FURUNO

SERVICE MANUAL

COLOR NET RECORDER

MODEL CN-24

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1. GENERAL

This chapter describes the basic operations of the transmitter unit. Most of operations are CPU controlled.

1.1 POWER SUPPLY

The transmitter unit is automatically powered by the pressure switch when it descends 10 m in the sea and turned off when it ascends to 5m deep point.

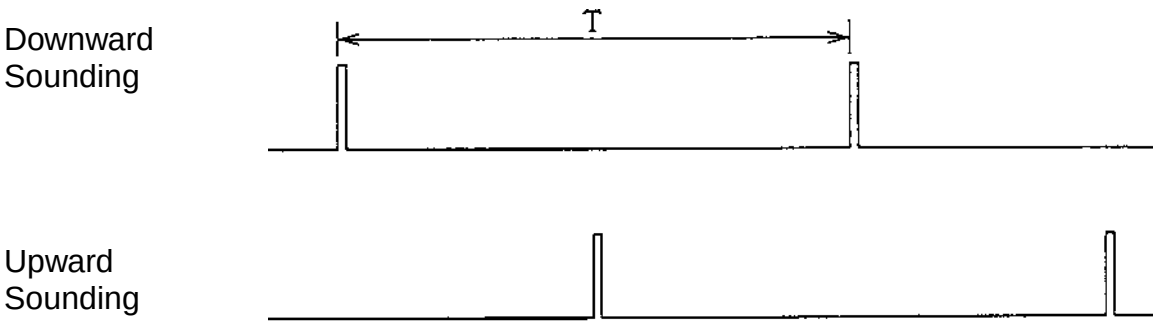
1.2 UPWARD AND DOWNWARD SOUNDING

The transmitter unit incorporates only one sounding transmitter/receiver circuit. The upward and downward transducers are alternately connected to the circuit by the action of a relay.

1.2.1 Sounding Rate

Two kinds of sounding rates are used to improve coverage area.

Standard Rate ("LOW" setting)



The time "T" between the pulses depends on the sounding range setting in the transmitter unit.

Fig. 1.1 Upward and Downward Sounding in Standard Mode

High Rate ("HIGH" setting)

In this rate, sounding is performed three times within one cycle of transmitter operation with standard rate.

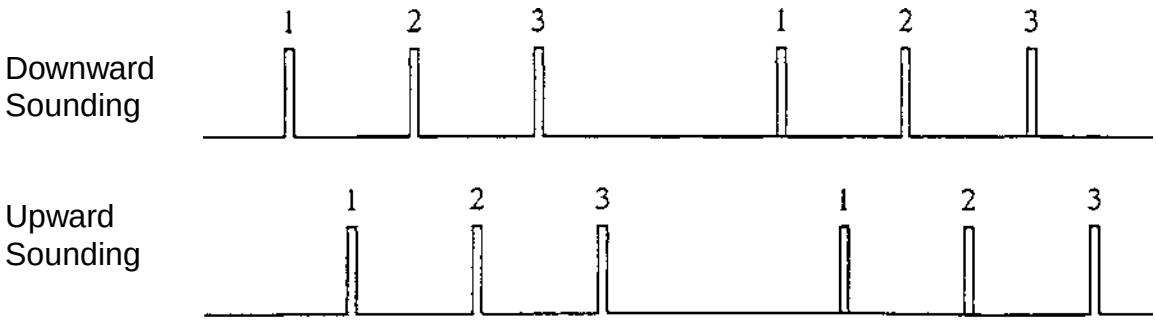


Fig. 1.2 Upward and Downward Soundings at High Rate

The receiver receives signals within the range in use at the first sounding, and it receives signals between 0 and 20 meters at the second and third soundings in both upward and downward directions. Generally, the blind zone occurs in short range due to the beam shape and rare transmission rate. The high transmission rate can reduce the blind zone and increase the number of reflection from the target.
Refer to the figure below.

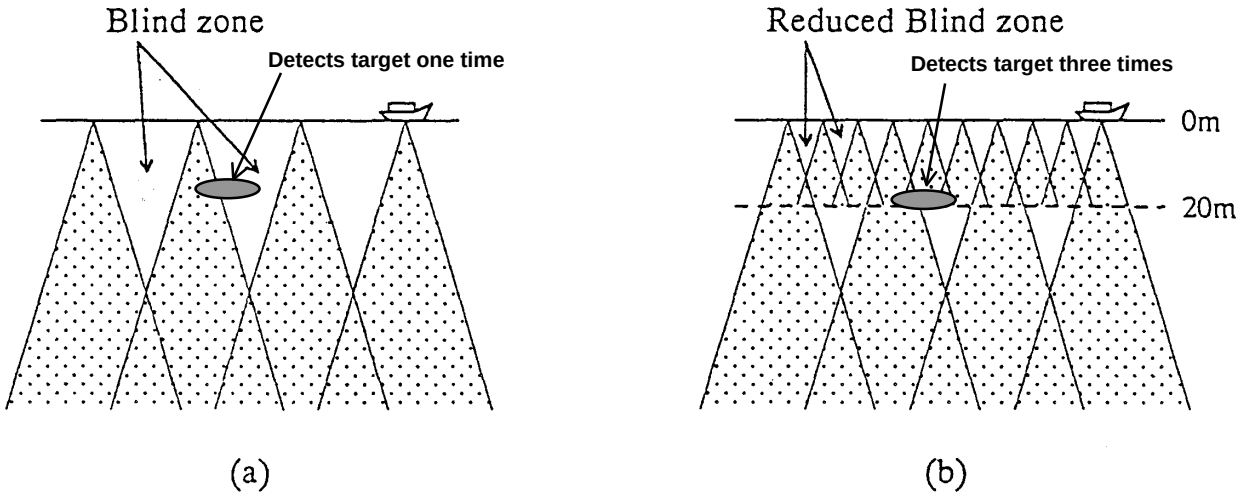


Fig. 1.3 Sounding Area (Standard versus High)

The received signals obtained by these three soundings are processed as follows in the transmitter unit.

a) 0 - 20m:The received echoes obtained from the three soundings are compared and the strongest echo is picked up and sent to the display unit.

b) more than 20m: The received echoes obtained from the first sounding are sent to the display unit.

1.3 DATA FORMAT FROM TRANSMITTER UNIT

The data sent from the transmitter unit to the paravane receiver consist of upward and downward sounding signals, sync code, temperature and depth data, and catch sensor data (option). Transmission sequence of these signals are shown in Fig. 1.4.

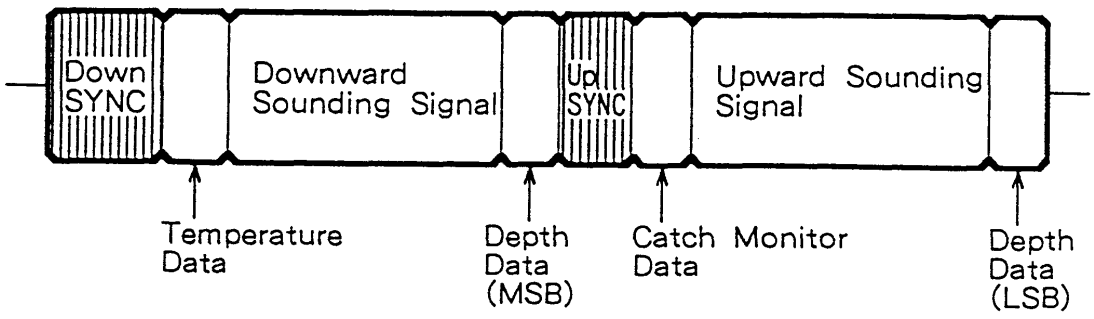


Fig. 1.4 Data Format

There are two SYNC codes, DN SYNC and UP SYNC, and (2) depth data is divided into two parts, MSB and LSB.

1.3.1 SYNC Code

The synchronous signal consists of 32bits binary coded data.
The DN SYNC code is attached to the beginning of each transmission cycle to enable the display unit identifying the signal. The coded pulses enable to reduce the effect of noise along the transmission line to the paravane receiver.
The S/N ratio becomes maximum when the number of bits is 2^n -1 (n: integer), 31 bits out of these 32 bits are actually used in the display unit. Fig. 1.5 shows the 32 bits code data.

Fig. 1.5 SYNC Code (DN SYNC)

The UP SYNC signal inserted before the catch monitor data consists of 15 bit binary code data and is used to stabilize the oscillation line of the upward sounding picture on the display unit.
For the modulation of the sync codes, the FS (Frequency Shift) modulation is employed; "1', and "0" are modulated at frequencies which are different by 1kHz each other, as shown bellow.

	Code/Frequency	
Transmission Frequency	0	1
33 kHz	33 kHz	34 kHz
40 kHz	40 kHz	41 kHz
50 kHz	50 kHz	51 kHz

1.3.2 Temperature Data

The water temperature is indicated by the time interval from the left edge of the temperature data region to the temperature signal (15 bit H/L code). The temperature data region is allocated next to the DN SYNC code.

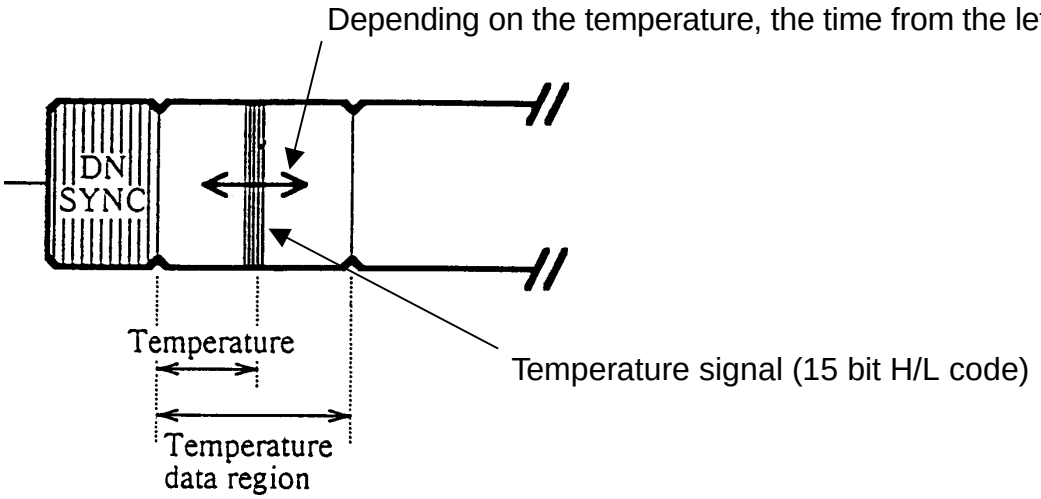


Fig. 1.6 Temperature data region

Note: In actual processing, the temperature data expressed by 9 bit binary number is divided into two parts, the lower 5 bits and the upper 4 bits, and the temperature data region is also divided into two sections. The time interval from the left edge of each section to temperature signal indicate the value of the lower 5 bit or upper 4 bit number. This configuration enables to shorten the length of the temperature data region.

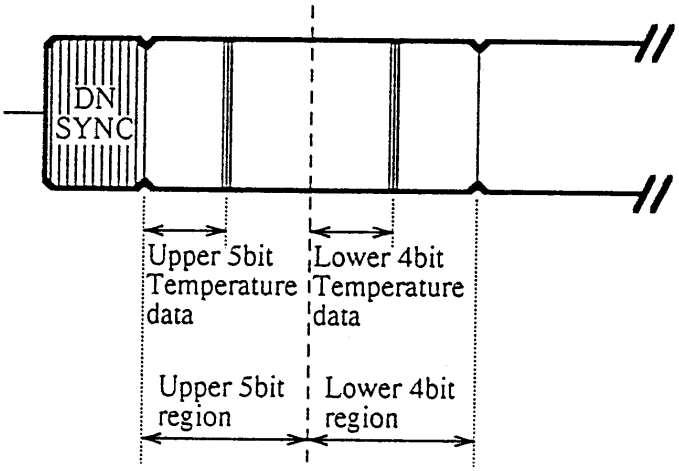


Fig. 1.7 Temperature data region

1.3.3 Upward/Downward Sounding

The received echo signals are transmitted to the paravane receiver with frequency-modulated form.
The echo signals received by the upward/downward sounding circuit are converted into 4 bits binary data which represent 15 stages signal level and then converted into FM signal by the V-F converter.

1.3.4 Depth Data

Like the water temperature measurement, the detected depth is indicated by the time from the left edge of the depth signal area to the depth signal (15 bit H/L code). However, to shorten the length of the depth signal area, the depth data is divided into two parts (upper 6 bits and lower 6 bits) and inserted into the pause areas of downward and upward sounding periods. See Fig. 1.8.

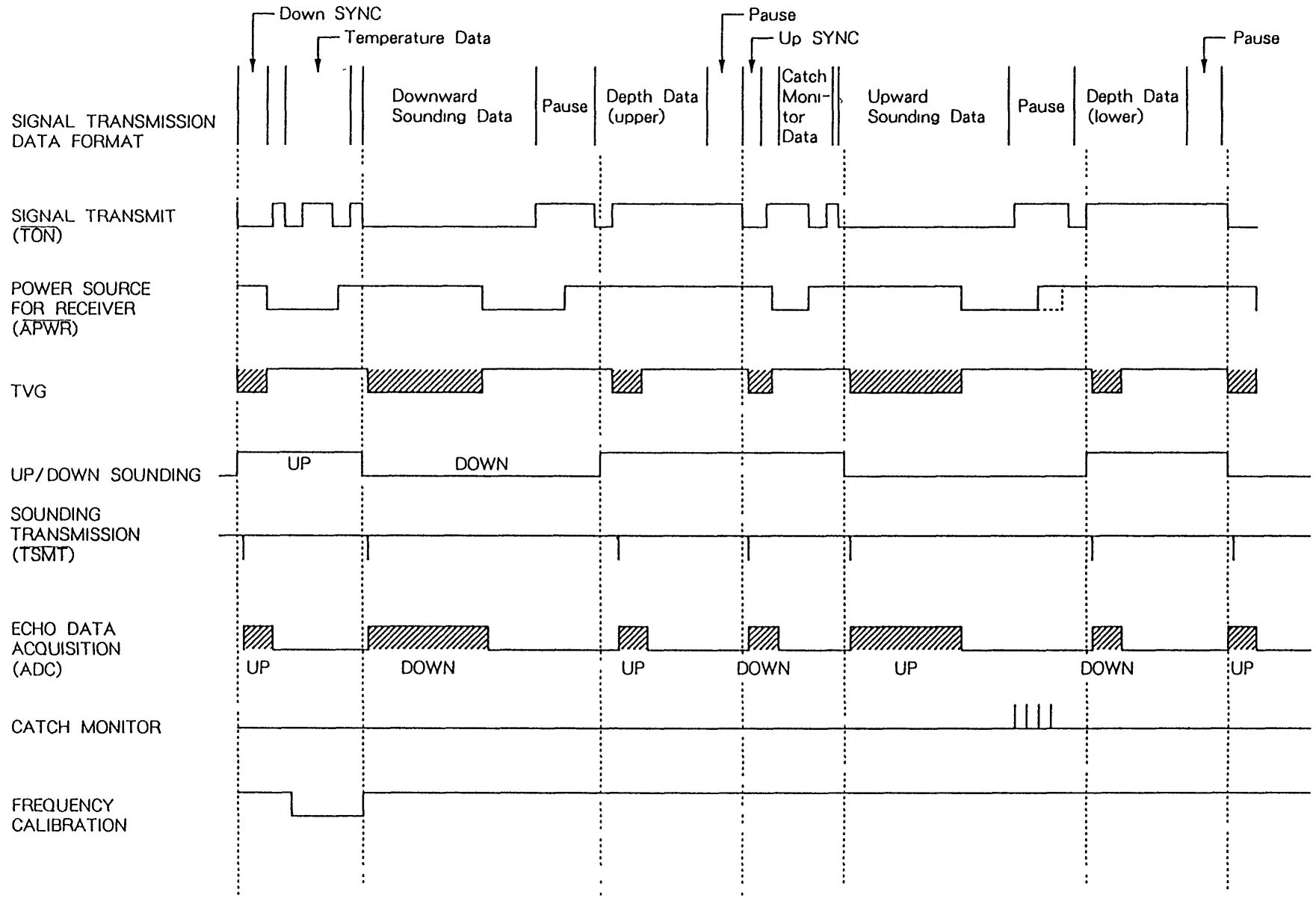


Fig. 1.8 Transmitter unit timing chart (range: 80/80 m and sounding rate: high)

2. CIRCUIT DESCRIPTION

2.1 TRANSMITTER UNIT

2.1.1 Board Function

Refer to the block diagram shown in figure 2.1. The transmitter unit consists of five PC boards. The table below shows the major functions of each PC board.

Board	Major Functions
TRS. A 01 P5742	1) Generates upward/downward sounding TX signals. 2) IF amplifier, mixer, and detector of received signals. 3) TVG control of received signals. 4) A/D conversion of received signals.
TRS. B 01 P5743	1) Power amplification of upward/downward sounding TX signals. 2) RF amplification of received signals.
SEN 01 P5744	1) Depth/water temperature measurement.
CO NT. A 01P5740	1) Control of transmitter, receiver and signal transmitter circuits by CPU. 2) Acquisition and processing of A/D converted received signals. 3) Power amplification of signal transmitted to paravane receiver.
CONT. B 01P5741	1) D/A conversion and frequency modulation of signals transmitted toward paravane receiver. 2) A/D conversion of depth and water temperature signals for acquisition by CPU. 3) Presetting of transmitter unit operation mode.

2.1.2 Power ON/OFF Control

When the transmitter unit reach at 10 m deep in the water, the pressure switch is turned on and activates the + 5 and 15 V regulator on the CONT A board. And the transmitter unit starts functioning automatically. When the transmitter unit rises above 10 m, the pressure switch is turned off, and the transmitter unit stops functioning.

2.1.3 Upward and Downward Soundings

Transmitter Circuit

The transmitter circuit for upward and downward soundings are incorporated on TRS. A and TRS. B boards. For the 75 kHz transmission, the 1.2 MHz signal generated by the CPU on the CONT A board is frequency-divided by 16 to 75kHz and 1.4 MHz generated by a crystal oscillator on the TRS.A board is divided by 8 to 175 kHz.

These 75 kHz or 175 kHz clock signals are applied to the succeeding gate circuit, where it is gated by 0.2ms long TSMT pulse from the CPU, and then sent to the power amplifier. The power amplifier amplifies the transmission signals to 100W and sent to the sounding transducer via the output transformer and the T/R circuit. The T/R circuit links the transducer to the transmitter circuit during transmission and to the RF amplifier during reception. Relay K1 selects the transducer for upward or downward sounding and is controlled by the CPU via the UP/DN CONT circuit.

Figure 2.2 and 2.3 show the transmitting waveform and TSMT signal.

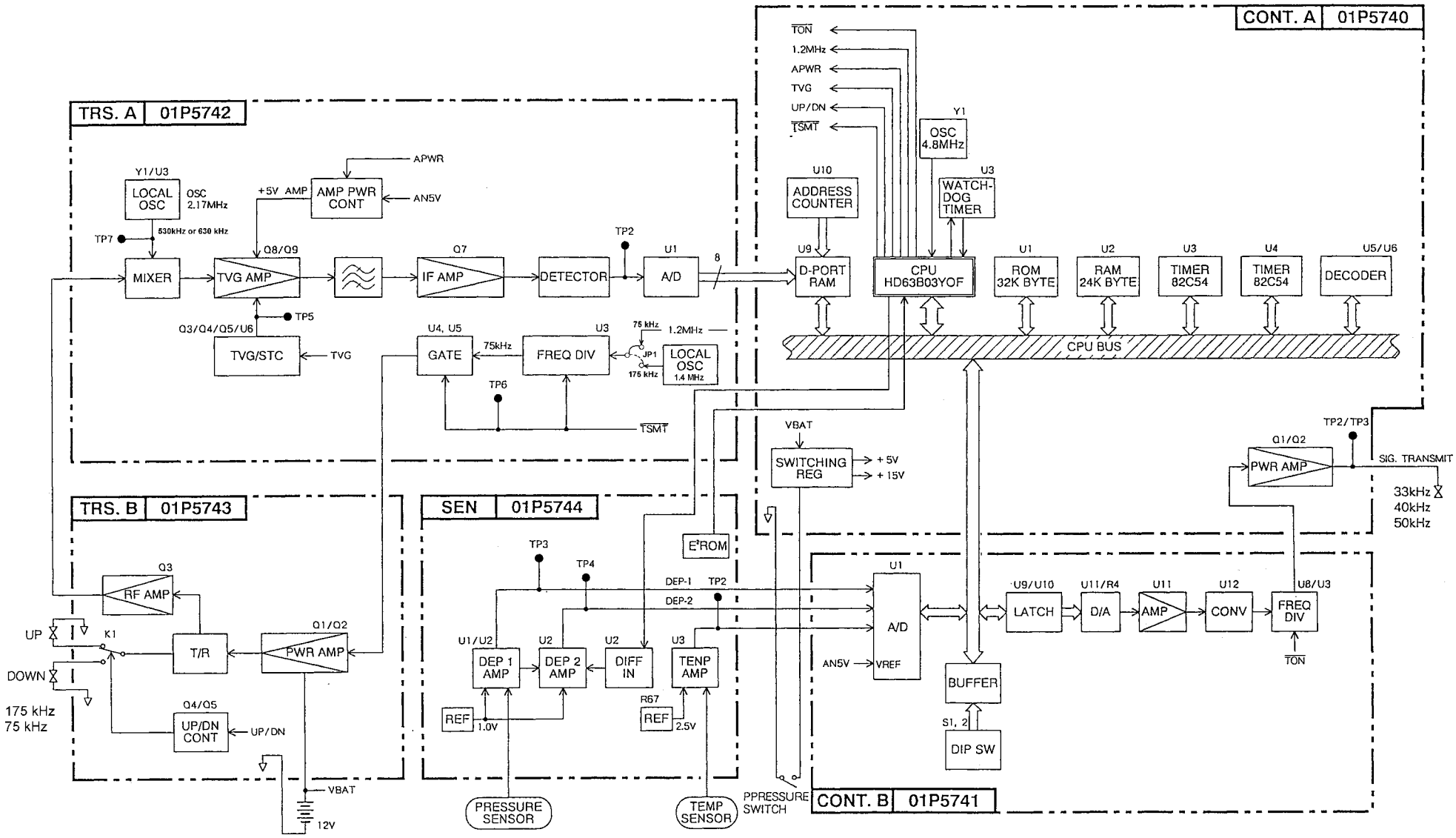
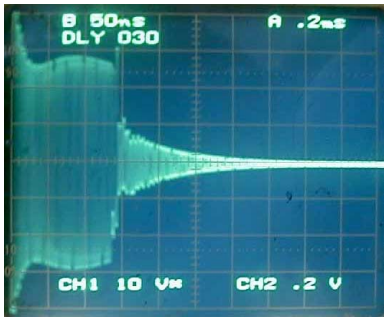


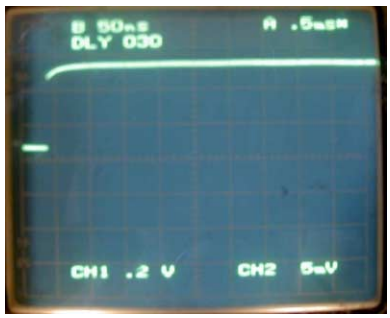
Fig. 2.1 Block Diagram of Transmitter Unit



100V/DIV
0.2ms/DIV

Measuring point: P4 #1 - P4 #4
Frequency:75 kHz

Fig. 2.2 TX waveform



2V/DIV
0.5ms/DIV

Measuring point: TP6 on TRS.A board
Frequency:75 kHz

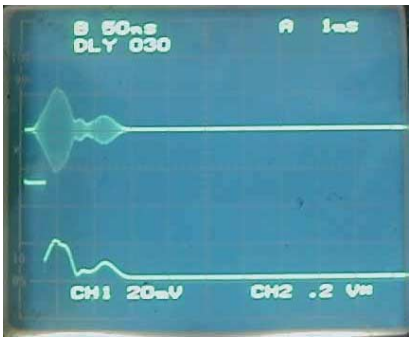
Fig.2.3 TX trigger: TSMT

Receiver Circuit

The received signal from the transducer is first amplified by the RF amplifier and then mixed with the local oscillator output to get a 455 kHz IF signal. The IF signal (Fig.2.4 CH1) is amplified and fed to the next stage's full wave detector. The output of the detector (Fig. 2.4 CH2) is A/D converted to eight bit echo data at specific sampling intervals.
The AMP PWR CONT circuit supplies + 5 V (AMP5V), which is controlled by APWR signal from the CPU, to the TVG amplifier only during the reception period to conserve battery consumption.

CH1

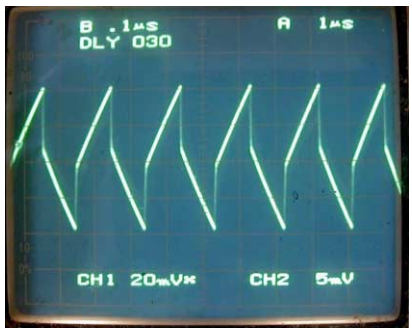
CH2



CH1
200mV/Div
1ms/Div
CH2
2V/Div
1ms/Div

Measuring point: CH1 -- TP3
CH2 ---TP2(ESIG)

Fig.2.4 Waveforms of received echo signal



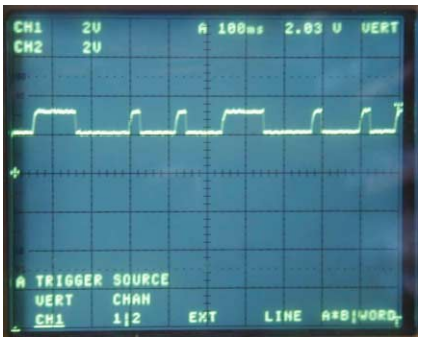
CH1
200mV/Div
1us/Div

Measuring point: TP7 (carrier)

Fig.2.5 Waveform of carrier signal

TVG Circuit

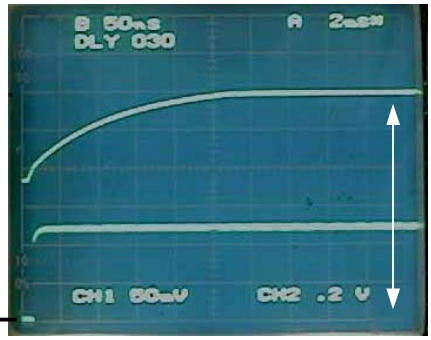
Triggered by the TVG (Time Varied Gain) signal from the CPU on the CONT A board, the TVG circuit generates an exponentially rising TVG voltage (TVG curve). This voltage controls the gain of the amplifier in such a way that the gain is minimum at the time of transmission and gradually increases with time. The TVG curve is factory set to a 30 log curve suitable for fish detection.
Fig.2.6 shows the waveforms of the TVG voltage.



CH1
2V/DIV
100ms/DIV

Measuring point: TP5 (VG)
Sounding rate: High

(A)



CH1

CH2

0 V

CH1
500mV/DIV
2ms/DIV
CH2
2V/DIV
2ms/DIV

Measuring point
CH1: TP5 (VG)
CH2: TP6

(B)

Fig. 2.6 waveforms of TVG voltage

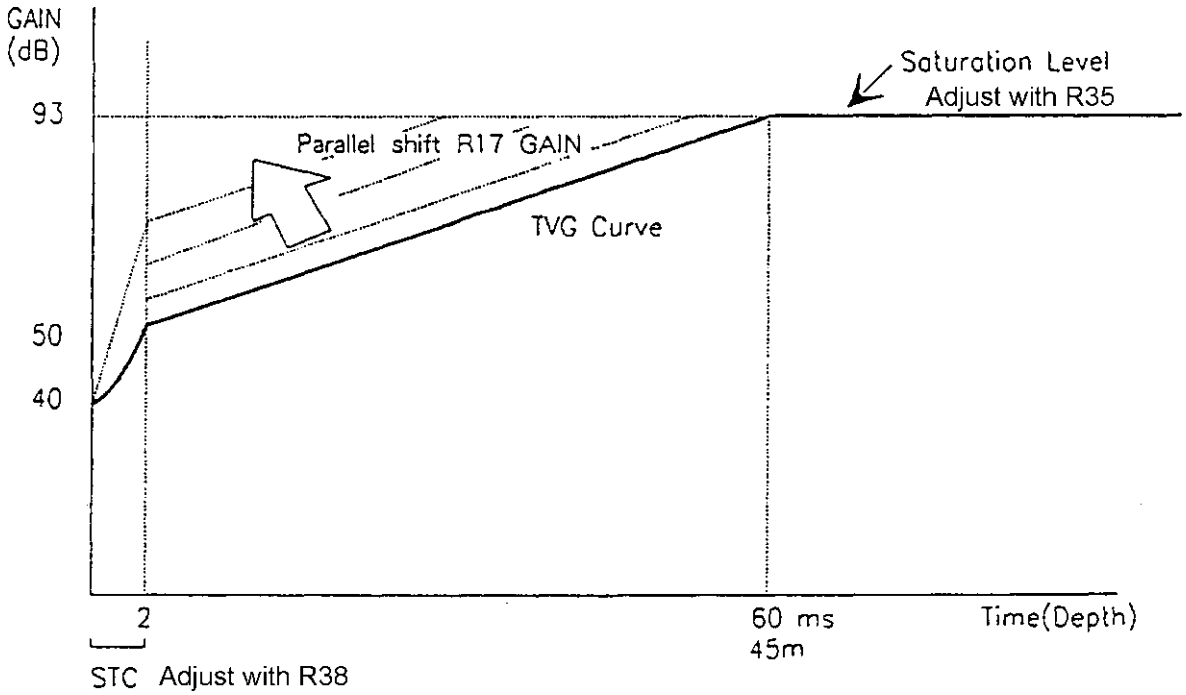


Fig. 2.7 TVG curve

The STC (Sensitivity Time Control) curve is also generated in the TVG circuit. It suppresses the echoes just below the oscillation line, making the oscillation line thin so as not to cover the fish echoes close to the head rope.

2.1.4 Depth/Temperature Measurement (SEN Board)

Depth Measurement

Refer to the simplified depth measurement circuit shown in figure 2.8.

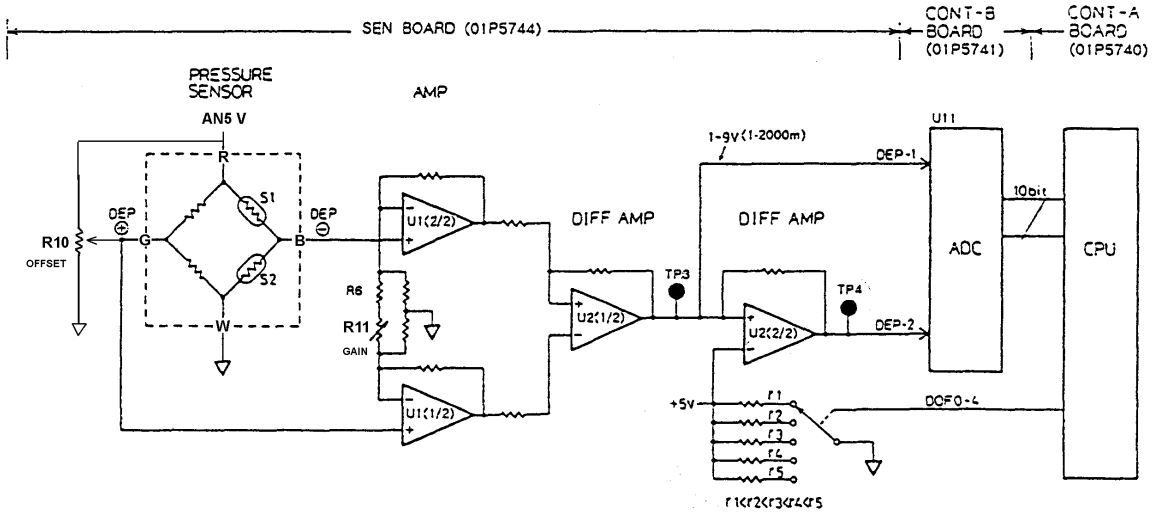


Fig. 2.8 Simplified Depth Measurement Circuit

1) The pressure sensor for depth measurement constitutes a Wheatstone Bridge. It balances at 0 m and the voltage difference between "+" and " - " becomes zero. (In fact there is 0.6 mV approximately, so R10 adjusts the off-set voltage to obtain 0 V.)

2) When the sensor (S1 and S2) detects water pressure, the resistance of one sensor increases and that of the other decreases, developing a voltage proportional to the depth across "+" and "-" terminals.

3) The voltage detected by the sensor device is once amplified at U1 (1/2) and (2/2), then led to differential amplifier U2 (1/2). The output of U2 (1/2) detected as DEP-1 at TP3 is 1 to 9 V which corresponds to the depth of 0 - 2000m. U1 (1/2) and (2/2) are an amplifier of high input impedance and employed to increase measuring accuracy.

4) The succeeding differential amplifier U2 (2/2) works to enhance the measuring resolution as much as five times. Namely the output at TP4 (DEP-2) varies from 1 to 9 V five times while DEP-1 at TP3 varies from 1 to 9V.
This is controlled by the CPU; the CPU monitors TP3 (DEP-1) voltage and changes the reference voltage of U2 (2/2) at depths corresponding to every 400m (400m, 80cm...160Cm). Refer to Figs. 2.9 for the operation.

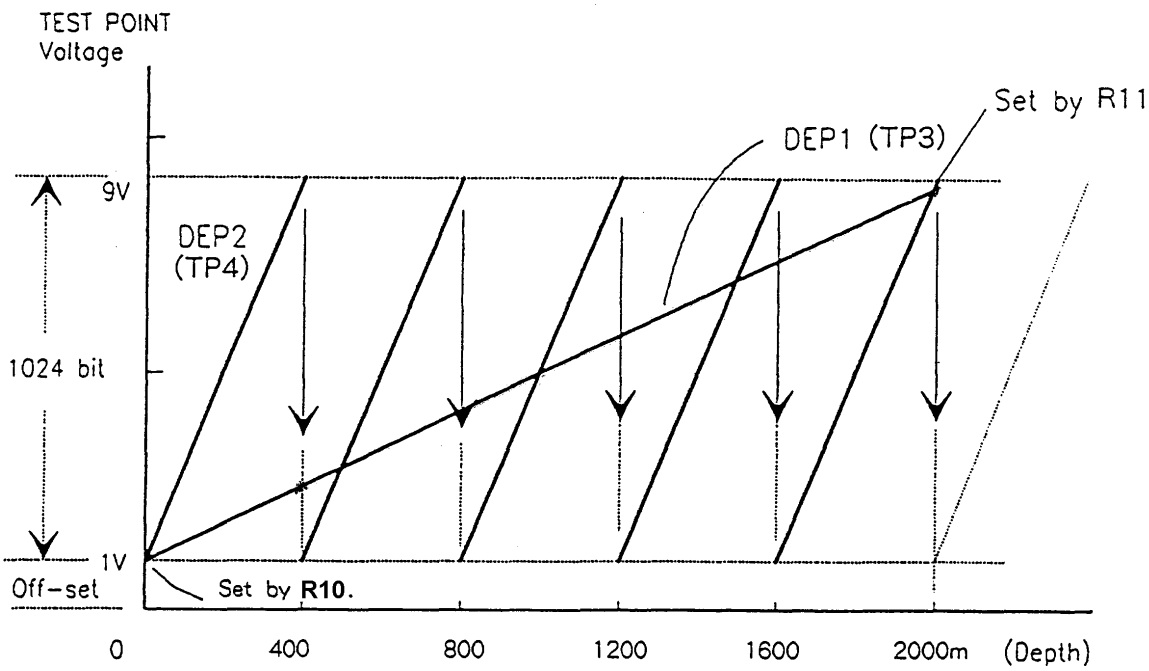


Fig. 2.9 Conversion Curve; depth vs. voltage

IMPORTANT

The pressure sensor is a non-linear device and the characteristic varies from device to device. As the calibration data for the sensor in use are stored in the EEROM (U5 on SEN board), the sensor and SEN board should be used as a pair, that is, both the sensor and SEN board should be replaced if either of them is defective.

