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FURUNO

SERVICE MANUAL

COLOR SCANNING SONAR

MODEL CSH-7

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(MAYA) CSH-7

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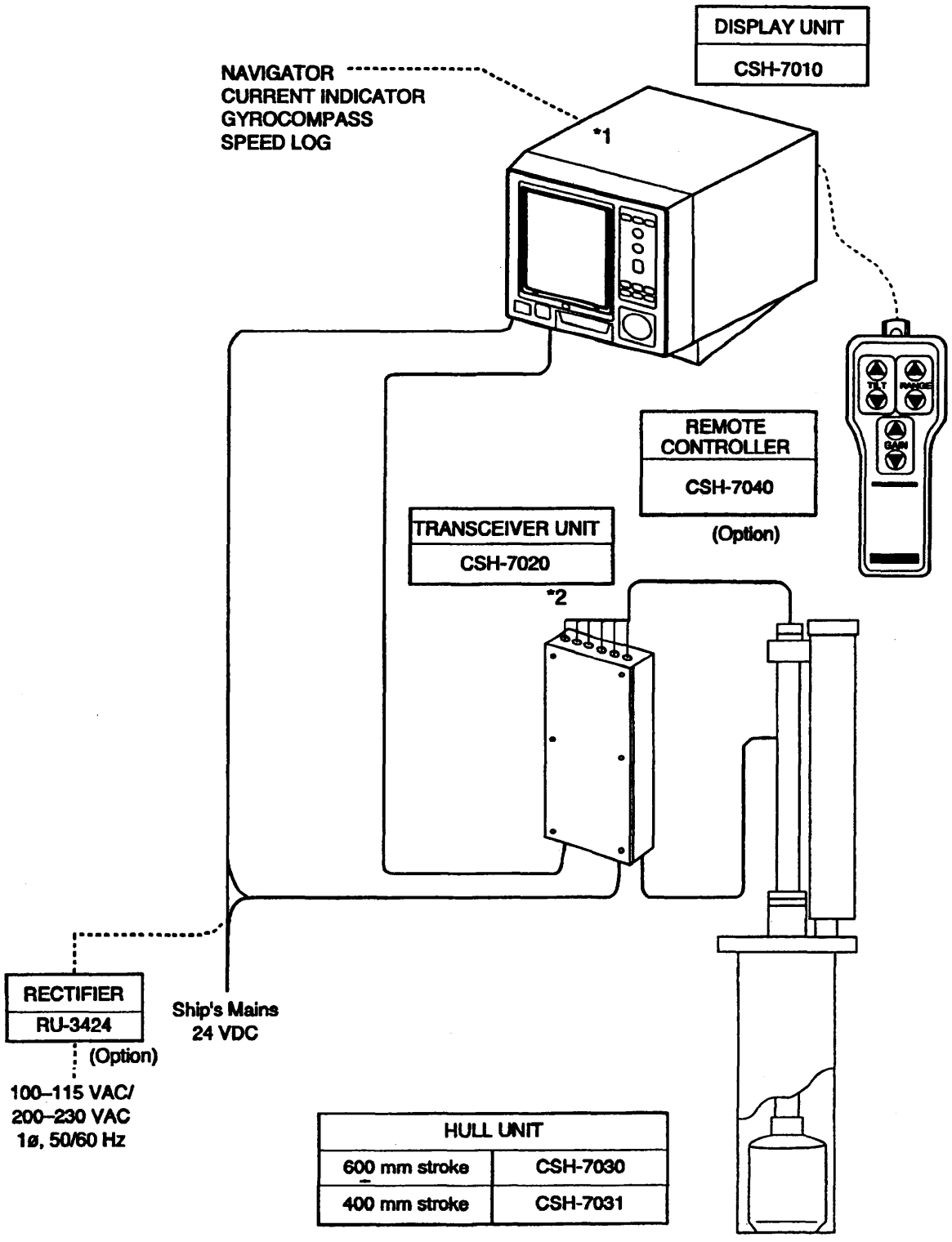
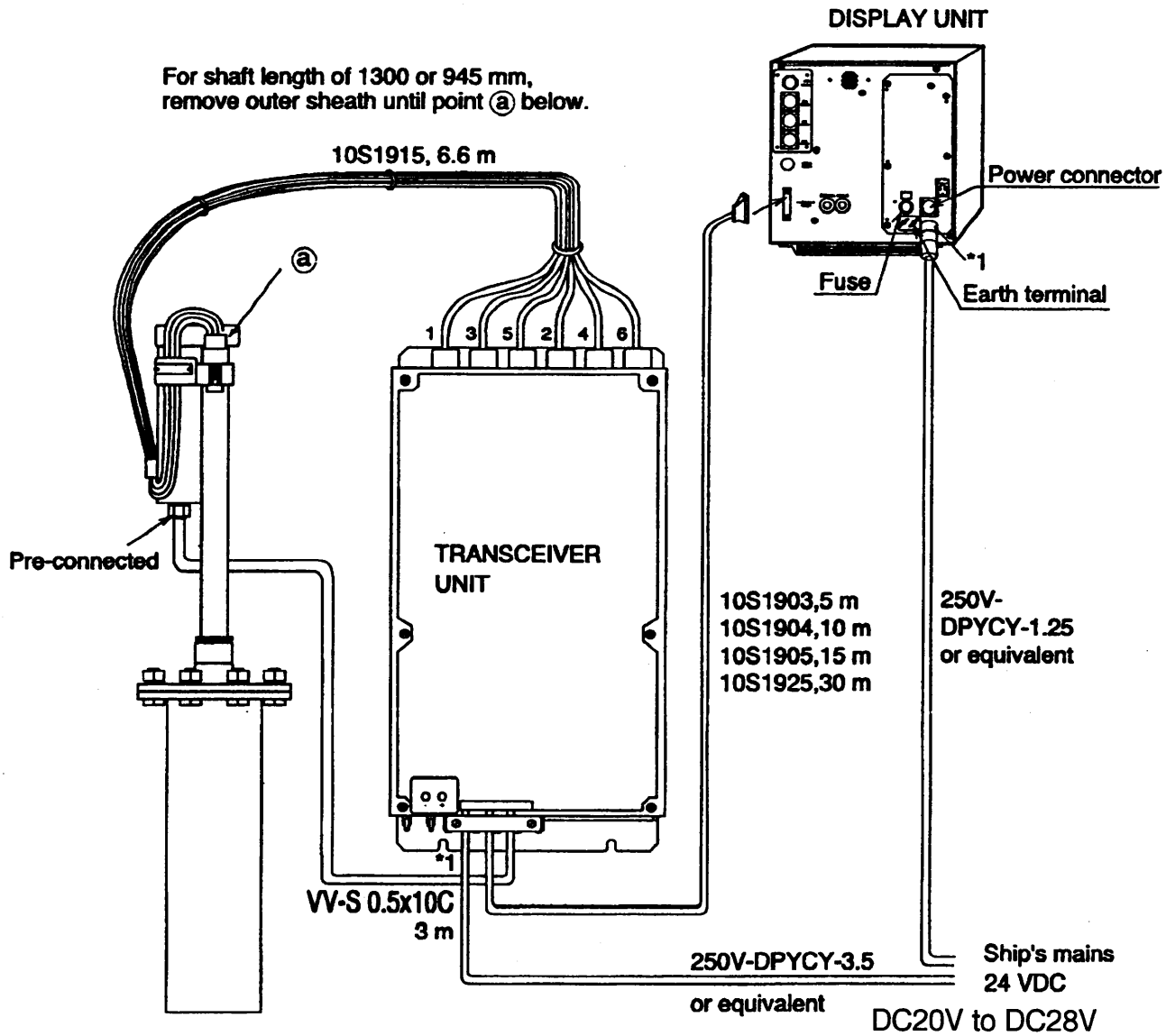
1. GENERAL

1.1 System Configulation



*1:Interface Module CSH-7050 (option) required to connect external equipment.
*2:The transceiver unit can be mounted on the hull unit with Tansceiver Frame Kit (option).

1.2 Wiring Diagram

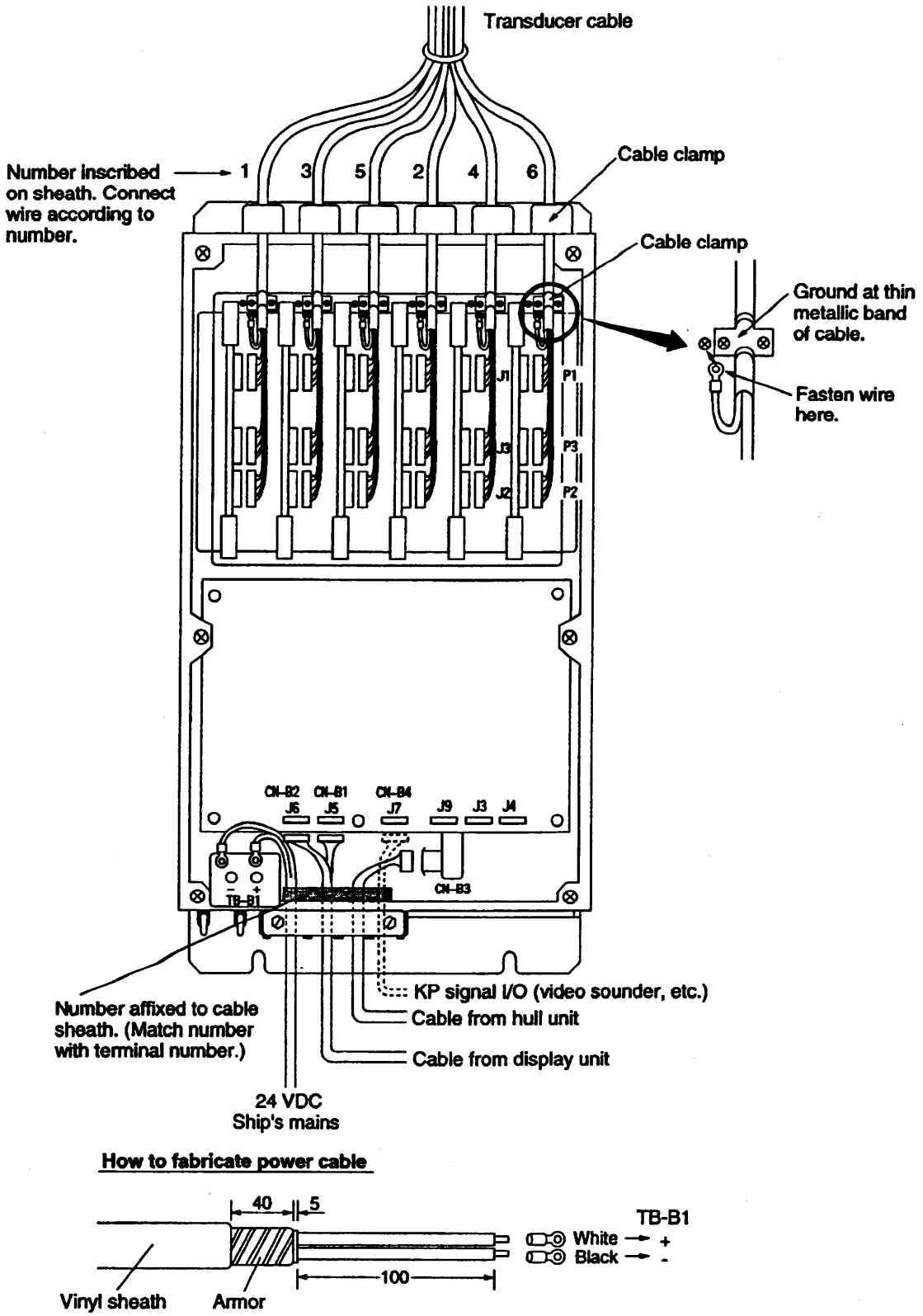


*1 Fabricate cable in field.

Power Consumption
160W (average)
180W (ship`s speed 16 knots,
raising transducer)

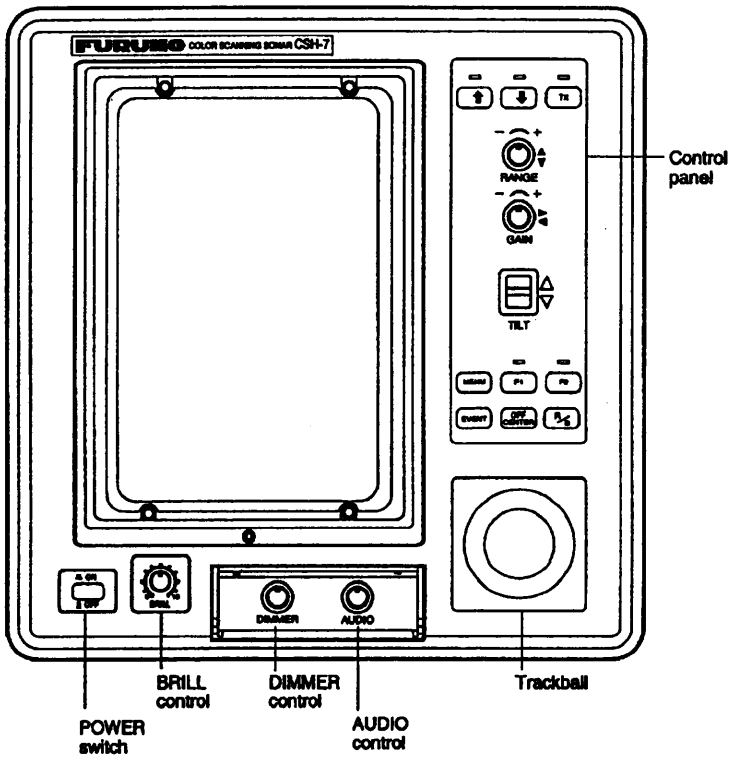
1.3 Wiring the Transceiver Unit

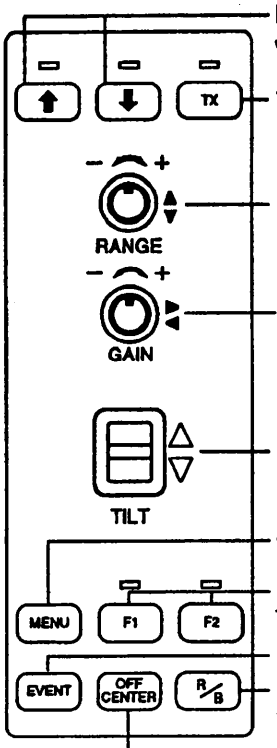
Except the power cable, all cables connected to the transceiver unit are factory-fitted connectors.



How to fabricate power cable

1.4 Display Unit Control Panel description





Raises, lowers the transducer, respectively. Lamp above a key blinks while the transducer is moving and lights when it stops.

Turns transmitter on/off; freezes the display. The lamp above the switch lights when the transmitter is turned on and flickers when off.

Selects a picture display range. Also functions to select items on menu screens. Note that this control turns endlessly in both directions.

Adjusts receiver sensitivity. Adjust for clear presentation of fish echoes. Also functions to change settings on menu screens.

Tilts the sounding beam between 0° and 55°. The current angle always appears on the screen.

Opens/closes the menu.

Function keys; execute assigned program when activated. The lamp above a key lights when function is activated.

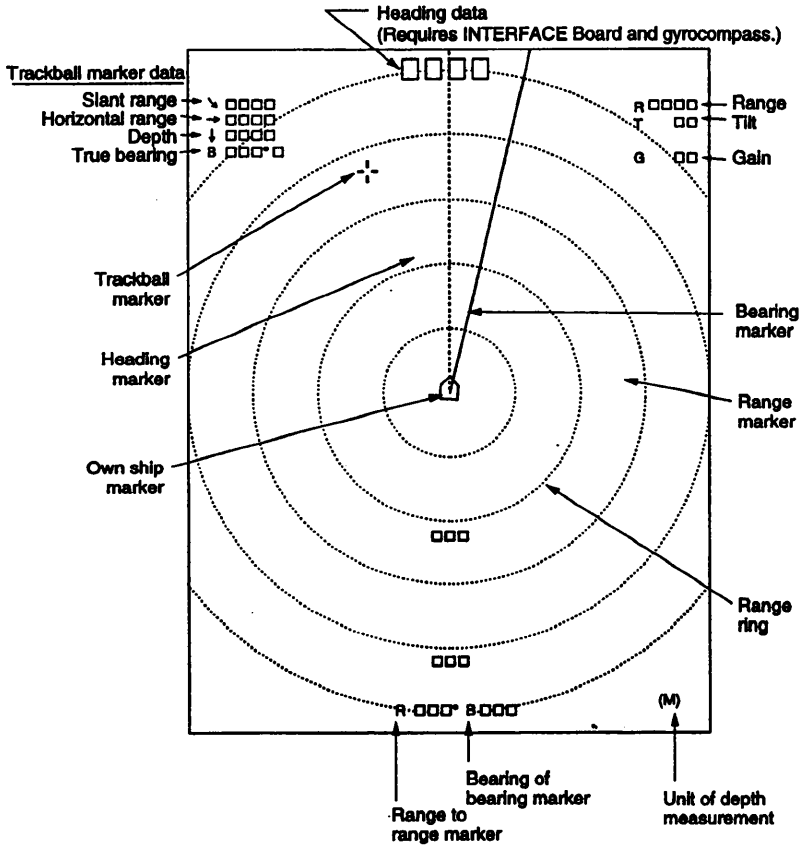
Inscribes/deletes an event marker.

Draws straight line, called bearing marker, from own ship position toward the trackball marker and simultaneously draws a circle (range marker) with a radius being the distance between the own ship marker and trackball marker. Range and bearing data of the intersection of the two markers are dislayed at the bottom of the screen. To turn off the range and bearing markers, move the trackball mark near the own ship position and press the R/B key.

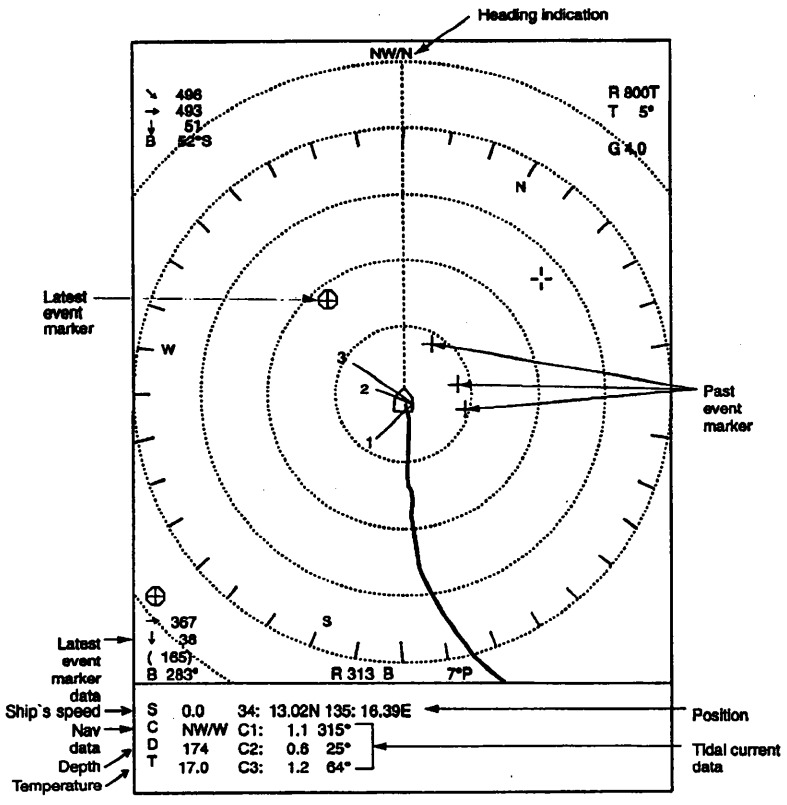
Shifts screen center to cursor location.

1.5 Markers and Data Display

● Standard Markers and Data



● Optional markers and data in the normal plus text mode



1.6 Scan Menu Operation

Press the MENU key in TX mode ON.
(The value shown on the menu screen is one programed to the FUNC key which is selected presently.)

	* * SCAN MENU * *	(RANGE SW: U/D GAIN SW: L/R)			
	DEGAUSS	: EXECUTE			
	AUTO DEGAUSS	: OFF	TIMER	GYRO	
†	DISPLAY MODE	: NORM	TEXT		
	TX OUTPUT	: 10			
	PULSELENGTH	: 10			
	TX CYCLE	: 10			
	TVG NEAR	: 10			
	TVG FAR	: 10			
	AGC	: 10			
	NOISE LIM	: 10			
	VP	: 0			
	IR	: 0			
†	MARK ERASE	: COURSE	SHIP		
#	HOR BEAM ANGL	: WIDE	NARROW		
#	RES COL CURVE	: LINEAR	1	2	3
#	COLOR EMPHASIS	: 1 (LOW)	2	3	4 (HIGH)
	FUNC1 PROG	: USER1	SETUP1	SETUP2	SETUP3
	FUNC2 PROG	: USER2	SETUP1	SETUP2	SETUP3
	USER PROG	: USER1	USER2		

† Requires INTERFACE Board.
# Locked setting (in red). To change, select item, adjust GAIN control to display YES, and press the TX key. Selected item appears in green; setting may now be changed.

Item	Description
DEGAUSS	Enables degaussing of the screen by pressing the TX key on the menu screen.
AUTO DEGAUSS	Selects how to automatically degauss the screen. TIMER degausses the screen every three minutes, and GYRO degausses the screen whenever the ship turns approximately 45°.
DISPLAY MODE	Selects a picture display mode. NORM: Displays the soner picture on entire screen TEXT: Displays soner picture on upper 9/10 of screen and text on bottom 1/10. Text includes position, speed, course, depth and tidal current.
TX OUTPUT	Sets output power in eleven steps; 0 is minimum, 10 maximum. Set to 10 for normal use, and use a lower power when sea surface reflections or seabed echo obscures fish schools in short range and shallow water operations. Note that the output power changes 10 seconds after the setting is changed.

Item	Description
PULSELENGTH	Sets a transmission pulselength in eleven settings; 0 is minimum and 10, maximum.
TX CYCLE	Sets transmission repetition rate in eleven settings; 1 for longest and 10, shortest.
TVG NEAR TVG FAR	Controls receiver sensitivity at short and long ranges, respectively. FAR: Over 100 m; position "5" is the standard setting. NEAR: Within 100 m; position "5" is the standard setting.
AGC	Suppresses echo tail of strong targets such as the seabed, for easy recognition of fish schools adjacent to the bottom. Position "1" or "2" is the standard setting.
NOISE LIM	Rejects noise displayed over the entire screen in light blue or blue. Position "3" is the usual setting.
VP	Adjusts the after-image of the echoes for proper period – echoes are stretched in the radial direction. Set to "0" when its function is not required.
IR	Rejects random noise and interference caused by other echo sounders or sonars.
MARK ERASE	Erases all own ship markers or course line.
HOR BEAM ANGL	Selects horizontal beam angle. Select wide for general use; narrow for better bearing discrimination.
RES COLOR CURVE	Sets the balance between weak and strong echoes. LINEAR varies output proportionally with input (actual echo strength). Select a higher setting to better emphasize weak echoes – weak echoes are displayed in stronger echo colors as the setting goes higher. The standard setting is LINEAR.
COLOR EMPHASIS	Sets the proportion of red in the color display; the higher the setting the greater the proportion of echoes displayed in red.
FUNC1 PROG	Selects program to use with the F1 key.
FUNC2 PROG	Selects program to use with the F2 key.
USER PROG	Enables programing of USER1 and USER2 programs.

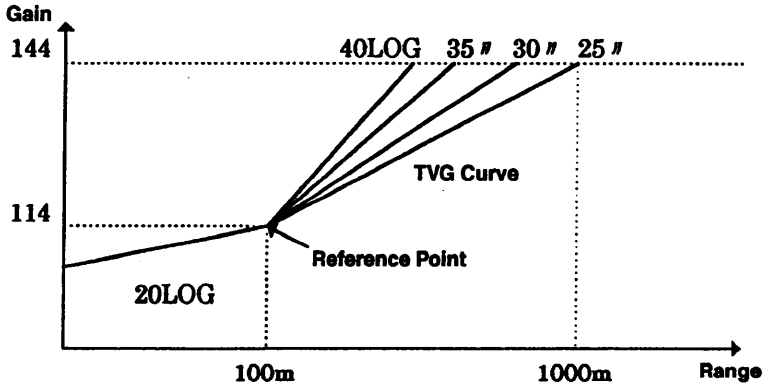
TVG Curve

The TVG curve determines the system gain. The curve is controlled by the TVG NEAR, TVG FAR and GAIN cotrollers. The basic TVG curve is obtained as follows with TVG NEAR and FAR controllers set both to position 5.

The curve up to 100 m is given by the equation "G = 20log R + 2αR", while the curve over 100 m is given by the following equations;

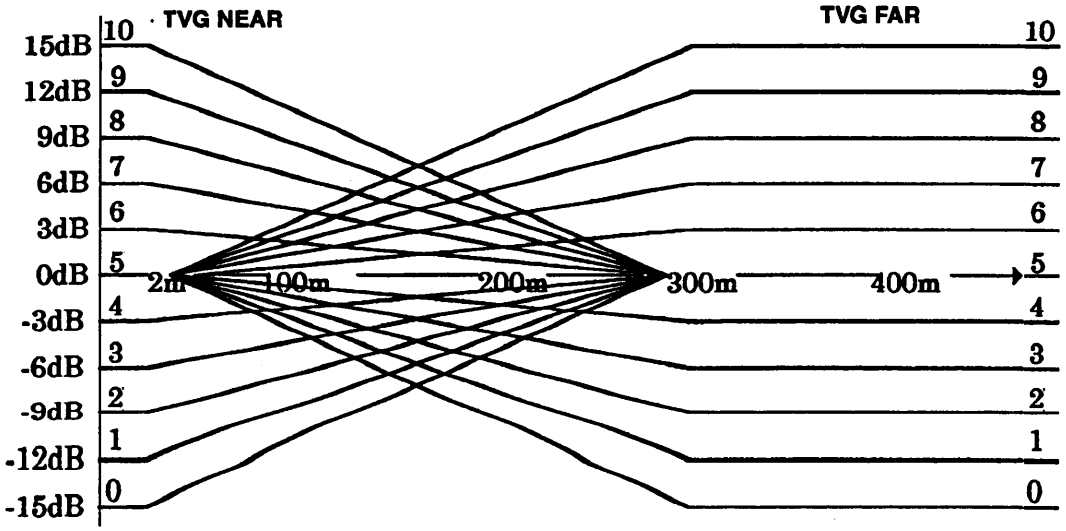
"G = 30logR + 2αR" or "G = 25logR + 2αR" or "G = 35logR + 2αR" or "G = 40logR + 2αR"

which are selected by the dip-switch S3 #5/#6 on the DIG board.

