FURUNO

SERVICE MANUAL

COLOR SEARCHLIGHT SONAR

MODEL CH-270

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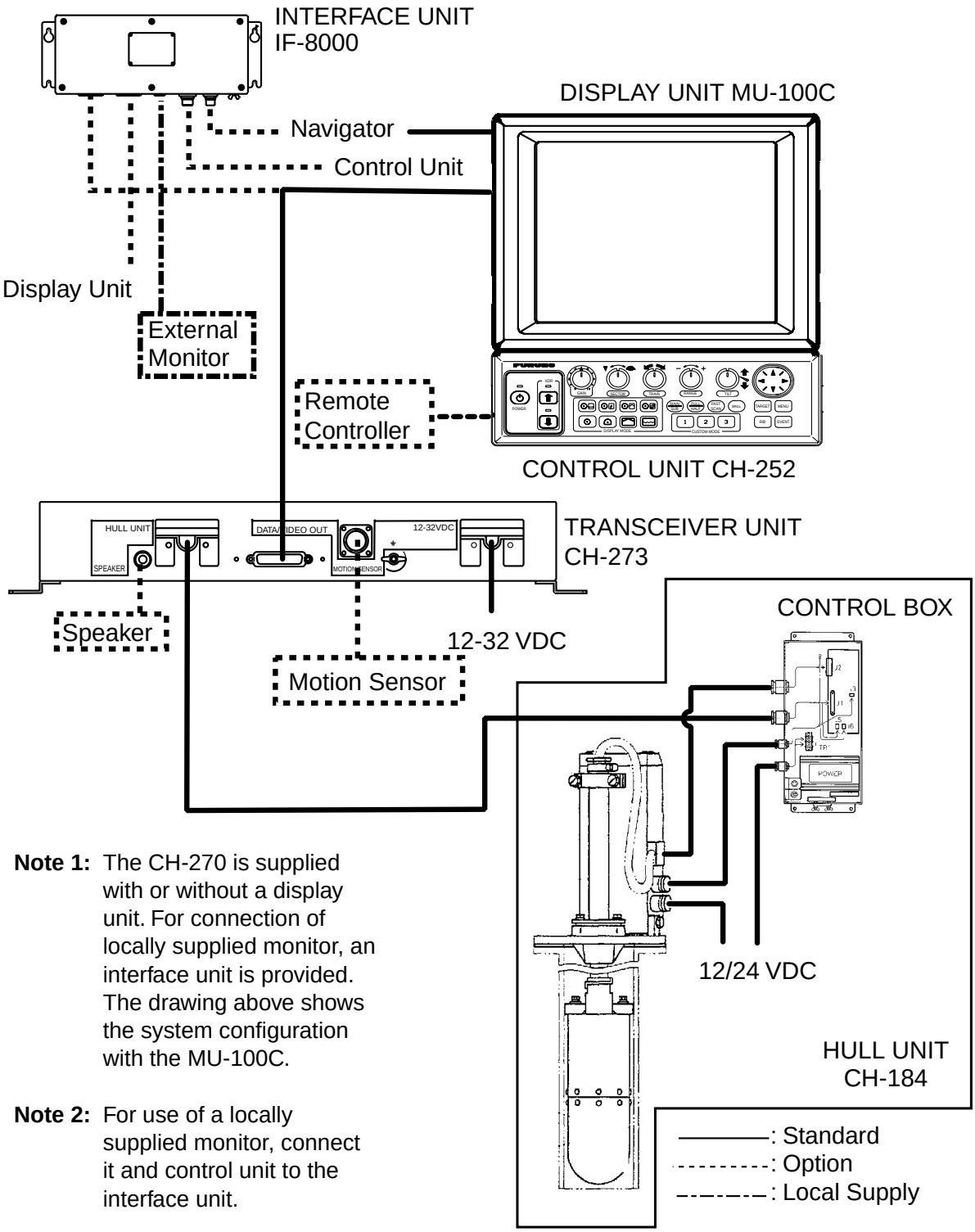
SYSTEM CONFIGURATION

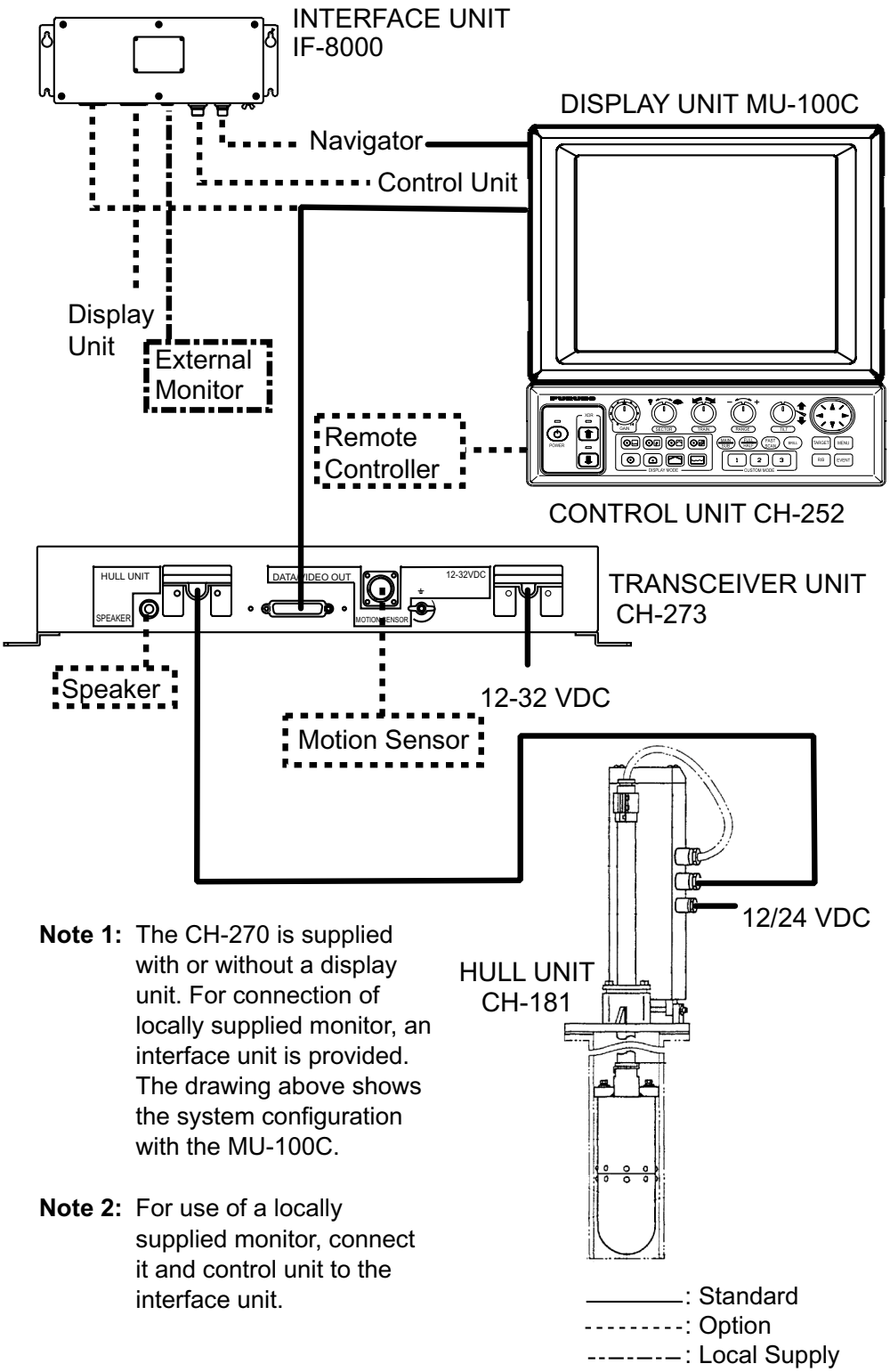
CH-270 (250 stroke)



Note 1: The CH-270 is supplied with or without a display unit. For connection of locally supplied monitor, an interface unit is provided. The drawing above shows the system configuration with the MU-100C.

Note 2: For use of a locally supplied monitor, connect it and control unit to the interface unit.

CH-270 (350 stroke)



Note 1: The CH-270 is supplied with or without a display unit. For connection of locally supplied monitor, an interface unit is provided. The drawing above shows the system configuration with the MU-100C.

Note 2: For use of a locally supplied monitor, connect it and control unit to the interface unit.

1. FUNCTION OF EACH UNIT

1.1 Display Unit (MU-100C)

The Display Unit (MU-100C) consists of DISP board (06P0238), LCD Inverter board, and LCD unit. Figure 1.1 shows the block diagram of Display Unit.

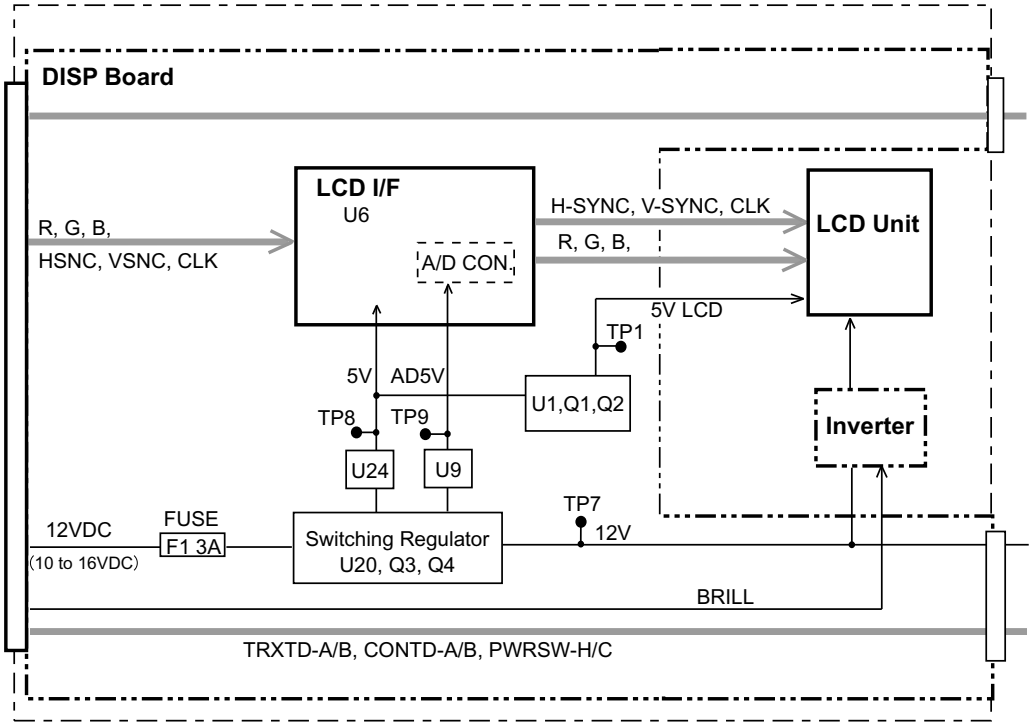


Figure 1.1 Block Diagram of Display Unit

The DISP board contains LCD interface circuit and a power switching regulator circuit. The LCD interface circuit converts the analoge R, G, B signals from the transceiver unit into six bit digital R, G, B signals with a A/D converter. H-SYNC, V-SYNC, and CLK (dot clock) signals from the transceiver unit are also supplied to the LCD unit through the LCD Interface circuit. The power switching regulator generates 5V for digital circuit, AD5V for the A/D converter, and 12V for the LCD inverter board.

The LCD unit consists of LCD module (10.4 inch's screen, TTF color LCD), LCD control board and a fluorescent lamp for back-lighting.

The LCD inverter board generates high voltage for the fluorescent lamp, and it's pulse length is controlled by the YC signal from the transceiver unit to adjust LCD brightness.

1.2 Control Unit (CH-252)

Figure 1.2 shows the block diagram of the Control Unit.

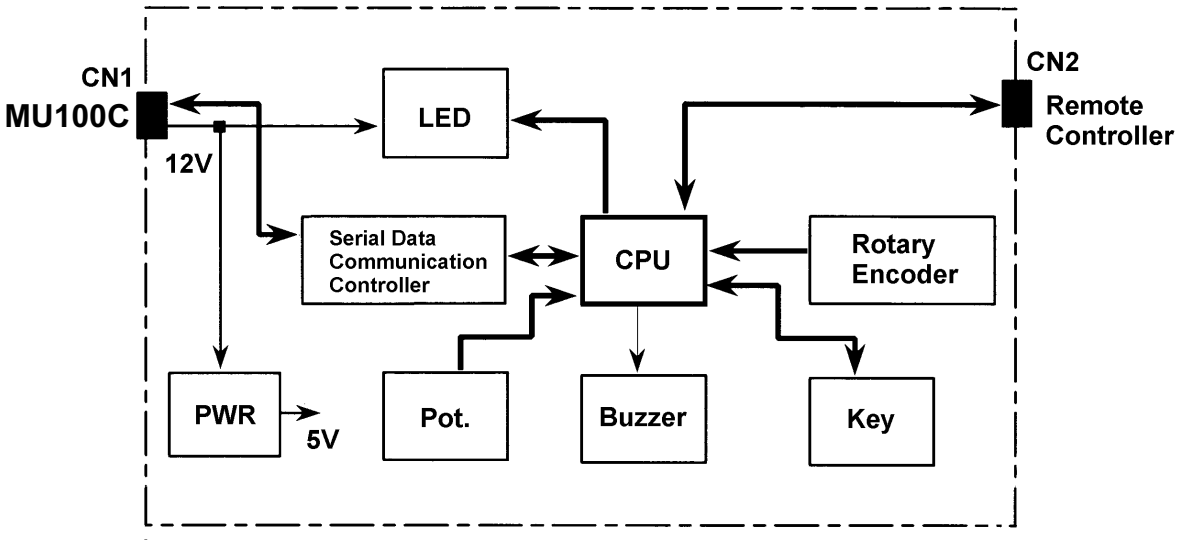


Figure 1.2 Block Diagram of Control Unit

The control unit consists of the control panel and PNL board.
The CPU on PNL board reads the settings on the control panel and sends the data to the CPU in transceiver unit through serial data communication bus.

The CPU on PNL board switches on and off LEDs and activates the buzzer.

1.3 Transceiver Unit (CH-273)

The Transceiver Unit consists of CPU board (06P0258), TRX board (06P0241), PWR board (06P0242), and PRA board (06P0259).

Major function of CPU board is;
1) To control transmitting and receiving circuits.
2) To generate train/tilt control signal.
3) To generate transducer raising/lowering control signal.
4) To generate analog RGB, H-SYNC, Y-SYNC, and clock signals for the display unit.
5) To read settings on the control panel.
6) To receive and send I/O signals through NMEA port.
7) To receive data from the motion sensor.
8) To generate character data.

1.3.1 CPU Board (06P0258)

The heart of CPU board is a main CPU (U17) and a Gate Array (U30).

The gate array (U30) outputs KP signal, TX carrier signals (TX0 and TX1), RGB signal, H/V-sync signal, AGC on/off signal ($\overline{\text{AGC}}$), power reduction signal ($\overline{\text{TXL}}$), TX frequency data (F0 to F1), Direct Digital Synthesis (DDS, U19)-related signal, and volume control signal (VOL0 to VOL7).

1.3.2 TRX Board (06P0241)

Figure 1.5 shows the block diagram of TRX board. The TRX board contains a transmission circuit, a receiver circuit, and a audio amplifier circuit.

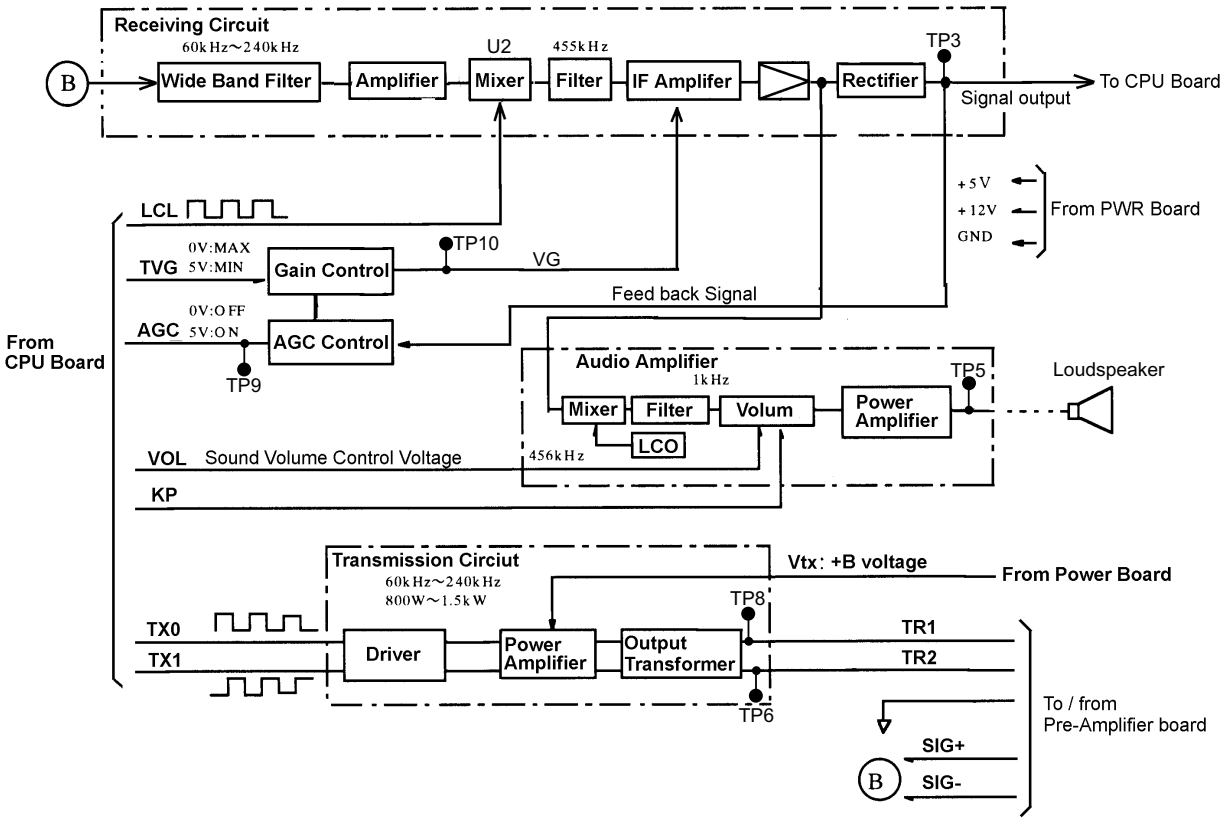


Figure 1.3 Block Diagram of TRX Board (06P0241)

Transmitter Circuit

Transmission carrier signal "TX0/TX1" from CPU board is amplified by Power MOS FET amplifier circuit (Q4, Q6, Q7, Q9, Q10, Q12, Q13, and Q15). The output level of TRX board is determined with +B voltage ("VTX" signal).

Receiver Circuit

The signal received by the transducer is sent to the wide band filter circuit through PRA board, and then, mixed with a carrier signal "LCL" to convert it into IF signal (455 kHz). The CPU board generates the carrier signal. The IF signal is amplified in accordance with GAIN/TVG settings, and then rectified. The rectified signal is sent to CPU board and AGC control circuit.

Audio Amplifier Circuit

The 455kHZ IF signal is also sent to the audio amplifier circuit to drive the loudspeaker.

1.3.3 PWR Board (06P0242)

Figure 1.6 shows the block diagram of PWR board.
The power on/off switch in the control unit generates PSW-H and PSW-L signals to send them to PWR board via the display unit. The PWR board generates 5V, -5V, 12V 12VD, and +B voltage (VTX).
The 12VD voltage (12VA) is supplied to the display unit via CPU board. The VTX voltage is determined with TXV voltage from CPU board.

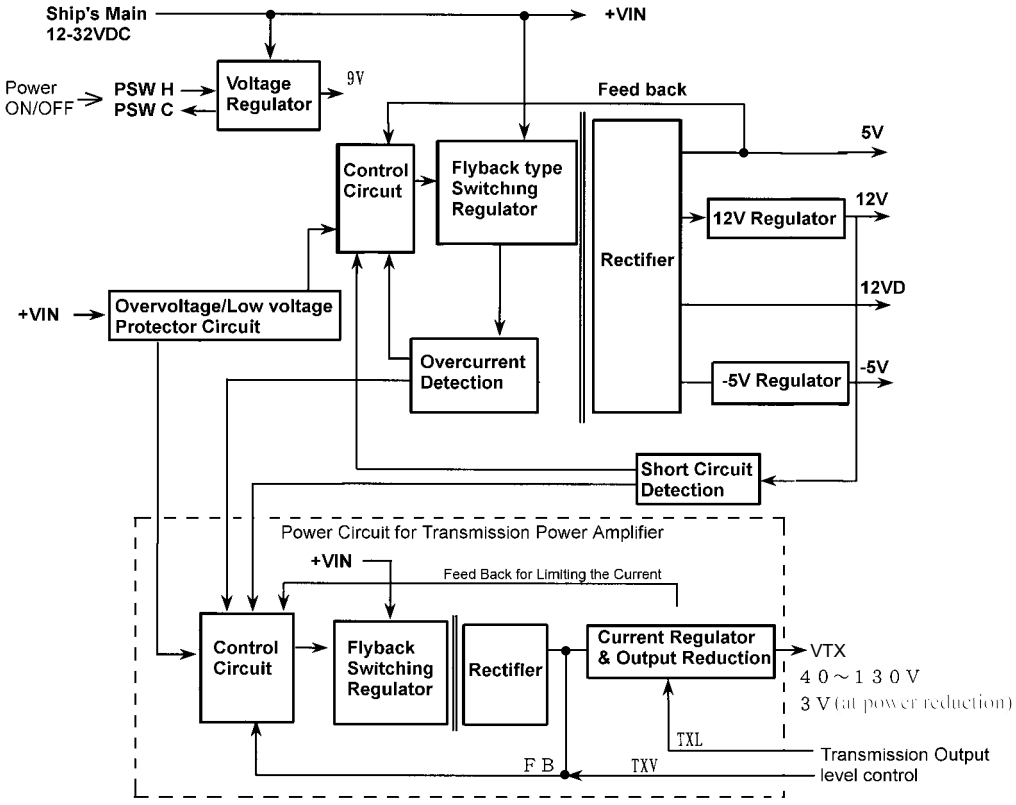


Figure 1.4 Function diagram of the PWR Board (06P0242)

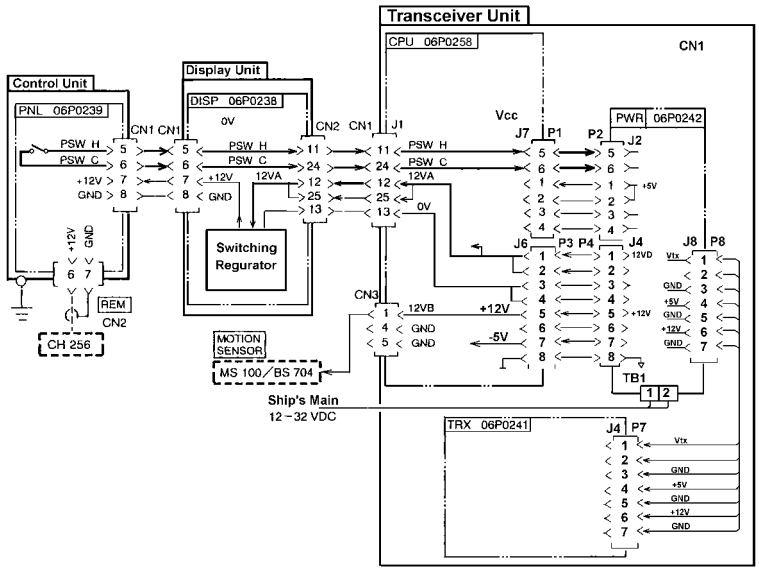


Figure 1.5 Shows power supply lines in the system.

1.3.4 PRA Board (06P0259)

The preamplifier (PRA) board, 06P0259 locates in the transceiver unit. Figure 1.6 shows the block diagram of PRA board.

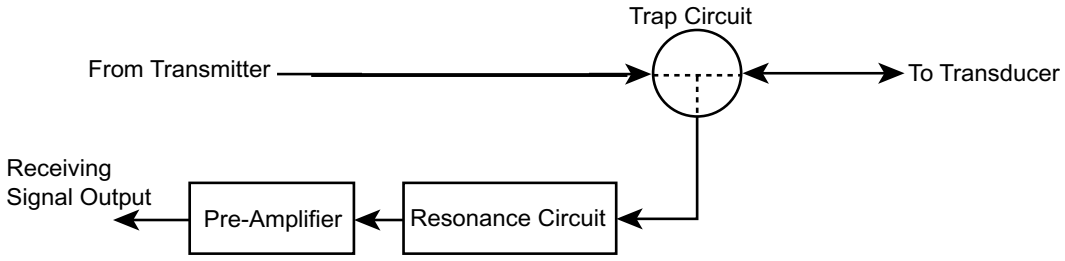


Figure 1.6 Block Diagram of PRA board

2. FUNCTIONAL DESCRIPTION

2.1 Transmission

Fig. 2.1 shows the signal flow in the transmitter.
The TX signal, TX0 and TX1, generated by CPU board (06P0258) is amplified by TRX board (06P0241). The output of the power amplifier is impedance-matched with the transducer with a matching transformer on PRA board (06P0259).
The +B voltage (VTX) from PWR board (06P0242) determines the transmitter output level according to menu settings.

Table 2.1 Transmission level and control voltage

Signals	Voltage	Measuring Points
TX output	1019 Vpp	Output of matching transformer on PRA board
TX output	713 Vpp	Between TP6 and TP8 on TRX board
VTX (+B voltage)	77 V	Resister "R13" on TRX board
Control Voltage TXV	3.0 V	TP1 on CPU board
TX output level with Dummy Load	592 Vpp	Between TP6 and TP8 on TRX board with Dummy Load

2.2 Reception

Fig. 2.2 shows the signal flow in the receiver.
The echo received by the transducer is amplified by the Pre-Amplifier board and mixed with the local carrier signal by the mixer U2 to generate 455 kHz IF signal.
The output of the buffer amplifier Q5 is sent to the rectifier, CR8/CR9, and then output to CPU board from J3 #1.

The gain control signal (TVG), 0 to 5 VDC, is generated by CPU board according to control panel setting. The TVG/AGC control circuit reshapes the TVG signal and output TVG signal, 0.5 to 1.7 VDC to amplifiers. When GAIN control is set to maximum, 1.7VDC is output.

Receiving the signal rectified by U7, the AGC feedback circuit also controls the TVG signal level.

The output of TRX board is converted into digital data by A/D converter "U35" and applied to Gate Array "U30" on CPU board.
The output of Gate Array is converted into R/G/B signal and sent to the display unit from #1, #2, and #3 of J1.

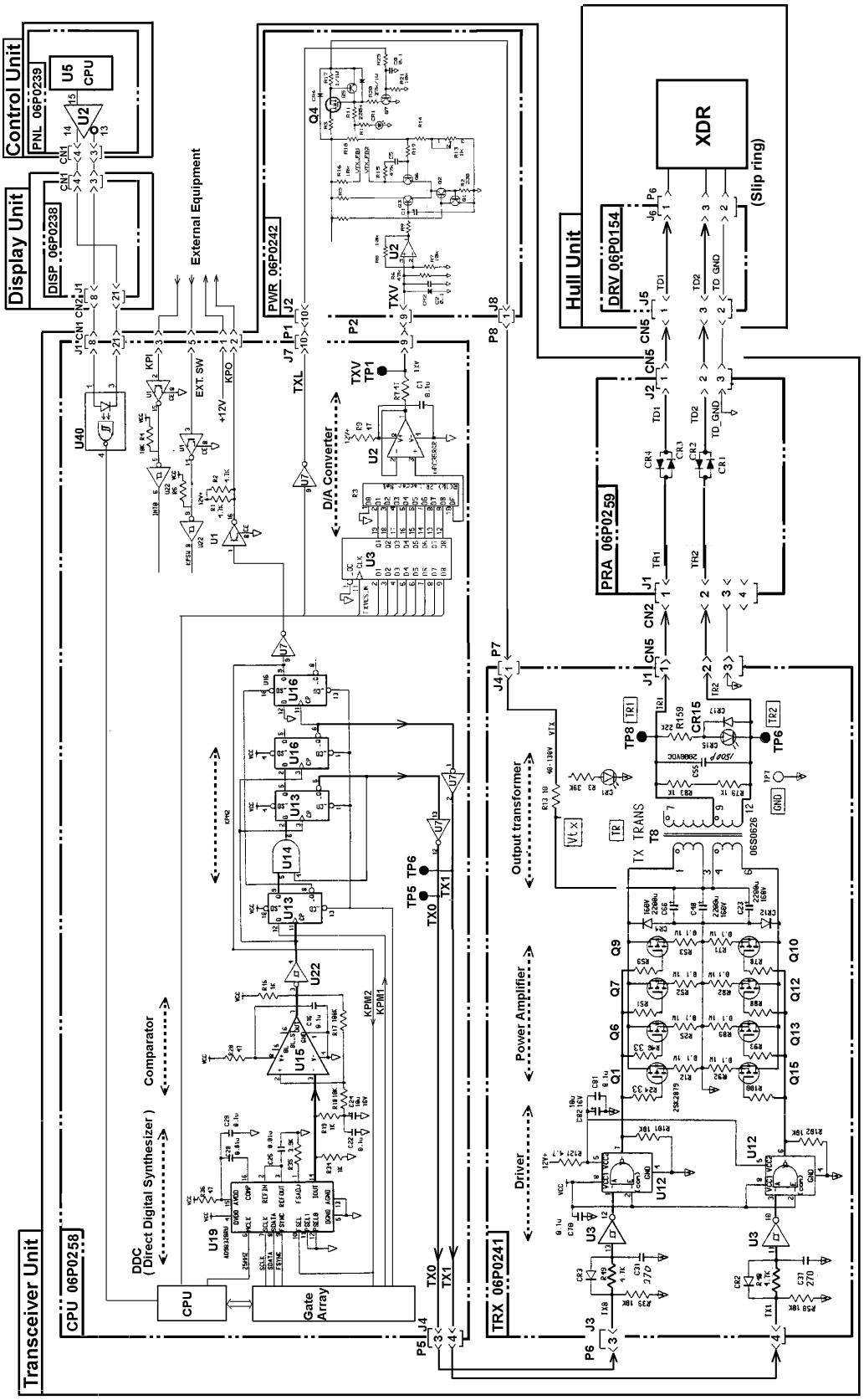


Figure 2.1 Signal Flow in Transmitter

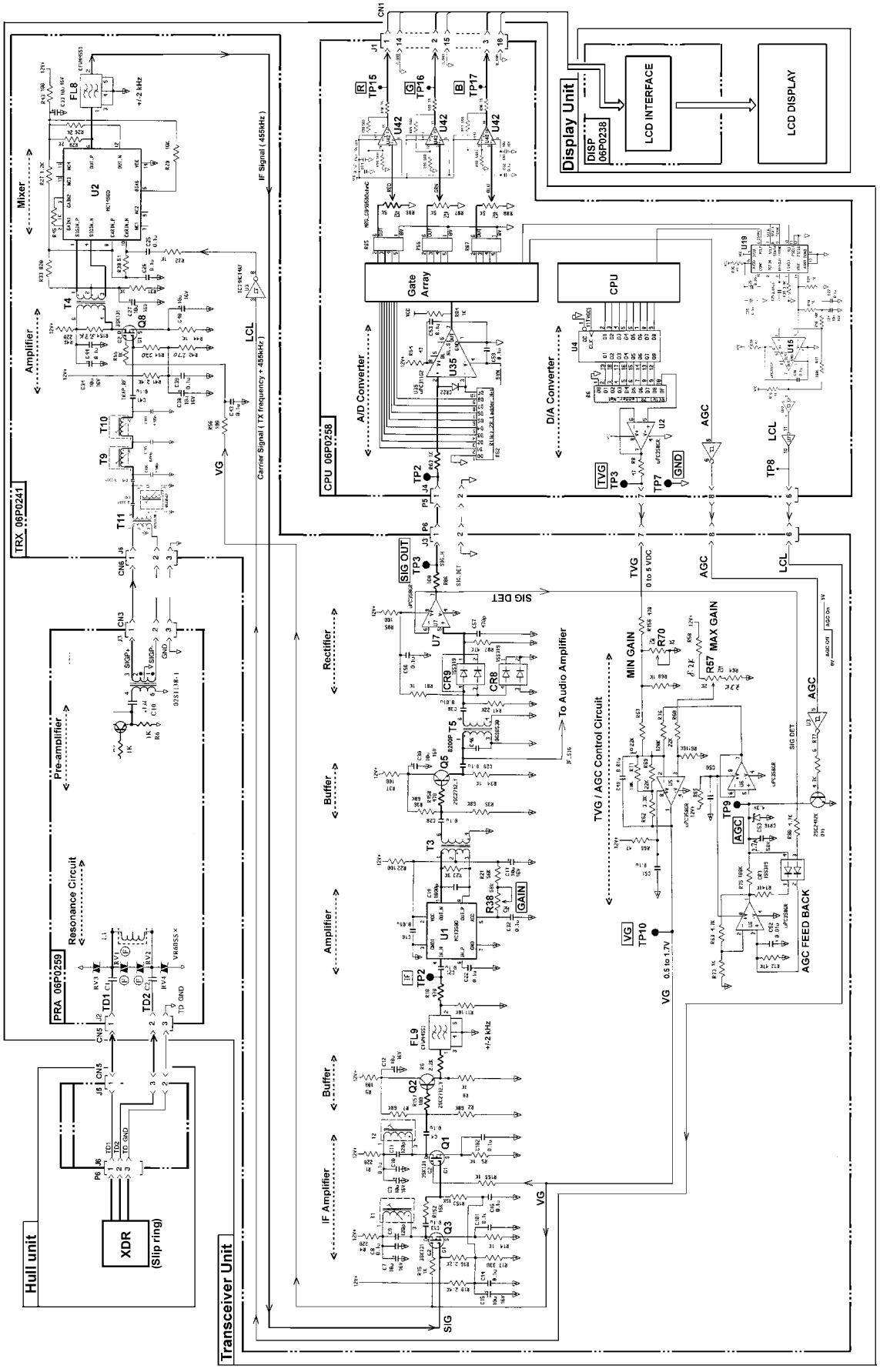


Figure 2.2 Signal Flow in Receiver

2.3 Raising/Lowering Transducer

See the simplified circuit diagram below. The CPU generates rising and lower control signals, $\overline{\text{UPC}}$ and $\overline{\text{DNC}}$. The $\overline{\text{DNC}}$ signal is generated when the down key is pressed and the $\overline{\text{UPC}}$ signal is generated when the up key is pressed. These signals change the status of R/L CONT signal.

Lowering Operation
The DC motor in the hull unit lowers the transducer, receiving R/L CONT signal from CPU board below.

1) When R/L CONT signal is HIGH, U9 on DRV board is led into conductive condition, causing that K1 activates.
2) Terminals ① and ② of the motor are connected to the negative and positive lines respectively to power the DC motor. The motor is connected to the positive line through the lower limit switch.
3) When the lower limit switch K3 is kicked, R2 is connected across the motor as a brake.

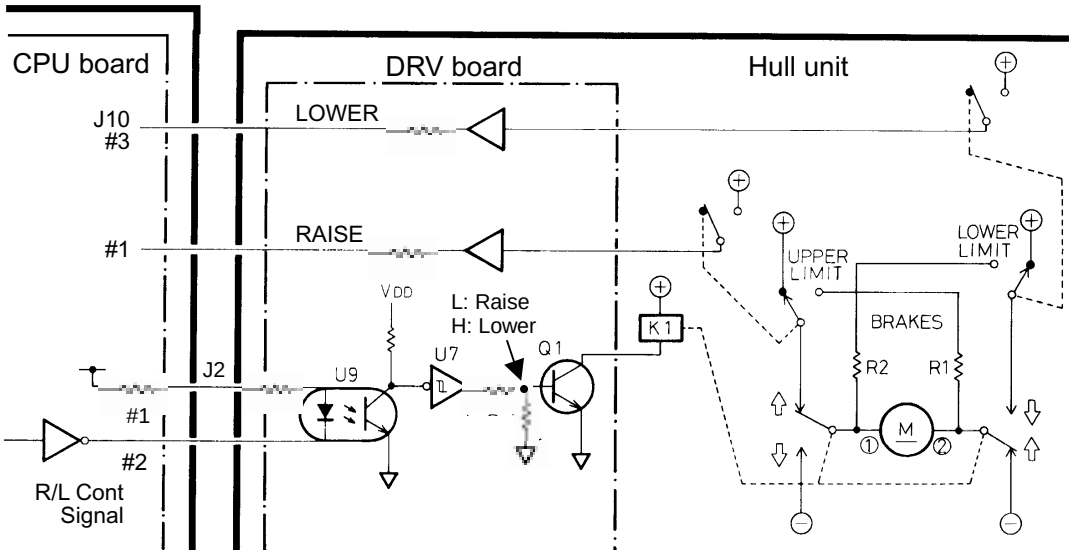


Figure 2.3 Raise/Lower Circuit

Raise Operation
The transducer raises in the following sequence.

1) When R/L CONT signal is LOW, U9 is led into cut off condition, causing that K1 inactivates.
2) Terminal ① of the motor is connected to the positive line through the relay contact and the upper limit switch S2, while terminal ② to the negative line through the relay contact. As a result, the motor rotates to raise the transducer.
3) When the transducer is completely hoisted up, the upper limit switch is kicked, causing that the positive line is disconnected from terminal ① and a brake resistor R1 is connected across the motor.

NOTE: When the display unit is turned off, the R/L level being fed from the display unit becomes LOW, and raise operation is executed automatically.

While the transducer is raising (lowering), the LED above up (down) arrow key on the control unit blinks and it lights when completed.

2.4 Tilting Transducer

Fig. 2.4 shows the simplified tilt control circuit.

The 4-phase stepping motor is controlled by a phased generator U3 on DRV board.

The CPU outputs a clock signal (TIM 1) to the phased pulse generator U3. Receiving the clock signal, the phased pulse generator outputs HIGH level in the sequence shown in Table 2-2, and the motor rotates accordingly. The phased pulse generator outputs HIGH level in reverse sequence when the H/L condition of TI DN/UP signal (TIM2) is changed and the motor rotates in opposite direction.

