

FURUNO

SERVICE MANUAL

NAVIGATIONAL ECHO SOUNDER

MODEL FE-680/680T



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SPECIFICATIONS OF FE-680-1/2 NAVIGATIONAL ECHO SOUNDER

1. DEPTH RANGE, SOUNDING RATE, PAPER SPEED, PULSE LENGTH, FREQUENCY:

MODEL	DEPTH RANGE (m)	SOUNDING RATE (*)	PAPER SPEED (mm/min)		PULSE LENGTH (msec)	FREQUENCY (kHz)
			F	S		
FE-680-1	0 - 10	336	8	4	0.5	200
	0 - 20	336	8	4	0.5	
	0 - 40	168	8	4	0.5	
	0 - 100	84	8	4	1.0	
	0 - 200	42	4	2	2.0	
	0 - 400	42	2	1	2.0	
FE-680-2	0 - 20	336	8	4	0.5	50
	0 - 40	336	8	4	0.5	
	0 - 80	168	8	4	0.5	
	0 - 200	84	8	4	1.0	
	0 - 400	42	4	2	2.0	
	0 - 800	21	2	1	2.0	

* Pulse repetition rate per minute

2. RECORDING SYSTEM

Belt straight line recording system

3. RECORDING PAPER

Dry electrosensitive paper

Type; PD-1520NW (150mm X 20m; 5.9" X 66'), Effective width (130mm; 5.1")

4. DIGITAL READOUT

a) Depth 732 : Seabed Depth (1m step)

b) Range 400 : Depth Range

5. OUTPUT POWER

300W

6. TRANSDUCER & TANK

FREQUENCY	TRANSDUCER	BEAM WIDTH (-3dB)	TANK	REMARKS
200kHz	200B-8B	5.4°	TTF-2000 TTS-2000-2 TTD-2000	Standard Option Option
50kHz	50B-6B	28°	TTF-5600 TTS-5600-2 TTD-5600	Standard Option Option

7. POWER SUPPLY

100/110/115/220/230VAC ±10%, 50/60Hz ±5%, 1∅, 50VA Approx.

8. COATING COLOR (Standard)

Front Door N5.0 Leather Tone
 Cabinet N6.0 New Tone No.5

9. EQUIPMENT LIST

Standard Supply

No.	NAME	TYPE	Q'TY	WEIGHT (kg)	DIMENSION (mm)			REMARKS
					W	H	D	
1	Recorder Unit	FE-680	1	10	292	350	152	Bulkhead Mount
		-1/2		11	350	350	152	FLUSH Mount
2	Transducer	200B-8B	1	3.6	110	65	110	with 15m cable
		50B-6B		4	90	90	90	"
3	Transducer Tank	TTF-2000	1	19	216	154	216	20mm thick
		TTF-5600		17	190	154	190	"
4	Installation Materials		1 set					
5	Spare Parts		1 set					

Optional Supply

No.	NAME	TYPE	WEIGHT (kg)	DIMENSION (mm)			REMARKS
				W	H	D	
1	Matching Box	MB-504	2.6	120	111	252	for FE-680-1
		MB-502		120	111	252	for FE-680-2
2	Transducer Switch Box	EX-8	2.7	174	150	85	Bulkhead Mount
			3	224	200	80	Flush Mount
3	Digital Depth Indicator	ED-202	11	400	210	245	Table-Top Mount
			"	400	210	245	Bulkhead Mount
			"	400	210	245	Overhead Mount
			"	380	210	245	Flush Mount
4	Watertight Junction Box	JIS F8821-1	1.6	∅105 x 60			
5	Transducer Tank	TTS-2000-2	28	260	294	260	for FE-680-1
		TTD-2000-3		300	342	300	"
		TTS-5600-2	26	260	294	260	for FE-680-2
		TTD-5600-3		300	342	300	"

SPECIFICATIONS OF FE-680T-1/2 NAVIGATIONAL ECHO SOUNDER

1. DEPTH RANGE, SOUNDING RATE, PAPER SPEED, PULSE LENGTH, FREQUENCY

MODEL	DEPTH RANGE (m)	SOUNDING RATE (*)	PAPER SPEED (mm/min)		PULSE LENGTH (msec)	FREQUENCY (kHz)
			F	S		
FE-680T-1	0 - 10	336	8	4	0.5	200
	0 - 20	336	8	4	0.5	
	0 - 40	168	8	4	0.5	
	0 - 100	84	8	4	1.0	
	0 - 200	42	4	2	2.0	
	0 - 400	42	2	1	2.0	
FE-680T-2	0 - 20	336	8	4	0.5	50
	0 - 40	336	8	4	0.5	
	0 - 80	168	8	4	0.5	
	0 - 200	84	8	4	1.0	
	0 - 400	42	4	2	2.0	
	300 - 700	42	2	1	2.0	

* Pulse repetition rate per minute

2. RECORDING SYSTEM

Belt straight line recording system

3. RECORDING PAPER

Dry electrosensitive paper

Type; PD-1520NW (150mm X 20m; 5.9" X 66'), Effective width (130mm; 5.1")

4. DIGITAL READOUT

a) Depth 132 : Seabed Depth (1m step)

b) Range 400 : Depth Range

5. OUTPUT POWER

300W

6. TRANSDUCER & TANK

FREQUENCY	TRANSDUCER	BEAM WIDTH (-3dB)	TANK	REMARKS
200kHz	200B-8B	5.4°	TTF-2000 TTS-2000-2 TTD-2000	Standard Option Option
50kHz	50B-6B	28°	TTF-5600 TTS-5600-2 TTD-5600	Standard Option Option

7. POWER SUPPLY

100/110/115/220/230VAC ±10%, 50/60Hz ±5%, 1Ø, 50VA Approx.