Temperature Measurement

The thermistor, which has characteristics shown in Fig. 2.10, is used as the sensor device. The variation of resistance caused by variation of temperature is converted to variation of voltage (shown in Fig. 2.11) by the TEMP AMP circuit and fed to the CPU through the A/D converter on the CONT B board.

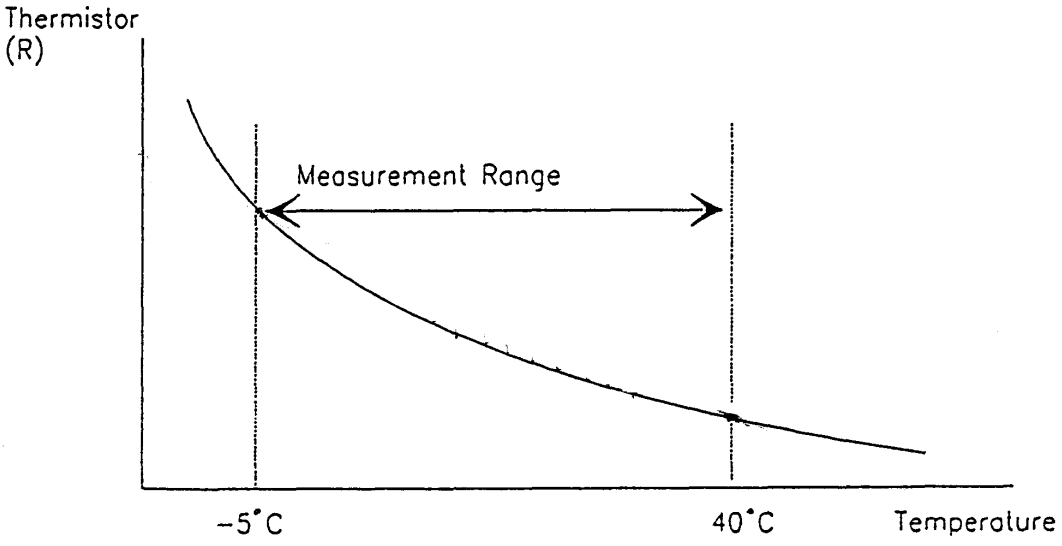


Fig. 2.10 Characteristics of the thermistor

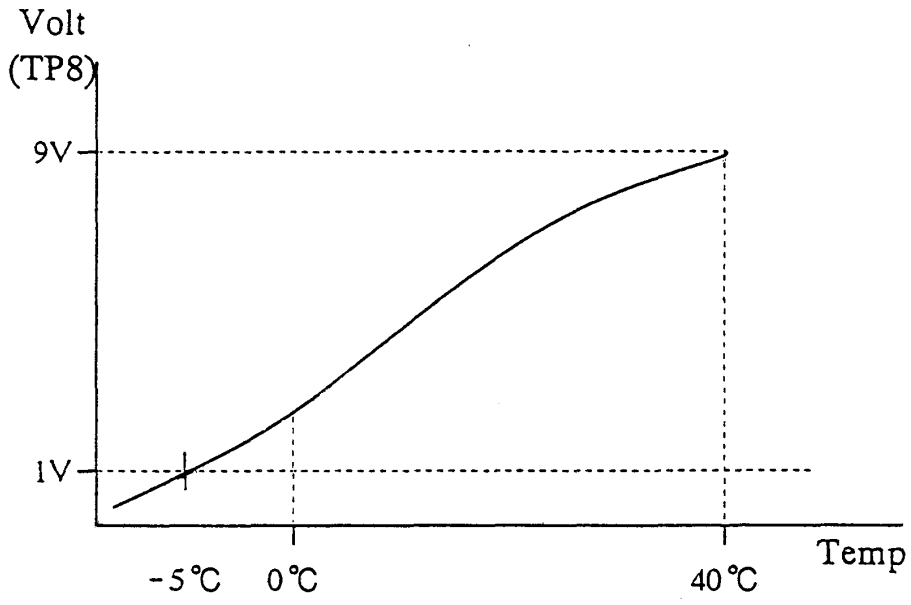


Fig. 2.11 Temperature Data (TP8)

2.1.5 Signal Transmission (CONT-A, CONT-B Boards)

Refer to the block diagram on page 2-2.

- **Echo, Depth and Temperature Data Reading by CPU**

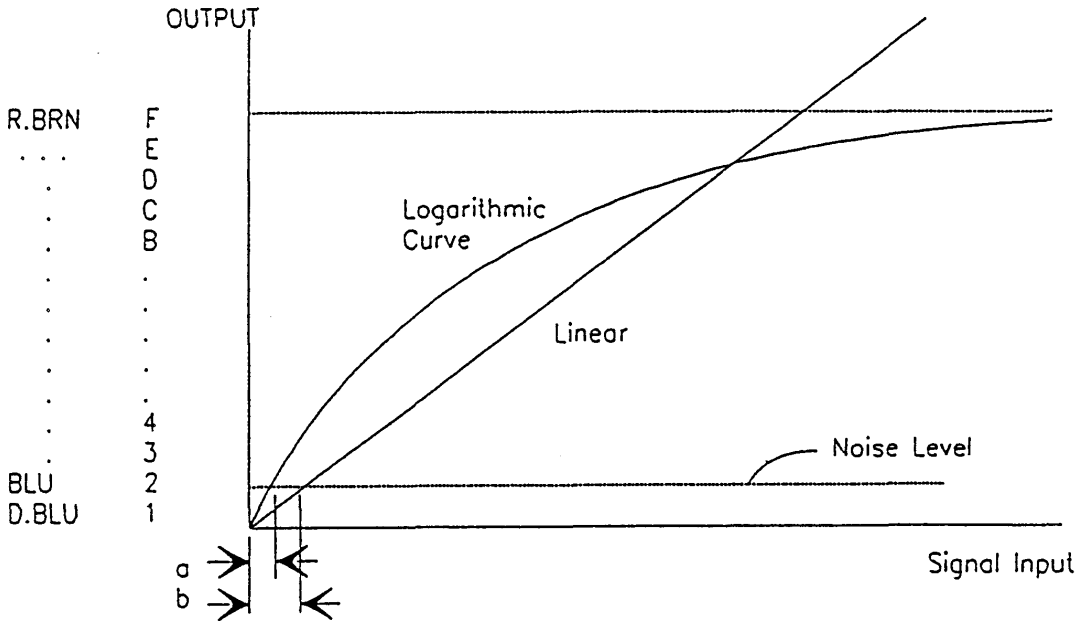
The eight bit echo data (256 step slices) from the TRS. A board are once applied to the dual-port RAM and finally transferred to the CPU. When writing the echo data into CPU, the sampling interval is controlled depending on the distance from the transmitter unit as shown in Table 2.1. In shorter ranges the data are picked up at shorter intervals to improve resolution. For example, in case of 320m range, the total sampling data are;

```
I ◄──────────────────────────────────────► I
0----------5----------10----------20----------40--------------------------320 m range
  512   +   256   +   256    +   256        3840 x 280/600 = 3072
```

Table 2.1

Range	Sampling Interval	Total Echo Data
0 - 5 m	1 cm	512
5 - 10 m	2 cm	256
10 - 20 m	4 cm	256
20 - 40 m	8 cm	256
40 - 640 m	16 cm	3840

The echo data read by CPU is compressed logarithmically from 8 bits to 4 bits and stored in scratch pad RAM U2 until they are read out for signal transmission. This logarithmic conversion enhances the low-level signals so that they may be less affected by noise during transmission toward the paravane receiver. If, for example, the noise level in the propagation path is as in Fig. 2.12, the signals within "b" are affected by noise in the linear conversion while those only within "a" are affected in the logarithmic conversion.



The low level signal Transmission can be improved against the noise.
*16 bits = 15 bits for signal + 1 bit for frequency calibration data

Fig. 2.12

Depth and temperature data from the SEN board are read by the CPU through the AD converter on the CONT B board and then stored in the scratch pad RAM U2.

- **Signal Transmission**

The temperature, upward and downward sounding and depth signals stored in the RAM are read out one after another according to the transmission format shown in Fig. 2.13. Those are D/A converted, frequency-modulated on the CONT B board and transmitted to the paravane receiver. Synchronous signals ("DOWN SYNC" and "UP SYNC") are made by software, stored in the ROM and read out at each transmitting timing.

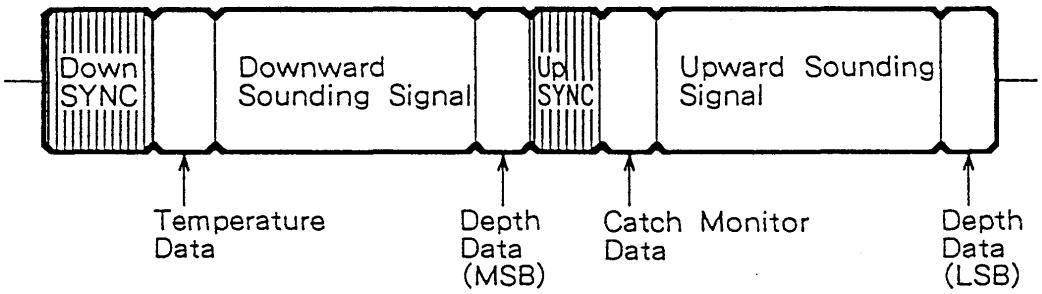


Fig. 2.13

The timers on the CONT A board operate as a frequency counter. It counts the Voltage to Frequency (V/F) converter output during the temperature data period and adjusts the signal level if V/P converter characteristic deviates from the rated range.

The echo data from the CPU consists of 8 bits (4 bits for echo data and 4 bits for frequency calibration data). The CPU determines the calibration value from timer's output count and writes it on the designated frequency calibration data bits to obtain 50kHz (33kHz, 40kHz) in no-modulation (no signal) state and 51kHz (34kHz, 41kHz) in maximum modulation state at TP1 and TP2.

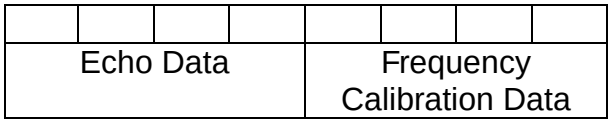


Fig. 2.14

The TON (Transmitter ON) is a gate signal which functions to cut the carrier signal for non signal period when transmitting the temperature, depth and catch monitor data. This control helps to conserve battery consumption. However, in the transmission period of upward and downward sounding data, the carrier signal is emitted even when there is no echo signal. Refer to Fig.1.8 TX unit timing chart.

- **Power Amplifier**

The output applied to the frequency divider is frequency-calibrated and FM-modulated signals. The frequency divider divides the frequency by 8 to produce the actual transmitting frequency of 33, 40 or 50kHz. A gate circuit is incorporated in the output of the frequency divider to provide the dead time to prevent the two power transistors from conducting simultaneously. The output of the frequency divider is sent to the power amplifier and applied to the transducer. The output power is 10W or 2.4W as determined by tap connections of the output transformer.

2.2 DISPLAY UNIT

The display unit consists of the following sections as shown in the block diagram on the next page.

(1) Power Supply (01 P5737)
(2) Amplifier Board (01P5725)
(3) Display and Signal Processing Board (01P5726)
(4) Panel Board (01P5729)
(5) Color Monitor (TM-140F2 or CDKC-14CE151)

2.2.1 Power Supply (POW 01P5727)

The power supply circuit is made up of a PWM (Pulse Width Modulation). Inverter employing switching regulator techniques like other Furuno-made echo sounders and radars. The PWM inverter universally operates on ship's mains of 10 - 40 VDC. Against the vibration of the load condition, it regulates the DC output line by changing the width of its output pulse. The power supply circuit provides +12 V, -12 V, +5V, and 130 V for the color monitor.

Each line is connected to the respective circuit as shown in Fig. 2.15.

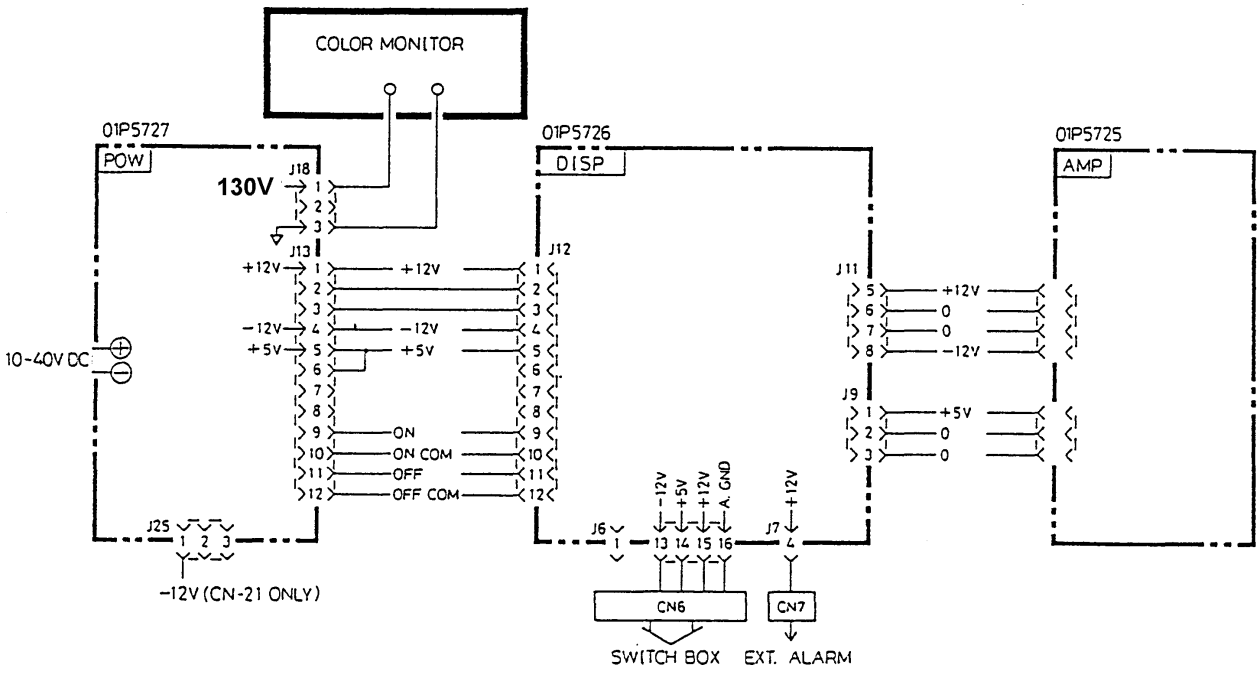


Fig. 2.15 Power Supply for Display Unit

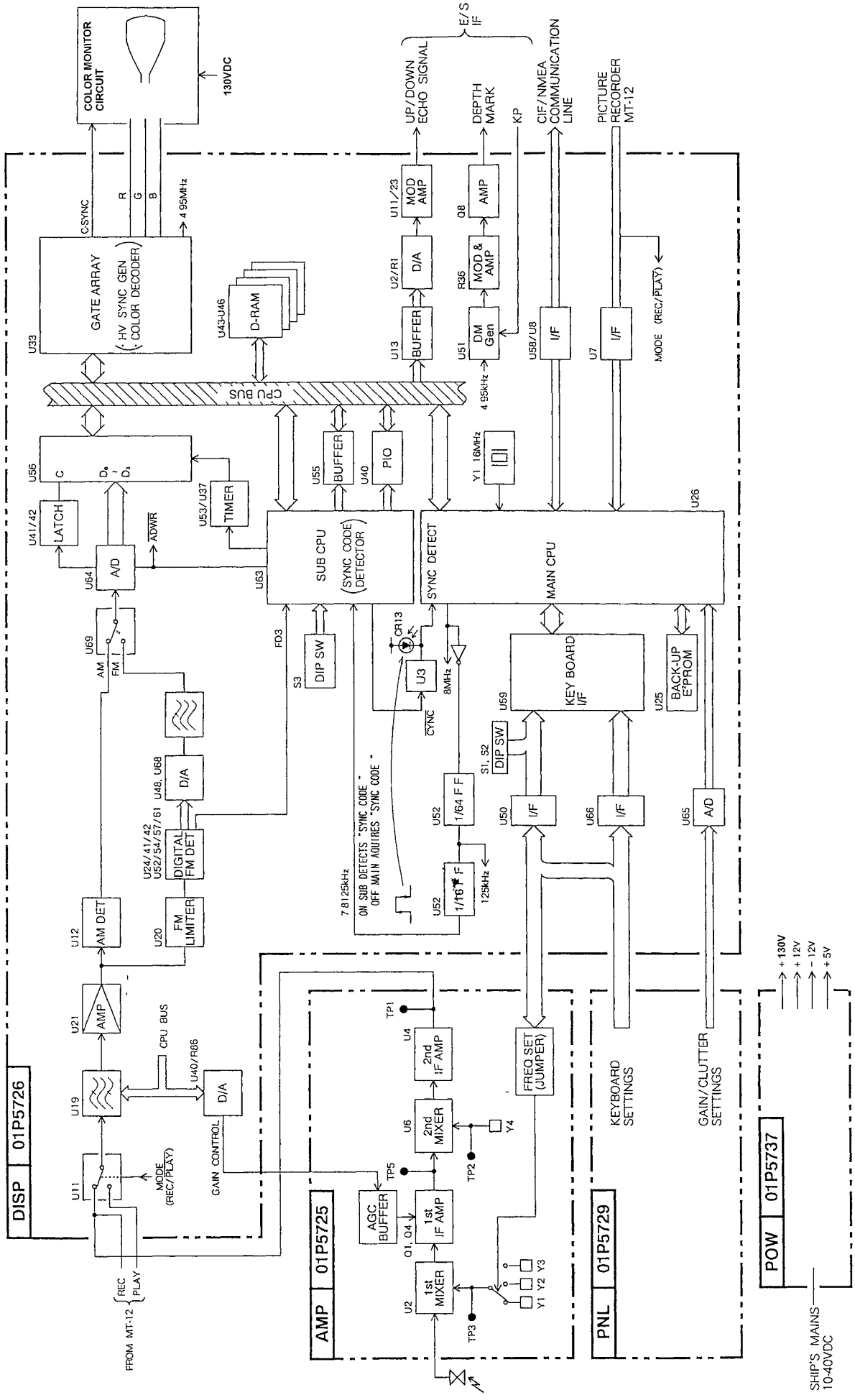


Fig. 2.16 Block Diagram of Display Unit

2.2.2 Receiver Board (AMP 01P5725)

On this board the FM and FS signals received through the receiving transducer is frequency-converted to be applied to the succeeding DISP board.

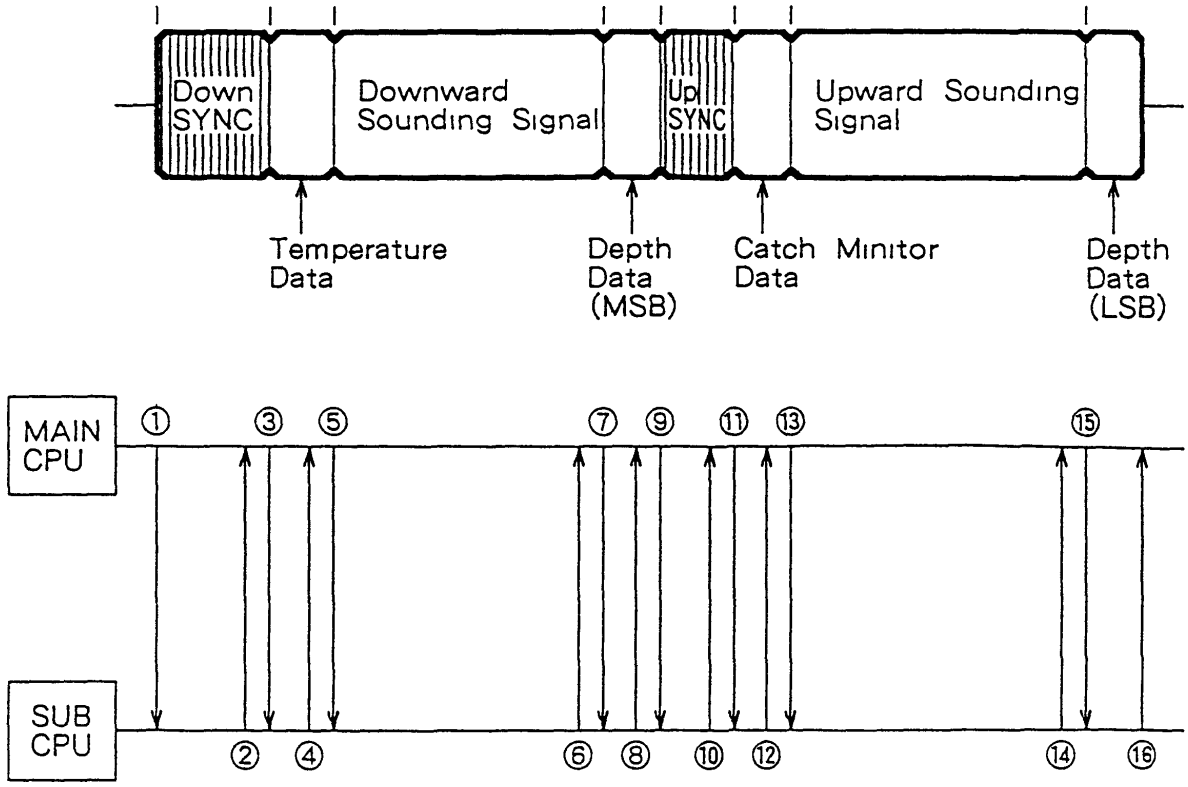
The received signals are sent to the first mixer where the frequency of the signals are converted to 455kHz IF frequency. The output of the first mixer is amplified and applied to the second mixer and IF amplifier. The output signal is 9.5±0.5 kHz (2nd IF frequency).
Amplifier gain and selection of the first local oscillators are controlled by the DISP board.

2.2.3 Display and Signal Processor Board (DISP 01P5726)

The DISP board incorporates two microcomputers, SUB and MAIN for enhanced processing speed. The SUB computer is a single chip MCU (Micro Computer Unit) which has a built-in ROM and RAM. Its major function is detecting the SYNC codes from the echo signal and sending them to the MAIN CPU. The MAIN CPU incorporates a built-in 256 byte RAM but no ROM. It uses an external ROM. The main functions are arithmetic processing of the temperature and depth data, the reading of operator's commands from the panel keys and writing the processed data into the video RAM via the gate array. It also acquires ship's speed data by communicating with external navigational equipment in the Furuno CIF format and generates the clock signal for the SUB MCU (SYNC code detector). The video RAM has three picture pages and one scale/character page. This enables instant switchover to the picture page selected by the presentation mode.

- **Echo Data Acquisition**

The FM echo signal (9.0 - 10.0 kHz) from the AMP board 01P5725 is led to the CPU-controlled low-pass filter U19 via selector U11. The selector selects the external (playback) signal if the picture recorder MT-12 is connected. Then, it is applied to the succeeding AM and FM detector circuits after being amplified by the buffer amplifier.
The AM detector functions to detect received signal strength. The FM detector demodulates the received FM signal.
Signal acquisition is performed by the combination work of the MAIN and SUB CPUs. First the SUB CPU detects the Down SYNC code from the received signal then the acquisition starts. The acquired data is directly transferred to the MAIN CPU's RAM (DMA transfer; Direct Memory Access) and interference rejection is executed if the "Noise Limiter" is turned on through the menu. Then the data is transferred to the video display RAM according to the presentation mode and the control of the gate array. See the signal acquisition sequence on the next page.



1 Down SYNC code detection command
2 Detection report
3 Temperature data acquisition command
4 Acquisition report
5 Down sounding data acquisition command
6 Acquisition report
7 Depth data(MSB) acquisition command
8 Acquisition report
9 Up SYNC code detection command
10 Detection report
11 Catch monitor data acquisition command
12 Acquisition report
13 Up sounding data acquisition command
14 Acquisition report
15 Depth data(LSB) acquisition command
16 Acquisition report

Fig. 2.17 Data Acquisition Sequence by CPUs

Reading Panel Setting Status

The operator's commands input through the control panel are all sent to the keyboard interface chip U59 via U66. It also collects the frequency data from the AMP board and setting of DIP switch. These status and data are acknowledged by the MAIN CPU to be processed following the operator's settings. Namely the operator selects the presentation mode of upward and downward combinations; for example, the MAIN CPU generates and sends the control command to the gate array to display the designated mode.

3. CHECK AND ADJUSTMENT

3.1 DISPLAY UNIT CHECK

As the CN-24 color net recorder is properly adjusted at the factory, no adjustment is required in the field. This also applies to the PC boards supplied as maintenance parts.
Do the following adjustments when malfunctioning is found or the equipment is overhauled.

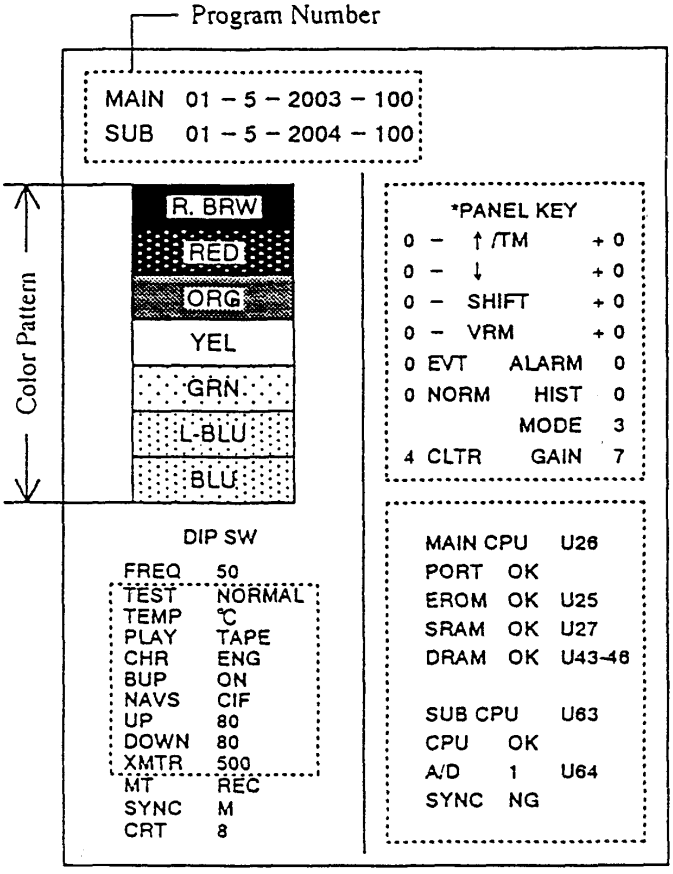
3.1.1 Self-Check

The self-check screen provides the information to check the following;

a) Panel switch contact
b) Function check (KP pulse, CIF line)
c) Device check (BEROM, SRAM, DRAM)

Procedure

1. Turn on the POWER for a few seconds, while pressing [-] key of TM RANGE. Self-check screen appears. The EVENT key functions to select a self-check; panel switch check and device/function check.
2. Check the functions in accordance with the figure 3.1.
3. To exit from the self-check mode, turn off the power.



PANEL SWITCH CHECK

To check keys for proper operation, press each key one by one while observing the screen. If the key is functioning properly, "0" is replaced by 1" when the key is pressed.
"ON" : 1. "OFF" : 0
Rotary switch -? contact number

DEVICE/FUNCTION CHECK

Pressing the VENT key moves the asterisk (*) to the item "MAIN CPU" and starts checking each device in the order displayed on the screen. In the DRAM check, the entire screen is alternately painted in reddish brown and white four times each. If everything is normal, "OK" appears. If something is wrong, nothing appears.

NOTE: PORT results

OK
1: defective CIF line
2: defective MT.12 line
3: Both CIF and MT.12 lines defective

To perform PORT check, connect dummy connector to J3. "1" is displayed without connection.

Indication of internal settings (S1 S2).
See pages 4-1 and 4-2.

Fig. 3.1 Self-Check

3.1.2 Power Supply Circuit (POW Board 01P5737)

Line Voltage Check

Voltage	Rated Value	Measuring Point	
		01P5726, DISP	01P5737
+5V	4.85 to 5.15 V	J12 #5	TP6
+12V	11.65t to 12.35 V	J12 #1	TP4
-12V	-12.6 to -11.4 V	J12 #4	TP5
+15 V			TP2
-15 V			TP3
+130V (TV)		-	TP1
GND		TP7 and TP8	TP7

Notes: 1) Confirm that each line voltage is within the rated value under the condition of maximum brilliance.
2) +130V line can be adjusted by R28.
3) Be careful not to short circuit +130V to ground while power is applied.
4) The current consumption of Display Unit is 1.7 to 2.3A.

Frequency Adjustment

Test Point	Adjusted by	Rated Value	Instruments
TP10 - TP8	R50	69.05 to 70.05kHz	Frequency Counter

3.2 TESTING FUNCTION IN AIR

3.2.1 Testing Transmitter Unit and Display Unit with Receiving Transducer.

Procedure

1. Arrange all units as shown below.

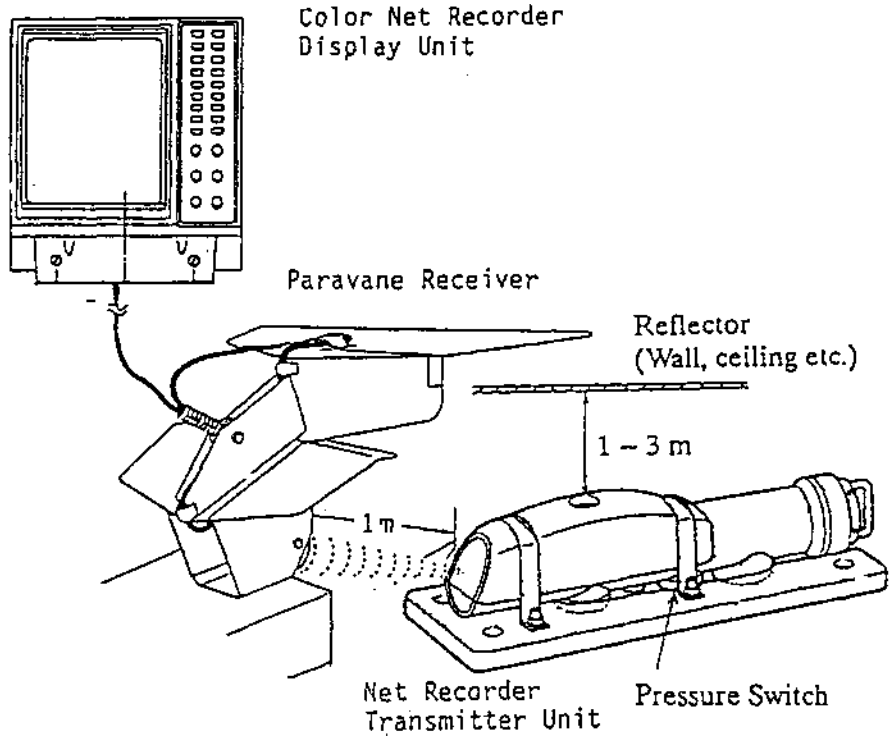


Fig.3.2

NOTE:

1) Stop the transmission within 5 minutes to prevent damage of transducer
2) The unit of 10 W TX output can not be checked in air The test can be done by one of two ways.
   - Reduce the output power down to 2.4Wand follow the procedures on page 4-4.
   - Place the TX unit in the water tank or bucket and check the operation. If signal transmitting transducer is working, you can hear the TX sound and sense the pressure on the transducer surface by hand. The display check can not be done with this method.

2. Rotate the screw of the pressure switch (test switch) clockwise with a screwdriver to turn on the transmitter unit.

3. Placing your finger on the radiating face, you can feel pulses if the transmission is made normally.

4. Turn on the display unit.
If all units (transmitter, receiver + cable and display unit) are operating satisfactory, some echoes are displayed on the screen. Note that the depth of echoes is four times greater than their actual depth since sound velocity in air is a quarter of the one in water.

5. If the operation check results are satisfactory, turn the test switch fully counterclockwise.

3.2.2 Test in Air without Paravane Receiver

Make the test cable and place the loop on the signal transmitting transducer as show in figure 7.3. The signal from the transducer can be picked up through the loop by the electromagnetic induction.

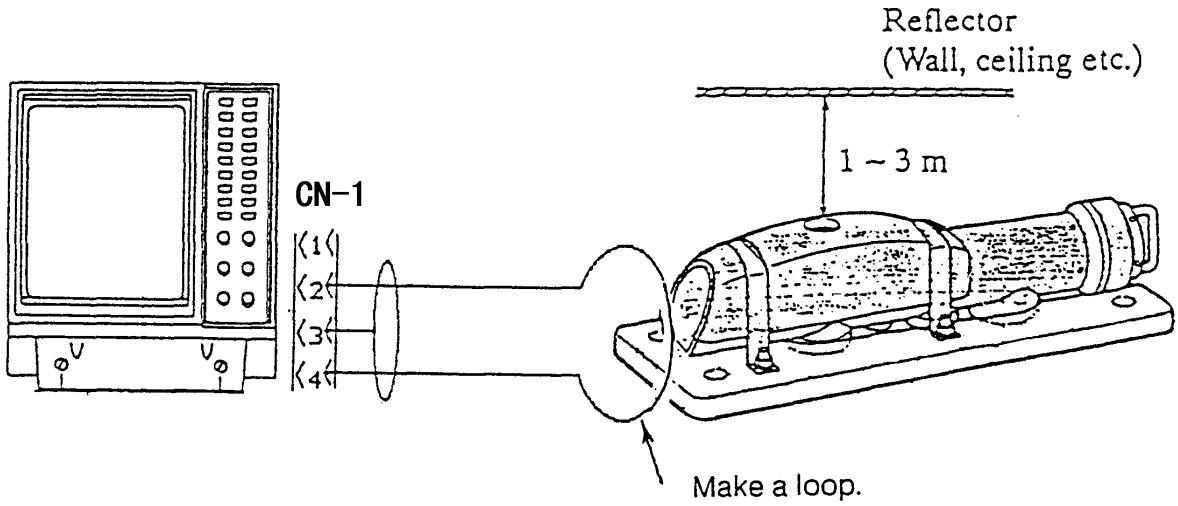


Fig. 3.3 Testing function in Air without Paravane Receiver

3.3 ADJUSTING TRANSMITTER UNIT

3.3.1 Gain Adjustment

The transmitter unit incorporates the preset potentiometers shown in the table. All potentiometers except for R17 (gain adjustment) on the TRS. A board are for factory adjustment. For R17, though it has been properly adjusted, readjust it when clear picture is not obtained. Note that too high gain setting will cause excessive noise.