Table 2.2

Output	Clock Cycle (DN/UP = H)								Clock Cycle (DN/UP = L)							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Ø1	L	L	L	L	L	H	H	H	H	H	L	L	L	L	L	H
Ø2	L	L	L	H	H	H	L	L	L	H	H	H	L	L	L	L
Ø3	L	H	H	H	L	L	L	L	L	L	L	H	H	H	L	L
Ø4	H	H	L	L	L	L	L	H	L	L	L	L	L	H	H	H

As shown in Fig. 2.4, a disc with slits is coupled to the motor through gears to detect tilts of +8°, -30°, and -93°. The slits activate the sensors (photo interrupters) which generate TI8 and TI93 signals. Using these signals, the CPU reads the tilt angle as shown in table below.

Table 2.3

+8° Signal (T18)	-93° Signal (T193)	Tilt
High	Low	+8°
High	High	-30°
Low	High	-93°

At every power-on, the CPU initializes the tile angle to –30°. If the CPU does not detect the tilt of 30°, error message TILT NG appears.

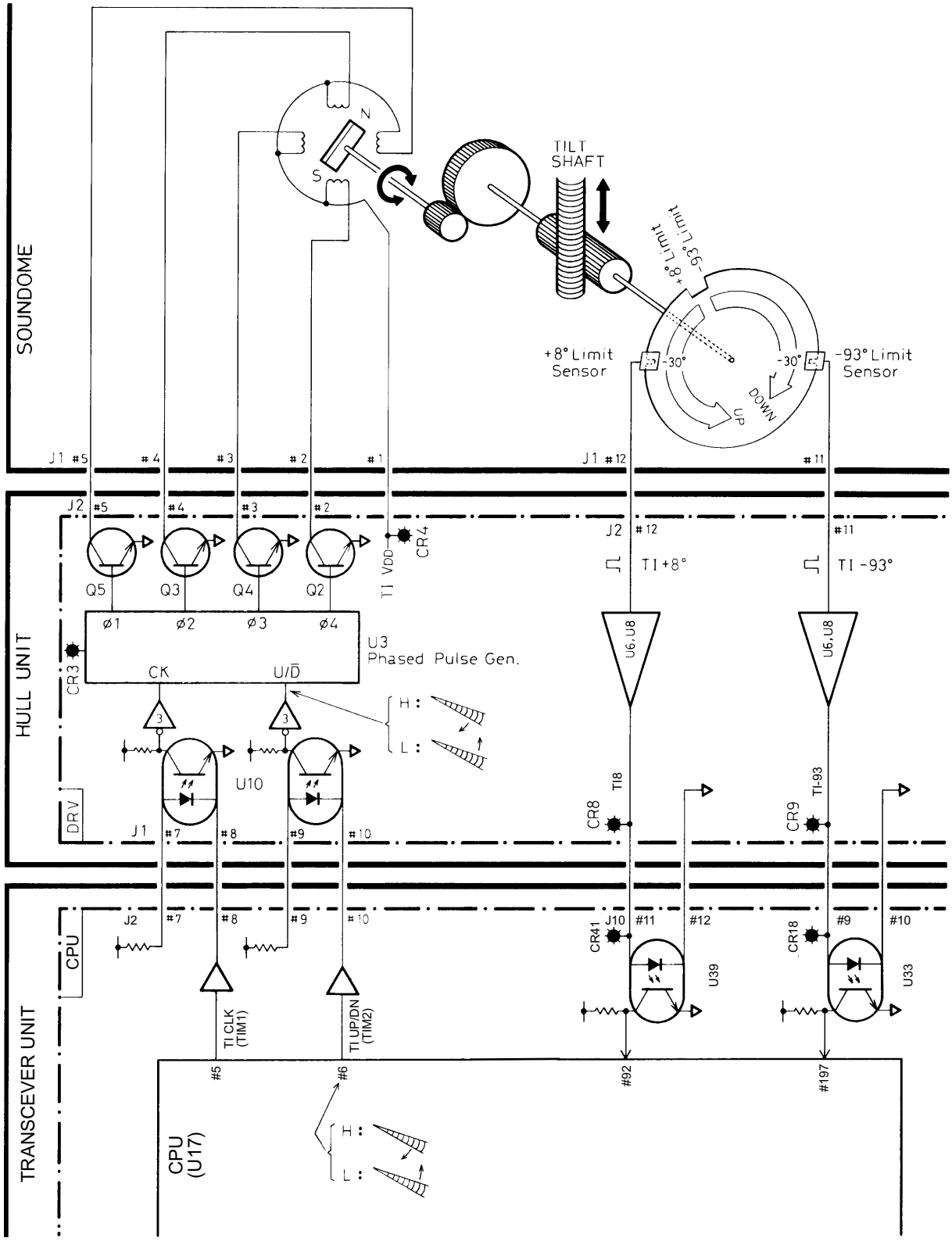

SOUNDOME
HULL UNIT
TRANSCEVER UNIT
TILT SHAFT
+8° Limit Sensor
-93° Limit Sensor
-30°
-30°
UP
DOWN
+8° Limit
-93° Limit
J1 #5
#4
#3
#2
#1
J1 #12
#11
J2
#5
#4
#3
#2
J2
#12
#11
CR4
TI VDD
TI +8°
TI -93°
Q5
Q3
Q4
Q2
ø1
ø2
ø3
ø4
U3
Phased Pulse Gen.
CK
U/D̄
CR3
U6,U8
U6,U8
H :
L :
U10
TI8
TI-93
CR8
CR9
DRV
J1
#7
#8
#9
#10
J2
#7
#8
#9
#10
CPU
CR41
J10
#11
#12
CR18
#9
#10
U39
U33
TI CLK (TIM1)
TI UP/DN (TIM2)
#5
#6
#92
#197
CPU (U17)
H :
L :

Figure 2.4

2.5 Training Transducer

Basically the circuit is the same as the tilt control circuit. See the simplified circuit diagram on the next page.

The phased pulse generator U5 drives the train motor with TR CLK (TRM1) and TR CW/CCW (TRM2) signals from CPU board.
A slit on the rotary disc generates a “Heading” signal (TR FORE) when the transducer faces toward the bow. The TR FORE signal is sent to the CPU as TR 0°. At every power-on, the CPU searches TR 0° signal. If the CPU does not detect TR 0° signal, error manage TRAIN NG appears.

The transducer rotates in either “normal” or “fast” mode. In the normal mode, transmission and reception are made while the transducer is rotating in 6° steps. In the fast mode, the transducer moves in 12° steps after transmission and reception are completed.

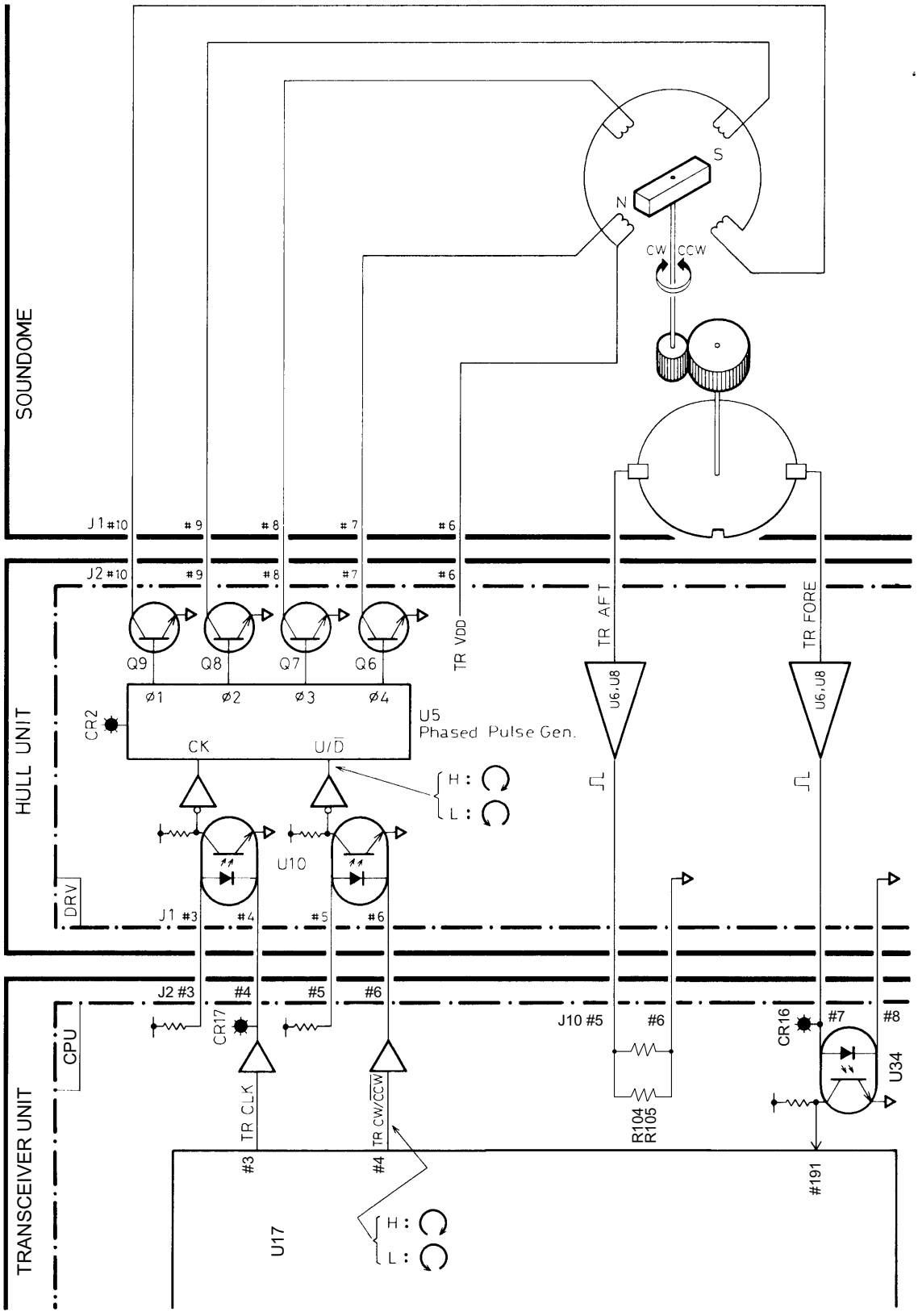

SOUNDOME
HULL UNIT
TRANSCEIVER UNIT
S
N
CW
CCW
J1 #10
#9
#8
#7
#6
J2 #10
#9
#8
#7
#6
Q9
Q8
Q7
Q6
TR VDD
TR AFT
TR FORE
U6,U8
U6,U8
CR2
ø1
ø2
ø3
ø4
U5
Phased Pulse Gen.
CK
U/D̄
H :
L :
U10
DRV
J1 #3
#4
#5
#6
J2 #3
#4
#5
#6
J10 #5
#6
#7
#8
CR17
CR16
U34
CPU
TR CLK
TR CW/CCW
R104
R105
#3
#4
#191
U17
H :
L :

Figure 2.5

2.6 Braking Tilt/Train Motor

Fig. 2.6 shows the power supply circuit for the tilt motor.
U2 is a retrigger able one-shot multivibrator of which Q output is held “H” while TI CLK is continuously applied to “Ain” pin.
Q1 and Q2 are “OFF” and “ON” respectively when TI CLK signal is applied to U2. When TI CLK signal is absent, outputs, Q and $\overline{Q}$ are held to LOW and HIGH respectively, causing that Q1 goes ON and Q2 OFF. Thus, 6V is applied to the tilt motor as “brake” signal through R4.

Power supply voltage 13.5V for the train motor is generated in the same way as the tilt motor.

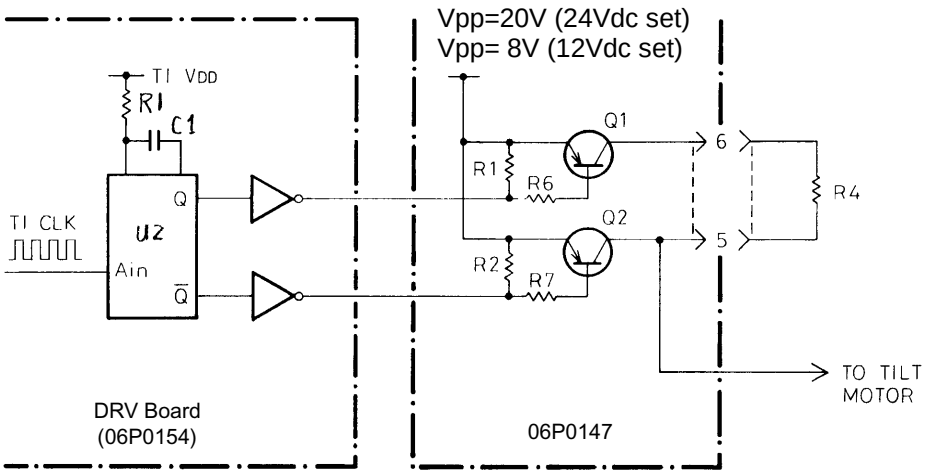


Figure 2.6 Power Supply for Tilt Motor

3. CHECK AND ADJUSTMENT

3.1 Test Points

DISP Board (06P0238)

Test Points	Name	Rating	Remarks
TP1	+5V	4.75 to 5.25 V	Source voltage of LCD control circuit in LCD 1.unit
TP3	PGND		
TP4	No name	2.40 V ± 0.05 V	
TP7	+12V	11.8 V to 12.2 V	Source voltage of LVD inverter board
TP8	+5V	4.75 V to 5.25 V	+5 V for DISP board
TP10	GND		
TP11	GND		
TP12	Switching Frequency	70 kHz ± 1 kHz	Adjusted by R65

CPU Board (06P0258)

Test Points	Name	Rating	Remarks
TP1	TXV	3.0 V	
TP2	SIG	0 to 5 V	Echo signal(DC level) from the TRX board
TP3	TVG	5 to 0 V	TVG curve
TP4	KP		Trigger pulse
TP5	TX0		Pulsed transmission carrier signal
TP6	TX1		Pulsed transmission carrier signal
TP7	GND		
TP8	LCL		Local signal
TP9	VOL	0 to 5 V	Audio volume control voltage
TP10	Not used		
TP11	DISP CLK	25.175 MHz	
TP12	GND		
TP13	PITCH	3.5 V	With no pitch signal
TP14	ROLL	3.5 V	With no roll signal
TP15	R	0 to 1.0 Vpp	Red
TP16	G	0 to 1.0 Vpp	Green
TP17	B	0 to 1.0 Vpp	Blue
TP18	GND		

TRX board (06P0241)

Test Points	Name	Rating	Remarks
TP1	GND		
TP2	IF	0 to10 Vpp	455 kHz IF signal
TP3	SIG OUT	0 to 10 VDC	Rectified receiving signal
TP4	GND		
TP5	AUD OUT	0 to 10 Vpp	1 kHz Audio Signal
TP6	TR2		See Figs. 3.1 and 3.2
TP7	GND	0 V	
TP8	TR1		See Figs. 3.1 and 3.2
TP9	AGC	0 to 3VDC	
TP10	VG	0.5 to 1.5 VDC	Gain control voltage; min: 0.5 V, Max: 1.5V.

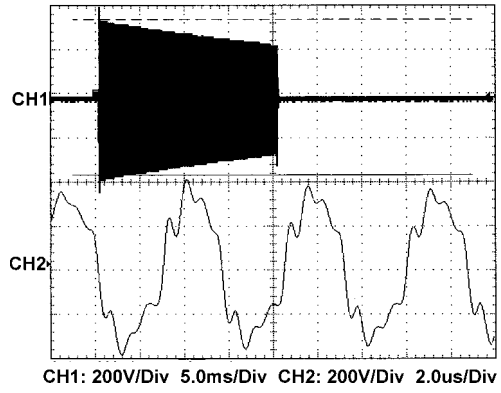


Figure 3.1 Output of TRX board (with transducer)

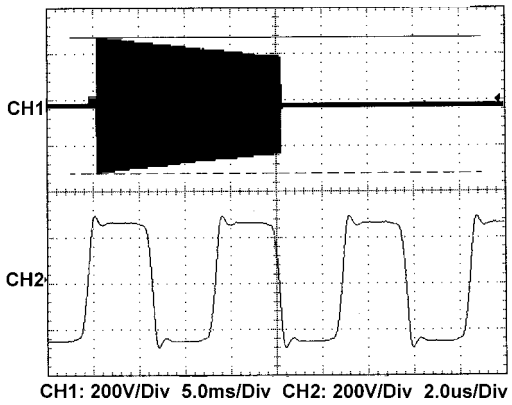


Figure 3.2 Output of TRX board (with dummy)

PWR Board (06P0242)

Test Points	Name	Rating	Remarks
TP1	GND		
TP2	VTX-G	0.9 V	MOS FET Gate Drive Clock
TP3	5 V	4.75 to 5.25 V	+5 V for CPU and TRX boards
TP4	TO VTX	See figure 3.3	
TP5	P CLK	68.0 ±0.05 kHz	Switching frequency of VTX voltage regulator
TP6	-VIN		GND
TP7	0 V		
TP8	TO 5 V	See figure 3.3	
TP9	TO 12 VD	See figure 3.3	
TP10	TO 12 V	See figure 3.3	

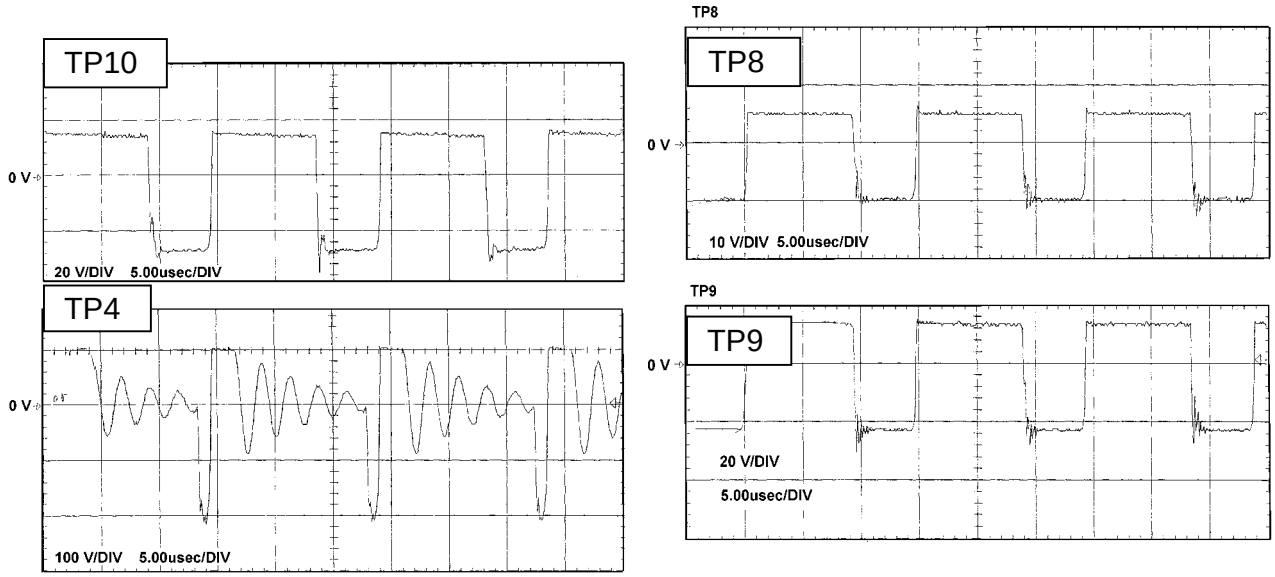
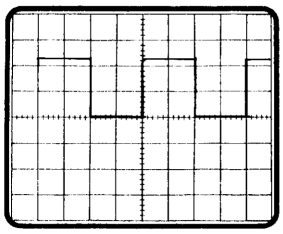


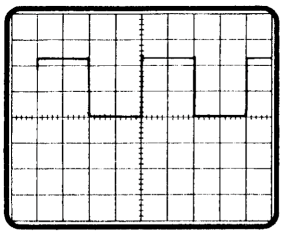
Figure 3.3 Waveforms at TP4/TP8/TP9/TP10

DRV Board (06P0154)



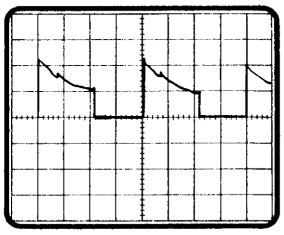
J1-#3(TR CLK)

Trigger : Internal
X-scale : 0.5m s/div.
Y-scale : 2 v/div.



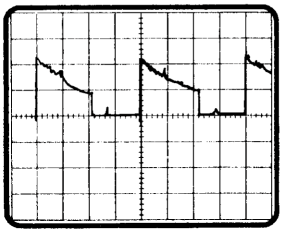
J1-#7(TI CLK)

Trigger : Internal
X-scale : 0.5m s/div.
Y-scale : 2 v/div.



Q2/Q3/Q4/Q5 Collector

Trigger : Internal
X-scale : 2m s/div.
Y-scale : 20 v/div.



Q6/Q7/Q8/Q9 Collector

Trigger : Internal
X-scale : 2m s/div.
Y-scale : 20 v/div.

3.2 LED Indication

● : ON ○ : OFF ◑ : Blink

TRX Board (06P0241)

LED	Name	Status	Remarks
CR1	VTX	●	+B voltage (Green)
CR15	TR	◑	Output signal, Blinks at every transmission

PWR Board (06P0242)

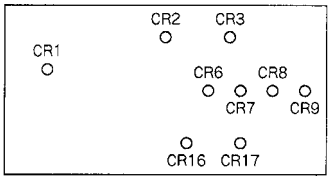
LED	Name	Status	Remarks
CR1	VTX	●	+B voltage (Green)
CR9	IN HL	○	Over voltage or low voltage indicator
CR12	+5V	●	Always ON (Green)
CR14	OVER CUR	○	Over current indicator, OFF in normal condition

CPU Board (06P0258)

LED	Name	Status	Remarks
CR6	R/L CONT	○ ●	ON when lowering, and OFF when raising
CR11	TRM2	○ ◑	Blinks when the transducer is rotating.
CR12	TIM2	○ ◑	Blinks when the transducer is tilting.
CR15	RAISE	○ ●	ON when upper limit switch is activated.
CR16	TR FORE	○ ●	ON when “Heading” is generated.
CR17	LOWER	○ ●	ON when lower limit switch is activated.
CR18	TI93	○ ●	ON when TI93 signal is generated
CR41	TI8	○ ●	ON when TI8 signal is generated

Train/Tilt Drive Board (06P0154)

LED	Name	Status	Remarks
CR1	VDD	○	+8V line
CR2	TRC	○ ●	Train Clock Pulse lights during train operation.
CR3	TIC	○ ●	Tilt Clock Pulse lights during tilt operation.
CR6	FORE	○ ●	Fore Signal blinks whenever transducer faces ship’s fore.
CR7	AFT	○ ●	Aft Signal blinks whenever transducer faces ship’s aft.
CR8 CR9	93°/+8°	○ / ● ● / ● ● / ○	Tilt Data +8° -30° 93°
CR16		○ ●	Lower Limit Switch Signal lights when the transducer lowers in full length.
CR17		○ ●	Upper Limit Switch Signal lights when the transducer is hoisted up.



06P0154 board

3.3 Adjustment

Use the proper instrument, otherwise the unit malfunctions.

DISP Board (06P0238)

Adjusters	Measuring Points	Measured by	Rating	Remarks
R65	TP12	Frequency Counter	70 kHz ±1 kHz	Switching frequency of power circuit
R75	TP7	Digital Multimeter	12.1 V9 ±0.1 V	
C63	TP4	Digital Multimeter	2.40 V ±0.05 V	LCD Clock Phase Adjustment

CPU Board (06P0258)

(1) R. G. B Level Adjustment

Adjusters	Measuring Points	Measured by	Rating	Remarks
R86(R)	TP15	Oscilloscope	1.0 Vpp ±0.05 V	Set screen color to white With test-pattern selection in system menu screen.
R87(G)	TP16			
R88(B)	TP17			

(2) ROLL, PITCH Adjustment

Adjusters	Measuring Points	Measured by	Rating
R101	TP13	Digital Multimeter	3.5 V when the pitch angle is zero.
R102	TP14	Digital Multimeter	3.5 V when the roll angle is zero.

PWR Board (06P0242)

Adjusters	Measuring Points	Measured by	Rating	Remarks
R34	J2 #1	Digital Multimeter	5.0 V ±0.01 V	
R29	TP5--TP6(GND)	Frequency Counter	68.0 ±0.05 kHz	Switching frequency of VTX voltage regulator
R13	J8 #1	Digital Multimeter	77 V	VTX voltage

TRX Board (06P0241)

The receiver in TRX board is adjusted by following steps below.

Instruments

1) Signal Generator
2) Volt-meter (dBuV)
3) Matching Transformer : 02S1138-1
4) Digital multi-meter

Connection

Connect the SG to J6 #1 and #2 on the TRX board via the Matching Transformer 02S1138-1, as shown in the Fig. 3.4.

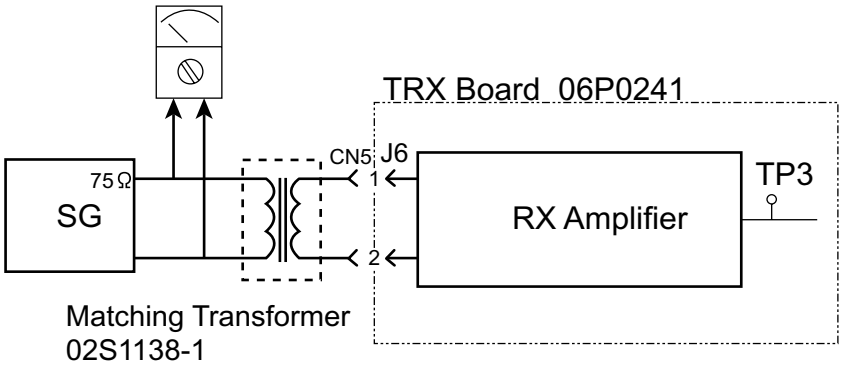


Figure 3.4

Procedures

To adjust receiver gain;

1. Set the frequency of the SG to 180 kHz.
2. Rotate R38 three steps from fully CCN position.

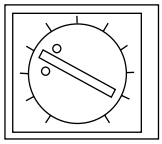


Figure 3.5

3. Unplug J6 and set the output level of the SG to 46 dBuV (measured by the Volt-meter).
4. Connect J6 and turn on CH-270.
5. Set the range to 1600 m, Gain to "10", and TVG to "0".
6. Adjust R57 to obtain 4.0 ±0.5 V at TP3 on TRX board.
7. Adjust transformers T1/T2/T3 so that the signal level at TP3 becomes maximum.
8. Readjust R57 to obtain 4.0 ±0.5 V at TP3.
9. Unplug J6 and set the output level of the SG to 53 dBuV. (measured by the Volt-meter)
10. Connect J6 and confirm that the signal level at TP3 is 9 VDC.
11. Unplug J6 and set the output level of the SG to 116 dBuV. (measured by the Volt-meter)
12. Set Gain to "0" and TVG to "10".
13. Adjust R70 so that the lowest level of the TVG curve at TP3 becomes 0.4 ±0.05 V.

4. PARTS LOCATION

4.1 Display Unit

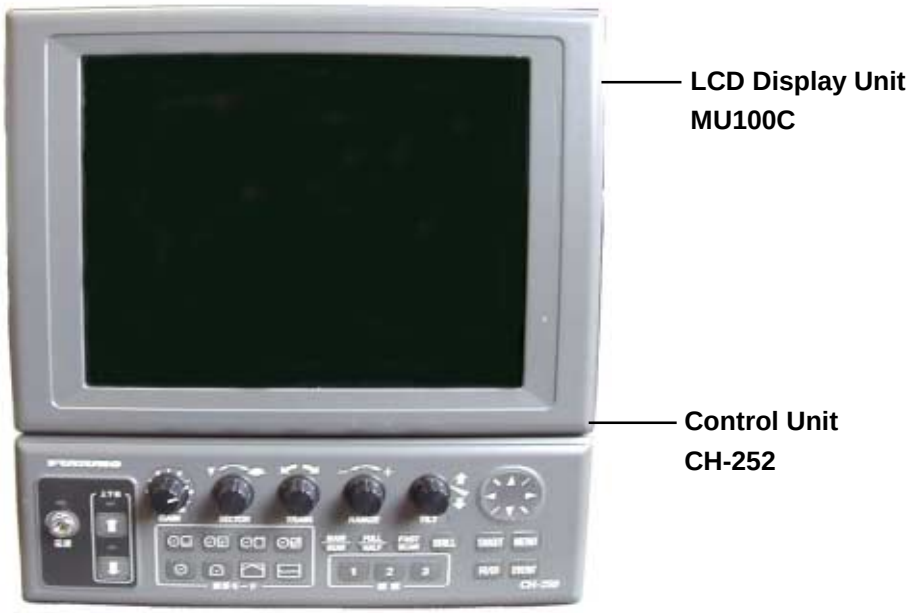


Figure 4.1 Display Unit Front View

Figure 4.2 Display Unit LCD/PCB Assembly

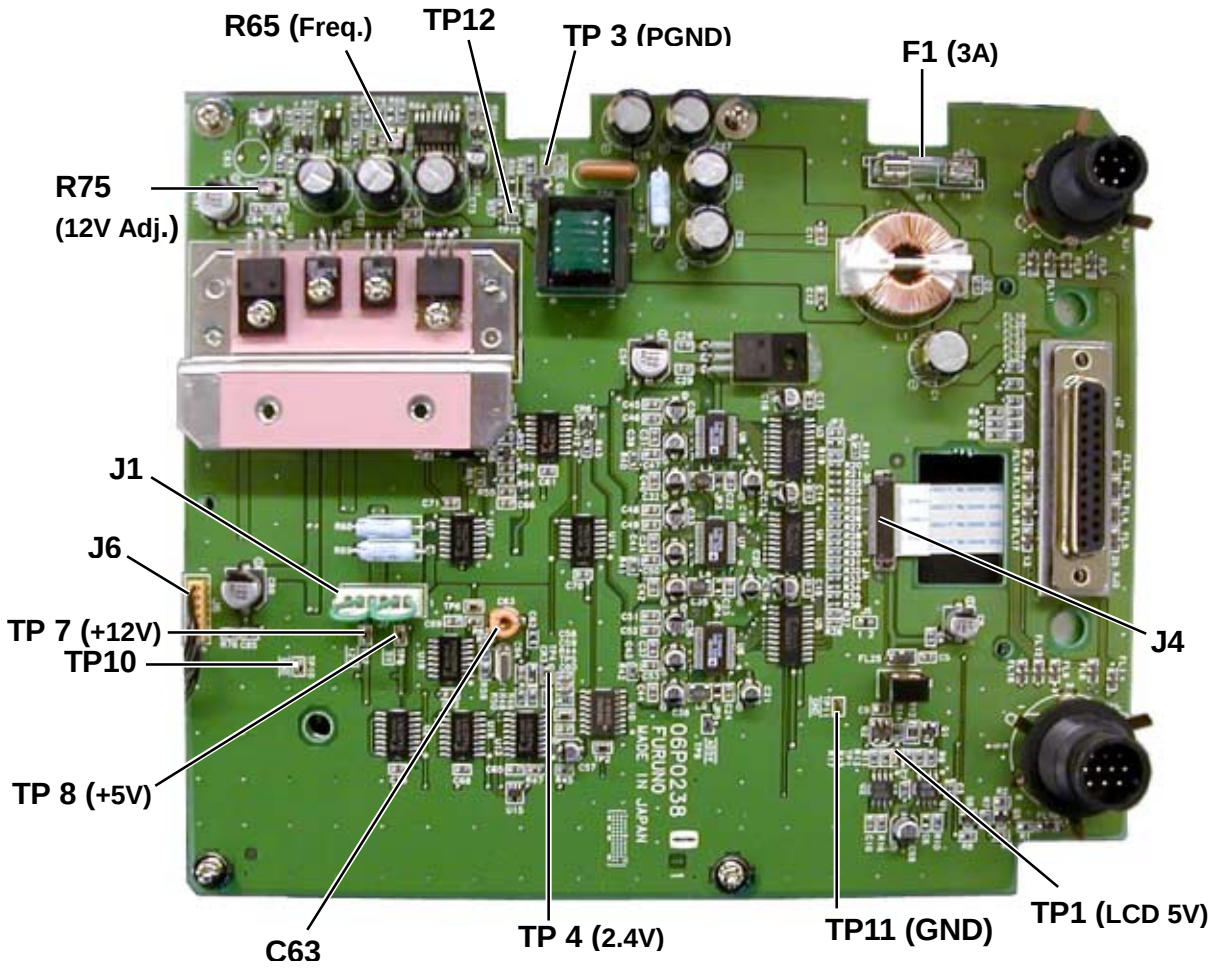


Figure 4.3 DISP Board (06P0238)

4.2 Control Unit

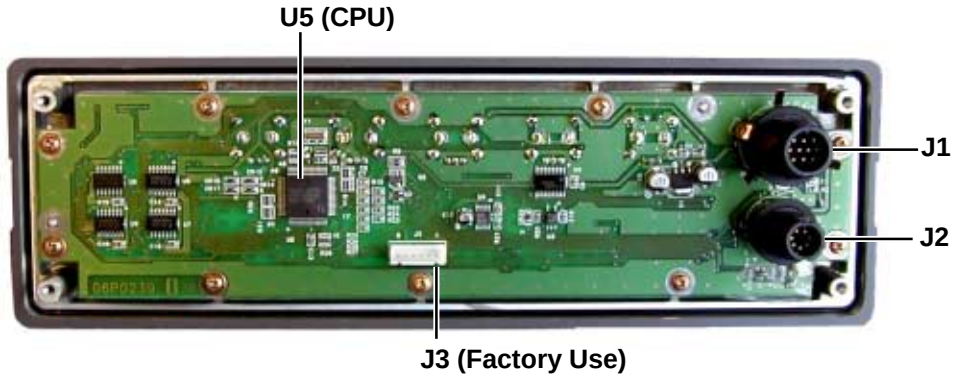


Figure 4.4 PNL Board (06P0239)

4.3 Transceiver Unit

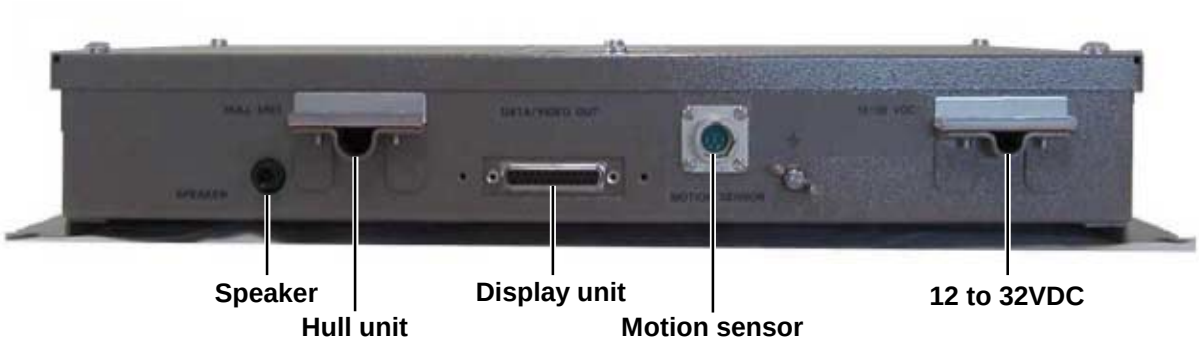


Figure 4.5 Transceiver Unit (CH-273)

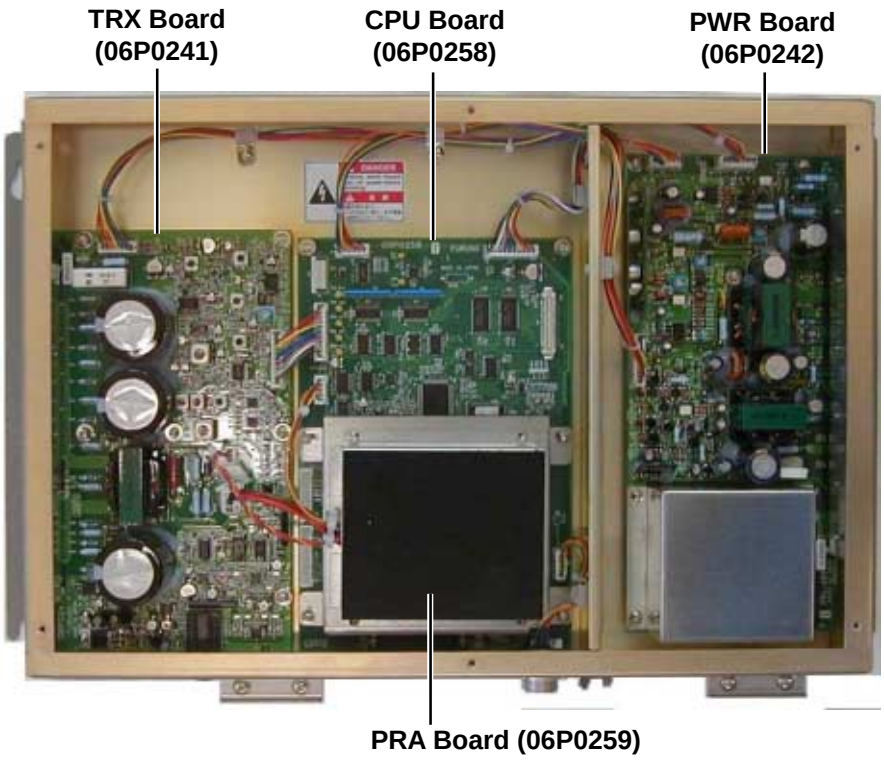


Figure 4.6 Transceiver Unit (CH-273)

