FURUNO

SERVICE MANUAL

ECHO SOUNDER

MODEL FE-808

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·Your Local Agent/Dealer

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(YOHA) FE-808

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SPECIFICATIONS OF **FE-808** ECHO SOUNDER

* *

1. DEPTH RANGE, SOUNDING RATE & PULSELENGTH:

RANGE			FE-808M (meter)	FE-808FT (foot)	FE-808FA/PA (fathom,passi)	SOUNDING RATE(/min.)	PULSELENGTH (msec)
NORMAL	1	a	0- 20	0- 30	0- 10	376	0.4
		b	10- 30	15- 45	5- 15		
	2	a	0- 40	0- 60	0- 20		
		b	20- 60	30- 90	10- 30		
	3	a	0- 80	0- 120	0- 40	188	1.0
		b	40- 120	60- 180	20- 60		
	4	a	0- 200	0- 300	0-100	94	
		b	100- 300	150- 450	50-150		
	5	a	0- 400	0- 600	0-200	47	2.0
		b	200- 600	300- 900	100-300		
	6	a	0- 800	0-1200	0-400	23.5(*)	
		b	400-1200	600-1800	200-600		
BOTTOM LOCK		1	5	7.5	2.5	*: 47 for foot scale	
		2	10	15	5		

2. RECORDING SYSTEM: Straight line recording

3. PRESENTATION MODE:
   a) Normal(full paper width)
   b) Normal(upper 2/3) plus Bottom Lock(lower 1/3)

4. RECORDING PAPER: Dry electrosensitive paper
   Type; PD-2020NW (204mmx20m)

5. PAPER SPEED: Range 1-3: 6, 9 or 18mm/min.
   Range 4-6: 2, 3 or 6mm/min.

6. INTENSITY GRADATION: Light-gray, gray and black

7. FREQUENCY & TRANSDUCER:
   28kHz : 28F-8(Std.), 28F-18(Opt.)
   50kHz : 50B-6(Std.), 50B-9(Opt.), 50F-8G(Opt.)
   60kHz : 60B-5S(Std.), 60B-52(Opt.)
   88kHz : 88B-8(Std.), 88B-10(Opt.)
   200kHz: 200B-5S(Std.), 200B-8/8N(Opt.)

8. OUTPUT POWER: 500W nominal

9. CONTROLS / SWITCHES:
   Front Panel: a) Range b) Gain
   c) Shadow Line
   d) Function (OFF/ON/BL-1/2)
   e) Event Marker
   Sub-Panel: a) Noise Limiter
   b) Paper Speed
   c) TVG (Time Varied Gain)
   d) Draft (zero line shift)
   e) Power Reduction
   f) Lamp

10. DIGITAL READOUT:
    a) Start depth and end depth [Shadow Line OFF]
    b) Start depth, seabed depth and end depth [Shadow Line ON]

11. POWER SUPPLY: 10.5 to 40VDC universal, 50W approx.

12. DIMENSIONS & WEIGHT: 366(W) x 418(H) x 138(D)mm, 12.2kg

[EQUIPMENT LIST]

No.	Name	Type	Q'ty	Remarks
1	Recorder Unit	FE-808	1	
2	Transducer		1	
3	Installation Materials		1 set	See separate list.
4	Spare Parts		1 set	See separate list.
5	Vinyl Cover	02-038-0001	1	Code No.: 000-879-498

[STANDARD SPARE PARTS]

No.	Name	Type	Code No.	Q'ty	Remarks
1	Fuse	F-7161, 7A	000-547-011	1	
2	Recording Stylus	02-015-2190-2	201-521-902	1	
3	Sand Paper	#240 90x90mm	000-835-008	1	
4	Recording Paper	PD-2020NW	000-878-457	1	
5	Pilot Lamp	P-12, 50mA	000-540-156	2	w/WHT leads

[INSTALLATION MATERIALS]

No.	Name	Type	Code No.	Q'ty	Remarks
1	Vinyl Cable	VCTF1.25x2C,5m	000-564-502	1	for power
2	Crimp-on Lug	FV1.25-3 RED	000-538-113	5	

[TRANSDUCER/TANK/THRU-HULL PIPE]

FREQUENCY	TRANSDUCER	TANK	THRU-HULL PIPE	USE
28kHz	28F-8 (000-015-003) Standard	T-604 (000-015-512)	TFB-5000 (000-015-206)	Steel Hull
		T-604-W (000-015-514)	TFB-1000 (000-015-201)	Wooden Hull
		T-604-F (000-015-513)	TRB-1000 (000-015-215)	Plastic Hull
		T-514 (000-015-416)	————	Sideboard
	28F-18 (000-015-004) Option	T-612 (000-015-534)	TFB-5000 (000-015-206)	Steel Hull
		T-612-W (000-015-536)	TFB-1000 (000-015-201)	Wooden Hull
		T-612-F (000-015-535)	TRB-1000 (000-015-215)	Plastic Hull
		T-2 (000-015-302)	————	Sideboard
50kHz	50B-6 (000-015-042) Standard	T-605 (000-015-515)	TFB-5000 (000-015-206)	Steel Hull
		T-605-W (000-015-517)	TFB-1000 (000-015-201)	Wooden Hull
		T-605-F (000-015-516)	TRB-1000 (000-015-215)	Plastic Hull
		T-27 (000-015-313)	————	Sideboard
	50B-9 (000-015-064) Option	T-603 (000-015-509)	TFB-5000 (000-015-206)	Steel Hull
		T-603-W (000-015-511)	TFB-1000 (000-015-201)	Wooden Hull
		T-603-F (000-015-510)	TRB-1000 (000-015-215)	Plastic Hull
		T-63 (000-015-326)	————	Sideboard

FREQUENCY	TRANSDUCER	TANK	THRU-HULL PIPE	USE
50kHz	50F-8G (000-015-066) Option	T-612 (000-015-534)	TFB-5000 (000-015-206)	Steel Hull
		T-612-W (000-015-536)	TFB-1000 (000-015-201)	Wooden Hull
		T-612-F (000-015-535)	TRB-1000 (000-015-215)	Plastic Hull
		T-2 (000-015-302)	———	Sideboard
60kHz	60B-5S (000-015-021) Standard	T-605 (000-015-515)	TFB-5000 (000-015-206)	Steel Hull
		T-605-W (000-015-517)	TFB-1000 (000-015-201)	Wooden Hull
		T-605-F (000-015-516)	TRB-1000 (000-015-215)	Plastic Hull
		T-27 (000-015-313)	———	Sideboard
	60B-52 (000-015-022) Option	T-603 (000-015-509)	TFB-5000 (000-015-206)	Steel Hull
		T-603-W (000-015-511)	TFB-1000 (000-015-201)	Wooden Hull
		T-603-F (000-015-510)	TRB-1000 (000-015-215)	Plastic Hull
		T-63 (000-015-326)	———	Sideboard
88kHz	88B-8 (000-015-024) Standard	T-606 (000-015-518)	TFB-5000 (000-015-206)	Steel Hull
		T-606-W (000-015-520)	TFB-1000 (000-015-201)	Wooden Hull
		T-606-F (000-015-519)	TRB-1000 (000-015-215)	Plastic Hull
		T-221 (000-015-366)	———	Sideboard
	88B-10 (000-015-025) Option	T-609 (000-015-528)	TFB-5000 (000-015-206)	Steel Hull
		T-609-W (000-015-530)	TFB-1000 (000-015-201)	Wooden Hull
		T-609-F (000-015-529)	TRB-1000 (000-015-215)	Plastic Hull
		T-501 (000-015-401)	———	Sideboard
200kHz	200B-5S (000-015-029) Standard	T-605 (000-015-515)	TFB-5000 (000-015-206)	Steel Hull
		T-605-W (000-015-517)	TFB-1000 (000-015-201)	Wooden Hull
		T-605-F (000-015-516)	TRB-1000 (000-015-215)	Plastic Hull
		T-27 (000-015-313)	———	Sideboard
	200B-8 (000-015-030) 200B-8N (000-015-045) Option	T-608 (000-015-525)	TFB-5000 (000-015-206)	Steel Hull
		T-608-W (000-015-527)	TFB-1000 (000-015-201)	Wooden Hull
		T-608-F (000-015-526)	TRB-1000 (000-015-215)	Plastic Hull
		T-31 (000-015-317)	———	Sideboard

CHAPTER 1. CIRCUIT DESCRIPTION

See the block diagram on page 1-2 for understanding of the following general description. Each circuit is explained in detail on page 1-3 and after.

TRANSMISSION

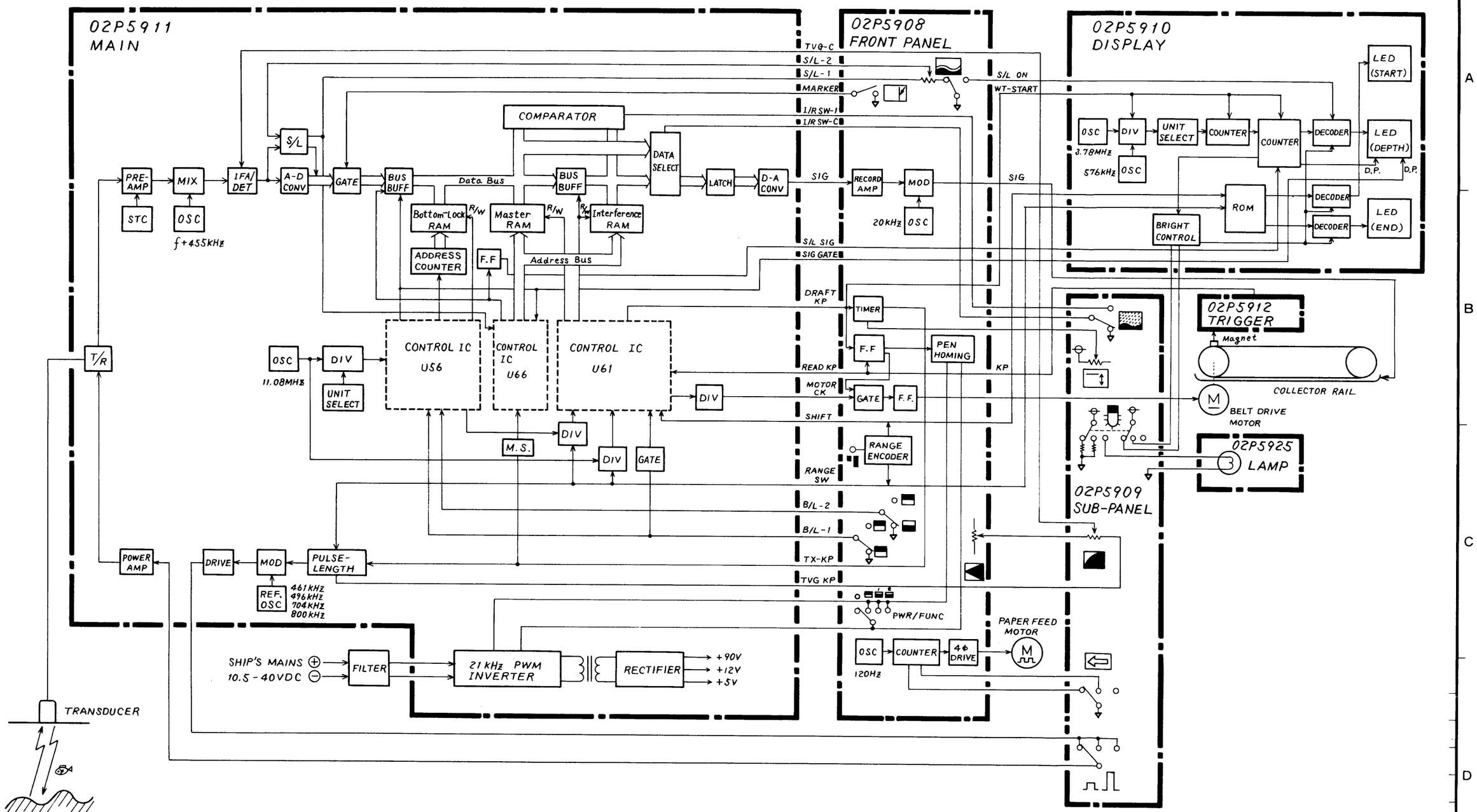
A negative-going keying pulse "KP" is produced at the TRIGGER board. This KP is led into the control IC U61 #13 on the MAIN board via the FRONT PANEL board. Upon terminating "READ" condition, a DRAFT KP comes out from U61 #11. The DRAFT KP is applied to the timer on the FRONT PANEL board, and the timer output kicks the pulselength generator as a TX-KP whose pulselength is controlled by the DRAFT control. Three kinds of TX pulselengths are determined there in accordance with the setting of the RANGE switch. The transmission pulse is modulated with the reference oscillator to get a transmission frequency. Output signal from the modulator is amplified by the driver, passes through the POWER REDUCTION switch on the SUB-PANEL board, and furthermore amplified by the power amplifiers. Then the output of the power amplifier is fed to the transducer via the T/R circuit.

RECEPTION

Received signal from the transducer passes through the T/R circuit, and is amplified by the pre-amplifier, where STC is effective. After mixing it with the local oscillator output, the 455kHz IF signal is obtained and amplified by the IF amplifier, where the gain and TVG are controlled. The IF signal is converted from analogue to digital in order to process digitally at the succeeding stages. Together, the analogue level of the SHADOW LINE control is converted into digital one. Three-bit data runs along the data bus line and is stored into three kinds of memories called Bottom-Lock RAM, Master RAM and Interference RAM. Each address and "READ/WRITE" timing is assigned to the control IC's U56, U61 and U66. If the NOISE LIMITER switch is turned on, last and present data stored into the Master RAM and the Interference RAM are compared by the comparator, and the data selector sends out the data without interference. The data is temporarily latched, and then converted into an analogue signal to be plotted on the recording paper. The analogue signal is amplified, and modulated with a carrier signal on the FRONT PANEL board. The modulated signal is finally led to the collector rail for plotting.

DISPLAY

Both the start and the end depth data are previously memorized in the ROM on the DISPLAY board. Each data is read out in accordance with the setting of the RANGE switch and the unit, and decoded from BCD code to 7-segment output in order to display on the upper and lower LED's. As for the middle display, i.e. depth, the SHADOW LINE control should be turned on. At the beginning of "WRITE" condition, the WT-START pulse comes out, and resets the counter. The counter starts counting the unit pulse selected by the unit selector until the S/L SIG is applied. The counter output is led to the decoder, and then the sea depth is displayed on the middle LED.



品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
承認 APPROVED	JUN 13 '84	三角法 THIRD ANGLE PROJECTION	名称 TITLE	FE-808 ブロック図 BLOCK DIAGRAM	
検図 CHECKED	June 13. 84	尺度 SCALE			
製図 DRAWN	June 13 '84	重量 WEIGHT kg	図番 DWG.NO.	C2285-011-B	

FURUNO ELECTRIC CO., LTD.

1-1. Transmitter

The block diagram, circuit diagram, and timing chart are shown below.

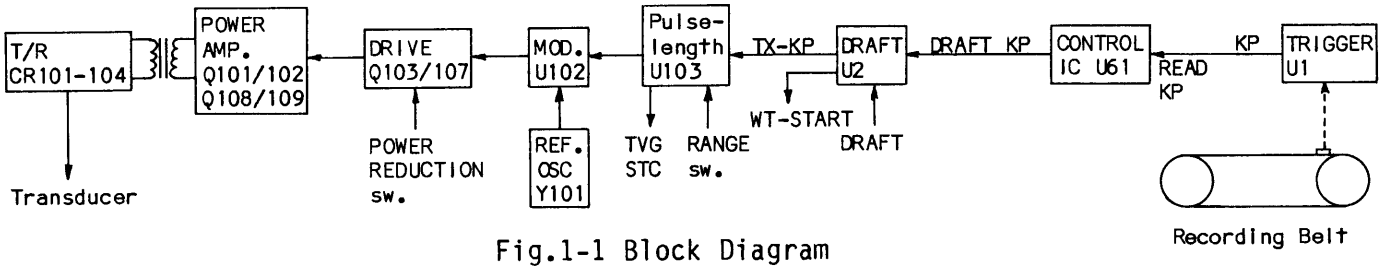


Fig.1-1 Block Diagram

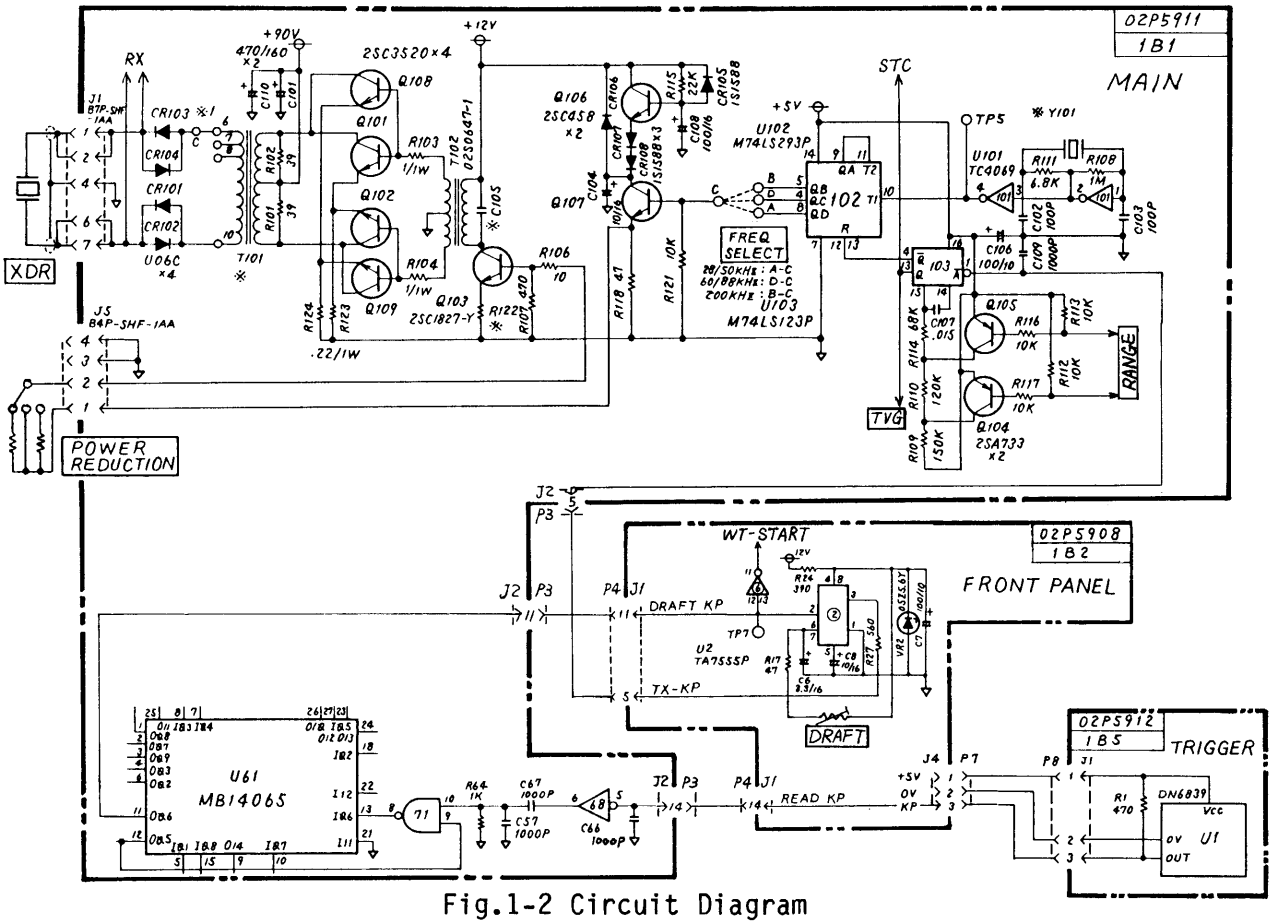


Fig.1-2 Circuit Diagram

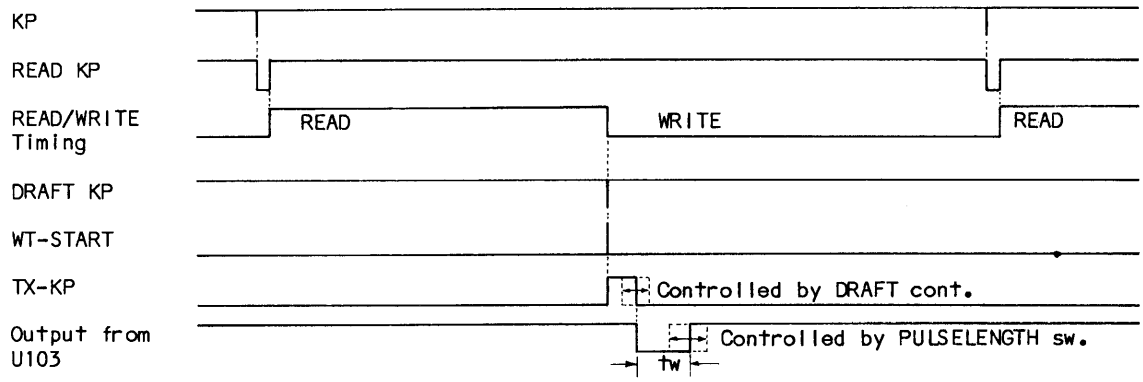


Fig.1-3 Timing Chart

A keying pulse (KP) comes out from the hall IC U1 mounted on the TRIGGER board where a strong magnetic flux crosses over it. Since a magnet is provided on the recording belt, the KP is obtained every rotation of the belt. This KP is applied to the control IC U61 #13 on the MAIN board via the FRONT PANEL board, and used to switch the "READ" and "WRITE" timing of the Master RAM U64. When terminating the "READ" condition, a negative-going pulse called DRAFT KP comes out at U61 #11. This pulse is led to the following draft control circuit.

DRAFT Control

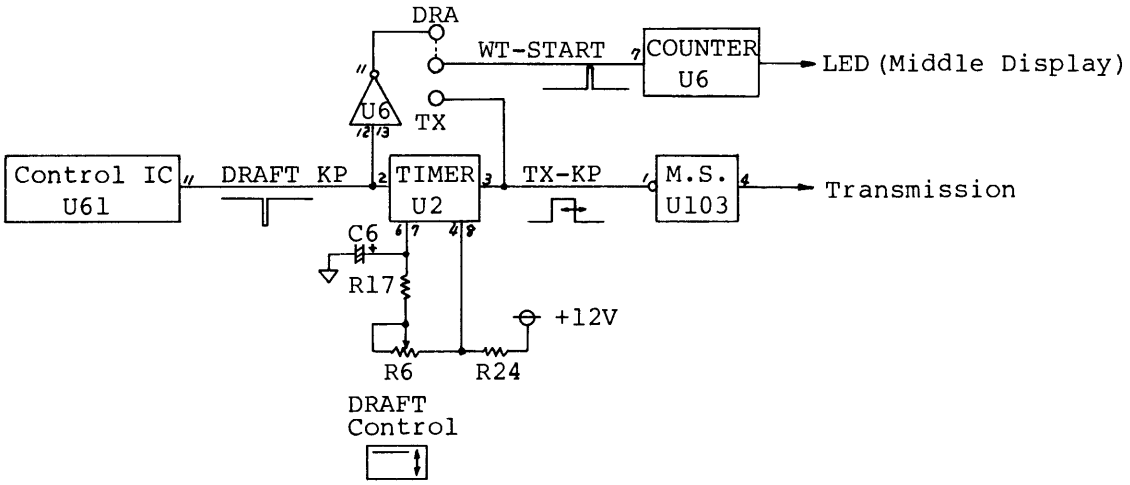


Fig.1-4

Upon application of a negative-going DRAFT KP coming from the control IC U61, the timer U2 functions as an one-shot multivibrator, and generates a positive-going pulse called TX-KP. Its pulselength is determined by the time constant set by C6, R17 and the DRAFT control R6. As the monostable multivibrator U103 is fired at the negative-going edge of the TX-KP, it is delayed by the time corresponding to the pulselength.

DRA/TX Jumper Wire

The equipment is factory-set to "DRA(DRAFT)". On this setting, the WT-START pulse, which resets the counter U6 to "0000" on the DISPLAY board, appears at the same timing as DRAFT KP. The timing of transmission, however, is delayed by the timer U2.

As a result, the zero line is shifted on the recording paper, and the middle digital display shows an actual sea depth from the sea surface to the sea bottom.

On the other hand, the zero line may not be shifted when the jumper wire is set to "TX". That is, the middle digital display shows a bottom clearance from the transducer to the seabed because the timing of WT-START is the same as transmission, and the DRAFT control is ignored for the digital display.

The TX-KP is led to the following pulselength selection circuit to get an assigned transmission pulselength.

PULSELENGTH Selection

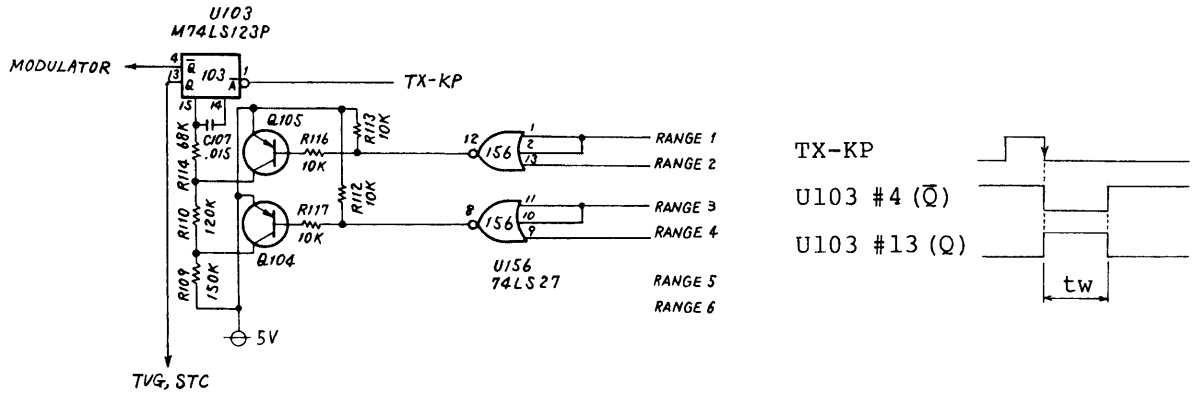


Fig.1-5

The pulselength among 0.4, 1.2 and 2.2 msec is selected in accordance with the setting of the RANGE switch. For example, when the RANGE switch is set to [1] or [2], the output terminal #12 of the NOR gate U156 turns to "L", and Q105 turns on. The pulselength, i.e. time constant of the multivibrator U103, is determined by the following equation.

$$tw\ (ns) = 0.45 \times R(k\Omega) \times C(pF)$$
$$= 0.45 \times R114 \times C107$$

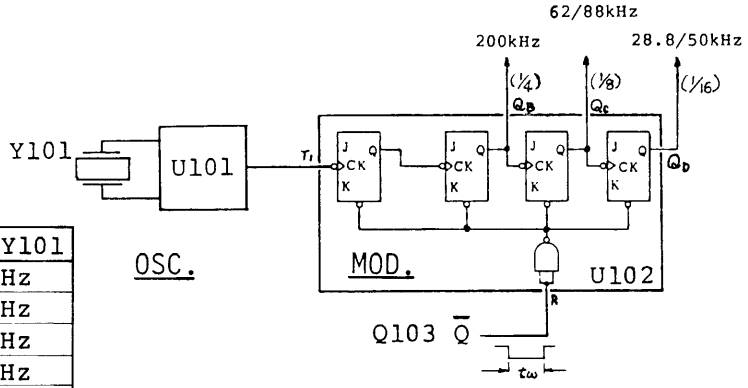
In the same manner, "tw" is given at respective range settings as follows.

RANGE [3] or [4] : $tw = 0.45 \times (R114 + R110) \times C107$
RANGE [5] or [6] : $tw = 0.45 \times (R114 + R110 + R109) \times C107$

Output terminals Q and $\overline{Q}$ of U103 are led to the modulator and TVG/STC circuits respectively.

MODULATOR & REF. OSC.

A clock pulse of 461kHz(for 28kHz sets), 800kHz(for 50/200kHz sets), 496kHz(for 60kHz sets) or 704kHz(for 88kHz sets) oscillated by Y101, U101 and associated parts is led to the binary counter U102. When a negative-going pulse having pulselength "tw" is fed to the reset terminals, U102 starts counting, and 200kHz, 62/88kHz and 28.8/50kHz signals come out at Q_B, Q_C and Q_D respectively while the clock pulse is present.



	TX FREQ.	L.OSC Y101
28kHz set	28.8kHz	461kHz
50kHz set	50kHz	800kHz
60kHz set	62kHz	496kHz
88kHz set	88kHz	704kHz
200kHz set	200kHz	800kHz

Fig.1-6

DRIVE, POWER REDUCTION, POWER AMPLIFIER & OUTPUT TRANSFORMER

The output signal from the modulator is amplified by the driver Q107 and Q103. The POWER REDUCTION switch located on the SUB-PANEL board is provided between Q107 and Q103 in order to control output power. After the driver stage, the transmission pulse is furthermore amplified by the power amplifier Q101/Q102 and Q108/Q109 to a required output level, and applied to the output transformer T101.

Q106 is provided not to transmit immediately after turning on the FUNCTION switch. C108 is charged in the first stage, and Q106 turns on after approximately 1.5 sec. As a result, +12V is led to the collector of Q107. To the contrary, upon turning the FUNCTION switch off, transmission stops after discharging C108. Thus, the power transistors Q101/102 and Q108/109 are protected from damage due to switching of the POWER switch.

T/R Circuit

The T/R circuit is a directional network for transmission and reception. It isolates the receiver during transmission, and vice versa so that the receiver is protected from strong transmission pulse and feeble received signal is led to the receiver stage with a minimum loss.

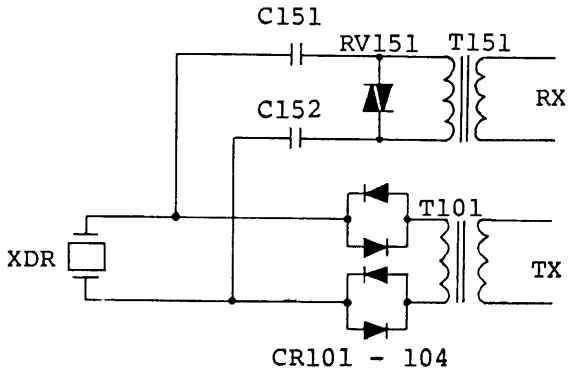


Fig.1-7

Transmission : Strong transmission pulse makes CR101 through CR104 and RV151 conduct, and is delivered to the transducer. Only a leakage of the transmission pulse is led to the receiver stage, and draws a transmission line (zero line) on the recording paper.

Reception : Since the received signal is too feeble to make CR101 through CR104 and RV151 conduct, the signal is led to the receiver stage. Impedance of loading capacitor C151/152 and transformer T151 is coincident with that of the transducer in order to effectively lead the signal to the receiver.

1-2. Receiver

Figures 1-8 and 1-9 show the block diagram and circuit diagram respectively.

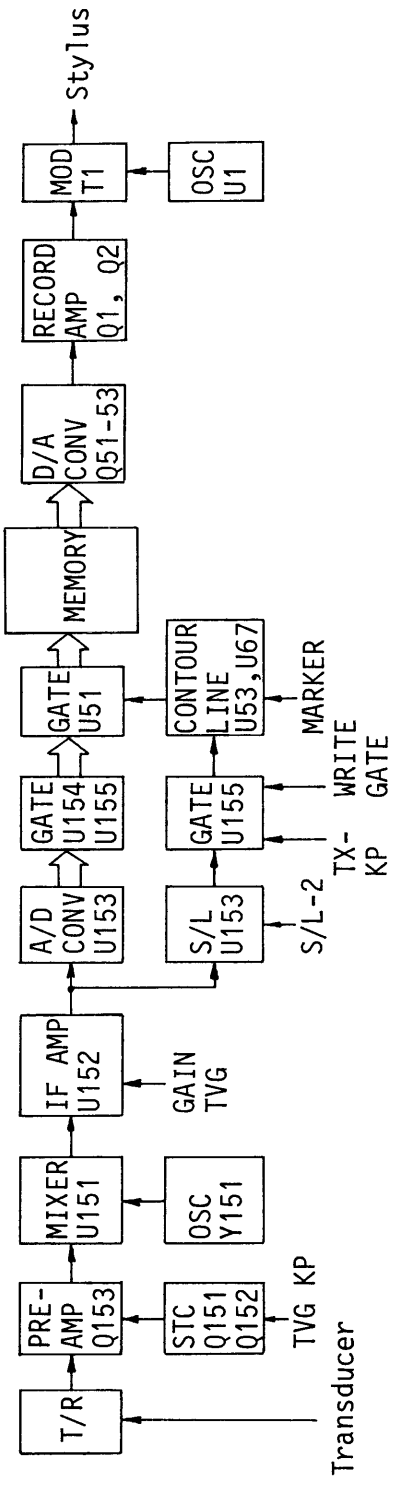


Fig.1-8 Block Diagram

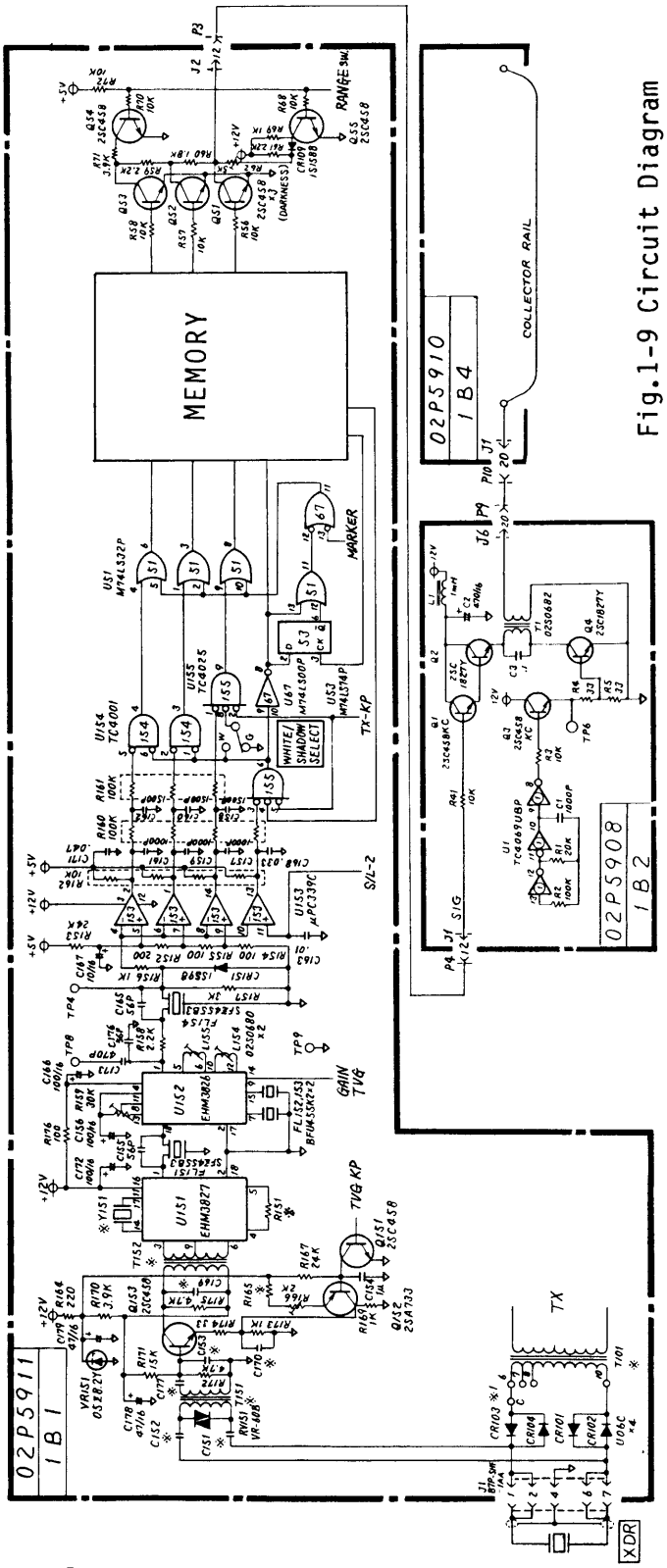


Fig.1-9 Circuit Diagram

The received signal from the transducer is amplified by the pre-amplifier Q153 after passing through T/R circuit. An output from the pre-amplifier is mixed with the output of local oscillator Y151 at the customized IC U151 to get a 455kHz IF signal. The oscillation frequency of Y151 is 484kHz, 505kHz, 517kHz, 543kHz or 655kHz for 28kHz sets, 50kHz sets, 60kHz sets, 88kHz sets or 200kHz sets respectively. IF signal passes through the 455kHz filter FL151 and is led to the IF amplifier U152. Both STC and GAIN/TVG circuits described below are provided to adjust the sensitivity of the receiver at this stage.