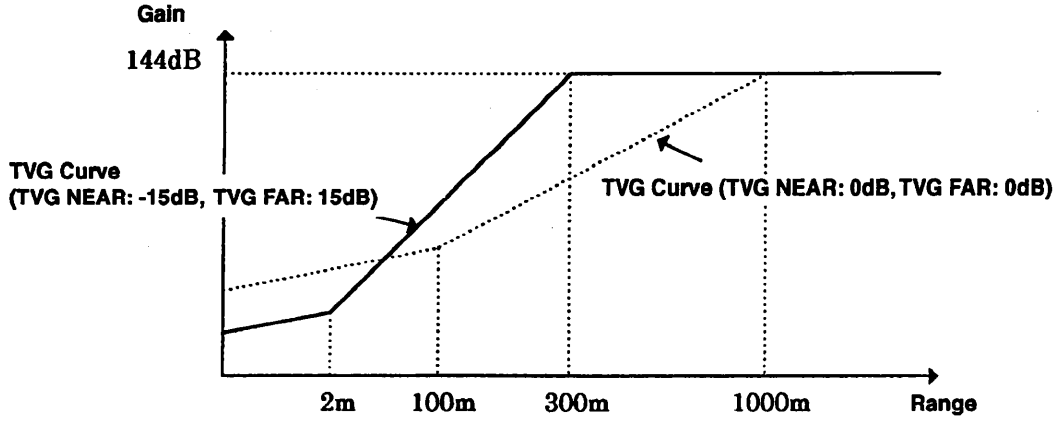


The reference point can be changed with dip-switch, S3 #3/#4 on the DIG board.

Changing the TVG NEAR and FAR settings adds the following curves to the basic TVG curve.



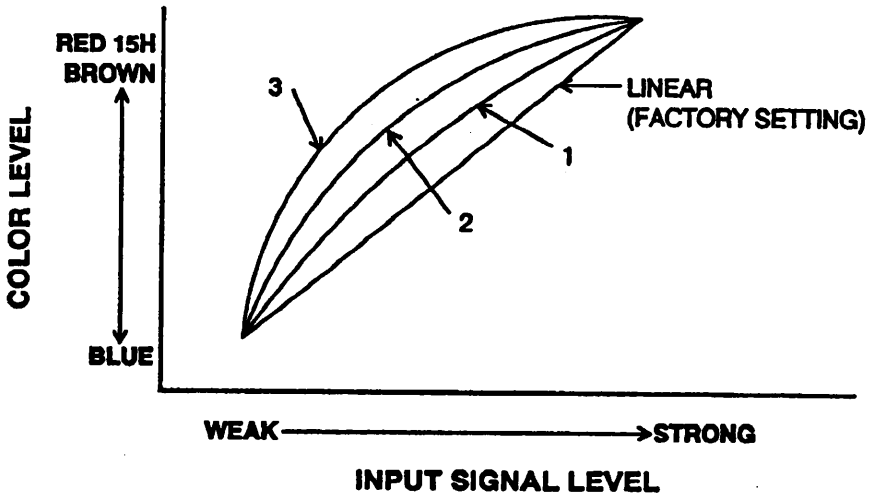
If, for example, the NEAR contrller is set to "0" and the FAR control to "10", the curve becomes as follows.



The short range gain can be adjusted with both the FAR and NEAR controllers. However, the NEAR control should be used for the short range since the FAR control changes the long range gain as well.

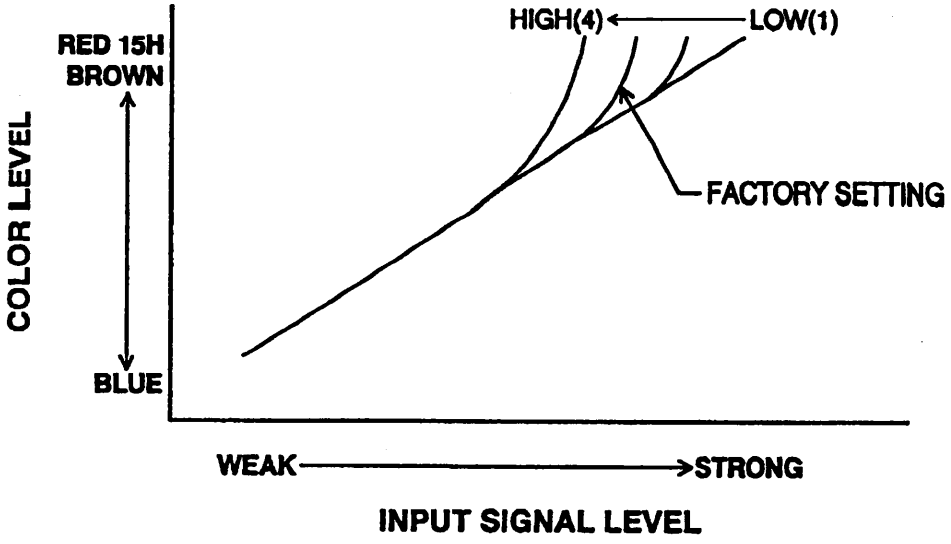
Response Color Curve

The response color curve determines signal level versus presentation color characteristics. In the linear characteristics, presentation colors change in proportion to the signal levels. As the higher the curve number, the more the color is allocated in the low signal level region; that is, resolution of weak signals is improved.



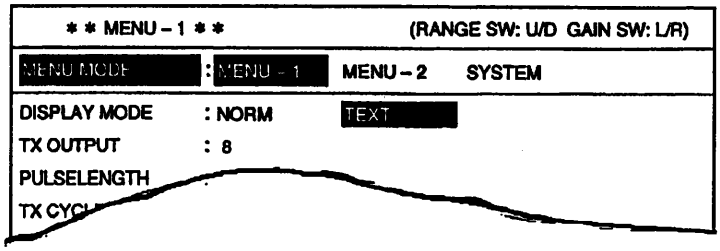
Color Emphasis

The color emphasis determines presentation colors for the echoes in the strong signal region. As the setting goes to a larger number, echoes displayed in strong colors increases as shown below



1.7 MENU-2 and SYSTEM on System Menu Operation

Press MENU in TX mode off.



MENU-2

		** MENU - 2 **	(RANGE SW: U/D GAIN SW: L/R)			
		MENU MODE	: MENU - 1	MENU - 2	SYSTEM	
#		EXT KP SYNC	: OFF	ON		
#		RANGE MARKER	: 1/4R	1/2R	OFF	
#	†	BEARING SCALE	: ON	OFF		
#	†	CURRENT MARK	: ON	OFF		
#	†	COURSE MARK	: 10R	5R	OFF	
#	†	HEADING INDI	: 32 - AZI	TRUE		
#	†	CURRENT INDI	: 32 - AZI	TRUE	±180°	360°
#	†	EVENT INDI	: 32 - AZI	TRUE	±180°	360°
#		MARK INDI	: ±180	360°		
#	†	POSITION DATA	: L/L	TD		

† Requires INTERFACE Board.
# Locked setting

Item	Description
EXT KP SYNC	Turns external KP synchronization on/off.
RANGE MARKER	Selects range marker length from 1/4 of range or 1/2 of range.
BEARING SCALE	Turns electronic bearing scale on/off.
CURRENT MARK	Turns the current (tide) mark on/off.
COURSE MARK	Selects length of the course line plot from 10 times or 5 times the range in use.
HEADING INDI	Selects heading indication; 32-azimuth, or true bearing.
CURRENT INDI	Selects current (tide) indication; 32-azimuth, true bearing, ±180°, or 360°.
EVENT INDI	Selects event indication; 32-azimuth or true bearing, ±180°, or 360°.
MARK INDI	Selects mark indication; ±180°, or 360°.
POSITION DATA	Displays position in latitude and longitude, or LOP (Line Of Position).

SYSTEM

	** SYSTEM MENU **		(RANGE SW: U/D GAIN SW: L/R)		
	MENU MODE	: MENU – 1	MENU – 2	SYSTEM	
#	HEADING ADJ	: 0°			
#	UNIT	: METERS	FEET	FATHOMS	PA/BRA
# †	SHIP'S SPD/BR	: LOG/GY	CI	NAV	
# †	LOG PULSE	: 200	400		
# †	CI BAUD RATE	: 4800	2400	1200	
# †	NAV FORMAT	: CIF	NMEA183	NMEA182	
# †	NAV BAUD RATE	: 4800	2400	1200	
# †	NAV DATA	: GPS	LC	DEC	DR
		: LA	ALL		
	MENU SELECT	: LOCK	UNLOCK		
#	SUB TEXT INDI	: OFF	ON		
#	LANGUAGE	: ENGLISH	日本語	ESPANOL	DANSK
	SELF TEST	: SINGLE	PANEL	COLOR	GRAY
		CONTI	SIO	ECHO-1	ECHO-2
	DEFAULTS	: EXECUTE			

† Requires INTERFACE Board.
# Locked setting

Item	Description
HEADING ADJ	Compensates for flange (in hull unit) alignment error. The picture rotates with RANGE switch operation. Resolution is to the nearest degree.
UNIT	Selects unit of depth measurement; meters, feet, fathoms, or passi/braza.
SHIP'S SPD/BR	Selects source of ship's speed/bearing input; log/gyrocompass, current indicator, or navigator.
LOG PULSE	Selects specifications of speed log connected; 200 or 400 pulses/mile. Consult the operator's manual of the speed log.
CI BAUD RATE	Selects current indicator baud rate; 4800, 2400, or 1200 baud. Consult the operator's manual of the current indicator.
NAV FORMAT	Selects format of connected navigator; CIF, NMEA0183 or NMEA0182. Consult the operator's manual of the navigator.
NAV BAUD RATE	Select current indicator baud rate; 4800, 2400, or 1200 baud. Consult the operator's manual of the navigator.
NAV DATA	Selects source of position data; GPS, LC (Loran C), DC (Decca), DR (Dead Reckoning) LA (Loran A) or AUTO. AUTO selects position data with the highest priority; GPS has the highest priority.
MENU SELECT	Locks/unlocks settings.
SUB TEXT INDI	For use by technicians.
LANGUAGE	Selects language to use.
SELF TEST	Selects a self test.
DEFAULTS	Resets to default settings by pressing the TX key.

2. CIRCUIT DESCRIPTION

2.1 Function of PC board

Display Unit

MAIN (10P6831):
1) Communicates with the CPU on the DIG board.
2) Generates video signal (R, G, B) for CRT
3) Processes STR, VP, and IR.
4) Converts coordination.
5) Processes video signal.
6) Generates H/V SYNC signal.
7) Reads panel key status.
8) Contains memory backup circuit.
9) Generates raise/lower control signal.
10) Generates test signal for self-check.

PNL (10P6836): Panel board

DPWR (10P6837): Power board consisting of PWM(pulse wide modulator), Generates +5V, ±12V and +90V(for monitor).

ITF (10P6840): Optional interface board
Interface circuit for the connection of Navaid, Current indicator, Gyro compass, and Speed log.

Transceiver Unit

PWR (10P6830):
1) Power board for transceiver unit. Generates, +5V, +12V, ±8V and +B voltage(+110V).
2) Controls +B voltage.
3) Detects overvoltage/over-current.
4) Contains a portion of raise/lower control circuit.

DIG (10P6831): Signal processor circuit
1) Contains TVG amplifier
2) Contains A/D converter for video signal.
3) Generates 4 bit digital echo data strings.
4) Converts input signal level into color level.
5) Generates afterimage of echoes for proper period.(VP function)
6) Rejects weak signal.(NL function)
7) Rejects random noise by correlation circuit. (IR function)

Digital control circuit
1) Generates gate signal (PPSW) for the TRX board.
2) Generates Pre-TVG data for the MB board.
3) Generates O.SEL/E.SEL signals for switching circuit on the MB board.
4) Generates FS(frame start) signal.
5) Generates "TEST signal" for echo test 2.

6) Generates KPR(Keying Pulse Reset).
7) Generates KP(Keying Pulse for Transmission).
8) Generates transmission carrier, CLKs.
9) Generates reference voltage(PWR1) which controls the transmission level.
10) Generates carriers for the mixer circuit on the TRX board.
11) Generates Pre-TVG signals for the MB board.
12) Generates TVG signals for TVG -AMP on the DIG board.
13) Provides input and output circuits for internal/external KPs

TRX (10P6832) Consisting of;
1) Trap circuit
2) Gate circuit for input signal from transducer
3) Pre-buffer amplifier
4) RX Tilt controller(controls the tilt angle of receiver beam)
5) Resisters for vertical beam forming
6) Transmission amplifier

MB (10P6833)
1) Contains adder circuit (combines the receiving signals from transducers vertically)
2) Contains switching circuit.
3) Outputs the ODD COM signal and EVEN COM signal for DIG board.

2.2 Display Unit

Refer to the block diagram Figure 2.2.
Major signals between display unit and transceiver unit are as follows.

KPR : The KPR (Keying Pulse Reset) signal is generated in the DIG board with the TX cycle and sent to the MAIN board in the display unit. The CPUs on the DIG board and the MAIN boards communicate each other, transferring the data, such as TX output, TX cycle, TVG, beam width, range, etc., during the reception of this signal.

In the transceiver unit, the transmission trigger pulse "KP" is generated at the trailing edge of the KPR signal while the TX switch is "ON" position and transducer is at lower limit position. Note that the KPR signal is generated irrespec tive of the setting of the TX switch.

In the display unit, the KPR signal is used as reference signal to synchronize the data acquisition start time with receiving start time.

FS : The FS (Frame Set) is master control signal of the receiver circuit. The transducer elements are switched over 360 degrees in one cycle of this signal whose frequency is 1.2 kHz. The raising edge of first cycle of the FS clock synchronizes with the trailing edge of KPR signal.

512FS: The 512 FS is a clock signal 512 times the FS frequency.
This clock is used for sampling the digital echo data strings in the MAIN board.

SIG 0 to SIG 3

The received signal is converted into 4 bit digital echo data strings (SIG 0 to SIG 3) on the DIG board and then sent to the MAIN board.

The 4 bit digital echo data strings sent from the balanced differential driver on the DIG board are received by the photo-couplers on the MAIN board, and sampled by the 512 FS clock signal which is sent from the DIG board. The sampling starts from after direction of transducer component. And the data sampled with the 512 FS is stored into the 360 degree memory(SCAN RAM).

The 360 degree memory

The 360 degree memory can store 512 echo data which are produced in each FS cycle. The echo data is written into the memory addressed by the θ - counter (1) and read out from the memory addressed by the θ-counter (2).
The θ-counter (1) is presetable by the CPU. When the heading error offset is entered on the menu screen, an appropriate value is loaded to rotate the picture.

The signal processing

The 360 degree memory data are outputted to the signal processing circuit.
In the signal processing circuit, interference rejection (I/R) and video processing (V/P) are performed.

Video RAM

The echo data from signal processor circuit is stored onto the Video RAM.
The video RAM contains all echo data processed in one transmission cycle.

Coordinate Conversion

The function of the coordinate conversion circuit is the address conversion of each echo data from polar (r, θ) to XY coordinate. This conversion is necessary to store each echo data in the video RAM at an address location corresponding to position on the screen as shown in figure 2.1.

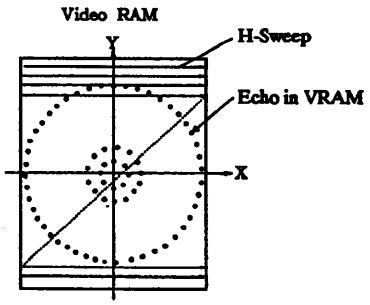


Figure 2.1 Coordinate conversion

In principle, the polar to XY coordinate conversion can be made with the following formula.

$$X = r \cos \theta \qquad Y = r \sin \theta$$

GDC(Graphic Display Controller) and Gate Array

Receiving commands and data from the CPU, the GDC writes the characters and markers and also generates V-SYNC and H-SYNC signals. The video signal, characters and markers are outputted through the Gate Array to the D/A converter of "R" "G" "B" signals.

Audio Circuit

Audio amplifier circuit is mounted on the MAIN board. It picks up the data in the direction pointed by the bearing marker on the CRT and applies them to the loudspeaker.

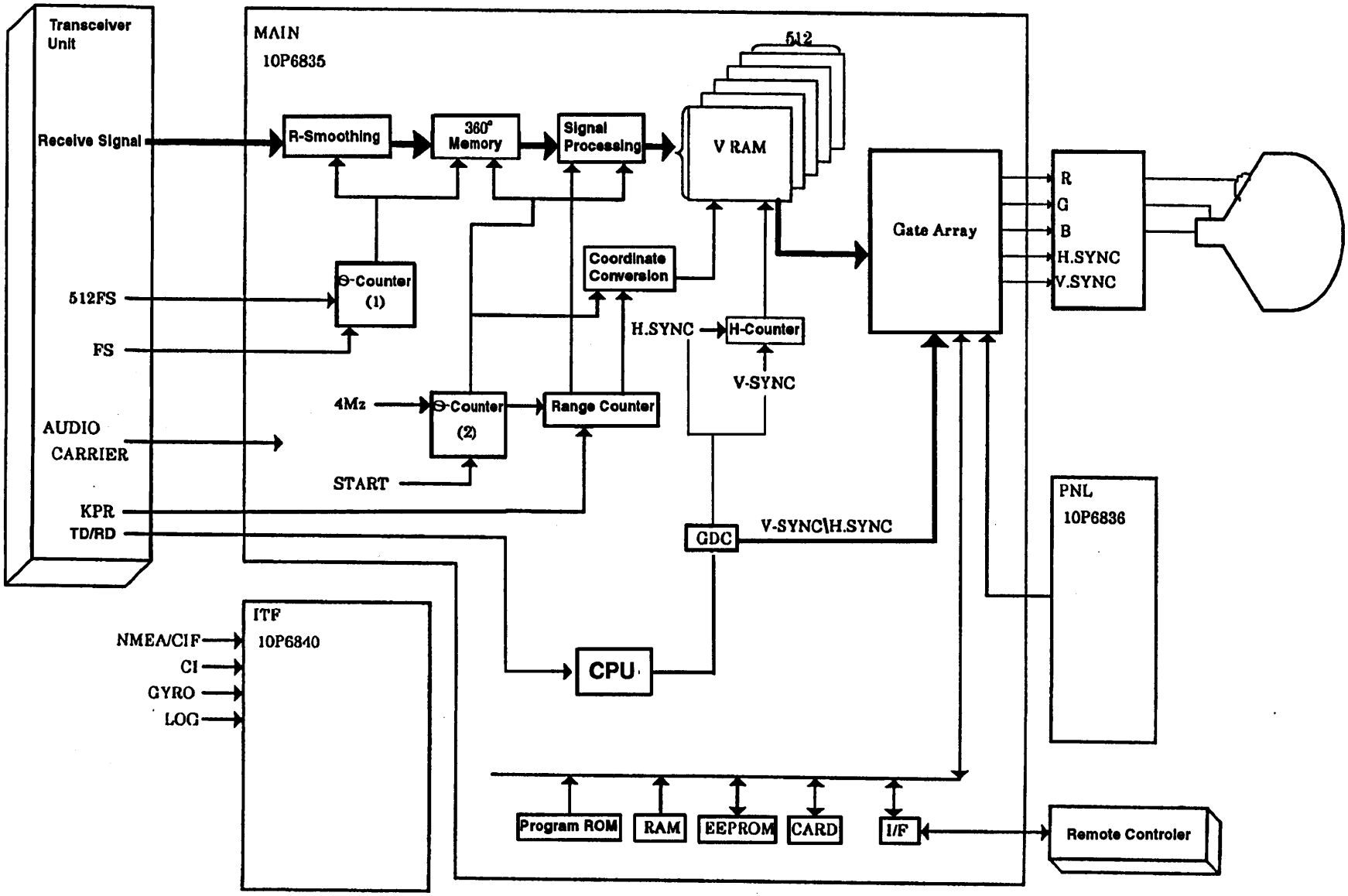


Figure 2.2 Block Diagram of Display Unit

2.3 Tramsmission

Refer to the figure 2.3. The transducer is made up of 120 small transducer elements distributed into six layers, as shown in figure 2.11.

The transducer elements on each layer are connected to corresponding TRX board, therefore total six TRX boards are incorporated in the transceiver unit. Each TRX board consists of one TX driver, TX amplifier and one receiving circuit, and drives the 20 transducer elements (120/6 = 20) on one layer. The transmission is activated when the TX switch on the control panel is set to ON and also the lower limit switch in the hull unit is tripped.

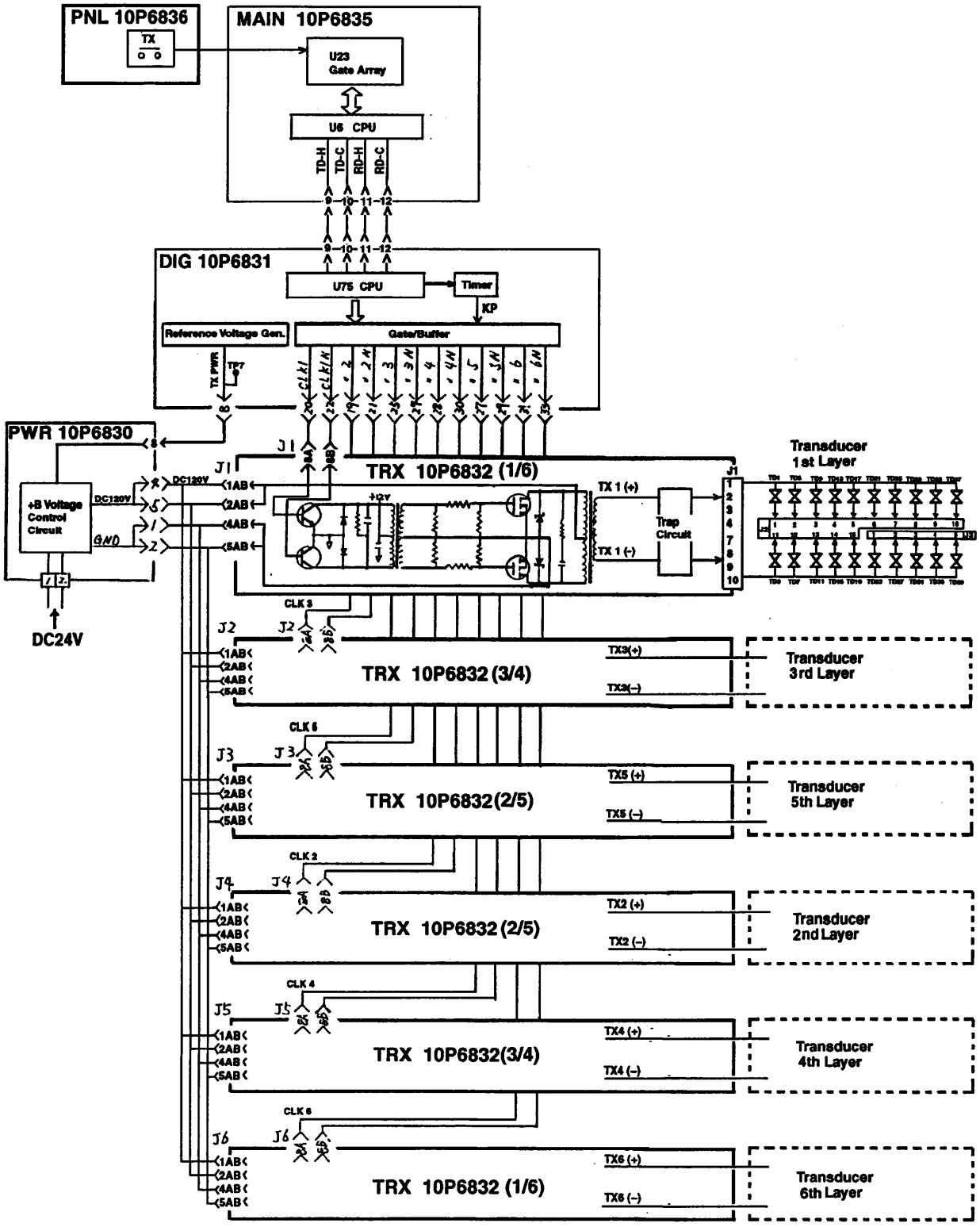


Figure 2.3. Tramsmission Circuit Block Diagram

Tilting the Transmission Beam

The carrier signals for transmission, CLK1 to CLK 6, are generated on the DIG board and supplied to each TRX board. To tilt the transmission beam, the phase differences among each carrier signal are controlled according to the tilt angle set on the control pannel. When tilt setting is "0 degree", no phase difference is made.

Transmission Level

The transmission output levels of each TRX board are equal and also controlled by the PWR1 voltage according to the TX OUTPUT selection on the scan menu. See figure 2.4.
Transmission output level obtained between TP1 and TP2 on the TRX board is **800Vpp to 1400Vpp** with dummy resistor when TX OUTPUT "10" is selected.

TX OUTPUT	4	6	8	10
PWR1	2.8V	4.8V	5.6V	6.7V

Figure 2.4 The level of PWR1 voltage

Compatibility

The TRX boards having the same number on the releasing tab are compatible, but the one having different number are not exchangeable because of the different value of weight resisters in the receiving circuit on the PC board.