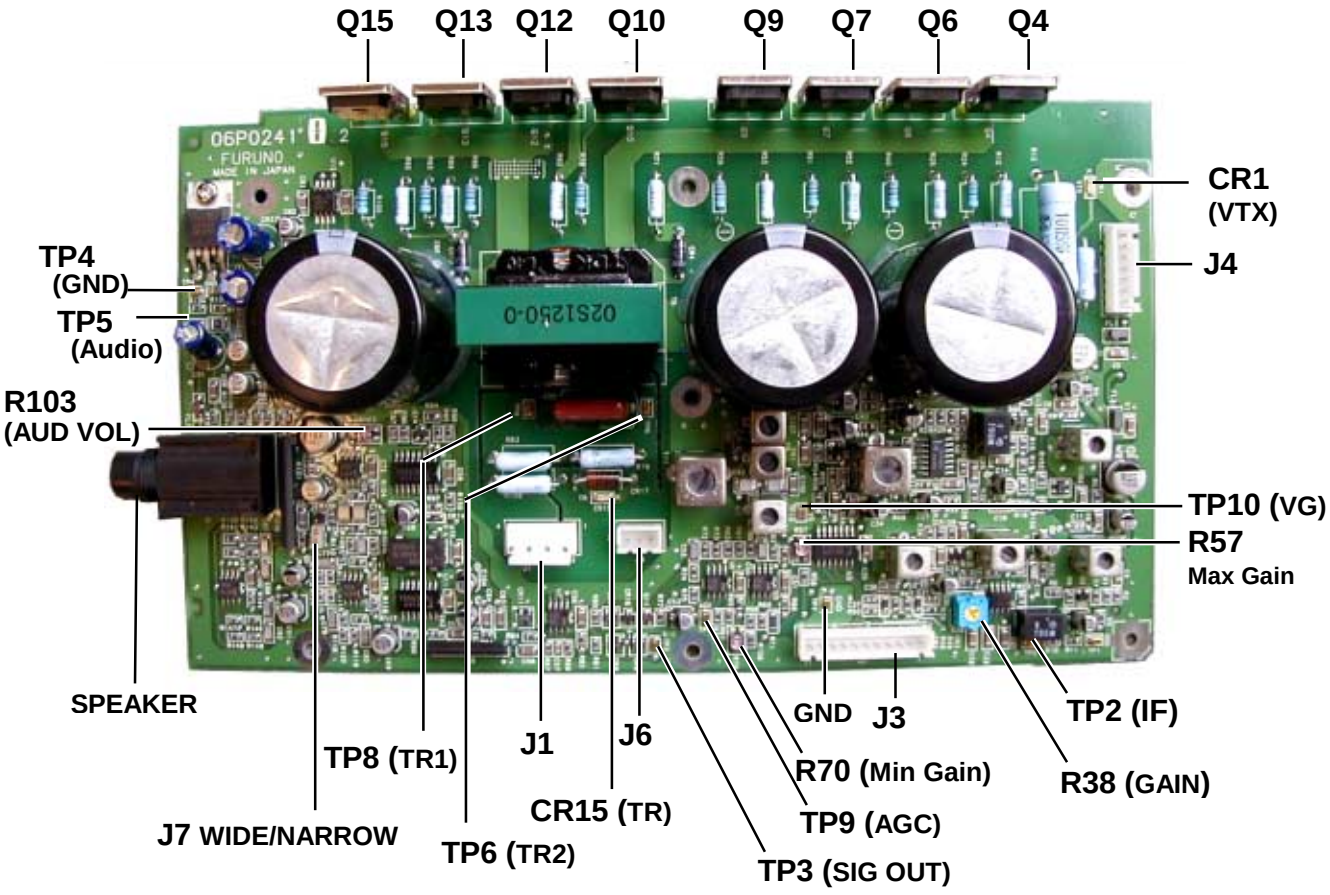


Figure 4.7 TRX Board (06P0241)

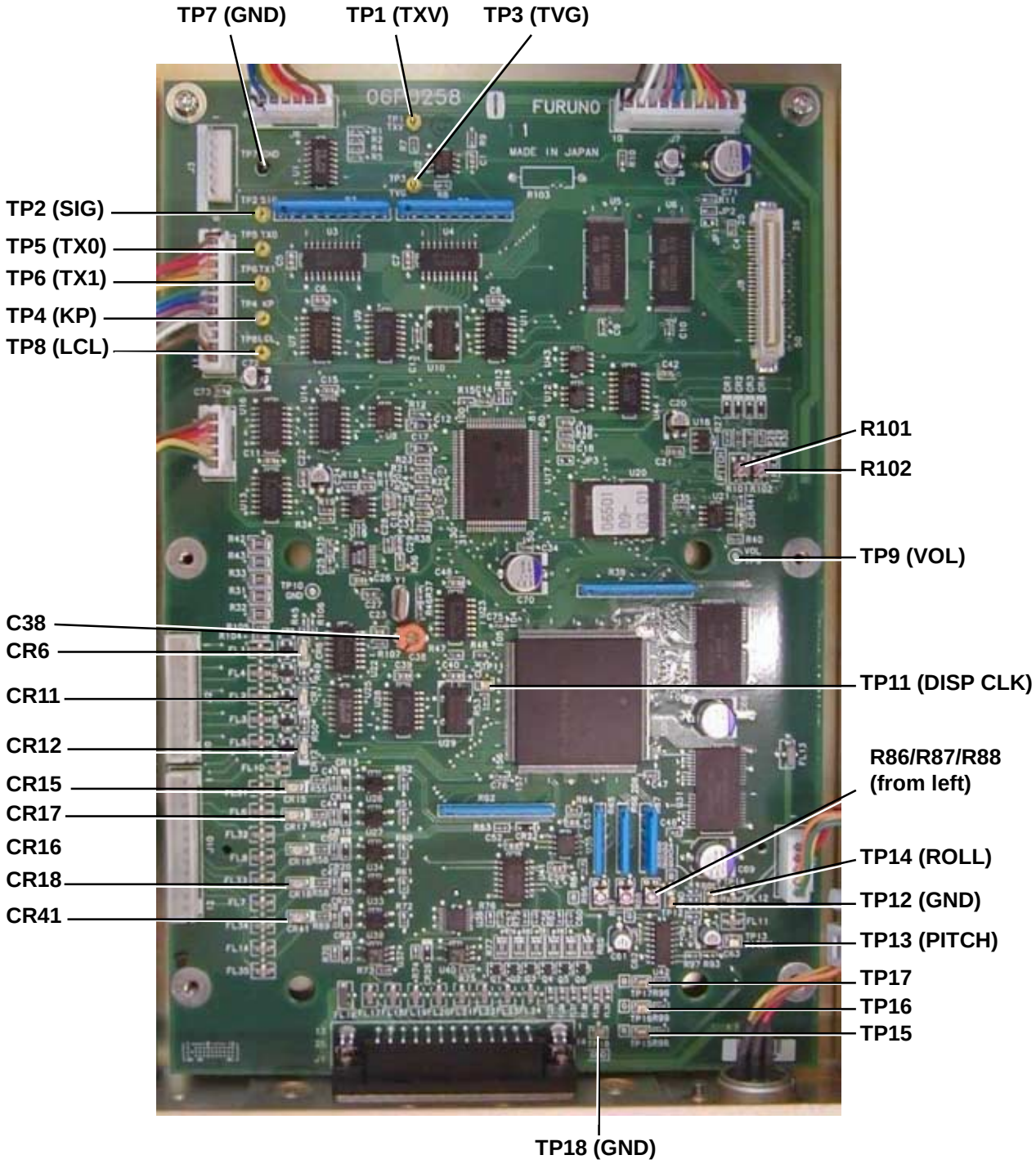


Figure 4.8 CPU Board (06P0258)

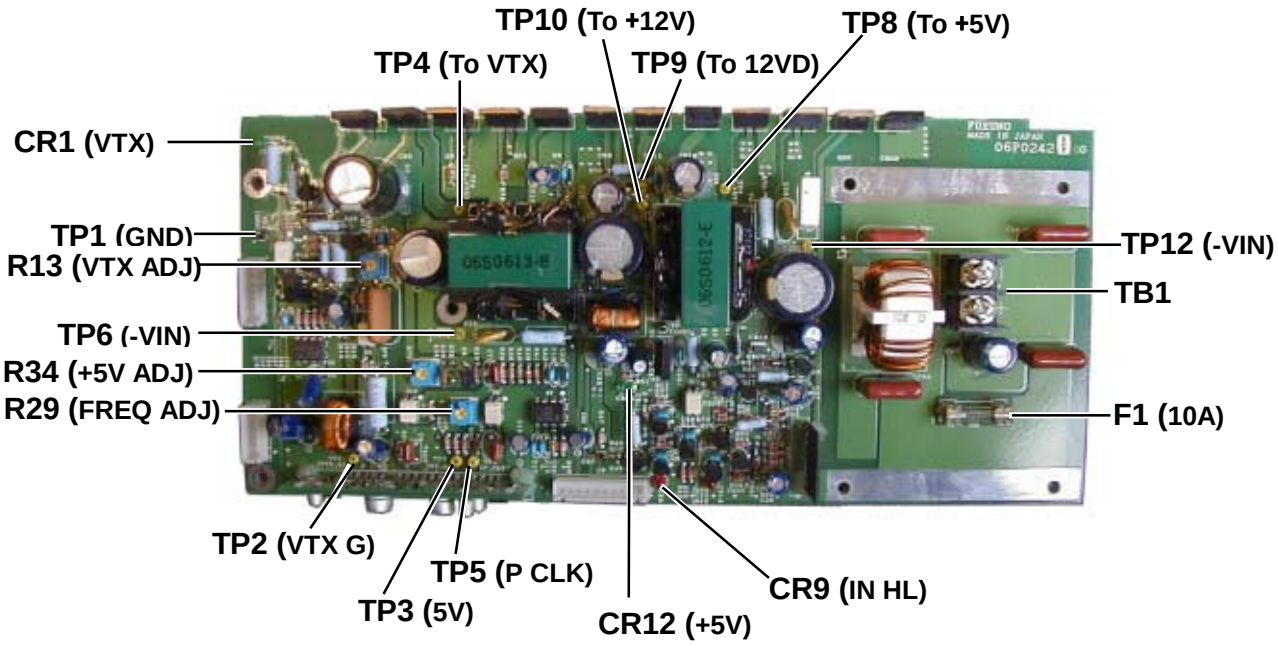


Figure 4.9 PWR Board (06P0242)

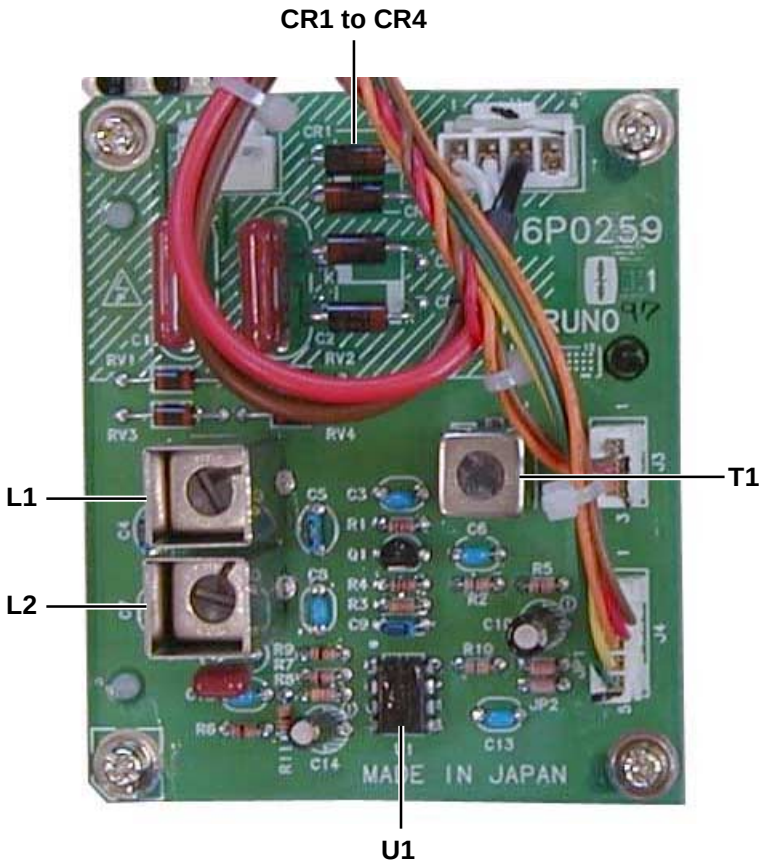


Figure 4.10 PRA Board (06P0259)

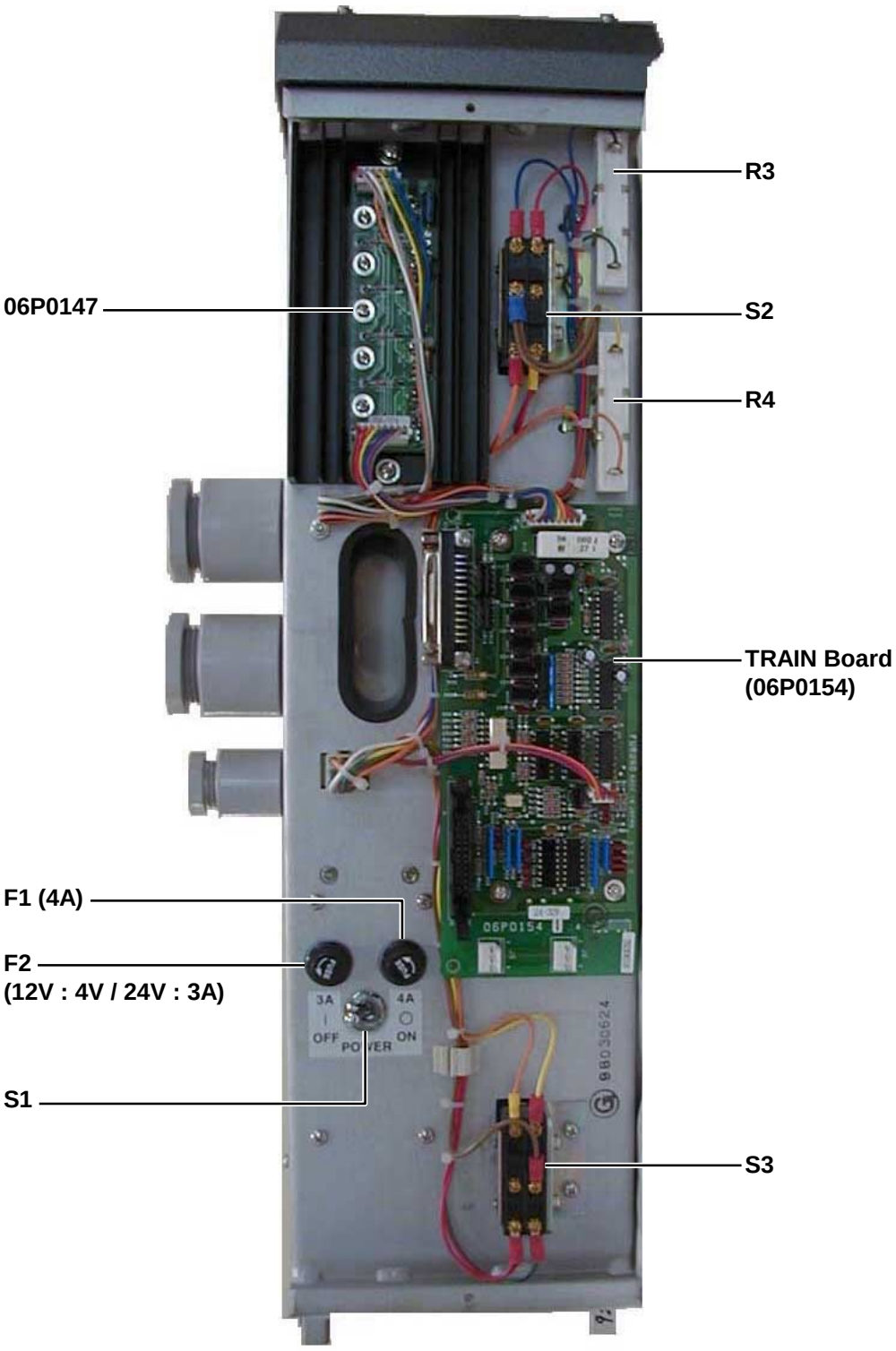


Figure 4.11 Raise/Lower Unit

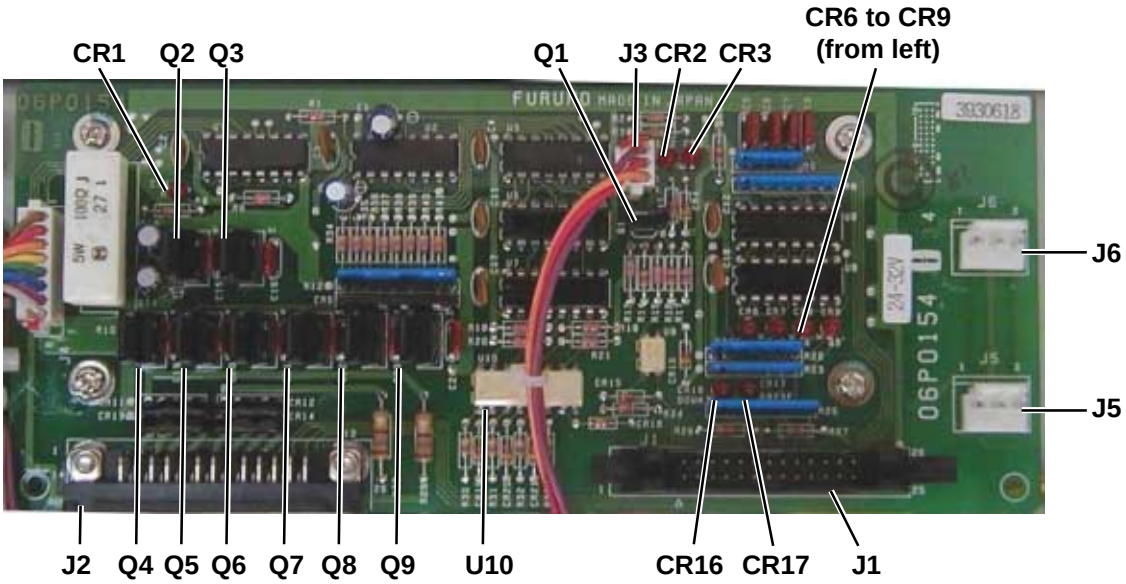


Figure 4.12 TRAIN Board (06P0154)

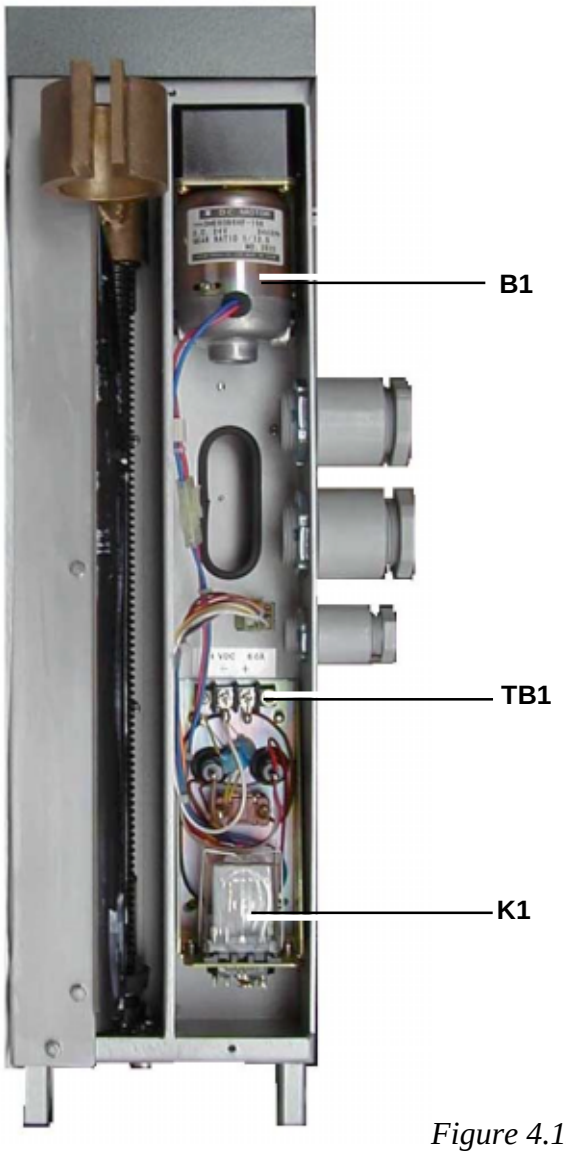


Figure 4.13 Raise/Lower Unit

5. MAINTENANCE

5.1 Replacement of Grease Cotton

(Every two years or when water leaks along with the main shaft.)

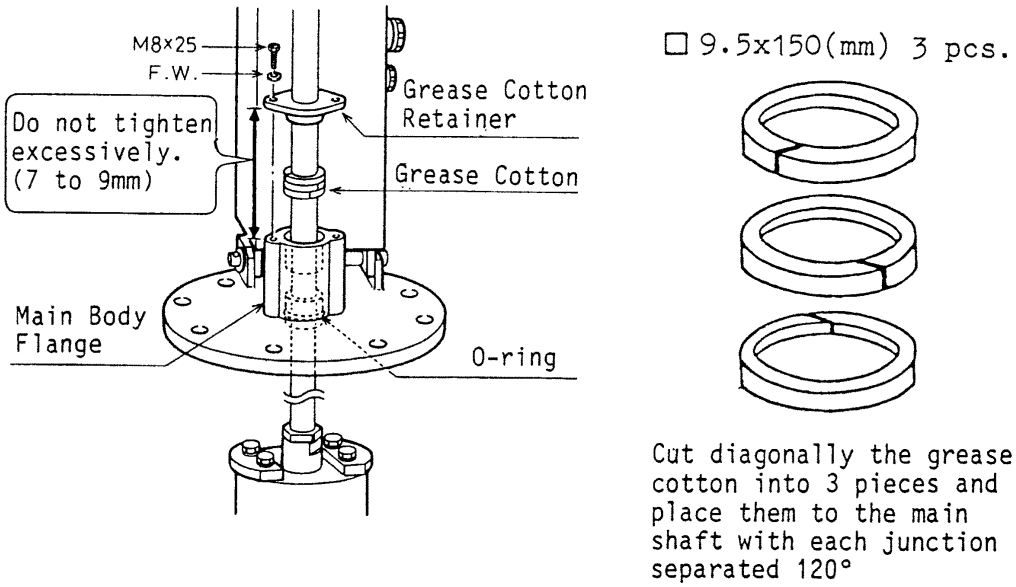


Figure 5.1

5.2 Soundome (D) Replacement

Disassembling

1) Place the soundome vertically.
2) Unscrew the soundome (D) fixing screws.
3) Insert screwdrivers with blade width of 7 to 9 mm to the slit on the soundome (D) and rotate them in the opposite directions each other. The upper soundome assembly will slide up by the width of the screwdriver.
4) Fix two attachment plates (supplied as installation materials) to the upper dome assembly as shown in Fig. 5.2.
5) Insert the screwdrivers between the plates and the slits of soundome (D) and rotates them. The upper dome assembly will be pushed up further and become loose enough to be removed by hand.

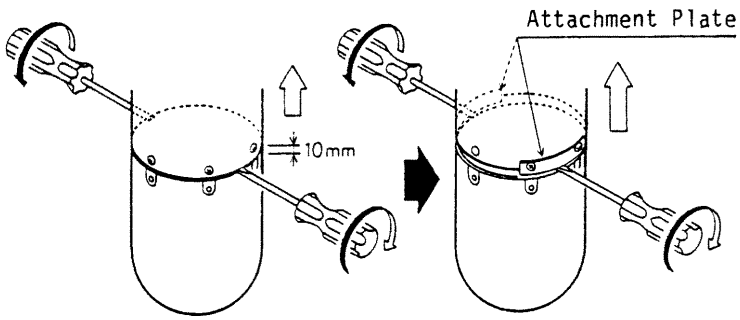


Figure 5.2

Assembling

1) Fill the soundome (D) with oil up to the white line on the inner surface.
2) Make sure that the o-ring is in position on the upper dome assembly.
3) Apply the sealant (Kinoruster) to the o-ring.
4) Fit the upper dome assembly into the soundome (D), marking sure that screw holes are aligned.
5) While pressing down the upper dome assembly, hand tighten screws.
6) Fasten the screws securely in diagonal order, especially for the first four screws maked by 1 to 4 in Fig. 5.3.

Note: Screws are self-locking type which requires no washers.
As repeated use will weakens the locking force, new screws should be used after in a few times of removal.

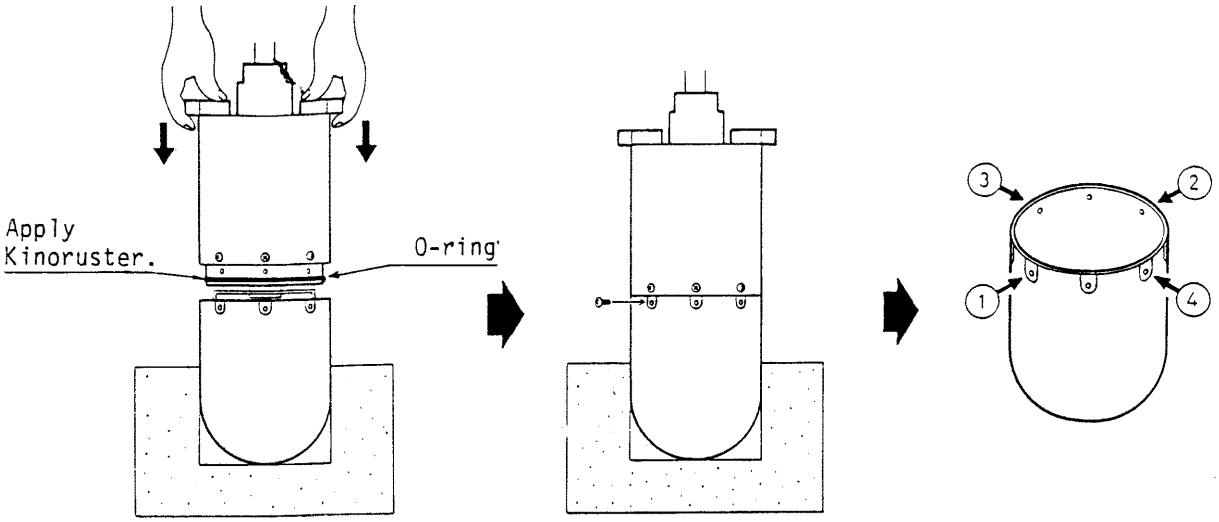


Figure 5.3

5.3 Transducer Replacement

Disassembling

1) Remove the transducer support (2 pcs.).
2) Detach the tilt arm assembly from the transducer by unscrewing eight screws.
3) Unsolder transducer lead wires (3 pcs.)

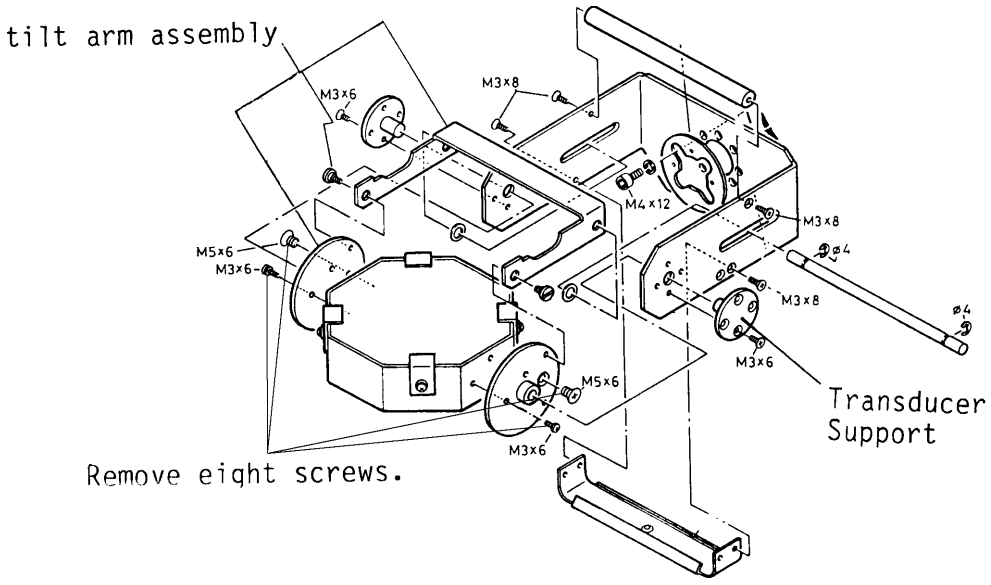


Figure 5.4

Assembling

1) Install the transducer with the transducer support (2 pcs.).
2) Screw the tilt pins (2 pcs.)
3) Solder transducer leads wires and fix them as shown in Fig. 5.5.

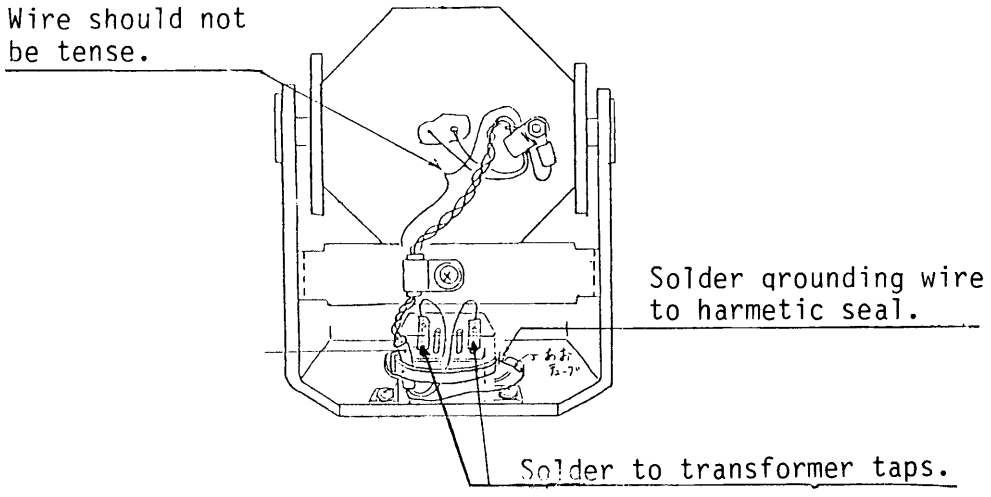


Figure 5.5

5.4 Tilt Gear Box Replacement

Disassembling

1) Loosen 8 screws and take off the soundome (U). To detach the soundome from the main body, use (-) screwdrivers in the same way as they have been used to remove the soundome (D). See Fig. 5.2.
2) Unplug P1.
3) Remove the gear box cover by loosening four screws.
4) Loosen four socket-head bolts and disengage the rack gear from the tilt shaft by lifting the gear box.

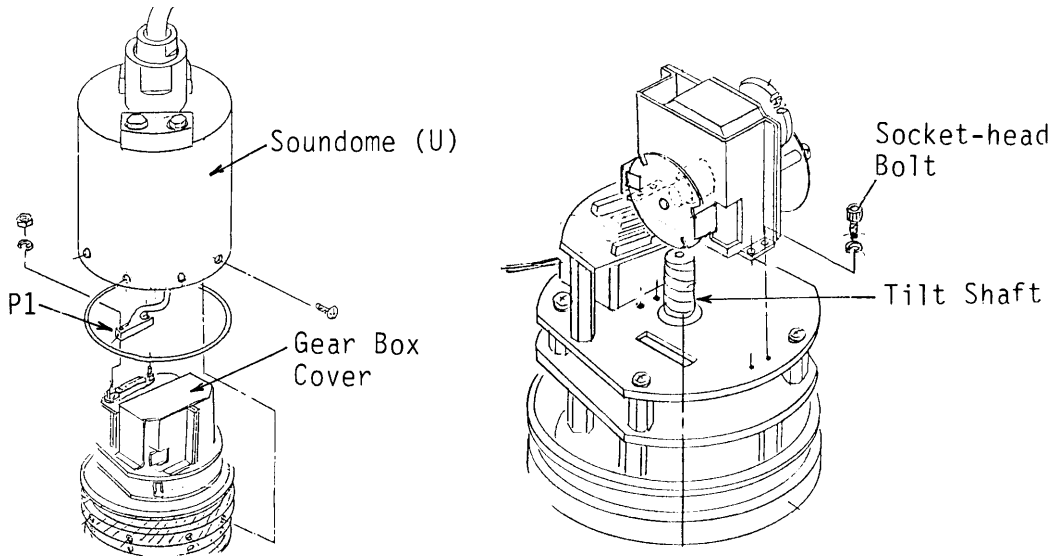


Figure 5.6

Assembling

1) Fully lower the tilt shaft.
2) Turning the tilt motor gear, position the socket-see screws for the tilt code disk as shown below.

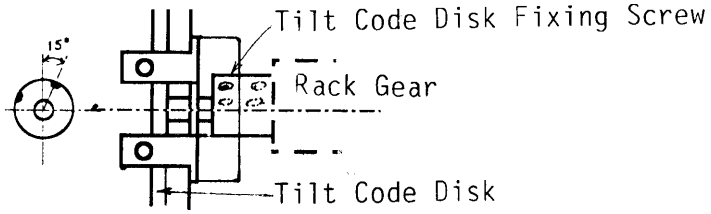


Figure 5.7

3) Install the gear box and engage the rack gear with the tilt shaft.
4) Adjust the position of the tilt gear box and set the backlash of the rack gear to 0.1mm to 0.2mm.
5) Secure the tilt gear box with four screws.

Note: Alignment of the tilt code disk is required. Refer to section 5.7.

5.5 Slip Ring Replacement

Disassembling

After removing the tilt gear box (see previous section), remove the followings parts until the slip-ring is exposed as shown in Fig. 5.9.

1) Unplug all connectors on pcb 06P0158.
2) Remove the chassis plate (U) assembly, unscrewing four screws.
3) Unscrew two socket set-screws to remove the train gear.
4) Unscrew four screws to remove the chassis plate (D) assembly.
5) Remove the train signal pcb 06P0155 (2 pcs.).
6) Remove the train code disk assembly by unscrewing two socket set-screw.
7) Remove the carbon brush assembly.

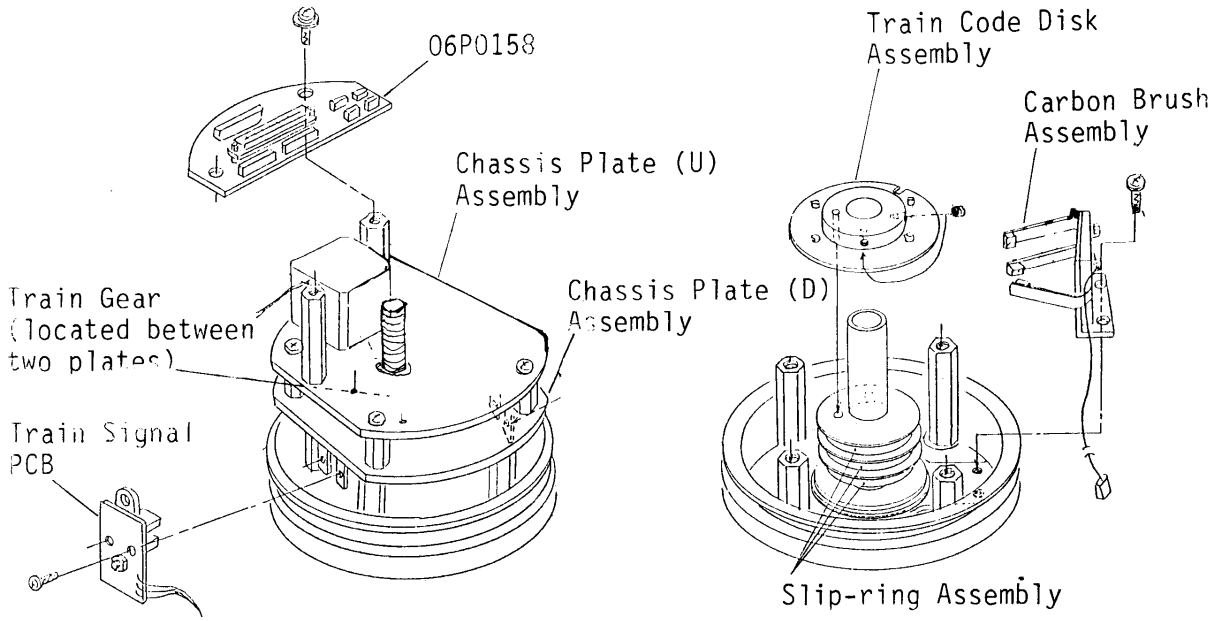


Figure 5.8

8) Unsolder the leads of slip-ring assembly.

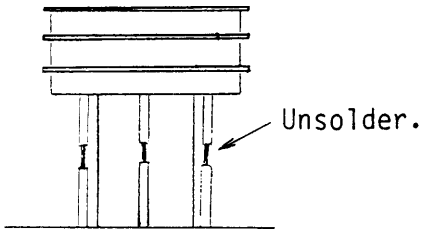


Figure 5.9

Assembling

1) Clean the slip-ring surface with alchol.
2) Pass the slip-ring assembly through the train shaft and install so that it may be in contact with the base of the train shaft.
3) Solder leads of the slip-ring and apply silicone rubber over them.
4) Loosen the carbon brush fixing screws and install the carbon brush assembly.
5) Tighten the carbon brush fixing screws so that the brushes contact the center part of the slip-rings as shown below.

Caution

Do not change the bending angle of the carbon brush.
The angle is set to 30° at the factory.

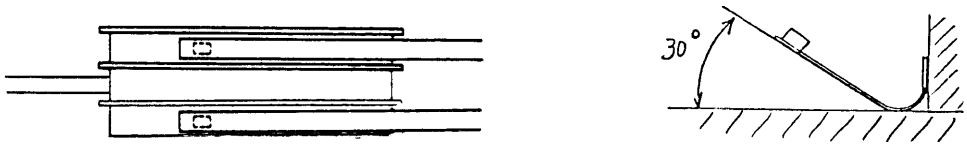


Figure 5.10

6) Follow steps 1) to 6) of disassembling procedure in reverse order.
   Note: The tilt gear should be positioned so that its screw holes may agree with the holes on the tilt shaft.

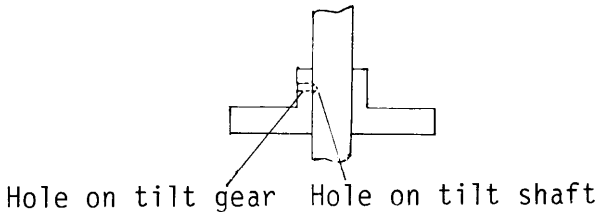


Figure 5.11

5.6 Carbon Brush Replacement

When the carbon brush assembly is replaced, use the procedure for the slip-ring replacement. When only one or two carbon brushes are replaced, it is unnecessary to disassemble soundome mechanisms. Unsolder the lead wire and loosen the socket head bolt with the ball wrench supplied as spare parts.