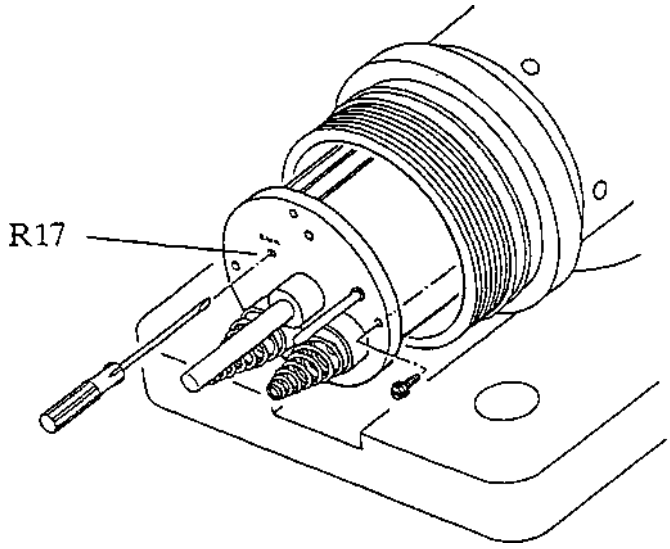


Figure 3.4 Gain adjustment

Function of adjusters in the transmitter unit

PCB	Pot.	Used for
CONT.B 01P5741	R5	Frequency deviation adjustment of FM modulation.
	R25	Frequency adjustment of FM modulation.
TRS.A 01P5742	R17	Gain adjustment of receiver circuit.
	R35	Maximum gain adjustment of receiver circuit.
	R38	STC (Sensitivity Time Control) curve adjustment.
SEN 01P5744	R10	Offset adjustment of depth measurement circuit.
	R11	Gain adjustment of depth measurement circuit.
	R12	Calibration of water temperature measurement circuit.

3.3.2 Depth Indication Adjustment

A oil pressurize instrument is required to adjust the depth indication.

Without the oil pressurize instrument, compensate the depth error by the "Net Depth" setting in menu screen and offset adjuster R10 on the SEN board.

Following shows the procedure to adjust the offset value "0 m" on the SEN board(01P5744).

1. Connect the test cable or receiving transducer as shown in figure 5.1 and 5.2.
2. Pull out the PC board assembly by the extension cable.

3. Operate the transceiver unit in air
4. Adjust the R10 on the SEN board as follows;
   1) When depth indication is "0m", turn the R10 on the SEN board to CW slowly so that the depth indication becomes 1m. Then turn the R10 slowly to CCW by a point where the depth indication starts to change from 1m to 0m.
   2) When depth indication is not 0m, turn the R10 to CCW slowly by a point where the depth indication starts to change to 0m.

Note: Do not adjust R11 on the SEN board without the oil pressurize instrument.

3.3.3 Adjusting Transmission Frequency on the CONT.B Board

When change the transmission frequency or the CONT.B board (01P5741). The V/F conversion circuit on the CONT.B board must be adjusted for each transmission frequency. (When only the CONT.B board is delivered, it is adjusted for the frequency 50kHz.)

Necessary Instrument

1. Oscilloscope
2. Signal generator
3. Frequency counter

Caution

Improper settings of the DIP switch may destroy the data of EVRAM on the SEN board.
Do not set the DIP switches S1 and S2 as follows, while adjusting the PC board.

S1	#1	#2	#3	#4	#5	#6	#7	#8
	OFF	OFF	ON	ON	X	X	X	OFF

S2	#1	#2	#3	#4
	OFF	OFF	OFF	OFF

When the S1 and S2 are set to above, the loading mode for NVRAM starts, and then all calibration data stored in factory may be canceled. In this case readjustment by using the oil Pressurize instrument is required.

Adjustment

1. Connect PC board assembly to the transmitter unit, using extension cable.
2. Record the present setting of the DIP switches S1 and S2 on the CONT.B board.
3. Set the DIP switch S1 as shown below;

Transmission frequency	S1							
	#1	#2	#3	#4	#5	#6	#7	#8
50 kHz	OFF	ON	ON	ON	ON	OFF	ON	ON
40 kHz	OFF	ON	ON	ON	ON	ON	OFF	ON
33 kHz	OFF	ON	ON	ON	ON	OFF	OFF	ON

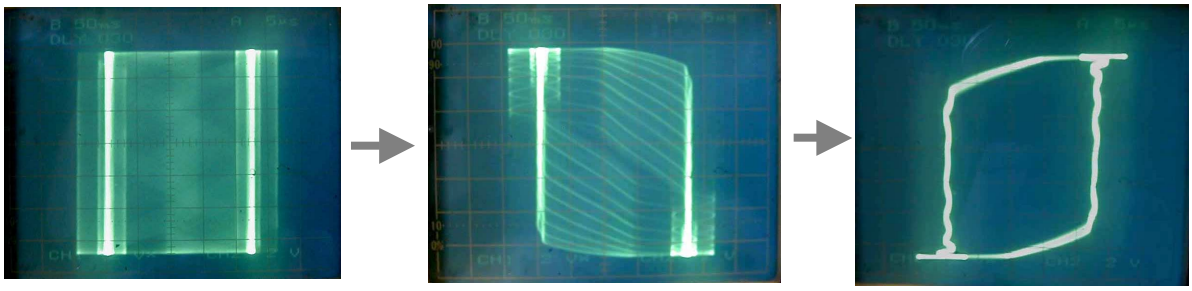
4. Connect the frequency counter to TP1(VFO) on the CONT.B board
5. Set all bits of the DIP switch S2 to OFF.
6. Turn on the transmitter unit by rotating the test screw of the pressure switch.
7. Adjust R25 on the CONT.B board so that the frequency obtained at the TP1 becomes as follows,

Transmission frequency	Frequency at TP1
50 kHz	400 kHz
40 kHz	320 kHz
33 kHz	264 kHz

8. Connect a probe CH1 of the oscilloscope to TP2 on the CONT.A board and the CH2 to the signal output of the signal generator.
9. Set the output frequency of the signal generator as shown bellow;

Transmission frequency	Signal generator
50 kHz	50 kHz
40 kHz	40 kHz
33 kHz	33 kHz

10. Select X-Y mode on the Oscilloscope in order to display the "Lissajous figure".
11. Adjust the R25 so that the "Lissajous figure" obtained on the oscilloscope becomes stable.



Waveform before adjustment adjusting Adjusted properly

Figure 3.5 Lissajous figure

11. Set the DIP switch S2 #4 to ON.

12. Turn the test switch off.

13. Set the DIP switch S1 as shown below;

Transmission frequency	S1							
	#1	#2	#3	#4	#5	#6	#7	#8
50 kHz	OFF	OFF	ON	ON	ON	OFF	ON	ON
40 kHz	OFF	OFF	ON	ON	ON	ON	OFF	ON
33 kHz	OFF	OFF	ON	ON	ON	OFF	OFF	ON

14. Set the DIP switch S2 #4 to OFF(all bits of S1: OFF).
15. Turn on the test switch
16. Adjust R5 on the CONT.B board so that the frequency obtained at the TP1 becomes as follows,

Transmission frequency	Frequency at TP1
50 kHz	408 kHz
40 kHz	328 kHz
33 kHz	272 kHz

Note; the frequency obtained at TP1 may be unstable, since it is modulated.

17. Set the output frequency of the signal generator as shown bellow;

Transmission frequency	Signal generator
50 kHz	51 kHz
40 kHz	41 kHz
33 kHz	34 kHz

18. Adjust the R5 so that the "Lissajous figure" obtained on the oscilloscope becomes stable, as shown in figure 3.3.
19. Set the DIP switch S2 #4 to ON.
20. Turn the pressure switch OFF
21. Set all other bits of DIP switches S1 and S2 to the original settings recorded in step 2.

3.4 ADJUSTMENT OF DISPLAY UNIT

3.4.1 Color Monitor Adjustment

Focus/brilliance

Call the self-check page by turning on the POWER while pressing [-] key of the TM RANGE.

1. Set the BRILLIANCE control at maximum.
2. Set the FOCUS pot. for the sharpest picture.

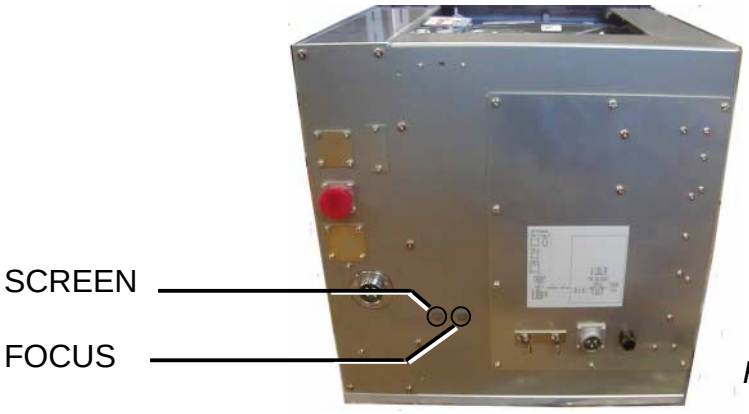


Fig.3.6 Display Unit Rear View

Adjusters on the CE MAIN board of the Monitor Unit

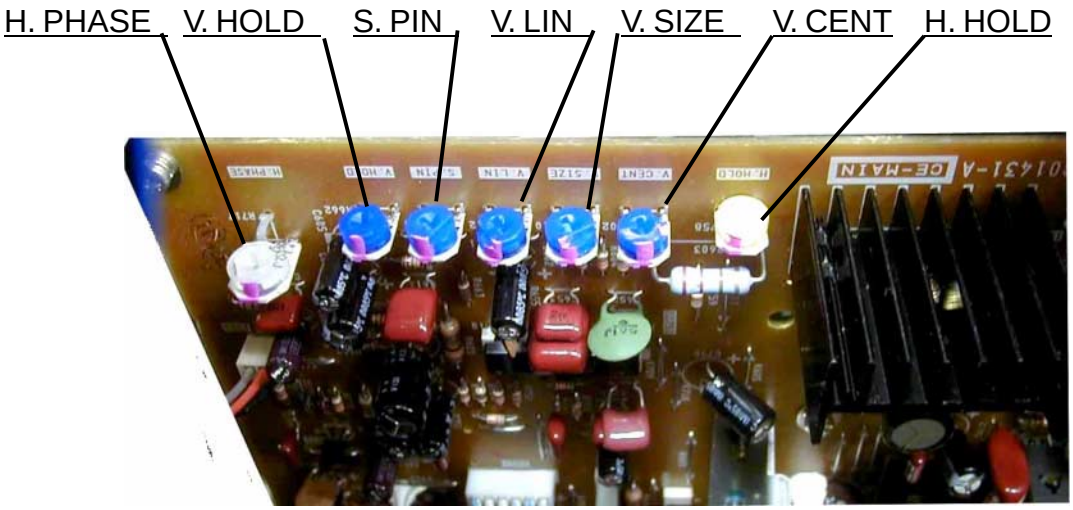


Fig.3.7 Adjusters on the CE MAIN board

3.4.2 DISP Board (01P5726)

Set the BRILLIANCE control at max. position, and the DEEP BLUE background is clearly distinguished from the blank area surrounding it. Set R64 (H-POSITION) so that the upper and lower blank areas become equal in width.

Set R65 (BLUE) to the center position. Adjust R66 (RED) so that the reddish brown can be identified under the BRILLIANCE setting of "4" to "6" position.

NOTE: Do not adjust the potentiometers on the CE VIDEO board connected to the CRT neck.

4. CHANGE OF SPECIFICATIONS

4.1 DISPLAY UNIT

4.1.1 Range Unit, Sounding Range, Data Format, etc.

Procedures

1) Turn off the power by pressing the PWR and OFF keys simultaneously.
2) Remove the display cover by loosening the fixing screws.
3) Change the settings of DIP switches S1, S2 and S3 on the DISP board 01P5726 referring to the figure/table below.

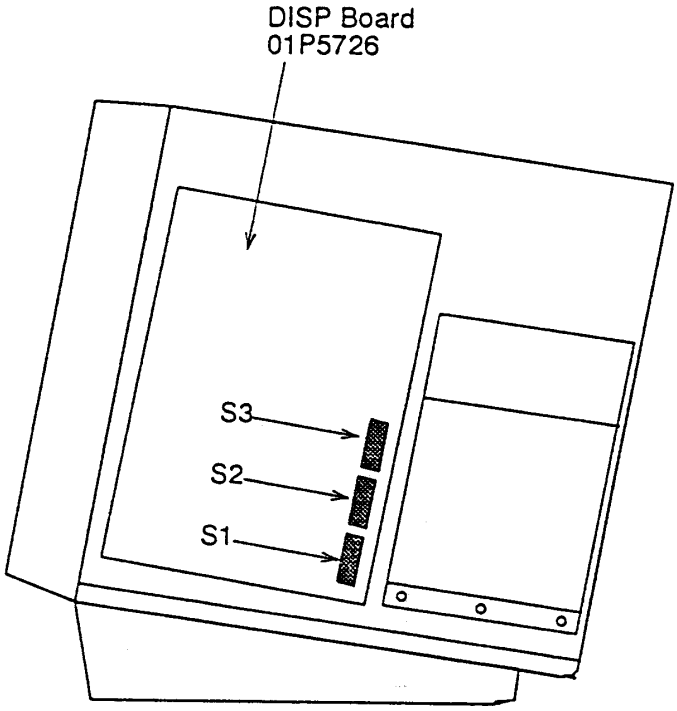


Fig 4.1 Locations of the dip-switches S1, S2, and S3

[S1 SETTINGS] - - For Display

No.	ITEMS		SETTING/CONTENTS							
1	Range Unit	RANGE UNIT	ON	M	OFF	FT	ON	FA	OFF	P/B
2			ON		ON		OFF		OFF	
3	Data Format	NAVS	ON	CIF			OFF	NMEA *2		
4	Memory back Up	BACK UP	ON	On			OFF	Off		
5	Menu Language	CHR	ON	English			OFF	Japanese		
6	MT-12 Operation *1	PLAY	ON	TAPE			OFF	PANEL		
7	Temperature	TEMP	ON	°C			OFF	°F		
8	Operating Mode	MODE	ON	Normal			OFF	Test		

* 1. This setting enables/disables the gain/clutter controls when playing back picture from picture recorder MT-12.

"ON": Gain/clutter controls are disabled. The recorded picture is played back as it is.
"OFF": Gain/clutter controls are enabled. The recorded picture can be gain/clutter controlled.

*2. No NMEA input/output data.

[S2 SETTINGS] - - For Synchronizing with Transmitter Unit

No	ITEMS		SETTING/CONTENTS							
1	Not used									
2										
3	Pressure sensor Max	XMTR	ON	2000 m	OFF	1000	ON	500		
4	Depth	TYPE	OFF		ON	m	ON	m		
5	Downward Sounding	DN	ON	80 m	OFF	160m	ON	320	OFF	640 m
6	Range	RANGE	ON		ON		OFF	m	OFF	
7	Upward Sounding	UP	ON	80m	OFF	160m	ON	320	OFF	640 m
8	Range	RANGE	ON		ON		OFF	m	OFF	

Note:

1. The upward/downward range settings on the display unit and the transmitter unit must be identical.
2. The maximum depth setting of the CN-2220 must be 2000m, since the pressure sensor in the transmitter unit is adjusted to 2000m in the maximum depth.

[S3 SETTINGS] - - For Synch Code detection (Threshold)

No	ITEMS		SETTING/CONTENTS	
1	Downward Synch Code (31 bit)	OFF	Allowance "5"	Do not change settings locally.
2		ON		
3		OFF		
4	Temperature/depth/Upward Synch Code (16 bit)	ON	Allowance "2"	
5		OFF		
6		ON		
7	Not used			
8				

NOTE: Hatched areas are factory settings.

4.2 TRANSMITTER UNIT

4.2.1 Sounding Range

The sounding range is set with DIP switch S1 on the CONT-B 01P5741 board. The switch is factory-set to 80m for both the upward and downward ranges. To change the factory setting, refer to the figure below.

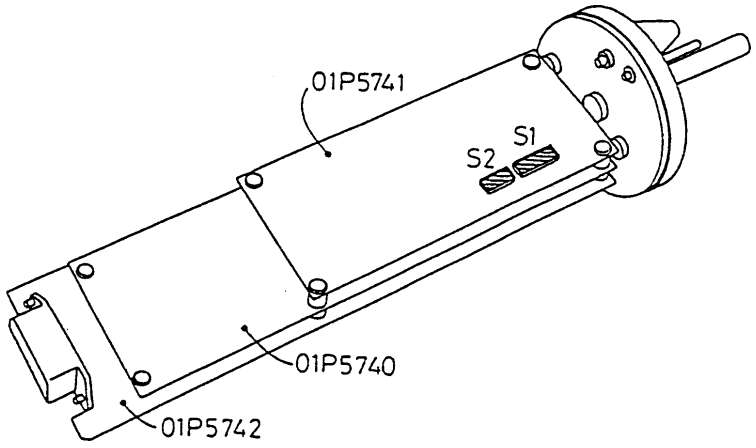
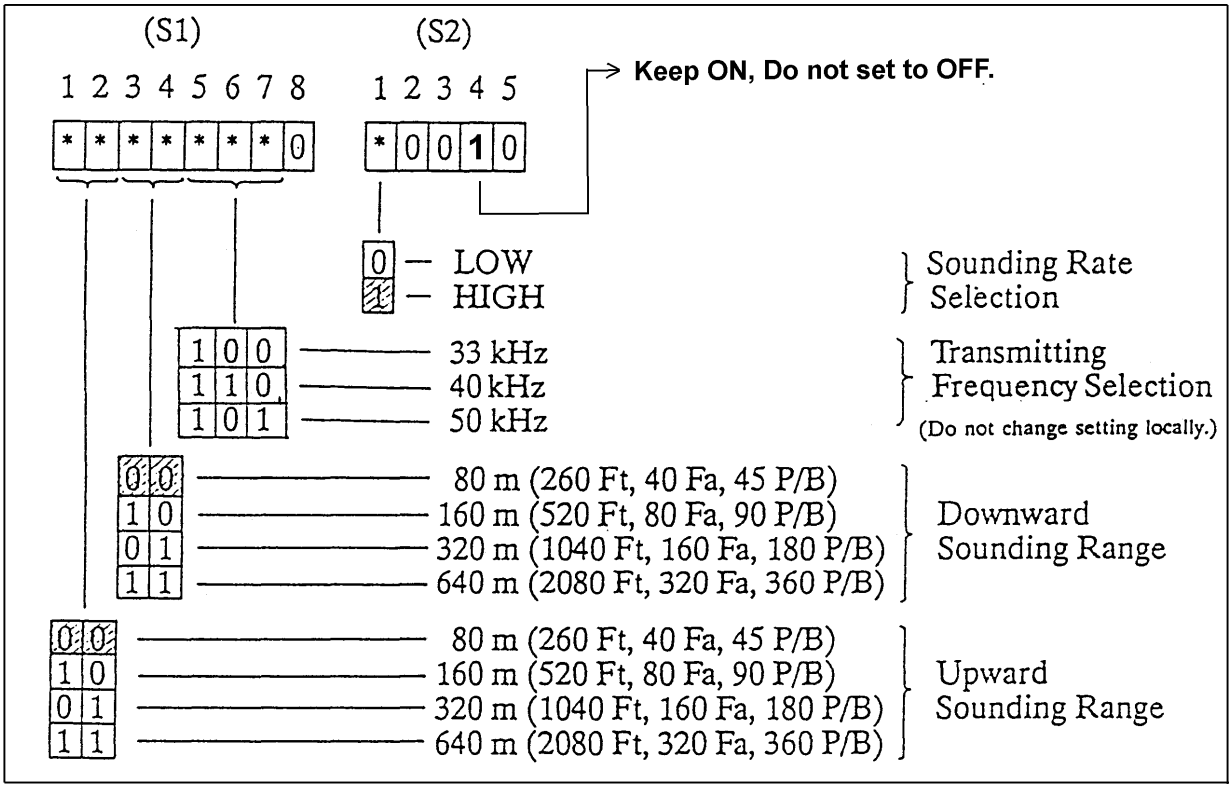


Fig. 4.2 S1, S2 Location

S1, S2 DIP SWITCH SETTING in Normal Operation Mode



Note: The sounding range determinates the maximum range for echo reception.

4.2.2 Sounding Rate

The sounding rate is set with S2 (#1) DIP switch on the CONT-B 01P5741 board. The switch is factory-set to "HIGH" (190 times/min).

When "LOW" is selected, the rate is down to 1/3 approximately. See table below.

The relation between sounding rates and Upward/Downward ranges is shown below.

RANGE (Up/Down)		80/ 80	160/ 80	160/ 160	320/ 80	320/ 160	320/ 320	640/ 80	640/ 160	640/ 320	640/ 640
Sounding Rate	LOW	63	59	55	51	48	43	37	36	33	27
	HIGH	190	177	165	154	145	130	113	108	99	81

4.2.3 Signal Transmitting Power

The signal transmitting power can be changed from 2.4W to 10 W or vice versa by changing the jumper connections (Jxx1 and Jxx2) on the CONT-A Board (01P5740).

Note: Increasing output power decreases the battery operating hour by 50% approximately.

The factory setting of the Output Power is 2.4 W

TX Freq.	Jumper Settings			Output Power
	Jxx1	Jxx2	Jxx3	
33kHz	A-LA	B-LB	2	2.4W
	A-HA	B-HB		10 W
40kHz	A-LA	B-LB	2	2.4W
	A-HA	B-HB		10 W
50kHz	A-LA	B-LB	1	2.4W
	A-HA	B-HB		10 W

The jumper Jxx3 must be set according to the frequency.

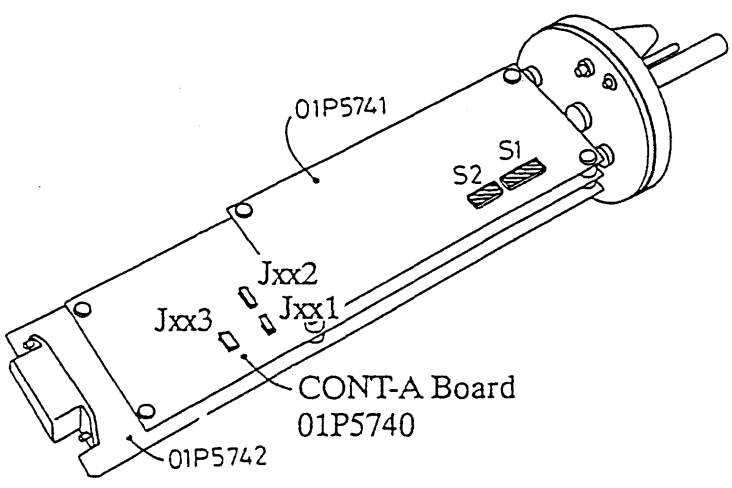


Fig. 4.3 Location of Jumper Blocks

4.2.4 Adjustment Mode

The DIP switches S1 and S2 are used when depth and transmission frequency adjustments are required.
The adjustment mode starts automatically when the DIP switch S2 #4 is set to OFF.
Following table shows the function of each settings of the S1 and S2.

0: OFF, 1: ON

S1								S2					Functions
1	2	3	4	5	6	7	8	1	2	3	4	5	
0	0	0	0	x	x	x	0	0	0	0	0	0	Adjusts offset (0 m) of depth scale
1	0	0	0	x	x	x	0	0	0	0	0	0	Adjusts full scale (2000m) of depth scale
0	1	0	0	x	x	x	0	0	0	0	0	0	Stores offset data of 1/5 section into RAM temporally
1	1	0	0	x	x	x	0	0	0	0	0	0	Stores full-scale data of 1/5 section into RAM temporally
0	0	1	0	x	x	x	0	0	0	0	0	0	Stores offset data of 2/5 section into RAM temporally
1	0	1	0	x	x	x	0	0	0	0	0	0	Stores full-scale data of 2/5 section into RAM temporally
0	1	1	0	x	x	x	0	0	0	0	0	0	Stores offset data of 3/5 section into RAM temporally
1	1	1	0	x	x	x	0	0	0	0	0	0	Stores full-scale data of 3/5 section into RAM temporally
0	0	0	1	x	x	x	0	0	0	0	0	0	Stores offset data of 4/5 section into RAM temporally
1	0	0	1	x	x	x	0	0	0	0	0	0	Stores full-scale data of 4/5 section into RAM temporally
0	1	0	1	x	x	x	0	0	0	0	0	0	Stores offset data of 5/5 section into RAM temporally
1	1	0	1	x	x	x	0	0	0	0	0	0	Stores full-scale data of 5/5 section into RAM temporally
0	0	1	1	x	x	x	0	0	0	0	0	0	Loads all data of RAM onto NVRAM
	0	0	1	x	x	x	1	0	0	0	0	0	Temperature adjustment mode selection
	1	0	1	x	x	x	1	0	0	0	0	0	
	0	1	1	A	B	C	1	0	0	0	0	0	Transmission frequency adjustment mode selection "GAIN"
	1	1	1	A	B	C	1	0	0	0	0	0	Transmission frequency adjustment mode selection "Offset"

X: any position.
A, B, C: sets according to transmission frequency.

Caution
Do not activate the adjustment mode, if any adjustments are not nessesary.

5. PARTS LOCATION

5.1 DISPLAY UNIT

Fig. 5.1 Display Unit side view

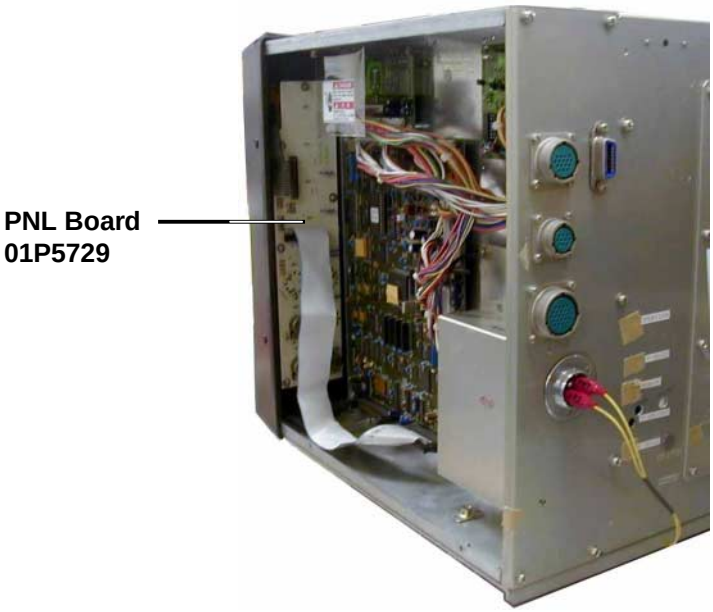


Fig. 5.2 Display Unit rear side view

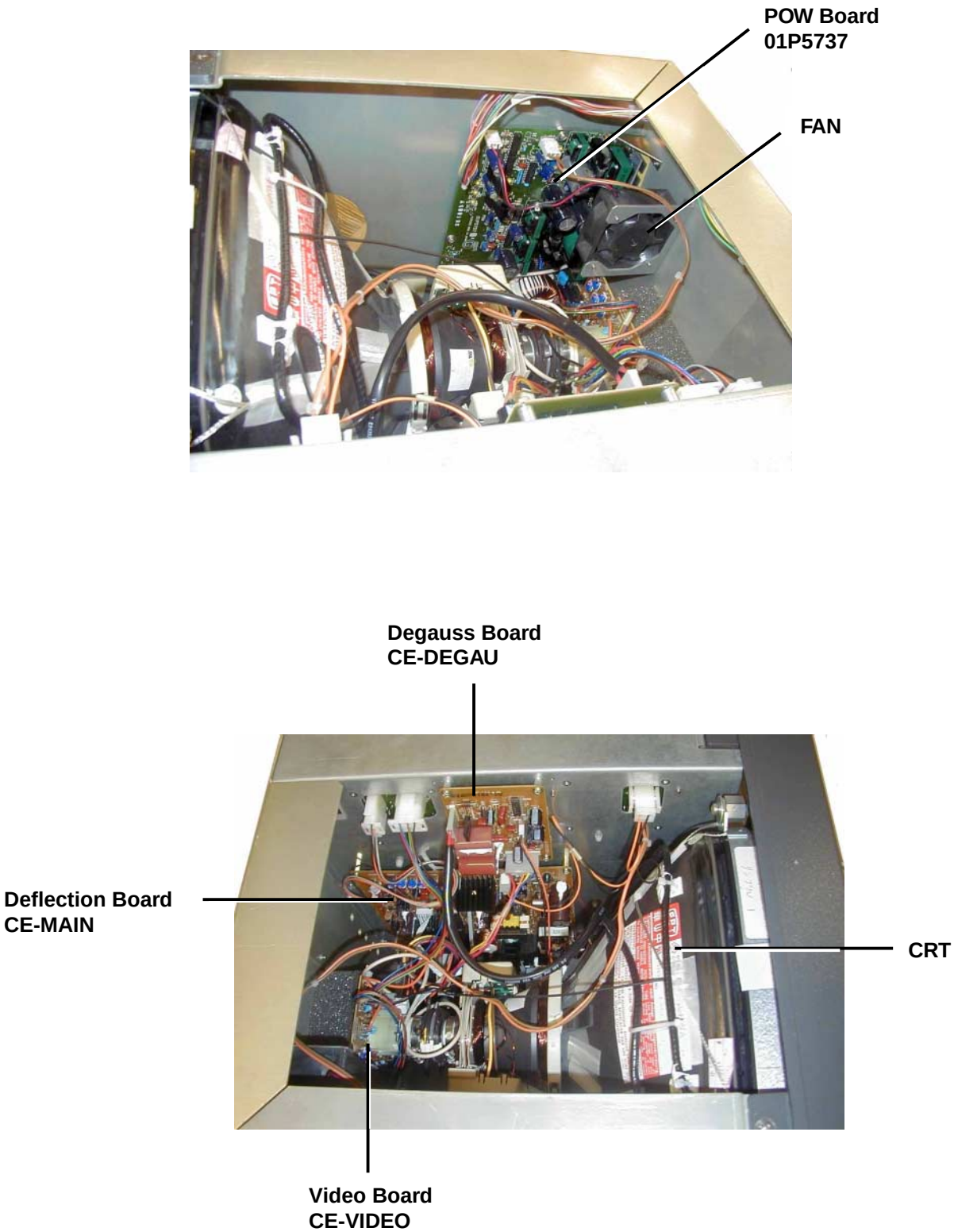


Fig.5.3 Display Unit; top view

DISP Board (01P5726)

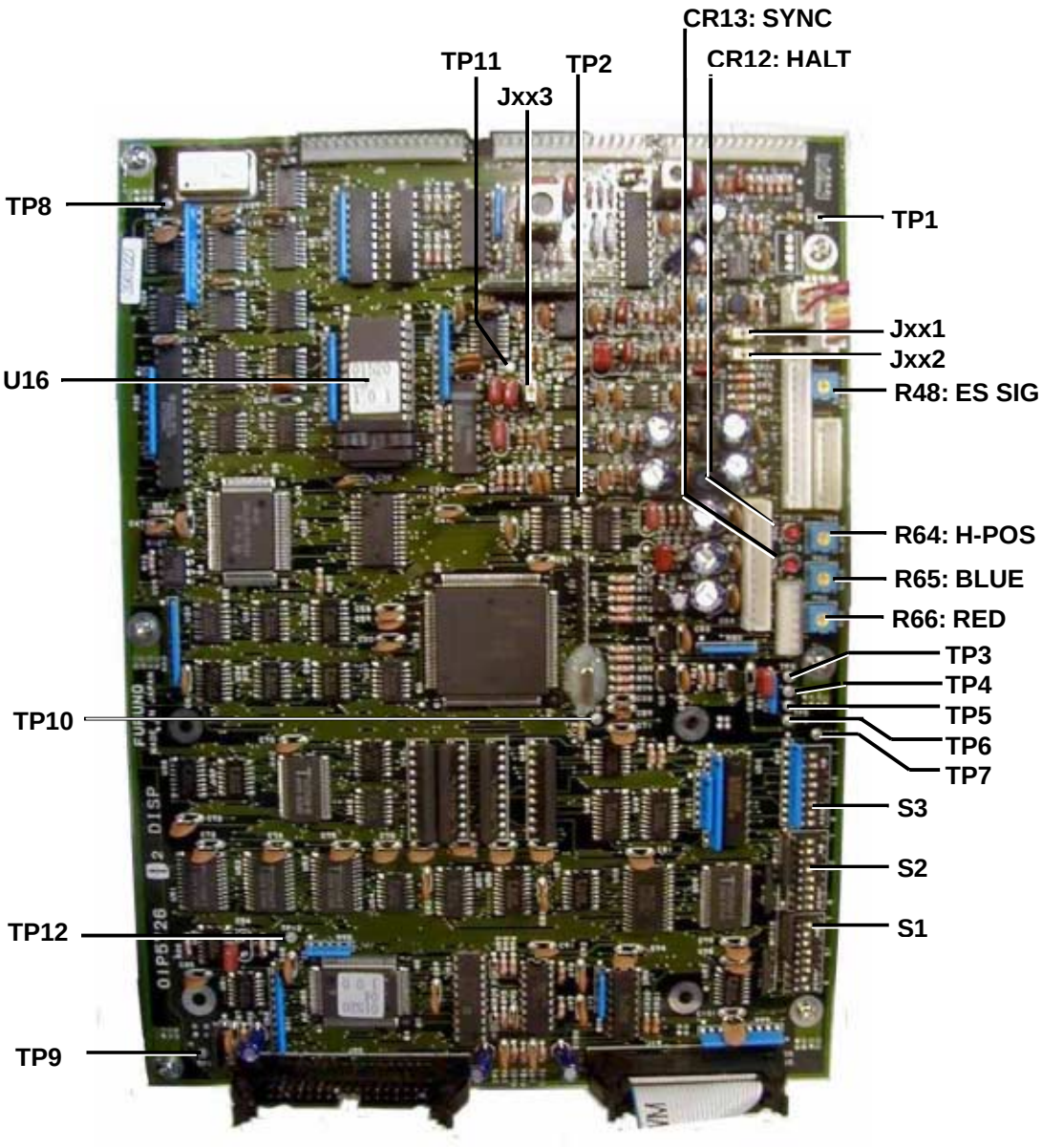


Fig. 5.4 DISP board

Adjusters	Names	Functions
R48	ES SIG	Adjusts signal output voltage for external unit
R64	H-POS	Adjusts vertical position of display, see chapter 3
R65	BLUE	Adjusts blue signal voltage, see chapter 3
R66	RED	Adjusts red signal voltage, see chapter 3

LEDs	Names	Functions
CR12	HALT	Always off
CR13	SYNC	Blinks when sync.code is detected

Jumpers	Functions
Jxx1	Set the signal transmitting power, see chapter 4.
Jxx2	
Jxx3	

Test Points		Remarks
TP1	SIG	Signal input from AMP board
TP2	AM OUT	Signal output from AM detector circuit
TP3	COP. SYNC.	Composite synchronous signal for monitor circuit
TP4	BLUE	Signal output "Blue"
TP5	GREEN	Signal output "Green"
TP6	RED	Signal output "Red"
TP7	GND	O V
TP8	GND	
TP9	GND	
TP10	GND	
TP11		Input of digital filter "U19"
TP12	100K	

Dip-Switches	Functions
S1	See chapter 4
S2	
S3	

AMP Board (01P5725)

