MARINE RADAR EQUIPMENT

JMA-9102-CA /-9303-CA
JMA-9252-6CA /9CA
JMA-7102-CA /-7303-CA
JMA-7252-6CA /9CA

FIELD SERVICE MANUAL

(BSH VERSION)

JRC Japan Radio Co., Ltd.

1 General

1.1 General and Equipment Composition

This radar is designed to withstand possible severe ambient conditions by using semiconductors (except for few special tubes) to upgrade the reliability of the circuits so that otherwise occurrence of external adverse cause or human error, equipment is almost free from the troubles.

That equipment's normal condition can be maintained by applying periodical function check and maintenance mentioned hereunder.

*Function Check

Check should be carried out regulary and whenever abnormalities being found, investigate the cause of trouble. In checking , care must be taken specially for high voltage circuits. Careless check or misjudgement may cause adverseco nsequences.

*Trouble shooting

Semi conductors are highly reliable components that except in a few cases of defects due to under estimated design and factory check or due to the human error, failure of semi-conductors are not so often exist. However, comparatively grater part of the cause of the trouble are such as due to high value resistor's damage by humidity, variable resistor's wear down or poor contacts of switches and relays.

Apart from the failure of components, there are de-tuning of circuit due to improper adjustment or loosed connection of cables due to lack of maintenance. It is more effective to make a check and adjustment taking these points in to consideration.

In case of the Fuse burnt out, check should be carried out to trace the back ground of over current even after the replacement. However it should be noted that the each fuse has its own varied cut off time.

JMA-9000 Series Radar uses 28 Inches high definition Monochrome CRT

JMA-7000 series Radars uses 21 Inches High definition Monochrome CRT

JMA-9000 and 7000 series Radars are classified by output power, Bands and Scanner size as follows.

Overall Model	Scanner size	Units	Output	Bands	CRT size
JMA-9102 -/-CA	12ft	2 Unit	10KW	S-band	28"
JMA-9252-6 -/-CA	6ft	2 Unit	25KW	X-band	28"
JMA-9252-9 -/-CA	9ft	2 Unit	25KW	X-band	28"
JMA-7102 -/-CA	12ft	3 Unit	30KW	S-band	21"
JMA-7252-6 -/-CA	6ft	2 Unit	25KW	X-band	21"
JMA-7252-9 -/-CA	9ft	2 Unit	25KW	X-band	21"

-CA stands for "with ARPA".
-E stands for Normal Radar without ARPA

Composition of Radar System and Ship's Power Supply

Model	Upper Scanner Type Middle Transceiver Type Lower Display Type	Power Supply
JMA-9102 JMA-9102-CA	NKE-1072 (*) NCD-3590-2/NCD-3591-2	AC200/220V, 50/60Hz 3φ AC100/110V, 50/60Hz 1φ
JMA-9252-6 JMA-9252-6CA	NKE-1052-6 (*) NCD-3590-2/NCD-3591-2	AC200/220V, 50/60Hz 1φ/3φ
JMA-9252-9 JMA-9252-9CA	NKE-1052-9 (*) NCD-3590-2/NCD-3591-2	AC100/110V 50/60Hz, 1φ
JMA-7102 JMA-7102-CA	NKE-1052 (*) NCD-3570-2/NCD-3570-CA2	AC200/220V, 50/60Hz 3φ AC100/110V, 50/60Hz 1φ
JMA-7252-6 JMA-7252-6CA	NKE-1052-6 (*) NCD-3570-2/NCD-3570-CA2	AC200/220V, 50/60Hz 1φ/3φ
JMA-7252-9 JMA-7252-9CA	NKE-1052-9 (*) NCD-3570-2/NCD-3570-CA2	AC100/110V 50/60Hz, 1φ

CA stands for ARPA.
Radar Type without CA notation means without ARPA.
Example·Radar display unit with ARPA:
NCD-3591-2/NCD-3570-CA2
·Radar display unit without ARPA:
NCD-3590-2/NCA-3570-2

For Referenc

The mark (*) at the end of scanner type changes by the voltage, phase and options specification as De-icing heater.
・Exact type of standard, NKE-1079 is NKE-1079-2F (AC220V, 3φmotor) and 1 stands for AC100V, 2 stands for AC200V and F:stands for 3φ and no mark means 1φ. Other additional codes are optional specifications.

Example:

NKE-1052-6-1DF

- No mark:Motor phase 1φ
  - F :Motor phase 3φ
- No mark:Without deicing heater
  - D :With deicing heater
- 2 :Motor work volt 200V
  - 1 :Motor work volt 100V
- No mark:12ft :S-band
  - 9 : 9ft :X-band
  - 6 : 6ft :X-band
- 1072:S-band Pedestal
  - 1052:X-band Pedestal

Above example means X-band Radar, 25kw type with de-icing heater driven by 110V 1φ motor.

Note:When the Main supply is 440VAC, stepdown transformer is required.

Name Plate of the each unit are specified as follows.
Antenna :SCANNER UNIT
Transceiver:TRANSMITTER-RECEIVER UNIT
Indicator :DISPLAY UNIT

1.2 Specifications

1.2.1 Overall specifications

(1) Type of Emission	PON
(2) Display System	Monochrome Raster scan System
(3) Display Area	High resolution CRT (Effective display area:more than 340 diameter)
(4) Range	0.25, 0.5, 0.75, 1.5, 3, 6, 12, 24, 48, 96 NM
(5) Range Resolution	Less than 30m
(6) Minimum Detectable Range	Less than 25m
(7) Bearing Accuracy	Less than 1°
(8) Bearing Display	Relative Bearing, True Bearing, North up Bearing
(9) Environmental Condition	Temperature Antenna −25℃~+55 (Not in operation −25℃~+70℃) Other than Antenna −15℃~+55℃ Relative Humidity +35℃ 95%
(10) Vibration	0~500 CPM All amplitude 3mm 500~1500CPM All amplitude 0.75mm 1500~3000CPM All amplitude 0.2mm
(11) Power Supply Input (Standard)	Antenna 6ft AC110/220V 50/60Hz 1φ 9ft AC110/220V 50/60Hz 1φ 12ft AC110/220V 50/60Hz 3φ Other than Antenna AC110/220V 1φ/3φ
(12) Power Consumption	
(13) Power Input Fluctuation	±10% of input voltage
(14) Preheat Time	Within 4 minutes
(15) Time from Stand-by to Operation	Within 15 seconds
(16) Applied Rules	First class Ministry of Transportation, First class Postal Administration, IMO, A477, A422, IEC945

1. 2. 2 Antenna

(1) Dimensions

6ft	Height	581×Turnig	diameter	1890mm
9ft	Height	581×Turnig	diameter	2830mm
12ft	Height	850×Turnig	diameter	4000mm

(2) Weight

6ft	48kg
9ft	53kg
12ft	145kg

(3) Polarization Plane: Horizontal Polarization

(4) Directional Characteristic

Horizontal Beam Width	6ft	1. 2°
	9ft	0. 8°
	12ft	1. 9°
Vertical Beam Width	6ft	25°
	9ft	25°
	12ft	30°
Side lobe Level	−26dB (Less than ±10°)	
	−30dB (Less than ±10°)	

(5) Revolution: abt. 26rpm (60Hz)
abt. 21rpm (50Hz)

(6) Drive Motor

6ft	AC110/220V 50/60Hz 1φ VA
9ft	AC110/220V 50/60Hz 1φ VA
12ft	AC220V 50/60Hz 3φ VA
	AC110V 50−60Hz 1φ VA

(7) Wind Velocity: With stands Relative wind Speed of 51. 5m/S (100Knots)

(8) Transmitting Frequency

X-band	9410±30MHz
S-band	3050±10MHz

(9) Peak output power

X-band	25KW
S-band	10KW

(10) Magnetron

X-band	M1437
S-band	M1430

(11) Transmitting pulse width/Repetition Frequency

Pulse width and repetition frequencies for the range 0. 25NM~0. 5NM and 24~120NM are as follows.

0. 25NM	0. 07μS/1900Hz
0. 5NM	0. 07μS/1900Hz
24NM	1. 2 μS/ 570Hz
48NM	1. 2 μS/ 570Hz
120NM	1. 2 μS/ 570Hz

10

Pulse width can be selected for the range from 0.75NM-12NM.

0.75NM (Short)	0.07μS/1900Hz
0.75NM (Middle)	0.1 μS/1900Hz
1.5NM (Short)	0.1 μS/1900Hz
1.5NM (Middle)	0.3 μS/1900Hz
1.5NM (Long)	0.6 μS/1100Hz
3NM (Short)	0.2 μS/1900Hz
3NM (Middle)	0.6 μS/1100Hz
3NM (Long)	1.2 μS/ 570Hz
6NM (Short)	0.6 μS/1100Hz
6NM (Middle)	1.2 μS/ 570Hz
12NM (Short)	0.6 μS/1100Hz
12NM (Middle)	1.2 μS/ 570Hz

(12) Modulator Circuit — Solid state Modulator Circuit

(13) Transmit/Receive Selector — Circulator+Diode Limitter

(14) Front End Module — Built in MIC

(15) Intermediate Frequency Amplifier

Intermediate Frequency	60MHz
Band width	20/6/3MHz
Gain	more than 90db
Amplifier Characteristics	Log amplifier

(16) Over-all Noise Index — 7.5dp (average)

(17) Tuning — Manual/Auto

1.2.4 Display Unit

(1) Dimensions

NCD-3590-2/3591-2	700 (Width) ×850 (Depth) ×1255 (Height)
NCD-3570-2/- (CA2)	535 (Width) ×720 (Depth) ×1215 (Height)

(2) Structure — Floor mount drip proof Structure

(3) Weight

NCD-3590-2/3591-2	110Kg
NCD-3570-2/- (CA2)	90Kg

(4) Power Supply Input — AC110/220V 50/60Hz 1φ/3φ

(5) Power Consumptions

NCD-3590-2/3591-2 (S)	900VA
NCD-3590-2/3591-2 (X)	700VA
NCD-3570-2/ (CA2) (S)	800VA
NCD-3570-2/ (CA2) (X)	600VA

(6) Power Supply Input Fluctuation	Power supply voltage ±10%
(7) Display Area	
NCD-3590-E/91-E	28˝Monochrome high definition CRT (Effective Diameter more than 340mm)
NCD-3570-E/-CAE	21˝Monochrome high definition CRT (Fffective Diameter more than 250mm)
(8) Ranges	0. 25, 0. 5, 0. 75, 1. 5, 3. 6, 12, 24, 48, 96NM
(9) Range Scales	0. 05, 0. 1, 0, 15, 0, 25, 0. 5, 1, 2, 4, 8, 16NM
(10) Accuracy of Range Scales	1. 5% of the maximum distance of the Mile Range in use or 70m which ever is larger
(11) Variable Range Marker	2 scales
(12) Variable Range Scale span	0~120. 0NM 4 Digits Presentation
(13) Bearing Scale	1° notch scale for 360°
(14) Off Center	65% Radius
(15) Trackball Cursor	Builtin (Target Range, Relative/True-Bearing presentation)
(16) EBL	2 (1 can be off center)
(17) EBL Bearing Indication	000. 0° ~359. 9° 4 Digit Presentation
(18) Tuning Indication	Bar graph
(19) Plotter	Electronic plotter (Maximum 10 points)
(20) SHM Presentation	Builtin
(21) TM System	Builtin (0. 25~24mile)
(22) STC	Manual/Auto
(23) FTC	ON/OFF/Auto
(24) Display Mode	Relative Bearing, True Bearing, Course-up.

(25) Other Ship's Trail Display	Short/Middle/Long/OFF True motion trail display at True Motion Display mode (TM) Relative Motion Trail display at Relative Motion Display Mode (RM)
(26) Video Processor	Builtin
(27) Interference Rejection	ON/OFF
(28) Guard Zone/Ring	Guard Zone function with ARPA Guard Ring function without ARPA Either Zone and Ring can be selected for whole circle or optional Bearing Sector
(29) Nav-Line	Built-in (128 points×10 sets)
(30) Peripheral Equipments	
Sub Indicator	By the specification of interface in separate sheet
GPS/Loran-C	JRC format NEMA-0183 (BWC, BWR, GGA, GGL, RMA, RMB, RMC, VBW, ZDA, VTG)
Radar Bouy	Interface specification in separate sheet
Total Nav	With ARPA only
LOG	Interface specification in separate sheet
GYRO	Interface specification in separate sheet
Interswitch	Interface specification in separate sheet

1. 2. 5 Repair Block

Circuit Block	Type	Unit	PC NO.
X-band Modulator NMA-441			
Modulator CKT	CPA-209	Transceiver	PC209
MHPS-CKT	CBD-1226	Transceiver	PC220
Rectifier	CBA-249	Transceiver	PC1001
T/R Control CCT	CMC-898	Transceiver	PC1101
X-band Receiver NRG-98			
IF amplifier CCT	CAE-344	Transceiver	PC301
S-band Modulator NMA-465			
Modulator CCT	CPA-210	Transceiver	PC210
MHPS-CCT	CBD-1257	Transceiver	PC220
Rectifier	CBA-249	Transceiver	PC1001
T/R Control CCT	CMC-898	Transceiver	PC1101
S-band Receiver NRG-88			
IF Amplifier CCT	CAE-344	Transceiver	PC301
NSK CCT	CMJ-304B	Display	PC4201
CPU Control Circuit	CMC-825-2	Display	PC4401
Timebase CCT	CED-34-J	Display	PC4402
ARPA Process CCT	CDC-876-2	Display	PC4403
Target Extention CCT	CPC-180C	Display	PC4450
Keyboard Process CCT	CMD-635	Display	PC4501
Trackball CCT	CHG-92	Display	PC4502
Panel CCT 1 (ARPA without)	CMD-660	Display	PC4503
Panel CCT 1 (ARPA with)	CMD-661	Display	PC4503
Panel CCT 2	CMD-659	Display	PC4504
Terminal Board CCT	CQD-1334	Display	PC4601
Relay CCT	CSC-523	Display	PC4701
Power Supply CCT 1	CBD-1164	Display	PC5101
Power Supply CCT 2	CBD-1227	Display	PC5102
Inter Switch CCT	CCL-263	Display	PC4301
For JMA-9000			
28´Monitor Deflection CCT	CMC-791	Display	PC7501
28´Monitor Socket CCT	CQD-1267	Display	PC7502
28´AVR CCT	CBD-1252	Display	PC7504
For JMA-7000			
21´Monitor Deflection CCT	CBC-716	Display	PC7501
21´Monitor Socket CCT	CQD-1145	Display	PC7502

Repair Block (continue)

Name of Block	Type	Unit	Remark
S band Motor with Gear (AC220V 3φ)	MPEM30030	Antenna	
S band Motor with Gear (AC110V 1φ)	MPEM30039	Antenna	Option
X band Motor with Gear (AC220V 3φ)	MPEM30037	Antenna	
X band Motor with Gear (AC220V 1φ)	MPEM30018	Antenna	Option
X band Motor with Gear (AC110V 1φ)	MPEM30016	Antenna	Option

1.2.6 Special Parts List

NKE-1072 (S band 10KW Transceiver)

Part No.	Item	Type	Code
V201	Magnetron	M1430	5VMAA00046

NKE-1052 (X band 25KW Antenna)

Part No.	Item	Type	Code
V201	Magnetron	M1437A	5VMAA00039
A101	Circulator	FCX68	6AJRD00001
A303	Diode Limitter	NJS6928	5EZAA00019
A302	Pin atteunater	NJS6926	5ENAC00019

CRT and High Voltage Power Supply

Part No.	Item	Type	Code
V1	28˝CRT	E8471B3	5VBAB00050
E1	28˝High Voltage power supply	H-7EPRD0017C	7EPRD0017C
V1	21˝CRT	E8130B39	5VBAB00066
E1	21˝High Voltage power supply	H-7EPRD0018B	7EPRD0018B

1. 2. 7 Spare Parts (6ZXRD000186) Fuses

Item	Type/Code	In use	Spare	Part	No. Where Used
Fuse	MF51NN-1A (5ZFAD00042)	1	3	F1	Antenna *1 Trasceiver *2
Fuse	MF60NR-10A (5ZFAD00018)	2	6	F5001 ~2	Display Unit AC110V
Fuse	MF60NR-5A (5ZFAD00017)	2	6	F5001 ~2	Display Unit AC220V
Time Lag Fuse	MF61-TS5 (5ZFAD00478)	3	9	F5003 ~5	Power supply for Motor in Display Unit
Time Lag Fuse	MF61-TL10 (5ZFAA00105)	3	9	F5003 ~5	Power supply for Motor in Display Unit *4
Fuse	MF51NN-10A (5ZFAD00457)	1	3	F1	Display Unit Power Supply Circuit
Fuse	MF51NN-6. 3A (5ZFAD00336)	1	3	F3	Display Unit Power Supply Circuit
Fuse	MF51NN-2A (5ZFAD00043)	3	9	F2	Display Unit Power Supply Circuit
Fuse	MF51NN-2A (5ZFAD00043)	3	9	F1~F2	Display Unit Defrection Circuit
Fuse	MF51NN-0. 5A (5ZFAD00041)	4	12	F1~F4	Display Unit NSK Circuit
Fuse	MF51NN-3A (5ZFAD00044)	2	6	F1~F4	28˝Display Unit Diflection CCT *3
Fuse	MF51NN-3. 15A (5ZFAD00227)	1	3	F1	Display Unit Terminal Board

*1 :In case of 2 unit
*2 :In case of 3 unit
*3 :Only for JMA-9000
*4 :In case of NKE-1052 used AC100/100V, 1Φ

1.2.8 List of ROMs

No.	Name in use	Version	Unit Name
1	MTR (Transceiver)	1.7	PC1101 in Scanner
2	NSK	1.1	PC4201 in NSK
3	PANEL	1.1	PC4501 in Keyboard
4	ARPA CPU	5.1	PC4403 in Display
5	ARPA TD	2.1	PC4403 in Display
6	INDICATOR	2.05	PC4401 in Display

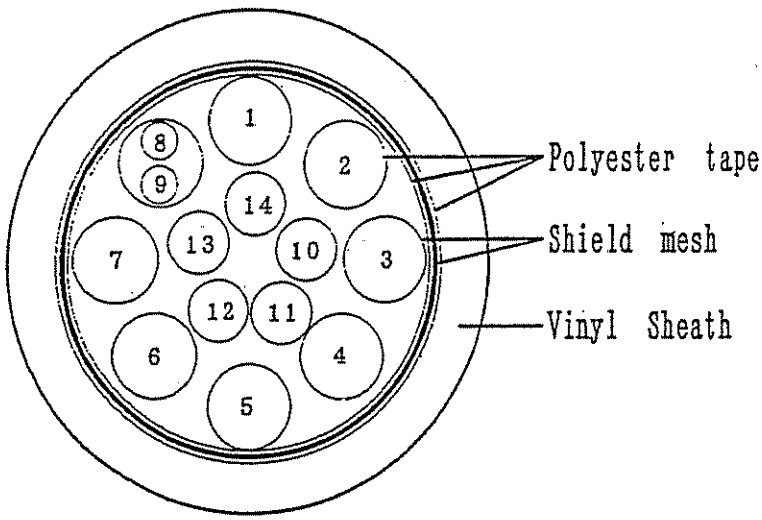
2 Installation

2.1 Installation Cable

2.1.1 Cables between Display Unit and Transceiver, Transceiver and Antenna.

14 Cores Composite Cable in Vinyl Sheath
JRC CODE H-2695110056

(Outer Diameter abt. 23mm)

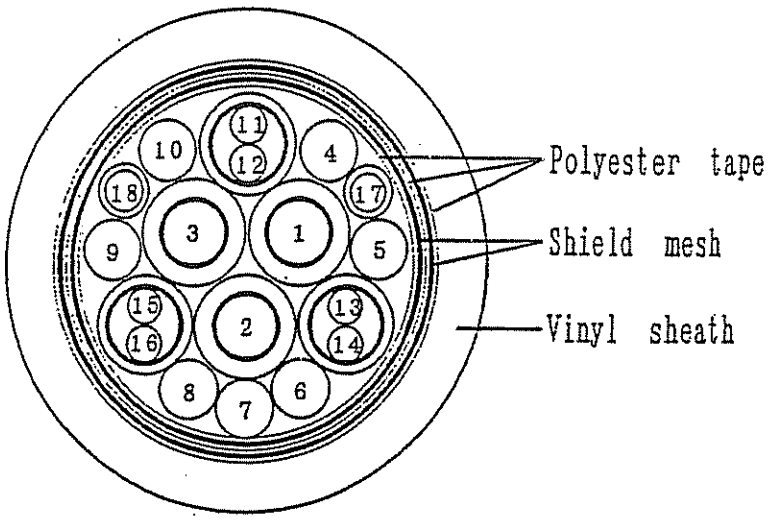


Core No.	Cross Section (mm2)	No.of wire/ ϕ	Color	Remarks
1	0.5	19/0.18	Black 1	Coaxial Cable
2	0.5	19/0.18	Black 2	Coaxial Cable
3	0.5	19/0.18	Black 3	Coaxial Cable
4	0.5	19/0.18	Black 4	Coaxial Cable
5	5.5	35/0.45	Yellow	
6	5.5	35/0.45	Green	
7	5.5	35/0.45	Brown	
8	0.3	12/0.18	White	Twisted pair cable with shield Sheath white
9	0.3	12/0.18	Orange	
10	2.0	37/0.26	Red	
11	2.0	37/0.26	Blue	
12	1.25	50/0.18	Black	
13	1.25	50/0.18	Purple	
14	0.5	19/0.18	Gray	Shield wire

2.1.2 Between 2 Display Units and Interswitch

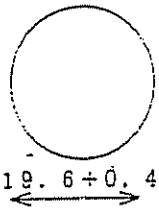
18 Cores Composite Cable in Vinyl Sheath
JRC CODE H-2695110057

(Outer Diameter abt. 22mm)

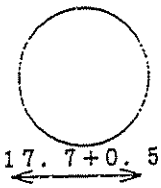


Core No.	Cross Section (mm2)	No.of wire/ ϕ	Color	Remarks
1	0.5	19/0.18	Black 1	Coaxial cable
2	0.5	19/0.18	Black 2	Coaxial cable
3	0.5	19/0.18	Black 3	Coaxial cable
4	2.0	37/0.26	Red	
5	2.0	37/0.26	Blue	
6	2.0	37/0.26	Yellow	
7	2.0	37/0.26	Purple	
8	2.0	37/0.26	Brown	
9	2.0	37/0.26	Green	
10	2.0	37/0.26	Black	
11	0.3	12/0.18	White/Red	Twist pare cable with Shield White sheath
12	0.3	12/0.18	White/Blue	
13	0.3	12/0.18	White/Yellow	Twist pare cable with Shield White sheath
14	0.3	12/0.18	White/purple	
15	0.3	12/0.18	White/Brown	Twist pare cable with Shield White sheath
16	0.3	12/0.18	White Green	
17	0.5	19/0.18	Gray	Shield cable
18	0.5	19/0.18	Orange	Shield cable

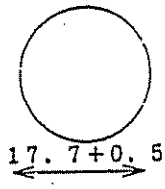
2.1.3 Cable for peripheral Equipments-1



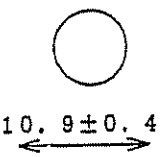
Between Antenna And Dispaly Unit
(H-2695110056)
((14 Cores Composite Cable)



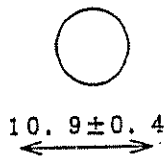
Interswitch-1(18 Cores Composite Cable)
(H-2695110057)



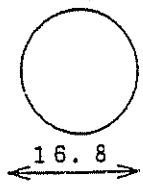
Interswitch-2(18 Cores Composite Cable)
(H-2695110057)



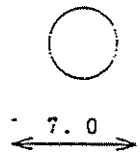
NAV-1(GPS Cable)
(250V TTYCYS-1)



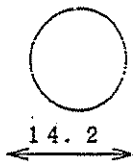
NAV-2(Loran Cable)
(250V TTYCYS-1)



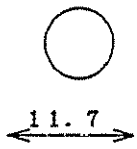
Power Supply Cable
(660V TPYC-5.5φ)



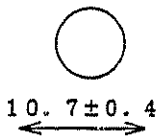
Key board(10 Cores Shield Composition Cable)
(H-7ZCRD00468)



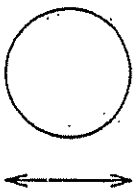
Gyro Cable
(250V MPYCYS-5)

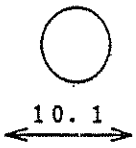


Log Cable
(250V DPYCS-1.25φ 2Core)



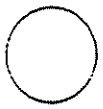
2 Channels Log Cable
(250V TTYCYS-1)





Slave Input/Output Cable(Radar Adaptor etc.)
(H-2695110006)

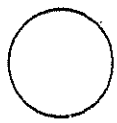
2.1.3 Cable for Peripheral Equipments-3



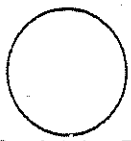
Output Cable for Extrnal CRT
(H-2695110034)
(11 cores composite cable)

Output Cable for ARPA
(250V TTYCYS-1)

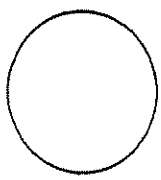
Output Cable for ARPA alarm
(250V TTYCYS-1)



Cable for Total-NAV
(250V TTYCYS-4)



Cable for Night Vision
(250V TTYCYS-4)

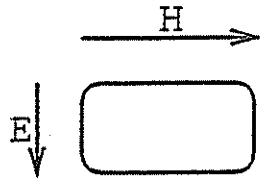


Cable for RS232C
(250V TTYCYS-7)

2.2 Installation of Antenna Unit

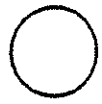
In planning location of the antenna unit, care must be taken not to let the Funnel, deck Crane and Mast or any other hull structure may enter the radiation beam of the radar. These obstacles often became cause of the false echoes or blind sectors on the screen. Allowable bending angle of the X-band wave guide and S-band coaxial cable are as follows.

Allowable bending angle (X-band)



E diredtion 200mmR
H direction 400mmR

Allowable bending angle (S-band)



HF-20D 350mmR

Above are the cross section of the waveguide and Coaxial cables.

2.2.3 Installation of Display Unit

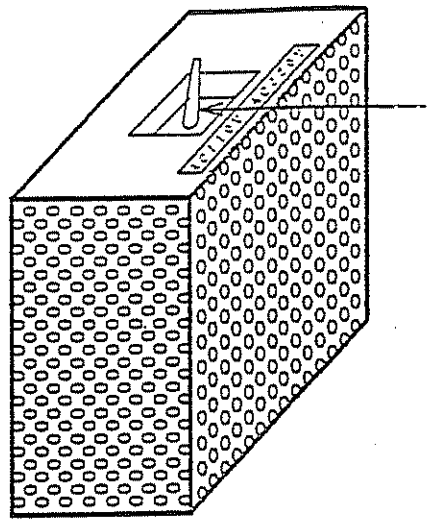
In installing Display Unit, connection cable should be designated cable (14 core composite cable: 2695110056).

Each radar unit are applied with spring formed gasket for shielding purpose, in order to prevent unwanted radiation of the radar wave from the each unit, shielding effect of these gasket must be secured electrically rigid.

The grounding of the each radar unit to the ship hull is also very important, earth conductivity to the hull should be as shortest and rigid as possible.

2.2.3.1 Selection of Power Supply Voltage

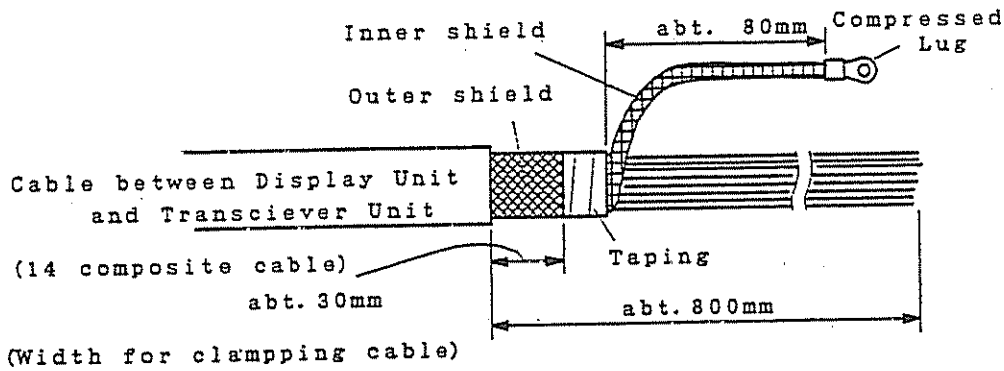
Power supply unit is located in lower lefthand side of the Display unit. Correct input voltage to be selected by change over switch as per labeled instruction. (See sketch next page)



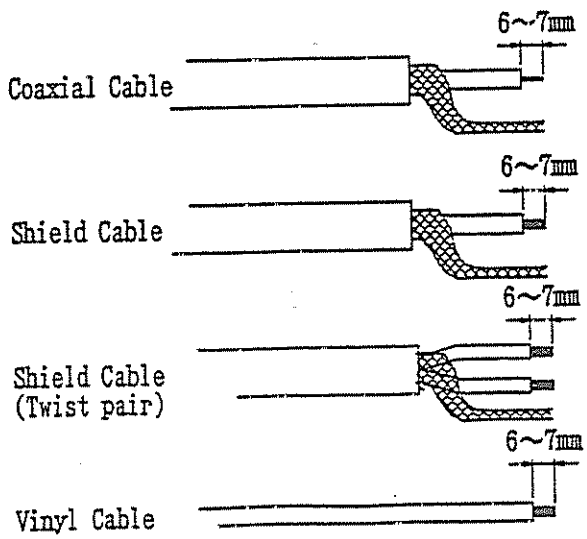
Pwoer Supply Unit
(located in lower lefthand side of Display Unit)

2.2.3.2 Cable End Process

1) Treatment of double shield mesh are as follows.



2) Cable end process to be done as follows.

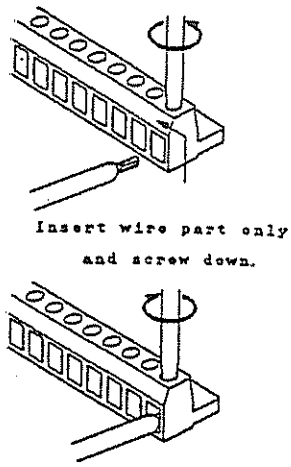


2.2.3.3 Connection to Terminals

Terminal board circuit for Display unit is combined terminal of plug and socket terminals. Insert wire part of the cable and screw down tightly as the sketch below then connect plug terminal with socket terminal base

Method of Cable Connection. (See sketch)

1) Turn hold down screw anticlock wise by Minus screw driver so as to open cable inlet.
2) Insert stripped part of wire into cable inlet up to the dead end.
3) Turn hold down screw clockwise by Minus driver so as to hold down the screw tightly.



2.4 Installation of Interswitch Unit (option)

2. 4. 1 Summary

Interswitch unit is for JMA-7000/9000 series Radar's change over system.

Standard length of the cables between each Display unit are 10m and maximum length is 50m.

Care must be taken that the length more than 50m may cause adverse effect to the performance of the Radars.

Number of interswitching combination among Display unit, Antenna, Transceiver unit are different depends on the 2 Radar systems or 3 Radar systems.

Difference of the system is defined by innersetting.

Table of Interswitch Modification Kit

No.	Item	Type	Quantity	Remarks
1	Interswitch kit	NQE-3015J	1	For self standing type Display unit
	① Interswitch circuit	MDCW10324	1	PCB with inner unit cables
	②Holder	BRBPC5130	5	H-25mm (For PCB fitting)
	③Holder	BRBPC5129	1	H-23mm (For PCB fitting)
	④Holder	BRBPC5127	4	H-15mm (For fitting failsafe board)
*	⑤Fitting failsafe board	MTT303275	1	For Right side Display unit
*	⑥Fitting failsafe board	MTT303275	1	For Left side Display unit
*	⑦Plug terminal base	H-7JIRD0133	1	For TB4605 (Pin No.seal color : White)
*	⑧Plug terminal base	H-7JIRD0134	1	For TB4606 (Pin No.seal color : YELLOW)
2	Installation cable	H-2695110057	10m	Max.50m, 1 for 2 systems, 2 for 3 systems

Note:

*Fitting failsafe board in case of 3 Radar systems, fitting failsafe board is not required for the Display unit located in center. In case of 2 Radar systems, fitting failsafe board is used only one of for Right or Left. Unused failsafe board to be kept on board for spare.

*Plug terminal Board to be used only one for 2 Radar systems, Two will be used for 3 Radar systems and in this case used for central Display unit. Usage will be for Right or for Left, unused failsafe board to be kept on board for spare.

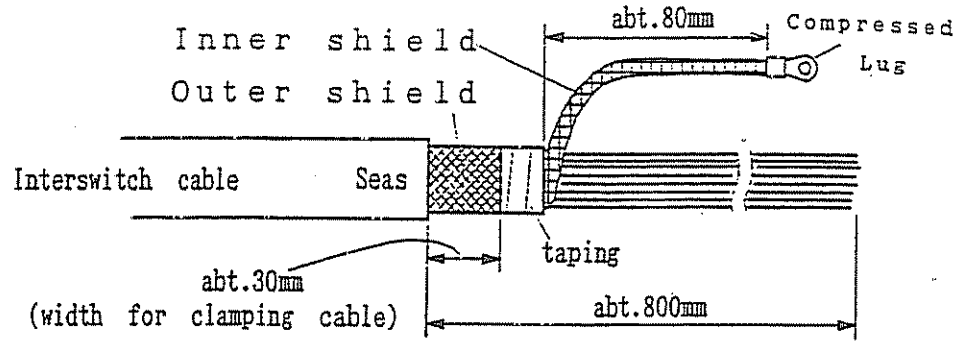
2. 4. 2 Connection for inner interswitch unit

In accordance with following procedure, interswitch circuit with 3 cables to be assembled in to Radar Display unit.

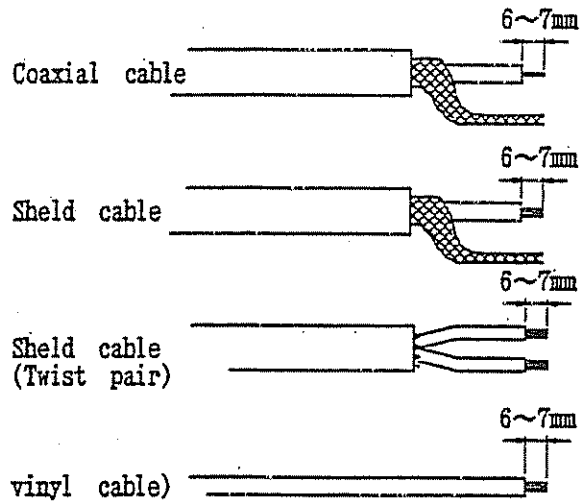
1) Remove Display unit front cover.
2) Remove existing NSK circuit out of Display unit.
3) Interswitch inner connection cables 3 each to be connected on terminal board circuit and assemble the interswitch circuit in the Display unit.
4) Fit back the removed NSK circuit.
5) Install fitting failsafe board as the sketch below.
There are 2 Fitting failsafe board. One is for Right side Display and another is for Left side Display.
In case of 3 Radar systems, center Display requires no failsafe board to be fitted.

2.4.3 Cable End Process

Treatment of double shield mesh are as follows.



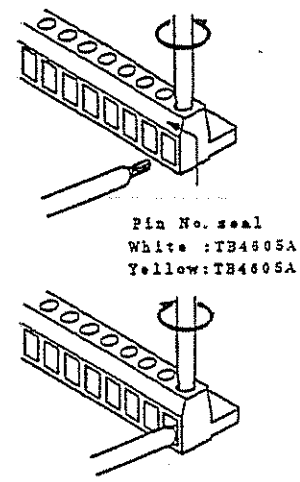
Cable end process to be done as follows.



Terminal board circuit for Display unit is combined terminal of plug and socket terminals. Insert wire part of the cable and screw down tightly as the sketch below then connect plug terminal with socket terminal base Method of cable connection.

1) Turn hold down screw anticlock wise by Minus screw driver so as to open cable inlet.
2) Insert stripped part of wire into cable inlet up to the dead end.
3) Turn hold down screw clockwise by Minus driver so as to hold down the screw tightly.

Cable connection tobe done in reference with related wiring diagrams without error.



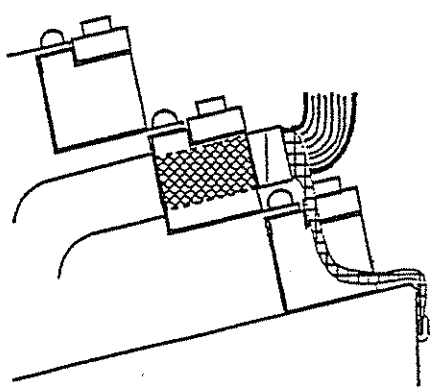
1) Remove cable binder for Interswich cable.

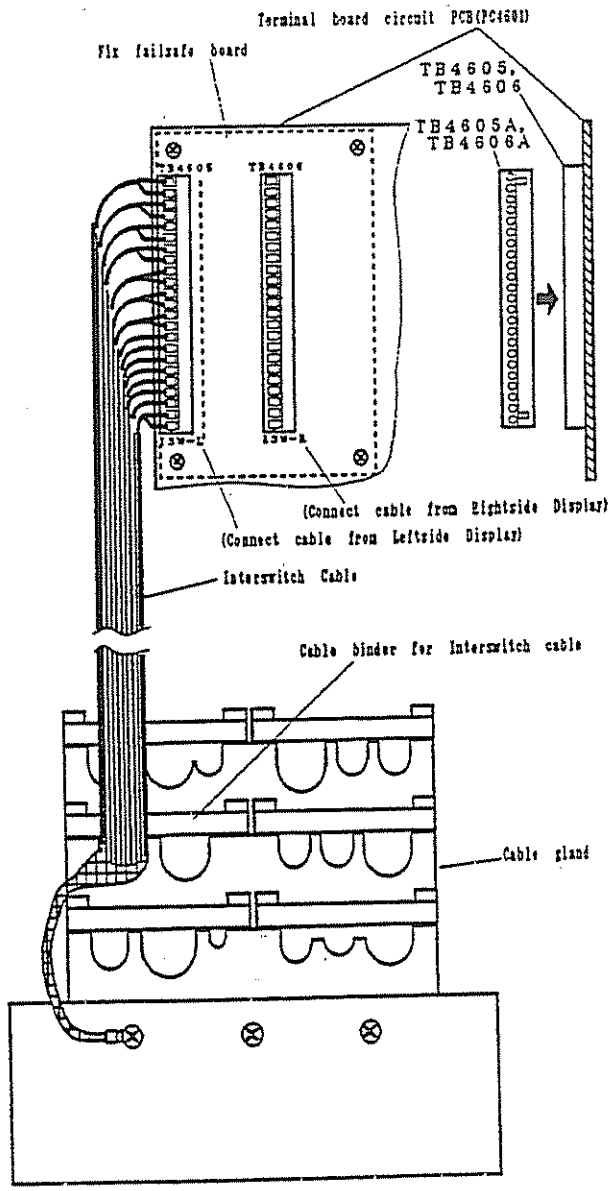
2) Bound the outer shield mesh with cable binder and fix them by a screw.

3) Inner shield mesh to be assembled and clamped by a compressed lug and fixed by a screw as the sketch.

4) Put the plug terminal base on socket terminal base and install fitting failsafe board.

Above example is for the case of 2 Radars system's. (sketch shows Right Display) terminal bard circuit receives cable from Le ft side Display.





2.5.1 NSK Unit Adjustment

The NSK unit of the radar can be applied to almost all types of gyrocompasses just by changing the settings of switches. (Stepper gyros of 24 to 100VDC and synchrogyros with primary excitation voltages of 50 to 115VAC).

Before turning on the power, follow the procedures below to set the buttons S1, S2 and S5, and the jumper pin JP1 on the NSK circuit (PC4201) to make them suitable to the type of the gyrocompass.

Since the gyro selection switches on the NSK circuit is set to the 360X synchrogyro before shipment, adjust the switches as follows to suit it to the gyrocompass fitted on the ship. For further details, see Appendix Figs. 138 and 139, the setting tables of gyrocompass and gyro/log select switches.

(1) Before turning on the system, set the buttons and jumper pin on the NSK unit (PC4201) as follows:

S1 : Set the button to [OFF].

S2 : Gyrocompasses output stepper or synchro signal. So, be sure to check the type of the gyrocompass fitted on the ship before setting S2.
Synchronizing signal ····· Set S2 to the [SYNC] position.
Stepper signal ····· Set S2 to the [STEP] position.

S5 : Set S5 to suite the applicable gyro in accordance with the S5 setting table.

S5-1 : Type
Synchronizing signal ····· [OFF]
Stepper signal ····· [ON]

S5-2, -3 : Gyro ratio

	360X	180X	90X	36X
S5-2	OFF	OFF	ON	ON
S5-3	OFF	ON	OFF	ON

S5-4 : Gyro direction

Normal (clockwise) ..... [OFF]

Reverse (counterclockwise) ..... [ON]

S5-5 : Log type

Pulse signal ..... [OFF]

Synchronizing signal ..... [ON]

S5-6 : Not used

S5-7, -8 : Log ratio

	Pulses/nm (Pulse signal)			
	800	400	200	100
	Rotations/nm (Synchro signal)			
	360X	180X	90X	36X
S5-7	OFF	OFF	ON	ON
S5-8	OFF	ON	OFF	ON

S6 : Log test

Set the button to [NORM].

JP1 : Gyro type

Synchro signal ... Select the [SYNC] position.

Stepper signal ... Select the [STEP] position.

(2) Connect the gyro signal and log signal cables to the NSK circuit (PC4201).

(3) Set S1 to [ON].

* If radar images and COURSE (own ship's true bearing indicator) indications are displayed in reverse direction after the power is turned on, set the button S5-4 to [ON].

Table 8.8 Gyro Log Selection Switches (DIP switch S5)

		1	2	3	4	5	6	7	8
Gyro signal (GYRO SIG.)	SYNC	0							
	STEP	1							
	360X		0	0					
	180X		0	1					
	90X		1	0					
	36X		1	1					
	Gyrational direction (DIRECTION)		Normal (NORM)		0				
			Reverse (REV)		1				
Log signal (LOG SIG.)	Type		PULSE			0			
			SYNCRO			1			
	Pulse number (PULSES/NM)						0		
			800P/360X					0	0
			400P/180X					0	1
			200P/90X					1	0
			100P/30X					1	1

2.5.2 Initialization

(1) Tuning Adjustment

Procedures

1 If automatic tuning is on, manual tuning.

2 Select the 24nm range scale or more, and set the tuning knob to its 12 o'clock position.

3 Press the [#] and [0] buttons.

ADJUST is selected.

4 Press the [1] button.

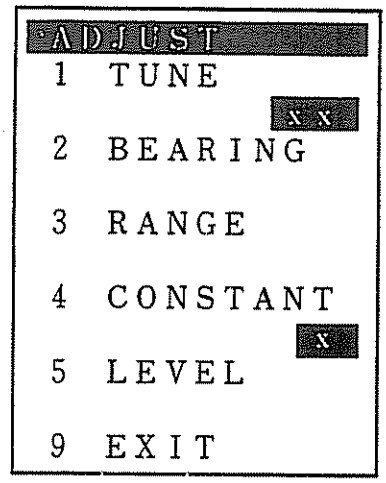
1:TUNE is selected.

5 Press any of the [1] to [9], [+] and [−] buttons to make the longest tuning indication at the screen, and press the [SEL] or [ENTER] button.

Exit

6 Press the [#] and [0] buttons.

ADJUST is closed.



ADJUST Menu in adjustment mode

(2) Bearing Adjustment

Perform adjustments for matching in bearing between the target measured previously using the compass of own ship, and the picture displayed on the CRT monitor of the radar.

Procedures

1 Press the AZI MODE switch and set the bearing display mode to relative display (HEAD UP).

2 Using the compass of the ship, measure the bearing of a suitable target (such as a ship at rest, a breakwater, or a buoy) relative to the bearing of own ship's bow. (For example, take the intended bearing as 25 degrees).

3 Press the MENU switch. This opens the main menu.

4 Press keys # and 0 in that order.

5 Press key 2 . This makes menu item 2 BEARING valid.

6 When EBL1 is displayed as a result, rotate the EBL control to set EBL1 to the target that was selected at step 2 above, and press the SEL key.

7 Rotate the EBL control to match the bearing displayed on the menu and the bearing of

8 If complete matching in bearing is not yet achieved, return to step 5 SEL above and repeat the operating procedure.

Exit

9 Press key 9 . This returns control to the main menu.

10 Press the 9 switch. This closes the main menu.

(3) Range Adjustment

Perform adjustments so that the range to the intended target in the display area is correctly displayed.

Procedures 1 **Press the MENU switch. This opens the main menu.**

2 **Press key # and 0 in that order.**

3 **Press key 3 . This makes menu item 3 RANGE valid.**

4 **Find from the PPI display a target to which the range is known. (For example, take this range as 0.33 nm).**

5 Display VRM1 on the video and move it to a target at a know range.

6 **When "ADJUST" is blinking on the menu, press the key + or − to move a target to the range of VRM1 and press the key SEL .**

7 **If complete matching in range is not yet achieved, return to step 4 above and repeat the operating procedure.**

Exit 8 **Press key 9 . This returns control to the main menu.**

9 **Press the 9 switch. This closes the main menu.**

(4) Adjusting Performance Monitor Adjustment (NJU-63/NJU-64)

This is required when an optional performance monitor is installed.

Procedures **1 If a radar selector is provided, set the radar mode to the master radar.**

2 Press the [VRM1/VRM2] switch to display VRM1, and set the VRM1 range to 16-18 nm*.

*: Set the VRM1 range to 16-18 nm if own waveguide is located between the scanner and the transceiver (X-band radar).

Set the VRM1 range to 18 nm either if the transceiver is located inside the scanner or for an S-band radar.

3 Press the [TEST] switch. This opens the main menu.

4 Press keys [7], This makes menu item PM valid.

5 Press key [1]. This makes menu item 1 MODE valid.

6 Press key [2]. This makes menu item 2 ON valid. This sets the radar to the relative bearing/off-center OFF/24-nm mode automatically.

7 Press key [2] once again. This makes menu item 2 SET valid.

8 Perform adjustments with the [+], [—] sign keys or the numeric keys so that the outer edge of the PM pattern is set to the VRM1 range which was set at step 2 above, and press the [SEL] key.

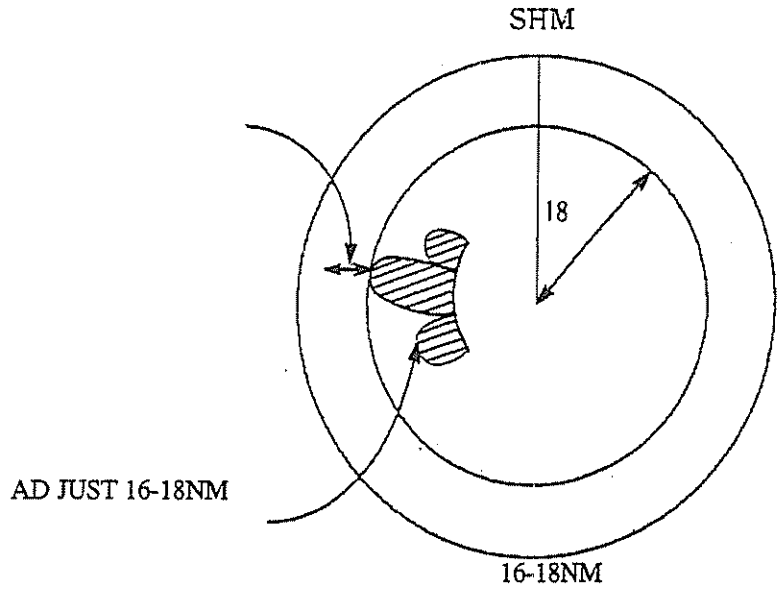
9 Press key [1] . This makes menu item [T MODE] valid.

10 Press key [1] once again. This makes menu item [T OFF] valid.

[Exit] 11 Press the key [9] . The TEST menu will exit.

12 **Attach the INFORMATION LABEL accompanying the performance monitor to a suitable position on the panel of the display unit.**

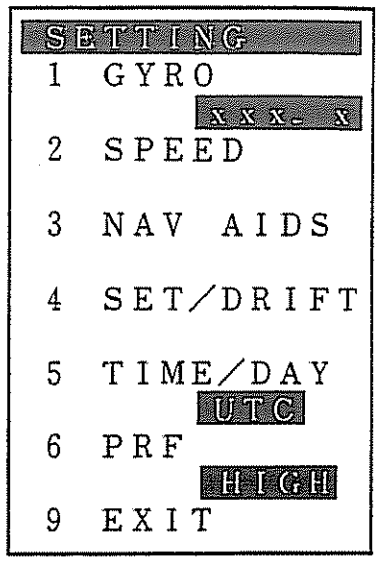
13 **Fill in the INFORMATION LABEL with the P.MON bar indicator value displayed at the bottom left of the display, and with the checked date.**



PM FORM

(6) True Bearing Adjustment

Perform adjustments for matching in the angle of bearing between the gyro and the radar.



Procedures

1 **Press the MENU switch. This opens the main menu.**

2 **Press keys 7 and 1 in that order. This makes menu item SETTING valid.**

3 **Press key 1 . This makes menu item 1 GYRO valid.**

4 **Perform adjustments with the + , − sign keys or the numeric keys so that the bearing matches that of the compass, and press the SEL Key.**

Exit

5 **Press the key 9 .**

The display will return to the Sub-Menu.

6 **Press the MENU switch.**

The Sub-Menu will be closed.

⚠ CAUTION
ARPA cannot operate if the gyro setting is finished. The menu for using gyro data will indicate * * * until the gyro data is set. The own ship's course will also indicate * * * .

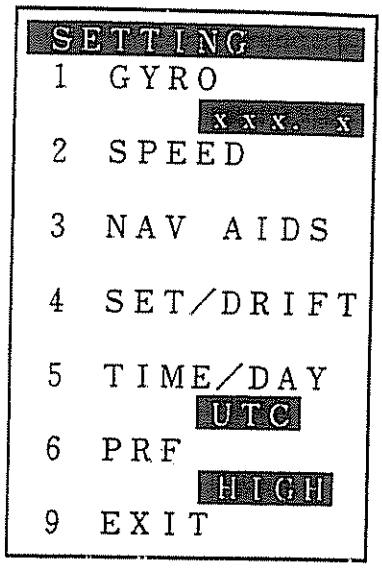
(7) Ship Speed Setting

Set a ship speed and other related data.

Procedures 1 Press the MENU switch. This opens the main menu.

2 Press keys 7 and 1 in that order. This makes menu item SETTING valid.

3 Press key 2. This makes menu item 2 SPEED valid.



4-1 For manual speed setting

(1) Press key 1 → 1. This makes menu item 1 MANUAL valid.

(2) Press key 2.

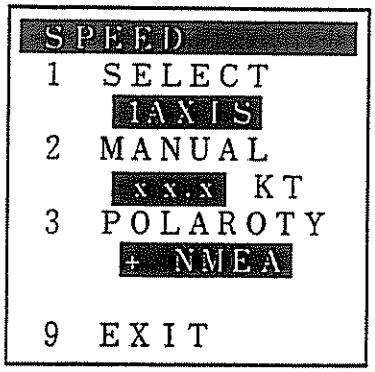
(3) Enter a speed (maximum: 99.9 nm) using the + , − sign keys or the numeric keys. The speed will be set.

4-2 For log setting

(1) Press key 1. This makes menu item 1 SPEED valid.

(2) Press key 2 for a single-axis log. Menu item 1AXIS will become valid.

(3) Press key 3 for a dual-axis log. Menu item 2 2AXIS will become valid.



4-3 Selecting "2-axis log data against water speed (NMEA signal)

(1) Press key the 3.

2 AXIS W will be selected.

8

4-4 Selecting "2-axis log data against ground speed (NMEA signal)

(1) Press the key [4].

2 AXIS G will be selected.

4-5 Selecting "2-axis log polarity (NMEA signal)

(1) Press the keys [3] → [1] if it is the + polarity.

POLARITY +NMEA will be selected.

(2) Press the keys [3] → [2] if it is the - polarity.

POLARITY -NMEA will be selected.

(8) Selecting External Navigator (i.e. LORAN, GPS)

Select the type of data to be received from navigation equipment such as a GPS.

Procedures

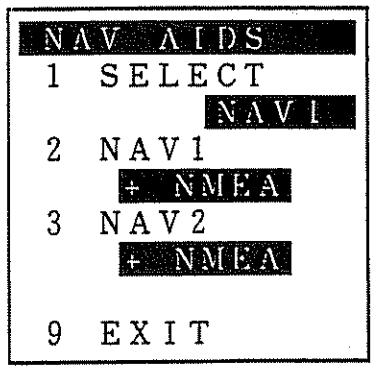
1 Press the MENU switch. This opens the main menu.

2 Press keys [7] and [1] in that order. This makes menu item 3 SETTING valid.

3 Press key [3]. This makes menu item 3 NAV valid.

4 Press the key [1].

1 NAV DATA will be selected.



4-1 If no navigation equipment is to be used

(1) Press key [1]. This makes menu item 1 NONE valid.

4-2 If navigation equipment 1 is to be used

(1) Press key [2] . This makes menu item 2 NAV1 valid.

4-3 If navigation equipment 2 is to be used

(1) Press key [3] . This makes menu item 3 NAV2 valid.

Exit 5 Press key the [2] .

2 NAV1 will be selected.

(1) Press key [1] for a plus NMEA signal polarity. Menu item 1 +NMEA will become valid.

(2) Press key [2] for a minus NMEA signal polarity. Menu item 2 -NMEA will become valid.

(3) Press key [3] for a plus JRC format signal polarity. Menu item 3 +JRC will become valid.

(4) Press key [4] for a minus JRC format signal polarity. Menu item 4 -JRC will become valid.

6 Press the [3] switch. This closes the main menu.

3 NAV2 will be selected.

(1) Press key [1] for a plus NMEA signal polarity. Menu item 1 +NMEA will become valid.

(2) Press key [2] for a minus NMEA signal polarity. Menu item 2-NMEA will become valid.

(3) Press key [3] for a plus JRC format signal polarity. Menu item 3 +JRC will become valid.

(4) Press key [4] for a minus JRC format signal polarity. Menu item 4 -JRC will become valid.

(9) Setting TIME/DAY Display Data

If time and day information is sent from the navigation equipment such as GPS by using NMEA0183 "ZDA" sentence, time and day information will be displayed on the CRT monitor.

Procedures 1 Press the (MENU) switch. This opens the main menu.

2 Press keys [3] and [SET] in that order. This makes menu item 3 SETTING valid.

3 Press key [5]. This makes menu item 5 TIME/DAY valid.

4 Select [1] to [3].

TIME/ DAY
1 OFF
2 UTC
3 LOCAL

Exit 5 Press the (MENU) switch. This closes the main menu.

(10) Adjusting the Interswitch

[Inspection after Installation]

Turn off ship's mains (switchboard) for radar.

1) When the installation ends, check that the interswitch is installed appropriately. Especially, check if the cable is connected correctly and also the cable shield braid is grounded accurately.
2) Check if all display units are accurately set internally.

[Inspection of Interswitch Operations]

Turn on ship's mains (switchboard) for radar to start the radar operation.

1) Inspection of Interswitch Patterns
   There are 6 interswitch patterns available in the 2-radar system
2) Adjustment/Inspection of Radar Pictures
   It is necessary to make the following three ways of adjustments in interswitch built-in radar systems when installed:
   - Range adjustment (0nm adjustment)
   - Bearing adjustment
   - Tuning adjustment

   Execute these three ways of adjustments according to the following interswitch pattern Nos., respectively.

2-unit radar system

a. Pattern No.1
b. Pattern No.2
   ① Adjustment between the display unit (right) and the MTR (right)
   (Adjust it by operating the panel of the display unit (right).)
   ② Adjustment between the display unit (left) and the MTR (left)
   (Adjust it by operating the panel of the display unit (left).)

(11) Adjustment of screen position

Though CRT is finished with adjustment before the shipment from the factory, readjustment may be required whenever. Necessary because there are difference of Magnetic field attche factory and at the delivered place.
Adjustment is made so as the center of picture circle and the center of CRT Display coincide.
Pay great care not to get electric shock.
Adjustment is different in JMA-7000 Radar (21˝CRT) and in JMA-9000 Radar (28˝CRT) respectively.
If the adjustment is not sufficient, follow the instruction of 5. 3/5. 4 "Adjustment of CRT" for further adjustment.

1. JMA-7000RADAR (12 Inches CRT)
 ·Remove Right hand side panel (Remove 8 M4 screws)
 ·Turn the Centering Magnet at the neck of CRT so as to adjust the picture circle into the center of CRT. A pair of Centering Magnet changes the strength of Magnetic Field and axis of Magnetic Flux by adjustment.
 ·After the above adjustment, put the side plate back to original position. (8 M4 screws)

2. JMA-9000RADAR (28 Inches CRT)
 ·Remove the screws fastening the Monitor unit
 ·Make loose screws fastening the operation part from the oval hole. (4 M5 screw)
 ·Slide whole Operation part toward you. (abt. 20mm)
 ·Take off the Escutcheon Board (Bezel).
 ·Life up the CRT part and make CRT surface horizontal. On this stage, CRT part is suspended by gas spring that you can take your hands off.
 ·Turn the Centering Magnet at the neck of CRT so as to adjust the picture circle in to the center of CRT. A pair of Centering Magnet changes the strength of Magnetic field and axis of Magnetic flux by adjustment.
 ·After the adjustment, assemble the unit in reverse procedure

6. ROM Version List

No.	Name in use	Version	Unit Name
1	MTR (Transceiver)	1.7	PC1101 in Scanner
2	NSK	1.1	PC4201 in NSK
3	PANEL	1.1	PC4501 in Keyboard
4	ARPA CPU	5.1	PC4403 in Display
5	ARPA TD	2.1	PC4403 in Display
6	INDICATOR	2.05	PC4401 in Display

3 Principle of Function

3. 1 Antenna
3. 1. 1 Radiator
3. 1. 2 Turning unit

3. 2 Transceiver
3. 2. 1 Modulator
3. 2. 2 Receiver
3. 2. 3 T/R Control Circuit

3. 3 Display unit
3. 3. 1 NSK Circuit
3. 3. 2 Power Supply unit
3. 3. 3 Operation keyboard
3. 3. 4 CRT Unit
3. 3. 5 CPU Control Circuit
3. 3. 6 Time base Circuit
3. 3. 7 ARPA Process Circuit
3. 3. 8 Interswitch Circuit
3. 3. 9 Performance Monitor Unit

3.1 Antenna

3.1.1 Radiator Part

Radiator part is composed by Slot wave guide to radiate horizontally polarized radar wave, Electromagnetic horn to ga in vertical directivity of radar beam and a metallic element to suppress sidelobes by the vertically polarized factors.

Radar wave feeds from one end of Slot wave guide through the rotary joint and another end is connected by non reflective terminator Radiation is effected in high efficiency and a few portion of power is consumed at the non reflection terminator.