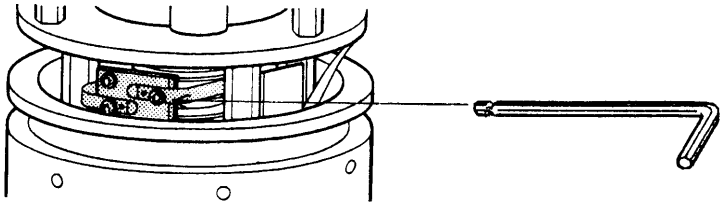


Figure 5.12

5.7 Tilt Code Disk Alignment

When the tilt gear bos is reinstalled, alignment of the tilt code disk is required.

The tilt code disk has three slits; two narrow slits for 30° signal and one wide slit +8° and 93° signals. Two narrow slits should be located in the center of photo sensors on tilt signal (1) and (2) boards. Note that improper alignment causes the error message “TILT NG” and stoppage of whole operation; if the mechanical stopper works before +8° or 93° signal is produced or if the two sensors are not activated simultaneously at 30° tilt, the error message is generated.

1) Remove the tilt signal (2) pcb 06P0156.
2) Loosen two socket set-screws on the shaft of the tilt code disk.

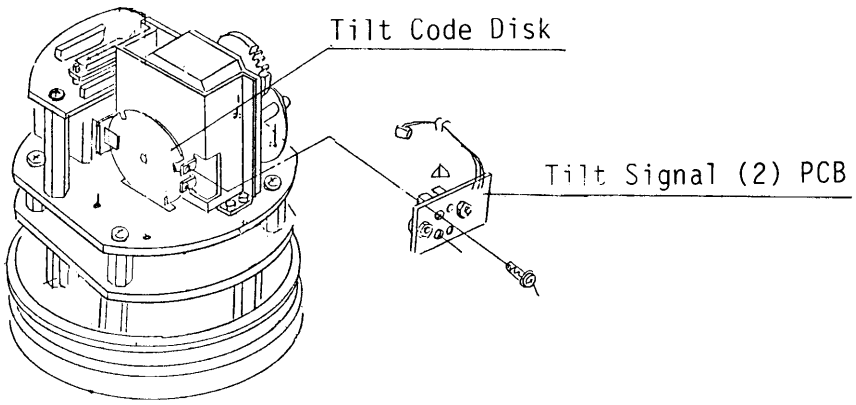


Figure 5.13

3) Place the soumdome assembly vertically.
4) Tilt the transducer exactly 30°

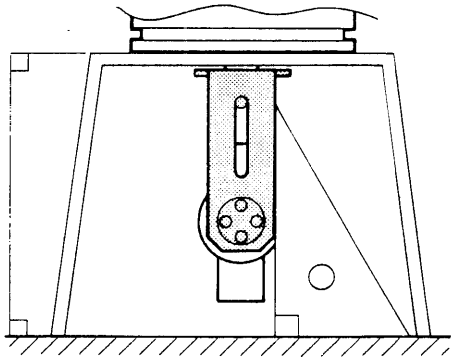


Figure 5.14 Placing Soundome Vertically

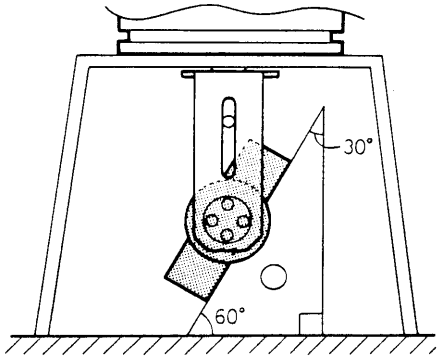


Figure 5.15 Tilting Transducer 30°

5) Rotate the tilt code disk so that the second narrowest slit is placed in the center of photo sensor on the tilt signal (1) pcb. See Fig.5.16. Be careful not change the tilt angle of the transducer.

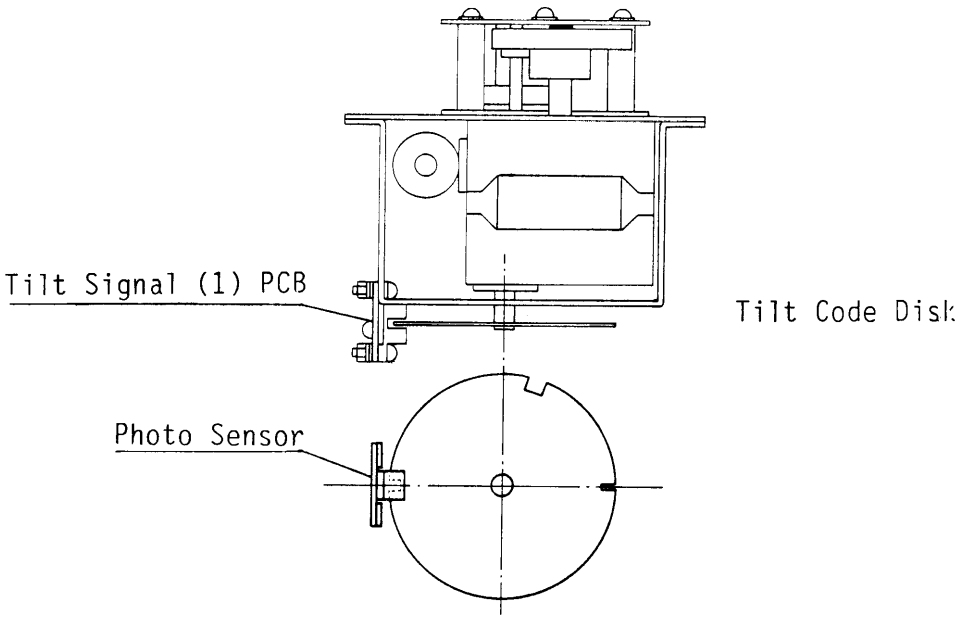


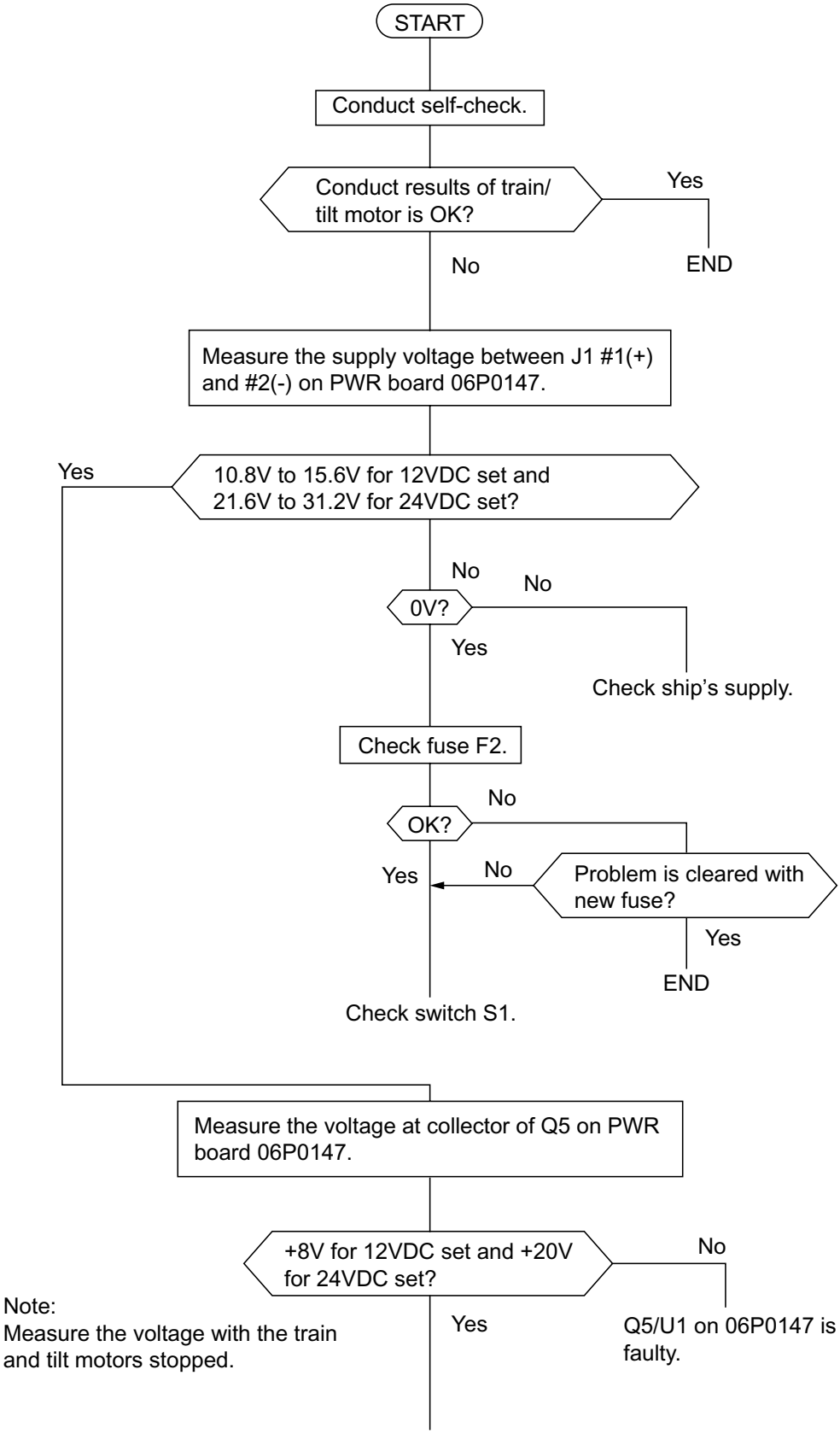
Figure 5.16

6) Fix the tilt code disk by tightening the socket set screws.
7) Reinstall the tilt signal (2) pcb.
8) Make all interconnections between the units.
9) Check that LEDs CR8 (+8°) and CR9 (93°) on the tilt driver pcb blinks simultaneously when the tilt angle is 30°.

6. TROUBLESHOOTING

6.1 Flow Chart

1) Train/Tilt Check



Operate the sonar in self-check mode where the display unit alternately drives the tilt/train circuits.

Train problem

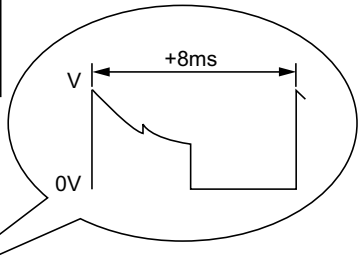
Which is faulty, tilt or train?

Tilt problem

Check tilt motor drive pulse on DRV board 06P0154.

Ø1 : Q5 (C)
Ø2 : Q3 (C)
Ø3 : Q4 (C)
Ø4 : Q2 (C)

Common is (-) of ship's supply.



Note that train and tilt circuits are driven alternately.

Check result is OK?

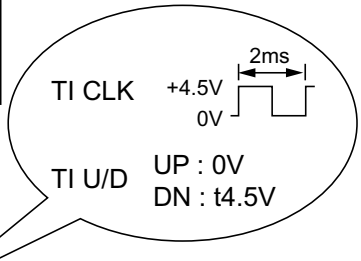
Yes

No (Driver circuit has problem.)

Drive circuit is OK.
(Tilt Motor or Feedback Circuit is faulty.)

Check TI CLK and TI DN/UP input signal on DRV board 06P0154.

TI CLK : U7 #12 J1 #20 (com)
TI DN/UP : U7 #6 J1 #20 (com)



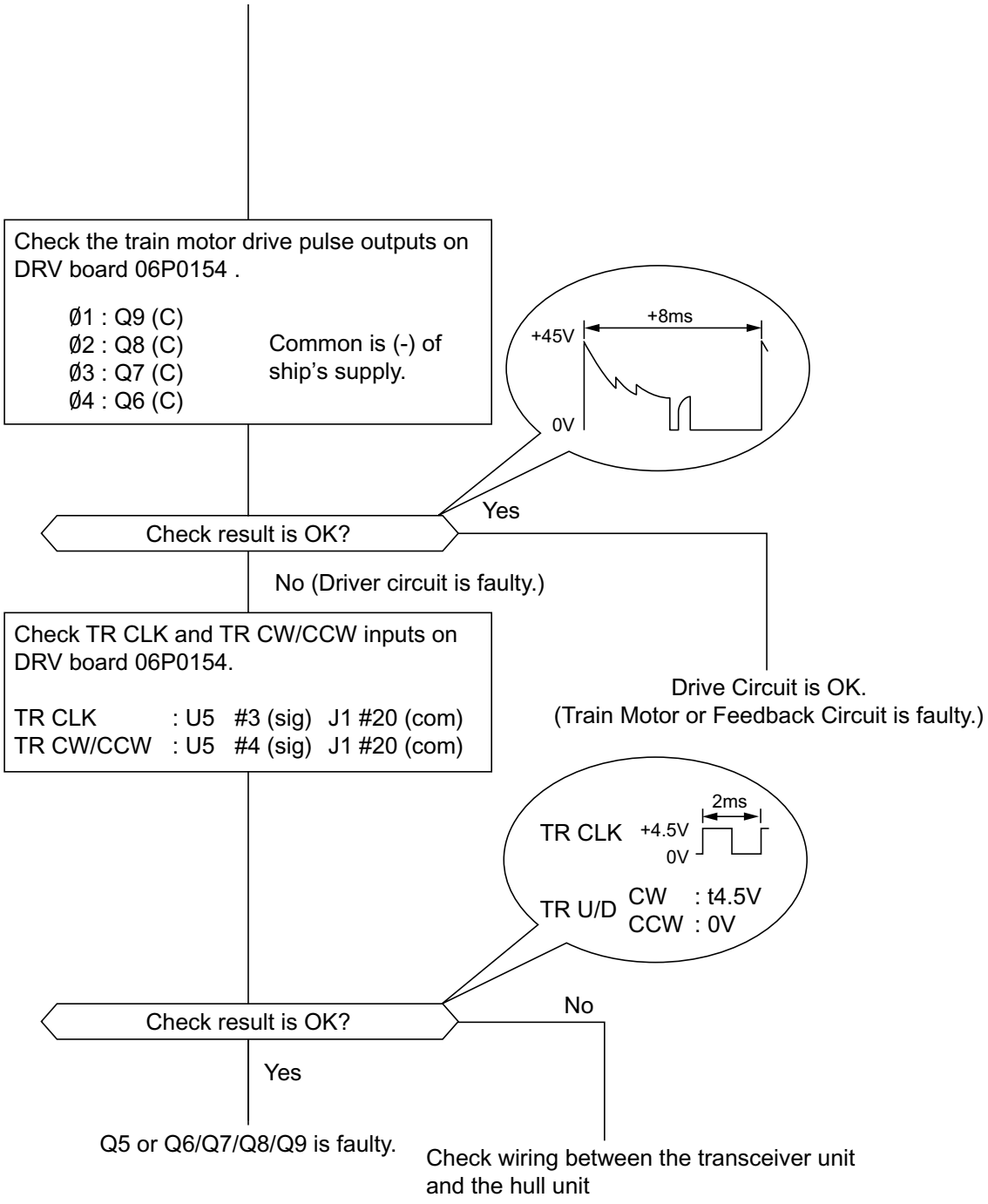
No

Check result is OK?

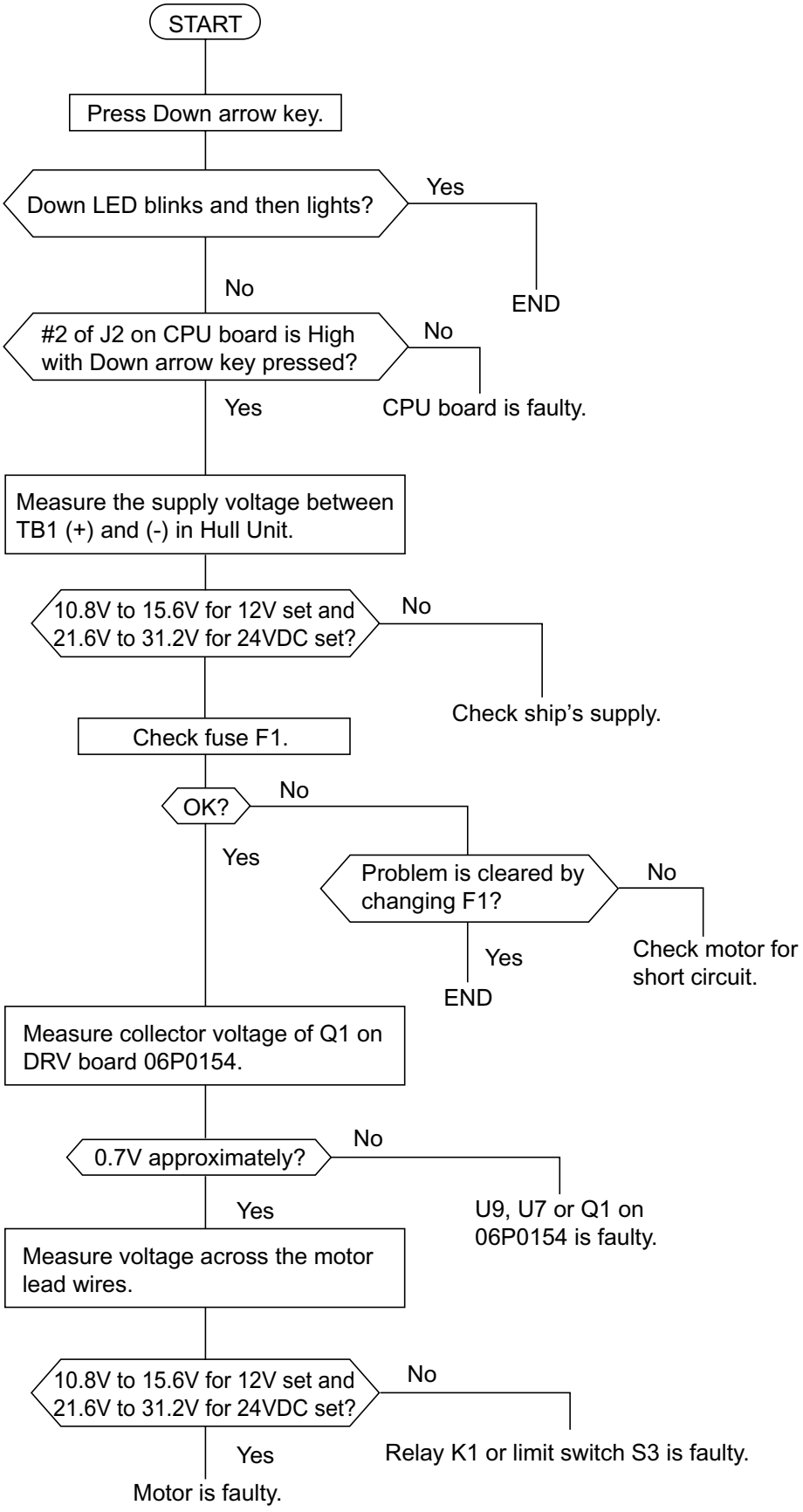
Yes

U3 or Q2/Q3/Q4/Q5 is faulty.

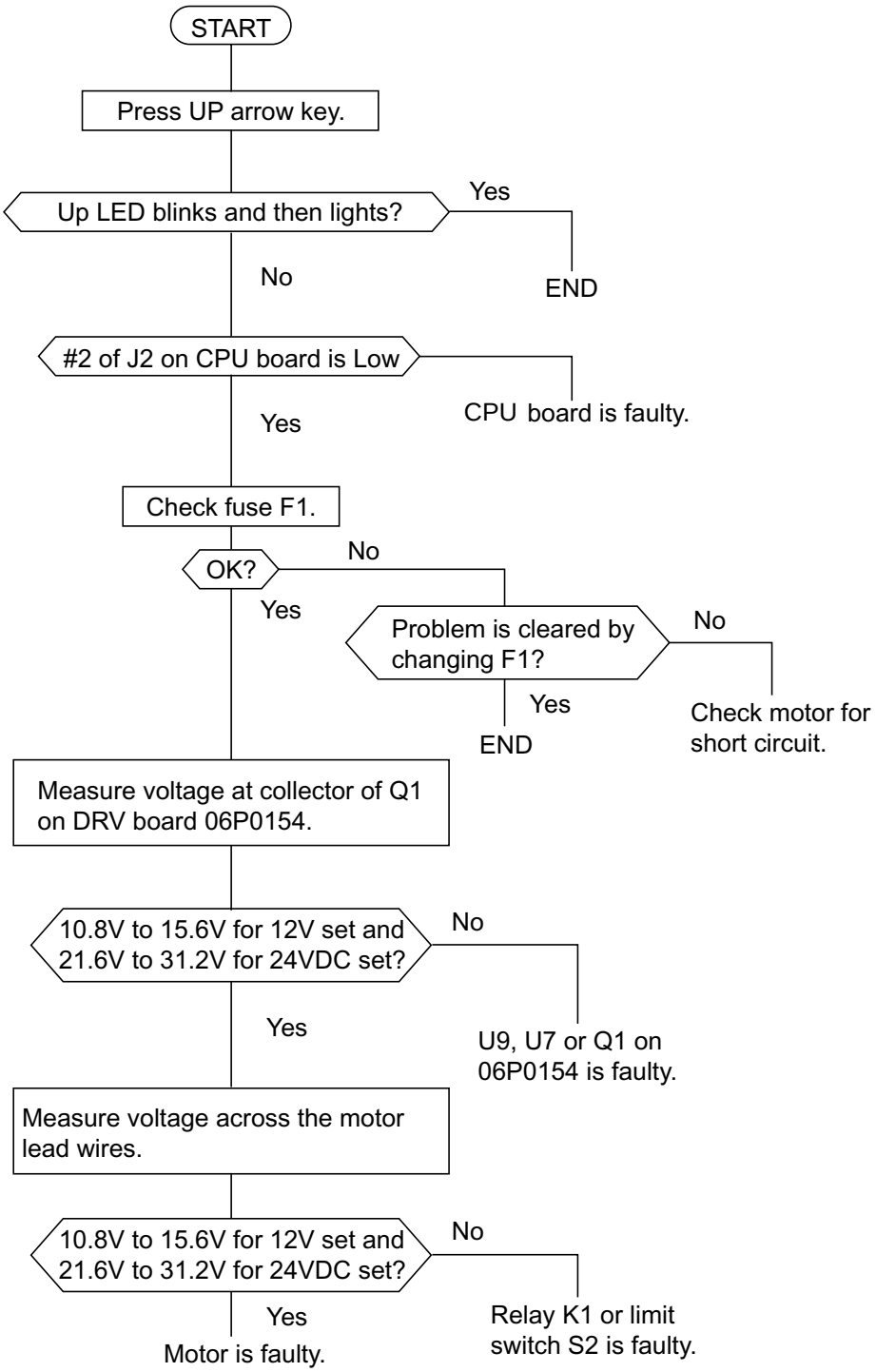
Check wiring between the transceiver unit and the hull unit.


Check the train motor drive pulse outputs on DRV board 06P0154 .
Ø1 : Q9 (C)
Ø2 : Q8 (C)
Ø3 : Q7 (C)
Ø4 : Q6 (C)
Common is (-) of ship's supply.
+8ms
+45V
0V
Check result is OK?
Yes
No (Driver circuit is faulty.)
Drive Circuit is OK.
(Train Motor or Feedback Circuit is faulty.)
Check TR CLK and TR CW/CCW inputs on DRV board 06P0154.
TR CLK : U5 #3 (sig) J1 #20 (com)
TR CW/CCW : U5 #4 (sig) J1 #20 (com)
2ms
TR CLK
+4.5V
0V
TR U/D
CW : t4.5V
CCW : 0V
Check result is OK?
No
Yes
Q5 or Q6/Q7/Q8/Q9 is faulty.
Check wiring between the transceiver unit and the hull unit

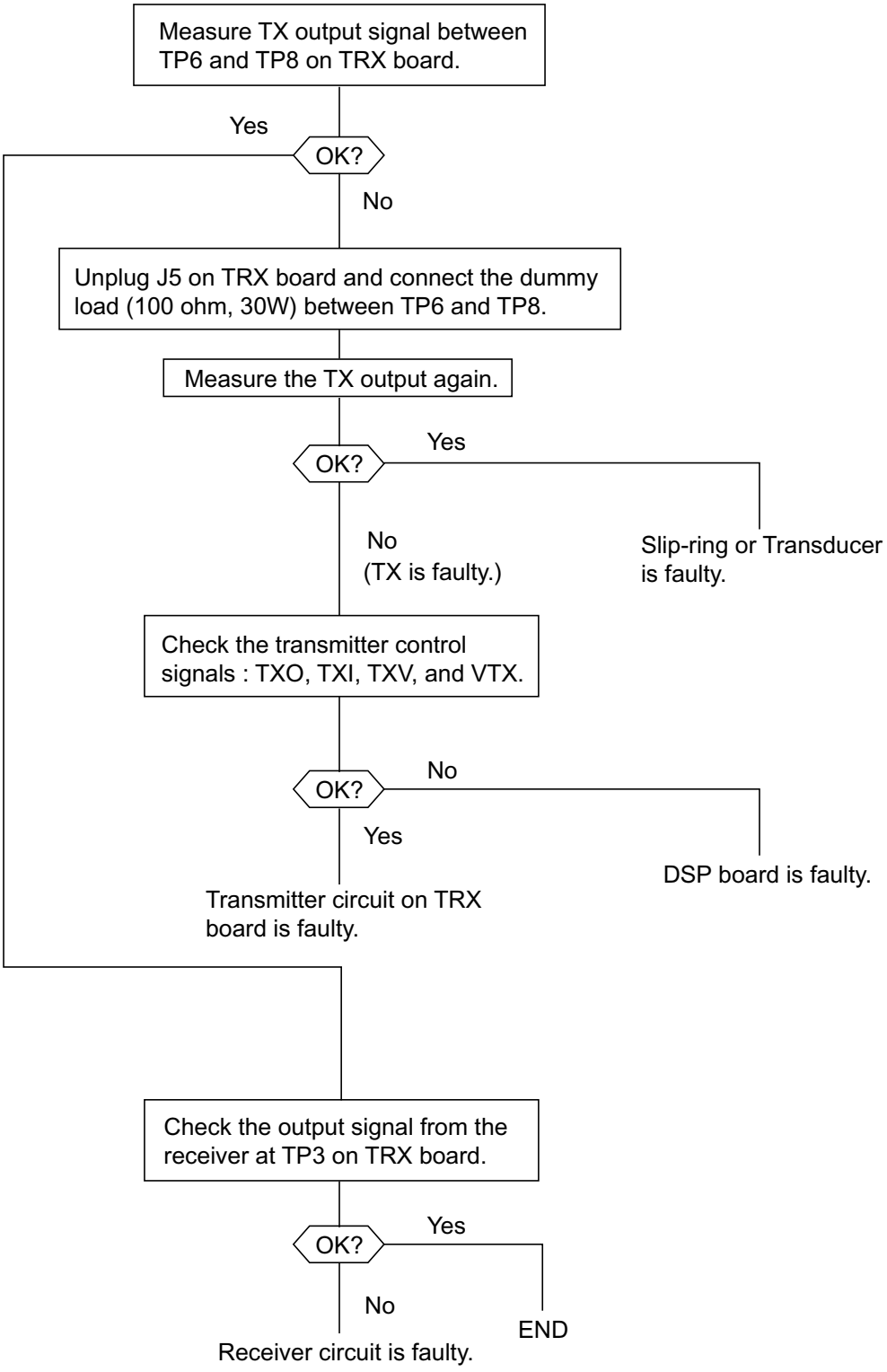
2) Soundome Lowering Check



3) Soundome Raising Check

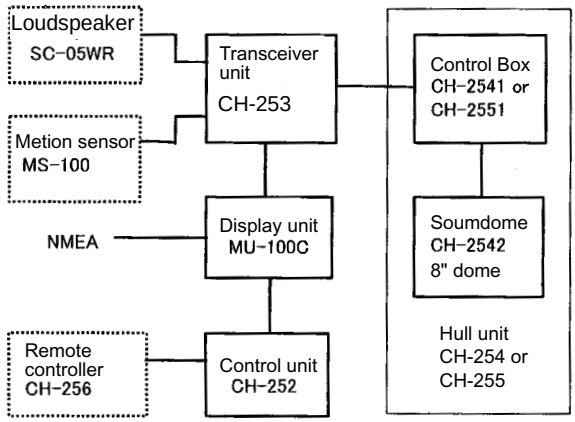
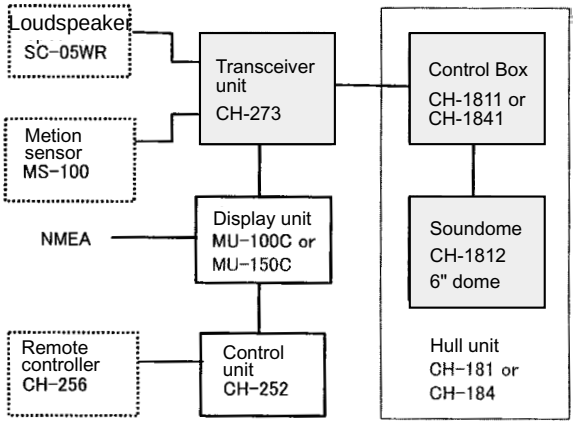
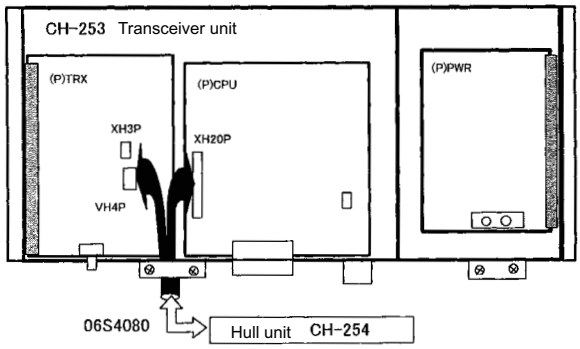
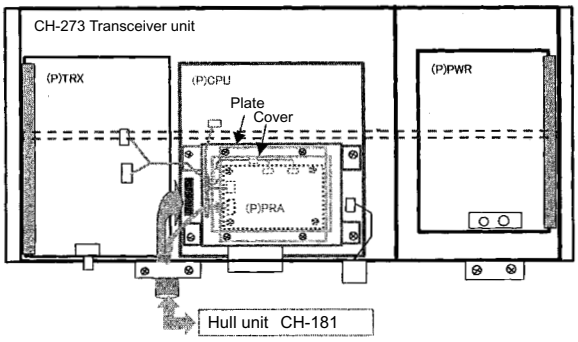


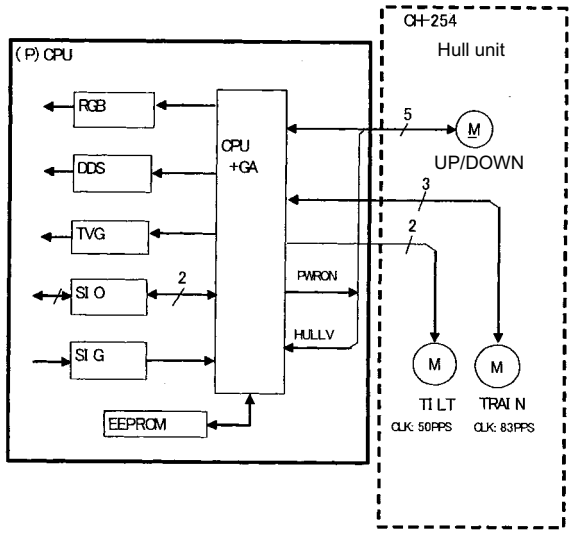
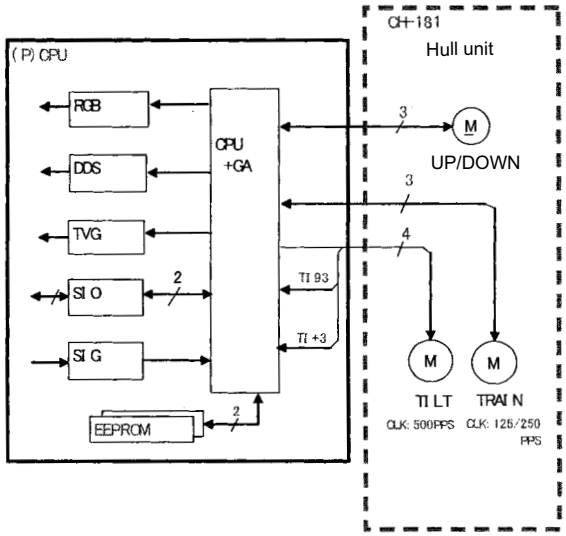
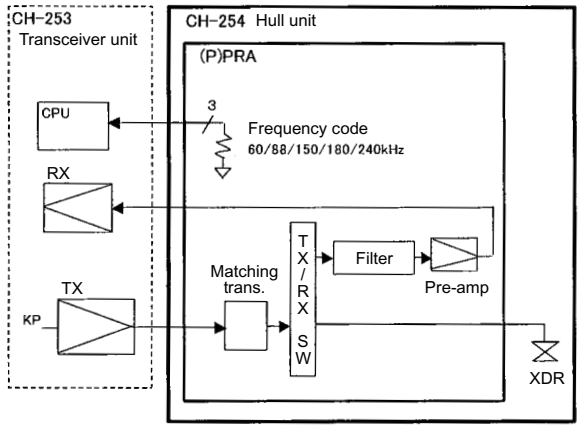
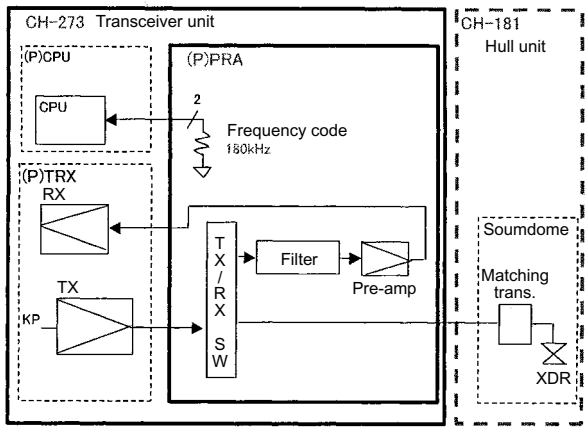
4) Transceiver Check



Appendix A CH-250 VS CH-270

Following shows the difference between CH-250 and CH-270

CH-250	CH-270
1) General 	The transceiver unit and the hull unit are differ from CH-250. The hull unit is the same as CH-18. 
2) Transceiver unit 	PRA board is piggyback mounted on CPU board in the transceiver unit. 