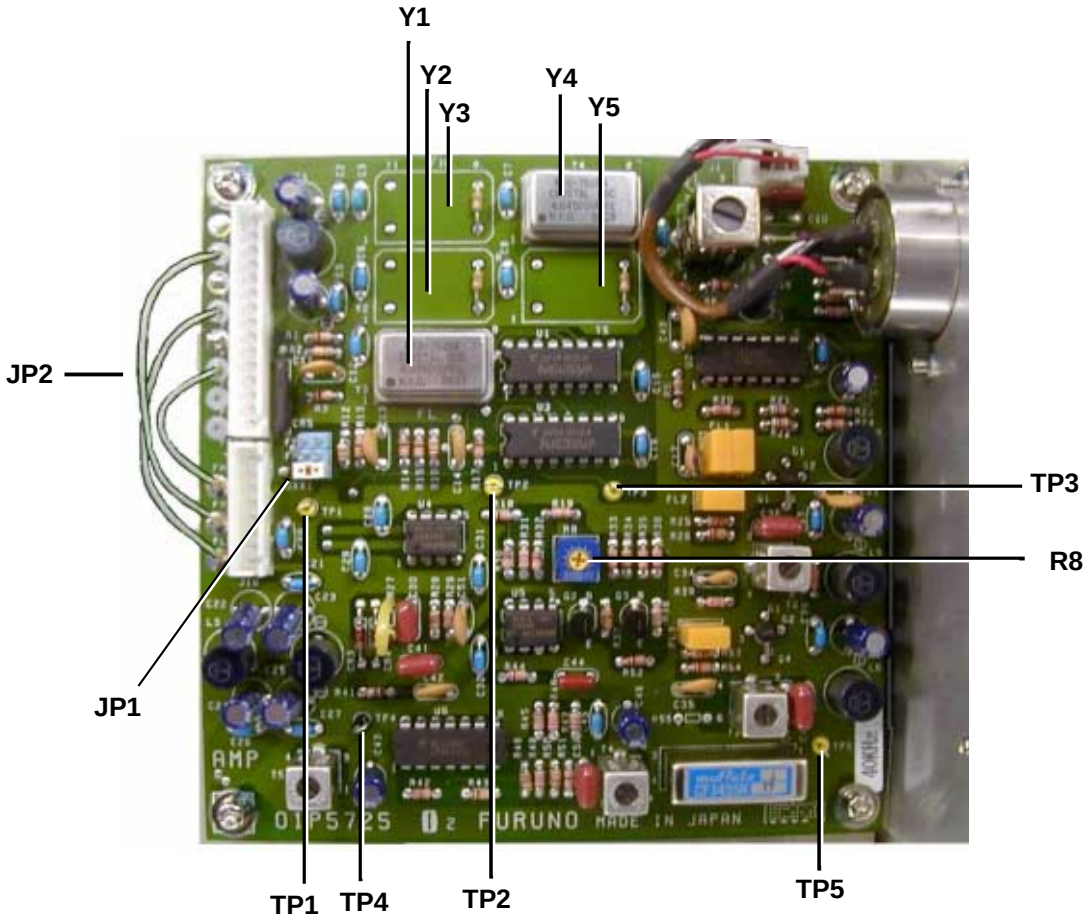


Fig. 5.5 AMP board

Adjuster	Name	Adjusting
R8	Preset gain	Adjust total gain of AMP circuit to 91 dB

Test Points	Names	Functions
TP1	SIG	Signal output of AMP circuit, maximum voltage;11 Vpp and 9 to 10 kHz
TP2	2nd Local	464.5 kHz
TP3	1st Local	505.5 kHz for 50 kHz, 488.5 kHz for 33 kHz, 495.5 kHz for 40 kHz
TP4	Analogue GND	
TP5	IF output	

Jumpers	Remarks
Jxx1	See chapter 7
Jxx2	

POW Board (01P5737)

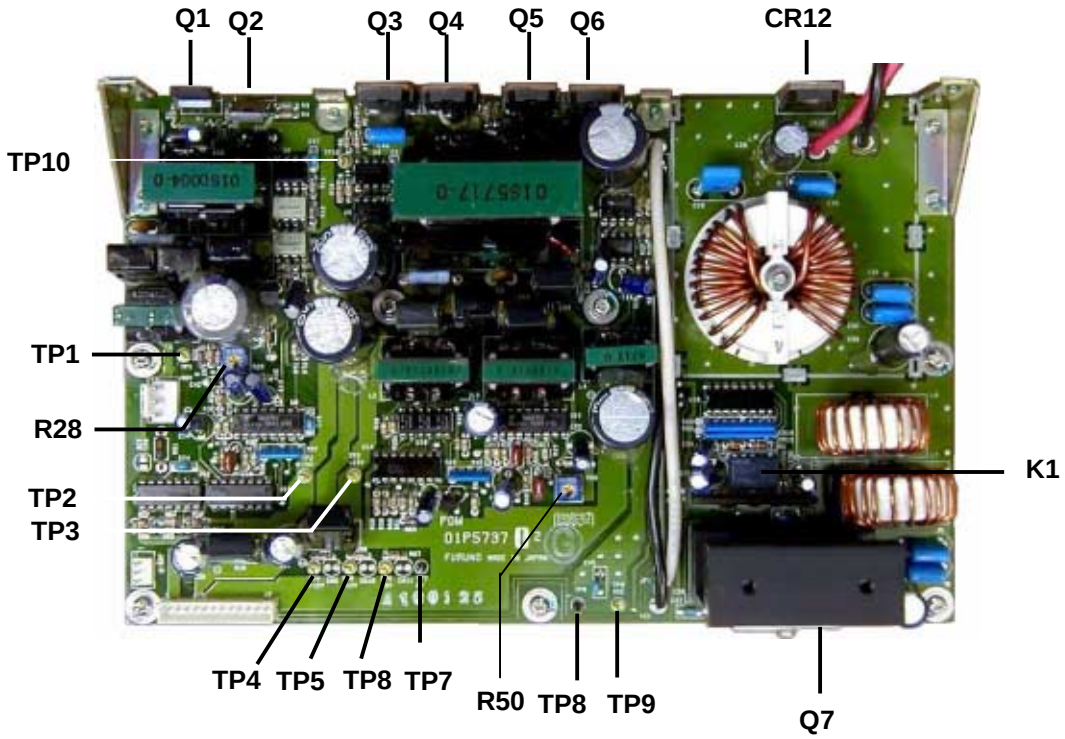


Fig. 5.6 POW board

Test Points	Names	
TP1	130 V	
TP2	+15 V	
TP3	-15 V	
TP4	+12 V	
TP5	-12 V	
TP6	5 V	
TP7	0 V	
TP8	-	Negative line of Ship's Main
TP9	Vcc	
TP10		

Adjusters	Names	
R28	+90 v ADJ	
R50	FREQ ADJ	

5.2 TRANSMITTER UNIT (CN-2220)

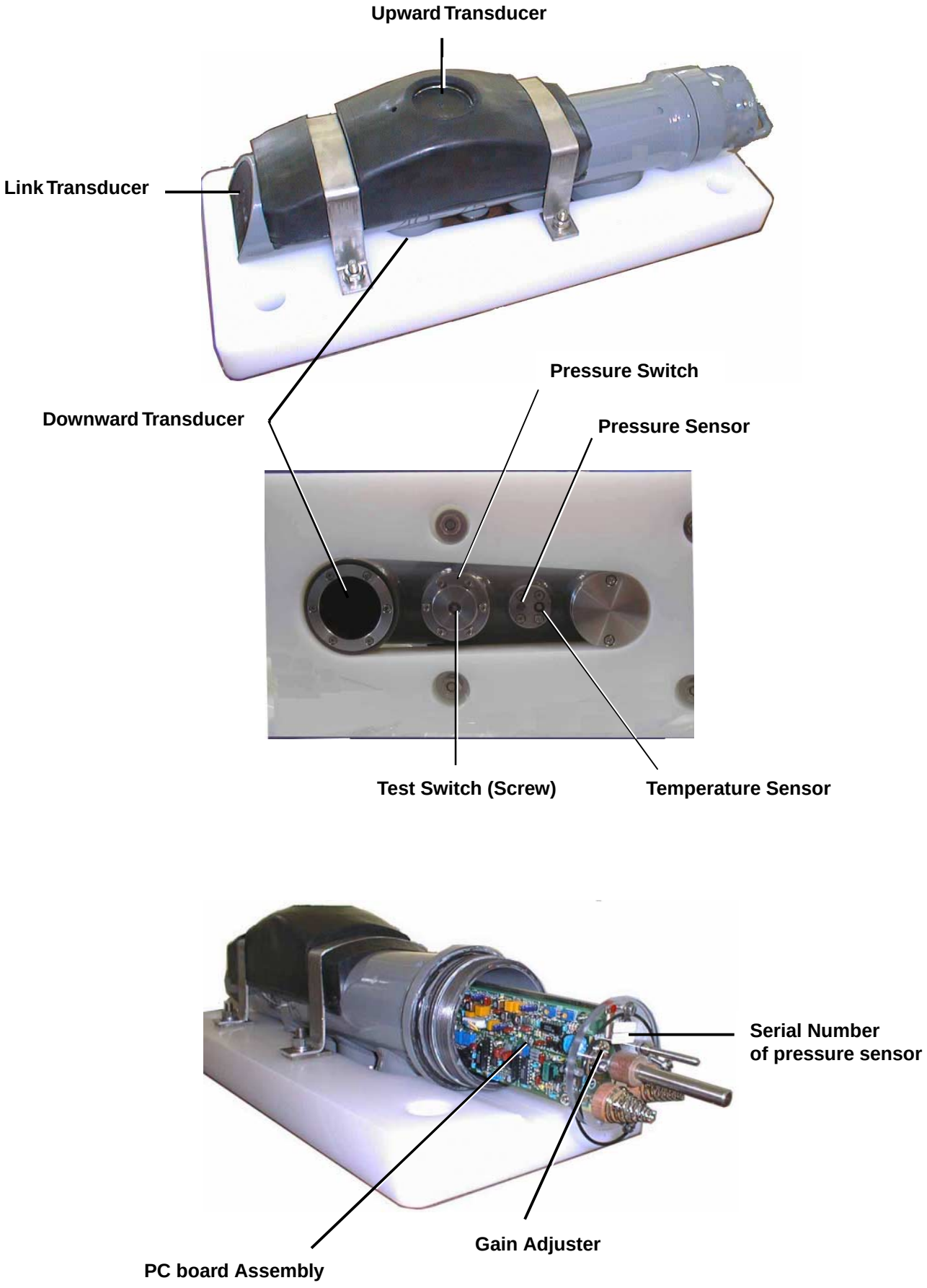
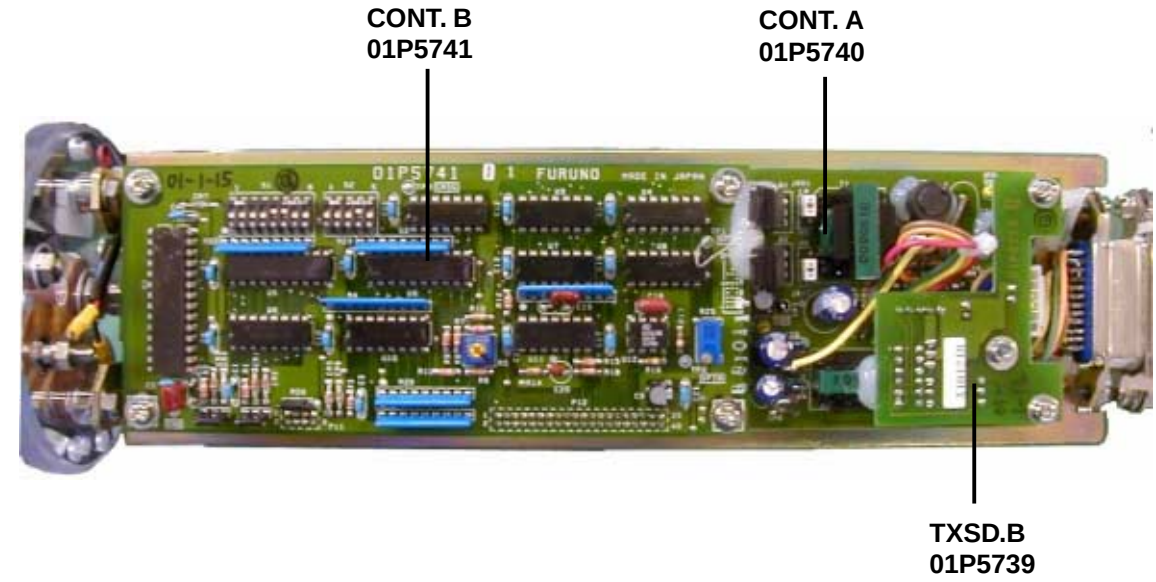


Fig 5.7 Transmitter Unit



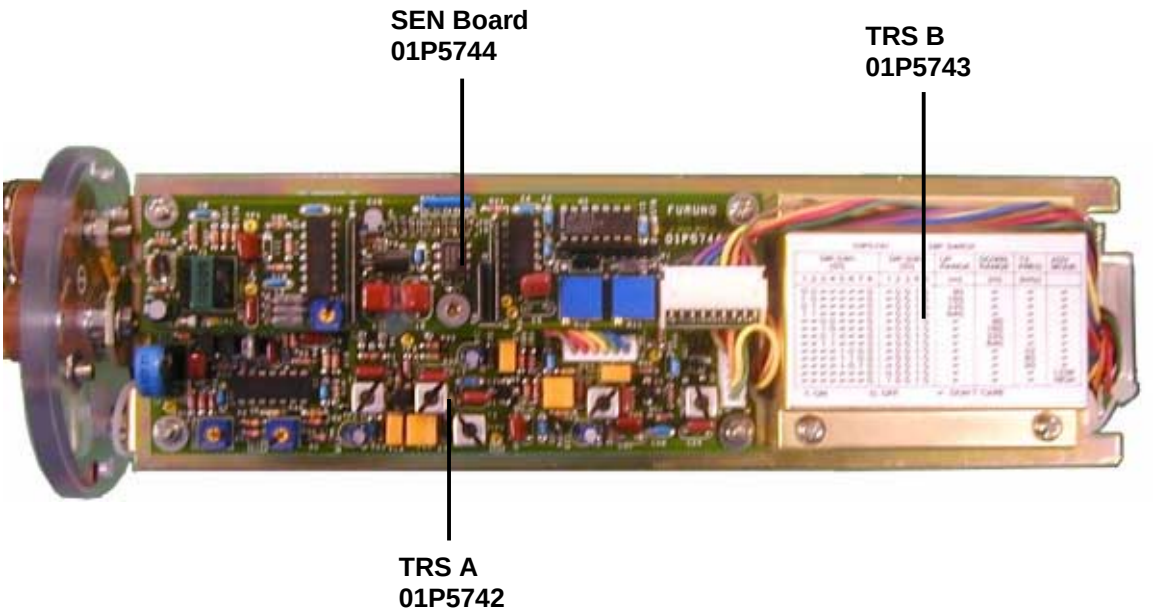


Fig 5.8 Transmitter unit; PC board assembly

SEN Board (01P5744)

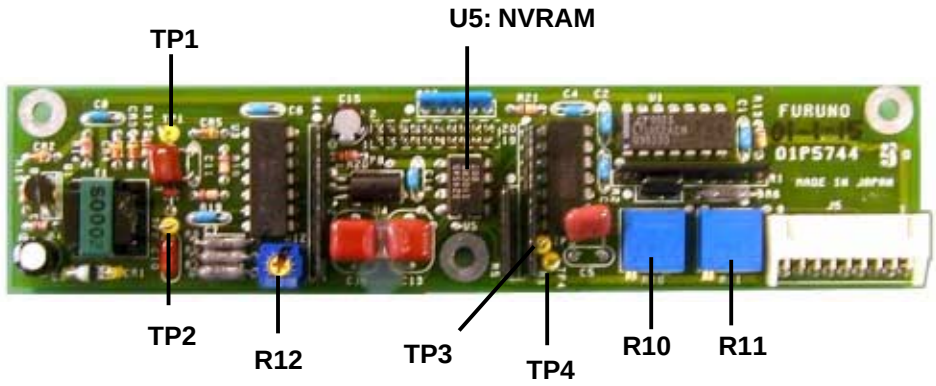


Fig.5.9 SEN Board (01P5744)

Test points	Names	Remarks
TP1	CAC	Catch sensor signal
TP2	TEMP	Temperature signal output; 1 to 9 voltages.
TP3	DEP1	Amplified output voltage of pressure sensor
TP4	DEP2	Magnified voltage of DEP1; 1 to 9 voltages.

Adjusters	Names	Remarkes
R10	OFF SET	Offset adjuster of depth measurement circuit
R11	GAIN	Gain adjuster of depth measurement circuit
R12	TEMP	Adjusts inclination of temperature sensor data

TRS A (01P5742)

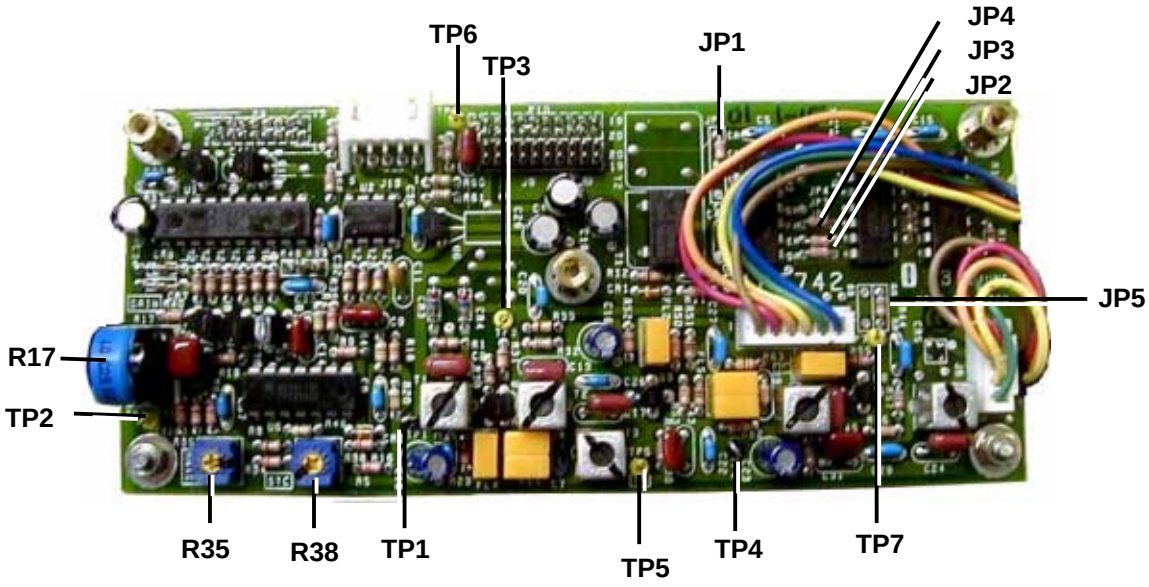


Fig 5.10 TRS.A board; 01P5742

Test points	Names	Remarks
TP1	GND	
TP2	ESIG	Echo signal (DC) inputted to A/D converter
TP3	SIG (AC)	Echo signal (AC)
TP4	GND	
TP5	VG	TVG voltage
TP6	TSMT	Transmission trigger pulse
TP7	CARRIER	Carrier signal for mixer circuit; 530 kHz for 75 kHz, 630 kHz for 175 kHz

Adjusters	Names	Remarks
R17	GAIN	Adjusts gain of IF amplifier
R35	MAX-G	Adjusts maximum gain
R38	STC	Adjust gain at short distance; 0 to 2 m

Jumpers	Remarks
JP1	Selects either signals 1.2 MHz or 1.4 MHz; 1.2 MHz for 75 kHz and 1.4 MHz for 175 kHz 1.2 MHz: Connects "CC" to "CA" 1.4 MHz: Connects "CC" to "CB"
JP2 JP3 JP4	Selects outputs of divider in accordance with transmission frequency JP2 JP3 JP4 75 kHz DA - DB EA - EB FA - FB 175 kHz EA - DB FA - EB GA - FB
JP5	Selects carrier signals in accordance with transmission frequency 75 kHz: put resister R44 between "AA" and "AA" 175 kHz: put resister R44 between "BB" and "BB"

TRS B (01P5743)

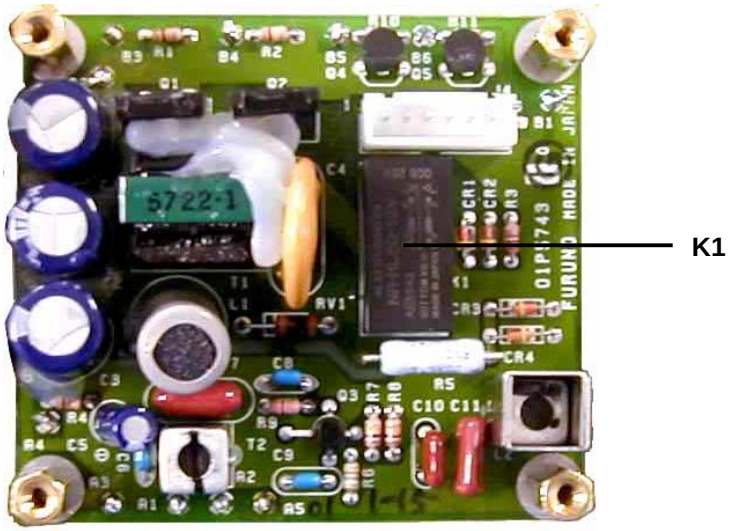


Fig.5.11 TRS.B board; 01P5743

CONT A (01P5740)

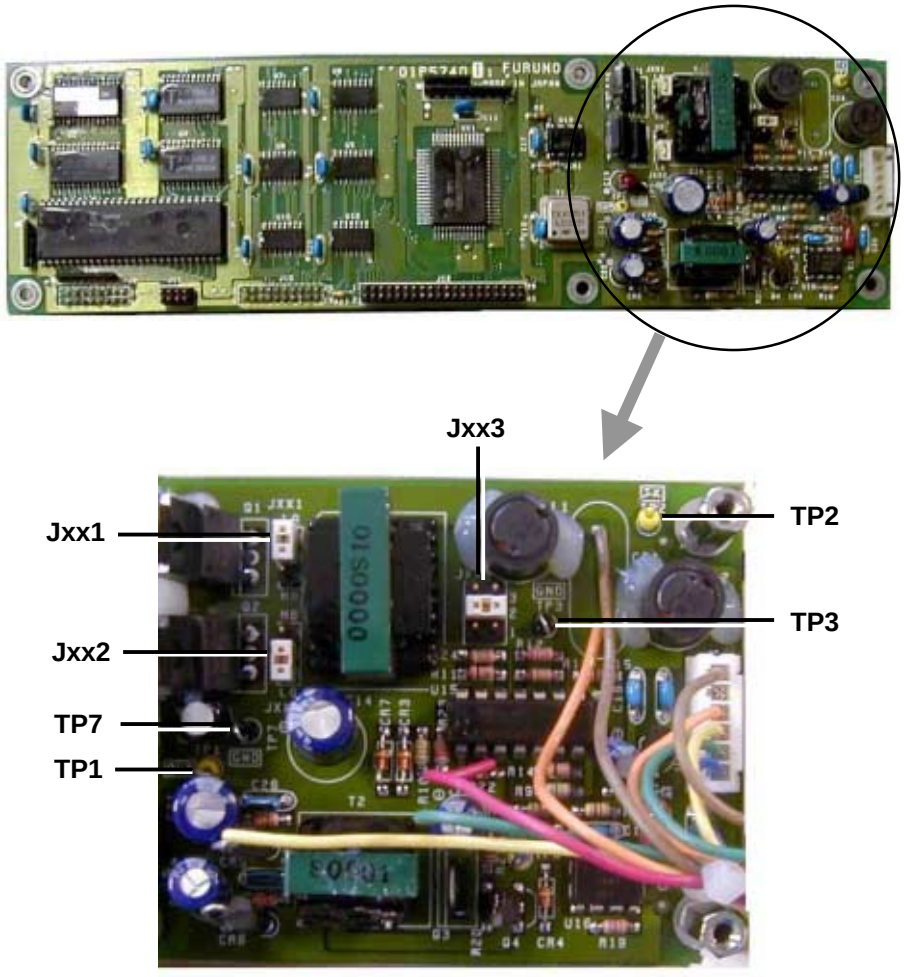


Fig 5.12 CONT. A board (01P5740)

Test Points	Names	Remarks
TP1	OWP	
TP2	TX1	Signal transmission output +
TP3	TX2	Signal transmission output - (GND)
TP7	GND	

Jumpers	Remarks
Jxx1	Sets output voltage
Jxx2	2.4 W: Jxx1 A - LA, Jxx2 B - LA; 10 W: Jxx1 A - HB, Jxx2 B - HB
Jxx3	Sets according to the link frequency 50 kHz: 1 , 40 kHz: 2 , 33 kHz: 2

CONT B (01P5741)

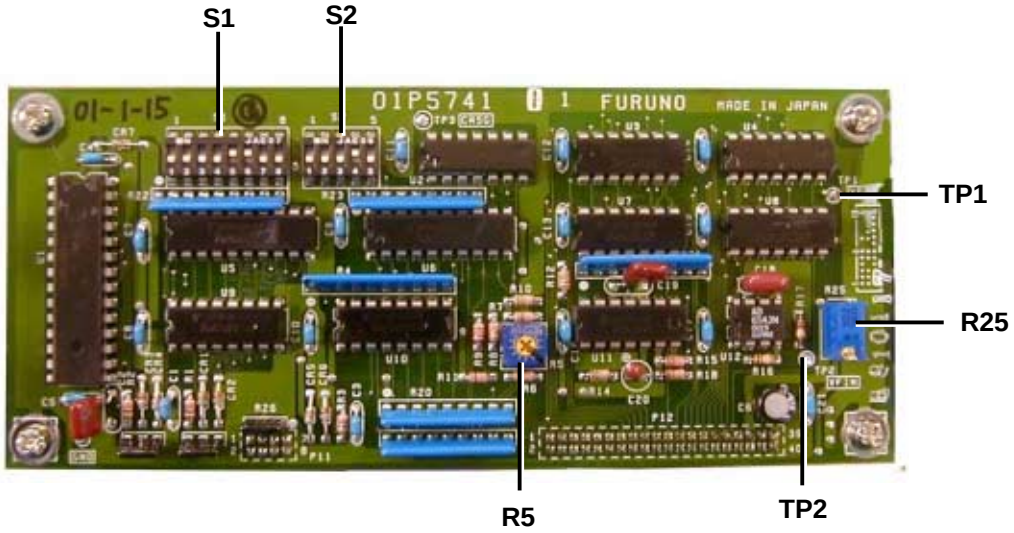


Fig 5.13 CONT. B board (01P5741)

Dip-switches	Remarks
S1	See chapter 4
S2	

Adjusters	Names	Remarks
R5	Gain	See chapter 3
R25	Off-set	

Test points	Names	Remarks
TP1	VFO	Output of VCO circuit; 8 times the signal transmission frequency
TP2	VFIN	Output of D/A converter; clock signal

TXSD B (01P5739)

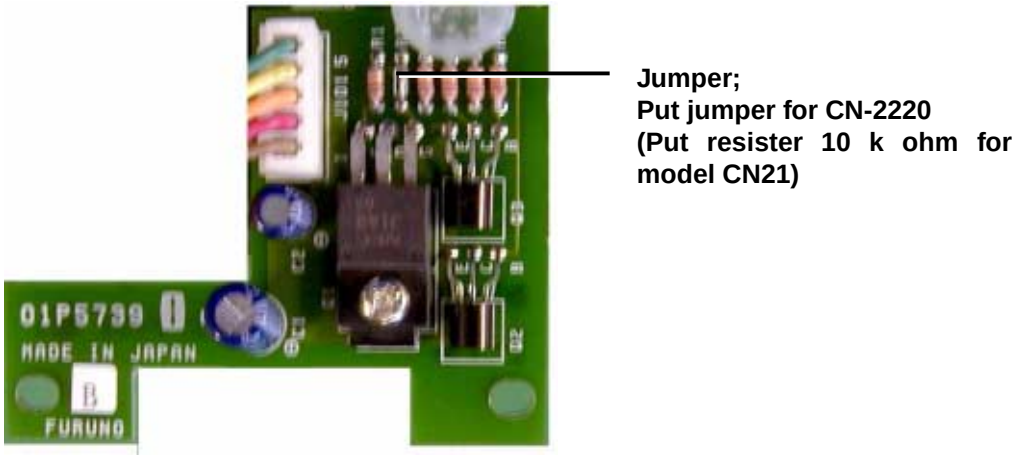


Fig 5.14 TXSD. B board (01P5739)

6. BOARD INTERCHANGEABILITY

6.1 DISPLAY UNIT

All boards except the AMP board 01P5725 in the display unit are common PC board for all frequency units.

The AMP board 01P5725 is fitted with a crystal oscillator for the designated signal transmission frequency (33, 40 or 50kHz) only.
The frequency can be changed by adding a crystal oscillator and changing jumper settings.

Necessary parts

Frequency	Type of Crystal	Code No.
33kHz	NTO-762BA 4885kHz	000-11 8-959
40kHz	NTO-762BA 4955kHz	000-118-960
50kHz	NTO-762BA 5055kHz	000-118-961

Procedures

1. #7 and #8 pin holes for crystal oscillator on the board are shorted by a jumper wire when crystal oscillators are not installed. Remove the jumper to install the crystal oscillator for the desired frequency.

2. Change the settings of jumper block Jxx1 and jumper wire as follows.

Frequency	Jumper Block Jxx1	Jumper Wire
33 kHz	FL	FL-F4
40 kHz	FM	FM-F2
50 kHz	FH	FH-F6

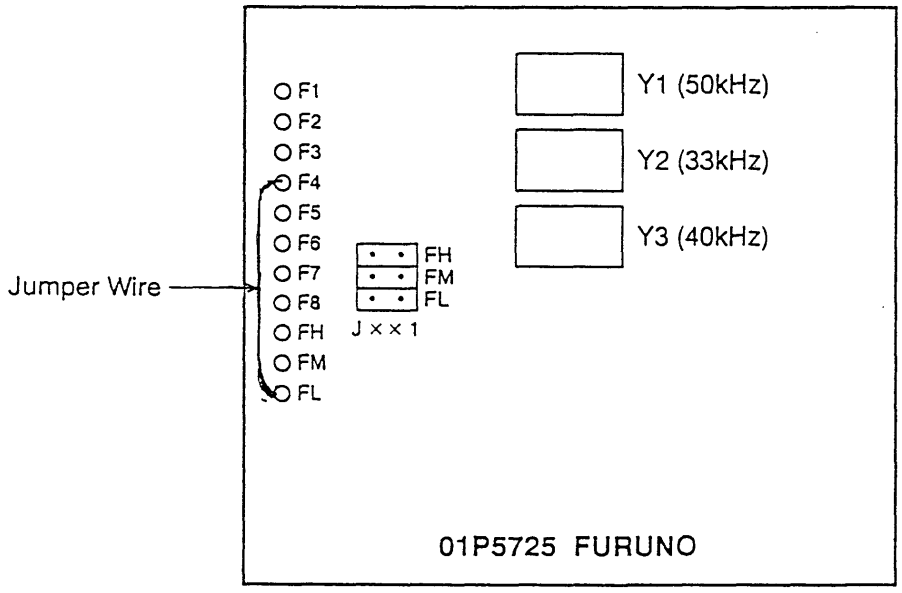


Fig.6.1 Jumper settings

Note: All jumper wires (FL-F4, FM-F2, FH-F6) are set previously in the factory

6.2 TRANSMITTER UNIT

1. SEN board 01P5744

The SEN board has a PROM(NVRAM) which stores the characteristics of the pressure sensor. Since the characteristics differ from sensor to sensor, it is not allowed to change either the SEN board or the pressure sensor only. Both should be replaced in pair.

Note: When the SEN board and pressure sensor are replaced, "0 m adjustment" is required. Refer to chapter 3.

2. CONTA. board 01P5740

The CONT A board can be used for all three signal transmission frequencies (33kHz, 40kHz, 50kHz) if jumper Jxx3 setting is changed. See page 4-4.

3. CONT. B board 01P5741

The adjustment of potentiometers R5 and R25 and the settings of the dip-switch S1 differ with the frequency. See page 3-5/4-3.

4. TRS. A board 01P5742 and TRS. B board 01P5743

The TRS. A and TRS. B boards differ with the sounding frequency, i.e., 75 kHz or 175 kHz.

5. TXSD. B board 01P5739

The TXSD. B board can be used for all three signal transmission frequencies.
Note: a jumper setting on the PC board must be put for the CN-24. See page 5-11 and circuit diagram.

7. CALIBRATION OF PRESSURE SENSOR

The calibration of the pressure sensor is required when either the pressure censor or the SEN board is replaced.

Caution

1) The pressure sensor and SEN board should be replaced as a pair when either of them is defective, because of the calibration data for each sensor is stored in the NVRAM (U5 on the SEN board). The serial numbers marked on the transceiver case and the PC board assembly must be identical.

2) To recalibrate the depth indication by adjusting a characteristic value of the pressure sensor, the accurate oil pressure device (maximum pressure; 206 kgf/cm^2) is required, do not try to adjust without the pressurize instrument.

3) When the DIP switch S2 #4 is set to OFF, the PC board assembly is entered into adjustment mode (depth sensor, frequency adjustment etc) automatically. DIP switch setting should not be changed carelessly in the adjustment mode. Otherwise, the sensor calibration data stored in NVRAM is destroyed and re-adjustment is required.

4) Since the calibration date corresponding to the given pressure are stored into the EEROM at every 2 sec after setting the DIP switch, set the DIP switch settings after the given pressure becomes stable.

5) The calibration data is stored into a RAM on the CONT.A board (01P5740) temporally before the final loading into the NVRAM on the SEN board.
All calibration data stored into the RAM are cleared off if once the power is tuned off under the adjustment mode (#4: OFF).
Do not turn off before storing the data into NVRAM.

6) Once the DIP switch is set to improper position , a wrong data is stored into RAM.
In this case, restart the adjustment from the first step.

Following shows the adjustment procedure using the oil pressurize instrument.

● Necessary instrument

1. Oil pressurize instrument
2. Adapter to link a oil pressure to the pressure sensor
3. Multimeter
4. Extension cable
5. LED indicator (2.7 k ohm resistor and LED)

● Preparation

1) Connect the PC board assembly to the transmitter by the extension cable.
2) Record the present DIP switch settings of S1 and S2 on CONT.B board.
3) Connect Multimeter to TP4 on the SEN board so as to obtain the voltage (DC).

4) Connect LED indicator to J13 on the TRS.A board as follows.

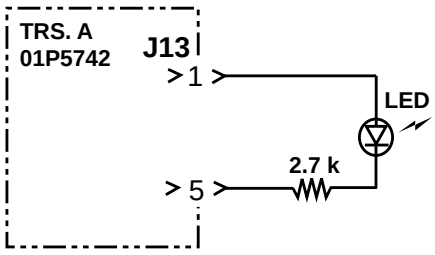


Figure 7.1 LED indicator circuit

5) Connect receiving transducer or test cable to the display unit and the TX transducer, see pages 5-2/5-3, in order to obtain the depth data on the display.

6) Connect the oil pressure device to pressure sensor of the transceiver unit.

● Adjustment

Turn on the transmitter unit by rotating the screw of the pressure switch (test switch) to clockwise(1.5 turn).

1. Offset and full scale adjustment

1) Set DIP switches S1 and S2 on the CONT B board as follows

S1	#1	#2	#3	#4	#5	#6	#7	#8
	off	off	off	off	X	X	X	off

S2	#1	#2	#3	#4
	off	off	off	**ON**

DIP switch settings of "X" is as follows

TX frequency	#5	#6	#7
50 KHz	on	off	on
40 KHz	on	on	off
33 KHz	on	off	off

2) Release pressuring (0 kgf/ cm^2)

3) Adjust the R10 on sensor board so that the depth indication on the display unit shows 0m.

4) Set the oil device to 206 kgf/cm^2

5) Adjust the R11 so that the depth indication on display unit shows 500m.