STC, GAIN/TVG Circuit

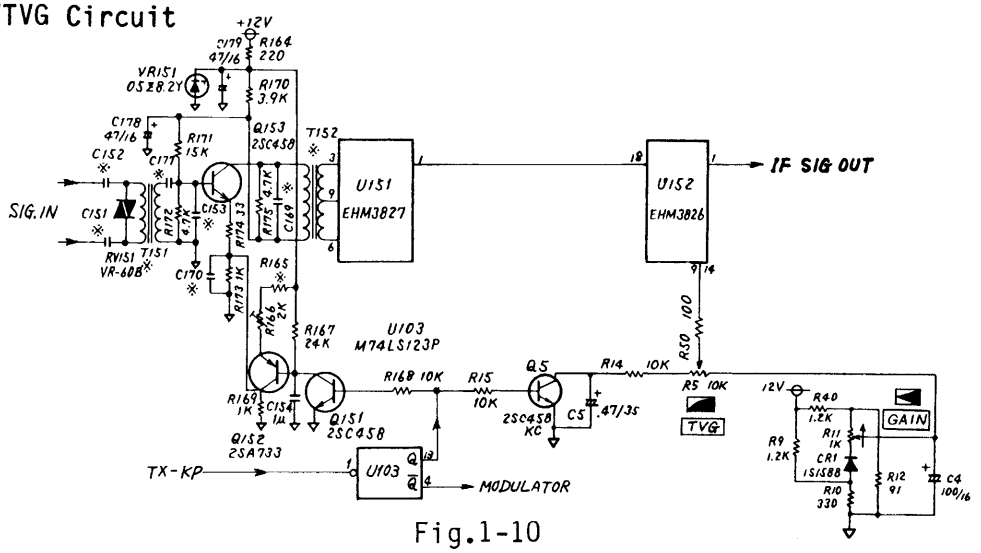


Fig.1-10

One of outputs from the one-shot multivibrator U103 is used for STC and GAIN/TVG circuits as a TVG KP having a pulselength "tw". Refer to page 1-5.
As for the STC circuit, Q151 turns on when the TVG KP is applied to the base, and C154 starts discharging through Q151. Upon terminating the TVG KP, C154 is charged up to 8.2V assigned to VR151. Its time constant is determined by R167 and C154, and the surface noise within approximately 7m from the sea surface is suppressed. The preset potentiometer R166 adjusts the gain, for Q152 also turns on and its collector voltage varies between approximately 0.5V to 0.7V. Figure 1-11 shows each waveform of Q152.

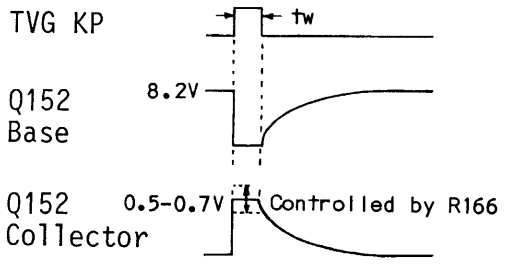


Fig.1-11

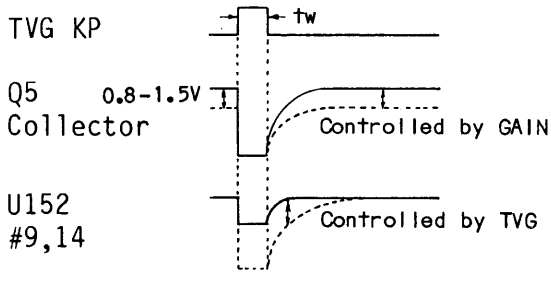


Fig.1-12

As for the GAIN/TVG circuit, Q5 located on the FRONT PANEL board turns on at the same timing as STC, and C5 discharges through Q5. As soon as the TVG KP goes away, C5 starts charging up to a certain level, i.e. approximately 0.8V to 1.5V, assigned to the GAIN control R11. The TVG voltage is adjusted by the TVG control R5. The TVG effect is expanded to the deeper range in comparison with the STC, i.e. approximately 30m from the sea surface.

The amplified IF signal again goes through the 455kHz filter FL154, and is detected by CR151. The succeeding voltage comparator U153 is used to convert the detected analogue signal into 3-bit digital signal in accordance with its analogue level to process digitally. Together, one of U153 is used to get the Shadow Line signal.

SHADOW LINE Control

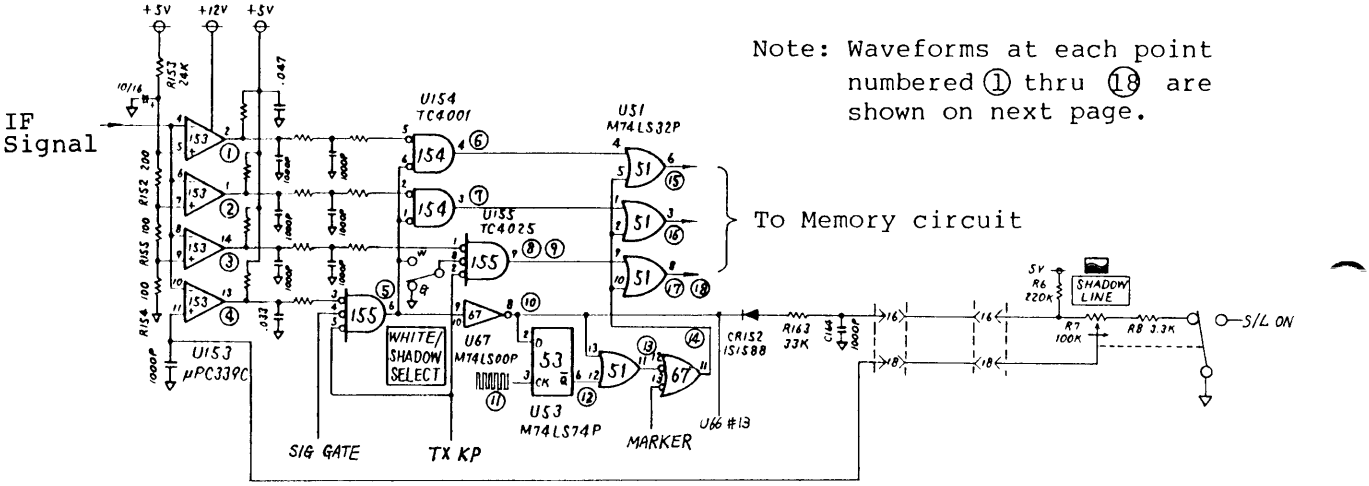


Fig.1-13

This circuit is provided to draw a light-gray shadow line (gap) with a black seabed contour for easy discrimination of fish echoes on or close to the seabed.

Reference voltages at U153 #5, #7 and #9 are given by dividing +5V with resistors connected in series, i.e. 80mV, 40mV and 20mV respectively. The reference voltage of U153 #11 varies according to the setting of the SHADOW LINE control R7, i.e.,

$$\text{S/L control to fully CW : } 5V \times \frac{R8}{R6+R7+R8} = \text{approx. } 50mV$$

$$\text{S/L control to fully CCW: } 5V \times \frac{R7+R8}{R6+R7+R8} = \text{approx. } 1.6V$$

Therefore, echo signal is classified dependent on its strength as shown below.

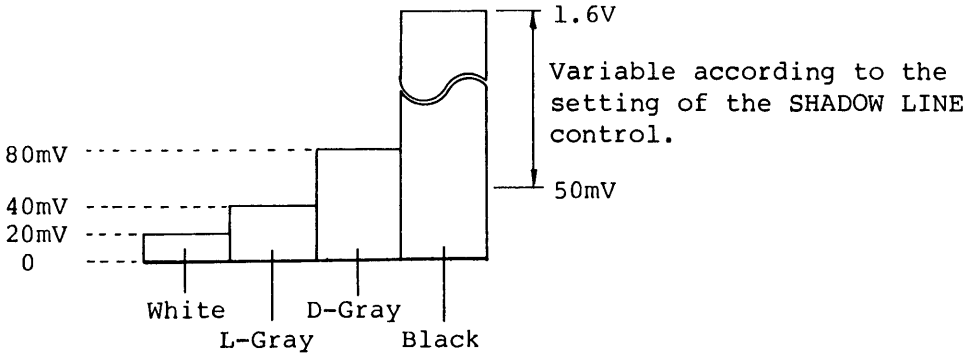
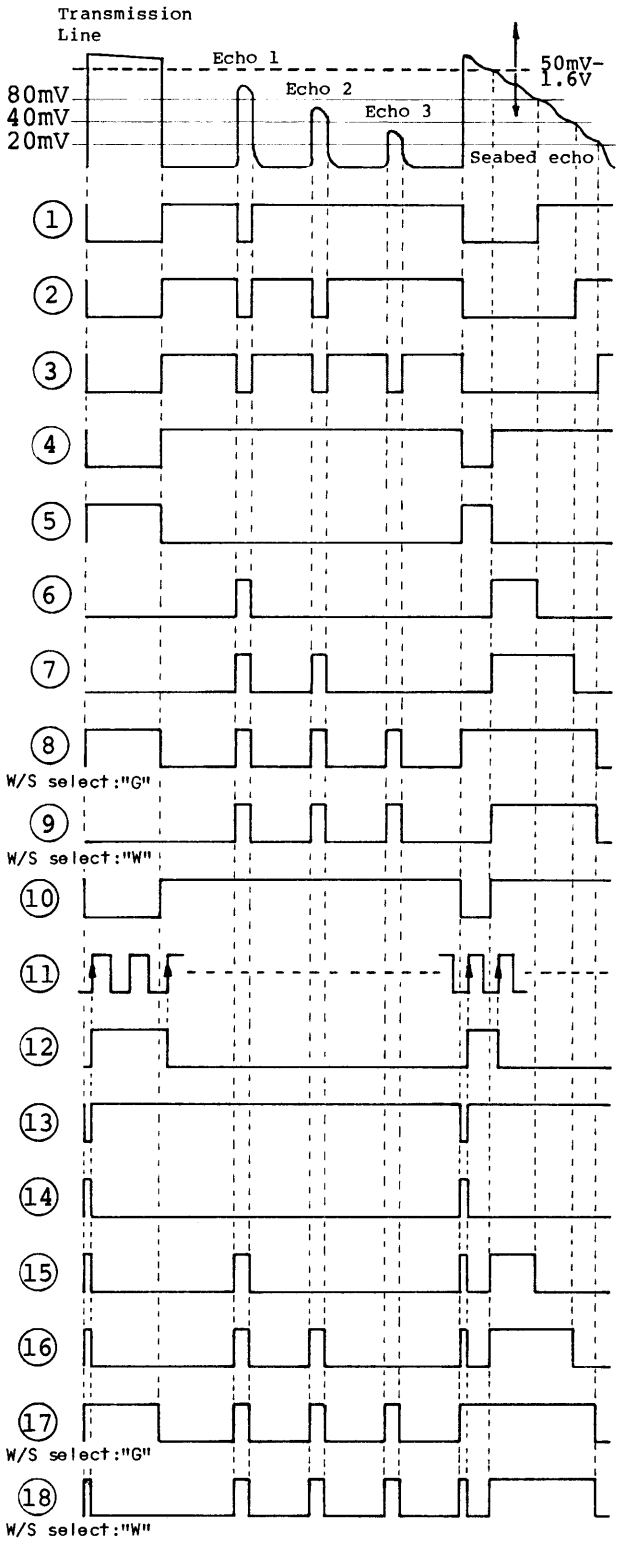


Fig.1-14



Suppose that an echo signal contains different level echoes; fish and seabed echoes.

Echoes exceeding 80mV come out at ① as a black level signal.

Echoes between 40mV and 80mV come out at ② as a dark-gray level signal.

Echoes between 20mV and 40mV come out at ③ as a light-gray level signal.

If the S/L control is set to the above level, output waveform at the left comes out at ④.

Since the SIG GATE and TX TRIG levels are "L", input signal at U155#3 is inverted and applied to U154 and U67.

This waveform is used to plot an echogram in black.

This waveform is used for plotting in dark-gray.

If the WHITE/SHADOW SELECT is set to "G", the left waveform is used for plotting in light-gray.

If the WHITE/SHADOW SELECT is set to "W", the left waveform is used for light-gray level to leave white gap below seabed contour.

The left waveform is applied to the D-input of U53 flip-flop.

The Address CK pulse coming from U61#3 is applied to U53#3, which is triggered by its positive going edge.

As a result, U53#6 is sliced by the clock input.

Both waveforms at ⑩ and ⑫ are OR-gated and the left waveform comes out.

The above waveform is inverted if the MARKER switch is "OFF", and applied to each input terminal of U51 for plotting a contour line.

Black contour line is added.

2nd echo and the mid-part of seabed trail is drawn in dark-gray.

If the WHITE/SHADOW SELECT is set to "G", a shadow line (gap) coloured light-gray appears between the seabed contour and trail.

If the WHITE/SHADOW SELECT is set to "W", a white line (gap) appears just below the seabed contour.

Fig.1-15

The digital signal (echo) is processed in the following memory circuit.

MEMORY Circuit

Figure 1-16 shows the block diagram of memory and its control circuit.

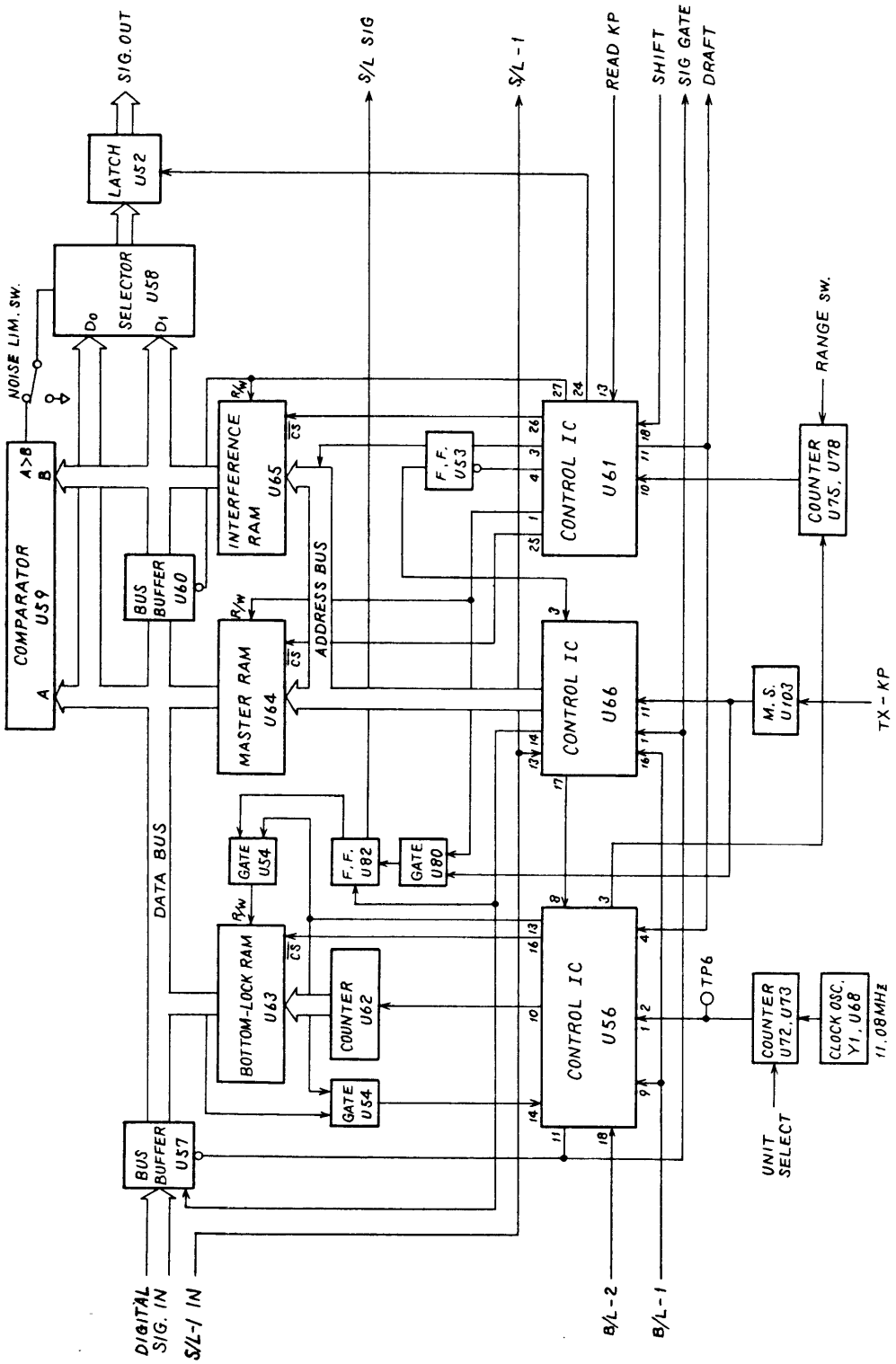


Fig.1-16 Block Diagram

An 11.08MHz clock pulse is given by Y1, U68 and associated parts, and it is divided by the down counters U72 and U73. The output frequency measured at TP6 is listed below.

Table 1-1

DEPTH UNIT	U72				U73				Div. Ratio	Freq. at TP6
	D_D	D_C	D_B	D_A	D_D	D_C	D_B	D_A		
M	0	0	1	0	1	1	0	0	1/2 x 1/12	461.7kHz
PA	0	0	1	0	1	0	1	0	1/2 x 1/10	554.0kHz
FA	0	0	1	0	1	0	1	1	1/2 x 1/11	503.6kHz
FT	0	0	0	1	1	0	1	1	1/1 x 1/11	1007.3kHz

These clock pulses are furthermore divided at the control IC U56, provided that the dividing ratio varies with the setting of the FUNCTION switch.

When the FUNCTION switch is set to "▭" (normal), the WRITE-CK pulse comes out at U56 #3, and applied to the counters U75 and U78. Output from the counter is gated with the RANGE switch, and led to the control IC U61 #10. Then, the following signals are produced at the U61.

Table 1-2

Signal	Output Terminal of U61
Address CK	# 3
Master RAM CS	#25
Interference RAM CS	#26
Interference RAM R/W	#27
Latch Enable	#24

The Address CK pulse is divided by U53, and led to the control IC U66 #3 in order to make an address signal for the Master RAM and the Interference RAM.

When the FUNCTION switch is set to "$\overset{1}{\square}$" or "$\overset{2}{\square}$" (bottom-lock), the B/L RAM CK pulse comes out at U56 #10, and actuates the counter U62 for the Bottom-Lock RAM U63.

Since the action of each memory and control IC is complicated, it is explained on the following three cases for easy understanding.

Case 1 FUNCTION switch : Normal "▭"
RANGE switch : Basic range "a"
SHADOW LINE control : OFF
NOISE LIMITER switch : ON

Refer to "Timing Chart in Case 1" on page 1-16.

After applying a READ KP to the control IC U61 #13, the R/W terminal #10 of the Master RAM U64 turns to "H" to allow "READ" condition, whilst the $\overline{CS}$ terminal #8 of the RAM repeats "L" and "H". Only when the $\overline{CS}$ terminal is "L", therefore, the stored data addressed from 0 (zero) to 768 is read out.
Together, since the control terminals of the bus buffer U57 are "H", no new data passes through. Therefore, the stored data inside the RAM is led to the A-inputs of the comparator U59, the Do-inputs of the selector U58 and also the Interference RAM U65 as described below.
As the R/W terminal of the Interference RAM are connected with the control terminals of the bus buffer U60, the data coming from the Master RAM can pass through U60 when the state of the Interference RAM is "WRITE", i.e. the R/W terminal is "L". When the terminal turns to "H", the data is led to the B-inputs of the comparator and the D1-inputs of the selector.
Therefore, the latest data is applied to the A-inputs of the comparator, whilst the data of past cycle is applied to B-inputs. Each data is compared in magnitude. If the former is greater than the latter, the selector takes the latter data, i.e. the data without interference comes out.
After counting 768th, the Master RAM turns to "WRITE" condition, when the control terminals of the bus buffer U57 turn to "L" to pass through new data. The new data is stored into the Master RAM from 0 (zero) to 768th addresses, provided that the Address CK frequency is different between "READ" and "WRITE" conditions. During this period, the data can pass through the bus buffer U60, however cannot be stored into the Interference RAM because the $\overline{CS}$ terminal of the RAM keeps "H".

Case 2 FUNCTION switch : Normal "▭"
RANGE switch : Phased range "b"
SHADOW LINE control : OFF

Refer to "Timing Chart in Case 2" on page 1-17.

The different point from the case 1 is that the counter address should be reset to 0 (zero) at counting of 384 during the WRITE period to write in the data for the phased range.
When the RANGE switch is set to "b", the control IC U61 #18 turns to "L", and a Count Reset pulse comes out at U61 #4 on 384th count. This pulse resets the flip-flop U53. The one output from U53 #9 is led to U64 #17 and U65 #17 as an address signal, whilst the other from U53 #8 is applied to the control IC U66 #3 and divided by U66. The divided signal is used as respective address signals for the Master RAM and the Interference RAM.

Case 3 FUNCTION switch : Bottom-Lock "1" or "2"
RANGE switch : Basic range "a"
SHADOW LINE control : ON

Refer to "Timing Chart in Case 3" on page 1-18.

Action in General

The SHADOW LINE control should be turned on to actuate Bottom-Lock function.

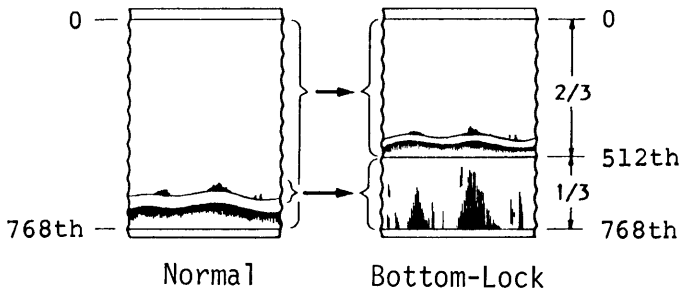


Fig.1-17

Signal corresponding to 768-bit on the normal recording mode is compressed on the upper 2/3 of the paper width, i.e. 512-bit.

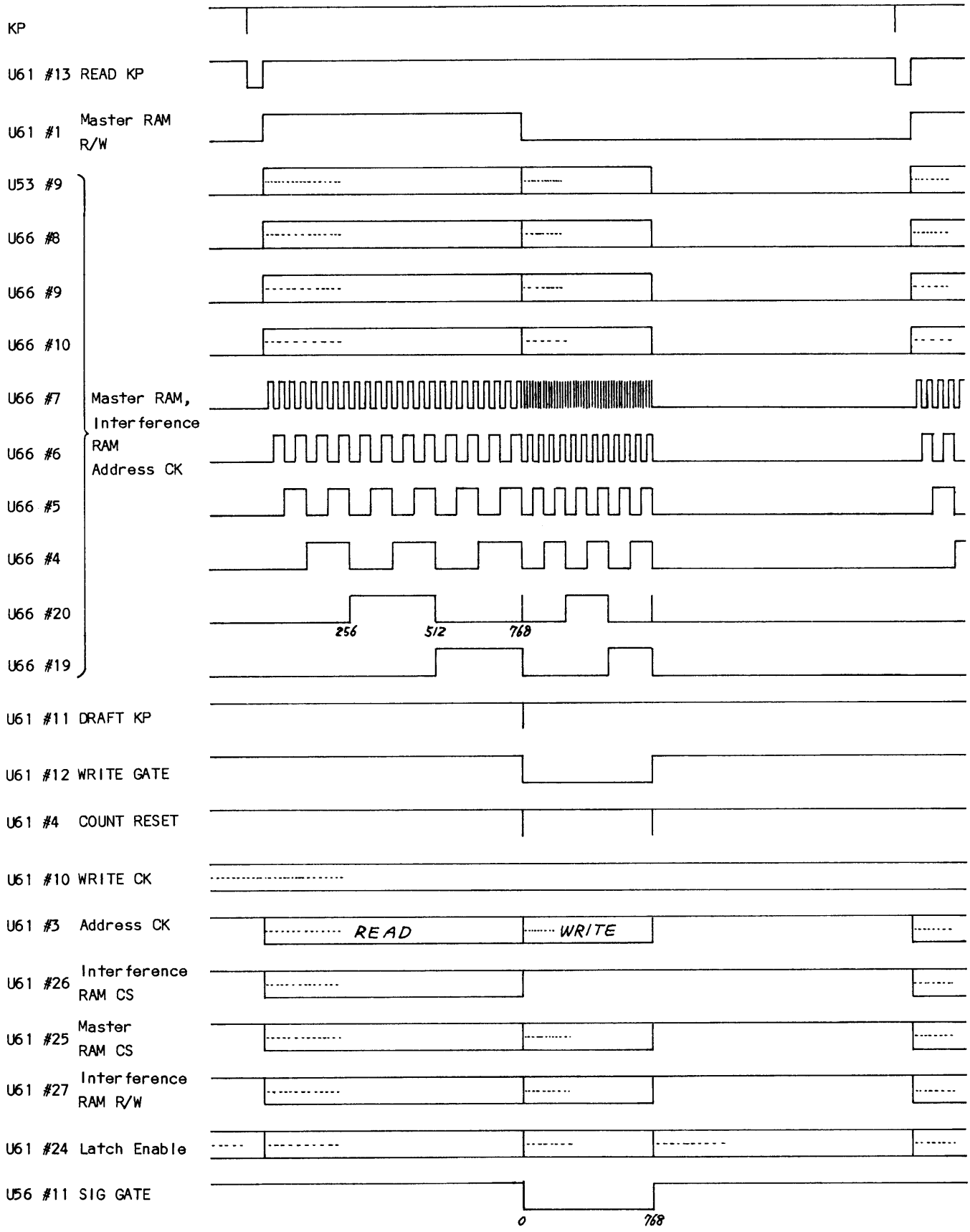
The WRITE CK pulse for the Master RAM should be 2/3 times that of the normal mode to accomplish the above. The dividing ratio is controlled by the control IC U56 by changing the FUNCTION switch between "Normal" and "Bottom-Lock" modes. When counting 512th, the B/L RAM turns from "WRITE" to "READ" condition, and the 256-bit data stored inside the RAM is transferred to the Master RAM. When the next READ KP is received, the Master RAM turns to "READ" condition, and the normal and expanded data are read out on the recording paper addressed from 0 (zero) to 768.

Action in Detail

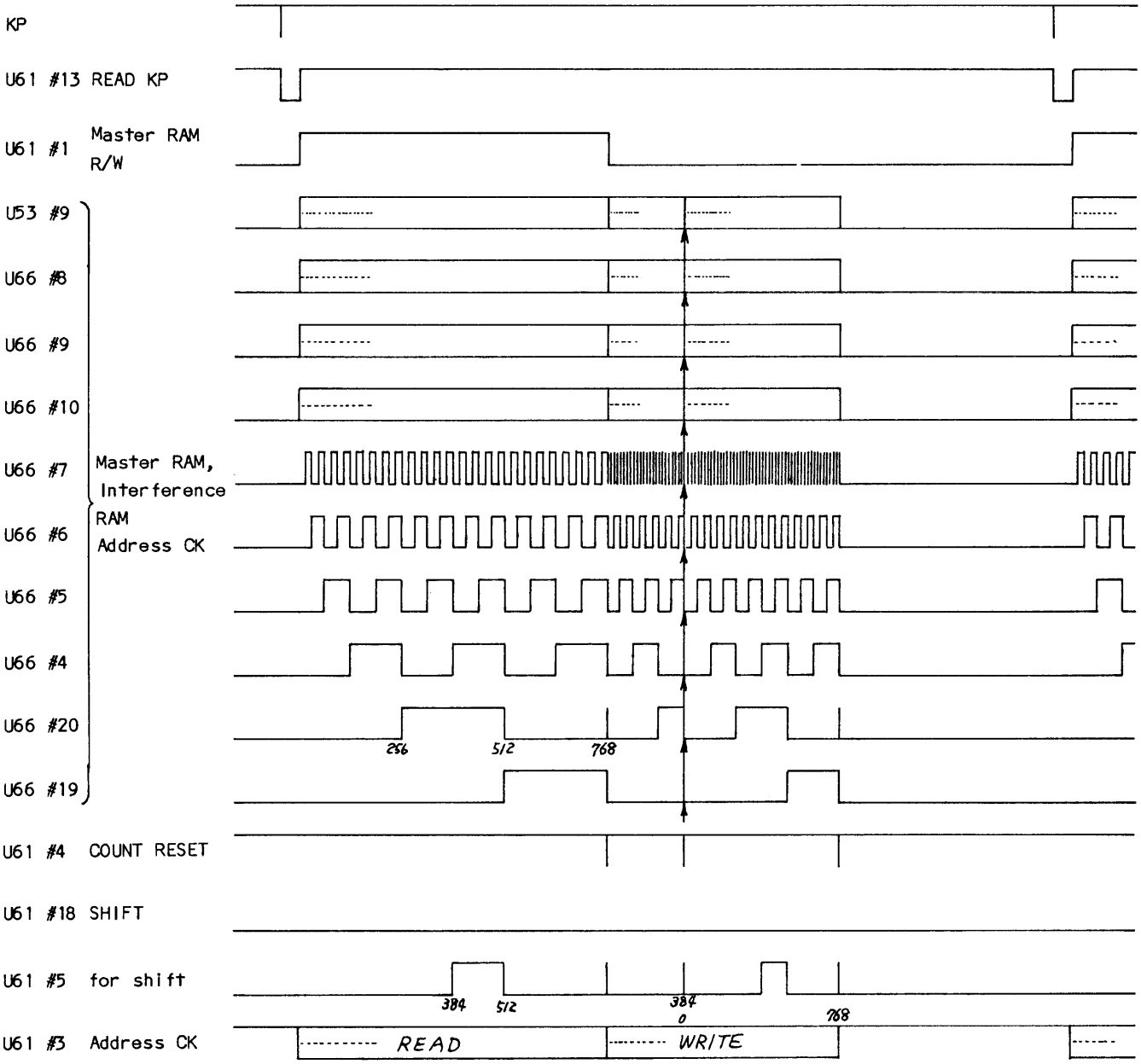
When the seabed is detected by the SHADOW LINE control, a negative-going pulse is applied to U66 #13. This S/L-1 pulse is processed by the control IC U66 and a S/L signal comes out at #14 and #17. The signal from U66 #14 is led to the 256-bit B/L RAM U63 #11 via the bus buffer U57, and stored to the RAM. The other signal from U66 #17 is fed to U56 #8 and stops the clock pulse for the B/L RAM CS. The $\overline{CS}$ terminal of the B/L RAM turns to "H" and the RAM stops "WRITE" action until the WRITE CK pulse for the Master RAM counts 512th. Upon coming 512th, the B/L RAM turns to "READ" condition, and the stored 256-bit data corresponding to 5m (for B/L-1) or 10m (for B/L-2) is read out and transferred to the Master RAM. When the stored S/L signal is read out from U63 #11, this signal passes thru the NAND gate U54, and applied to U56 #14 as a B/L RAM S/L TRIG. This trigger starts the counter in the control IC U66, and also changes the frequency of the WRITE CK pulse to write the 256-bit echoes above the sea bottom into the Master RAM.

The shadow line should not be effected on the transmission line. The multivibrator U103 is provided to cut it for the depth of 4m.

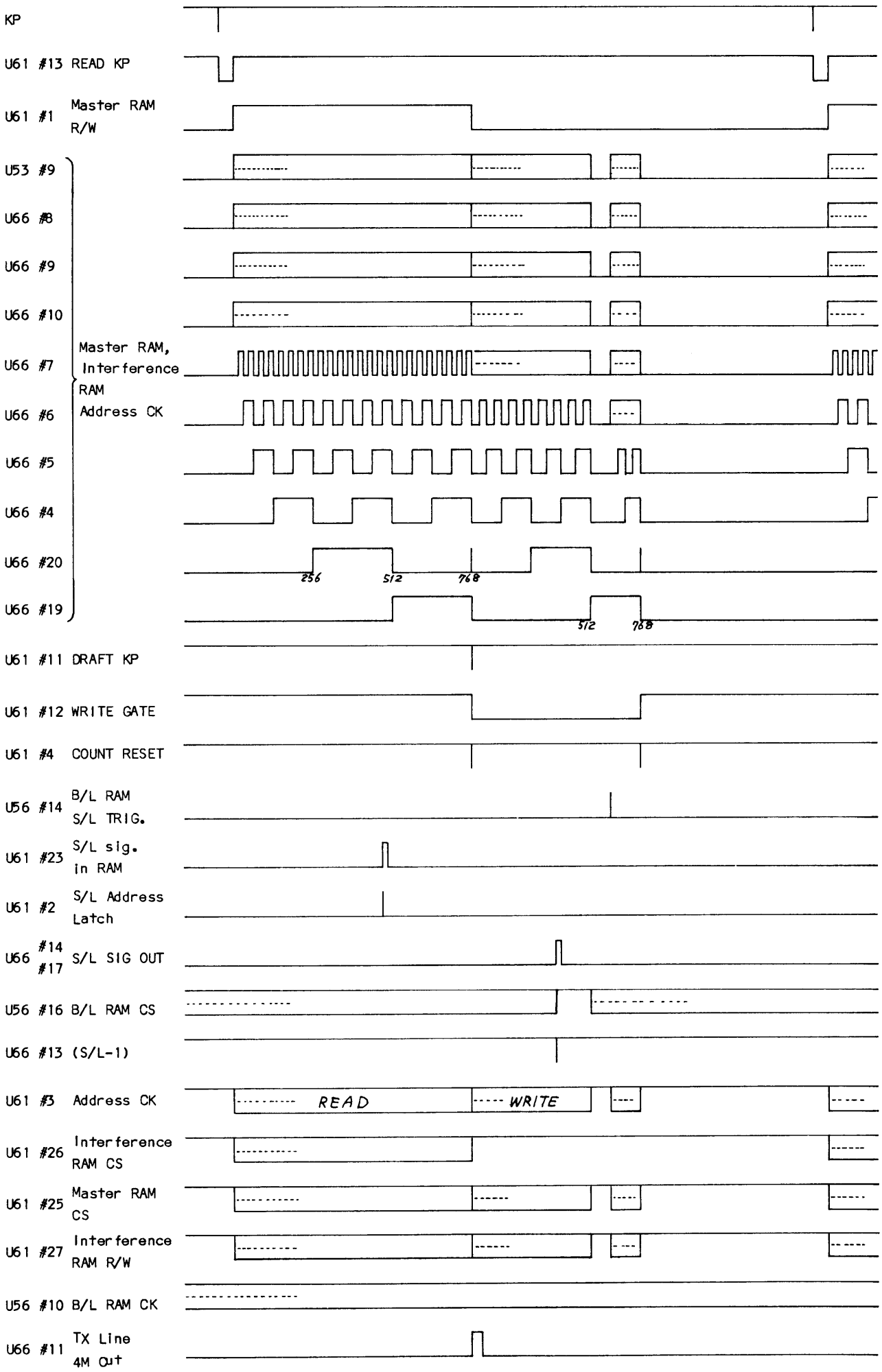
Timing Chart in Case 1



Timing Chart in Case 2



Timing Chart in Case 3



The digital echo signal stored in the memory circuit is led to the latch U52 and the D/A converter Q51 through Q53.