	TRX 10P6832(1/6)	TRX 10P6832(3/4)	TRX 10P6832(2/5)
TRX 10P6832(1/6)	O		
TRX 10P6832(3/4)		O	
TRX 10P6832(2/5)			O

Figure 2.5 Compatibility of the TRX board

2.4 Receive Circuit

Refer to the block diagram figure 2.9 and figure 2.10.
The transducer of CSH-7 consists of 120 transducer elements, and each transducer element is seprated into 6 layers. Refer to figure 2.11.
General receiving signal flow is shown in figure 2.6.

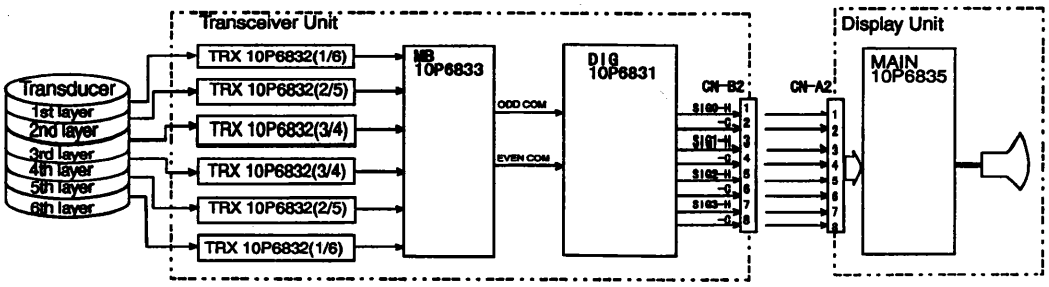


Figure 2.6 Receiving signal flow

Gate circuit on the TRX board

Two transducer elements placed in opposite direction on the same layer are connected to the same gate circuit on the TRX board and switched by gate pulse (PPSW) one after the other, as shown in figure 2.7.
The gate pulse consists of ten gate pulses named PPSW1, PPSW5, PPSW9, PPSW13, PPSW17, PPSW21, PPSW25, PPSW29, PPSW33 and PPSW37 generated on the DIG board. Following table shows the signal lines connected to transducer elements are turned on by the respective gate pulses.

Gate Pulse	Number of transduce gated by the gate pulse.
PPSW1	1, 2, 3, 4
PPSW5	5, 6, 7, 8
PPSW9	9, 10, 11, 12
PPSW13	13, 14, 15, 16
PPSW17	17, 18, 19, 20
PPSW21	21, 22, 23, 24
PPSW25	25, 26, 27, 28
PPSW29	29, 30, 31, 32
PPSW33	33, 34, 35, 36
PPSW37	37, 38, 39, 40

Figure 2.7 Transducer number controlled by the respective gate pulse.

Figure 2.8 shows which elements are conducted simultaneously. For example, 9 to 28 are on (sold arrow), and then 13 to 32 are on (broken arrow).

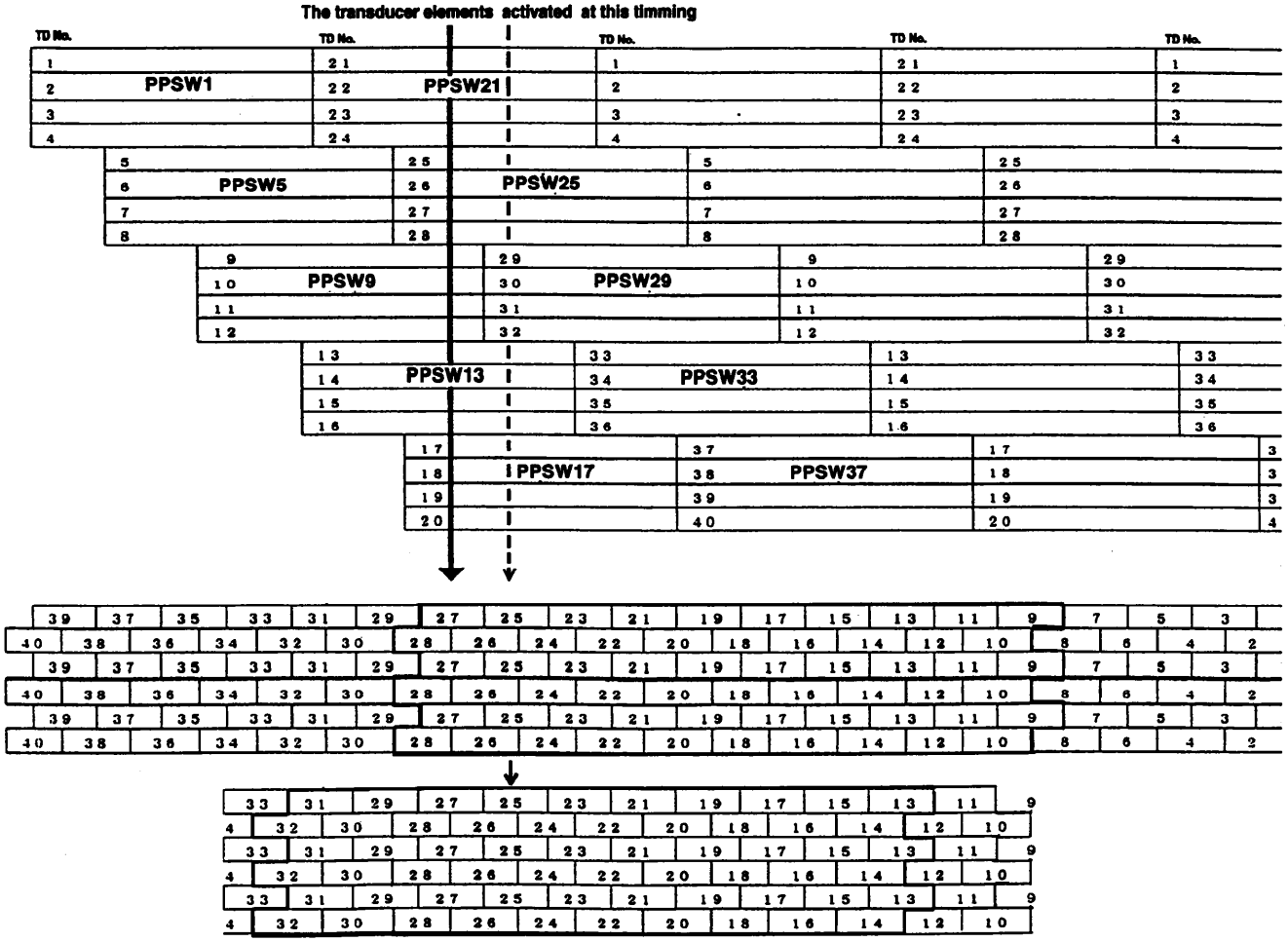


Figure 2.8 Functional diagram of gate pulse

Mixer circuit on the TRX board

The signal outputs of gate circuit are send to the mixer circuit at where the signals are mixed with carrier signals to convert the frequency to 75 kHz. The frequency of carrier signal is; 130.2 kHz for 55 kHz unit and 119.5 kHz for 70 kHz unit. The carrier signals, marked Ca1, Ca2, Ca3, Ca4, Ca5 and Ca6, are generated from the DIG board individually for each layers.

Tilting the receiving beam

When transmission beam is tilted, the phase difference are obtained on the receiving signal among each layer of transducer. These phase difference are canceled by mixing with carrier signals.
For this purpose, the phase of each carrier signal is controlled according to the tilt angle.

Forming the vertical beam

The output of mixer circuits are send to the Adder on the DIG board so as to combine the transducer elements located in a vertical line.
The number of transducer element in a line vertically and the weight resistor of each signal line on the TRX board determines the vertical beam width.

Pre-TVG Amp

The output from the adder is amplified by the P-TVG AMP and then send to the switching circuit. The amplitude of the P-TVG AMP is controlled by the eight bit binary coded P-TVG data generated on the DIG board.

Switching circuit

The outputs of the adder circuit are switched by the switching circuit sequentially so as to rotate the transducers. Since the switching circuit of CSH-7 consists of two circuit, two serial outputs (ODD COM and EVEN COM) are outputted from the MB board and sent to the TVG AMP circuit individually on the DIG board.

TVG Amp

The amplitude of the TVG AMP is controlled by the eight bit binary coded data which is determined by the GAIN/TVG setting on the control pannel and dip-switch setting S3 #3, #4, #5, #6, #7 and #8.
The ODD COM and EVEN COM signals are amplified by the individual TVG amplifier and combined into one signal line.

A/D convertor

The analogue signal output of TVG amplifier is converted into digital data by the A/D convertor and then sent to the signal processing circuit.

Signal processing circuit

The functions accomplished in the signal processing circuit are AGC, Horizontal Beam Forming, Noise Limitting, and Color conversion.
The receiving signal processed for the above functions are converted to four bit binary coded data and outputted to the display unit.

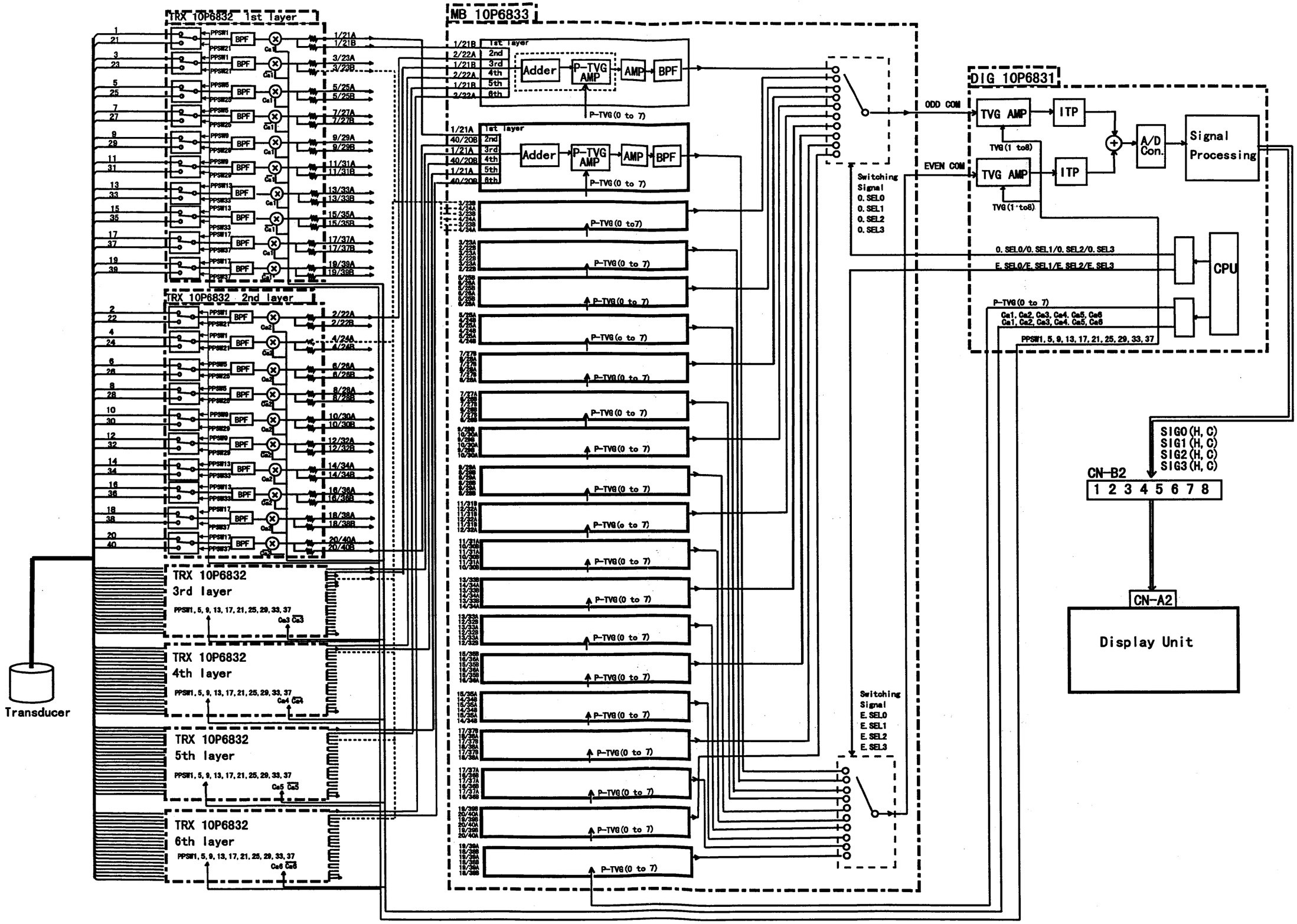


Figure 2.9 General block diagram of receiving circuit

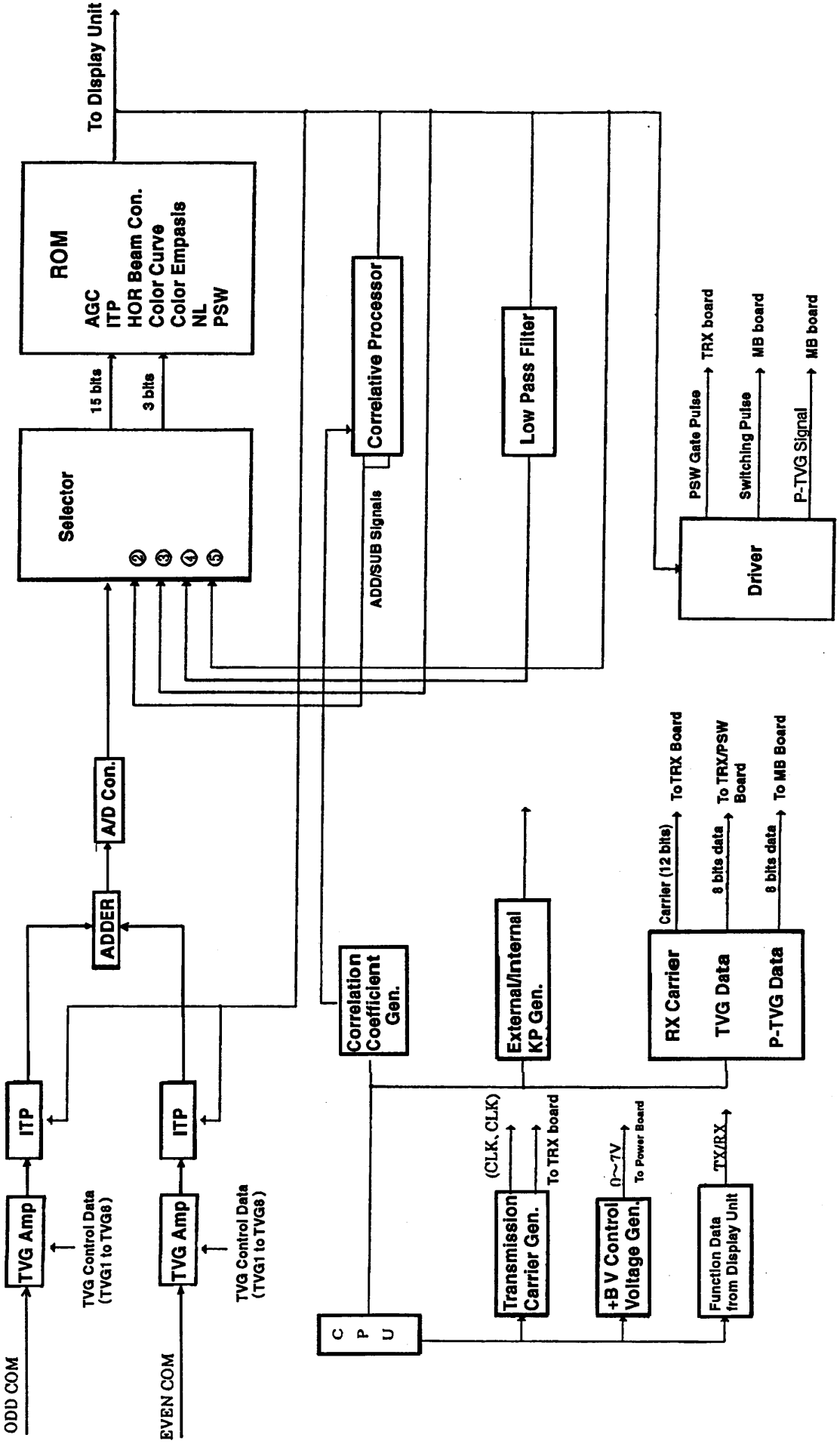


Figure 2.10 Block Diagram of the DIG board

P 2

Pin No.	TD No.	Cable Color
1	1	BRN/RED 1
2	3	L-GRN/BLK 2
3	5	L-GRN/RED 2
4	7	GRY/BLK 2
5	9	GRY/RED 2
6	11	WHT/BLK 2
7	13	WHT/RED 2
8	15	BRN/BLK 3
9	17	BRN/RED 3
10	19	BRN/BLK 1
11	2	YEL/BLK 1
12	4	WHT/RED 3
13	6	WHT/BLK 3
14	8	GRY/RED 3
15	10	GRY/BLK 3

Connector Type : B15B-XH-AGU

P 3

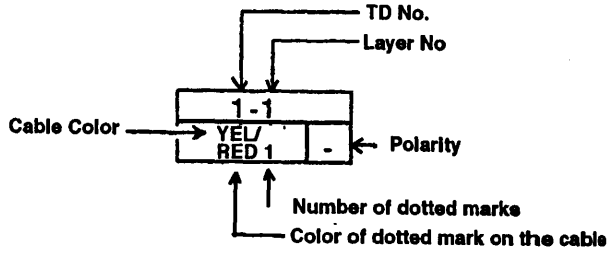
Pin No.	TD No.	Cable Color
1	12	L-GRN/RED 3
2	14	L-GRN/BLK 3
3	16	YEL/RED 3
4	18	YEL/BLK 3
5	20	YEL/RED 1
6	Shassis GND	WHT/BLK 1
7		YEL/RED 2

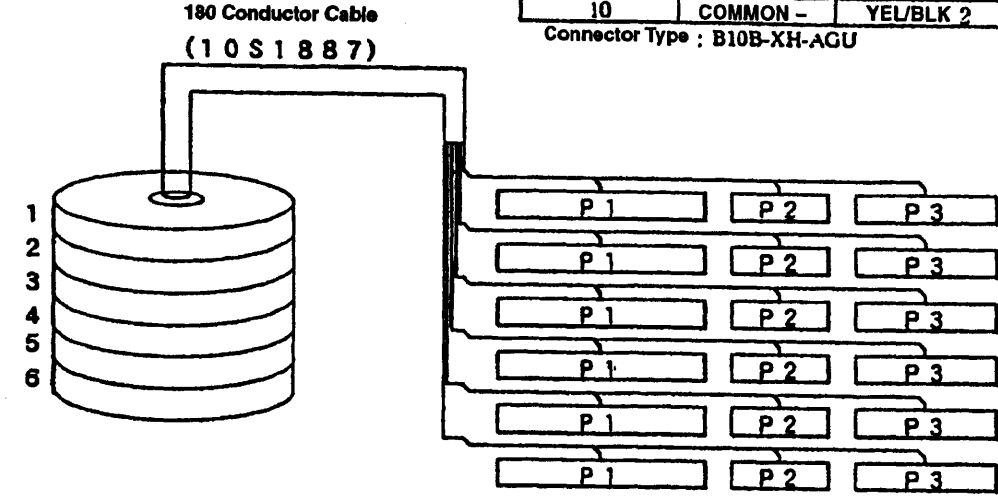
Connector Type : B17B-XH-AGU

P 1

Pin No.	TD No.	Cable Color
1	COMMON +	L-GRN/BLK 1
2	COMMON +	L-GRN/RED 1
3	COMMON +	GRY/BLK 1
4	COMMON +	GRY/RED 1
5	NC	
6	NC	
7	COMMON –	WHT/RED 1
8	COMMON –	BRN/BLK 2
9	COMMON –	BRN/RED 2
10	COMMON –	YEL/BLK 2

Connector Type : B10B-XH-AGU





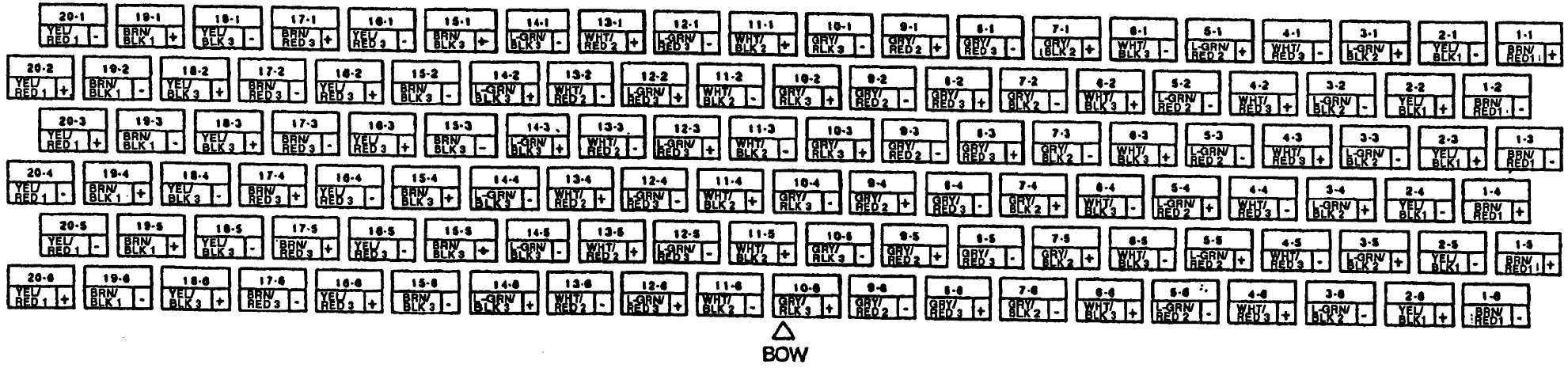


Figure 2.11 Conection diagram of transducer elements

2.5 Power On/Off Control Sequence

See figure 2.12.
When the switching regulator on the DPWR board in the display unit is activated by pressing the power switch, the +12 voltage in the display unit is supplied to the relay K1 on the DIG board as Pon-H signal. The switching regulator in transceiver unit is activated when the relay K1 on the DIG board becomes on condition.
Since the relay K1 on the MAIN board keeps the on condition of switching regrator on the DPWR board while the transducer is in the lower position, the power can not be turned off until the transducer is retracted and the upper limit switch is tripped, even if the power switch is turned off.
When the power switch is turned off, "raise" command(+5V) is outputted to the POW board from the MAIN board to hoist up the transducer automatically and then power supply circuit becomes off when transducer is retracted.

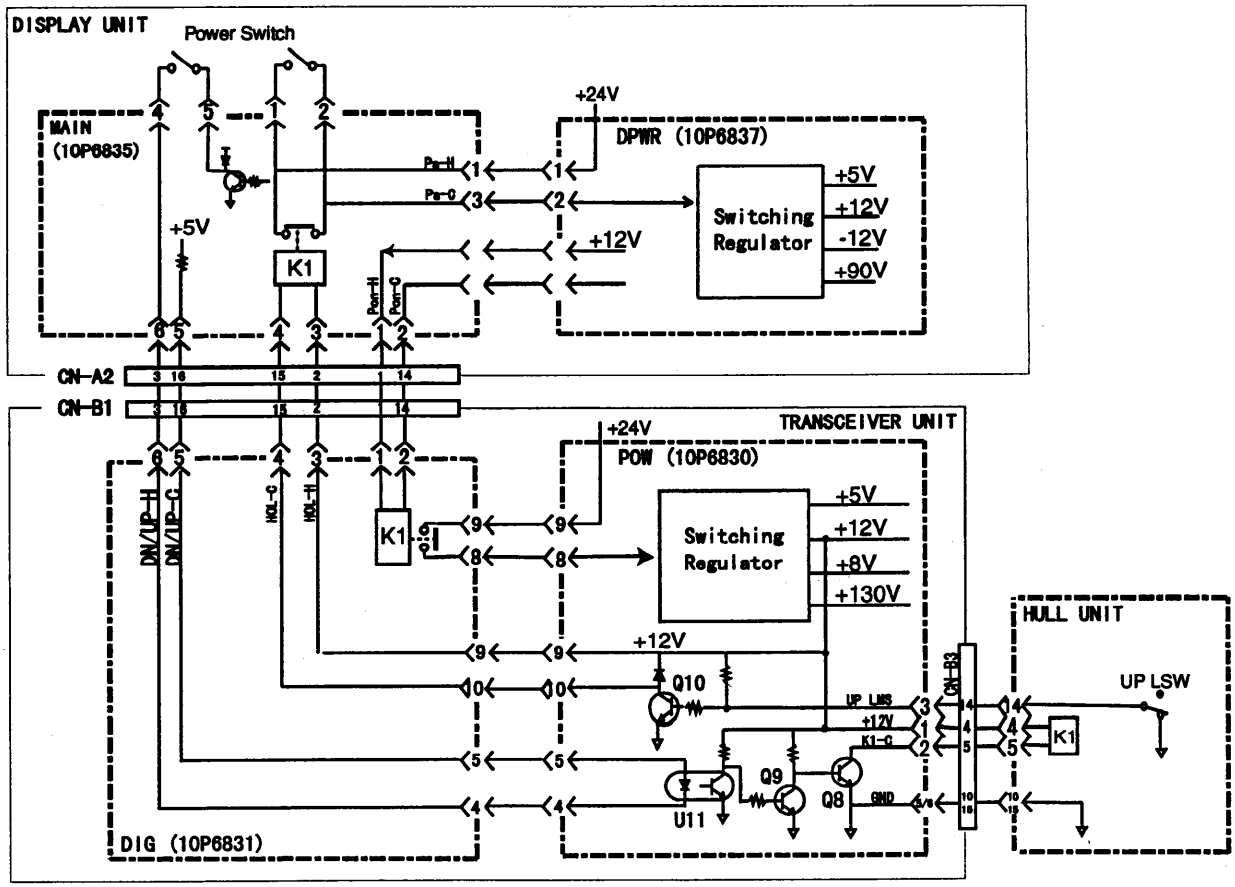


Figure 2.12 Schematic diagram of power on/off circuit

2.6 Transducer Raise/Lower Control Sequence

Refer to the figure 2.13.
The "raise/lower" command from the transducer ⇩ /⇧ switches on the control panel are read by the CPU on the MAIN board through the Gate Array U23.
Raising or lowering the transducer is made by the DC motor (DC+24V).
When the relay K1 in the hull unit is inactivated, the negative voltage is applied to the P1 #1 and positive voltage is applied to P1 #3 of the motor so that the motor rotates in the transducer raising direction.

