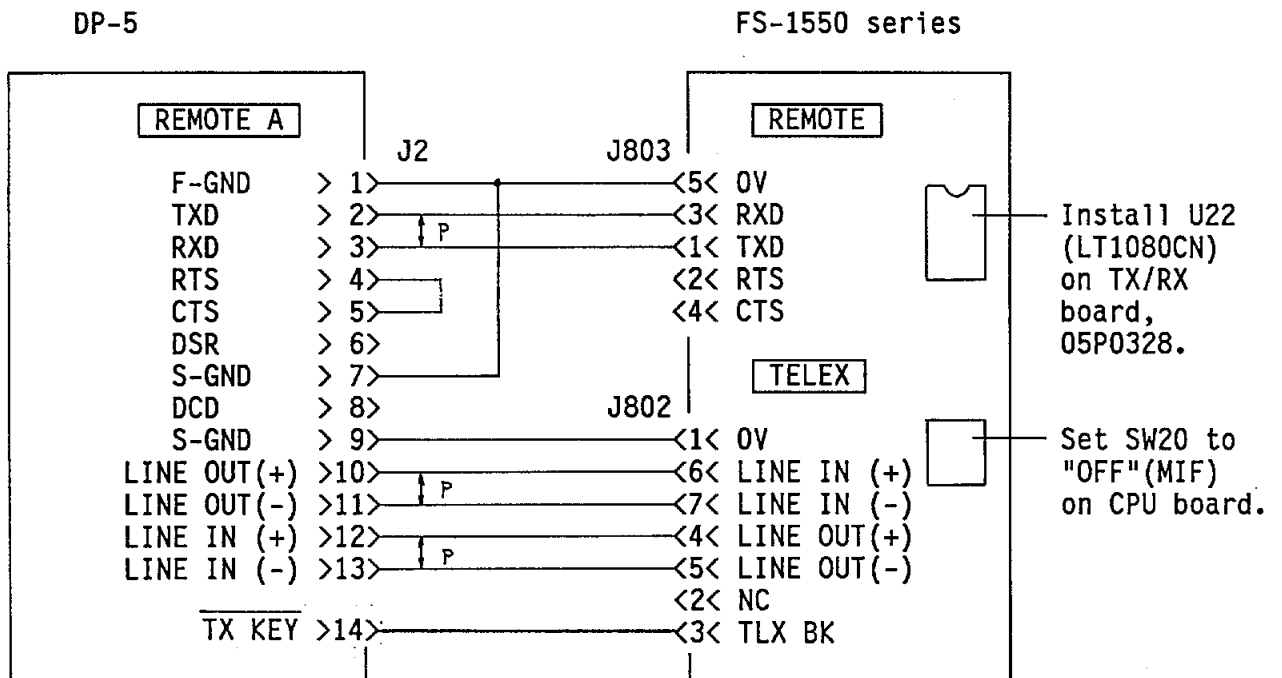
Replacement of MPU on the CPU Board

When FS-1550 series transceiver unit having S/No.5587-1835 and before(May.1991) is connected to DP-5, replacement of MPU(U1 on the CPU board) with a new one having program No.0550125110(Code No.005-923-800) is required.

3. Connection with Furuno NBDP Terminal DP-5

Connection

CONNECTOR	No.	COLOR	SIGNAL	FUNCTION
TELEX (1B08J0002)	1.	BRN	OV	Connected to ground.
	2.	RED	SCAN STOP	Not used.
	3.	ORG	TLX BK	Gets the transceiver ready to transmit.
	4.	YEL	LINE OUT(+)	0dBm/600 ohms audio output.
	5.	GRN	LINE OUT(-)	
	6.	BLU	LINE IN (+)	0dBm/600 ohms audio input.
	7.	PPL	LINE IN (-)	
REMOTE (1B08J0003)	1.	BRN	TXD	Transmit Data
	2.	RED	RTS	Request to Send
	3.	ORG	RXD	Receive Data (Cont. Sig.)
	4.	YEL	CTS	Clear to Send
	5.	GRN	OV	Common