8. COATING COLOR (Standard)

Front Door N5.0 Leather Tone
Cabinet N6.0 New Tone No.5

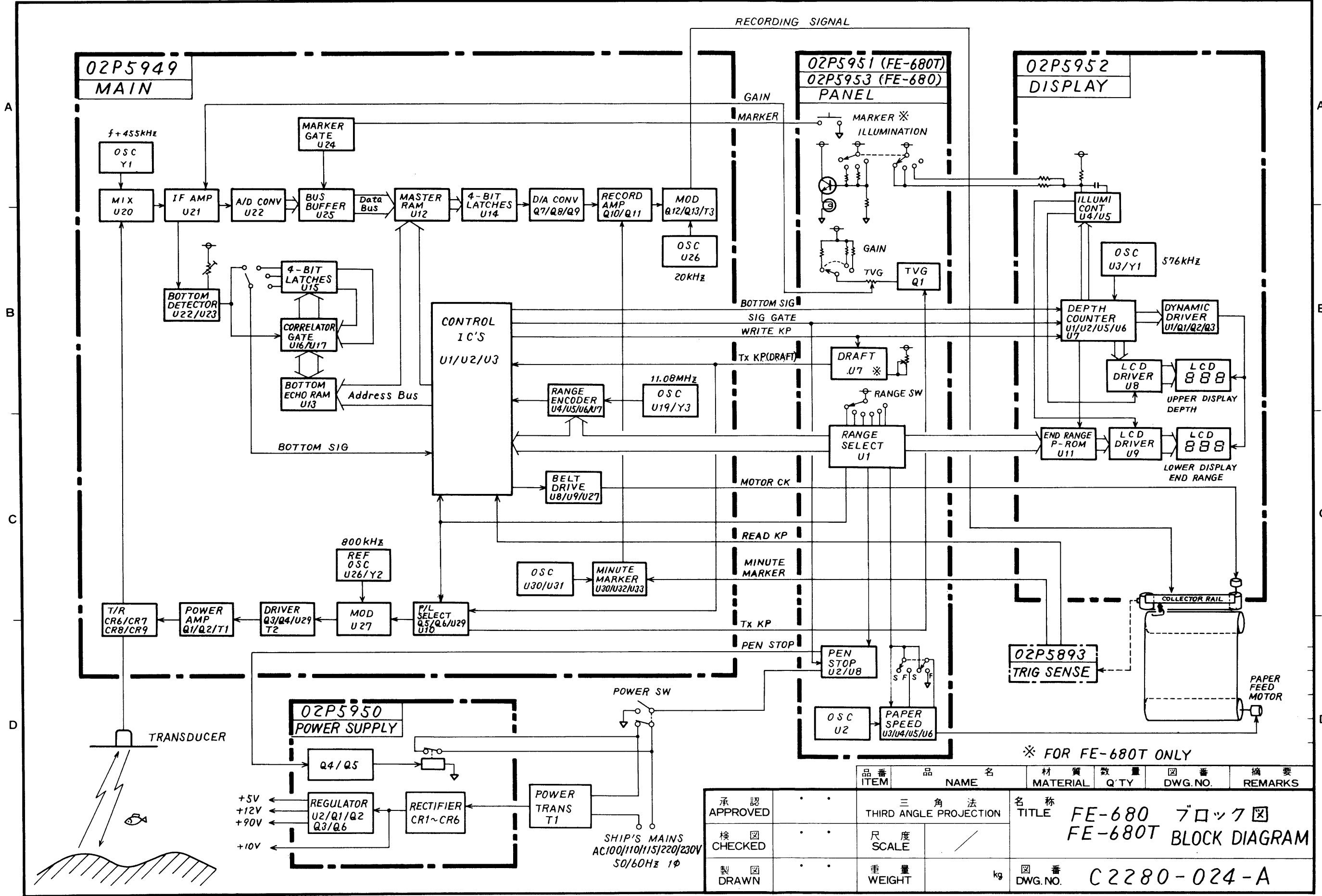
9. EQUIPMENT LIST

Standard Supply

No.	NAME	TYPE	Q'TY	WEIGHT (kg)	DIMENSION (mm)			REMARKS
					W	H	D	
1	Recorder Unit	FE-680T	1	10	292	350	152	Bulkhead Mount Panel Mount
		-1/2		11	350	350	152	
2	Transducer	200B-8B	1	3.6	110	65	110	with 15m cable "
		50B-6B		4	90	90	90	
3	Transducer Tank	TTF-2000	1	19	216	154	216	20mm thick "
		TTF-5600		17	190	154	190	
4	Installation Materials		1 set					
5	Spare Parts		1 set					

Optional Supply

No.	NAME	TYPE	WEIGHT (kg)	DIMENSION (mm)			REMARKS
				W	H	D	
1	Matching Box	MB-504 MB-502	2.6	120	111	252	for FE-680T-1 for FE-680T-2
2	Transducer Switch Box	EX-8	2.7 3	174 224	150 200	85 80	Bulkhead Mount Flush Mount
3	Digital Depth Indicator	ED-202	11	400	210	245	Table-Top Mount
			"	400	210	245	Bulkhead Mount
			"	400	210	245	Overhead Mount
			"	380	210	245	Flush Mount
4	Watertight Junction Box	JIS F8821-1	1.6	Ø105 x 60			
5	Transducer Tank	TTS-2000-2	28	260	294	260	for FE-680T-1
		TTD-2000-3		300	342	300	for FE-680T-1
		TTS-5600-2	26	260	294	260	for FE-680T-2
		TTD-5600-3		300	342	300	for FE-680T-2



品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
承認 APPROVED	三角法 THIRD ANGLE PROJECTION	名称 名称			FE-680 ブロック図
検図 CHECKED	尺度 SCALE	名称 名称			FE-680T BLOCK DIAGRAM
製図 DRAWN	重量 WEIGHT	kg		図番 DWG.NO.	C2280-024-A

CHAPTER 1. CIRCUIT DESCRIPTION

The FE-680/680T echo sounders consist of the transmitter, receiver, memory, paper feed motor, recording belt drive motor, control panel, display, power supply and associated circuits. Following descriptions are explained referring to the block diagram on page 1-0 and individual circuit diagrams. The list below shows major differences, between FE-680 and FE-680T for easy understanding of this manual.

	FE-680T	FE-680
Type Approval Authority	Ministry of Transport, Japan	Department of Transportation, England
Marker Button	Provided	Not provided
Draft Control	Provided	Not provided
PANEL board	02P5951	02P5953

1-1. Transmitter (MAIN Board 02P5949)

The block and actual circuit diagrams are shown below.

