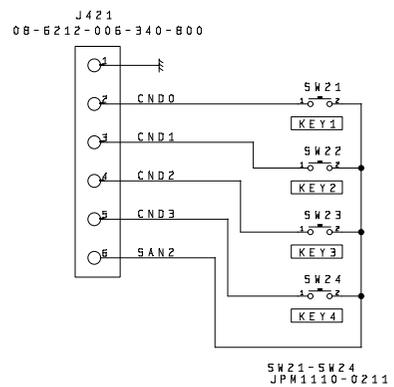
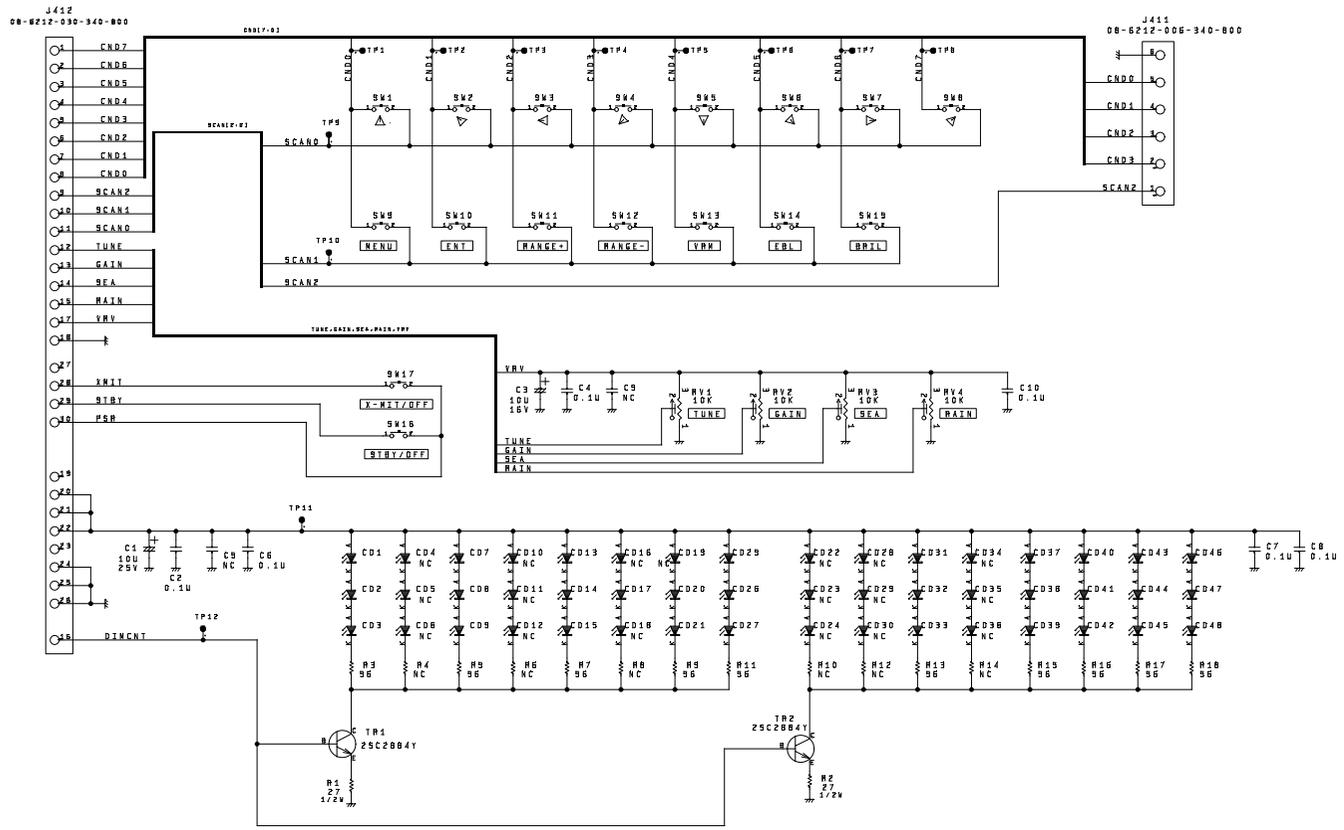


【图 107 CME-307 变频器接线图】  
 [Fig.107 CIRCUIT DRAWING OF MODULATOR UNIT CME-307]