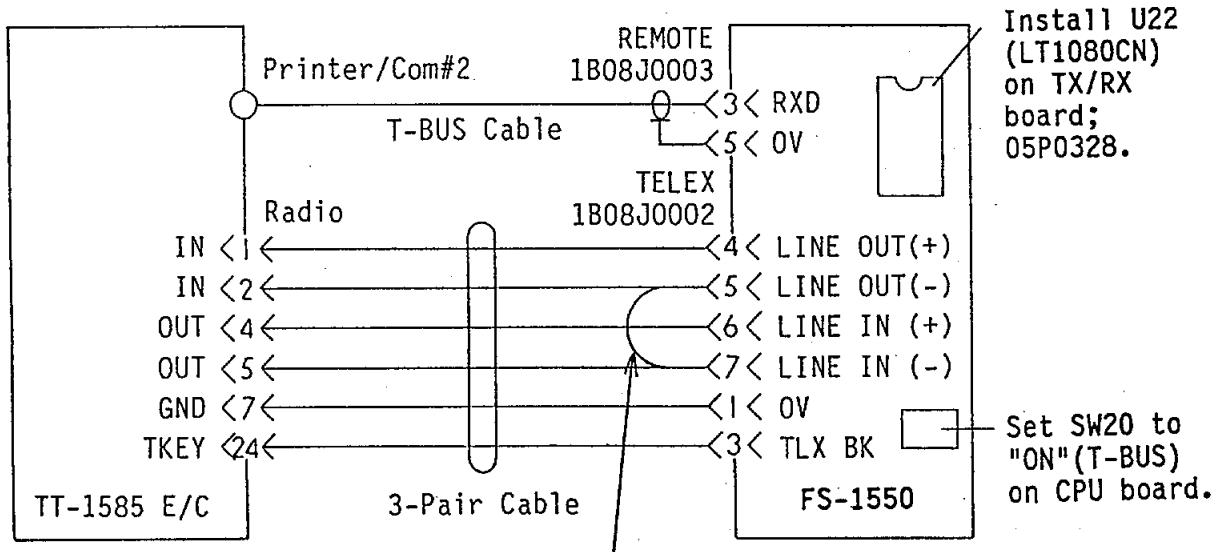
Setting of Communication Parameter on DP-5

BK Timing PreTone: 50ms
 BK Timing PostTone: 10ms
 Slave Delay: 50ms

4. Connection with T&T Model 1600

Connection

CONNECTOR	No.	COLOR	SIGNAL	FUNCTION
TELEX (1B08J0002)	1.	BRN	OV	Connected to ground.
	2.	RED	SCAN STOP	Not used.
	3.	ORG	TLX BK	Gets the transceiver ready to transmit.
	4.	YEL	LINE OUT(+)	0dBm/600 ohms audio output.
	5.	GRN	LINE OUT(-)	
	6.	BLU	LINE IN (+)	
	7.	PPL	LINE IN (-)	0dBm/600 ohms audio input.
REMOTE (1B08J0003)	1.	BRN	TXD	Transmit Data (Not used)
	2.	RED	RTS	Request to Send (Not used)
	3.	ORG	RXD	Receive Data (Cont. Sig.)
	4.	YEL	CTS	Clear to Send (Not used)
	5.	GRN	OV	Common



Connect a jumper wire here.
(This jumper wire is not needed for
Serial No. 5586-0426 and after.)

Setting of Communication Parameter on TT-1600

Transmitter Pre-Key = $45 \times 1.25\text{ms}$
 Transmitter Post-Key = $5 \times 1.25\text{ms}$
 Slave Delay = $45 \times 1.25\text{ms}$

5. Modification for CW operation

To operate in CW, connect telegraph key to "CW" jack on the rear side of the FS-1550 after detaching the rubber cover on the connector jack. If the plug of telegraph key does not mate the jack, connect plug supplied as installation material, to the telegraph key.