CH-250	CH-270
3) Hull unit control	
	
4) PRA board	
	

CH-270 MECHANICAL PARTS LIST

Raise/Lower Control, Dwg. No. C1271-E01-A

P/N	PARTS NAME	TYPE/DWG. NO.	CODE NO.	REMARKS
1	RETRACTION TANK (STEEL)	06-013-2501-0 *1M*	100-099-190	
	RETRACTION TANK (FRP)	06-013-2511-0 *1M*	100-099-200	
	RETRACTION TANK (STEEL)	06-013-2502-0*1.8M*	100-100-320	
	RETRACTION TANK (FRP)	06-013-2521-0*1.8M*	100-100-340	
	RETRACTION TANK (STEEL)	06-013-2503-0*3.5M*	100-100-330	
2	CASKET	06-013-2303-1	100-098-711	
3A	COMPLETESOUNDOME ASSY.	CH-1812-1-24	006-541-550	12 V, 2.4 m cable
	COMPLETE SOUNDOME ASSY.	CH-1812-270-2-24	006-549-890	24 V, 2.4 m cable
	COMPLETE SOUNDOME ASSY.	CH-1812-1-35	006-541-560	12 V, 3.5 m cable
	COMPLETE SOUNDOME ASSY.	CH-1812-270-2-35	006-549-900	24 V, 3.5 m cable
	COMPLETE SOUNDOME ASSY.	CH-1812-270-2-52	006-549-910	24 V, 5.2 m cable
4	LOCK WASHER	06-013-2402-0	100-098-740	
5	LOCK NUT	06-013-2401-0	100-098-730	
6	SOUNDOME SHAFT. 1.	06-008-1021	100-028-500	
	MAIN SHAFT	SHJ-0006-1 FH105/106	661-000-061	
	SOUNDOME SHAFT. L.	06-007-1572	600-715-720	
7	MAIN BODY FLANGE	06-013-2301-1	100-098-691	
8	TRUNION PIN	06-013-2302-0	100-098-700	
10	GREASE COTTON	9. 5SQUARE, 0. 6M	000-859-103	
11	GREASE COTTON RETAINER	SHJ-0003	661-000-031	
13	MINI PILLOW	BSF1518	000-875-883	
14	MINI PILLOW	BSF1518	000-875-883	
16	BUSH (1)	06-007-1547-1	600-715-471	
17	RELAY MOUNTING PLATE	06-013-2221-2	100-099-502	
18	HULL UNIT COVER (3)	06-013-2214-1	100-099-441	
19	DUST SEAL COVER	06-013-2217-1	100-099-471	
20	COVER FIXING PLATE	06-013-2216-1	100-099-461	
21	HULL UNIT COVER (2)	06-013-2213-1	100-099-431	
22	STOPPER	SHN-0003	661-400-032	
23	PARALLEL KEY (2)	SHJ-1006	661-010-060	
24	NUT PLATE	06-911-0017-0	100-016-560	
25	SOUNDOME PIPE HOLDER	06-013-2219-1	100-099-492	
26	WASHER	06-011-2111-0	100-057-940	
27	GASKET	06-011-2112-0	100-057-950	
28	FIXING GLAND	06-008-1031-0	100-028-520	
29	LOCK BAR	06-007-1550-0	600-715-500	
30	SPRING	06-013-2228-0	100-099-570	
31	LOCK NUT (1)	06-007-1549-0	600-715-490	
32	C-TYPE CIRCLIP	DIA 13	000-800-050	
33	SPRING FIXING RING	06-013-2229-0	100-099-580	
34	BALL BEARING	3/8	000-878-309	
35	PARALLEL KEY (1)	SHJ-1026	661-010-260	
36	SPACER (3)	06-013-2241-0	100-099-680	
37	TOP COVER	06-013-2215-1	100-099-451	
38	NUT FOR BEARING	AN-02	000-863-601	
39	BEARING WASHER	AW-02X	000-864-981	
40	SCREW SHAFT SPUR GEAR	06-013-2222-1	100-099-511	

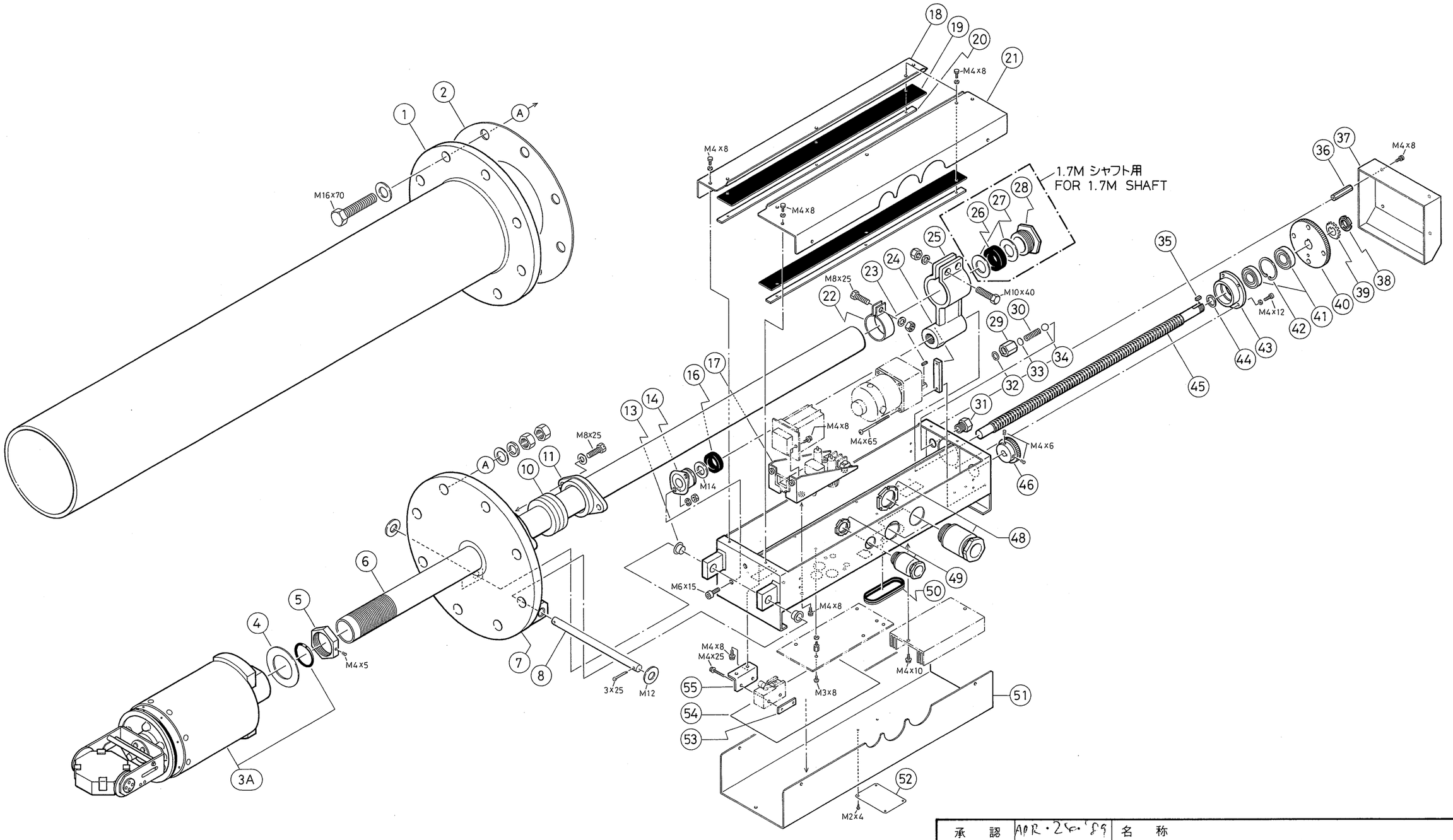
P/N	PARTS NAME	TYPE/DWG. NO.	CODE NO.	REMARKS
41	TAPERED ROLLER BEARING	30202	000-873-100	
42	C-TYPE CIRCLIP	DIA 35	000-866-416	
43	SCREW SHAFT HOUSING	06-013-2224-0	100-099-530	
44	BEARING COLLOR	06-013-2225-0	100-099-540	
45	SCREW SHAFT	06-013-2218-1	100-099-482	
46	MOTOR SPUR GEAR	06-013-2223-0	100-099-520	
48	CABLE GLAND	PM25	000-801-022	
49	CABLE GLAND	PM-15	000-801-024	
50	RUBBER WITH SLIT	FTU-241 *142MM*	000-801-719	
51	HULL UNIT COVER (1)	06-013-2212-1	100-099-421	
52	NAME PLATE	06-013-2201-0	100-098-680	
53	REED SWITCH FIXING NUT	06-013-2227-0	100-099-560	
54	HULL UNIT STICKER	06-013-2202-0	100-099-360	
55	REED SWITCH MOUNTING	06-013-2226-1	100-099-551	

Soundome, Dwg. No. C1271-E02-B

P/N	PARTS NAME	TYPE/DWG. NO.	CODE NO.	REMARKS
1	SOUNDOME (U)	06-013-2101-3	100-098-753	
2	TRANSDUCER ASSEMBLY	CH-1812	006-542-330	
3A	TRANSDUCER ARM ASSEMBLY	CH-1812	006-542-560	
6	TRANSDUCER SUPPORT	06-011-2247	100-058-220	
8	TILT ARM SHAFT	06-013-2136-0	100-099-081	
9	O-RING	JISB2401-1A-P115	000-851-177	12 V, 2.4 m cable
10	SOUNDOME FIXING FLANGE	06-013-2103-3	100-098-803	24 V, 2.4 m cable
11	O-RING	JISB2401-1A-P115	000-851-177	12 V, 3.5 m cable
12	BRUSH ARM FIXING FLANGE	06-013-2115-0	100-098-900	24 V, 3.5 m cable
13	BRUSH ARM FIXING RED	06-013-2116-1	100-098-911	12 V, 5.2 m cable
14	CARBON BRUSH	06-007-1327-0	000-431-007	24 V, 5.2 m cable
15	SPACER (49)	06-013-2111-0	100-098-860	
16	CODE PLATE (1) ASSEMBLY	CH-1812	006-542-530	
17	TILT SHAFT	06-013-2121-1	100-098-951	
18	PHOTO COUPLER MOUNTING PLATE	06-013-2117-1	100-098-921	
19	TRAIN GEAR	06-013-2118-0	100-098-930	
20	CHASSIS PLATE (1)	06-013-2126-1	100-099-001	
21	CODE PLATE (2) ASSEMBLY	CH-1812	006-542-540	
22	TRAIN MOTOR GEAR	06-013-2124-0	100-098-980	
23	GEAR BOX COVER	06-013-2128-1	100-099-021	
24	SPACER (49)	06-013-2111-0	100-098-860	
25A	SOUNDOME (U)	06-013-2102-2	100-098-792	
	SOUNDOME ASSEMBLY	CH-1812-24	006-541-660	With 2.5 m cable
	SOUNDOME ASSEMBLY	CH-1812-35	006-541-670	With 3.5 m cable
	SOUNDOME ASSEMBLY	CH-1812-54	006-541-680	With 5.4 m cable
26	TANK GUIDE and SOCKET HEAD CAP SCREW	06-022-2101 M8x25 SUS	100-306-210 000-148-333	
27	WASHER	06-011-2204	100-157-990	
28	CABLE GASKET	06-011-2203-0	100-057-980	
29	CABLE PIPE	06-007-1302-0	600-713-020	
30	O-RING	JISB2401-1A-P38	000-851-137	
31	TANK GUIDE SOCKET HEAD CAP SCREW	06-022-2101 M8x25 SUS	100-306-210 000-148-333	
32	TILT MOTOR GEAR	06-013-2109-1	100-098-851	
33A	MOTOR MOUNTING PLATE ASSY.	CH-1812	006-542-520	
37	GEAR BOX MOUNT	06-013-2127-1	100-099-011	
38	SPACER (19)	06-013-2112-1	100-098-871	
39	CHASSIS PLATE (D) ASSEMBLY	CH-1812	006-542-510	
40	SLIP RING ASSEMBLY	06-011-2231-1	100-058-121	
41	TRAIN SHAFT SSEMBLY	CH-1812	006-542-550	
42	O-RING	JISB2401-4D-P12	000-851-253	
43	BEARING RING	FTRA-3552	000-801-708	
44	ROLLER	FNTA-3552	000-801-707	
45	O-RING	JISB2401-4D-P32	000-801-709	
46	BEARING RING	FTRA-3552	000-801-708	
47	HERMETIC SEAL LINER	06-013-2138-1	100-099-101	
48A	TILT ARM ASSEMBLY	CH-1812	006-542-570	
51	SOUNDOME STICKER	06-013-2151-0	100-098-760	

FURUNO

D - 1



承認 APPROVED	APR・26・'89 T.NAKAMURA	名称 TITLE	上下動部 RAISE/LOWER CONTROL
検図 CHECKED	APR・26・'89 T.K.D.S.	CH-180	
製図 DRAWN	APR・24・'89 M.YAMADA	図番 DWG.NO.	C1271-E01-A

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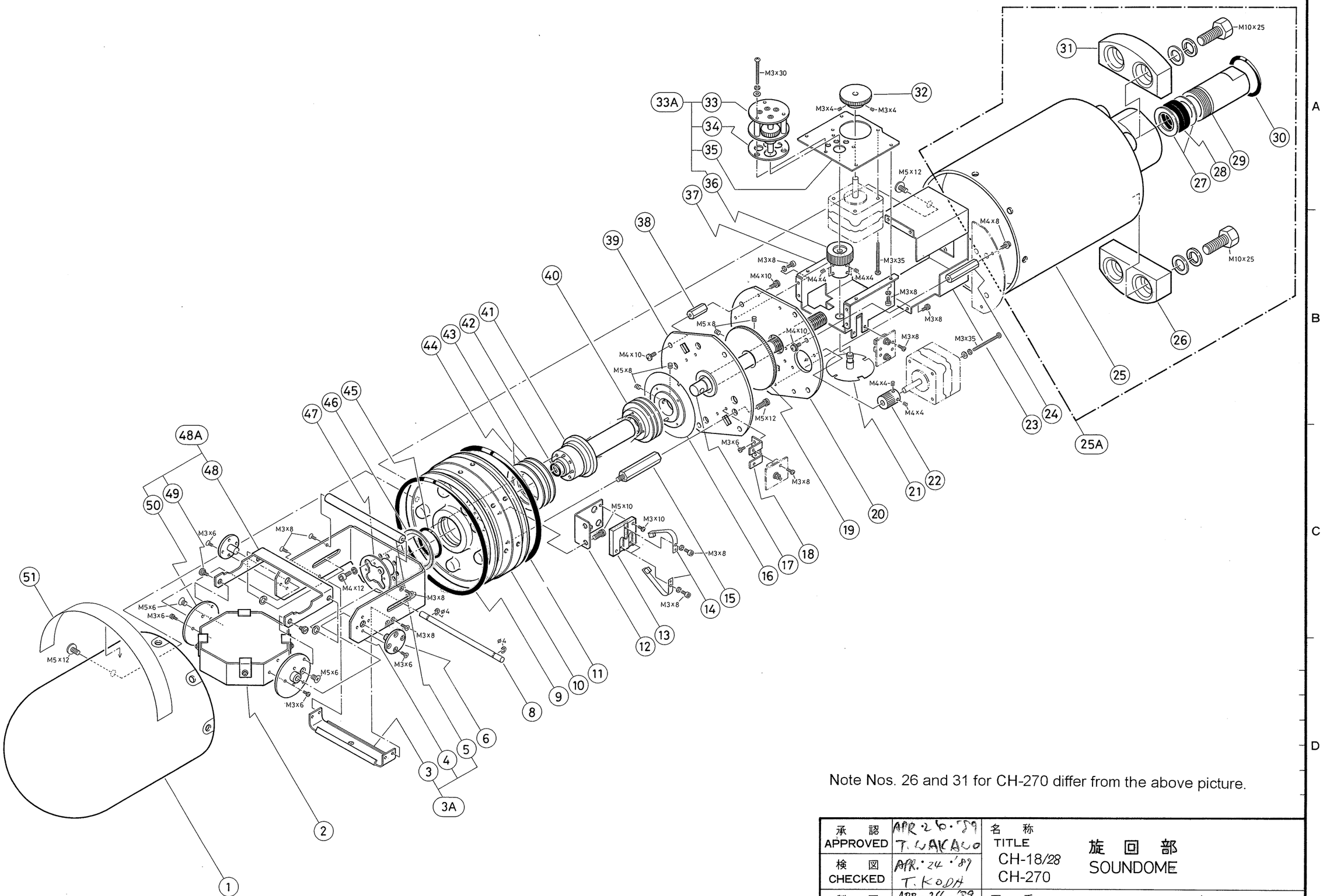
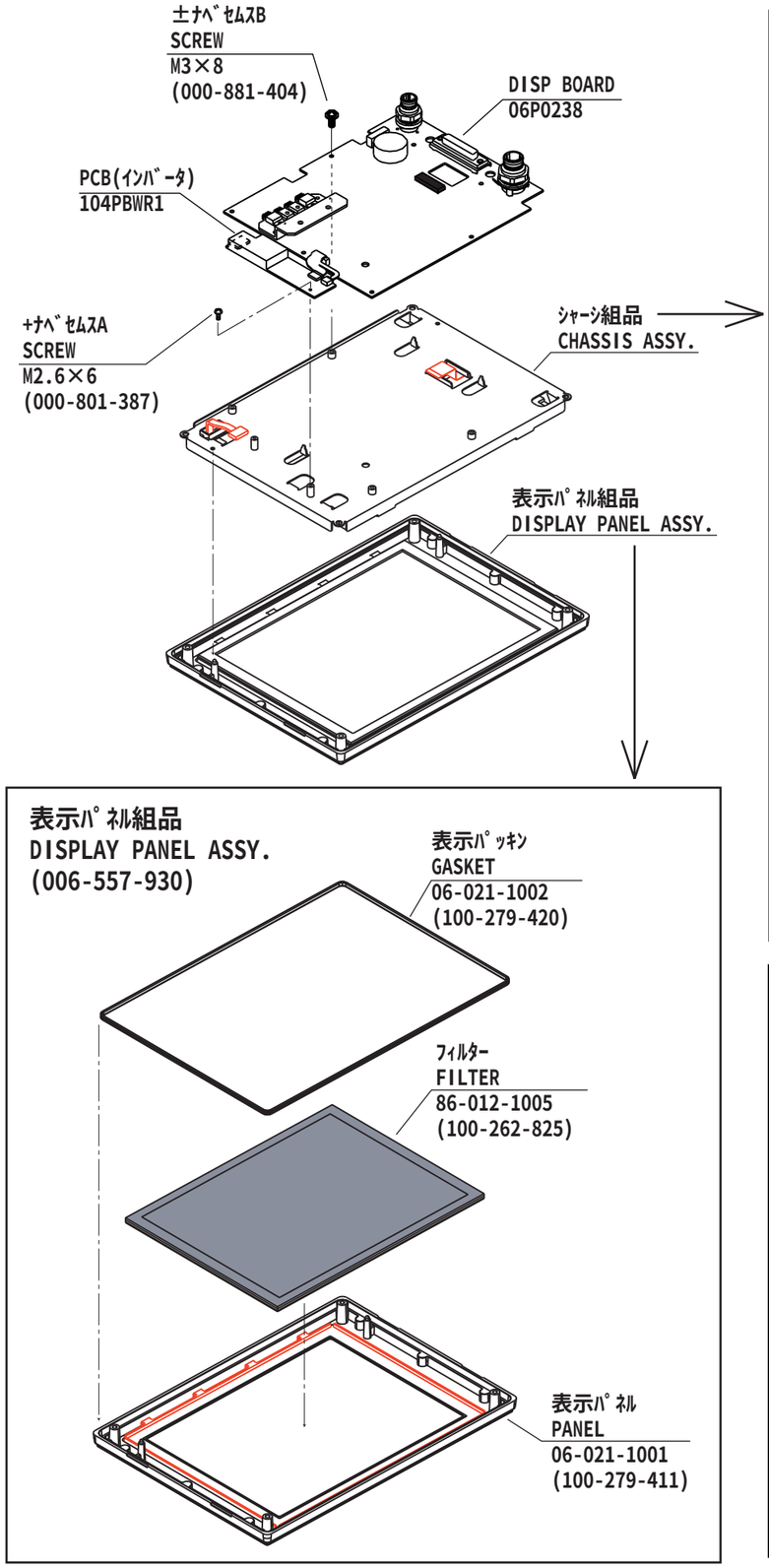
FURUNO

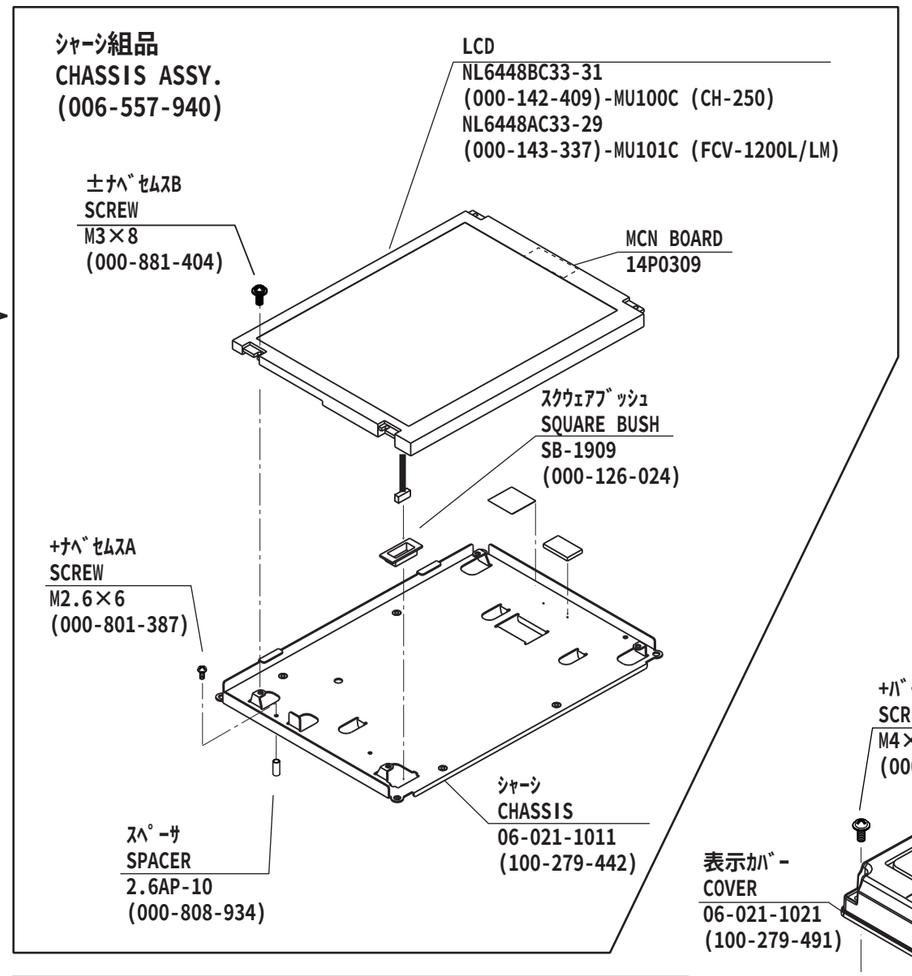


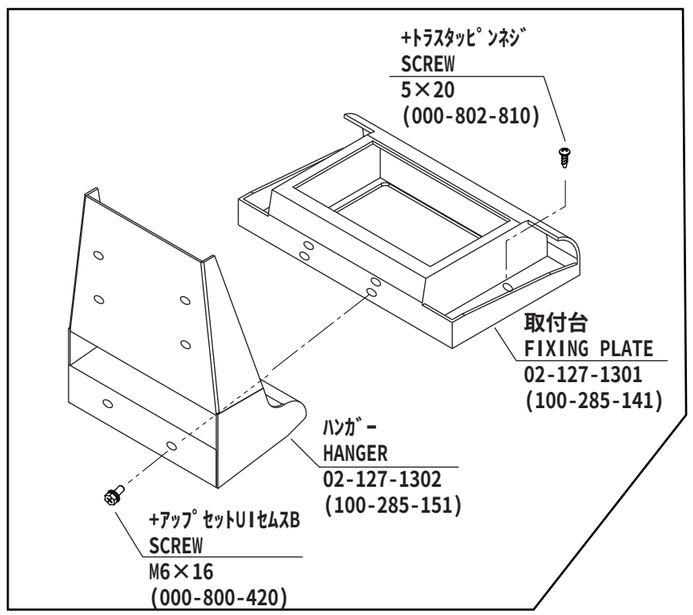
Note Nos. 26 and 31 for CH-270 differ from the above picture.

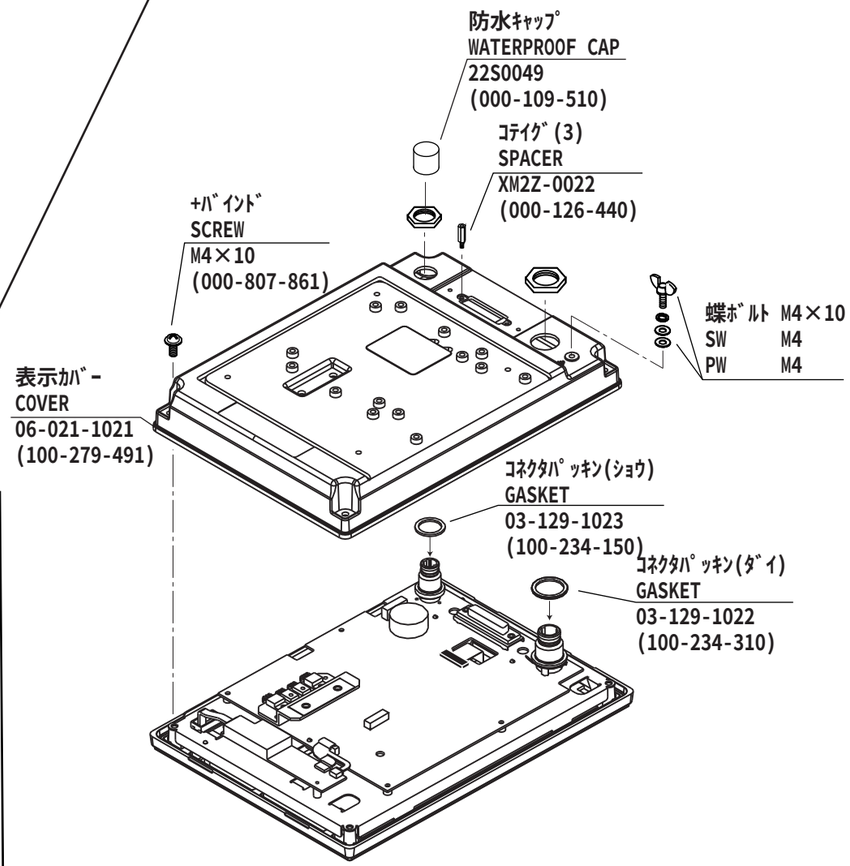
承認 APPROVED	APR.26.'89 T.WAKAO	名称 TITLE	旋回部 SOUNDOME
検図 CHECKED	APR.24.'89 T.KODA	CH-18/28 CH-270	
製図 DRAWN	APR.24.'89 M.USUDA	図番 DWG.NO.	C1271-E02-B

FURUNO ELECTRIC CO., LTD.



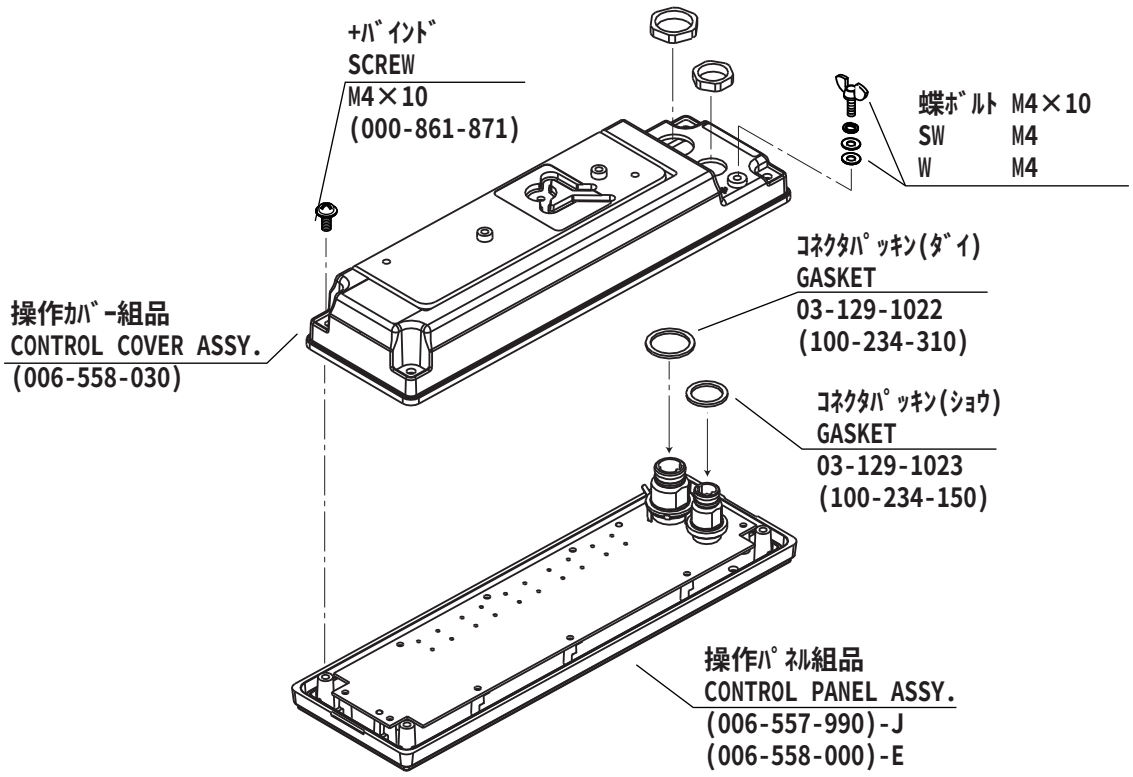


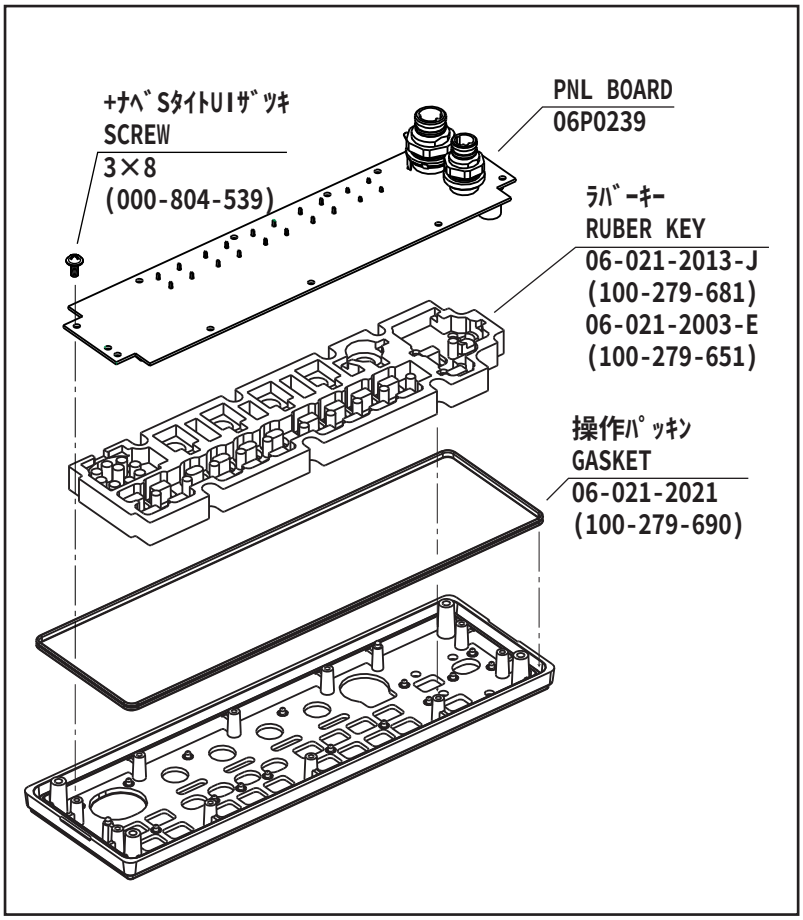


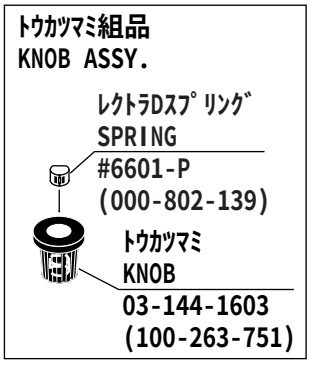


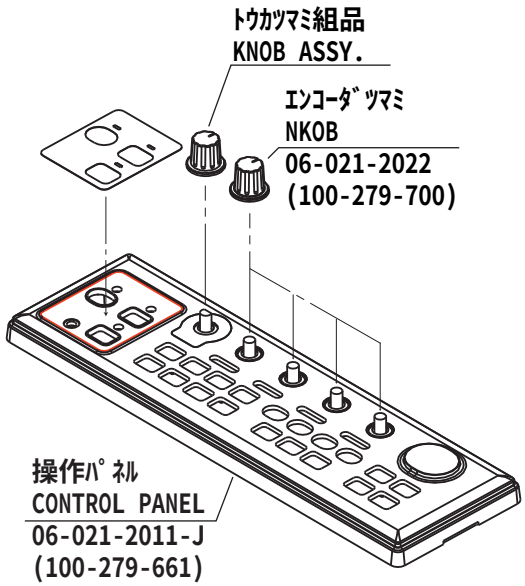
CH-250/S/270: MU-100C FCV-1200L/1200LM: MU-101C

APPROVED 承認 2002.8.6		TITLE	MU-100C MU-101C 表示部 DISPLAY UNIT
CHECKED 審査 2002.8.6			
DRAWN 製図 2002.8.6		DWG. NO.	C1316-E01-D



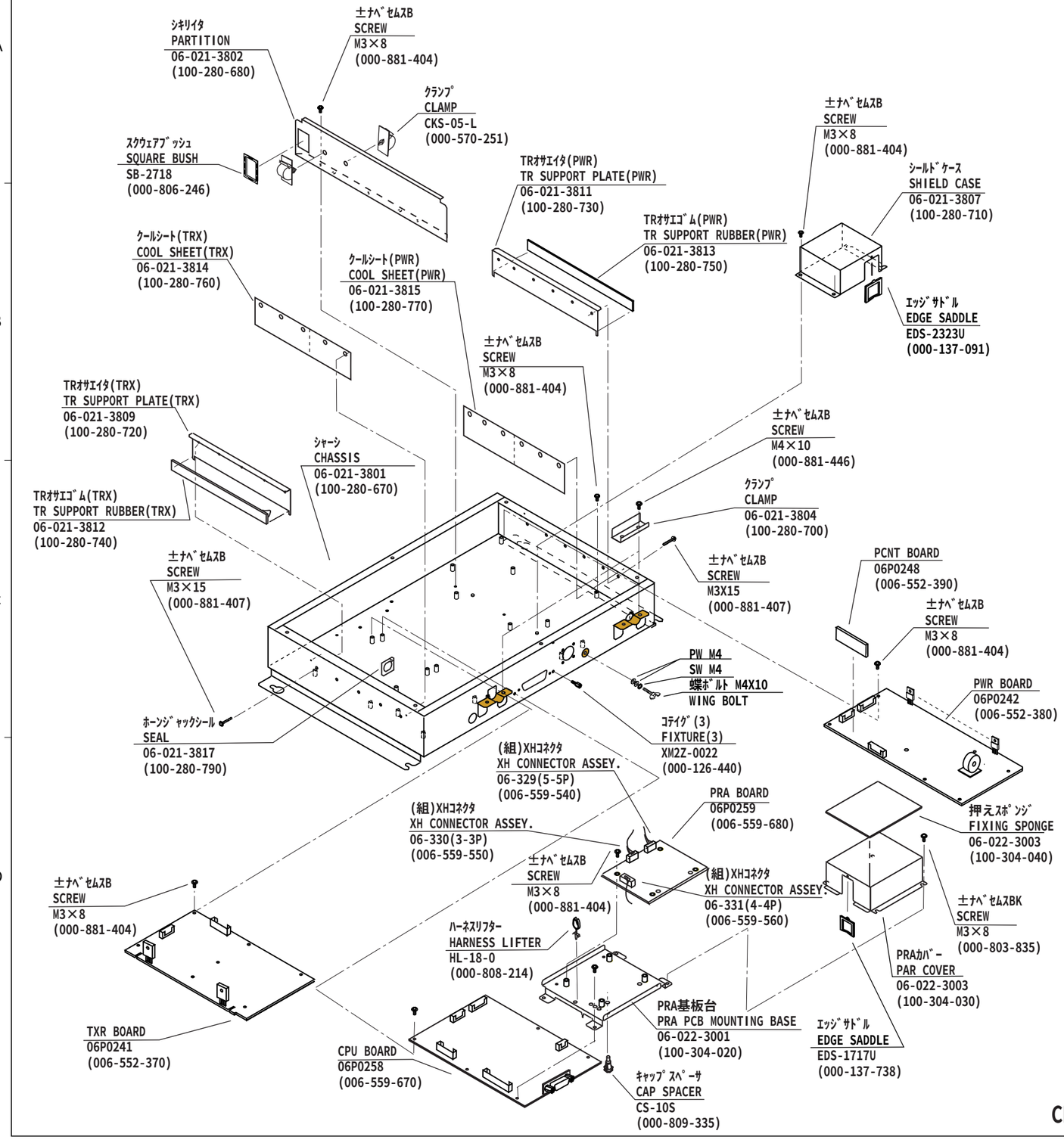


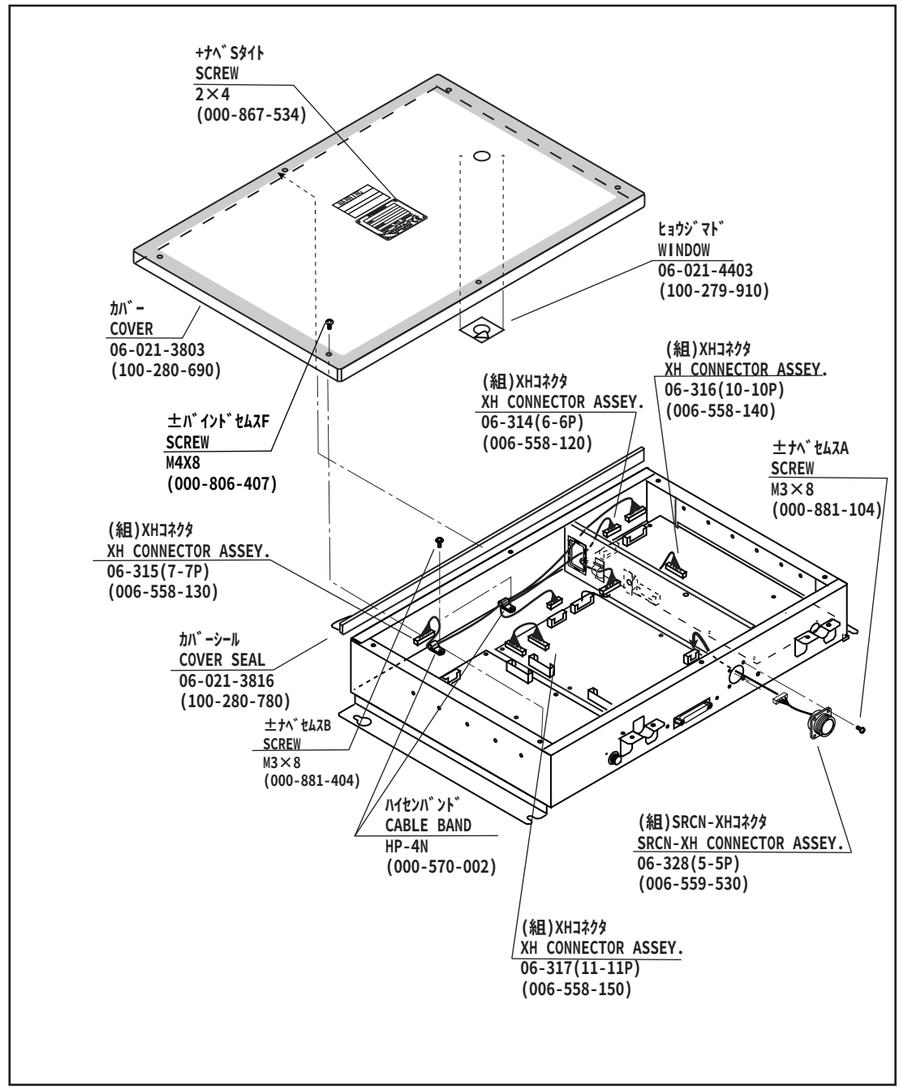




APPROVED 承認 2002.8.6		TITLE	操作部 CONTROL UNIT
CHECKED 審査 2002.8.6		CH-252	
DRAWN 製図 2002.8.6		DWG. NO.	C1316-E02-C

CH-250/270

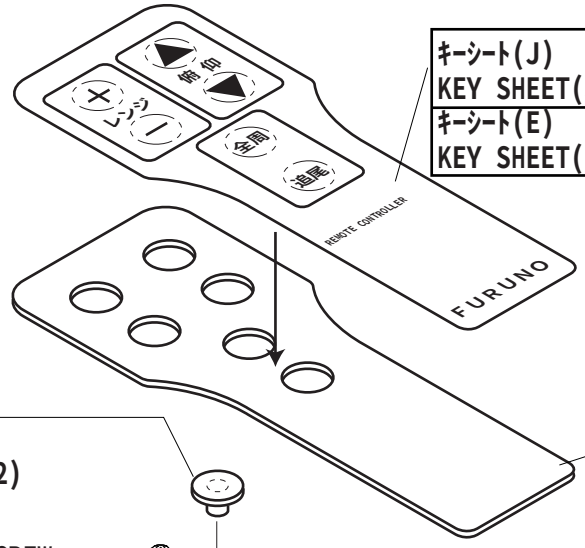




CH-270

APPROVED	1・Jul.・2004 H.Kuwamura	TITLE	送受信装置 TRANSCEIVER UNIT
CHECKED	1・Jul.・2004 T.Yoshida	CH-273	
DRAWN	30・Jun.・2004 M.Nakanishi	DWG. NO.	C1322-E01-A