D-A CONVERTER Circuit

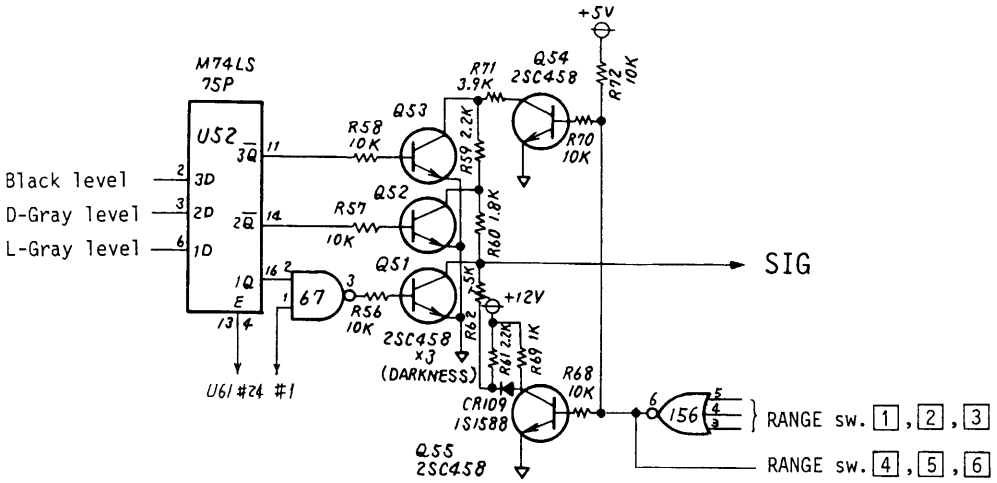


Fig.1-18

The following table 1-3 shows how the digital (echo) signal is converted to echo signals of three densities (black, dark-gray, light-gray) by three switching transistors Q51 to Q53.

Table 1-3

U52 Input Level	U52			Q51	Q52	Q53	Output Signal Level at Q51 collector
	$3\overline{Q}$	$2\overline{Q}$	1Q				
Black	L	L	H	OFF	OFF	OFF	6V approx.
Dark-Gray	H	L	H	OFF	OFF	ON	4V approx.
Light-Gray	H	H	H	OFF	ON	ON	2V approx.

Q54 and Q55 are provided to decrease the output signal level because the recording belt rotates at slow speed in deeper ranges 4, 5 and 6.
The output signal level can be adjusted by the preset potentiometer R62, for the series resistance is changed.

The analogue signal from the D-A converter is led to the following recorder amplifier and modulated with a carrier. At the final stage, the signal is led to the collector rail and the recording stylus to draw an echogram.

RECORDER AMP. & MODULATOR

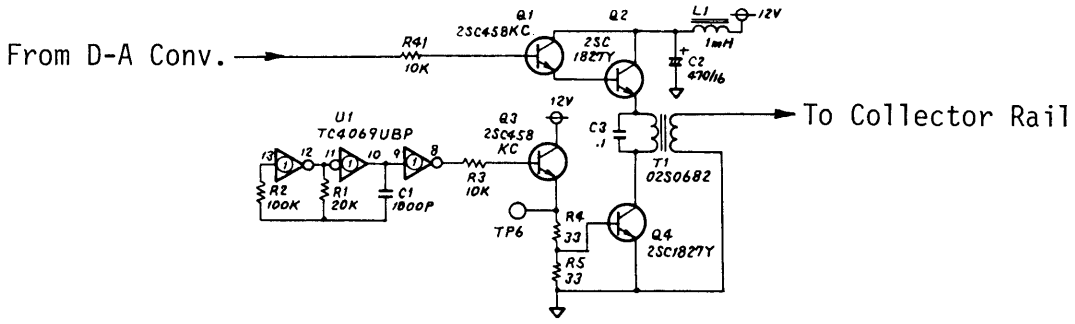


Fig.1-19

The D-A converter output is amplified by Q1 and Q2 located on the FRONT PANEL board. U1, R1 and C1 form the oscillator circuit to produce a carrier of approx. 20kHz, which is measured at TP6. This carrier is amplified by Q3 and Q4, and modulated with the D-A converter output at T1. The modulated signal is stepped up by T1 and led to the recording paper via the collector rail.

1-3. Display

The DISPLAY board digitally indicates the recording start depth, end depth and seabed depth. Warning indications "low signal" and "overflow" are also provided.

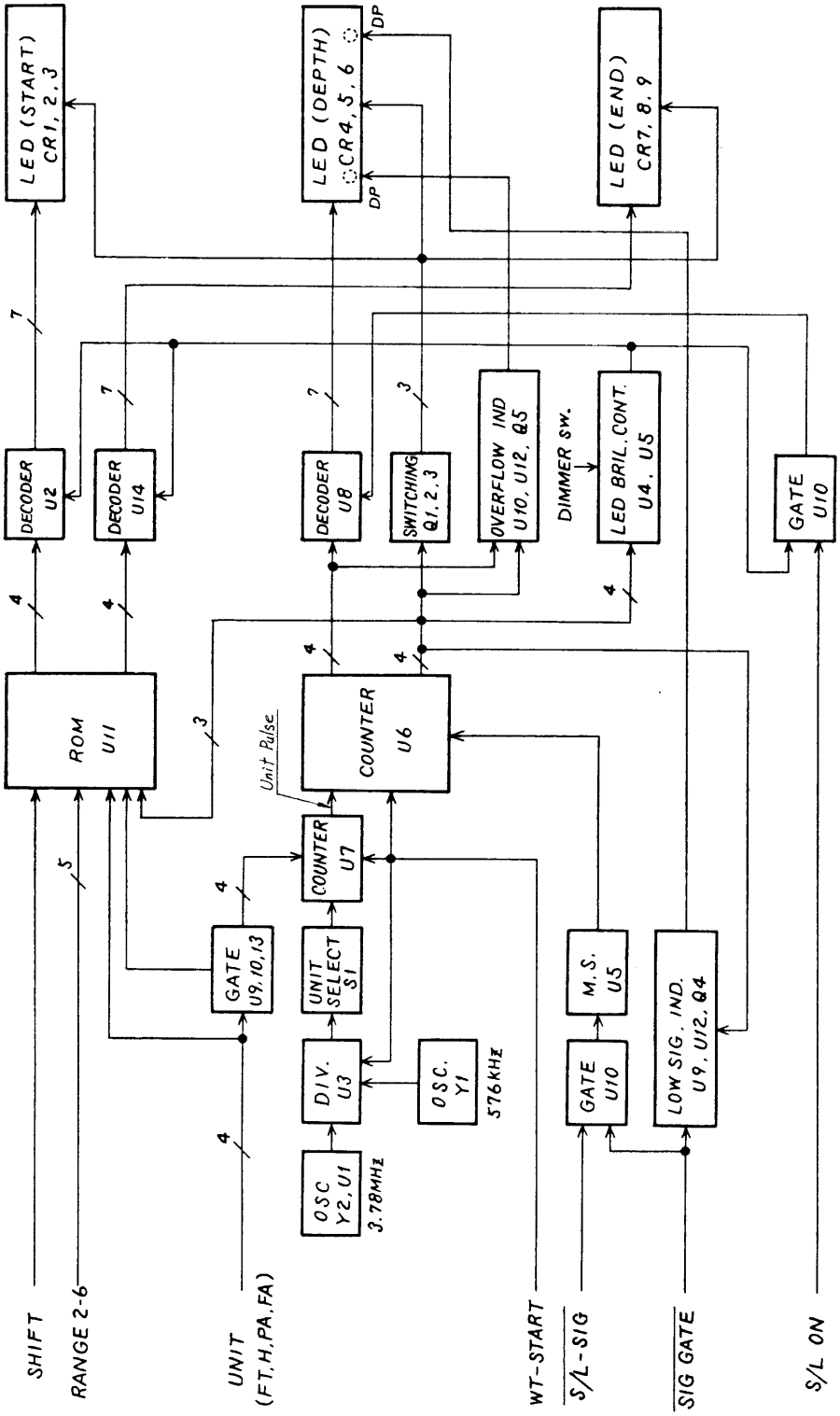


Fig.1-20 Block Diagram

SEABED DEPTH Indication

The SHADOW LINE control should be correctly adjusted to indicate the seabed depth.
The 4-digit decade counter U6 is reset to "0000" by the WT-START pulse at the beginning of the "WRITE" timing, and starts counting the clock input called "Unit Pulse". When the shadow line signal is detected, a negative-going S/L SIG comes out. This S/L SIG is led to the transfer terminal #6 of the counter via the gate U10 and the multivibrator U5. At the same time, the counting data comes out at the BCD output terminals A to D, and is led to LED's via the decoder/driver U8. That is, when the digit select T1(#4) is "H", 10^3 digit (MSB and not used to display) comes out. In like manner, when T2(#3), T3(#2) and T4(#1) are "H" by turns, 10^2 digit, 10^1 digit and 10^0 digit(LSB) come out respectively. Refer to the timing chart below.

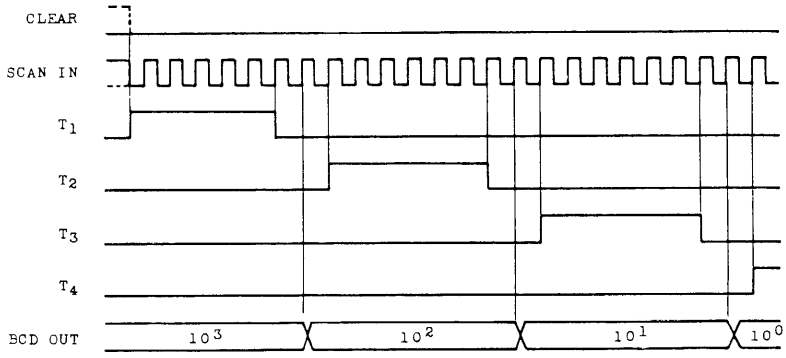


Fig.1-21

Outputs from the digit select T2 to T4 are connected to the ROM U11 as address inputs and also to three switching transistors Q1 to Q3. Since each collector of the transistors is applied to the common anode of each LED, each digit of the depth is displayed by turns in accordance with the digit select pulses. Together, when the SHADOW LINE control is turned off, only 10^0 digit is displayed as "0(zero)" because the digit select T4 is connected to the blank control terminal #11 of U6.

"Overflow" Indication

Output from the digit select T1(MSB) is used for indication of "overflow". If U6 counts over "999", the BCD output terminal D turns to "L". When the positive pulse is applied to the gate U10 #4, the flip-flop U12 is triggered, and Q5 turns on. As a result, the overflow lamp lights up.

"Low Signal" Indication

If the shadow line signal is too weak, the flip-flop U12 cannot be reset. Therefore, U12 #5 which is connected to U9 #9 keeps "H". Other inputs of the gate U9 are the SIG GATE and the digit select T4 pulse coming from the counter U6. Only when all the inputs are "H", Q4 turns on and the low signal lamp flickers.

"Unit Pulse"

The clock frequency for the counter U6 should be changed in accordance with the unit selected.
When the Unit Selector takes "M", "PA" or "FA", the crystal Y1 is used as a reference oscillator. A clock pulse of 576kHz is divided by 128 at the divider U3, and 4.5kHz is applied to the counter U7 #4. Since the data input of U7 is assigned to the Unit Selector, the output from U7 #6 is different as below.

Table 1-4

Unit	Ref. OSC.	Input of U7				Dividing Ratio	Output "Unit Pulse"
		D_D	D_C	D_B	D_A		
M	Y1	0	1	1	0	1/6	750Hz
PA		1	0	1	0	1/10	450Hz
FA		1	0	1	1	1/11	409Hz
FT	Y2	0	1	1	0	1/6	2.46kHz

When the Unit Selector takes "FT", the crystal Y2 is used instead of Y1.
A clock pulse of 3.78MHz is divided by 256 at U3, and 14.766kHz is applied to U7 #4. As the data inputs D_D, D_C, D_B and D_A are 0, 1, 1 and 0 in turn, 2.46kHz unit pulse comes out at U7 #6.

START/END DEPTH Indication

A programmable ROM (4096-word x 8-bit), which has a Range Table shown below, is used. No adjustment is required by doing this.

Range Table of ROM

Address:

A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0
Factory Set	UNIT	UNIT	SHIFT	RANGE 6	RANGE 5	RANGE 4	RANGE 3	RANGE 2	Digit Select T4	Digit Select T3	Digit Select T2
*3				*2				*1			

	Address	Contents
*1	0001 (1)	10^2 digit RANGE sw. other than 2
	0010 (2)	10^1 digit RANGE sw. other than 2
	0100 (4)	10^0 digit RANGE sw. other than 2
	1000 (8)	10^2 digit RANGE 2
	1010 (A)	10^1 digit RANGE 2
	1100 (C)	10^0 digit RANGE 2
*2	0000 (0)	RANGE 1 or 2
	0001 (1)	RANGE 3
	0010 (2)	RANGE 4
	0100 (4)	RANGE 5
	1000 (8)	RANGE 6
*3	1000 (8)	Foot
	1001 (9)	Foot SHIFT
	1010 (A)	Meter
	1011 (B)	Meter SHIFT
	1110 (E)	FA, PA
	1111 (F)	FA, PA SHIFT

Data:

D7	D6	D5	D4	D3	D2	D1	D0

D7 D6 D5 D4 → START DEPTH data
D3 D2 D1 D0 → END DEPTH data

LED Brightness Control

The DIMMER switch controls not only the illumination for the recording paper and control panel but also brightness of LED displays.

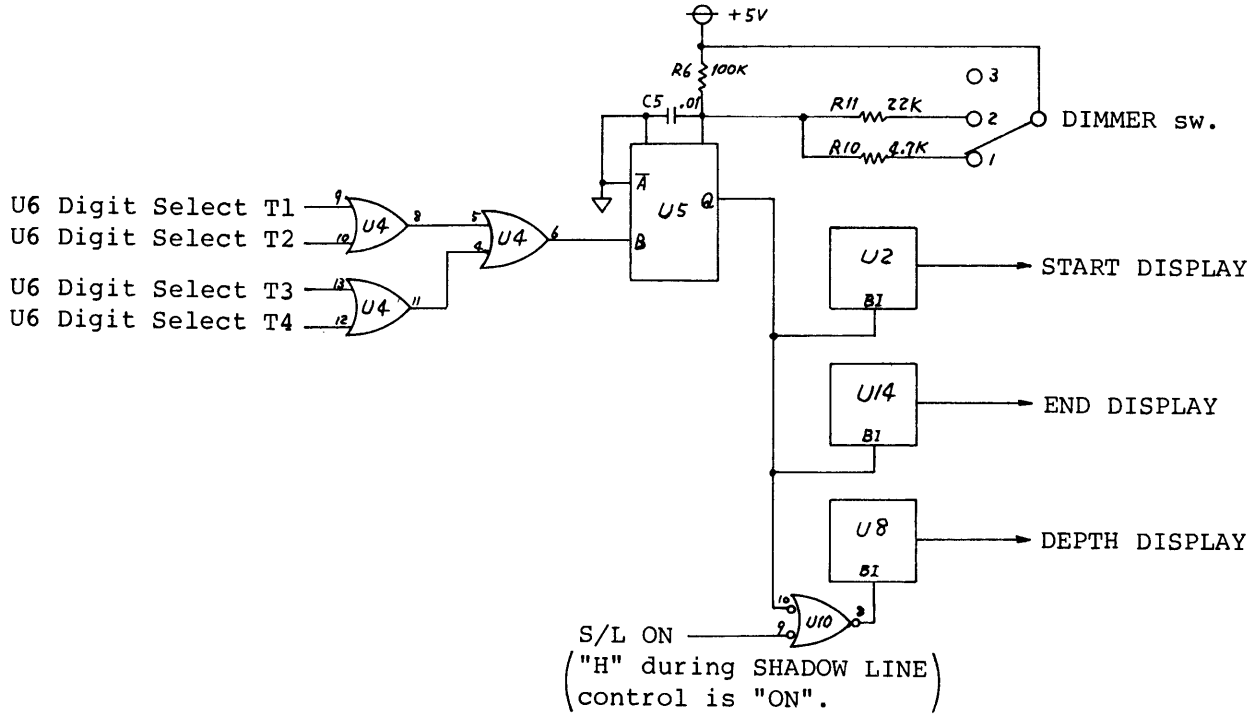


Fig.1-22

Since the inputs of the OR gate U4 are connected to the digit select terminals of U6, continuous pulse T1+T2+T3+T4 (See Fig.1-21) is applied to the retriggerable multivibrator U5.

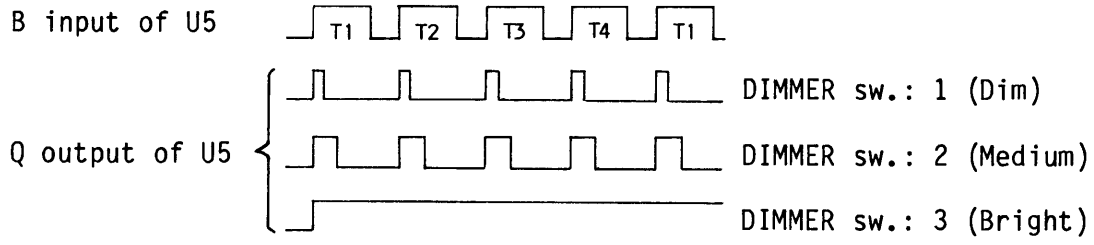


Fig.1-23

The DIMMER switch selects either R6, R10 or R11 which controls a duty ratio of U5 output. Therefore, a brightness of LED's is controlled with the different U5 output.

1-4. Motor Control and Pen Homing

PAPER FEED MOTOR Control

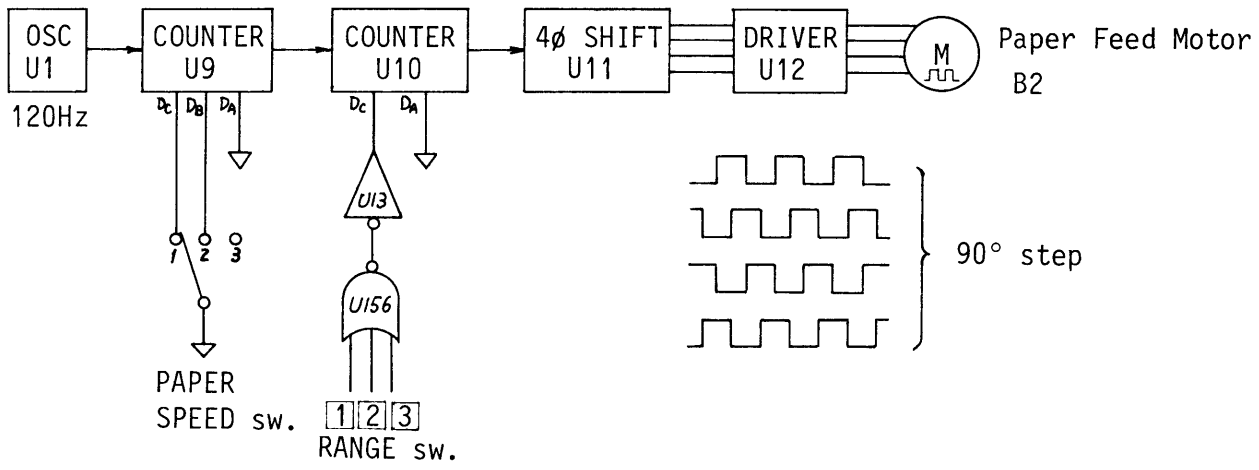


Fig.1-24

U1 and associated parts oscillate at 120Hz to produce a clock pulse. The clock pulse is led to the counter U9. Its data inputs D_B and D_C are selected by the PAPER SPEED switch. For example, the data inputs come to 1010 (BCD code) when the PAPER SPEED switch is set to "1". In case of this, 120Hz clock pulse is divided by 6, and 20Hz clock pulse comes out. The data input D_C of the following counter U10 is also controlled by the RANGE switch. That is, the TTL level at D_C is "H" when the RANGE switch takes 1 , 2 , or 3 . The clock pulse divided by U9 is furthermore divided by 2 (RANGE sw.: 1 , 2 , 3) or 6 (RANGE sw.: 4 , 5 , 6). Therefore, the pulse listed below is applied to the following flip-flop as a clock pulse in order to shift by 90° steps.

Table 1-5

RANGE \ PAPER SPEED	1	2	3
1 2 3	10Hz	15Hz	30Hz
4 5 6	3.3Hz	5Hz	10Hz

The clock pulse is divided by 2 and led to the paper feed motor B2.

BELT DRIVE MOTOR Control

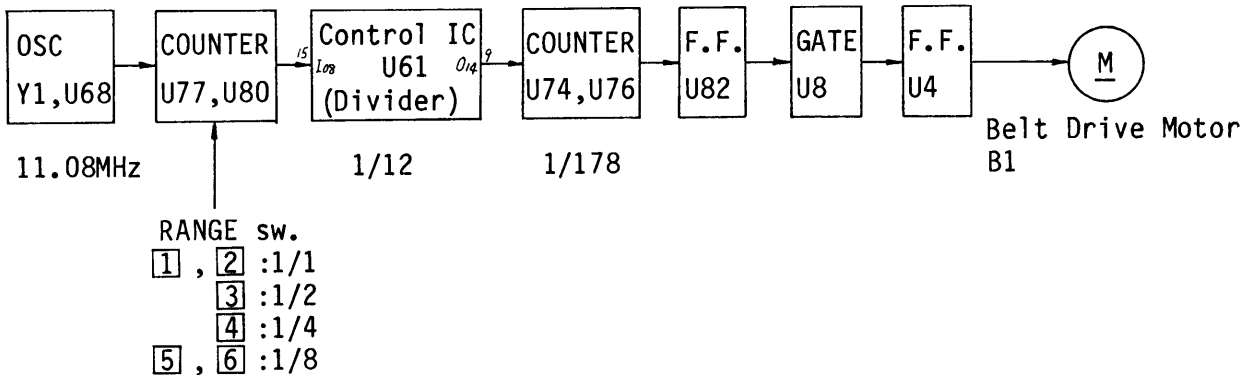


Fig.1-25

An 11.08MHz clock pulse generated by Y1 and U68 is led to the counter U77 and the gate U80. Its dividing ratio is 1/1, 1/2, 1/4 and 1/8 when the RANGE switch is set to 1 / 2 , 3 , 4 and 5 / 6 respectively. After this stage, the clock pulse comes into the control IC U61, and is divided by 12. The output from U61 #9 is down-counted by U76 and U74, and divided by 2 at the flip-flop U82. The clock pulse passes through the NAND gate U8, and is furthermore divided by 2 at U4 located on the FRONT PANEL board. After passing through the SUB-PANEL board, the clock pulse is applied to the belt drive motor as a motor clock. Frequencies of motor clock pulses are as follows, depending on the setting of the RANGE switch.

RANGE sw. 1 & 2 : 1.297kHz
RANGE sw. 3 : 0.648kHz
RANGE sw. 4 : 0.324kHz
RANGE sw. 5 & 6 : 0.162kHz

PEN HOMING Circuit

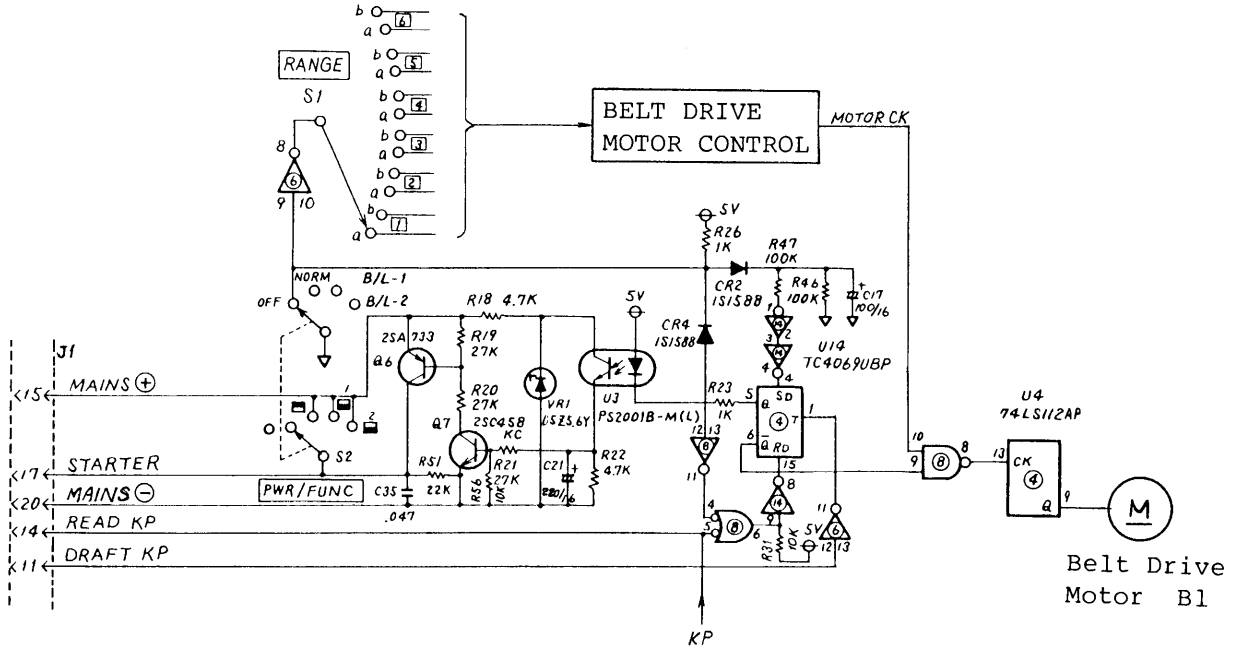


Fig.1-26

This circuit is provided to automatically stop the recording stylus at the rear of the recording plate, i.e. opposite to the recording paper. It may clear away the risk of getting damage to the stylus when changing the recording paper. Suppose that the POWER switch is cut off now. The rotating speed of the belt drive motor is slowed down to that of the RANGE [5] / [6], for the common line of the RANGE switch is immediately turned to "H". The motor goes on rotating at the above speed even though the POWER switch is cut off because the inverter circuit is still oscillating. The input terminal #4 of the gate U8 turns to "H", and the other #5 turns from "H" to "L" upon application of KP. The reset terminal #15 of U4, therefore, turns to "L". On the other hand, the set terminal #4 of U4 is kept "H" because C17 is discharging. The output terminal #5(Q) of U4 keeps "L", and U3, Q7 and Q6 are conductive. However, the output terminal turns to "H" when the DRAFT KP is applied to the clock terminal #1 of U4, and U3 is cut off. Then, Q7 and Q6 are cut off after finishing discharge of C21, and the inverter stops oscillation. See para.1-5.
Since the MOTOR CK pulse is controlled by the output terminal #6($\overline{Q}$) of U4, the MOTOR CK pulse is blocked by the gate U8 when the DRAFT KP is applied. Then, the recording belt stops rotation after running a short distance by moment of inertia. As a result, the recording stylus will stop behind the paper.

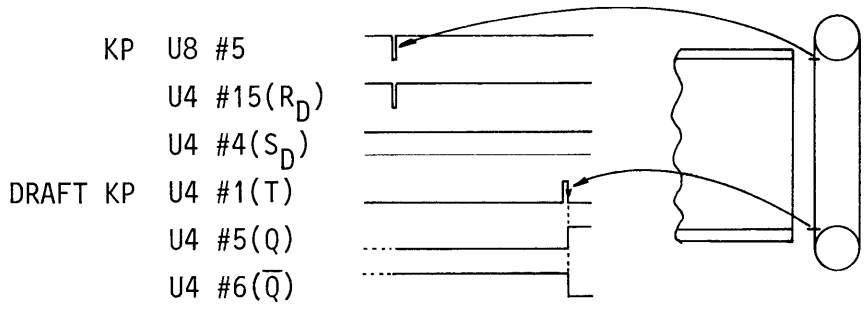


Fig.1-27

1-5. Power Supply

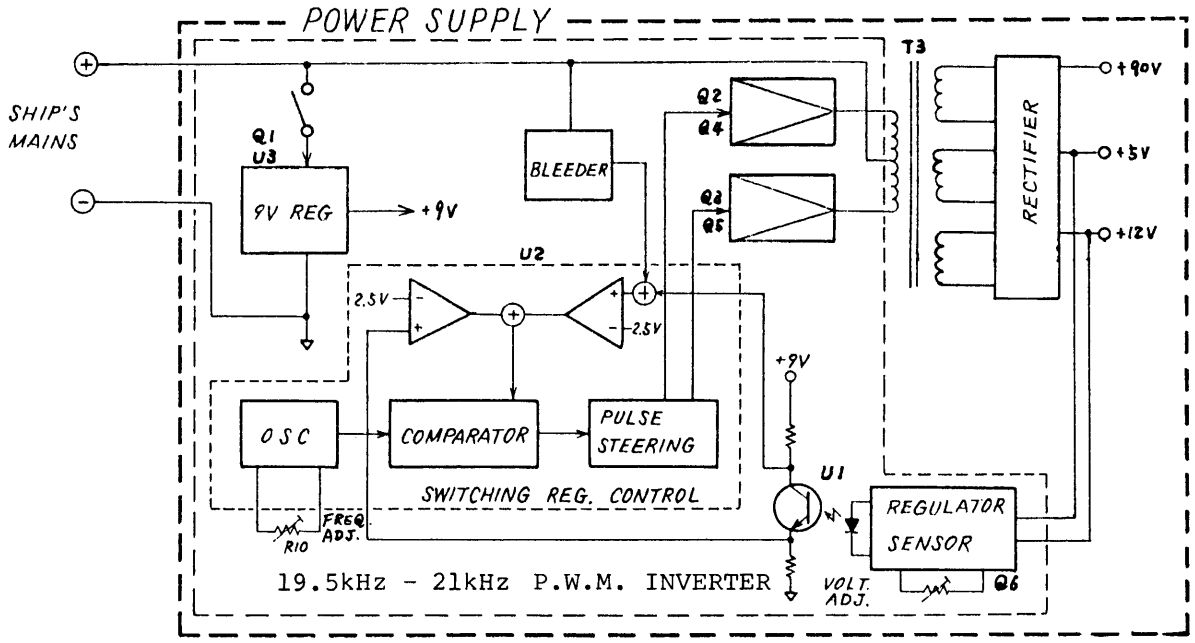


Fig.1-28 Block Diagram

The power supply circuit is made up of 19.5kHz-21kHz PWM (Pulse Width Modulation) inverter employing switching regulation technique, protector and rectifier. The PWM inverter universally operates on ship's mains of 10.5-40Vdc. Against the variation of the mains voltage, it regulates the output DC line voltages by changing width of its output pulse.

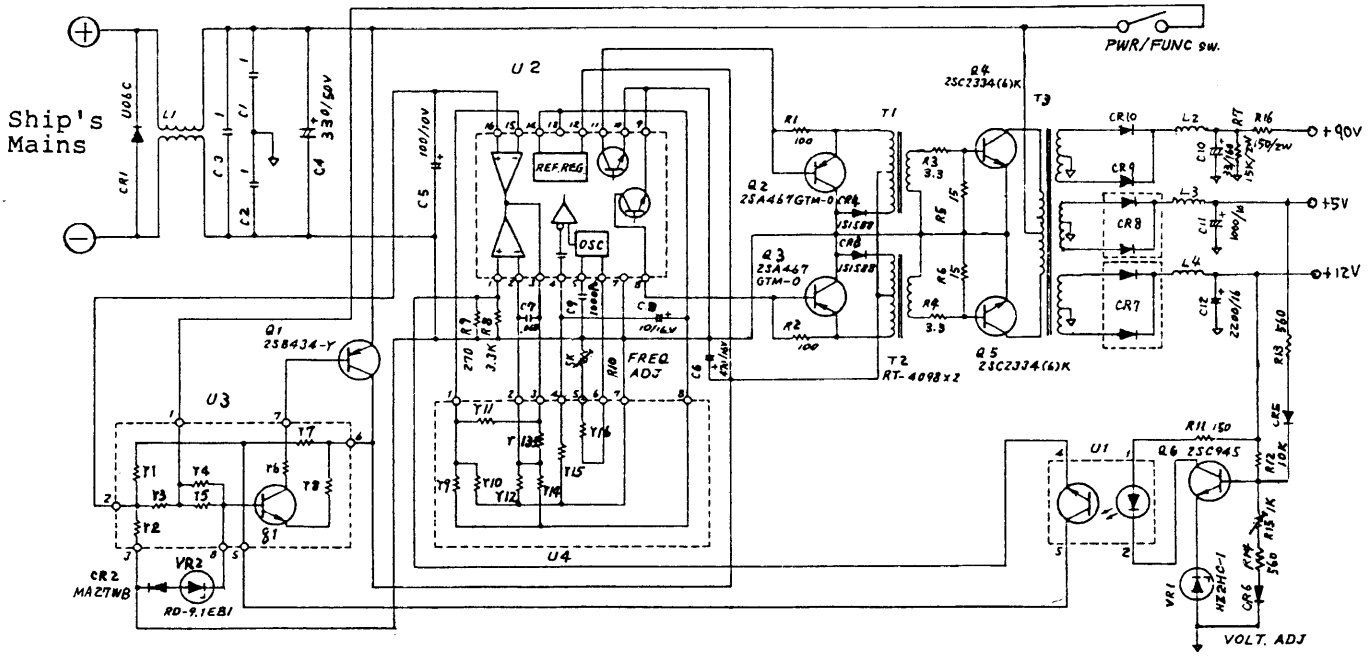


Fig.1-29 Circuit Diagram

PWM INVERTER

The PWM inverter consists of the switching regulator control IC U2, 9V regulator Q1/U3, pulse width control circuit U1/Q6, driver Q2/Q3 and output amplifier Q4/Q5.

Figure 1-30 shows the block diagram of switching regulator control IC U2 and figure 1-31, its operating waveform.