Lowering the transducer

When the "lower" command is applied to the CPU, the CPU activates the transistor Q14 on the MAIN board. The photo coupler U11 on the POW board becomes on when the transistor Q14 is triggered into conduction.
The relay K1 in the hull unit is controlled by the transistor Q8 on the POW board which is triggered by the U11 through Q9 in the transceiver unit. When the relay K1 is activated by the transistor Q8, positive voltage is applied to P1 #1 and negative voltage is applied to P1 #3 of the raise/lower motor so that the motor rotates in the transducer lowering direction.

Raising the transducer

When the "raise" command is applied to the CPU, the CPU inactivates the transistor Q14 so that the photo coupler U11 and the transistor Q8 become off. Once the transistor Q8 becomes off, the relay K1 in the hull unit is inactivated. Then the motor rotates in the transducer raising direction.

When the power switch is turned off, the feedback line of photo coupler U11 is opened. And then the motor rotates in the raising direction in the same way mentioned above.

Feedback Line

The transducer's position is monitored by the CPU on the DIG board, which is connected to the U.LSW and D.LSW status lines through transistors Q1 and Q2, and sent to the CPU on the MAIN board through the communication lines.
The CPU on the MAIN board controls the raise/lower LED status in accordance with the status of U.LSW and D.LSW lines.
Also the feedback line connected to the U.LSW line generates the warning message "XDXR UNRETRACTED". The CPU on the MAIN board starts counting time at the moment the power switch is set to OFF, or ⇩ switch is pressed, and generates the visual and audible warnings if the transducer is not retracted completely within 35 seconds.

Brake Circuit

Two kind of brake circuit are incorporated in the hull unit, one is assembled with motor itself and the other is composed by resister R1.
1.The brake circuit assembled with the motor is to prevent falling down the transducer by vibrations when CSH-7 is not used for a long term. The brake circuit activates when DC 24 voltages is supplied to P2 #1 of the brake circuit through the power switch. When the power switch is turned on, the DC24 voltage line is open-circuited and then brake is released.

2.The resistor R1 is to make short circuit in order to stop the motor quickly when upper or lower limit switch is tripped.