The maximum direction of the Beam is tilted about 4.5 degrees to the right looking in the direction of radiation at horizontal plain.

Radiator Surface is such structure that in order to minimize radiation loss, dielectric material of very little loss are fabricated.

3.1.2 Scanner Drive Unit

Scanner Drive Unit consists of following parts.

Drive motor
Shaft Encoder
Scanner Safety Switch

Drive motor turns scanner through reduction gear and in case of S-band Radar, "Slow starter circuit" is used for protection of gear from excess load.

Shaft Encoder turns in synchronization with the turning of scanner. Encoder generates 2048 pulses and one pulse of stan dard signal per one revolution of scanner and transmitted to the display unit through the transceiver unit.

Safety switch is for the safety of human being near the scanner for the time of antenna maintenance to prevent unwanted turning of the scanner.

3.2 Transceiver Unit

Transceiver unit is consist of following blocks.
However, in 2 units type, following parts are installed in the scanner unit.

- ·Modulator Unit
- ·Receiver Unit
- ·T/R Control circuit

3.2.1 Modulator Unit

Modulator unit is composed of MH power supply unit, charging circuit, Trigger circuit, Switching circuit and Pulse transformer as the FIG 1.

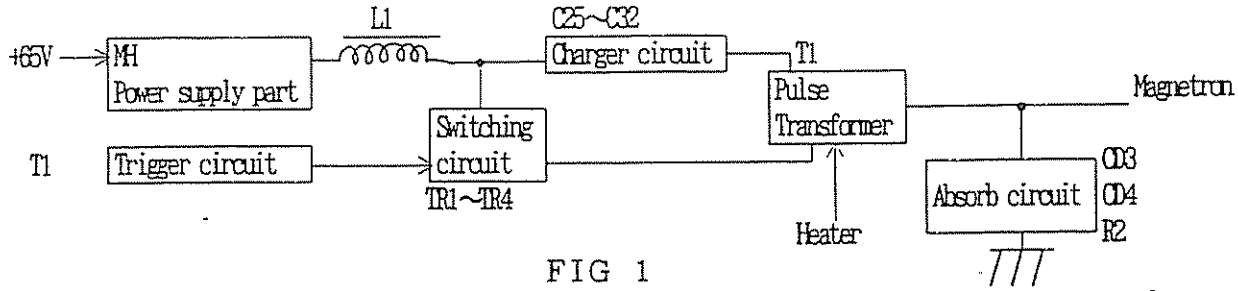


FIG 1

The DC 65V supplied from the display unit is converted to DC 600V in MH power supply part (converter transformer of abt. 40KHz switching frequency) and feed into the charging circuit.
Transmitting trigger generated in T/R control circuit came in to the trigger circuit then the switching circuit composed of TR1~TR4 became "ON" during the applied pulse width. The current go through the changing circuit, pulse transformer and switching circuit and made available the -8KV 8A pulse voltage and current at the secondary side of the pulse transformer.
The Magnetron, connected next to the secondary side of the pulse transformer, generates micro wave of a pulse width corresponds to the transmitting trigger.
Accordingly, this modulator circuit is the hard tube system rather than the conventional line type of PFN usage.

3. 2. 2 Receiver Unit

The receiver unit consist of the following circuits.

- IF Unit
- Monitor Unit
- Tuning Indicator Unit

·IF Unit

The signal from the MIC IF terminal is separated in two ways.
That the one is amplified in ①(AMP) and band width (3, 6, 10 MHz) are designated while pass through the ②(BWS cir) by BS1~BS3 then further amplified in ③(AMP) and ④(LOG AMP×6). The another is potentially devices for level adjustment and amplified in ⑧(AMP) and ⑦(LOG AMP×3). The former is the circuit line for the detection of weaker signal and the latter is for the detection of stronger signal without affected by saturation.

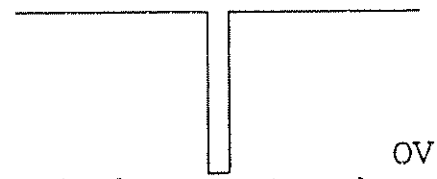
These 2 lines are added in ⑤ adding circuit and forms the Logarithmic characteristic. Finally the video signal is available through the ⑥(Low-Pass-Filter+Buffer circuit).

·Monitor Part

Monitor voltage come out from MIC MONI terminal is amplified in ⑨(AMP) and send out.

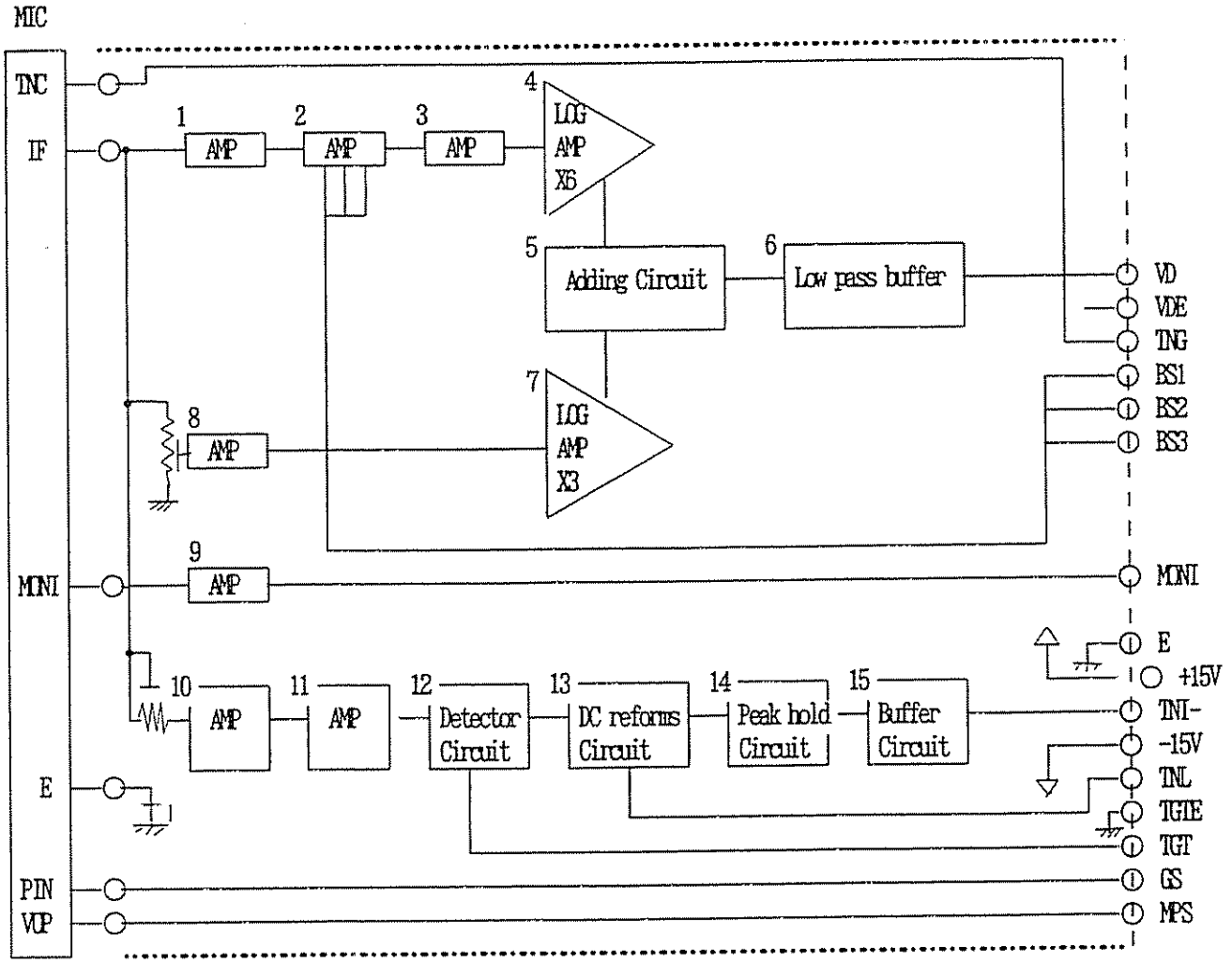
·Tuning Indicator

The signal came out from MIC 1F terminal is separated befor entering 1F part and feed in to tuning indication circuit. The signal adjusted of its level by input level adjust volume is amplified in 10, 11 (AMP). After passing 10, 11 (AMP) detected in 12 (Detector Circuit) and became detected wave form of negative polarity and reformed to a DC voltage. On this, stage adjustment is made so as the signal peak became DC OV by TNL voltage. In 12 (Detector Circuit) establish Gate to amplify only the Main bang portion and attenuate rest of the portions. The purpose of above process is to stabilize the tuning indication voltage.



Main bang gate signal.

The signal go through the 14 "Peak Hold Circuit" and reformed in DC peak Voltage and pass through 15 "Buffer Circuit" as an output signal.



Receiving part Black Diagram

3. 2. 3 T/R Control Circuit

T/R control circuit consist of following part.

- ·CPU control part
- ·MTR communication
- ·A/D converter circuit
- ·D/A converter part 1
- ·D/A converter part 2
- ·Tuning voltage generator circuit
- ·Band width signal generator circuit
- ·TI drive circuit
- ·Performance Monitor Control Signal generator circuit
- ·TIV. VD Mixing circuit
- ·Bearing Signal mixing circuit

·CPU control part

CPU control circuit consist of NEC μPD7810 mainly. Around CPU, SN75176B (MTR communication Line), A/D converter (CPU) interface protection circuit, MM1099BF (Watchdog, Reset1C) are used. CPU control part control' s MB 88346B (D/A converter), U/D Link Gate array, Band width signal generator circuit.

There are such circuit as tuning voltage generator circuit for Receiver, Pin Attenuator control signal generator circuit, TI drive circuit, TIY·VD mixing circuit, Bearing signal mixing circuit, Performance Monitor control signal generator circuit.

Type of LSI used and design specification of each Blocks are described as follows.

·MTR communication

Communication carried on between transceiver and Display unit under following conditions.

Communication IC	SN75176BPS
Communication Line	Semi double Balanced Line
Communication Standard	RS485
Synchronization	Start-Stop Synchronism
Flow control	NIL
Baud Rate	9600 Baud
Data length	8 Bit
No. of Start Bit	1 Bit
No. of Stop Bit	1 Bit
Parity	Yes (Even No.)

·A/D Converter circuit

The signal to enter A/D converter is divide by resistors in less than +5V maximum and input to A/D converter.

Signal for A/D converter	A/D input terminal
Tuning indicator voltage	AN0 (TNI)
Micro Front End Monitor voltage	AN1 (MONI)
MAG current	AN2 (MAGI)
Magnetron Heater voltage (for sensing)	AN3 (HPVS)
Performance Monitor Detection voltage	AN4 (TXI)
For inner transceiver temperature Detection voltage	AN5 (TPMONI)

Tuning indicator voltage	AN6 (TNI) (spare)
MAG current	AN7 (MAGI) (spare)

·D/A Converter Part 1
Analogue Output Voltage 0~+5V

Analogue Output Signal	D/A output terminal
Receiver Tuning Voltage 1 (Coarse adjust)	AO1 (TNCV1)
Receiver Tuning Voltage 2 (Fine adjust)	AO2 (TNCV2)
Receiver Tuning Indicator Control Voltage	AO3 (TNL)
Receiver Band width signal	AO4 (BS1)
Receiver Band width signal	AO5 (BS2)
Receiver Band width signal	AO6 (BS3)
Pin Attenuator Preset Level 1	AO7 (PAL1)
Pin Attenuator Preset Level 2	AO8 (PAL2) (spare)
Pin Attenuator Preset Level 3	AO9 (PAL3) (spare)
Performance Monitor Attenuation Level	AO10 (LVR)

·D/A Converter Part 2
Analogue Output Voltage 0~+5V

Analogue Output Signal	D/A output terminal
Receiver Tuning Voltage 1 (Coarse adjust)	AO1 (TNCV1)
Receiver Tuning Voltage 2 (Fine adjust)	AO2 (TNCV2)
Receiver Tuning Indicator Control Voltage	AO3 (TNL)
Receiver Band width signal	AO4 (BS1)
Receiver Band width signal	AO5 (BS2)
Receiver Band width signal	AO6 (BS3)
Pin Attenuator Preset Level 1	AO7 (PAL1)
Pin Attenuator Preset Level 2	AO8 (PAL2) (spare)
Pin Attenuator Preset Level 3	AO9 (PAL3) (spare)
Performance Monitor Attenuation Level	AO10 (LVR)

·Tuning Voltage Generator Circuit

Receiver Tuning Voltage 1 (Coarse adjust)	0~+35V(256 Division output)
Receiver Tuning Voltage 2 (Fine adjust)	0~+ 5V(256 Division output)

Above circuit consist of operational Amplifier by semipower supply and Resistors etc.

·Band width Signal Generator Circuit
Receiver Band width Selection is made by feeding BS1~BS2 signals to the Receiver so as to change band width.

Voltages supplied to BS1~BS3 are +15V (ON), −15V (OFF)

Receiver Band width Signal			
Wide Band	BS1:ON	BS2:OFF	BS3:OFF
Middle Band	BS1:OFF	BS2:ON	BS3:OFF
Short Band	BS1:OFF	BS2:OFF	BS3:ON

Modulator Band Signal

★ Short pulse SHORT:ON (OV), OFF(High impedance)

·TI Drive Circuit

TI "U/D Line Gate Array output" to be driven in transistor push-pull circuit. Amplitude +15V positive Logic output.

·Performance Monitor Control Signal Generator Circuit

This circuit generate transmitting trigger, Performance Monitor Attenuation Level control, performance Monitor ON/OFF signal (including poewr sourse).

Performance Monitor Control Signal

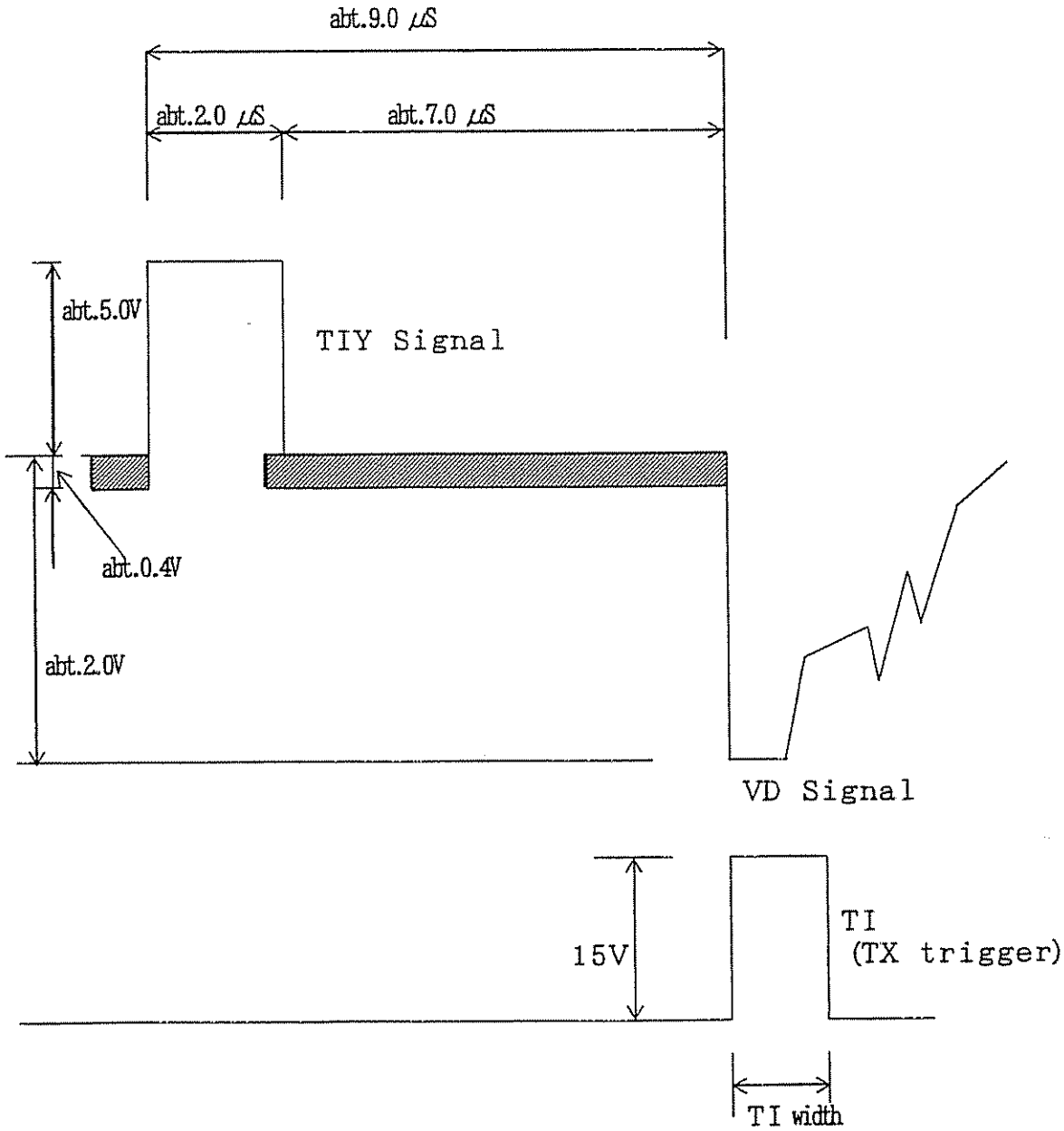
Transmitting trigger TI :0, +15V Positive Logic output

Performance Monitor Attenuation Level LVR :0~+5V (256 steps)

Performance Monitor ON/OFF PMS :ON (+15V), OFF (OV)
(Used for power supply too)

·TIY/VD Mixing Circuit

TIY to be positive level and VD to be Negative level and Mixed in this circuit. (output impedance abt. 50Ω)

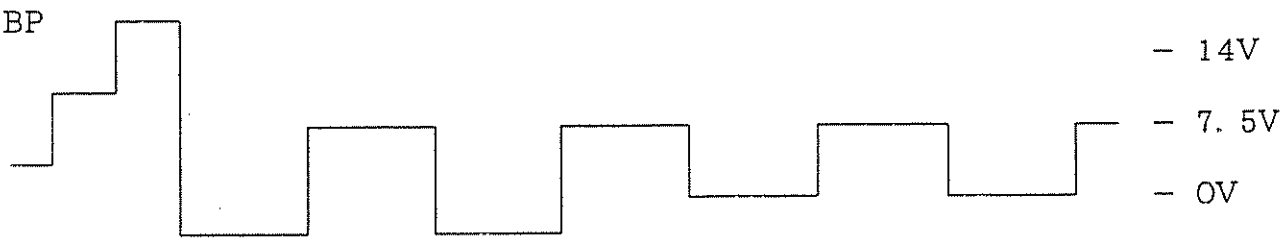


TIY Signal width	:abt. 2. 0μS
From TIY decay time to VD signal	:abt. 7. 0μS
TIY Signal level	:abt. 5. 0V (50Ω Terminator)
VD Signal Noise level	:abt. 0. 4V (50Ω Terminator)
VD Signal Max output level	:abt. 2. 0V (50Ω Terminator)
TI width	:Almost same as pulse width

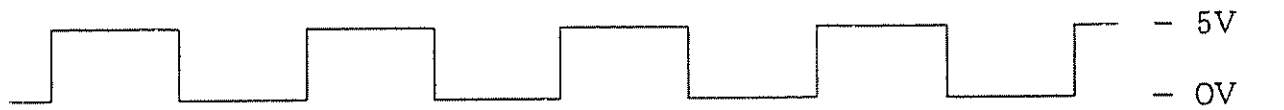
·Bearing Signal Mixing Circuit
REFB signal "U/D Link Gate Array output" to be overlapped on AZCKB signal "U/D Link Gate Array output".
REFB signal is 1 pulse/1 revolution.
AZCKB signal is 4096 pulses/1 revolution.

·Status of Bearing signal transfer from Transceiver unit to Display unit

·BP

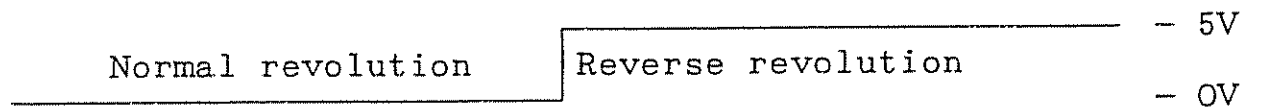


·QP



·$\overline{ZP}$

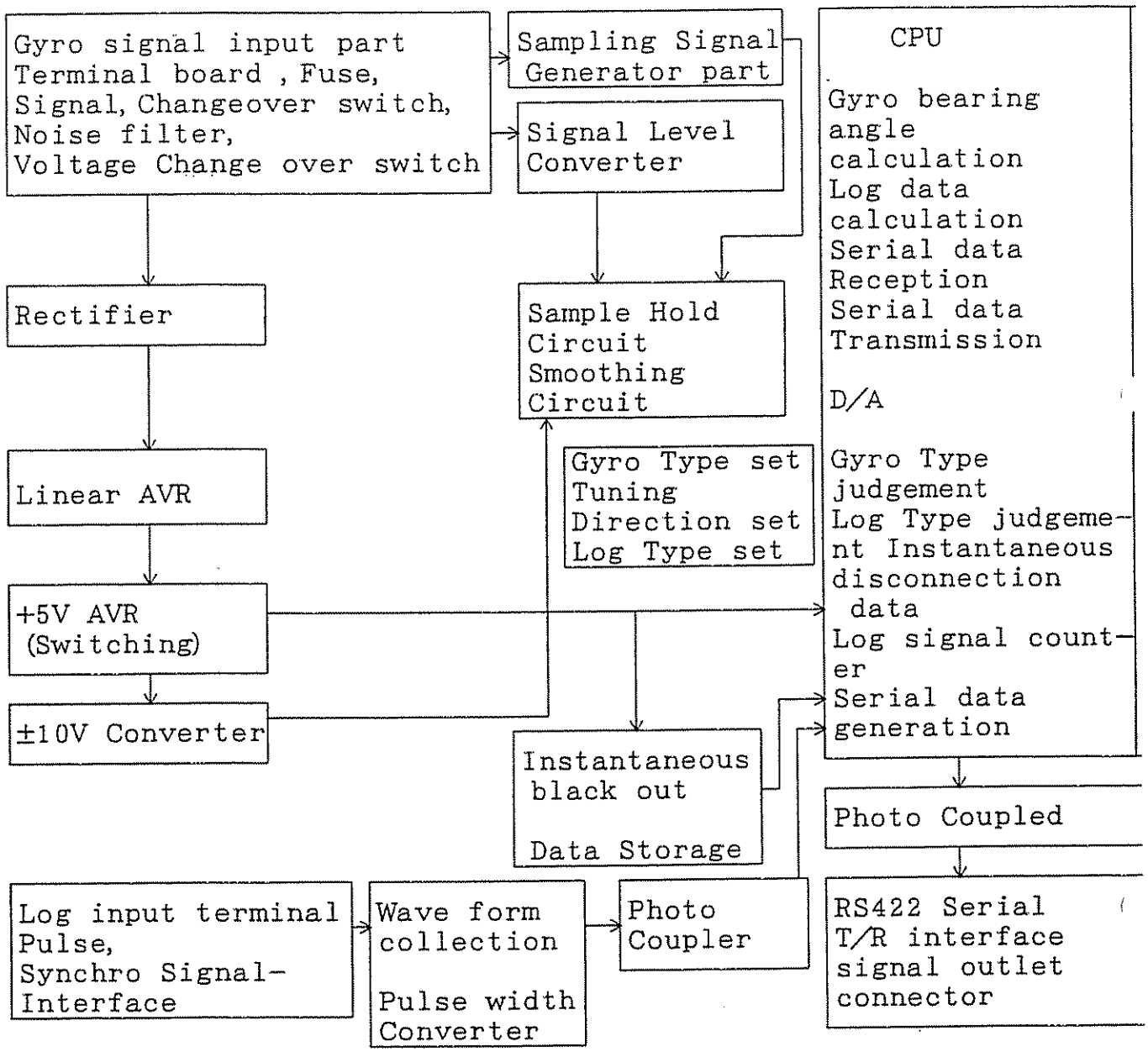
·DIR (Time of Reverse revolution "H")



3.3 Display Unit

3.3.1 NSK Circuit

NSK is divided into following blocks.



·Gyro input power source voltage and Current

Working voltage Range

Synchro type AC50V~AC115V 50/60/400Hz
Step type DC35V~DC70V (Allowable upto DC 100V)
+COMMON Type
−COMMON Type

·Necessary Power Source Current for operation

Synchro type	AC100V Type	55mA (TYP)
	AC 50V Type	90mA (TYP)
Step type	DC 35V Type	100mA (TYP)

·Compatible Angular Velocities

Synchro type	360×	2rpm	(MAX)
	90×	4rpm	
	36×	4rpm	
Step type	180×	2rpm	(MAX)
	90×	4rpm	

·Data Renewal times
50Hz·····Renew the Data every 20mS.

☆Log signals
·Input
Pulse Type
Input Impedance 820Ω
Contact signal, or Voltage Signal of Within a range of 0V~50V
Detection is made that less than 2V is Low and more than 2V is High.
Synchro Type
Input Impedance 20KΩ
Connect either 2 signal cables out of 3 phase signal cables of secondary side of synchro transformer. Primary side of which is for AC50V~AC115V, 50/60Hz.

·Ship Speed and number of Pulse
Pulse Frequency F to be calculated as $F=V\times P\times \frac{1}{3600}$ Hz

In above formula, P stands for number of pulse (Pulse/NM)
V stands for ship speed (KT/H)

·Pulse type and Synchro type
Pulse type send out contact signal or voltage signal in respond to ship's speed. For contact signal type, receives contact signal itself. For voltage signal, 2V will be the threshold voltage and compatible pulse number will be 800, 400, 200 and 100.
Synchro type send out turning signal modulated by AC 60Hz in synchro motor in respond to ship's speed. Pick up the variation of one phase and eliminate the 60Hz carrier factor. Variation of revolution is converted in number of pulses so as to obtain speed. Compatible turning Ratio will be 360X, 180X 90X and 30X.

·Speed Limit

Pulse type	From 0.1 to 110KT
Synchro type	360×from 0.1 to 13KT
	180×from 0.1 to 26KT
	90×from 0.1 to 54KT
	30×from 0.1 to 10KT

·Over Flow
When the input signal does not come for more than 73 seconds, judgement is made that Log counter over flown and stopped (OKT) or signal is disconnected so as to display 00.00KT output and Log signal error.

·Power Consumption

At AC100V 55mA 5.5W
At AC 50V 90mA 2.7W

·Connection of Signal Cables

Gyro signal to be connected on TB 10 [GYRO INPUT].
only one type of signal symchro or step can be connected.
Synchro Signal

TB10

1/R1	Primary side of signal	R1
2/S1	Secondary side of synchro signal	S1
3/S2	Secondary side of synchro signal	S2
S3	Secondary side of synchro signal	S3
5/R2	Primary side of synchro signal	R2

Step Signal

TB10

1/R1	Phase A of step signal
2/S1	Phase B of step signal
3/S2	Phase C of step signal
S3	No connection
5/R2	Common Signal line

Log signal to be connected on TB 20 [LOG INPUT].
only one type of pulse contact or synchro can be connected.

TB20

P+	Pulse type [+] signal line
P−	Pulse type [−] signal line
S+	Either 2 lines out 3 secondary S1, S2, and S3 lines
S−	to be connected.

Check items:Fuse F1, F2, F3, F4 (0.5A) are inserted and firmly locked in.

·Output

Output signal
Output terminal J4201
Output signal exchanges Data with Radar Display unit.
Type of output RS422 Baud Rate 9600 Baud
Data length 8 bits
Start bit 1 bit
Stop bit 2 bits
Parity Even No. parity

Connector	Signals
J4201 −1	+5V (0.15A)
J4201 −2	Earth
J4201 −3	RS422 Input +side
J4201 −4	RS422 Input −side
J4201 −5	RS422 Output +side
J4201 −6	RS422 Output −side

Function of other switches

S3 Used for CPU (1C 17) resetting.
Even reset applied, memorized Data will not be cleared.
Bearing angle immediately before the stoppage or reset being memorized, same data will start at the next operation.

S4 Zero return switch.
At the time of this switch being activated, memorized data turns to Zero degree.

S6 Log speed test signal generate switch.
In [TEST] position, 18. 04 Kt speed signal is generated.
Normally switched on [NORM] position.

Note :When you with to set bearing angle to 0°, S4 Zero return switch can be used as same effect as actual speed is Zero However, NSK considers that above setting is not external incomming signal thus keep on asking initial input setting value.

Log Signal

Log Signal Process Circuit being operated by the power of Gyro signal, Gyro signal should always be supplied into the circuit.

At the absence of Gyro signal, output Data will turn to 00. 00 KT in result of over flow after 72 seconds.

In any circumstance, turn the S6 to [TEST] position will Generate 18. 04 KT signal therefore S6 should always be in [NORM] position.

Confirm that S5-5, S5-7, S5-8 are correctly set up.

The LED (CD22) [PULSE] indicates that the voltage supplied on TB20 (P+, P-) is "Open" or "More than +2V" against [P+] terminal.

The LED (CD24) [LOGSIG] indicates that the selected pulse or synchro signal is active in the counter circuit.

*Others:
The LED (CD26) [TxD] indicates that RS422 signal is transmitted from CMJ-304B.

The LED (CD25) [RxD] indicates that RS422 signal is send from Radar Display unit to CMJ-304A.

3. 3. 2 Power Supply Part

Power supply circuit consist of Rectifier and smoothing part, Pre-power part, AVR part 1, AVR part 2.

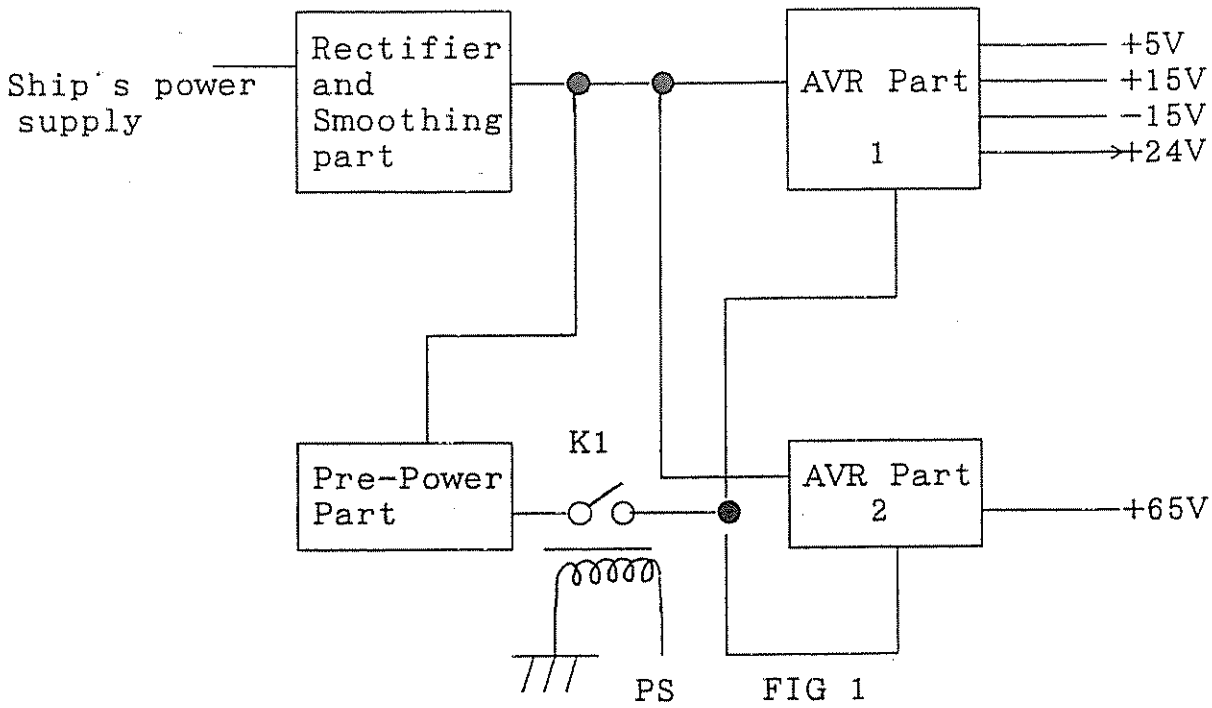


FIG 1

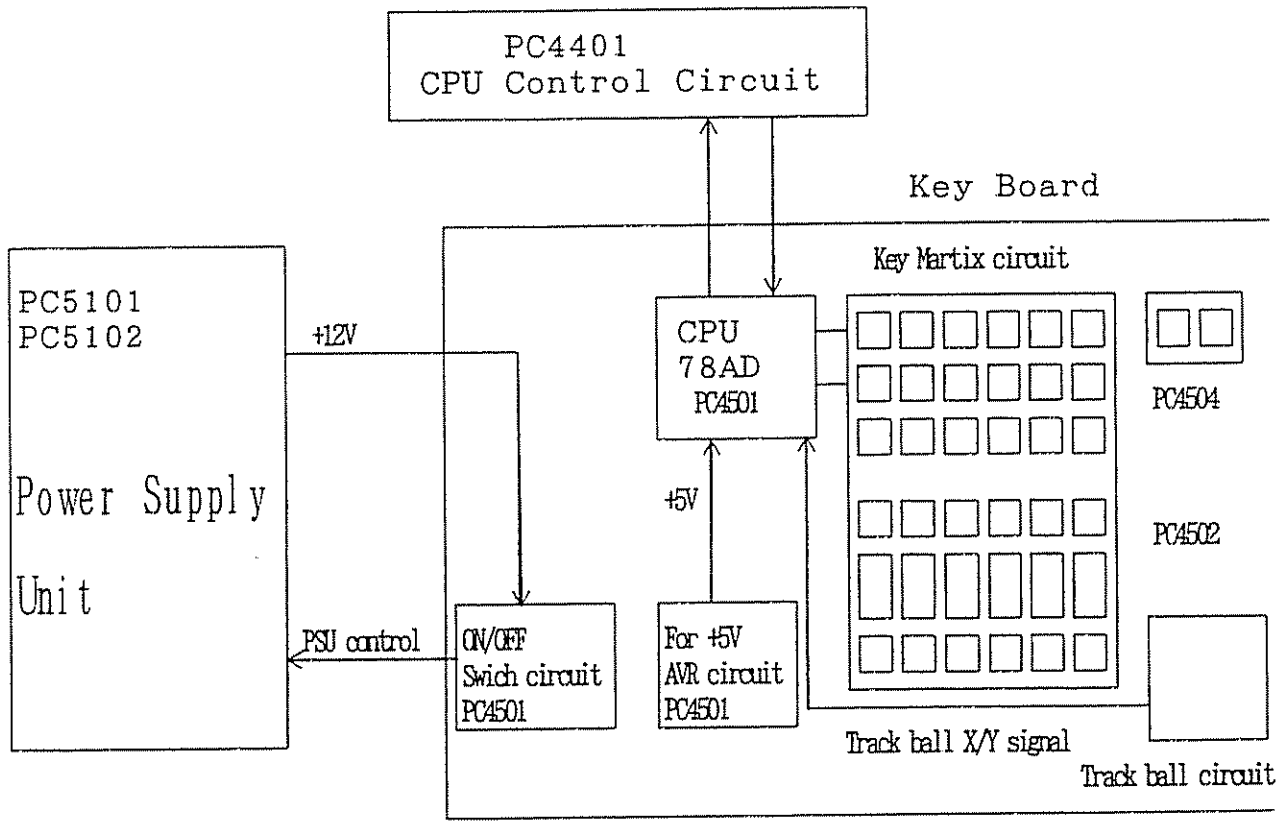
Ship's power source (AC 100/200V) connected to Rectifying/ Smoothing circuit. Rectified DC 250V supplied to Pre-Power part, AVR part 1 and AVR part2.

Pre-power part have a converter AVR operated by 200KHz switching frequency and generate +12V Pre-power and DC 20V power supply for the control circuit of Pre-power part, AVR-1 and AVR 2.

Pre-power source +12V will be sent to Display unit operation panel part which will energize K-1 as a PS signal, so as to distribute control voltage abt. 20V to the AVR part 1 and AVR part 2. Converter AVR, controlled by 200KHz switching frequency, controlls AVR 1 to supply +5V, ±15V and +24V and also controlls AVR part 2 to supply +65V.

3. 3. 3 Key Board Part (PC 4501, PC4502, PC4503, PC4504)

Key Board Consist of following circuits.
Key Board process circuit (PC4501)
Trackball Circuit (PC4502)
Panel Circuit 1 (PC4503)
Panel Circuit 2 (PC4504)



*Key Board Process Circuit (PC4501)
By using CPU, panel switch data and velum control data are quantized and processed and these data are transmitted to CPU control circuit (PC 4401) by built-in serial communication LSI. Likewise, by means of seria communication controlls audible alarms in accordance with the order from CPU control circuit.

*Track Ball Circuit (PC4502)
Track ball circuit send out X-Y signal to Key Board Process circuit (PC4502) in accordance with rolling angle of the track ball and detect the position of cursor acquisition.

*Panel Circuit 1 (PC4503)
Panel circuit 1 controlls panel switches, This circuit consist of all switches except "MENU" and "ENTER".
Switch control is made by using the data obtained in Matrix Circuit and detected by the CPU of key board process circuit.

*Panel Circuit 2 (PC 4504)
Panel circuit 2 controlls switches same as panel circuit 1 but used for detection of keys "MENU" and "ENTER".

As same as panel circuit 1, control is made by using the data obtained in Matrix circuit and detected by CPU of key board process circuit.

3. 3. 4 CRT Part

CRT Monitor control part is consist of 28 Inches CRT(E847IB39), Deflection Coil (H-7LGRD0037), CRT High Voltage power supply and with following 3 PCB circuits.

① Deflection Drive circuits CMC-791 (PC7501)
② CRT socket circuit CQD-1267 (PC7502)
③ Monitor Power supply circuit CBD-1252 (PC7504)

Circuit configuration shown in block diagram.

《Deflection Drive Circuit:PC7501》

Power source obtained from Monitor PSU PC7504 are +87V and +24V.

+87V is supplied to power for horizontal deflection.
+24V is supplied to power for vertical deflection and for driving horizontal output transformer.

(1) Horizontal Sweep Circuit

Horizontal trigger signal applied on IC3-1 and compared with the pulse, generated on horizontal output transformer T1. So as the trigger signal drives horizontal drive transformer T2 after a predetermined time. Output from T2 drives horizontal deflection transistor TR4 enabling to flow deflection current in horizontal deflection coil. Screen's symmetrical balance is taken by horizontal lineality coils L1, L2, L3 and L8. Length of horizontal sweep length can be changed by RV1 (H. LENGTH) witch controlls IC2 output voltage.

(2) Vertical Sweep Circuit

Vertical trigger signal applied on IC4-5pin. Deflection current send out from IC4-1 is synchronized with trigger signal and through the vertical deflection coil fed back again to IC4-12 pin. Vertical direction of sweep length can be changed by adjusting RV6 (V. LENGTH).

(3) Dynamic Focus Circuit

Dynamic focus voltage abt. 700P-P is generated in secondary coil of dynamic focus transformer T3. Primary side of the transformer is driven by parabolic voltage through C22.

The parabolic voltage is generated in C21 and C57 connected to horizontal lineality coil. This voltage is used to equalize the focus of horizontal direction on the CRT screen. Dynamic forcus voltage for vertical direction is obtained from parabolic voltage adjusted by RV8 (V. DFOCUS) and amplified by IC5.

Eventually, the dynamic forcus voltage are synthetic voltage of dynamic forcus voltage of horizontal and vertical directions and on top of that, static focus voltage obtained from CRT power source is added and applied altogether on CRT focus terminal. Dynamic forcu circuit

equalize the focus beam on CRT screen evenly all over.

(4) Blanking Circuit
The purpose of this circuit is to erase the return sweep and leave the sweep run from left to right.
Negative horizontal blanking pulse taken out from horizontal output transformer T1 is added with vertical blanking pulse and amplified in TR14. On top of that, voltage for brilliancy adjustment is added and applied on CRT grid. By doing so, electron beam during the return sweep is shut off.

(5) CRT Brilliancy Circuit
The voltage adjusted by CRT brilliancy knob to be applied on the base of TR16. After adjusted and amplified by RV16 [INTEN SET] and IC5, TR17 supplied on CRT grid through the TR10 emitter follower together with unblanking voltage. By adjusting RV10, pre-set for CRT brilliancy adjustment can be performed.

(6) Video Amplifier Circuit
The purpose of this circuit is amplify the video signal, which was taken out from video memory and applied A/D conversion, up to the level to illuminate the CRT.
The positive pole video signal come into J7502 and amplified in TR27 and TR28 and became the signal level of 30~40Vp-p.
Above signal is further amplified in buffer TR29 and TR30 and converted into low impedance video signal. Through C92, CD63 and CD64, reformed in DC and feed to CRT cathode in negative potential.

《CRT Socket Circuit:PC7502》
This is a CRT socket to connect CRT monitor control signals to CRT tube. This circuit has a function to protect excess voltage or current caused by CRT static discharge.

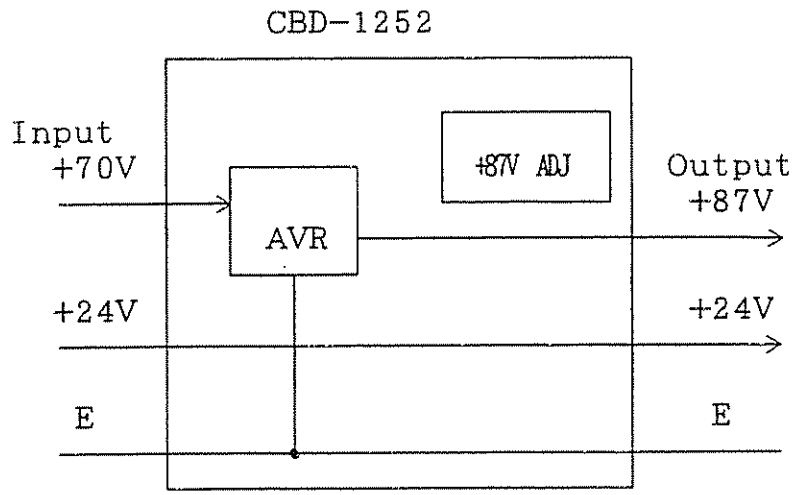
《Monitor Power Supply Circuit:PC7504》
Input voltages to this circuit are +70V and +24V. The +70V pass through AVR circuit and converted into +87V and +24V goes direct to PC7501. Voltage +87V can be obtained by adjusting RV1 [AVR ADJ].

《CRT High Voltage Sources》
CRT High voltage source generate bias voltage to make possible the CRT to illuminate. Receiving +24V from PC7501 and generate 5KV static focus voltage and 20KV CRT anode high voltage.

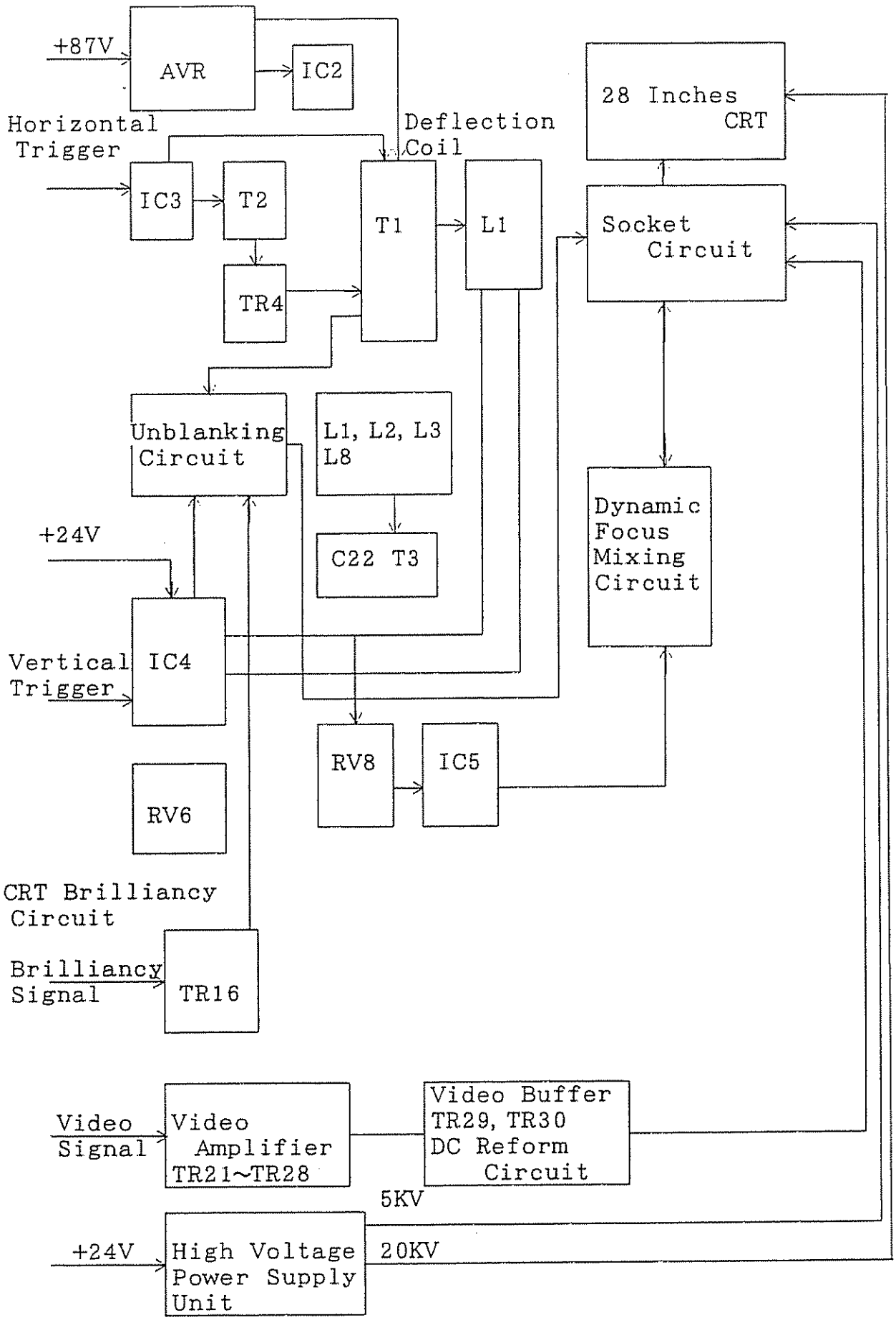
《Deflection Coil》
Deflection coil consist of Horizontal coil and vertical coil and connected on PC7501 by connector J7507. On CRT yoke, 4 magnet poles are attached to compensate lineality of deflection coil at 4 corners of the screen. By sliding

these 4 magnets, lineality of 4 corners of the screen can be adjusted. The centering Magnet is also attached with to fix the position of picture frame in the center of CRT.

PC7504
CRT Monitor Power Supply Circuit Block Diagram



PC7501 CMC-791 Deflection Circuit Block Diagram



3. 3. 5 CPU Control Circuit (PC4401)
CPU control circuit consist of following blocks.

1. CPU Control Part
2. Serial Communication Interface Circuit
3. AGDC/Graphic/PPI Frame Memory Circuit
4. The Iteration/Trail Circuit
5. Frame Video Process Circuit
6. D/A Converter/Synchro-Signal Interface Circuit

1. CPU Control Part
CPU (IC2) is a 16bit Microprocessor and processed by clock X1 (39. 321MHz).
CPU controlls all PCB and units of transceivers etc.
CPU has external memory of 128K byte static memory (IC17), 64K byte E2PROM (IC18/19) and programmed 512K byte EPROM (IC16).
Static Memory has a back up function by means of super capacitor and memorable time is for several days.
E2PROM stores installation data, Navigational data such as NAV-LINE/GUARD ZONE planned by user Unless otherwise erased by user, these stored data will be stored semi permanently.
ROM for programming stores control data for total Radar system and contents of which are also stored semi permanently. CPU controlls other PCB by means of CPU's address for external use, Data bus and control signals.
CPU controlls other units (NSK/NAVAID/TRANSCEIVER/Panel Circuit etc.) through serial communication interface.

2. Serial Communication Interface Circuit
There are 5 channels of serial communication lines.
One channel built in CPU and rest of 4 channels are in LSI IC-20 and IC-21 2 channels each. Usage of each IC are as follows.

CPU Build-in Serial Communication

Channel	Purpose	Baud Rate	Standard
IC2 Input	Key board (Receive)	9600	RS-422
IC2 Output	Key board (Transmit)	9600	

External Serial Communication

Channel	Purpose	Baud Rate	Standard
IC20 Input	Transceiver (Receiver)	9600	RS-485
IC20 Output	Transceiver (Transmit)	9600	
IC20 Input	NSK Input (Receive)	9600	RS-422
IC20 Output	NSK Output (Transmit)	9600	

Channel	Purpose	Baud Rate	Standard
IC21 Input	NAVAID Input (Receive)	1200/4800	RS-422
IC21 Output	NO use		
IC21 Input	NMEA Log Data	4800	RS-422
IC21 Output	RS232 Receive Input	9600	RS-232C
NO2. BCH Output	RS232C Transmit Output	9600	

Serial Communication line for data exchange with Transceiver unit is Half duplex communication and all other data exchanges are Full duplex communications.

3. AGDC/Graphic/PPI Frame Memory Circuit

Graphic control circuit is controlled by μPD72123 (AGDC) and Gate array. Graphic plane consist of 1 word 16 bits. Graphic address line provides A0~A20 21 bits and the screen is sectioned in G0~G11. G0 only has an area of 2048×1028 and G1~G11 composed of 1024×1024 areas. Clipping of each frames are controlled by software algorithm. Thereby, no special hardware clipping is made.

Memory refreshing is done by GDC during blanking time. AGDC controls screen's reading/writing and display address. Also controlling Display control signal, Image drawing address, Image drawing control signal, Refresh address and Refreshing.

As mentioned above, graphic memory consist of 11 frames (G1~G11) of 1024×1024 dots and 1 frame (G0) of 2048×1024 dots.

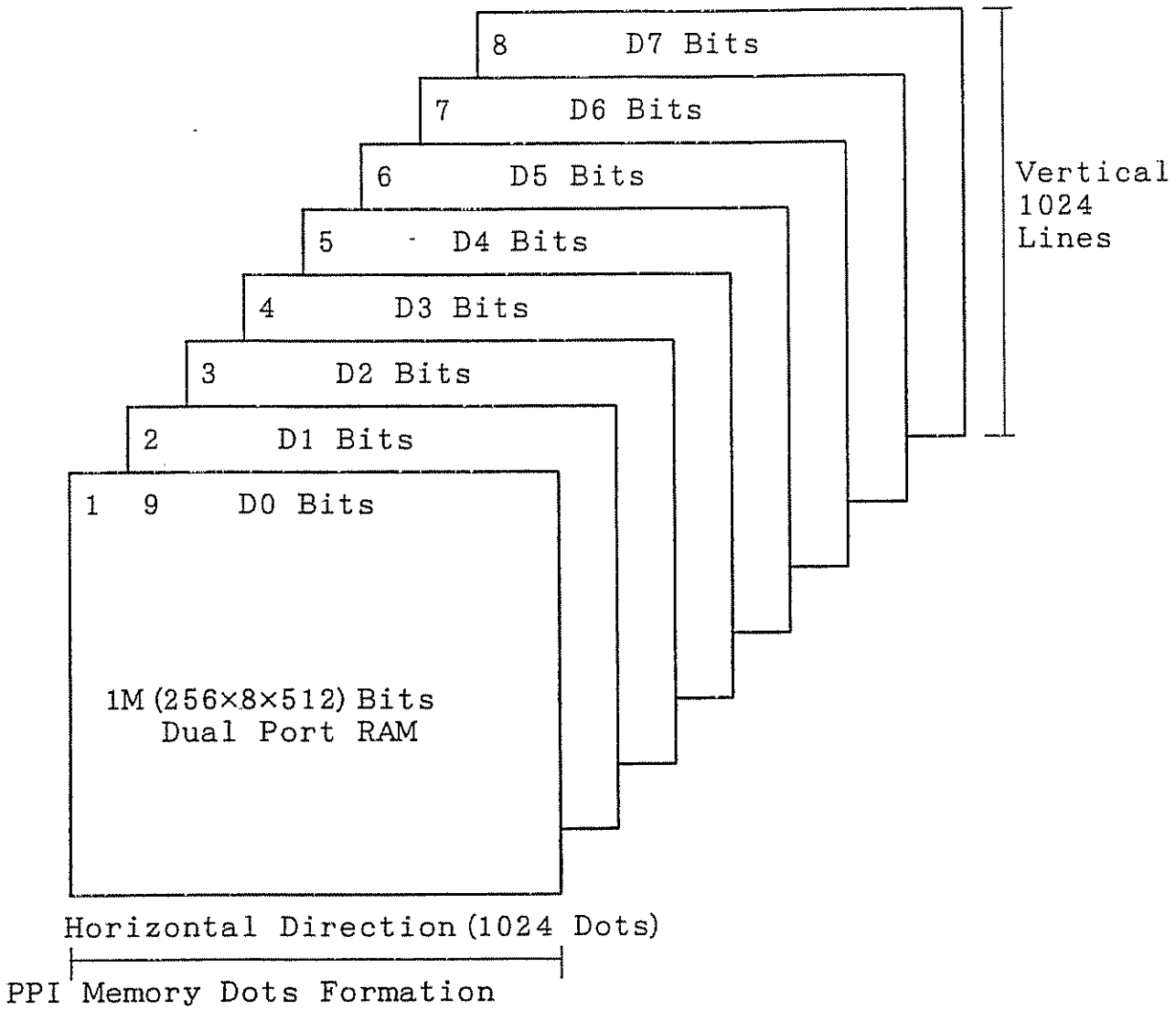
By using 1M-bits 8port-dual-port-RAM, and 8 port Dram for Page-mode-read-write-cycle, making 1 word 16 bits length. (See block diagram)

This system employs 1M-bits 8port-dual-port-RAM (DRAM). DRAM consist of 8 frames of 256 dots×512 dots plane.

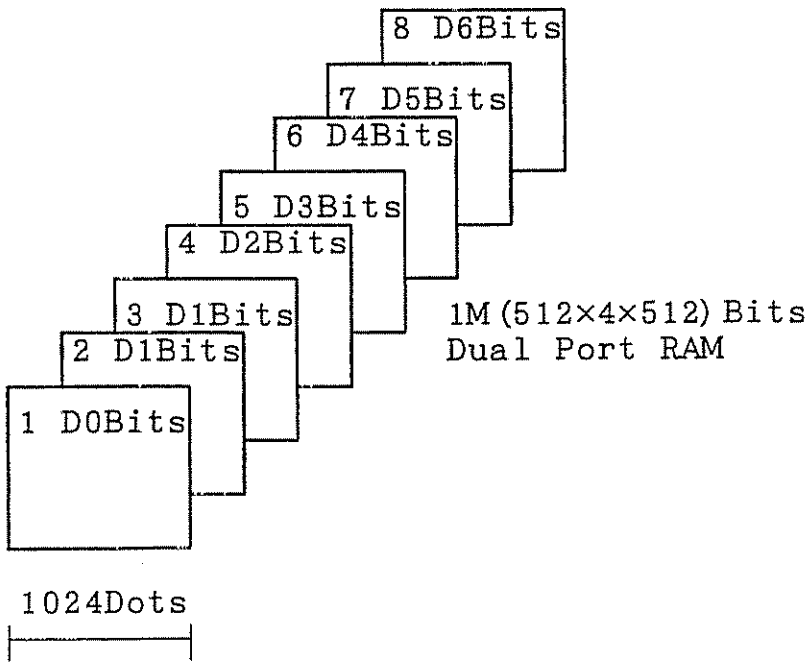
Picture frame is composed so as the DRAM 1 plane correspond to 1 dot on the raster. Thereby, the data wrote down by row-column-address are one horizontal scan's 8 dots. However in AGDC, writing should be made 1 word per 16 bits unit. Therefore, by using image control Gate Array (Mentioned Inter), drive the DRAM in Page-mode, made it possible to write down 16 dots at once. Read-out can be made 8 dots data in 1 access, that you access to the serial port of memory once every 8 dots clock.

PPI Frame Memory consist of 4 Frames of 1024×1024 dots. By using 1M bits 4 ports dual port RAM and 4 ports DRAM is used to Read-modify-write-cycle (See block diagram). This system employs 1M bits 4 ports DRAM. DRAM consist of 4 frames of 512 dots×512 dots. Each plane's D0~D3 is taken in harmonic direction and Horizontal one dot each on the screen are assigned as a DRAM. Accordingly, one dot at the upper leftend of the screen is the first DRAM of 4 DRAMs and next one dot is the 2nd DRAM, next one dot is the 3rd DRAM and next dot again is the 4th DRAM. For the following dots, above DRAM is assigned in order.

Graphic Frame Memory Formation (1024×1024 Dots)



PPI Memory Dots Formation



Graphic Screen Formation

Screen	Number Type	Contents
GO	IC51 HM538123BJ-8	Character Display (Left side)
G1	IC52 HM538123BJ-8	EBL1, EBL2 Display
G2	IC53 HM538123BJ-8	VRM1, VRM2 Display
G3	IC54 HM538123BJ-8	Plot Mode (Without ARPA) ARPA Mode (When connected with ARPA)
G4	IC55 HM538123BJ-8	Guard Zone Mode
G5	IC56 HM538123BJ-8	FIX Marker Mode
G6	IC57 HM538123BJ-8	NAVLINE (When Connected with Total-Nav, TOTAL-NAV MODE)
G7	IC58 HM538123BJ-8	SHM, Cursor Mode
G8	IC59 HM538123BJ-8	ARPA Mode
G9	IC60 HM538123BJ-8	TOTAL NAV Mode
G10 (GO)	IC61 HM538123BJ-8	Character Display (Right side)
G11	IC77 HM538123BJ-8	Guard Zone Process Display
G12	IC78 HM538123BJ-8	Mask Mode

4. Iteration/Trail circuit

The target among the seaclutter has a Iterative characteristics compare to seaclutter. The Iteration circuit is employed for purpose to detect the target among the seaclutters.

The Iterative circuit consist of PPI memory IC62~IC66, scanning iteration data programmed IC47 (1K×4bits PROM) and single process LSI IC-44.

The data ROM for scan Iteration and meaning of address are as follows.

A3~A0 are the real time video data come out from timebase circuit. Whereas, A4~A7 are the data read out from the PPI memory.

A8~A9 became as follows by mode change.