2. Sensor curve adjustment

Set DIP switches S1 and S2 as follow(S2 #4: OFF)

S1	#1	#2	#3	#4	#5	#6	#7	#8
	off	off	off	off	X	X	X	off

S2	#1	#2	#3	#4
	off	off	off	**OFF**

"Temporal storing the "0" data of 1/5 curve"

1) Set the oil pressurize device to 0 kgf/ cm^2

2) Set DIP switches S1 and S2 as follow (S1 #2: ON)

S1	#1	#2	#3	#4	#5	#6	#7	#8
	OFF	**ON**	OFF	OFF	X	X	X	off

S2	#1	#2	#3	#4
	off	off	off	off

3) Confirm that the LED lights up from blinking.

"Temporal storing the full scale data of 1/5 curve"

4) Set the oil pressurize device to 41. 2 kgf/ cm^2 and keep it by a step 8.

5) Set DIP switches S1 and S2 as follow (S1 #1: ON)

S1	#1	#2	#3	#4	#5	#6	#7	#8
	ON	ON	OFF	OFF	X	X	X	off

S2	#1	#2	#3	#4
	off	off	off	off

6) Confirm that the LED lights up from blinking.

"Temporal storing the "0" data of 2/5 curve"

7) Confirm that the pressure is 41. 2 kgf/cm^2.

8) Set DIP switches S1 and S2 as follow (S1 #1:OFF, #2:OFF, #3:ON

S1	#1	#2	#3	#4	#5	#6	#7	#8
	OFF	OFF	ON	OFF	X	X	X	off

S2	#1	#2	#3	#4
	off	off	off	off

8) Confirm that a voltage at TP4 changes from 9 to 1 volts

"Temporal storing the full scale data of 2/5 curve"

9) Set the oil pressurize device to 82.4 kgf/ cm^2, and keep it by the step 13.

10) Set DIP switches S1 and S2 as follow

S1	#1	#2	#3	#4	#5	#6	#7	#8
	on	off	on	off	X	X	X	off

S2	#1	#2	#3	#4
	off	off	off	off

11) Confirm that the LED lights up from blinking.

"Temporal storing the "0" data of 3/5 curve"

12) Confirm that the pressure is 82.4 kgf/ cm^2.

13) Set the DIP switches S1 and S2 as follow;

S1	#1	#2	#3	#4	#5	#6	#7	#8
	off o	n	on	off	X	X	X	off

S2	#1	#2	#3	#4
	off	off	off	off

13) Confirm that voltage at TP4 changes is from 9 to 1 volts

"Temporal storing the full scale data of 3/5 curve"

14) Set the oil device to 123.6 kgf/ cm^2, and keep it by the step 17.

15) Set DIP switches S1 and S2 as follow;

Si	#1	#2	#3	#4	#5	#6	#7	#8
	on	on	on	off	X	X	X	off

S2	#1	#2	#3	#4
	off	off	off	off

16) Confirm that the LED lights up from blinking.

"Temporal storing the "0" data of 4/5 curve"

17) Confirm that the pressure is 123.6 kgf/ cm^2.

Set the DIP switches S1 and S2 as follow;

S1	#1	#2	#3	#4	#5	#6	#7	#8
	off	off	off	on	X	X	X	off

S2	#1	#2	#3	#4
	off	off	off	off

17) Confirm that the voltage at TP4 changes from 9 to 1 volts

"Temporal storing the full scale data of 4/5 curve"

18) Set the oil pressur to 164 8 kgf/ cm^2, and keep it by a step 22.

19) Set DIP switches S1 and S2 as follow

S1	#1	#2	#3	#4	#5	#6	#7	#8
	on	off	off	on	X	X	X	off

S2	#1	#2	#3	#4
	off	off	off	off

20) Confirm that the LED lights up from blinking.

"Temporal storing the "0" data of 5/5 curve"

21) Confirm that the oil pressure is 164.8 kgf/ cm^2.

22) Set the DIP switches S1 and S2 as follow;

S1	#1	#2	#3	#4	#5	#6	#7	#8
	off	on	off	on	X	X	X	off

S2	#1	#2	#3	#4
	off	off	off	off

22) Confirm that the voltage at TP4 changes from 9 to 1 volt.

"Temporal storing the full scale data of 5/5 curve"

23) Set the oil pressure to 206 kgf/ cm^2, and keep it by a step 25.

24) Set the DIP switches 51 and S2 as follow

S1	#1	#2	#3	#4	#5	#6	#7	#8
	on	on	off	on	X	X	X	off

S2	#1	#2	#3	#4
	off	off	off	off

25) Confirm that the LED lights up from blinking.

"Storing all data (1/5 to 5/5) into NVRAM"

26) Set DIP switches S1 and S2 as follow

S1	#1	#2	#3	#4	#5	#6	#7	#8
	off	off	on	on	X	X	X	off

S2	#1	#2	#3	#4
	off	off	off	off

27) Confirm that the LED lights up from blinking.

Caution

The calibration data stored into NVRAM at a moment when the DIP switches are set to above. If the DIP switches are set to above before completing the adjustment. Improper calibration data are stored into NVRAM, which produce erratic depth indication.

28) Turn off the transmitter unit by rotating the screw of pressure switch to CCW..

29) Set the oil device to 0 kgf/ cm^2.

30) Set DIP switches S1 and S2 as follow

S1	#1	#2	#3	#4	#5	#6	#7	#8
	off	off	off	off	X	X	X	off

S2	#1	#2	#3	#4	
	off	off	off	**"on"**	(Normal mode)

Caution

If turn on the power again before setting the DIP switch to above (S2 #4: ON), All data of NVRAM may broken.

3. Confirmation of result of adjustment

1) Turn on the transmitter unit by rotating the screw of the pressure switch (test switch) to clockwise
2) Set the oil pressure to 0 kgf/ cm^2.

3) Confirm that the depth indication on the display is within 0 to 1 m.

4) Set the oil pressure to 82 4 kgf/ cm^2.

5) Confirm if the depth indication is within 790 to 810 m.

6) Set the oil pressure to 206 kgf/ cm^2.

7) Confirm if the depth indication is within 1990 to 2000 m.

8) Set the oil pressure to 0 kgf/ cm^2. Set the DIP switches S1 and S2 to original setting.

8. DISASSEMBLING/ASSEMBLING TRANSMITTER UNIT

1. How to fix or remove the Battery case and End Cover.

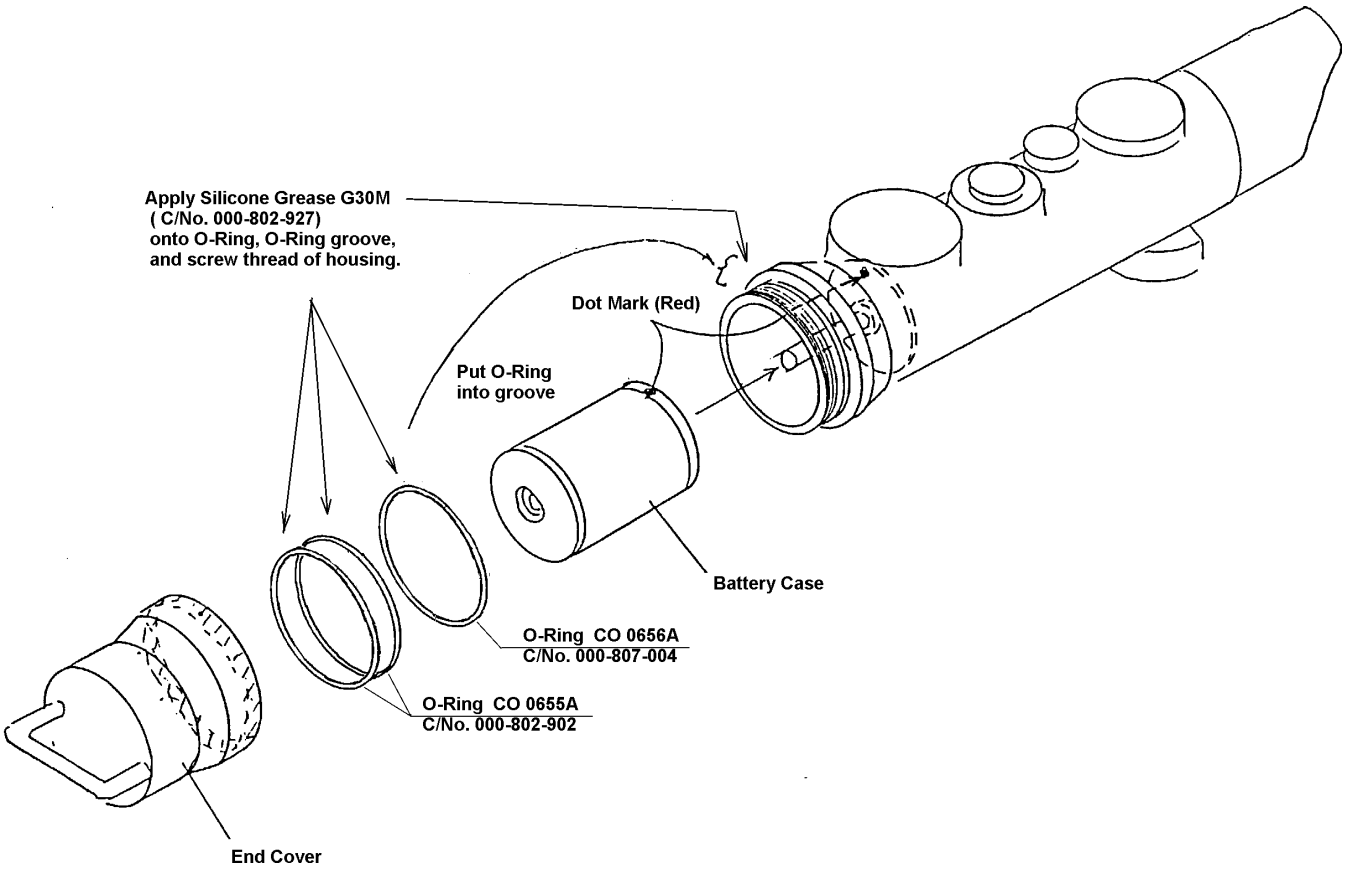


Fig.8.1 Battery case and End cover

2. How to fix and remove the PC board assembly.

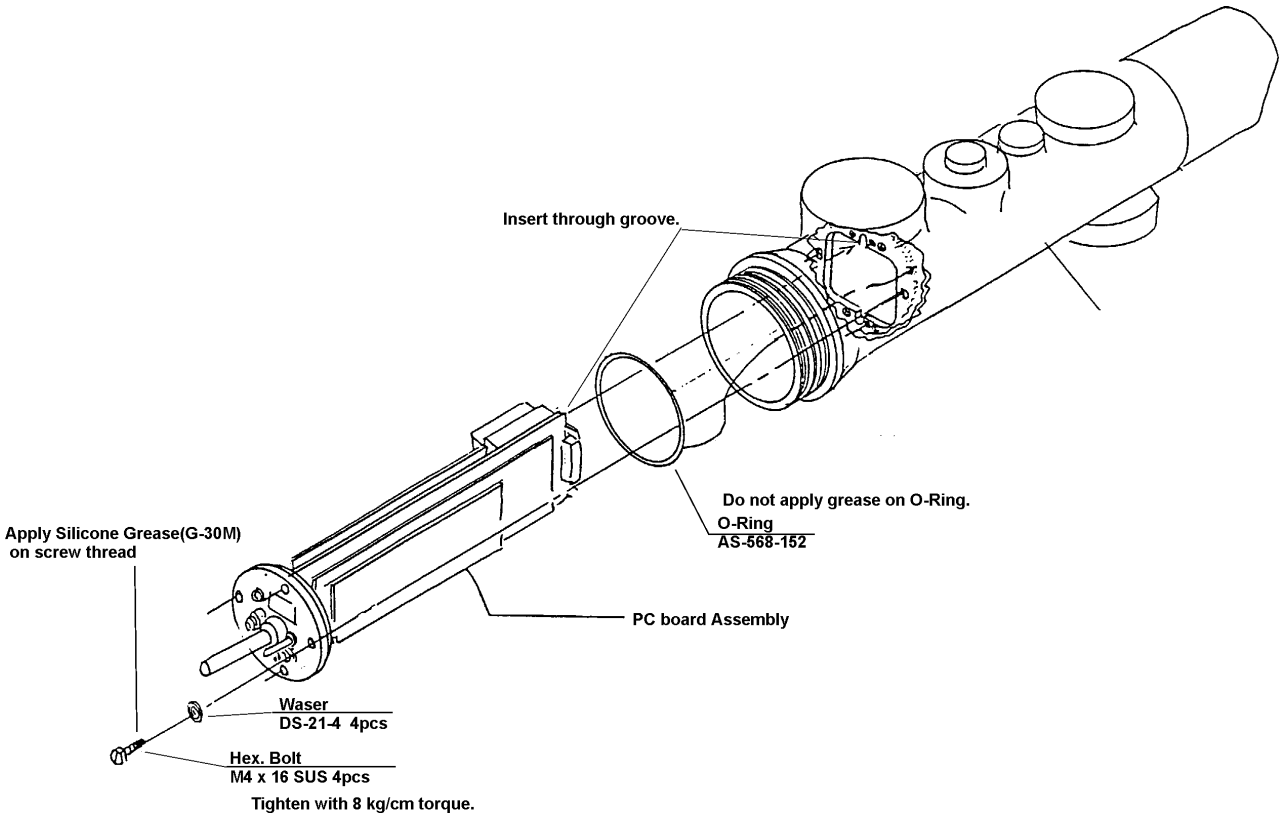


Fig. 8.2 PC board assembly

3. How to fix and remove the Link Transducer

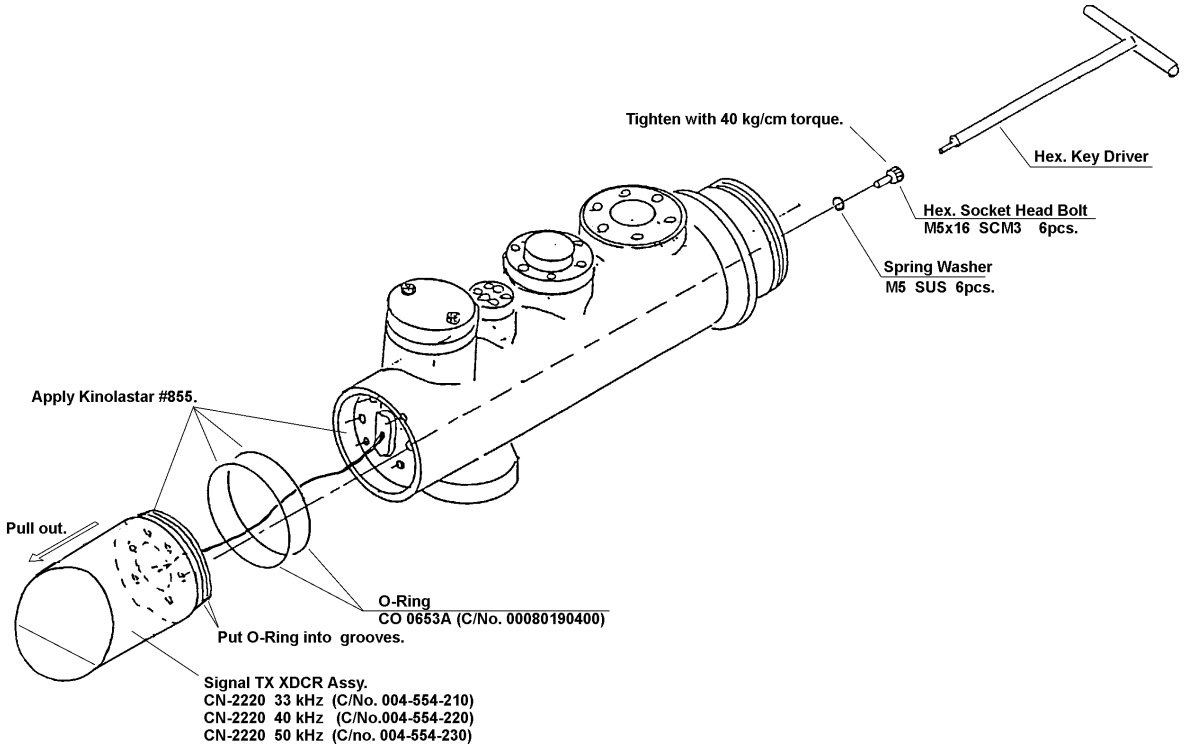
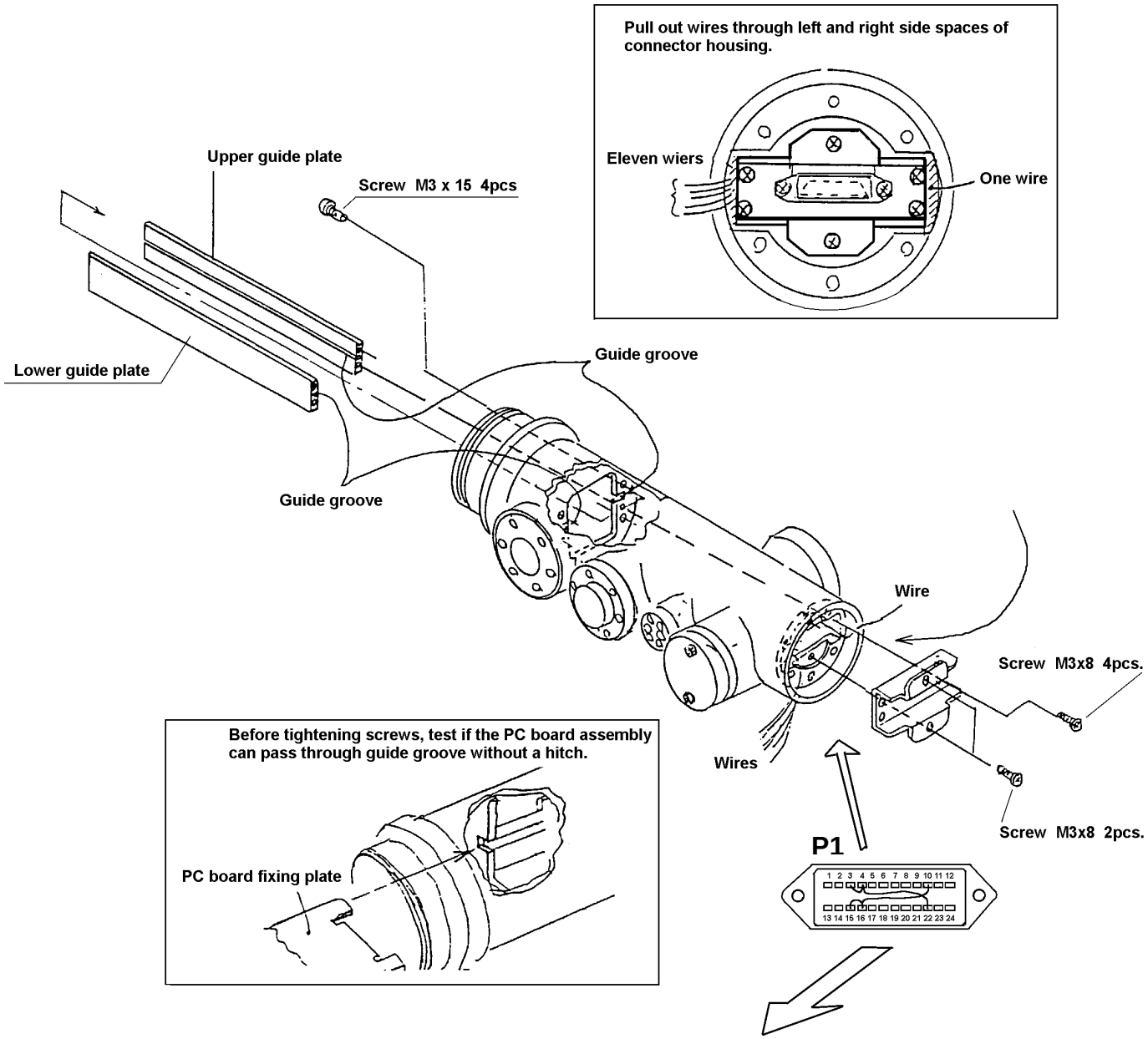


Fig.8.3 Link Transducer

4. How to fix and remove the guide plate and wires from the plug P1.



Pin No.	Wire color	Connected to;	Pin No.	Wire color	Connected to;
1			13		
2	GRAY	PRESSURE SWITCH	14	YELLOW	PRESSURE SENSOR
3	JUMPER		15	JUMPER	
4	JUMPER		16	JUMPER	
5	YELLOW	LINK TRANSDUCER	17	BLUE	LINK TRANSDUCER
6	PINK	PRESSURE SENSOR	18	WHITE	PRESSURE SENSOR
7	LIGHT GREEN	PRESSURE SENSOR	19	BLUE	PRESSURE SENSOR
8	WHITE	TEMPERATURE SENSOR	20	WHITE	TEMPERTURE SENSOR
9	JUMPER		21	JUMPER	
10	JUMPER		22	JUMPER	
11	YELLOW	UPWARD TRANSDUCER	23	YELLOW	UPWARD TRANSDUCER (SHIELD WIRE)
12	GREEN	DOWNWARD TRANSDUCER	24	GREEN	DOWNWARD TRANSDUCER (SHIELD)

Fig.8.4 Guide plate and Plug P1

5. How to fix and remove the transducer.

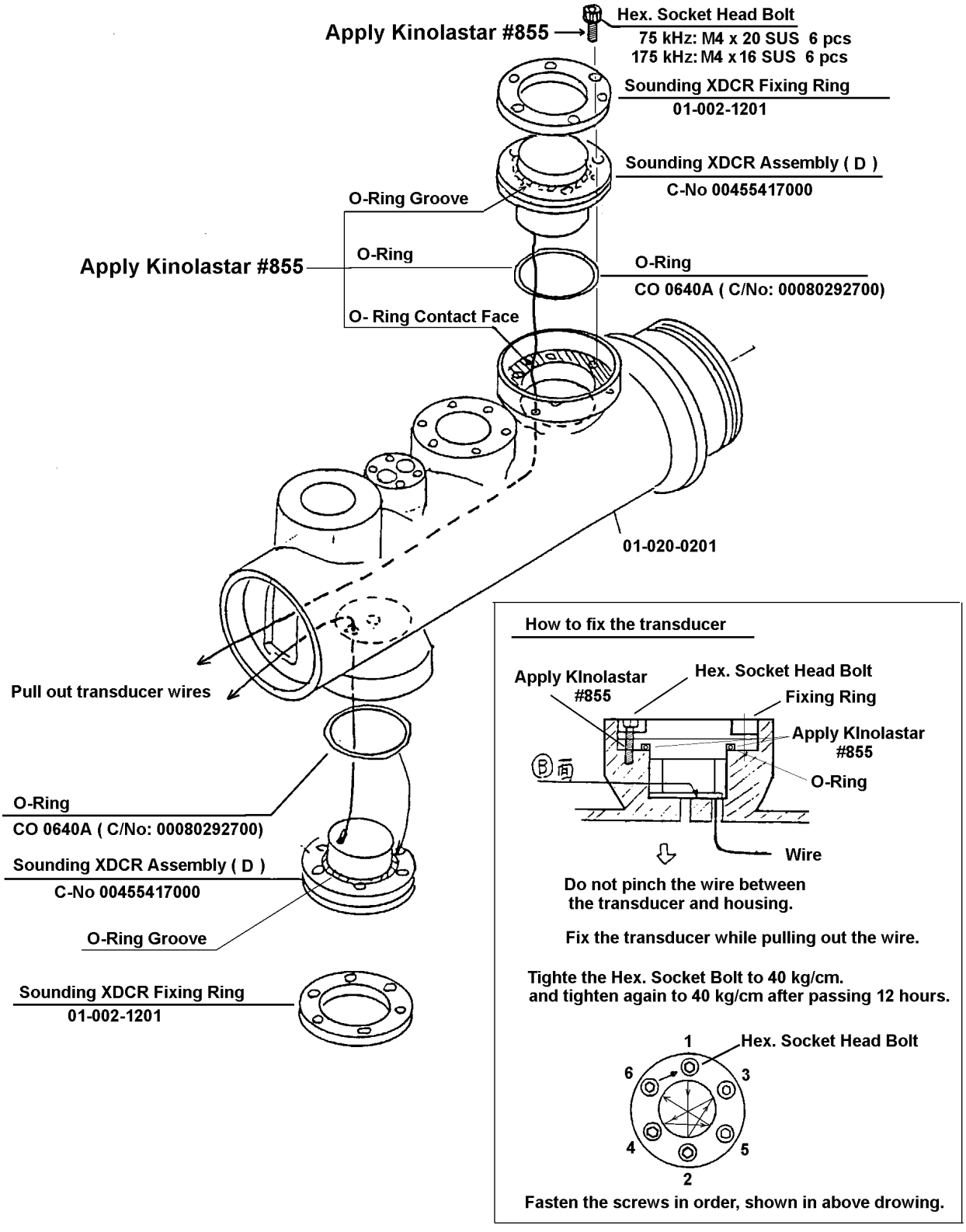


Fig. 8.5 Upward and downward transducers

When removing the transducer from housing , follow to the procedure shown in figure 8.6.

Prepare the tool shown in figure 8.6 and carefully rotate little by little.

Too much rotating may twist off the wire connected to the transducer.

Caution: do not pry the transducer with driver.

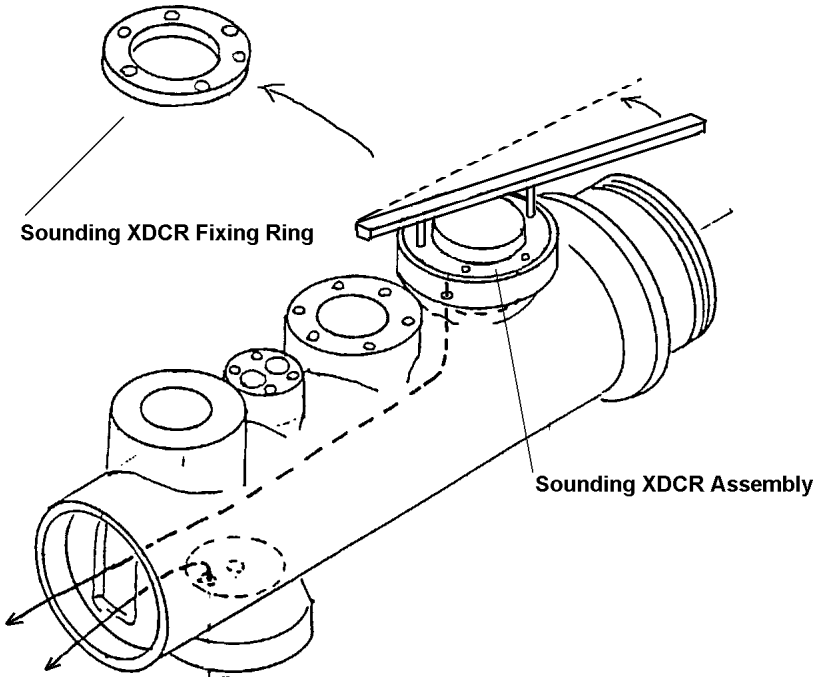


Fig. 8.6 Removing transducer

7. How to fix and remove the Pressure Switch.

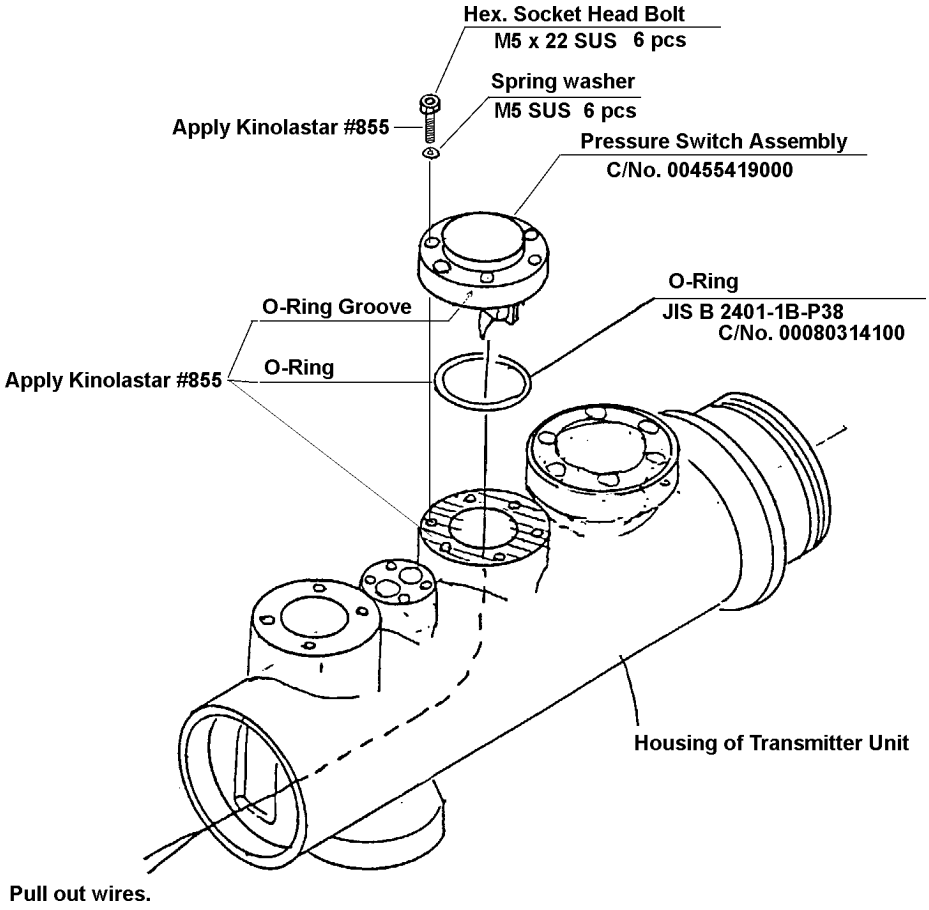
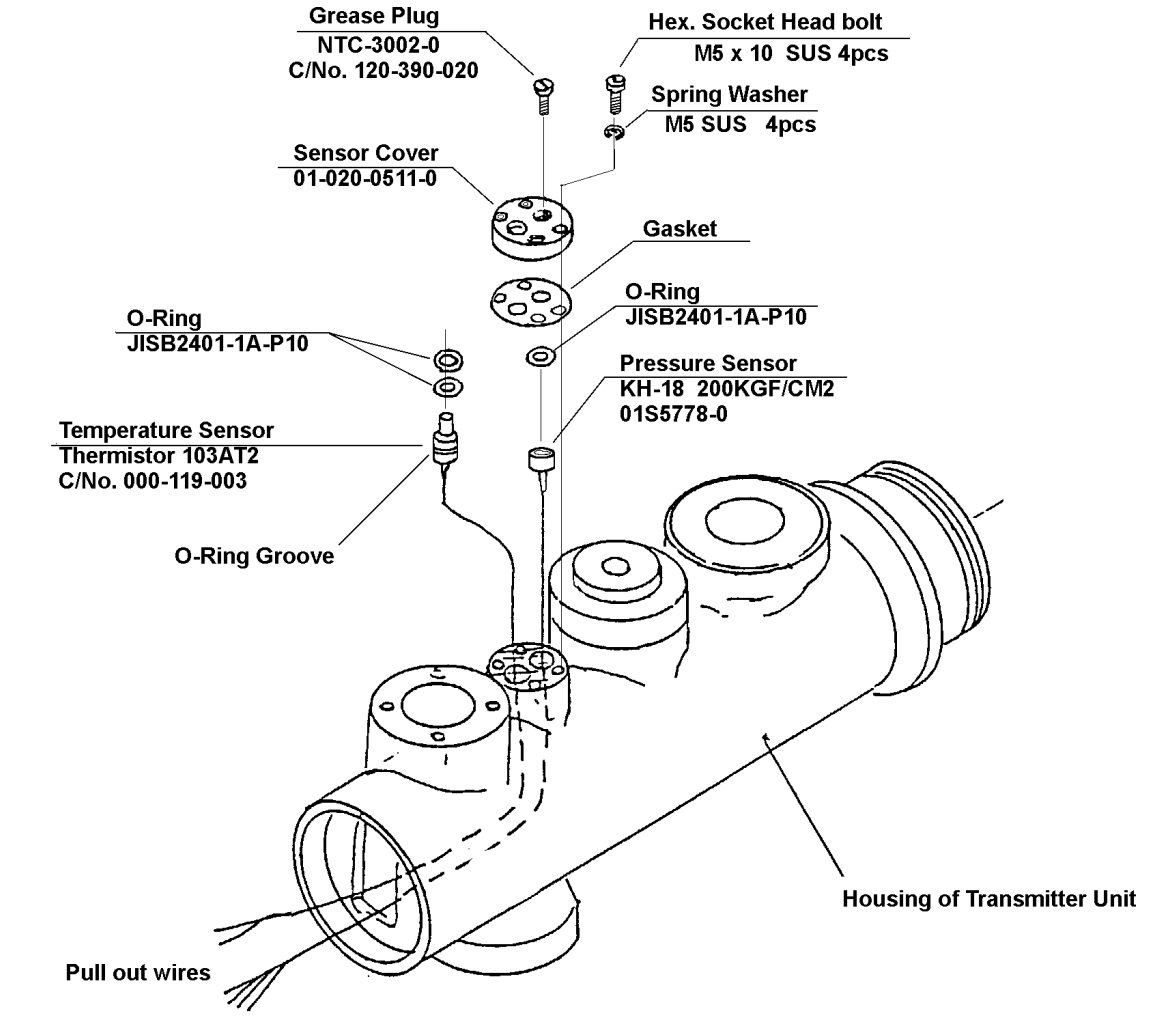


Fig. 8.7 Pressure Switch

8. How to fix and remove the Pressure Sensor and temperature Sensor.



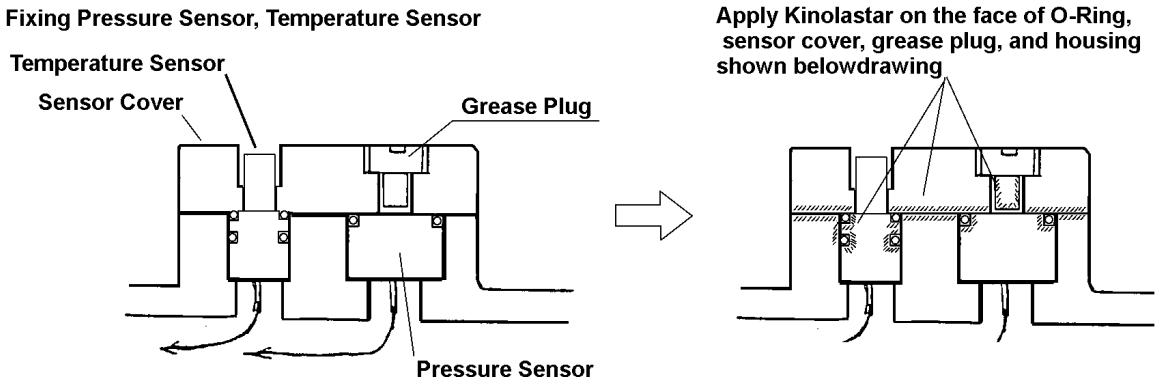


Fig. 8.9 Pressure Sensor and Temperature Sensor

SPECIFICATIONS OF COLOR NET RECORDER CN-24

DISPLAY UNIT CN-2410

1. Display

14" diagonal, rectangular CRT.
Echo ; presented in 7 color graduations (with selectable background color)
Temperature ; presented in graphical form and digital value.

2. Presentation Mode

(1) Downward mode
(2) Upward + downward mode
(3) True Motion (upward + downward) mode
Each mode incorporates Normal and Historical picture advancement modes.