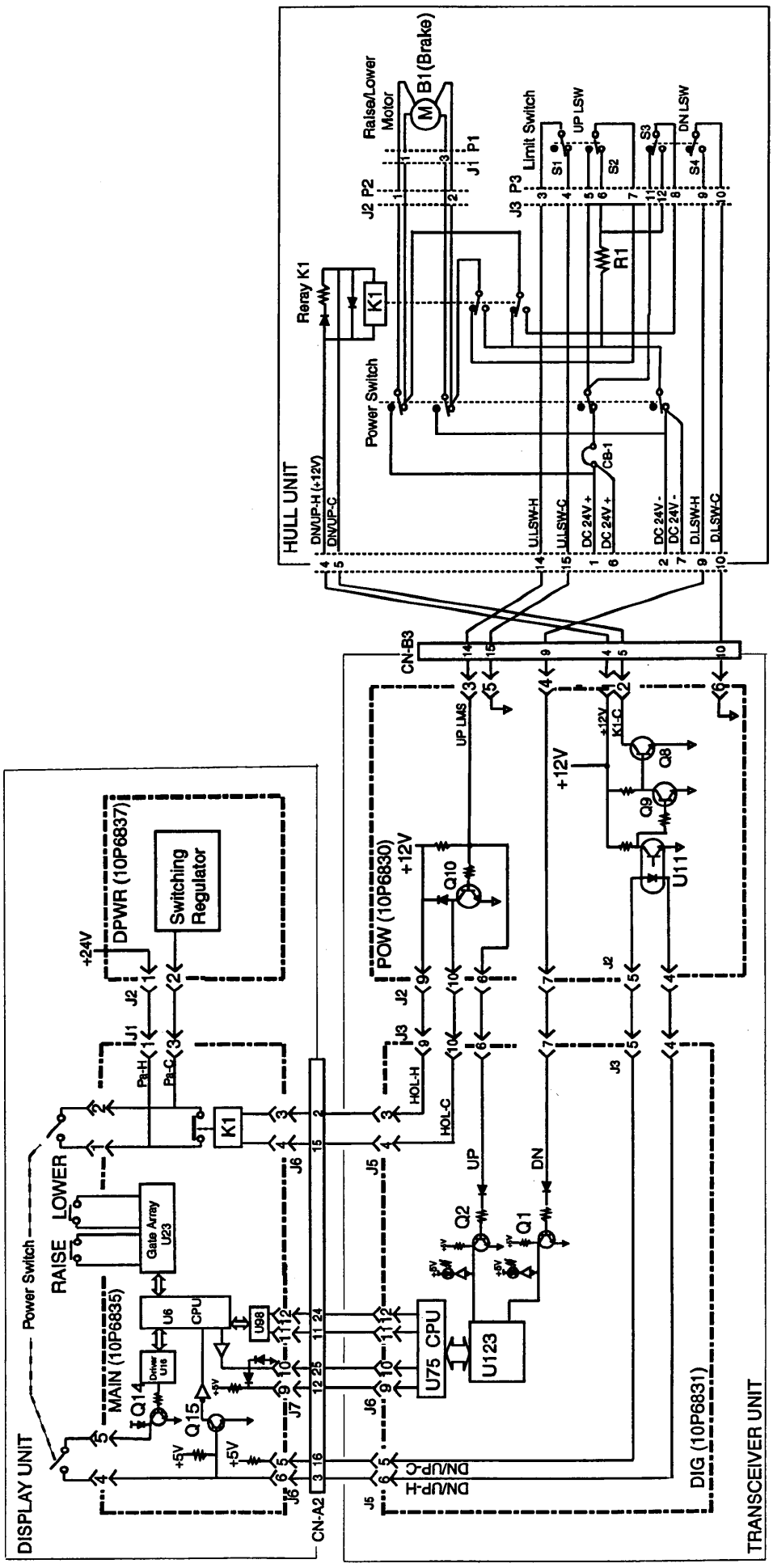


Figure 2.13 Schematic diagram of raise/lower control circuit

3. PARTS LOCATION

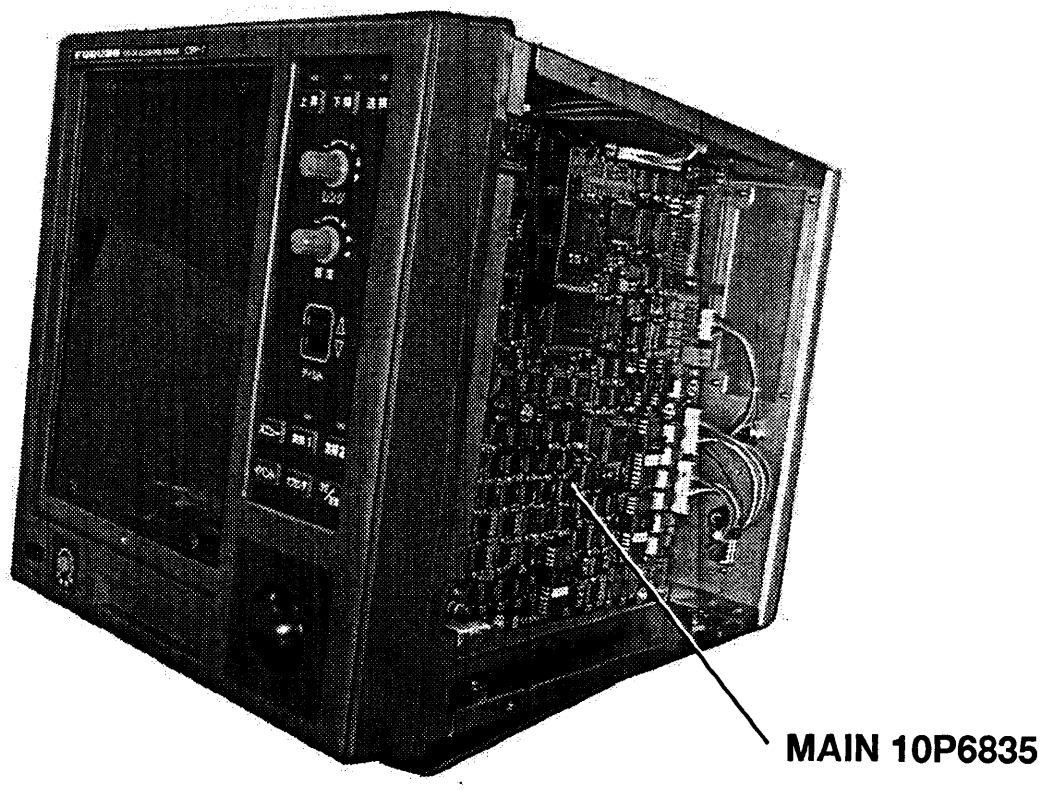


Figure 3.1 Display Unit, front view

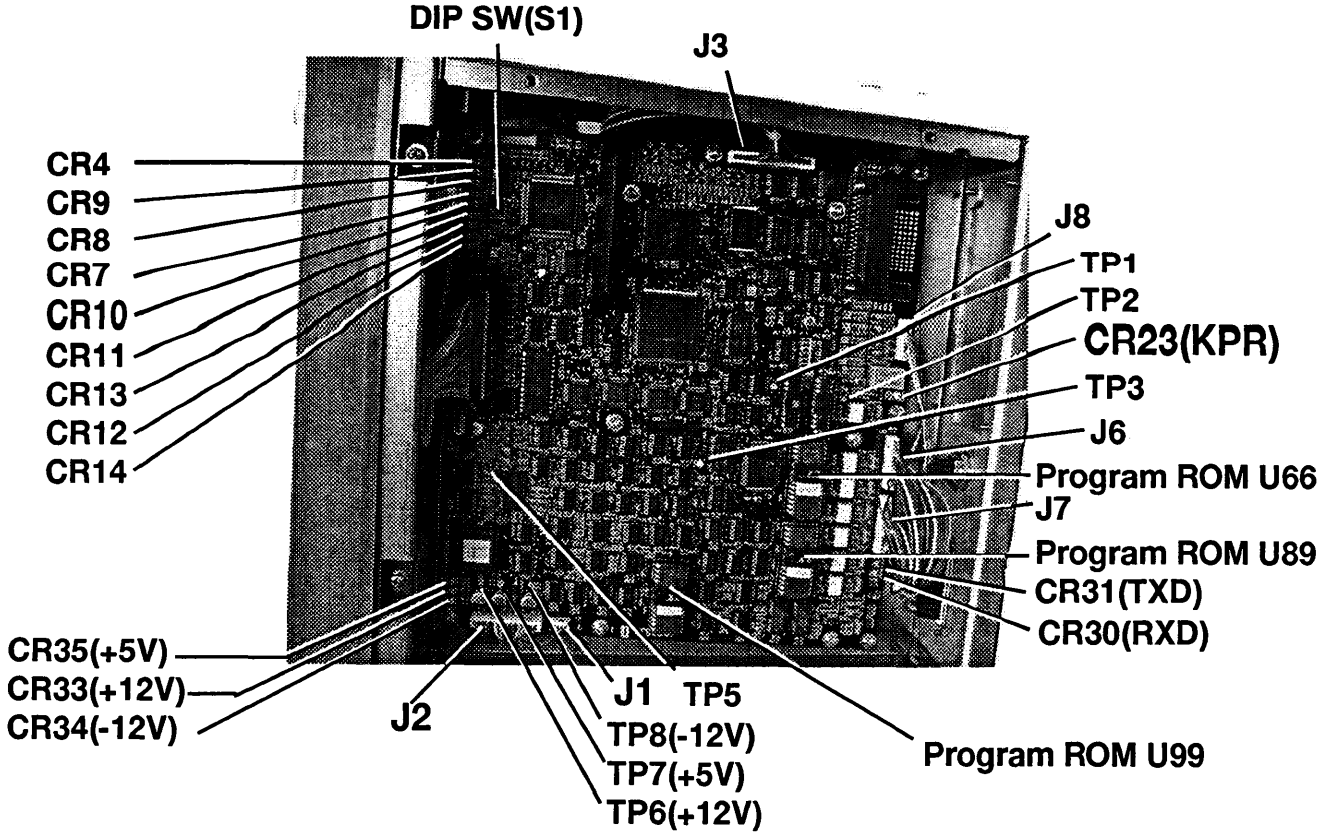


Figure 3. 2 Display Unit, MAIN 10P6835

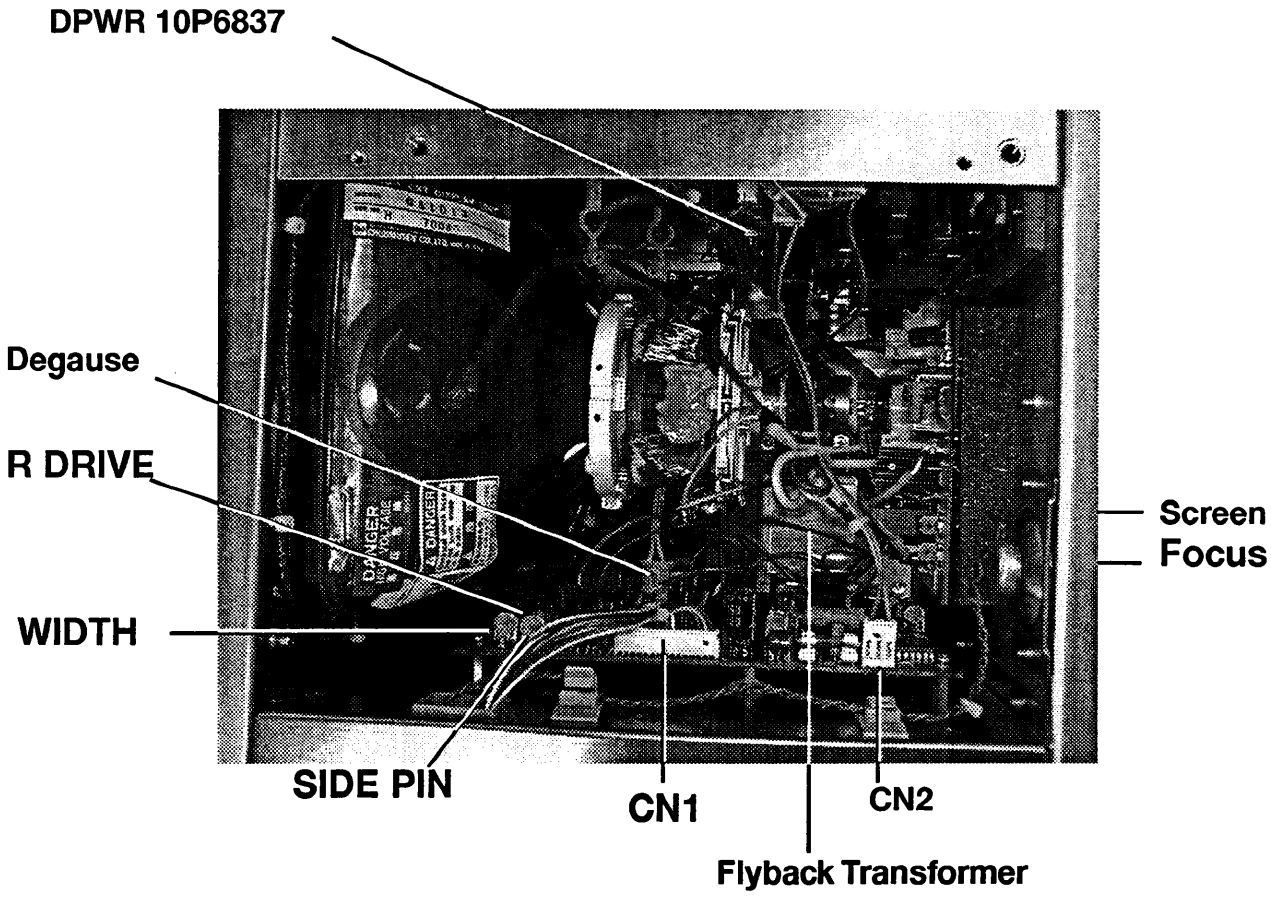


Figure 3.3 Display Unit , top view

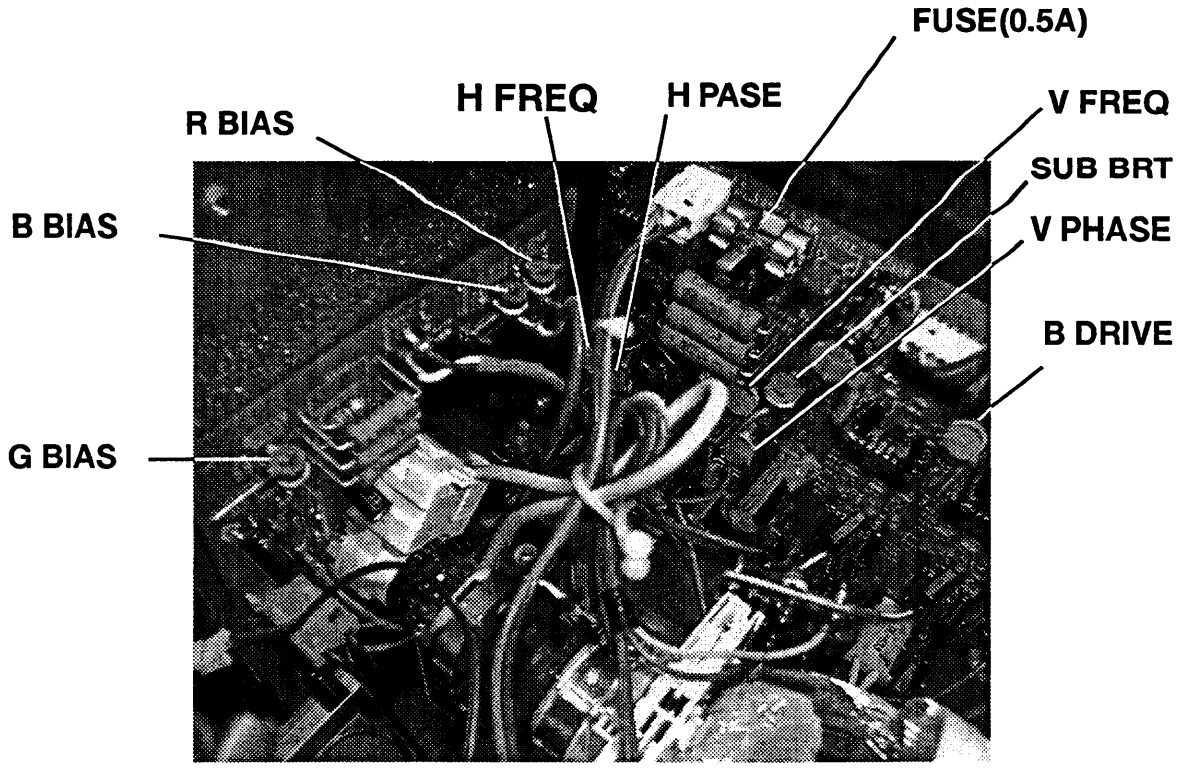


Figure 3.4 Display Unit, TV monitor P.C. board

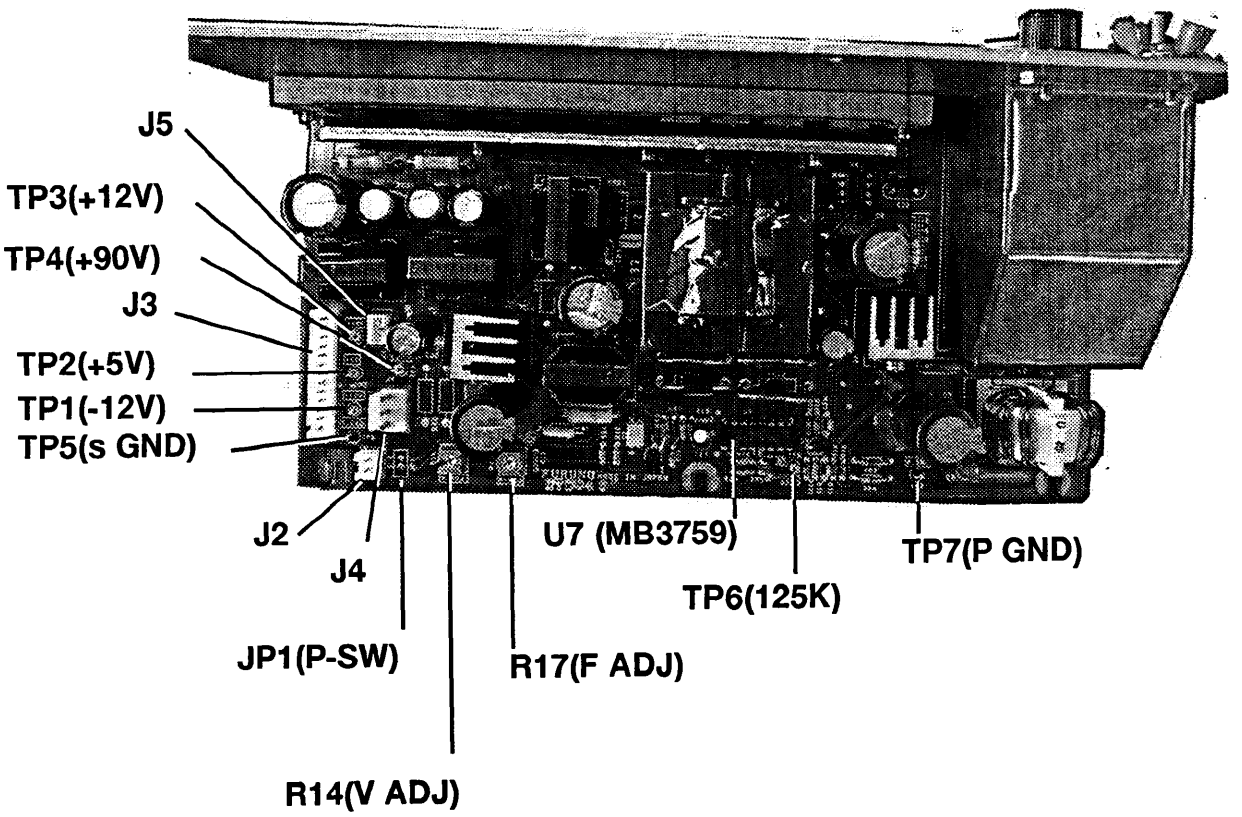


Figure 3.5 Display Unit, DPWR 10P6837

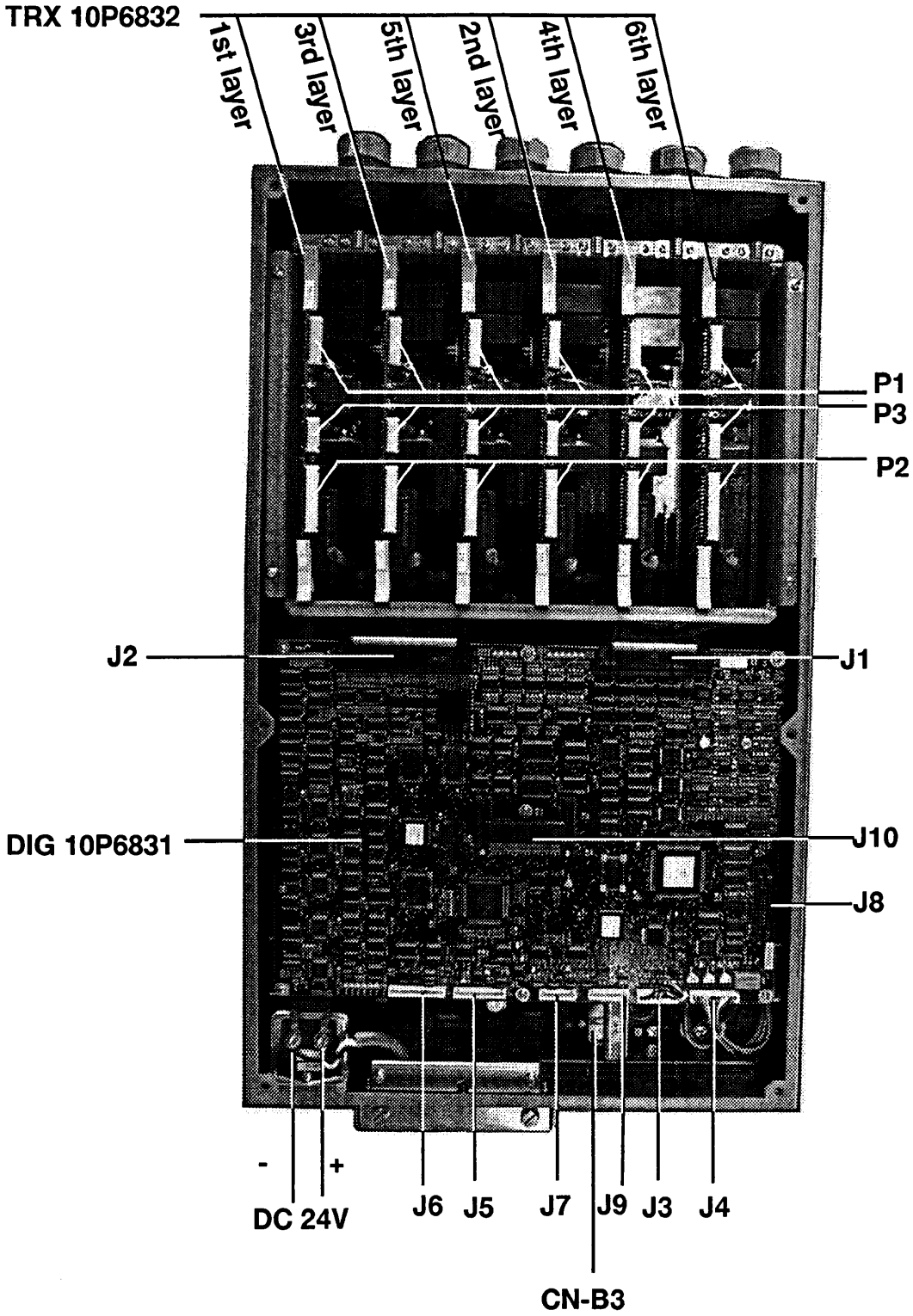


Figure 3.6 Transceiver Unit, front view

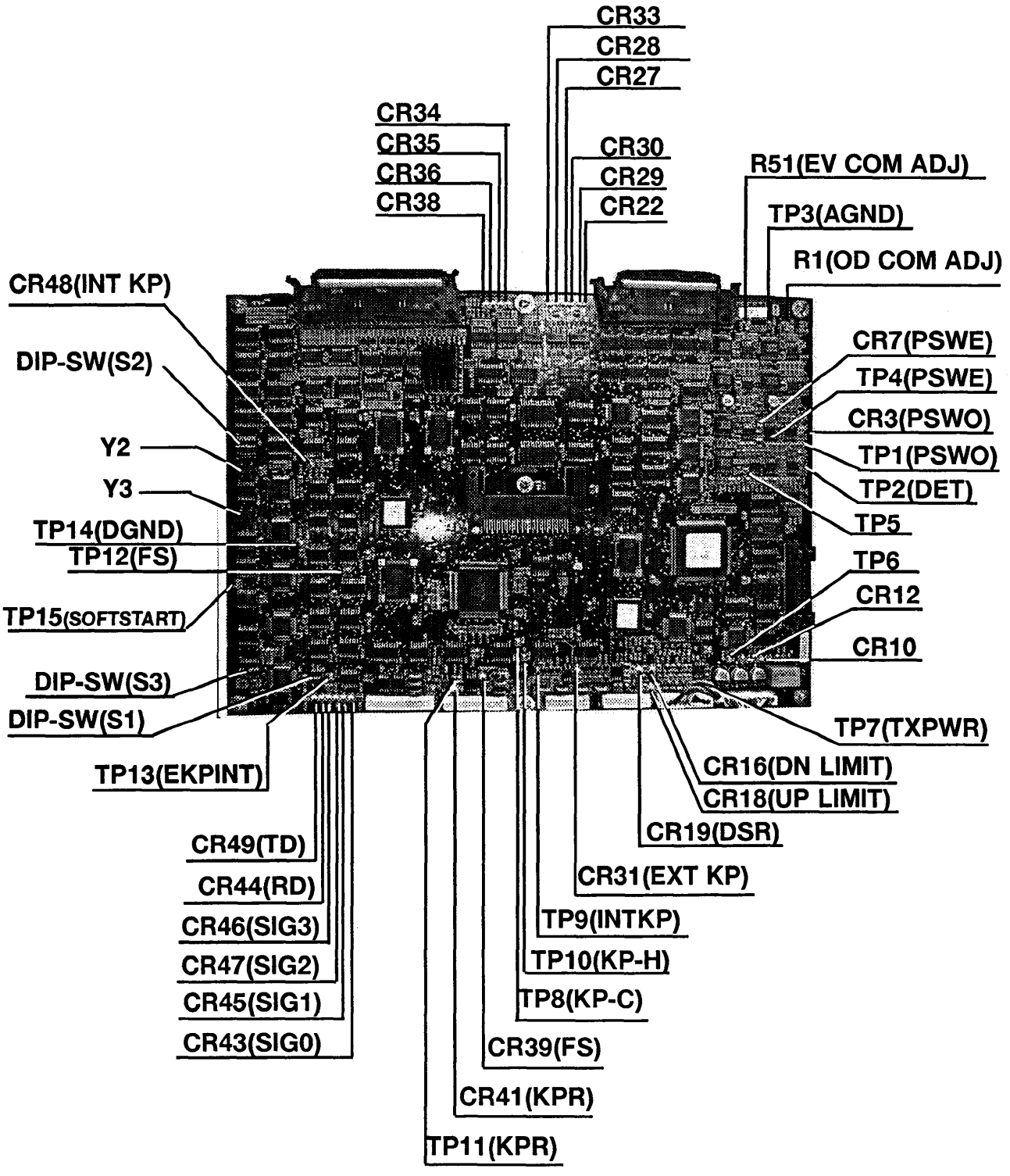


Figure 3.7 Transceiver Unit, DIG 10P6831

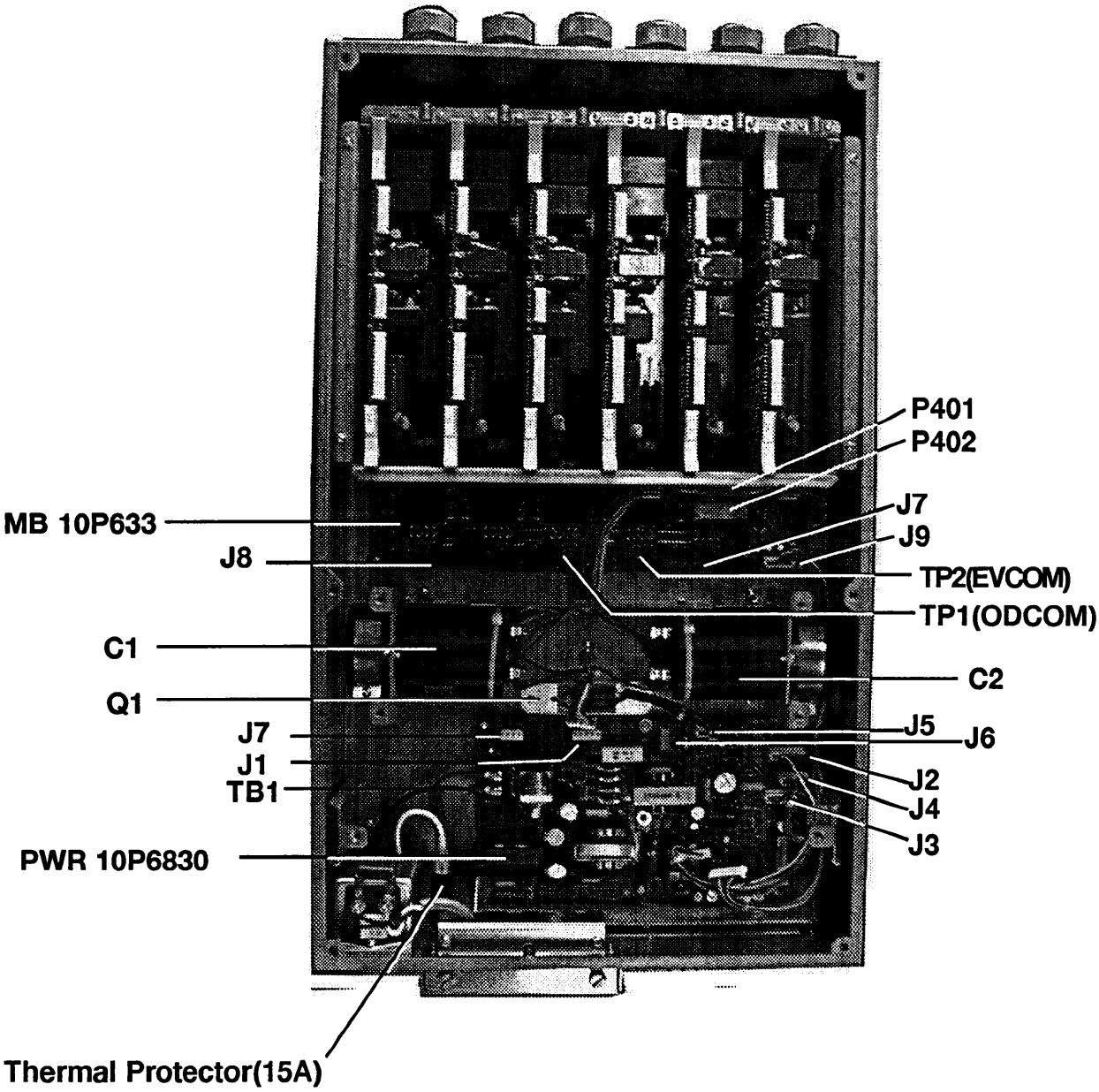


Figure 3.8 Transceiver Unit, front view removed the DIG board

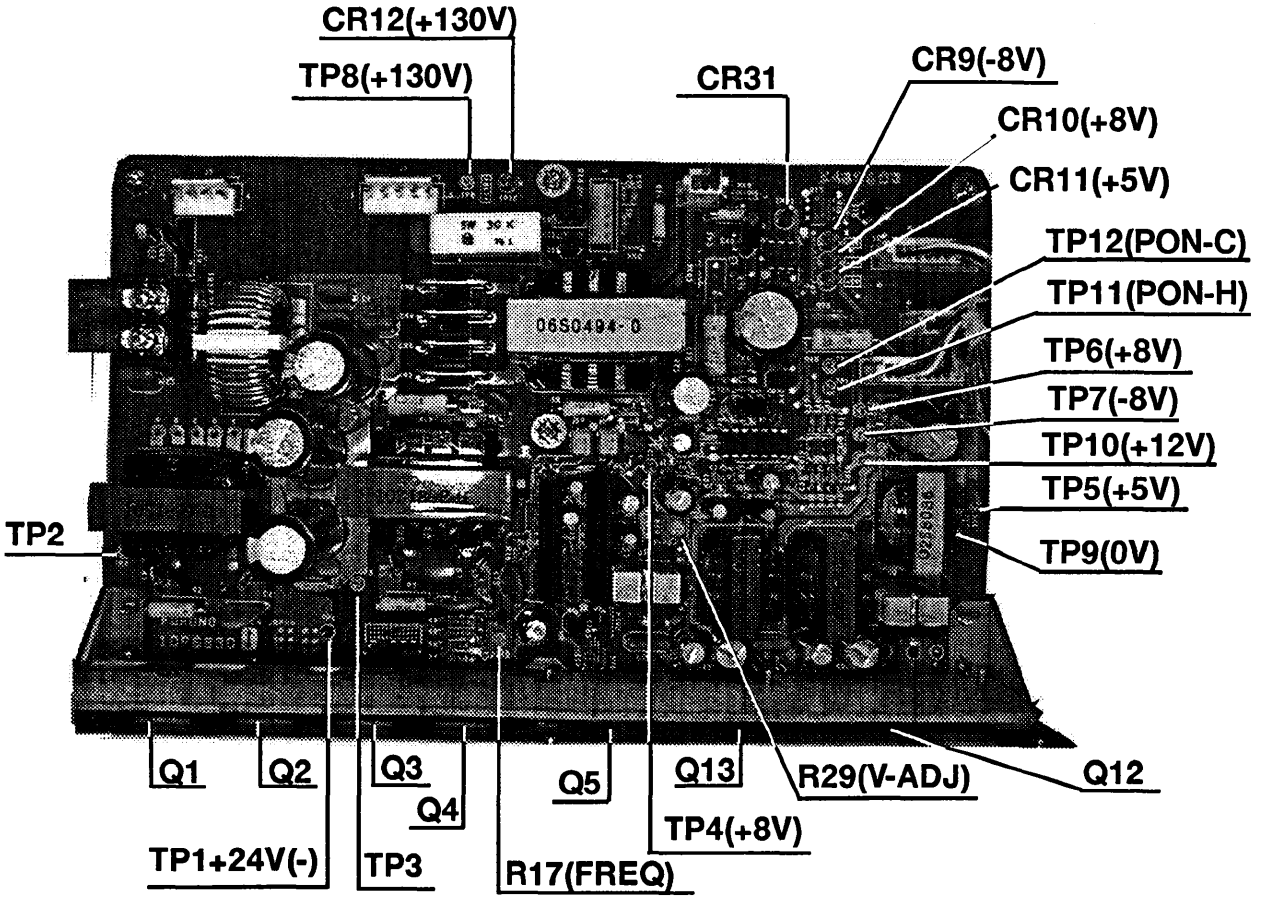


Figure 3.9 Transceiver Unit, PWR board 10P6830

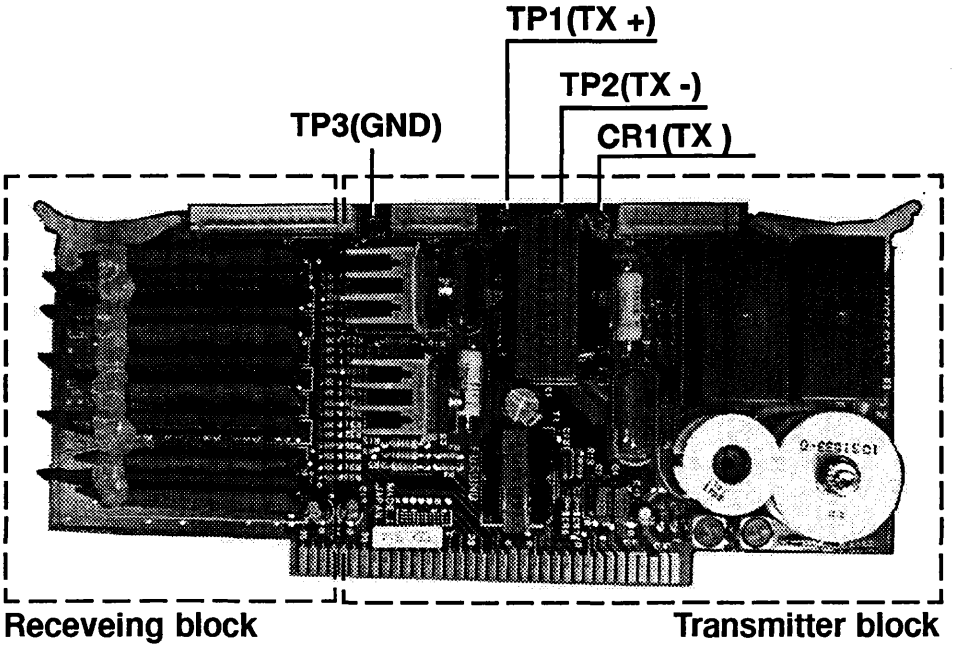


Figure 3. 10 Transceiver Unit, TRX board 10P6832

4.TROUBLESHOOTING

4.1Dip-Switches

Display Unit

MAIN (10P6835)

S1 #1 ON: Normal operation
OFF: Stand alone mode

#2 ON:: Freeze on
OFF: Freeze off

#3 ON: EEPROM Check on
OFF: EEPROM check off

#4 Not used

Transceiver Unit

DIG (10P6831)

S1 #1 Polarity of external KP input
ON: negative polarity OFF: Positive polarity

#2 Polarity of internal KP output
ON: negative polarity OFF: positive polarity

#3 Not used

#4 Not used

S2 #1/#2/#3/#4 Not used

#5/#6 Model selection
When system frequency is 55kHZ, set #5/#6 to ON.
When system frequency is 70 kHz, set #5/#6 to OFF.

#7/#8 Not used

S3 #1/#2 Selects the range at where the P-TVG curve saturate.

#1	ON	200m	OFF	400m	ON	600m	OFF	800m
#2	ON		ON		OFF		OFF	

#3/#4 Selects the gain of TVG curve at 100m.

#3	ON	109dB	OFF	114dB	ON	119dB	OFF	124dB
#4	ON		ON		OFF		OFF	

#5/#6 Selects TVG curve.

#5	ON	25log	OFF	30log	ON	35log	OFF	40log
#6	ON		ON		OFF		OFF	

#7/#8 Selects the range of TVG NEAR on Menu.

#5	ON	100m	OFF	200m	ON	300m	OFF	400m
#6	ON		ON		OFF		OFF	

4.2 LED status

MAIN Board 10P6835 in the display unit.

LED	Signal	Status	Remarks
CR4		●	
CR7		●	
CR8		●	
CR9		●	
CR10		●	
CR11		●	
CR12		●	
CR13		●	
CR14	DN/UP	○ ●	Lights when is lowering.
CR23	KPR	◑	Blinks
CR30	RXD	◑	Blinks with data from trasnsceiver unit.
CR31	TXD	◑	Blinks when some control settings are changed.
CR33	+12V	○	Lights
CR34	-12V	○	Lights
CR35	+5V	○	Lights

TRX Board 10P6832 in transceiver unit

LED	Signal	Status	Remarks
CR1	TX	◑	Blinks with transmission output

PWR Board 10P6830 in transceiver unit

LED	Signal	Status	Remarks
CR9	-8V	○	Lights
CR10	+8V	○	Lights
CR11	+5V	○	Lights
CR12	+130V	○	Lights
CR31	PWR1	○	Lights

DIG Board 10P6831 in transceiver unit

LED	Signal	Status	Remarks
CR3	PSWO	◑	Blinks with receiving signal input from MB board.
CR7	PSWE	◑	Blinks with receiving signal input from MB board.
CR10	-8V	○	Lights
CR12	+8V	○	Lights
CR16	DN LIMIT	● ○	Lights when lower limit switch is ON.
CR18	UP LIMIT	● ○	Lights when upper limit switch is ON.
CR19	DSR	●	Factory use.
CR22	Tilt 2^0	● ○	Lights according to the tilt angle.
CR29	Tilt 2^1	● ○	EX;
CR30	Tilt 2^2	● ○	
CR27	Tilt 2^3	● ○	
CR28	Tilt 2^4	● ○	
CR33	Tilt 2^5	● ○	
CR34		●	Normally off
CR35		●	Normally off
CR36		●	Normally off
CR38		◑	Blinks
CR39	FS	◑	Blinks
CR41	KPR	◑	Blinks
CR44	RD	◑	Blinks when some controls such as GAIN/TILT are changed.
CR49	TD	◑	Blinks when some controls such as GAIN/TILT are changed.
CR43	SIG0	◑	Blinks with receive signal input
CR45	SIG1	◑	Blinks with receive signal input
CR47	SIG2	◑	Blinks with receive signal input
CR46	SIG3	◑	Blinks with receive signal input
CR31	EXT KP	●	Blinks with external KP.
CR48	INT KP	●	Keep OFF with normal operation.

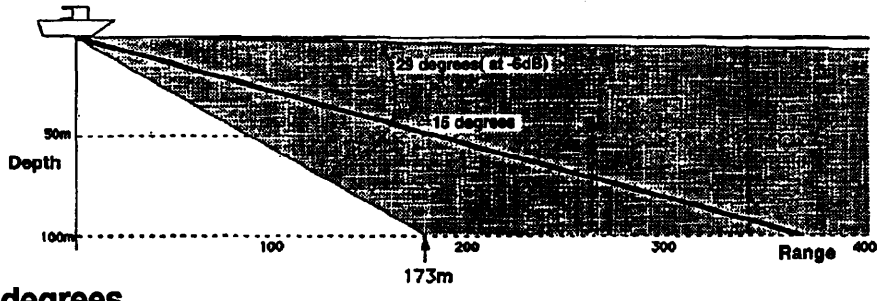
	CR22	CR29	CR30	CR27	CR28	CR33
Tilt 0	●	●	●	●	●	●
Tilt 30	○	○	○	○	○	●
Tilt 55	○	○	○	●	○	○

5. ANALYSIS OF PRESENTATION

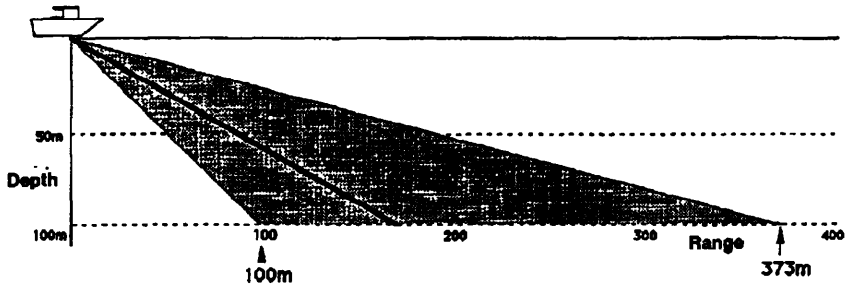
5.1 Signal propagating area

Vertical beam angle at -6 dB down point is 29 degrees. Horizontal beam angle at -6 dB down point is 21 degrees when horizontal beam angle "WIDE" is selected on the scan menu and 19.5 degrees with "NARROW".
For example, the vertical signal propagating area is as follows when tilt angle is set to 15 degrees or 30 degrees.

Tilt:15 degrees



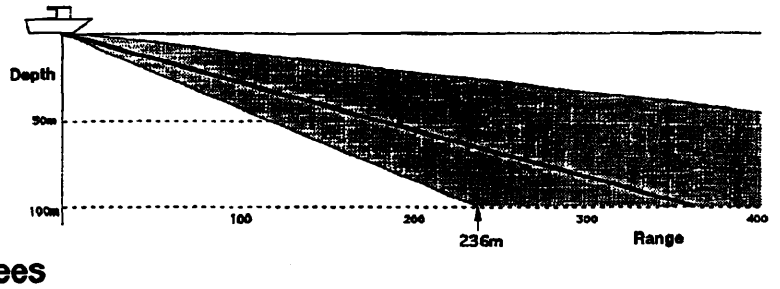
Tilt:30 degrees



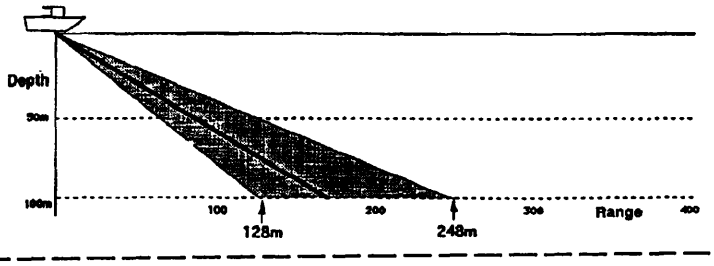
As mentioned above, the feature of propagating area of CSH-7 is that the vertical beam angle is wider. Therefore, should be taken account of this feature when operate the CSH-7 and analyze the echo presentation. An example of vertical beam angle of other sonar is as below.

The signal propagating area of model CSH-5 with tilt angle 15 and 30 degrees.

Tilt:15 degrees



Tilt:30 degrees



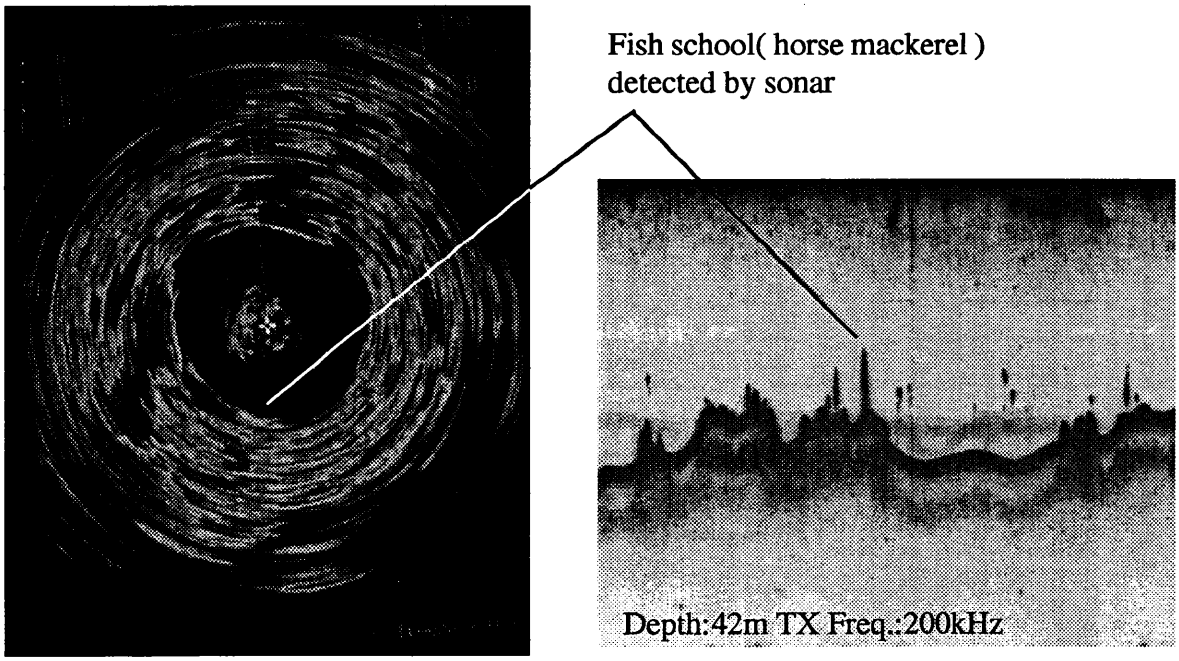
5.2 Pictures on the Screen

Following are the picture of CSH-7 (55 kHz) taken on the baby pursesiner.
Major settings used at this fishing ground, 40 m to 50 m depth, are as follows;

TX OUTPUT: 10 PULSELENGTH: 5 TX CYCLE: 7
TVG NEAR : 5 TVG FAR : 7 AGC : 7
NL : 8 VP :1 IR : 0
HOR BEAM ANGL: NARROW RES COLOR CURVE: 1
COLOR EMPHASIS: 3 GAIN: 5

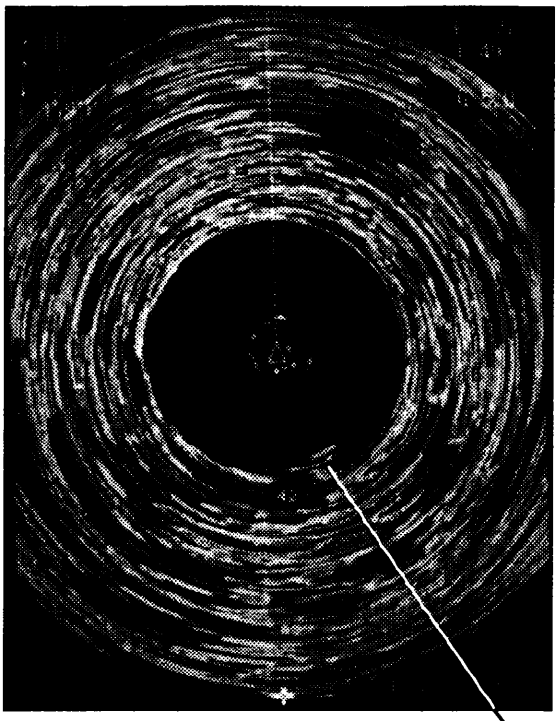
Note: 1.The pulselength and AGC controls are effective to reduce the seabed and sur face reflections.
2.In order to detect a small fish school, keep the gain settings (GAIN/TVG FAR) at higher position.
3. Use horizontal beam "NARROW"
4. Functioning IR may not preferable to detect small fish school.