50x50x80x80



キーシート(J) KEY SHEET(J)	06-021-6011 (100-279-870)
キーシート(E) KEY SHEET(E)	06-021-6001 (100-279-860)

キートップ
KEY TOP
22-018-1006
(100-157-912)

フィルムヨウイタ
PLATE FOR KEY-SHEET
10-061-5001
(100-248-071)

+ナベ Pタイト UIサ゛ツキ
PANHED P-TIGHT SCREW
3X8 鉄 虹
(000-803-253)

N M3
SW M3
PW M3

REM BOAD
06P0247
(006-559-280)

スペーサ
SPACER
SQ-9
(000-801-850)

ブザーパッキン
BUZZER GASKET
03-118-1005
(100-185-291)

ボウスイテープ
WATERPROOF TAPE
64-019-4003
(100-212-660)

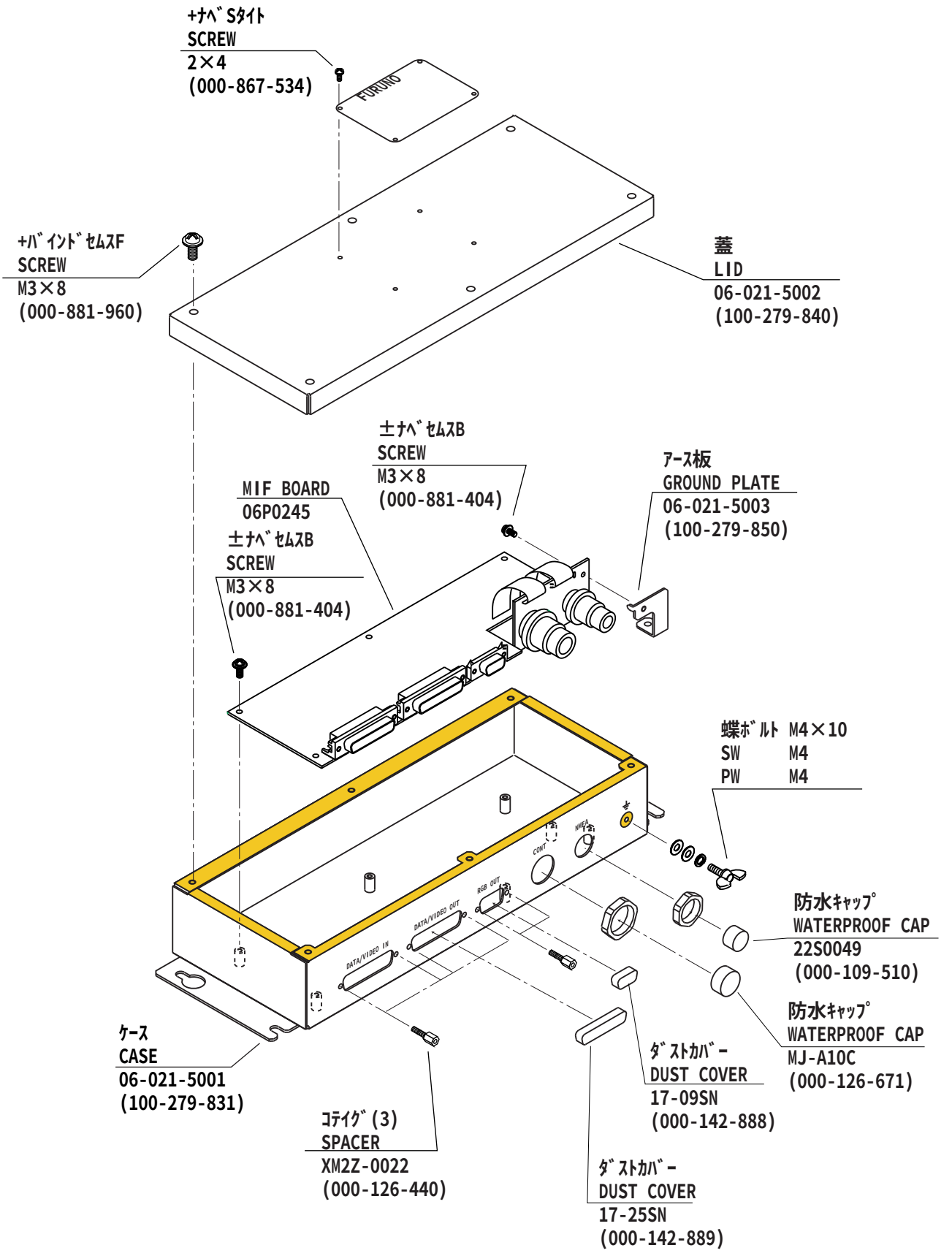
(組)リモコンケーブル
REMOTE CONTROLLER CABLE ASSEY.
80-0637
(006-557-920)

リモコンケース
REMOTE CONTROLLER CASE
64-019-4001
(100-250-421)

Oリング
O-RING
JISB2401-1A-P12
(000-851-111)

APPROVED 1.Jul.2004 H.Kuwamura		TITLE	リモートコントローラ CH-256 REMOTE CONTROLLER
CHECKED 1.Jul.2004 T.Yoshida			
DRAWN 30.Jun.2004 M.Nakanishi		DWG. NO.	C1322-E02-A

CH-250/270



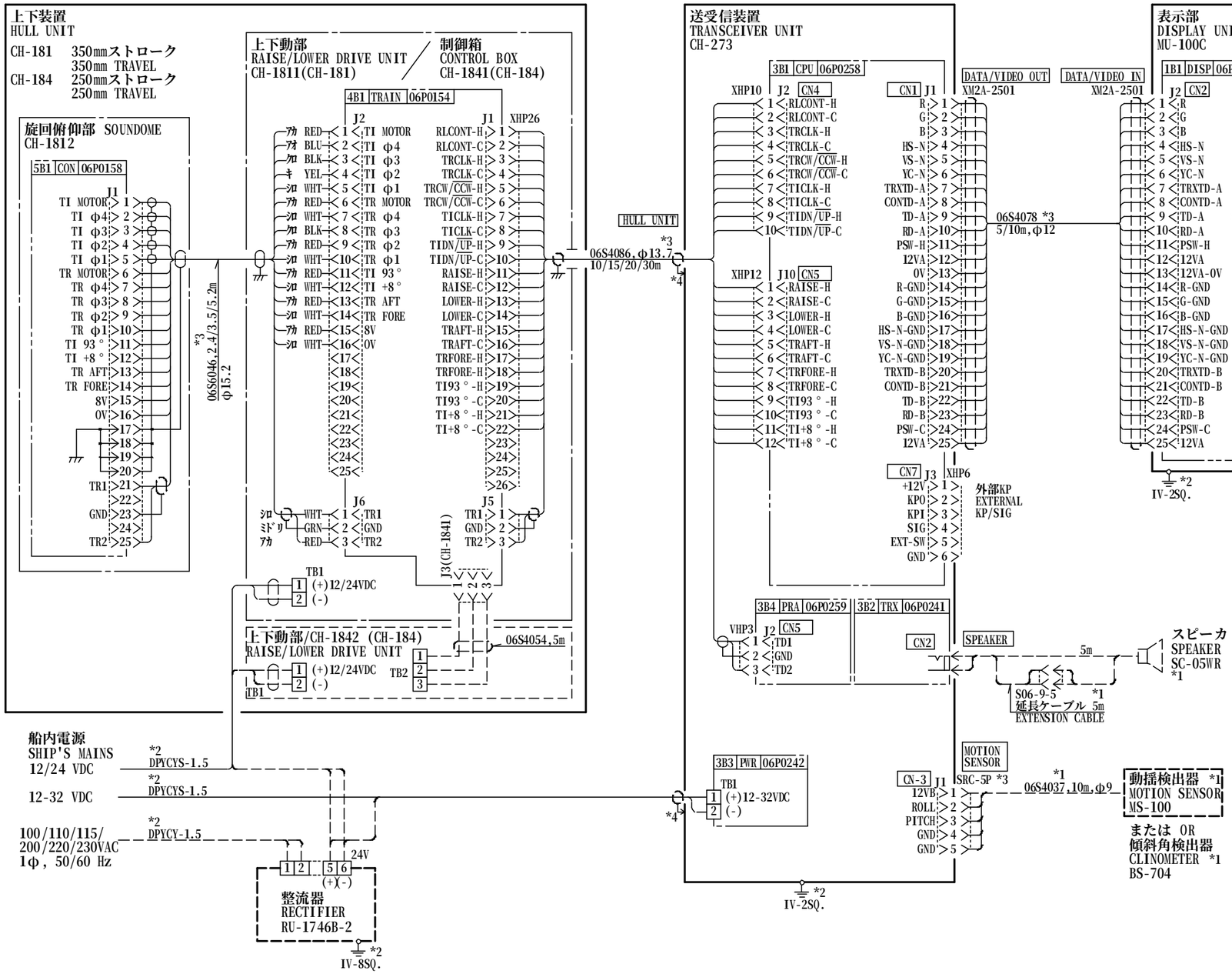
APPROVED		TITLE	インターフェイスユニット
CHECKED		IF-8000	INTERFACE UNIT
DRAWN		DWG. NO.	C1316-E07-C

CH-250/270
FCV-1200L/1200LM

List of Schematic Diagrams

FURUNO

S - 1



注記
＊1）オプション。
＊2）造船所手配。
＊3）コネクタは工場で取付済み。
＊4）ケーブルクランプでアースに落とす。

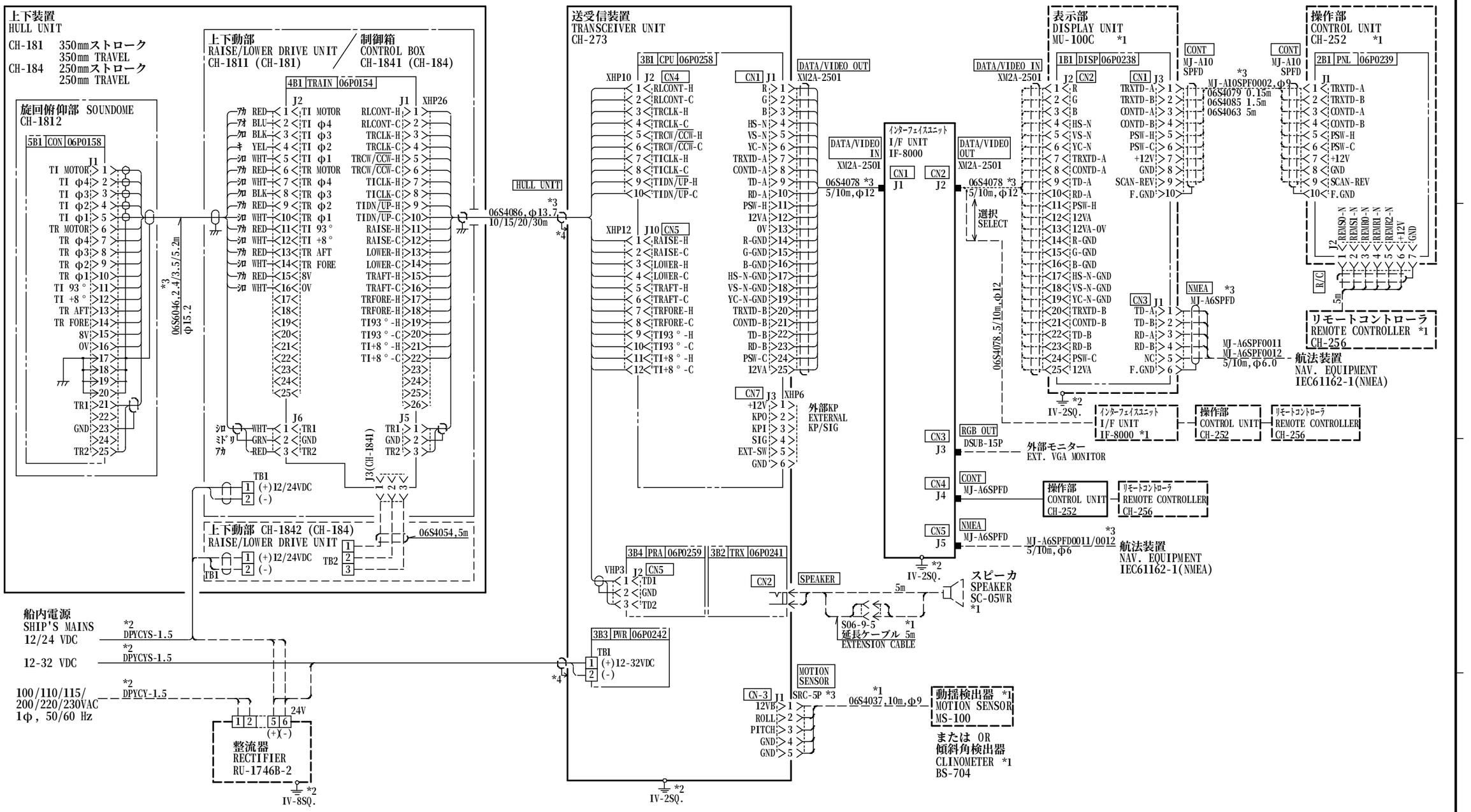
NOTE
*1. OPTION.
*2. SHIPYARD SUPPLY.
*3. CONNECTOR PLAG IS FITTED AT FACTORY.
*4. GROUND BRAIDED SHIELD THRU CABLE CLAMP.

DRAWN 2003. May H. MAKI		TITLE	CH-270
CHECKED Takahashi T.		名称	カラーLCDサーチライトソナー
APPROVED Takahashi T.			相互結線図
SCALE / MASS kg		NAME	COLOR LCD SEARCHLIGHT SONAR
DWG No. C1322-C01- C	06-022-0001-0		INTERCONNECTION DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO

S - 2

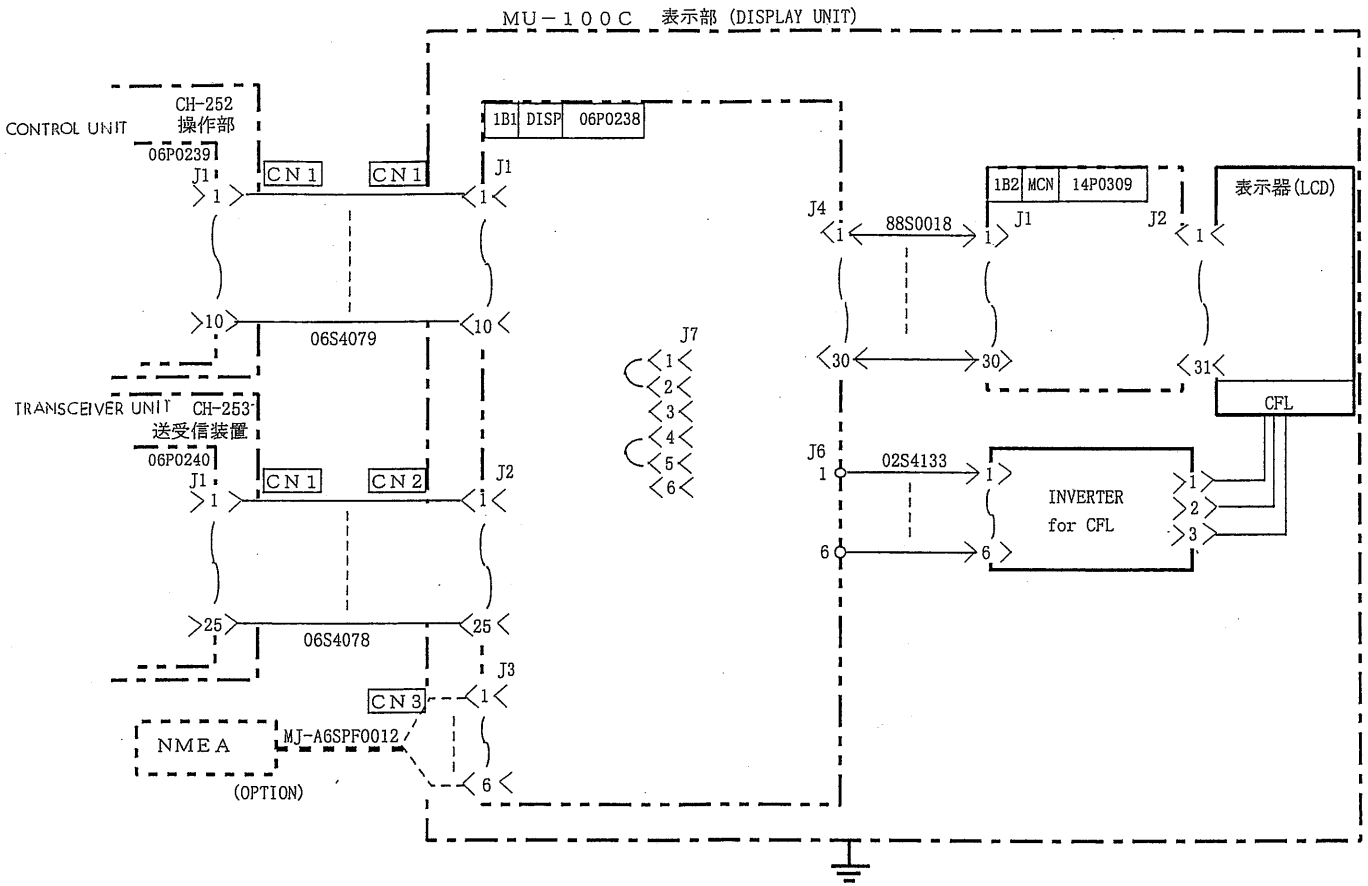


注記
＊1）オプション。
＊2）造船所手配。
＊3）コネクタは工場で取付済み。
＊4）ケーブルクランプでアースに落とす。

NOTE
*1. OPTION.
*2. SHIPYARD SUPPLY.
*3. CONNECTOR PLAG IS FITTED AT FACTORY.
*4. GROUND BRAIDED SHIELD THRU CABLE CLAMP.

DRAWN 2003. May H. MAKI			TITLE CH-270
CHECKED Takahashi T.			名称 カラーLCDサーチライトソナー（I/Fユニット使用）
APPROVED Takahashi T.			相互結線図
SCALE	MASS kg		NAME COLOR LCD SEARCHLIGHT SONAR (W/IF UNIT)
DWG No. C1322-C02- B		06-022-0002-0	INTERCONNECTION DIAGRAM

FURUNO ELECTRIC CO., LTD.

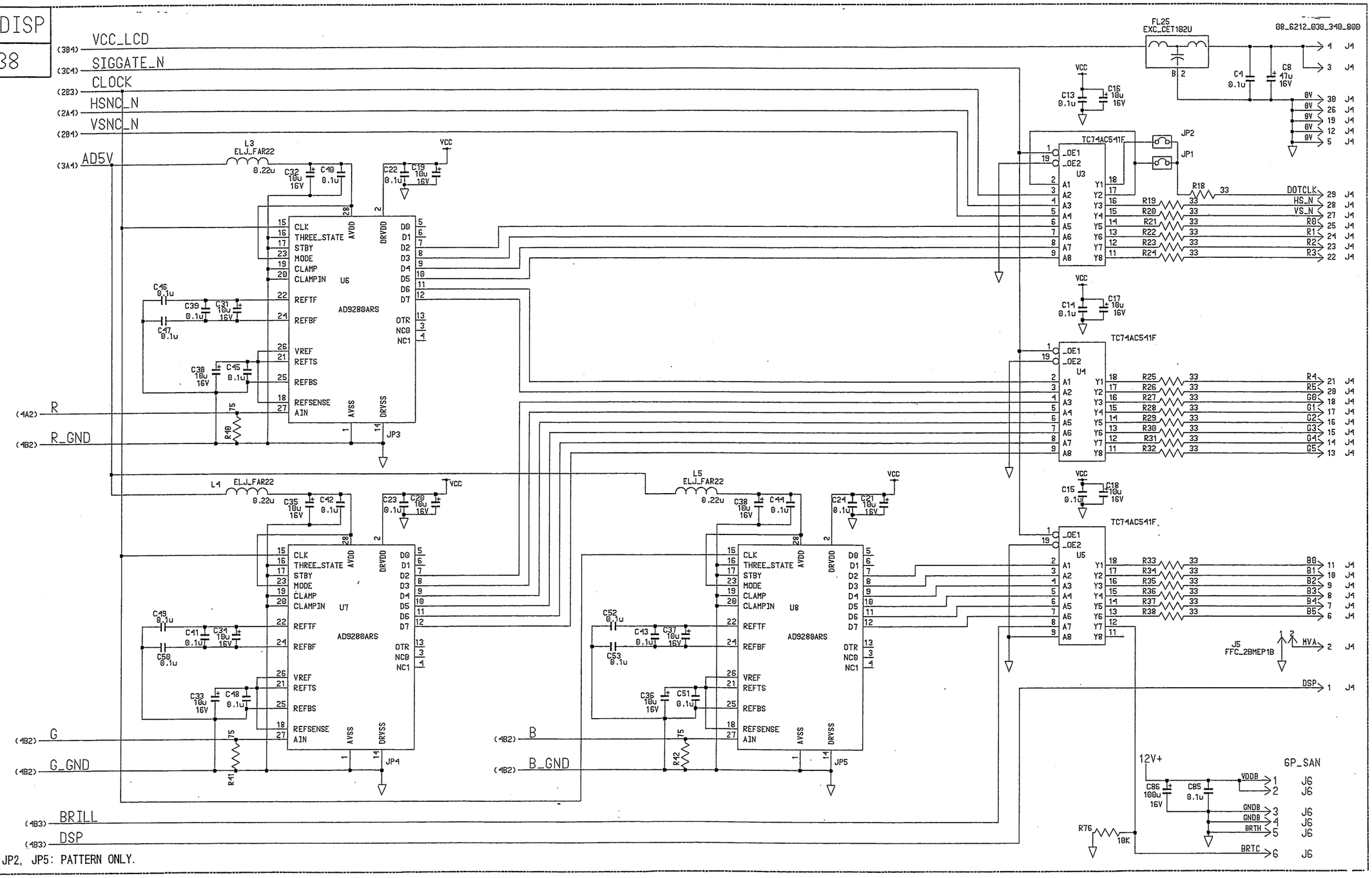


DRAWN Mar.31'00 T.YAMASAKI			TYPE MU-100C
CHECKED Mar.31'00			名称 表示部（総合）
APPROVED Mar.31'00	CH250S CH250		回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME DISPLAY UNIT(GENERAL)
DWG NO. C1316-K01- A	06-021-1001- 0		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

1B1 DISP

06P0238

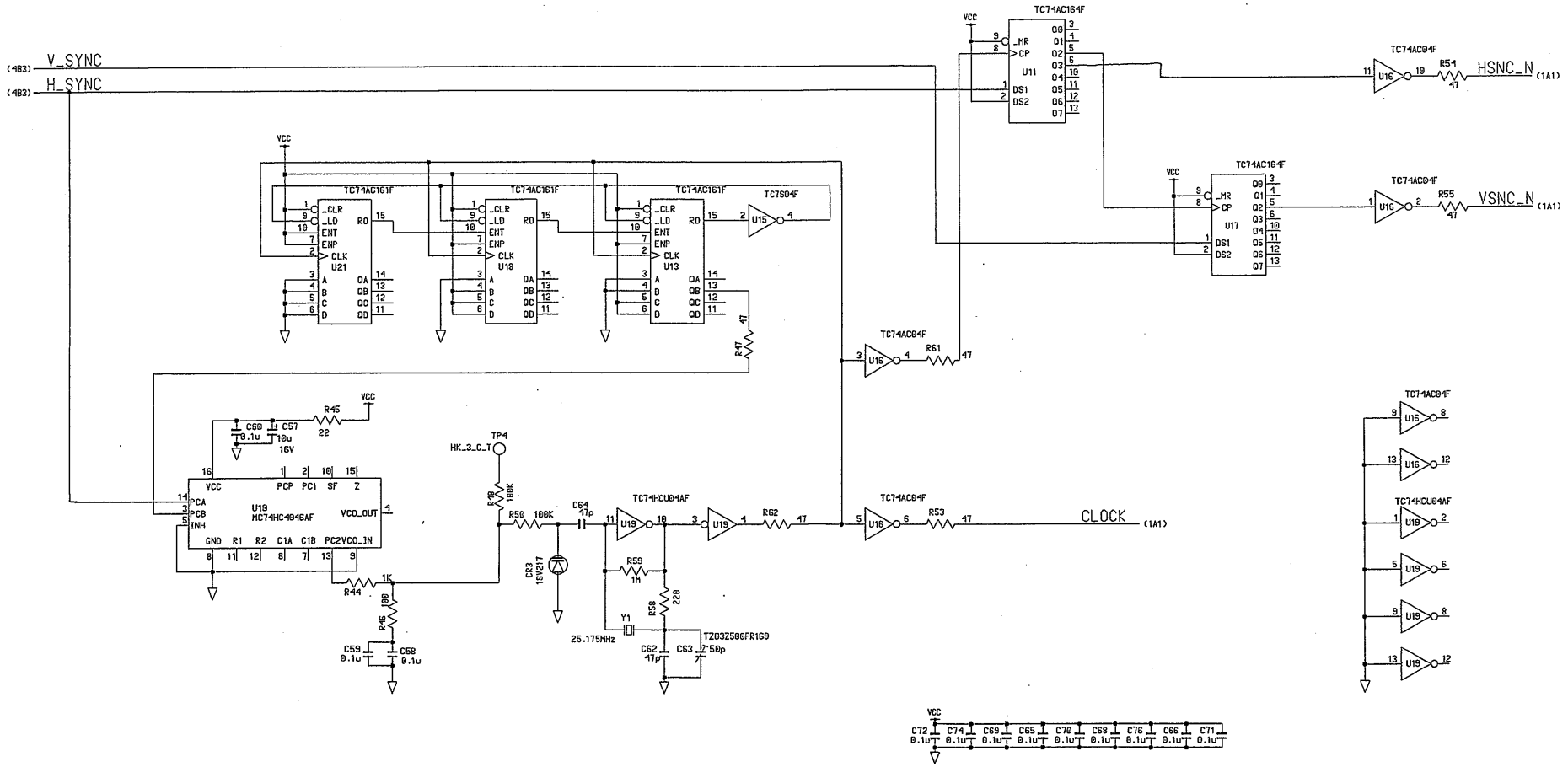


DRAWN Oct'10'00 T.YAMASAKI			TYPE 06P0238 (1/4)
CHECKED Oct'11'00 Y.K			名称 DISP回路
APPROVED Oct'11'00 Y.K	CH-250	1B 1	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME DISP PCB
DWG NO. C1316-K08- A	06-021-1101- 1		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO

1B1	DISP
06P0238	



NOTE C62: PATTERN ONRY.

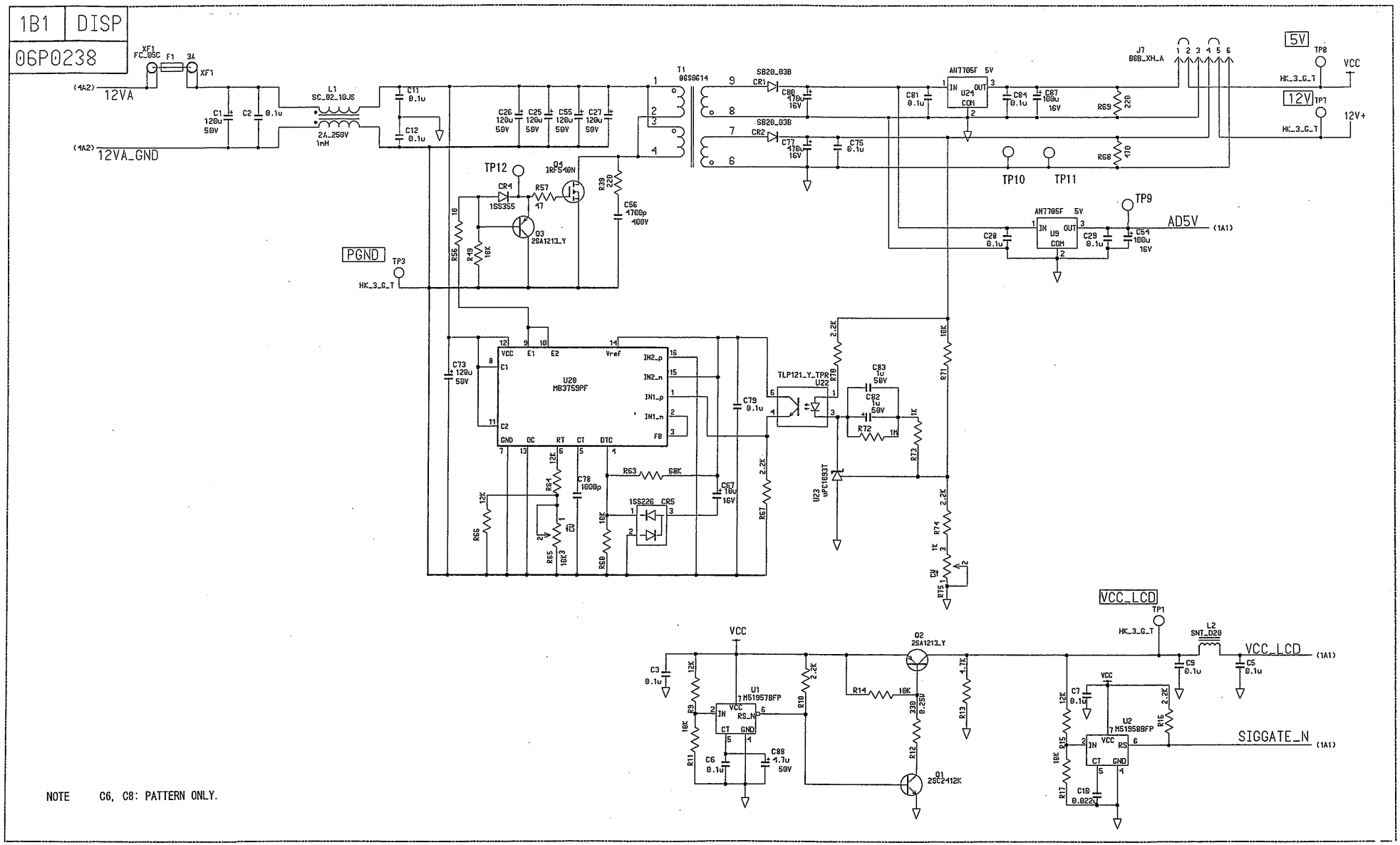
DRAWN 06'10'00 T.YAMASAKI			TYPE 06P0238 (2/4)
CHECKED Oct 11 '00 T.K			名称 DISP回路
APPROVED Oct 11 '00 T.K	CH-250	1B 1	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME DISP PCB
DWG NO. C1316-K09- A	06-021-1102- 1		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO

1B1 | DISP

06P0238



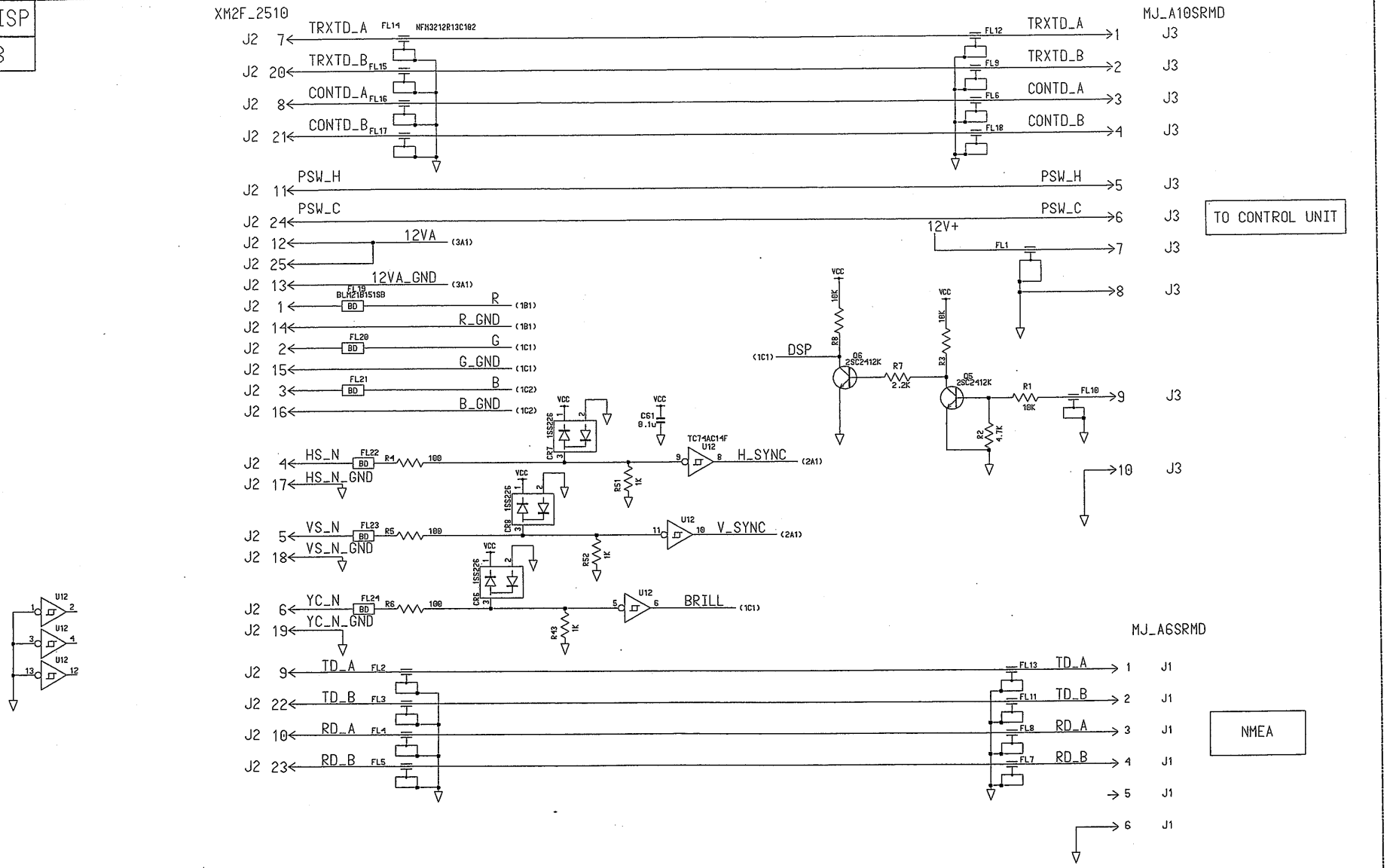
DRAWN Oct/10'00 T.YAMAMOTO			TYPE 06P0238 (3/4)
CHECKED Oct/11'00 Y.K			名称 DISP回路
APPROVED Oct/11'00 Y.K	CH-250	1B 1	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME DISP PCB
DWG NO. C1316-K10- A	06-021-1103- 1		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

S-6

FURUNO

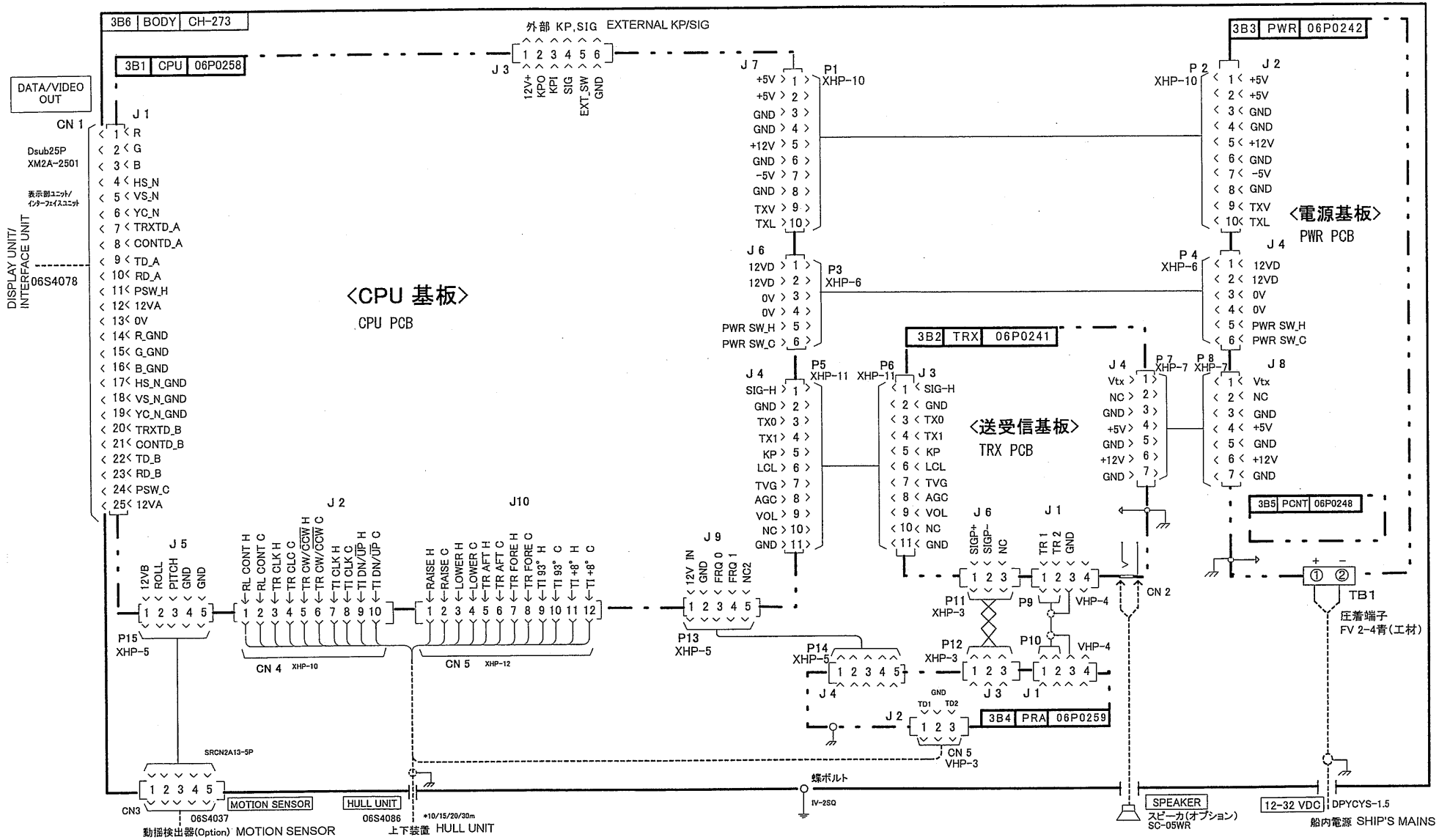
1B1	DISP
06P0238	



DRAWN 0ct10'00 IWAMASAKI			TYPE 06P0238 (4/4)
CHECKED Oct 11'00			名称 DISP回路
APPROVED Oct 11'00	CH-250	1B 1	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME DISP PCB
DWG NO. C1316-K11- A	06-021-1104- 0		SCHEMATIC DIAGRAM

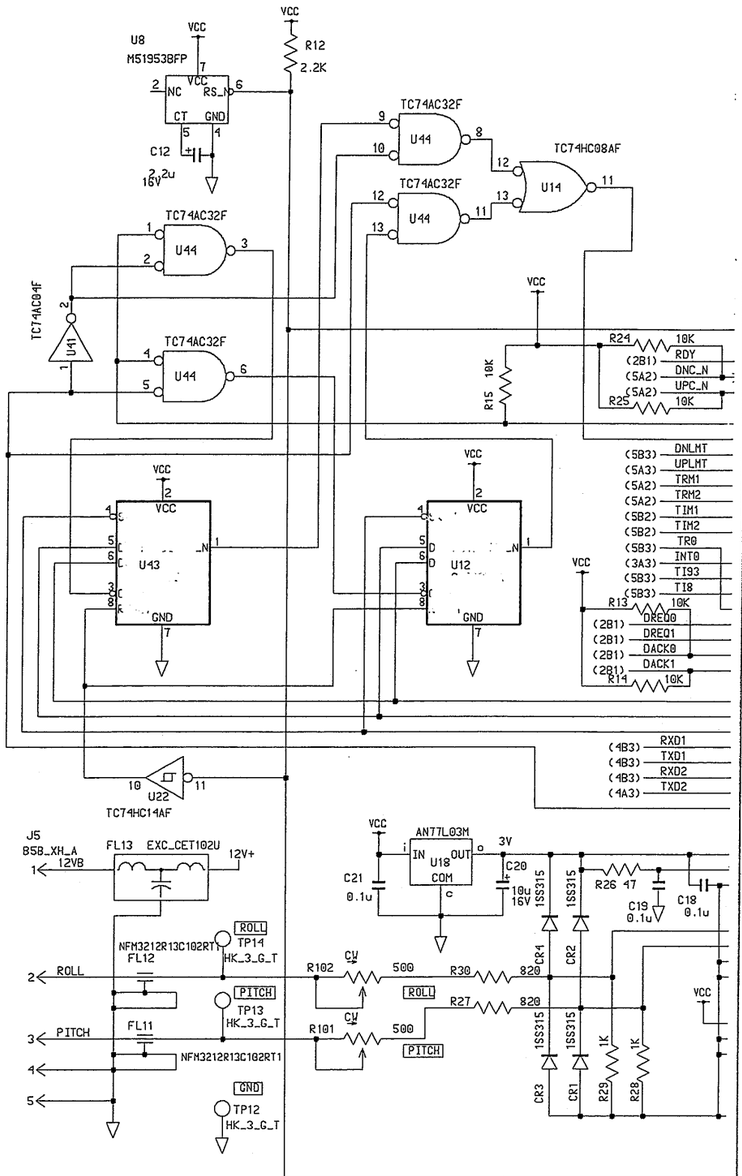
FURUNO ELECTRIC CO., LTD.