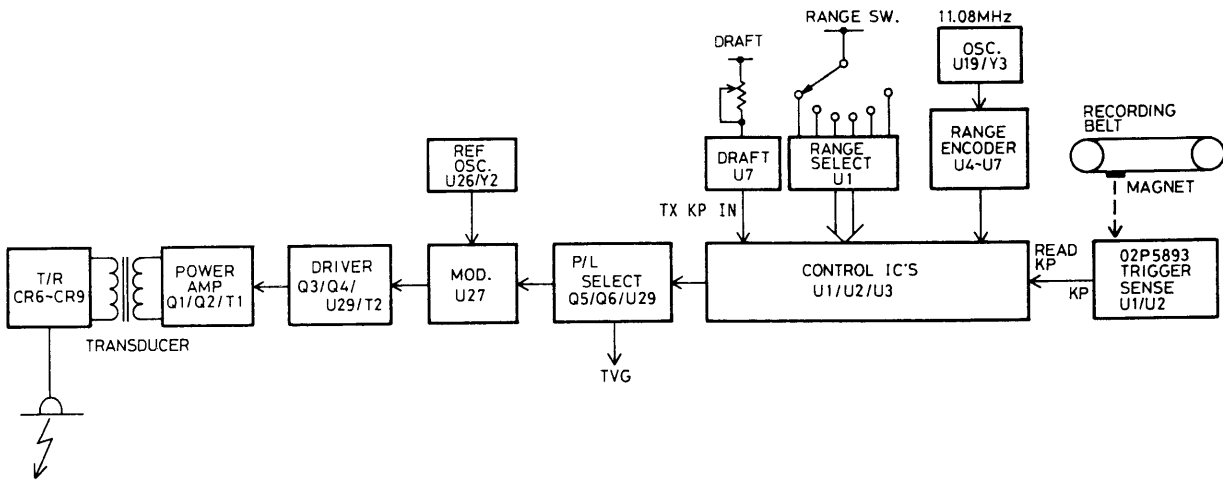


Fig.1-1 Block Diagram

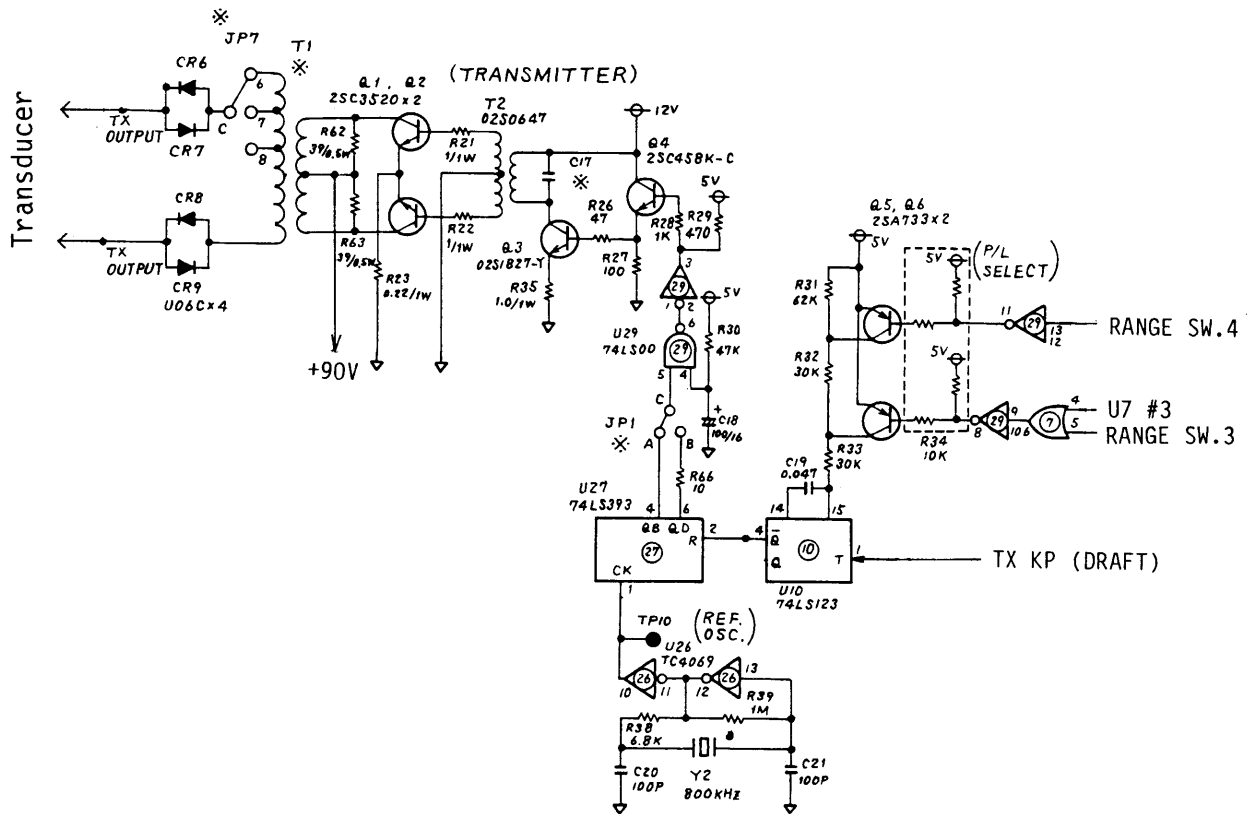


Fig.1-2 Circuit Diagram

The transmitter circuit is kicked by keying pulse TX/KP generated in control circuit U1/U2/U3 and produces a transmit signal across the secondary winding of output transformer T1 as below. Then, this signal is fed to the transducer fitted on the ship's hull bottom thru the T/R circuit which converts an electric energy into an ultrasonic sound and vice versa.

Note that the TK/KP pulse is delayed by a time (depth) corresponding to the DRAFT control setting for FE-680T type.

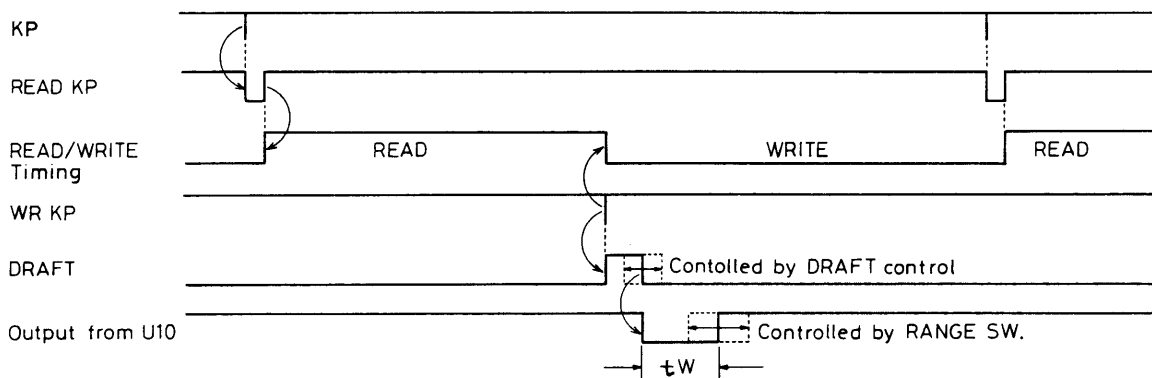


Fig.1-3 Timing Chart

Draft Control (PANEL Board 02P5951)

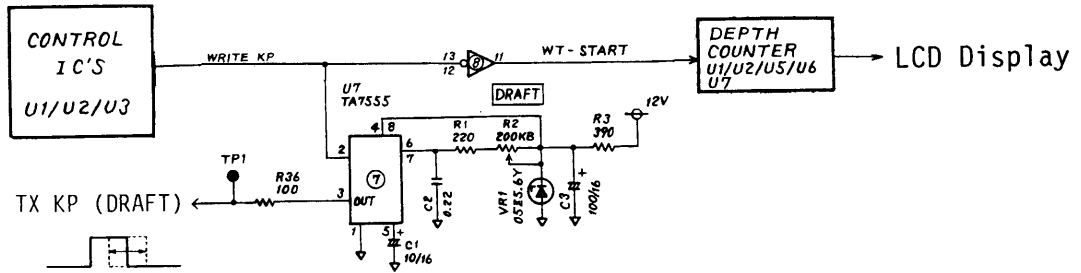


Fig.1-4 Draft Control Circuit

Upon application of negative going pulse WRITE KP, U7 functions as an one-shot, and generates positive going pulse TX KP IN of whose pulse-length is determined by the time constant set by C2, R1 and DRAFT Control R2. Thus, the transmitter is fired at the negative going edge of trigger pulse TX KP IN with a delay of its time which corresponds to ship's draft.

Pulselength Setting

The transmit signal should have a certain pulselength enough to drive the transducer. The pulselength select circuit consists of U10, Q5, Q6 and associated components, and is controlled to select a pulselength among 0.5, 1.0 and 2.0ms with a range select pulse produced by U3 which is connected with the DEPTH RANGE selector. This range select pulse turns on either Q5 or Q6. Thus a combination of R31, R32, R33 is selected to change the time constant of monostable multivibrator U10 as below.