Address		Memory	Video	Output	Mode
A_9	A_8	$A_7 \sim A_4$	$A_3 \sim A_0$	$D_3\ D_2\ D_1\ D_0$	
0	0	Optional		$D_N = A_3\ A_2\ A_1\ A_0$	Straight
0	1			$D_n = A_{(3\sim0)} \times \frac{1}{2} + A_{(3\sim0)} \times \frac{1}{2}$	Scan Iteration mode "EAST"
1	0			$D_N = A_{(3\sim0)} \times \frac{1}{4} + A_{(3\sim0)} \times \frac{3}{4}$	Scan Iteration mode "MIDDLE"
1	1			$D_n = A_{(3\sim0)} \times \frac{1}{8} + A_{(3\sim0)} \times \frac{7}{8}$	Scan Iteration mode "SLOW"

·Straight

Output=Present Scan data

·Iteration 1

$$\text{Output} = (\text{Present Scan data}) \times \frac{1}{2} + (\text{A data 1 Scan before}) \times \frac{1}{2}$$

·Iteration 2

$$\text{Output} = (\text{Present Scan data}) \times \frac{1}{4} + (\text{A data 1 Scan before}) \times \frac{1}{4}$$

·Iteration 3

$$\text{Output} = (\text{Present Scan data}) \times \frac{1}{8} + (\text{A data 1 Scan before}) \times \frac{7}{8}$$

The purpose of the Trail circuit is to display the target stored in PPI Frame Memory and erase it time by time. In this function, other target moving relatively to own ship remains on the screen as a trail. This process also is used the similar IC as the process of Iteration.

The trail presentation can be set in 3 steps until the target in trail disappears.

5. Frame Video Process Circuit

Frame Video process circuit composed of IC-30 gate array.

This Gate array consist of Graphic·PPI-data parallel-series converter-circuit, Graphic-brilliancy-data-forming circuit, Graphic-and-PPI data-crossing-detect-circuit, Display-memory-serial-port-control-signal-generating-circuit as in a form of the ASIC.

By receiving dots clock signal (66MHz), the circuit generate various control signals for each circuit, distribute 1/2, 1/4, 1/8, and 1/16 divided clock signals and Display-memory-serial-port-control-signal.

After the Display-memory-serial-port-output data being applied with parallel/series conversion and various process, the Graphic-display-brilliancy-data, Graphic·PPI-data-crossing detection-flog will be sent out.

The IC-30 is dividied in following blocks.

- ·Graphic data parallel/series conversion block
- ·PPI data parallel/series conversion block
- ·Graphic Brilliancy data Forming Block
- ·Graphic and PPI Data super position Detection Block
- ·Guard Zone detection block
- ·Display memory serial port control signal generate block

·Graphic data parallel/series conversion block

Serial port output data of the 2 graphic display memories to be entered by time division then latch the data and parallel series conversion for the 8 data is carried out.

Parallel Series Conversion clock is 66MHz, Load clock is 8.25MHz.

Other than character plane are send out applied with Mask in Mask plain. (If the situation requires to take off the Mask in such case as in the test-mode, correct the data in the Mask plane. If the situation requires to output the plane data independently, carry out the setting by Graphic Mask Data (W02, W01).

·PPI data parallel Series Conversion Block

Receive the output data of NO. 1 PPI, NO. 2 PPI display memory serial ports and latch the data and after NO. 1 PPI, NO. 2 PPI data are selected or averaged, carry out the 4 data parallel series conversion.

Parallel series conversion clock is 66MHz, Load clock is 16.5MHz.

The NO. 1 PPI and NO. 2 PPI data will be selected by PPI display select data (W02).

·Graphic Brilliancy data Forming Block

On the basis of output data from Graphic data parallel series conversion block, after the priority process, select the required Brilliancy data (3bits). Graphic display Brilliancy data will be set up by CPU (W04~W0D).

·Graphic and PPI data super position Detecting Block

Detect the super position of Graphic data and PPI data and output the flag. The graphic plane to detect super position can be set up by cross Memory Select Data (W10, W11) (More than 2 plane can be set up). The level for the PPI data to detect the super position can be set up by Cross data select (W12).
The width of super position detect flag can be set up of its overlapping only by Fore/Aft 1 dot plus, Fore/Aft 2 dots plus, Fore/Aft 3 dots, plus and by cross-detect-width-data (W14). In changing the setting of cross detect width data, graphic Brilliancy data and PPI data to be shifted.
Each cross-shift-data:Graphic (W0F) can be used for above shifting.

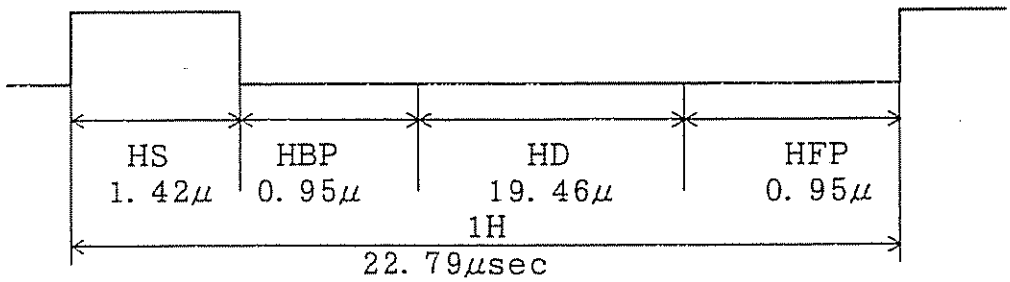
·Guard Zone Detect Block
Column direction (X-axis) detect mode and row direction (Y-axis) detect mode are prepared by Zone data and PPI data.
Detection is executed by column direction and rom direction in combination.
PPI data comparator output level can be set by zone detect setting level:PPI (W15). Column direction detect mode can be set by Zone detect setting mode:column (W16). Row direction direction detect mode can be set by Zone detect setting mode :Row (W17).

·Display Memory Serial Port Control Signal Generate Block
By dividing Dot clock (66MHz) into 1/2 (33MHz), 1/4 (16.5MHz), 1/8 (8.25MHz) and 1/16 (4.125MHz) each clocks and made available. Input and latch the HS and VS then after applied shift, made HSD and VSD available. The volume of shift can be set by synchrosignal-shift-data 1 (W18) and synchro signal-shift-data 2 (W19). The display position of Character display, Graphic display and PPI display can be shifted in a 8 dots unit respectively.
Setting of display position of character display is made by character-display-display-position-Data (W1A), of Graphic display is made by Graphic-display-display-position-Data and of PPI display is made by PPI-display-display-position-Data (W1C).
For the purpose of Graphic-display-memory serial-port-control, the serial-port-enable-signal and the clock signal for the serial data access are produced and made available.

6. D/A Converter/Synchronous Signal Interface Circuit
The IC-32 (D/A converter) process the density of brilliancy by receiving control signal from IC-30 and in accordance with the built in color-paletter and send out the video data to the CRT. The video output impedance is 50Ω, maximum clock is 1/2 of 67.303MHz.

The synchronous-signal-Interface transfer the Horizontal/Vertical synchronous signal came out from AGDC into IC-30 and after normalization, convert them into low impedance through the complementary circuit and feed to the CRT.
Horizontal/Vertical synchronous signal is as follows.

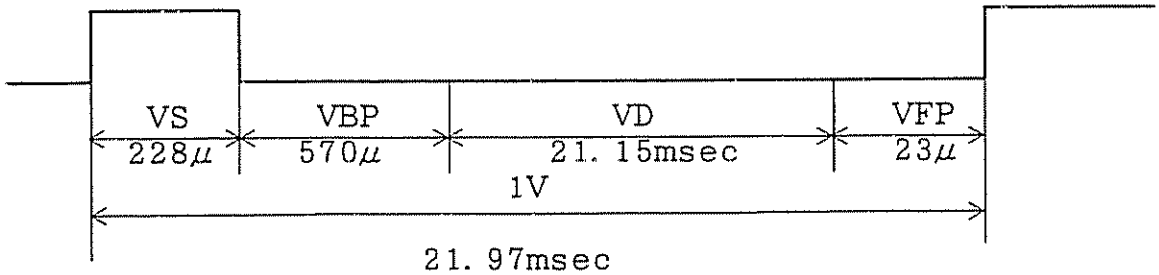
◎ Horizontal Synchronous Signal (HS) :positive polarity
Horizontal synchronous signal will be send out in following timing. Dotclock is 67.4043MHz.



Frequency=43.88KHz
1word=2clock=32dots=475nsec
1dot =14.8nsec→67.4043MHz
1H=22.79μsec=48words=96clock=1536dots
HD=19.46μsec=41words=82clock=1312dots
HFP= 0.95μsec= 2words=4clock= 64dots
HBP= 0.95μsec= 2words=4clock= 64dots
HS= 1.42μsec= 3words=6clock= 96dots
WC=19.46μsec=41words=82clock=1312dots

★ Output impedance:abt. 22Ω
★ Output amplitude:4.3V−0V (NO load), 2.1V−0V (22Ω terminator)

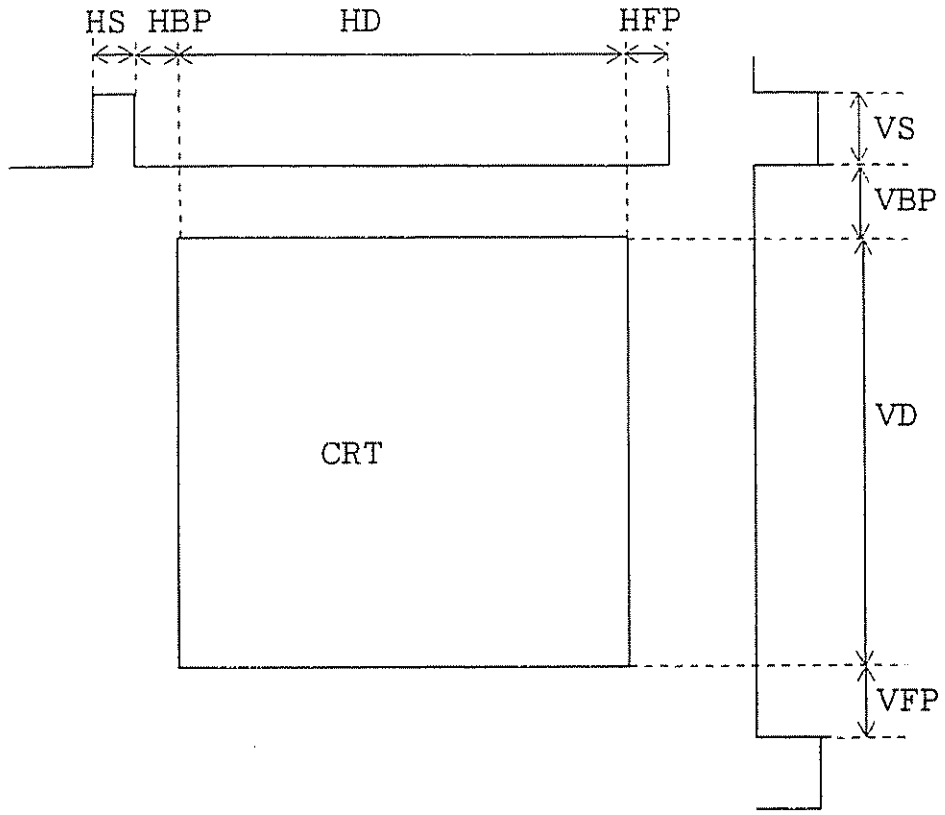
◎ Vertical Synchronous Signal (VS) :Positive polarity
Horizontal synchronous signal send out in following timing.

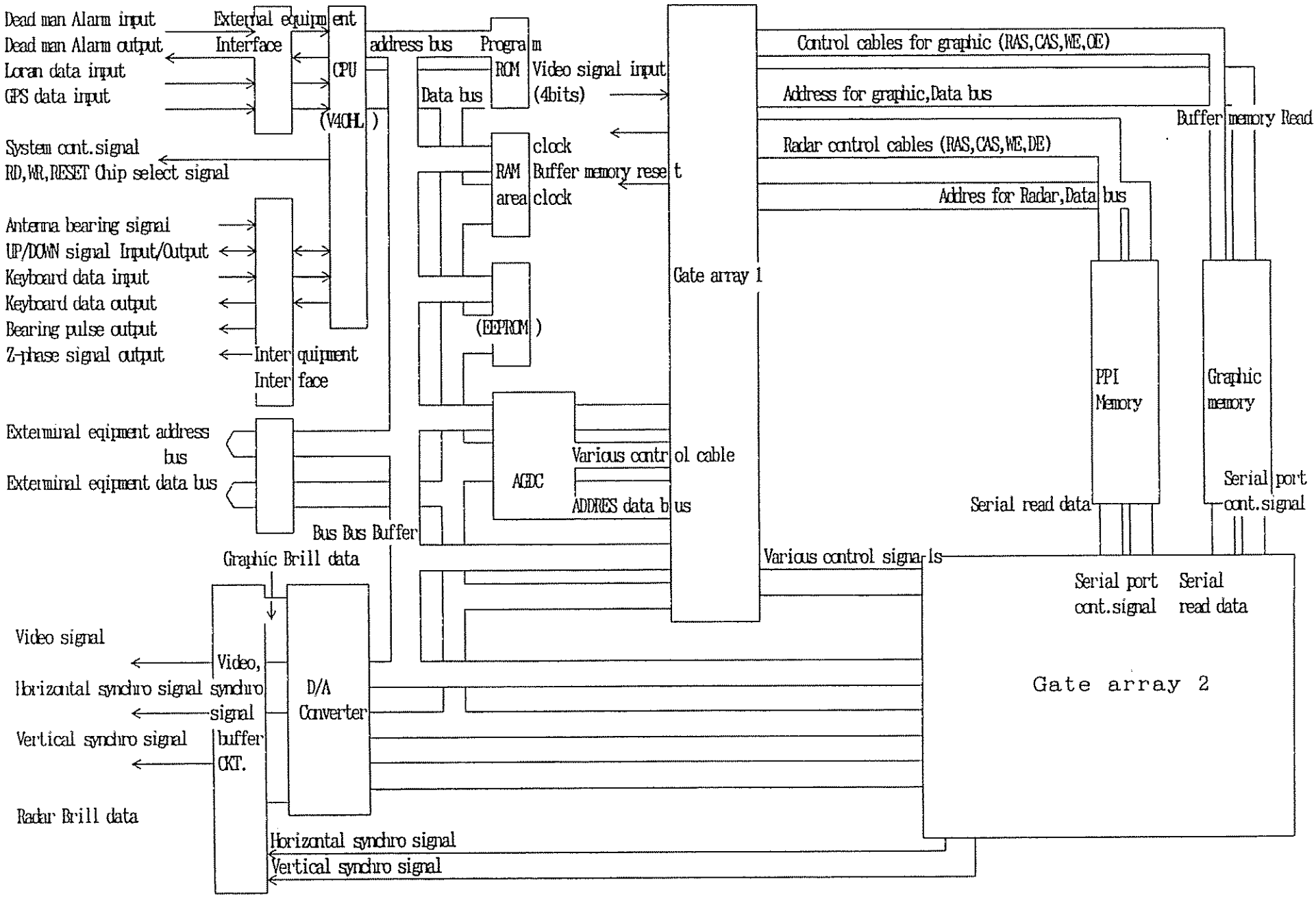


Frequency=45.5Hz
1V=964H=21.97msec
1VD=928H=21.15msec
VFP= 1H= 23μsec
VBP= 25H=570μsec
VS= 10H=228μsec

★ Output Impedance :abt. 22Ω
★ Output Amplitude :4.3V−0V (No load), 2.1V (22Ω terminator)

Horizontal Synchronous Signal and Vertical Synchronous Signa
l relation in 2 Dimensions.




Dead man Alarm input
Dead man Alarm output
Loran data input
GPS data input
External equipment Interface
CPU
(V40HL)
address bus
Program ROM
Data bus
Video signal input (4bits)
clock
RAM area
Buffer memory reset
clock
System cont.signal
RD,WR,RESET Chip select signal
Control cables for graphic (RAS,CAS,WE,OE)
Address for graphic,Data bus
Buffer memory Read
Radar control cables (RAS,CAS,WE,DE)
Addres for Radar,Data bus
Antenna bearing signal
UP/DOWN signal Input/Output
Keyboard data input
Keyboard data output
Bearing pulse output
Z-phase signal output
Interface
Interface
(EEPROM)
Gate array 1
PPI Memory
Graphic memory
Exterminal eqipment address bus
Exterminal eqipment data bus
AGDC
Various control cable
ADDRES data bus
Serial read data
Serial port cont.signal
Bus Bus Buffer
Graphic Brill data
Various control signals
Serial port cont.signal
Serial read data
Video signal
Horizontal synchro signal
Vertical synchro signal
Radar Brill data
Video, synchro signal buffer CKT.
D/A Converter
Gate array 2
Horizontal synchro signal
Vertical synchro signal

3.3.6 Timebase Circuit

Timebase/Signal Process Circuit consist of following blocks

1. Various System Clock Generator Circuit
2. Video/Trigger Separator Circuit
3. Gain/STC/Rain Rate Control Circuit
4. AUTO STC Control Circuit
5. FTC Circuit
6. A/D Converter
7. Buffer memory for Speed Converter
8. Signal Process Circuit
9. Buffer memory for Scan-Converter
10. Guard Ring Circuit

1. Various System Clock Generator Circuit

The original oscillator circuit of the system clock are X-2 (68.034MHz;0.25~0.5NM) and MX6 (45.356MHz;0.75/120NM) used as a main clock and X-1 (80MHz;for all ranges) is used for ARPA clock.

Various system clocks for the Trigger/Video signal generated in the transceiver unit are generated in IC-1.

Clock system configuration shown in FIG-2 and sampling clock for mutual relation is shown in FIG-3.

2. Video/Trigger Separator Circuit

System trigger TIY and Video signal are synthesized in transceiver unit and transferred to the Display unit timebase/signal process circuit.

The IC-48 eliminate the TIY signal and send out only the necessary length of video signal to the next stage TR2, TR3 video amplifier. On the other hand, only the TIY signal is separated in TR31 and used as a system trigger.

3. GAIN/STC/Rain Rate Control Circuit

STC and Rain-rate-curve are generated in IC-35, IC-36 and controlled by STC Rain rate knob and fed to the base of TR-3 together with Gain control voltage.

TR2, TR3 are the differential amplifier circuit.

The amplified video output processed with above STC/Rain-Rate /Gain control is available from the TR3.

The address for the IC-35 and IC-36 will be generated by IC-2.

4. AUTO-STC Control Circuit

The AUTO-STC wave form in correspond with the status of video signal, generated in the circuit IC-3, IC39~40, IC42~43, IC-61~64 and applied on the base of TR6. TR5 and TR6 is a differential amplifier circuit and at the outlet of TR6, video signal controlled by AUTO STC is available.

5. FTC Circuit

In general, frequency factor of Rain and Snow are rather low compare to the targets, so that by passing through the High pass Filter, factor of rain and snow will be eliminated.

The CD-5 is a sort of variable capacitor, combined with R-30, forming a High pass Filter. The cut off frequency of this High pass Filter is controlled by CD-5 through FTC knob on the operation panel. By doing so, eliminate the Rain/Snow clutters.

6. A/D Converter

The analogue signal treated with STC/Rain Rate/FTC process is converted into 8 bits digital signal by A/D converter.

The IC-4~7 is the main A/D converter and in order to operate in high speed in responds to the incoming clock, generate the clock of its phase 90 degrees delayed and carry out the quantization.

The A/D conversion is done by sampling clock and transfer the data to the buffer memory for the speed conversion.

The IC-13 is a A/D converter for the ARPA, carry out the ARPA clock A/D conversion for all ranges and transfer the data to ARPA PCB.

7. Buffer Memory for Speed Converter

The 8bits video degital signal changed to the high speed sampling in above mentioned A/D converter, write down into the IC-11 in 4 phases process from IC-8 by the sampling clock.

At the same time, accessed by signal process clock in 4 phases process and transferred to the signal process circuit after latched by IC-12 8 bits latch circuit.

8. Signal Process Circuit

Various signal process to be carried out in IC-2, IC-3 and IC-16~33. Content of signal process is as follows.

A. Interference Rejection
B. Sweep Averaging
C. AUTO-FTC Process
D. Pulsestretch

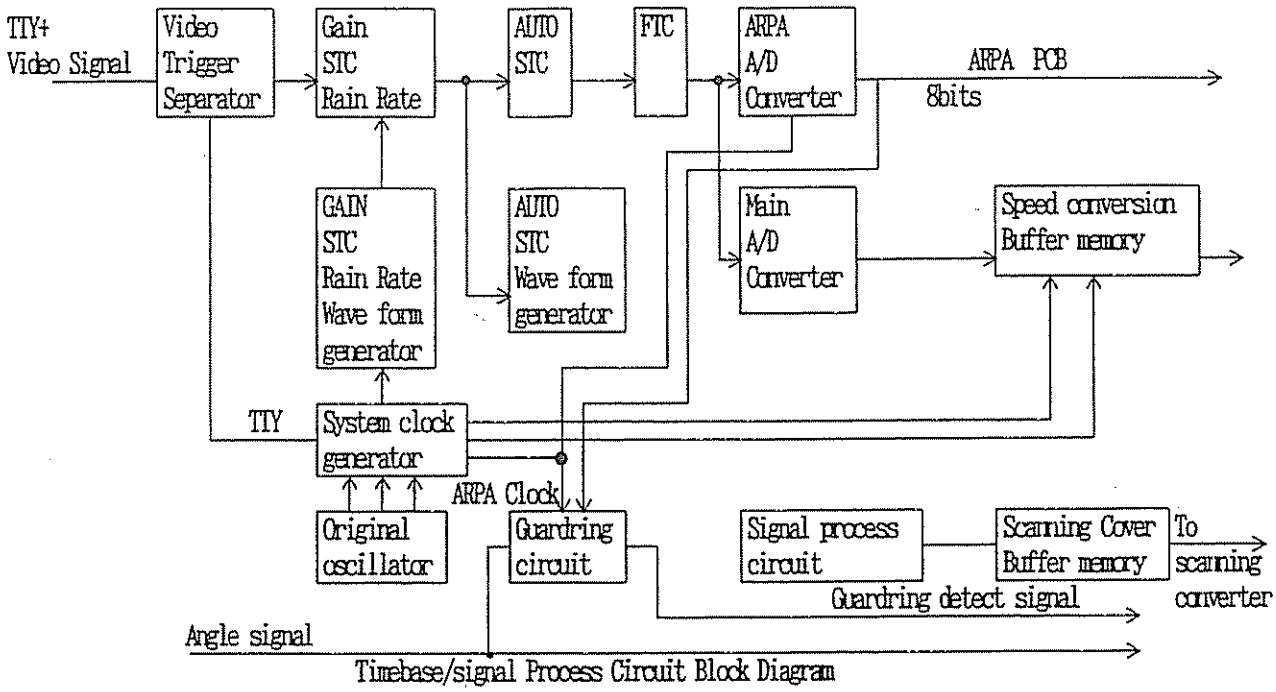
9. Buffer Memory for Sean Converter

The signal processed digital video signal is converted into 4 bits and synchronized with signal process clock then write down into the Buffer memory of IC-34.

On the other hand, read out process is made by scan converter work clock which started at the edge of antenna bearing pulse rise time regardless to the timeing of write down and the data is transfer to the scan converter.

10. Guard Ring Circuit

When a target acquired in the closed sector (starting and finishing bearing, and starting and finishing distance designated), the circuit output "H" level to motivate CPU detects the echo.



Timebase/signal Process Circuit Block Diagram

3.3.7 ARPA process circuit

・Summary

Comparison of ARPA Process circuit between JMA-7000/9000 Radar and former JMA-8000M2 Radar.

	JMA-7000/9000	JMA-8000M11
Acquisition Area	32NM	40NM
Acquirable Number	40 Targets	60 Targets
Method of Auto-acquisition	Set up 2 Zones of 0.5NM width in distance direction and Acquire target in that zone.	Able to cover allarea by Auto acquisition except inside Suppression Ring Line
Guard Ring	Set up 2 zones of 0.5m width in distance direction and whenever the target enter that zone, the alarm sounds.	Able to set up optional Distance Ring zone.
Combined use of Auto-Acquire and Guard Ring	Auto-Acquisition is in priority	Possible
Symbol	IEC872 Base	JRC symbol
Method of target Detection	Calculation Method for center of Gravity in the Gate	Method of Hard Logic Calculation
Signal process Frequency	20MHz	8.91 MHz

A Feature of JMA-7000/9000 ARPA

1. Improvement in Target Defection

So far, position data has been obtained by means of Hardware logic to synthesize or reform the shape of the target.

In this new radar system, accurate position is computed in Software process of the shape of the target picked up in each gate respectively of its center of gravity.

2. Improvement in Signal Process

Compare to conventional method, sampling frequency was raised higher that acquisition area were shortened but the

video waveform in short pulse were accurately recreated.
In all, improvement were achieved in acquiring echoes in short range and tracking performance.
Also in ARPA territory, having independent signal process circuit as same as timebase circuit, ARPA can be able to process signal independently.

3. Minimizing Failure of IC Circuit Employment
The 3 PCB so far used were assembled in one and more IC components are employed to minimize the possibility of failure.
In graphic process, Radar side GDC being used thereby there would be no problems about the dis-location of the symbols.

II Summery of Major Blocks
1. ARPA process circuit (Target detection circuit)
Target detection circuit is consist of Logic circuit in IC-16 and IC-17~22 Line memories to store the data of each sweep.
The signal came in to the Gate is reformed to a square shape for easy treatment in later process. The target's left edge angle, right edge angle and length of distance direction are taken up for counting. By the angle of target's right edge, interruption signal is generated in IC-1 TD CPU and read out the data and computing the target's position.
This circuit is used for Initial Auto-acquisition mode and for the detection of Initial Guardring Entering target.

2. ARPA Process Circuit (BANK address generate circuit)
The system is computing center of gravity of the data in the gate. For this purpose, quantized output for every sweep are write down into the memory called BANK.
BANK being a pair for Quantized HIGH and for LOW and write down the quantized data for every 32 sweep and read out from 1C-1 TD CPU alternatively. Namely, one BANK address composed of the distance and the number of sweep (Bearing) write down the data in to its memory.
Another BANK memory is connected with the address from CPU, read out the data from the address in correspond to the distance and the bearing of the gate. The charenge over of above 2 address is done in IC-16. As ARPA process area is 32NM, in order to cover that area, 10 bits are used and rest of 5bits are used for the number of sweep that BANK change over is done every 32 sweeps.

3. BANK Memory Circuit
The BANK memory consist of 1C-23-37 and IC-77.
As mentioned above, BANK is a memory to store quantized output for each sweep. Each BANK is changed over for read out and write down purpose for every 32 sweep.
The IC-23, 24 are the serial-parallel converter circuit to convert quantized output for every 8 bits.
The signal converted in 8 bits latched in buffer of IC-25, 26, 31, and write down in to the memory of IC-33~36 in a

timing controlled in IC-16, 37 and 77.
The IC-33 and 34 form a BANK pair and IC-35 and 36 forms another BANK pair. The IC-33 and 35 take the part of Quantized HIGH memory and IC-34 and 37 take the part of

Quantized Low memory.
The IC-27~34 is used when the transceiver operate the data from BANK memory to memory per gate, IC-1 TD CPU read the data through these IC for access.

4. Memory per Gate Circuit
The IC-76 and IC-108 are the memory per Gates.
During the BANK read-out period, the stored data in the BANK memory will be accessed by IC-1 TD CPU and wrote down in the assigned memory area in the order of gate number and from the left end to the right so as to facilitate the process after the end of the gate.
The area of 800H is assigned for 1 target. This figure is equivalent to abt. 20° for the gate of 0.25NM distance direction and abt. 10° for the gate of 0.5NM.
The center of gravity calculation on for each target from the memory per gate will be done while there were no transmission of data from BANK memory.

5. Target Detect (TD) CPU Circuit and Peripheral Circuit
The IC-1 is called TD CPU and is used for the CPU for target detection. The CPU is NEC V40HL (16MHz version) and internal bus 16 bits, external bus 8 bits of 8086 class CPU.
The CPU is due for following jobs.

- ·Reception of Gyro data from NSK and setting against IC-16
- ·Communication with ARPA CPU.
- ·Interruption to the target detect circuit for data access.
- ·Order changeover to the BANK and operation of data from BANK memory to the memory per gate.
- ·Center of gravity calculation of the target from the memory per gate.
- ·Calculation of predicted position from the target's position and setting of the gate.

The IC-2 is a V-40 peripheral gate array and takes care of Address Bus, Data Bus's Input/Output separation, and formation of memory control signal etc.
The IC-3 is a ROM for TD CPU and of 2M bits type.
The IC-5 is used for TD CPU memory and is 1M bits SRAM.

IC-7 is the dual port RAM to communicate with IC-81 ARPA CPU.
The IC can be accessed either from TD CPU or from ARPA CPU and one write down is made every one scan. That , in the occurrence of one write down in one address cause another CPU an interruption and enabling to read out thus maintain communication.

IC-42 and IC-98 are the 1/0 port for TD CPU and used for the control of the target detect circuit.

When the TD CPU is running normally and the trigger signal is transmitted, CD-6 flickers. (Flickering speed changes in respond to the repetition frequency.)

6. ARPA CPU Circuit and Peripheral Circuit

IC-81 is ARPA CPU and is used for target detection. NEC V40HL (16MHz version) is used for CPU as same as TD CPU.

The purpose of the CPU is as follows.

- Communication with Radar CPU
- Communication with TD CPU
- Generate key control commands for ARPA
- Calculation for target symbolization and GDC graphic coordinate axis
- Calculation of CPA/TCPA and Vector
- Calculation for trial maneuver
- Communication with peripheral equipments

IC-82 take the part of separation of the address bus and data bus by means of V40 gate array, producing control signals for I/O and memories.

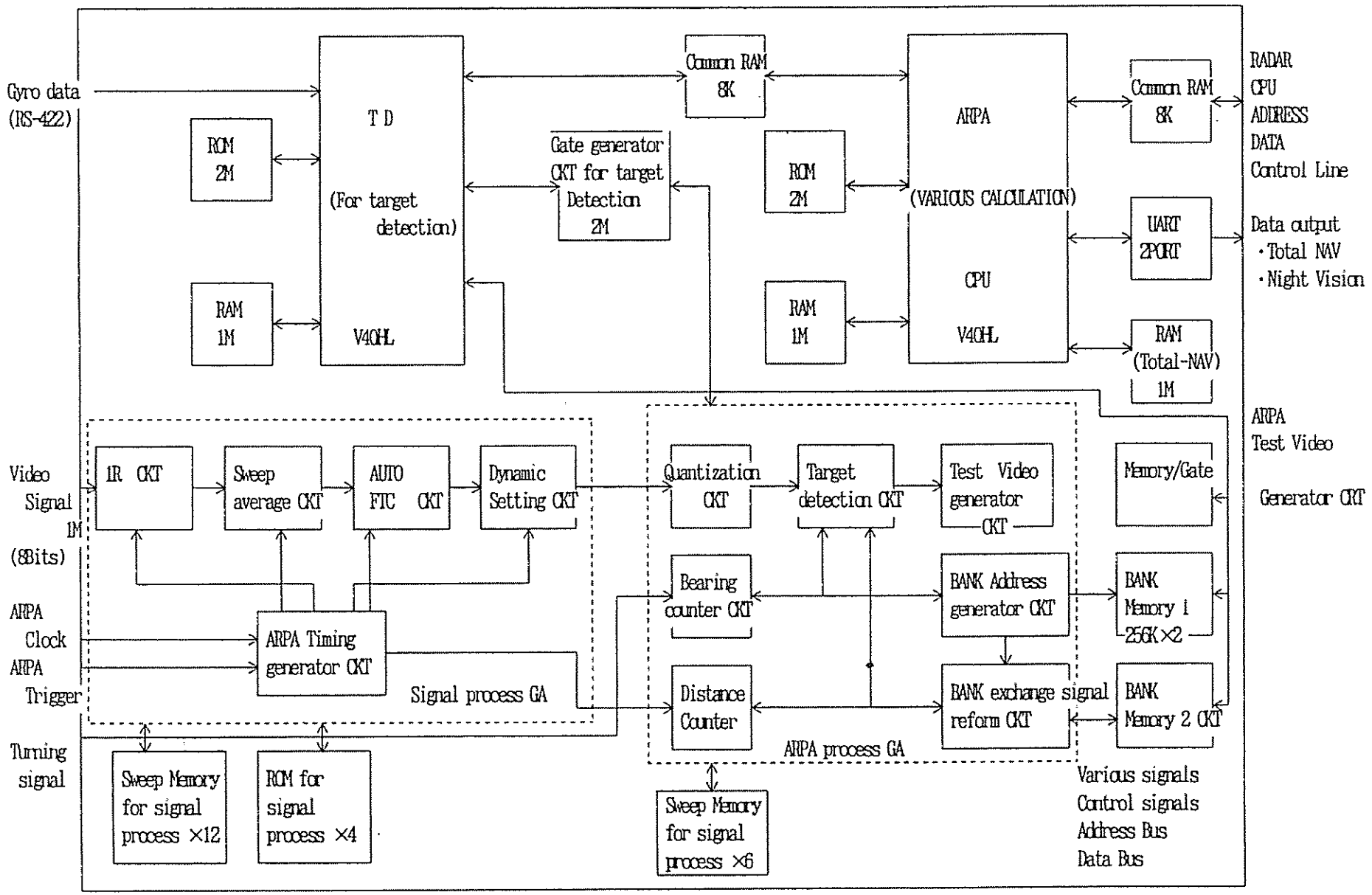
IC-83 is 2M bits ROM for ARPA CPU. IC-85 and IC-92 are 1M bit SRAM. IC-85 is used for external memory for ARPA CPU and IC-92 is used for NAV-data register memory in case of TOTAL NAV usage.

IC-93 and IC-97 used for power supply sensor and back up battery changeover circuit to maintain the power supply to IC-92 memory data in case of main power source black out.

The capacity of Battery can be checked by the code displayed in MAINTE menu.

IC-86 is the dual port RAM used for the communication with the Radar CPU. When the communication does not go well, The error message ARPA ERR displayed upper right part of the screen. This is the indication that ARPA CPU is considered to be abnormal.

ARPA Process Circuit Block Diagram



3.3.8 INTERSWITCH PROCESS CIRCUIT

Special Features
* Can be installed in display unit thus requires no space.
* Able to interchange maximum 3 scanners and 3 display units.
* Simple installation.
* Controlled by CPU.

Interswitch Process Circuit consist of following blocks.
1. CPU Circuit
2. Communication Control Circuit
3. Signal Exchange Control Circuit
4. Power Supply Circuit

1. CPU Circuit

CPU circuit controlls the transitive status of informations commanded from the display unit to connect antenna with display unit through interswitch.

CPU (IC-1) using 16 bits Microcomputor (NEC V-40).

The IC-2 is the gate array around V-40 and took the part of separating the Data-bus and the Address-bus also processing I/O memory control signals.

The IC-3 is a ROM for controlling programs. The IC-4 is a RAM. No backup system is provided.

The IC-7, 8, 20 are the data buffers and maintains control data from the CPU.

The IC-12 with SW-3 are the switch circuit to designates the number of the units to be connected or to assign own identification number. (See separate page for detail).

2. Communication Control circuit

In case of the radar system without interswitch, the communication exchanged between the display unit and antenna directly. But the system with interswitch, communication are relayed through the interswitch circuit.

In case of STRAIGHT mode, the Interswitch relay the data and send out to own display unit and antenna.

In case of CROSS mode, interswitch send the data to the circuit line among the interswitche and the interswitch connected with the antenna in operation receives the data with own ID number and send out the data to the antenna. That, in communication control circuit, data traffic among the display unit, interswitch and transceiver units are controlled.

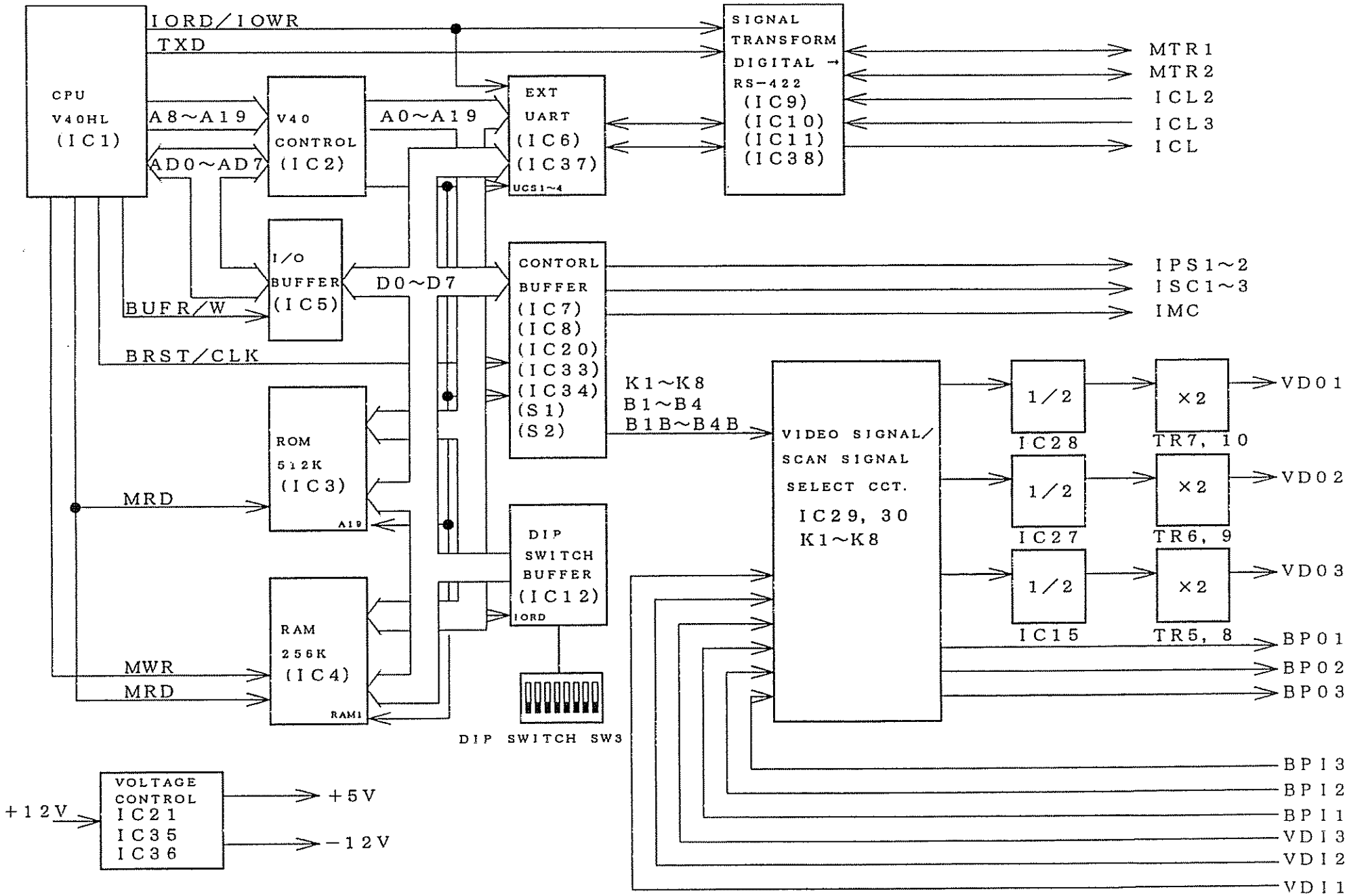
The IC-6, IC-37 are two channels UART-IC and is to input and output the serial data. Also using input and output of IC-1 serial data. These signals are of TTL interface however, conversion between RS-485 interface signal and TTL-interface signal will be carried out in IC-9, 10, , 11 and 38.

81

3. Signal Exchange Control Circuit
Status controlled signals from the CPU will be boosted by IC-13, 14, 24 and 25 and by the photomos relay IC-33 and 34 drive the relays. In case of the system is set on forced-STRAIGHT-mode, this circuit will controlls to bypass the communication line, video line and turning signal line (through interswitch) and directly connect the signals to each units.

4. Video signal circuit
Video-trigger signal will be amplified in high speed OP-amplifier of IC-15, 27 and 28 keeping the characteristics intact and through the complimentary circuit of TR-5, 8 and TR-7, 10, output is taken out at 47 Ohm impedance. The IC-31, 32 exchanges the turning signal lines.

5. Power Supply Circuit
Interswitch circuit is energized by the pre-power voltage from the display unit therefore, without turning ON the display unit, the circuit is energized by the ship's mains.
From the pre-power voltage 12V, +5V is made from IC-21 and -12V from IC-35 and 36.



CCL-263 PC43 1 INTER SWI CH CIRCUIT

UNDERSTANDING OF TUNING

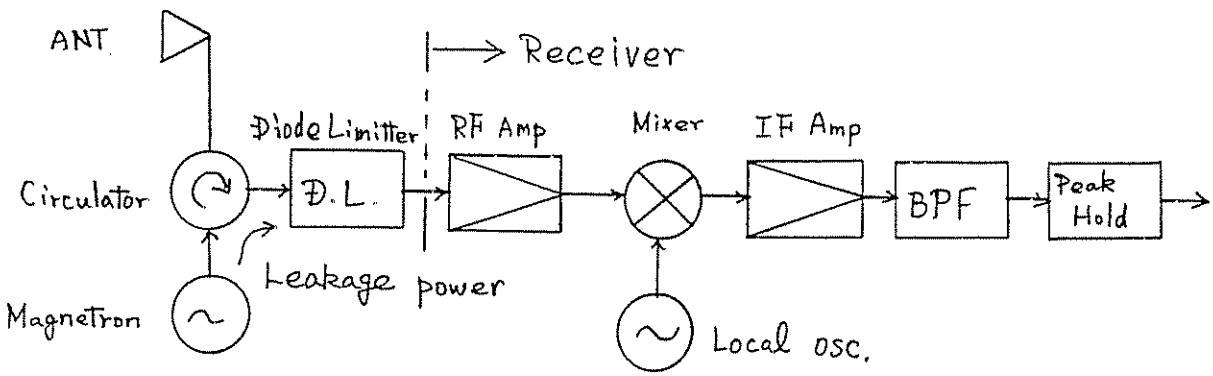
Section 3. 11 of IEC 936 states in its performance check, "Means should be available to check that the equipment is correctly tuned, even in the absence of targets. "

Based on the above, JRC radars are made in the following manner:

1) Tuning method

JRC's tuning method in the absence of targets avail of a TUNE indicator displayed on radar screen. JRC's TUNE indicators avail of the RF leakage power transmitted from the magnetron. This signal catched by a receiver is converted down to an intermediate frequency with the local oscillator in the receiver. The downconverted signal is then amplified by amplifier with narrow band width, detected and peak-held on the tuning circuit in the receiver, then converted to a DC voltage and sent to the indicator to be displayed on the screen as a tuning indication. Therefore, even on the open sea where there aren't any targets, tuning can be made accurate by adjusting the tuning indicator to maximum.

Usual echo's box type avail of the leakage power of magnetron,too. This power with time delay is displayed on the radar screen,and in absence of targets tuning can be correctly tuned by adjusting this image to maximum. Therefore I think the basic concept is the same.



2) Check of Tuning system

Check of tuning system is made with a performance monitor.

JRC's performance monitors (PM) have a built-in oscillator that transmits synchronized microwave with the transmitting freqency of the radar. The transmit ting freqency of this oscillator is swepping so that the frequency range of the magnetron used by a marine radar can be covered. This allows checking of the local oscillator in the receiver and sensitivity of the receiving system even on the open sea where there aren't any targets.

Therefore, the performance of the receiving system can be checked for the entire magnetron frequency range with 2), and tuning with the TUNE indicator as described in 1) can be used to adjust the tuning so that it is appropriate for the currently used magnetron frequency even when there aren't any targets.

1. GENERAL

Radar Performance Monitor type NJU-63/64 have a function of monitoring the radar performances in combination with the S/X-band radar.This equipments can be available,while the radar is used operationally,to determine readily a significant drop in performance relative to a calibration standard established at time of installation.

2. COMPOSITION

Name	Model name	Model name
Performance monitor	NJU-63 (Sband)	NJU-64 (Xband)
PM equipment internal devices	CQC-818	CQC-750
RF circuit	CTM-106 (PC1/PC2)	CTM-101 (PC1/PC2)
Driver circuit	CCF-82-1 (PC3)	CCF-82 (PC3)
Cable	7ZCRD0450	7ZCRD0450

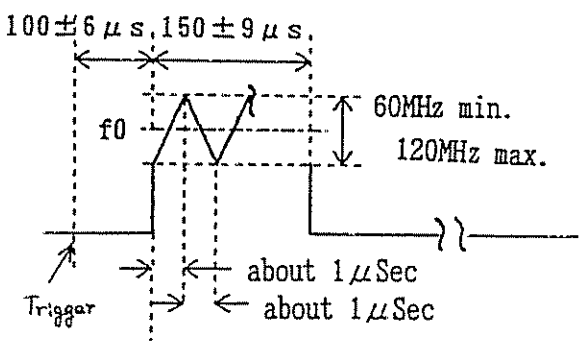
3. PRINCIPLE

This equipment is installed on the pedestal side of the radar antenna. It has a function to receive and detect part of the electric power emitted from the antenna and to output the peak hold voltage, and a function to emit the AM- and FM-modified microwaves to the antenna, synchronous to the radar transmission trigger.

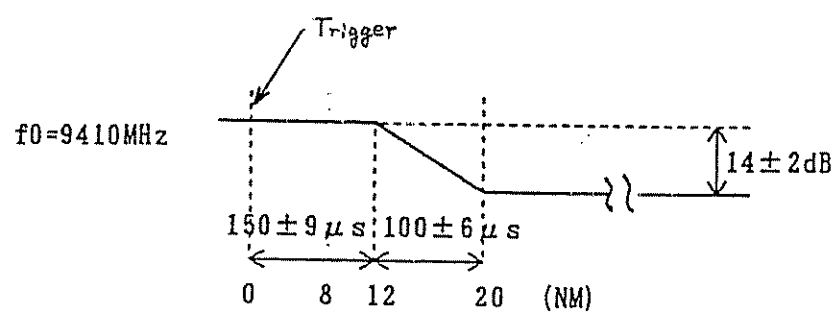
Fig. 3.1 is a schematic diagram of this equipment. The FR circuit comprises the MICs of the transmitter system (PC1) and receiver system (PC2).

The transmitter system (PC1) comprises the VCO, 10dB D/C, ATT1, ATT2 and ANT.
The VCO emits microwaves of about 8dBm which is FM-modulated by the FCV signal from the driver circuit. The 10dB D/C provides isolation between the VCO and load and serves to ensure stable oscillation.

The ATT1 and ATT2 are reflective variable attenuators based on pin diodes, and the ATT2 makes the microwave level changeable using the AT2 signal V-I converted inside the driver circuit by the LVR signal from the indicator. Furthermore, the ATT1 applies a specified AM modulation to microwaves through the AT1 signal from the driver circuit.



① FM modulated waveform



② AM modulated waveform

85

The ANT is a printed circuit board bipole, and emits AM- and FM-modulated microwaves into space.

The receiver system (PC2) comprises the ANT, 30dB D/C and DET. The ANT is the same as that of the transmitter system. It picks up the high frequency signal from the radar antenna. After level is adjusted by the 30dB D/C, video signals are captured by the DET, and are then output to the driver circuit.

The driver circuit (PC3) has the following three functions; (1) a function to stabilized the +15VDC to +5VDC and +12VDC, (2) a function to generate the FM modulated waveform (FCV signal) and the AM modulated waveform (AT1) synchronized with the PT1 signal (transmission trigger) from the indicator, and (3) a function to generate AT2 signals through level adjusting signal (LVR) from the indicator. Furthermore, it serves to amplify video signals from the receiver system (PC2) and to output the peak hold voltage to the indicator.

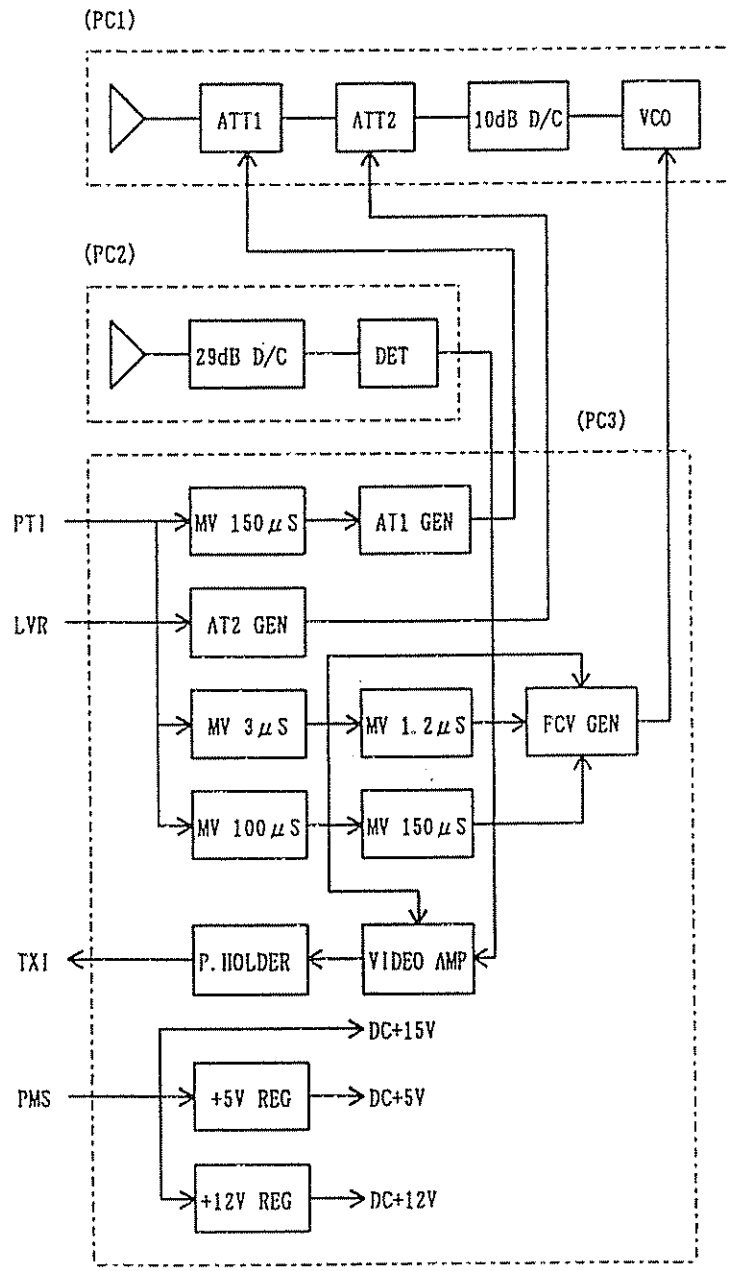


Fig3. 1

86

4. SPECIFICATION

4.1 Electric performance

4.11 Transmitter system (transmitter monitor)	NJU-63	NJU-64
(1) Frequency range	3050±30MHz	9410±30MHz
(2) Output signal		
① Peak hold voltage	DC2～9V	DC2～9V
② Fluctuations of holding voltage	2% max. (≦2.5sec)	2% max. (≦2.5sec)
③ Dynamic range	25dB min.	25dB min.
(3) Permissible maximum power received	56dBm min.	49dBm min.
4.12 Receiver system (receiver monitor)		
(1) Frequency range	3050±30MHz	9410±30MHz
(2) Transmitting power		
① Maximum	-32±3dBm	-28±3dBm
② Transmitting power fluctuation (within the band)	≦ ±1.5dB	≦ ±1.5dB
③ Level adjusting range	10dB min.	10dB min.
4.13 Power supply		
(1) Voltage	DC +15V±5%	DC +15V±5%
(2) Current	110mA max.	110mA max.

4.2 Environmental conditions

4.21 Temperature

Non-operating: -25～+75°C

Operating: -25～+55°C

4.22 Humidity 93% at +40°C

4.23 Water resistance IEC-945

4.24 Corrosion resistance IEC-945

4.25 Vibration Test shall be conducted under the following conditions in three directions (vertical, longitudinal and lateral directions), and no failure shall be present after electric power is turned on.

5～12.5Hz : ±1.6 mm±10%

12.5～25.0Hz : ±0.38mm±10%

25.0～50.0Hz : ±0.1 mm±10%

4.3 External dimensions

4.31 Equipment proper

(1) External dimensions & Weight

NJU-63 : W 150±4 × D 249.0±4 × H 56±4 mm

2.0 Kg max

NJU-64 : W 150±4 × D 215.5±4 × H 56±4 mm

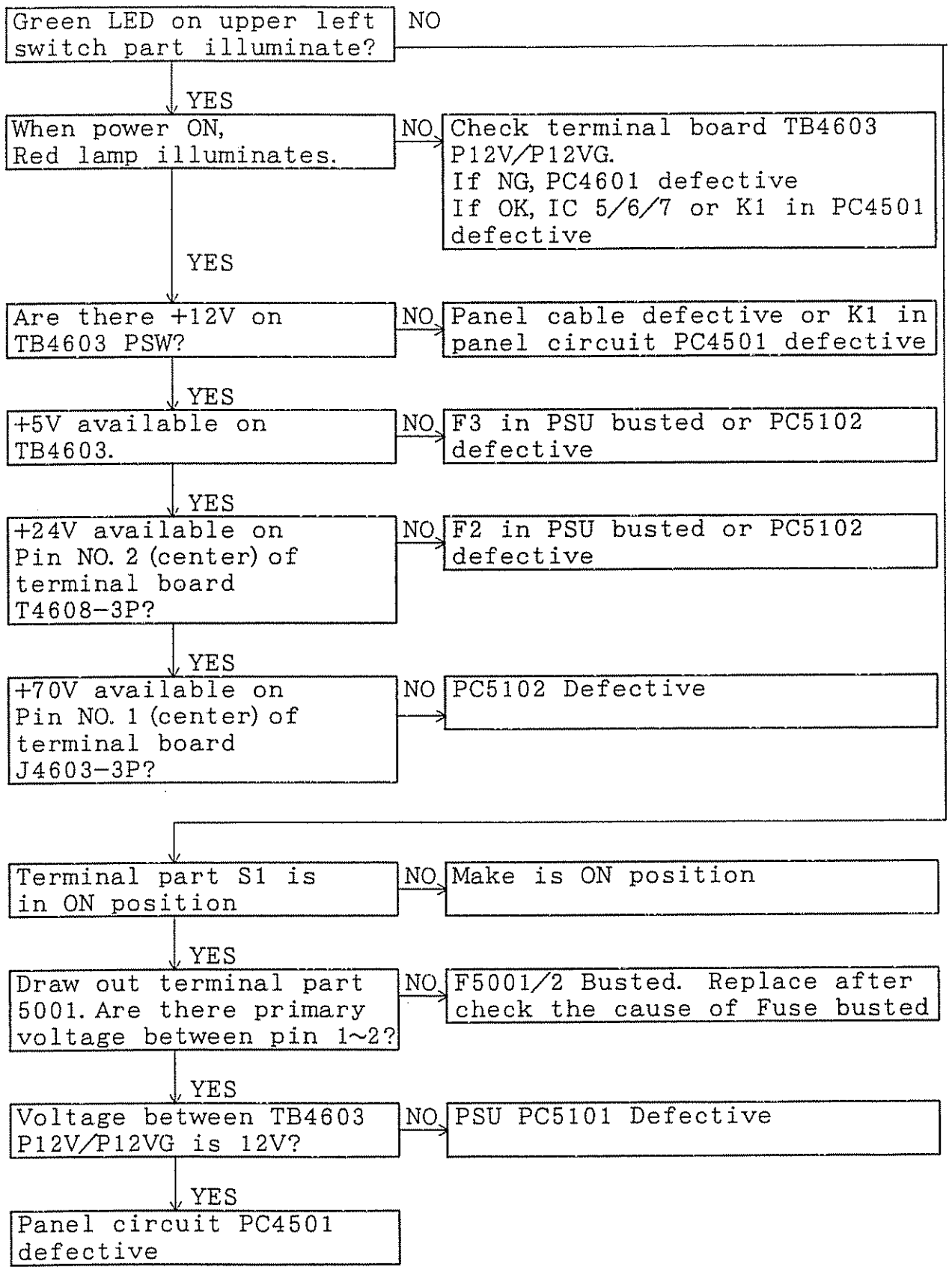
1.5 Kg max

4 Trouble Shooting

4.1 Diagnosis on trouble symptom and Recovery Method

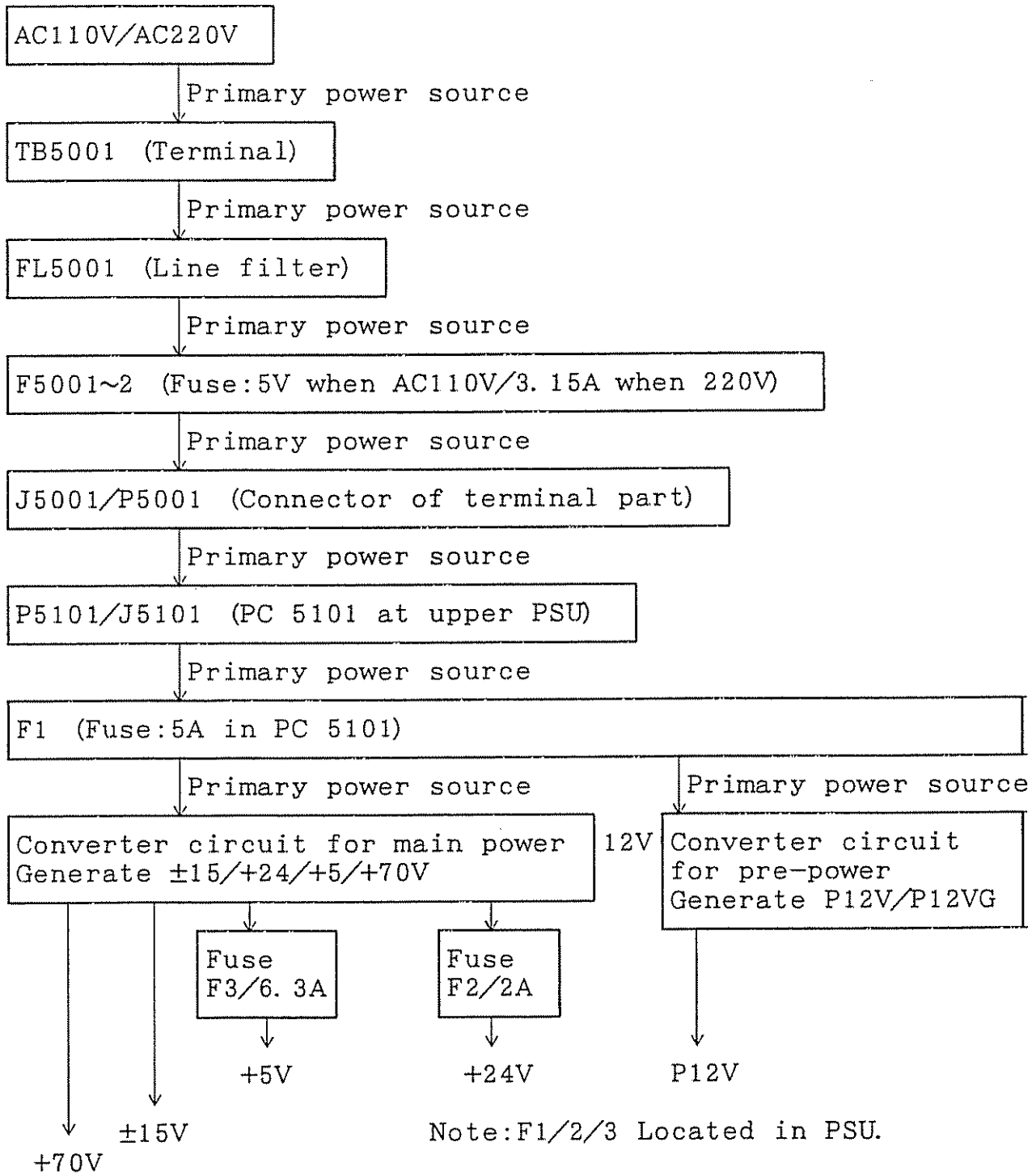
Case1 :Unable to supply power
Case2 :Unable to go to ST-BY even after 3 minutes countdown
Case3 :STANDBY state does not go to TRANSMIT state
Case4 :Automatically return to ST-BY state from TRANSMIT state
Case5 :Position of tuning knob is different in obtaining maximum tuning indication and in adjusting clearest picture.
Case6 :Maximum deflection of tuning Bar is not appropriate
Case7 :Poor sensitivity
Case8 :Unable to control CRT Brilliancy from control panel
Case9 :CRT does not illuminates
Case10 :In TRANSMIT mode, no picture but markers available
Case11 :Picture moves toward scanner turning direction
Case12 :No Navaid data displayed
Case13 :No LOG (1 axis) data displayed
Case14 :No GYRO data displayed
Case15 :ARPA does not acquire target
Case16 :No ARPA menu displayed
Case17 :Big error in course and speed of ARPA targets
Case18 :Unable to update ARPA data
Case19 :Target in ARPA data changed course and speed but vector does not follow correctly

Case 1: Unable to supply power



☆For Reference

Circuit flow of primary power source to secondary power source (Lower Voltages)



Remarks Turn ON the S5001 in terminal part, converter circuit for pre-power start function.