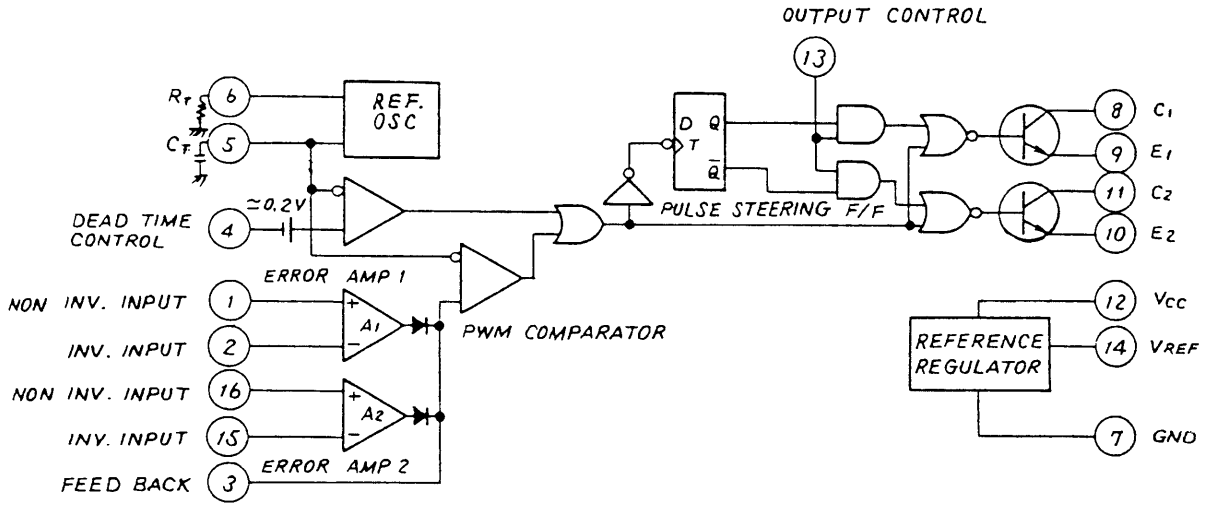
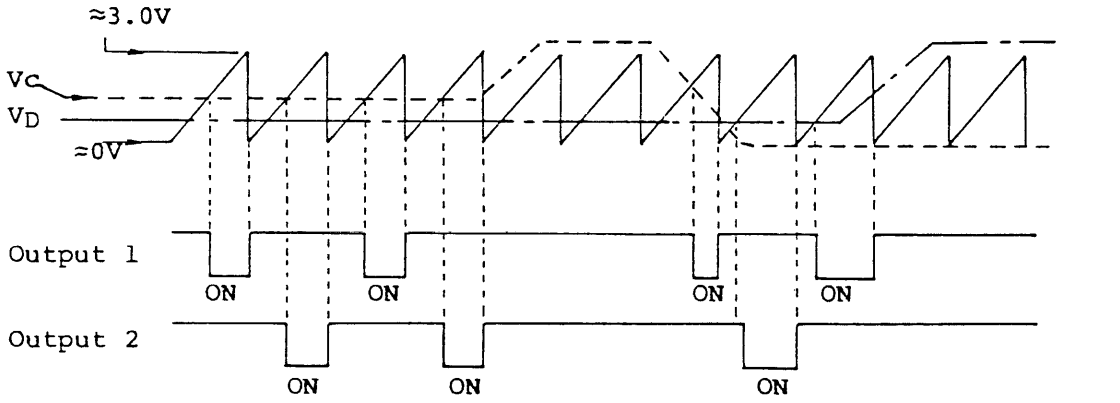


Fig.1-30 Block Diagram of Switching Regulator Control IC U2



Vc: Output of Error Amplifier V_D: Voltage on Dead Time Control Pin

Fig.1-31 Operating Waveform of U2

The reference oscillator in U2 is a sawtooth wave oscillator. Its frequency is set by external resistor R_T and capacitor C_T and given by $f=1.2/C_TR_T$. It is set to 39kHz through 42kHz by R10. The dead time control pin #4 determines a maximum duty ratio of inverter output square wave. In the switching regulator circuit, the dc output line voltages are maintained constant against fluctuation of supply voltage by varying width of output waveform.

However, in case the output stage is in push-pull connection, it is necessary to limit the maximum width of the output waveform so that the width may not become so wide as to drive two output transistors into conduction simultaneously. If the ship's mains voltage drops and the duty ratio of the square wave becomes nearly 50% as in figure 1-32, the output transistors will simultaneously conduct for a certain period because the transistors have a storage time. In the circuit, dead time of approximately 2us, which is longer than the storage time of the transistor 1.5us, is provided by pin #4 grounded through r15.

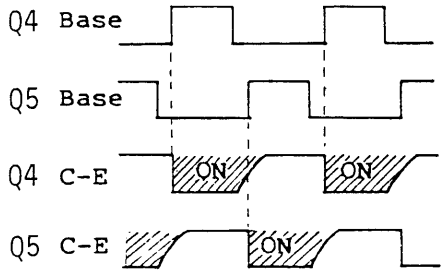


Fig.1-32

C8 and r15 in U4 are for starting the PWM inverter softly. The dead time control pin #4 of U2 is fed with time varying positive voltage for about 0.1 seconds after power-on until C8 is fully charged.

Of the two error amplifiers A1 and A2 in U2, A1 is used to control pulse width and A2 as a comparator.

The pulse width control circuit shown in figure 1-33 stabilizes dc output line voltages by moving up and down the slice level for the reference oscillator output sawtooth wave, that is, by converting mains voltage and load variations into the variation of pulse width.

The voltage variation on +12V line is detected and fed back to the error amplifier A1 in U2 via a photo coupler.

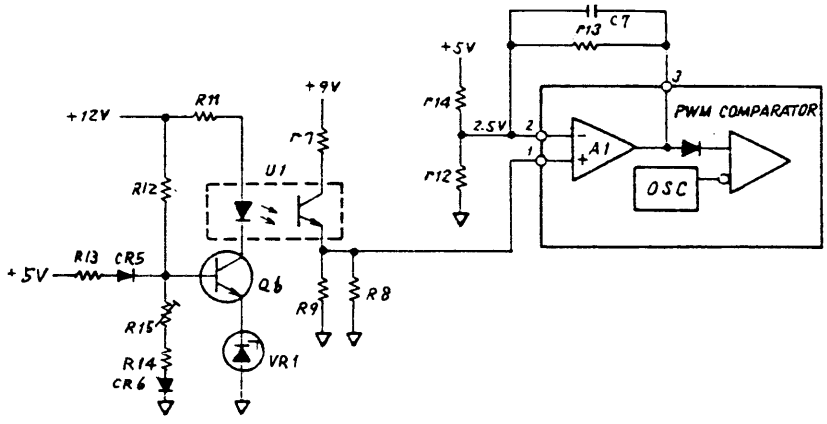


Fig.1-33 Pulse Width Control Circuit

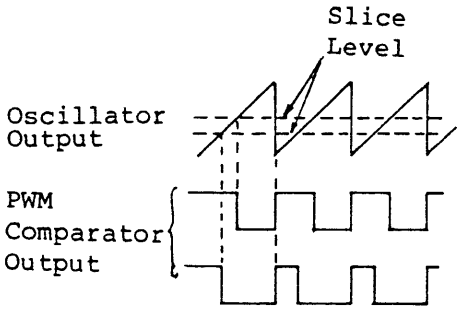


Fig.1-34

The error amplifier A1 has a gain of about 40dB as given by the ratio of r13 to r12/r14 and it is provided with a reference voltage of 2.5V at its inverting input pin. +12V line has been set to 11.6V with R15 and light emitting diode in U1 is drawing current of about 20mA. If a voltage on +12V line changes by some reason, the current in the light emitting diode and then a voltage on non-inverting input pin of error amplifier changes accordingly. The difference of voltage between inverting and non-inverting pins of A1 is amplified 100 times (40dB) and the resultant dc output is fed to the PWM comparator in U2 to move the slice level of sawtooth wave as in figure 1-34.

The regulated +9V used in the PWM inverter is provided by the circuit shown in figure 1-35. CR2 is for temperature compensation. It has a temperature coefficient of about -4mV/°C against 4.6mV/°C of zener diode VR2.

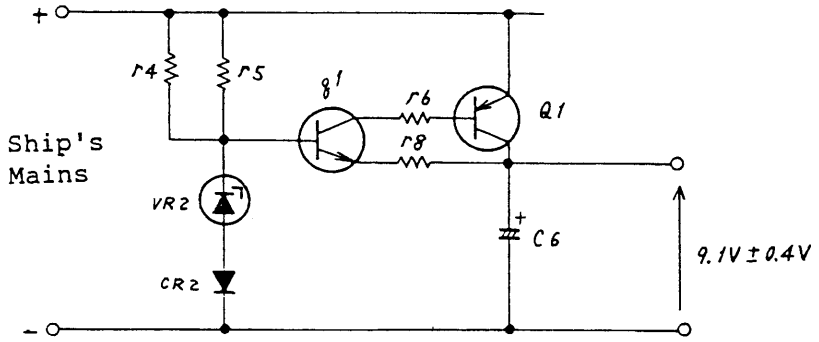


Fig.1-35 +9V Regulator

PROTECTOR

The protector circuit shown in figure 1-36 operates to disable the inverter operation when the following states occur.

(1) When the ship's mains exceeds about 41V (mains overvoltage protection).
(2) When one of dc output lines is grounded (output shortcircuit protection).

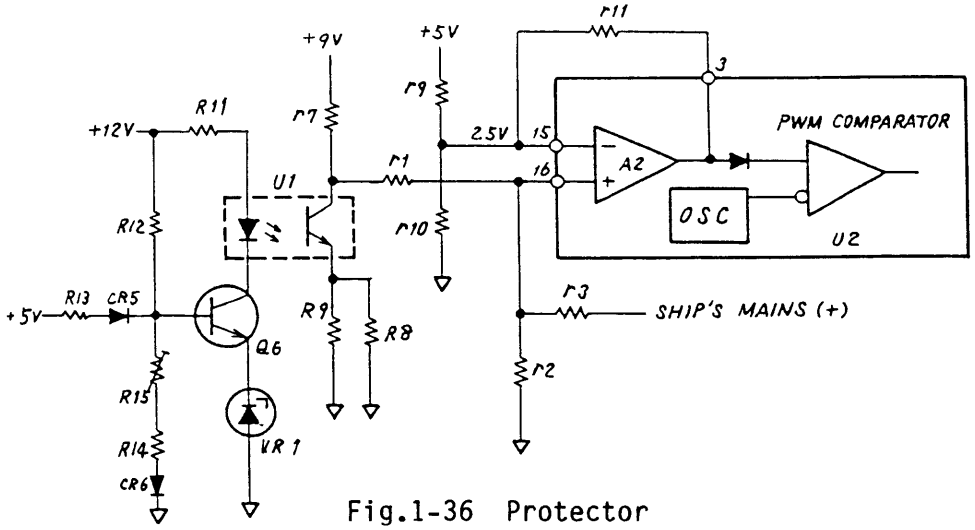


Fig.1-36 Protector

The ship's mains voltage is divided by r3 and r2, and fed to the error amplifier A2 in U2. Value of r2 and r3 is determined so that the voltage at non-inverting pin of A2 does not exceed 2.5V as far as the ship's mains is below 40V. Then, the output of A2 usually remains negative and exerts no effect on the PWM comparator in U2.

If the ship's mains rises to 41V, the voltage at the non-inverting pin becomes higher than 2.5V and the output of A2 goes positive. Since the positive voltage is higher than amplitude of the sawtooth wave in the output of reference oscillator, output of the PWM comparator is held "L" at all times and the sawtooth wave is blocked to suspend operation of the inverter.

The protection against shortcircuit of dc output lines is performed by Q6 and U1. If one of the dc output lines is grounded, the voltage on +12V line drops and the current flowing in the light emitting diode of U1 decreases. This results in increase of collector voltage of the photo-transistor over 2.5V, and inverter operation stops.

CHAPTER 2. ADJUSTMENT

Items to be checked and adjusted are listed on pages 2-3 thru 2-5 together with its check points and ratings.

Note 1. The power supply circuit on the MAIN board can be separately checked. Disconnect the plug P2 and connect the following dummy loads on each line.

+90V line J6 #7 ... 1.5k ohms/30W
+12V line J6 #4 ... 25 ohms/30W
+ 5V line J6 #1 ... 5 ohms/30W

2. Disconnect the plug P11 to stop transmission.

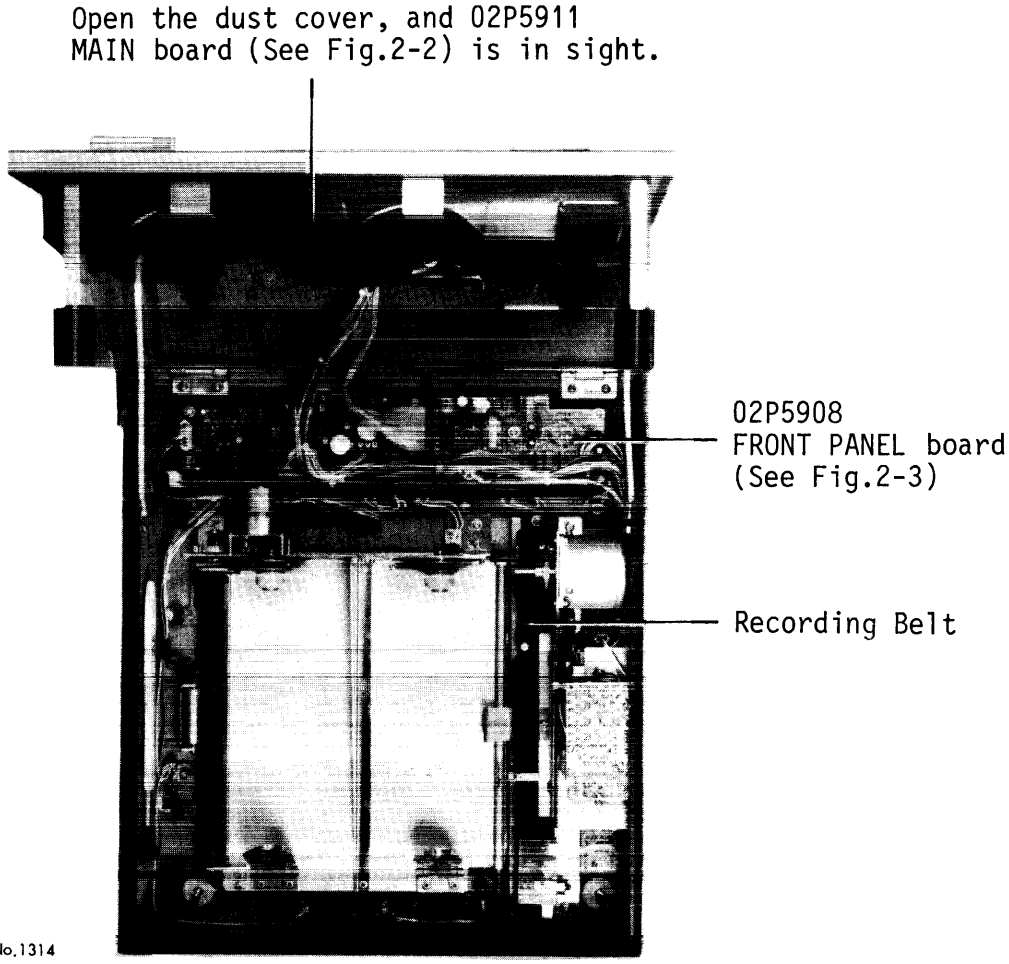


Fig.2-1 Inside View

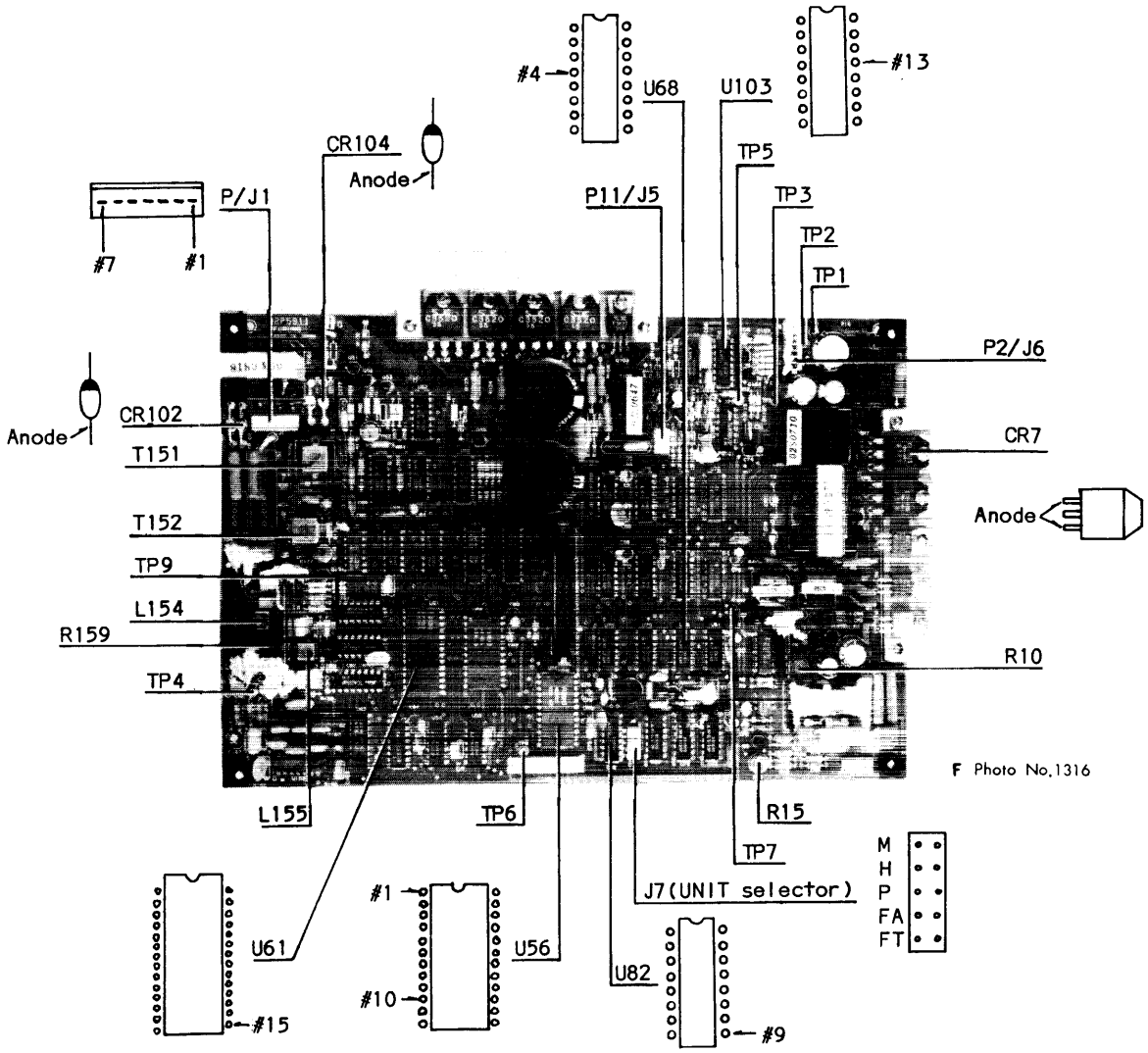


Fig.2-2 02P5911 MAIN board

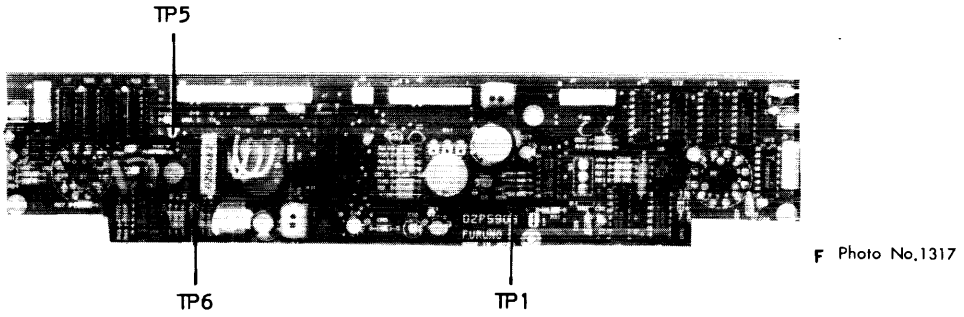
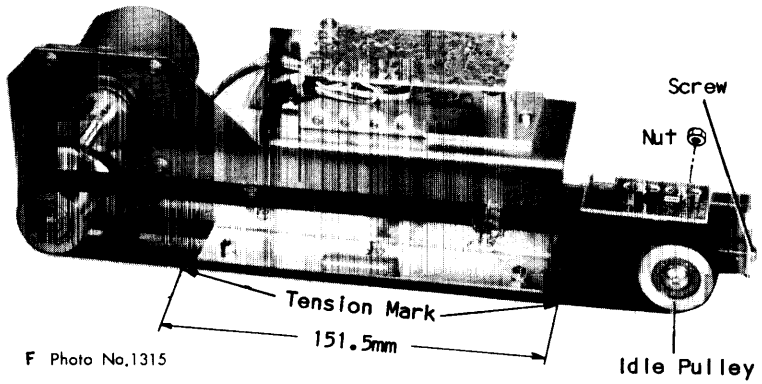


Fig.2-3 02P5908 FRONT PANEL board

Table 2-1 Check Items

Item	Rating	Check Point	Equipment	Adjustment/Remarks
02P5911 MAIN board				
+ 5V Line Voltage +12V Line Voltage +90V Line Voltage	+5±0.1V 12- 13V 85-100V	TP3(+)-TP7(-) TP2(+)-TP7(-) TP1(+)-TP7(-)	Multimeter	Adjust +5V line voltage by R15 at first, and then check +12V and +90V line voltages.
Inverter Freq.	19.5-21.0kHz	CR7 Anode-TP7(GND)	Freq. Counter	Adjust R10 so that the recording is not affected.
Pulselength	0.32-0.48mS 0.8 -1.2mS 1.6 -2.4mS	U103 #13(Q)	Oscilloscope	RANGE sw.: 1 , 2 RANGE sw.: 3 , 4 RANGE sw.: 5 , 6
Clock Osc. Freq.	10.97-11.19MHz	U68 #4	Freq. Counter	
Ref. Osc. Freq.	458.7-463.3kHz 796.0-804.0kHz 493.5-498.5kHz 700.5-707.5kHz	TP5	Freq. Counter	For 28kHz sets For 50kHz and 200kHz sets For 60kHz sets For 88kHz sets
Motor CK	2.55-2.60kHz 1.20-1.40kHz 0.60-0.70kHz 0.30-0.35kHz	U82 #9	Freq. Counter	RANGE sw.: 1 , 2 RANGE sw.: 3 RANGE sw.: 4 RANGE sw.: 5 , 6
READ CK	10.97-11.19MHz 5.45- 5.60MHz 2.70- 2.80MHz 1.37- 1.40MHz	U61 #15	Freq. Counter	RANGE sw.: 1 , 2 RANGE sw.: 3 RANGE sw.: 4 RANGE sw.: 5 , 6
WRITE CK	456.4- 465.6kHz 547.9- 559.0kHz 498.4- 508.4kHz 996.5-1016.5kHz	TP6 (U56 #1)	Freq. Counter	UNIT selector(J7): M(meter) UNIT selector(J7): P(passi) UNIT selector(J7): FA(fathom) UNIT selector(J7): FT(foot)
Bottom-Lock 1 CK	38.1-38.9kHz 45.6-46.6kHz 41.5-42.3kHz 82.9-84.6kHz	U56 #10	Freq. Counter	UNIT selector(J7): M(meter) UNIT selector(J7): P(passi) UNIT selector(J7): FA(fathom) UNIT selector(J7): FT(foot) Set FUNCTION sw. to "1".

Item	Rating	Check Point	Equipment	Adjustment/Remarks
Bottom-Lock 2 CK	19.0 -19.45kHz 22.8 -23.3kHz 20.75-21.15kHz 41.45-42.3kHz	U56 #10	Freq. Counter	UNIT selector(J7): M(meter) Set FUNCTION UNIT selector(J7): P(passi) sw. to " 2 ". UNIT selector(J7): FA(fathom) UNIT selector(J7): FT(foot)
RX Gain	85dBu	TP4(+)-TP9(-)	Sig. Generator Valve Voltmeter	Connect the voltmeter (100dBu range) between TP4(+) and TP9(-). Set the SG output level to 20dBu, and connect it between J1#1 and #7. Adjust the GAIN control to get appropriate deflection of the voltmeter, and tune T151, T152, L154 and L155. Change the SG output level to 10dBu, and set the GAIN control to "10". Adjust R159 so that the voltmeter indicates 95dBu.
TX Output	380Vpp or less 600 - 900Vpp 1150 - 1750Vpp 150Vpp or less 280 - 420Vpp 1100 - 1700Vpp 210Vpp or less 250 - 380Vpp 680 - 1020Vpp 350Vpp or less 450 - 700Vpp 900 - 1350Vpp 300Vpp or less 400 - 600Vpp 750 - 1150Vpp	Between CR102 anode and CR104 anode	Oscilloscope	200kHz, POWER REDUCTION sw.: A 200kHz, POWER REDUCTION sw.: B 200kHz, POWER REDUCTION sw.: C 88kHz, POWER REDUCTION sw.: A 88kHz, POWER REDUCTION sw.: B 88kHz, POWER REDUCTION sw.: C 60kHz, POWER REDUCTION sw.: A 60kHz, POWER REDUCTION sw.: B 60kHz, POWER REDUCTION sw.: C 50kHz, POWER REDUCTION sw.: A 50kHz, POWER REDUCTION sw.: B 50kHz, POWER REDUCTION sw.: C 28kHz, POWER REDUCTION sw.: A 28kHz, POWER REDUCTION sw.: B 28kHz, POWER REDUCTION sw.: C
02P5908 FRONT PANEL board				
Paper Feed Osc.Freq.	114-126Hz	TP5-TP1(GND)	Freq. Counter	
Recording Osc. Freq.	19.0-21.0kHz	TP6-TP1(GND)	Freq. Counter	

Item	Rating Check Point	Adjustment/Remarks
OTHERS Recording Belt Tension	 F Photo No.1315	Adjust the distance between two Tension Marks drawn on the recording belt for 151.5mm. Unfasten a nut, and move the position of the idle pulley by turning a screw.

CHAPTER 3. MAINTENANCE

3-1. Cleaning

A certain amount of carbon powder will pile up inside the recorder after lengthy use. If not cleaned up at regular intervals, it may cause trouble.

To clean up carbon powder accumulated on the pc board or around the recording belt, open the front door, unfasten two fixing screws and swing down the recorder mechanism.

Sweep away carbon powder with the brush supplied inside the cabinet. Use of vacuum cleaner is also effective for removing carbon powder.

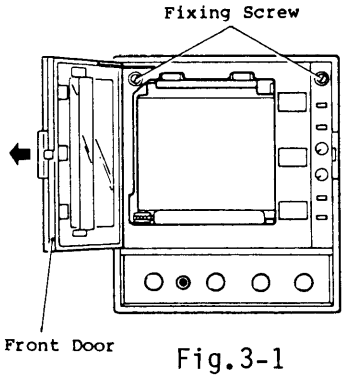


Fig.3-1

3-2. Lubrication

In order to ensure trouble-free operation for a considerably long period, some of the moving mechanical parts should be lubricated at least once every year.

Fig.3-2 shows the parts to be lubricated. Use high quality grease specified for use in precision machinery. (Recommend "LIMAX #1", Furuno Code: 000-824-056.)

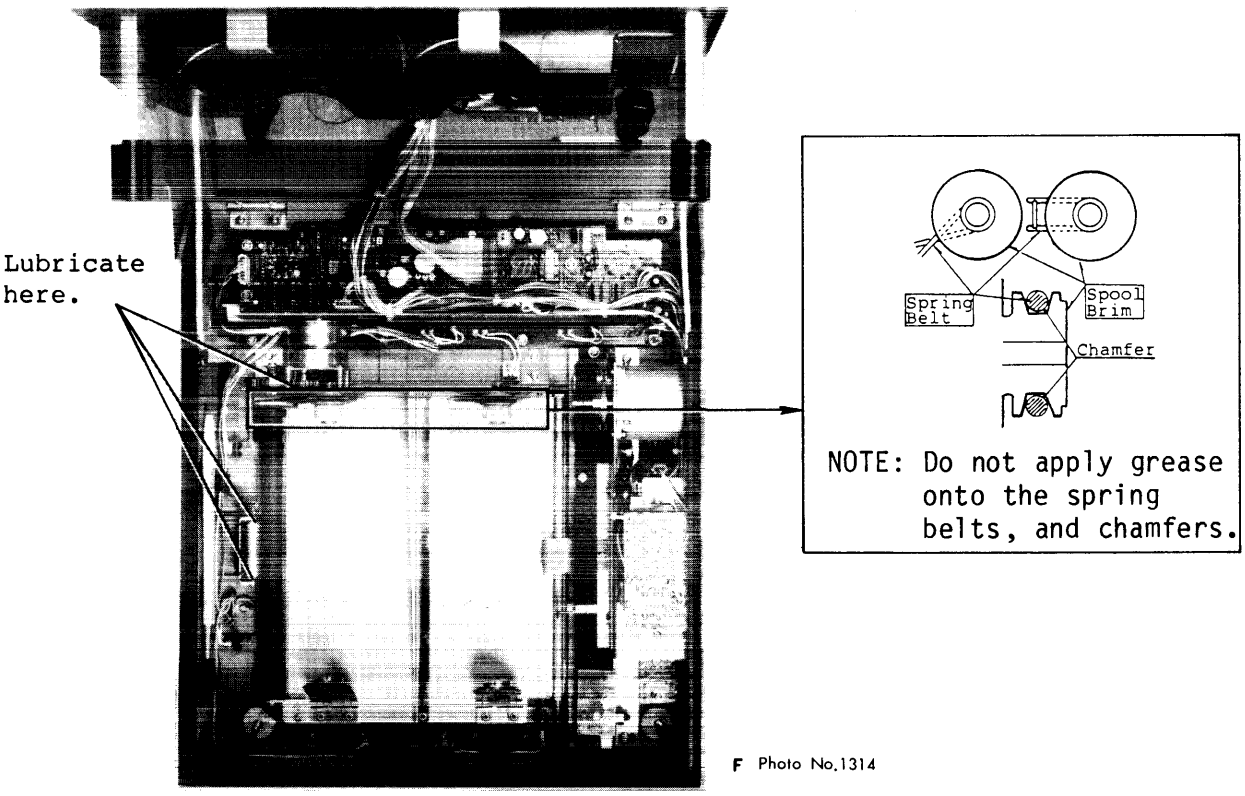


Fig.3-2

3-3. Replacement of Spring Belt

When replacing the Spring Belt (Drive) shown in Fig.3-3, beware of twisting direction.

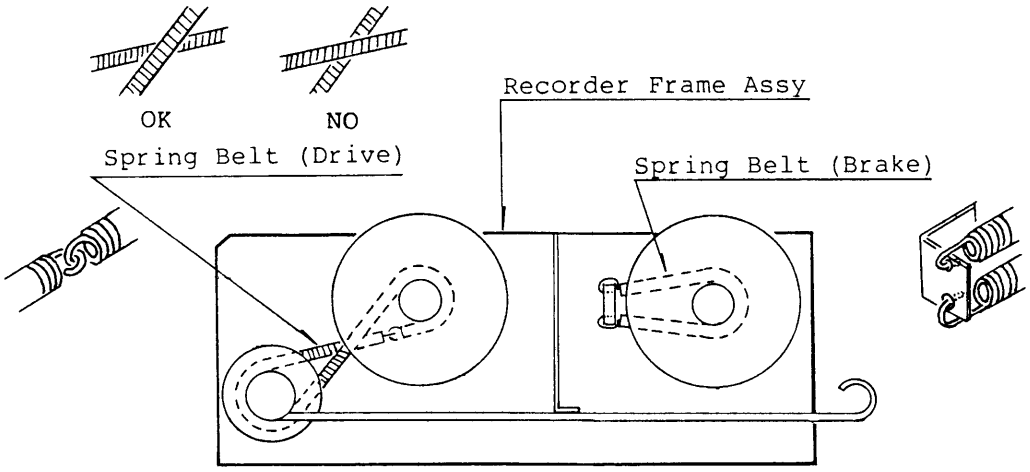


Fig.3-3

3-4. Replacement of Motors

Belt Drive Motor

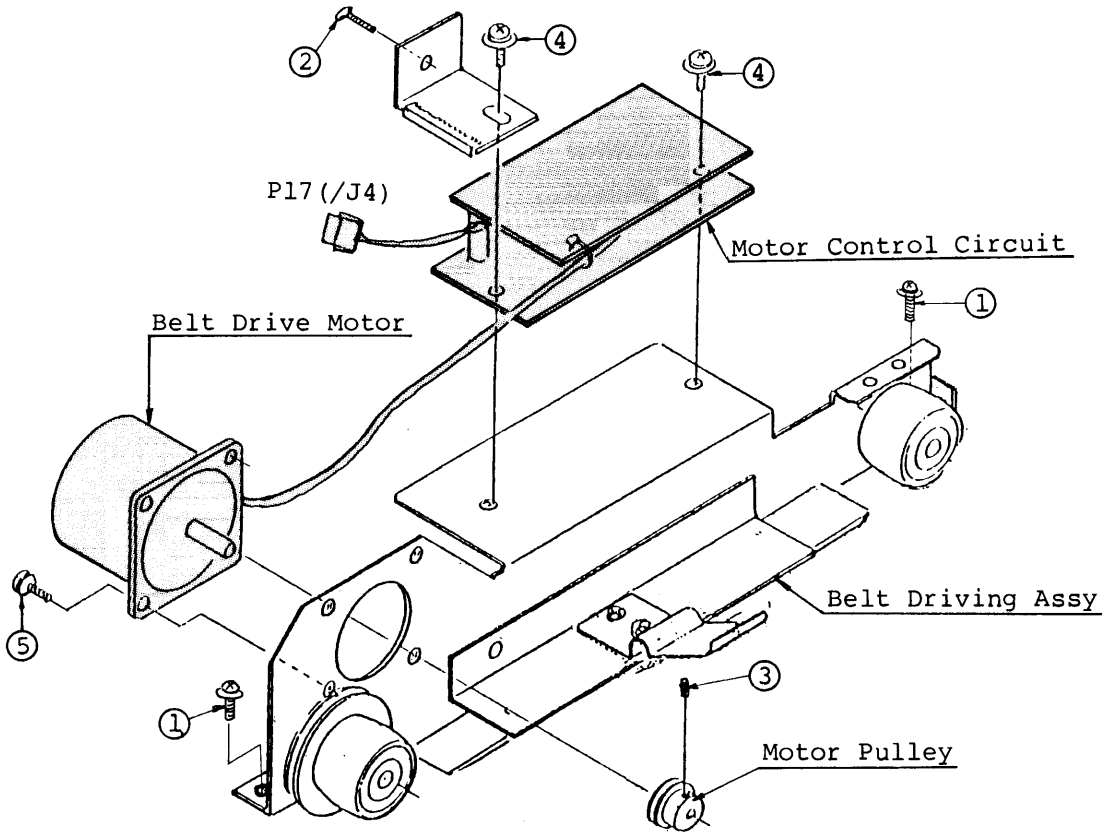


Fig.3-4

1. Pull out the plug P17 from J4 mounted on the SUB-PANEL board.
2. The Belt Driving Assy can be taken out by undoing two M4x8 screws ① and an M3x12 screw ② .
3. Unfasten an M3x4 set screw ③ , and the Motor Pulley comes free.
4. Unfasten two M3x8 screws ④ and four M4x8 screws ⑤ , and the Belt Drive Motor with the control circuit can be removed.