3. Basic Display Range

	Range	1	2	3	4
Downward /Upward	Meters Fathoms Feet Passi Brazars	10	20	30	40
True Motion	Meters Fathoms Feet Passi Brazars	20	40	80	160

NOTES 1) Display start depth can be shifted in 1 m(fa, ft, p/b) steps in true motion mode.
2) Basic display ranges are reprogram-able on the menu.
3) Unit is selectable by internal DIP switch.

4. Range Shift

(Available on True Motion mode only)
Manual ; 0-2000 m, 0-1080 fa, 0-6560 ft, 0-1200 P/B
Auto ; The net trace shifts to the center of the screen when it comes to 1/4 or 314 of the screen from the top.

5. Display Advancement

Normal Mode ; OFF (Freeze), 1/8, 1/6, 114, 1/2 1/1 (Scan line/transmission)
Historical Mode ; 5/10/15/30/60/90/120(minutes/screen)
Six hours of observation is available in Downward mode.

6. Net Depth Indication 0 - 2000m

7. Temperature Indication

Digital Readout; -50C - +400C in O.10C step, (200F - 1000F in O.20F step)
Graph ; plotted in the interval of ±50C(±100F). When the temperature rises above or falls below the limits of the scale, the graph is shifted to the center of the scale.

8. Marker & Digital Readout

Marker ; Minute marker, VRM marker

Readout ; Net depth, temperature
(L/L data & time is displayed when connected with nay, system.)

9. Input/output Data*(CIF or NMEA Format)

Input ; Ship's position (L/L), ship's speed, ship's bearing, time

Output ; Net depth, temperature (CIF only)
* Optional EIS interface kit is required.

10. Output for external display/recorder unit

1) Echo Signal (upward/downward)
2) Net depth (Synchronous signal "KP" is necessary to input.)

Optional E/S interface kit (OPO1-5) is required. Echo Signal can be connected to the color video sounder/recorder which have monitor channel.

11. Picture Record/Playback

Picture Recorder MT-12 (Optional MT-12 interface kit is required when connecting with MT-12.)

12. Power Supply and Consumption

10-40 VDC, less than 100 W
100/110/115/200/230 VAC, 50-60 Hz, 1•
(optional rectifier RU-3423 is required.)

PARAVANE RECEIVER ND-85XX

1. Frequency and Beamwidth

Frequency	Beamwidth
33 kHz	34 degrees (-3dB)
40 kHz	30 degrees (-3dB)
50 kHz	28 degrees (-3dB)

2. Transducer Tilt Angle Adjustable to 15°, 25° or 35° below horizontal

3. Maximum Pressure 5kg/cm^2 (equivalent to 50m)

4. Cable length & Strength 70m, tensile strength: more than 1000 kgf

5. Towing Speed Normal reception up to 6 knots

TRANSMITTER UNIT CN-2220

1. Signal Transmission Characteristics and Operating Hour of Battery Pack

Frequency	Output	Beam width	Battery Operating hour	TX Range*
33 kHz	2.4 W	34° (-3 dB)	20 hours (LR-20)	3800 m max.
40 kHz		32° (-3 dB)	10 hours (BP-2)	3000 m max.
50 kHz		28° (-3 dB)		2200 m max.

Frequency	Output	Beam width	Battery Operating hour	TX Range*
33 kHz	2.4 W	34° (-3 dB)	9 hours (LR-20)	4500 m max.
40 kHz		32° (-3 dB)	5 hours (BP-2)	3600 m max.
50 kHz		28° (-3 dB)		2800 m max.

* affected by sea condition and others

2. Signal Transmission Mode

Sync pulse : Frequency shift code modulation
Echo : Frequency modulation
Depth/Water Temp : Pulse position modulation

3. Sounding Characteristics

Frequency	Output	Beam width	Minimum range	Max Detection Range
75 kHz	100 W	33° (-3 dB)	1.5 m	640 m

4. Sounding Rates and Sounding Range

	Sounding Rate	Sounding Range
Low	28-68 times/mm.	0 - 640 m
High	83-206 times/mm.	

5. Pulse length 0.6 ms

6. Temperature Measurement -50C to +400C or 200F to 1000F (Accuracy *0.5%)

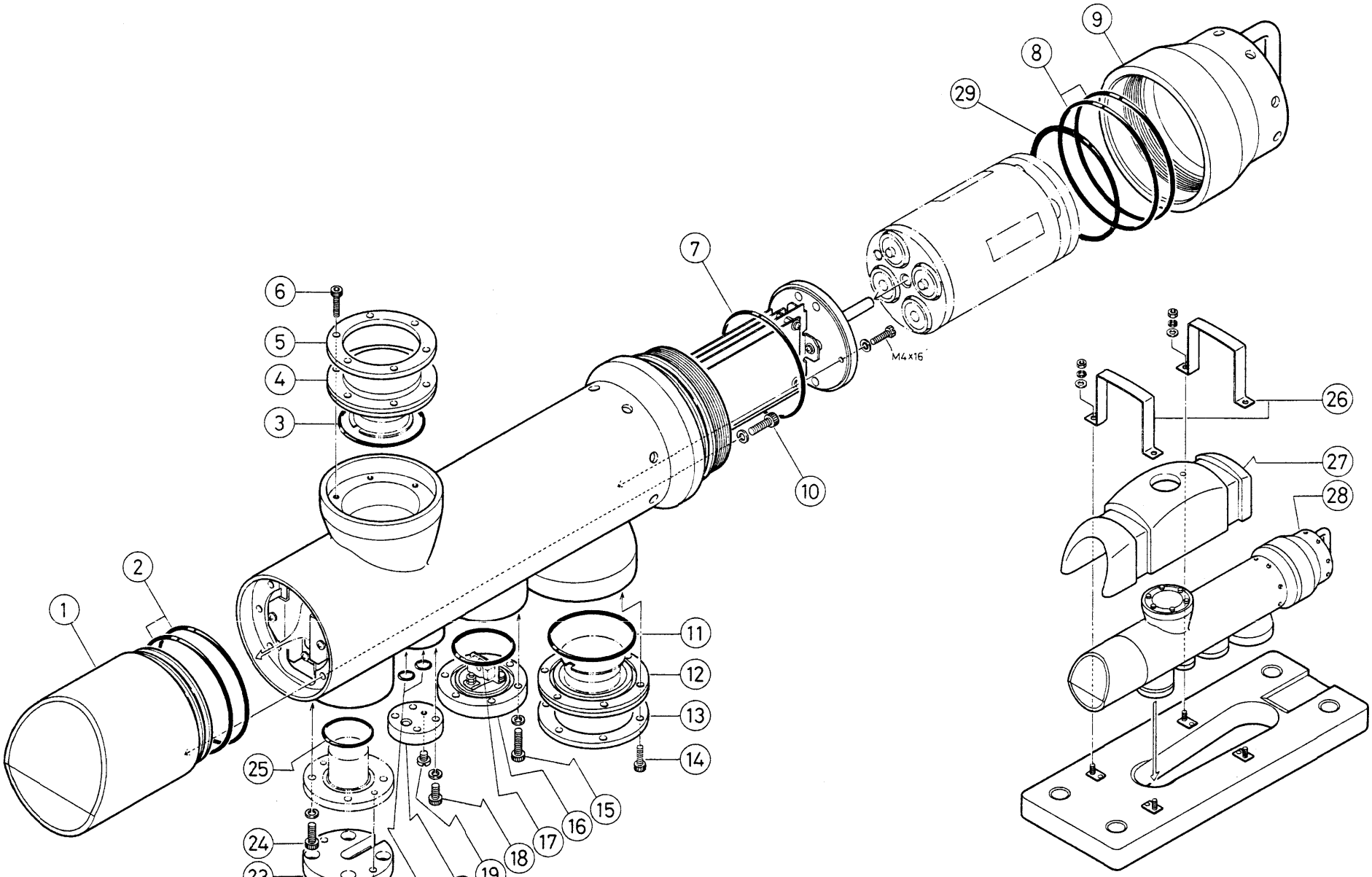
7. Maximum Depth & Ambient Temperature

2000 m, -100C - +400C

8. Power Supply

12VDC, Alkaline-manganese dry cell LR-20 8 pcs. Or Ni-Cd batterypack BP-2 (option)
Automatically switched on at 10 m deep point.

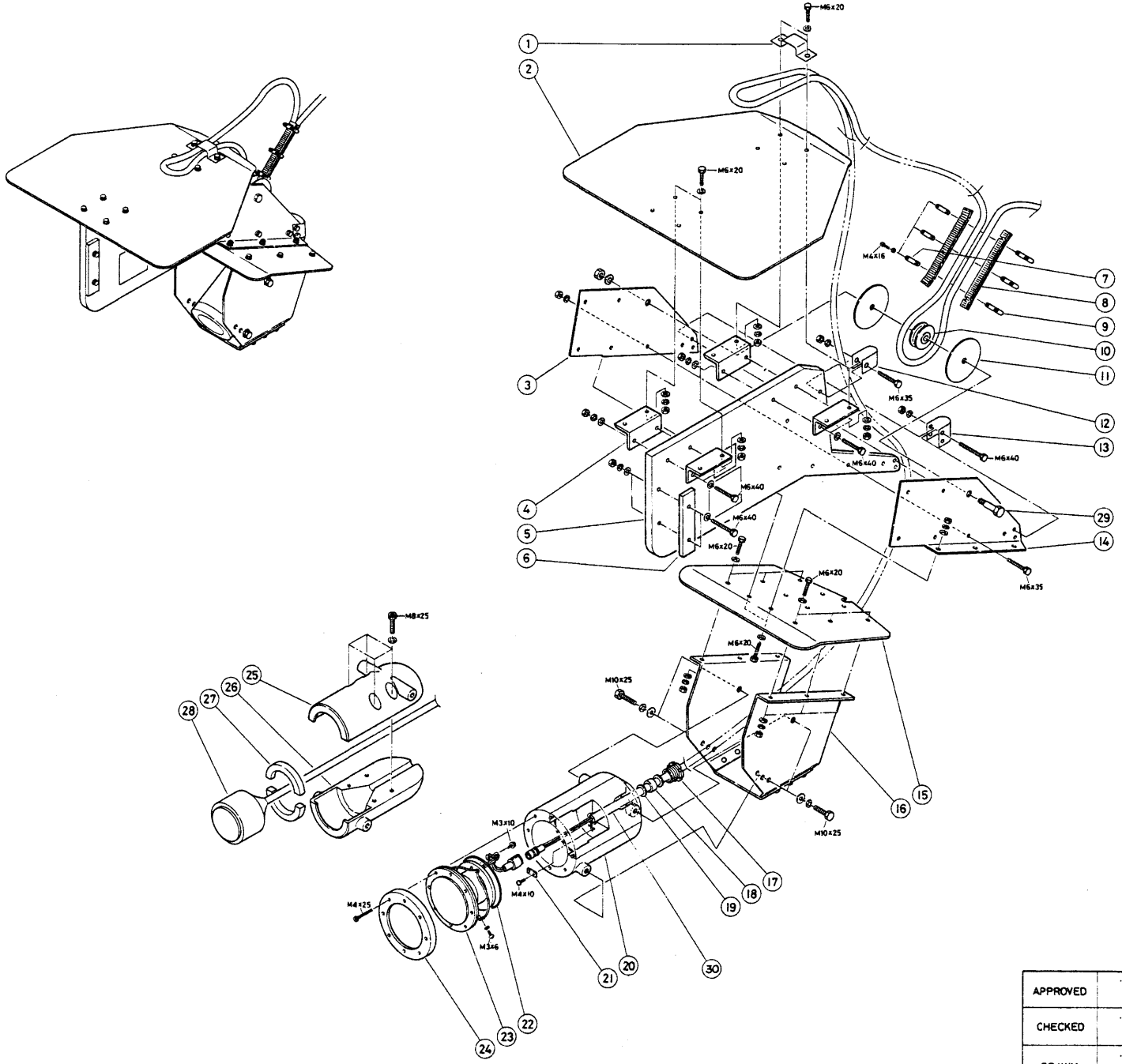
FURUNO



承認 APPROVED	June 25. '93 M. IKEDA	名称 TITLE	発信器 TRANSMITTER UNIT
検図 CHECKED	JUN. 24. '93 K. OKAMOTO	CN-22	
製図 DRAWN	JUN. 24. '93 M. ISHIDA	図番 DWG. NO.	C1284-E01-B

FURUNO ELECTRIC CO., LTD.

D-1



APPROVED		TITLE	受波器展開図
CHECKED		FNR	PARAVANE RECEIVER
DRAWN		DWG. NO	C1240-010-A

MECANICAL PARTS LIST

TRANSMITTER UNIT

1	SIGNAL TX XDCR ASSY	CN-2220 33KHZ	004-554-210	33KHZ
	SIGNAL TX XDCR ASSY	CN-2220 40KHZ	004-554-220	40KHZ
	SIGNAL TX XDCR ASSY	CN-2220 50KHZ	004-554-230	50KHZ
2	O-RING	CO 0653A	000-801-904	
3	O-RING	CO 0640A(JASO 2056)	000-802-927	
4	SOUNDING XDCR ASSY(UP)	CN-2220	004-554-160	75kHz
			004-455-467	175KHz
5	SOUNDING XDCR FIXING RING	01-002-0201-2	190-202-012	
6	HEX. SOCKET HEAD BOLT	M4X16 SUS304	000-862-419	
7	O-RING	AS568-152 1115-70	000-802-926	
8	O-RING	CO 0655A	000-802-902	
9	END COVER	01-020-0701-0	100-153-850	
10	HEX. SOCKET HEAD BOLT	M5X16 SCM3 BLACK	000-862-429	
11	O-RING	CO 0640A(JASO 2056)	000-802-927	
12	SOUNDING XDCR ASSY(DOWN)	CN-2220	004-554-170	75kHz
			004-554-680	175kHz
13	SOUNDING XDCR FIXING RING	01-002-0201-2	190-202-012	
14	HEX. SOCKET HEAD BOLT	M4X16 SUS304	000-862-419	
15	HEX. SOCKET HEAD BOLT	M10X20 SUS304	000-862-472	
16	ASSEMBLY	CN-2220	004-554-190	
17	O-RING	J1SB2401-IA-P39	000-851-138	
18	HEX.SOCKET HEAD BOLT	M5X12 SUS304	000-862-480	
19	GREASE PLUG	NTC-3002-0	120-390-020	
20	SENSOR COVER	01-020-0511-0	100-155-190	
21	O-RING	JISB2401-P10	000-851-108	
22	HEX. SOCKET HEAD BOLT	M5X14 SUS304	000-805-627	
23	COIL	01-006-4132-1	190-641-321	
24	HEX. SOCKET HEAD BOLT	M5X14 SUS304	000-805-627	
25	O-RING	J1SB2401-1A-P38	000-851-137	
26	TRANSMITTER CLAMP	NPC-0002-2	160-300-022	
27	PROTECTION RUBBER	NPC-0001-1	160-300-011	
28	TRANSMITTER FIXING BOARD	CN-2220-33/40/50W	004-554-000	WOOD
	TRANSMITTER FIXING BOARD	CN-2200-33/40/50P	004-554-010	PLASTIC
29	HOUSING		004-553-460	

PARAVANE RECEIVER

1	CABLE BAND (B)	NRF-1026-0	140-610-260
2	HORIZONTAL STABILIZER	NRF-1001-1	140-610-011
3	SUPPORTING PLATE (R)	NRF-1004-1	140-610-041
4	ANGLE	NRF-1009-0	140-610-090
5	VERTICAL STABILIZER	NRF-1002-2	140-610-022
6	BALANCING BLOCK	NRF-1010-1	140-610-101
7	FIXING METAL *2 *	NRF-1017	140-610-170
8	CABTYRE CLAMP	NRF-1015-1	140-610-151
9	FIXING METAL *1*	NRF-1016	140-610-160
10	GROOVED PULLEY	NRF-1014	140-610-140
11	BRIM	NRF-1024-0	140-610-240
12	CABLE BAND (A)	NRF-1025-0	140-610-250
13	CABLE PROTECTOR	NRF-1007-0	140-610-070
14	SUPPORTING PLATE (L)	NRF-1005-1	140-610-051
15	DESCENDING WING	NRF-1003-1	140-610-031
16	XDR CASE FIXING PLATE	NRF-1020-1	140-610-201
17	GLAND	JIS F8801	000-870-194
18	GASKET	JIS F8801 20C	000-870-265
19	WASHER	JIS F8801 20C	000-870-211
20	TRANSDUCER CASE	01-002-3001-0	190-230-010
21	WIRE FIXING PLATE	NSA-1114-0	120-911-140
22	O-RING	JIS B2401-G85	000-851-314
23	TRANSDUCER ASSY. (50KHZ)	ND8550	006-334-090
	TRANSDUCER ASSY. (40KHZ)	ND8540	006-334-050
	TRANSDUCER ASSY. (40KHZ	ND8533	006-349-140
	TRANSDUCER	5OKHZ	006-334-100
	TRANSDUCER	40KHZ	006-334-060
	TRANSDUCER	33KHZ	006-349-170
	CABLE ASSY. 50M	ND-8 NM-8*50M*	006-336-720
	CABLE ASSY. 70M	ND-8 NM-8*7OM*	006-336-730
24	XDR FIXING RING	01-002-3005-0	190-230-050
29	FULCRUM BOLT	NRF-1008-0	140-610-080
30	CABLE ASSEMBLY	006-336-720	

ELECTRICAL PARTS LIST

DISPLAY UNIT

PRINTED CIRCUIT BOARD

01P5737 POWER ASSY	CN-2410	002-177-050
01P5726A DISP	CN-2410	002-177-070
01P5729A PNL	CN-2410	002-177-750
01P5725 AMP 33KHZ	CN-22	004-553-720
01P5725 AMP 40KHZ	CN-20/21/22	002-174-130
01P5725 AMP 50KHZ	CN-20/21/22	002-174-140

COLOR MONITOR

CDKC-14CE151		000-139-814

PROGRAM ROM

PROMO152009101 1 SET	01P5726 CN2410	002-177-090

CAPACIOR

1804C0001	MMD22A1O5K	1UF 250V	000-114-953
1B04C0002	MMD22A1O5K	1UF 250V	000-114-953
1B04C0003	MMD22A1O5K	1UF 250V	000-114-953

FUSE

1B04F0001	FGBO 15A	AC125V	000-549-014

TRANSMITTER UNIT

PRINTED CIRCUIT BOARD

01P5740A 33KHz		0045539400
01P5740A 50KHz		0045539600
01P5740/5739B ASSY. 33KHZ	CN-2220-33	002-176-830
01P5740/5739B ASSY. 40KHZ	CN-2220--40	002-176-840
01P5740/5739B ASSY. 50KHZ	CN-2220--50	002-176-850
01P5739B		002-176-810
01P5741 CONT.B	CN-2220	004-553-970
01P5742A TRS.A 75KHz	CN-2220	004-553-980
01P5742A TRS.A 175KHz	CN-2220	004-554-030
01P5743 TRS.B.P. 75KHz	CN-2220	004-553-990
01P5743TRS.B.P. 175KHz	CN-2220	004-554-070

ASSEMBLY

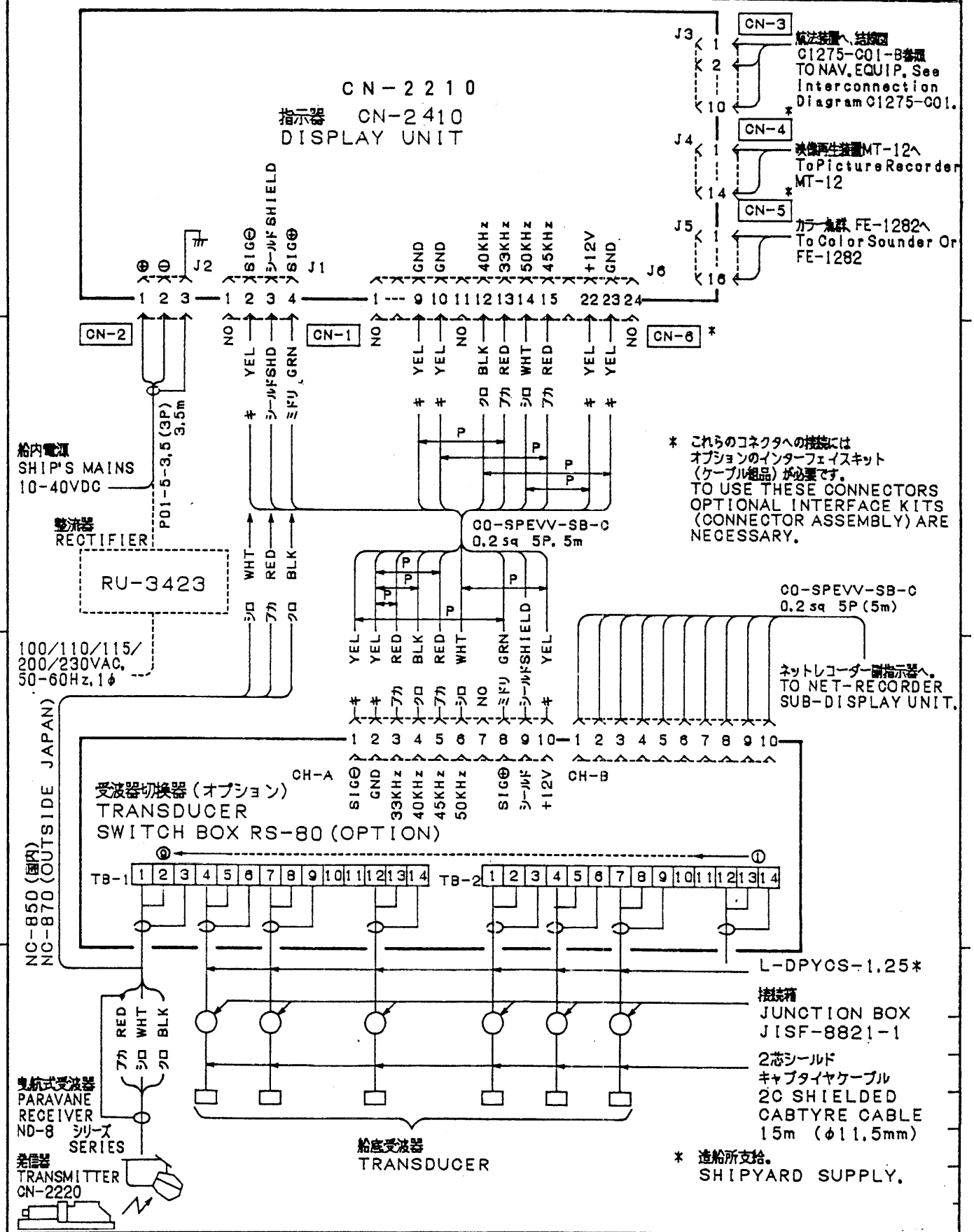
PRESSURE SENSOR (KH15/SEN board)	W/01P5744	004-554-140
SOUNDING TRANSDUCER 75KHz	UPWARD	004-554-160
SOUNDING TRANSDUCER 75KHz	DOWNWARD	004-554-170
SOUNDING TRANSDUCER 175KHz	UPWARD	004-554-670
SOUNDING TRANSDUCER 175KHz	DOWNWARD	004-554-680
TX TRANSDUCER ASSEY	33KHZ	004-554-210
TX TRANSDUCER ASSEY	40KHZ	004-554-220
TX TRANSDUCER ASSEY	50KHZ	004-554-230
PRESSURE SWITCH		004-554-190

THERMISTOR

2B11RTOOO1 103AT2		000-119-003

FURUNO

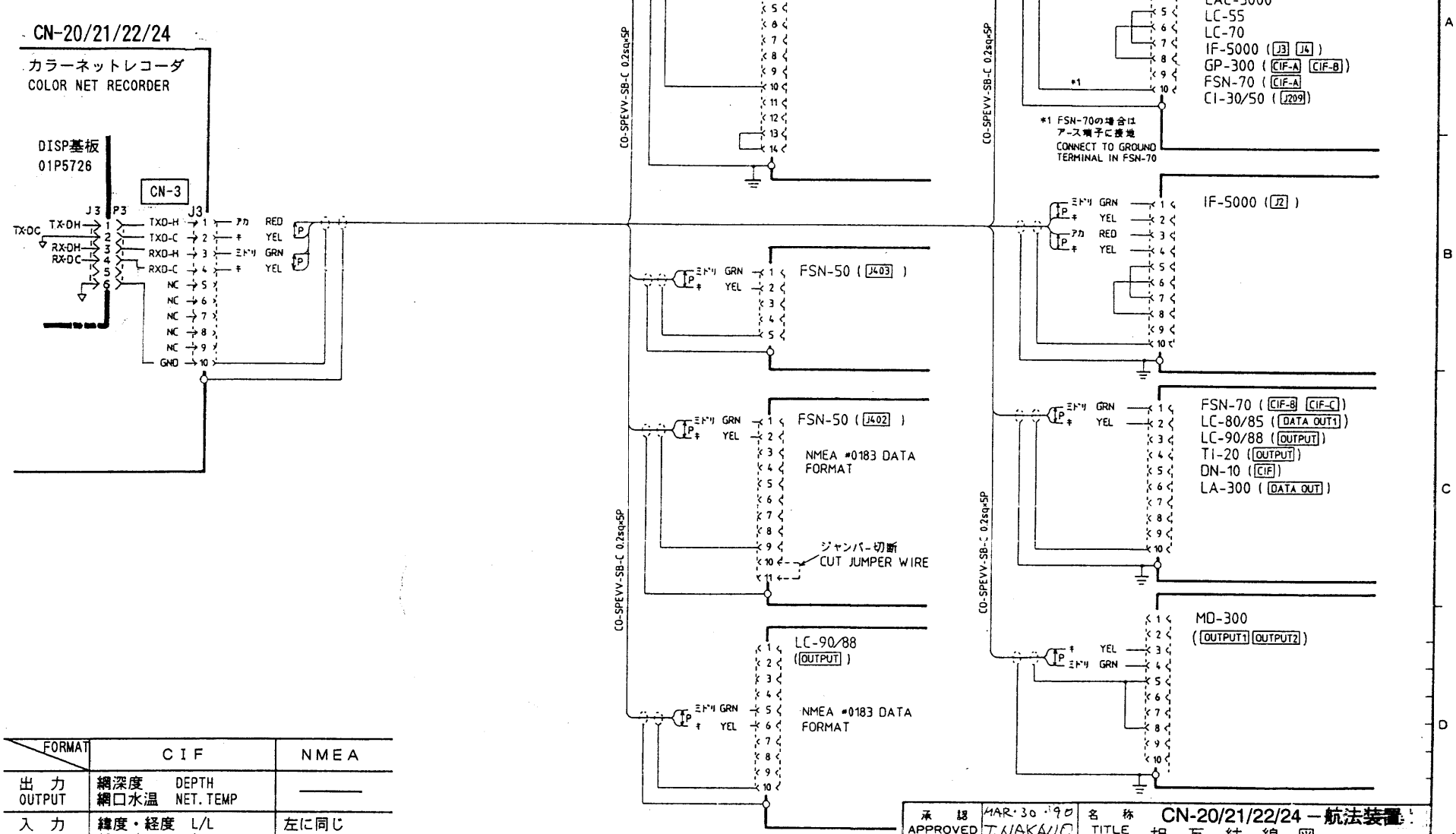
S-1



DRAWN Aug. '96 Y.EBISU			TYPE CN-22/24
CHECKED Aug. 1'96 K.Kusunoki			名称 カラーネットレコーダー
APPROVED Aug 2 '96 K.OTA	CN-22/24		相互結線図
SCALE —	MASS — kg	APPLICABLE TO; (MODEL)	BLOCK NO. NAME COLOR NET RECORDER
DWG NO. C1284-C01- C			INTERCONNECTION DIAGRAM

FURUNO ELECTRIC CO., LTD.

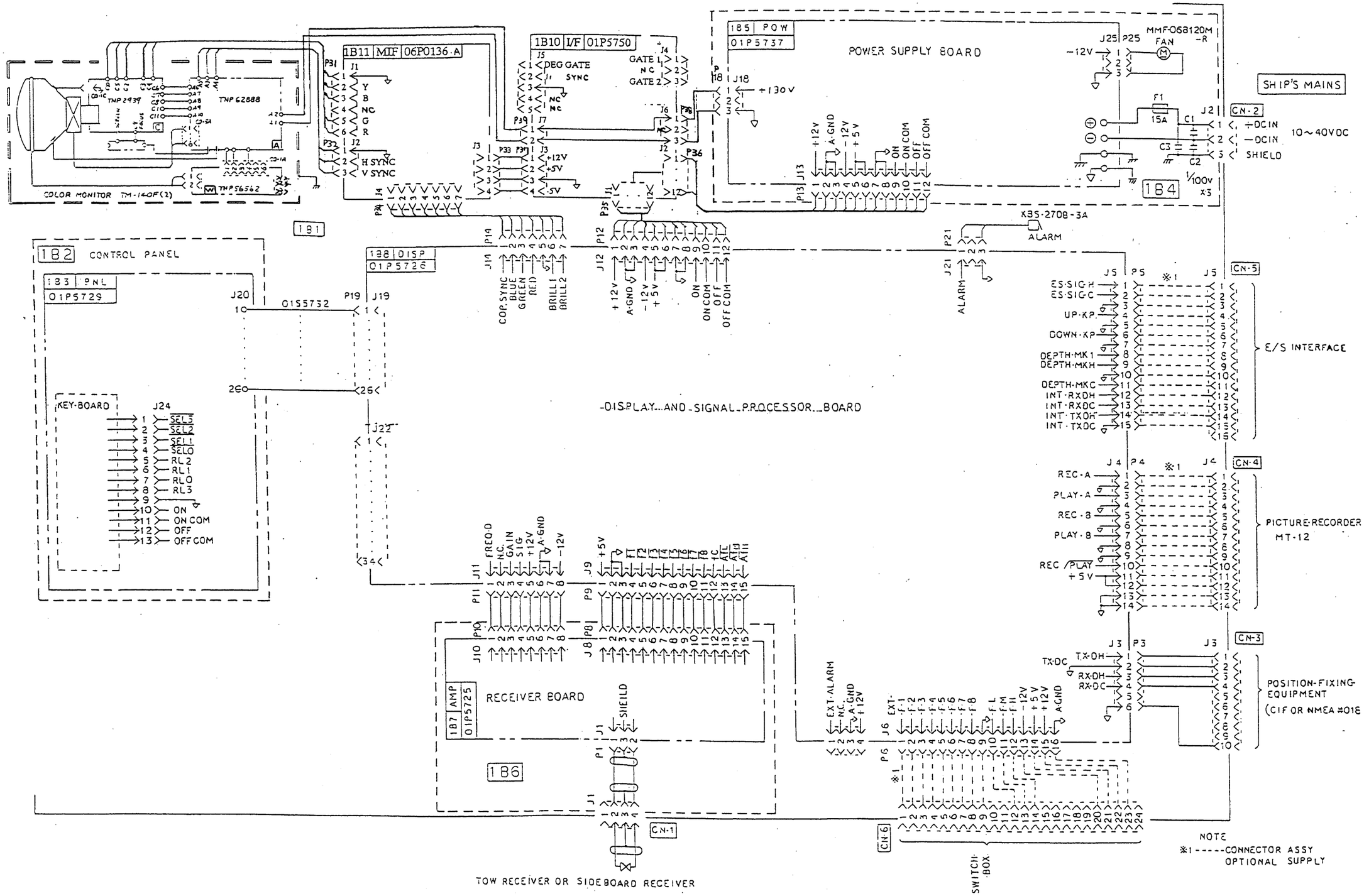
FURUNO



FORMAT	CIF	NMEA
出 力 OUTPUT	網深度 DEPTH 網口水温 NET. TEMP	——
入 力 INPUT	緯度・経度 L/L 船 速 Ship's speed コース Ship's bearing 時 刻 Time	左に同じ Same as left.

承 認 APPROVED	MAR. 30 '90 T. NAKANO	名 称 TITLE	CN-20/21/22/24 一航法装置 相 互 結 線 図 COLOR NET RECORDER-NAV. EQUIPMENT INTERCONNECTION DIAGRAM
検 図 CHECKED	MAR 30 '90 M. USUDA		
製 図 DRAWN	Mar. 30. '90 T. MIYOSHI	図 番 DWG. NO.	C1275-C01-D

FURUNO ELECTRIC CO., LTD.



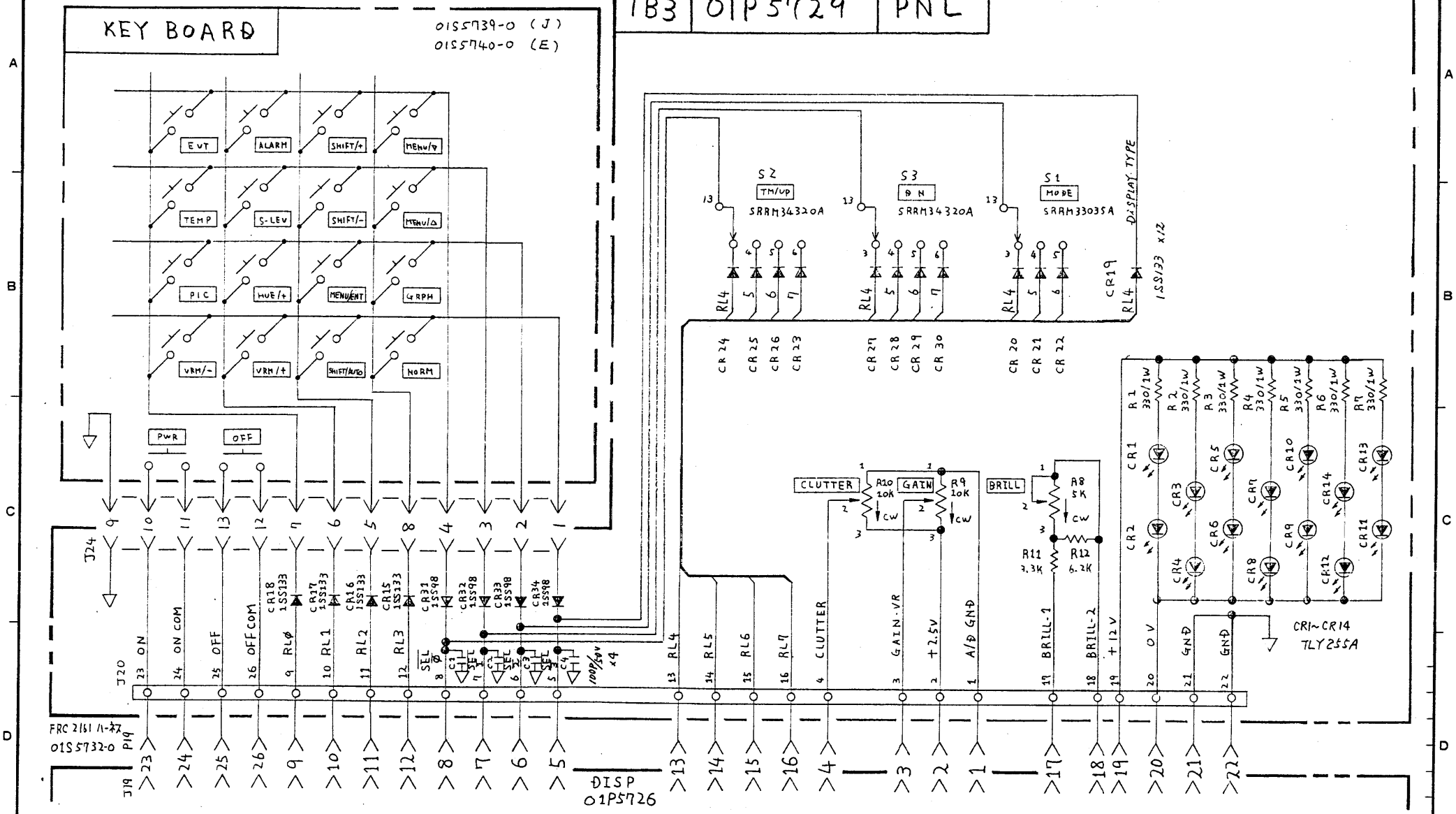
変更通知書番号	符 号	訂正年月日	訂 正 記 事	担 当
	△	. .		
	△	. .		
	△	. .		
	△	. .		
	△	. .		