Pre-power P12V/P12VG (+12V) to be used for energizing panel circuit main power relay and for its relay circuit and for converter circuit for main power as an Auxiliary power source.

The function of prepower can be checked visually by observing LED on "POWER" switch at the upper left hand of the panel.

Meaning of panel switch "POWER" ON is to apply P12V ON PSW of terminal board. To short circuit PSW and P12V makes main converter circuit start function and lower voltage power sources will be distributed to all circuits for normal operation, however without key board, CRT brilliancy will be s et to lowest level and unable to represent picture. This met hods effective for the check of power sources.

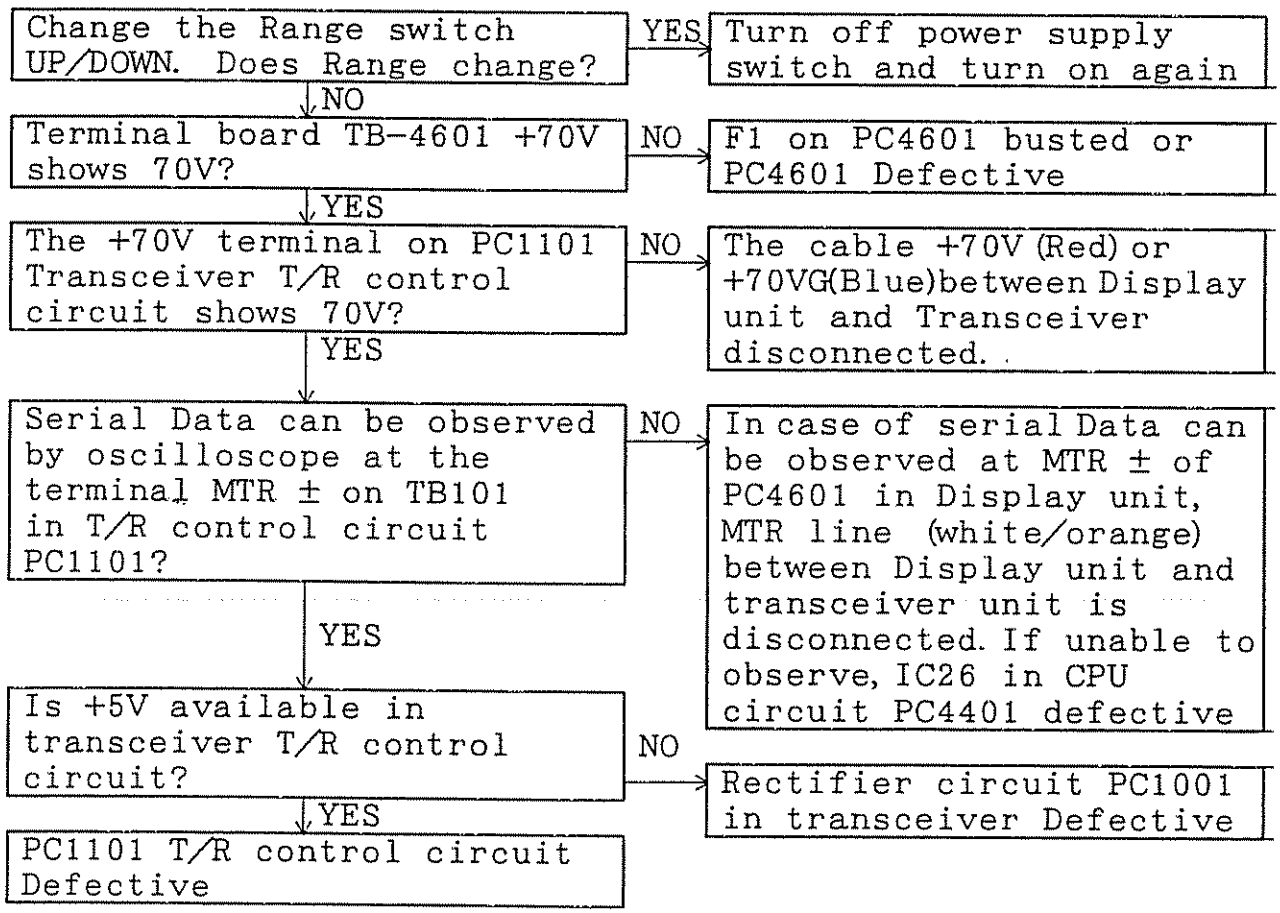
Prepower circuit has a circuit protection which sometimes activate before the fuse blow off. In this case, turn the main switch S5001 to OFF and after 2 to 3 minutes, turn ON again so as to reset the protection device to restore the normal function.

Power supply part normally a quiet circuit however depends o n the condition of the load, (specially such optional load a s INTERSWITCH) "sizzling" sound may be heard. This noise can be disregarded if the noise is unnoticiable behind the front cover.

Input to power supply part is taken from U/V line regardless to the single or three phases. Therefore, in case of single phase, connection to be made on U/V line.

At the AC terminal part, Fuse F5001/2 is 5A when AC110V and 3.15A when source is AC220V.

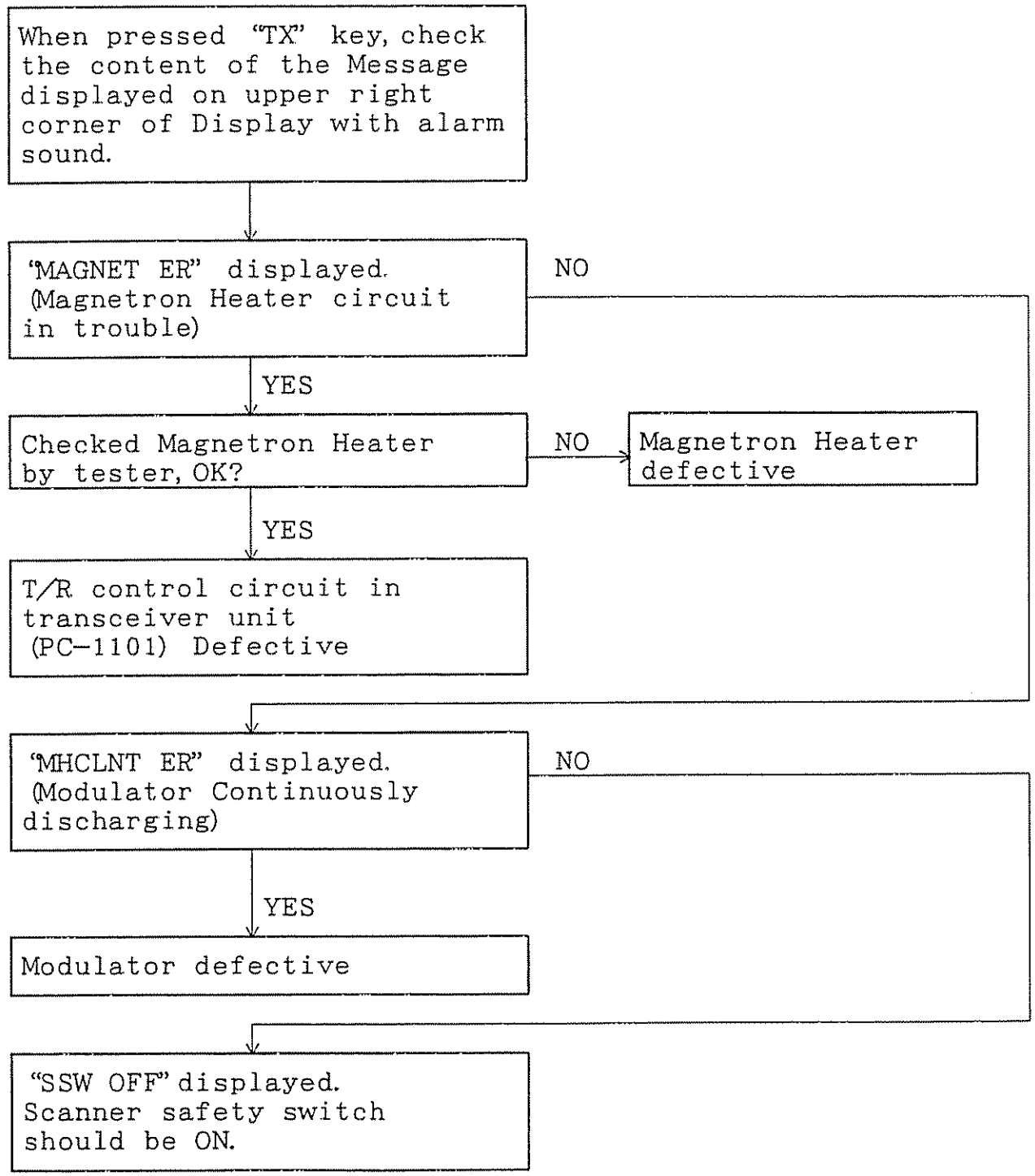
Case 2 :Unable to go to ST-BY even after 3 minutes countdown



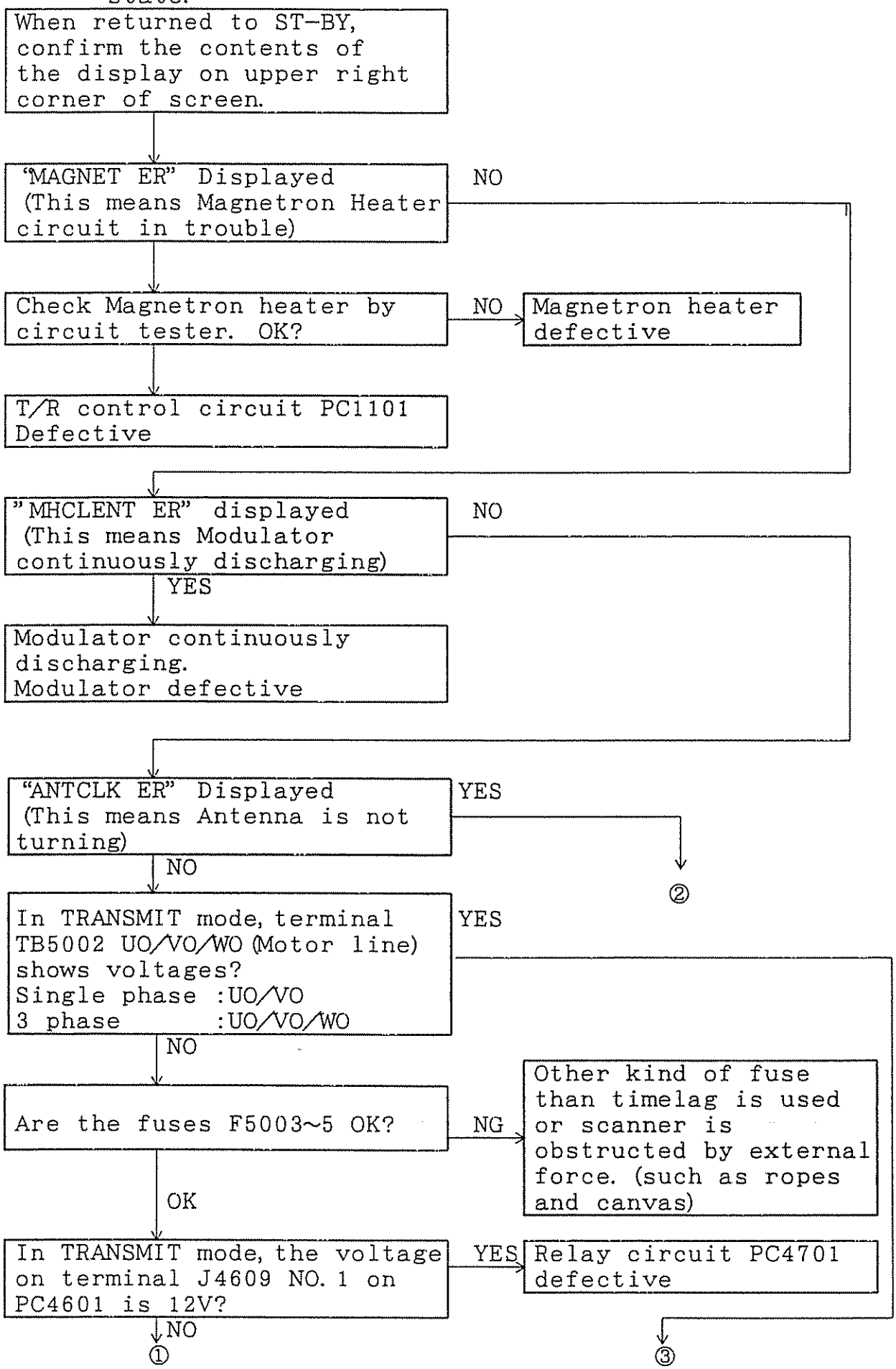
For Reference

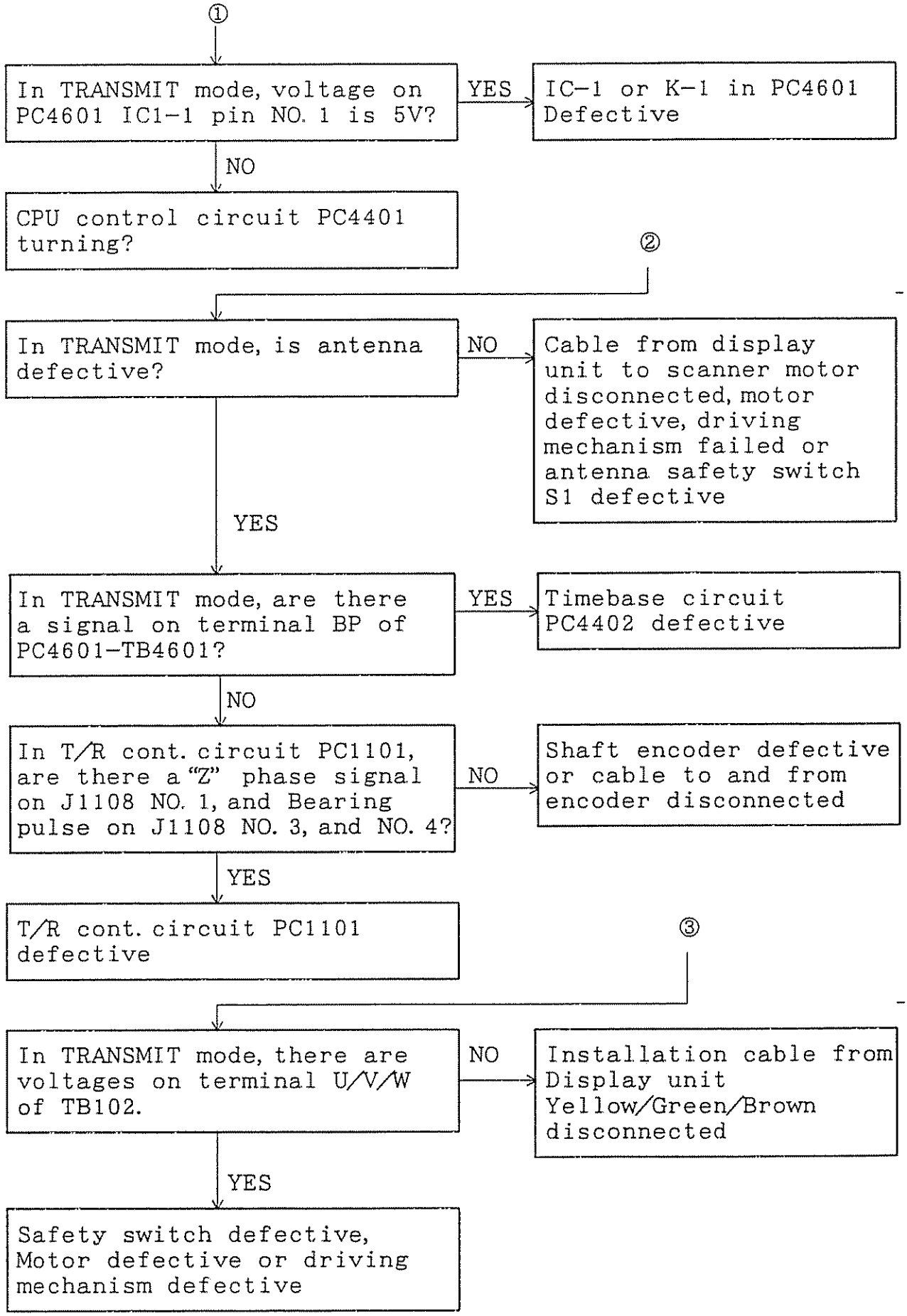
This Radar can be put in to STAND by condition forcibly by pressing key "#" in panel switch for abt. 10 second. This function should be used only when the Magnetron is sufficiently pre-heated and immediate re-transmission is required for emergency or Repair maintenance purposes.

Case 3:STANDBY state does not go to TRANSMIT state.



Case4 :Automatically return to ST-BY state from TRANSMIT state.




①
In TRANSMIT mode, voltage on PC4601 IC1-1 pin NO. 1 is 5V?
YES
IC-1 or K-1 in PC4601 Defective
NO
CPU control circuit PC4401 turning?
②
In TRANSMIT mode, is antenna defective?
NO
Cable from display unit to scanner motor disconnected, motor defective, driving mechanism failed or antenna safety switch S1 defective
YES
In TRANSMIT mode, are there a signal on terminal BP of PC4601-TB4601?
YES
Timebase circuit PC4402 defective
NO
In T/R cont. circuit PC1101, are there a "Z" phase signal on J1108 NO. 1, and Bearing pulse on J1108 NO. 3, and NO. 4?
NO
Shaft encoder defective or cable to and from encoder disconnected
YES
T/R cont. circuit PC1101 defective
③
In TRANSMIT mode, there are voltages on terminal U/V/W of TB102.
NO
Installation cable from Display unit Yellow/Green/Brown disconnected
YES
Safety switch defective, Motor defective or driving mechanism defective

95

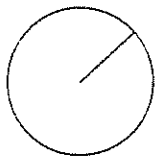
Case 5 :Position of tuning knob is different in obtaining maximum tuning indication and in adjusting clearest picture.

Turn the tuning knob to right side to get the better tuning but to get clearest picture, tuning knob to be turned to left side.

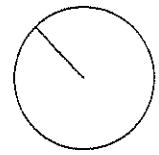
NO
→to ①

↓YES

Position of knob where the tuning bar shows maximum length



Position of knob where the picture became clearest



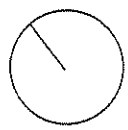
Turn the tuning core of L15 to clockwise (for example abt. 45°)

Location of L51
X-band Receiver CAE-344
S-band Receiver CAE-344-1

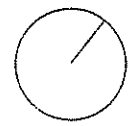
①
↓

Turn the tuning knob to left side to get the better tuning but to get clearest picture, tuning knob to be turned to right side.

Position of knob where the tuning bar shows maximum length



Position of knob where the picture became clearest



Turn the tuning core of L-15 to counterclockwise (for example abt. 45°)

Case 6 :Maximum deflection of tuning bar is not appropriate

In 24 NM Range, tuning saturate or indicator Bar less than 8 scale?

saturate →

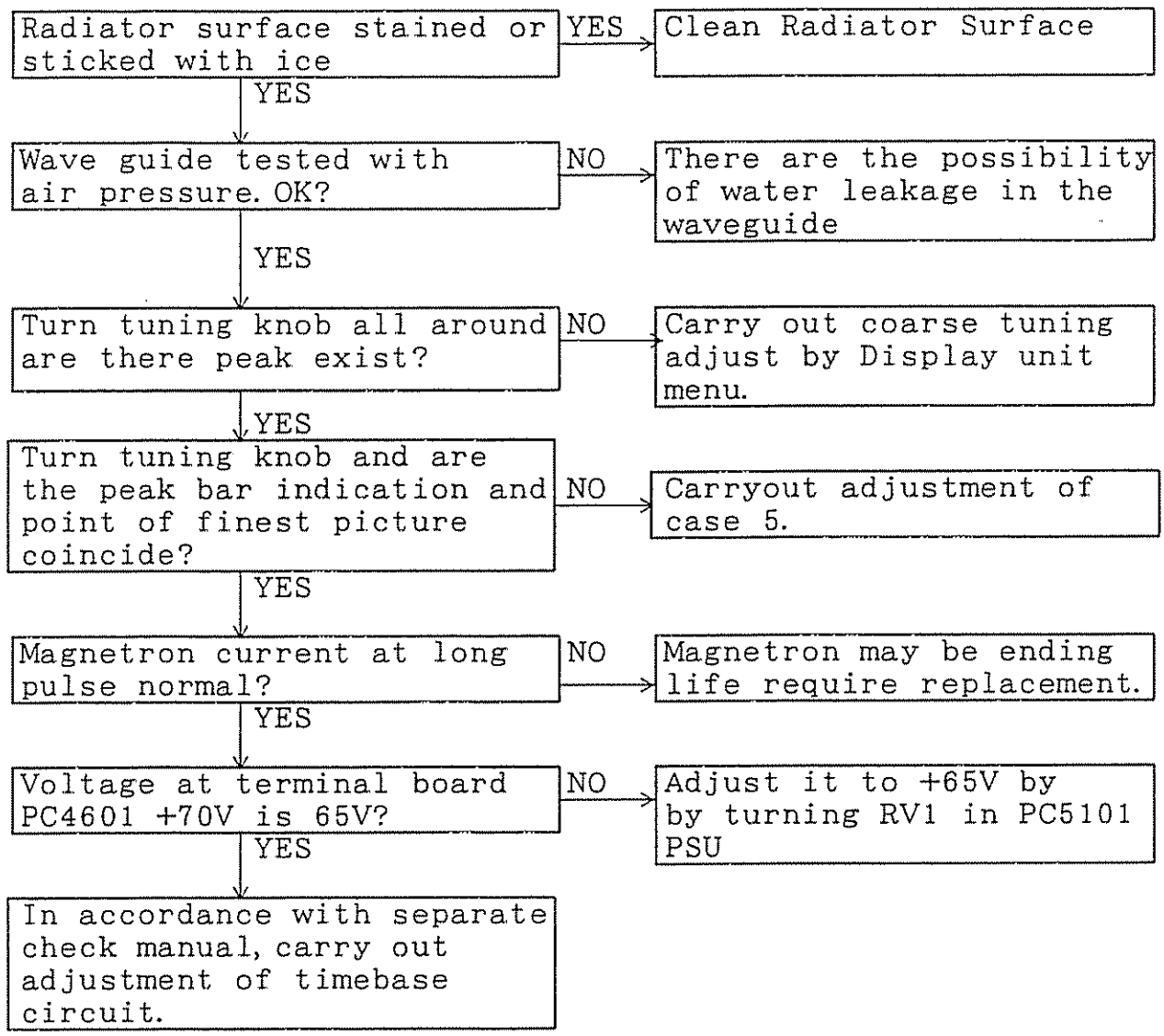
Take tuning in Range above 24NM and turn RV1 to CCW direction so that LED (CD8) illuminates

↓Less than 8 scale

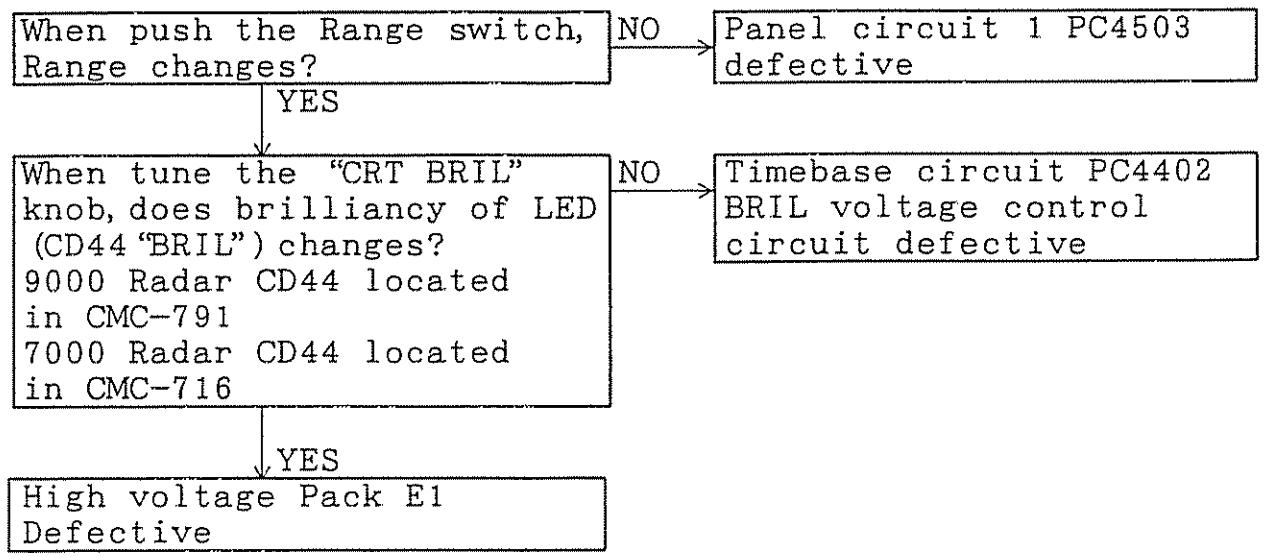
Take tuning in Range above 24NM and turn RV1. clockwise so that LED (CD8) illuminates

Location of RV1 & CD-8:
X-band Receiver CAE-344
S-band Receiver CAE-344-1

Case 7 : Poor Sensitivity



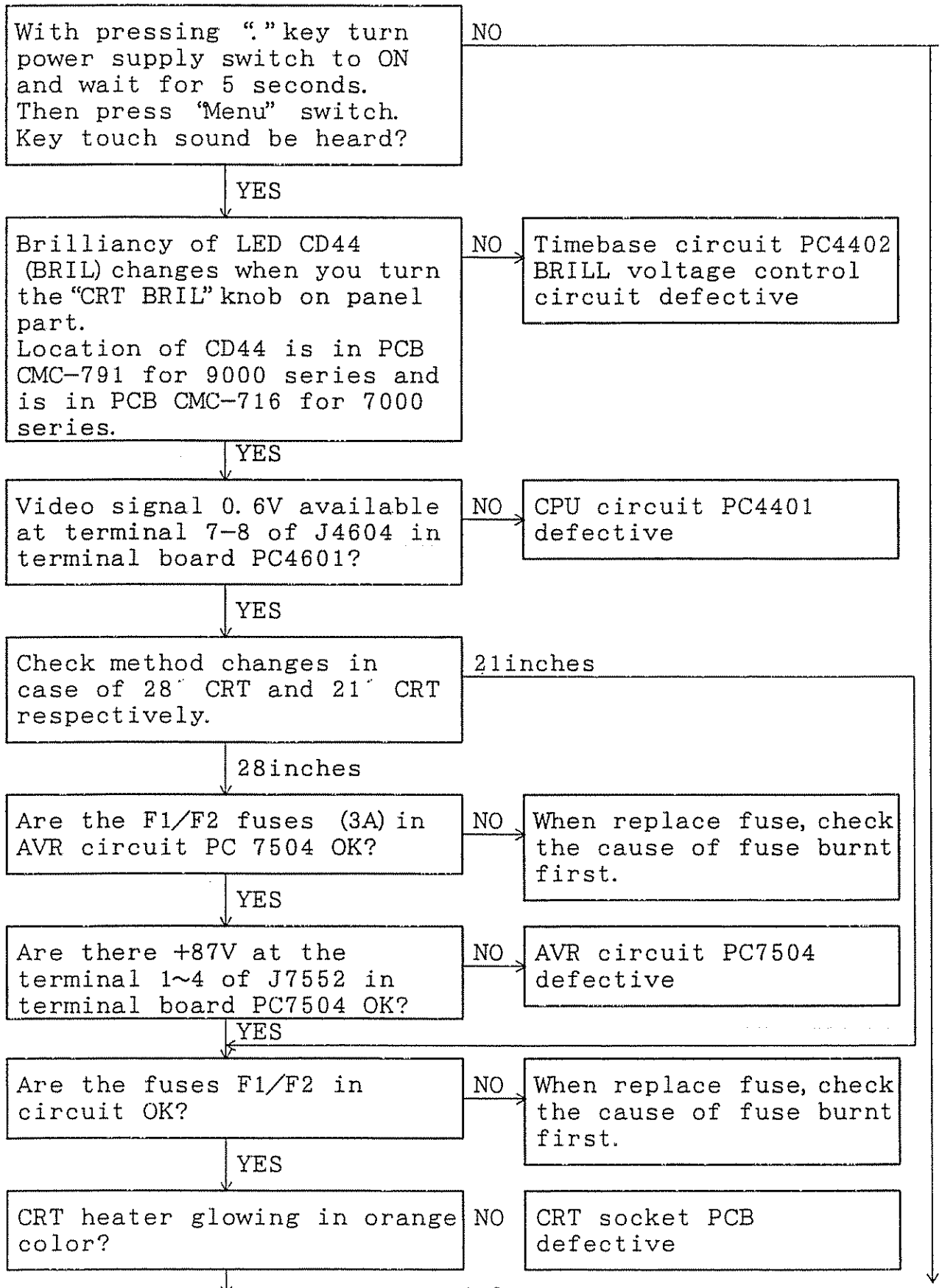
Case8 : Unable to control CRT brilliancy from control panel

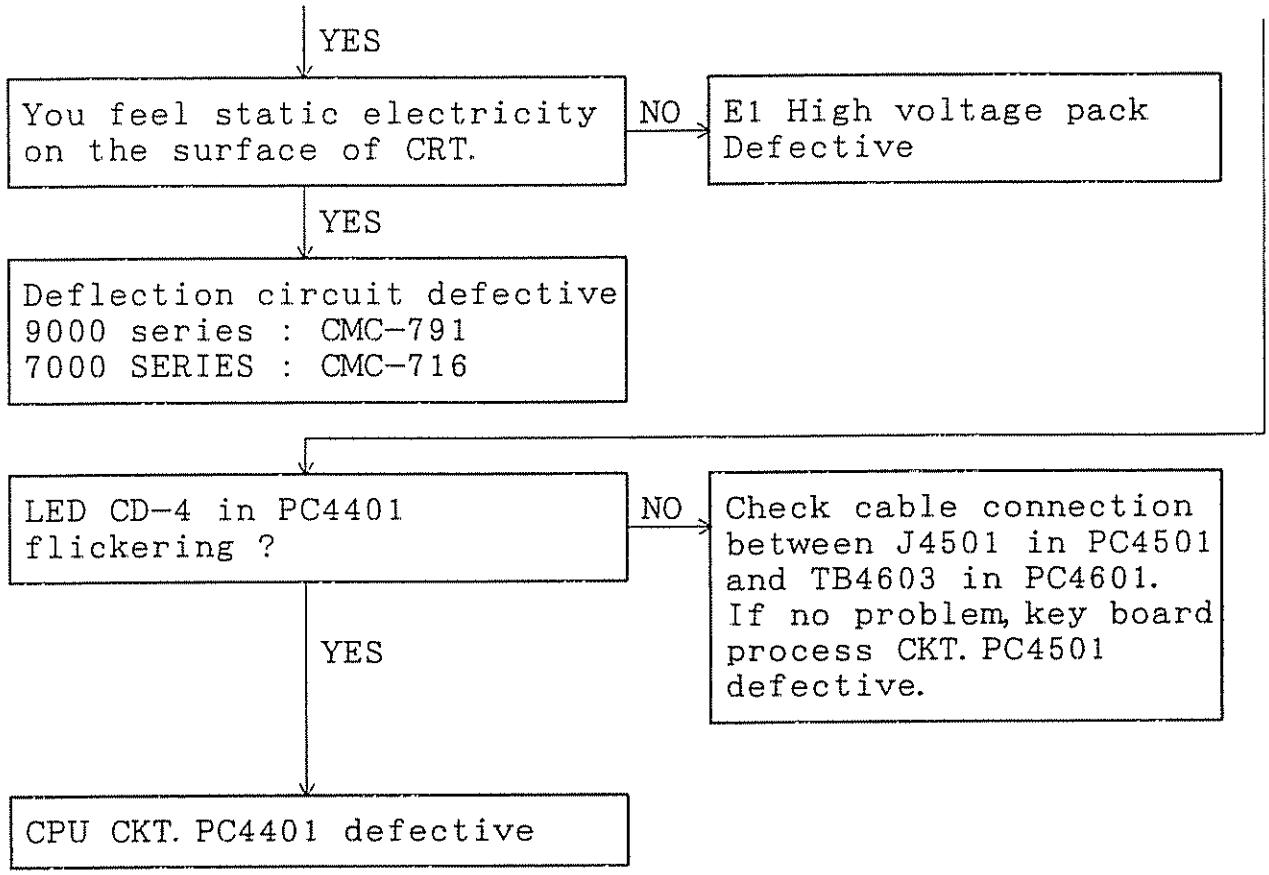


97

Warning CRT deflection circuit use a high voltage. Do not check components touch with wet bare hand!!!

Case 9 :CRT does not illuminate



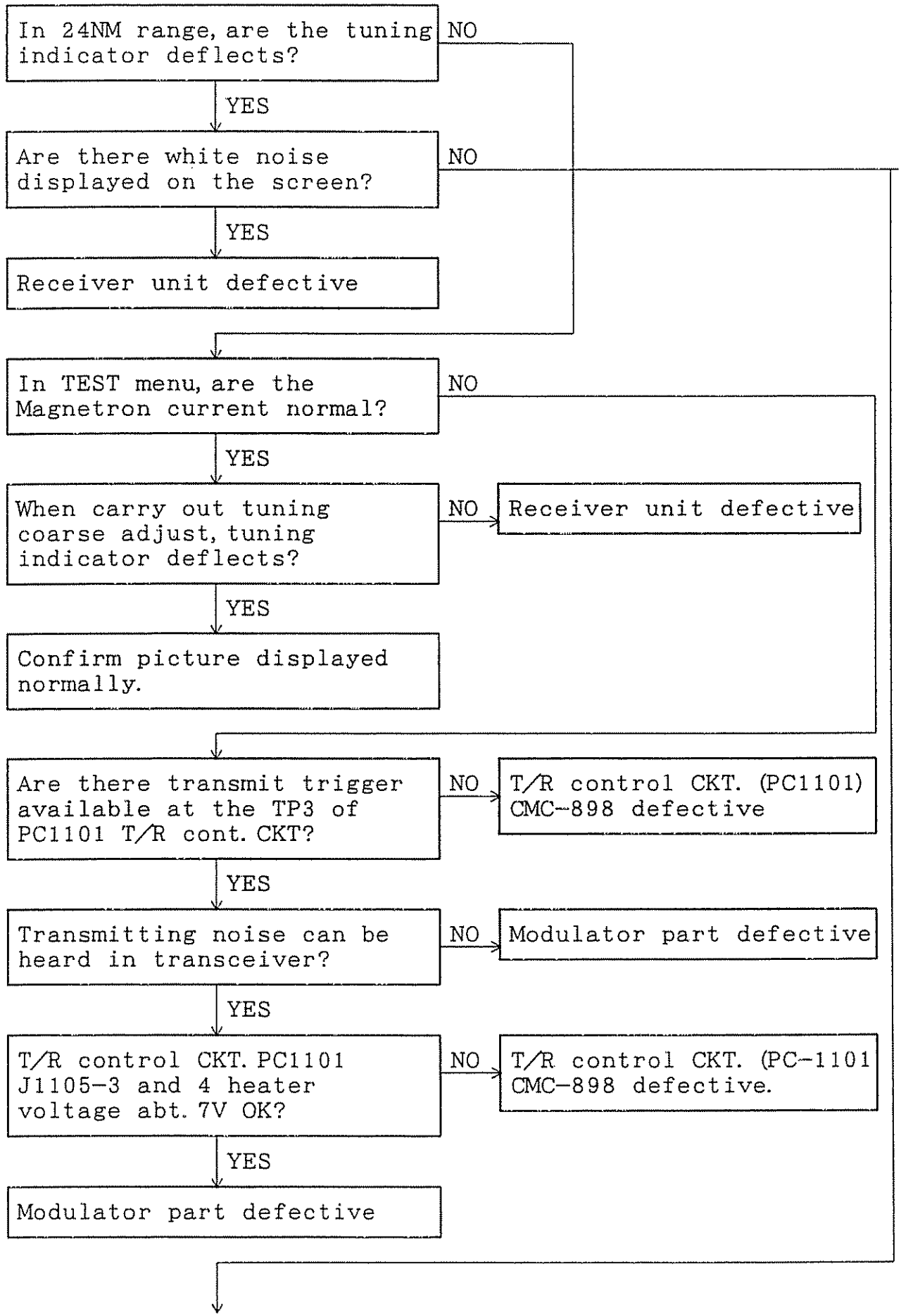


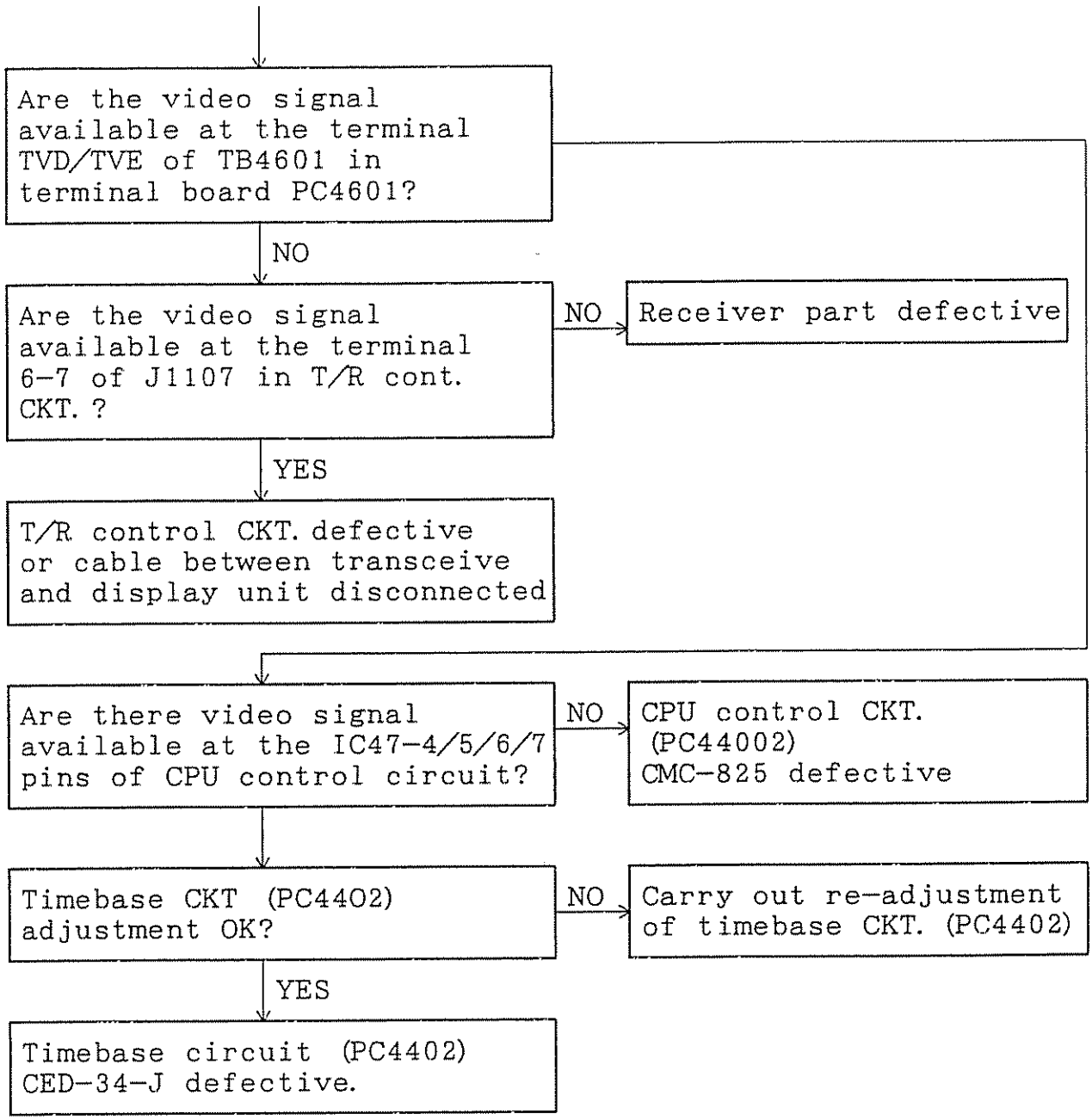
Remarks

Difference of circuits between JMA-7000 (21 inches) series and JMA-9000 (28 inches) series Radars are as follows. JMA-9000 radar use AVR circuit PC-7504 for CRT deflection. The deflection circuit, CRT neck circuit and high voltage power supply pack are different each other.

In AVR CKT. PC7504, there are fuses F1 & F2 (3A) and likewise in deflection circuit, there are fuses F1 & F2. Therefore, in case of failure around CRT, there are no interchangeability for the parts around CRT as above mentioned but rest of the circuits are all interchangeable.

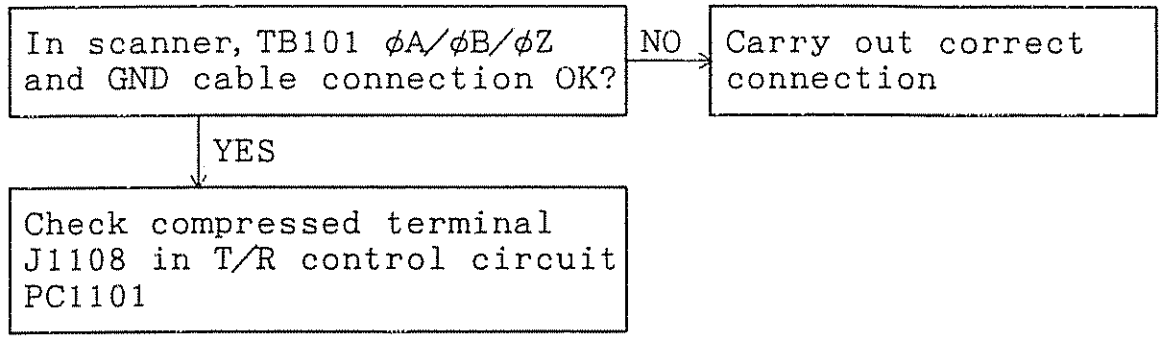
Case 10 : In TRANSMIT mode, no picture but markers available



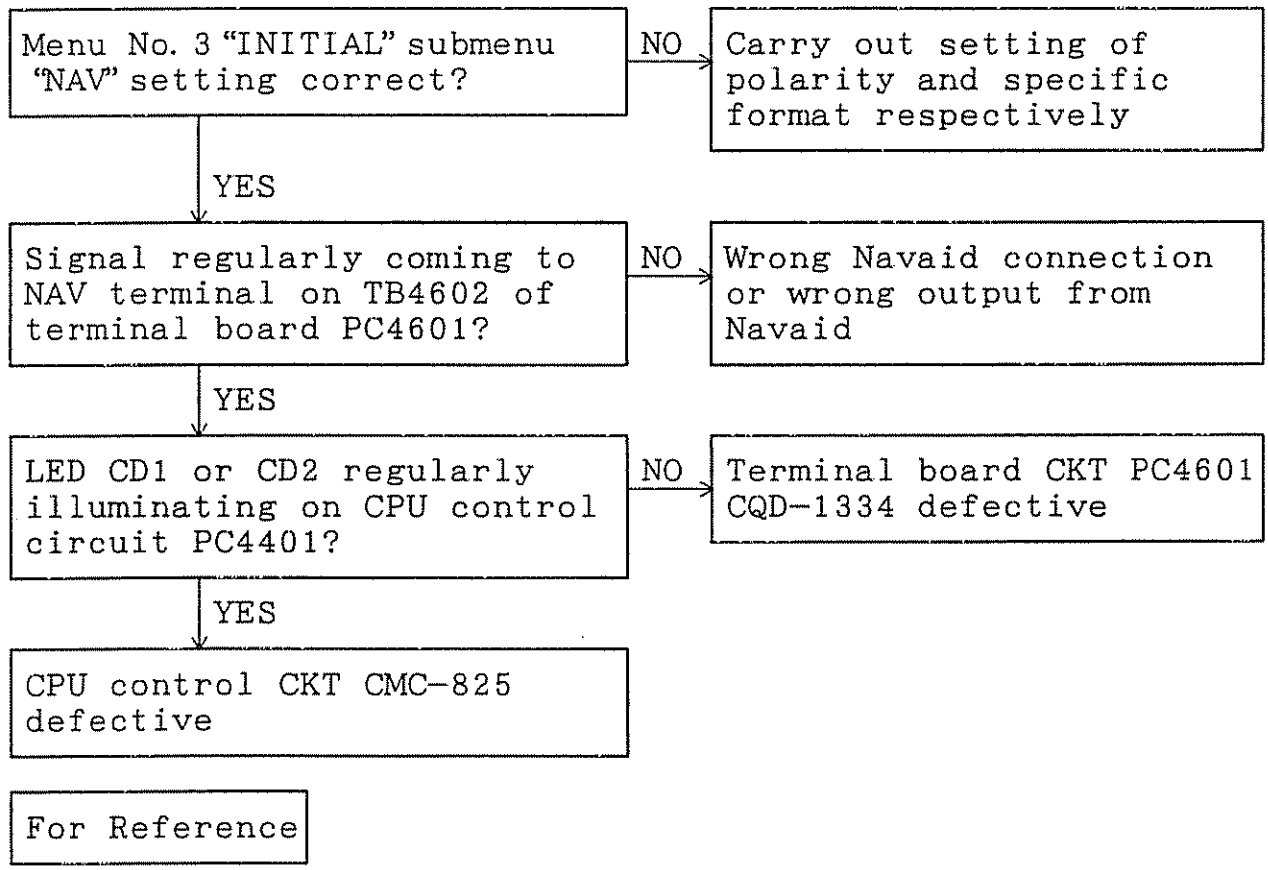

Are the video signal available at the terminal TVD/TVE of TB4601 in terminal board PC4601?
NO
Are the video signal available at the terminal 6-7 of J1107 in T/R cont. CKT. ?
NO
Receiver part defective
YES
T/R control CKT. defective or cable between transceive and display unit disconnected
Are there video signal available at the IC47-4/5/6/7 pins of CPU control circuit?
NO
CPU control CKT. (PC44002) CMC-825 defective
Timebase CKT (PC4402) adjustment OK?
NO
Carry out re-adjustment of timebase CKT. (PC4402)
YES
Timebase circuit (PC4402) CED-34-J defective.

101

Case 11 :Picture moves toward scanner turning direction



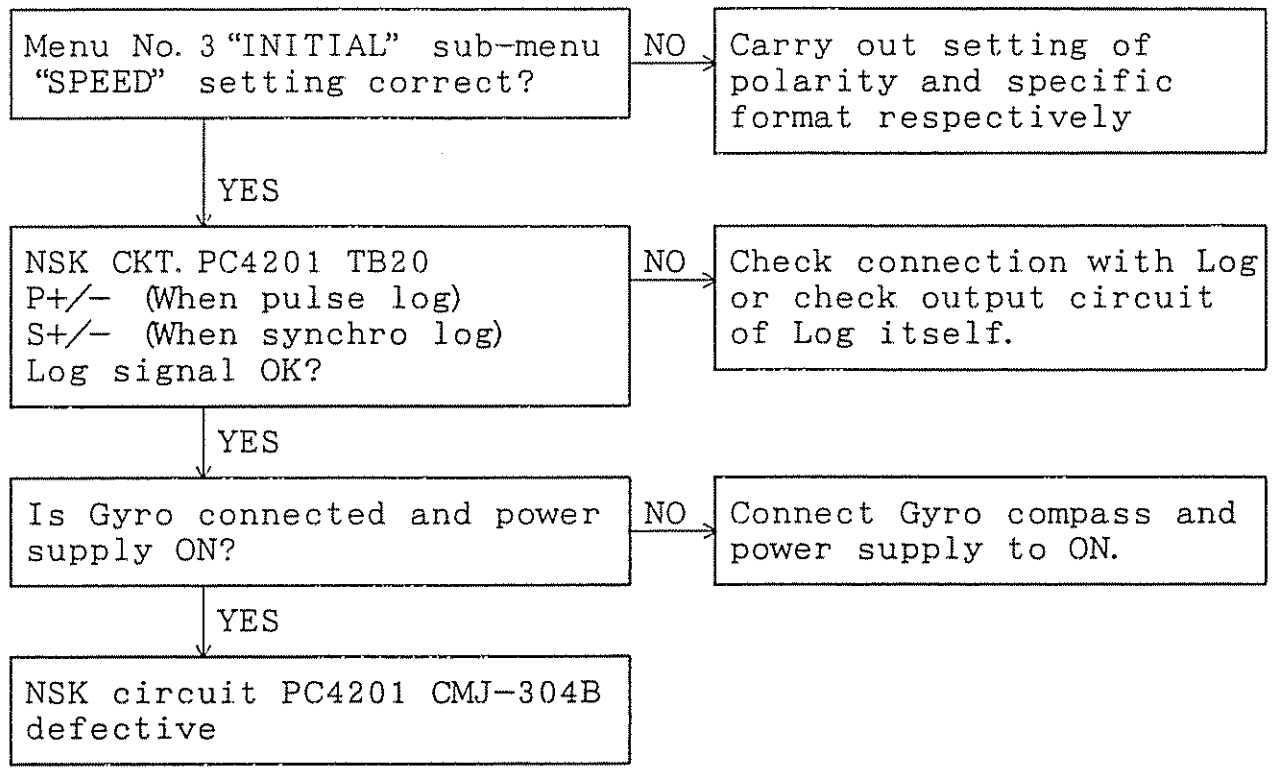
Case 12 :No NAVAID data displayed



For Reference

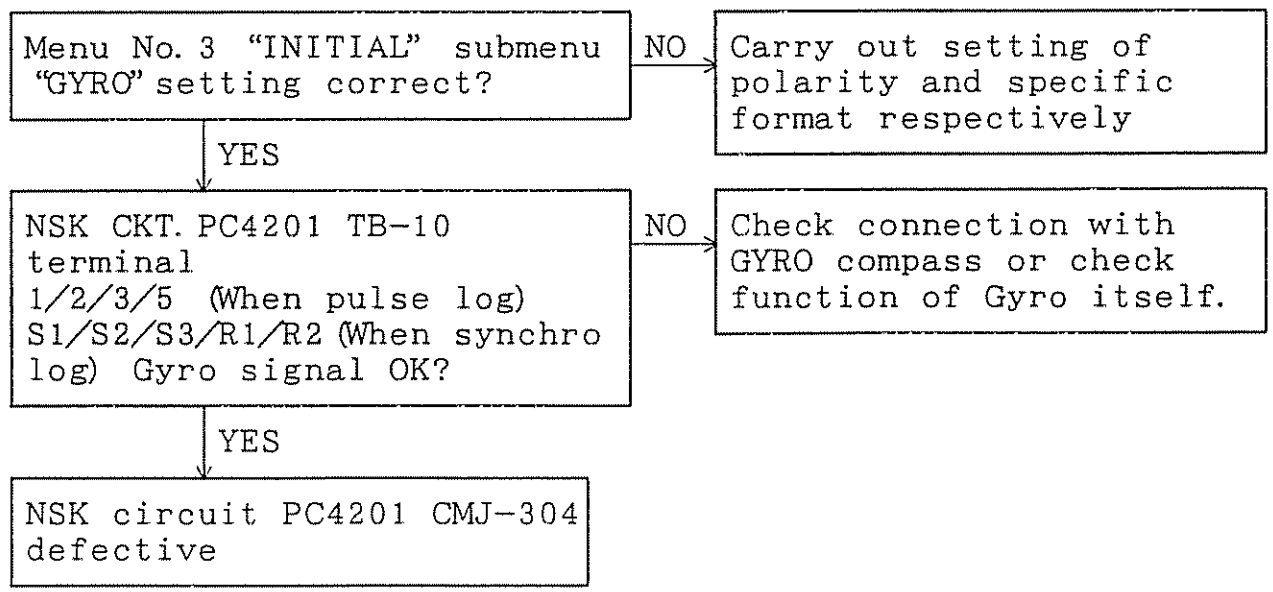
Should the position data from Navaid are not coming to display unit, use of Own ship's trail and Nav-line will be restricted for practical operation.

Case 13 :No Log (1 axis) data displayed



Remarks:
The built-in CPU in NSK circuit (PC4201) CMJ-304B communicate with the main CPU in display unit and transfer Log and Gyro data to main CPU. Since power source is provide d from Gyro compass, even the log signal is normally supplied, transfer process can not be made if the Gyro compass power supply switch is OFF. There fore, even if you use Log input, you should turn on the Gyro power supply.

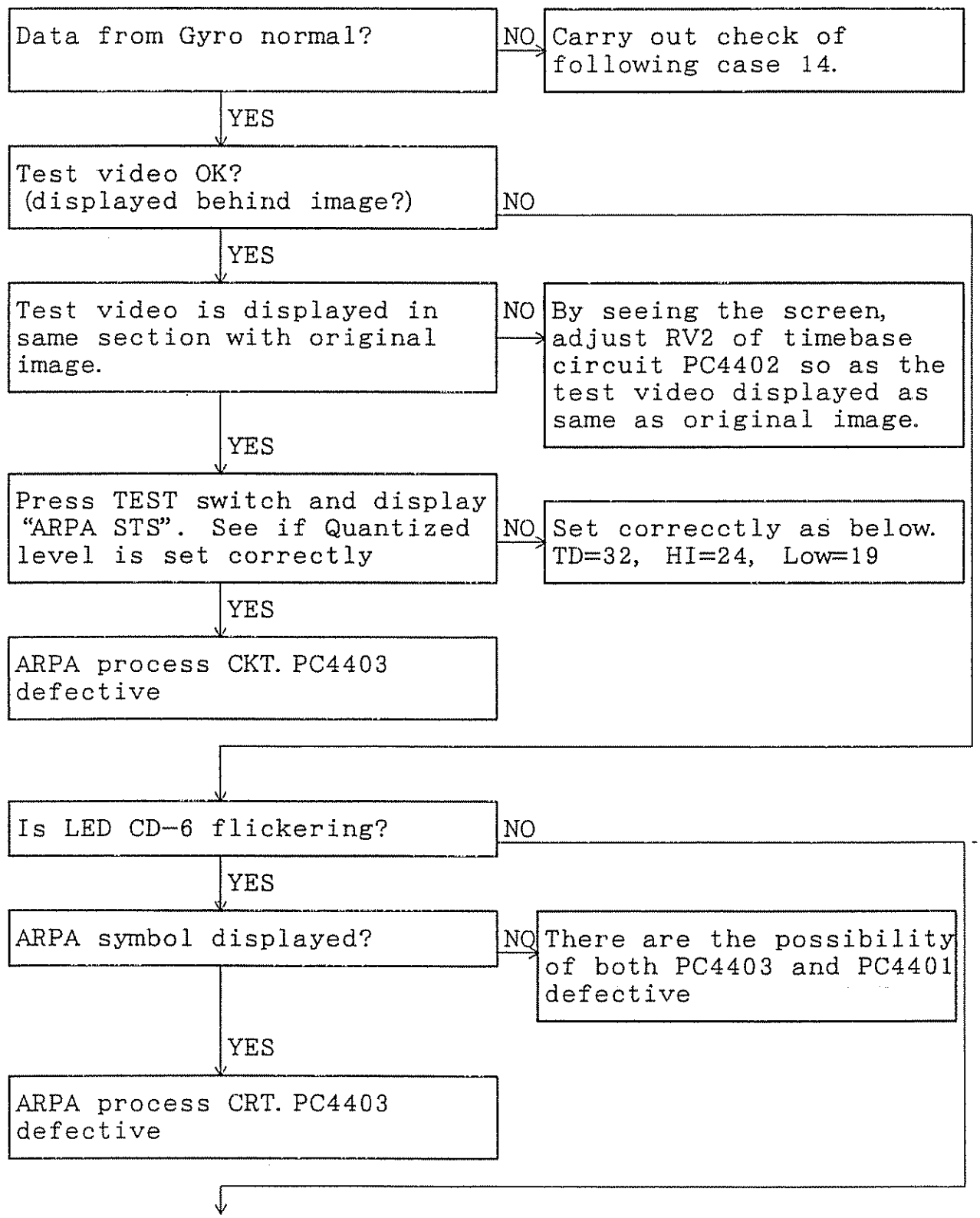
Case 14 :No Gyro Data Displayed

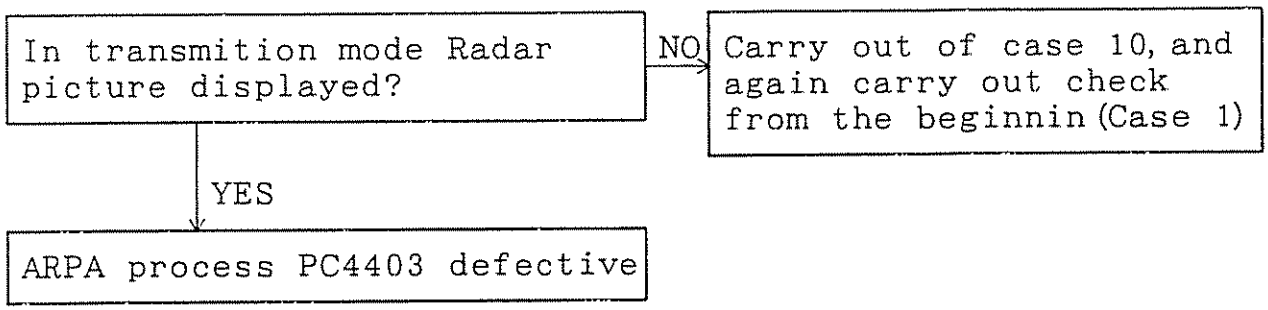


For Reference

CMJ-304 B's former version CMJ-304A has such problem that when connected with TG-6000 Gyro compass (TOKIMEC), additional "power up kit of TOKIMEC made to be used together otherwise function will not be satisfactory.