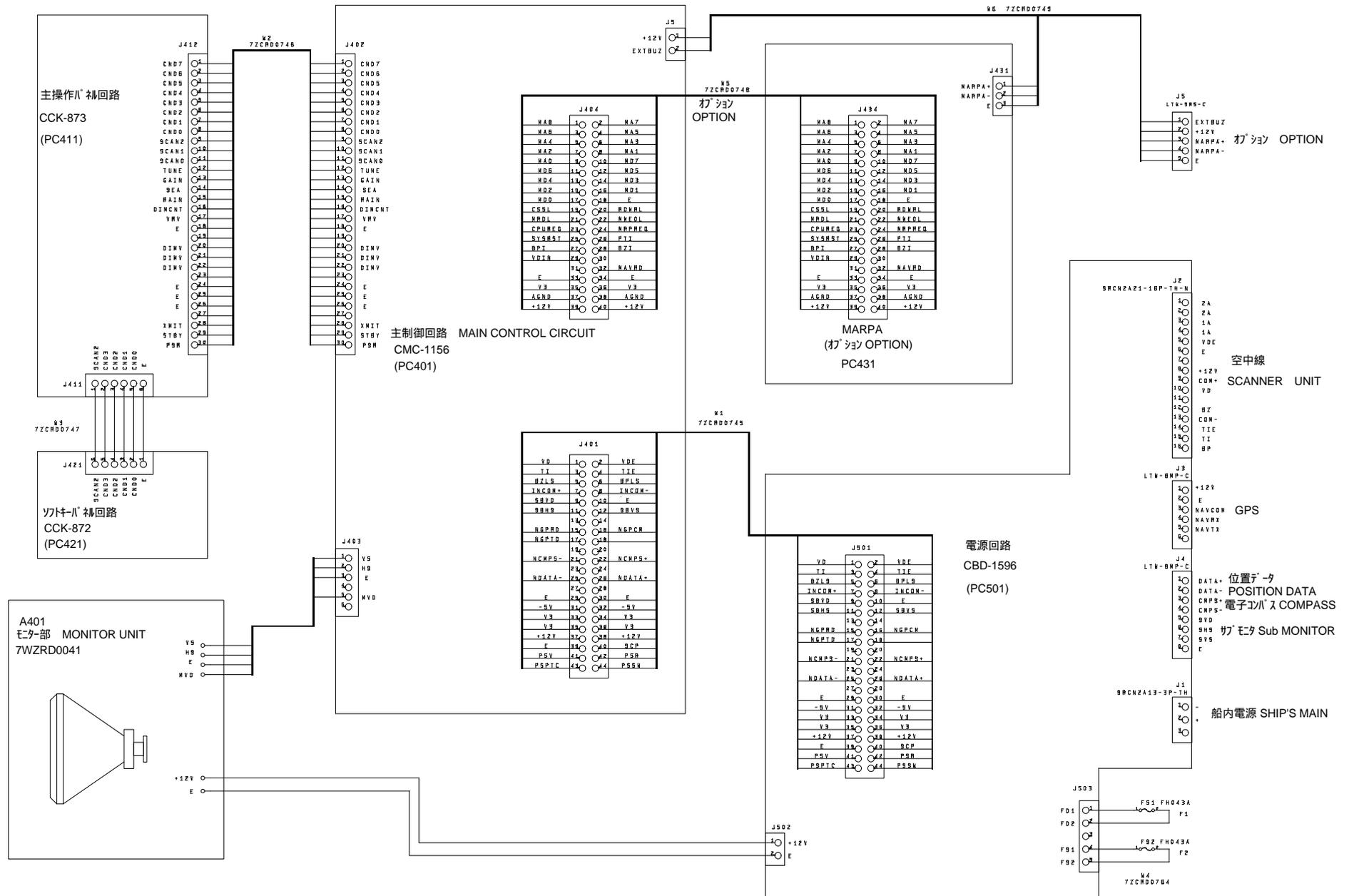


【图 1 1 3 C C K - 8 7 2 ソフトパネル 制御回路接続図】

【Fig.113 CIRCUIT DRAWING OF SOFT KEY PANEL UNIT CCK-872】

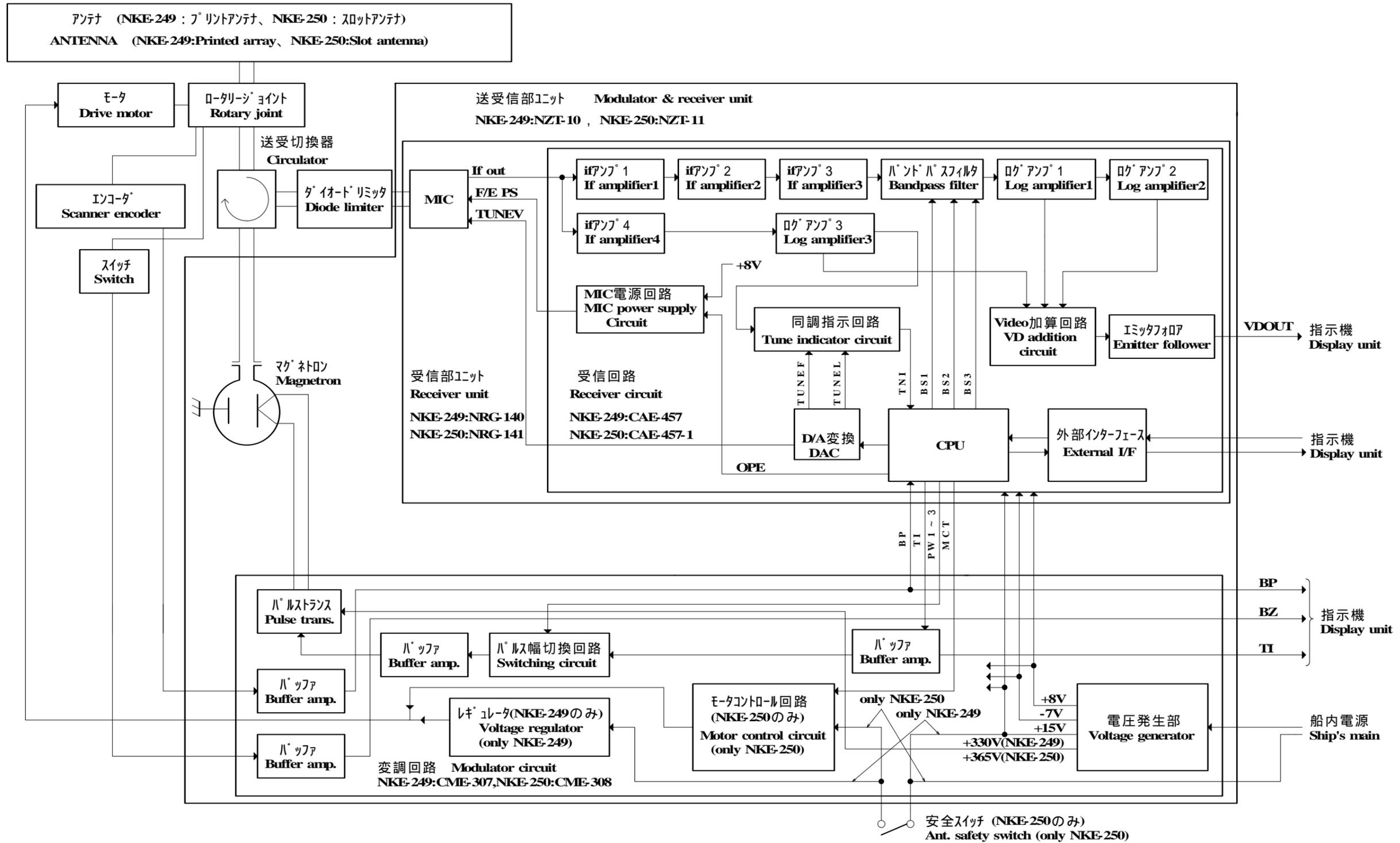


【図114 CCK - 873 主操作パネル回路接続図】  
 【Fig.114 CIRCUIT DRAWING OF MAIN PANEL UNIT CCK-873】



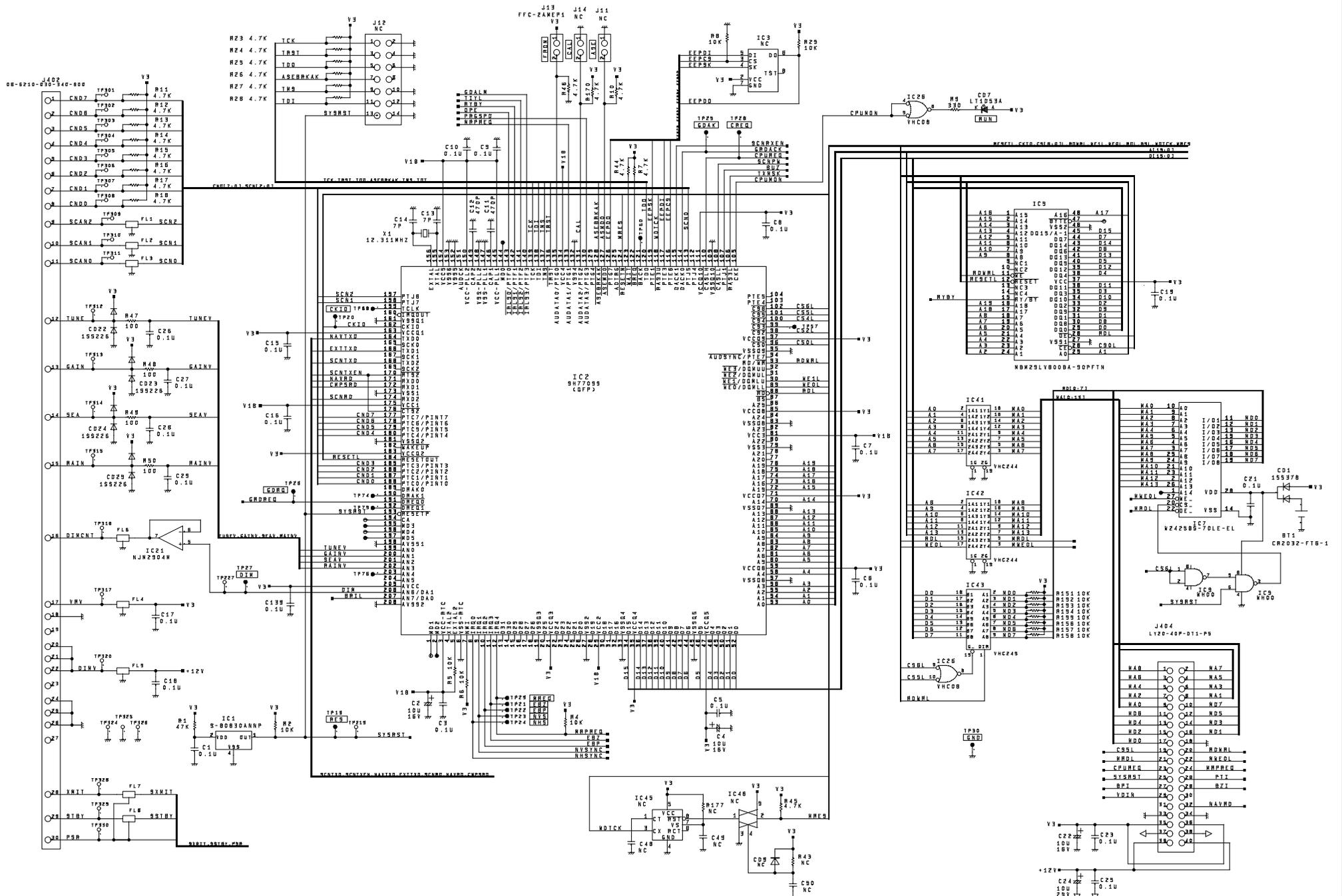
【図 1 1 1 NCD - 4 1 7 0 指示機機内接続図】

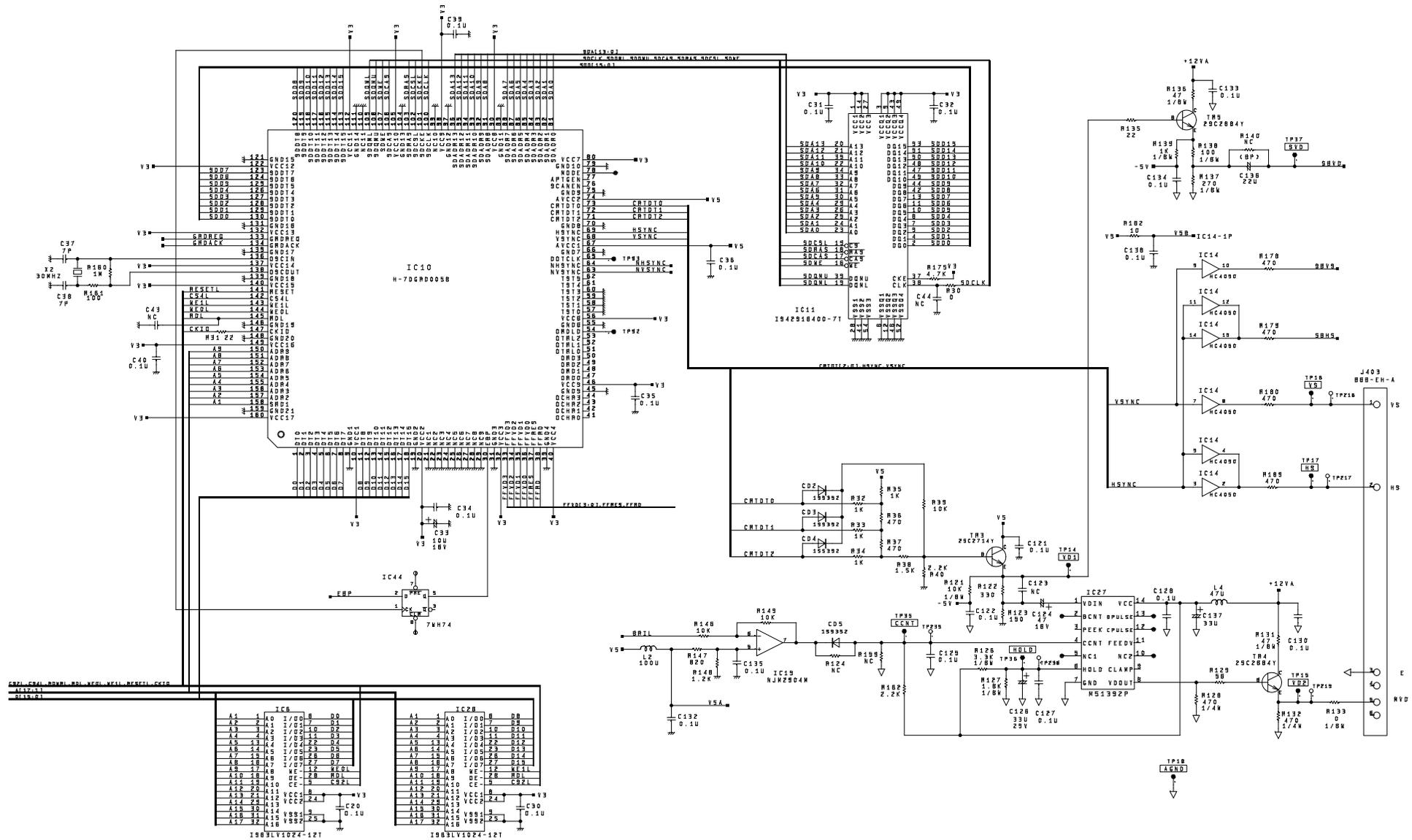
【Fig.111 INTERNAL CONNECTIONS OF DISPLAY UNIT NCD-4170】