Depth Range	Q5	Q6	Selected resistors	Pulse length
1,2,3	OFF	ON	R33	0.5ms
4	ON	OFF	R32,R33	1.0ms
5,6	OFF	OFF	R31-R33	2.0ms

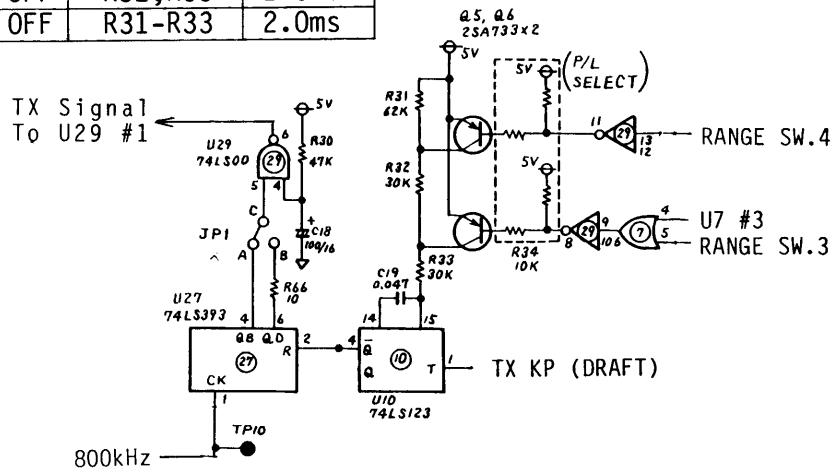


Fig.1-5 Pulselength (P/L) Select Circuit

Reference Oscillator and Modulator

An 800kHz signal oscillated by U26/Y2 is led to the modulator of binary counter U27. When a negative-going pulse having pulselength "tw", which is the same as of transmission pulse, is fed to the reset terminal of U27, it starts counting, and 200kHz and 50kHz signals come out at Q_B and Q_D respectively. Jumper JP1 is put between either C and A(200kHz); or C and B(50kHz), depending on system frequency. See Fig.1-5.

Frequency	U27	REF.OSC.Y2
50KHz	#Q _D	800kHz
200KHz	#Q _B	

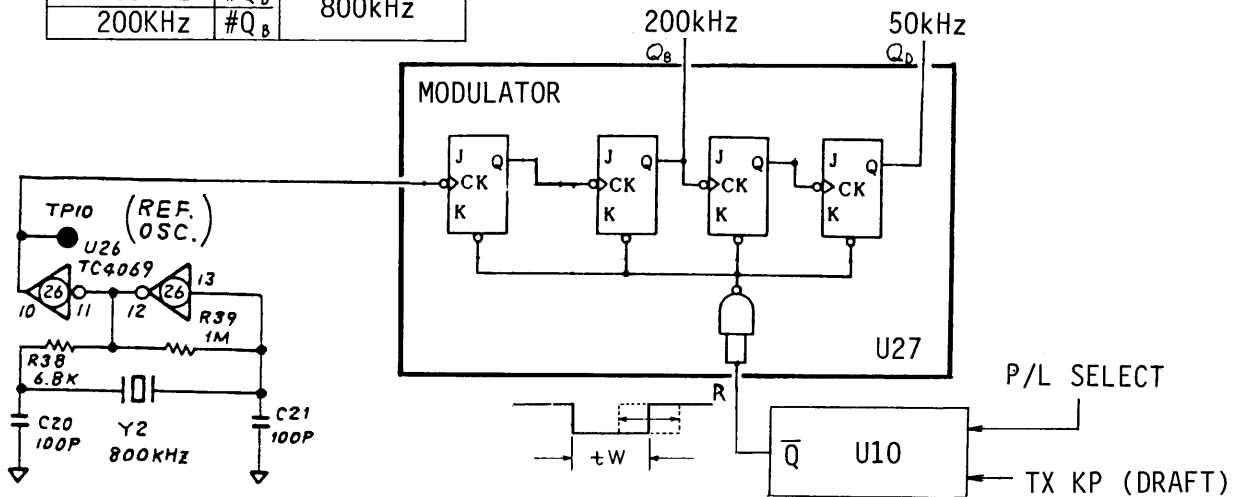


Fig.1-6

Driver, Power Amplifier & Output Transformer

An output signal from the modulator is amplified upto a required output level by power amplifier Q1/Q2 thru emitter follower Q4 and driver Q3, and then fed to the transducer thru the T/R circuit.

T/R Circuit

The T/R circuit is a directional network for the transmitter and the receiver. It isolates the receiver by varistors RV1 and RV2 during transmission period so that the receiver is protected from strong transmission signals. On the contrary, weak received signals are fed from the transducer to the receiver with a minimum loss during receiving period.

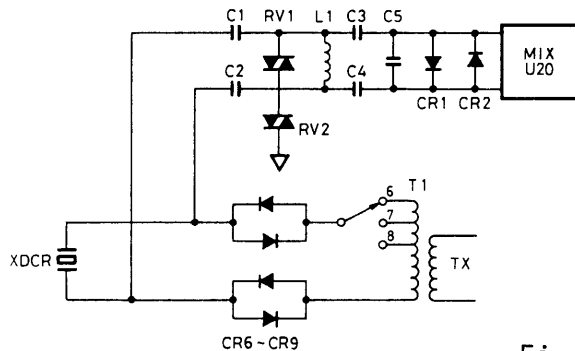


Fig.1-7 T/R Circuit

Transmission: Strong transmission signals make CR6 thru CR9, RV1 and RV2 conduct, and are delivered to the transducer. Only a low level transmission signal leaks to the receiver, and draws a transmission line (zero line) on the recording paper.

Reception: Since the received signals are too weak to make CR6 thru CR9, RV1 and RV2 conduct, all received signals are led to next receiver stages.

Loading capacitors (C3/4) and coils (L1/2) are selected according to a system frequency so that the transducer leads the signals to the receiver in a best impedance matching condition.

1-2. Receiver

Figures 1-7 and 1-8 show the block and circuit diagrams. The receiver consists of the mixer, local oscillator, IF amplifier, A/D converter and bottom signal detector. In this stage, an weak electrical signal converted from an ultrasonic signal by the transducer is amplified and detected by this receiver.