Horse mackerel on the seabed

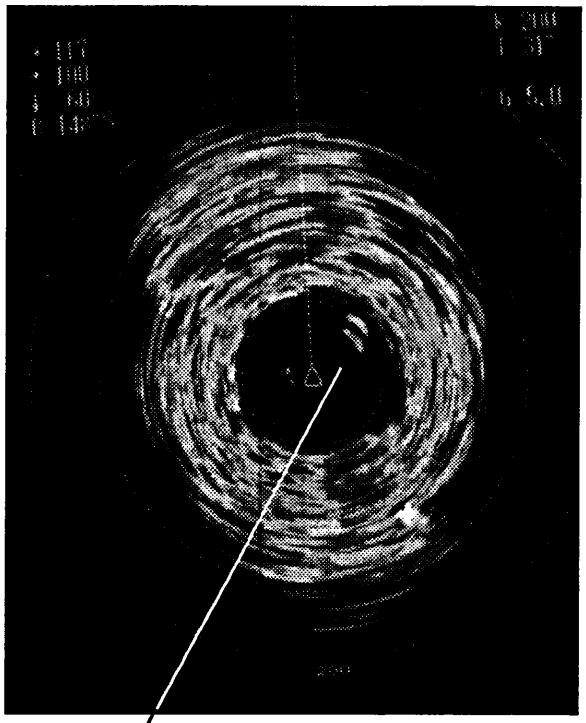


Range:150m, Tilt :22deg, G:5

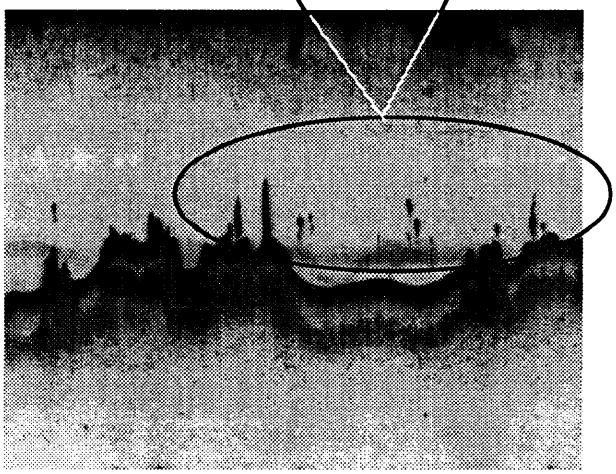
Horse mackerel on the seabed



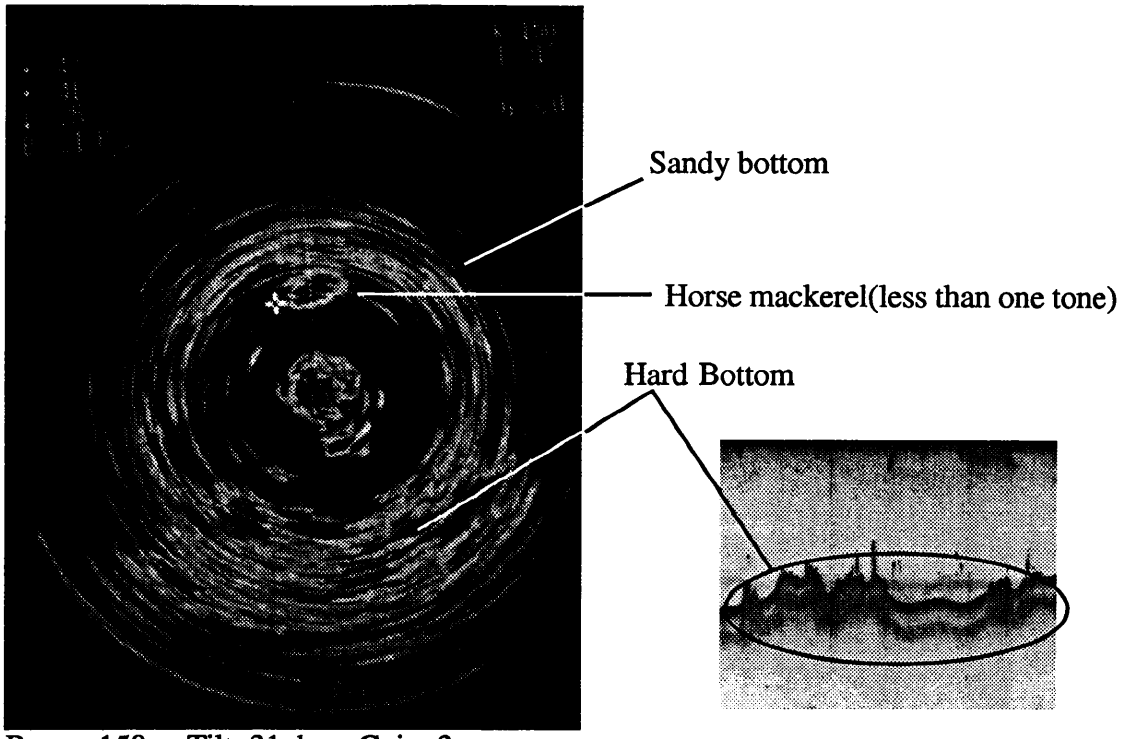
Range:85m, Tilt: 49 deg. Gain: 5



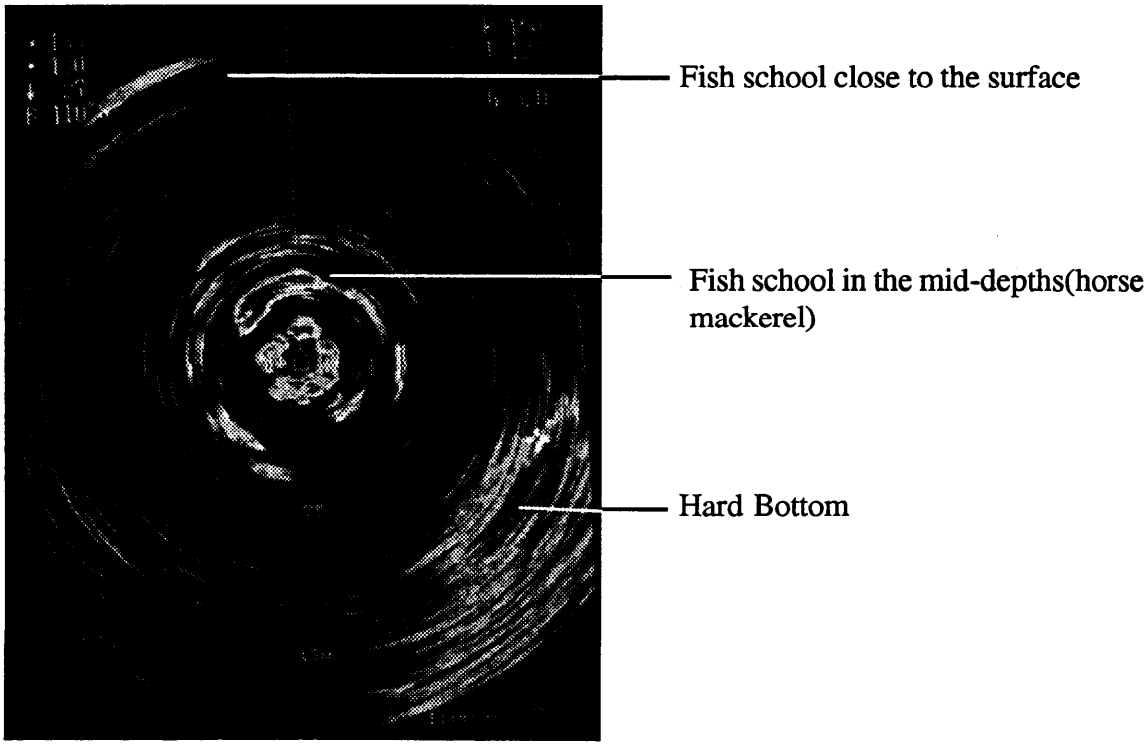
Range:200m, Tilt: 31 deg. Gain: 5



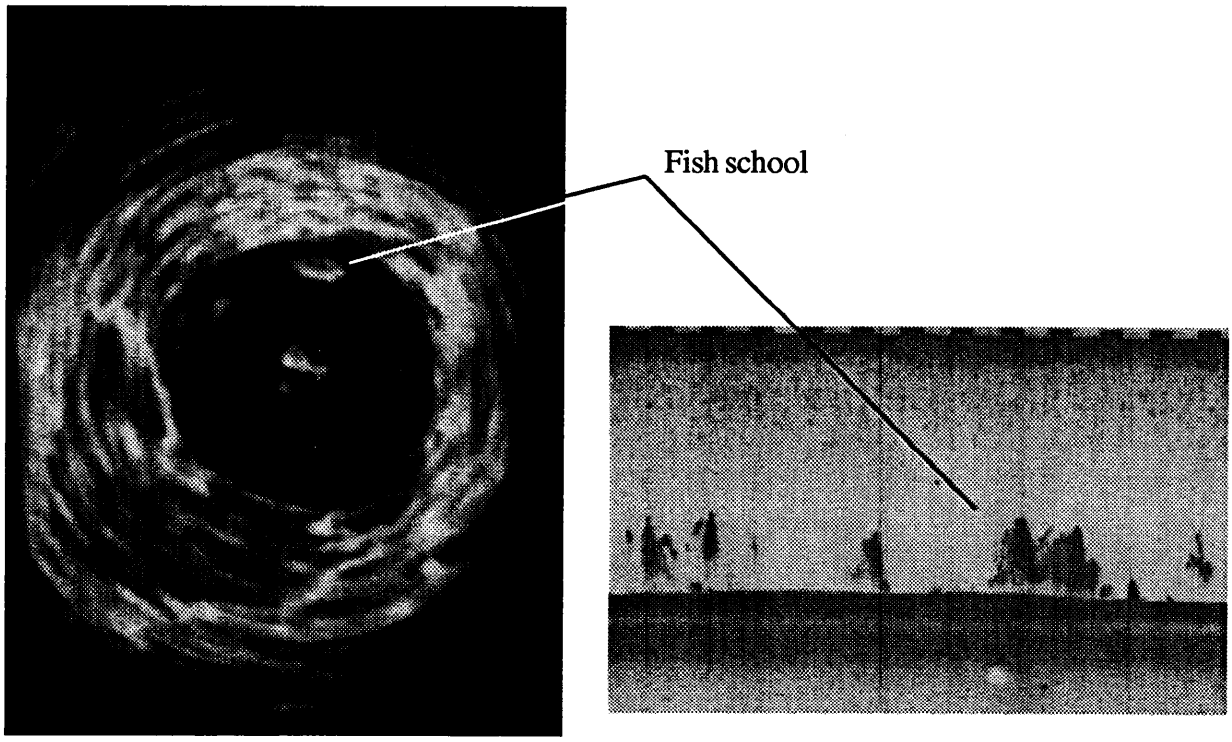
The fish school lured to the fishing lamp.



Range:150m, Tilt: 31 deg. Gain: 3

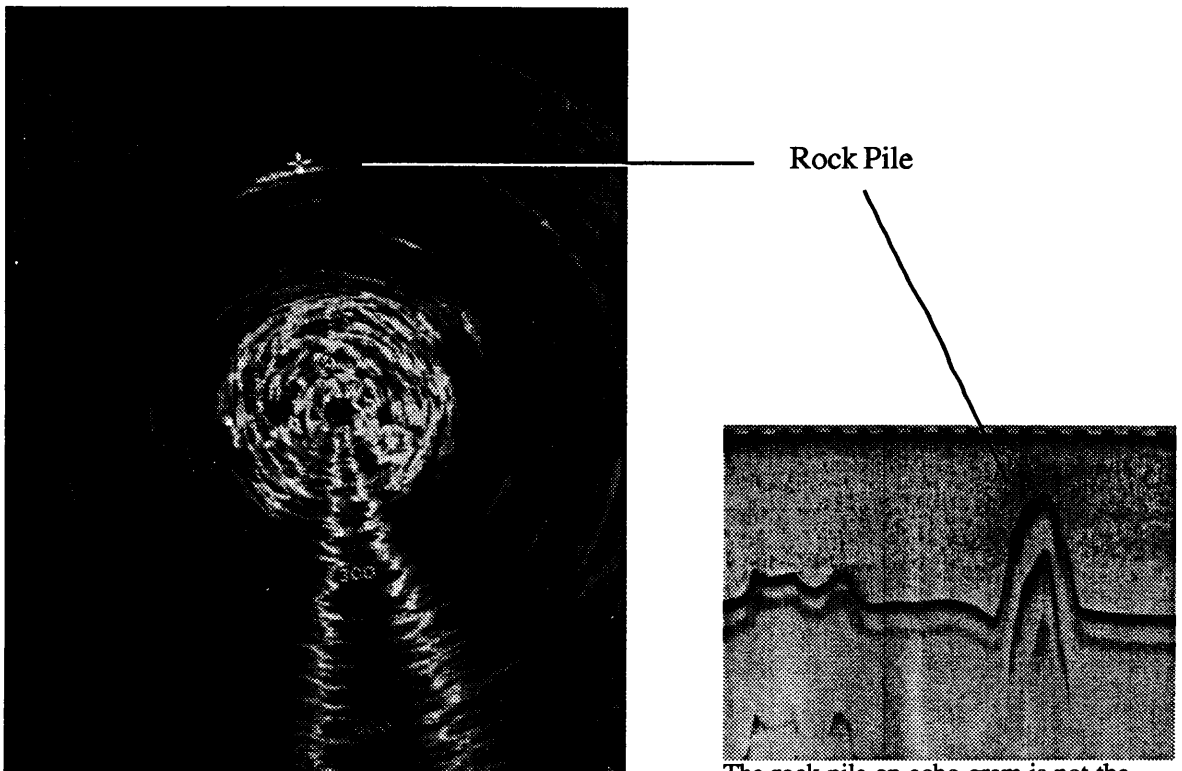


Range:150m, Tilt: 12 deg. Gain: 3



Range:150m, Tilt: 30 deg. Gain: 3

Rock Pile

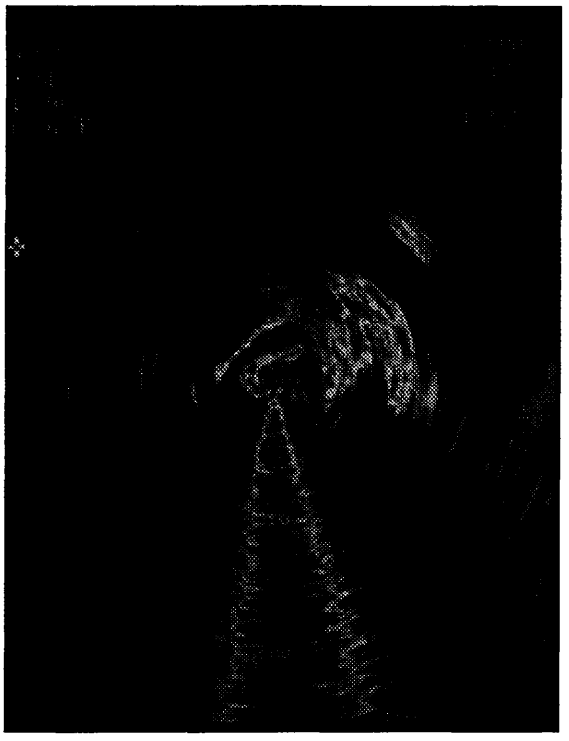


Range: 600m, Tilt: 6 deg. Gain: 4.5

The rock pile on echo gram is not the one on the screen, but mentioned for reference.

Difference of the presentation between H-WIDE and H-NARROW.

Horizontal Beam NARRW.

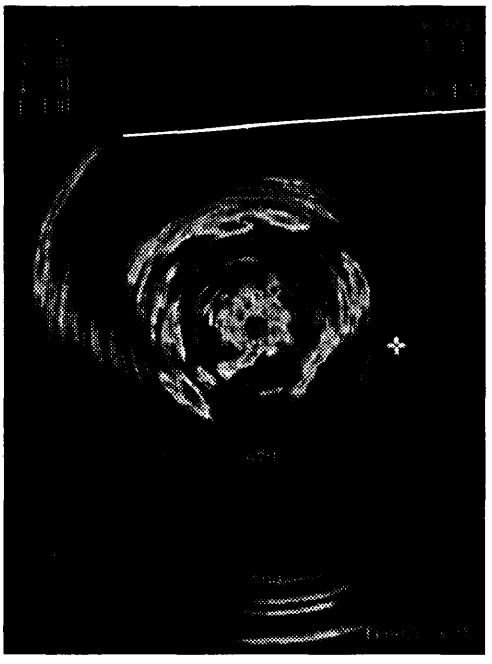


Range:500m, Tilt: 10 deg. Gain: 5.5

Horizontal Beam WIDE.

Range:800m, Tilt: 7 deg. Gain: 4.5

Picture of ship's wake



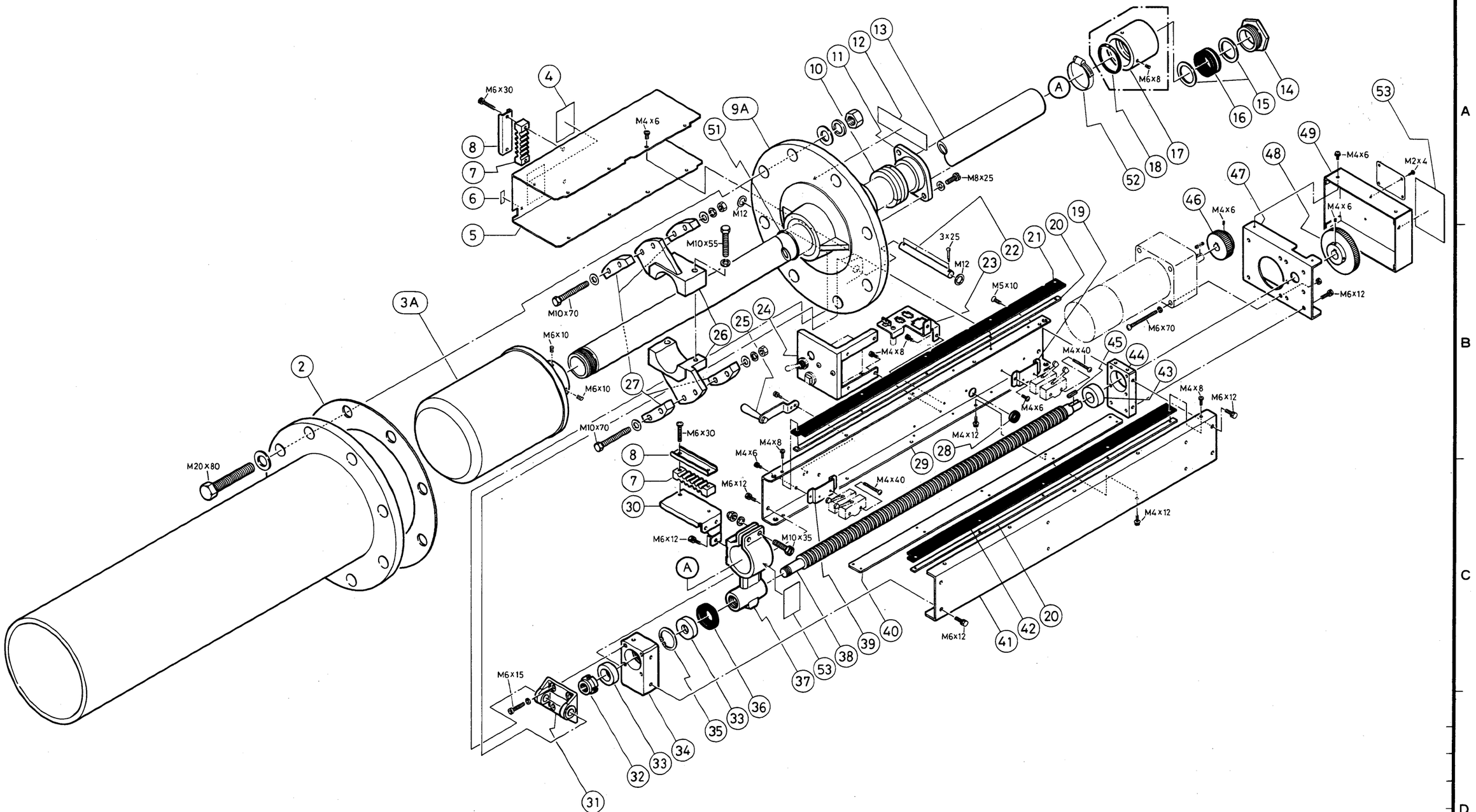
Own ship's wake at 500m

Range:500m, Tilt: 4 deg. Gain: 4.5

The ship's wake can be detected from maximum 740 m.

FURUNO

D - 1



CSH-7

承認 APPROVED	Jun. 9 '97 S. Koizumi	名称 TITLE	上下装置
検図 CHECKED	Jun. 6 '97 TAKAHASHI	CSH-7030/7031	HULL UNIT
製図 DRAWN	Jun. 6 '97 E. MIYOSHI	図番 DWG. NO.	C1302-E01-A

FURUNO ELECTRIC CO., LTD.

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MECHANICAL PARTS LIST

1997- 7

MODEL	CSH-7	
UNIT	HULL UNIT	PAGE
REF. DWG.	C1302-E01-A	M- 1

SYMBOL	PARTS NAME	TYPE/DWG. NO	CODE NO.	REMARKS
2	GASKET	SHJ-0009-1	661-000-091	
3A	TRANSDUCER ASSEMBLY	H7-55-42	006-026-860	55KHZ
	TRANSDUCER ASSEMBLY	H7-70-42	006-026-890	70KHZ
4	LABEL	10-061-3025-0	100-251-050	
5	COVER	10-061-3041-0	100-250-750	
6	LABEL	10-061-3022-0	100-248-830	
7	CABLE CLAMP	10-044-2127-1	100-112-311	
8	CABLE FIXING PLATE	10-044-2128-1	100-112-321	
9A	MAIN BODY FLANGE	10-044-2201-0	100-112-540	
10	GREASE COTTON	9.5SQUARE *0.7M*	000-801-891	
11	GREASE COTTON RETAINER	10-044-2204-1	100-112-571	
13	MAIN SHAFT	10-044-2301-1	100-112-591	1300 MM
	MAIN SHAFT (15)	10-044-2311-0	100-124-100	1550 MM
	UPPER SHAFT	10-044-2305-0	100-112-630	945 NM
14	CABLE GLAND	10-061-3081-0	100-250-780	
15	FLAT WASHER	10-061-3082-0	100-250-790	
16	GASKET	10-061-3083-0	100-250-800	
17	WATERPROOF ATTACHMENT	10-044-2321-0	100-124-090	
18	O-RING	JISB2401-1A-G55	000-851-308	
19	ULSW MOUNTING ANGLE	10-044-2109-1	100-112-221	
20	COVER FIXING PLATE	10-044-2156-0	100-112-510	STROKE 400
	COVER FIXING PLATE	10-044-2122-1	100-112-431	STROKE 600
21	DUST COVER (2)	10-044-2158-0	100-112-530	STROKE 400
	DUST COVER (2)	10-044-2129-0	100-112-450	STROKE 400
22	TRUNNION SHAFT	10-044-2205-1	100-112-581	
23	CONNECTOR FIXING PLATE	10-061-3023-2	100-248-842	
24	RELAY MOUNTING BASE	10-061-3021-1	100-248-821	
26	TANK GUIDE	10-044-2401-1	100-112-641	
27	TANK GUIDE (2)	SHJ-0015	661-000-150	
28	GROMMET	G-46	000-871-306	
29	SIDE PLATE (2)	10-061-3061-1	100-250-761	STROKE 400
	SIDE PLATE (2)	10-061-3011-2	100-248-812	STROKE 600
30	CABLE FIXING PLATE	10-061-3031-1	100-250-811	
31	TRUNNION CATCH	10-044-2108-2	100-112-212	
32	U-NUT	FU03SS	000-801-888	
33	BEARING	30203	000-873-101	
34	LOWER METAL BASE	10-044-2104-1	100-112-201	
35	C-TYPE CIRCLIP	NOMINAL 40MM SK5	000-866-418	
36	CUSHION	10-044-2124-1	100-112-281	
37	MAIN SHAFT HOLDER	10-044-2102-1	100-112-181	
38	SCREW SHAFT	10-044-2151-0	100-112-460	STROKE 400
	SCREW SHAFT	10-044-2101-1	100-112-381	STROKE 600
39	LSW MOUNTING ANGLE	10-044-2110-2	100-112-422	
39	LSW MOUNTING ANGLE	10-044-2155-0	100-112-500	
40	SIDE PLATE (3)	10-044-2154-0	100-112-490	STROKE 400
	SIDE PLATE (3)	10-044-2107-1	100-112-411	STROKE 600
41	SIDE PLATE (1)	10-061-3012-0	100-250-740	STROKE 400
	SIDE PLATE (1)	10-061-3062-0	100-250-770	STROKE 600
42	DUST COVER (1)	10-044-2157-0	100-112-520	STROKE 400
	DUST COVER (1)	10-044-2123-1	100-112-441	STROKE 600
43	BALL BEARING	6203	000-873-336	
44	UPPER METAL BASE	10-044-2103-1	100-112-191	
45	PARALLEL KEY	4X4X20 S45C	000-801-889	
46	MOTOR GEAR	10-044-2112-1	100-112-231	
47	MOTOR FIXING PLATE	10-044-2117-1	100-112-251	
48	SCREW SHAFT SPUR GEAR	10-044-2115-1	100-112-241	
49	GEAR COVER	10-044-2119-1	100-112-261	
51	O-RING	JISB2401-1A-P55	000-851-152	
53	LABEL	10-061-3025-0	100-251-050	

FURUNO

ELECTRICAL PARTS LIST
電気部品表

1997- 7

MODEL	CSH-7 (CSH-7010)		
UNIT	DISPLAY UNIT 指示装置		PAGE
REF. DWG.	C1302-K01-A	BLOCK NO.	E-1

SYMBOL 記号		TYPE 型名	CODE NO. コード番号	REMARKS 備考	RECOMMENDED SERVICE PARTS 出荷単位
		PRINTED CIRCUIT BOARD	プリントキバン		
		10P6837,DPWR	006-028-330	POWER ASSY.	○
		10P6836,PNL	006-026-350		○
		10P6835,MAIN	006-027-270		○
		10P6840,ITF	006-027-080	OPTION	○
		CRT ASSEMBLY	CRT クミヒン		
		QA1012	000-139-425		
		ASSEMBLY	クミヒン		
		CSH-7010-J	006-026-340	10P6836 JAPANESE	○
		CSH-7010-E	006-026-560	10P6836 ENGLISH	○
		80-0552	006-026-430	BUZZER ASSY.	○
		COOLING FAN	ファンモーター		
B	1	MF-40B-12H	000-127-160		
		RESISTOR	テイコウ		
R	1	RK097111T10KB	000-126-353		
R	2	RK0971110-10KB	000-131-481		
R	3	RK0971110-10KB	000-131-481		
		SWITCH	スイッチ		
S	1	SDDFC3-1A-3	000-139-421		
		TRACKBALL	トラックボール		
TB	1	EUA-FTF814B	000-115-533		
		CABLE WITH CONNECTOR	コネクターツキケーブル		
W	1	FRC5-A040 ハーネス	000-139-901		

- END -

FURUNO

ELECTRICAL PARTS LIST
電気部品表

1997- 5

MODEL	CSH-7 (CSH-7020)		
UNIT	TRANSCEIVER UNIT 送受信装置		PAGE E-2
REF. DWG.	C1302-K03-A C1302-K04-A	BLOCK NO.	