DRAWN JULY 30 '96 T. Kimura			TYPE
CHECKED July 30 '96 K. Okameto			名称 指示器総合 回路図
APPROVED July 30 '96 K. Okamoto		CN-24	
SCALE /	MASS kg	APPLICABLE TO: (MODEL)	BLOCK NO.
DWG NO. C1301-K01- A		01-022-1001- 0	NAME DISPLAY UNIT GENERAL SCHEMATIC DIAGRAM

古野電気株式会社

FURUNO

1B3	01P5729	PNL

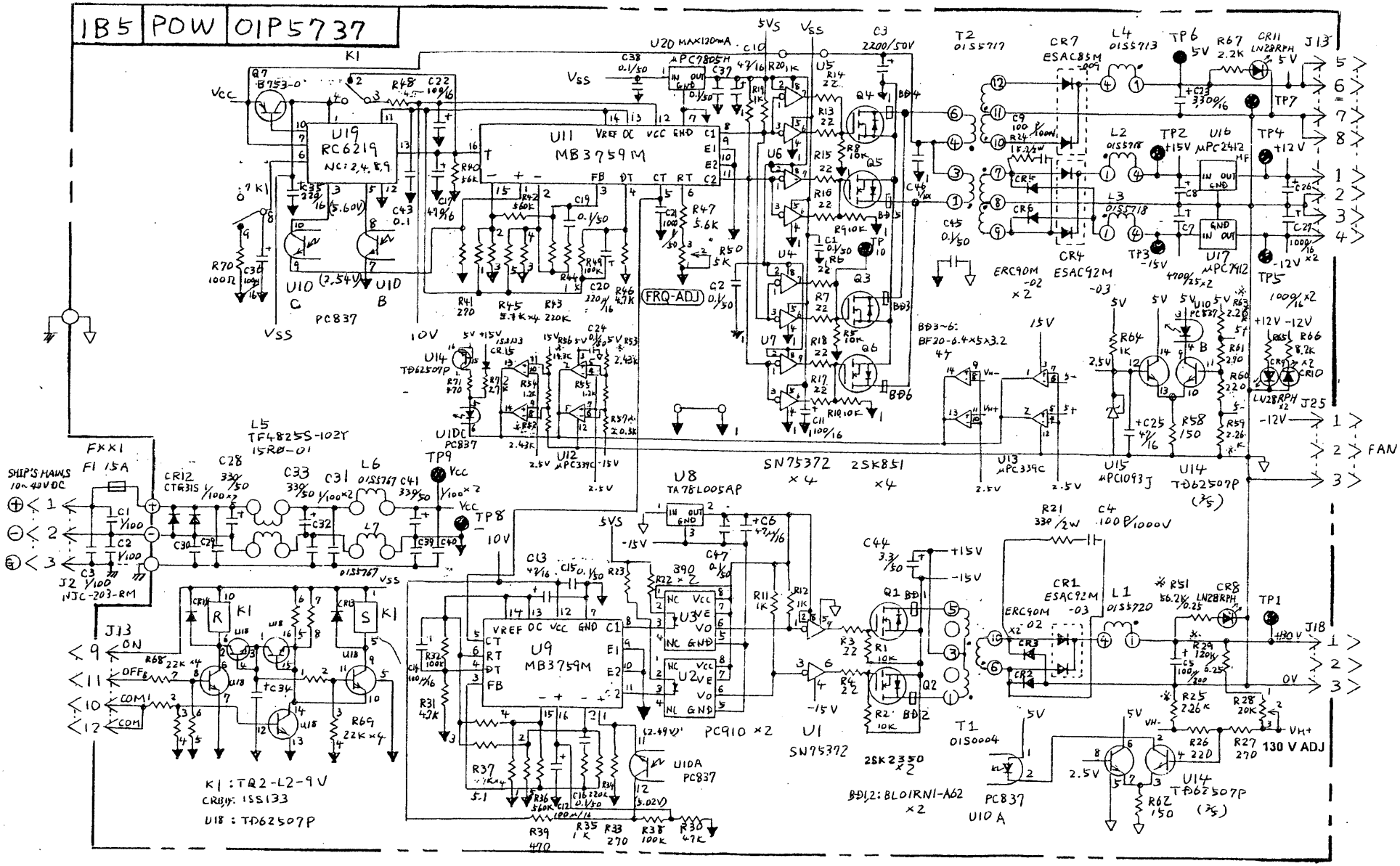


CN-21/22

承認 APPROVED	APR・6・'90 T.NAKANO	名称 TITLE	01P5729 操作パネル CONTROL PANEL
検図 CHECKED	APR・6・'90 M. USUDA		
製図 DRAWN	Mar・30・'90 T.MIYOSHI	図番 DWG. NO.	C1276-K02-A

FURUNO ELECTRIC CO., LTD.

FURUNO

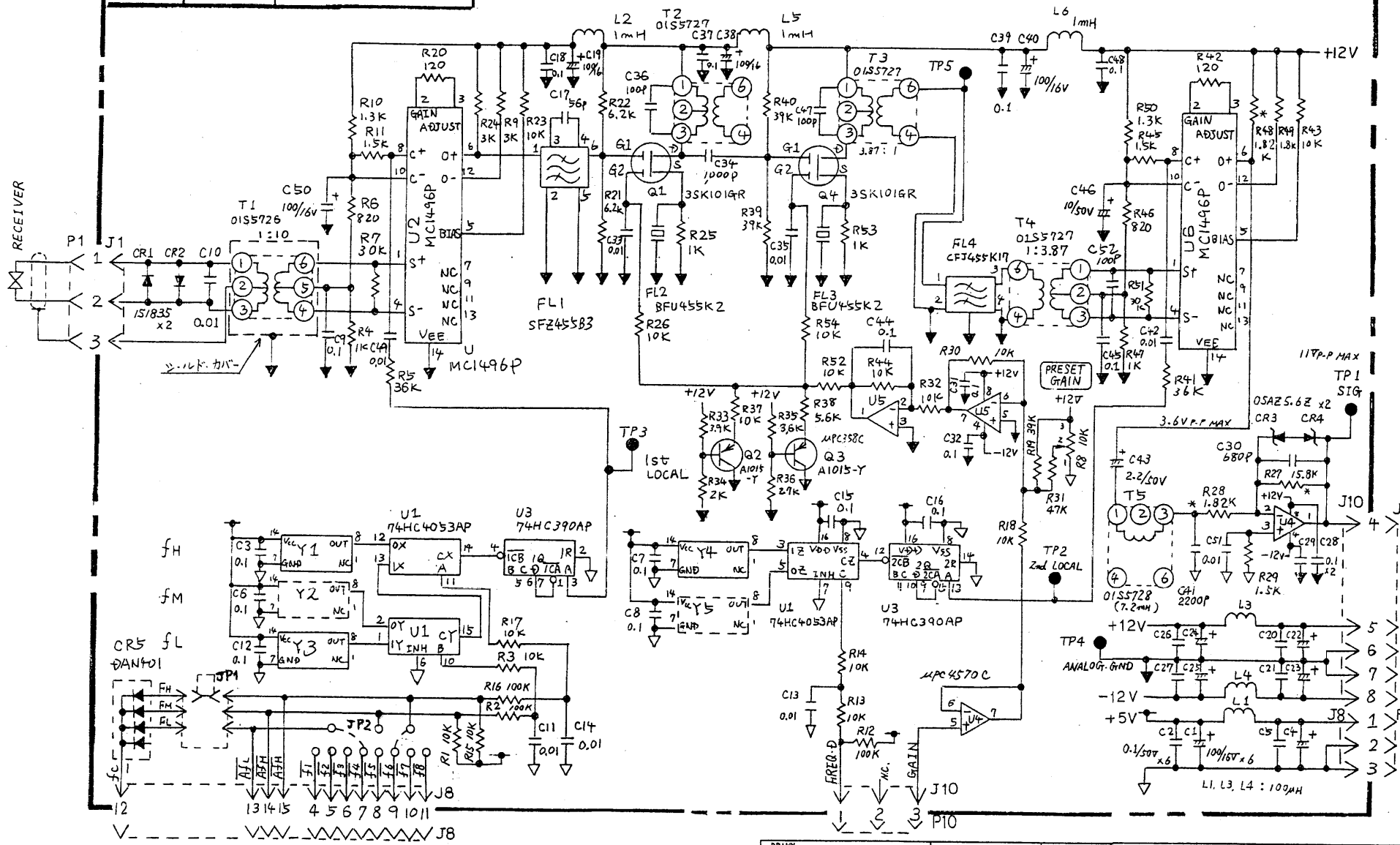


DRAWN May 7 '01 T.YAMASAKI			TYPE 01P5737
CHECKED May 8 '01 Y.K			名称 指示部電源部
APPROVED May 8 '01 Y.K	CN-21/22 CN-24	1B 5	回路図
SCALE / MASS kg	APPLICABLE TO: (MODEL)	BLOCK NO.	NAME POW PCB
DWG NO. C1276-K03- B	01-022-1012- 1		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO

1B7	AMP	01P5725



	Y1	Y2	Y3	Y4	ジャンパー JUMPER JP1	JP2
33kHz	—	4885kHz	—	4845kHz	FM	FM-F2
40kHz	—	—	4955kHz		FL	FL-F4
50kHz	5055kHz	—	—		FH	FH-F6

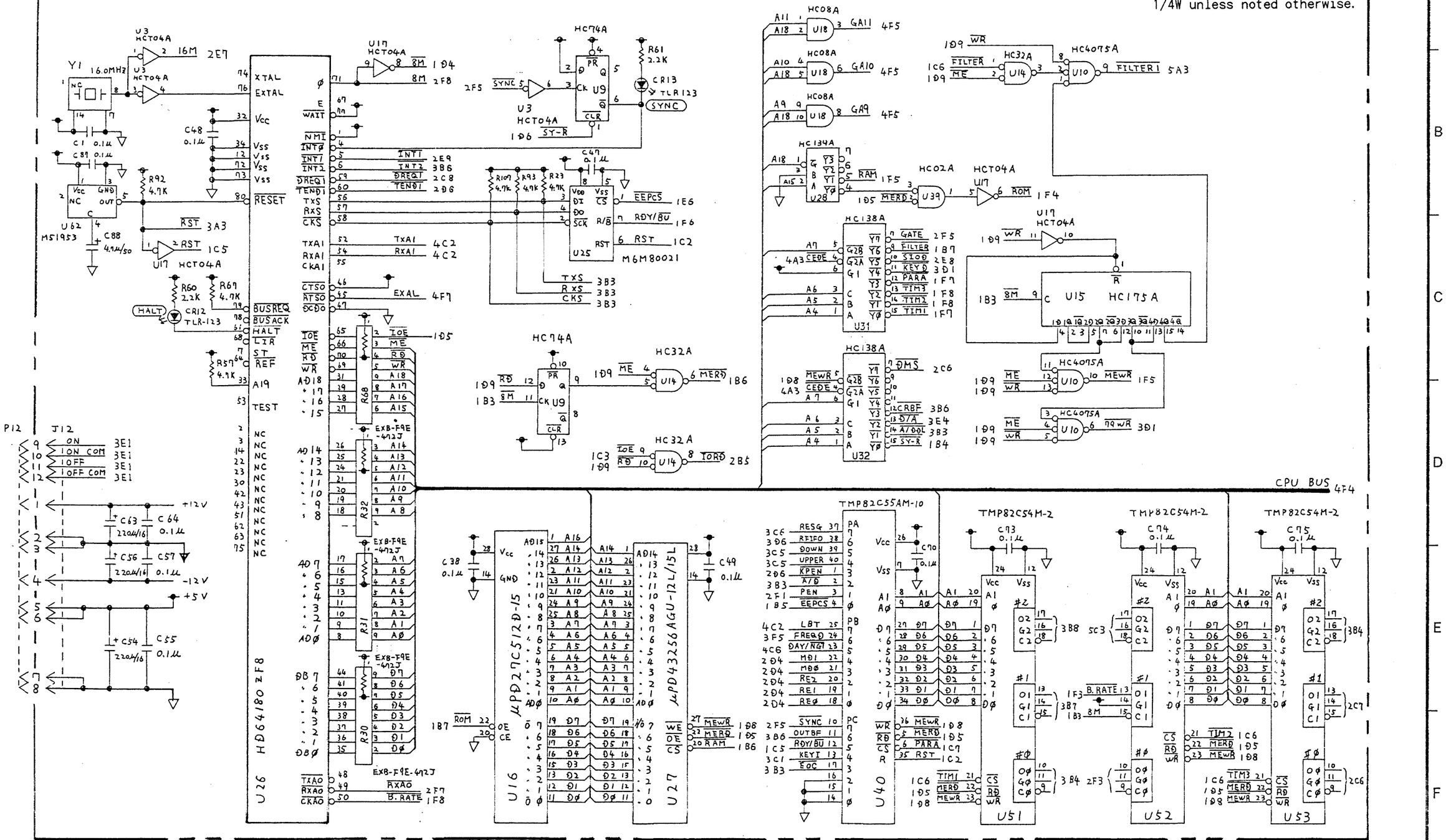
Y5 : 予備。#7-#8間はジャンパーしておく。
SPARE. #7 and #8 is jumpered.

DRAWN Apr/16'01 T.TAMASAKI			TYPE 01P5725
CHECKED Apr/18'01 Y.Kimura			名称 受信アンプ基板
APPROVED Apr/18'01 Y.Kimura	CN-2410 CN-2210		回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME AMP BOARD
DWG NO. C1275-K04- E	01-020-0011- 0		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

1B8 | 01P5726 | DISP

NOTE : 指示なき抵抗はすべて1/4W。
All resistors are type of 1/4W unless noted otherwise.



DRAWN Apr.16'91 TYAMASAKI			TYPE 01P5726 (1/5)
CHECKED Apr.18'91			名称 信号処理基板
APPROVED Apr.18'91	CN-2410 CN-2210	1B 8 1B 8	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME DISP BOARD
DWG NO. C1275-K05- B	01-019-1051- 0		SCHEMATIC DIAGRAM

1B8 01P5726 DISP

SM6100 U64 CR7 1SS97 CR25 1SS97 C98 0.1μ C97 47μ/16 5V-1 ADIN 5B9 ADWR 2D5

HC74A U42 HC73A U41 HC574A U56 HC139A U28 A7 IORD 1D5 CPU BUS 1D9

FMSIG 5C2 TEPL 2F5 JXX3 T N PXX3 NORMAL TEST HC74A U54 SIGN 2D1 ADWR 2C1

100K 5C5 TP12 U53 TMP82C54 4E6 1D6 4.95M DMS U53 TMP82C54 U3 HCT04A DREQ1 1B3 MODE:3 DMG 5B8 MODE:1 U39 HC02A KPEN SYNC 1E6 2F5 1B3 TENDT U39 HC74A

C94 0.1μ TxD 3D8 Q3 UN1121 CR9 1SS133 R46 220 CR8 1SS133 R47 470 MERD MEWR CPU BUS 1D9 DTR DSR RTS CTS TXC RXC B.RATE 1F8 CLK RST CS STOD 4.95M 4E6 1C2 1C6 TxRDY TxEMP RxRDY U58 TMP82C51AM-10 U1 HC08A U3 HCT04A INTT 1B3 J3 TX-DH TX-DL JXX2 CIF NMEA PXX2 CIF NMEA P3

P22 J22 SIGN 2C5 DI7 DI6 DI5 DI4 DI3 DI2 DI1 DI0 SEL3 SEL2 SEL1 SEL0 SD7 SD6 SD5 SD4 SD3 SD2 SD1 SD0 M/CHARP CK SYI RST 1C2 PEN 1E6 CKS TXS 1C4 U17 HCT04

C86 0.1μ C89 0.1μ 16M 1B2 EXB-F5E-472J R90 RE2 RE1 RE0 MD1 MD0 RST 1C2

U63 HD647180X0F-8

R91 EXB-F9E-472J U52 TMP82C54 HCT04A HC126A R85 4.9K 5C6 FD3 8M 9 HC393A U61 125K 3C1 5C7 MODE:3 2D6 SYNC

HC541A U55 R87 EXB-F9E-472J S3 S-3 THRESHOLD LEVEL ON OFF REFER TO OPERATOR'S MANUAL 1D9 CPU BUS 2C3 TEPL 1C6 GATE 1D5 MERD

C12 0.1μ R28 4.7K 1F3 RXAO U8 R26 47 CR2 1SS133 R29 470 JXX1 CIF PXX1 CIF RX-DH NMEA NMEA N.C PC900

DRAWN Apr16'01 TYAMASAKI			TYPE 01P5726 (2/5)
CHECKED Apr18'01			名称 信号処理基板
APPROVED Apr18'01	CN-2410 CN-2210	1B 8 1B 8	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME DISP BOARD
DWG NO. C1275-K06- B	01-019-1052- 0		SCHEMATIC DIAGRAM

1B8 01P5726 DISP

S-1 UNIT

1	2	UNIT
ON	ON	M
OFF	ON	FT
ON	OFF	FA
OFF	OFF	P Bor C0

S-1 FUNCTION

	NAME	ON	OFF
3	NAVS	CIF	NMEA
4	BACK UP	ON	OFF
5	CHR	ENGLISH	JAPAN
6	PLAY	TAPE	PANEL
7	TEMP	°C	°F
8	MODE	NORMAL	TEST

*NAVSの変更時には、ジャンパー2ヶ所も変更する。

S-2

1	2	NOT USED

S-2 XMTR TYPE

3	4	TYPE
ON	ON	500
OFF	ON	1000
ON	OFF	2000
OFF	OFF	

S-2 DN RANGE

5	6	RANGE
ON	ON	80
OFF	ON	160
ON	OFF	320
OFF	OFF	640

S-2 UP RANGE

7	8	RANGE
ON	ON	80
OFF	ON	160
ON	OFF	320
OFF	OFF	640

U65 μPD7001 — U59 TMP82C79M-2 — U50 LS621 — U66 LS145 — U51 TMP82C54 — U53 TMP82C54 — U34 HC4040A — U36 HC08A — U35 HCT04A — U30 HC74A — U39 HC02A — U49 HC126A — U67 HC4053A — U14 HC32A — U11 HC4053A — U13 HM63021-RP34 — U2 HC238A — U1 HC08A — U49 HC574A — R1 MRG7072 — R86 MRG7072 — U60 HC4538A — U5 TD62783 — U6 PC849 — Q8 2SC1815-Y — Q2 UN1121 — U23 μPC4570 — S1 MODE — S2

CPU BUS

1B8 | 01P5726 | DISP

U33
μPD65Ø5ØGD-Ø2Ø

U7 MC145442

U4 TD62382

U6 PC847

U5 TD62783

U35 HCT04A

U29 HC4538A

U69 HC4053A

U47 HC126A

U3 HCT04A

Q7 2SC1815

Q4 2SC1815-Y

Q5 2SC1815-Y

Q6 2SC1815-Y

Q1 2SC1815-Y

U18 HC08A

U1 HC08A

Y3 9.9MHz

TP3 COP. SYNC

TP4 BLUE

TP5 GREEN

TP6 RED

J14 P14

J21 P21

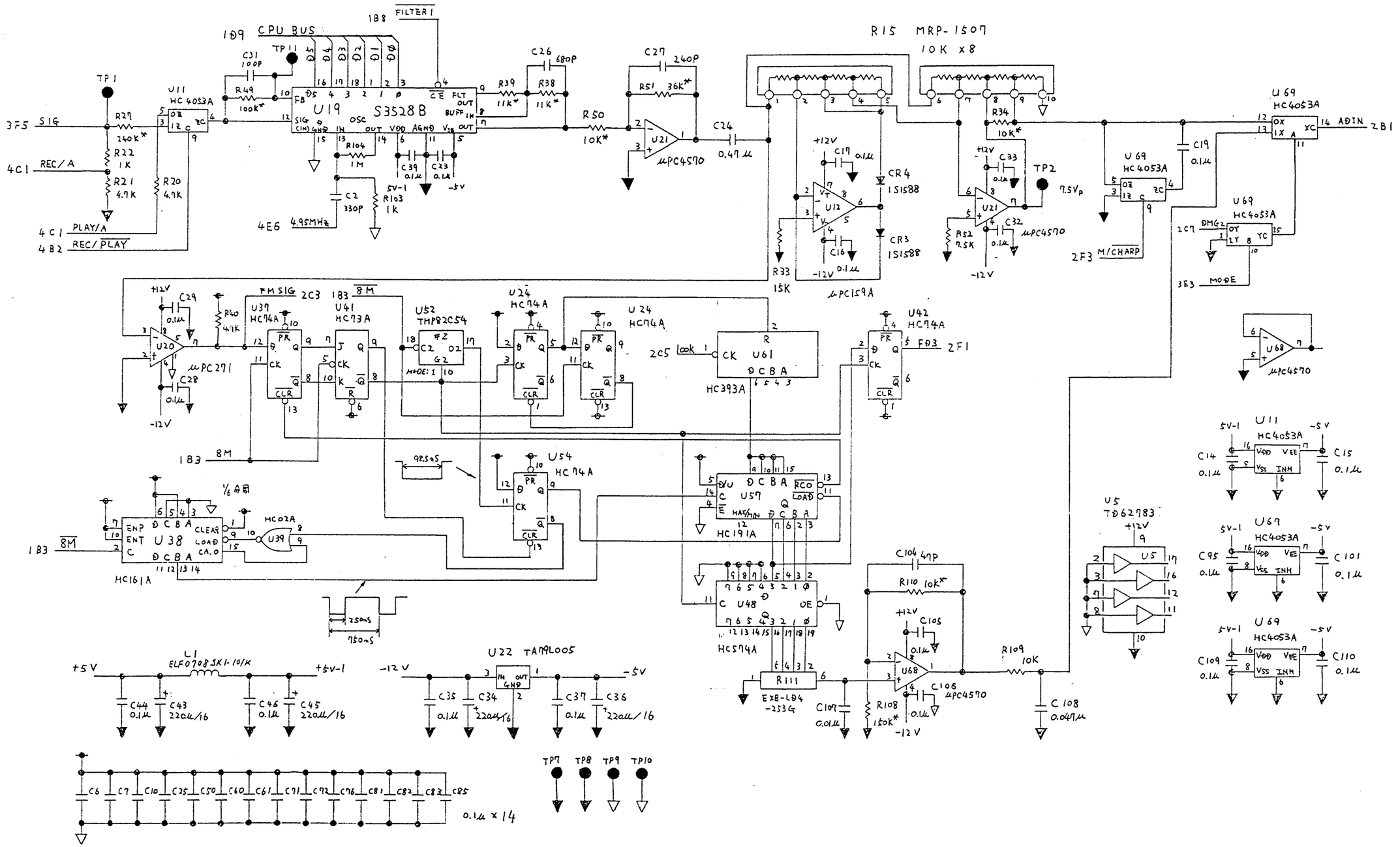
J7 P7

J6 P6

J4 P4

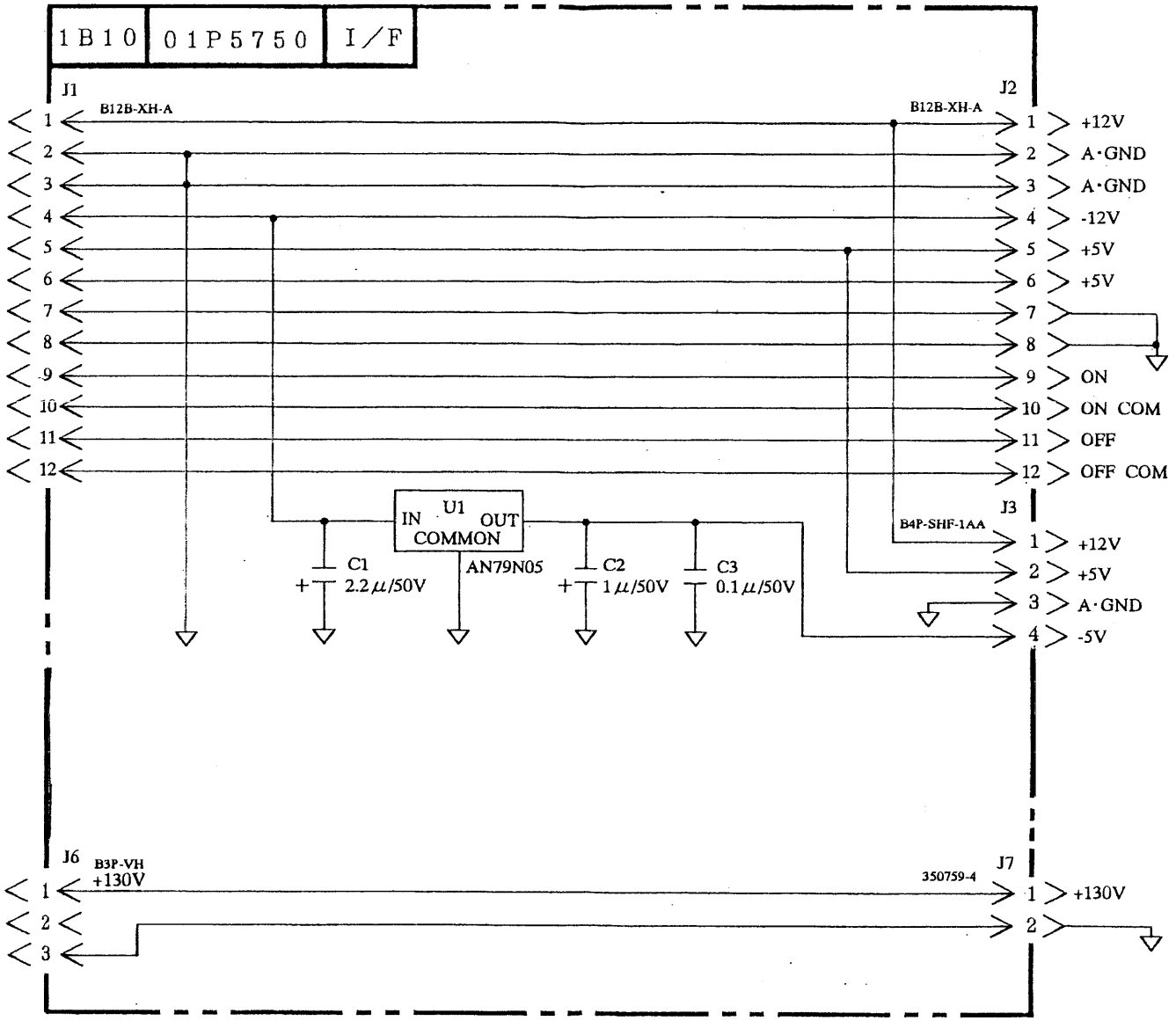
DRAWN Apr16'01 T.YAMASAKI			TYPE 01P5726 (4/5)
CHECKED Apr18'01 Y.K			名称 信号処理基板
APPROVED Apr18'01 Y.K	CN-2410 CN-2210	1B 8 1B 8	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME DISP BOARD
DWG NO. C1275-K08- B	01-019-1054- 1		SCHEMATIC DIAGRAM

1B8 | 01P5726 | DISP



DRAWN Apr.16'01 T.YAMASAKI			TYPE 01P5726 (5/5)
CHECKED Apr.16'01 Y.K			名称 信号処理基板
APPROVED Apr.16'01 Y.K	CN-2410 CN-2210	1B 8 1B 8	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME DISP BOARD
DWG NO. C1275-K09- B	01-019-1055- 0		SCHEMATIC DIAGRAM

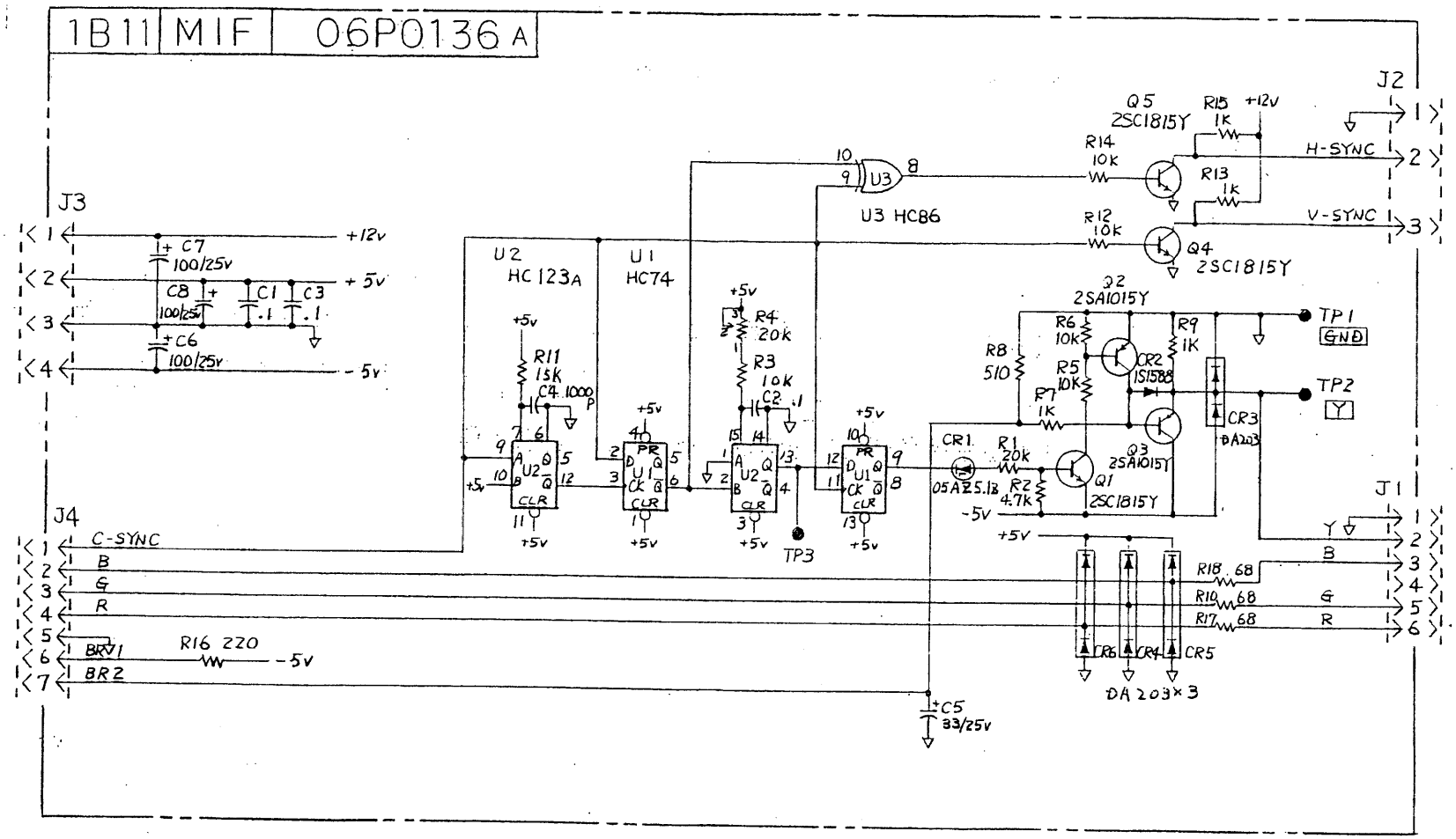
FURUNO



DRAWN May 7 '01 T. YAMASAKI			TYPE 01P5750
CHECKED May 8 '01 Y.K			名称 インターフェイス基板
APPROVED May 8 '01 Y.K	CN-24	1B10	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME I/F PCB
DWG NO. C1301-K03- A	01-022-1013- 1		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

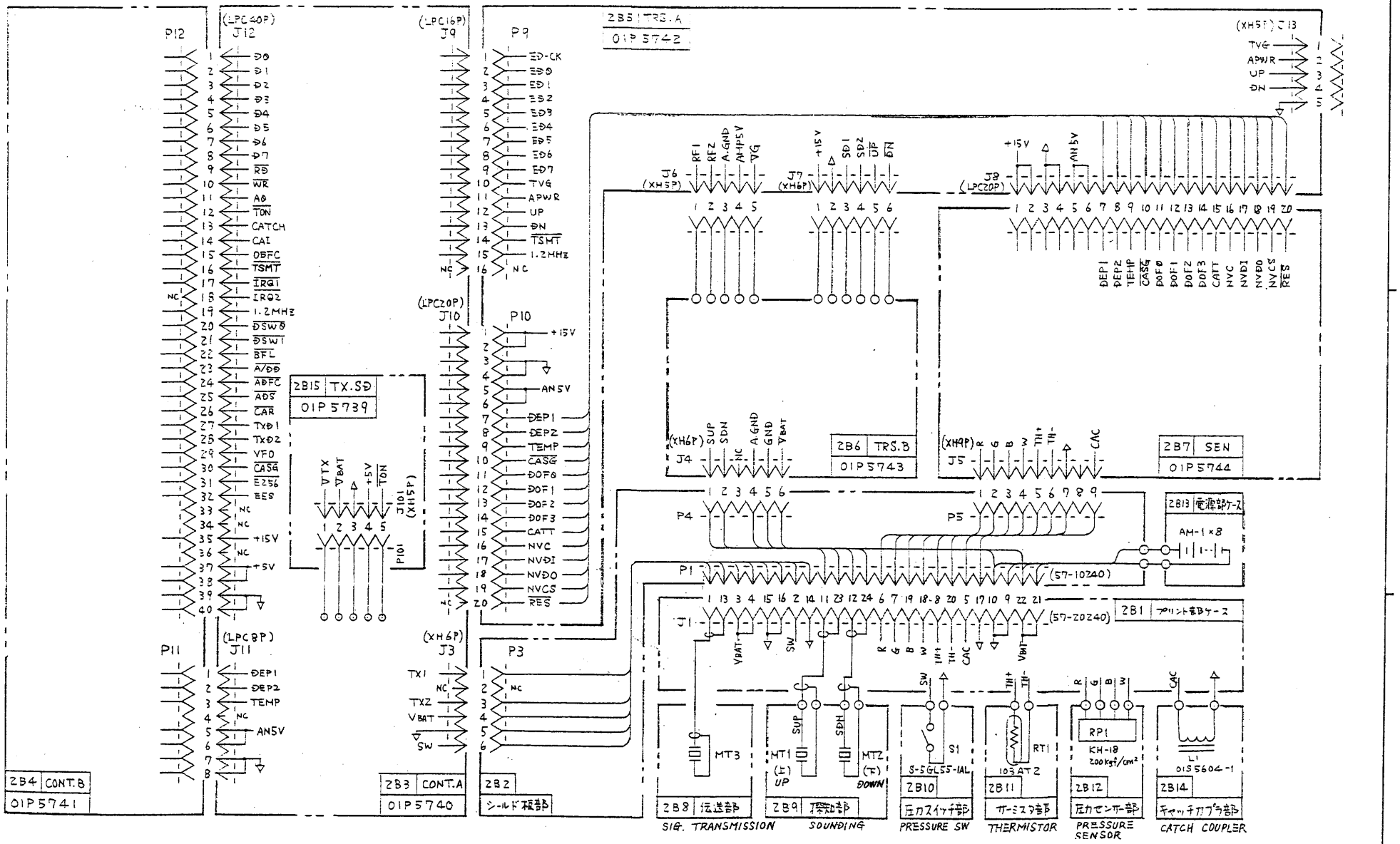
FURUNO



DRAWN May 7'01 T.YAMASAKI			TYPE 06P0136A
CHECKED May 8'01 Y.K			名称 モニターインターフェイス基板
APPROVED May 8'01 Y.K	CN-24	1B11	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME MIF PCB
DWG NO. C1301-K02- A	01-022-1014- 0		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