FURUNO



DRAWN 03/04/21 T. YAMASAKI		TYPE	CH-273
CHECKED 03/04/22 S. Asanuma		名称	送受信装置
APPROVED 03/04/22 T. Moriguchi	CH-270		回路図
SCALE / MASS	MODEL / BLOCK No.	NAME	TRANSCEIVER UNIT
Dwg No. C1322-K01- A	06-022-1001-0		SCHEMATIC DIAGRAM

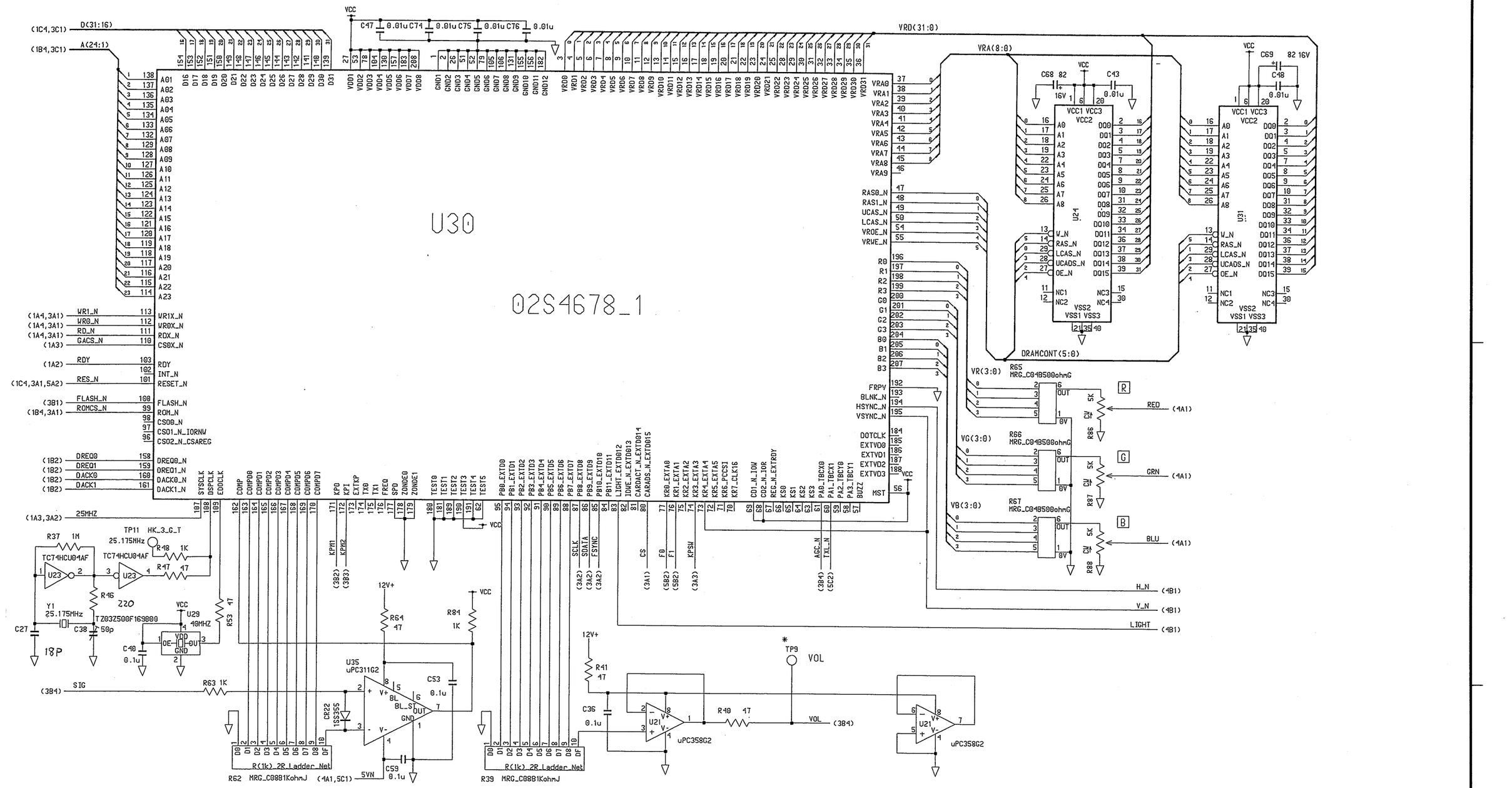
FURUNO ELECTRIC CO., LTD.



CPU and Peripheral circuit

NOTE *: JP3 IS NOT INCLUDED IN PARTS LIST.

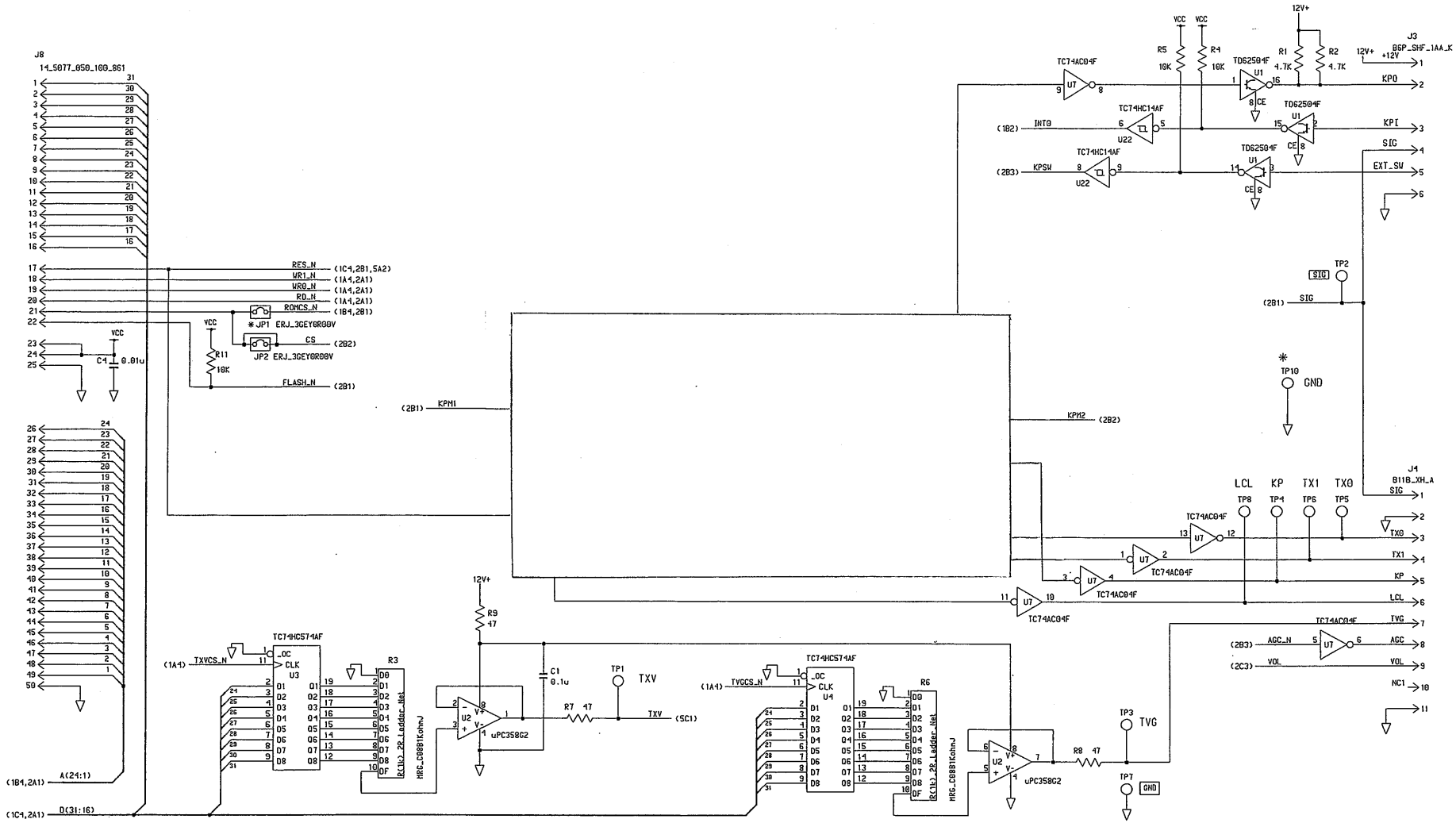
DRAWN 04/06/18 T.YAMASAKI		TYPE	06P0258 (1/5)
CHECKED 04/07/07 H.Hayashi		名称	CPU基板
APPROVED 04/07/07 H.Hayashi	CH-273 3B 1		回路図
SCALE MASS	MODEL BLOCK No.	NAME	CPU PCB
Dwg No. C1322-K02- A	06-022-1101-0		SCHEMATIC DIAGRAM



NOTE *: TP9 IS NOT INCLUDED IN PARTS LIST.

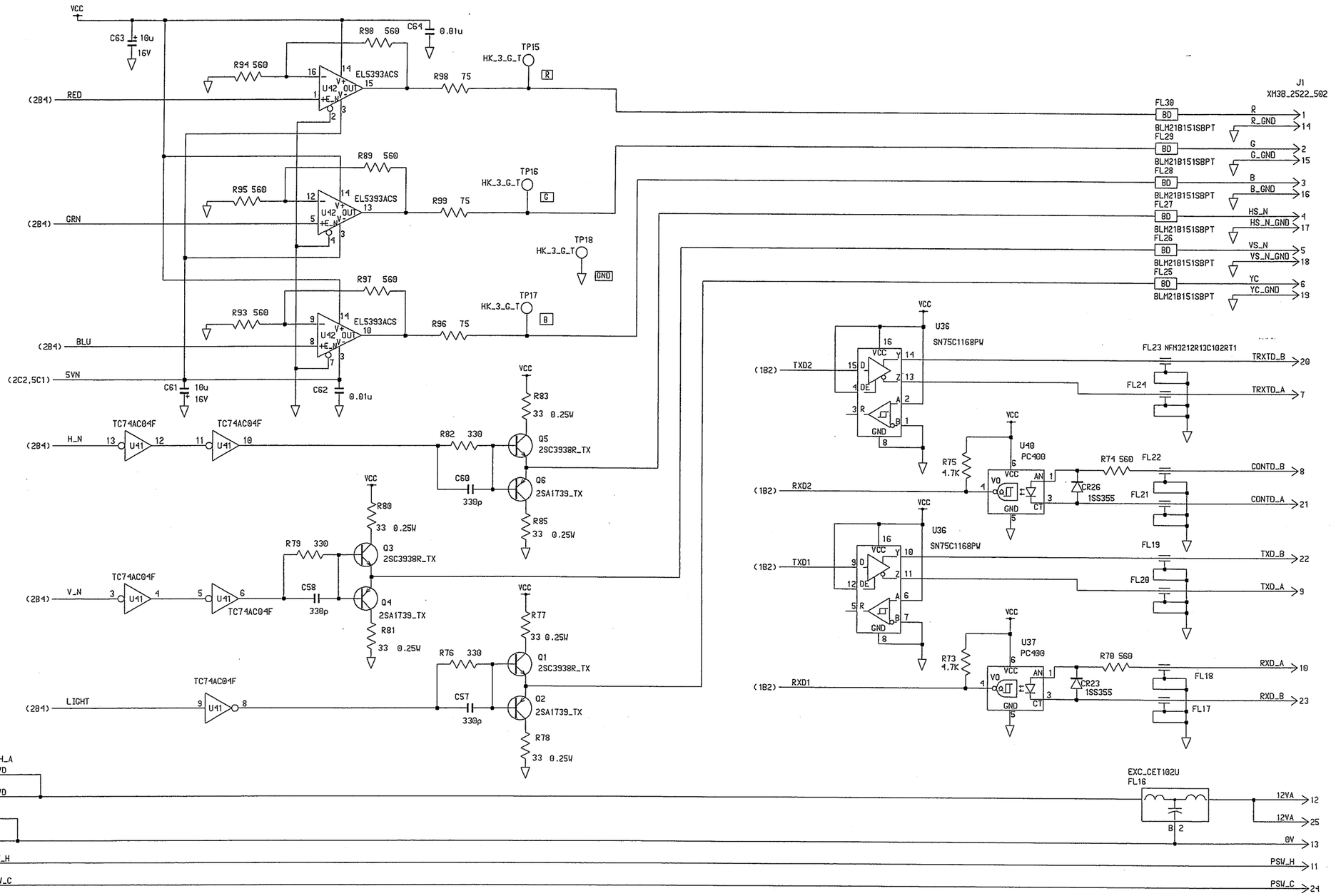
DRAWN 04/06/18 T. YAMASAKI		TYPE	06P0258 (2/5)
CHECKED 04/07/07 H. Hayashi		名称	CPU基板
APPROVED 04/07/07 H. Hayashi	CH-273 3B 1		回路図
SCALE / MASS	MODEL / BLOCK No.	NAME	CPU PCB
Dwg No. C1322-K03- A	06-022-1102-1		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

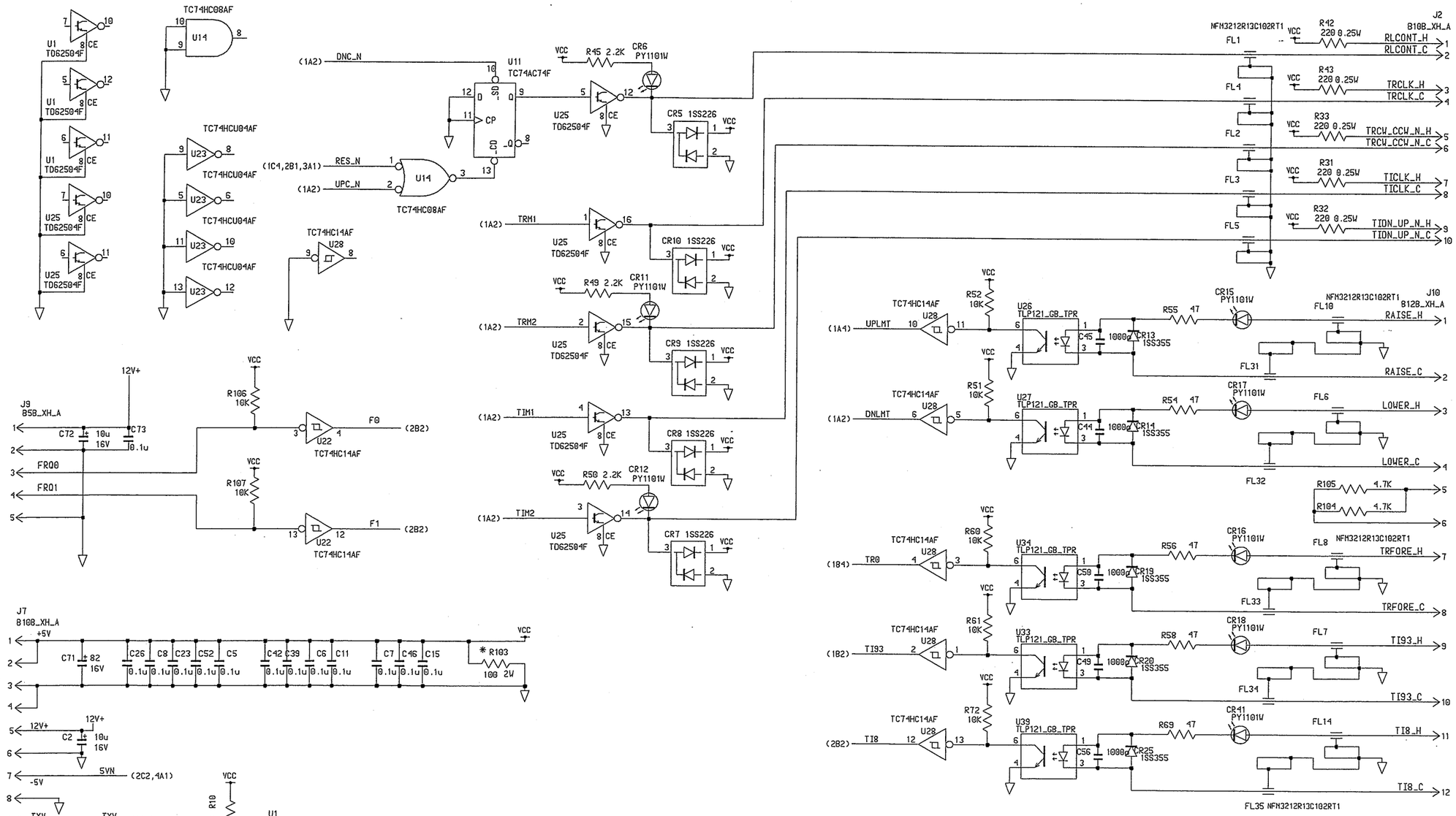


NOTE *: JP1 AND TP10 ARE NOT INCLUDED IN PARTS LIST.

DRAWN 04/06/18 T.YAMASAKI		TYPE	06P0258 (3/5)
CHECKED 04/07/07 M.Hayashi		名称	CPU基板
APPROVED 04/07/07 M.Hayashi	CH-273 3B 1		回路図
SCALE MASS	MODEL BLOCK No.	NAME	CPU PCB
Dwg No. C1322-K04- A	06-022-1103-0		SCHEMATIC DIAGRAM



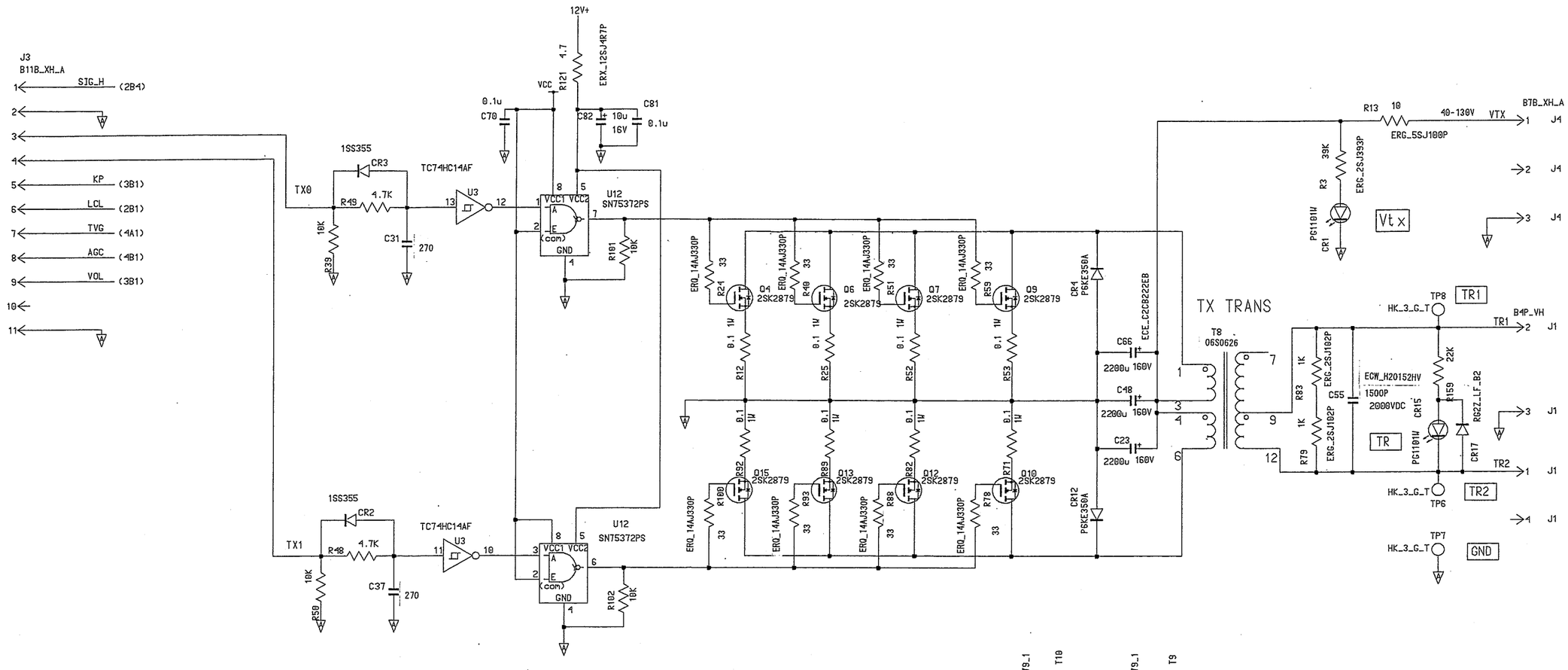
DRAWN 04/06/18 T.YAMASAKI		TYPE	06P0258 (4/5)
CHECKED 07.07.07 M.Hayashi		名称	CPU基板
APPROVED 07.07.07 M.Hayashi	CH-273 3B 1		回路図
SCALE MASS	MODEL BLOCK No.	NAME	CPU PCB
Dwg No. C1322-K05- A	06-022-1104-0		SCHEMATIC DIAGRAM



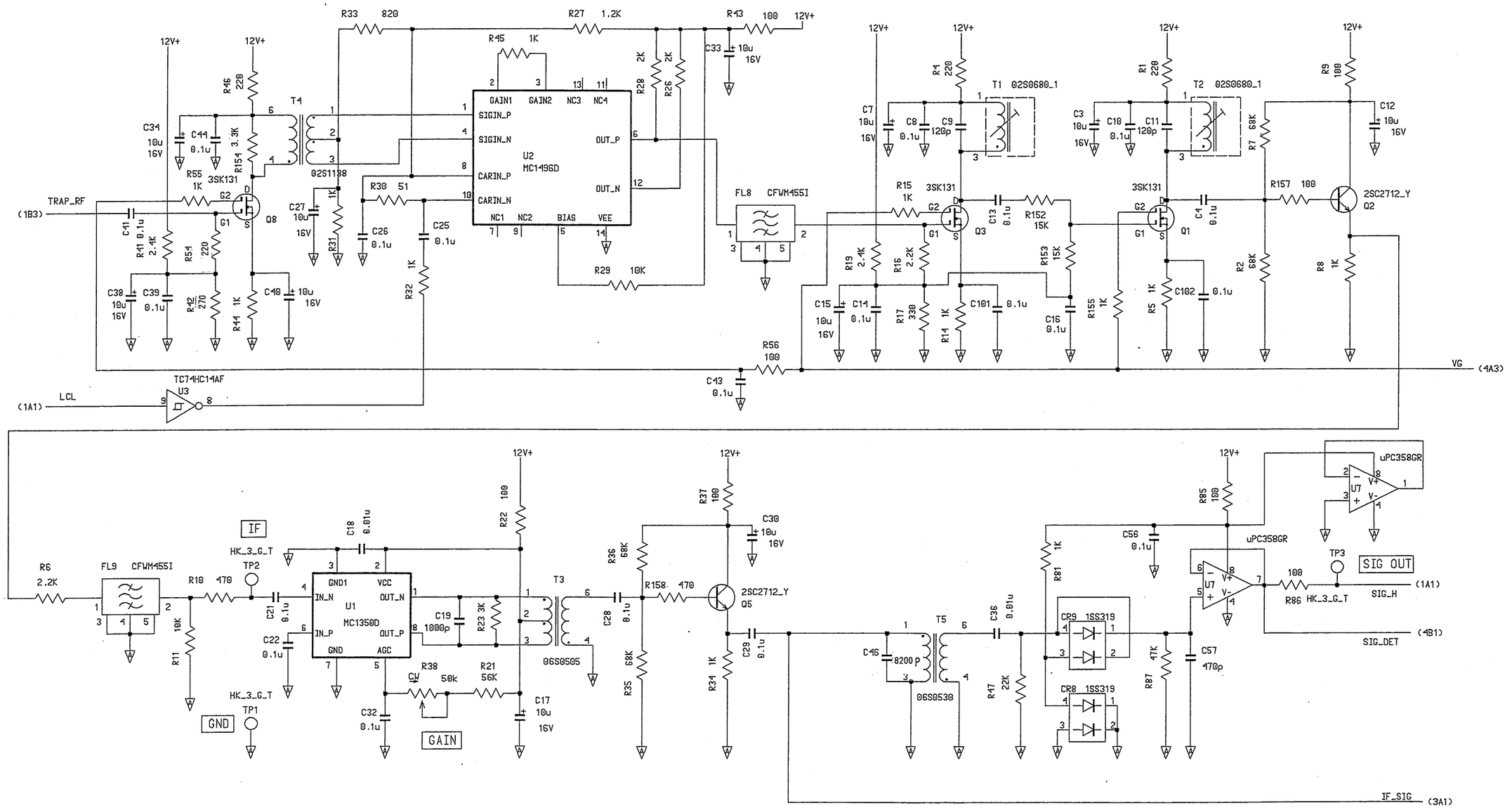
NOTE *: R103 IS NOT INCLUDED IN PARTS LIST.

DRAWN 04/06/18 T. YAMASAKI		TYPE	06P0258 (5/5)
CHECKED 04.07.07 M. Hayashi		名称	CPU基板
APPROVED 04.07.07 M. Hayashi	CH-273 3B 1		回路図
SCALE / MASS	MODEL / BLOCK No.	NAME	CPU PCB
Dwg No. C1322-K06- A	06-022-1105-0		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

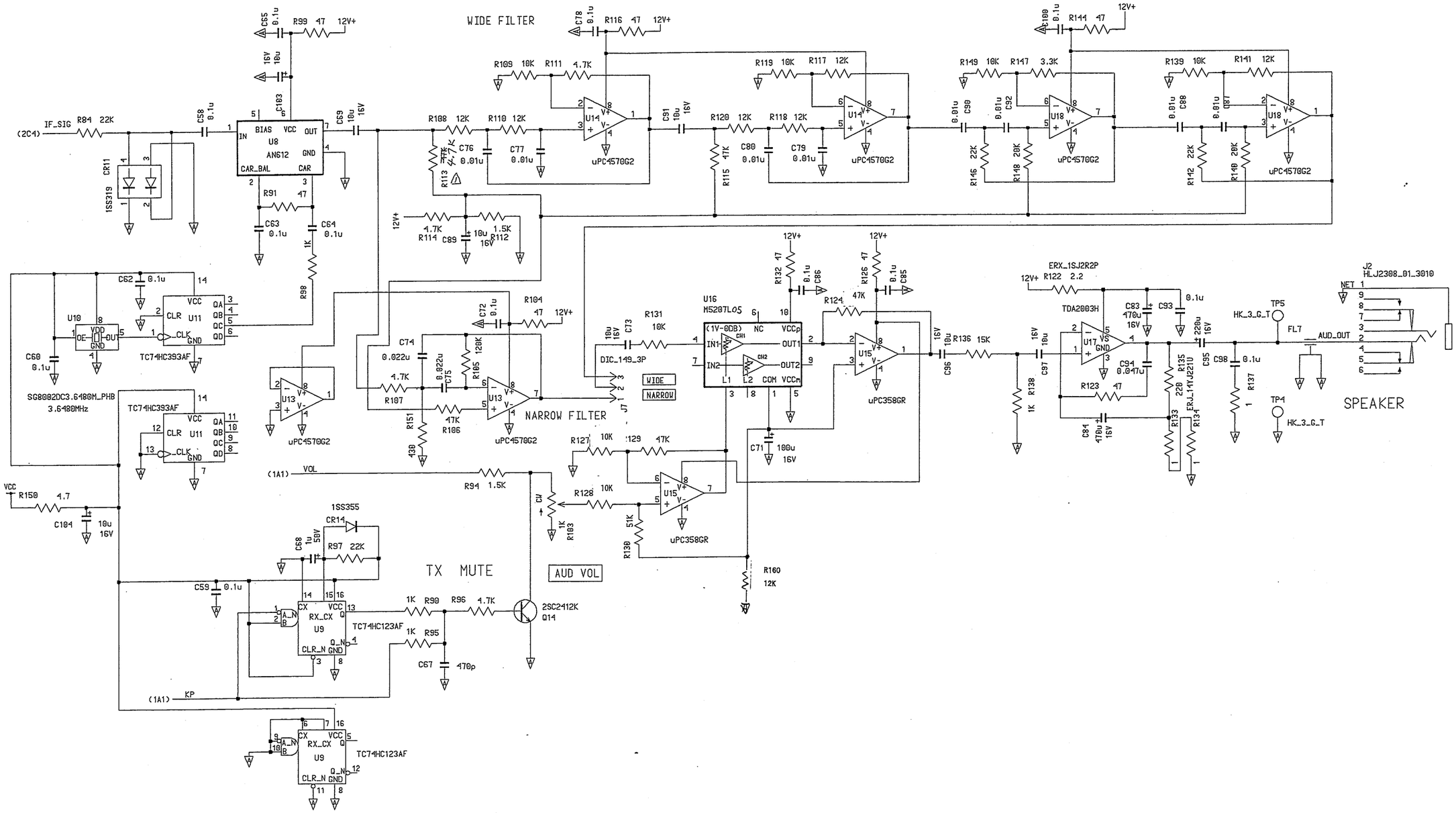


DRAWN Oct.10.'00 T.Yamashita			TYPE 06P0241 (1/4)
CHECKED Oct.11.'00 T.Kimura			名称 TRX回路
APPROVED Oct.11.'00 T.Kimura	CH-250	3B 2	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME TRX PCB
DWG NO. C1316-K12- A	06-021-3201- 2		SCHEMATIC DIAGRAM



DRAWN Oct 10 '00 TYAMAZAKI			TYPE 06P0241 (2/4)
CHECKED Oct 11 '00 YKimi			名称 TRX回路
APPROVED Oct 11 '00 YKimi	CH-250	3B 2	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME TRX PCB
DWG NO. C1316-K13- A	06-021-3202- 1		SCHEMATIC DIAGRAM

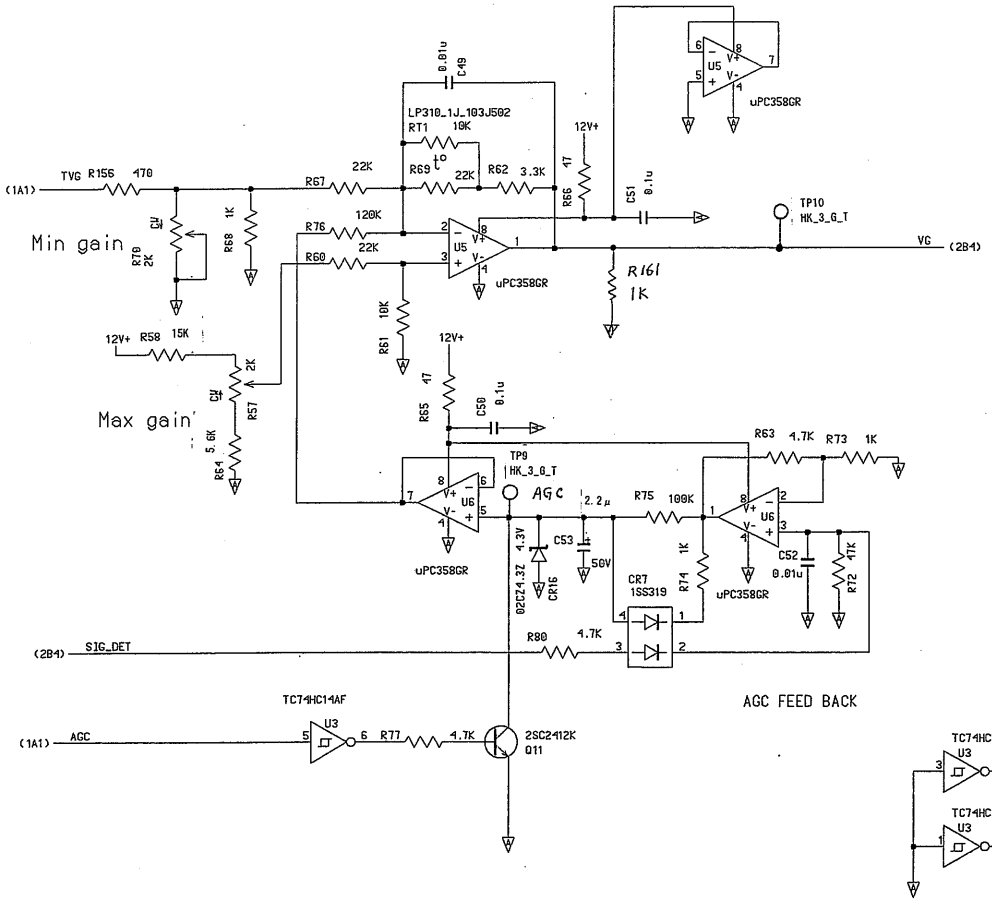
AUDIO



DRAWN Oct 10'01 a.m. T.YAMASAKI			TYPE 06P0241 (3/4)
CHECKED Oct/10/'01 Y.K			名称 TRX回路
APPROVED Oct/10/'01 Y.K	CH-250	3B 2	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME TRX PCB
DWG NO. C1316-K14- A	06-021-3203- 1		SCHEMATIC DIAGRAM

FURUNO

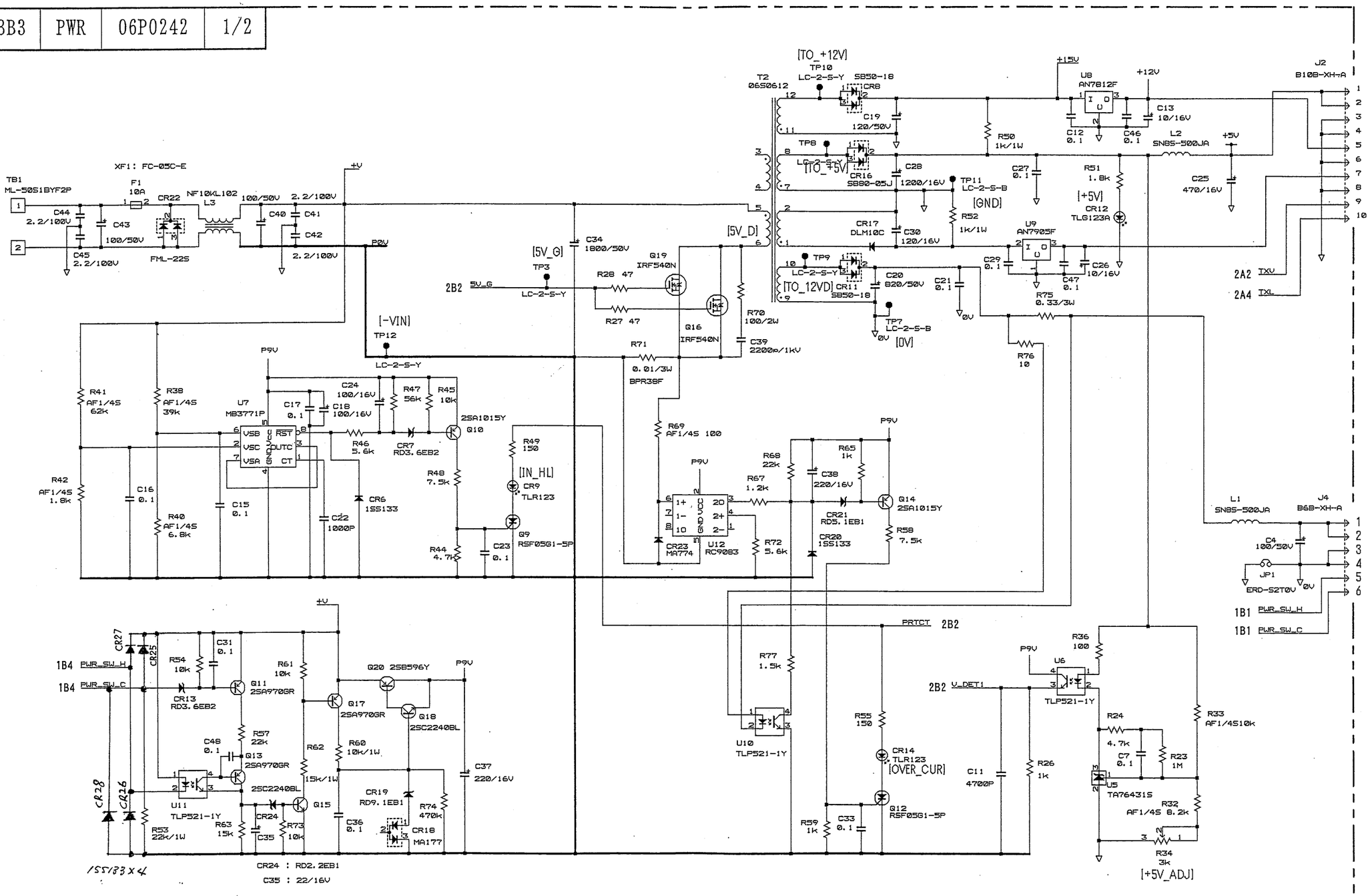
GAIN CONTROLL



DRAWN 00/12/07 T.YAMADA			TYPE 06P0241 (4/4)
CHECKED 00/11/07			名称 TRX回路
APPROVED 00/11/07		CH-250	3B 2 回路図
SCALE /	MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO. NAME TRX PCB
DWG NO. C1316-K15- A		06-021-3204- 3	SCHEMATIC DIAGRAM