Paper Feed Motor

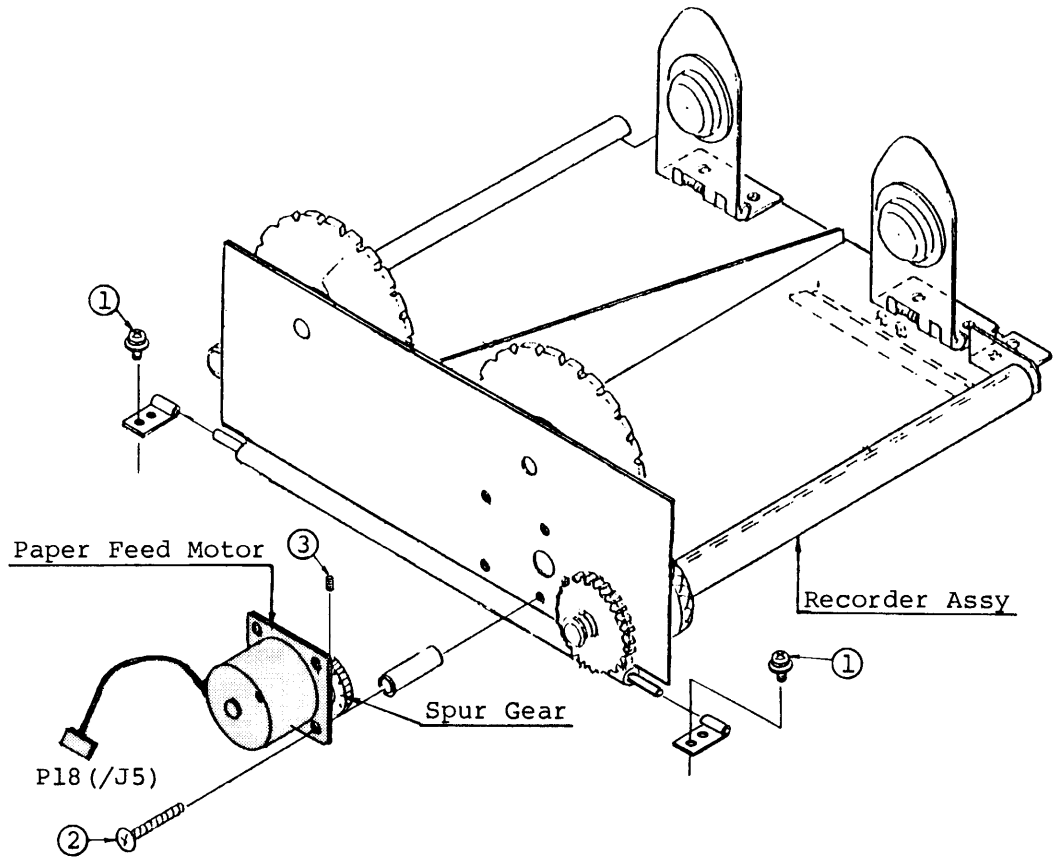


Fig.3-5

1. Pull out the plug P18 from J5 mounted on the FRONT PANEL board.
2. Undo four M3x6 screws ① , and the Recorder Assy can be taken out.
3. Undo four M3x16 screws ② .
4. Undo an M3x3 set screw ③ for the Spur Gear, and the Paper Feed Motor can be removed.

3-5. Transducer Check

The transducer unit mainly consists of the vibrating element and the cable. The 50kHz (50B-6 & 50B-9), 60kHz, 88kHz and 200kHz transducers are made of barium titanate ($BaTiO_3$), whilst the 28kHz and 50kHz (50F-8G) transducers are made of ferrite core. The former is electrostriction type, and the latter is magnetostriction type.

Judgement on whether the transducer is good to use or not can be accomplished by the following tests.

Quick Check

In the field, connect a new transducer instead of the existing one to the echo sounder. If the echogram is improved by this exchange, the transducer or its cable is considered to be faulty. On the contrary, if no difference is met, the other electronic circuit may be faulty. This way of checking is simple and useful.

50B-6/9, 60B-5S/52, 88B-8/10 and 200B-5S/8/8N Transducer Check

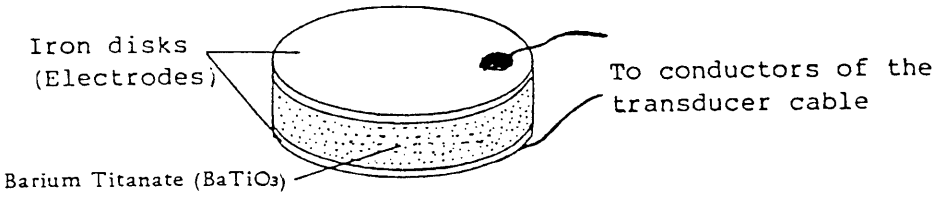


Fig.3-6 Construction of Transducer

1. Insulation Test

   The insulation resistance between the shield and each conductor is cardinal check to determine whether the transducer is defective or not.

   A megger (500Vdc) is used for this check.

   Rated Value: 10 megohms or more

2. Capacitance Test of Transducer Cable

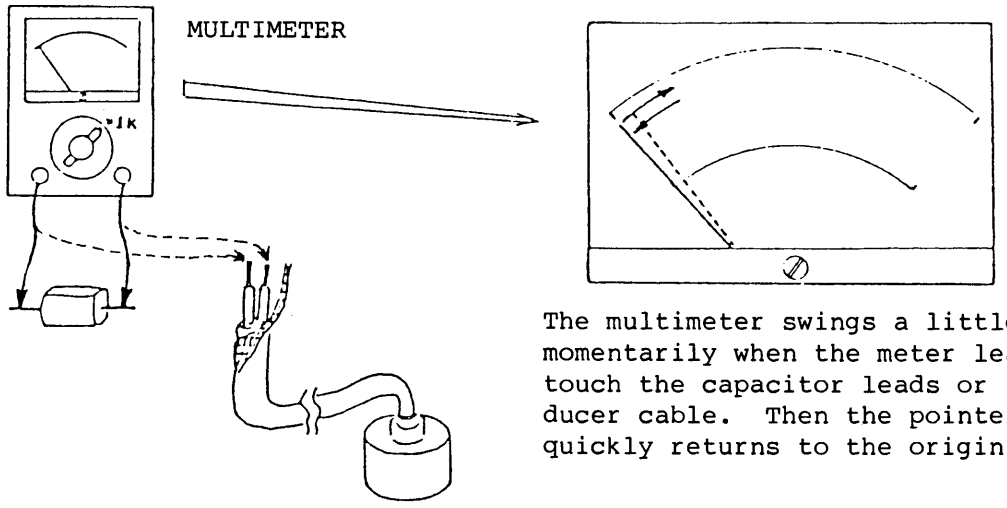
Even though the transducer itself is not faulty, there still remains an important matter to be checked; if the cable is cut off on the way or not. The transducer cable has two conductors and one ends of them are connected to the iron disks sandwitching the transducer element. It can be checked by measuring the capacitance whether the inner conductors are cut off at any portion or not. Prepare the capacitance meter and measure the capacitance of the transducer.

Table 3-1

Transducer	Normal Capacitance (between two conductors)	
50B-6	8250pF ± 10%	Including 10m cable (100pF/m).
50B-9	15000pF ± 10%	Including 10m cable (100pF/m).
60B-5S	8000pF ± 10%	Including 10m cable (100pF/m).
60B-52	14000pF ± 15%	Including 15m cable (100pF/m).
88B-8	3300pF ± 15%	Including 15m cable (100pF/m).
88B-10	5700pF ± 15%	Including 15m cable (100pF/m).
200B-5S	2560pF ± 15%	Including 10m cable (100pF/m).
200B-8	5100pF ± 10%	Including 10m cable (100pF/m).
200B-8N	10300pF ± 20%	Including 15m cable (100pF/m).

If no capacitance meter is available, use the popular multimeter as below.
Prepare a multimeter and two kinds of capacitors which have the equivalent value to the above capacitance. Set the multimeter to resistance range of more than 'x 1k'. Refer to the figure below. Read the multimeter deflection when the leads of multimeter touch across the prepared capacitor. Do the same for the transducer and compare the deflections. The normal transducer cable indicates nearly the same deflection as the capacitor.

If water soaks into the transducer, the multimeter swings to zero or some value.
If the cable is cut off on the way, the multimeter does not swing at all or swings little.



The multimeter swings a little momentarily when the meter leads touch the capacitor leads or transducer cable. Then the pointer quickly returns to the origin.

Fig.3-7 Capacitance Test

3. Impedance Test

In order to check the transducer in the field without taking it out from ship's hull, the following method is also available. Refer to figure below.

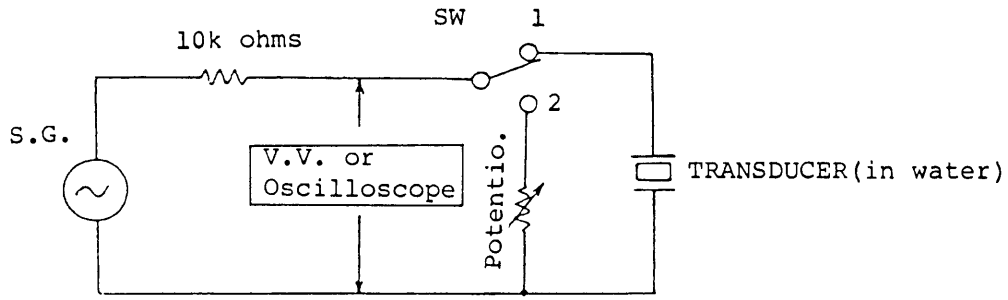


Fig.3-8 Impedance Test

1) Set the switch to "1".

2) Set the output frequency of signal generator at a certain frequency (adjacent to resonant frequency), and measure the voltage across the transducer with a precision voltmeter or oscilloscope.

3) Turn the switch to "2" and adjust the potentiometer so that the V.V. or oscilloscope may indicate the same voltage as above, then measure the resistance of potentiometer. This resistance may be considered as the impedance of transducer at the above frequency.

4) Do the same at the other different frequencies, then plot the measured resistance.

Thus the resistance curve is obtained and the typical one is shown in the figure below. Compare it with the other typical one for judgement. The important point is the ratio at A to B.

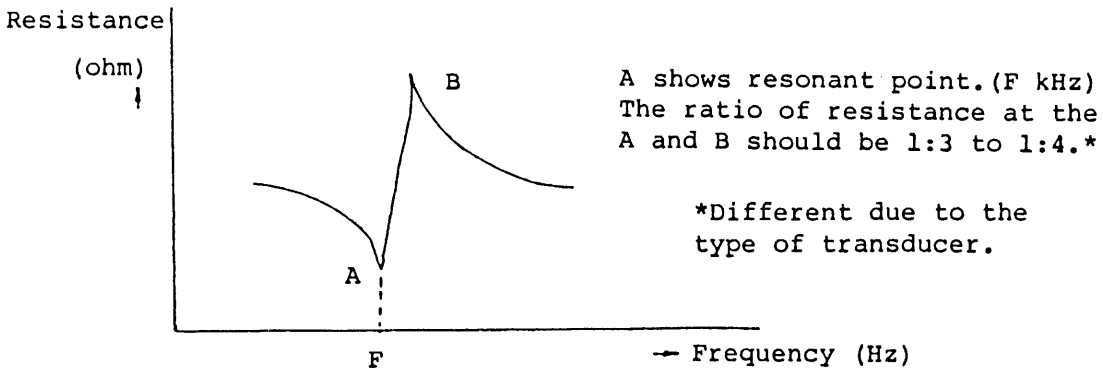


Fig.3-9 Characteristic Curve

28F-8, 28F-18 and 50F-8G Transducer Check

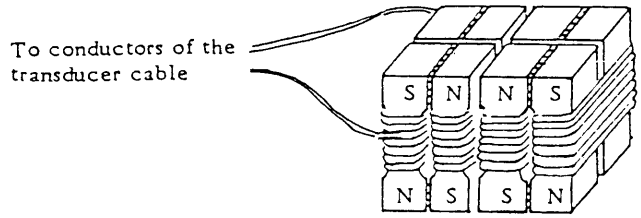


Fig.3-10 Construction of Transducer

1. Insulation Test

   Do the same test as mentioned above on 50kHz(50B-6/9), 60kHz, 88kHz and 200kHz transducers (barium titanate type) check.

Refer to page 3-4.

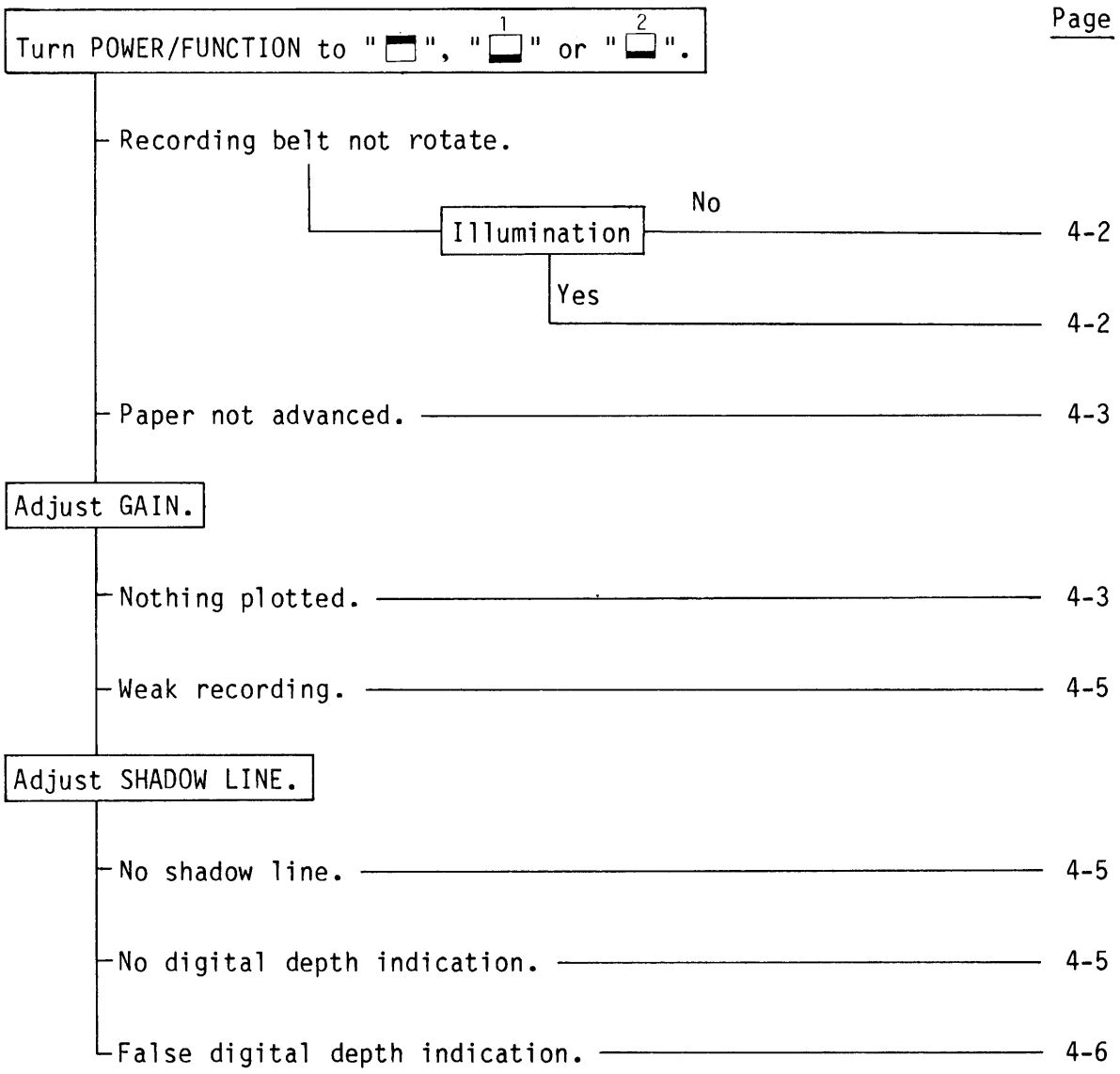
2. Conduction Test

   The ferrite core type transducer is not regarded as capacitor because the ferrite core is wound by the lead wire. Conduction test, therefore, is carried out instead of capacitance test.

   Prepare a multimeter, and measure the resistance between conductors of transducer cable.
   The resistance should be approximately one ohm.

CHAPTER 4. TROUBLESHOOTING

All circuits are operated from +12V, +5V, +90V produced in the power supply circuit. Therefore, it is recommended to check respective line voltages prior to the troubleshooting for individual circuits. Refer to Chapter 2. Adjustment. As for the waveforms at each check point, refer to the circuit diagrams.

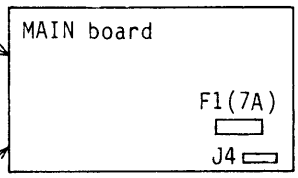


Recording belt not rotate. No illumination with Dimmer switch "2" or "3".

Supply voltage and polarity are normal? (10.5V thru 40VDC between #1(+) and #5(-) of J4 on the MAIN board)

No → Check ship's mains voltage at switch board.

Yes



Fuse F1(7A) OK?

No → Replace the fuse.

Yes

Check the power supply circuit for a shortcircuit in any of +90V, +12V or +5V line.

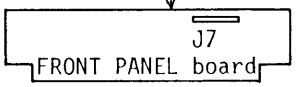
Blows again. Do Not use the fuse with larger capacity.

Recording belt not rotate but illumination normal.

MOTOR CK is present on pin #4 of J7 on the FRONT PANEL board?

No

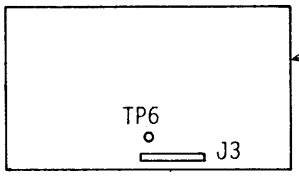
Yes



MOTOR CK is present on pin #12 of J3 on the MAIN board?

Yes → ○Check U4 and U8 on the FRONT PANEL board.
○Replace the motor.

No



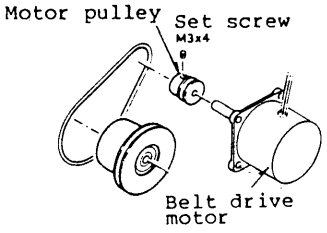
Waveform at TP6 on the MAIN board is normal?

Yes → U61, U74, U76 or U82 may be faulty.

No → Check clock osc. circuit(U68, Y1).

Motor pulley set screw loosened?

Yes → Fasten the set screw.



No

Recording belt or recording stylus jammed? (Check the recording belt or recording stylus for strange materials which overload the motor).

Yes → Remove the strange materials.

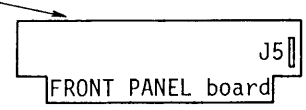
No

Replace the motor.

Paper not advanced.

PAPER FEED CK is applied to pin #2, #3, #4 and #5 of J5 on the FRONT PANEL board?

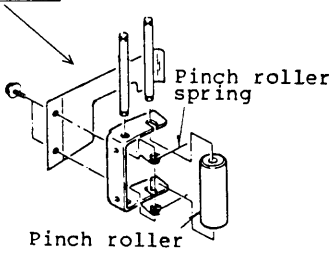
No → Check the paper feed control circuit on the FRONT PANEL board.



Yes

Pinch roller pressure is OK?

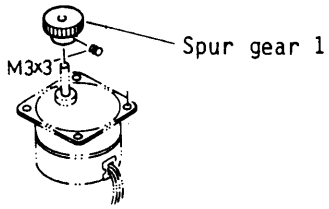
No → Replace the pinch roller springs.



Yes

Spur gear 1 set screw loosened?

Yes → Fasten the set screw.



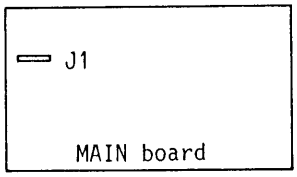
No

Replace the paper feed motor.

Nothing plotted.

Press the MARKER switch, and a straight line appears across the paper?

No → Check the condition of the recording stylus.



Yes

Transmission is OK?
Observe TX output waveform across pins #1 and #7 of J1 on the MAIN board.

No → Transducer is normal?

No → Replace the transducer.

Yes

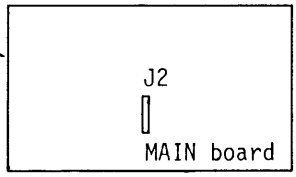
Yes

Proceed to the RX trouble flow on next page.

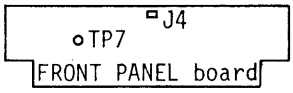
Proceed to the TX trouble flow on next page.

TX Trouble Flow

TX-KP pulse is present on pin #5 of J2 on the MAIN board?
- Yes → Check the transmitter circuit on the MAIN board.
- No →



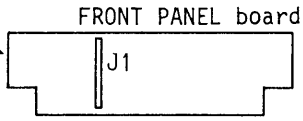
DRAFT KP is present at TP7 on the FRONT PANEL board?
- Yes → Check the draft circuit (U2) on the FRONT PANEL board.
- No →



KP is applied to pin #3 of J4 on the FRONT PANEL board?
- Yes → U61, U68 or U71 on the MAIN board may be faulty.
- No → Replace U1 on the TRIGGER board.

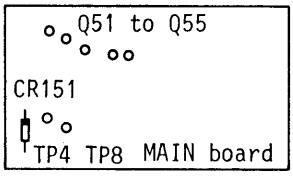
RX Trouble Flow

Signal is received at pin #12 of J1 on the FRONT PANEL board?
- Yes → ∘ Check the recording osc./ mod. circuit on the FRONT PANEL board.
- No →



∘ Check the recording stylus, and collecter rail for bad contact.

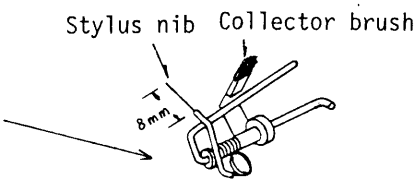
Waveform at TP8 on the MAIN board is normal?
- No → Check the T/R, mix., osc., STC and IF amp. circuits on the MAIN board.
- Yes →



Waveform at TP4 on the MAIN board is normal?
- No → Check CR151 on the MAIN board.
- Yes → Check Q51-Q55 on the MAIN board.

Weak Recording.

Adjust the length of the stylus nib for 8mm or replace the whole stylus assembly. Check if the collector brush is properly running on the collector rail.



Proceed to the RX trouble flow on the previous page.

No shadow line.

RX gain is sufficient enough? See Chapter 2. Adjustment.
- No → Check the receiver circuit.
- Yes ↓

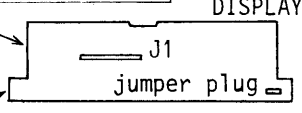
Check the shadow line circuit. Refer to pages 1-10 and 1-11.
- No → U153, U155, U51, U67 or U53 may be defective.
- Yes ↓

Check the D-A converter Q51 for light-gray gradation.

No digital depth indication.

Confirm that water depth is more than 5m.

Negative going S/L SIG appears at J1 #9 on the DISPLAY board when turning SHADOW LINE control CW?
- No → U66, U67 or U82 on the MAIN board may be defective.
- Yes ↓



Clock is present at the jumper plug for calibrating unit on the DISPLAY board?
- No → U1, U3, Y1 or Y2 may be faulty.
- Yes ↓

Check U5, U6, U7 and U8 on the DISPLAY board.

False digital depth indication.

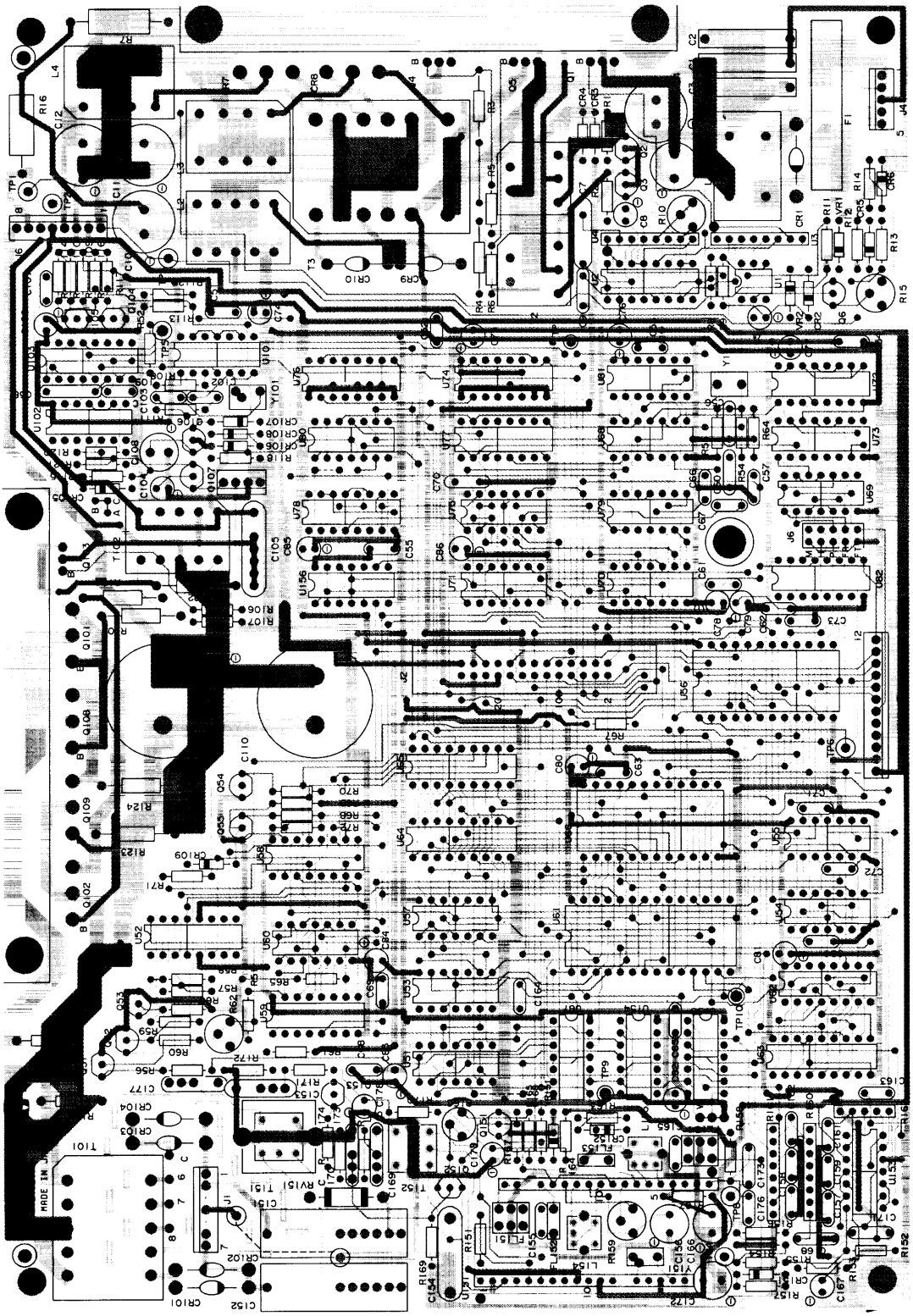
Stable shadow line is provided on the seabed?

No — If the shadow line disappears intermittently due to heavy rolling and pitching, the depth indication becomes unstable. Check the transducer installation.

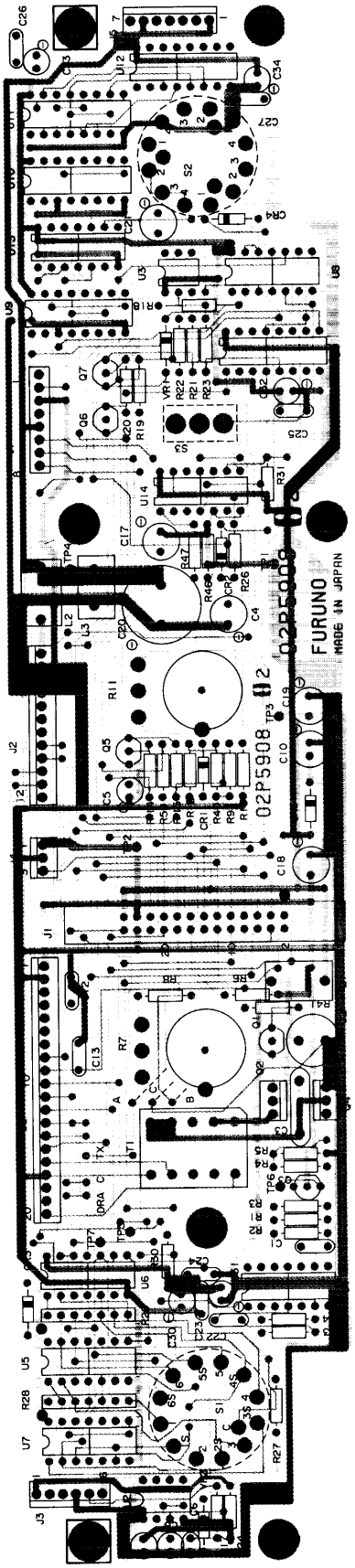
Yes — If the receiver gain or shadow line sensitivity is too high, a shadow line is effected on fish echoes or noise to cause false depth indication. Decrease the gain and readjust the shadow line.

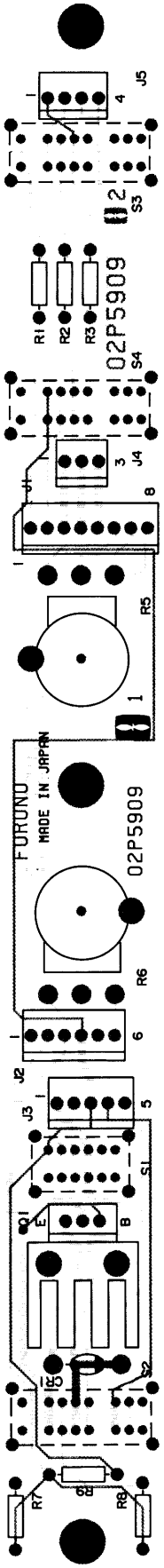
Note: If the set is switched on under heavy interference from other echo sounder or electric machine, the shadow line is effected on the interference and the depth indication becomes false.

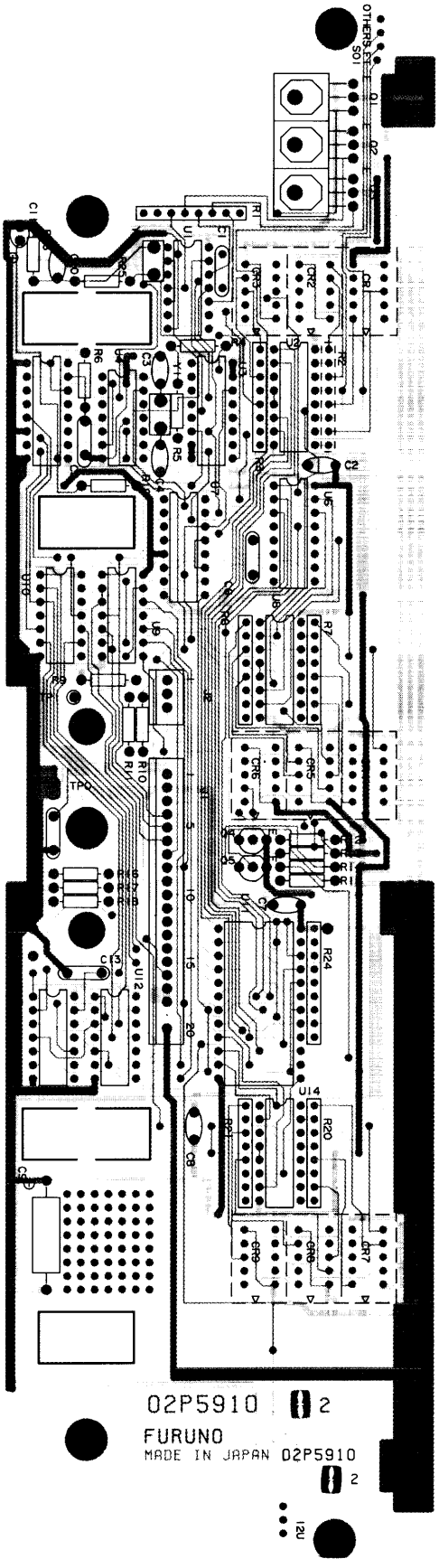
CHAPTER 5. PARTS LOCATION



02P5911 MAIN BOARD







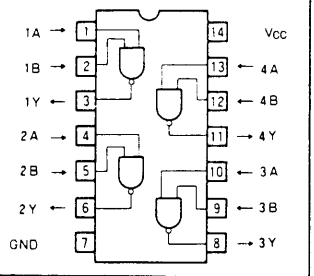
02P5908 FRONT PANEL BOARD 02P5909 SUB-PANEL BOARD 02P5910 DISPLAY BOARD

CHAPTER 6. TECHNICAL DATA

TTL IC

TYPE	FUNCTION	MFR	CODE NO.	FIG.
M74LS00P	Quad 2 Input NAND	MTB	000-151-202	1
M74LS02P	Quad 2 Input NOR		000-151-203	2
M74LS04P	Hex Inverters		000-151-204	3
M74LS08P	Quad 2 Input AND		000-151-228	4
M74LS10P	Tri 3 Input NAND		000-151-213	5
M74LS11P	Tri 3 Input AND		000-151-214	6
M74LS27P	Tri 3 Input NOR		000-151-184	7
M74LS30P	8 Input NAND		000-151-191	8
M74LS32P	Quad 2 Input OR		000-151-192	9
M74LS74AP	Dual D-FFs with Preset and Clear		000-151-193	10
M74LS75P	4-Bit Latches		000-151-209	11
M74LS85P	4-Bit Magnitude Comparator		000-151-194	12
M74LS112AP	Dual JK-FFs with Preset and Clear		000-151-195	13
M74LS123P	Dual Retriggerable Single Shot		000-151-190	14
M74LS125AP	Dual 3 State Bus Buffers		000-151-196	15
M74LS157P	2 to 1 Data Selectors		000-151-197	16
M74LS161AP	Sync 4-Bit Binary Counters		000-151-216	17
M74LS175P	Quad D-FFs		000-151-185	18
M74LS193P	Sync 4-Bit Binary UP/DN Dual CK Counters		000-151-340	19
M74LS247P	BCD-TO-7 Segment Decoders/Drivers		000-151-186	20
M74LS293P	4-Bit Binary Counters		000-151-199	21
M74LS393P	Dual 4-Bit Binary Counters		000-151-220	22
SN74LS669N	Sync 4-Bit UP/DN Counter	TI	000-168-194	23

1



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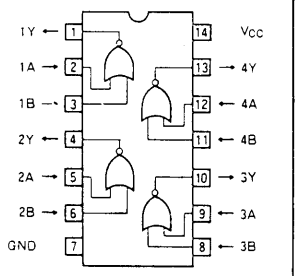

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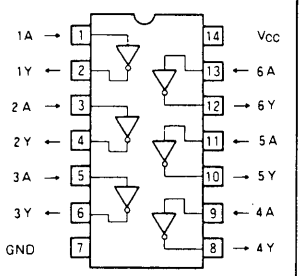

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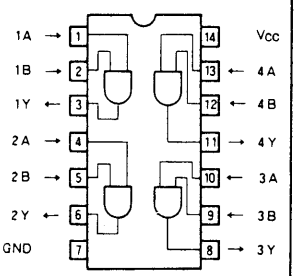

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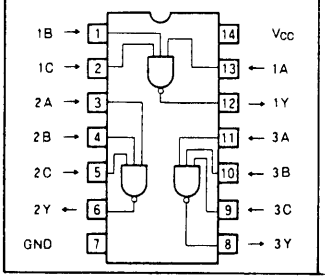

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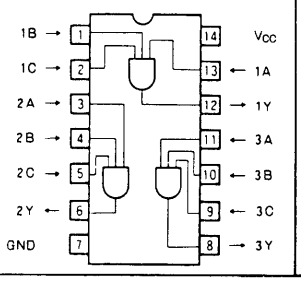