JMA - 2300シリーズ空中線 (NKE - 249、NKE - 250) 回路ブロック図

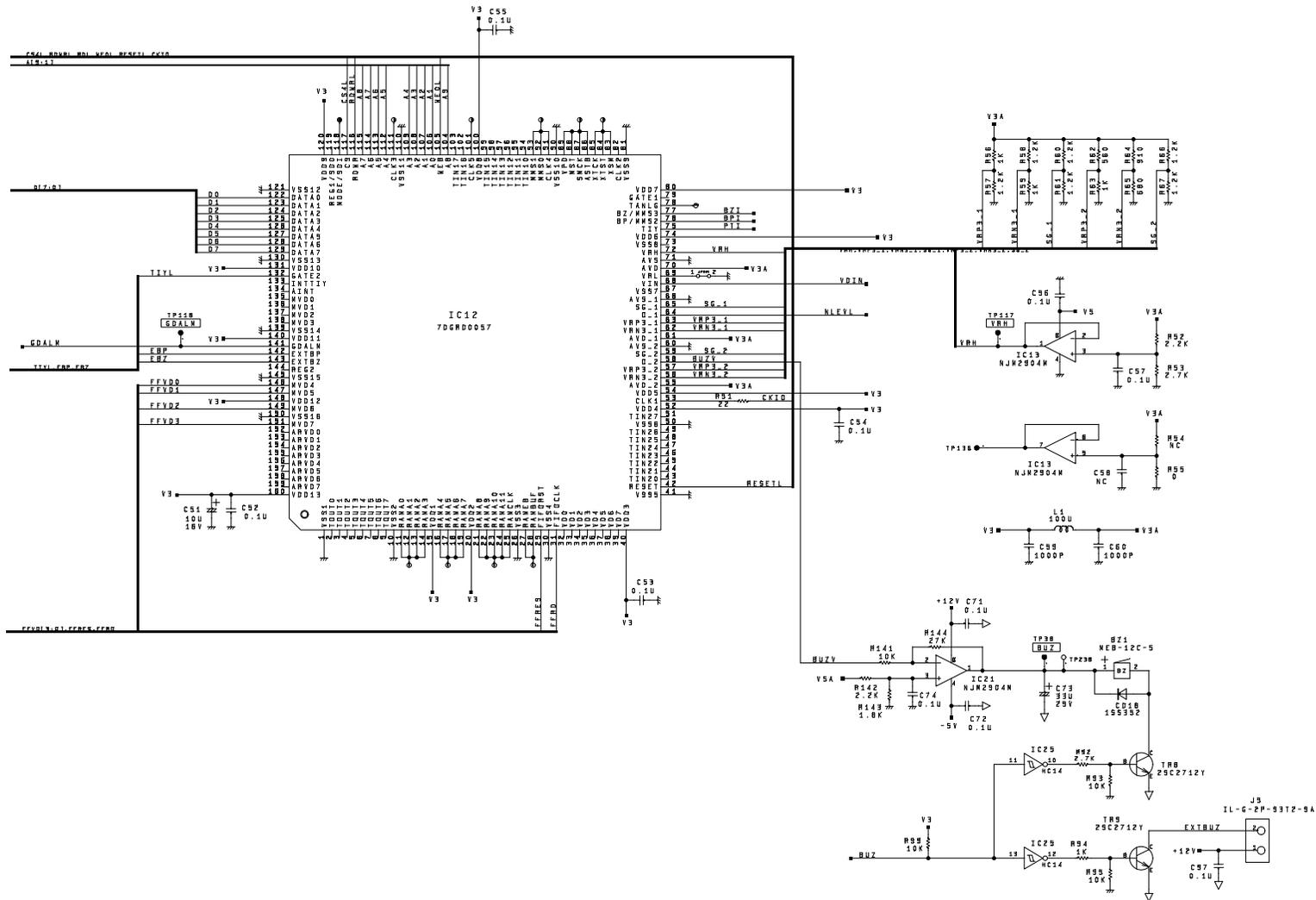
JMA - 2300 SERIES CIRCUIT DIAGRAM OF SCANNER UNIT (NKE - 249、NKE - 250)





【图 112-2 CMC - 1156 主控制回路接统图 (2 / 4)】

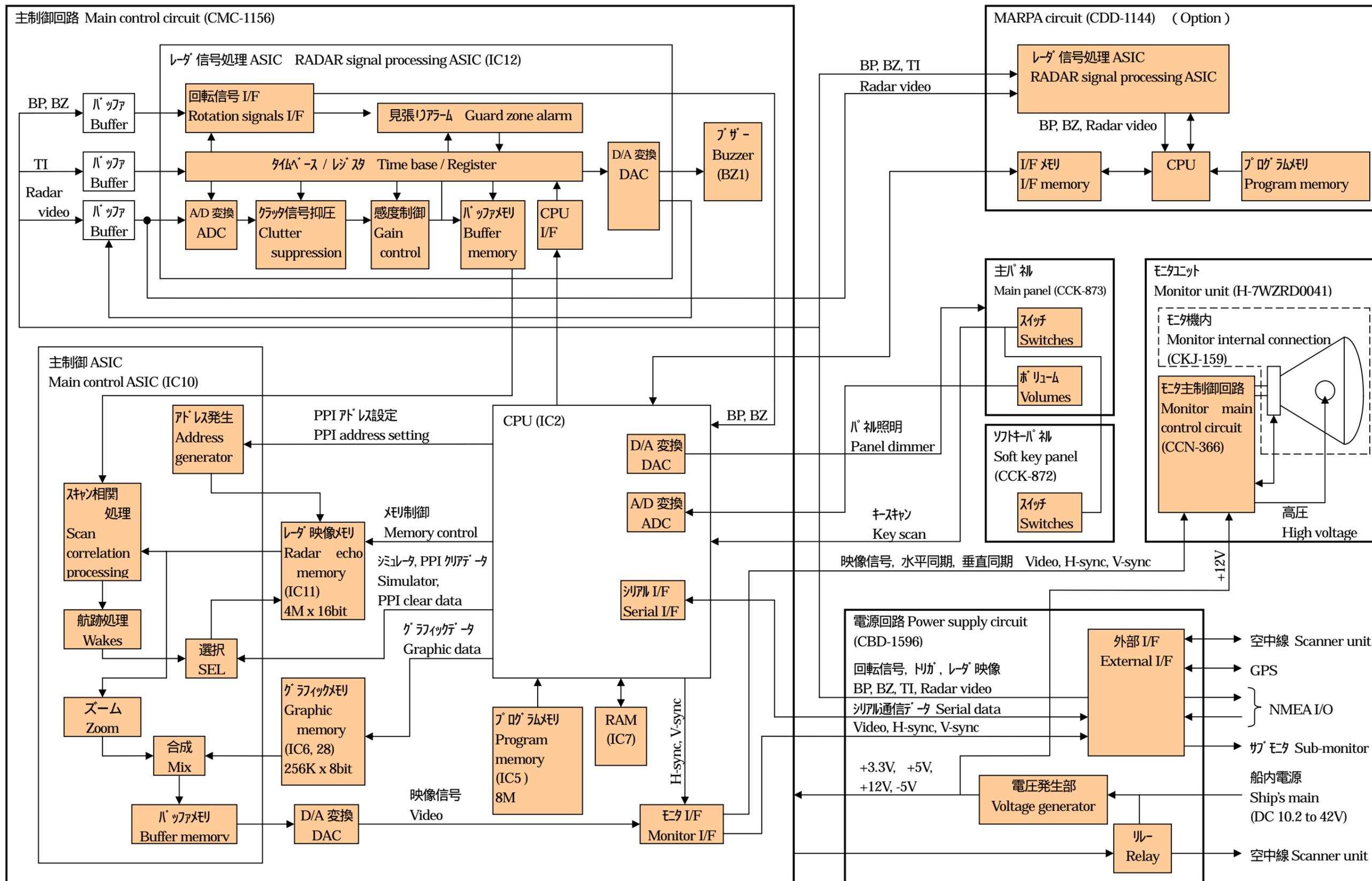
【Fig.112-2 CIRCUIT DRAWING OF MAIN CONTROL UNIT CMC-1156 (2/4)】



【图 112 - 3 CMC - 1156 主制御回路接続図 ( 3 / 4 )】

【Fig.112-3 CIRCUIT DRAWING OF MAIN CONTROL UNIT CMC-1156 (3/4)】





JMA-2300シリーズ 指示機(NCD-4170)回路ブロック図  
 JMA-2300 SERIES CIRCUIT DIAGRAM OF DISPLAY UNIT(NCD-4170)

## **Circuit explanation of display unit type NCD-4170**

The display unit type NCD-4170 is composed of the following circuit block.

- a) Main control circuit
- b) Power supply circuit
- c) Main panel circuit
- d) Soft key panel circuit
- e) Monitor control circuit

The input power supply range of the display unit is between DC+10.2V and DC+42V, and the signal composition between the display unit and the scanner unit is as mentioned in the following.

- a) Power supply : Between DC+10.2V and DC+42V.
- b) Transmitting trigger : 8Vp-p, Frequency depends on radar range.
- c) Radar video : Approx.1.8Vp-p<sub>max</sub>
- d) Rotation pulses : 2048pulses/rev, 5Vp-p
- e) Bearing signal : 1 pulse/rev, 5Vp-p
- f) Communication line : RS-485, Half duplex

### **1 . Power supply circuit(CBD-1596)**

This circuit is the DC-DC converter power supply of the fly-back form, and supplies various voltages to each circuit inner the display unit.

Input voltage range is between DC+10.2V and DC+42V, and when the input voltage is less than 9V or more than 46V, the oscillation of the converter is stopped to protect the circuit by the over-voltage, low voltage protection circuit. Furthermore, when connection of the input power supply is reverse, the circuit is protected with protection diode CD1 and the fuse F1.

The output voltage are +12V (1.5A max), +3.3V(1.5A max) and -4.7V (0.1A max), and the output of +3.3V is adjusted in the precision of  $\pm 0.05V$  using the volume RV1 ' +3.3V ADJ ' . The switching frequency is 70kHz, which is controlled by the oscillator IC (IC1), and the regulation of the output voltage is made using feedback of the output of +12V.

And, this circuit has the sensor of the output of +3.3V to protect a circuit for the occurrence of an unexpected unusual voltage. When +3.3V output exceeds +3.6V, oscillation of the converter is stopped, and the power supply circuit stops the function.

And, this circuit has the relay ' K1 ' which controls a power supply to the scanner unit. This relay works with the output of +12V, when the relay switch on, the ship ' s main is supplied to the scanner unit through the noise filter and the fuse ' F2 ' .

## **2 . Main control circuit(CMC-1156)**

This circuit controls the main system of the radar with the micro-chip (IC2) which CPU core is SH3 (manufactured by Hitachi), and with the program memory (IC5) and the work memory (IC7).