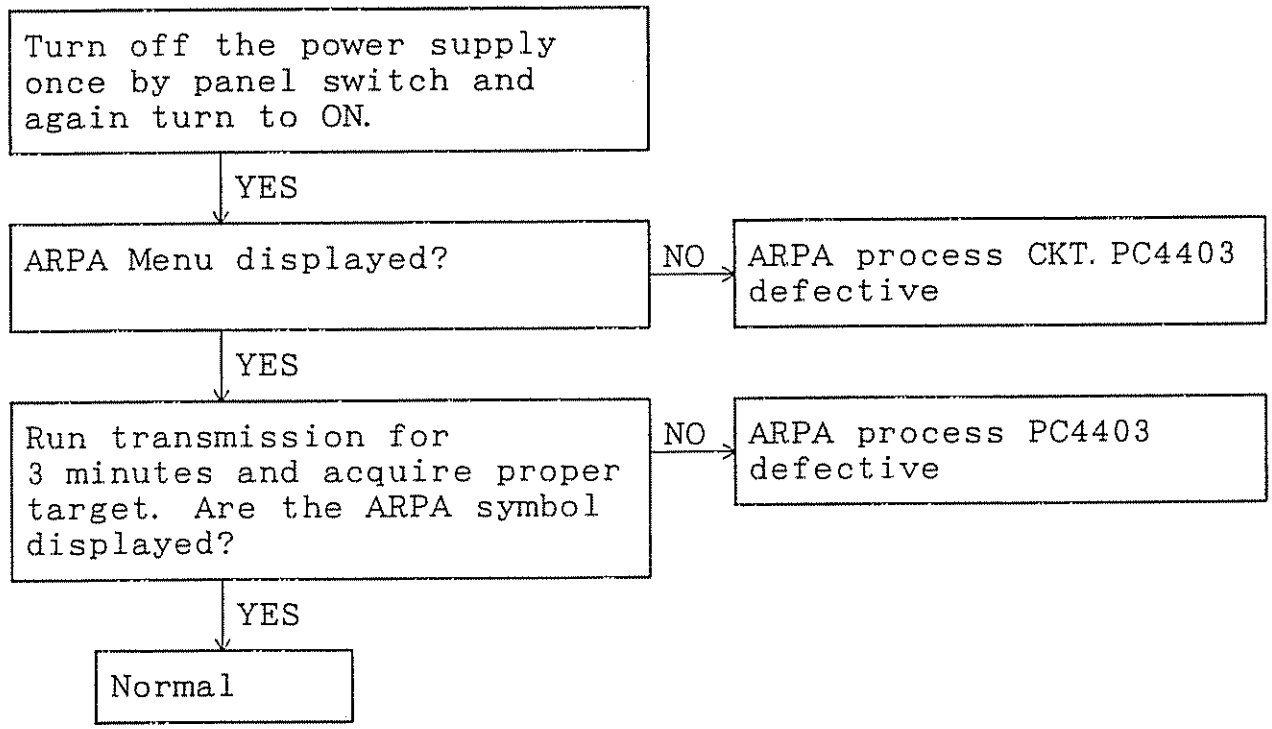
Case 15 : ARPA does not acquire target





Remarks:
ARPA can not be operated without the Gyro compass is connected and normally operated. Therefore, when ARPA does not operate, check if the Gyro data is normally supplied or not. (Example :when "ARPA no function: press Acquisition switch, "Operator Error" displayed)

Case 16 :No ARPA Menu displayed

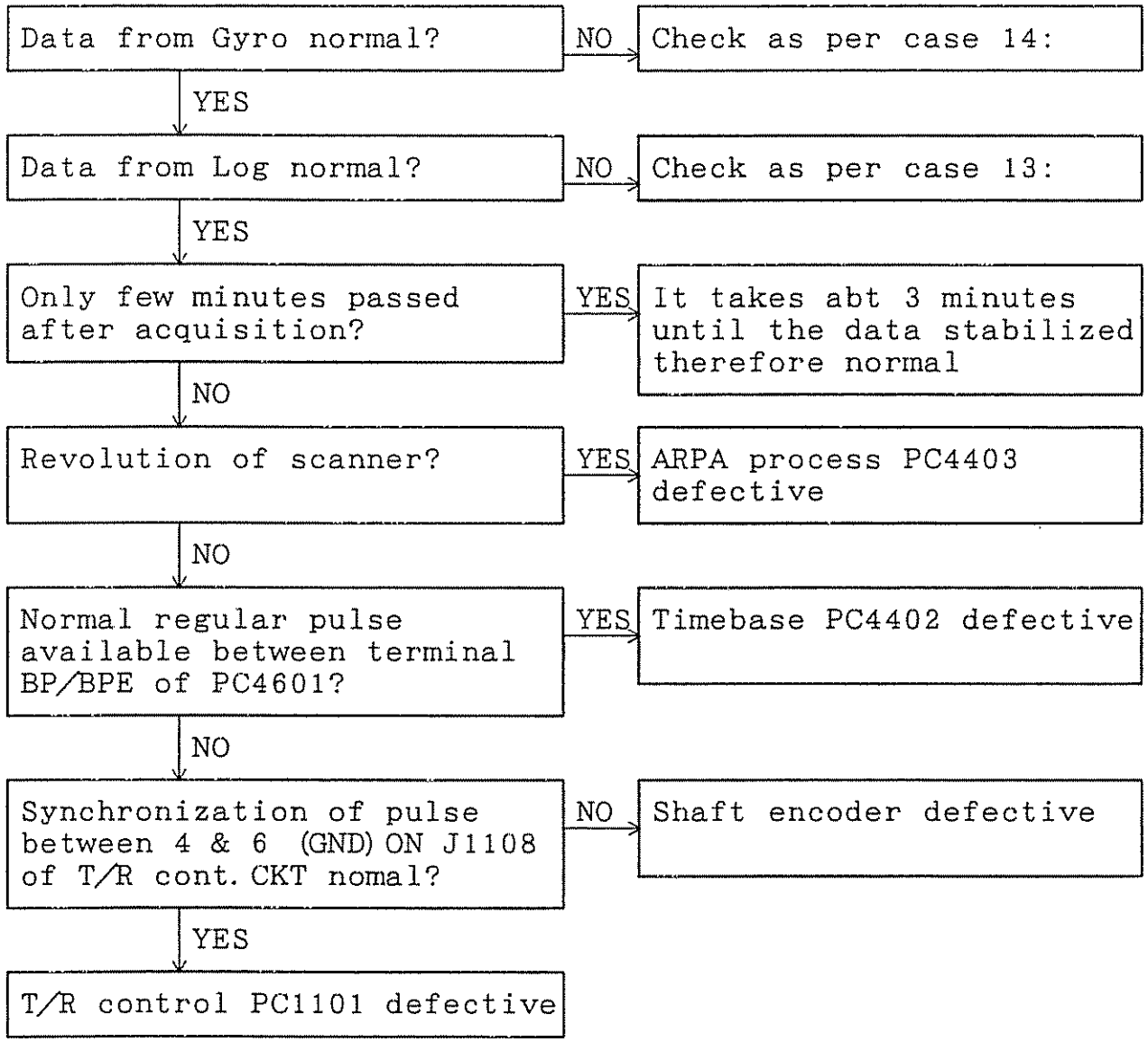


Remarks:
In normal operation, occurrence of CPU over-run as above example are very few however, there are the possibility of occurrence in result of insufficient shielding and groundin g of equipment or instantaneous black out of power supply.

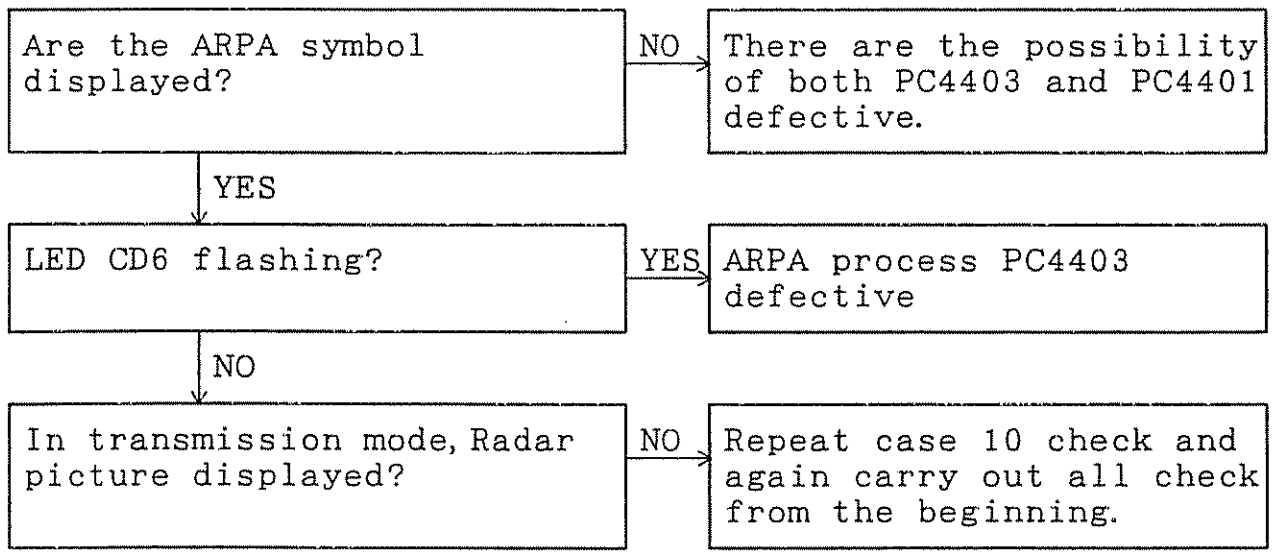
In normal running process, CPU process circuit PC4401 and ARPA process circuit PC4403 are exchanging data each other through common memories. When by some reason, communication through common memories blocked then "ARPA ERR" displayed on upper right part of the screen.
If the data communication is impossible from the beginning, upper right part of the screen ARPA data display area becam e "blank" status.

105

Case 17 :Big error in course and speed of ARPA targets



Case 18 :Unable to update ARPA data



ARPA process (PC4403) defective

Case19 :Target in ARPA data change course and speed but vector does not follow correctly

Make ARPA "VECTOR CONST" value more larger.

For Reference

Generally, changing VECTOR CONST provide following symptoms.

Change VECTOR CONST larger makes vector follows faster but respond slower.
Change VECTOR CONST smaller makes vector follows slower but respond faster.

Taking above symptom into consideration in changing setting value of "VECTOR CONST".

4.2 Self Diagnosis Function

This Radar has a facility to record and display operating condition and cause of circuit failure etc.
Self diagnosis function can be displayed by pushing "TEST" switch on panel switch part. Items displayed are as follows.
1 MEMORY (Condition of Memory function)
2 SENSOR (Operating condition of each unit)
3 (Condition of communication among connected units) 4 RAMVER (Display Rom versions)
5 ERROR LOG (Record and display cause of circuit error)
6 ARPA STS (ARPA operating condition display)

1 MEMORY (Condition of Memory function)
Press TEST switch and press SUB-menu-1 displays following.

```
MEMORY
RAM        OK
E2PROM     OK
GRAPHIC    OK
ROM        OK
DPRAM      OK
9 EXIT
```

Each memory's operating conditions displayed. It should be OK for all item.
In this memory check, any item are displayed as NG, CPU circuit PC4401 could be defective.

2 SENSOR (Operations condition of each unit)
Press TEST switch and press SUB-menu-2 displayed following.

```
SENSOR
SAFE SW
          ON
ANT CLK
        MOVE

MH CURENT
MAGI       OK
|_|_|_|_|_|_|
9 EXIT
```

SAFE SW-ON means scanner safety switch is ON position. When this display shows OFF. "SSW OFF" message will be displayed at the upper right corner, just below the word STANDBY, at the same time. When this is OFF, Radar transmission impossible and scanner Motor does not turn. On this stage, turn this switch to ON position but transmission and motor does not function.
You should press "TX" switch on the panel.
ANT CLK-MOVE means in transmission mode, antenna is turning normally. If antenna is not turning "STOP" message displayed and at the same time, message "ANT CLK ERR" will be displayed in upper right part of error display area.

When the Modulator circuit is in Normal operation, SENSOR display shows "MH CURRENT-OK" and bar graph below indicate 3 to 8 scales.
In case of abnormal condition such as continuous discharge, display shows "NG" and the bar graph shows "0".

3. LINE DATA (Condition of communications among connected units) Press "TEST" switch and press Sub-menu-3 so as to display following.

```
LINE DATA
KEY       OK
MTR       OK
NAV       NC
NSK       OK
2AXIS     NC
ARPA      OK
INTSW     OK
9 EXIT
```

"KEY" display shows condition of communication with keyboard. "OK" for normal and "NG" for failure.

"MTR" display display shows condition of communication with transceiver. "OK" for normal and "NG" for failure.

"NAV" display shows condition of data receiving condition from GPS or other NAV-AID. "OK" for normal and "NC" for no connection.

"NSK" display shows condition of communication with NSK. "OK" for normal and "NG" for failure or no connection.

"2AXIS" display shows data receiving condition from 2 axis speed log.
"OK" for normal and "NC" for failure.

"ARPA" display shows data exchange condition with ARPA.
"OK" for normal and "NG" for failure.
In case of no ARPA, this item displayed as "***".

"INTSW" display shows communication condition with Interswitch unit.
"OK" for normal and "NG" for failure.
In case of no INTERSWITCH, this item displayed as "***".

4. ROMVER (Display Rom versions)
Press TEST switch and press SUB-menu displays following.

```
ROM VERSION
KEY
       V1. 0
NSK
       V1. 0
MTR
       V1. 0
INDICATOR
       V1. 0
    6-05-01
   12:34:56
ARPA
       V1. 0
ARPA TD
       V1. 0
  9 EXIT
```

KEY shows Rom version of IC-9 in panel circuit PC5103.

NSK shows Rom version of IC-19 in NSK circuit PC4201.

MTR shoes Rom version IC-6in MTR circuit PC1101.

INDICATOR shows ROM version of IC-16 in CPU circuit PC-4401.
2 groups of figure beneath the version number indicates
date of ROM produced and time of ROM produced.
6-05-01 denotes 1996-MAY-01
12:34:56 denotes 12:34 hours 56 seconds

ARPA shows ROM version of IC-83 in ARPA circuit PC-4403.

ARPA TD shows ROM version of IC-3 in ARPA circuit PC-4403.

5 ERROR LOG (Record and display cause of circuit error)

Press TEST switch and press Sub-menu-5 displays following.

```
ERROR LOG
1 ALL CLEAR
GYRO ERR ○
GYRO ERR ☒

9 EXIT
```

ERROR LOG memorise maximum 10 cases of contents among the errors in separate list. When exceed 10, older one erased off.
GYRO ERR "○" denotes there were error is the past but now restored normal condition.
GYRO ERR "☒" denotes that an error is now prevailing.
On this stage, press "1" will clear out all error memories.

6 ARPA STS (ARPA Operating condition display)

Press TEST switch and press SUB-menu-6 displays following.

```
ARPA TEST
INT NO.
          0
V-CONST
          4
Q-LVD TD
         32
Q-LVD HI
         24
Q-LVD LO
         32
GATESIZE
    NARROW
TRACK NO
          0
9 EXIT
```

"INT NO" shows present number of interruptions to the ARPA CPU.

"V-CONST" shows index number of averaging to prevent fluctuation of vector.

"Q-LVD TD" shows threshold value of echoes intake level at manual acquisition. TD/HI/LO values are, more larger the higher the threshold and lesser the influence of noises but on the contrary difficult to acquire echoes.

"Q-LVD HI" shows threshold value of short range echoes intake at manual acquisition.

"Q-LVD LO" shows threshold value of long range echoes intake at manual acquisition.

"GATESIZE" shows the size of acquisition gate.
Acquiring gate shows the gate size now set up. There are 3 gate sizes. WIDE/NARROW/SMALL.

"TRACK NO" denotes now acquiring number of ship's.

4.3 REPLACE MENT OF MAJOR PARTS

4.3.1 Replacement of NKE-1052/1052D Transceiver Unit

◎Removing the transceiver unit
·Figure 1 shows the transceiver unit existing after the frame cover of the pedestal has been removed.
·First, loosen screw A in two places of the cover.
·Slide the cover upward and remove it by pulling to the front.
·Disconnect the following connectors:
P1108, P1109, P1110, TB101A
·Loosen and remove the M5 screws located in four places of the unit.
·Lifting the unit, remove it by pulling to the front.

◎Removing the transceiver unit
Remount this unit in the reverse order to that of mounting. To remount the unit, first check that it has moved in to the depths with the waveguide of the circulator as its reference and then remount the M5 screws to fix the unit.

◎Removing the modulator
To replace the magnetron located at the modulator, first remove the screws located in only two places out of four of the front panel and just loosen the screws in the other two places. Next, loosen the screws in two places each of the three side panels and remove the cover of the modulator.

◎Removing the receiver unit
·Remove the locking bolts located in four places of both the diode limiter and the pin attenuator.
·Loosen the screws in four places of the metallic chassis of the receiver unit. This allows the unit tobe removed with its cover remaining mounted.

◎T/R control unit
This unit be accessed by removing the screws located in two places of the front panel and those located in four places of the right-hand side panel.

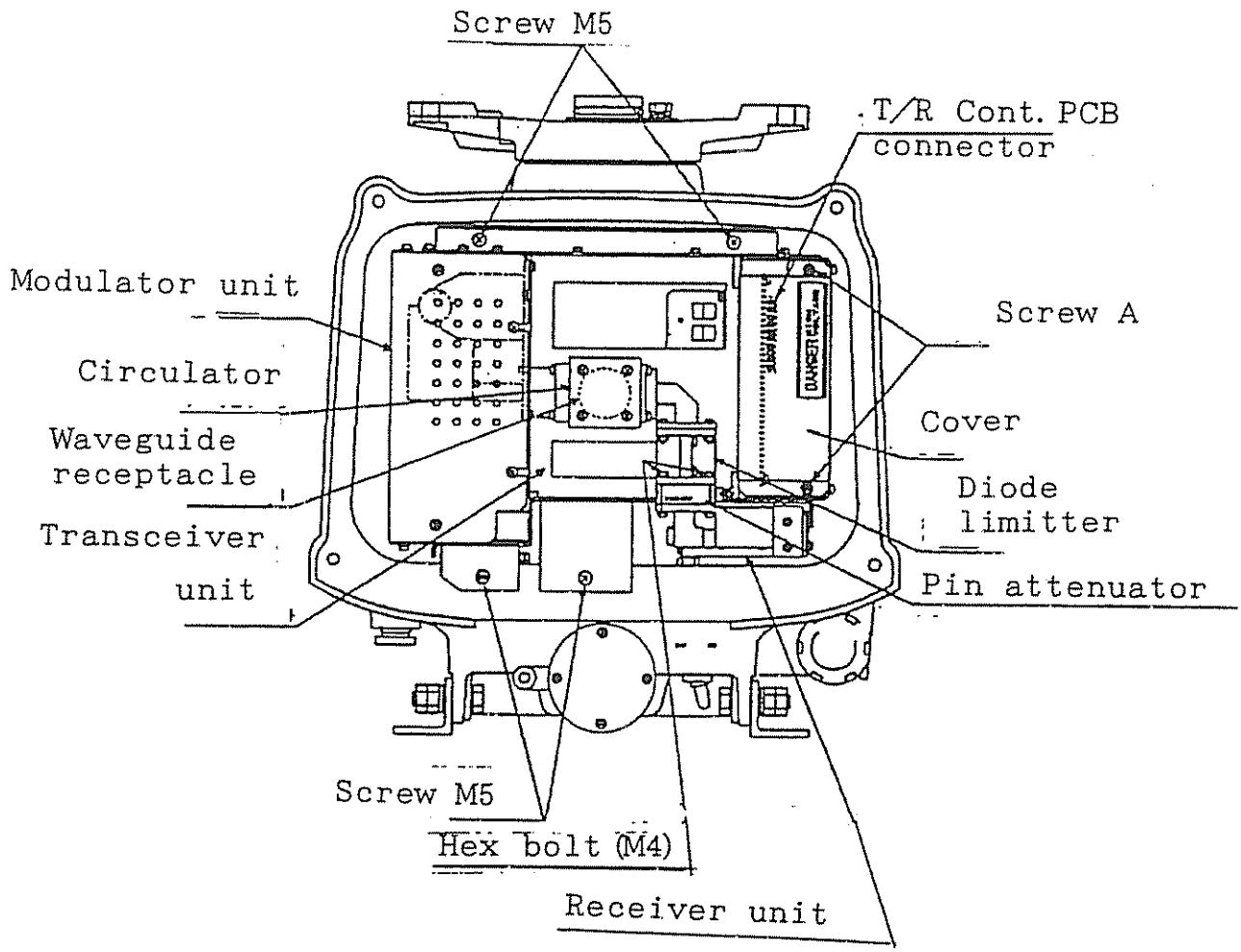

Screw M5
T/R Cont. PCB connector
Modulator unit
Screw A
Circulator
Cover
Waveguide receptacle
Diode limitter
Transceiver unit
Pin attenuator
Screw M5
Hex bolt (M4)
Receiver unit

FIG-1

4. 3. 2 Replacement of Magnetron (V201)

Remove the shield cover from the modulator and then after checking that no charge remains inside the modulation high-voltage circuit, for the NKE-1052 or the NTG-3027, remove the socket of the magnetron, or for the NTG-3037, unscrew and remove the lead wires. Next, remove the four screws that hold the magnetron. It can now be removed. When mounting a new magnetron, be careful not to bring a screwdriver or other tools into contact with the magnetron and not to rest it on an iron plate. After replacement, correctly connect the lead wires.

Notes:
- To discharge the residue high voltage, hold insulated grip of a screw driver while one end of metallic part earthed on the ground, bring another end to touch R42.
  Special attention must be pain for dangerous high voltage.
- Remarks for the handing of magnetron stored in a long time
  Long stored magnetron is required following aging process, or otherwise the magnetron will be damaged by sparking or short life.
- Take longer pre-heating time. (maintain 20 to 30 minutes ST-BY condition)
- Start operation from short pulse range and gradually switch to long pulse operation. If the function becomes unstable, turn the radar back to ST-BY condition for further 5 to 10 minutes' aging and resume operation.
- Turning adjustment must be carried out after abt. 15 minutes transmission.
- Adjust RV1 in receiver unit to get tuning indication up to 10 points with no over range in TUNE indicator on display unit.

4. 3. 3 Replacement of Diode Limitter (A202/203)

- Remove the two hex rod screws that hold the receiver in place, and remove the receiver unit.
  The diode limiter is screwed down to a circulator. Removal of these four screws allows the diode limiter to be removed.
  A new diode limiter must be mounted so that the arrow faces in the direction of the receiver.

4. 3. 4 Replacement of PIN Attenuator (A204)

- After removing the receiver mentioned above, remove the four screws that hold the PIN Attenuator, and then after checking the wiring status, remove the PIN Attenuator.
  Reconnect the wiring into the same status as that which was checked before replacement.

4. 3. 5 Replacement of CRT (21 Inch CRT)

·Remove the three M4 screws from the cover located at the bottom of the screen, and from the frame of the monitor.
·Insert a screwdriver into the small holes in the cover and loosen the four M5 screws that holding the control part.
·Slide the entire control part abt. 20mm toward you.
·Remove the four M6 screws from the right front panel and remove it.
·Remove the eight M4 screw from the right side panel and remove it.
·Dis connect all external cables from the CRT. (access from right)
·Remove CRT from the bracket by removing four M8 screws.
·In reverse procedure, install new CRT into the bracket. pay care position of anode terminal of CRT.

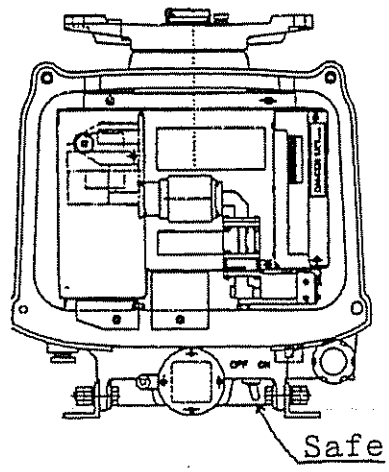
4. 3. 6 Replacement of CRT (28 Inch CRT)

·Remove the three M4 screw from the cover located at the bottom of the screen, and from the frame of the monitor.
·Insert a screwdriver into the small holes in the cover and loosen the four M5 screws that hold the controls.
·Slide the entire controls unit through about 20mm towards you.
·Remove the four M6 screws from the front panel and remove it.
·Remove the four M8 screws that secure the CRT to the frame.
·Gently pull the CRT upward and make the tube surface horizontal. Once the tube surface has become horizontal, the CRT can be released since it is supported by a gas spring automatically.
·Dis-connect all external electrical connections to the CRT. For further details, see the notes listed in Section 7. 5, MAJOR PART REPLACEMENT.
·Remove the two screws that secure the gas spring to the frame. During removal of these screws. one person must support the CRT toprevent it from dropping.
·Remove the metallic retaining fittings from the T-hinges.
·After removing the CRT from the frame (two-person operation), orient the tube surface downward and gently place it on a table or desk.
·Remove the socket, the deflection coil, and anode terminal.
·Remove the four M8 fitting from the CRT.
·Mount the removed M8 fittings on a new CRT checking the mounting position of the anode terminal, and reassemble the CRT in a reverse order to that described above.

115

4. 3. 7 Replacement of Geared Motor (NKE-1052 siries)

·Turn the power supply OFF.
·Turn the scanner safety switch OFF.
·Remove the scanner pedestal cover.
·In case of NKE-1052 (2 unit), Follow the in struction "Replacement of transceiver unit".
·NKE-1059 as follows.
·Remove four M5 screws for terminal board and remove it.
·Disconnect wiring to motor from the terminal board.
·In case of single phase motor, remove capacitor by removing screw.
·Remove motor unit by taking off two M10 hex bolts.
·New geared motor to be fixed by two M10 hex bolts but before fastening the bolts, turn the scanner slowly by hand and check if the alignment of the gearing is normal.
·In case of single phase motor, install one phase control capacitor.
·Connect wiring connection on terminal board.
·Fit back terminal board in original position.
·Check wiring.
·In case of NKE-1052 (2 unit), install transceiver unit and finish wiring.
·Fit back pedestal cover.
·Turn on the scanner safety switch and confirm normal turning.

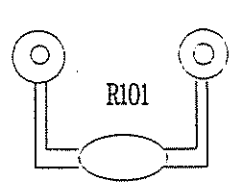


NKE-1052

4. 3. 8 Replacement of Geared Motor (NKE-1072 220V 3φ→110V 1φ)·
Re move the both cover of scanner pedestal.
·Disconnect the 220V 3φ motor cable from the terminal board TB102-MU1, MU2, MU3.
·Take off terminal board from the pedestal.
·Remove 4 M8 hex bolts and take out 220V 3φ motor out of terminal board side opening. (pay care that the motor is very heavy).
·Remove the cable between terminal board B102, W2 and MW2.
·Five cables extended from 110V 1φ motor to be cut in abt. 500mm length and attach compressed lug (V 1. 25-4) respectively, (color of cables Red, Yellow, Blue, Gray, Black).
·Prepare wiring materials:
Connect compressed lug (V1. 25-4) on one end of each cable.

Required cable	50/0. 18
Cable 1. Black	350mm 2
Cable 2. Red	350mm 1
Cable 3. Green	350mm 1

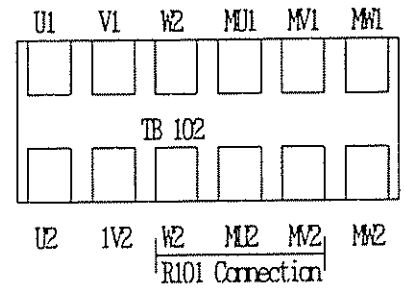
·Connect cable on capacitors (capacitor has no polarity)
·Connect above Cable 1 on both end of the CR (35μF) by soldering or by compressed sleeve.
·Connect above Cable 2 and 3 on the terminal of CS (250μ 125V-no color nomination).
·Install capacitor holder on the terminal board as FIG. 3, and fix CR and CS capacitors on capacitor holder as per the sketch below.
·Bring in 110V 1φ motor from terminal board side opening and fix it by 4 M8 bolts. Be fore fix the bolts, turn the rotor of the motor so as to check gears are aligned in place.
·Install terminal board with capacitors fitted in the pedestal.
·Connect cable from the motor and CR, CS capacitors on the terminal board TB102. Refer to Drawing ED01 NKE-1079-121 wiring diagram in Scanner.
·Install R101.
·As the sketch below, attach compressed lug on both end of R101 (10KΩ 2W ERG2ANJ103) and cover lead wire with insulater tube.



← V1. 25 Compressed lug

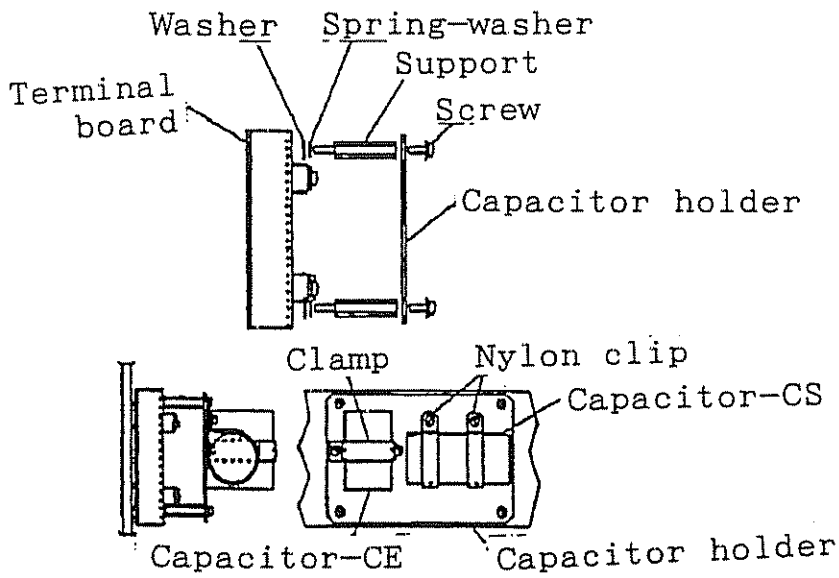
← Cover by Insulater tube

·The R101 to be connected between W2 and MV2 of TB102 as the sketch below.



·Check wiring and short circuit never exist.
·Fit back cover of both sides.
·Turn on safety switch S101 and confirm normal turning.

FIG-3



4. 3. 9 Replacement of ROM

The ROMs used in JMA-7000/9000 are shown in 1. 2. 8 ROM list. When the replacement of IC-16 in PC-4401 (CMC-825 CPU cont. CKT.) to be done, following procedure to be carried out. Other ROM can be replaced without any limitation. After the replacement of IC-16 and carried out replacement procedure, following contents will be initialized.

☆Setting value at the time of installation

Range adjustment value
Bearing adjustment value
Tuning adjustment value
Selection of Nav aids
Selection of speed log

☆User's Registered Data

NAV LINE data
Guardring data
Personal code data

After the replacement of ROM and carried out replacement procedure, initial setting at the time of installation to be done again.

○Replacement procedure

1. Press [TEST] so as open menu.

2. Press [#], [9], [0], [0], [0].

(You may disregard alarm sound in pressing above switch)

3. TEST menu changes as follows and the item "8 MEINTE" appears.

TEST secret menu

```
TEST MENU
1 MEMORY
2 SENSOR
3 LINEDATA
4 ROMVER
5 ERRORLOG
6 ARPA STS
* ********
8 MAINTE        ← This item appears.

PRESS TEST
TO EXIT
```

4. Press [8], MAINTE selected and following menu displaysd

Sub menu for maintenance

```
MAINTE
1 RAM
2 E2PROM
3 DPRAM
4 ROM
5 PORT
6 CONFIG
7 WATCH
8 E2PCLEAR
9 EXIT

XMIT TIME
         H
```

5. Press [8], E2PCLEAR selected and following menu displayed.

Sub menu for clearing E2PROM

```
E2PCLEAR
1 COMDEF
2 COMFIX
3 ARPA
4 NAV
5 PCODE
6 GRING
7 ALLCLEAR
9 EXIT
```

6. Press [7], ALLCLEAR selected and display locked for few seconds.

To check the locked condition is free, roll trackball and see if data picked up by trackball changes. If the locked condition continued, trackball data will not change.

7. After confirming the lock condition free, press range switch and change to 48NM range.

120

8. Turn off the power supply and pressing [.] press [ON]

at the same time. After few seconds picture displayed on the screen and indicated range on the upper left corner of the screen should be 6NM.
On this stage, if the range were remained in 48NM, turn off the power supply and again repeat above procedure.

9. If the range is in 6NM, initialzation of ROM is completed.
10. Again turn the power supply to OFF and ON again.
Then carry out the initial settings at the time of installation.

121

5. Adjustment Procedure

5. 1 Power Supply unit

5. 2 Power Supply unit for 28 Inches CRT

5. 3 28 Inches CRT (JMA-9000)

5. 4 21 Inches CRT (JMA-7000)

5. 5 Timebase Circuit

5. 6 Method of ARPA GATE

Adjustment of the Radar is completed before the shipment from the factory however, If situation require, overall adjustments are as follows.

5.1 Power Supply unit voltage adjustment (PC5102)

Item	Adjustment procedure	Check	Remarks
1)	Power supply to ON. Connect digital voltmeter between PC4402 IC21-20 pin and TP7 (GND) and adjust RV-1 [+5V] of PC5102 so as to set the value to +5.0V ±0.25V.		PC4402 Adjustment to be done
2)	Connect digital voltmeter between TB4601 +70V and +70VG and adjust RV2 [+70V] of PC5102 so as to set the value to +65 ±1.0V.	Check	3 minutes after the power supply ON.

5.2 28 Inches CRT PSU (PC7504)

Item	Adjustment Procedure	Check	Remarks
LED Display	All 3 Leds illuminate when the operation is normal.	Check	PC7504
	*+24V CD8 +24V OK *+70V CD9 +70V OK *+85VOUT CD7		PC7504 PC7504 PC7504
	Adjust [AVR ADJ] RV-1 on PC7504 so as the voltage at P7552 pin 1 and 4 became 87V±1.0V	Set	PC7504

5.3 28 Inches CRT Adjustment

Item	Adjustment Procedure	Check	Remarks
	◎ Function of Adjustment point [H. LENGTH] RV1:Controlls Horizontal length of the picture. Warning: If horizontal length were excessively long, Flyback voltage goes higher to burnt components around CRT neck. [H. DUTY] RV4 Observing the current for +87V load and adjust RV4 so as to seek the minimum current point. Note: In case unable to measure current for +87V, RV4 must not be adjusted of its position at the time of shipment from factory. Otherwise blow the Fuse F1 (2A) or damage TR4.		

23

Item	Adjustment Procedure	Check	Remarks
Adjustment around CRT	H. HOLD RV3 For the purpose to hold the screen not to scroll to Horizontal direction. Adjustment is made that the screen is synchronized from the moment power is supplied. SIDE PCC RV2 Adjustment to be made so as the Horizontal lines are same length all over the screen that the vertical age of the both side of the screen is straight. V. DFOCUS RV8 Adjustment to be made so as the focus of the screen is equalized all over the screen. Combined adjustment of RV9 FOCUS is required alternately with seeing the picture. V. LIN RV5 Adjustment is made so as the interval of vertical direction is equalized. V. LENGTH RV6 Control the vertical length of the screen. V. SHAPE RV7 Adjustment is made that the length of the picture in up-and-down direction from the center of vertical direction are equal. FOCUS RV9 Adjustment is made to get clear focus of the picture. INTEN SET RV10 Controlls brilliancy of the screen. Point of adjustment is that at the minimum adjustment point of the Brilliancy-Controller on operation panel is the point picture fade away. L3 L3 Adjustment is made so as the length of the left and right side of the picture became the same. Also adjustment is made the circle in the picture can be seen true circle on the screen. The centering Magnet (a pair of thin dounut shaped magnet with control knob) is attached on the deflection coil. The strength of magnetic field can be changed by moving the cross angle of this pair magnets whereas direction of the magnetic field can be changed by turning pair of magnet together Adjustment of the screen position is made by this centering magnet. At the 4 corner of the deflection coil, 4 magnetic bars are attached. By using non-magnetic adjust bar, turn the magnet bar marks picture around magnet changes. Fix this adjustment at the most warpless shape of the picture.		

Item	Adjustment Procedure	Check	Reamrks
	These magnet bar can be slided toward circumferential direction holding the turning angle as it is. By alternate adjustment of turning and sliding of the magnet, warpless presentation of the picture can be obtained.		
Adjustment of RV4 H. DUTY	By seeing the current meter connected on J7501 +87V turn RV4 [H. DUTY] so as to seek the point of minimum current. If the picture sways or wavy, turn RV4 counter clockwise for about a notch. Note: This adjustment should be carried out again after the completion of all other adjustment and setting.		
Adjustment of Deflection Coil	Loose the deflection coil fixing bolt at the neck of CRT and turn the Coil so as the Ship-head-Line became vertical to the screen then fix tight the fixing bolt.		
RV10 INTEN SET	Adjustment RV10 so as the back intensity of the picture does not go exceed. If the synchronization of the picture frame is unstable, adjust [H. HOLD] to seek the stabilized point.		
RV1 H. lENGTH	Turn RV1 [H LENGTH] so as the inner diameter of bearing scale (Horizontal direction) became 346mm. (Further fine adjustment will be done later on). On this stage, EBL and Range ring to be displayed on the screen by control from operation panel.		346mm ±1mm
RV5 V. LINE	Turn RV5 [V. LIN] so as the interval of Range Rings became even and edge of the circles are all as true circle as possible.		
RV7 V. SHAPE	Turn RV7 [V. SHAPE] so as the Range-Ring circle is symmetrical in upper and lower part.		
RV6 V. LENGTH	Turn RV6 [V. LENGTH] so as to adjust the inner diameter of bearing scale (vertical direction) became 346mm.		346mm ±1mm
RV2 SIDE PCC	Turn RV2 [SIDE PCC] so as the vertical side of the screen 100Ks true vertical line		
L3	Turn [L3] so as to adjust the Range ring became symmetrical in lefthand right part. On this stage, length of its Horizontal direction may changes witch to be adjusted of its Horizontal direction to 346mm inner diameter of the bearing scale by adjusting RV1 [H. LENGTH]. Now the display should be 346mm true circle.	Check	346mm ±1mm
RV3	Synchronization should be stable at the time of power supply switch ON. If unstable, adjust RV3 [H. HOLD] to take synchronization.		

Item	Adjustment Procedure	Check	Reamrks
Centering Magnet	A pair of Centering Magnet to be used for adjustment of the position of the screen. By changing opening angle of magnet, strength of the magnetic field can be changed and by turning pair of magnet together, the direction of the magnetic field can be changed.		
Focus	Focus adjustment is made by turning RV8 [V. DFOCUS] so as to obtain clear even focus all over the display.		
Fine Adjustment	So far, coarse adjustment were completed. Procedure for fine adjustment is as follows. Use of transparent film of standard display pattern is more convenient. By using centering magnet, center of display can be shifted but the lineality of the outskirts of the circle will be deformed. Following volume controlls are used for the compensation of linealities. [V. LIN] RV5 [V. SHAPE] RV7 [V. LENGTH] RV6 [SIDE PCC] RV2 L3		
RV10 INTEN SET	Turn the Brilliancy knob fully clockwise and adjust RV10 [INTEN SE] so as to make the condition of the screen just before the raster can be seen. On this stage, turn the Brilliancy knob fully counter-clockwise will fade away the display picture.	Check	
Deflection Coil Magnet	When the lineality of the screen outskirts are deformed, adjust 4 magnet bars to compensate the lineality.		
RV4 H. DUTY	By measuring the current of 87V line at J7501, turn RV4 [H. DUTY] to seek the minimum point of the current. Set the position of RV4 one notch left hand side of the above minimum current point. On this stage, there should be no "Swaying" nor "Waving" of the screen.	Check	
Lock the Deflection Coil	After confirming the display presentation is normal, (1) Apply lock paint on alignment magnet fixing bolts. (2) Apply silicon rubber (KE45) on 4 magnet bars on, deflection coil for lock up purpose.		
Confirma-tion	(1) Diameter of inner bearing scale should be 346mm ±1mm. (2) Whole display presentation is evenly focused.		

5.4 21 Inches CRT Adjustment

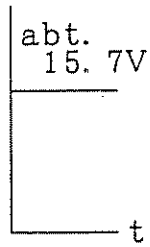
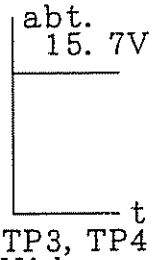
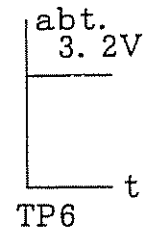
Item	Adjustment Procedure	Check	Reamrks
Ready for power supply	[H. LENGTH] RV1:Controlls Horizontal length of the picture Important! If the Horizontal length were excessively long, Flyback voltage will goes higher and way burnt components around CRT neck. [H. DUTY] RV4 Observing the current for +70V load and adjust RV4 so as to seek the minimum current point. Note:In case unable to measure cueent for +70, RV4 must not be adjusted of its setting position at the time of shipment from the factory. Otherwise blow the Fuse F1 (2A) or damage TR4. [H. HOLD] RV3 RV3 is used for the purpose to hold the screen not to scroll to Horizontal direction. Adjustment is made that the screen is synchronized from the moment power is supplied. [SIDE PCC] RV2 Adjustment to be made that Horizontal lines are same length all over the screen that the vertical edge of the both side of the screen is straight. [V. DFOCUS] RV8 Adjustment to be made so as the focus of the screen is equalized all over the screen. Com ined adjustment of RV9 [FOCUS] is required alternately with seeing the picture. [V. LIN] RV5 Adjustment is made so as the interval of vertical direction is equalized. [V. LENGTH] RV6 Control the vertical length of the screen. [V. SHAPE] RV7 Adjustment is made that the length of the picture in up and down direction from the center of the screen in vertical direction are equal. [FOCUS] RV9 Adjustment is made to get the clear focus of the picture. [INTEN SET] RV10 Controlls brilliancy of the screen. Point of adjustment is that at the minimum adjustment point of brilliancy-controller on operation panel is the point where picture fade-away. [L3] L3 Adjustment is made so as the length of the left and right side of the picture became the same. Also adjustment is made the circle in the picture can be seen true circle on the screen.		

Item	Adjustment Procedure	Check	Reamrks
Adjustment Around CRT	The Centering Magnet (A pair of thin Dounut shaped magnet with control knob) is attached on the deflection coil. The strength of magnetic field can be changed by moving the cross angle of this pair magnets whereas the direction of magnet field can be changed by turning pair of magnet together. Adjustment of screen position is made by this centering magnet. At the 4 corners of the deflection coil, 4 magnetic bars are attached. By using non-magnetic adjust bar, turning the magnetic bar makes picture around magnets changes. Fix this adjustment at the most warpless shape of the picture. These magnetic bar can be slided toward circumferential direction holding the turning angle as it is. By alternate adjustment of turning and sliding of the magnets, warpless presentation of the picture can be obtained.		
Adjustment RV4 H. DUTY	By seeing the current meter connected on J7501 +70V, turn RV4 [H. DUTY] so as to seek the point of minimum current. If the picture is swaying or wavy, turn RV4 counter clockwise for about one notch. Note: This adjustment should be carried out again after the completion of all other adjustment and setting.		
Adjustment of Deflection Coil	Loose the deflection coil fixing bolt at the neck of CRT and turn the coil so as the Ship-head-Line became vertical to the screen then fix tight the fixing bolt.		
RV10 INTEN SET	Adjust RV10 so as the back ground intensity of the picture does not go exceed. If the synchronization of the picture frame is unstable, adjust [H. HOLD] to seek the stabilized point.		
RV1 H. LENGTH	Turn RV1 [H. LENGTH] so as the inner horizontal diameter of the bearing scale became within 265~270mm. (Further fine adjustment will be done later on). On this stage, EBL and Range ring to be displayed on the screen by the control from operation panel.		
RV5 V. LIN	Turn RV5 [V. LIN] so as the interval of the Range rings became even and edge of the circles are all as true circle as possible.		
RV7 V. SHAPE	Turn RV7 [V. SHAPE] so as the Range-ring circle is symmetrical in upper and lower part.		
RV6	Turn RV6 [V. LENGTH] so as to adjust the inner diameter of the bearing scale in vertical direction became 267± 1mm.		267± 1mm

Item	Adjustment Procedure	Check	Reamrks
RV2 SIDE PCC	Turn RV2 [SIDE PCC] so as the vertical side of the screen looks true vertical line.		
L3	Turn [L3] so as to adjust the Range-ring became symmetrical in left and right part. On this stage, length of Horizontal direction may changes which to be adjusted of its horizontal direction to 267±1mm inner diameter of the bearing scale by adjusting RV1 [H. LENGTH]. Now the display should be 267±1mm true circle.	Check	267± 1mm
RV3 H. HOLD	Synchronization should be stable at the time of power supply switch ON. If unstable, adjust RV3 [H. HOLD] to take synchronization.		
Centering Magnet	A pair of Centering Magnet to be used for the adjustment of the position of the screen. By changing opening angle of the magnet, strength of the magnetic field can be changed and by turning pair of magnet together, the direction of magnetic field can be changed.		
RV9 FOCUS	Focus of the picture can be adjusted by turning RV9 [FOCUS]. Further adjustment is made by turning RV8 [V. DFOCUS] so as to spread even focus on left and right parts and center part of the picture circle.		
Fine Adjustment	So far, coarse adjustment were completed. Procedure for fine adjustment is as follows. Use of transparent film of standar display pattern is more convenient. By using centering magnet, center of display can be shifted but the lineality of the outskirts of the circle will be deformed. Following volume controlls are used for the compensation of linealities [V. LIN] RV5 [V. SHAPE] RV7 [V. LENGTH] RV6 [SIDE PCC] RV2 L3		
RV10 INTEN SET	When turn the Brilliancy knob counter clockwise, the brilliancy should be changed and disappear at the CCW dead end. Set up the RV10 [INTENSET] at the point raster glow fade away and Brilliancy knob turned fully clockwise.		
Deflection Coil Magnet	When the lineality of the display outskirts are deformed, adjust 4 magnets bars on the deflection coil by stainless adjust bar to make the display warpless.		

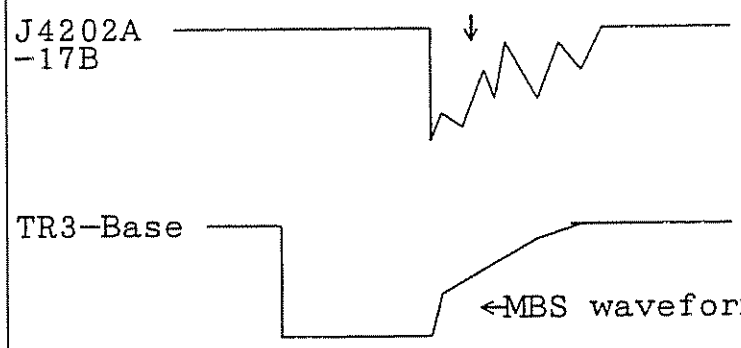
Item	Adjustment Procedure	Check	Remarks
RV4 H. DUTY	By measuring the current of 70V line at J7501, turn RV4 [H. DUTY] to seek the minimum point of the current. Set the position of RV4 one notch left hand side of the above minimum current point. On this stage, there should be no "swaying" nor "waving" of the screen.		
Lock the Deflection Coil	After confirming the display presentation is normal, turn loose the deflection coil fixing bolt and push hard the coil on CRT neck so as the SHM shown true vertical on the screen then tighten the fixing bolts. After checking the normality of the screen, apply silicon Rubber (KE45) between deflection coil and CRT neck and CRT neck with CRT socket so as to fix each other.		

5.5 Adjustment of Timebase

Item	Adjustment Procedure	Check	Reamrks
	Set Radar in transmission mode.	Check	
	Select Range in 24NM and 1R indication to be ON condition.	Check	
	Turn Gain knob on operation panel to be fully clockwise, STC knob to be fully counterclockwise and FTC knob to be counterclockwise. On this stage, SEA AND RAIN function mode should be in "MANUAL" condition.		
1)	Adjustment of GAIN MAXB RV3 Connect oscilloscope on TP3. Adjust RV3 [GAIN MAXB] on PC4402 so as the video wave form at the TP3 never goes away from the standard level of the video signal yet noise level became maximum.		TP3, TP4 Video Wave- form Fig1.
2)	Adjustment of GAIN MAXA RV4 Connect oscilloscope on TP4. Adjust RV4 [GAIN MAXA] on PC4402 so as the video wave form at the TP4 never goes away from the standard level of the video signal yet noise level became maximum.		 TP3, TP4 Video Wave- form Fig2.
3)	Adjustment of ARPA GAIN MAX RV8 Connect oscilloscope on the Emitter of TR8. Adjust RV8 [ARPA GAIN MAX] on PC4402 so as the video waveform at the Emitter of TR8 never goes away from the standard level of the video signal yet noise level became maximum as FIG 1. On this stage, waveform at the Emitter of TR8 and at TP4 should be in the same level, yet the levels will change in similar way in respond to adjustment of Gain knob.	Check	 TP6 Video Wave- form Fig3.
4)	Adjustment of MAIN NOISE LEVEL RV1 Turn Gain knob on the keyboard counterclockwise. Adjust RV1 [MAIN NOISE LEVEL] so as the video level on the screen decrease and became invisible. Turn Gain knob fully clockwise. Connect oscilloscope on TP5 and on this stage, basement of the noise level should be abt. 3. 8V as FIG2.		

131

Items	Adjustment Procedure	Check	Reamrks
5)	Adjustment of RV2 ARPA NOISE LEVEL. For his adjustment, PCB CDC-876 (finished with adjustment) to be used. Connect Oscilloscope on TP6. Apply coarse adjust of RV2 [ARPA NOISE LEVEL] so that the basement of the noise level became abt. 3. 2V. Press Menu Switch then press "2", "SET" so that Sub-menu is open. Then press "3" "," "1" so as to stop the function of "Scan-Iteration". Press Menu Switch then press "1", "5" "SET" so as to select Sub-menu for "15. ARPA". Further press the "3", "1" so that the value at the time of TD turned in negative display should be 32. If the value is not 32, enter "3", "2", "SET" so as to make it 32. Further press "2" so that the value at the time of "2 HIGH" turned in negative display should be 24. If not, press "2", "4", "SET" so as to make it 24 then press "C". Then press "3" so that the value at the time of "3 LO" turned in negative display should be 19. If not, press "1", "9", "SET" so as to make it 19. After check the setting is correct, press "C". Further press "9" to escape from the Sub-menu. Again after check the setting is correct, press "C". Select Radar range in 3NM, and press "1" and select "TEST VD" then press "1" (SET), "9" (VD2) so as to select VD2 (VIDEO IN). On this stage, there should be a test video signal few nautical miles behind the target. If the shape of a test video signal is not like the target, adjust RV2 so as to make the test video signal similar to the shape of the target. Press "1" (SET), "2" (VD1) so as to display VD1 (VIDEO IN of TD). On this stage, number of targets should be less than the number of VD2. Press "1" (SET), "4" (PVD1) so as to display PVD1 (VD IN LO level). On this stage, number of target should be more than the number of VD2.	Check Check Check Check Check	PC4403

Items	Test Procedure	Check	Reamrks
	Confirm that when turn the Gain knob counterclockwise, Radar target fade away and at the same timing, test video signal also be fade away.	Check	
	Next press "1" (SET), "7" (PVD4) then PVD4 (HIT signal) should be displayed behind the target.	Check	
	Change radar range in 48NM and observing the target, confirm PVD4 (HIT signal) is displayed behind the target in the long distance.	Check	
	If the HIT signal is displayed other than near the target, adjust RV2 not to display the HIT signal.		
6)	Adjustment of MBS START RV7 Adjust RV7 so as the Rise of main bang and the Decay of MBS waveform coincided.		
	 FIG4 Relation between Main bang and MBS		
7)	Adjustment of MBS LEVEL RV5 Set radar range in 0.25NM. Connect Oscilloscope A CH on J4402-17B and B CH on the base of TR3 in PC4402. Adjust RV5 MBS LEVEL so as the amplitude of the MBS waveform at the base of TR3 became abt. 1.5V as Fig4. On this stage, final adjustment to be made so as to cause no opening in the center. (not necessary to be 1.5V).		
8)	Adjustment of Auto-STC and confirmation of Auto-RAIN Change STC and RAIN to manual mode. Turn RAIN knob fully counterclockwise. Turn GAIN knob fully clockwise. Turn STC knob and display targets in 6NM range. Set tuning so as the picture is more clear around 2NM distance. These setting position are going to be the standard setting therefore knobs to be left fixed as it is.		

Items	Test Procedure	Check	Remarks
	Press AUTO-STC switch. When pressed switch, the menu displayed on the left hand side of the screen. Observin the images and control ±switch to set up the value to 70. Observing the targets, turn RV6 so as to fix the angle at the position where the images can be seen clearly around 2NM distance compare with the adjustment of manual STC. Press "SET" switch to bring the display to initial menu. Again press AUTO-SEA switch so as to return to manual mode then confirm original image. Again press AUTO-SEA and confirm images around 2NM distance. (AUTO-SEA) You can escape from the menu by pressing "C" switch but in this case set up parameters are all cleared. Check if image changes by operating ±switch. Set up by default value 70 and finish the procedure. Noto: Should the AUTO-RAIN switch is pressed during the setting operation, the system function switched to AUTO-RAIN mode. Confirmation of AUTO-RAIN Confirmation of AUTO-RAIN to be made displaying the image on 6NM range. No adjustment required. When AUTO-RAIN switch being pressed the menu displayed on left hand side of the screen. Check if the image changes by the operation of +—switch in6NM range. Finish the setting operation by pressing "SET" switch. Escape from the setting operation by pressing "C" switch. Default setting value is 160. Confirm there are not much difference between AUTO and MANUAL RAIN usage. Press AUTO-RAIN switch so as to go back to original MANUAL mode. Note: Should the AUTO-SEA switch is pressed during the setting operation, the system function will be switched to AUTO-SEA mode.	Check	RV6

5.6 Method of ARPA GATE

ARPA GATE is displayed on tracking and DATA READ targets. (2-targets)

Method.

1. Acquire Target.
2. Set DATA READ Mode.
3. Set Past Position. (etc. 0. 5, 1, 2, 4)
4. Press the [TEST] switch and key [7], [0], [0], [0].

   (TEST MENU 7 ARPA AUX append.)
5. Press key [7].

   (Select 7. ARPA AUX and ARPA MENU appear)
6. Press key [1].

   (Select 1. GATE DISP and MODE appear)
7. Press keys [1], [2].

   (Select GATE DISP ON MODE)
8. Press keys [9], [9] and switch [TEST].

6. Fitting of Options

6. 1 Output to Slave Display

6. 2 Radar Buoy

6. 3 Remote Display

6. 4 Own Display to be a Slave Display

6. 5 Interswitch

6. 6 Total Navigator (Under development)

6. 7 Night Vision (Under development)

6. 8 Personal Computer :RS232C (Under development)

JMA-7000/9000 Radar can be fitted with following options.

○ Output to slave Display
○ Radar Buoy
○ Remote Display
○ Own Display to be a Slave Display
○ Interswitch
○ Total Navigator (under development)
○ Night Vision (under development)
○ Personal Computer:PS232C (under development)

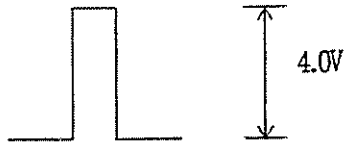
6.1 Slave Display

Output for slave will be as follows.
·Video output (50Ω terminator)
·Trigger Signal (50Ω terminator)
·Turning Signal (Open collector output)

·Video output
Video output, TB4604-5:SVD
TB4604-6:SVDE (return)

Negative pole signal

·Trigger Signal
Trigger signals are, TB4604-3:ETIY1
TB4604-4:ETIY1E
Time of trigger raise to video signal abt. 6μ second

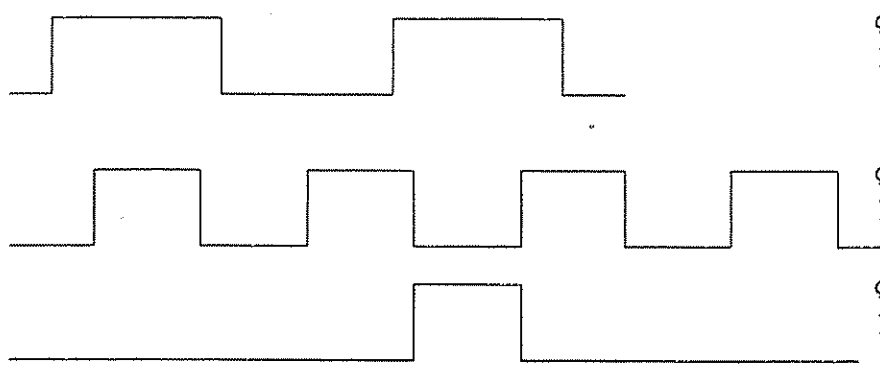


·Turning Signal
Turning signal are, TB4604-11:EXφB
TB4604-12:EXφOUTG (return)
TB4604-13:EXφZ
TB4604-14:EXφOUTG (return)

The φB, φZ both to be used by pulling up with 1K~2K resister.
The φB output can be changed of its pulse/1 revolution by changing jumperwire in timebase circuit PC4402.

J2 is connected by pattern and is standard output of 4096 pulses.
J2 connected in reverse side, output pulse is 2048 pulses.

137



6.2 Radar Buoy

Radar Buoy output signal is follows

·Trigger signal (50Ω terminator)

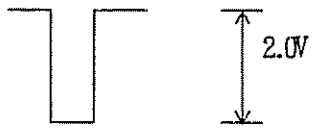
·Turning signal (open collector output)

Above output is same as above mentioned slave output.

Input from Radar Buoy signal is as follows.

·Radar Buoy Video signal (50Ω terminator)

Video signal is negative pole.



6.3 Remote Display

Remote display output

Monitor output signal a follows.