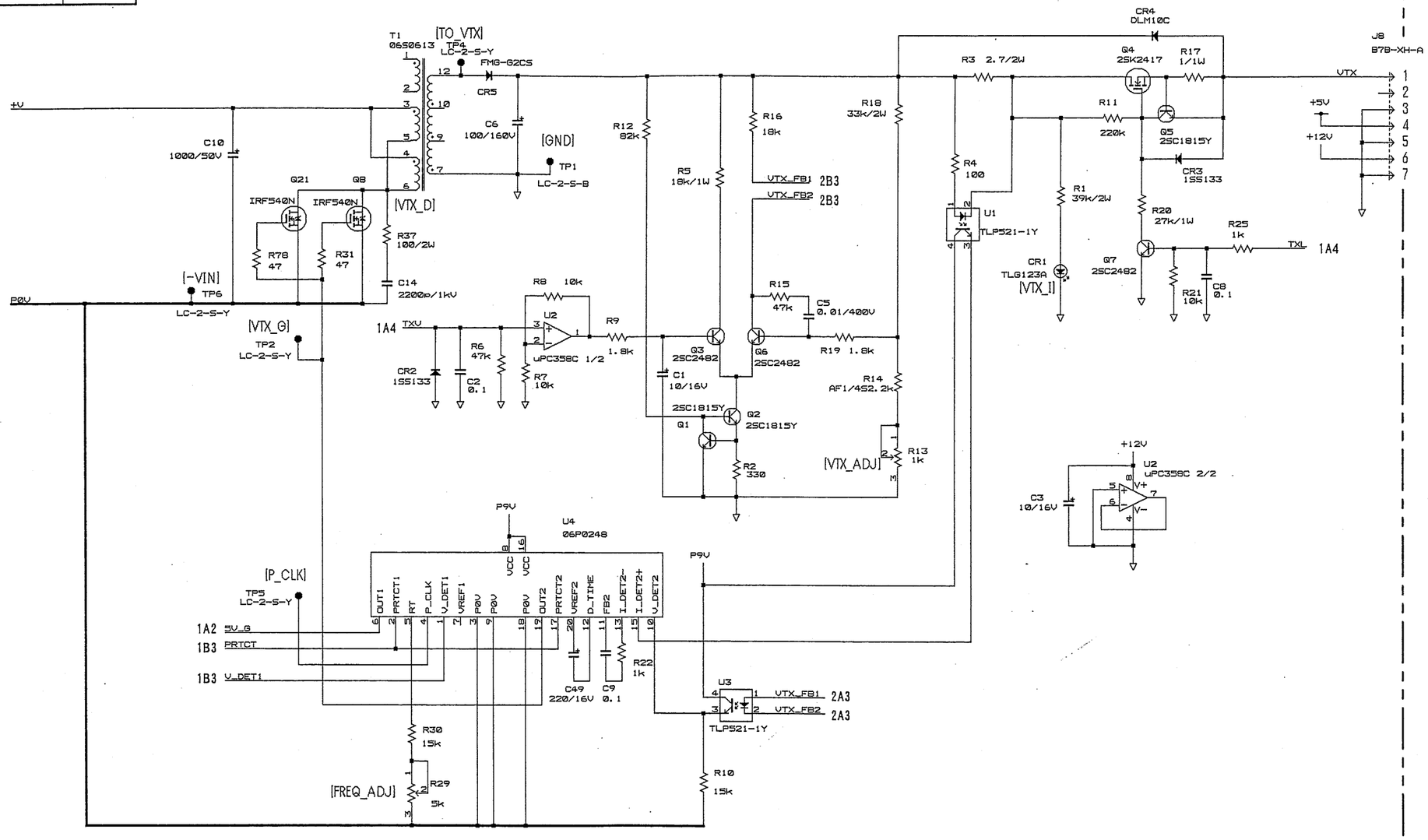
FURUNO ELECTRIC CO., LTD.

3B3	PWR	06P0242	1/2



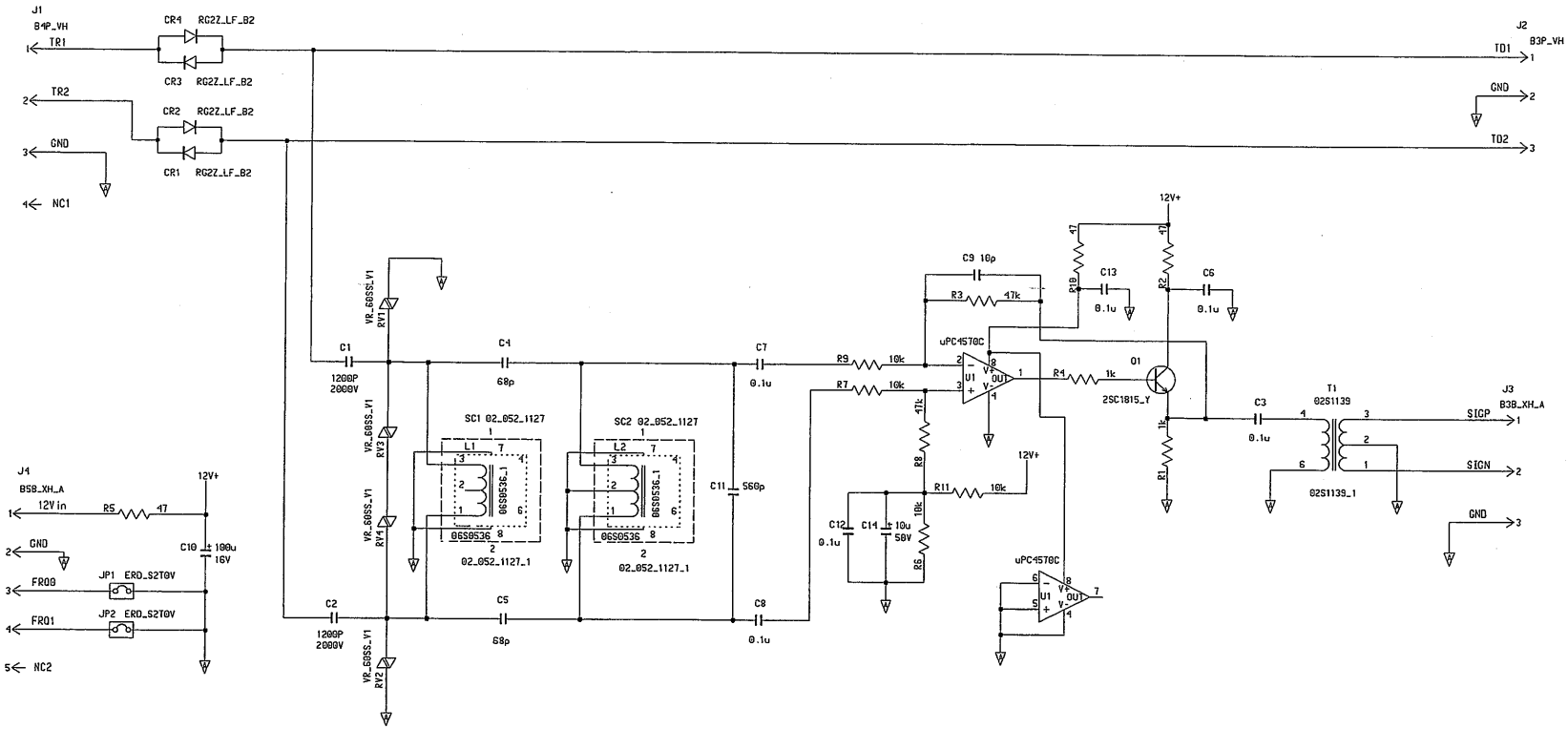
DRAWN Mar.31'00 T.YAMADA			TYPE 06P0242(1/2)
CHECKED Mar.31'00 Y.K			名称 PWR基板
APPROVED Mar.31'00 S.Yoshikawa	CH-253		回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME PWR PCB
DWG NO. C1316-K03- A	06-021-3301- 1		SCHEMATIC DIAGRAM

3B3	PWR	06P0242	2/2



DRAWN T.YAMASAKI			TYPE 06P0242(2/2)
CHECKED T.K			名称 PWR基板
APPROVED	CH-253		回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME PWR PCB
DWG NO. C1316-K04- A	06-021-3302- 0		SCHEMATIC DIAGRAM

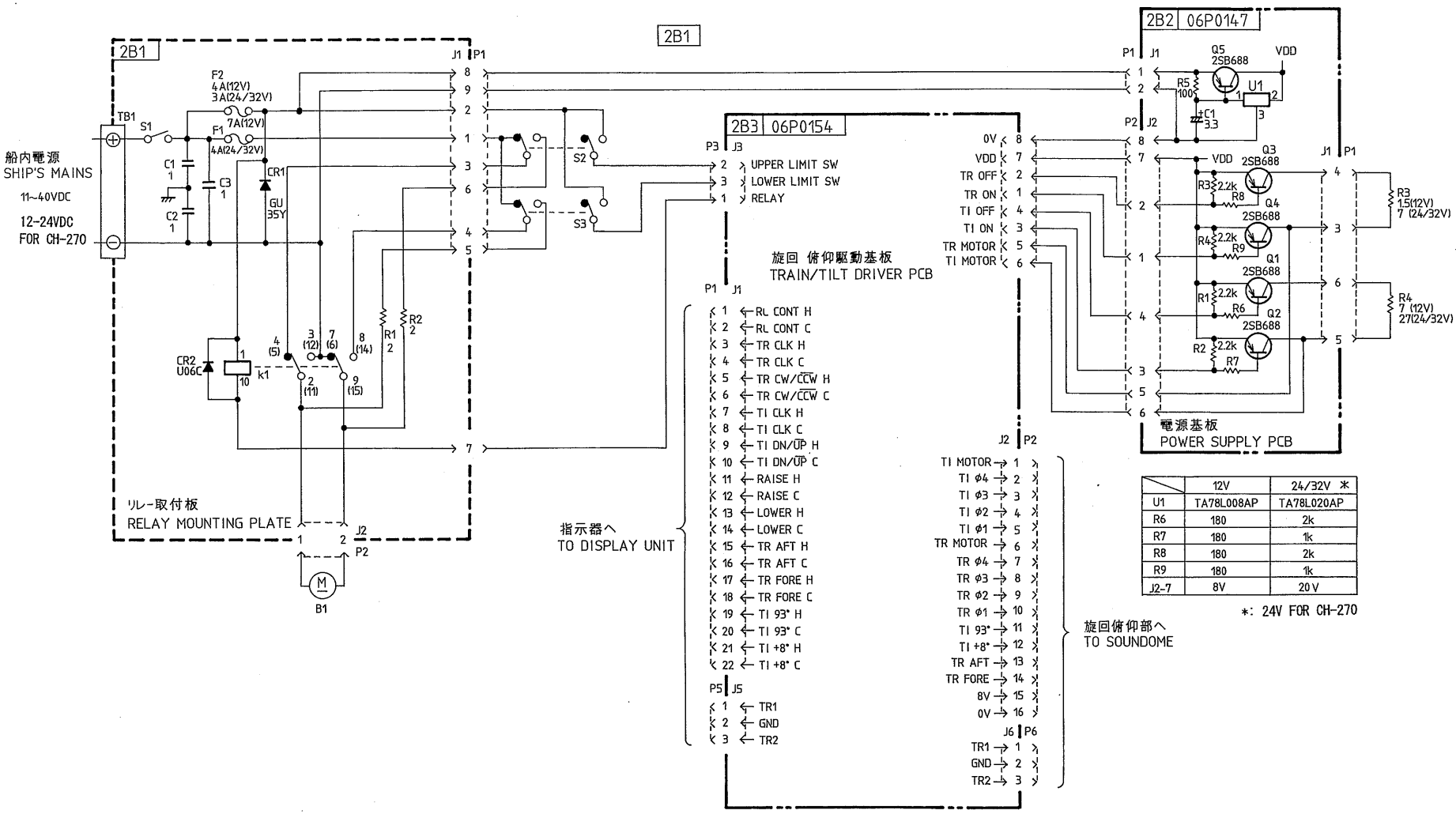
FURUNO



DRAWN 04/06/18 T.YAMASAKI			TYPE 06P0259
CHECKED 04.07.07 M.Aoyagi			名称 PRA基板
APPROVED 04.07.07 M.Aoyagi		CH-273 3B 4	回路図
SCALE	MASS	MODEL BLOCK No.	NAME PRA PCB
Dwg No. C1322-K07- A		06-022-1201-0	SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO



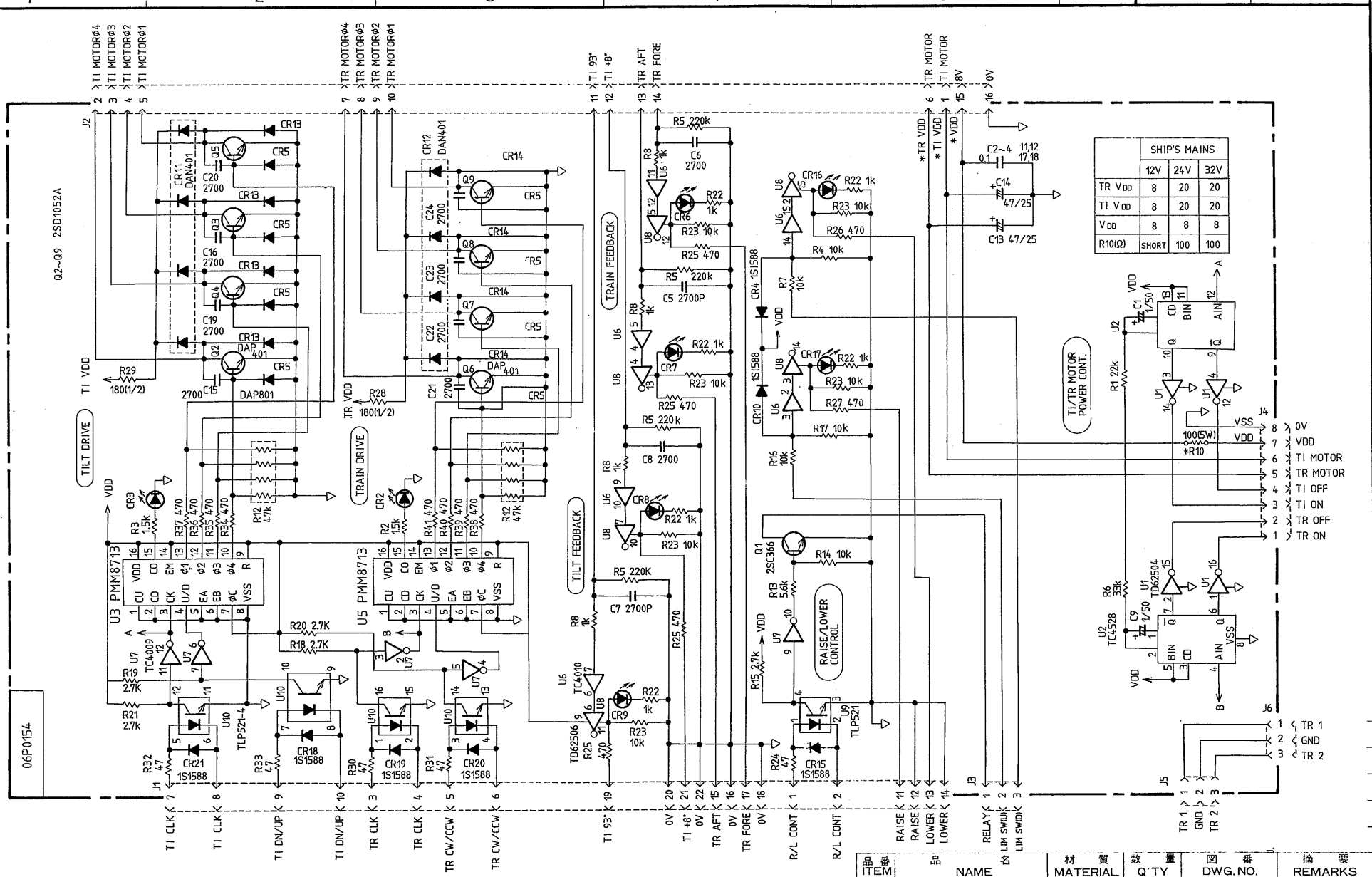
	12V	24/32V *
U1	TA78L008AP	TA78L020AP
R6	180	2k
R7	180	1k
R8	180	2k
R9	180	1k
J2-7	8V	20V

*: 24V FOR CH-270

DRAWN 04/07/06 T.YAMASAKI			TYPE CH-1811
CHECKED 04/07/06 Y.Okamoto			名称 上下動部
APPROVED 04/07/6 Y.Okamoto	CH-18/28/270	2B	回路図
SCALE / MASS	MODEL	BLOCK No.	NAME RAISE/LOWER DRIVE UNIT
Dwg No. C1271-023- C			SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO



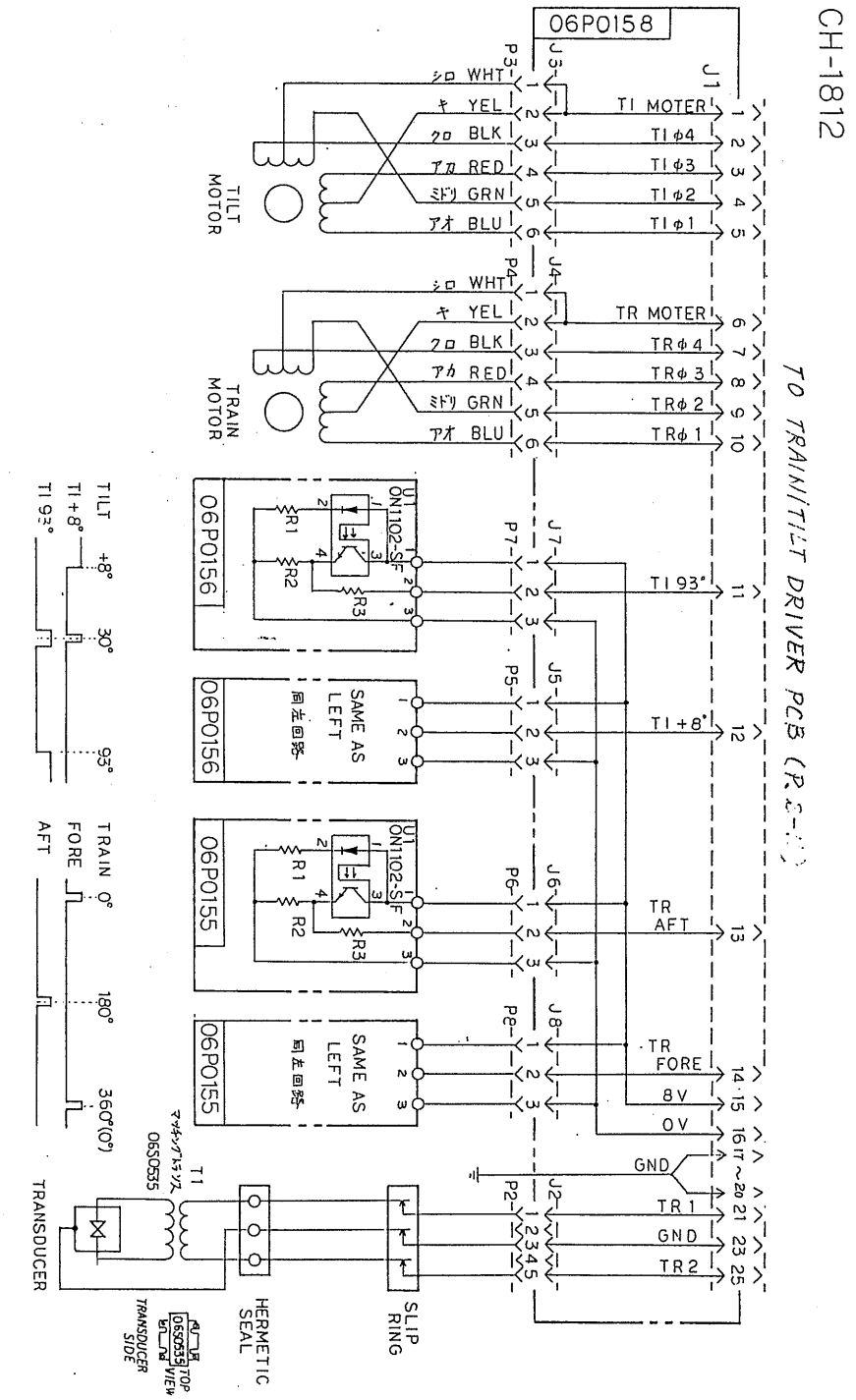
ITEM	NAME	MATERIAL	Q'TY	DWG. NO.	REMARKS

APPROVED	THIRD ANGLE PROJECTION	TITLE	旋回/俯仰駆動基板 06P0154 TRAIN/TILT DRIVER BOARD
CHECKED	SCALE		
DRAWN	WEIGHT kg	DWG. NO.	C1271-001-B

CH-18/28

FURUNO ELECTRIC CO., LTD.

FURUNO



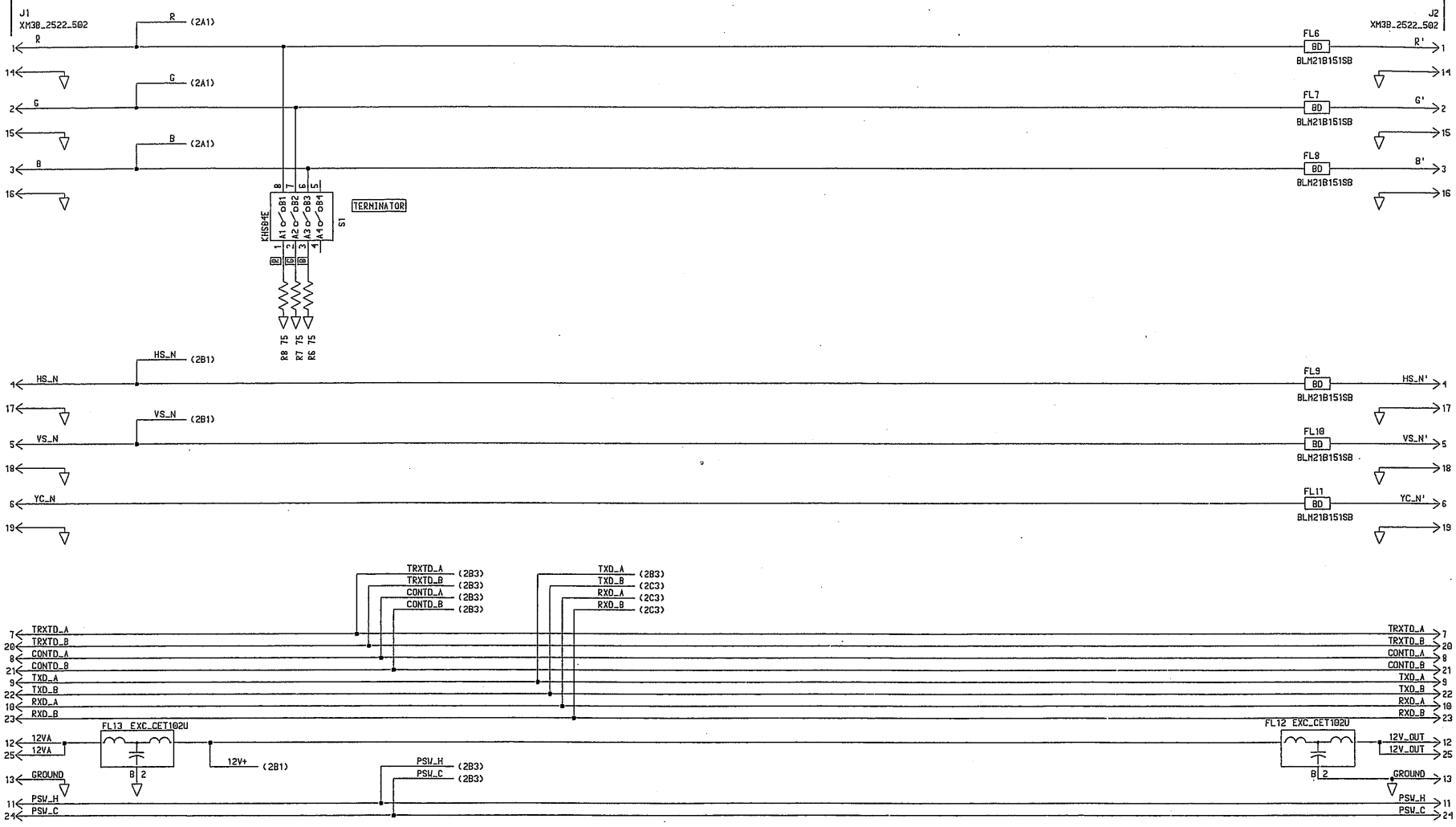
品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	APR.26.'94 T.NODA	三角法 THIRD ANGLE PROJECTION		名称 TITLE	旋回俯仰部 SOUNDOME
検図 CHECKED	APR.24.'94 T.NODA	尺度 SCALE	/		
製図 DRAWN	DEC.6.'93	重量 WEIGHT	kg	図番 DWG.NO.	C1271-036-A

FURUNO ELECTRIC CO., LTD.

FURUNO

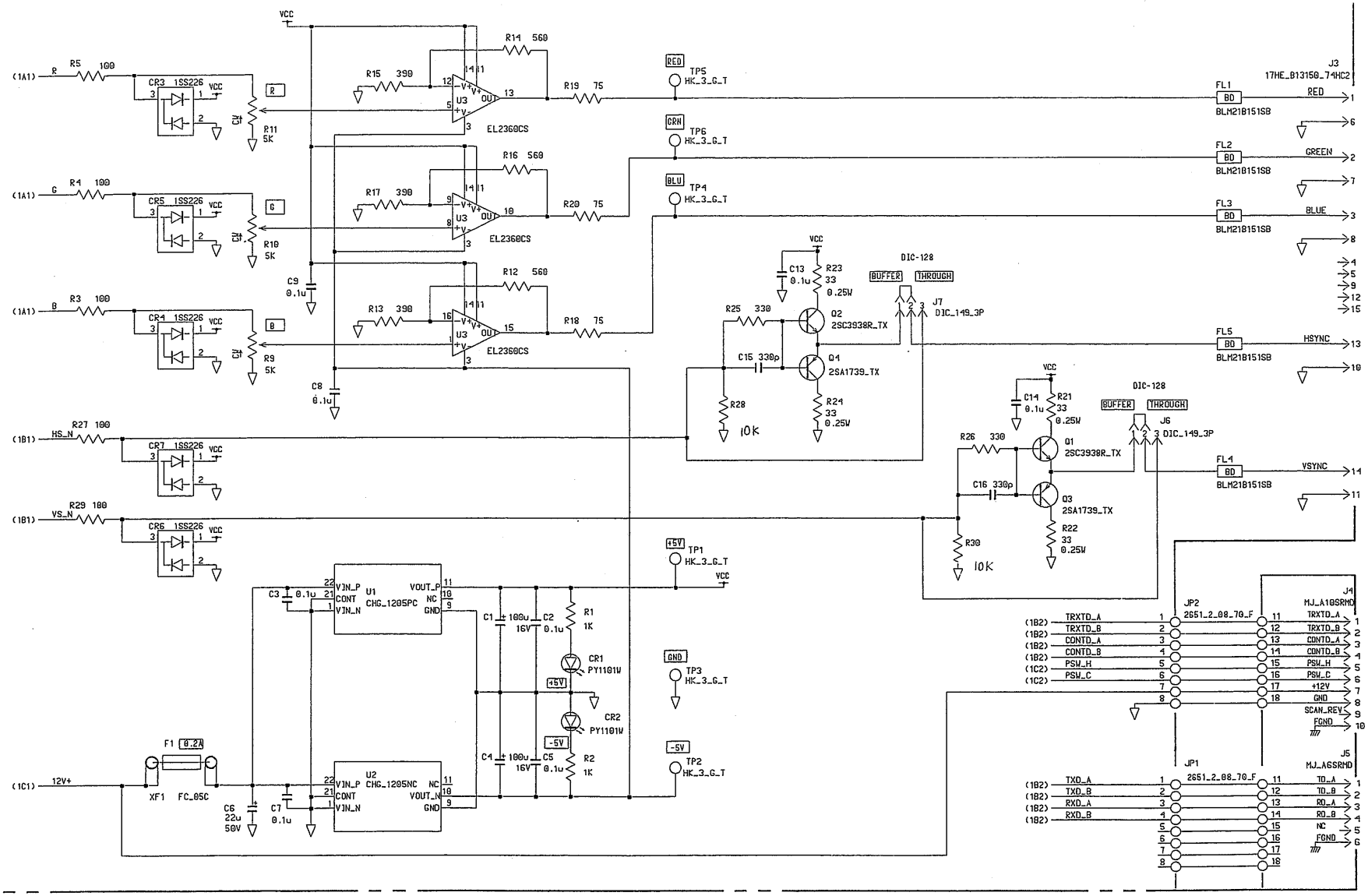
B1	MIF	06P0245



DRAWN June 12 '00 T.YAMASAKI			TYPE IF-8000 (1/2)
CHECKED June 12 '00 Y.Kimura			名称 インターフェイスユニット
APPROVED June 12 '00 Y.Kimura			回路図
SCALE /	MASS kg	APPLICABLE TO; (MODEL) / BLOCK NO.	NAME INTERFACE UNIT
DWG NO. C1316-K06- A		06-021-6001- 0	SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO

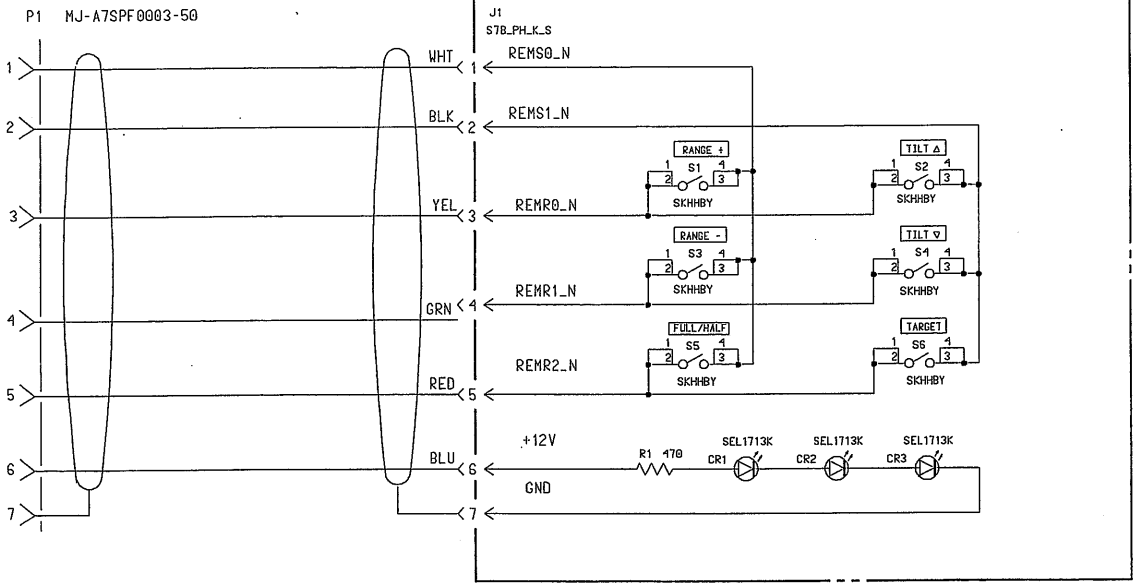


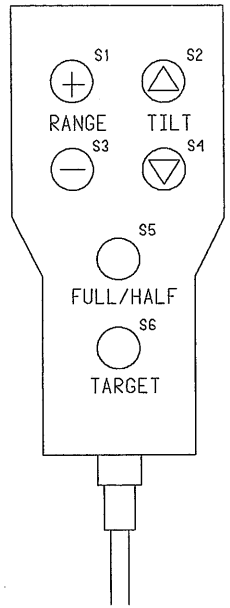
DRAWN June 12'00 T.YAMASAKI			TYPE IF-8000 (2/2)
CHECKED June 12'00 Y.K			名称 インターフェイスユニット
APPROVED June 12'00 Y.K			回路図
SCALE /	MASS kg	APPLICABLE TO; (MODEL) / BLOCK NO.	NAME INTERFACE UNIT
DWG NO. C1316-K07- A		06-021-6002- 1	SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO

6B1	REM	06P0247

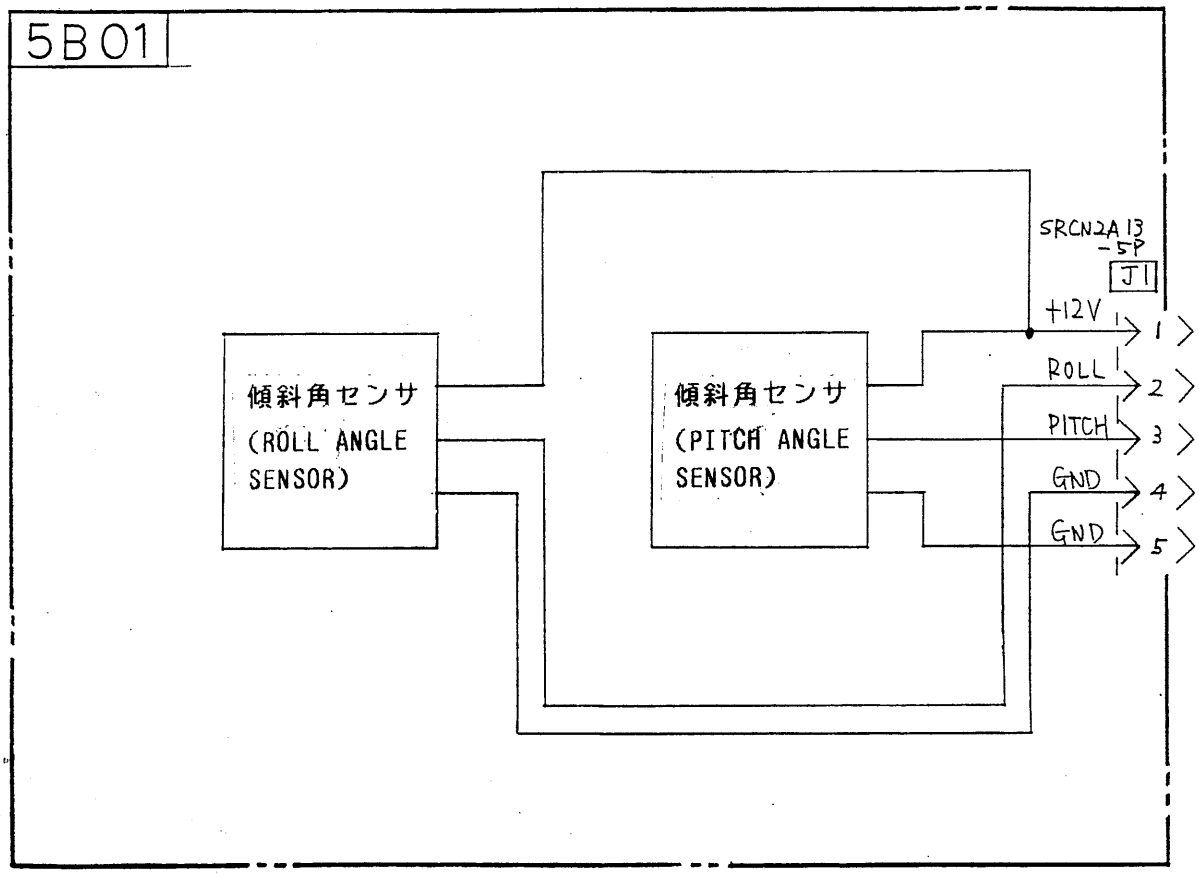




DRAWN Oct.10'00 T.YAMASAKI			TYPE 06P0247
CHECKED Oct.11'00			名称 REM回路
APPROVED Oct.11'00	CH-250	6B 1	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME REM PCB
DWG NO. C1316-K25- A	06-021-5001- 0		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO



品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	AUG.20.'86 T. NAKAJO	三角法 THIRD ANGLE PROJECTION		名称 TITLE	BS-704 傾斜角検出器 INCLINOMETER
検図 CHECKED	Aug.20.'86 T. KODA	尺度 SCALE	/		
製図 DRAWN	Aug.20.'86	重量 WEIGHT	kg	図番 DWG.NO.	C1259-041-A

FURUNO ELECTRIC CO., LTD.