The main functions of this circuit are radar signal processing, screen drawing and an interface with the outside.

Almost all the radar signal processing is done by the signal processing ASIC (IC12) with digital style. After adjustment of reference level, the radar video signal sent from the scanner unit is inputted to IC12 as an analog signal. The inputted video signal is changed into the digital signal by the eight bits A/D converter included inside at the sampling rate of about 50MHz. The suppression of sea and rain clutter signal by technique of the STC and the FTC, and the radar interference rejection are carried out at the digitized video signal. After sweep average and gain processing are carried out more, the video signal is stores in the built-in buffer memory.

In the STC, the gain of the radar video signal is restrained as low as near distance which sea clutter signal is contained, with STC parameter selected by antenna height setting via maintenance menu and position of the sea knob on the operation panel.

And, the basic data of STC parameter are transferred to IC12 from the CPU after power on of the display unit, and STC parameter is calculated at a speed which is the same as the sampling rate of the above-mentioned A/D converter one after another inside IC12.

In the FTC, the rain clutter signal is suppress by the high pass filter processing which characteristics depends on the position of the RAIN knob on the operation panel.

In the interference rejection processing, a rank filter technique is done with three sweep video signals stored in memories with built-in IC12, and the rejection level, when strong is IR2, weak is IR1, is selectable by soft key on the operation panel.

The IR1 is suitable to reject of comparatively weak interference signals, it works as median filter which outputs the middle level signal in the data of three sweep.

On the other hand, the IR2 is suitable to reject of comparatively strong interference signals, it outputs the minimum level signal in the data of three sweep.

The video signal stored in the buffer memory inside IC12 is sent to ASIC (IC10) for screen drawing, and processing of scan correlation and the echo trail are done on the XY coordinate.

In conversion from the polar coordinate to the XY coordinate, the coordinate of the each video signal is calculated one after another based on the PPI center coordinate set up from the CPU in the address generator part inside IC10, and the address of the memory (IC11) for the video signal is controlled.

The video signal that the above-mentioned processing of scan correlation and echo trail were done on the XY coordinate is stored in the memory (IC11).

The scan correlation processing averages the level of the last processing result stored in of the memory (IC11) and this raw data, referring to the operation table stored in RAM inside IC10.

After processing of the scan correlation and the echo trail, zoom processing is carried out in the video signal. Then the video signal data is mixed with the graphic data, and is stored in the buffer memory inside IC10.

The signal stored in the buffer memory inside IC10, is changed into the analog signal by the D/A converter part, and it is supplied to the monitor unit through the monitor interface part.

The signal specifications that it is supplied to the monitor unit are as mentioned in the following.

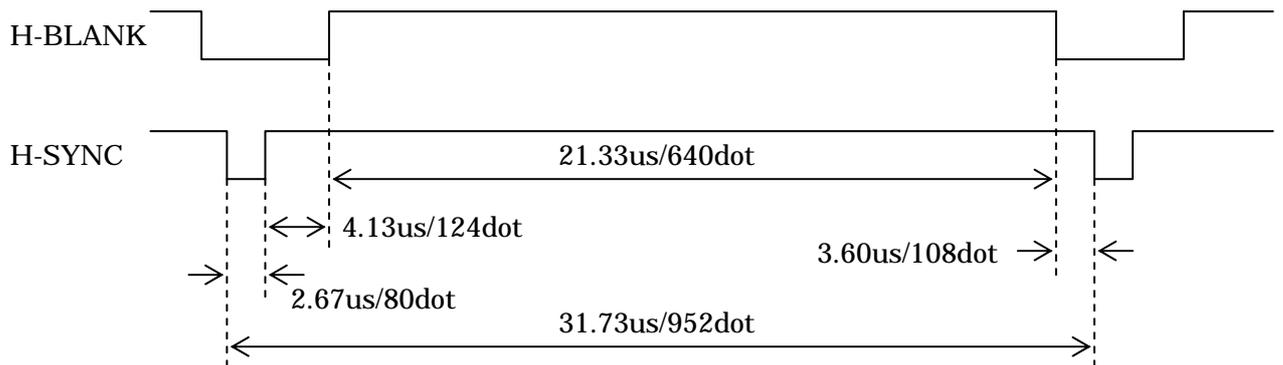
**For monitor signal timing**

Dot clock : 30MHz

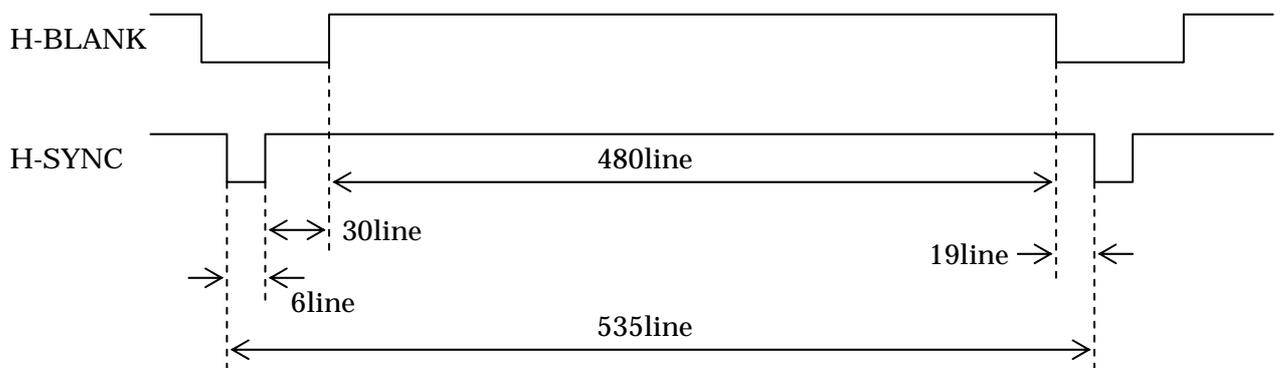
Horizontal synchronous frequency : 31.51kHz

Vertical synchronous frequency: 58.9Hz

**Horizontal**



**Vertical**



The serial communication data with the scanner unit is transmitted or received through the RS-485 interface (IC16 and IC29). The communication speed is 9600bps. The main communication data are as follows.

No.	Contents	Direction	Remarks
1	Tune indication level	From scanner to display	
2	Scanner identification	From scanner to display	
3	Tune voltage level	From display to scanner	
4	Selection of transmitting pulse	From display to scanner	
5	Selection of receiver band width	From display to scanner	
6	Pulse repetition frequency	From display to scanner	
7	Selection of radar range	From display to scanner	
8	Others	Both direction	

### **3 . Control panel(CCK-872/CCK-873)**

The control panel is composed by the main control panel circuit(CCK-873) and the soft key panel circuit(CCK-872).

The main control panel circuit is composed of 4 volumes, 17 switches and 48 LEDs for the lighting, and the soft key panel circuit is composed of 4 switch.

The key condition is recognized by key scanning of the time interval of about 30ms.

And, a volume output voltage is taken into the micro-chip with the A/D converter of CMC-1156-IC2 by sampling of the time interval of about 50ms.

### **4 . Monitor unit(7WZRD0041)**

This monitor unit is non-interlace type with 10 inches monochrome CRT.

It is composed of monitor internal connection (CRT with the deflection yoke ; CKJ-159) and monitor control circuit (CCN-366).

The main specifications are as follows.

Input power : 11.5V ± 0.5V

Resolution : 640x480(VGA)

Dot clock : 30MHz

Horizontal synchronous frequency : 31.51kHz

Vertical synchronous frequency : 58.9Hz

Maximum brilliance : more than 400cd/m<sup>2</sup> ( when input signal is 2.2V<sub>p-p</sub> )

## *Circuit explanation of Scanner unit type NKE-249/NKE-250*

### 1.Circuit explanation of Modulator circuit (CME-307,308)

Ship's mains pass through the relay inside display unit and is inputted to the scanner unit. That power supply passes through the noise removal filter of input part and is inputted to step-down chopper circuit. Feedback circuit (IC3 etc) and PWM control IC (IC1) controls output voltage of step-down chopper circuit to be stabilized in about 7.5 (V).

Push-pull converter (IC2, T1 etc) supplies four kinds of voltages as follows on the basis of 7.5(V).

+8(V) : Mainly, for the power supply of IF amplifier ,LOG amplifier and front end

+15(V) : Mainly, for the motor drive circuit

-7(V) : Mainly, for the Magnetron heater voltage

+330(V)(JMA-2343)、 +365(V)(JMA-2344) : High voltage for modulator

PW1 ~ 3 signal from receiver unit forms pulse width(4 pulses) in transmitting pulse forming circuit (TR7, RV1 etc). Voltage of this pulse passes through transmitting pulse drive circuit(TR9,10 etc) and is increased by pulse transformer(T2). After that ,it is supplies to magnetron.

In the case of JMA-2343, +12(V) is supplied from voltage regulator to motor, for the purpose of the number of antenna rotation which became stable. The power supply of motor is turned on or off by MCT(pulse signal) signal that is supplied from receiver unit to modulator unit.

In the case of JMA-2344, duty of MCT is controlled by BP(Bearing pulse signal), and MCT is supplies from receiver unit to modulator unit. On the basis of it, motor drive circuit(TR19,20) controls switch of power supply of motor, for the purpose of the number of antenna rotation which became stable.

## 2.Circuit explanation of Receiver circuit (CAE-457,457-1)

IF signal(60MHz) that was outputted from MIC(E101) is divided into three at terminal of IF signal output line.