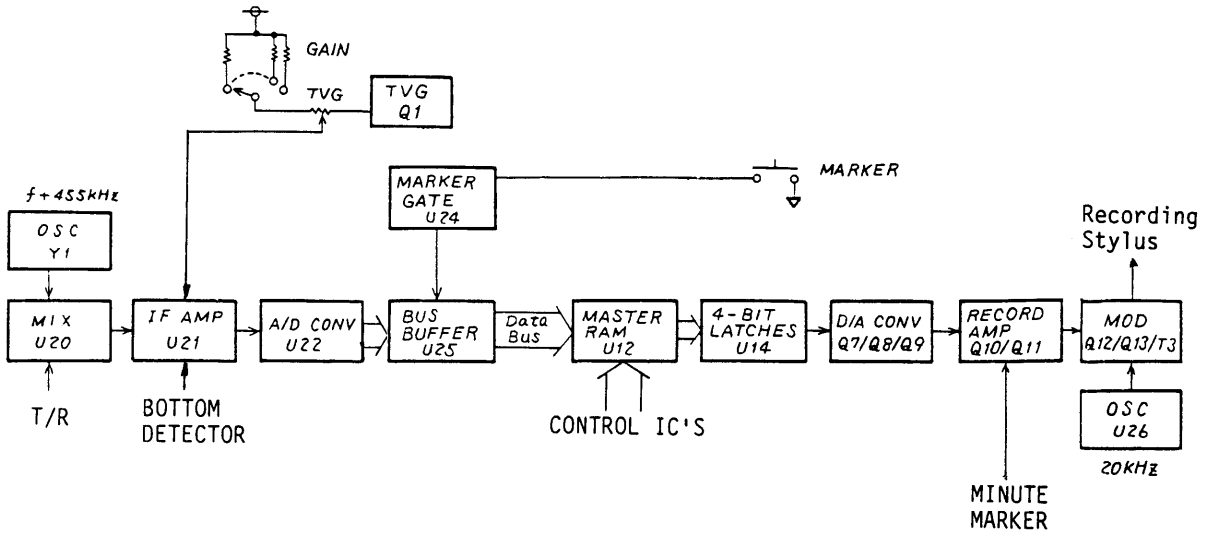


Fig.1-8 Block Diagram

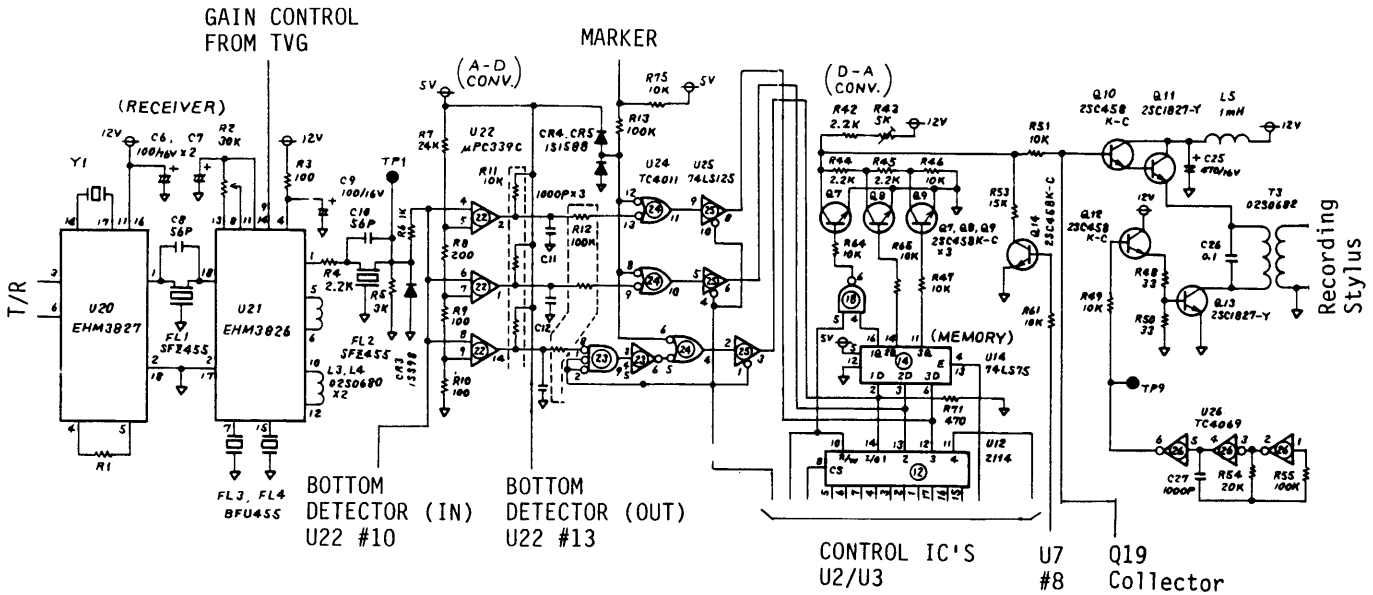


Fig.1-9 Circuit Diagram

U20 and U21 are customized IC's designed for echo sounder which are used for the mixer/local oscillator and IF amplifier. The received signal from the transducer is mixed with the local oscillator output, of which frequency is determined by Y1, to get 455kHz IF signal. An oscillating frequency of Y1 is 505kHz for 50kHz set or 655kHz for 200kHz set. An IF signal is amplified by IF amplifier U21 after passing thru 455kHz filter FL1. Its amplification factor is controlled by a combination of TVG and GAIN control settings. The amplified IF signal goes thru 455kHz filter FL2, and is detected by CR3. Voltage comparator U22 is used to convert the detected analogue signal into 3-bit digital signal depending on its analogue level.

These digital signals are stored in memory U12 (described later) and then led to Q7 thru Q9 thru latch U14, where a digital signal is converted back to an analogue one. Then its output signal is fed to recorder amplifier Q10/Q11 and then modulated with approx. 20kHz carrier frequency oscillated by U26, R54, R55 and C27, and finally amplified by Q12 and Q13 to draw an echogram on the recording paper.

TVG and GAIN Controls (PANEL board, 02P5951 for FE-680T, 02P5953 for FE-680)

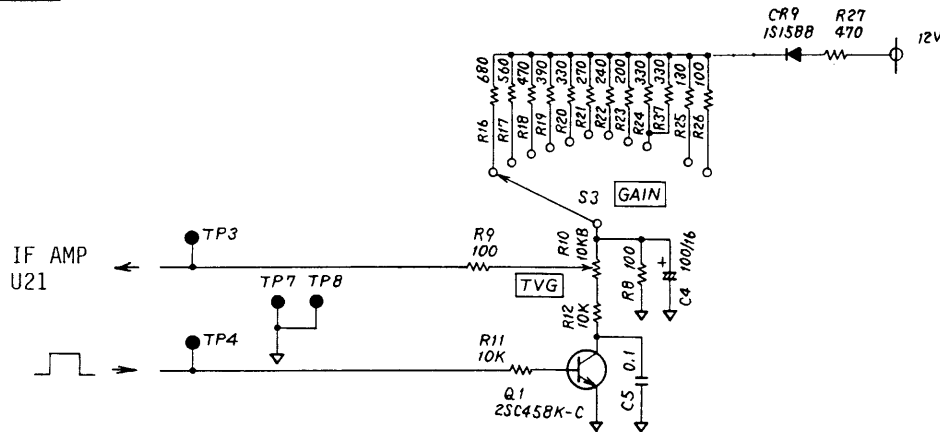


Fig.1-10 TVG and GAIN Control Circuit

TVG is short for Time Varied Gain and works as a time (depth) dependent gain control to obtain an uniform echo presentation. Its curve is shown below. On the contrary, the GAIN control adjusts the receiver sensitivity equally on the entire range.

As soon as a TX KP OUT pulse is fed to Q1 base, C5 starts discharging thru Q1. On the contrary, after its pulse goes away, C5 starts charging up to a certain level, i.e., approx. 0.9 to 2.0V, dependent on the setting of the GAIN control. Its level is sensed by TVG potentiometer R10 and fed to IF amplifier U21 as a gain control signal. Thus, the TVG voltage is adjusted by preset potentiometer R10.