·Horizontal synchro signal (output impedance, see separate sheet)

·Vertical synchro signal (output impedance, see separate sheet)

·Video Signal (50Ω terminator)

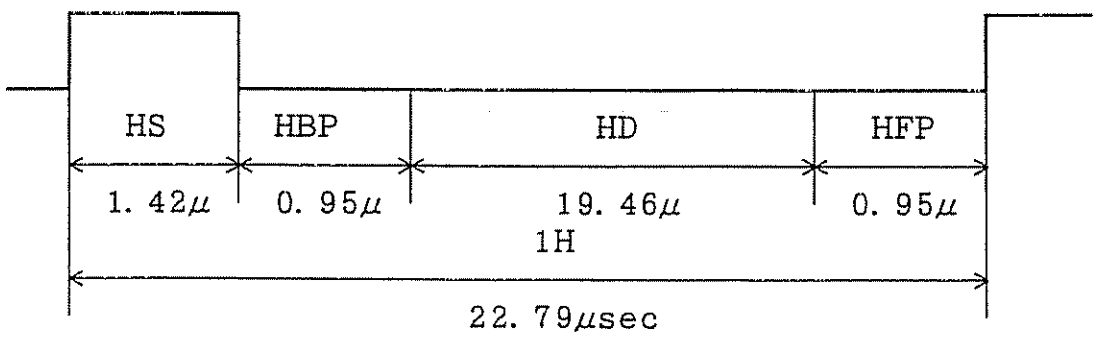
·Horizontal synchro signal (HS) :

positive pole TB4604-19:EHSY

TB4604-20:EHSYG

Horizontal synchro signal send out as follows.

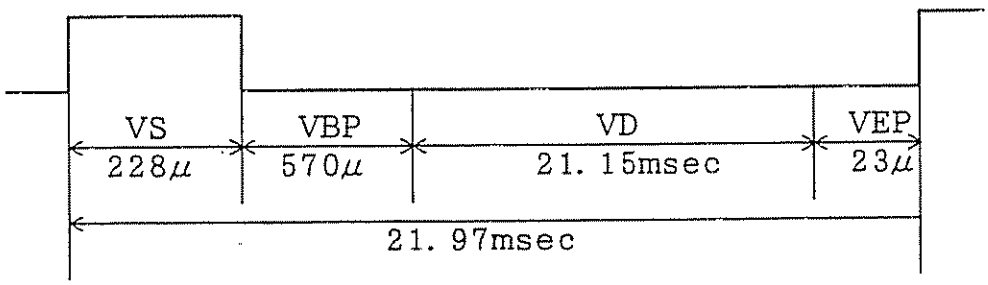
Dot clock:67.4043 MHz.



Frequency=43.88KHz
1 word=2clock=32dots=475nsec
1 dots=14.8nsec→67.4043MHz
1H=22.79μsec=48words=96clock=1536dots
HD=19.46μsec=41words=82clock=1312dots
HFP= 0.95μsec= 2words= 4clock= 64dots
HBP= 0.95μsec= 2words= 4clock= 64dots
HS= 1.42μsec= 3words= 6clock= 96dots
WC=19.46μsec=41words=82clock=1312dots

★Output Impedance :abt. 22Ω
★Output Amplitude :4.3-0V (No load), 2.1V-0V (22Ω terminator)
·Vertical synchronous signal:positive pole TB4604-21:EVSY
TB4604-22:EVSYG

Horizontal Synchronous Signal is send out in following timing.



Frequency=45.5Hz
1V=964H=21.97msec
1VD=928H=21.15msec
VFP= 1H= 23μsec
VBP= 25H=570μsec
VS= 10H=228μsec

★ Output Impedance:abt. 22Ω
★ Output Amplitude:4.3V-0V (No load, 2.1V-0V (220Ω terminator)
·Video Output:Positive pole TB4604-23 EVD
TB4604-24 EVDG

★ Output Impedance:abt. 50Ω
★ Output Amplitude:0.6V-0V (50Ω terminator)

6.4 Unit to be a slave Radar

In case of put one radar to be a slave radar, inter-connection is different when the Master Radar is JMA-7000/9000 series or other radars.

☆In case of Master radar is JMA-7000/9000

Input for slave radar is as follows.

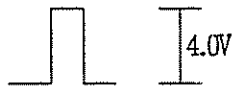
·Video Input (50Ω terminator)
·Trigger Signal Input (10kΩ terminator)
·Turning Signal (Composite signal)

·Video Input (Negative pole:50Ω terminator)
Video Input, TB4601-1 :T$\overline{VD}$
TB4601-2 :T$\overline{VE}$

Negative pole signal

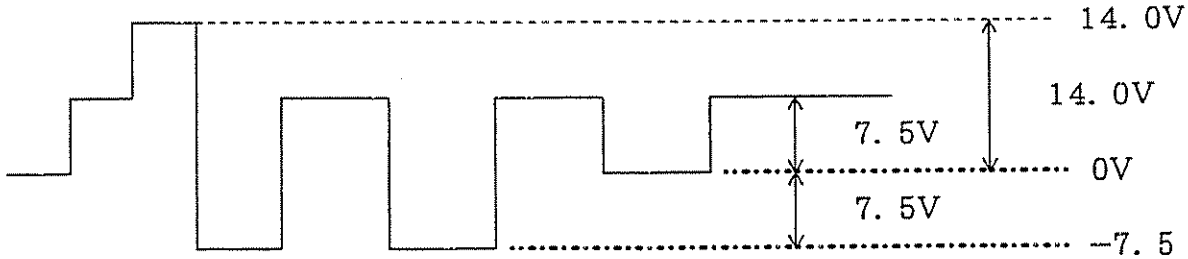
·Trigger signal Input (10KΩ terminator:TTL input)
Trigger signal TB4604-9 :ITIY
TB4604-10:ITIYE

From trigger rise time to video signal is abt. 6μsec.



·Turning Signal (Composite Signal:10KΩ)
Video Input :TB4601-3:BP
TB4601-4:BPE

The BP signal (composite) from JMA-7000/9000 Radar Transceiver.



Note:
☆When the Master radar is other than JMA-7000/9000.

The Input for slave Radar is as follows.

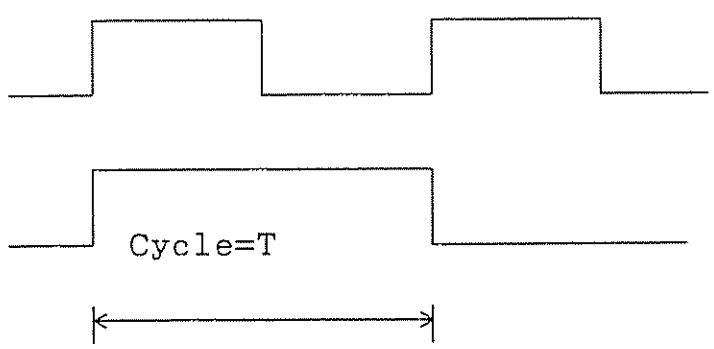
·Video Input (50Ω terminator)
·Trigger Signal Input (10KΩ terminator)
·Turning Signal

·Video Input (50Ω terminator)
Video signal is same a above

·Trigger Signal Input (10KΩ terminator)
Trigger Signal is same as above

·Turning Signal
Turning signal :TB4604-15:EXφA (1KΩ with pull-up)
TB4604-16:EXφB (1kΩ with pull-up)
TB4604-17:EXφZ (1KΩ with pull-up)
TB4604-18:EXΩING (return)

The phase A (φA) open circuit makes reverse turn, short circuit to TB4604-18 (GND) makes right turn there fore connection should be made without fail.



For φZ, Input value should be the cycle length of the φB.

6.5 Interswitch

Refer to 2.4

6.6 Total Navigator (Under development)
6.7 Night Vision (Under development)
6.8 Personal Computer :RS232C (Under development)

141

7. Maintenance

7. 1 Antenna

7. 2 Transceiver

7. 3 Display unit

7. 4 Coaxial cable

7. 5 Wave Guide

7.1 Antenna NKE-1072/1052

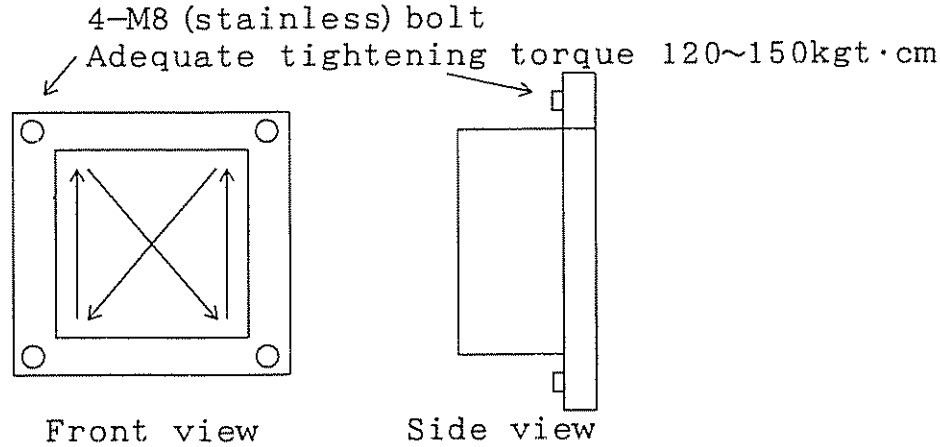
Repair or maintenance of the scanner to be carried out only after turn off the power supply switch (S5001:OFF) and scanner safety switch (S. 101) at the scanner pedestal.

Note:
Whenever removal of pedestal cover is required, tightening method of the holding down bolts are as follows.

a) The adequate tightening torque for the holding down bolts are 120~150kgf·cm. (Adequate to maintain water tight and not to damage the gasket).
Normally, the packing may start to deform and pushed out at the torque of more than 150kgf·cm. Furthermore, excess torque on the bolt may damage the screw thread.

b) Required tools are 11×13 wrench, 13×17 spanner with arm length of less than 200mm.

c) When tighten the bolts, insert all bolts and turn them until difficult to turn by hand then tighten them by spanner evenly and in order as the sketch below.
Tightening cycle to be 4 to 5 stages until reach the adequate torque.



Pedestal cover tightening order and adequate torque

☆ Radiator

If the surface of the radiator became dirty due to the adherence of soot, salt, dust, paint or birds' dropping, it will lower the performance of the Radar because of loss in radiation and inner reflection.

Check the surface of radiator periodically and whenever found stained, clean it by soft cloth wet with alcohol or water and keep it clean all the time. Never use gasoline, benzine, trichloroe thylene, keton etc that those solvents may damage the surface.

☆ Turning Drive Unit

·Oiling of Oil-Seal

By using greasegun, supply grease through the grease nipple. Grease nipple is located scanner pedestal side for X-band and in front for S-band.

Grease supply to be carried out every 6 months and the quantity will be abt. 100g per one supply. Adequate quantity is that small amount of grease may overflow from the grease cup.

Grease should be of MOBILUX from Mobil Oil or equivalent. (For scanner type NKE-1052/1059, greasing to be done after take off the side cover.)

·Oiling on Gear Mechanism

By using brush or spatula, spread evenly on main shaft drive gear and encoder drive gear teeth.

It will be better to spread grease in the interval of shorter period but once every 6 months will be the standard.

Greas should be of MOBILUX from Mobil oil or equivalent.

·Fixing stand

Scanner pedestal fixing stand and holding down bolts to be checked of corrosion or damage regularly and should be maintained in safer condition. Application of paint coating are good for anti-corrosion. Painting once very 6 months will be more better.

7.2 Display Unit NCD-3570-/(-CAE), NCD-3590-/3591-

Should the dust accumulated on the surface of the CRT, deteriorate the transparency and readability of the screen. Cleaning to be done by soft linen or cotton cloth wet with fresh water. Never use hard cloth or gasoline and benzine.

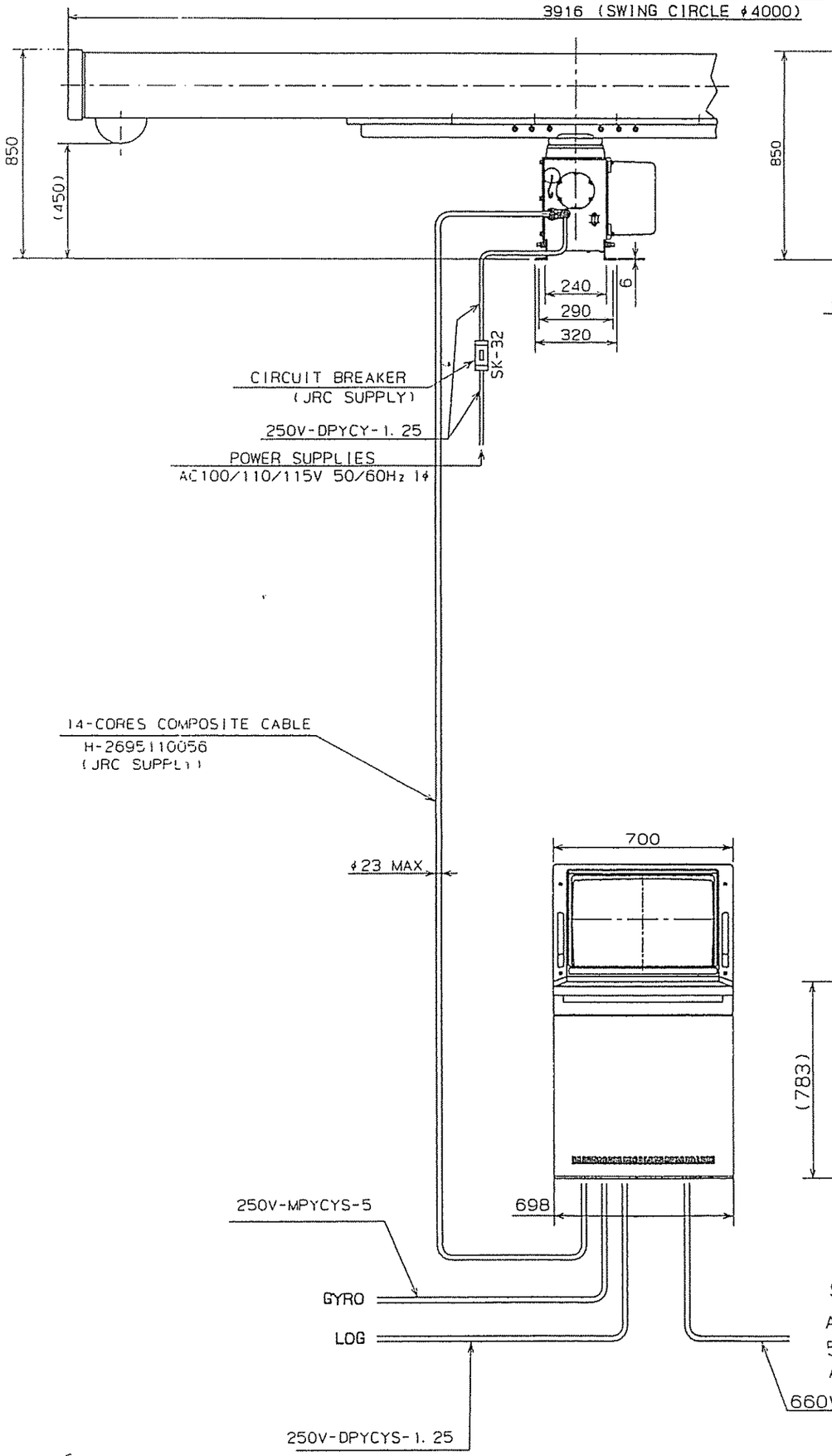
7.3 Coaxial Cable (S-band)

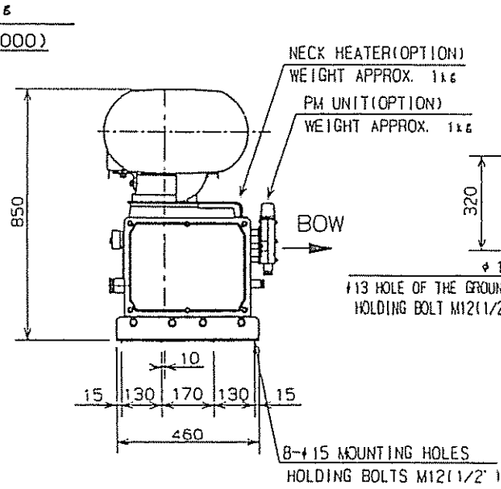
Coaxial tube glands at the coaxial cable terminal are applied with water tight process at the time of installation however, care must be paied to check the gland carefully for water leakage. Painting on coaxial gland every 6 months, depends on the visual check, is recommendable.

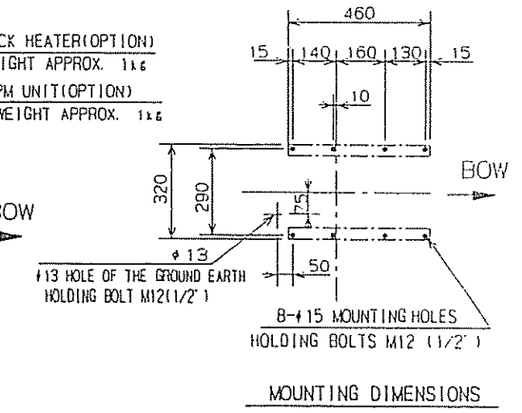
7.4 Wave Guide

Every junction point of the wave guide from scanner side down to deck penetration part to be checked for possible water leakage. It is recommendable to apply painting every 6 months.

NKE-1072 SCANNER UNIT WEIGHT APPROX. 145kg





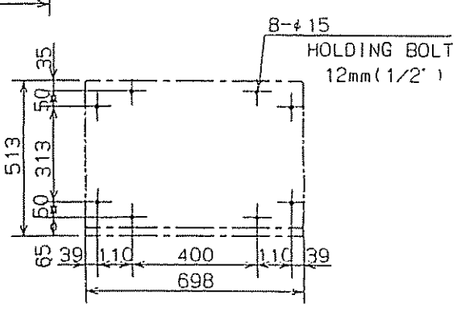


MOUNTING DIMENSIONS

NCD-3590-C/NCD-3591-A

DISPLAY UNIT

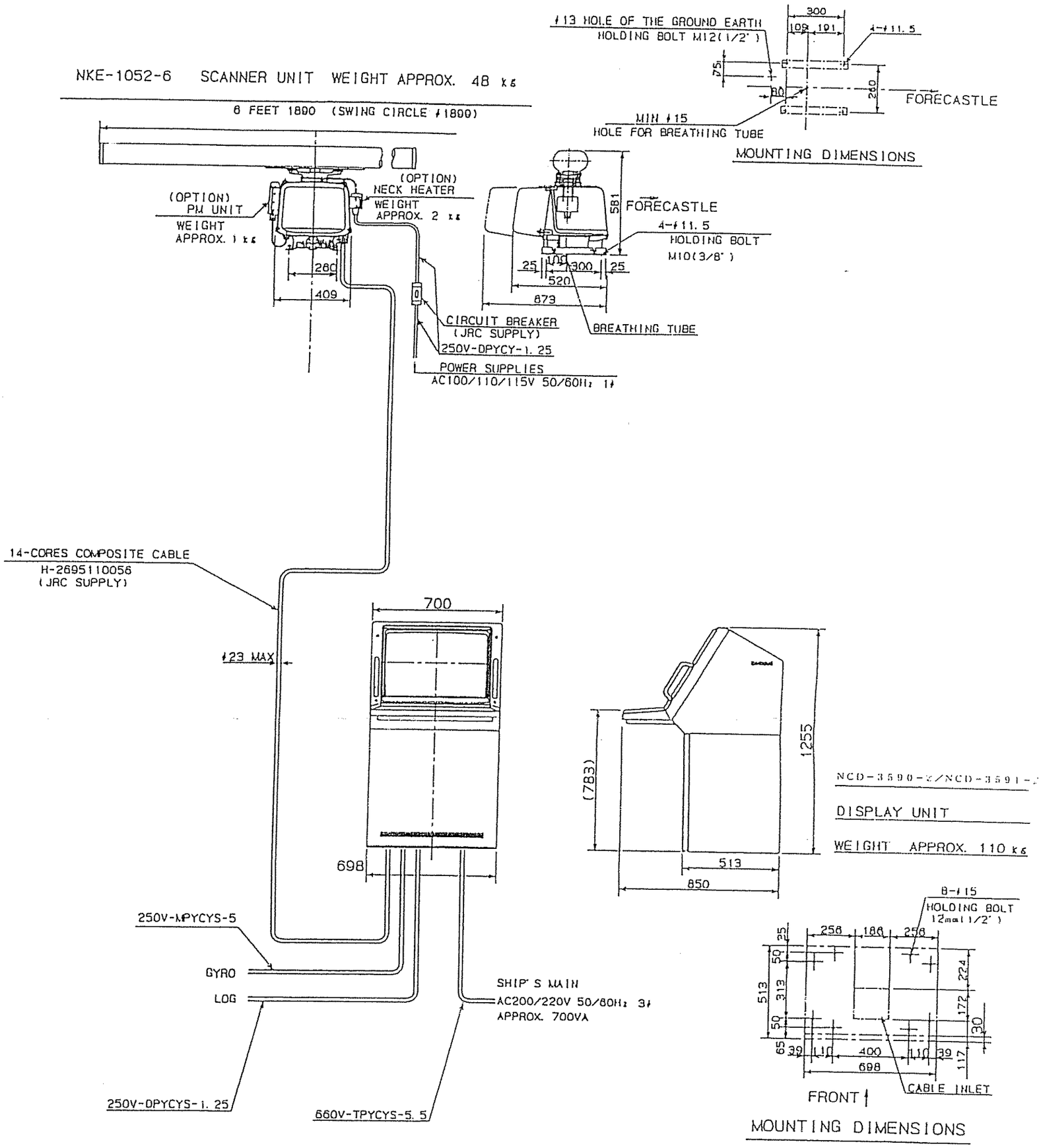
WEIGHT APPROX. 110 kg



MOUNTING DIMENSIONS

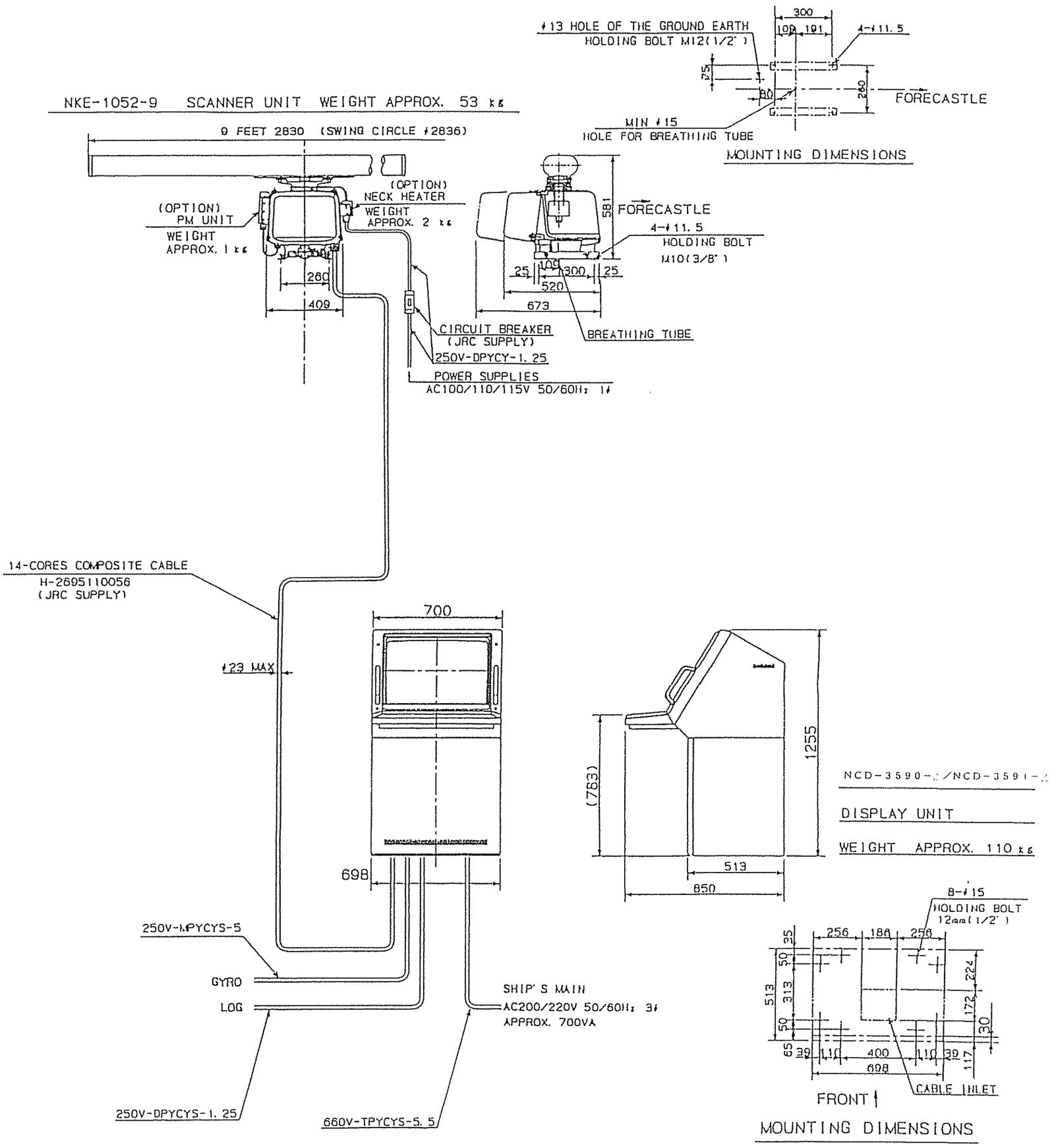
NOTES: 1 ELIMINATING THE INTERFERENCE ON FREQUENCIES USED FOR MARINE COMMUNICATIONS AND NAVIGATION DUE TO OPERATION OF THE RADAR. ALL CABLES OF THE RADAR ARE TO BE RUN AWAY FROM THE CABLES OF RADIO EQUIPMENT (EX. RADIOTELEPHONE, COMMUNICATIONS RECEIVER AND DIRECTION FINDER, ETC.). ESPECIALLY INTER-WIRING CABLES BETWEEN SCANNER UNIT AND DISPLAY UNIT OF THE RADAR SHOULD NOT BE RUN PARALLEL WITH THE CABLES OFF RADIO EQUIPMENT.

FIG. 101 GENERAL SYSTEM DIAGRAM OF RADAR.
TYPE JMA-9102 /JMA-9102-CA



NOTES: 1 ELIMINATING THE INTERFERENCE ON FREQUENCIES USED FOR MARINE COMMUNICATIONS AND NAVIGATION DUE TO OPERATION OF THE RADAR. ALL CABLES OF THE RADAR ARE TO BE RUN AWAY FROM THE CABLES OF RADIO EQUIPMENT (EX. RADIOTELEPHONE, COMMUNICATIONS RECEIVER AND DIRECTION FINDER, ETC.). ESPECIALLY INTER-WIRING CABLES BETWEEN SCANNER UNIT AND DISPLAY UNIT OF THE RADAR SHOULD NOT BE RUN PARALLEL WITH THE CABLES OFF RADIO EQUIPMENT.

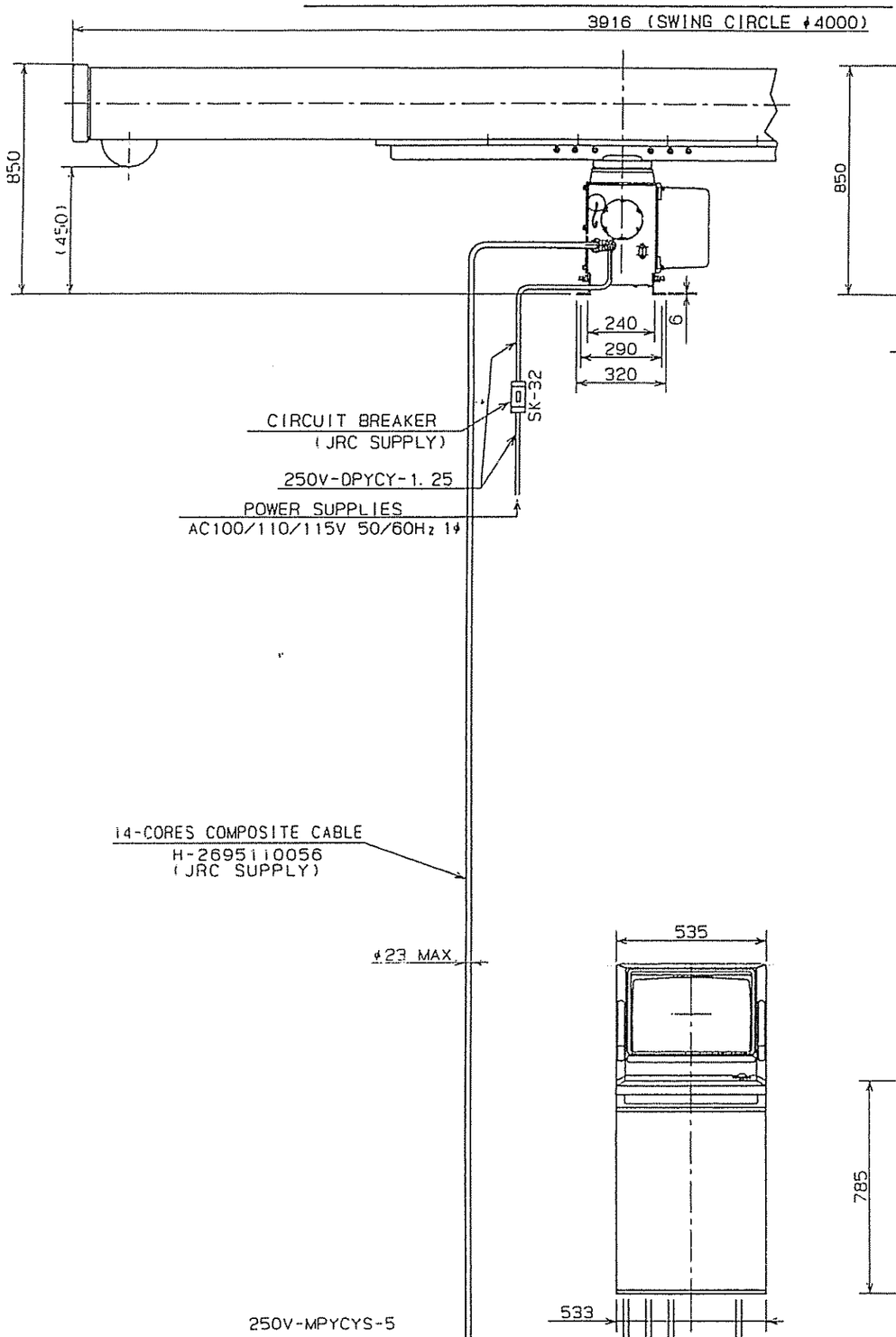
FIG. 102 GENERAL SYSTEM DIAGRAM OF RADAR, TYPE JMA-9252-6 /JMA-9252-6CA

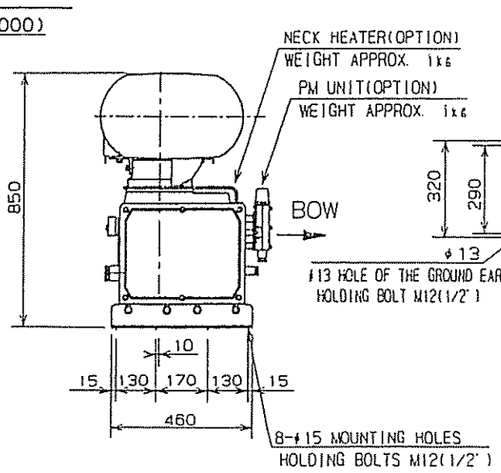


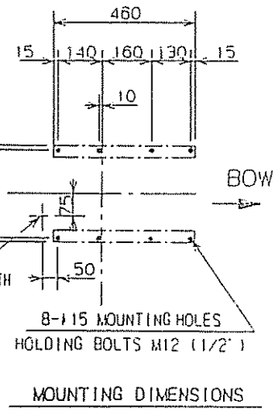
NOTES: 1 ELIMINATING THE INTERFERENCE ON FREQUENCIES USED FOR MARINE COMMUNICATIONS AND NAVIGATION DUE TO OPERATION OF THE RADAR. ALL CABLES OF THE RADAR ARE TO BE RUN AWAY FROM THE CABLES OF RADIO EQUIPMENT (EX. RADIOTELEPHONE, COMMUNICATIONS RECEIVER AND DIRECTION FINDER, ETC.). ESPECIALLY INTER-WIRING CABLES BETWEEN SCANNER UNIT AND DISPLAY UNIT OF THE RADAR SHOULD NOT BE RUN PARALLEL WITH THE CABLES OFF RADIO EQUIPMENT.

FIG. 103 GENERAL SYSTEM DIAGRAM OF RADAR.
TYPE JMA-9252-9 /JMA-9252-9CA

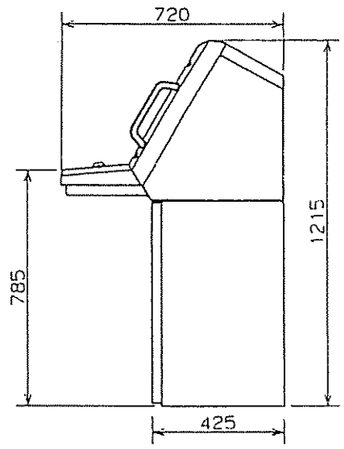
NKE-1072 SCANNER UNIT WEIGHT APPROX. 145kg







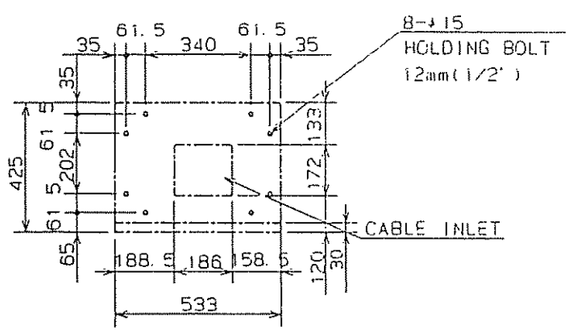
MOUNTING DIMENSIONS



NCD-3570-X/NCD-3570-CA

DISPLAY UNIT

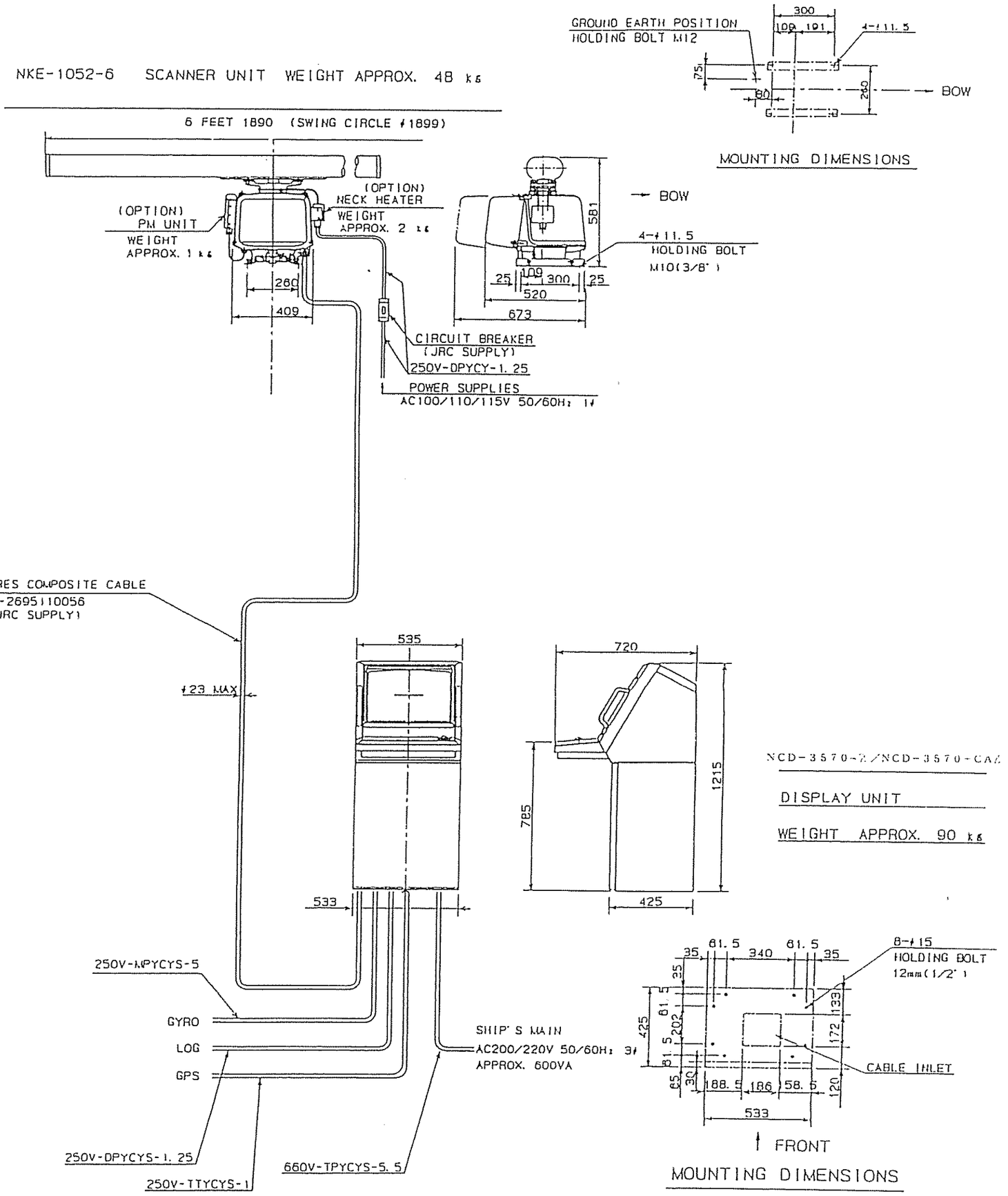
WEIGHT APPROX. 90 kg



MOUNTING DIMENSIONS

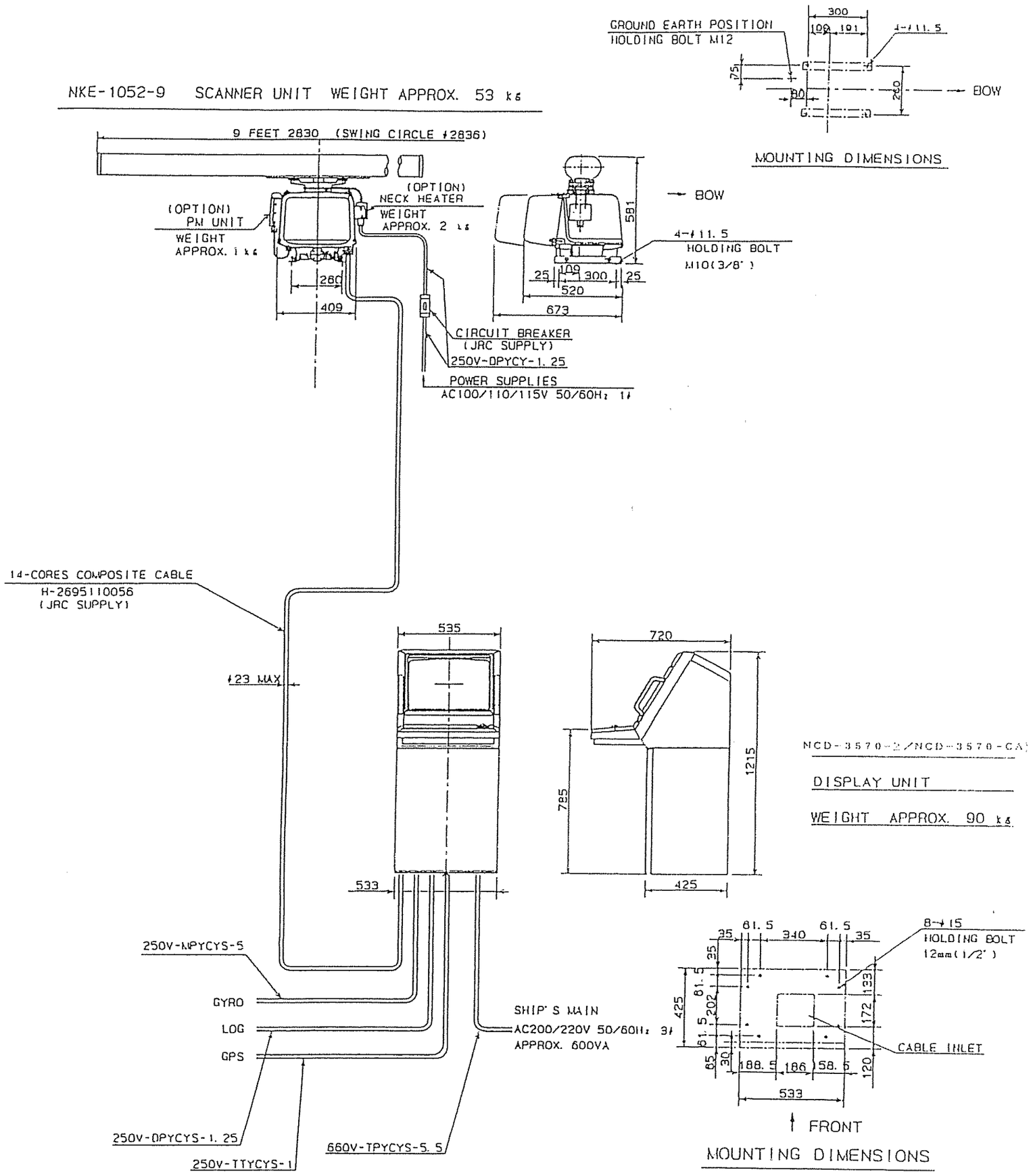
NOTES: 1 ELIMINATING THE INTERFERENCE ON FREQUENCIES USED FOR MARINE COMMUNICATIONS AND NAVIGATION DUE TO OPERATION OF THE RADAR. ALL CABLES OF THE RADAR ARE TO BE RUN AWAY FROM THE CABLES OF RADIO EQUIPMENT (EX. RADIOTELEPHONE, COMMUNICATIONS RECEIVER AND DIRECTION FINDER, ETC.). ESPECIALLY INTER-WIRING CABLES BETWEEN SCANNER UNIT AND DISPLAY UNIT OF THE RADAR SHOULD NOT BE RUN PARALLEL WITH THE CABLES OFF RADIO EQUIPMENT.

FIG 104 GENERAL SYSTEM DIAGRAM OF RADAR, TYPE JMA-7102 /JMA-7102-CA



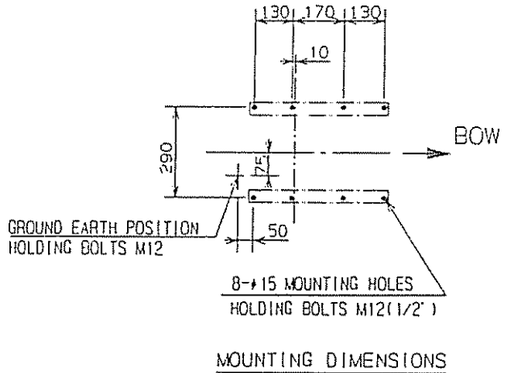
NOTES: 1 ELIMINATING THE INTERFERENCE ON FREQUENCIES USED FOR MARINE COMMUNICATIONS AND NAVIGATION DUE TO OPERATION OF THE RADAR. ALL CABLES OF THE RADAR ARE TO BE RUN AWAY FROM THE CABLES OF RADIO EQUIPMENT (EX. RADIOTELEPHONE, COMMUNICATIONS RECEIVER AND DIRECTION FINDER, ETC.). ESPECIALLY INTER-WIRING CABLES BETWEEN SCANNER UNIT AND DISPLAY UNIT OF THE RADAR SHOULD NOT BE RUN PARALLEL WITH THE CABLES OFF RADIO EQUIPMENT.

FIG. 105 GENERAL SYSTEM DIAGRAM OF RADAR, TYPE JMA-7252-6 /JMA-7252-6CA



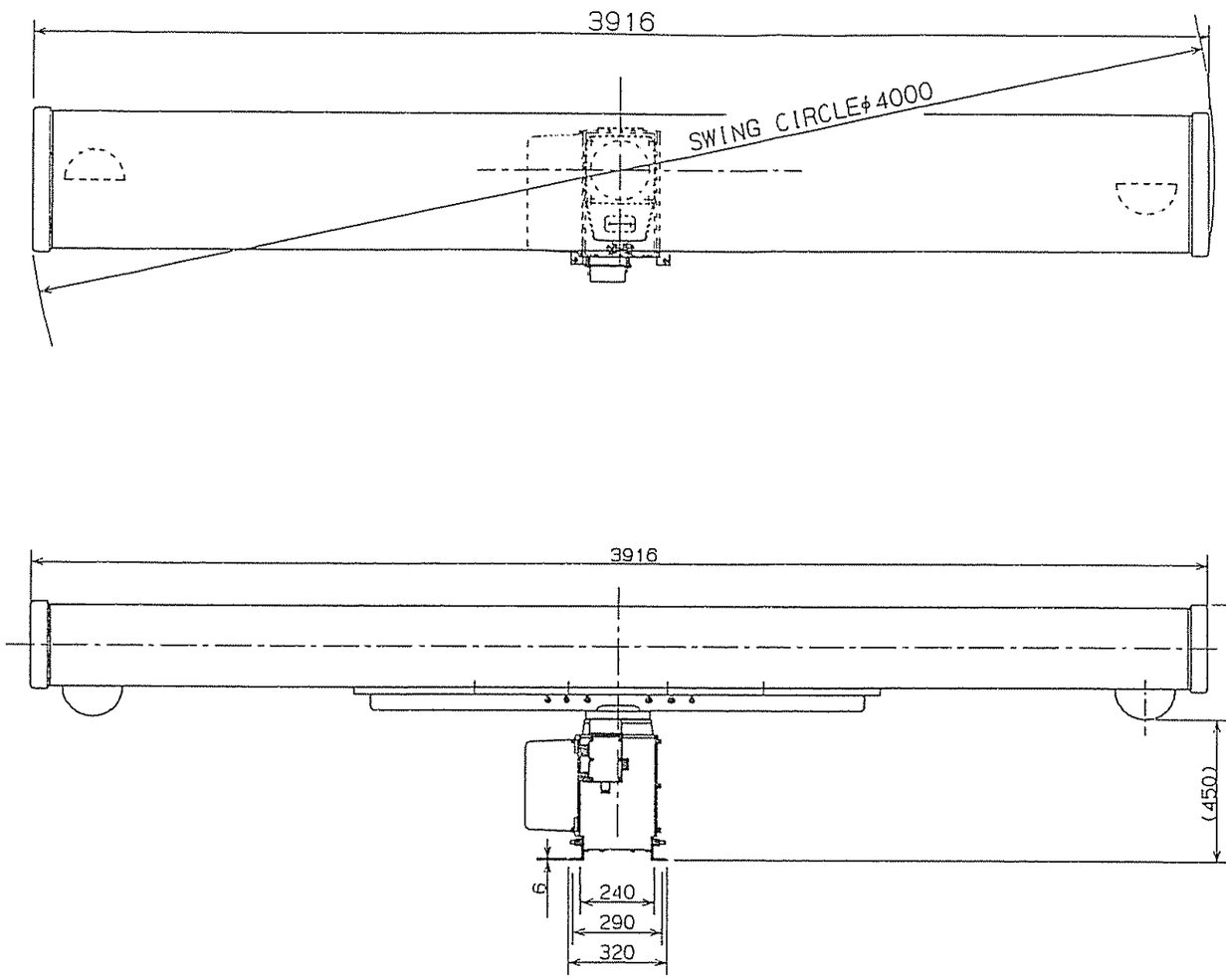
NOTES: 1 ELIMINATING THE INTERFERENCE ON FREQUENCIES USED FOR MARINE COMMUNICATIONS AND NAVIGATION DUE TO OPERATION OF THE RADAR. ALL CABLES OF THE RADAR ARE TO BE RUN AWAY FROM THE CABLES OF RADIO EQUIPMENT (EX. RADIOTELEPHONE. COMMUNICATIONS RECEIVER AND DIRECTION FINDER. ETC.). ESPECIALLY INTER-WIRING CABLES BETWEEN SCANNER UNIT AND DISPLAY UNIT OF THE RADAR SHOULD NOT BE RUN PARALLEL WITH THE CABLES OFF RADIO EQUIPMENT.

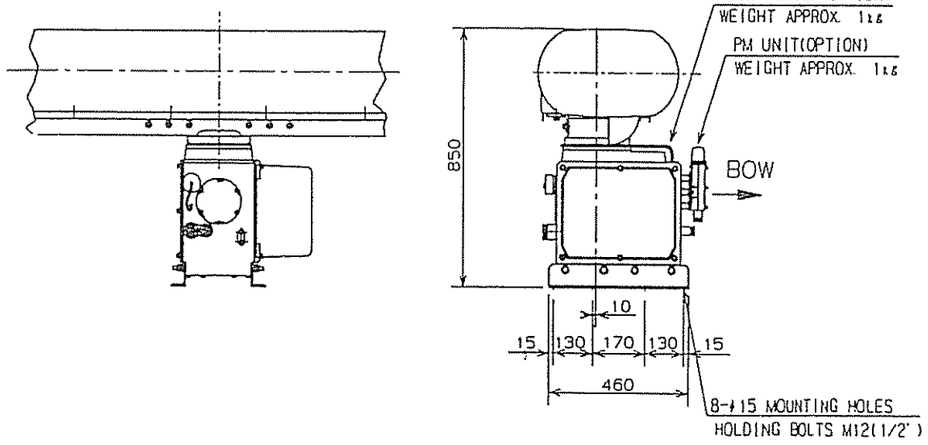
FIG 106 GENERAL SYSTEM DIAGRAM OF RADAR, TYPE JMA-7252-9 /JMA-7252-9CA



MOUNTING DIMENSIONS

UNLESS OTHERWISE SPECIFIED				
DIMENSION		SPECIFIED		TOLERANCE
	0	TO	30	± 1
OVER	30	TO	120	± 1.5
OVER	120	TO	400	± 2.5
OVER	400	TO	1000	± 4
OVER	1000	TO	2000	± 6
OVER	2000	TO	3000	± 8

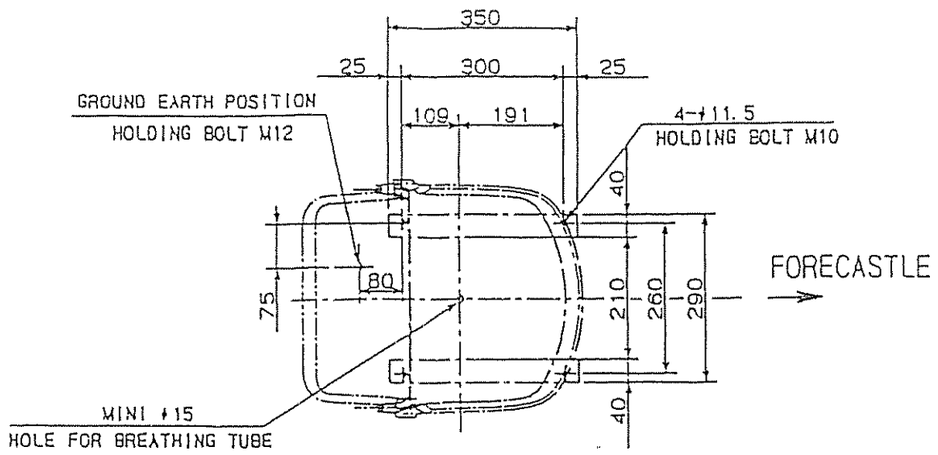


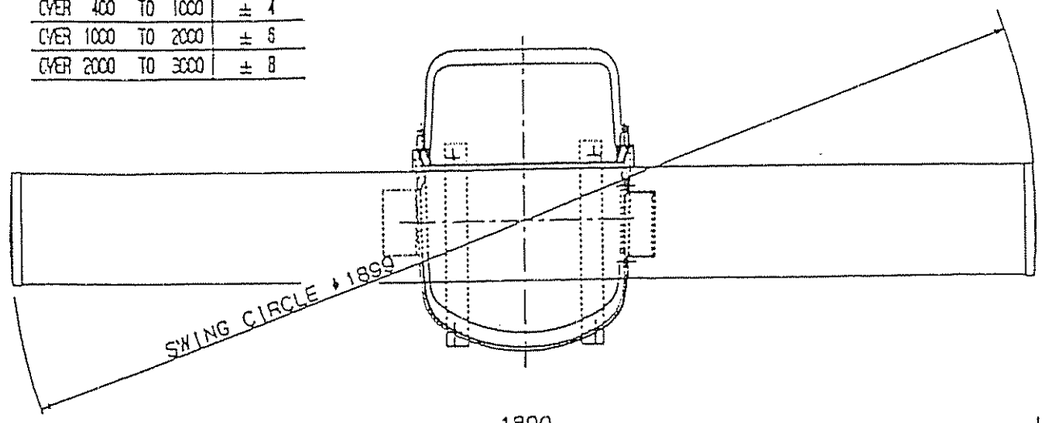


WEIGHT APPROX.	145 kg
COLOR ARRAY	MUNSELL N9
PEDESTAL	MUNSELL N6

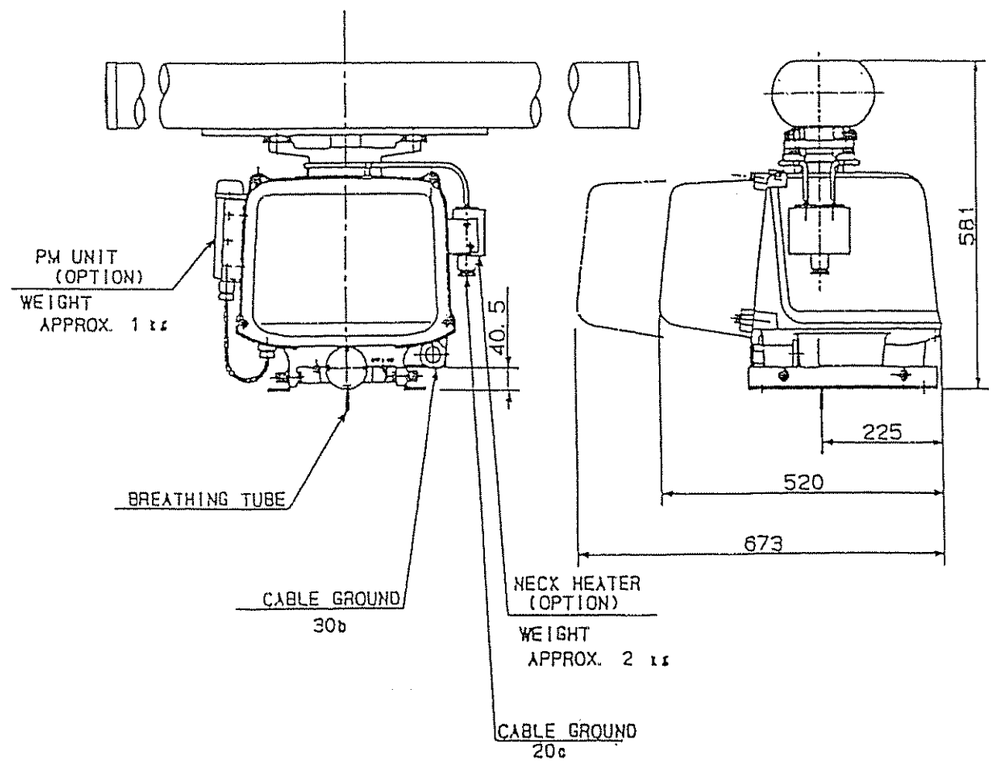
FIG. 107 EXTERIOR DRAWING OF SCANNER UNIT, TYPE NKE-1072

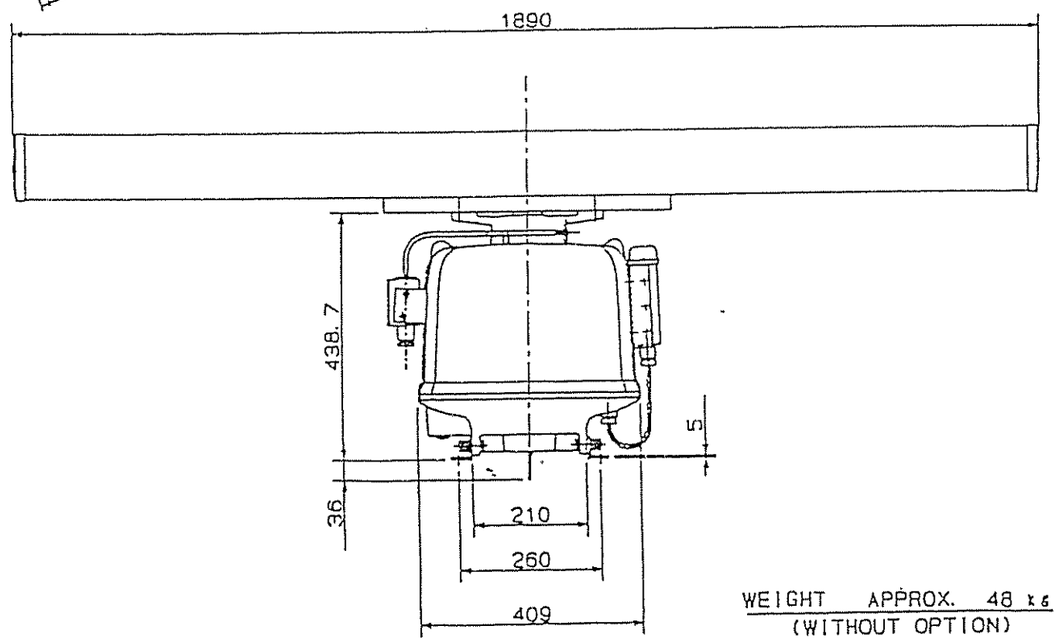
UNLESS OTHERWISE SPECIFIED				
DIMENSION SPECIFIED				TOLERANCE
	0	TO	30	± 1
OVER	30	TO	120	± 1.5
OVER	120	TO	400	± 2.5
OVER	400	TO	1000	± 4
OVER	1000	TO	2000	± 6
OVER	2000	TO	3000	± 8





MOUNTING DIMENSIONS



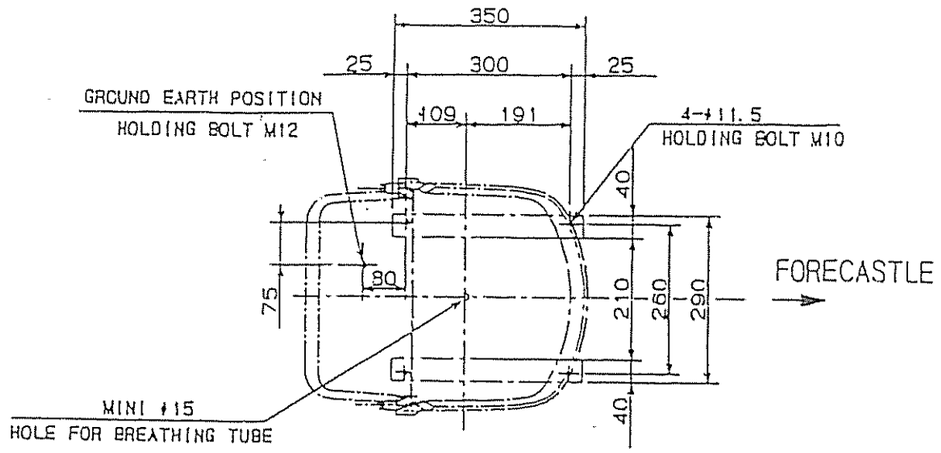


WEIGHT APPROX. 48 kg
(WITHOUT OPTION)