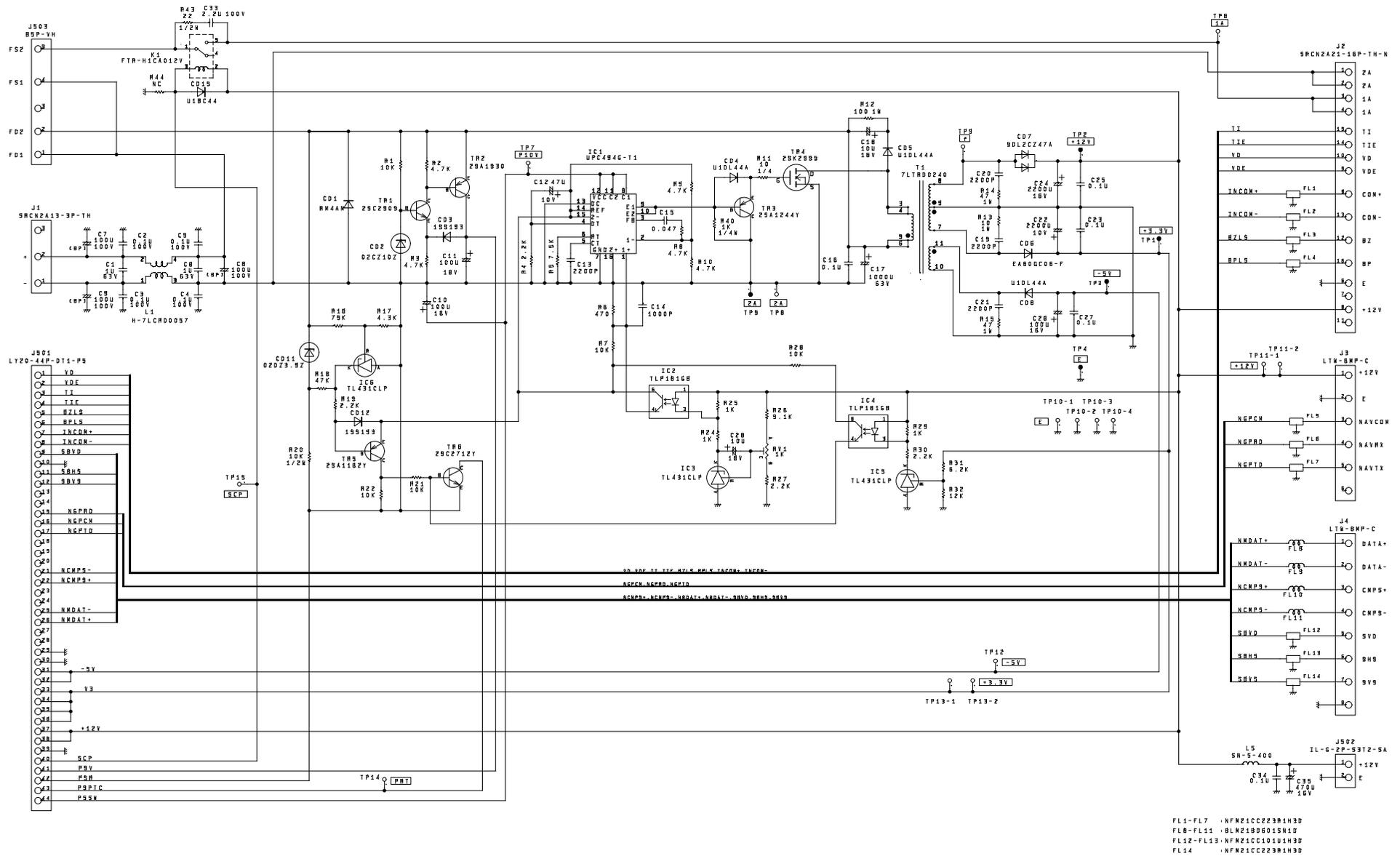
The first signal is inputted to weaker signal line. This signal is amplified by IF amplifier1,2,3(TR3,4,5 etc) and inputted to pulse width selection circuit that is changed three band width by selection signal (BS1 ~ 3) from CPU(IC4). After that, the signal pass through bandwidth filter and is inputted to LOG amplifier(IC2,3). Low pass filter(R129, C69) keeps that LOG amplifier is not saturated terminal output signal with white noise.

The second signal is inputted to stronger signal line and is decreased voltage by R31 and R35 , for the purpose of not become of MIC saturation level. Gain of the signal is adjusted by IF amplifier 4 (TR6 etc) for the purpose of composite signal of weaker and stronger signal line which got linear performance at the composite point. Adding circuit (TR12,13 etc) adds weaker and stronger signal line's electric current that is amplified by LOG IC. After that, the signal pass through buffer circuit(TR14,15 etc) and is send to display unit as video signal.

The third signal is inputted to tuning indication circuit. IF signal's voltage level is decrease by TUNE\_L from D/A converter (IC11). Main bang signal inside of IF signal is amplified by TR8 and that's bandwidth is limit to center frequency of weaker signal line by bandwidth filter(TR4 etc). TUNE\_F from D/A converter is able to make fine adjustment center frequency of this bandwidth. After that, the signal is detected by TR9 and reformed to a DC voltage(+5V).That signal's peak is held by C63 and CD18 etc and is inputted to A/D converter inside of CPU as tuning indicating signal (TNI).

In addition that, D/A converter output MIC's tuning voltage (TUNEV) and control local frequency of MIC.

As it is stated before, transceiver (IC7,18) communicate with Display unit so that CPU(IC4) controls BS1 ~ 3, D/A converter and tuning voltage.



【图 115 CBD - 1596 电源回路接续图】

【Fig.115 CIRCUIT DRAWING OF POWER SUPPLY UNIT CBD-1596】

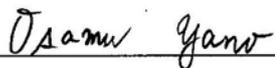
TECHNICAL INFORMATION  
FROM  
MARINE RADAR GROUP

Subject : Trouble of the radar echo omission due to improper installation of  
the reed switch and their countermeasure.

Equipment : NKE-2102 for JMA-5310 and JMA-5110,  
NKE-2062 for JMA-5106,  
NKE-250 for JMA-2344,  
NKE-283 for JMA-609.

Date : Mar. 02, 2007

Issue Number : RD070302A



O. Yano  
Manager,  
Marine Radar Group  
Engineering Department  
Marine Electronics Division

- Priority [  ] A: Carry out immediately  
[  ] B: Carry out at periodical inspection  
[ X ] C: Carry out upon client's request  
[  ] D: Information and news

### 1. Subject

Trouble of the radar echo omission due to improper installation of the reed switch and their countermeasure

### 2. Objective Equipment

Following equipment shipped before about July, 2006

JMA-5310, JMA-5110, JMA-5106, JMA-2344 and JMA-609

Please refer to the objective serial number of the scanner unit listed in attached paper.

### 3. Outlines

#### 【Countermeasure】

Please replace the mounting plate for the reed switch to modified one which have been stocked ( code : MTB383221 ).

Then please throw the detached mounting plate away.

When urgent action is necessary with no modified plate, please execute the emergency procedure described in “Countermeasure for improper installation of the reed switch”.

#### 【Content】

The reed switch to generate azimuth signal which works with the magnet on the main gear, is not installed to appropriate position, therefore the switch operation is sensitive to environmental temperature (Especially, at the low temperature) and might not work correctly though it is a rare case. As a result, the radar echo omission occurs within the range of the angle of about 10°.

Usually, it doesn't return normally when the phenomenon occurs once, therefore please execute the above-mentioned countermeasure.

### 4. Attached document

- Instruction manual for replacement of the reed switch mounting plate
- Replacement report table of the mounting plate for the reed switch
- Objective serial number list
- Countermeasure for improper installation of the reed switch

JMA-5310/5110/5106/2344/609

Radar Scanner Unit

NKE-2102/2062/250/283

Instruction manuals for replacement of  
the reed switch mounting plate

Mar. 02, 2007 Marine Radar G

## Introduction

Please replace the reed switch mounting plate used for JMA-5310 / 5110 / 5106 / 2344 / 609 radar scanner unit ( Type : NKE-2102 / 2062 / 250 / 283 ) according to this manual.



Please confirm the power supply of all radars (all in case of the plural equipment) is turning off, before the work. Moreover, turn off the breaker of a former power supply for safety.



Please note that there is no injury by using gloves etc. when you work. Moreover please pay attention not to drop the tools and parts from a high place for safety.



Please work in the situation with few shakes of the ship while mooring in the inside the harbor.



Please note that the radiator of the antenna doesn't knock against the human body enough when you work. There is a possibility that the radiator of the antenna rotates because of the wind etc.

## Procedure of replacement of the reed switch mounting plate

### Procedure 1 Removing the connectors

Open the pedestal and disconnect the connectors with cable to remove the transmitter-receiver unit. (Refer to following table)

Scanner type	Circuit name	Circuit type	Connector No.	Destination
NKE-2102	Modulator cir.	CPA-248	J1, J3	Installation cable
			J13	BP generator
			J14	Reed switch
	Power supply cir.	CBD-1645	J11	Motor
			J15, J16	Safety switch
	Receiver cir.	CAE-475-1	J302	Installation cable
Filter cir.	CFR-193	J4, J5	Installation cable	
NKE-2062	Modulator cir.	CME-323	J1	Installation cable
			J11, J13	Motor part
			J14	Reed switch
			J15, J16	Safety switch
	Receiver cir.	CAE-475-1	J302	Installation cable
	Filter cir.	CFR-193	J4, J5	Installation cable
MTR filter cir.	CFR-194	J3	J3	Installation cable
NKE-250	Modulator cir.	CME-308	J201, J202	Installation cable
			J207, J208	Motor par
			J204	Safety switch
			J205	Reed switch
	Receiver cir.	CAE-475-1	J302	Installation cable
NKE-283	Internal connection		J101 ( relay connector)	Reed switch
	Terminal board cir.	CQD-2011	J1	Installation cable
	Motor driver cir.	TD12900-244	J1, J3	Motor
	Power supply cir.	CBD-1645	J1001	Terminal
			J16	Safety switch
	Filter cir.	CFR-193	J4, J5	Terminal
J401			Safety switch	

Refer to Figure 1, 2 and 3 to confirm the location of the connectors in each scanner unit.

Loosen the 4 screws (A) to remove the transmitter-receiver unit from the scanner unit.