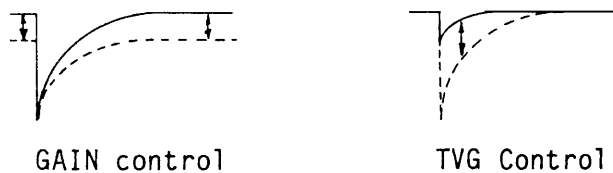


Fig.1-11

1-3. Memory

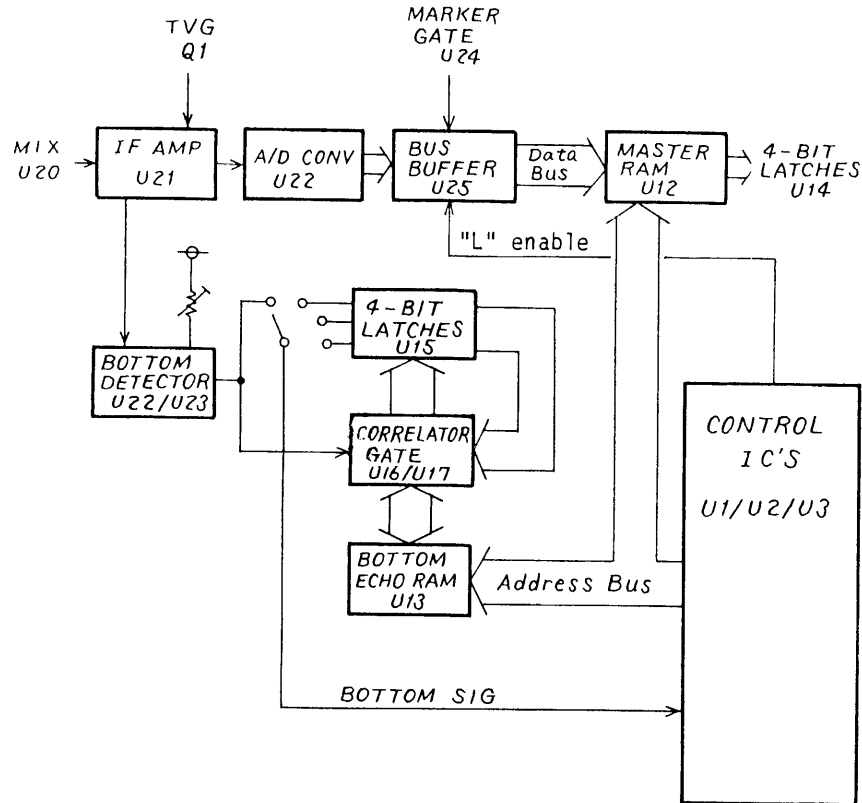


Fig.1-12. Memory Block Diagram

The 3-bit signal coming from A/D CONVERTER U22 passes thru bus buffer U25 when "L" enable gate signal is applied. Then it is stored into RAM U12. Its write address and timing are assigned by the address counter in CONTROL IC'S U1/U2/U3.

The U12 is the master RAM which stores all the data between the start depth and the end depth with the resolution of a 768th of the range.

When the unit is shipped from the factory, it is set to directly feed the BOTTOM SIGNAL to control circuit U1/U2/U3 without using the correlator gate. An output of IF amplifier U21 is also fed to bottom detector U22/U23 which produces a BOTTOM SIGNAL. As a seabed echo is comparatively stronger than fish or flotages, echo signals exceeding a certain threshold is detected as a seabed echo. If this signal varies at every transmission cycle, seabed depth is indicated unstably. Correlator gate U16/U17, bottom echo RAM U13 and 4-bit latch U15 can be used to correlate successive seabed echoes for stable depth indication.

1-4. Belt Drive Motor (MAIN board 02P5949)

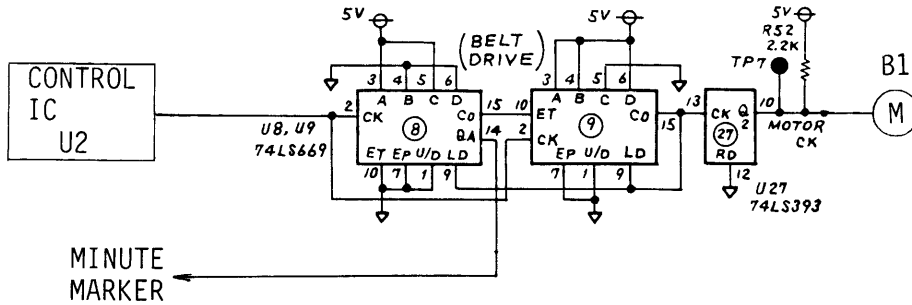


Fig.1-13 Belt Drive Motor Circuit

The belt drive motor is driven by a clock pulse coming from the belt drive clock pulse generator. The belt drive clock pulse generator consists of two synchronous 4-bit up/down counters U8/U9, dual 4-bit binary counter U27 and associated circuit. The circuit divides a clock pulse by 144(= 6x12x2) which is fed from U2-#9. As a result, the belt drive motor is driven by the following frequencies.

Range	Clock at TP7	Sounding Rate
1,2	1200-1400Hz	336
3	600- 700Hz	168
4	300- 350Hz	84
5,6	150- 175Hz	42

1-5. Pen Stop

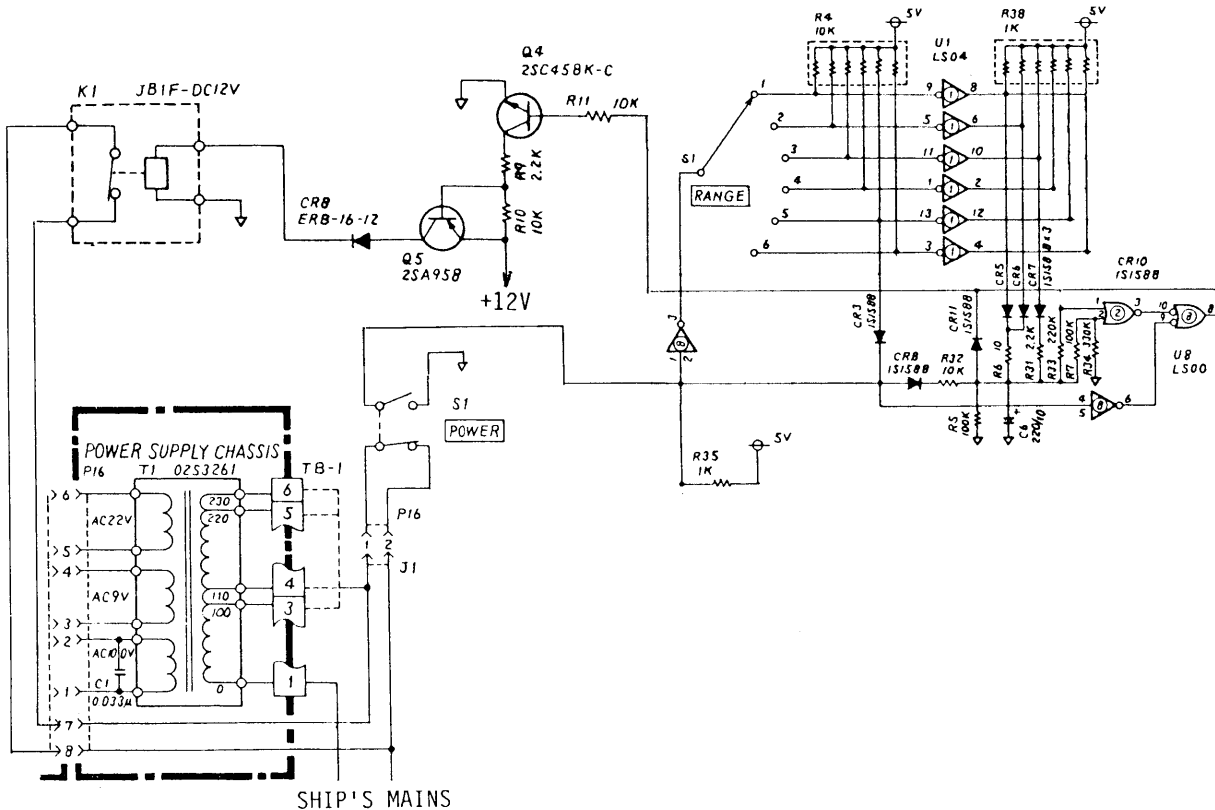


Fig.1-14 Pen Stop Circuit

This circuit is provided to automatically stop the recording stylus at the rear side of the recording plate. i.e., opposite to the recording paper. It may clear away the risk of damaging the recording stylus while changing the recording paper.

Suppose that the POWER switch is turned off now. The belt drive motor goes on rotating at this moment because ship's mains voltage is applied to the entire circuit. On the other hand, switch S1 closes and CR8 anode goes low. Then, the pen stop circuit of U2, U8 and associated circuit produces a positive going pulse. This pulse turns Q4 on, and Q5 goes off to deactivate relay K1. Thus supply voltage is cut off and the belt drive motor stops rotating.