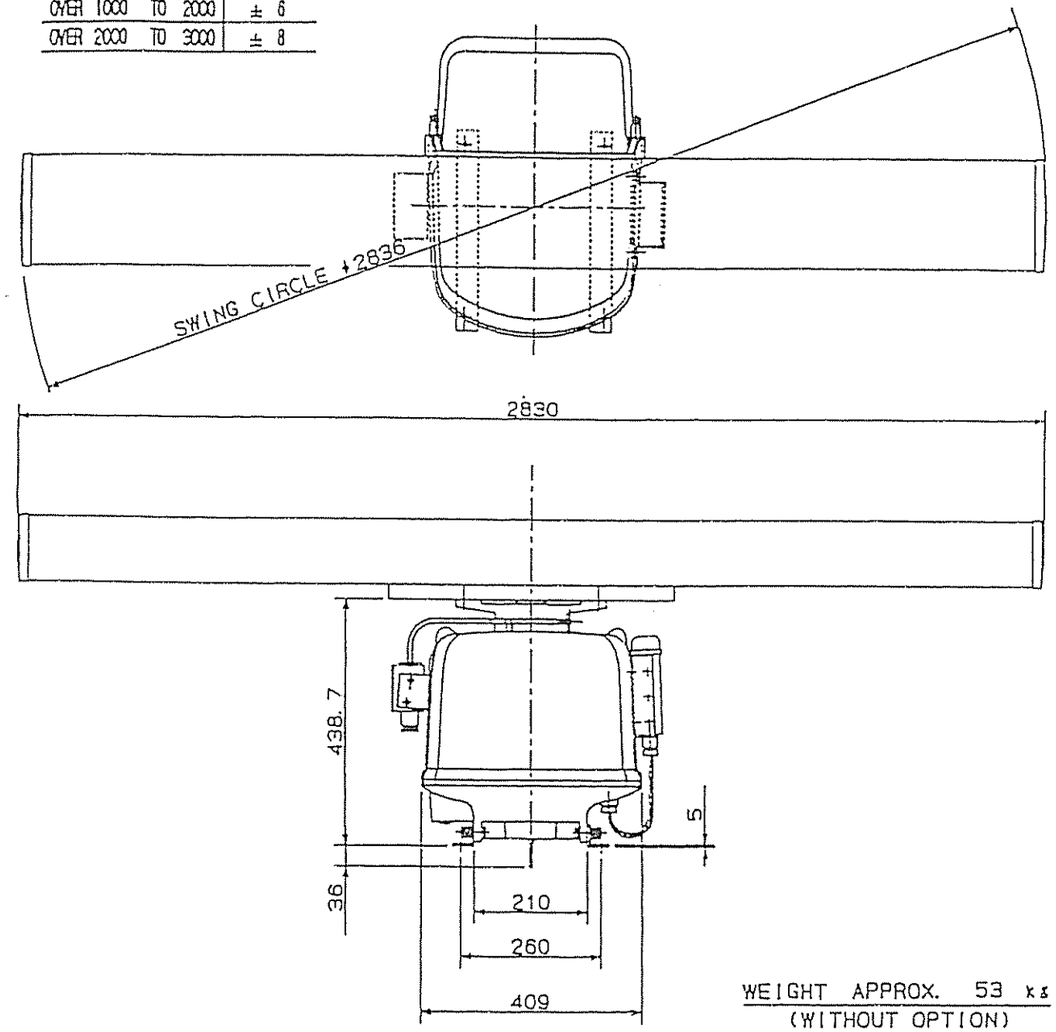
COLOR MUNSELL N9

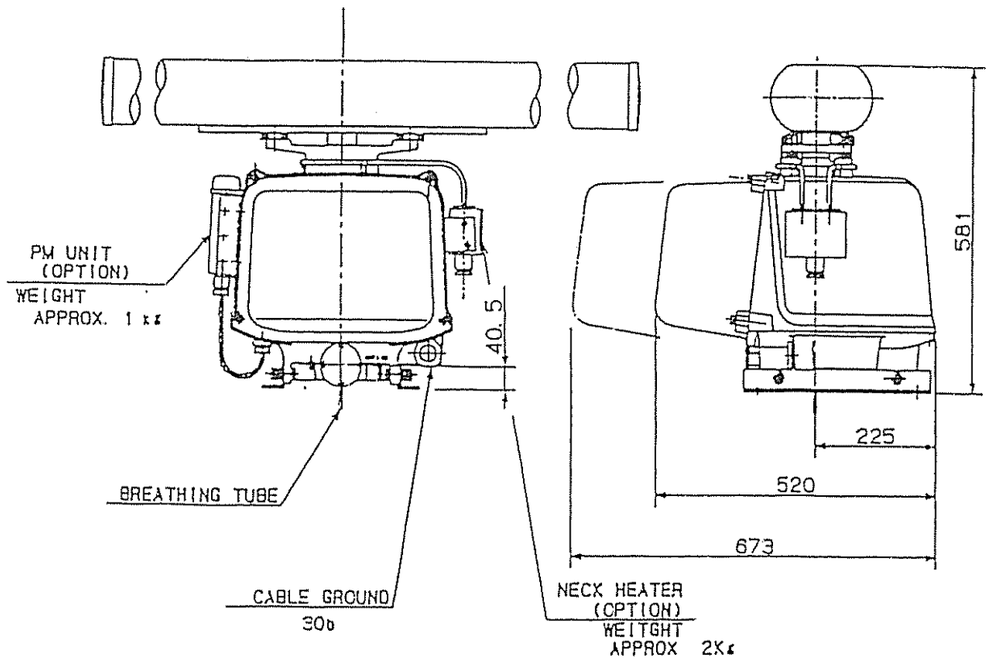
FIG. 108 EXTERIOR DRAWING OF SCANNER UNIT,
TYPE NKE-1052-6

UNLESS OTHERWISE SPECIFIED			
DIMENSION	SPECIFIED		TOLERANCE
0	TO	30	± 1
OVER 30	TO	120	± 1.5
OVER 120	TO	400	± 2.5
OVER 400	TO	1000	± 4
OVER 1000	TO	2000	± 6
OVER 2000	TO	3000	± 8



MOUNTING DIMENSIONS

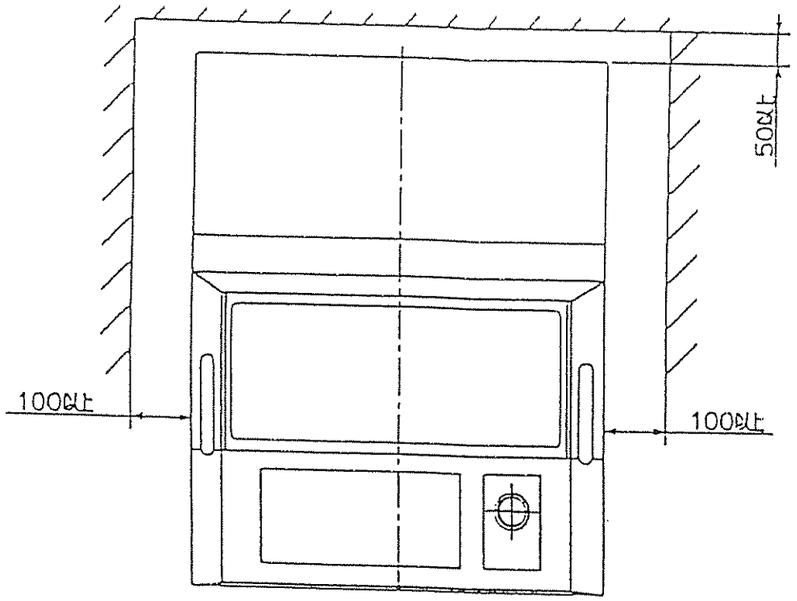


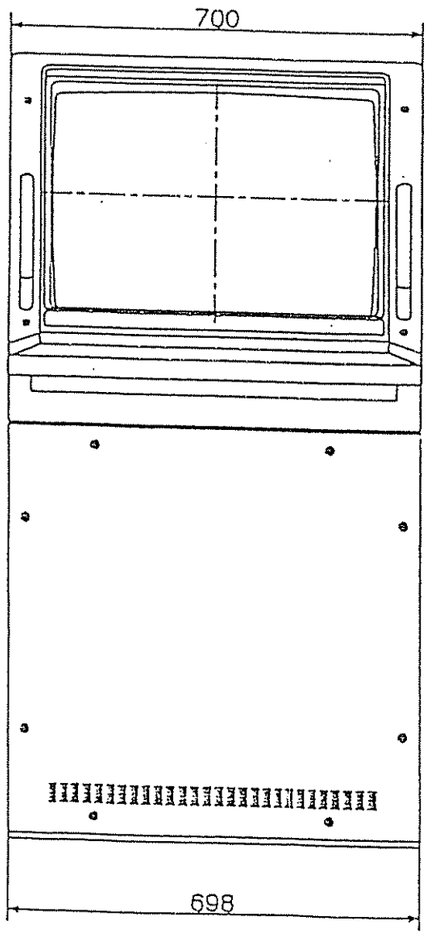


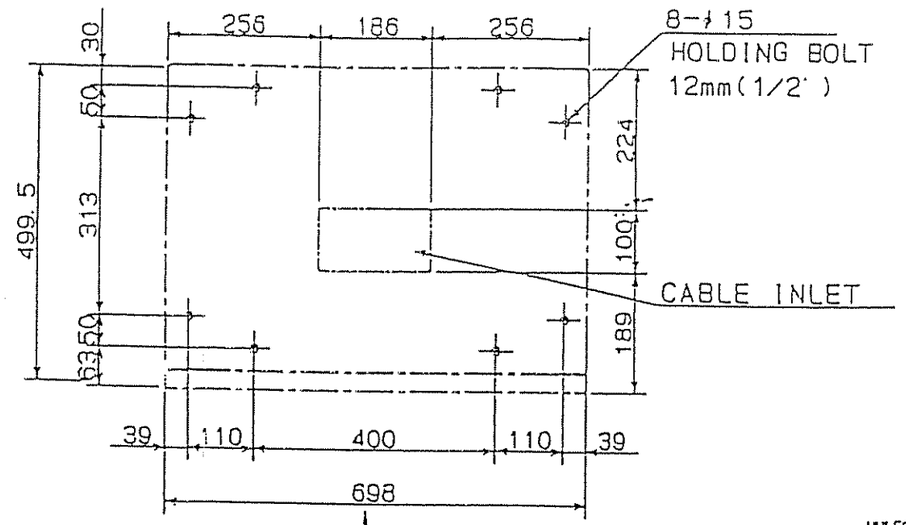
WEIGHT APPROX. 53 kg
(WITHOUT OPTION)

COLOR MUNSELL N9

FIG. 109 EXTERIOR DRAWING OF SCANNER UNIT.
TYPE NKE-1052-9

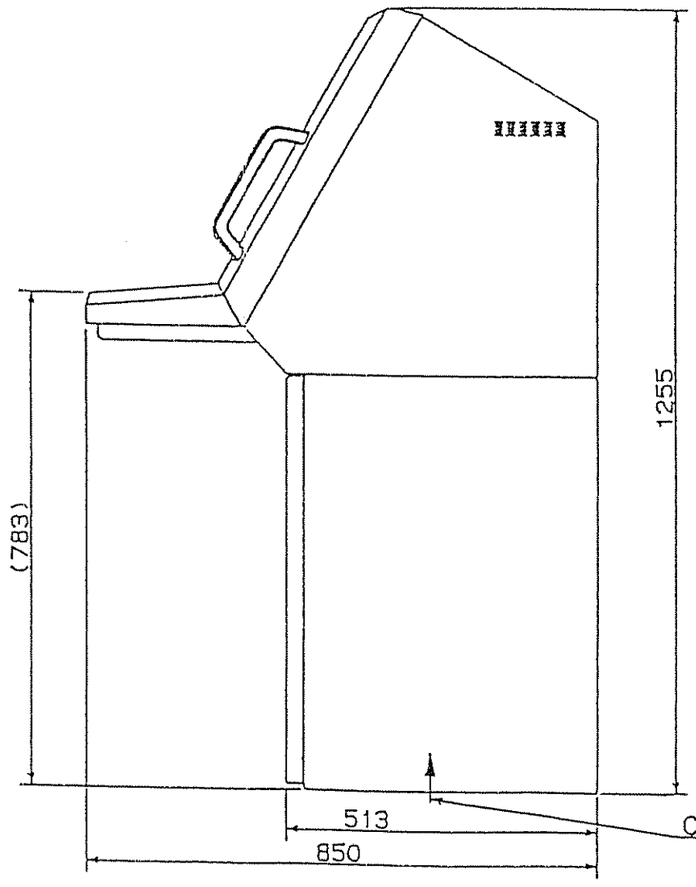






MOUNTING DIMENSIONS

FRONT



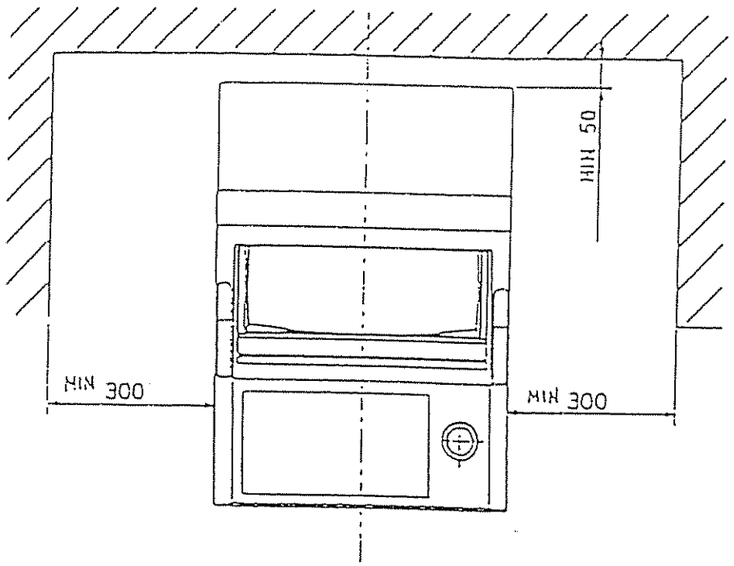
UNLESS OTHERWISE SPECIFIED	
DIMENSION SPECIFIED	TOLERANCE
0 TO 30	± 1
OVER 30 TO 120	± 1.5
OVER 120 TO 400	± 2.5
OVER 400 TO 1000	± 4
OVER 1000 TO 2000	± 6
OVER 2000 TO 3000	± 8

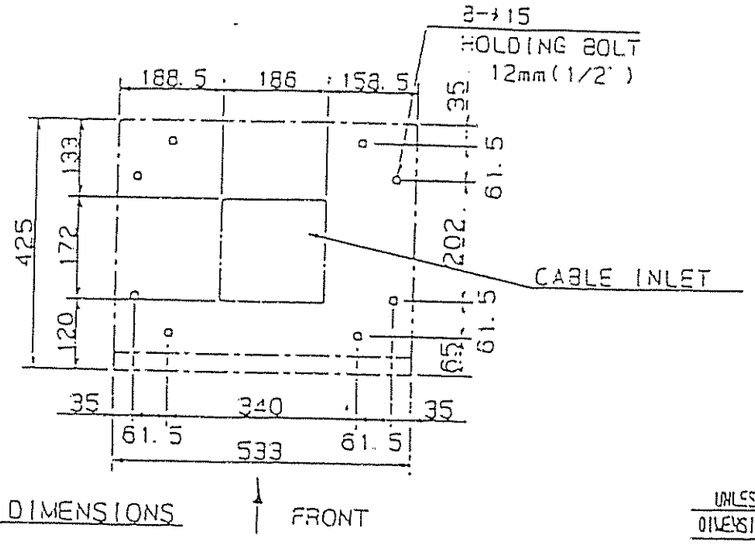
WEIGHT APPR. 110 kg

COLOR MUNSELL 2.5G7/2

466

FIG. 110 EXTERIOR DRAWING OF DISPLAY UNIT,
TYPE NCD-3590-2/NCD-3591-2

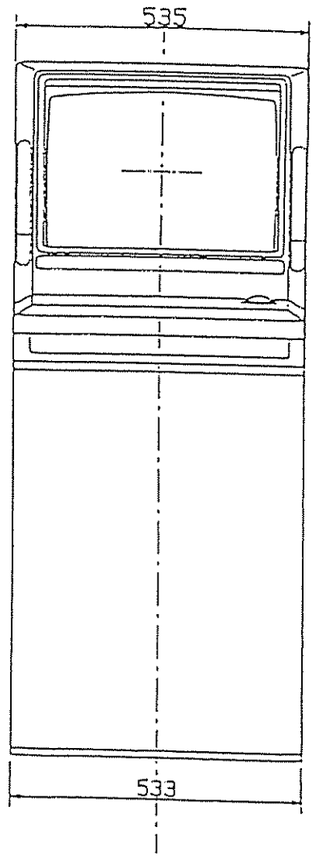


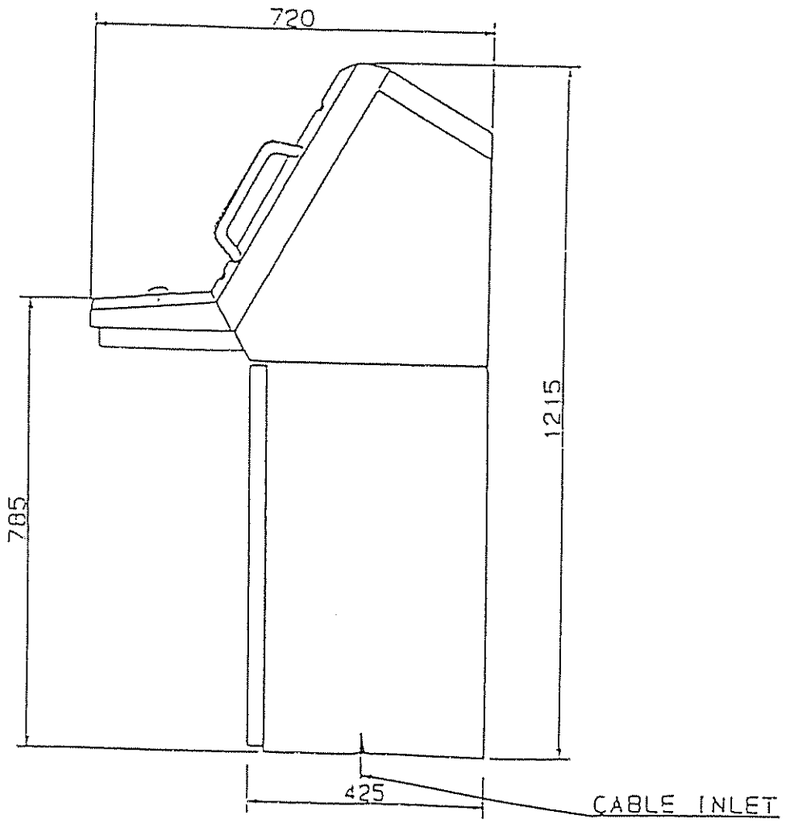


MOUNTING DIMENSIONS

FRONT

UNLESS OTHERWISE SPECIFIED			
DIMENSION	SPECIFIED		TOLERANCE
0	TO	30	± 1
OVER 30	TO	120	± 1.5
OVER 120	TO	400	± 2.5
OVER 400	TO	1000	± 4
OVER 1000	TO	2000	± 6
OVER 2000	TO	3000	± 8





WEIGHT APPROX. 90 kg

COLOR MUNSELL 2.5G7/2

FIG 111 EXTERIOR DRAWING OF DISPLAY UNIT.
TYPE NCD-3570-□/NCD-3570-CA□

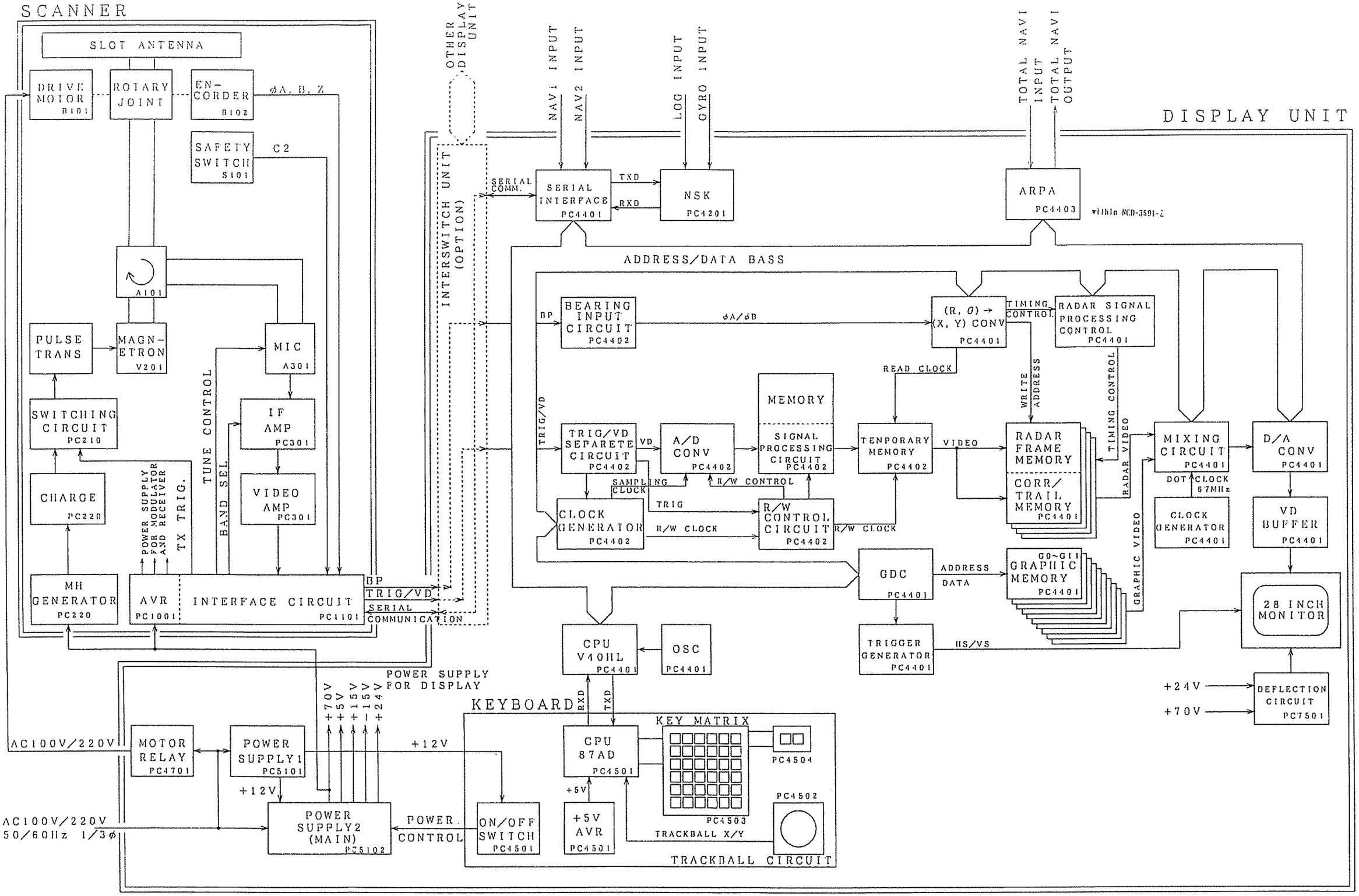


FIG. 112 BLOCK DIAGRAM OF RADAR.
TYPE JMA-9102 /JMA-9102-CA

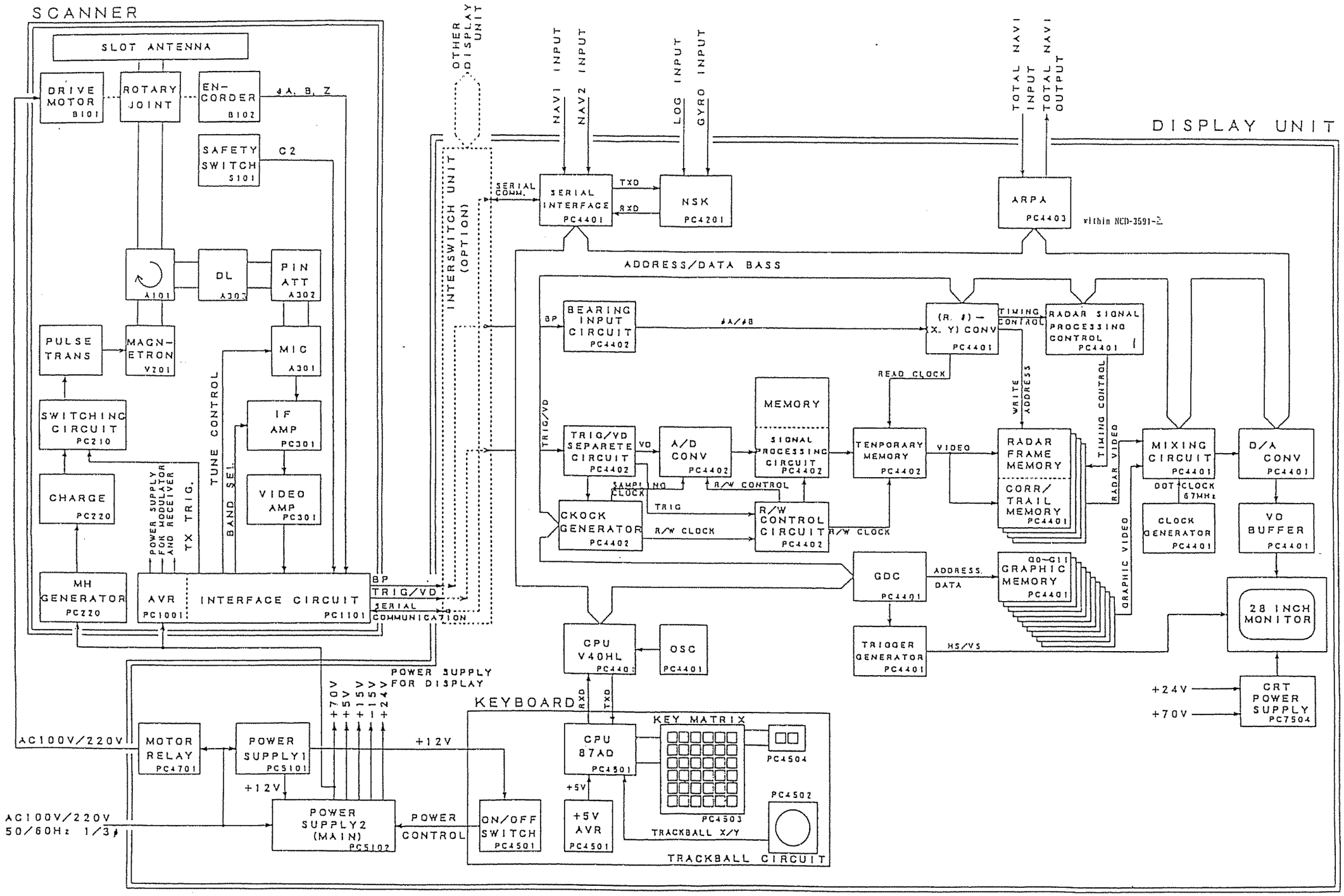


FIG 113 BLOCK DIAGRAM OF RADAR.
TYPE JMA-9252-6 /JMA-9252-6CA /
JMA-9252-9 /JMA-9252-9CA

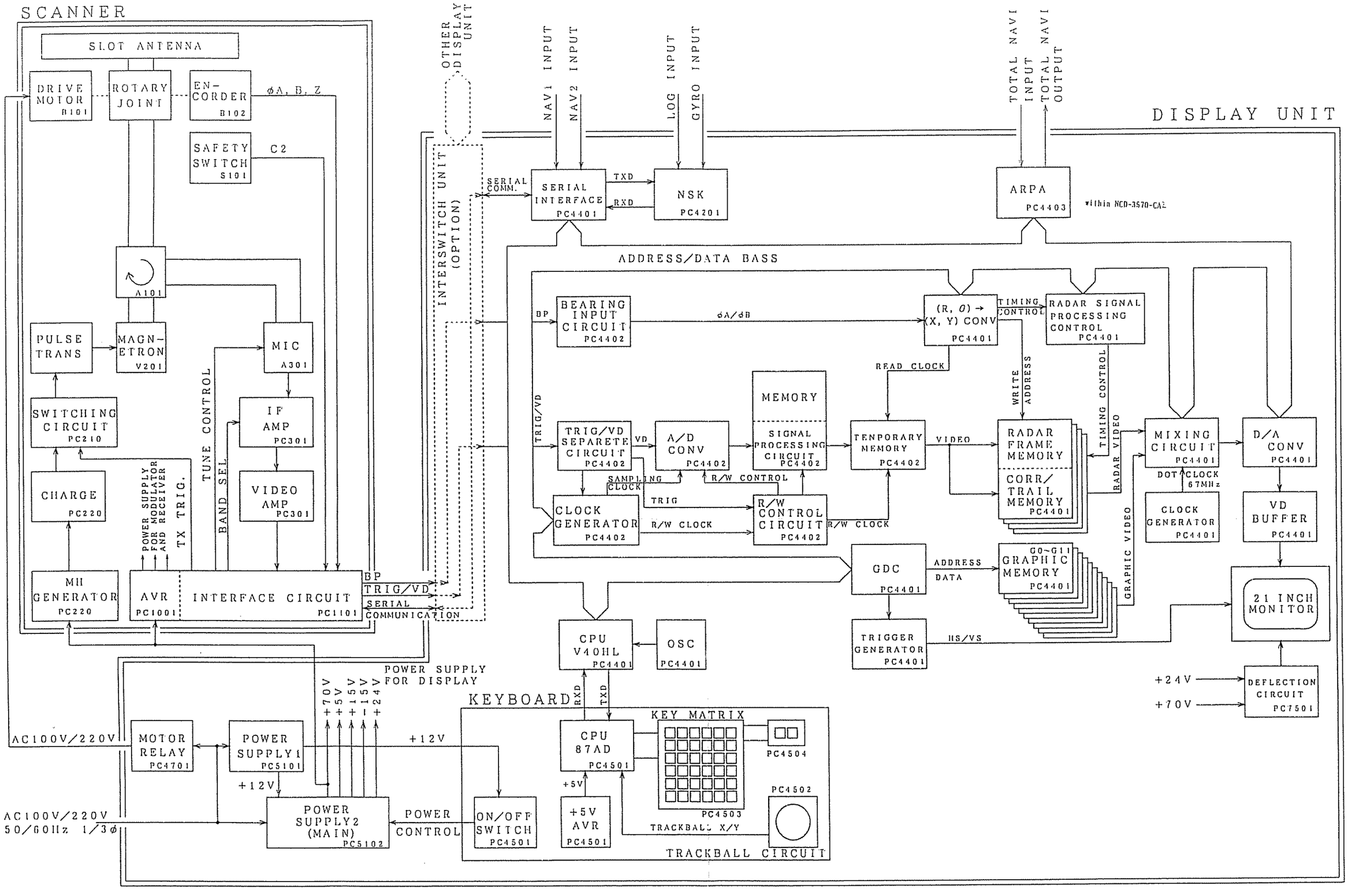


FIG. 114 BLOCK DIAGRAM OF RADAR,
TYPE JMA-7102 /JMA-7102-CA

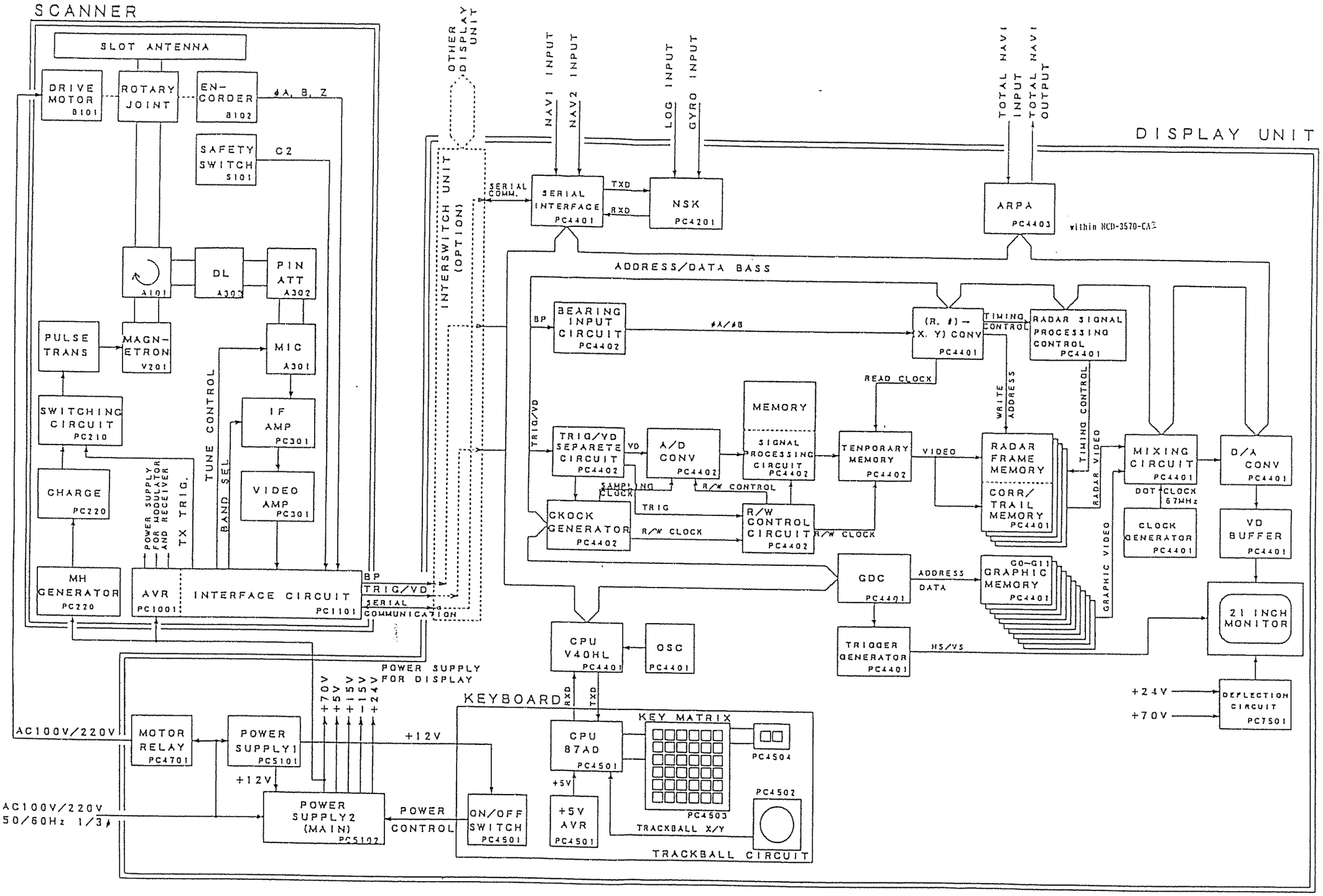


FIG. 115 BLOCK DIAGRAM OF RADAR,
TYPE JMA-7252-6 /JMA-7252-6CA /
JMA-7252-9 /JMA-7252-9CA

DISPLAY UNIT NCD-3570-□/-3570-CA□/-3590-□/-3591-□

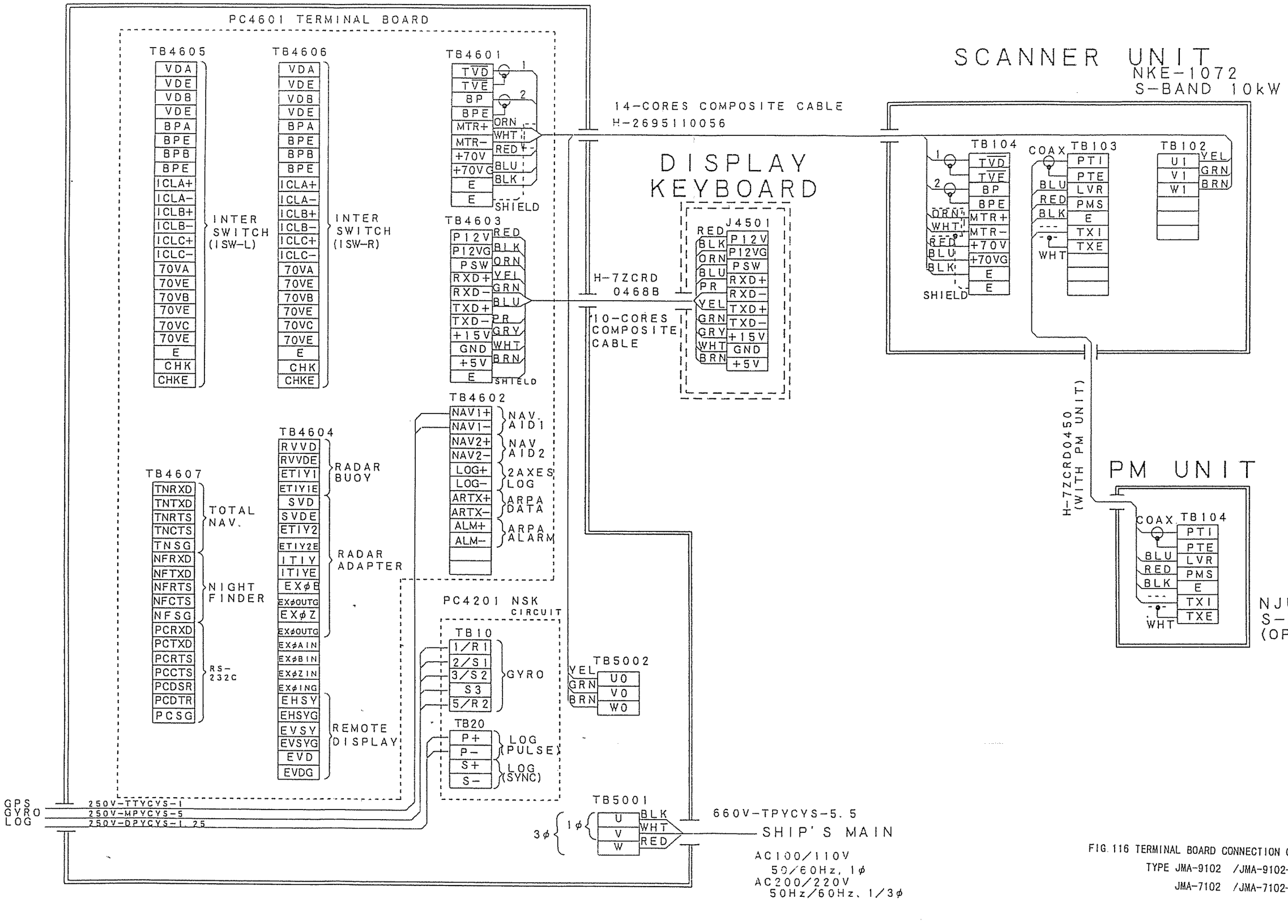


FIG. 116 TERMINAL BOARD CONNECTION OF RADAR, TYPE JMA-9102 /JMA-9102-CA / JMA-7102 /JMA-7102-CA

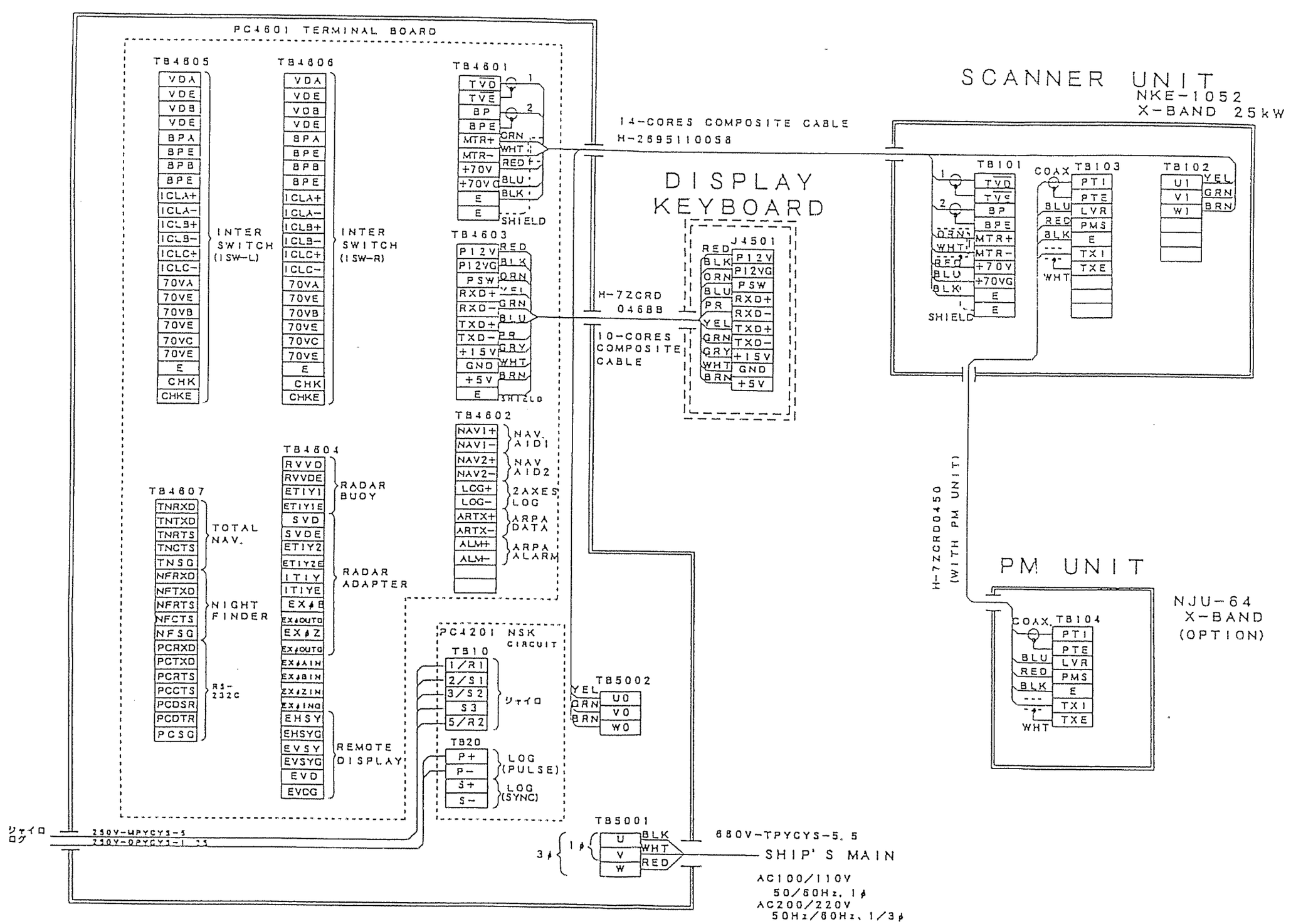
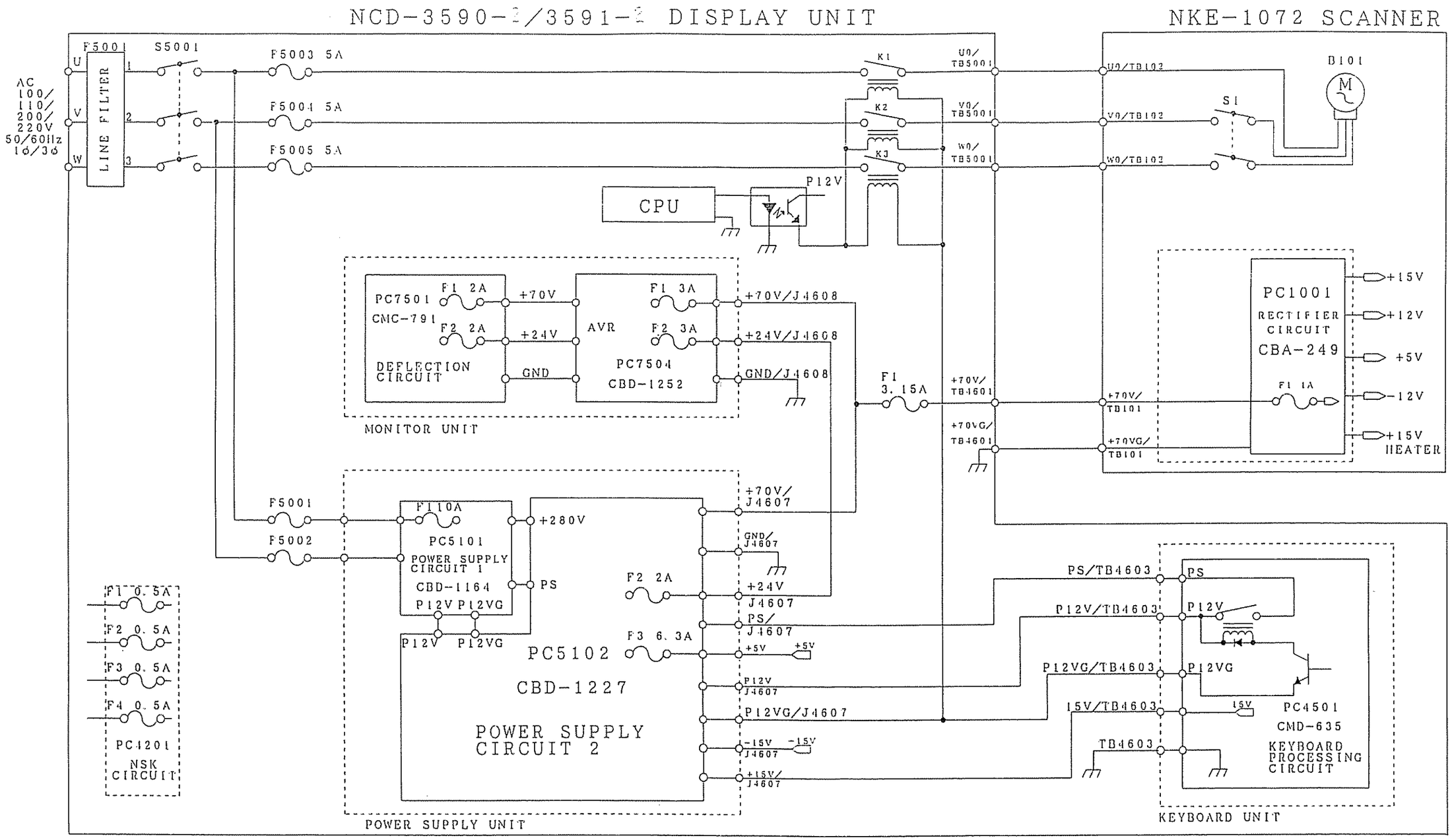


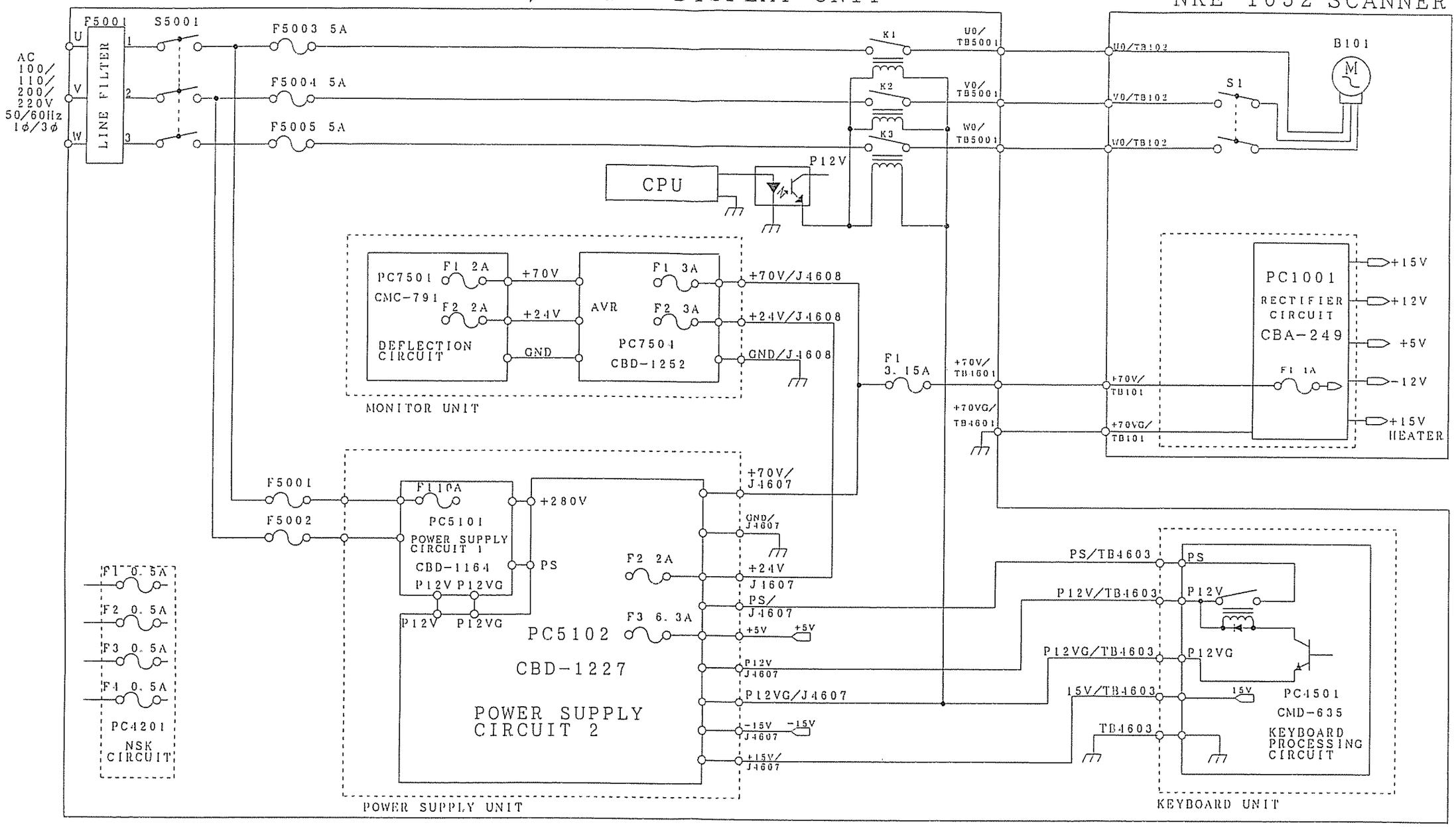
FIG. 117 TERMINAL BOARD CONNECTION OF RADAR.
TYPE JMA-9252 /JMA-9252-CA /
JMA-7252 /JMA-7252-CA



※ F5001 AND F5002
5A : WHEN PRIMARY SUPPLY (AC200V/220V)
10A: WHEN PRIMARY SUPPLY (AC100V/110V)

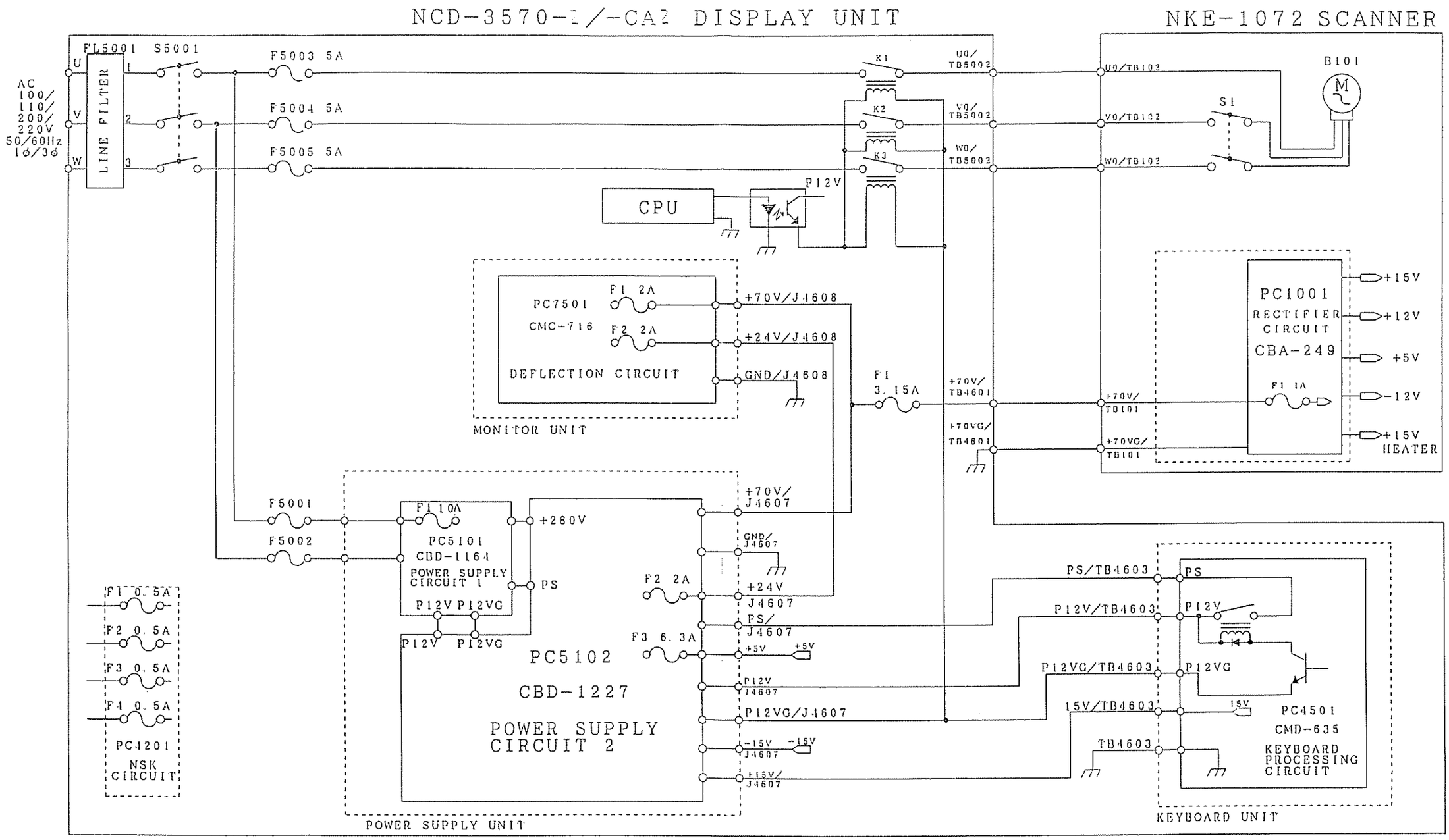
※ F5003 AND F5001, F5005
5A : WHEN PRIMARY SUPPLY (AC200V/220V)
10A: WHEN PRIMARY SUPPLY (AC100V/110V)

FIG 118 PRIMARY POWER SUPPLY OF RADAR.
TYPE JMA-9102 /JMA-9102-CA



※ F5001 AND F5002
5A : WHEN PRIMARY SUPPLY (AC200V/220V)
10A: WHEN PRIMARY SUPPLY (AC100V/110V)

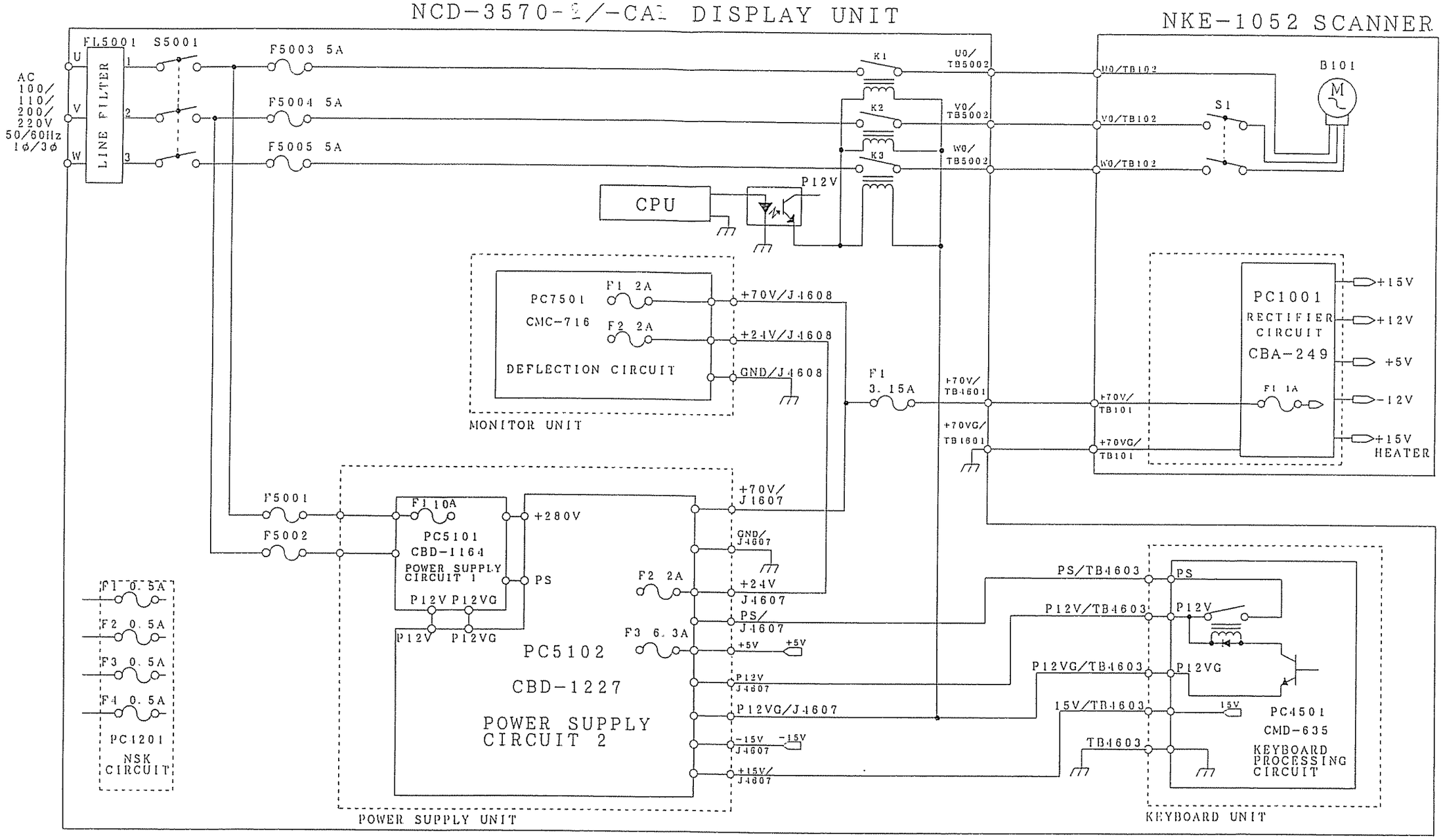
FIG. 119 PRIMARY POWER SUPPLY OF RADAR,
TYPE JMA-9252-6 /JMA-9252-6CA /
JMA-9252-9 /JMA-9252-9CA