For NKE-2102

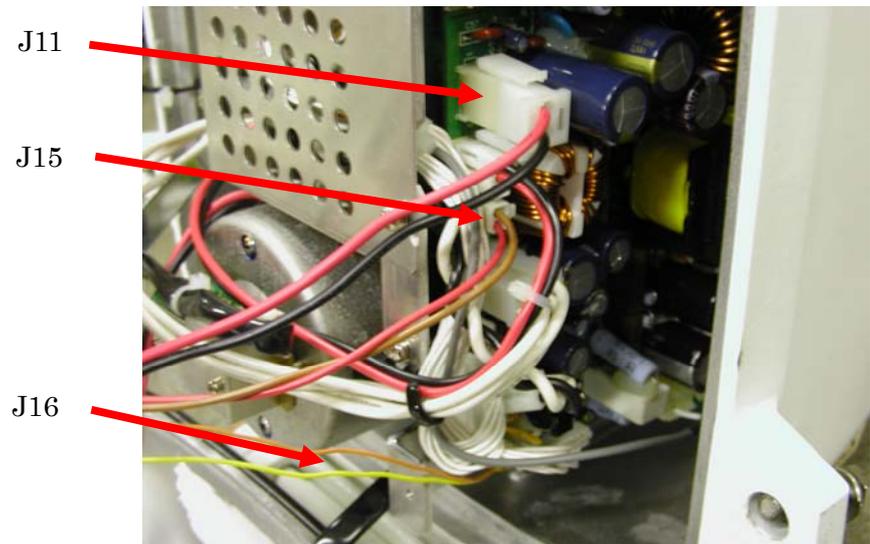
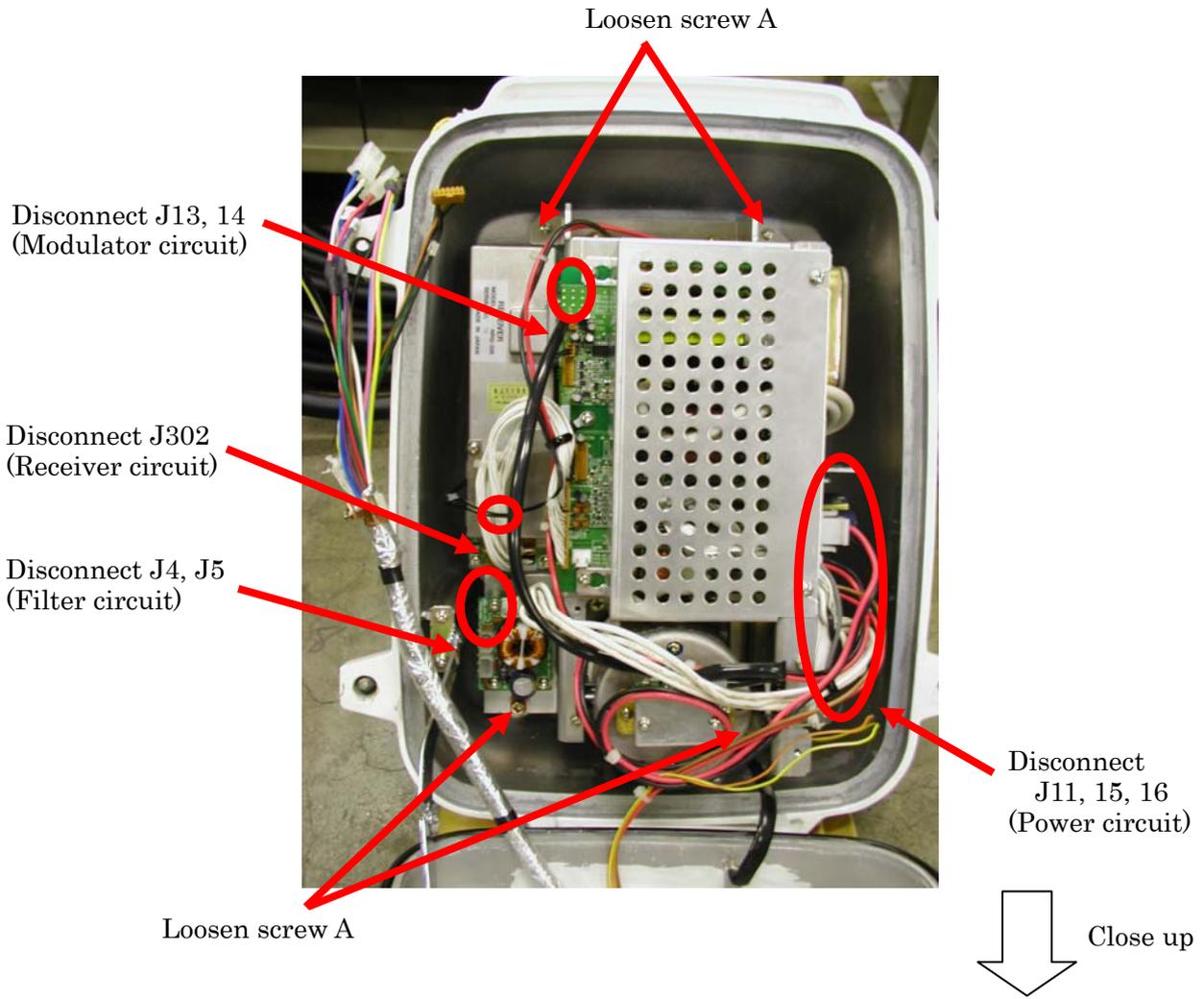


Fig.1 Internal view of NKE-2102

# For NKE-2062 and 250

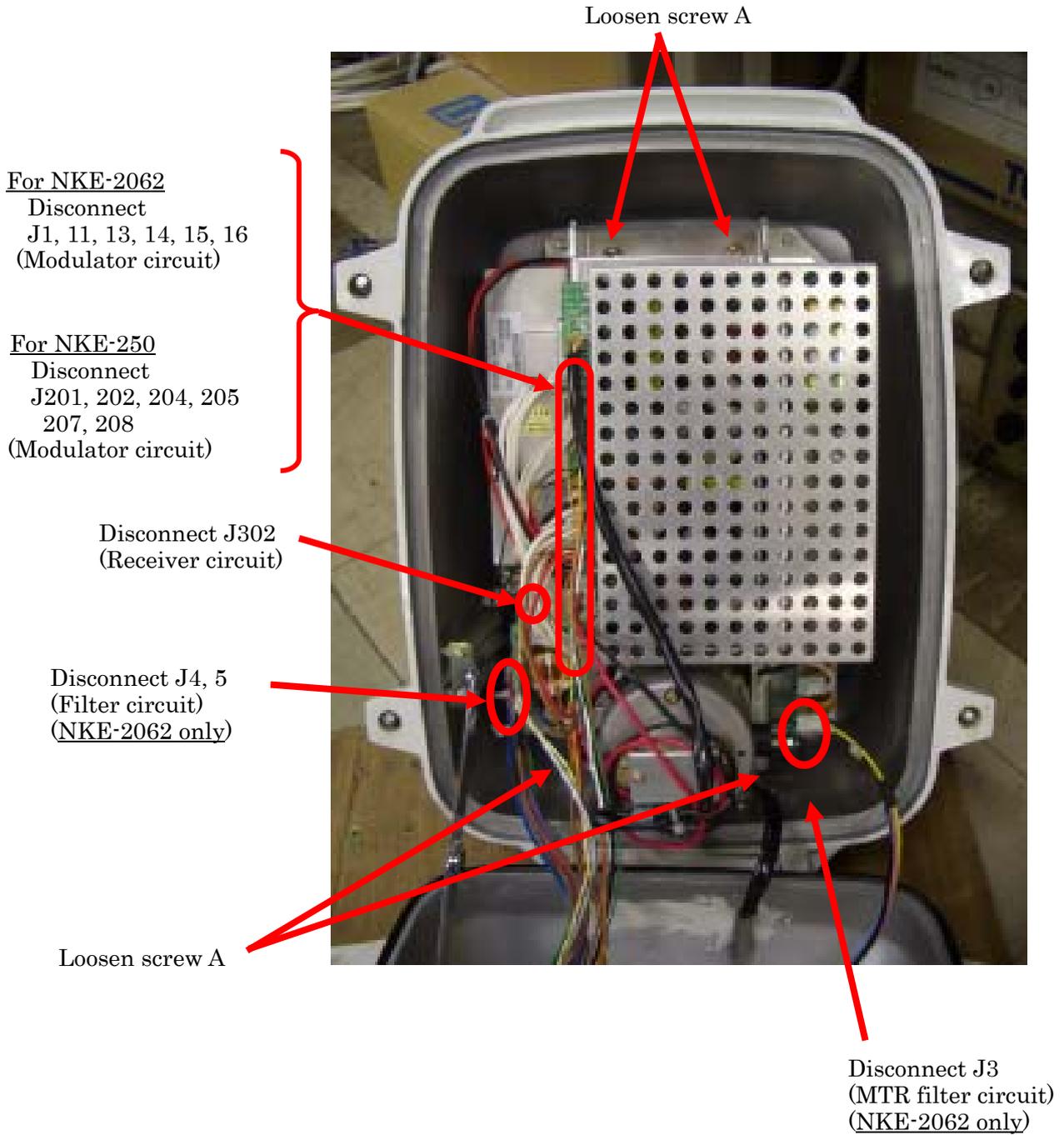


Fig.2 Internal view of NKE-2062/250  
NKE-250 does not have the filter circuit (CFR-193) and the MTR filter circuit (CFR-194).