1-6. Paper Feed Motor (PANEL board 02P5951 for FE-680T, 02P5953 for FE-680)

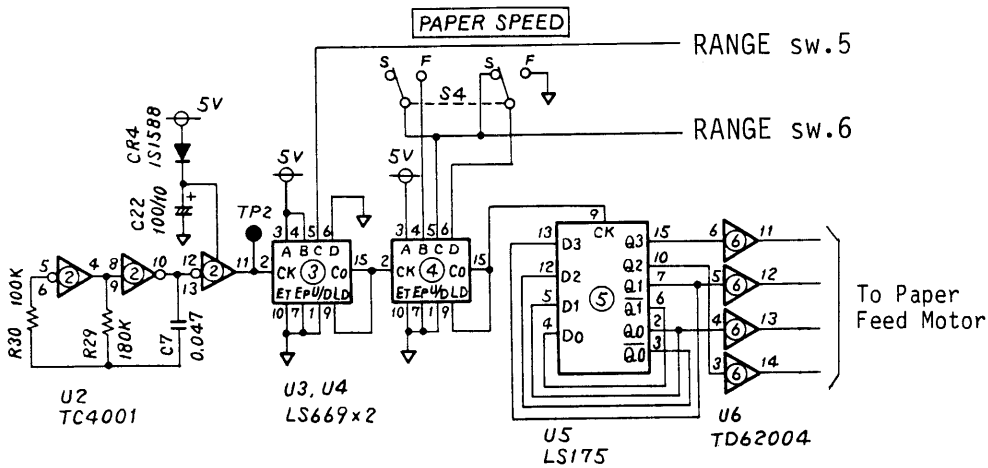


Fig.1-15 Paper Feed Motor Circuit

The paper feed motor is driven by four-phase signal which is generated by U5. U1 and associated circuit oscillate at 120Hz to produce a clock pulse. The clock pulse is fed to U3 and U4. Data inputs U4-B/C/D and U3-C are set by the DEPTH RANGE switch. And data inputs U4-B and D are set by the PAPER SPEED switch. For example, the data inputs are 0011(BCD code) when the DEPTH RANGE switch is set to "3". In this case, a 120Hz clock pulse is divided by 3 to produce a 20Hz clock pulse. Data inputs B, C and D of counter U3 are also controlled by the DEPTH RANGE and PAPER SPEED switches. In like manner, this clock pulse is divided by "2" to obtain the final paper feed motor drive pulse. For other combination of the DEPTH RANGE and PAPER SPEED switches, see the table below to know an actual motor drive frequencies. Paper feeding speed is also verified using minute marks plotted on the recording paper.

Range	Paper Speed	U3 Data Input	Divided by	U3 CO	U4 Data Input	Divided by	U4 CO
1,2,3,4	F (8mm)	0011	4	30Hz	0001	2	15Hz
	S (4mm)	0011	4	30Hz	0011	4	7.5Hz
5	F (4mm)	0001	2	15Hz	0001	2	7.5Hz
	S (2mm)	0001	2	15Hz	0011	4	3.75Hz
6	F (2mm)	0011	4	30Hz	0111	8	3.75Hz
	S (1mm)	0011	4	30Hz	1111	16	1.875Hz

1-7. Digital Display

The Display Board digitally indicates the recording end range and seabed depth. Note that the FE-680T-2 additionally has the phase indicator for operator's warning on use of the phased depth range of 300-700m.

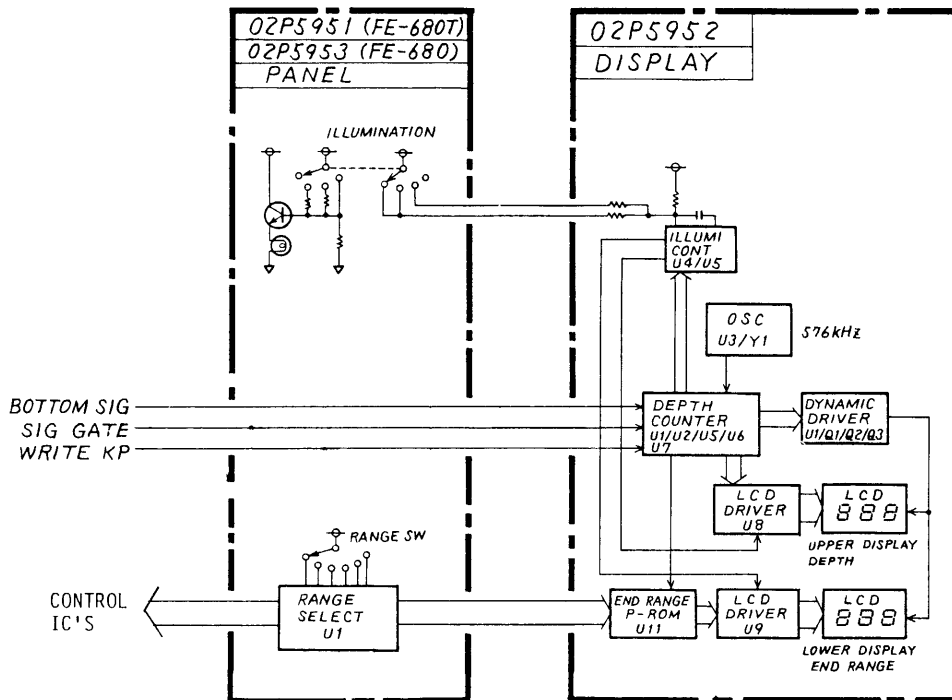


Fig.1-16 Digital Display Circuit

Sea Depth Indication

First, take into account that a stable seabed echo should be plotted on the recording paper in order to read a seabed depth. When the sea bottom is detected by the MAIN board and a BOTTOM SIG pulse is generated. The negative-going BOTTOM SIG pulse is applied to transfer terminal #6 of U6 via U10 gate and U5 multivibrator at the instant, counter U6 stops counting sea depth.

Sea depth is obtained to count a frequency of a clock pulse coming from the reference counter. The depth counter consists of U1, U2, U5 and U6. This circuit is controlled with three pulses; WT-START, BOTTOM SIG and SIG GATE pulses. 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 a clock pulse from U7. This function is performed only while BOTTOM SIG exists within a period of SIGNAL GATE pulse. The counter output is in BCD format like the End Range Data. Therefore, this data is converted and indicated on the LCD displays with the same method. If a sea bottom is not detected within SIGNAL GATE, the counter continues counting upto 999.