※ F5001 AND F5002
5A : WHEN PRIMARY SUPPLY (AC200V/220V)
10A: WHEN PRIMARY SUPPLY (AC100V/110V)

※ F5003 AND F5004 , F5005
5A : WHEN PRIMARY SUPPLY (AC200V/220V)
10A: WHEN PRIMARY SUPPLY (AC100V/110V)

FIG. 120 PRIMARY POWER SUPPLY OF RADAR.
TYPE JMA-7102 /JMA-7102-CA



※ F5001 AND F5002
5A : WHEN PRIMARY SUPPLY (AC200V/220V)
10A: WHEN PRIMARY SUPPLY (AC100V/110V)

FIG.121 PRIMARY POWER SUPPLY OF RADAR.
TYPE JMA-7252-6 /JMA-7252-6CA /
JMA-7252-9 /JMA-7252-9CA

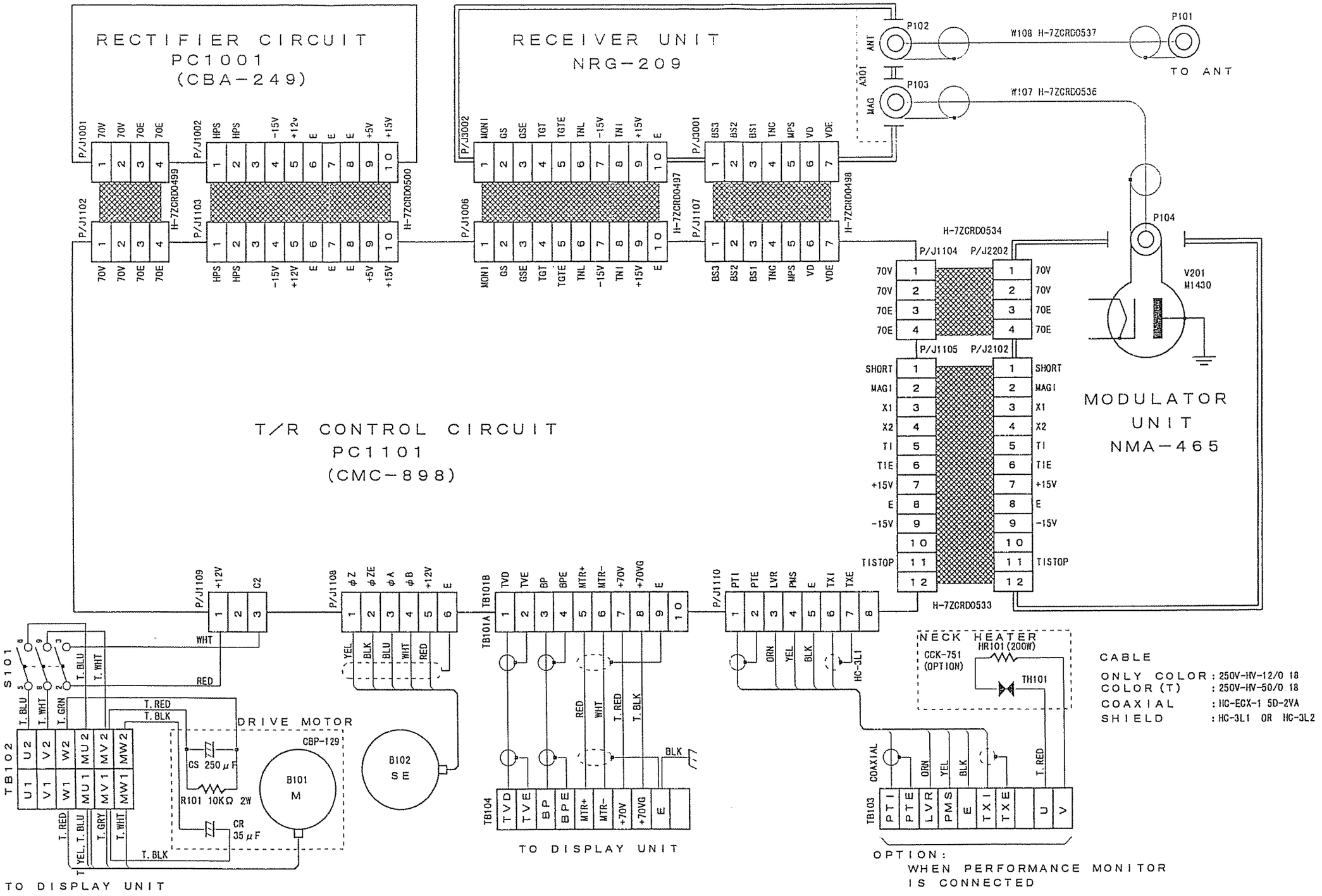


FIG 122 INTERNAL CONNECTION OF SCANNER UNIT,
TYPE NKE-1072-1

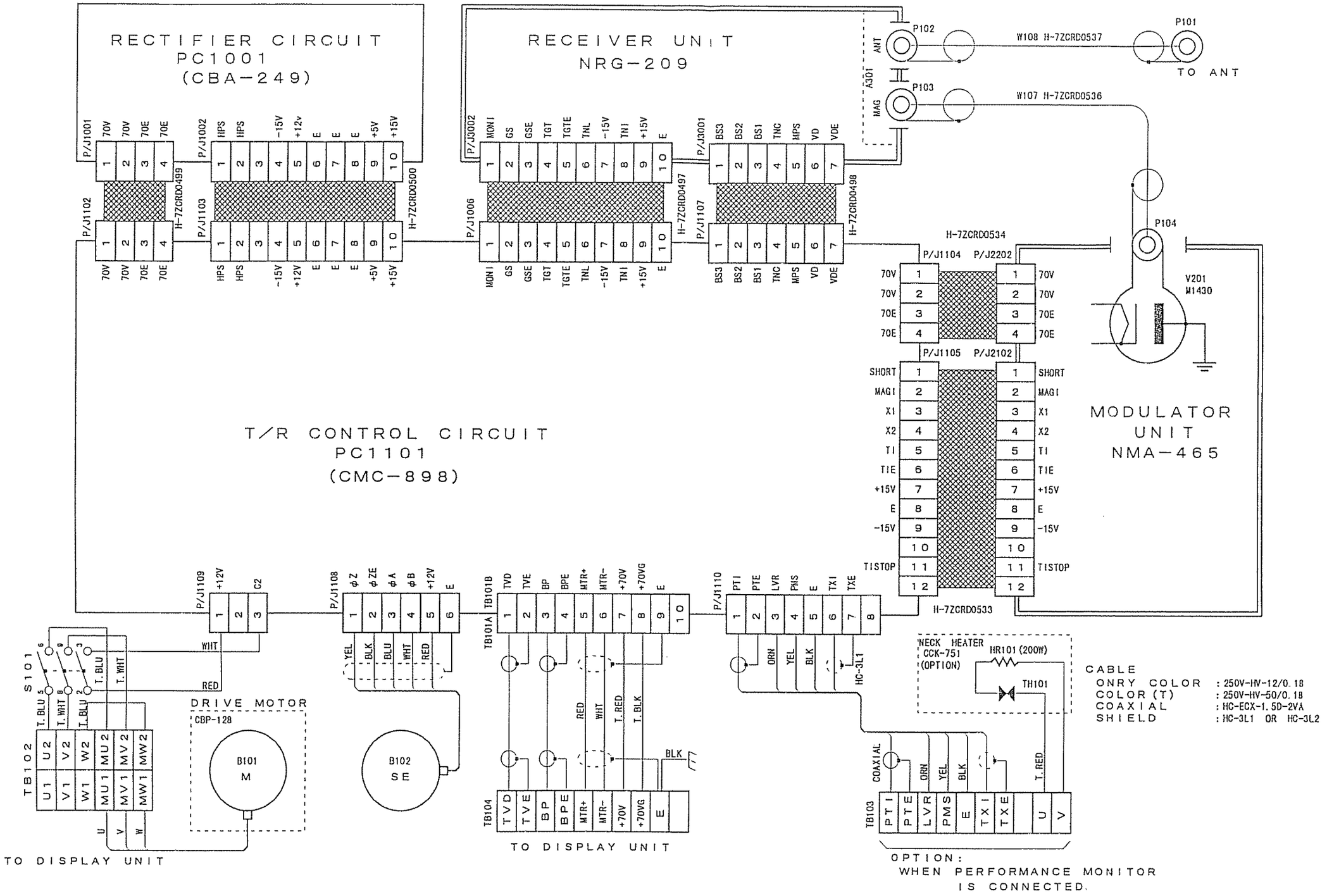


FIG 123 INTERNAL CONNECTION OF SCANNER UNIT.
TYPE NKE-1072-2

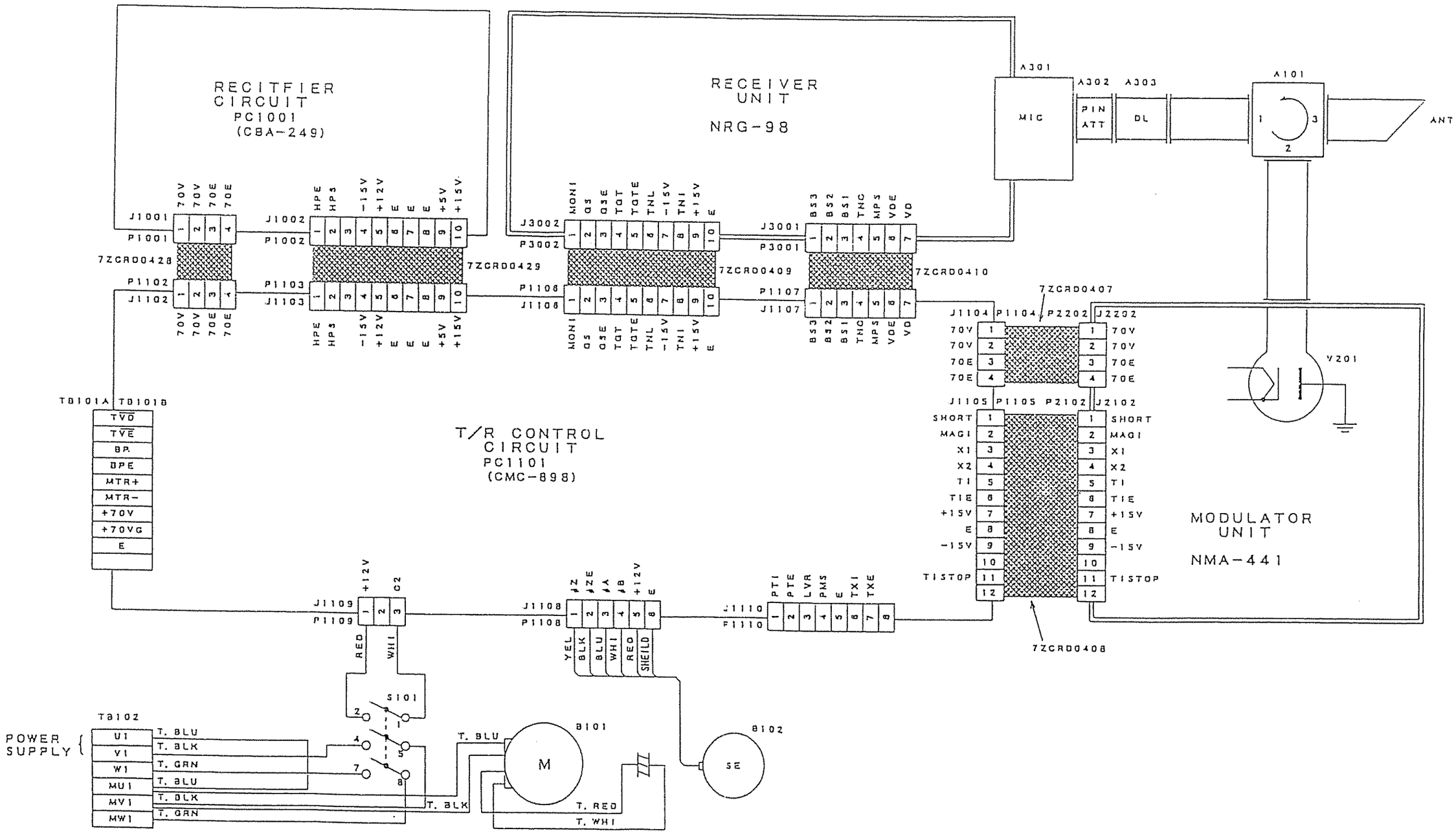


FIG. 124 INTERNAL CONNECTION OF SCANNER UNIT,
TYPE NKE-1052-61/62/91/92

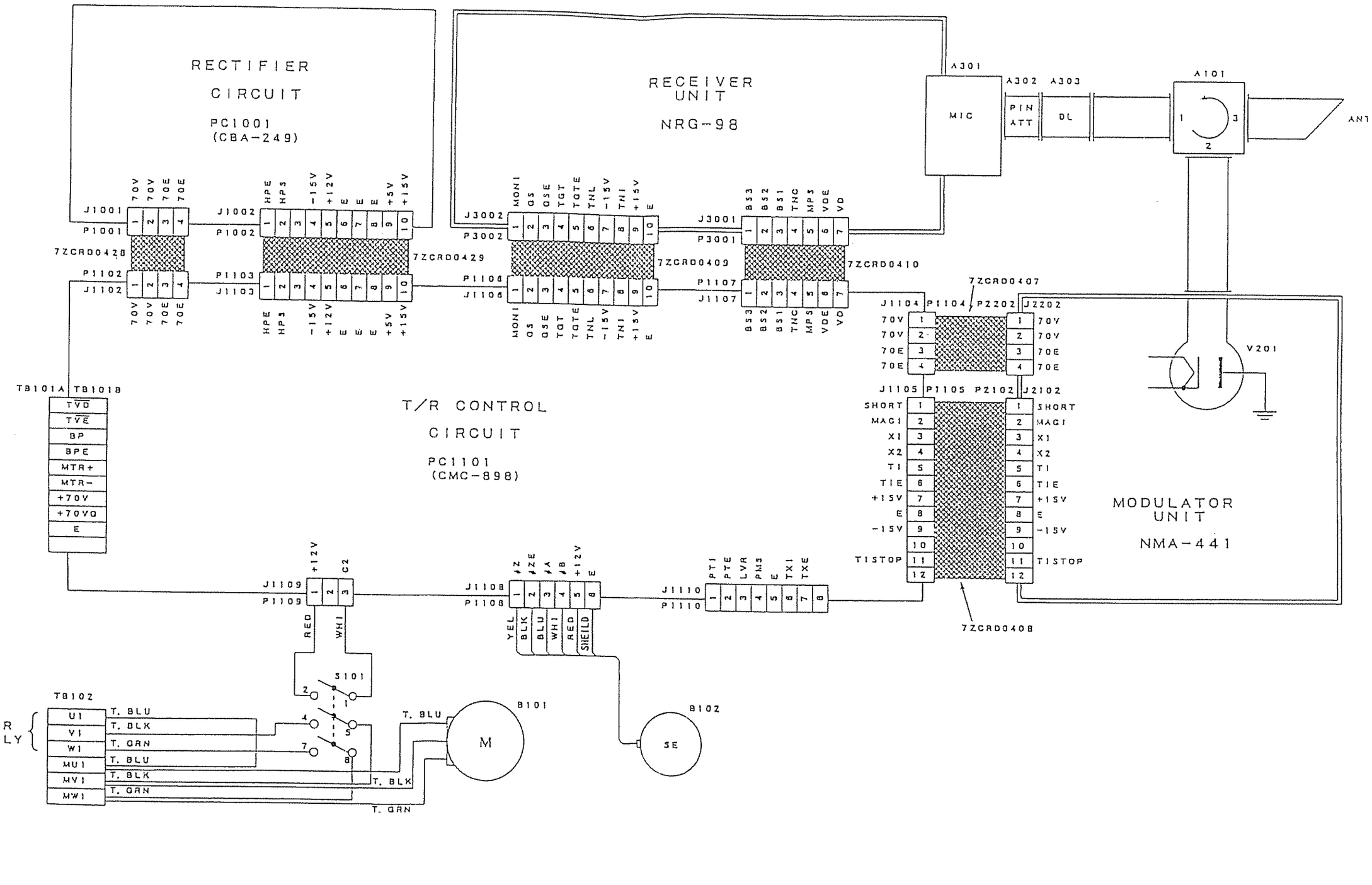
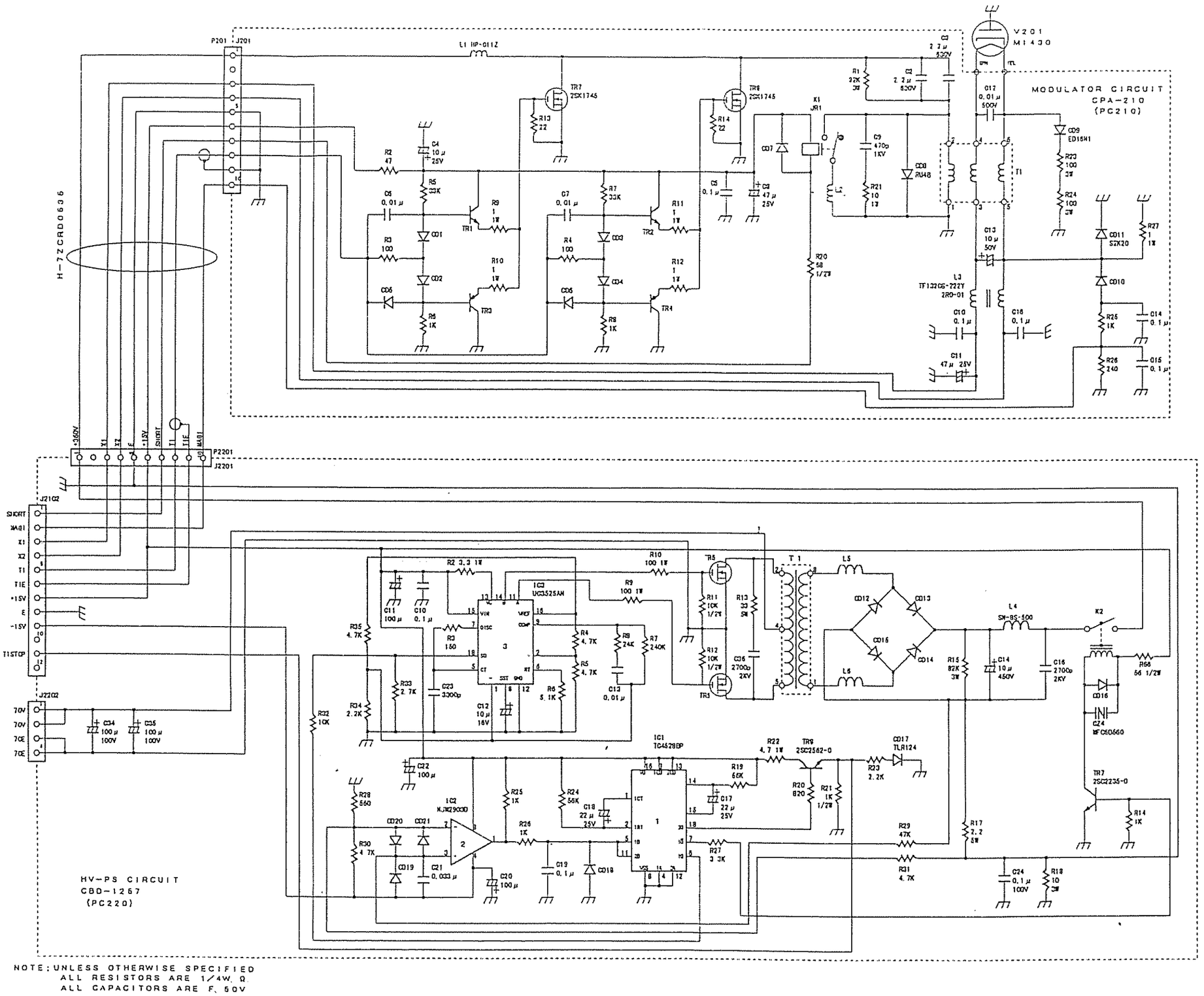


FIG 125 INTERNAL CONNECTION OF SCANNER UNIT,
TYPE NKE-1052-61F/62F/91F/92F



NOTE: UNLESS OTHERWISE SPECIFIED
ALL RESISTORS ARE 1/4W, Ω
ALL CAPACITORS ARE F, 50V

FIG. 126 INTERNAL CONNECTION OF MODULATOR UNIT, TYPE NMA-465

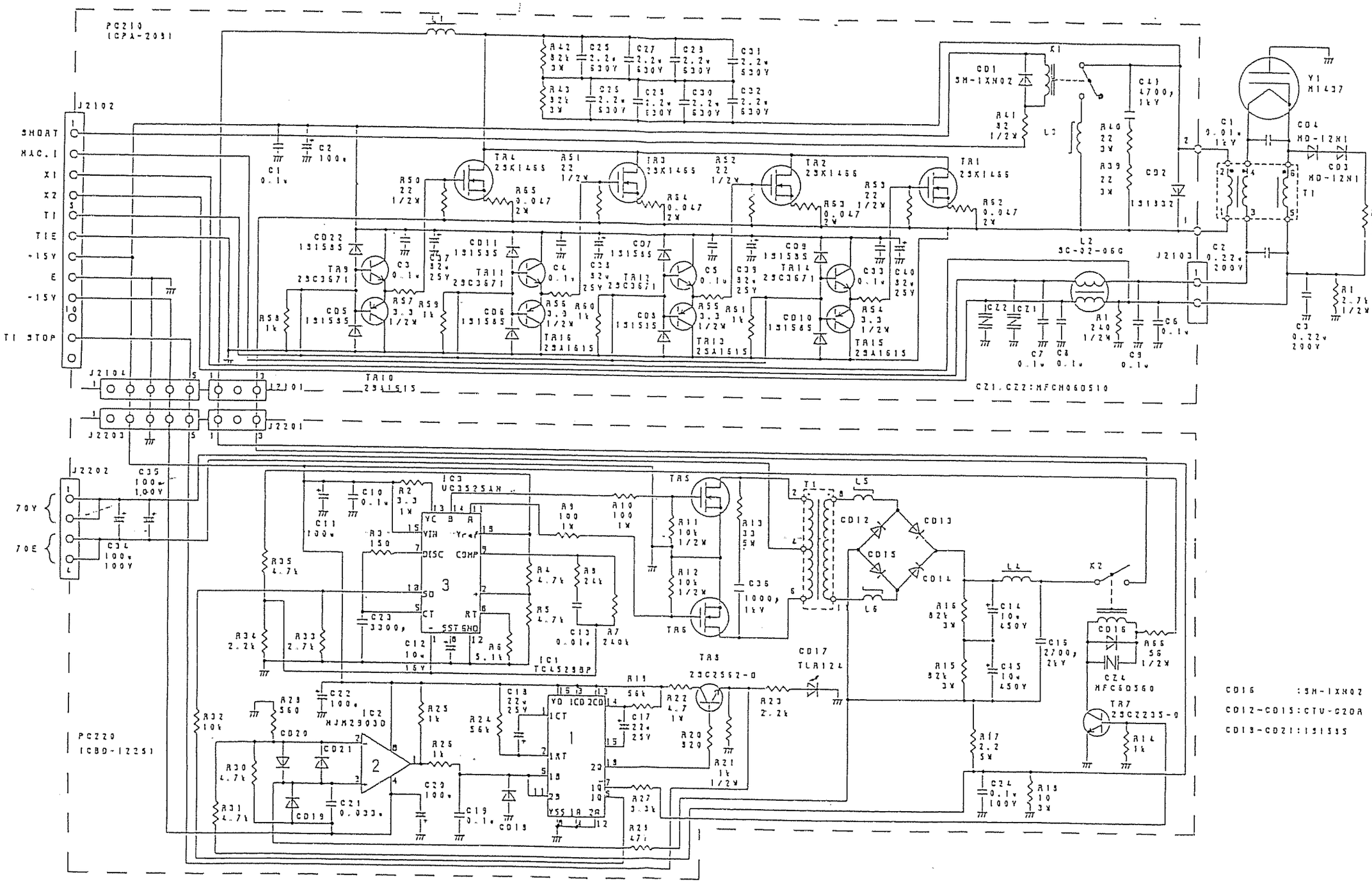
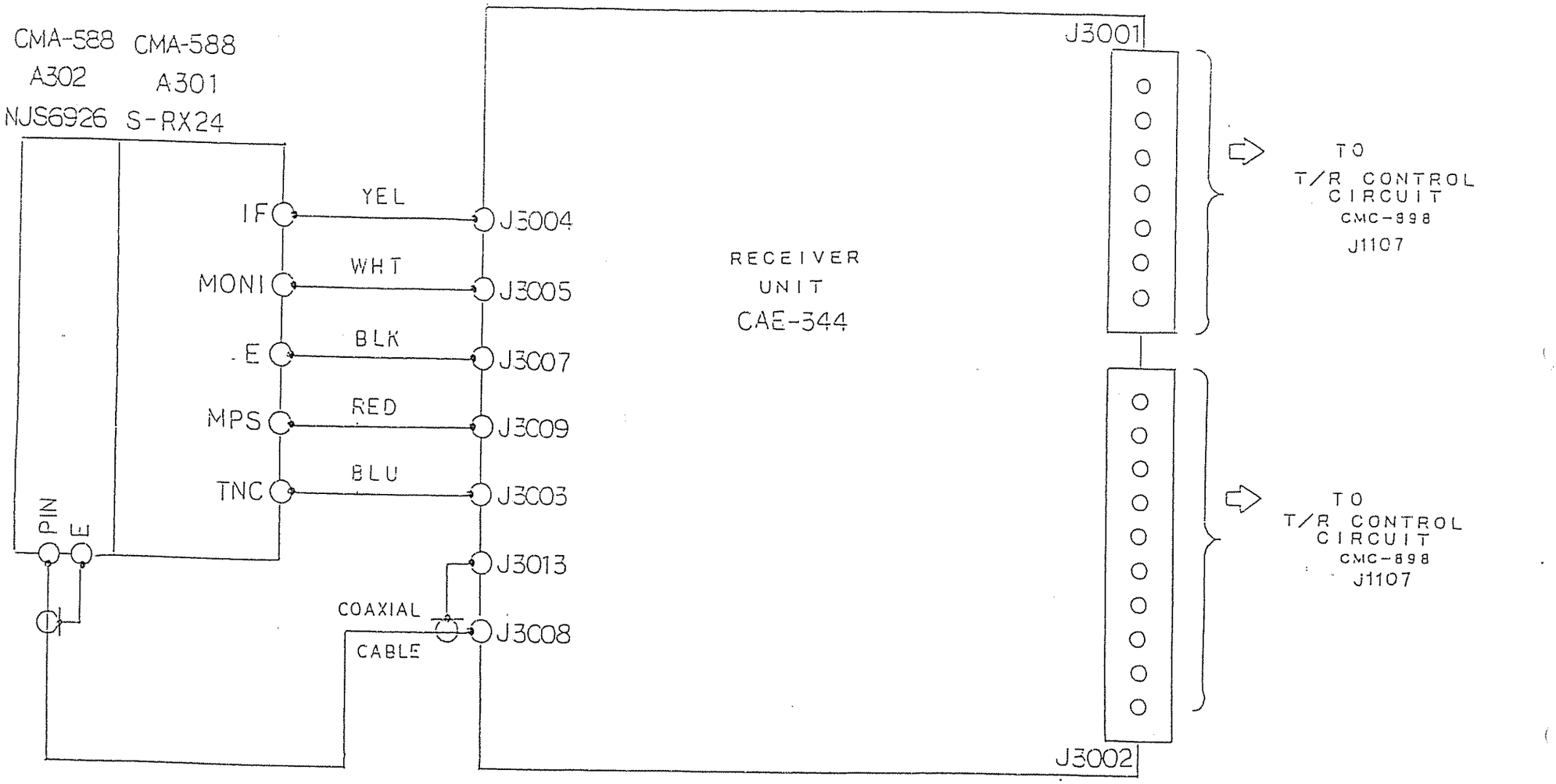


FIG. 127 INTERNAL CONNECTION OF MODULATOR UNIT.
TYPE NMA-441



CABLE

COAXIAL : HC-ECX-1.5D-2VA

COLOR : 250V-HV-12/0.18

FIG. 129 INTERNAL CONNECTION OF RECEIVER UNIT.
TYPE NRG-98

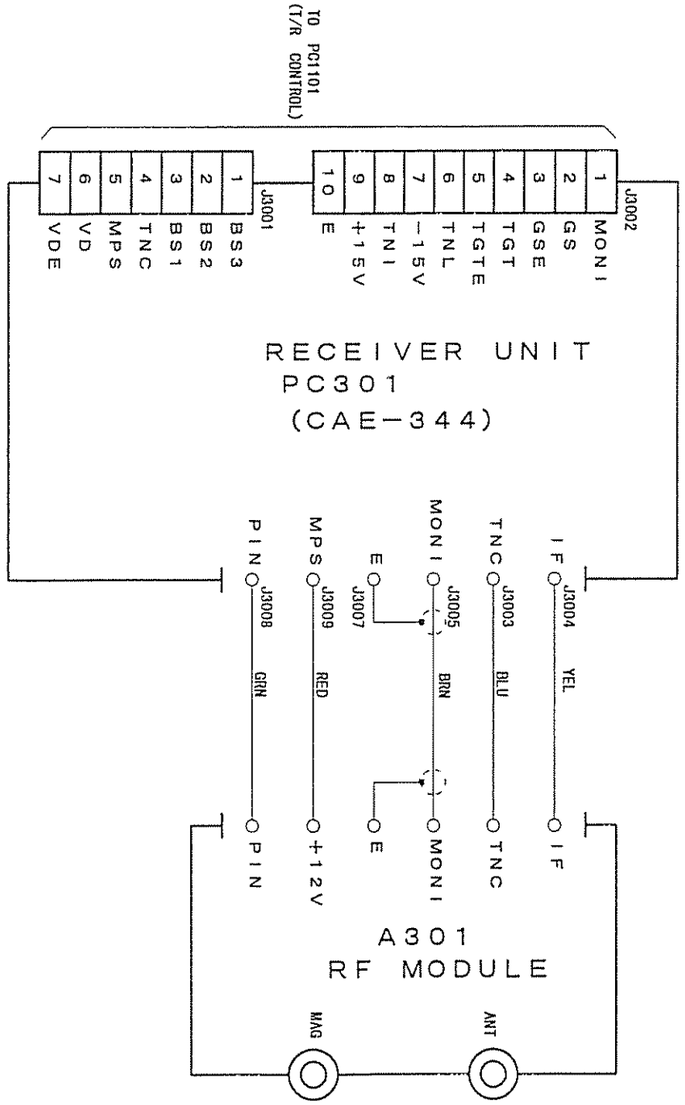


FIG. 128 INTERNAL CONNECTION OF RECEIVER UNIT.
TYPE NRG-209

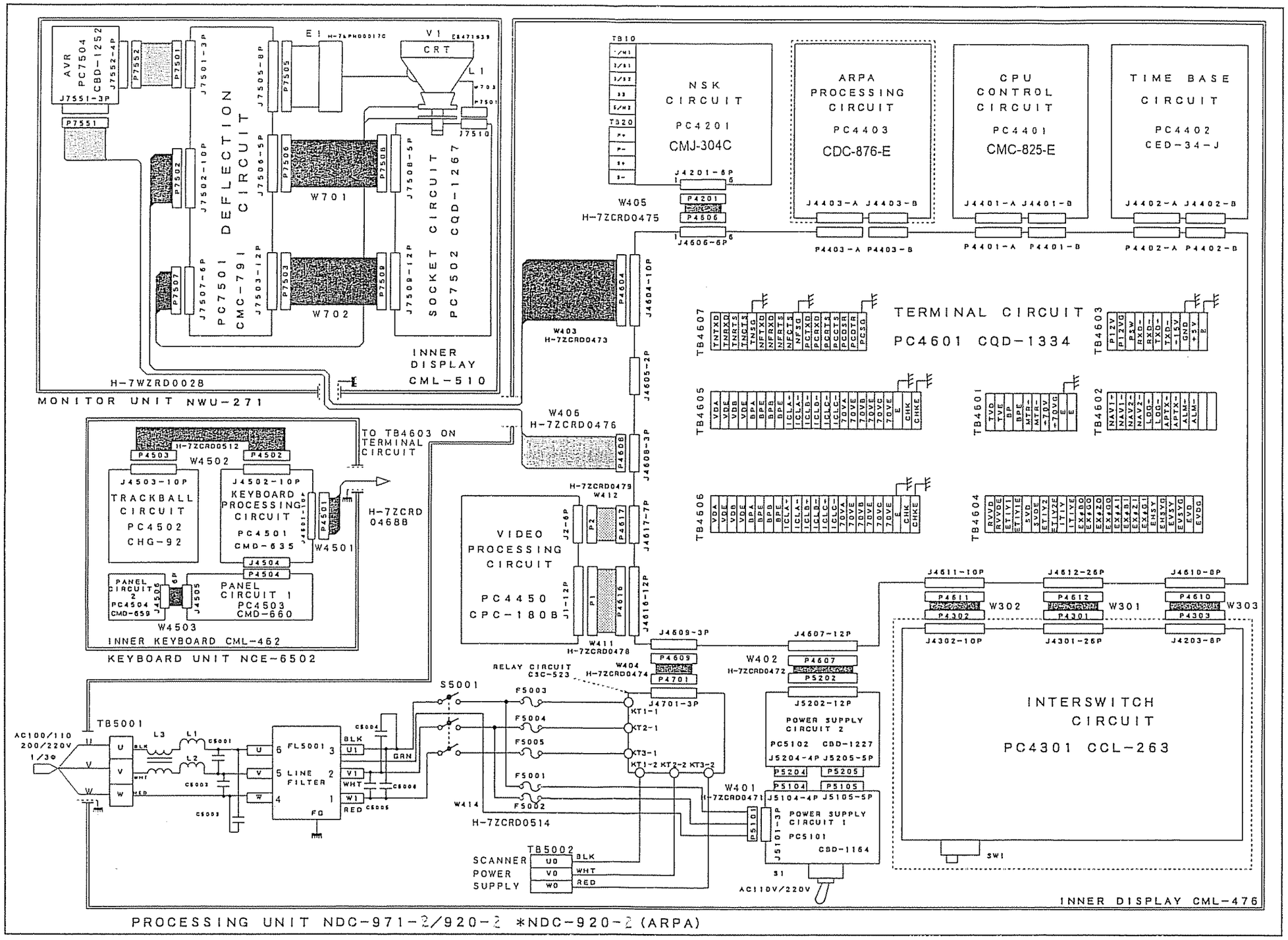


FIG.130 INTERNAL CONNECTION OF DISPLAY UNIT, TYPE NCD-3590-2/NCD-3591-2

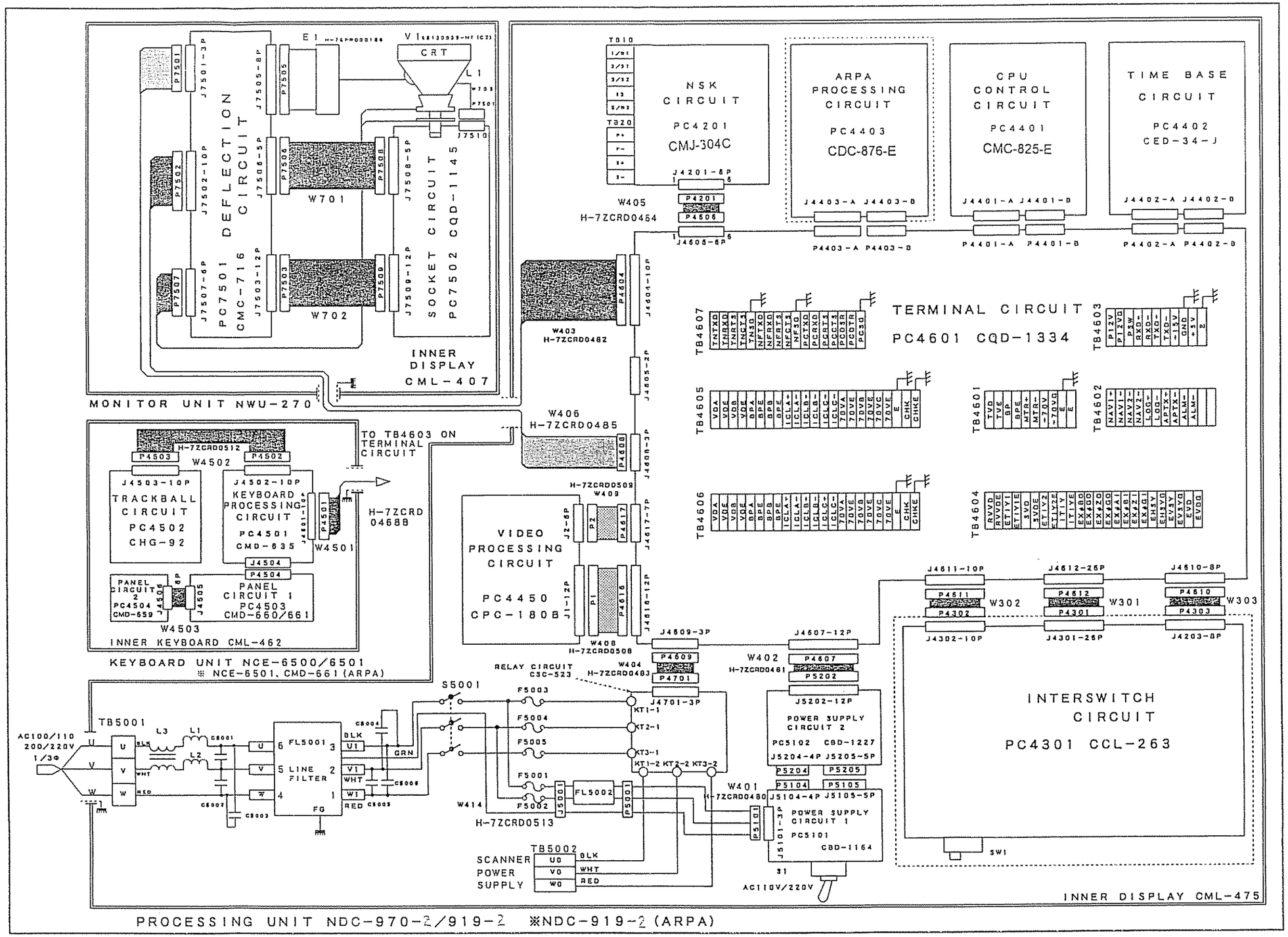


FIG. 131 INTERNAL CONNECTION OF DISPLAY UNIT, TYPE NCD-3570-2/NCD-3570-CA2

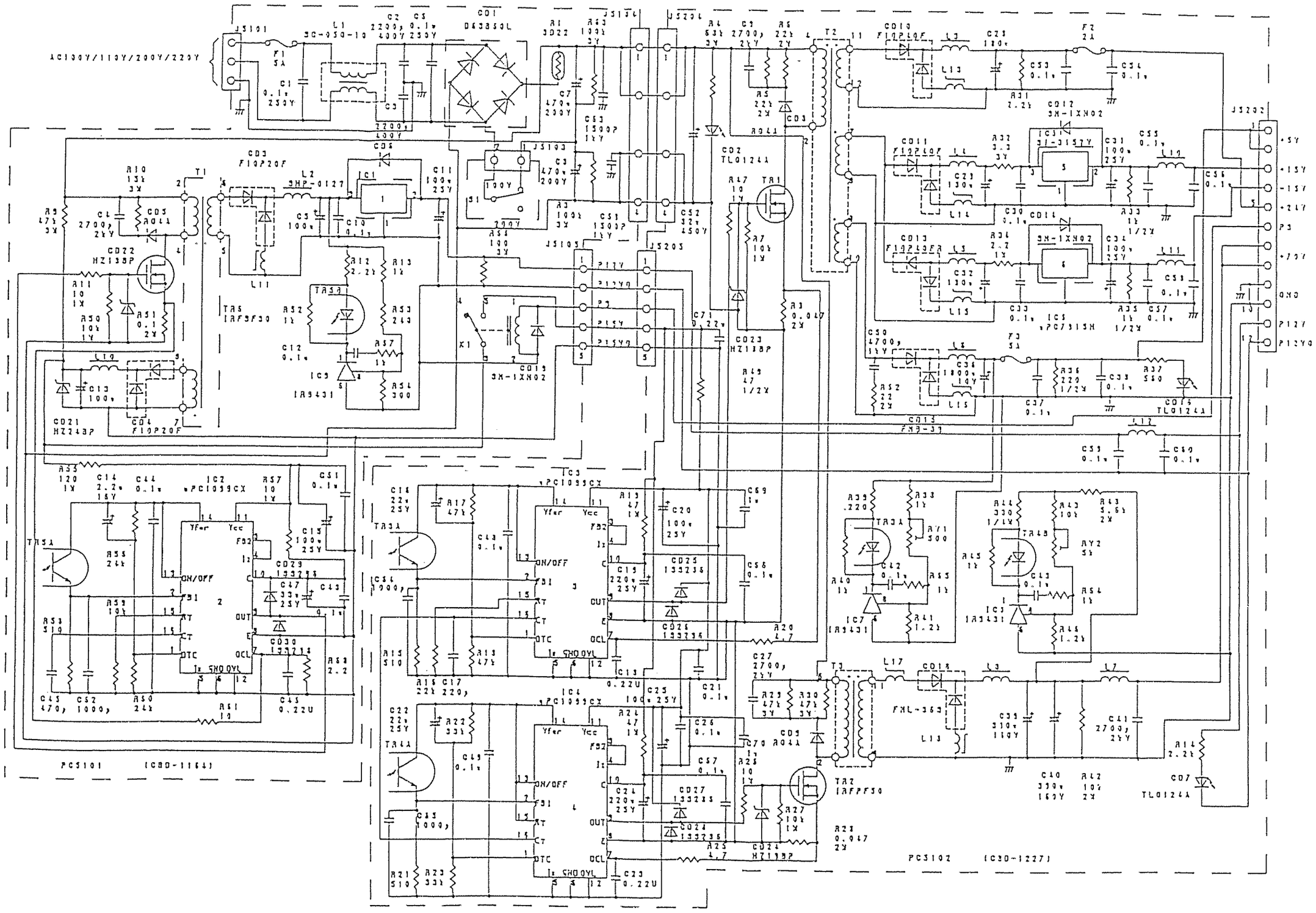
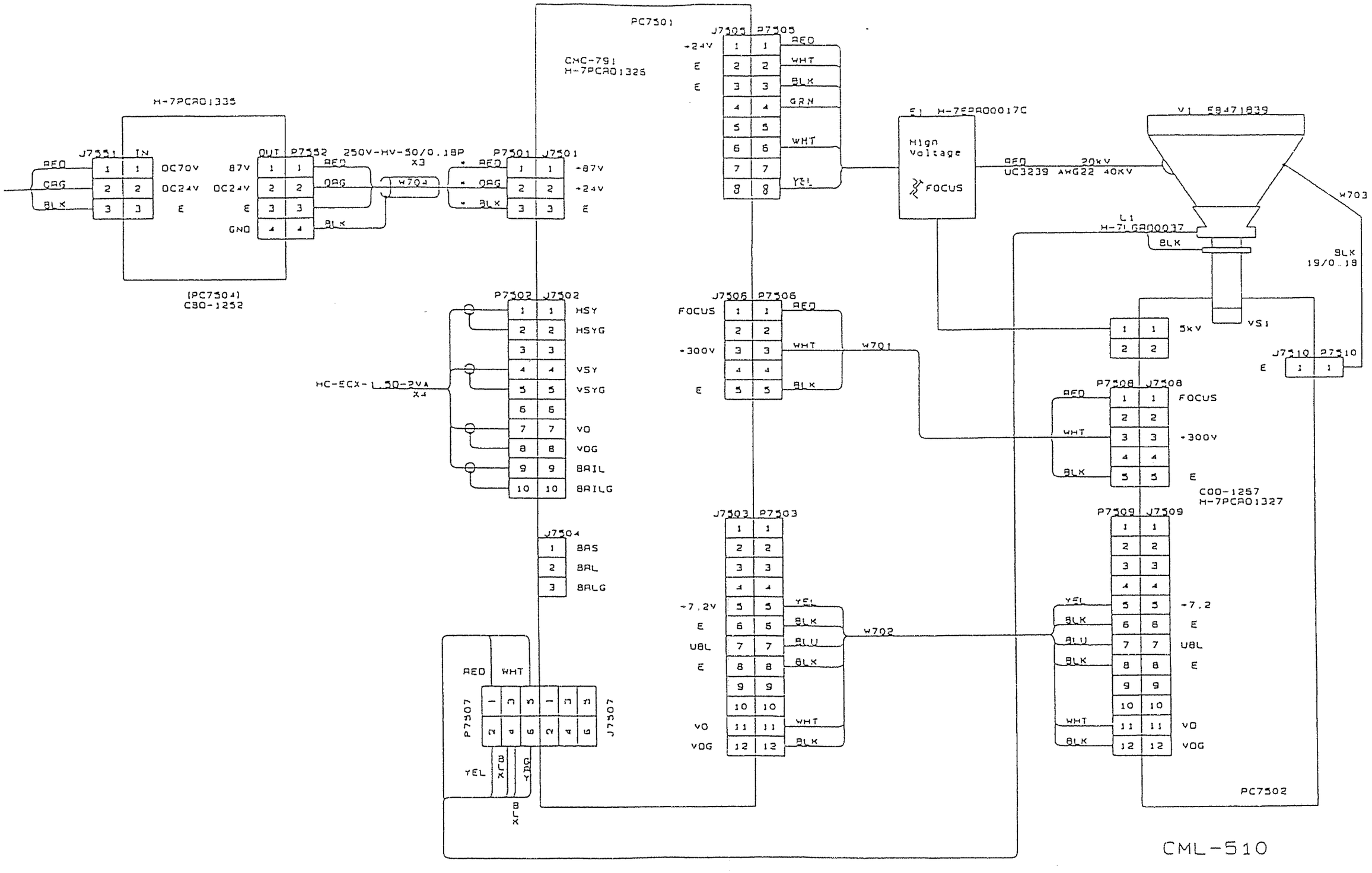
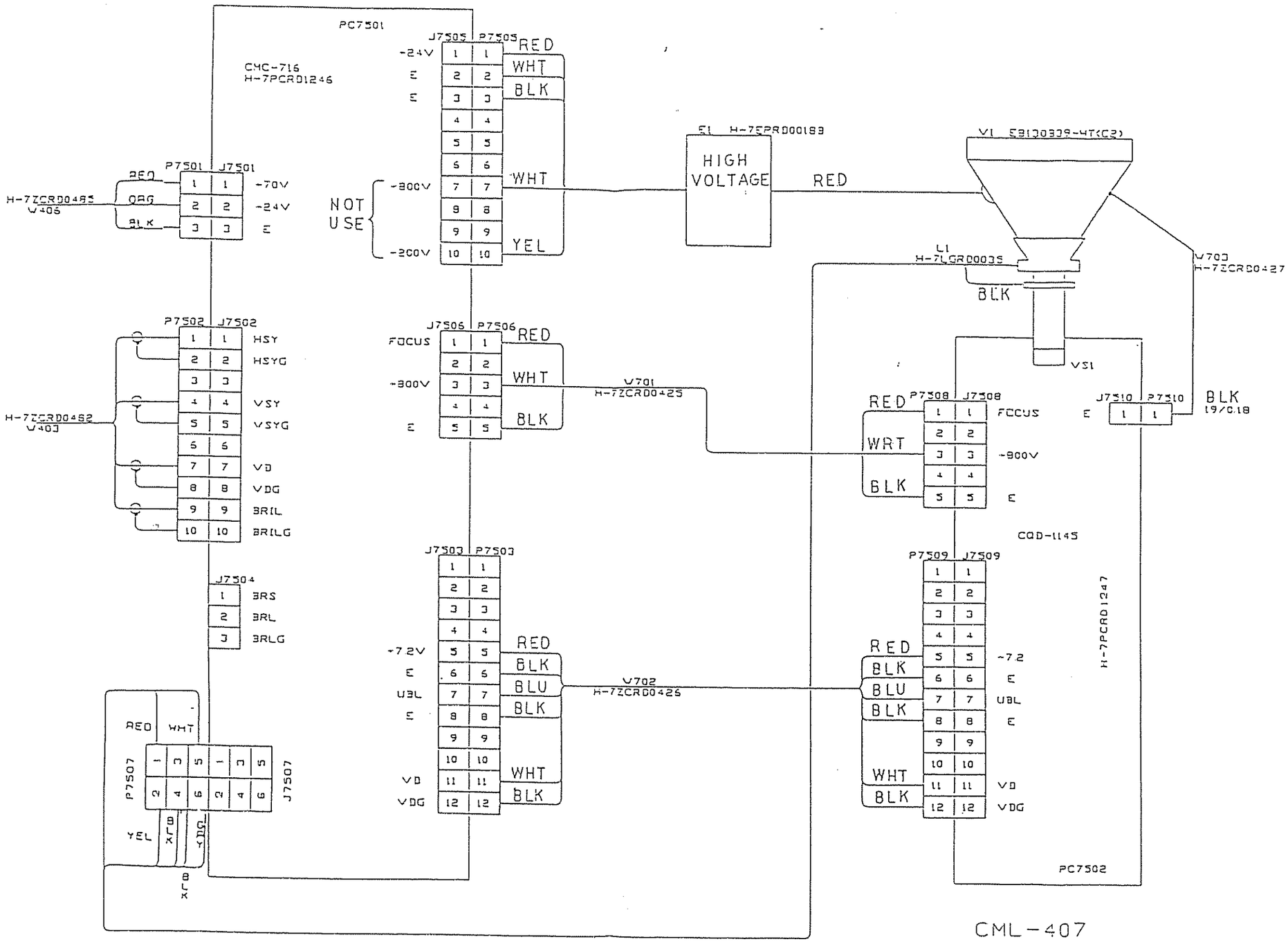


FIG 132 INTERNAL CONNECTION OF POWER SUPPLY
OF DISPLAY UNIT.
TYPE NCD-3590-2/NCD-3591-2/
NCD-3570-2/NCD-3570-CA2



CML-510

FIG. 133 INTERNAL CONNECTION OF MONITOR PART OF DISPLAY UNIT.
TYPE NCD-3590-2/NCD-3591-2



CML-407

FIG 134 INTERNAL CONNECTION OF MONITOR PART OF DISPLAY UNIT.
TYPE NCD-3570-2/NCD-3570-CA2

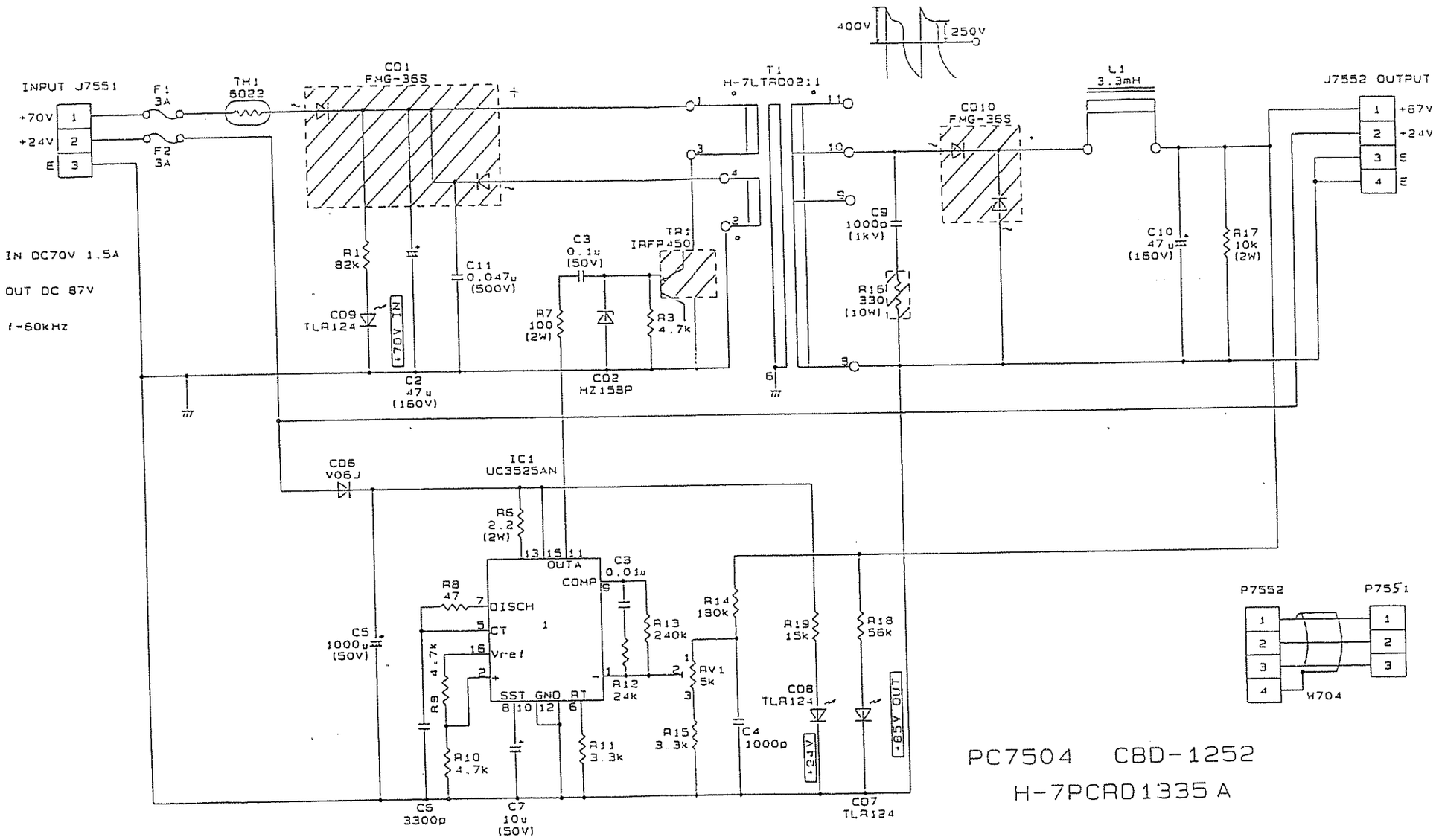


FIG. 135 INTERNAL CONNECTION OF MONITOR POWER OF DISPLAY UNIT, TYPE NCD-3590-2/NCD-3591-2

NOTE : when removing or touching the PC4201. set the gyro power supply swith S1 to OFF or cut-off the gyro signal input to TB10 or J4202 in order to prevent damages to IC'S and to avoid electrical shocks.

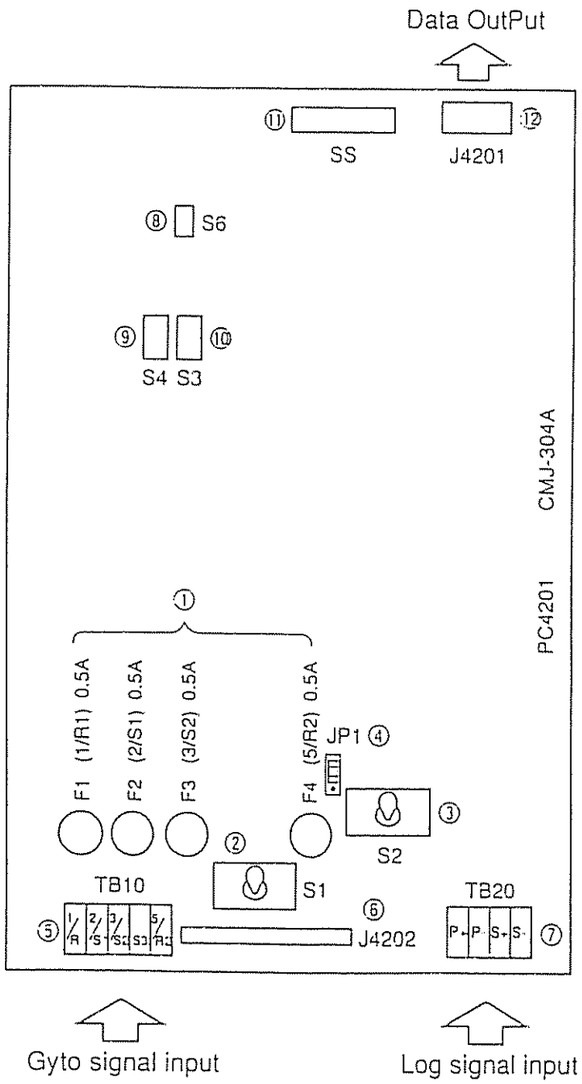
NOTE1 : Do not for get to sel The switch S1 (②) to OFF befor performing the connection of gyro.
If the switch S1 (②) is set to ON without the correct setting of S2 (③) fuses F1～F5 (①) may burn out.
When setting the switch S1 (②) to ON, following settings must be all completed.

NOTE2 : Fuses are F1～F4 (①) and are used in each Lines of gyro signals and exterior power supply line.
When the fuse has burned out, replace with same type fuse after investigating the cause of burn-out.
Fuse is MF51NN-0.5A.

NOTE3 : Selectir of applicable gyro. Setting of S2 (③) and S5 (⑪) Should be made correctly in accordance with the setting table. The revolution direction (bit8) of S5 (⑪) after energized. and if the revolution is reversed. if Should be changed over.

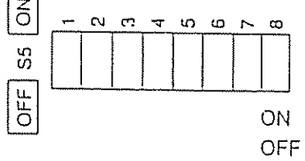
NOTE4 : S5 (⑪) -5～8 deawing are setting for speed log signals of the ships.

NOTE5 : The elecrtric current for Gyro signals is as follows.
Step Type 70mA (DC35V)
Syncro Type 50mA (AC100V)



SETTING GYRO SWITCH

a. S5 (⑪) Gyro Type selector switch.
S5 setting to be mode according to setting Tadle.



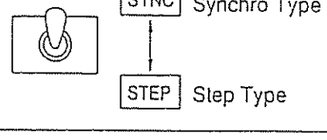
Refor to Fig.139

ON : 1
OFF : 0
} to be specified

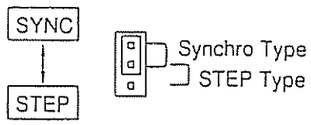
S5 SETTING TABLT

		1	2	3	4	5	6	7	8
GYRO SIGNAL	SYNC	0							
	STEP	1							
	360X		0	0					
	180X		0	1					
	90X		1	0					
	36X		1	1					
	DIRECTION				0				
					1				
LOG SIGNAL	TYPE	PULSE				0			
		SYNCRO				1			
	PULSE/NM						0		
		800P/360X						0	0
		400P/180X						0	1
		200P/90X						1	0
		100P/36X						1	1

b. S2 (③) Gyro Type Selector

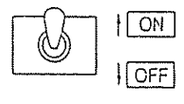


c. JPI (④) Gyro Type Selector



d. S3 (10) , S4 (9) is Used by Service personnel
- S3 (⑩) reset the CPU.
- S4 (⑨) setting for "O" degree of the bearing.

e. S1 (②) Gyrp power supply switch



After confirming the Completion of all settings, set to ON.

FIG. 136 INTERNAL SETTING OF NSK LOG OF RADAR.
TYPE JMA-7000 /JMA-9000 SERIES