SYMBOL 記号	TYPE 型名	CODE NO. コード番号	REMARKS 備考	RECOMMENDED SERVICE PARTS 出荷単位
	PRINTED CIRCUIT BOARD	ﾌﾟﾘﾝﾄｷﾊﾞﾝ		
	10P6832,TRX	006-026-780	55KHZ 1:6	○
	10P6832,TRX	006-026-790	55KHZ 2:5	○
	10P6832,TRX	006-026-800	55KHZ 3:4	○
	10P6832,TRX	006-026-810	70KHZ 1:6	○
	10P6832,TRX	006-026-820	70KHZ 2:5	○
	10P6832,TRX	006-026-830	70KHZ 3:4	○
	10P6831,DIG	006-026-760	55KHZ	○
	10P6831,DIG	006-026-770	70KHZ	○
	10P6830,PWR	006-028-440		○
	ASSEMBLY	ｸﾐﾋﾝ		
	CSH-7020-55	006-026-570	55KHZ 10P6833,MB	○
	CSH-7020-70	006-026-580	70KHZ 10P6833,MB	○
	CSH-7020	006-027-410	NOISE FILTER	○
	CAPACITOR	ｺﾝﾃﾞﾝｻｰ		
C 1	SME160LGSN-10000MC	000-139-772		
C 2	SME160LGSN-10000MC	000-139-772		
	CIRCUIT BREAKER	ｻｰｷｯﾄﾌﾞﾚｰｶｰ		
CB 1	NRF110-15A	000-133-538		
	TRANSISTOR	ﾄﾗﾝｼﾞｽﾀｰ		
Q 1	2SK1491	000-138-397		

- END -

FURUNO

ELECTRICAL PARTS LIST
電気部品表

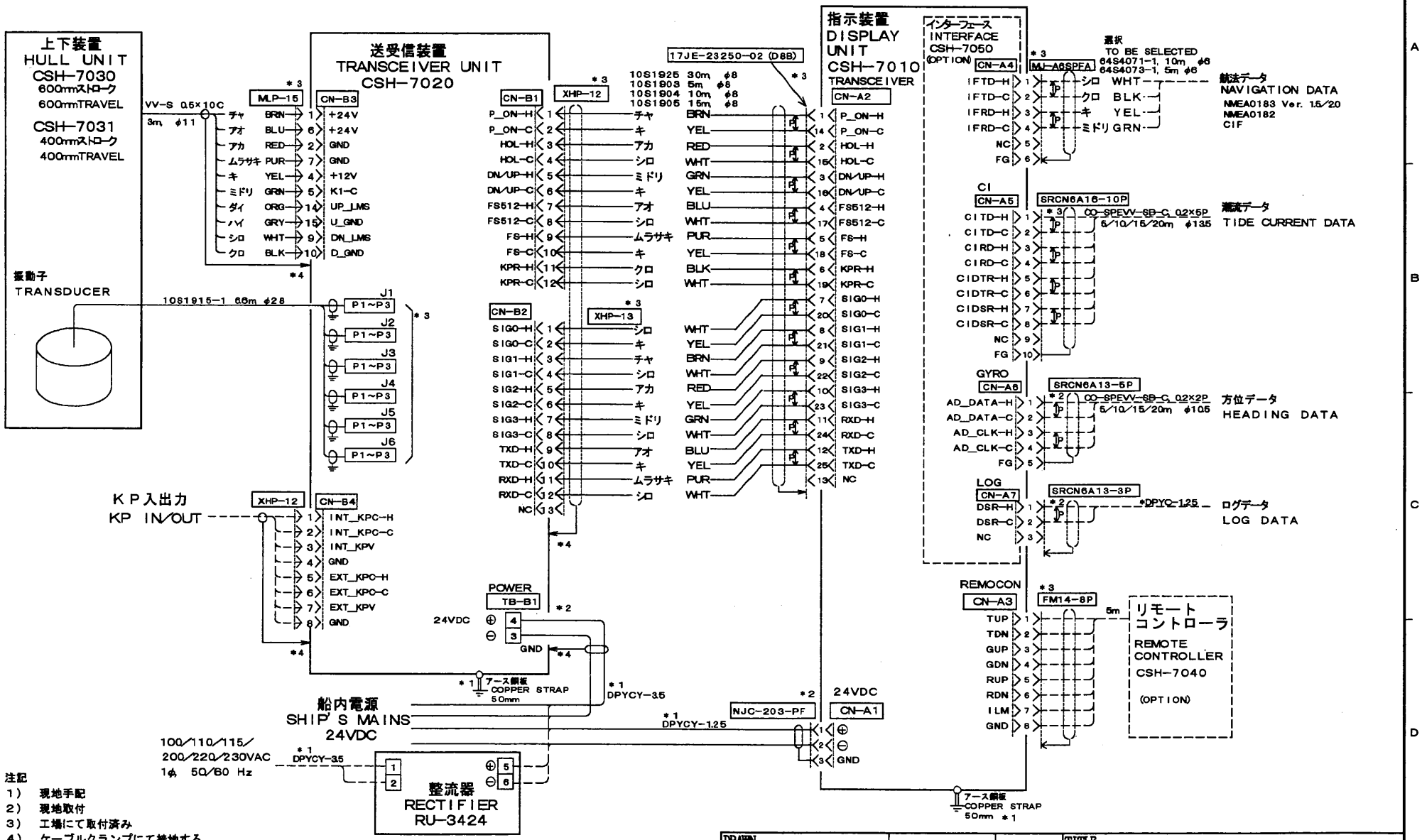
1997- 7

MODEL	CSH-7 (CSH-7030/31)			
UNIT	HULL UNIT 上下装置			PAGE
REF. DWG.	C1302-K06-A	BLOCK NO.		E-3

SYMBOL 記号		TYPE 型名	CODE NO. コード番号	REMARKS 備考	RECOMMENDED SERVICE PARTS 出荷単位
		MOTOR	モーター		
B	1	M75J01B-GE004-HF05AE	000-139-312		
		CAPACITOR	ｺﾝﾃﾞﾝｻｰ		
C	1	ECQ-E1105KF3	000-139-154		
		CIRCUIT BREAKER	ｻｰｷｯﾄﾌﾞﾚｰｶｰ		
CB	1	NRF110-8A	000-139-311		
		DIODE	ﾀﾞｲｵｰﾄﾞ		
CR	1	BD-713G-5	000-139-171		
CR	2	BD-711R-5	000-108-619		
		RELAY	ﾘﾚｰ		
K	1	MM2XP-D DC12V	000-117-775		
		RESISTOR	ﾃｲｺｳ		
R	1	FA0-5W-15	000-118-305		
R	2	ERG-2SJ152P	000-375-476		
R	3	ERD-S2TJ220V	000-135-425		
R	4	ERG-1SJ102P	000-375-409		
		SWITCH	ｽｲｯﾁ		
S	1	X-10GM2	000-121-325		
S	2	X-10GM2	000-121-325		
S	3	X-10GM2	000-121-325		
S	4	X-10GM2	000-121-325		
S	5	ET425N12	000-139-110		
		RELAY SOCKET	ﾘﾚｰｿｹｯﾄ		
XK	1	8PFA	000-456-804		

- END -

FURUNO



注記
1) 現地手記
2) 現地取付
3) 工場にて取付済み
4) ケーブルクランプにて接地する

NOTES
*1: LOCAL SUPPLY.
*2: FIT LOCALLY.
*3: FITTED AT FACTORY.
*4: GROUND THRU CABLE CLAMP.

DRAWN	Dec. 2 '97 T. YAMASAKI	TITLE	CSH-7
CHECKED	Dec 8 '97 K. KUSUNOKI	名称	カラースキャニングソナー
APPROVED	Dec 8 '97 A. YAMAGUCHI		相互結線図
SCALE	—	MASS — kg	NAME COLOR SCANNING SONAR
DWG No.	C1302-C01- G		INTERCONNECTION DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO

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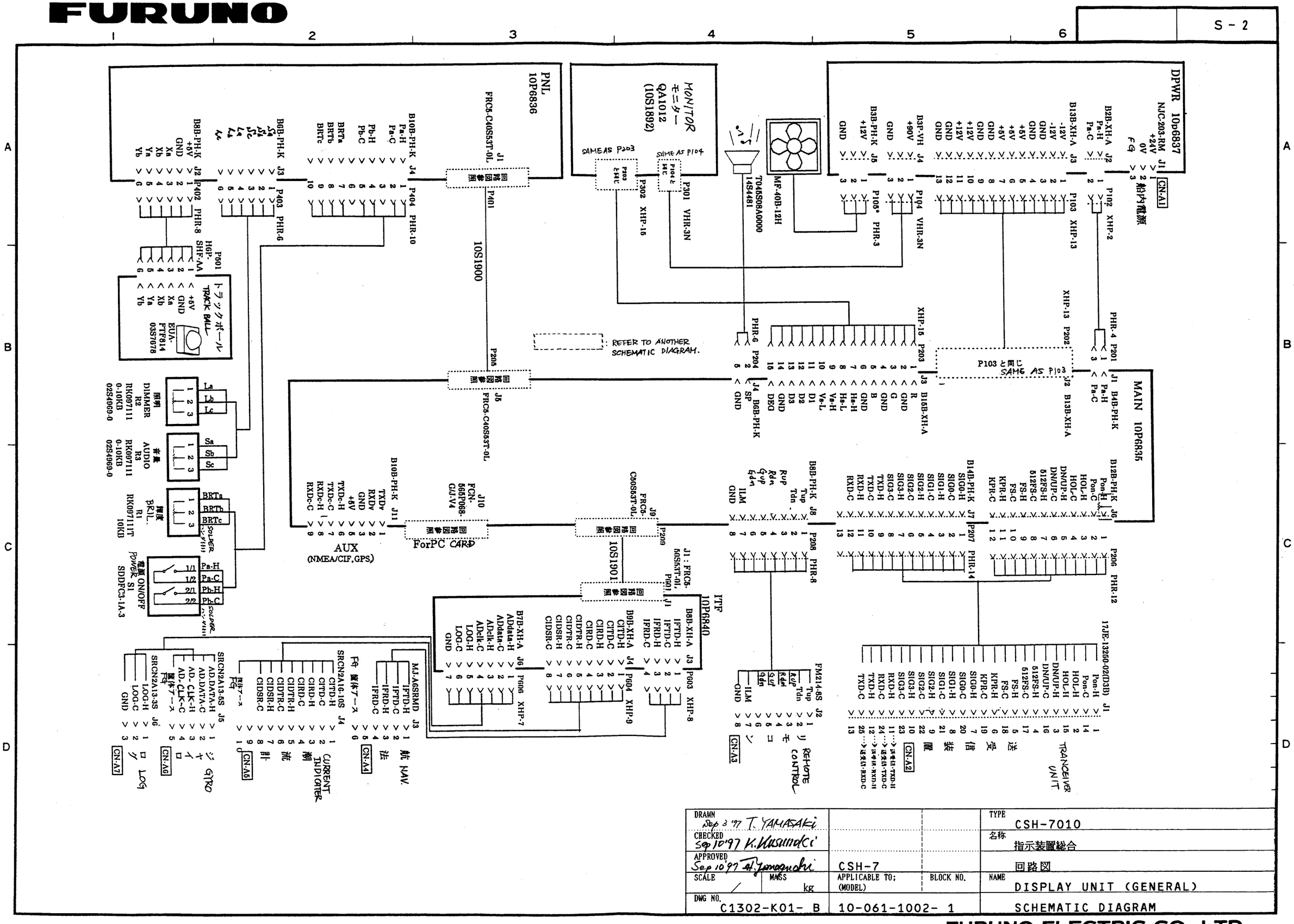
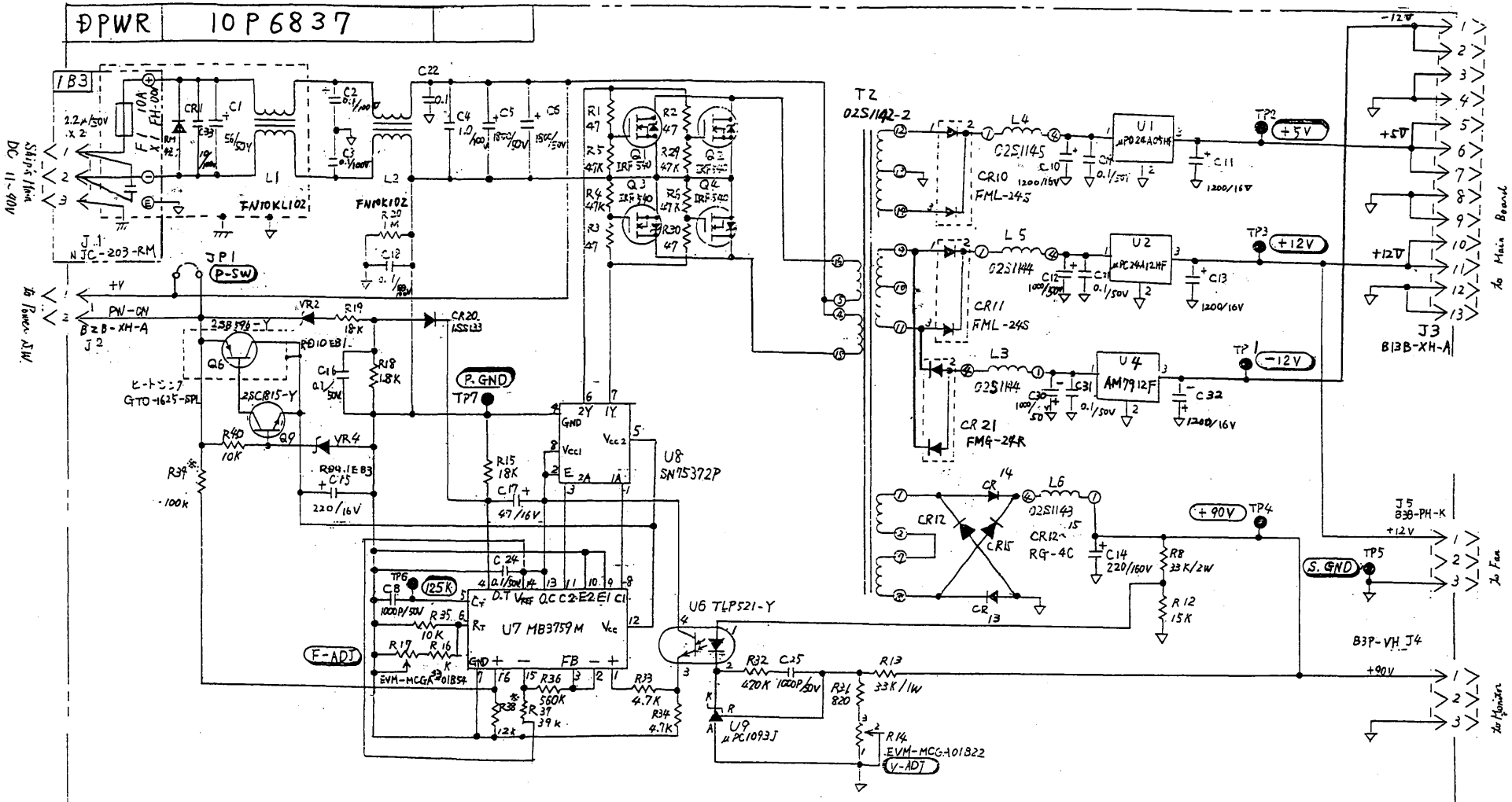
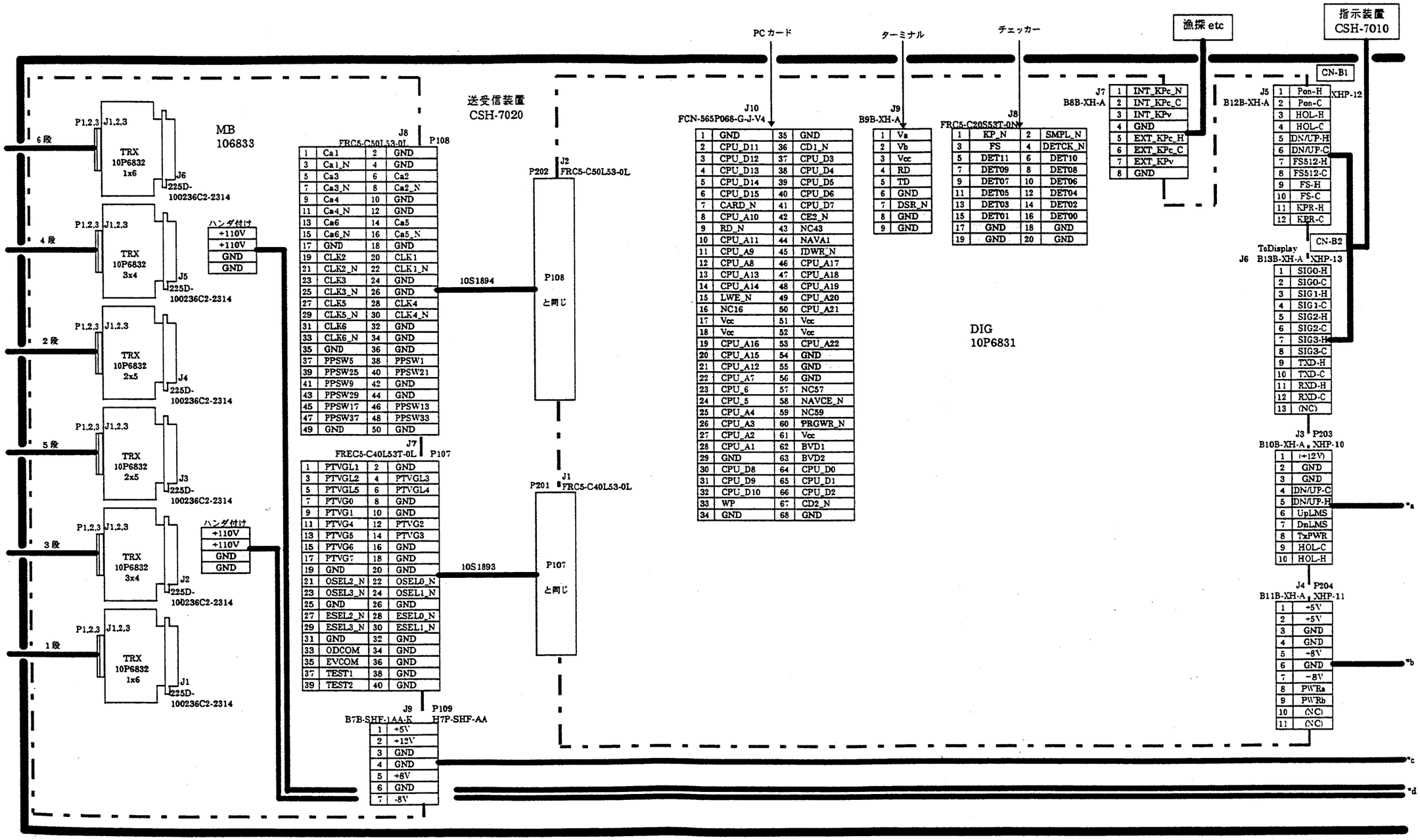


DRAWN Sep 3 '97 T. YAMASAKI			TYPE CSH-7010
CHECKED Sep 10'97 K. Matsumoto			名称 指示装置総合
APPROVED Sep 10 97 A. Yamaguchi	CSH-7		回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME DISPLAY UNIT (GENERAL)
DWG NO. C1302-K01- B	10-061-1002- 1		SCHEMATIC DIAGRAM

FURUNO



DRAWN May 6 '97 T. YAMASAKI			TYPE	10P6837
CHECKED May 7 '97 K. Kusunoki			名称	指示装置電源基板
APPROVED May 7 '97 T. Yamaguchi		CSH-7010		回路図
SCALE — MASS — kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME	DISPLAY UNIT POWER BOARD
DWG NO. J1302-K02- A	10-061-1023- 3			SCHEMATIC DIAGRAM



1	Ca1	2	GND
3	Ca1_N	4	GND
5	Ca3	6	Ca2
7	Ca3_N	8	Ca2_N
9	Ca4	10	GND
11	Ca4_N	12	GND
13	Ca6	14	Ca5
15	Ca6_N	16	Ca5_N
17	GND	18	GND
19	CLK2	20	CLK1
21	CLK2_N	22	CLK1_N
23	CLK3	24	GND
25	CLK3_N	26	GND
27	CLK5	28	CLK4
29	CLK5_N	30	CLK4_N
31	CLK6	32	GND
33	CLK6_N	34	GND
35	GND	36	GND
37	PPSW5	38	PPSW1
39	PPSW25	40	PPSW21
41	PPSW9	42	GND
43	PPSW29	44	GND
45	PPSW17	46	PPSW13
47	PPSW37	48	PPSW33
49	GND	50	GND

1	PTVGL1	2	GND
3	PTVGL2	4	PTVGL3
5	PTVGL5	6	PTVGL4
7	PTVG0	8	GND
9	PTVG1	10	GND
11	PTVG4	12	PTVG2
13	PTVG5	14	PTVG3
15	PTVG6	16	GND
17	PTVG7	18	GND
19	GND	20	GND
21	OSEL2_N	22	OSEL0_N
23	OSEL3_N	24	OSEL1_N
25	GND	26	GND
27	ESEL2_N	28	ESEL0_N
29	ESEL3_N	30	ESEL1_N
31	GND	32	GND
33	ODCOM	34	GND
35	EVCOM	36	GND
37	TEST1	38	GND
39	TEST2	40	GND

1	+5V		
2	+12V		
3	GND		
4	GND		
5	+8V		
6	GND		
7	-8V		

1	GND	35	GND
2	CPU_D11	36	CD1_N
3	CPU_D12	37	CPU_D3
4	CPU_D13	38	CPU_D4
5	CPU_D14	39	CPU_D5
6	CPU_D15	40	CPU_D6
7	CARD_N	41	CPU_D7
8	CPU_A10	42	CE2_N
9	RD_N	43	NC43
10	CPU_A11	44	NAVA1
11	CPU_A9	45	IDWR_N
12	CPU_A8	46	CPU_A17
13	CPU_A13	47	CPU_A18
14	CPU_A14	48	CPU_A19
15	LWE_N	49	CPU_A20
16	NC16	50	CPU_A21
17	Vcc	51	Vcc
18	Vcc	52	Vcc
19	CPU_A16	53	CPU_A22
20	CPU_A15	54	GND
21	CPU_A12	55	GND
22	CPU_A7	56	GND
23	CPU_6	57	NC57
24	CPU_5	58	NAVCE_N
25	CPU_A4	59	NC59
26	CPU_A3	60	PRGWR_N
27	CPU_A2	61	Vcc
28	CPU_A1	62	BVD1
29	GND	63	BVD2
30	CPU_D8	64	CPU_D0
31	CPU_D9	65	CPU_D1
32	CPU_D10	66	CPU_D2
33	WP	67	CD2_N
34	GND	68	GND