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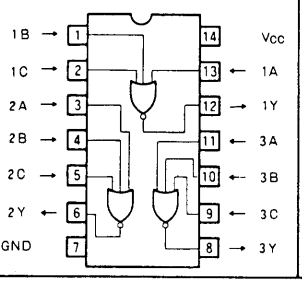

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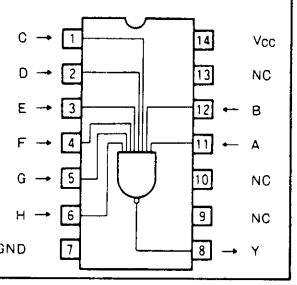

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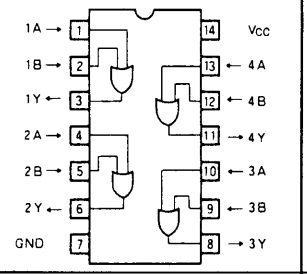

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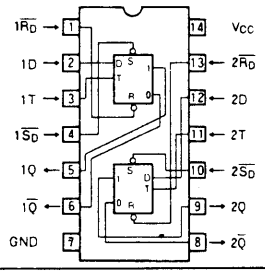

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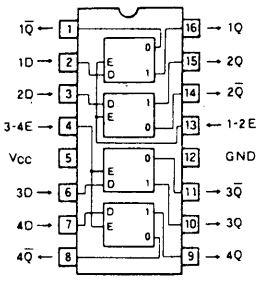

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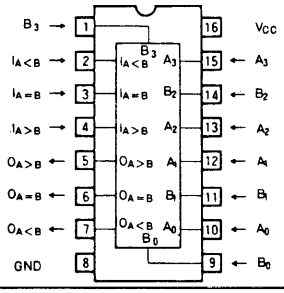

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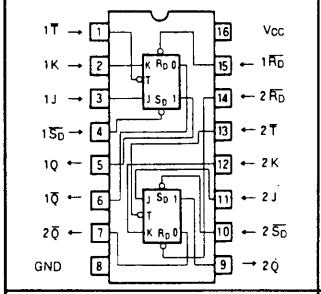

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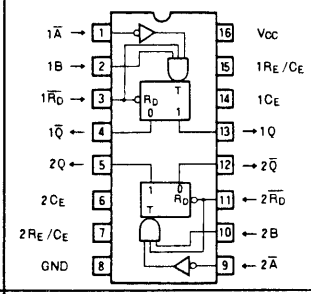

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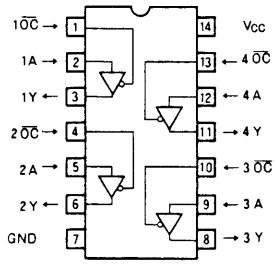

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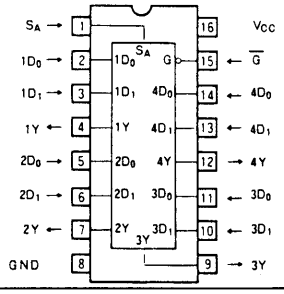

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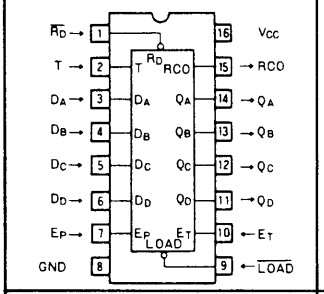

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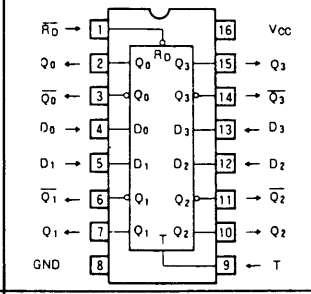

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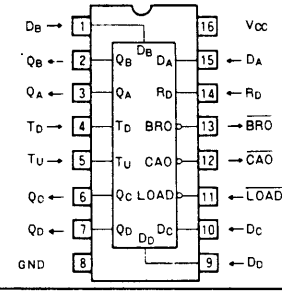

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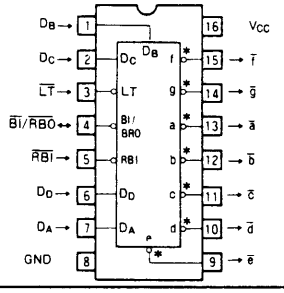

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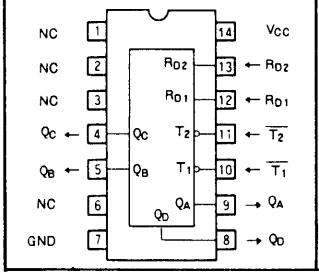

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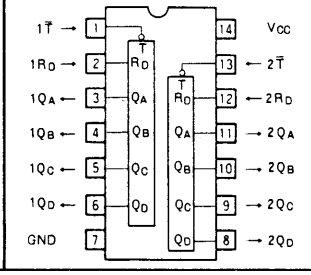

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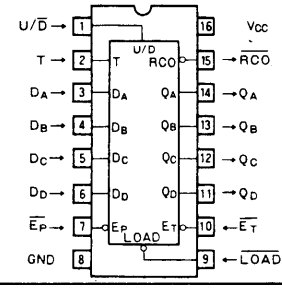
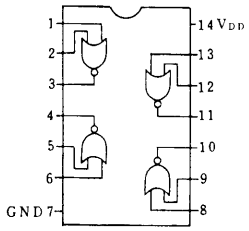


C MOS IC

TYPE	FUNCTION	MFR	CODE NO.	FIG.
TC4001BP	Quad 2-Input NOR	TOS	000-163-240	24
TC4025BP	Triple 3-Input NOR	↓	000-163-249	25
TC4040BP	12-Stage Binary Ripple Counter	↓	000-163-254	26
TC4069UBP	Hex Inverter	↓	000-163-265	27
TC5048P	17-Stage High Speed Freq. Divider	↓	000-163-848	28
TC5051P	4 Digit Decade Counter	↓	000-163-342	29

24



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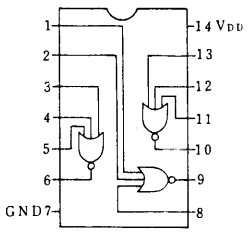
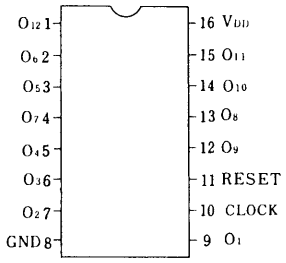


26



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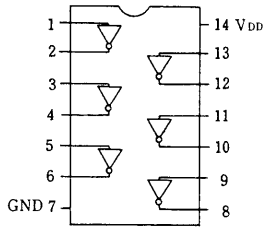

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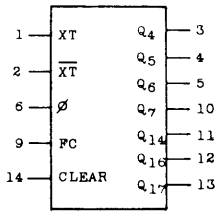
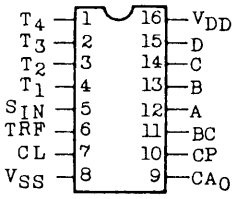


VDD1 ; 16 VSS1 ; 8
VDD2 ; 15 VSS2 ; 7

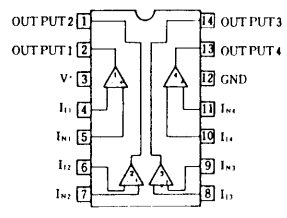
29



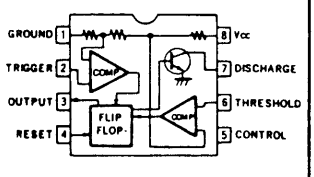
LINEAR IC

TYPE	FUNCTION	MFR	CODE NO.	FIG.
uPC339C	Quad Voltage Comparator	NEC	000-161-055	30
TA7555P	Timer	TOS	000-163-007	31

30



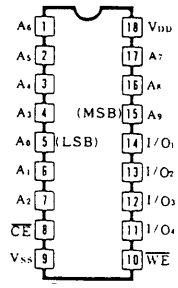
31



MEMORY

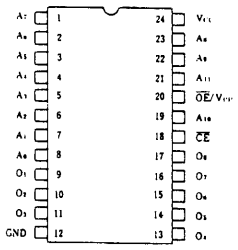
TYPE	FUNCTION	MFR	CODE NO.	FIG.
M5L2114LP	4K nMOS Static RAM (1024x4)	MTB	000-151-154	32
MBM2732A-35Z-G	4K BYTE MOS ROM	FUJ	000-157-371	33

32



CS	WE	I/O	MODE
H	X	Hi-Z	Not Selected
L	L	H	Write 1
L	L	L	Write 0
L	H	DOUT	Read

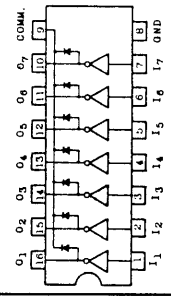
33



OTHERS

TYPE	FUNCTION	MFR	CODE NO.	FIG.
TD62004P	Large Current Darlington Transistor Array	TOS	000-163-091	34
MB14065	Custom IC Timing Generator	FUJ	000-157-550	35
MB14066	Custom IC Timing Generator	FUJ	000-157-551	36
MB14067	Custom IC Timing Generator	FUJ	000-157-552	37
EHM-3826H42	Custom IC IF AMP	MAT	000-164-258	38
EHM-3827W79	Custom IC Mixer	MAT	000-164-259	39
DN6839A	Switch Type Hall IC	MAT	000-164-401	40
PS2001B-M	Photo-Coupler	NEC	000-134-355	41

34



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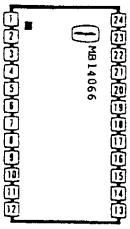
36



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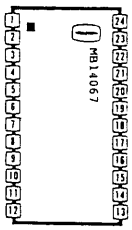

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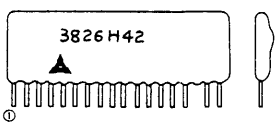

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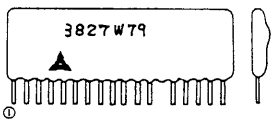

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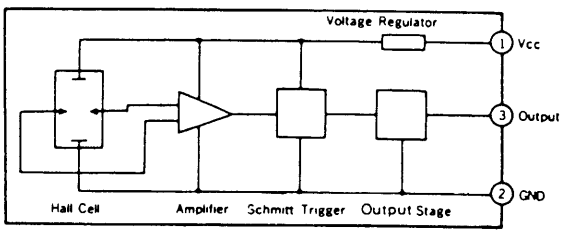

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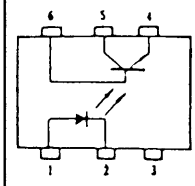
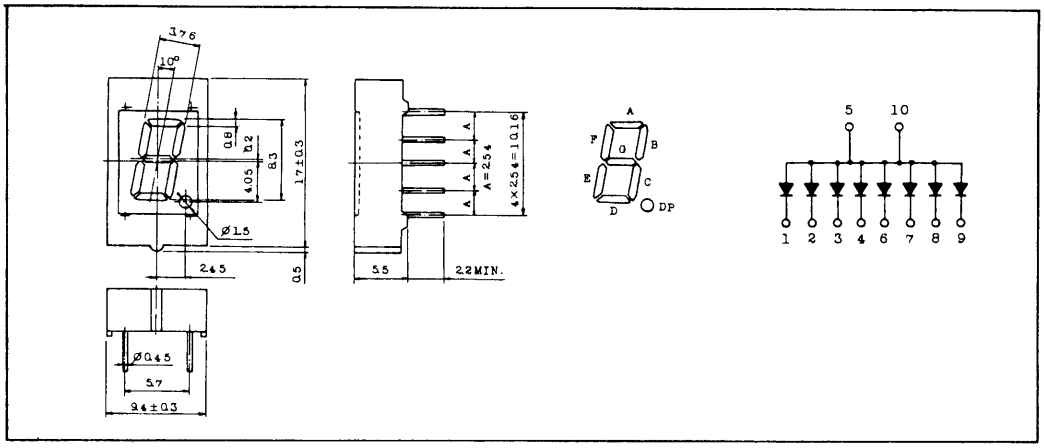


1. Anode
2. Cathode
3. NC
4. Emitter
5. Collector
6. Base

LIGHT EMITTING DIODE

TYPE	MFR	CODE NO.
TLR-313	TOS	000-135-812



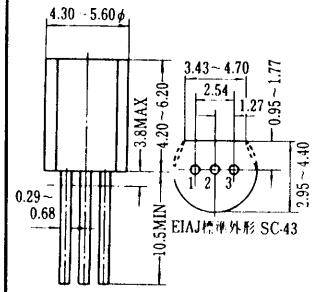
TRANSISTOR

TYPE	CODE NO.	MFR.	APPLI-CATION	CONST-RUCTION	ABSOLUTE MAX RATINGS AT 25°C					CHARACTERISTICS(25°C)				TO NO.	OUT-LINE
					VCBO (V)	VEBO (V)	IC (MA)	PC (MW)	TJ (°C)	VCE (V)	IC (MA)	HFE	FT (MHZ)		
2SA467GTMO	000116930	TOS	RF	SI.EP	-40	-5	-400	400	125	-1	-100	70-140	100		Q1
2SA733	000117445	NEC	RF.AF	SI.E	-60	-5	-100	250	125	-6	-1	200	180		Q1
2SA743A-C	000117466	HTC	RF.PA	SI.E	-50	-4	-1A	8W	150	-4	-50	120	120		Q2
2SB434-Y	000120871	TOS	PA	SI.EME	-50	-5	-3A	25W*	150	-5	-500	120-240	10		Q3
2SC1061C	000124520	HTC	PA	SI.T	50	4	3A	25W	150	4	1A	100-200	8		Q3
2SC1815-Y	000125631	TOS	AF	SI.E	60	5	150	400	125	6	2		80		Q1
2SC1827-Y	000125650	SKN	PA	SI.TME	100	6	4A	30W	150	4	1A	100-200	10		Q4
2SC2334-6K	000126152	NEC	SW	SI	150	7	7A	1.5W	150			100-200			Q3
2SC3520	000126280	SKN	PA	SI	500	10	18A	130W	150	4	10	15			Q5
2SC458PKC	000123677	HTC	RF	SI.EPA	30	5	100	200	125	12	2	100-500	230		Q1
2SC945	000124420	NEC	RF.AF	SI.E	60	5	100	250	125	6	1	200	250		Q1

NOTE: VCBO=COLLECTOR-BASE VOLTAGE (EMITTER OPEN), VEBO=EMITTER-BASE VOLTAGE (COLLECTOR OPEN), IC=COLLECTOR CURRENT, PC=POWER DISSIPATION, TJ=JUNCTION TEMPERATURE, VCE=COLLECTOR-EMITTER VOLTAGE, IC=COLLECTOR CURRENT, HFE=STATIC FORWARD CURRENT TRANSFER RATIO, FT=TRANSITION FREQUENCY.

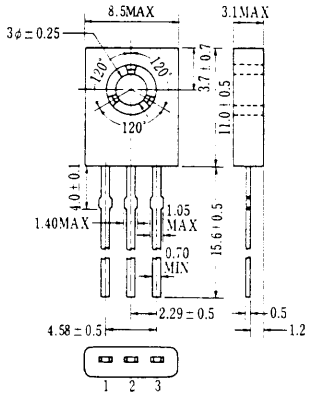
Q1

1. Emitter
2. Collector
3. Base



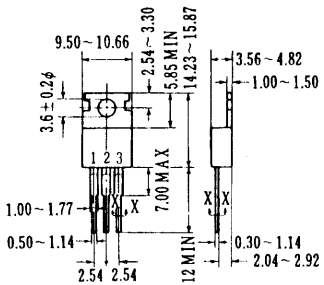
Q2

1. Emitter
2. Collector
3. Base



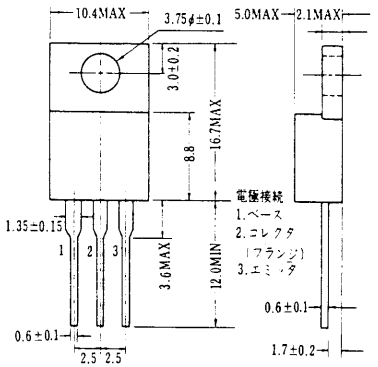
Q3

1. Base
2. Collector
3. Emitter



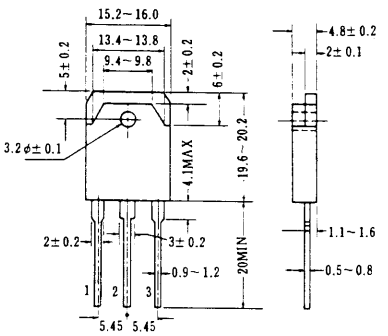
Q4

1. Base
2. Collector
3. Emitter



Q5

1. Base
2. Collector
3. Emitter



DIODE

TYPE	CODE NO.	MFR.	APPLICATION	CONSTRUCTION	ABSOLUTE MAX RATINGS AT 25°C						FORWARD (25°C)				REVERSE (25°C)		OUTLINE
					VRM (V)	VR (V)	VI (V)	IFM (MA)	IO (MA)	IS (A)	MIN IF (MA)	VF (V)	MAX VF (V)	IF (A)	MAX IR (UA)	VR (V)	
CTU-32S	000132461	SKN	R	SI.D	200	140			12A	80			1.5	10	10	200	D6
DFG1B8	000136013	HTC	R	SI.D	800				0.4	30			2.5	0.4			D4
MA27W-B	000133733	MAT	TEMP.	SI.D	150MW			100				1.26	1.36	3MA	1	6	D1
U06C	000135901	HTC	R	SI.D	200				2A	80			1.4	2			D5
1SS98	000114011	NEC	D.MIX	SI.SB	150MW	5			50				0.34	1MA	0.5	1	D3
1S1588	000112795	TOS	SW	SI.EP	35	30		360	120	0.5			1.3	0.1	0.5	30	D2

NOTE: VRM=MAXIMUM REVERSE VOLTAGE, VR=MAX DC REVERSE VOLTAGE, VI=MAX AC INPUT VOLTAGE(RMS), IFM=MAX PEAK FORWARD CURRENT, IO=MAX AVERAGE DC OUTPUT CURRENT, IS=MAX FORWARD TRANSIT CURRENT, IF=FORWARD CURRENT, VF=FORWARD VOLTAGE, IR=REVERSE CURRENT, VR=REVERSE VOLTAGE.

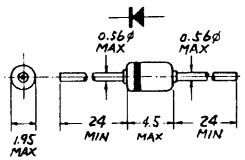
ZENER DIODE

TYPE	CODE NO.	MFR.	APPLICATION	CONSTRUCTION	ABS MAX		ZENER VOLTAGE VZ				MAX DYNAMIC RESISTANCE		THERMAL COEFFICIENT OF VZ	REVERSE (25°C)		OUTLINE
					P (MW)	IZ (MA)	MIN (V)	AVG (V)	MAX (V)	IZ (MA)	RZ (OHM)	IZ (MA)	(% /°C)	MAX IR (UA)	VR (V)	
HZ2HC-12	000131128	HTC		SI.PL	500	200	2.2		2.4		-1.5	5		10	0.5	D2
RD9.1EB1	000134835	NEC		SI.PL	400		8.5		9.6	20	10	20		2	6	D2
05Z5.6Y	000110487	TOS		SI.P	500	82	5.5		5.8	5	30	5	0.032	1	2	D2
05Z8.2Y	000110810	TOS		SI.PL	500	56	7.7	8.2	8.7	5	20	5	0.060	1	6.5	D2

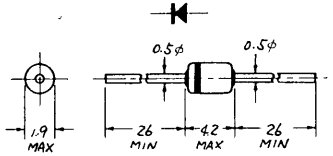
NOTE: P=MAXIMUM POWER DISSIPATION, IZ=ZENER CURRENT, IR=REVERSE CURRENT, VR=REVERSE VOLTAGE.

MANUFACTURER(MFR.): FUJ=FUJITSU, HTC=HITACHI, IRJ=INTERNATIONAL RECTIFIER (JAPAN), MAT=MATSUSHITA, MOT=MOTOROLA, MTB=MITSUBISHI, NEC=NIPPON ELECTRIC, NJR=NEW JAPAN RADIO, OKI=OKI ELECTRIC, ORG=ORIGIN ELECTRIC, SKN=SANKEN ELECTRIC, SND=SHINDENGEN ELECTRIC, SON=SONY, STL=STANLEY ELECTRIC, SYO=SANYO, TOS=TOSHIBA, FJD=FUJI ELECTRIC

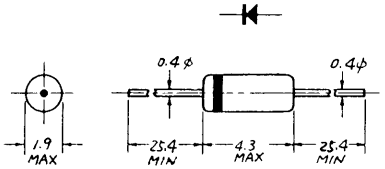
D1



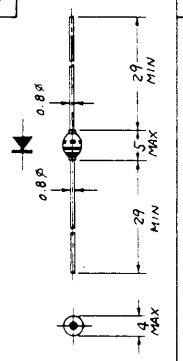
D2



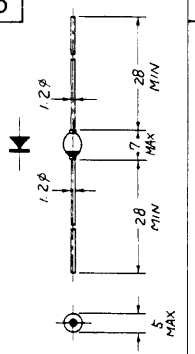
D3



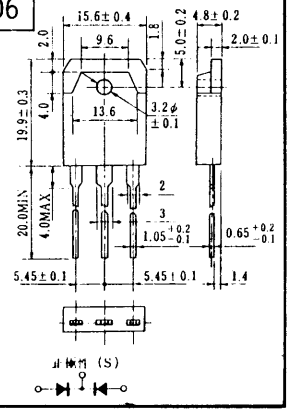
D4



D5



D6



SYMBOL 記号		TYPE 型名	SPECIFICATIONS 規格	CODE NO. コード番号	REMARKS 備考
		FE-808 SCHEMATIC DIAGRAM Dwg. No. C2285-004-C			
		PRINTED CIRCUIT BOARD プリントキバン			
		02P5911,MAIN(28KHZ)	FE-808	001-334-740	
		02P5911,MAIN(50KHZ)	FE-808	001-334-750	
		02P5911,MAIN(60KHZ)	FE-808	001-334-650	
		02P5911,MAIN(88KHZ)	FE-808	001-334-660	
		02P5911,MAIN(200KHZ)	FE-808	001-334-760	
		02P5910,DISPLAY	FE-808	001-334-730	
		02P5908,FRONT PANEL	FE-808	001-334-710	
		02P5909,SUB-PANEL	FE-808	001-334-720	
		02P5912,TRIGGER	FE-808	001-334-770	
		02P5925,LAMP	FE-808	001-334-780	
		MOTOR	モーター		
B	1	FNF-1203P	02S4220-0	000-432-052	WITH P17
B	2	SP4-41570		000-431-117	
		CAPACITOR	コンデンサー		
C	1	FCQ-W30683K	0.068UF 3KV	000-245-356	23KHZ ONLY
		DIODE	ダイオード		
1B03CR0001		U06C		000-135-901	
		LAMP	ランプ		
DS	1	P-12, 12V, 50MA		000-540-156	
DS	2	P-12, 12V, 50MA		000-540-156	
DS	3	P-12, 12V, 50MA		000-540-156	
DS	4	P-12, 12V, 50MA		000-540-156	
1B06DS0001		P-12, 12V, 50MA		000-540-156	
1B06DS0002		P-12, 12V, 50MA		000-540-156	
1B06DS0003		P-12, 12V, 50MA		000-540-156	
		FILTER	フィルター		
FL	1	PLF-2V-15A-012		000-588-825	
		JACK	ジャック		
1B03J0001		B8P-SHF-1AA	8P	000-505-556	
1B03J0002		B6P-SHF-1AA	6P	000-505-554	
1B03J0003		B5P-SHF-1AA	5P	000-505-553	
1B03J0004		B3P-SHF-1AA	3P	000-505-551	
1B03J0005		B4P-SHF-1AA	4P	000-505-552	
1B05J0001		BS3P-SHF-1AA	3P	000-505-566	
		PLUG	プラグ		
P	1	H7P-SHF-AA,7P	NH HOUSING	000-505-600	
		LHF-001T-0.8SS		000-505-493	
P	2	H5P-SHF-AA,5P	NH HOUSING	000-505-598	
		LHF-001T-0.8SS		000-505-493	
P	3	02S-5300-1		000-505-187	
P	4	02S-5300-1		000-505-187	
P	5	H12P-SHF-AA,12P	NH HOUSING	000-505-605	
		LHF-001T-0.8SS		000-505-493	
P	6	H12P-SHF-AA,12P	NH HOUSING	000-505-605	
		LHF-001T-0.8SS		000-505-493	
P	7	H3P-SHF-AA,3P	NH HOUSING	000-505-596	
		LHF-001T-0.8SS		000-505-493	
P	8	H3P-SHF-AA,3P	NH HOUSING	000-505-596	
		LHF-001T-0.8SS		000-505-493	
P	9	H20P-SHF-AA,20P	NH HOUSING	000-505-607	
		LHF-001T-0.8SS		000-505-493	
P	10	H20P-SHF-AA,20P	NH HOUSING	000-505-607	
		LHF-001T-0.8SS		000-505-493	
P	11	H4P-SHF-AA,4P	NH HOUSING	000-505-597	
		LHF-001T-0.8SS		000-505-493	
P	12	H4P-SHF-AA,4P	NH HOUSING	000-505-597	
		LHF-001T-0.8SS		000-505-493	
P	13	H6P-SHF-AA,6P	NH HOUSING	000-505-599	
		LHF-001T-0.8SS		000-505-493	
P	14	H6P-SHF-AA,6P	NH HOUSING	000-505-599	
		LHF-001T-0.8SS		000-505-493	
P	15	H8P-SHF-AA,8P	NH HOUSING	000-505-601	
		LHF-001T-0.8SS		000-505-493	
P	16	H8P-SHF-AA,8P	NH HOUSING	000-505-601	
		LHF-001T-0.8SS		000-505-493	
P	18	H7P-SHF-AA,7P	NH HOUSING	000-505-600	
		LHF-001T-0.8SS		000-505-493	
P	19	H5P-SHF-AA,5P	NH HOUSING	000-505-598	
		LHF-001T-0.8SS		000-505-493	
P	20	H3P-SHF-AA,3P	NH HOUSING	000-505-596	
		LHF-001T-0.8SS		000-505-493	

SYMBOL 記号		TYPE 型名	SPECIFICATIONS 規格	CODE NO. コード番号	REMARKS 備考
		TRANSISTOR	トランジスター		
1B03Q0001		2SC1061-C		000-124-520	
		RESISTOR	テイコウ		
1B03R0002		ERD-25TJ221	0.25W 220	000-330-341	
1B03R0003		ERD-25TJ331	0.25W 330	000-330-345	
1B03R0005		EVH09AS30B14	10K,B	000-302-012	
1B03R0006		EVH09AS30B24	20K,B	000-302-013	
1B03R0007		ERD-25TJ102	0.25W 1K	000-330-357	
1B03R0008		ERD-25TJ471	0.25W 470	000-330-349	
1B03R0009		ERD-25TJ102	0.25W 1K	000-330-357	
1B05R0001		ERD-25TJ471	0.25W 470	000-330-349	
		SWITCH	スイッチ		
1B03S0001		SSA-042(L=12)		000-474-554	NOISE LIM
1B03S0002		SSA043		000-474-553	DIMMER
1B03S0003		SSA043		000-474-553	PWR REDUC
1B03S0004		SSA043		000-474-553	PAPER SPD
		TERMINAL BOARD	タンシバン		
TB	1	ML-3391C-6P		000-531-057	
TB	2	ML-3391C 3P		000-531-056	
		INTEGRATED CIRCUIT	シュウセキカイロ		
1B05U0001		DN6839A	HALL IC	000-164-401	
		FE-808 MAIN BOARD Dwg. No. C2285-005-D			
		CAPACITOR	コンデンサー		
1B01C0001		MD2-2A-105K	1UF 100V	000-262-371	
1B01C0002		MD2-2A-105K	1UF 100V	000-262-371	
1B01C0003		MD2-2A-105K	1UF 100V	000-262-371	
1B01C0004		ECEA1HS331	330UF 50V	000-201-469	
1B01C0005		ECEA1AS101	100UF 10V	000-201-414	
1B01C0006		ECE-A1CS471	470UF 16V	000-201-430	
1B01C0007		ECQ-M 1H 683KZ	0.068UF 50V	000-260-381	
1B01C0008		ECE-A1CS100	10UF 16V	000-201-423	
1B01C0009		DM15C102K1	1000PF, 100V	000-222-315	
1B01C0010		ECE-A2CS330	33UF 160V	000-201-502	
1B01C0011		ECEA1AS102	1000UF 10V	000-201-418	
1B01C0012		ECEA1CS222	2200UF 16V	000-201-432	
1B01C0051		DD310BC473M50V08	0.047UF 50V	000-252-042	
1B01C0052		DD310BC473M50V08	0.047UF 50V	000-252-042	
1B01C0053		DD310BC473M50V08	0.047UF 50V	000-252-042	
1B01C0054		DD310BC473M50V08	0.047UF 50V	000-252-042	
1B01C0055		DD310BC473M50V08	0.047UF 50V	000-252-042	
1B01C0056		DM15C221K1	220PF, 100V	000-222-250	
1B01C0057		ECQ-M1H102KZ	1000PF 50V	000-260-360	
1B01C0058		ECQ-M1H104KZ	0.1UF 50V	000-260-390	
1B01C0060		DM15C221K1	220PF, 100V	000-222-250	
1B01C0061		DD310BC473M50V08	0.047UF 50V	000-252-042	
1B01C0062		DD310BC473M50V08	0.047UF 50V	000-252-042	
1B01C0063		DD310BC473M50V08	0.047UF 50V	000-252-042	
1B01C0064		DD310BC473M50V08	0.047UF 50V	000-252-042	
1B01C0065		DD310BC473M50V08	0.047UF 50V	000-252-042	
1B01C0066		ECQ-M1H102KZ	1000PF 50V	000-260-360	
1B01C0067		ECQ-M1H102KZ	1000PF 50V	000-260-360	
1B01C0068		DD310BC473M50V08	0.047UF 50V	000-252-042	
1B01C0069		DD310BC473M50V08	0.047UF 50V	000-252-042	
1B01C0070		DD310BC473M50V08	0.047UF 50V	000-252-042	
1B01C0071		ECQ-M1H102KZ	1000PF 50V	000-260-360	
1B01C0072		ECQ-M1H102KZ	1000PF 50V	000-260-360	
1B01C0073		ECQ-M1H222KZ	2200PF 50V	000-260-366	
1B01C0074		ECEA1AS470	47UF 10V	000-201-413	
1B01C0075		ECEA1AS470	47UF 10V	000-201-413	
1B01C0076		ECEA1AS470	47UF 10V	000-201-413	
1B01C0077		ECEA1AS470	47UF 10V	000-201-413	
1B01C0078		ECEA1AS470	47UF 10V	000-201-413	
1B01C0079		ECEA1AS470	47UF 10V	000-201-413	
1B01C0080		ECEA1AS470	47UF 10V	000-201-413	
1B01C0081		ECEA1AS470	47UF 10V	000-201-413	
1B01C0082		ECEA1AS470	47UF 10V	000-201-413	
1B01C0083		ECEA1AS470	47UF 10V	000-201-413	
1B01C0084		ECEA1AS470	47UF 10V	000-201-413	
1B01C0085		ECEA1AS470	47UF 10V	000-201-413	
1B01C0086		ECEA1AS470	47UF 10V	000-201-413	
1B01C0101		ECE-T2CR471SL	470UF,160V	000-205-502	
1B01C0102		DD107CH101J50V	100PF,50V	000-253-916	
1B01C0103		DD107CH101J50V	100PF,50V	000-253-916	
1B01C0104		ECE-A1CS100	10UF 16V	000-201-423	
1B01C0105		ECQ-E-1105KZ	1UF 100WV	000-261-566	28KHZ
		ECQ-M1H334KZ	0.33UF 50V	000-260-389	50KHZ
		ECQ-M1H334KZ	0.33UF 50V	000-260-389	60KHZ
		ECQ-M1H334KZ	0.33UF 50V	000-260-389	88KHZ
		ECQ-M1H473KZ	47000PF 50V	000-260-385	200KHZ

NOTE:
備考:

SYMBOL 記号	TYPE 型名	SPECIFICATIONS 規格	CODE NO. コード番号	REMARKS 備考
1801C0106	ECEA1AS101	100UF 10V	000-201-414	
1801C0107	ECQ-M1H153KZ	0.015UF 50WV	000-260-374	
1801C0108	ECE-A1CS101	100UF 16V	000-201-427	
1801C0109	ECQ-M1H102KZ	1000PF 50V	000-260-360	
1801C0110	ECE-T2CR471SL	470UF,160V	000-205-502	
	ERX-1ANJ2R2	1W 2.2	000-371-063	
1801C0151	ECWH10H682JR	0.0068UF 1000V	000-259-610	28KHZ
	ECW-H12H 332JD	3300PF 1200WV	000-261-969	50KHZ
	ECW-H12H 272JD	2700PF 1200WV	000-100-113	60KHZ
	ECW-H12H 152JR	1500PF 1200WV	000-261-967	88KHZ
	ECW-H12H 102JD	1000PF 1200WV	000-261-968	200KHZ
1801C0152	ECWH10H682JR	0.0068UF 1000V	000-259-610	28KHZ
	ECW-H12H 332JD	3300PF 1200WV	000-261-969	50KHZ
	ECW-H12H 272JD	2700PF 1200WV	000-100-113	60KHZ
	ECW-H12H 152JR	1500PF 1200WV	000-261-967	88KHZ
	ECW-H12H 102JD	1000PF 1200WV	000-261-968	200KHZ
1801C0153	ECQ-M1H103KZ	0.01UF 50V	000-260-370	28KHZ
	ECQ-M1H222KZ	2200PF 50V	000-260-366	50KHZ
	ECQ-M1H152KZ	1500PF 50WV	000-260-362	60KHZ
	ECQ-M1H102KZ	1000PF 50V	000-260-360	88KHZ
	DM15C471K1	470PF, 100V	000-222-280	200KHZ
1801C0154	ECQ-E-1105KZ	1UF 100WV	000-261-566	
1801C0155	DD106CH560J50V	56PF,50V	000-253-912	
1801C0156	ECE-A1CS101	100UF 16V	000-201-427	
1801C0157	ECQ-M1H102KZ	1000PF 50V	000-260-360	
1801C0158	ECQ-M1H152KZ	1500PF 50WV	000-260-362	
1801C0159	ECQ-M1H102KZ	1000PF 50V	000-260-360	
1801C0160	ECQ-M1H152KZ	1500PF 50WV	000-260-362	
1801C0161	ECQ-M1H102KZ	1000PF 50V	000-260-360	
1801C0162	ECQ-M1H152KZ	1500PF 50WV	000-260-362	
1801C0163	ECQ-M1H103KZ	0.01UF 50V	000-260-370	
1801C0164	ECQ-M1H103KZ	0.01UF 50V	000-260-370	
1801C0165	DD106CH560J50V	56PF,50V	000-253-912	
1801C0166	ECE-A1CS101	100UF 16V	000-201-427	
1801C0167	ECE-A1CS100	10UF 16V	000-201-423	
1801C0168	ECQ-M 1H 333KZ	0.033UF 50V	000-260-380	
1801C0169	ECQ-M-1H392KZ	3900PF 50WV	000-260-368	28KHZ
	ECQ-M1H182KZ	1800PF 50WV	000-260-363	50KHZ
	ECQ-M1H152KZ	1500PF 50WV	000-260-362	60KHZ
	ECQ-M1H102KZ	1000PF 50V	000-260-360	88KHZ
	DM15C471K1	470PF, 100V	000-222-280	200KHZ
1801C0170	ECQ-M1H104KZ	0.1UF 50V	000-260-390	28KHZ
	ECQ-M1H104KZ	0.1UF 50V	000-260-390	50KHZ
	ECQ-M1H104KZ	0.1UF 50V	000-260-390	60KHZ
	ECQ-M1H104KZ	0.1UF 50V	000-260-390	88KHZ
	ECQ-M1H222KZ	2200PF 50V	000-260-366	200KHZ
1801C0171	DD310HC473M50V08	0.047UF 50V	000-252-042	
1801C0172	ECE-A1CS101	100UF 16V	000-201-427	
1801C0173	DM15C471K1	470PF, 100V	000-222-280	
1801C0176	DD106CH560J50V	56PF,50V	000-253-912	
1801C0177	ECQ-M1H104KZ	0.1UF 50V	000-260-390	28KHZ
	ECQ-M1H104KZ	0.1UF 50V	000-260-390	50KHZ
	ECQ-M1H104KZ	0.1UF 50V	000-260-390	60KHZ
	ECQ-M1H104KZ	0.1UF 50V	000-260-390	88KHZ
	ECQ-M1H103KZ	0.01UF 50V	000-260-370	200KHZ
1801C0178	ECE-A1CS470	47UF 16V	000-201-426	
1801C0179	ECE-A1CS470	47UF 16V	000-201-426	
	DIODE	ダイオード		
1801CR0001	U06C		000-135-901	
1801CR0002	MA27W-H		000-133-733	
1801CR0003	1S1588		000-112-795	
1801CR0004	1S1588		000-112-795	
1801CR0005	1S1588		000-112-795	
1801CR0006	1S1588		000-112-795	
1801CR0007	CTU-32S	BRIDGE	000-132-461	
1801CR0008	CTU-32S	BRIDGE	000-132-461	
1801CR0009	DFG-1B8		000-136-013	
1801CR0010	DFG-1B8		000-136-013	
1801CR0101	U06C		000-135-901	
1801CR0102	U06C		000-135-901	
1801CR0103	U06C		000-135-901	
1801CR0104	U06C		000-135-901	
1801CR0105	1S1588		000-112-795	
1801CR0106	1S1588		000-112-795	
1801CR0107	1S1588		000-112-795	
1801CR0108	1S1588		000-112-795	
1801CR0109	1S1588		000-112-795	
1801CR0151	1SS98	SHOTTKY	000-114-011	
1801CR0152	1S1588		000-112-795	
	FUSE	ヒューズ		
1801F0001	F-7161, 7A, AC125V	6.4MM DIA	000-547-011	
	FILTER	フィルター		
1801FL0151	SFZ45593 02S3635-0		000-588-812	
1801FL0152	BFU455K2 02S3636-0		000-588-808	
1801FL0153	BFU455K2 02S3636-0		000-588-808	
1801FL0154	SFZ455R3 02S3635-0		000-588-812	