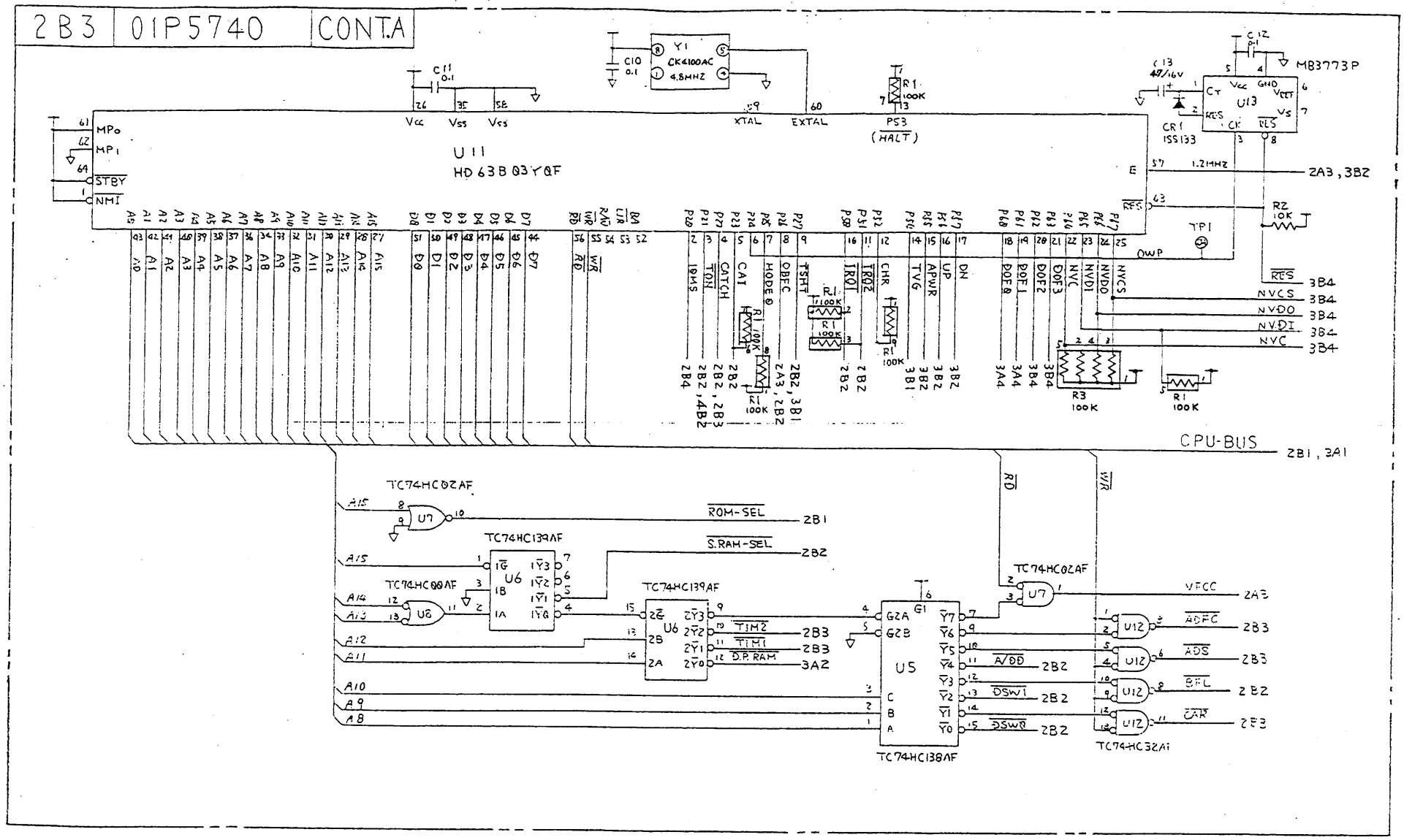
FURUNO



DRAWN Apr.16'01 TYAMASAKI			TYPE CN-2220
CHECKED Apr.16'01 Y.K			名称 発信器総合
APPROVED Apr.16'01 K.K	CN-24 CN-22		回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME TRANSMITTER UNIT
DWG NO. C1284-K12- B	01-020-1001- 4		SCHEMATIC DIAGRAM

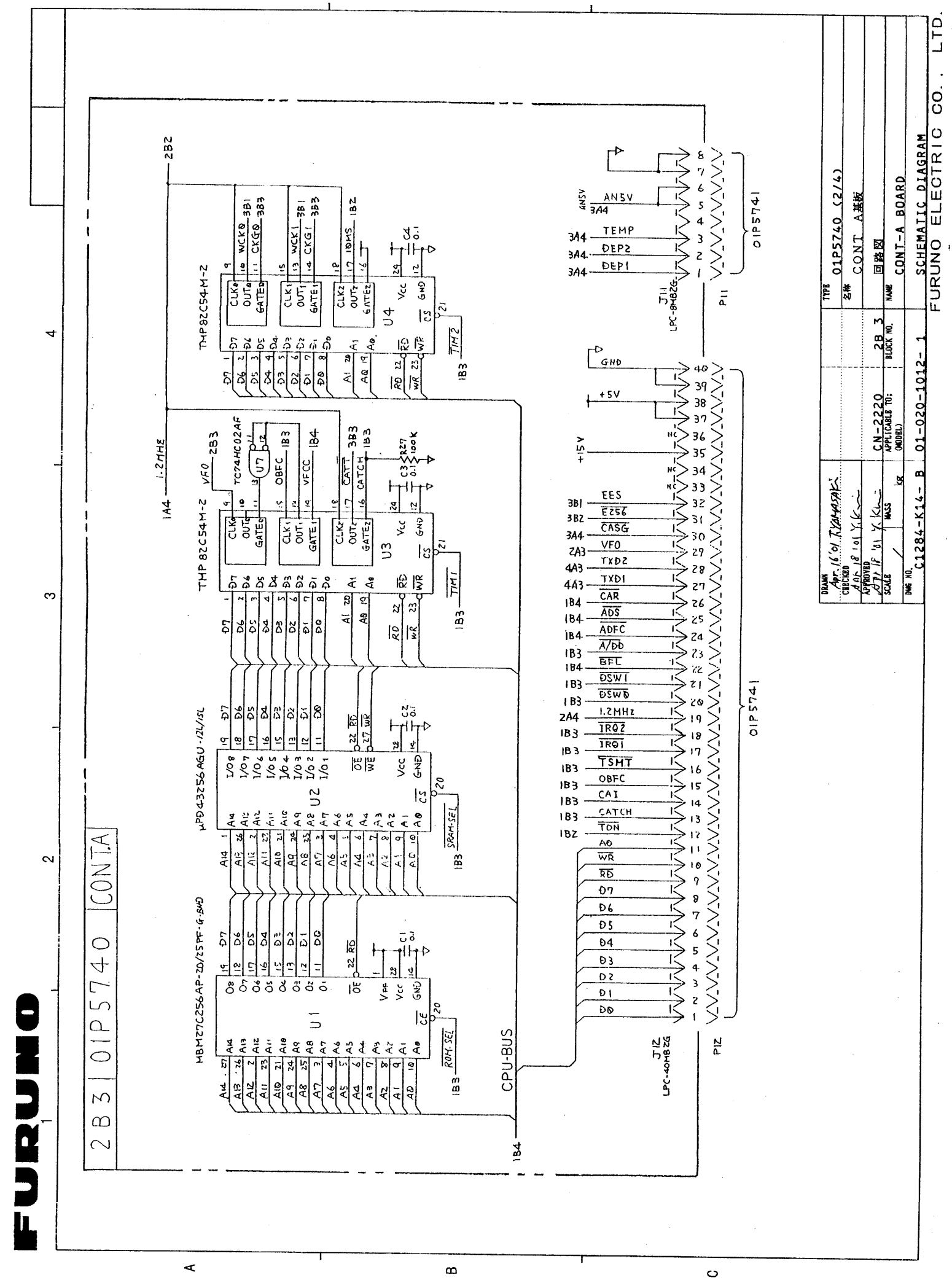
FURUNO ELECTRIC CO., LTD.

FURUNO



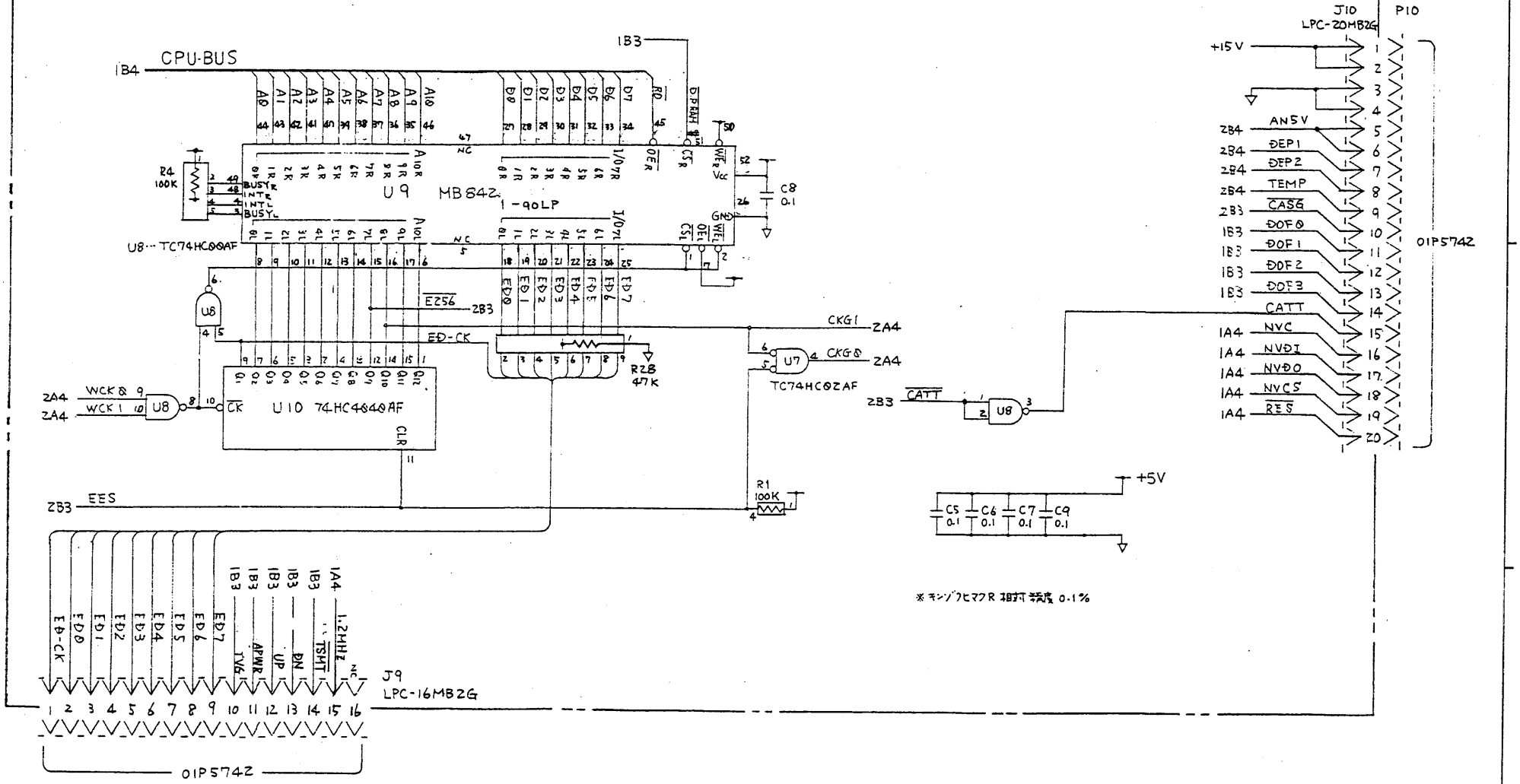
DRAWN Apr 16'01 T.YAMASAKI				TYPE 01P5740 (1/4)
CHECKED Apr 18'01 T.K				名称 CONT-A基板
APPROVED Apr 18'01 T.K		CN-2220	2B 3	回路図
SCALE /	MASS kg	APPLICABLE TO: (MODEL)	BLOCK NO.	NAME CONT-A BOARD
DWG NO. C1284-K13- B		01-020-1011- 3		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.


2B3 01P5740 CONTA
MBM27C256AP-20/25PF-G-BWD
μPD43256AGU-12L/15L
TMP82C54M-2
TC74HC02AF
CPU-BUS
ROM-SEL
SRAM-SEL
1.2MHz
VFO
OBFC
CATT
CATCH
TON
TSMT
IRQ1
IRQ2
CAI
EES
E2S6
CASG
CAR
ADS
ADFC
A/DD
BFL
DSW1
DSWD
TXD1
TXD2
RXD
TEMP
DEP2
DEP1
AN5V
+5V
+15V
GND
CN-2220
LPC-40H8Z6
01P5741
01P5740 (2/4)
CONT A基板
回路図
CONT-A BOARD
SCHEMATIC DIAGRAM
C1284-K14- B 01-020-1012- 1
FURUNO ELECTRIC CO., LTD.

FURUNO

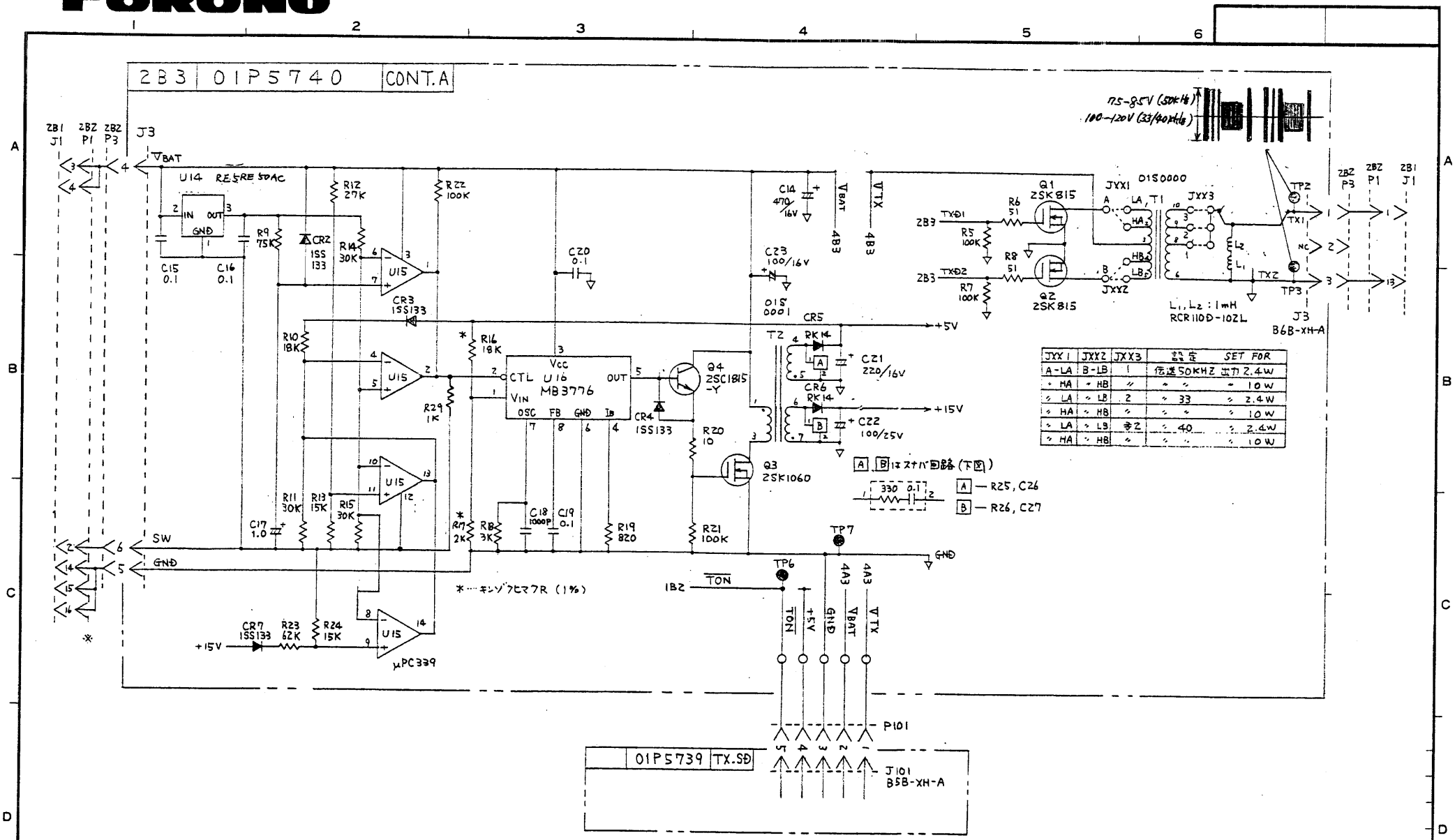
2B3 | 01P5740 | CONT.A



DRAWN Apr.16'01 T.YAMASAKI			TYPE 01P5740 (3/4)
CHECKED Apr.18'01 Y.K			名称 CONT A基板
APPROVED Apr.19'01 Y.K	CN-2220	2B 3	回路図
SCALE / MASS kg	APPLICABLE TO: (MODEL)	BLOCK NO.	NAME CONT.A BOARD
DWG NO. C1284-K15- B	01-020-1013- 2		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO

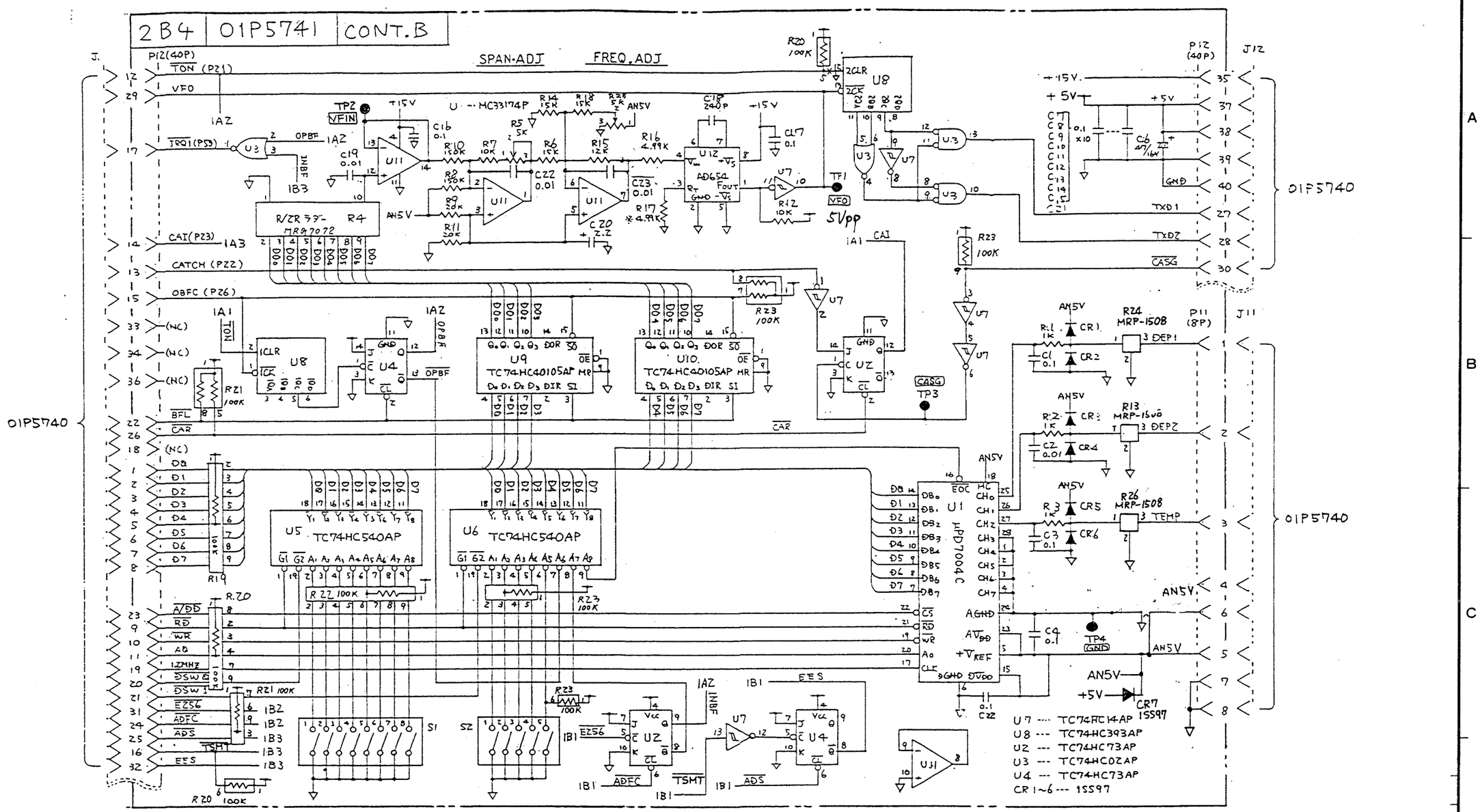


JYX1	JYX2	JYX3	設定	SET FOR
A-LA	B-LB	1	低速50KHZ 出力	2.4W
〃 HA	〃 HB	〃	〃 〃	10W
〃 LA	〃 LB	2	〃 33	〃 2.4W
〃 HA	〃 HB	〃	〃 〃	〃 10W
〃 LA	〃 LB	未2	〃 40	〃 2.4W
〃 HA	〃 HB	〃	〃 〃	〃 10W

DRAWN Apr.16'01 T.YAMASAKI			TYPE 01P5740 (4/4)
CHECKED Apr.18'01			名称 CONT-A基板
APPROVED Apr.18'01	CN-2220	2B 3	回路図
SCALE / MASS kg	APPLICABLE TO: (MODEL)	BLOCK NO.	NAME CONT.A BOARD
DWG NO. C1284-K16- B	01-020-1014- 4		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

2B4 | 01P5741 | CONT.B



DRAWN Apr.16.'01 Yamasaki			TYPE 01P5741
CHECKED Apr.18.'01 Y.K			名称 CONT-B基板
APPROVED Apr.18.'01 Y.K	CN-2220	2B 4	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME CONT.B BOARD
DWG NO. C1284-K17- B	01-020-1015- 3		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

2B5 | 01P5742 | TRS.A

U3 TC74HC393AP
U4 TC74HC00AP
U5 TC74HC02AP

U2 μPC358C
Q8,9 3SK101-GR

J6 B5B-XH-A
J7 B6B-XH-A
J8 LPC-20MB2G
P10 LPC-20FDG
P9 LPC-16FDG
J13 S5B-XH-A

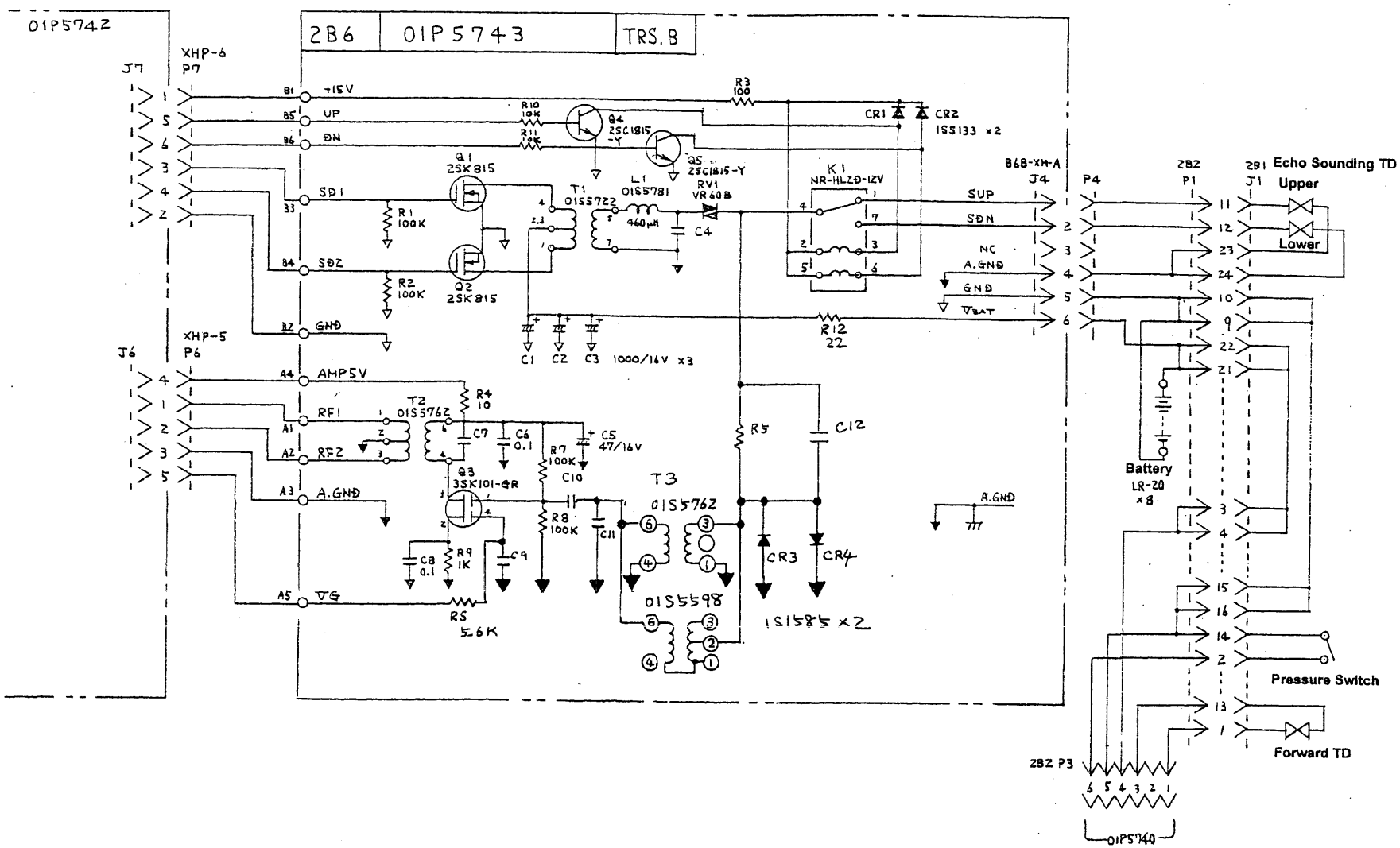
01P5743
01P5744
01P5740

U1 SM6100

J13: Factory use
※ J13は、水深・水温・伝送周波数 調整モニタ用コネクタ

DRAWN Apr.16'01 T.YAMASAKI			TYPE 01P5742
CHECKED Apr.18'01 Y.C			名称 TRS-A基板
APPROVED Apr.18'01 Y.K		CN-2220	回路図
SCALE /	MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME TRS A BOARD
DWG NO. C1284-K18- B		01-020-1016- 10		SCHEMATIC DIAGRAM

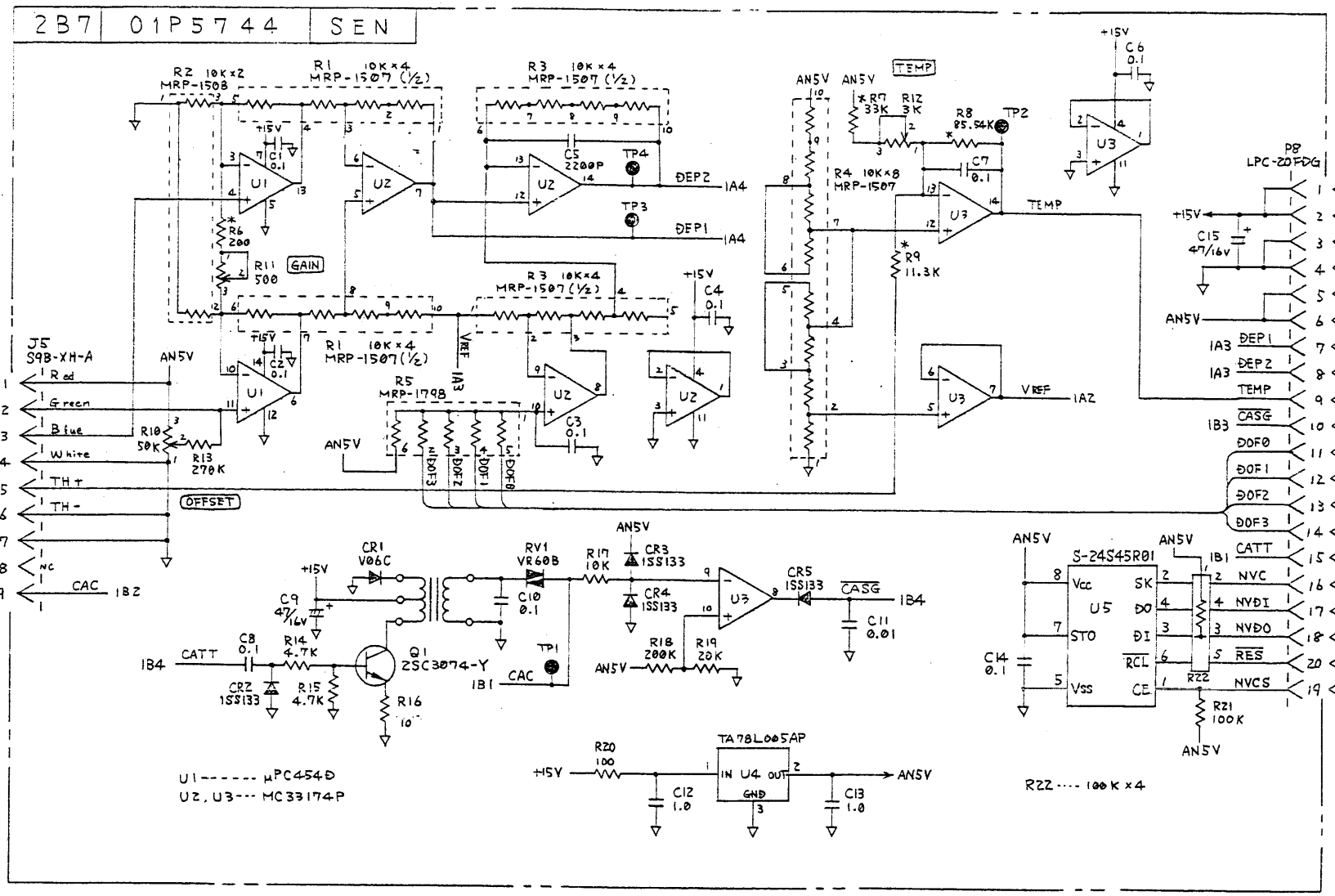
FURUNO



DRAWN Apr.16'01 TYAMASAKI			TYPE 01P5743
CHECKED Apr.16'01			名称 TRS-B基板
APPROVED Apr.16'01	CN-2220	2B 6	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME TRS B BOARD
DWG NO. C1284-K19- B	01-020-1017- 5		SCHEMATIC DIAGRAM

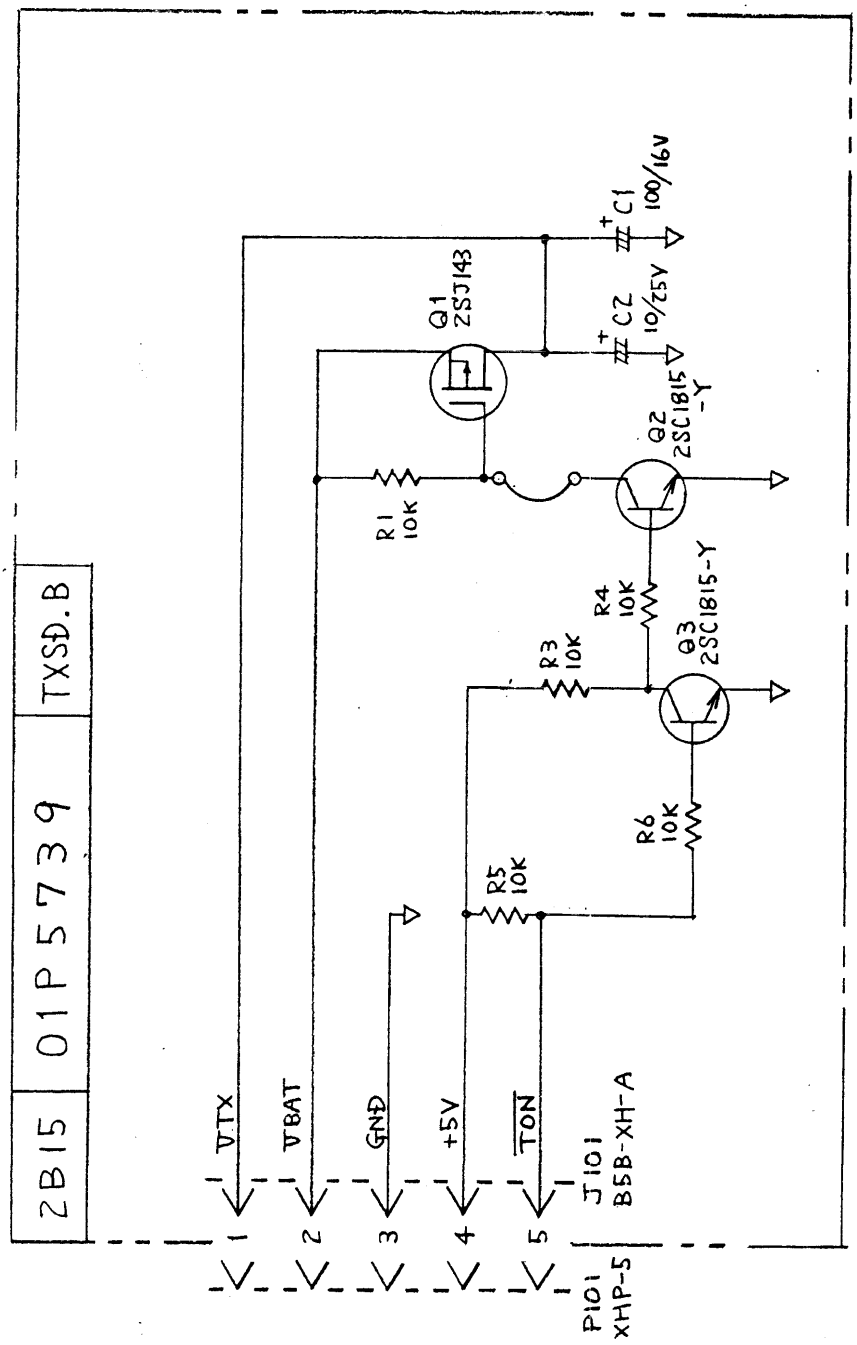
FURUNO ELECTRIC CO., LTD.

FURUNO



DRAWN Apr.16'01 YAMASAKI			TYPE	01P5744
CHECKED Apr.16'01 Y.K			名称	SEN基板
APPROVED Apr.16'01 Y.K	CN-2220	2B 7		回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME	SEN BOARD
DWG NO. C1284-K20- B	01-020-1018- 1			SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.



DRAWN Apr 16'01 TYAMASAKI			TYPE 01P5739
CHECKED Apr 18 '01 K.K			名称 TXSD. B基板
APPROVED Apr 18 '01 K.K	CN-2220	2B15	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME TXSD.B BOARD
DWG NO. C1284-K21- B	01-020-1019- 0		SCHEMATIC DIAGRAM