1	Va		
2	Vb		
3	Vcc		
4	RD		
5	TD		
6	GND		
7	DSR_N		
8	GND		
9	GND		

1	KP_N	2	SMPL_N
3	FS	4	DETCK_N
5	DET11	6	DET10
7	DET09	8	DET08
9	DET07	10	DET06
11	DET05	12	DET04
13	DET03	14	DET02
15	DET01	16	DET00
17	GND	18	GND
19	GND	20	GND

1	INT_KPc_N	
2	INT_KPc_C	
3	INT_KPv	
4	GND	
5	EXT_KPc_H	
6	EXT_KPc_C	
7	EXT_KPv	
8	GND	

1	Pon-H	
2	Pon-C	
3	HOL-H	
4	HOL-C	
5	DN/UP-H	
6	DN/UP-C	
7	FS12-H	
8	FS12-C	
9	FS-H	
10	FS-C	
11	KPR-H	
12	KPR-C	

1	SIG0-H	
2	SIG0-C	
3	SIG1-H	
4	SIG1-C	
5	SIG2-H	
6	SIG2-C	
7	SIG3-H	
8	SIG3-C	
9	TXD-H	
10	TXD-C	
11	RXD-H	
12	RXD-C	
13	(NC)	

1	(+12V)	
2	GND	
3	GND	
4	DN/UP-C	
5	DN/UP-H	*a
6	UpLMS	
7	DnLMS	
8	TxPWR	
9	HOL-C	
10	HOL-H	

1	+5V	
2	+5V	
3	GND	
4	GND	
5	-8V	
6	GND	*b
7	-8V	
8	PWRa	
9	PWRb	
10	(NC)	
11	(NC)	

DRAWN	May 6 '97 T. KAMASAKI		TYPE CSH-7020
CHECKED	May 7 '97 K. MIZUNOKI		名称 送受信装置総合（1／2）
APPROVED	May 7. '97 H. Yamaguchi	CSH-7	回路図
SCALE —	MASS — kg	APPLICABLE TO; (MODEL)	BLOCK NO. NAME TRANSCEIVER UNIT(GENERAL)1/2
DWG NO.	J1302-K03- A	10-061-2002- 0	SCHEMATIC DIAGRAM

FURUNO

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送受信装置
CSH-7020

P302 J2
H10P-SHF-AA B10P-SHF-1AA-K

1	(+12V)
2	GND
3	GND
4	DN/UP-C
5	DN/UP-H
6	UpLMS
7	DnLMS
8	TxPWR
9	HOL-C
10	HOL-H

P303 J3
H11P-SHF-AA B11P-SHF-1AA-K

1	+5V
2	+5V
3	GND
4	GND
5	+8V
6	GND
7	−8V
8	PWRa
9	PWRb
10	(NC)
11	(NC)

P304 J4
H7P-SHF-AA B7P-SHF-1AA-K

1	+5V
2	+12V
3	GND
4	GND
5	+8V
6	GND
7	-8V

*a
*b
*c
*d

PWR
10P6830

TB1
ML-50S1BYF2P

1	+24V
2	GND

CB1 NRF110-15A

FL1 ZAC2210-11

TB-B1

+24V
−
船内電源
DC24V

ECQ-E1106KF

J7 P307
B4P-VH VHR-4N

1	+24V
2	+24V
3	GND
4	GND

P306
J6 H6P-S
B6P-SHF-1AA-K HF-AA

1	+12V
2	K1-c
3	UpLms
4	DnLms
5	U-GND
6	D-GND

J403 MLR-15

1	+24V
2	+24V
7	GND
8	GND
4	+12V
5	K1-c
14	UpLms
15	U-GND
9	DnLms
10	D-GND

CN-B3
MLP-15

上下装置
CSH-7030

P305
J5 H6P-SHF-AA
B5P-SHF-1AA-K

1	GATE
2	DRAIN
3	SOURCE

GATE
DRAIN
SOURCE
Q1 2SK1491

J1 P301
B5P-VH VHR-5N

1	GND
2	GND
3	(NC)
4	+110V
5	+110V

+110V
GND
C1
SME160LGSN2000MB

+110V
GND
C2
SME160LGSN2000MB

J402 MLR-6 / P402 MLP-6

1	+110V
4	+110V
3	GND
6	GND

J401 MLR-6 / P402 MLP-6

1	+110V
4	+110V
3	GND
6	GND

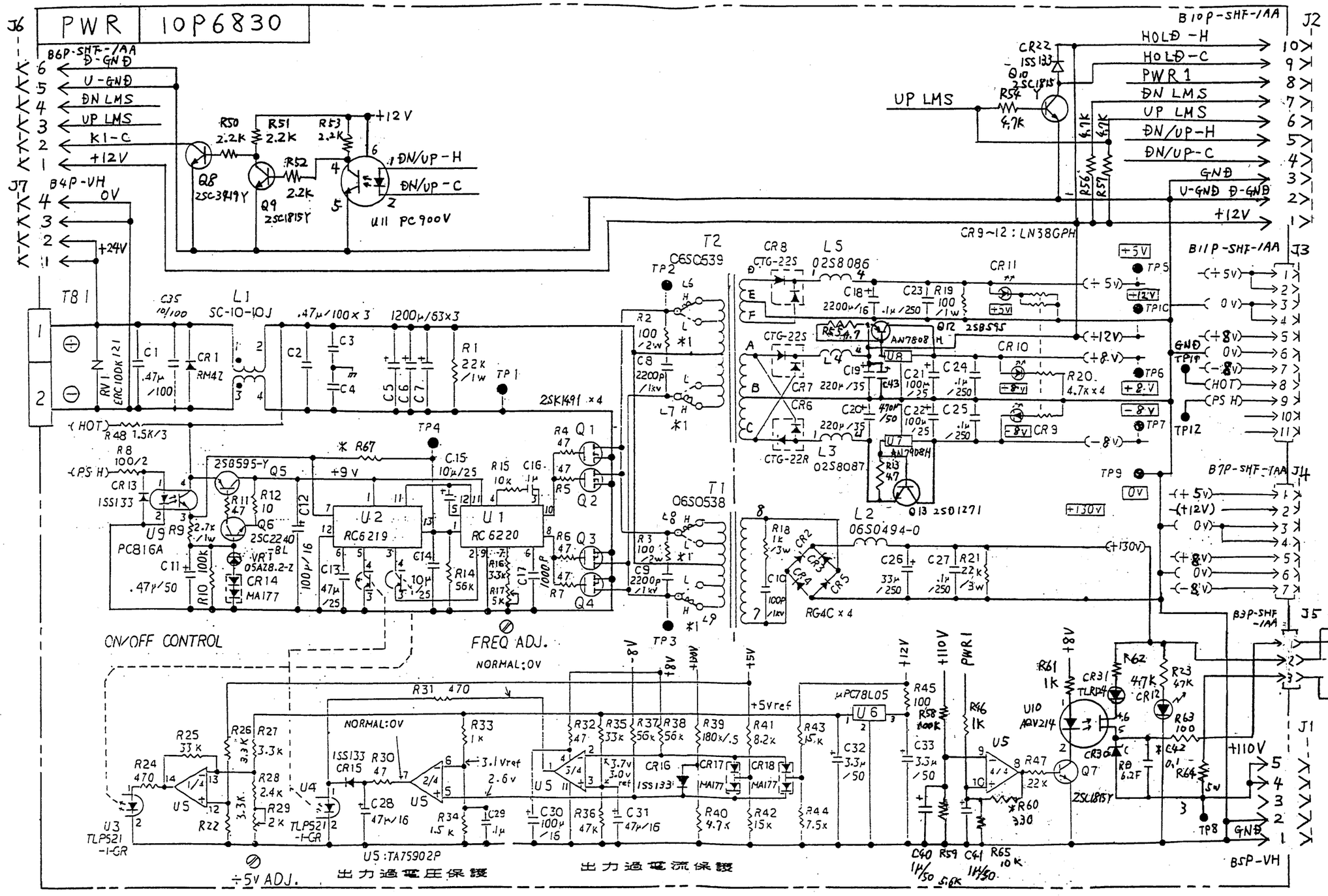
DRAWN May 6 '97 T. YAMASAKI			TYPE CSH-7020
CHECKED May 7 '97 K. OKUSUNOKI			名称 送受信装置総合（2／2）
APPROVED May 7 '97 H. Yamaguchi	CSH-7		回路図
SCALE — MASS — kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME TRANSCEIVER UNIT(GENERAL)2/2
DWG NO. J1302-K04- A	10-061-2003- 2		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO

S - 6

PWR | 10P6830

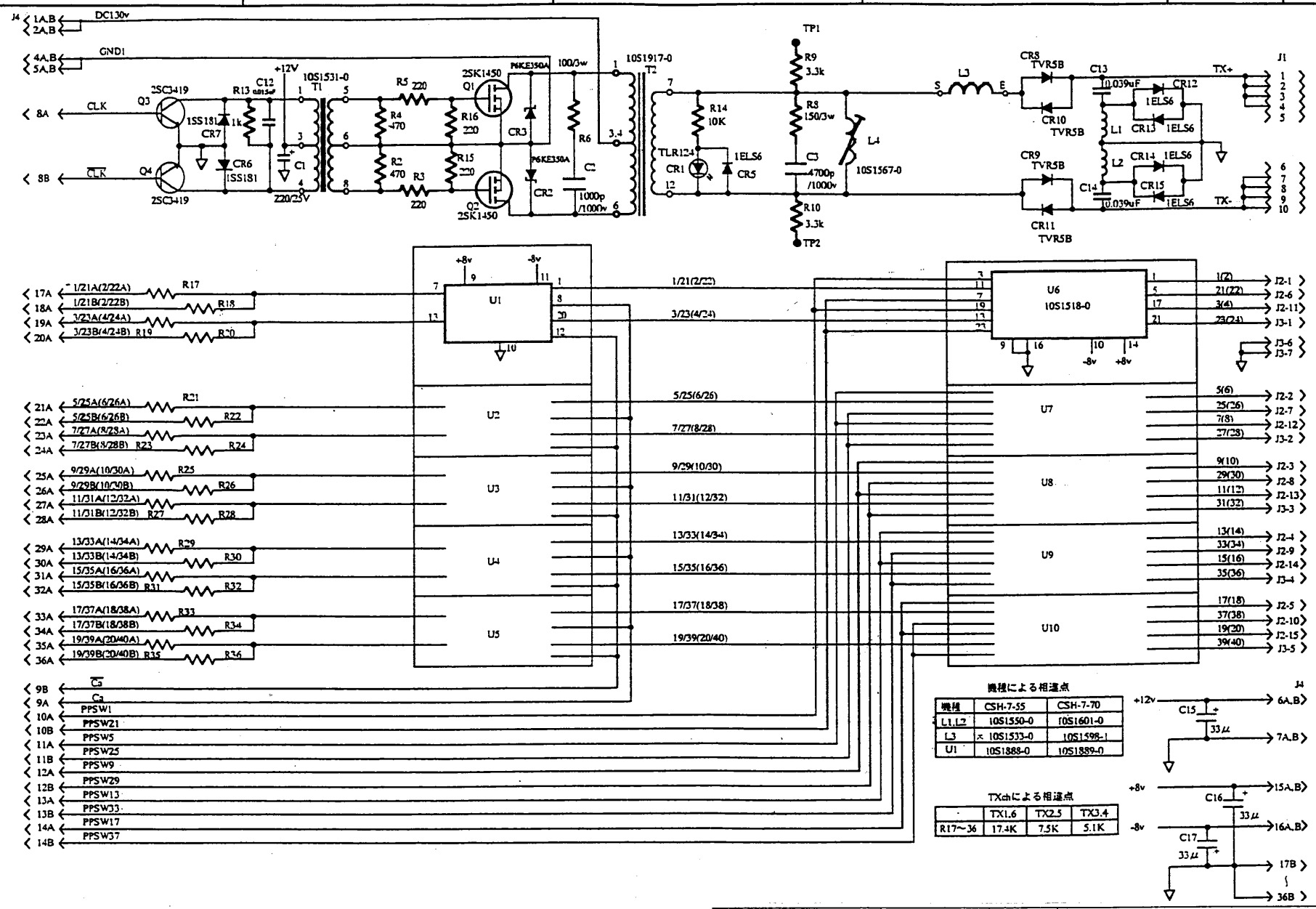


注記） ＊印の部品は実装なし。

DRAWN May 8 '97 T.YAMASAKI			TYPE 10P6830
CHECKED MAY 8 '97 K.KUSUNOKI			名称 送受信装置電源基板
APPROVED May 9 '97 H.Yamaguchi		CSH-7020	回路図
SCALE ―	MASS ― kg	APPLICABLE TO; (MODEL)	BLOCK NO. NAME TRANSCEIVER UNIT POWER BOARD
DWG NO. J1302-K05- A		10-061-2031- 3	SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO



DRAWN Dec.18.'98 T.Yamasaki			TYPE 10P6832-11
CHECKED Dec 18'98 K.Kusunoki			名称 TRX基板
APPROVED Dec 18'98 K.Kusunoki	CSH-7020		回路図
SCALE / MASS kg	APPLICABLE TO: (MODEL)	BLOCK NO.	NAME TRX PCB
DWG NO. C1302-K07- A	10-061-2011- 0		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO

S - 8

機種	CSH-7-55	CSH-7-70
U2	10S1536-2	10S1593-1

機種による相違点

DRAWN	Dec18'98 T.YAMASAKI		TYPE	10P6833-11
CHECKED	Dec18'98 K.Kusunoki		名称	MB基板（1／2）
APPROVED	Dec18'98 K.Kusunoki	CSH-7020		回路図
SCALE / MASS kg		APPLICABLE TO; (MODEL) / BLOCK NO.	NAME	MB PCB(1/2)
DWG NO.	C1302-K08- A	10-061-2012- 0		SCHEMATIC DIAGRAM

TX1

R	No.	S
130V	1	130V
130V	2	130V
	3	
GND1	4	GND1
GND1	5	GND1
12V	6	12V
GND	7	GND
CLK1	8	CLK1
Ca1	9	Ca1
PPSW21	10	PPSW1
PPSW25	11	PPSW5
PPSW29	12	PPSW9
PPSW33	13	PPSW13
PPSW37	14	PPSW17
8V	15	8V
-8V	16	-8V
GND	17	H-sig20
GND	18	H-sig1
GND	19	H-sig2
GND	20	H-sig3
GND	21	H-sig4
GND	22	H-sig5
GND	23	H-sig6
GND	24	H-sig7
GND	25	H-sig8
GND	26	H-sig9
GND	27	H-sig10
GND	28	H-sig11
GND	29	H-sig12
GND	30	H-sig13
GND	31	H-sig14
GND	32	H-sig15
GND	33	H-sig16
GND	34	H-sig17
GND	35	H-sig18
GND	36	H-sig19

J1
225D-10036C2-2314

TX3

R	No.	S
130V	1	130V
130V	2	130V
	3	
GND1	4	GND1
GND1	5	GND1
12V	6	12V
GND	7	GND
CLK3	8	CLK3
Ca3	9	Ca3
PPSW21	10	PPSW1
PPSW25	11	PPSW5
PPSW29	12	PPSW9
PPSW33	13	PPSW13
PPSW37	14	PPSW17
8V	15	8V
-8V	16	-8V
GND	17	H-sig20
GND	18	H-sig1
GND	19	H-sig2
GND	20	H-sig3
GND	21	H-sig4
GND	22	H-sig5
GND	23	H-sig6
GND	24	H-sig7
GND	25	H-sig8
GND	26	H-sig9
GND	27	H-sig10
GND	28	H-sig11
GND	29	H-sig12
GND	30	H-sig13
GND	31	H-sig14
GND	32	H-sig15
GND	33	H-sig16
GND	34	H-sig17
GND	35	H-sig18
GND	36	H-sig19

J2
225D-10036C2-2314

TX5

R	No.	S
130V	1	130V
130V	2	130V
	3	
GND1	4	GND1
GND1	5	GND1
12V	6	12V
GND	7	GND
CLK5	8	CLK5
Ca5	9	Ca5
PPSW21	10	PPSW1
PPSW25	11	PPSW5
PPSW29	12	PPSW9
PPSW33	13	PPSW13
PPSW37	14	PPSW17
8V	15	8V
-8V	16	-8V
GND	17	H-sig20
GND	18	H-sig1
GND	19	H-sig2
GND	20	H-sig3
GND	21	H-sig4
GND	22	H-sig5
GND	23	H-sig6
GND	24	H-sig7
GND	25	H-sig8
GND	26	H-sig9
GND	27	H-sig10
GND	28	H-sig11
GND	29	H-sig12
GND	30	H-sig13
GND	31	H-sig14
GND	32	H-sig15
GND	33	H-sig16
GND	34	H-sig17
GND	35	H-sig18
GND	36	H-sig19

J3
225D-10036C2-2314

TX2

R	No.	S
130V	1	130V
130V	2	130V
	3	
GND1	4	GND1
GND1	5	GND1
12V	6	12V
GND	7	GND
CLK2	8	CLK2
Ca2	9	Ca2
PPSW21	10	PPSW1
PPSW25	11	PPSW5
PPSW29	12	PPSW9
PPSW33	13	PPSW13
PPSW37	14	PPSW17
8V	15	8V
-8V	16	-8V
GND	17	H-sig1
GND	18	H-sig2
GND	19	H-sig3
GND	20	H-sig4
GND	21	H-sig5
GND	22	H-sig6
GND	23	H-sig7
GND	24	H-sig8
GND	25	H-sig9
GND	26	H-sig10
GND	27	H-sig11
GND	28	H-sig12
GND	29	H-sig13
GND	30	H-sig14
GND	31	H-sig15
GND	32	H-sig16
GND	33	H-sig17
GND	34	H-sig18
GND	35	H-sig19
GND	36	H-sig20

J4
225D-10036C2-2314

TX4

R	No.	S
130V	1	130V
130V	2	130V
	3	
GND1	4	GND1
GND1	5	GND1
12V	6	12V
GND	7	GND
CLK4	8	CLK4
Ca4	9	Ca4
PPSW21	10	PPSW1
PPSW25	11	PPSW5
PPSW29	12	PPSW9
PPSW33	13	PPSW13
PPSW37	14	PPSW17
8V	15	8V
-8V	16	-8V
GND	17	H-sig1
GND	18	H-sig2
GND	19	H-sig3
GND	20	H-sig4
GND	21	H-sig5
GND	22	H-sig6
GND	23	H-sig7
GND	24	H-sig8
GND	25	H-sig9
GND	26	H-sig10
GND	27	H-sig11
GND	28	H-sig12
GND	29	H-sig13
GND	30	H-sig14
GND	31	H-sig15
GND	32	H-sig16
GND	33	H-sig17
GND	34	H-sig18
GND	35	H-sig19
GND	36	H-sig20

J5
225D-10036C2-2314

TX6

R	No.	S
130V	1	130V
130V	2	130V
	3	
GND1	4	GND1
GND1	5	GND1
12V	6	12V
GND	7	GND
CLK6	8	CLK6
Ca6	9	Ca6
PPSW21	10	PPSW1
PPSW25	11	PPSW5
PPSW29	12	PPSW9
PPSW33	13	PPSW13
PPSW37	14	PPSW17
8V	15	8V
-8V	16	-8V
GND	17	H-sig1
GND	18	H-sig2
GND	19	H-sig3
GND	20	H-sig4
GND	21	H-sig5
GND	22	H-sig6
GND	23	H-sig7
GND	24	H-sig8
GND	25	H-sig9
GND	26	H-sig10
GND	27	H-sig11
GND	28	H-sig12
GND	29	H-sig13
GND	30	H-sig14
GND	31	H-sig15
GND	32	H-sig16
GND	33	H-sig17
GND	34	H-sig18
GND	35	H-sig19
GND	36	H-sig20

J6
225D-10036C2-2314

1	P. TVG. L1	2	GND
3	P. TVG. L2	4	P. TVG. L3
5	P. TVG. L5	6	P. TVG. L4
7	P. TVG0	8	GND
9	P. TVG1	10	GND
11	P. TVG4	12	P. TVG2
13	P. TVG5	14	P. TVG3
15	P. TVG6	16	GND
17	P. TVG7	18	GND
19	GND	20	GND
21	O SEL2	22	O SEL0
23	O SEL3	24	O SEL1
25	GND	26	GND
27	E SEL2	28	E SEL0
29	E SEL3	30	E SEL1
31	GND	32	GND
33	ODCOM	34	GND
35	EVCOM	36	GND
37	TEST1	38	GND
39	TEST2	40	GND

J7
FRC5-40

1	Ca1	2	GND
3	Ca1	4	GND
5	Ca3	6	Ca2
7	Ca3	8	Ca2
9	Ca4	10	GND
11	Ca4	12	GND
13	Ca6	14	Ca5
15	Ca6	16	Ca5
17	GND	18	GND
19	CLK2	20	CLK1
21	CLK2	22	CLK1
23	CLK3	24	GND
25	CLK3	26	GND
27	CLK5	28	CLK4
29	CLK5	30	CLK4
31	CLK6	32	GND
33	CLK6	34	GND
35	GND	36	GND
37	PPSW5	38	PPSW1
39	PPSW25	40	PPSW21
41	PPSW9	42	GND
43	PPSW29	44	GND
45	PPSW17	46	PPSW13
47	PPSW37	48	PPSW23
49	GND	50	GND

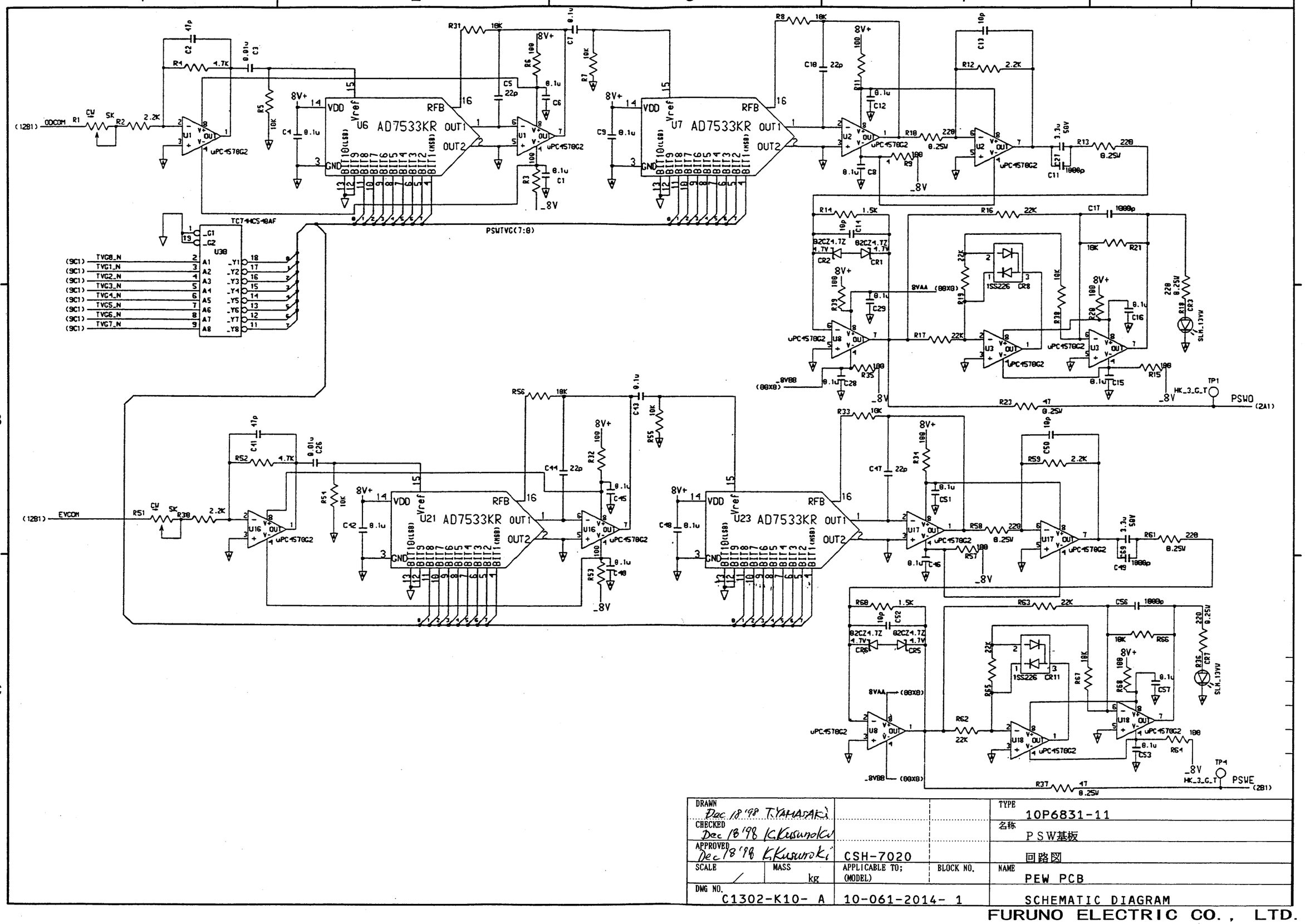
J8
FRC5-50

1	5V
2	12V
3	GND
4	GND
5	8V
6	GND
7	-8V

J9
B7P-SHF-1AA

DRAWN	Dec 18 '98 T. YAMASAKI		TYPE 10P6833-11
CHECKED	Dec 18 '98 K Kusuno/Ki		名称 MB基板 (2/2)
APPROVED	Dec 18 '98 K Kusuno/Ki	CSH-7020	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME MB PCB(2/2)
DWG NO. C1302-K09- A	10-061-2013- 0		SCHEMATIC DIAGRAM

FURUNO



DRAWN Dec 18'98 T.YAMASAKI			TYPE 10P6831-11
CHECKED Dec 18'98 K.Kusunoki			名称 PSW基板
APPROVED Dec 18'98 K.Kusunoki	CSH-7020		回路図
SCALE /	MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME PEW PCB
DWG NO. C1302-K10- A	10-061-2014- 1			SCHEMATIC DIAGRAM