For NKE-283

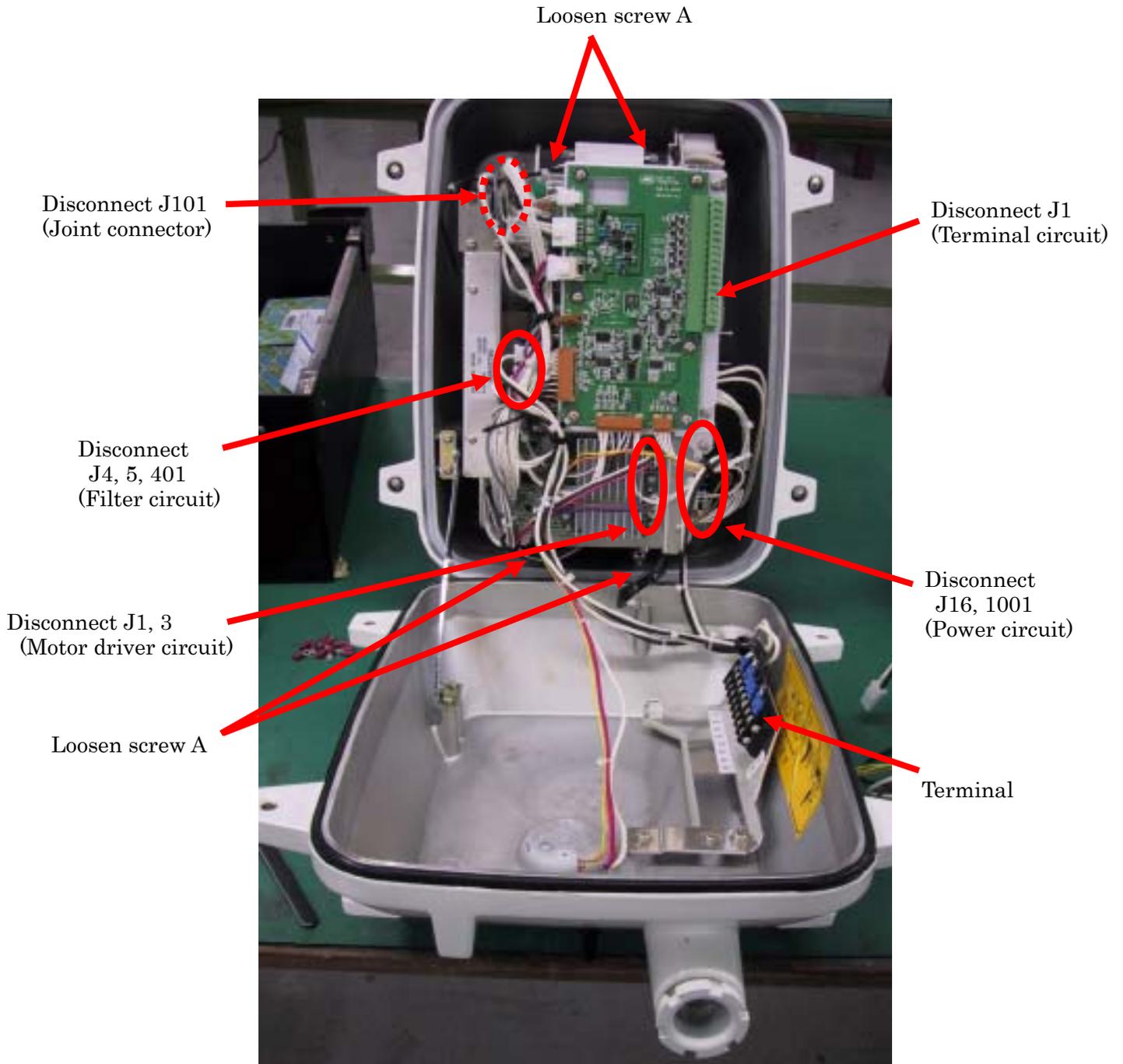


Fig.3 Internal view of NKE-283

**Procedure 2 Removing the transmitter-receiver unit**

Remove the transmitter-receiver unit from the scanner unit.

**Procedure 3 Removing the reed switch**

Unscrew the 2 screws (B) and remove the reed switch with the mounting plate.

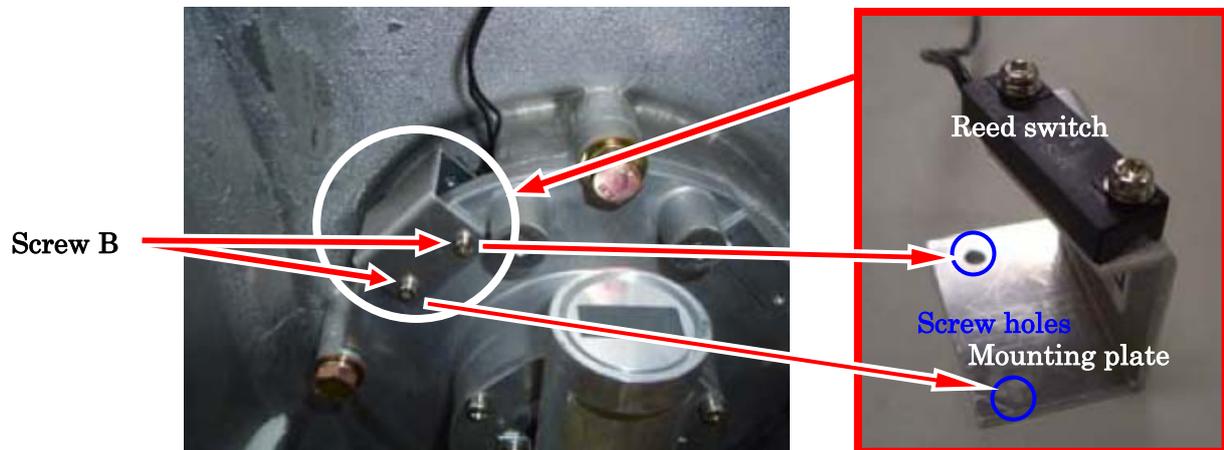


Fig.4 View of the reed switch installation

**Procedure 4 Replacing mounting plate**

Unscrew the 2 screws (C) and replace the mounting plate with the modified one.

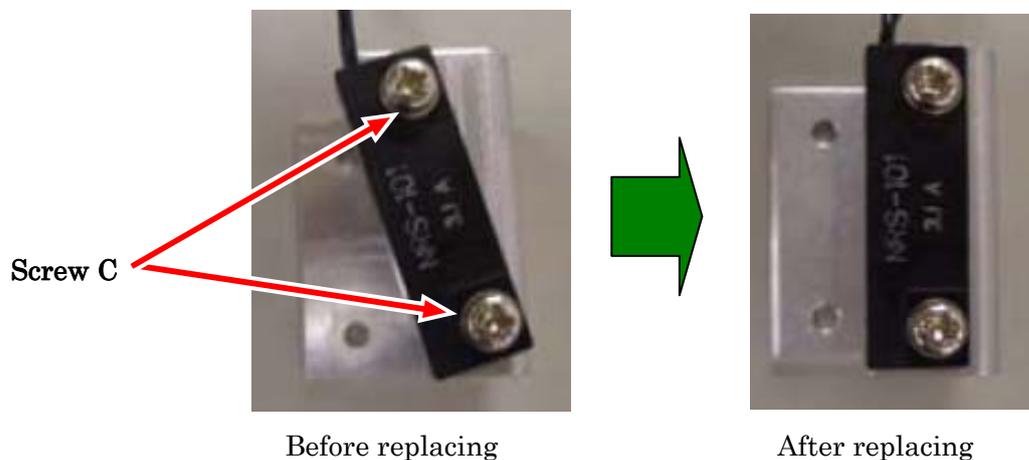


Fig.5 Replacing the reed switch mounting plate

**Procedure 5 Installation of the reed switch and the transmitter-receiver unit**

Install the reed switch with the modified mounting plate to scanner unit.

Install the transmitter-receiver unit which removed at procedure 2 and tighten the 4 screws (A), and connect all connectors and cables which disconnected at procedure 1.

When closing the pedestal, confirm the correct connection and notice the cables is not damaged.

**Procedure 6 Confirming the operation**

Please turn on the power supply of the radar, and execute the bearing adjustment.

Fill in the result confirmation on the attached check sheet, and send it to the Marine Service Department.

**Reed switch installation trouble**  
**(Technical Information : RD070302A)**

Objective Equipment and serial number

Unit type	Qty.	Serial number		Remarks
		start	end	
NKE-2102	100	LZ 37956	- LZ 38055	
	100	LZ 39562	- LZ 39661	
	100	LW 37303	- LW 37402	
	100	LW 37453	- LW 37552	
	100	LW 38013	- LW 38112	
	150	LW 38373	- LW 38522	
	200	LW 39173	- LW 39372	
	200	LB 60001	- LB 60200	
	100	LB 61093	- LB 61192	
	150	LB 61784	- LB 61933	
	70	LZ 30631	- LZ 30700	
	100	LZ 30701	- LZ 30800	
	105	LZ 36701	- LZ 36805	
	100	LZ 39762	- LZ 39861	

Unit type	Qty.	Serial number		Remarks
		start	end	
NKE-2062	70	LZ 30061	- LZ 30130	
	100	LZ 30531	- LZ 30630	
	200	LZ 31351	- LZ 31550	
	400	LZ 33651	- LZ 34050	
	300	LZ 36401	- LZ 36700	

Unit type	Qty.	Serial number		Remarks
		start	end	
NKE-250	100	LX 34431	- LX 34530	
	100	LX 36485	- LX 36584	
	200	LX 36185	- LX 36384	
	550	LX 37335	- LX 37884	
	150	LX 39820	- LX 39969	
	200	LZ 31001	- LZ 31200	
	300	LZ 32951	- LZ 33250	
	400	LZ 35851	- LZ 36250	
	450	LZ 37306	- LZ 37755	
	300	LA 61601	- LA 61900	
	450	LA 62651	- LA 63100	
	400	LA 63701	- LA 64100	
	300	LA 64801	- LA 65100	
	300	LA 65401	- LA 65700	
	300	LA 66001	- LA 66300	
	550	LA 66901	- LA 67450	
200	LA 67666	- LA 67865		

Unit type	Qty.	Serial number		Remarks
		start	end	
NKE-283	200	LW 37813	- LW 38012	
	300	LW 38573	- LW 38872	
	2	LB 60301	- LB 60302	
	10	LB 60783	- LB 60792	
	200	LB 60893	- LB 61092	

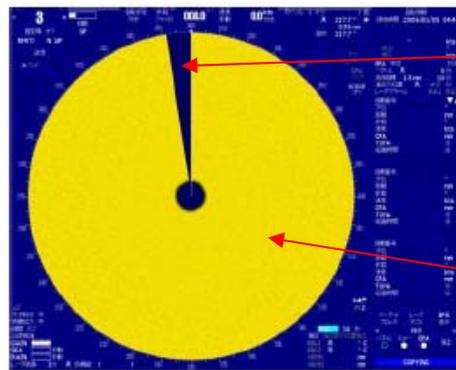
## Countermeasure for improper installation of the reed switch

Mar. 02, 2007  
Marine Radar Group

### 【Content】

There are few trouble reports of the radar echo omission due to improper installation of the reed switch. Radar model and scanner unit type are as follows.

- NKE-2102 for JMA-5310 and JMA-5110
- NKE-2062 for JMA-5106
- NKE-250 for JMA-2344
- NKE-283 for JMA-609



Radar echo omission within the range of the angle of about 10°.