SYMBOL 記号	TYPE 型名	SPECIFICATIONS 規格	CODE NO. コード番号	REMARKS 備考
	JACK	ジャック		
1801J0001	B7P-SHF-1AA	7P	000-505-555	
1801J0002	FHC2-C26S13-0L	26P	000-505-156	
1801J0003	B12P-SHF-1AA	12P	000-505-560	
1801J0004	B5P-SHF-1AA	5P	000-505-553	
1801J0005	B4P-SHF-1AA	4P	000-505-552	
1801J0006	B8P-SHF-1AA	8P	000-505-556	
1801J0007	FFC-10BMEP1B		000-501-902	
	COIL	コイル		
1801L0001	SC-02-101		000-424-971	
1801L0002	02S0710-1		000-727-710	
1801L0003	RL-4157	330UH	000-734-157	
1801L0004	RL-4157	330UH	000-734-157	
1801L0154	02S0680-0	1MH	000-727-680	
1801L0155	02S0680-0	1MH	000-727-680	
	PLUG	プラグ		
1801P0001	DIC-252		000-501-951	
1801P0002	H8P-SHF-AA,8P	NH HOUSING	000-505-601	
	LHF-001T-0.8SS		000-505-493	
	TRANSISTOR	トランジスター		
1801Q0001	2SB434Y		000-120-871	
1801Q0002	2SA467GTM-O		000-116-930	
1801Q0003	2SA467GTM-O		000-116-930	
1801Q0004	2SC2334,6,K		000-126-152	
1801Q0005	2SC2334,6,K		000-126-152	
1801Q0006	2SC945		000-124-420	
1801Q0051	2SC458KC		000-123-675	
1801Q0052	2SC458KC		000-123-675	
1801Q0053	2SC458KC		000-123-675	
1801Q0054	2SC458KC		000-123-675	
1801Q0055	2SC458KC		000-123-675	
1801Q0101	2SC3520		000-126-280	
1801Q0102	2SC3520		000-126-280	
1801Q0103	2SC1827-Y	WITH ACCESSORY	000-125-651	
1801Q0104	2SA733		000-117-445	
1801Q0105	2SA733		000-117-445	
1801Q0106	2SC458KC		000-123-675	
1801Q0107	2SC458KC		000-123-675	
1801Q0108	2SC3520		000-126-280	
1801Q0109	2SC3520		000-126-280	
1801Q0151	2SC458KC		000-123-675	
1801Q0152	2SA733		000-117-445	
1801Q0153	2SC458KC		000-123-675	
	RESISTOR	抵抗		
1801R0001	ERD-25TJ101	0.25W 100	000-330-333	
1801R0002	ERD-25TJ101	0.25W 100	000-330-333	
1801R0003	ERX-1ANJ3R3	1W 3.3	000-371-067	
1801R0004	ERX-1ANJ3R3	1W 3.3	000-371-067	
1801R0005	ERD-25TJ150	0.25W 15	000-330-313	
1801R0006	ERD-25TJ150	0.25W 15	000-330-313	
1801R0007	ERG-2ANJ153	2W, 15K	000-371-383	
1801R0008	ERD-25TJ332	0.25W 3.3K	000-330-369	
1801R0009	ERD-25TJ271	0.25W 270	000-330-343	
1801R0010	EVM-38GA00B53	5K,B	000-307-852	
1801R0011	ERD-25TJ151	0.25W 150	000-330-337	
1801R0012	ERD-25TJ103	0.25W 10K	000-330-381	
1801R0013	ERD-25TJ561	0.25W 560	000-330-351	
1801R0014	ERD-25TJ561	0.25W 560	000-330-351	
1801R0015	EVM-38GA00B13	1K,B	000-307-848	
1801R0016	ERG-2ANJ151	2W, 150	000-371-352	
1801R0051	ERD-25TJ471	0.25W 470	000-330-349	
1801R0052	ERD-25TJ154	0.25W 150K	000-330-409	
1801R0054	ERD-25TJ472	0.25W 4.7K	000-330-373	
1801R0055	ERD-25TJ222	0.25W 2.2K	000-330-365	
1801R0056	ERD-25TJ103	0.25W 10K	000-330-381	
1801R0057	ERD-25TJ103	0.25W 10K	000-330-381	
1801R0058	ERD-25TJ103	0.25W 10K	000-330-381	
1801R0059	ERD-25TJ222	0.25W 2.2K	000-330-365	
1801R0060	ERD-25TJ182	0.25W 1.8K	000-330-363	
1801R0061	ERD-25TJ222	0.25W 2.2K	000-330-365	
1801R0062	EVM-38GA00B53	5K,B	000-307-852	
1801R0064	ERD-25TJ102	0.25W 1K	000-330-357	
1801R0065	ERD-25TJ471	0.25W 470	000-330-349	
1801R0067	ERD-25TJ102	0.25W 1K	000-330-357	
1801R0068	ERD-25TJ103	0.25W 10K	000-330-381	
1801R0069	ERD-25TJ102	0.25W 1K	000-330-357	
1801R0070	ERD-25TJ103	0.25W 10K	000-330-381	
1801R0071	ERD-25TJ392	0.25W 3.9K	000-330-371	
1801R0072	ERD-25TJ103	0.25W 10K	000-330-381	
1801R0101	ERG-12ANJ390	0.5W,39	000-371-695	
1801R0102	ERG-12ANJ390	0.5W,39	000-371-695	
1801R0103	ERX-1ANJ1R0	1W 1	000-371-055	
1801R0104	ERX-1ANJ1R0	1W 1	000-371-055	
1801R0106	ERD-25TJ100	0.25W 10	000-330-309	
1801R0107	ERD-25TJ471	0.25W 470	000-330-349	
1801R0108	ERD-25TJ105	0.25W 1M	000-330-429	
1801R0109	ERD-25TJ154	0.25W 150K	000-330-409	

NOTE:
備考:

SYMBOL 記号	TYPE 型名	SPECIFICATIONS 規格	CODE NO. コード番号	REMARKS 備考
1R01R0110	ERD-25TJ124	0.25W 120K	000-330-407	
1R01R0111	ERD-25TJ6R8	0.25W 6.8R	000-330-377	
1R01R0112	ERD-25TJ103	0.25W 10K	000-330-381	
1R01R0113	ERD-25TJ103	0.25W 10K	000-330-381	
1R01R0114	ERD-25TJ683	0.25W 68K	000-330-401	
1R01R0115	ERD-25TJ223	0.25W 22K	000-330-389	
1R01R0116	ERD-25TJ103	0.25W 10K	000-330-381	
1R01R0117	ERD-25TJ103	0.25W 10K	000-330-381	
1R01R0118	ERD-25TJ470	0.25W 47	000-330-325	
1R01R0121	ERD-25TJ103	0.25W 10K	000-330-381	
1R01R0122	ERX-1ANJ1R0	1W 1	000-371-055 28KHZ	
	ERX-1ANJ1R0	1W 1	000-371-055 50KHZ	
	ERX-1ANJ2R2	1W 2.2	000-371-063 60KHZ	
	ERX-1ANJ1R0	1W 1	000-371-055 88KHZ	
	ERX-1ANJR22	1W 0.22	000-371-039 200KHZ	
1R01R0123	ERX-1ANJR22	1W 0.22	000-371-039	
1R01R0124	ERX-1ANJR22	1W 0.22	000-371-039	
1R01R0151	ERD-25TJ102	0.25W 1K	000-330-357 28KHZ	
	ERD-25TJ102	0.25W 1K	000-330-357 50KHZ	
	ERD-25TJ102	0.25W 1K	000-330-357 60KHZ	
	ERD-25TJ102	0.25W 1K	000-330-357 88KHZ	
	ERD-25TJ101	0.25W 100	000-330-333 200KHZ	
1R01R0152	ERD-25TJ201	0.25W 200	000-330-340	
1R01R0153	ERD-25TJ243	0.25W 24K	000-330-390	
1R01R0154	ERD-25TJ101	0.25W 100	000-330-333	
1R01R0155	ERD-25TJ101	0.25W 100	000-330-333	
1R01R0156	ERD-25TJ102	0.25W 1K	000-330-357	
1R01R0157	ERD-25TJ302	0.25W 3K	000-330-368	
1R01R0158	ERD-25TJ222	0.25W 2.2K	000-330-365	
1R01R0159	RVS0707V100-3-503M	30K	000-319-850	
1R01R0160	EXB-T44104K	0.25W 100KX4	000-378-844	
1R01R0161	EXB-T44104K	0.25W 100KX4	000-378-844	
1R01R0162	EXB-P84-103K	0.125W 10K X 4	000-378-582	
1R01R0163	ERD-25TJ333	0.25W 33K	000-330-393	
1R01R0164	ERD-25TJ221	0.25W 220	000-330-341	
1R01R0165	ERD-25TJ562	0.25W 5.6K	000-330-375 28KHZ	
	ERD-25TJ562	0.25W 5.6K	000-330-375 50KHZ	
	ERD-25TJ562	0.25W 5.6K	000-330-375 60KHZ	
	ERD-25TJ562	0.25W 5.6K	000-330-375 88KHZ	
	ERD-25TJ432	0.25W 4.3K	000-330-372 200KHZ	
1R01R0166	RVS0707V-100-3R202	2KB	000-319-819	
1R01R0167	ERD-25TJ243	0.25W 24K	000-330-390	
1R01R0168	ERD-25TJ103	0.25W 10K	000-330-381	
1R01R0169	ERD-25TJ102	0.25W 1K	000-330-357	
1R01R0170	ERD-25TJ392	0.25W 3.9K	000-330-371	
1R01R0171	ERD-25TJ153	0.25W 15K	000-330-385	
1R01R0172	ERD-25TJ472	0.25W 4.7K	000-330-373	
1R01R0173	ERD-25TJ102	0.25W 1K	000-330-357	
1R01R0174	ERD-25TJ330	0.25W 33	000-330-321	
1R01R0175	ERD-25TJ472	0.25W 4.7K	000-330-373	
1R01R0176	ERD-25TJ101	0.25W 100	000-330-333	
	VARISTOR	バリスター		
1R01RV0151	VR-60R		000-182-612	
	TRANSFORMER	トランス		
1R01T0001	RT-4098		000-734-098	
1R01T0002	RT-4098		000-734-098	
1R01T0003	02S0824-1		000-729-703	
1R01T0101	02S0880-0		000-100-082 28KHZ	
	02S0881-0		000-100-083 50KHZ	
	02S0869-0		000-100-117 60KHZ	
	02S0871-0		000-100-100 88KHZ	
	02S0882-0		000-100-087 200KHZ	
1R01T0102	02S0647-1		000-727-647	
1R01T0151	02S0826-0		000-729-704 28KHZ	
	02S0827-0		000-729-705 50KHZ	
	02S0872-0		000-100-101 60KHZ	
	02S0872-0		000-100-101 88KHZ	
	02S0824-0		000-729-706 200KHZ	
1R01T0152	02S0829-0		000-729-707 28KHZ	
	02S0830-0		000-729-708 50KHZ	
	02S0875-0		000-100-102 60KHZ	
	02S0875-0		000-100-102 88KHZ	
	02S0831-0		000-729-709 200KHZ	
	INTEGRATED CIRCUIT	シングルチップIC		
1R01U0001	PS2001B-M OR L		000-134-356	
1R01U0002	MB3759M		000-157-500	
1R01U0003	RC-4210-1	HI-MIC	000-164-253	
1R01U0004	RC-4214-1		000-378-100	
1R01U0051	M74LS32P		000-151-192	
1R01U0052	M74LS75P		000-151-209	
1R01U0053	M74LS74AP		000-151-207	
1R01U0054	M74LS00P	TTL	000-151-202	
1R01U0055	M74LS04P	TTL	000-151-204	
1R01U0056	MB14067 02S4615-0		000-157-552	
1R01U0057	M74LS125AP		000-151-196	
1R01U0058	M74LS157P	TTL	000-151-197	
1R01U0059	M74LS85P		000-151-194	
1R01U0060	M74LS125AP		000-151-196	
1R01U0061	MB14065 02S4613-0		000-157-550	
1R01U0062	TC40403P	CMOS	000-163-254	
1R01U0063	MBM2114A-15LM-G		000-157-346	
1R01U0064	MBM2114A-15LM-G		000-157-346	
1R01U0065	MBM2114A-15LM-G		000-157-346	
1R01U0066	MB14066 02S4614-0		000-157-551	
1R01U0067	M74LS00P	TTL	000-151-202	
1R01U0068	M74LS04P	TTL	000-151-204	
1R01U0069	M74LS10P	TTL	000-151-213	
1R01U0070	M74LS03P	TTL	000-151-202	
1R01U0071	M74LS00P	TTL	000-151-202	
1R01U0072	M74LS193P		000-151-340	
1R01U0073	M74LS193P		000-151-340	
1R01U0074	SN74LS669N		000-168-194	
1R01U0075	M74LS393P	TTL	000-151-220	
1R01U0076	SN74LS669N		000-168-194	
1R01U0077	M74LS161AP		000-151-187	
1R01U0078	M74LS193P		000-151-340	
1R01U0079	M74LS30P		000-151-191	
1R01U0080	M74LS02P	TTL	000-151-203	
1R01U0081	M74LS00P	TTL	000-151-202	
1R01U0082	M74LS112AP		000-151-195	
1R01U0101	TC4069UBP	CMOS	000-163-265	
1R01U0102	M74LS293P		000-151-199	
1R01U0103	M74LS123P	TTL	000-151-190	
1R01U0151	EHM3827W79	02S4611-0	000-164-259	
1R01U0152	EHM3826H42	02S4612-0	000-164-258	
1R01U0153	UPC339C		000-161-055	
1R01U0154	TC4001BP	CMOS	000-163-240	
1R01U0155	TC4025BP	CMOS	000-163-249	
1R01U0156	M74LS27P		000-151-184	
	ZENER DIODE	ツエナーダイオード		
1R01VR0001	HZ2HC-1	ZENER	000-131-128	
1R01VR0002	RD-9.1FB1		000-134-835	
1R01VR0151	05Z8.2V	ZENER	000-110-810	
	FUSE HOLDER	ヒューズホルダー		
1R01X0001	S-N5051		000-509-056	
	CRYSTAL	クリスタル		
1R01Y0001	CSA11.0MMX11		000-491-049	
1R01Y0101	CSR461E2	02S3641-0	000-491-020 28KHZ	
	CSR800A7	02S3634-0	000-491-042 50KHZ	
	CSR496F2	02S3645-0	000-100-114 60KHZ	
	CSR704A2	02S3649-0	000-100-116 88KHZ	
	CSR800A7	02S3634-0	000-491-042 200KHZ	
1R01Y0151	CSR484F4	02S3642-0	000-491-021 28KHZ	
	CSR505F2	02S3632-0	000-491-043 50KHZ	
	CSR517P2	02S3646-0	000-100-115 60KHZ	
	CSR543P2	02S3647-0	000-100-094 88KHZ	
	CSR655A2	02S3633-0	000-491-044 200KHZ	

FE-808 FRONT PANEL BOARD
Dwg. No. C2285-009-C

	CAPACITOR	コンデンサー		
1R02C0001	DM15C102K1	1000PF, 100V	000-222-315	
1R02C0002	ECE-A1CS471	470UF 16V	000-201-430	
1R02C0003	ECQ-M1H104KZ	0.1UF 50V	000-260-390	
1R02C0004	ECE-A1CS101	100UF 16V	000-201-427	
1R02C0005	ECS F35ER47	0.47UF 35V	000-232-358	
1R02C0006	ECSF16E3R3	3.3UF 16WV	000-232-335	
1R02C0007	ECEA1AS101	100UF 10V	000-201-414	
1R02C0008	ECE-A1CS100	10UF 16V	000-201-423	
1R02C0010	ECEA1AS101	100UF 10V	000-201-414	
1R02C0012	ECQ-M1H102KZ	1000PF 50V	000-260-360	
1R02C0013	ECQ-M1H102KZ	1000PF 50V	000-260-360	
1R02C0017	ECE-A1CS101	100UF 16V	000-201-427	
1R02C0018	ECEA1AS221	220UF 10V	000-201-415	
1R02C0019	ECE-A1CS101	100UF 16V	000-201-427	
1R02C0020	ECEA1CS332	3300UF 16V	000-201-433	
1R02C0021	ECE-A1CS221	220UF 16V	000-201-426	
1R02C0022	ECQ-P1223GZ	0.022UF, 100V	000-261-902	
1R02C0023	DD310BC473M50V08	0.047UF 50V	000-252-042	
1R02C0024	DD310BC473M50V08	0.047UF 50V	000-252-042	
1R02C0025	DD310BC473M50V08	0.047UF 50V	000-252-042	
1R02C0026	DD310BC473M50V08	0.047UF 50V	000-252-042	
1R02C0027	DD310BC473M50V08	0.047UF 50V	000-252-042	
1R02C0030	ECEA1AS470	47UF 10V	000-201-413	
1R02C0031	ECEA1AS470	47UF 10V	000-201-413	
1R02C0032	ECEA1AS470	47UF 10V	000-201-413	
1R02C0033	ECEA1AS470	47UF 10V	000-201-413	
1R02C0034	ECEA1CS330	33UF 16V	000-201-425	
1R02C0035	ECQ-M1H473KZ	47000PF 50V	000-260-385	
1R02C0036	ECEA1AS221	220UF 10V	000-201-415	

NOTE:
備考:

SYMBOL 記号	TYPE 型名	SPECIFICATIONS 規格	CODE NO. コード番号	REMARKS 備考
	DIODE	ダイオード		
1B02CR0001	1S1585		000-112-795	
1B02CR0002	1S1586		000-112-795	
1B02CR0003	1S1588		000-112-795	
1B02CR0004	1S1588		000-112-795	
1B02CR0005	1S1588		000-112-795	
1B02CR0006	1S1588		000-112-795	
	JACK	ジャック		
1B02J0001	FRC2-C26S13-0L	26P	000-505-156	
1B02J0002	B12P-SHF-1AA	12P	000-505-560	
1B02J0003	B6P-SHF-1AA	6P	000-505-554	
1B02J0004	B3P-SHF-1AA	3P	000-505-551	
1B02J0005	B7P-SHF-1AA	7P	000-505-555	
1B02J0006	B20P-SHF-1AA	20P	000-505-562	
1B02J0007	B8P-SHF-1AA	8P	000-505-556	
	COIL	コイル		
1B02L0001	FL1315-102KR50	02S0037	000-427-510	
1B02L0002	FL1315-102KR50	02S0037	000-427-510	
1B02L0003	FL1315-102KR50	02S0037	000-427-510	
	TRANSISTOR	トランジスター		
1B02W0001	2SC458KC		000-123-675	
1B02W0002	2SC1827-Y	WITH ACCESSORY	000-125-651	
1B02W0003	2SC458KC		000-123-675	
1B02W0004	2SC1827-Y	WITH ACCESSORY	000-125-651	
1B02W0005	2SC458KC		000-123-675	
1B02W0006	2SA733		000-117-445	
1B02W0007	2SC458KC		000-123-675	
	RESISTOR	テイコウ		
1B02R0001	ERD-25TJ203	0.25W 20K	000-330-388	
1B02R0002	ERD-25TJ104	0.25W 100K	000-330-405	
1B02R0003	ERD-25TJ103	0.25W 10K	000-330-381	
1B02R0004	ERD-25TJ330	0.25W 33	000-330-321	
1B02R0005	ERD-25TJ330	0.25W 33	000-330-321	
1B02R0006	ERD-25TJ224	0.25W 220K	000-330-413	
1B02R0007	EVH-09HS40C15,100K	02S4916-0	000-302-028	S/L CONT
1B02R0008	ERD-25TJ332	0.25W 3.3K	000-330-369	
1B02R0009	ERD-25TJ122	0.25W 1.2K	000-330-359	
1B02R0010	ERD-25TJ331	0.25W 330	000-330-345	
1B02R0011	EVH-09AS40B13,1K	02S4915-0	000-302-005	GAIN CONT
1B02R0012	ERD-25TJ910	0.25W 91	000-330-332	
1B02R0014	ERD-25TJ103	0.25W 10K	000-330-381	
1B02R0015	ERD-25TJ103	0.25W 10K	000-330-381	
1B02R0017	ERD-25TJ470	0.25W 47	000-330-325	
1B02R0018	ERG-1ANJ472	1W 4.7K	000-371-300	
1B02R0019	ERD-25TJ273	0.25W 27K	000-330-391	
1B02R0020	ERD-25TJ273	0.25W 27K	000-330-391	
1B02R0021	ERD-25TJ273	0.25W 27K	000-330-391	
1B02R0022	ERD-25TJ472	0.25W 4.7K	000-330-373	
1B02R0023	ERD-25TJ102	0.25W 1K	000-330-357	
1B02R0024	ERD-25TJ391	0.25W 390	000-330-347	
1B02R0026	ERD-25TJ102	0.25W 1K	000-330-357	
1B02R0027	ERD-25TJ561	0.25W 560	000-330-351	
1B02R0028	EXB-P86-103K	10KX6	000-378-575	
1B02R0029	EXB-P86-103K	10KX6	000-378-575	
1B02R0030	ERD-25TJ103	0.25W 10K	000-330-381	
1B02R0031	ERD-25TJ103	0.25W 10K	000-330-381	
1B02R0040	ERD-25TJ122	0.25W 1.2K	000-330-359	
1B02R0041	ERD-25TJ103	0.25W 10K	000-330-381	
1B02R0043	ERD-25TJ184	0.25W 180K	000-330-411	
1B02R0044	ERD-25TJ104	0.25W 100K	000-330-405	
1B02R0046	ERD-25TJ104	0.25W 100K	000-330-405	
1B02R0047	ERD-25TJ104	0.25W 100K	000-330-405	
1B02R0050	ERD-25TJ101	0.25W 100	000-330-333	
1B02R0051	ERD-25TJ223	0.25W 22K	000-330-389	
1B02R0056	ERD-25TJ103	0.25W 10K	000-330-381	
	SWITCH	スイッチ		
1B02S0001	SRM101C	02S3857-0	000-460-277	RANGE
1B02S0002	SRM-1034,SHAFT 20MM	02S3845-0	000-460-270	PWR/FUNC
1B02S0003	8N1021-10 BLK		000-471-121	MARKER
	TRANSFORMER	トランス		
1B02T0001	02S0682-0		000-727-543	
	INTEGRATED CIRCUIT	シュウセキカイロ		
1B02U0001	TC4069UBP	CMOS	000-163-265	
1B02U0002	TA7555P		000-163-007	
1B02U0003	PS2001B-M OR L		000-134-356	
1B02U0004	M74LS112AP		000-151-195	
1B02U0005	M74LS00P	TTL	000-151-202	
1B02U0006	M74LS00P	TTL	000-151-202	
1B02U0007	M74LS30P		000-151-191	
1B02U0008	M74LS00P	TTL	000-151-202	
1B02U0009	M74LS161AP		000-151-187	
1B02U0010	M74LS161AP		000-151-187	
1B02U0011	M74LS175P		000-151-185	
1B02U0012	TD62004P		000-163-091	
1B02U0013	M74LS04P	TTL	000-151-204	
1B02U0014	TC40A90BP	CMOS	000-163-265	
	ZENER DIODE	ツエナーダイオード		
1B02VR0001	05Z5.6Y	ZENER	000-110-487	
1B02VR0002	05Z5.6Y	ZENER	000-110-487	

FE-808 DISPLAY BOARD
Dwg. No. C2285-008-C

SYMBOL 記号	TYPE 型名	SPECIFICATIONS 規格	CODE NO. コード番号	REMARKS 備考
	CAPACITOR	コンデンサー		
1B04C0001	FCQ-M1H102KZ	1000PF 50V	000-260-360	
1B04C0002	FD21Y5V1H104Z	0.1UF 50V	000-254-900	
1B04C0003	ECC-F1H101JC	100PF, 50V	000-256-910	
1B04C0004	ECC-F1H101JC	100PF, 50V	000-256-910	
1B04C0005	FCQ-M1H103KZ	0.01UF 50V	000-260-370	
1B04C0006	FCQ-M1H102KZ	1000PF 50V	000-260-360	
1B04C0007	FD21Y5V1H104Z	0.1UF 50V	000-254-900	
1B04C0008	FD21Y5V1H104Z	0.1UF 50V	000-254-900	
1B04C0009	ECEA1AS221	220UF 10V	000-203-254	
1B04C0010	FCQ-M1H102KZ	1000PF 50V	000-260-360	
1B04C0011	FCS F35ER47	0.47UF 35V	000-232-358	
1B04C0012	FCQ-M1H102KZ	1000PF 50V	000-260-360	
1B04C0013	FCQ-M1H102KZ	1000PF 50V	000-260-360	
	DIODE	ダイオード		
1B04CR0001	TLR-313		000-135-812	
1B04CR0002	TLR-313		000-135-812	
1B04CR0003	TLR-313		000-135-812	
1B04CR0004	TLR-313		000-135-812	
1B04CR0005	TLR-313		000-135-812	
1B04CR0006	TLR-313		000-135-812	
1B04CR0007	TLR-313		000-135-812	
1B04CR0008	TLR-313		000-135-812	
1B04CR0009	TLR-313		000-135-812	
	JACK	ジャック		
1B04J0001	B20P-SHF-1AA	20P	000-505-562	
1B04J0002	B3P-SHF-1AA	3P	000-505-551	
	TRANSISTOR	トランジスター		
1B04W0001	2SA743A-C		000-117-466	
1B04W0002	2SA743A-C		000-117-466	
1B04W0003	2SA743A-C		000-117-466	
1B04W0004	2SC1815-Y		000-125-631	
1B04W0005	2SC1815-Y		000-125-631	
	RESISTOR	テイコウ		
1B04R0001	EXB-T44-221J	220OHMX4	000-378-800	
1B04R0002	EXB-T44240J	240HMX4	000-378-802	
1B04R0003	EXB-T44240J	240HMX4	000-378-802	
1B04R0004	ERD-25TJ105	0.25W 1M	000-330-429	
1B04R0005	ERD-25TJ682	0.25W 6.8K	000-330-377	
1B04R0006	ERD-25TJ104	0.25W 100K	000-330-405	
1B04R0007	EXB-T44240J	240HMX4	000-378-802	
1B04R0008	EXB-T44240J	240HMX4	000-378-802	
1B04R0009	ERD-25TJ103	0.25W 10K	000-330-381	
1B04R0010	ERD-25TJ472	0.25W 4.7K	000-330-373	
1B04R0011	ERD-25TJ223	0.25W 22K	000-330-389	
1B04R0012	ERD-25TJ220	0.25W 22	000-330-317	
1B04R0013	ERD-25TJ103	0.25W 10K	000-330-381	
1B04R0014	ERD-25TJ103	0.25W 10K	000-330-381	
1B04R0015	ERD-25TJ220	0.25W 22	000-330-317	
1B04R0016	ERD-25TJ103	0.25W 10K	000-330-381	
1B04R0017	ERD-25TJ103	0.25W 10K	000-330-381	
1B04R0018	ERD-25TJ103	0.25W 10K	000-330-381	
1B04R0019	ERD-25TJ102	0.25W 1K	000-330-357	
1B04R0020	EXB-T44240J	240HMX4	000-378-802	
1B04R0021	EXB-T44240J	240HMX4	000-378-802	
1B04R0024	EXB-P86-103K	0.125W 10K X 8	000-378-503	
1B04R0025	ERD-25TJ472	0.25W 4.7K	000-330-373	
1B04R0026	ERD-25TJ222	0.25W 2.2K	000-330-365	

NOTE:
備考:

SYMBOL 記号	TYPE 型名	SPECIFICATIONS 規格	CODE NO. コード番号	REMARKS 備考
	SWITCH	スイッチ		
1804S0001	DIC-252		000-501-951	UNIT CAL
	FFC-3CM1B		000-501-849	
	INTEGRATED CIRCUIT	シュウセキカイロ		
1804U0001	M74LS04P	TTL	000-151-204	
1804U0002	M74LS247P		000-151-186	
1804U0003	TC5048P		000-163-848	
1804U0004	M74LS32P		000-151-192	
1804U0005	M74LS123P	TTL	000-151-190	
1804U0006	TC5051P	C MOS	000-163-342	
1804U0007	M74LS193P		000-151-340	
1804U0008	M74LS247P		000-151-186	
1804U0009	M74LS11P		000-151-214	
1804U0010	M74LS08P		000-151-228	
1804U0011	MBM2732A-35Z-G	PROM	000-157-371	
1804U0012	M74LS74AP		000-151-207	
1804U0013	M74LS04P	TTL	000-151-204	
1804U0014	M74LS247P		000-151-186	
	CRYSTAL	クリスタル		
1804Y0001	CSB576P2		000-491-046	
1804Y0002	CSA3.78MS11		000-491-048	

SYMBOL 記号	TYPE 型名	SPECIFICATIONS 規格	CODE NO. コード番号	REMARKS 備考

NOTE:
備考:

SYMBOL 記号	PARTS NAME 部品名	TYPE/DWG. NO. 型名/図番	CODE NO. コード番号	REMARKS 備考
	Refer to Dwg. No. C2285-010-B.			
1A	FRONT DOOR ASSY		001-334-470	
1	SCALE RETAINER.1.	02-038-1303-0	203-813-030	
2	FRONT DOOR CATCH	02-038-1306-0	203-813-060	
3	HANDLE	02-038-1311-0	203-813-110	
4	STICKER.3.	02-038-1316-0	203-813-160	
5	STICKER.2.	02-038-1315-0	203-813-150	
6	STICKER.1.	02-038-1314-0	203-813-140	
7	FRONT DOOR	02-038-1301-0	203-813-010	
8	EMBLEM	02-038-1309-0	203-813-090	
9	WASHER.1.	02-038-1116-0	203-811-160	
10	STOPPER PIN.2.	02-038-1307-0	203-813-070	
11	PLASTIC PLATE	02-038-1302-1	203-813-021	
12	FRONT DOOR PACKING	02-038-1308-0	203-813-080	
13	SCALE RETAINER.2.	02-038-1304-0	203-813-040	
14	RECORDING PLATE SPONGE	02-038-1415-1	203-814-151	
15	PLASTIC HEAD SCREW	M3 X 6; BLACK	000-862-531	
16	FRONT DOOR SHAFT	02-038-1115-1	203-811-151	
17	FIXING SCREW	02-038-1127-0	203-811-270	2 PCS
18	LED COVER	02-038-1107-0	203-811-070	3 PCS
19	CASE	02-038-1101-0	203-811-010	
20	SPONGE	02-038-1123-0	203-811-230	
21	RUBBER PACKING.1.	02-038-1105-0	203-811-050	
22A	STOPPER ASSY		001-228-560	2 PCS
23A	FRONT DOOR STOPPER ASSY		001-334-480	
24	GROUND PLATE	02-038-1113-0	203-811-130	
25A	PINCH ROLLER ASSY		001-228-570	
25	PINCH ROLLER BRACKET	02-019-1020-3	201-910-203	
26	PINCH ROLLER SHAFT	02-019-1019-0	201-910-190	2 PCS
27	PINCH ROLLER SPRING(2)	02-019-1022-1	201-910-221	
28	PINCH ROLLER	02-019-1018-0	201-910-180	
29	PINCH ROLLER SPRING(1)	02-019-1021-1	201-910-211	
30	RECORDING PLATE SUPPORT	02-038-1104-0	203-811-040	2 PCS
31	NON-GLARE FILM.3.	02-038-1418-1	203-814-181	
32	NOTICE FOR PAPER	FDX-2114-0	211-921-140	
33	RECORDING PLATE	FE-808	001-334-550	
34	CATCH TAB	02-019-3008-1	201-930-081	2 PCS
35	CAUTION FOR STYLUS	02-038-1419-0	203-814-190	
36	STYLUS GUIDE	02-038-1405-0	203-814-050	
37	SPOOL RETAINER	02-038-1404-0	203-814-040	2 PCS
38	PAPER SPOOL	F-50705	000-878-461	
39	RECORDING STYLUS ASSY (DRY)	02-015-2190-2	201-521-902	
40	DRIVING BELT	02-038-1503-0	203-815-030	
41A	RECORDING BELT ASSY	FE-808	001-334-540	
42A	PAPER GROUND PLATE ASSY		001-334-500	
43A	IDLE PULLEY ASSY		001-334-450	
43	IDLE PULLEY	F-3011-0	210-400-850	
44	BEARING	608SSU	000-874-020	2 PCS
45	IDLE PULLEY SHAFT	FDX-2223-1	211-922-231	
46	ROD PROTECTION RUBBER	02-038-1214-1	203-812-141	2 PCS
47	CASE FIXING ROD	02-038-1204-1	203-812-041	2 PCS
48	DUST COVER RETAINER	02-038-1211-1	203-812-111	2 PCS
49	LAMP HOLDER	FDY-1007-1	211-810-071	4 PCS
50	DUST COVER	02-038-1205-2	203-812-052	
51	STICKER.5.	02-038-1213-1	203-812-131	
52	BRUSH	0.5 BLACK	000-831-516	
53	FASTENER	D01-0210	000-867-369	2 PCS
54	REEL KEEPER	02-038-1208-0	203-812-080	2 PCS
55	DUST COVER RETAINER	02-038-1207-1	203-812-071	
56	SOLE PLATE	02-038-1201-1	203-812-011	
57	EXHAUST COVER (SMALL)	02-038-1202-0	203-812-020	
58	STICKER.4.	02-038-1212-1	203-812-121	
59	GROMMET	SG-20A	000-871-392	2 PCS