Radar echo  
(Using test video at the factory)

Fig.1 Example of the phenomenon

### 【Cause】

The reed switch to generate azimuth signal which works with the magnet on the main gear, is not installed to appropriate position, therefore the switch operation is sensitive to environmental temperature (Especially, at the low temperature) and might not work correctly though it is a rare case. As a result, the radar echo omission occurs within the range of the angle of about 10°.

Usually, it doesn't return normally when the phenomenon occurs once, therefore please execute the following countermeasure.

### 【Countermeasure】

Please replace the mounting plate for the reed switch to modified one which have been stocked ( code : MTB383221 ).

Then please throw the detached mounting plate away.

When urgent action is necessary with no modified plate, please execute the emergency procedure as follows.

<Emergency procedure>

- a) Move the position of the reed switch with the mounting plate in the direction where the reed switch goes away from the magnet ( cogwheel in the main axis ).

The mounting plate can be slightly moved by loosening the screw because it is fixed to the case in the vicinity of the scanner's cogwheel with two screws.

(The trouble might be able to be improved because of a little positioning the mounting plate.)

- b) When it is not improved by above-mentioned a), expand the screw hole diameter of the mounting plate with thin file etc. to get more range of movement, and move the position of the reed switch. The expanded screw hole is enough only by one.

**【Current installation of the reed switch】**

When removing the reed switch from the scanner unit, unscrew the following 2 screws.

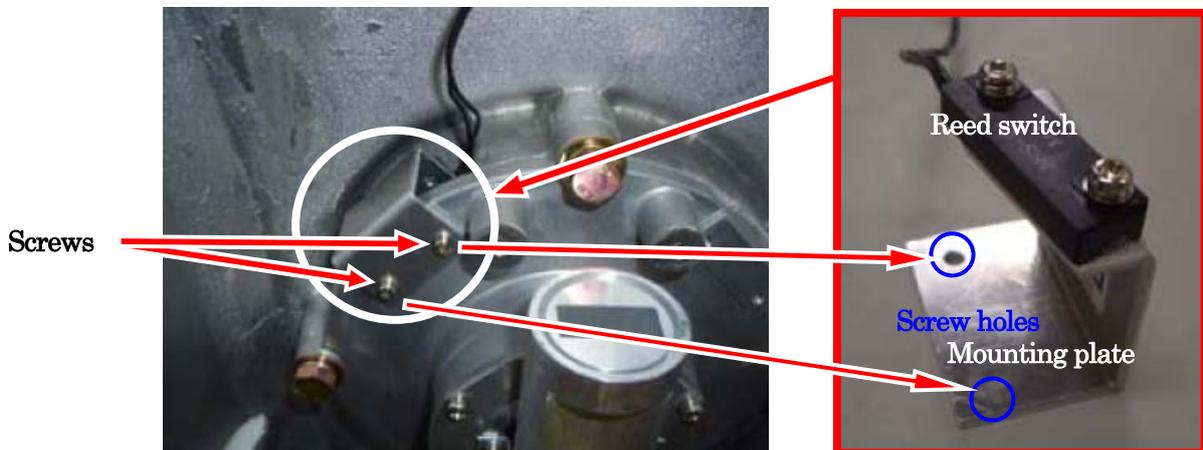


Fig.2 View of the reed switch installation

**【Countermeasure】**

Please replace the mounting plate for the reed switch to modified one which have been stocked (code : MTB383221 ).

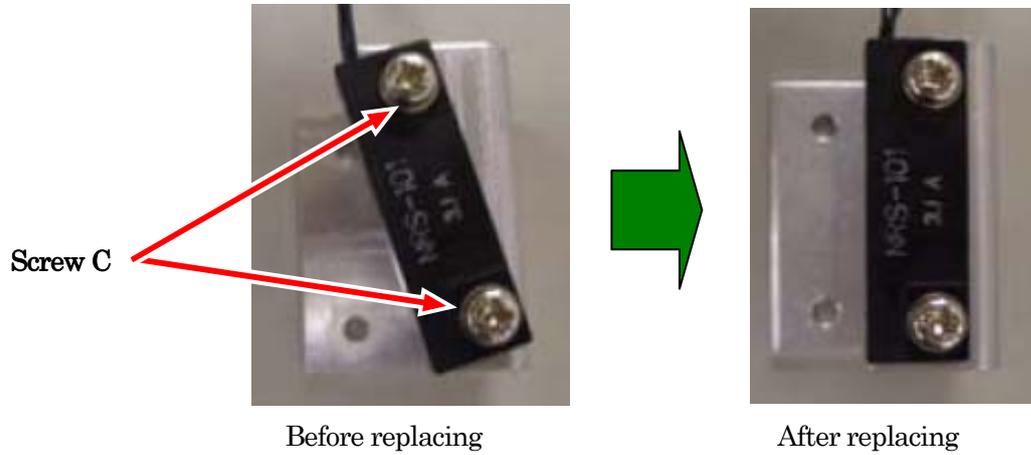
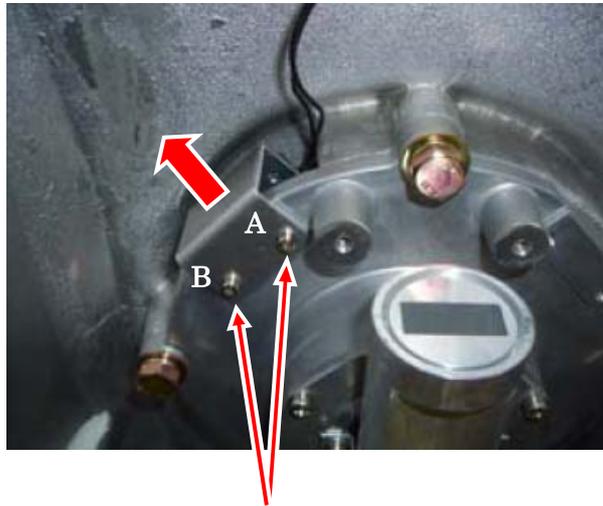


Fig.3 Replacing the reed switch mounting plate

■ Emergency procedure



- a) Move the position of the reed switch with the mounting plate in the direction where the reed switch goes away from the magnet.
- b) When it is not improved by above-mentioned a), expand the screw hole (A) diameter of the mounting plate to get more range of movement, and move the position of the reed switch.

### 3.3.24 Locking a fixed target on the radar PPI screen while the ship is navigating

Normally, the PPI image moves as the ship moves.

This method of display is called:

Relative Motion : RM

In contrast to this, the display mode in which the echo images from fixed targets such as land do not move and the location of the ship (center of the PPI) moves according to the course and speed of the ship is called:

True Motion : TM

- In order to undertake TM display, it is necessary to input bearing information and the ship's speed information from a navigation device.  
Please refer to "3.6.1 Obtaining information on bearing" and "3.6.2 Obtaining information on speed" with respect to information on bearing and on speed.

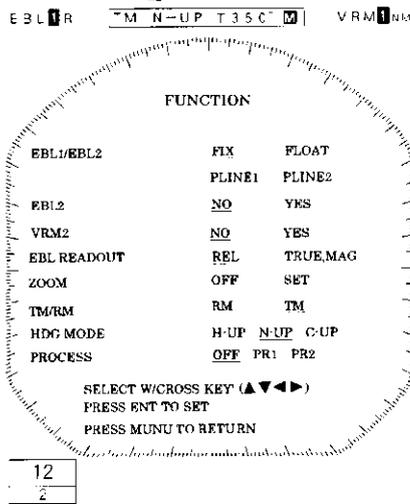
#### Commencing True Motion display

(a) Select "TM" in the line "TM/RM" - the menu "FUNCTION".

The motion display on the PPI screen will change to "TM".

- The bearing display with TM is enabled is only N-UP.

True Motion Display mode: TM



**Canceling true motion display**

- (a) Select "RM" in the line "TM/RM" - the menu "FUNCTION".  
 The TM is canceled and the mode is now N-UP of RM.

Relative Motion Display mode: RM

EBL PR RM N-UP T 3 5 0 VRM RM

FUNCTION

EBL1/EBL2	FIX	FLOAT
	PLINE1	PLINE2
EBL2	NO	YES
VRM2	NO	YES
EBL READOUT	REL	TRUE/MAG
ZOOM	OFF	SET
TM/RM	RM	TM
HDG MODE	H-UP	N-UP C-UP
PROCESS	OFF	PR1 PR2

SELECT W/CROSS KEY (▲▼◀▶)  
 PRESS ENT TO SET  
 PRESS MUNIT TO RETURN

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## 3.6 External Navigation Devices

● Please refer to "9.3.4 Display unit rear panel" on connections.

This radar equipment has the following busses at the rear of the display unit.

- NMEA 

	CMPS+ and CMPS- terminals of the EXT1(J3) connector
	NAVRX and NAVCOM terminals of the GPS(J4) connector

An external navigation device with either of these busses may be connected for input and output of information.

### 3.6.1 Obtaining information on bearing

In order to obtain information on the bearing of the ship, one of the following needs to be connected to the display unit.

- Magnet compass
- GPS gyro

Bearing information is input from either the CMPS or NAVRX terminals.

### 3.6.2 Obtaining information on speed

In order to obtain information on the speed of the ship, one of the following devices need to be connected to the display unit.

- GPS
- LORAN C

Speed information is input from either the CMPS or NAVRX terminals.

### 3.6.3 Obtaining information on position

In order to obtain information on the ship's position in terms of latitude and longitude, one of the following devices need to be connected to the display unit.

- GPS
- LORAN C

In order to obtain the ship's position information using LORAN C time difference, the following needs to be connected to the display unit.

- LORAN C

(19) Input from external device

GPS (NMEA0183)

Electric compass or GPS compass (NMEA0183)

NMEA0183 version : v1.5, v2.1, v2.3

Latitude/Longitude : GGA, RMA, RMC, GLL

Waypoint : RMB, BWC

Speed : VTG, RMA, RMC, VHW

Course : VTG, RMA, RMC

Ship's head : HDT, VHW, HDM, HDG

VARIATION : HDG, RMA, RMC

TD (LoranC time difference) : GLC, GTD, RMA

(20) Output to external device

Cursor data (Bearing/Range)

NMEA0183 RSD sentence\*\*

Sub monitor

(Vertical/Horizontal synchronous signal,  
video signal)

\* You need a connection with navigation device or bearing sensor.

\*\* Data output only when pushing ENTER key.