NOTE:
備考:

SYMBOL 記号	PARTS NAME 部品名	TYPE/DWG. NO. 型名/図番	CODE NO. コード番号	REMARKS 備考
60	HINGE	TH-78 NO.3 SUS	000-872-109	2 PCS
61	CLAMPING BAR	02-015-1106-1	201-511-061	2 PCS
62	STOPPER BRAID	02-038-1102-0	203-811-020	2 PCS
63	DUST PROTECTION PLATE.1.	02-038-1114-1	203-811-141	
64	LAMP BOARD MOUNTING PLATE	02-038-1112-2	203-811-122	
65A	ANGLE ASSY		001-334-490	
66	WASHER	FDX-2224-0	211-922-240	3 PCS
67	FIBER WASHER .2.	FDW-2208-0	211-722-080	2 PCS
68	NYLON WASHER	FDW-2209-0	211-722-090	
69	FRAME PLATE	02-038-1501-1	203-815-011	
70	BELT SUPPORT ANGLE	02-038-1504-0	203-815-040	
71	BELT SUPPORT	02-038-1505-0	203-815-050	
72	MOTOR PULLEY	02-038-1502-0	203-815-020	
73A	DRIVE PULLEY ASSY		001-334-460	
73	DRIVE PULLEY SHAFT	FDW-2212-2	211-722-122	
74	BEARING	626ZZ	000-874-065	2 PCS
75	DRIVE PULLEY	FDX-2211-3	211-922-113	
76	BRIM SHAFT	02-019-3010-1	201-930-101	2 PCS
77	SPOOL BRIM	02-038-1408-0	203-814-080	2 PCS
78	BRIM LINER	02-038-1409-1	203-814-091	2 PCS
79	SPRING BELT (BRAKE)	02-019-3017-2	201-930-172	
80	SPRING BELT (DRIVE)	02-019-3016-4	201-930-164	
81	NON-GLARE FILM.2.	02-038-1417-1	203-814-171	
82	NON-GLARE FILM.1.	02-038-1416-0	203-814-160	
83	SPUR GEAR.2.	02-038-1412-0	203-814-120	
84	BRAKE SPRING	02-038-1414-0	203-814-140	
85	SPUR GEAR.1.	02-038-1411-0	203-814-110	
86	SPACER	3X6X13 C2700W	000-877-142	4 PCS
87	BOARD SPACER.B.	SB-6M3-10-F	000-877-126	3 PCS
88	SWITCH COVER.3.	02-038-1121-0	203-811-210	4 PCS
89	SWITCH COVER.2.	02-038-1117-0	203-811-170	2 PCS
90	CASE SPONGE.2.	02-038-1106-3	203-811-063	1 SET
91	CATCH SPRING	02-038-1103-0	203-811-030	
92	KNOB WITH POINT MARKING	K-2605 TYPE P WHITE	000-510-891	2 PCS
93	SUB-PANEL	02-038-1119-0	203-811-190	
94	FRONT PANEL	02-038-1118-0	203-811-180	
95	KNOB WASHER	02-038-1126-1	203-811-261	2 PCS
96	KNOB	02-019-8501-0	000-515-450	4 PCS
97	KNOB CAP	03-004-1066-0	300-410-660	4 PCS
98	RUBBER BUSH	MD06-10080	000-471-198	
99A	SCALE PLATE.1.ASSY	FE-808 M.FA.PA	001-334-790	
99	SCALE PLATE.1.	02-038-1305-0	203-813-050	FOR M,FA,PA
99A	SCALE PLATE.2.ASSY	FE-808 FT	001-334-950	FOR FT (OPTION)
99	SCALE PLATE.2.	02-038-1313-0	203-813-130	FOR FT (OPTION)
100	SCALE NON-GLARE PLATE	02-038-1312-1	203-813-121	
101	MOUNTING BRACKET	02-038-2001-1	203-820-011	OPTION
102	VINYL COVER	02-038-0001-0	000-879-498	
103A	BELT DRIVING ASSY	FE-808	001-334-820	
104A	RECORDER FRAME ASSY	FE-808	001-334-830	

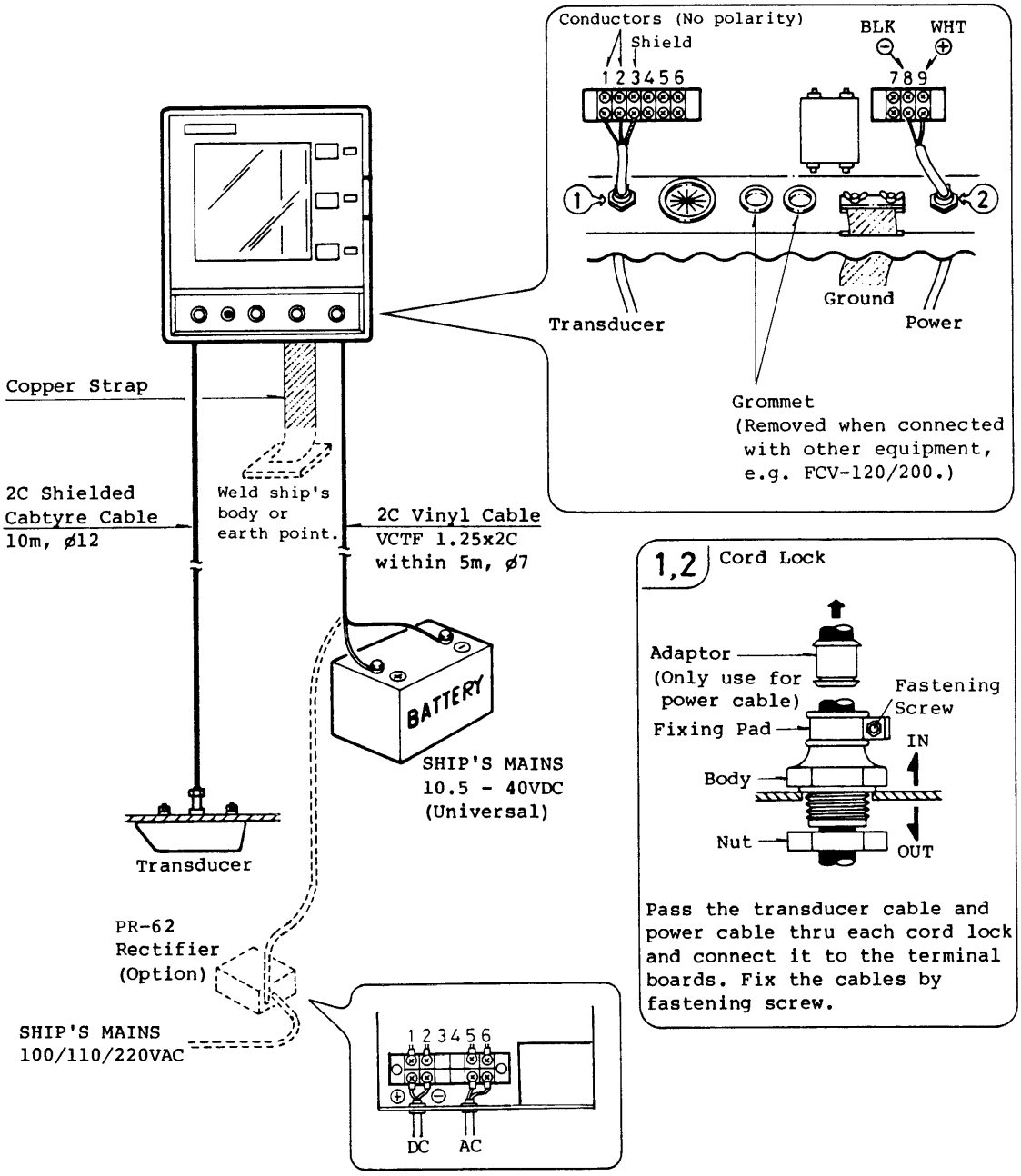
NOTE:
備考:

MAINTENANCE PARTS LIST NO.M02200
FOR FE-808

*1:DEPOT MAINTENANCE PARTS FOR 1 SET IN 2 YEARS
*2:SHIPBORNE RUNNING PARTS FOR 10 SETS IN 2 YEARS

CODE NO.	NAME OF PARTS	TYPE	SPECIFICATIONS	QUANTITY *1	QUANTITY *2	REMARKS
000-431-117	PULSE MOTOR	SP4-41570		1		
000-432-052	DC MOTOR	FNF-1203P	02S4220-0	1		
000-540-156	LAMP WITH WHITE LEAD WIRE	P-12, 12V, 50MA		4		
000-549-013	FUSE GLASS TUBE TYPE	FGB0 7A AC125V	00S0080	10	5	
000-015-003	TRANSDUCER	28F-8		1		STANDARD
000-015-004	TRANSDUCER	28F-18		1		OPTION
000-015-021	TRANSDUCER	60B-5S		1		STANDARD
000-015-022	TRANSDUCER	60B-52		1		OPTION
000-015-024	TRANSDUCER	88B-8		1		STANDARD
000-015-025	TRANSDUCER	88B-10		1		OPTION
000-015-029	TRANSDUCER	200B-5S		1		STANDARD
000-015-030	TRANSDUCER	200B-8		1		OPTION
000-015-042	TRANSDUCER	50B-6		1		STANDARD
000-015-045	TRANSDUCER	200B-8N		1		OPTION
000-015-064	TRANSDUCER	50B-9		1		OPTION
000-015-066	TRANSDUCER	50F-8G		1		OPTION
001-334-650	PRINTED CIRCUIT BOARD	02P5911,MAIN(60KHZ)	FE-808	1		
001-334-660	PRINTED CIRCUIT BOARD	02P5911,MAIN(88KHZ)	FE-808	1		
001-334-710	PRINTED CIRCUIT BOARD	02P5908,FRONT PANEL	FE-808	1		
001-334-720	PRINTED CIRCUIT BOARD	02P5909,SUB-PANEL	FE-808	1		
001-334-730	PRINTED CIRCUIT BOARD	02P5910,DISPLAY	FE-808	1		
001-334-740	PRINTED CIRCUIT BOARD	02P5911,MAIN(28KHZ)	FE-808	1		
001-334-750	PRINTED CIRCUIT BOARD	02P5911,MAIN(50KHZ)	FE-808	1		
001-334-760	PRINTED CIRCUIT BOARD	02P5911,MAIN(200KHZ)	FE-808	1		
001-334-770	PRINTED CIRCUIT BOARD	02P5912,TRIGGER	FE-808	1		
001-334-780	PRINTED CIRCUIT BOARD	02P5925,LAMP	FE-808	1		
000-371-352	METAL OXIDE FILM RESISTOR	ERG-2ANJ151	2W, 150	1		
000-371-383	METAL OXIDE FILM RESISTOR	ERG-2ANJ153	2W, 15K	1		
001-334-540	RECORDING BELT ASSY	FE-808		1		
201-521-902	RECORDING STYLUS ASSY (DRY)	02-015-2190-2		5	2	
201-930-164	SPRING BELT (DRIVE)	02-019-3016-4		1		
201-930-172	SPRING BELT (BRAKE)	02-019-3017-2		1		
203-815-030	DRIVING BELT	02-038-1503-0		1		

CONNECTION DIAGRAM



FURUNO

S-2

02P5911
1B1
メイン
MAIN

02P5908
1B2
操作パネル
FRONT PANEL

02P5912
1B5
トリガー
TRIGGER

02P5910
1B4
深度表示
DISPLAY

02P5909
1B3
内部パネル
SUB-PANEL

02P5925
1B6
ランプ
LAMP

送受波器へ
TO TRANSDUCER

船内電源(+)
SHIP'S MAINS
10.5-40VDC
(-)

C01 0.068/3KV(For 28KHz)
FL01 PLF-2V-15A-012

TB1 TB2 P1 P2 J1 J4 P3 J2 P4 J1 P5 J3 P6 J2 P7 J4 P8 J1 P9 J6 P10 J1 P11 J5 P15 J7 P13 J3 P18 J5 P20 J2 P12 J5 P16 J1 P17 J4 P14 J2 P19 J3

TX OUTPUT
GND
TX OUTPUT
DC IN ⊕
DC IN ⊖

RANGE 5
SHIFT
RANGE 2
RANGE 4
TX-KP
RANGE 3
RANGE 6
S/L SIG
TVG KP
RANGE 1
DRAFT KP
SIG
B/L-1
READ·KP
MAINS ⊕
S/L-1
STARTER
S/L-2
TVG-C
MAINS ⊖
RANGE 9,5,6
B/L-2
+5V
0V
+12V
SIG GATE

基板1B1 のJ2/P3側に同じ SAME AS J2/P3 ON PCB 1B1

基板1B2 のP6/J2側に同じ SAME AS P6/J2 ON PCB 1B2

+12V
0V
0V
0V
MARKER
UNIT (FT)
UNIT (H)
UNIT (P)
UNIT (FA)
I/R SW-C
I/R SW-1
MOTOR CK

+5V
0V
KP

+12V
CK
CK
CK
CK
+12V
GRN
RED
YEL
WHT
BLU
GRN

B2 M 紙送りモーター PAPER FEED MOTOR

U1 DN6839 Vcc 0V OUT
R1 470

+5V
0V
UNIT(FT)
UNIT(H)
UNIT(FA)
UNIT(P)
WT-START
SIG GATE
S/L SIG
SHIFT
RANGE 6
RANGE 5
RANGE 4
RANGE 3
RANGE 2
S/L-ON
0V
0V
SIG OUT

+5V
0V
UNIT (FT)
UNIT (H)
UNIT (FA)
UNIT (P)
WT-START
SIG. GATE
S/L SIG
SHIFT
RANGE 6
RANGE 5
RANGE 4
RANGE 3
RANGE 2
S/L-ON
0V
SIG OUT

POWER REDUCT.
COM.
0V
0V

PAPER SPEED SW-1
PAPER SPEED SW-2
0V
MOTOR CK
+12V
TVG VR-3
TVG VR-2
TVG VR-1

+12V
I/R SW-C
I/R SW-1
0V
DRAFT VR
DRAFT VR

DIM
COM
MEDIUM

ベルト駆動 BELT DRIVE
B1 M

R3 330
R2 220
S3
R5 10K,B
S4
R6 20K,B
S1
R7 1K
R8 470
S2
CR1 U06C
Q1 2SC1061-C
DIMMER : 1
R9 1K

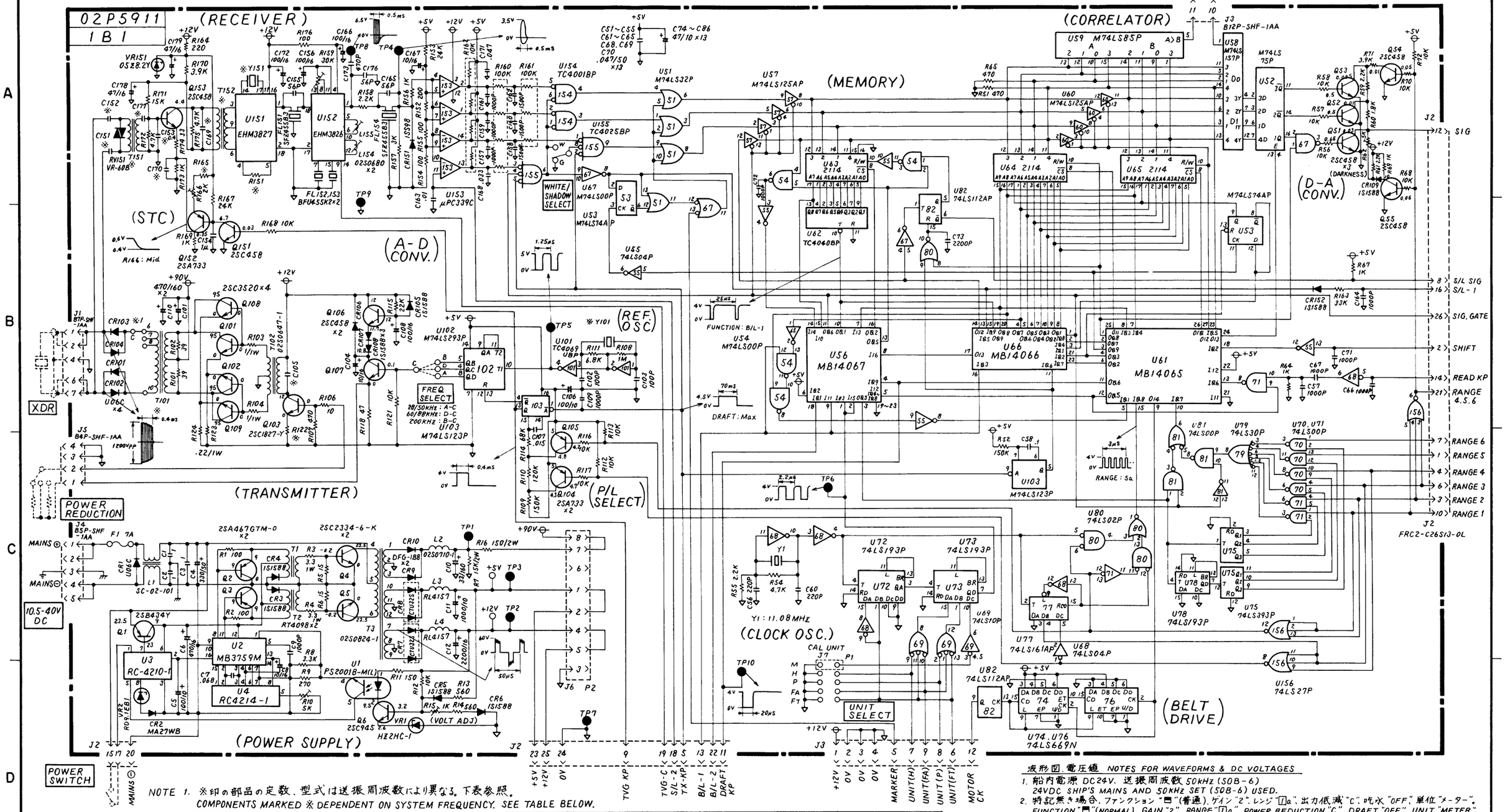
DS1 DS2 DS3 DS4

承認 APPROVED	NOV 16 '83	名称 TITLE	総合回路図 FE-808 SCHEMATIC DIAGRAM
検図 CHECKED	Nov. 7 '83		
製図 DRAWN	Nov. 5 '83	図番 DWG. NO.	C2285-004-C

FURUNO ELECTRIC CO., LTD.

FURUNO

S-3



NOTE 1. ※印の部品の定数、型式は送振周波数により異なる。下表参照。
COMPONENTS MARKED ※ DEPENDENT ON SYSTEM FREQUENCY. SEE TABLE BELOW.

	C105	C151, C152	C153	C169	C170	C177	T101	T151	T152	R122	R151	R165	Y101	Y151	※1 (STANDARD)	※1 (OPTION)	
28kHz	1.0μF	0.0068μF	0.01μF	3900PF	0.1μF	0.1μF	02S0880	02S0826	02S0829	1/1W	1K	5.6K	461KHz	484KHz	7-C(28F-8)	8-C(28F-18)	
50kHz	0.33μF	0.0033μF	2200PF	1800PF	0.1μF	0.1μF	02S0881	02S0827	02S0830	1/1W	1K	5.6K	800kHz	505kHz	7-C(50B-6)	8-C(50B-9)	6-C(50F-8G)
60kHz	0.33μF	0.0027μF	1500PF	1500PF	0.1μF	0.1μF	02S0869	02S0872	02S0875	2.2/1W	1K	5.6K	496kHz	517kHz	6-C(60B-5S)	7-C(60B-S2)	
88kHz	0.33μF	0.0015μF	1000PF	1000PF	0.1μF	0.1μF	02S0871	02S0872	02S0875	1/1W	1K	5.6K	704kHz	543kHz	6-C(88B-8)	7-C(88B-10)	
200kHz	0.047μF	0.001μF	470PF	470PF	0.0022μF	0.01μF	02S0882	02S0828	02S0831	0.22/1W	100	4.3K	800kHz	655kHz	6-C(200B-5S)	7-C(200B-8)	8-C(200B-8N)

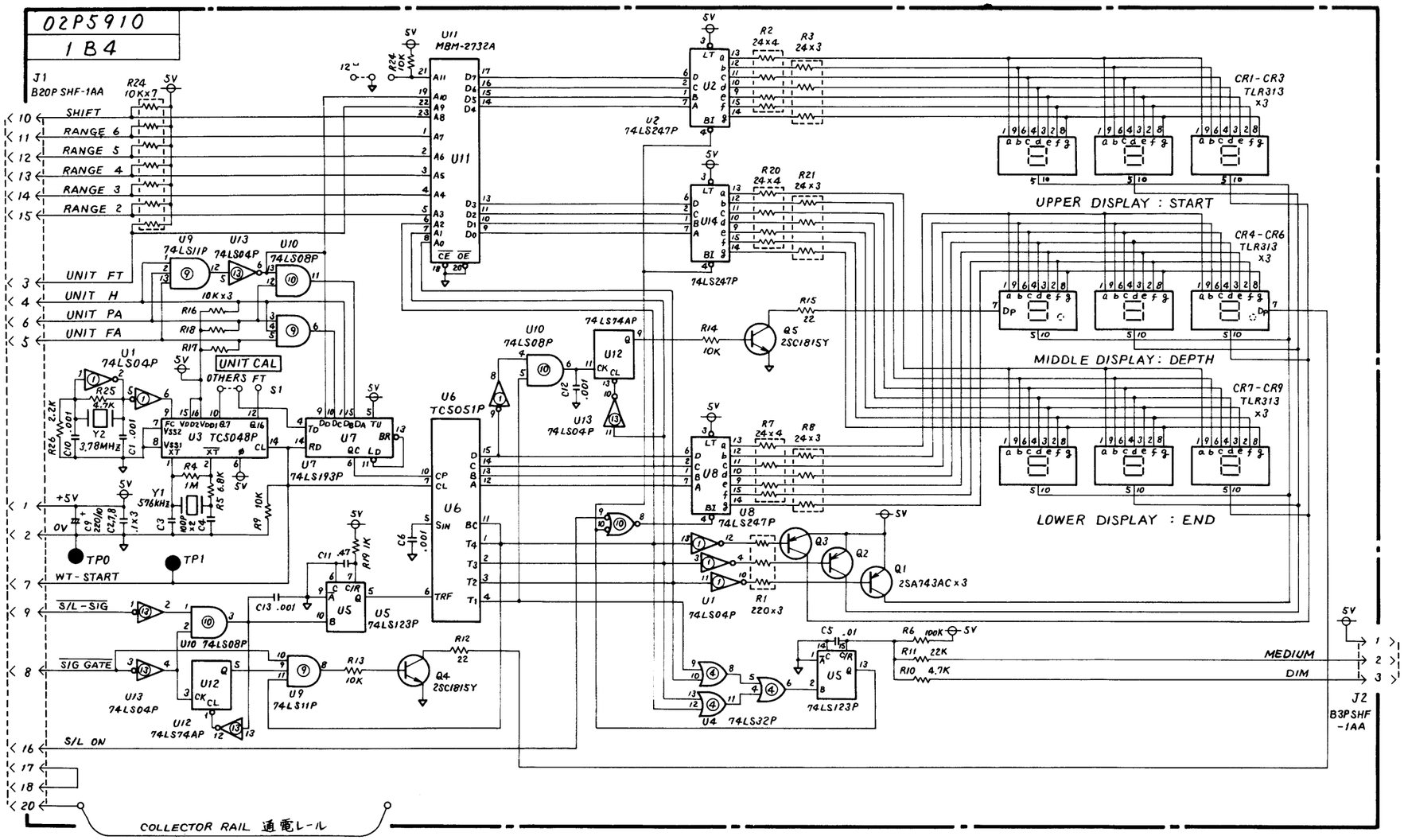
2. 特記なき抵抗の値はΩ(1/4W)、コンデンサの容量はμF。
ALL RESISTANCE IN OHMS (1/4W) AND CAPACITANCE IN MICROFARADS UNLESS NOTED OTHERWISE.

波形図、電圧値 NOTES FOR WAVEFORMS & DC VOLTAGES

1. 船内電源 DC24V、送振周波数 50kHz (50B-6)
24VDC SHIP'S MAINS AND 50kHz SET (50B-6) USED.
2. 特記無き場合、ファンクション "■"(普通)、ゲイン "2"、レンジ "/a"、出力低減 "C"、吃水 "OFF"、単位 "メーター"。
FUNCTION "■"(NORMAL), GAIN "2", RANGE "/a", POWER REDUCTION "C", DRAFT "OFF", UNIT "METER", UNLESS NOTED OTHERWISE.
3. Q1～Q5の各電圧値は、テスターの(−)リードをCR1アノードに接続して測定。
VOLTAGES OF Q1 THRU Q5 ARE MEASURED WITH NEGATIVE LEAD OF MULTIMETER CONNECTED TO CR1 ANODE.

承認 APPROVED	Nov.10.'83	名称 TITLE	FE-808 メイン基板 MAIN BOARD
検図 CHECKED			
製図 DRAWN		図番 DWG.NO.	C2285-005-D

FURUNO ELECTRIC CO., LTD.



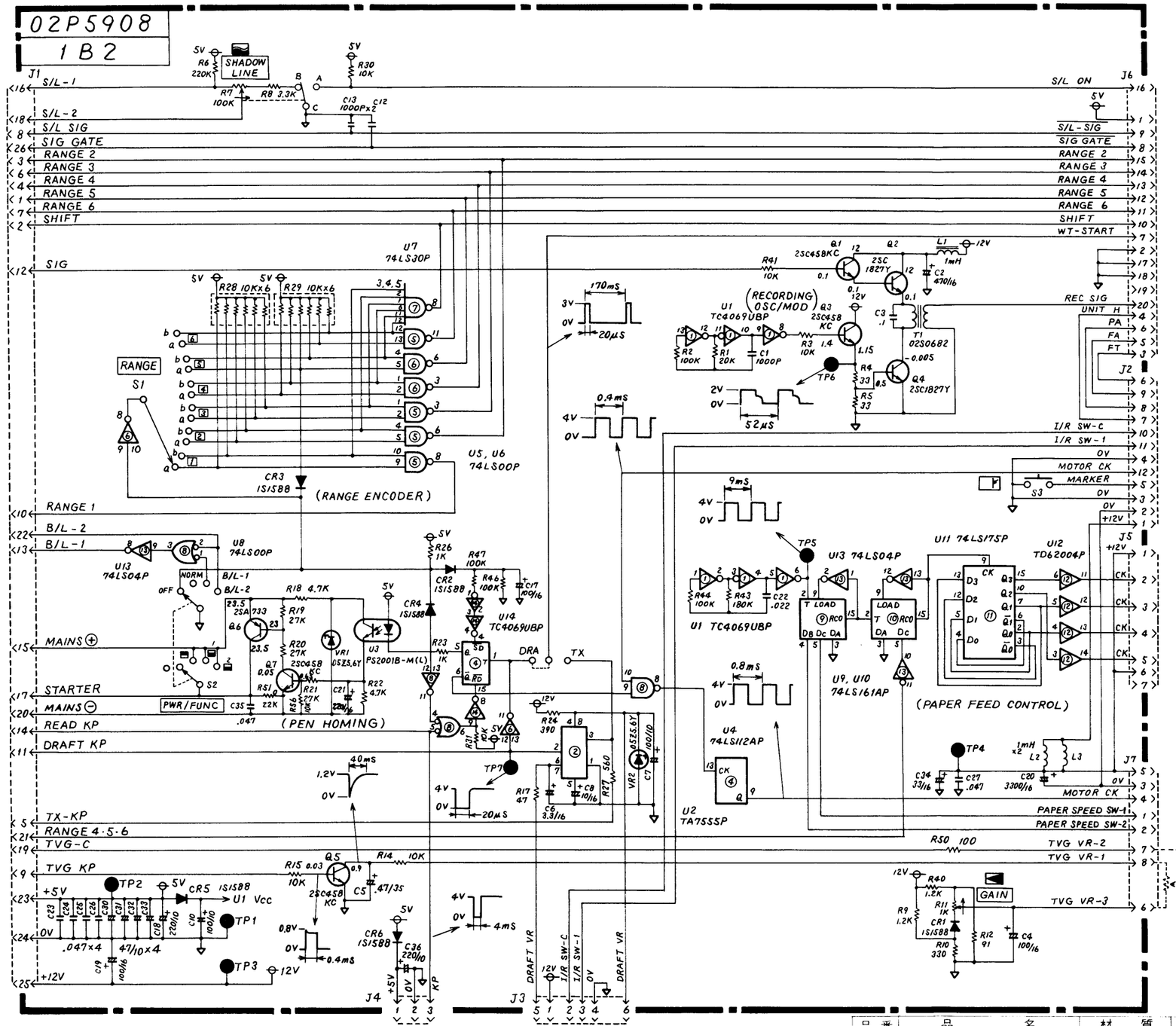
NOTE 1. 特記無き抵抗の値はΩ(1/4W)、コンデンサの容量はμF。
ALL RESISTANCE IN OHMS (1/4W) AND CAPACITANCE IN MICROFARADS UNLESS NOTED OTHERWISE.

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

承認 APPROVED	Nov. 4 '93	三角法 THIRD ANGLE PROJECTION	名称 TITLE: FE-808 深度表示基板 DISPLAY BOARD
検図 CHECKED	Nov. 4 '93	尺度 SCALE	
製図 DRAWN	Nov. 4 '93	重量 WEIGHT kg	図番 DWG.NO. C2285-008-C

FURUNO ELECTRIC CO., LTD.

02P5908
1B2



波形図.電圧値
NOTES FOR WAVEFORMS & DC VOLTAGES

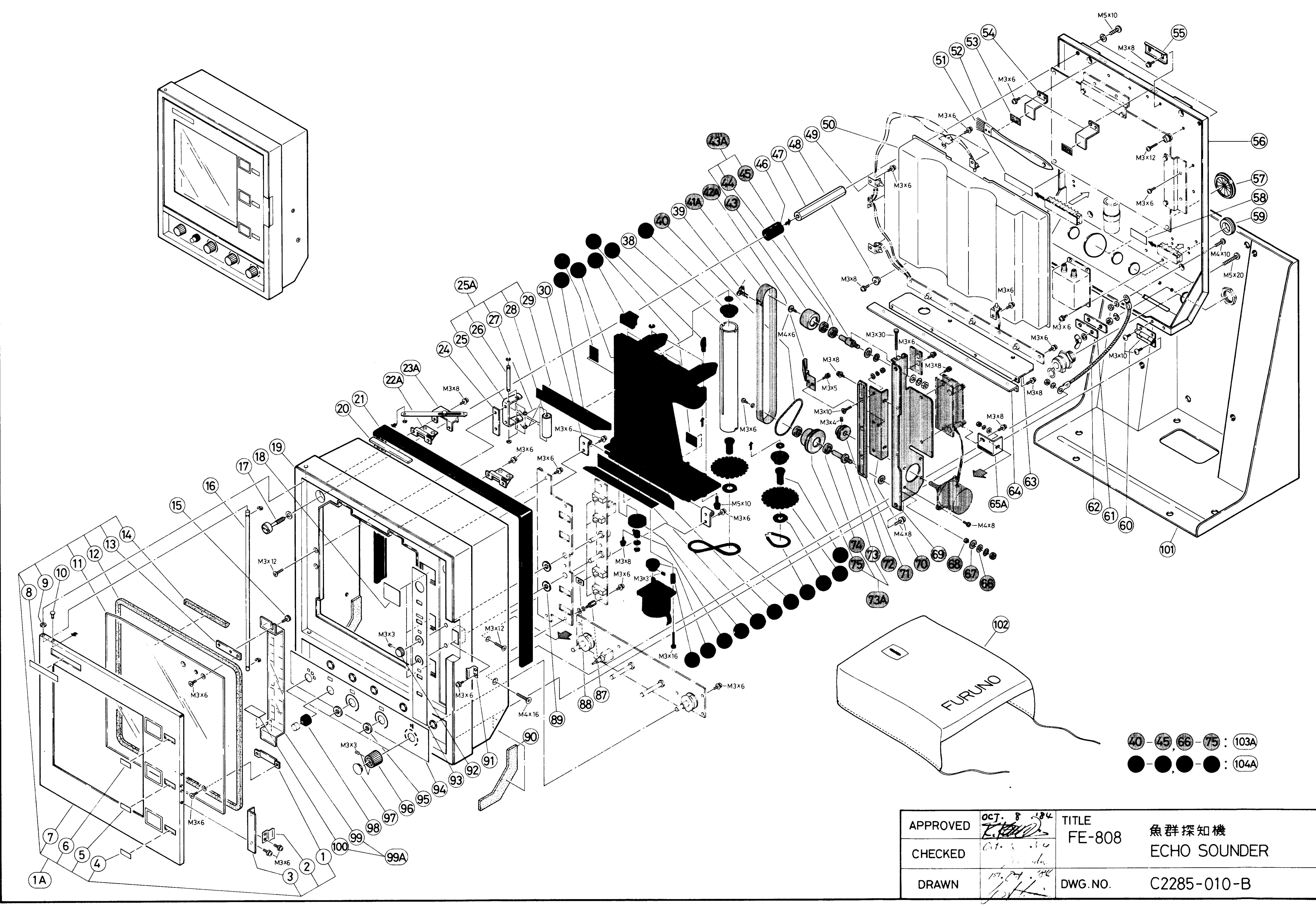
1. 船内電源 DC24V, 送振周波数 50kHz (50B-6)。
   24VDC SHIP'S MAINS AND 50kHz SET (50B-6) USED.
2. 特記無き場合、ファンクション"■"(普通)、ゲイン"2"、レンジ"1a"、出力低減"C"、吃水"OFF"、単位"メーター"。
   FUNCTION "■" (NORMAL), GAIN "2", RANGE "1a", POWER REDUCTION "C", DRAFT "OFF", UNIT "METER", UNLESS NOTED OTHERWISE.
3. Q6, Q7の電圧値は、テスターの(−)リードをQ7エミッターに接続して測定。
   VOLTAGES OF Q6 AND Q7 ARE MEASURED WITH NEGATIVE LEAD OF MULTIMETER CONNECTED TO Q7 EMITTER.

NOTE 1. 特記無き抵抗の値はΩ(1/4W)、コンデンサの容量はμF。
ALL RESISTANCE IN OHMS (1/4W) AND CAPACITANCE IN MICROFARADS UNLESS NOTED OTHERWISE.

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

承認 APPROVED	Nov. 11. '89	三角法 THIRD ANGLE PROJECTION	名称 TITLE: FE-808 操作パネル基板 FRONT PANEL BOARD
検図 CHECKED	Nov. 11. '89	尺度 SCALE	
製図 DRAWN	11TH. Nov. '89	重量 WEIGHT kg	図番 DWG.NO. C2285-009-C

FURUNO ELECTRIC CO., LTD.



APPROVED	OCT. 8 '84	TITLE FE-808	魚群探知機 ECHO SOUNDER
CHECKED			
DRAWN		DWG.NO.	C2285-010-B