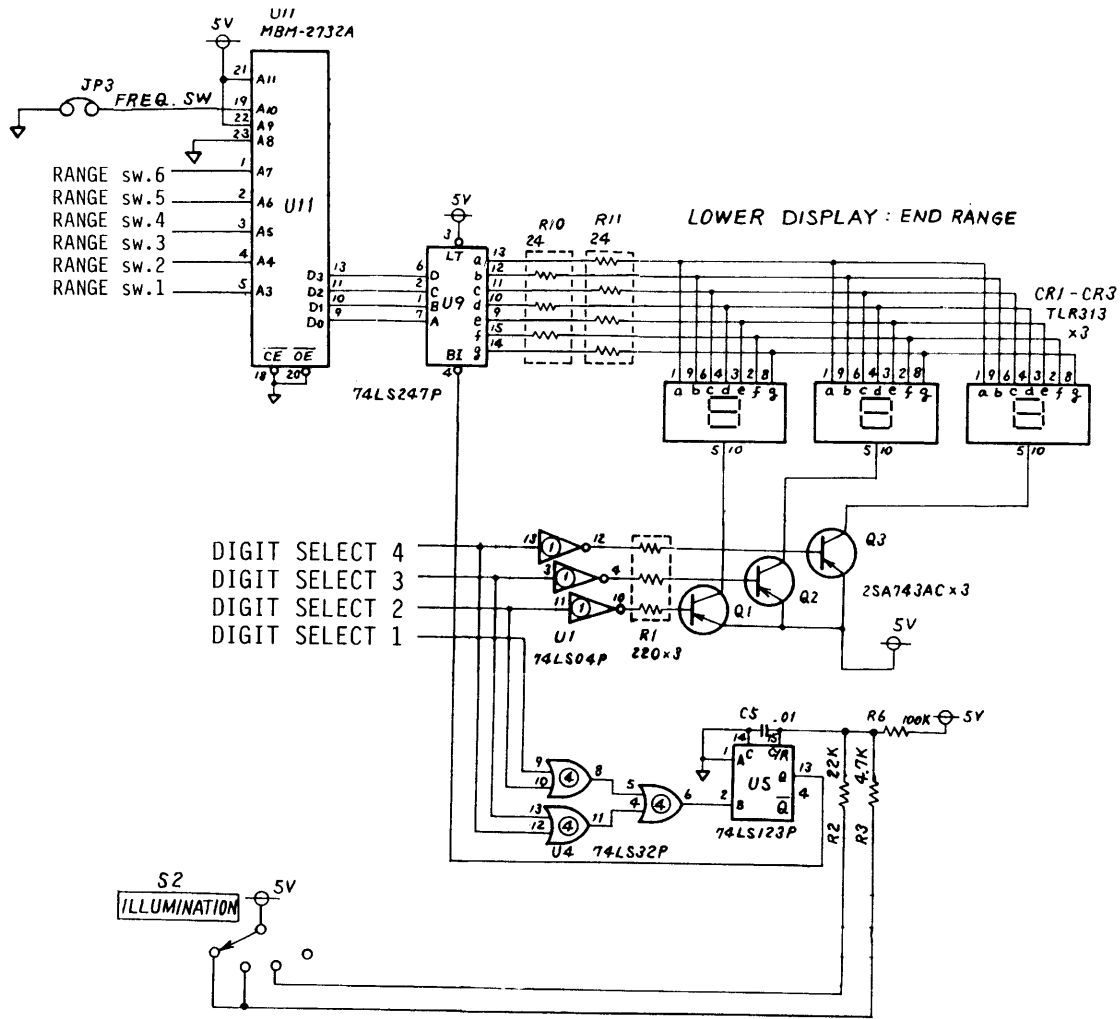


Fig.1-17 Sea Depth Indicator Circuit

End Range

The range setting information coming from RANGE selector circuit U1 is fed to the End Range Programmable ROM U11 to produce end range data according to the preprogrammed equation. Then LCD driver U9 converts U11 output of BCD format data into 7-segment data for indicating an end range. The LCD driver clocks three LCDs at a frequency determined by one shot multivibrator U5. Higher frequency illuminates the LCDs more brightly. This frequency is determined by the value of the resistor connected to the ILLUMINATION control switch S2.

LCD Brightness Control

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

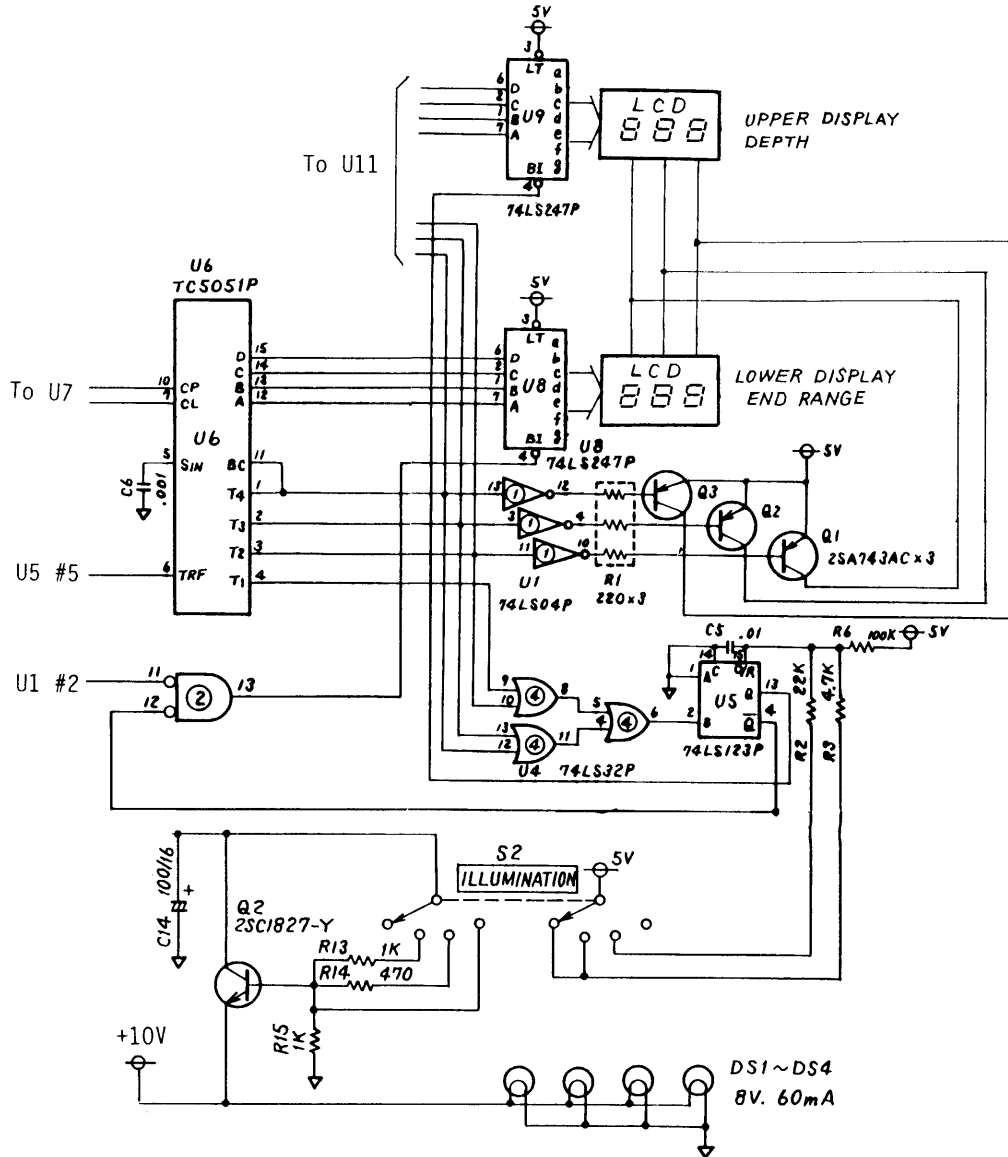


Fig.1-18 LCD Brightness Control Circuit

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

The ILLUMINATION switch selects either R2, R3 or R6 which controls a duty ratio of U5 output. Therefore, a brightness of LED's and the phase indicator is controlled with the different U5 output. Also, the outer wafer of the ILLUMINATION switch selects either R13 or R14 which controls a current flow through Q2. Thus a brightness of illumination lamps DS1-DS4

1-8. Power Supply

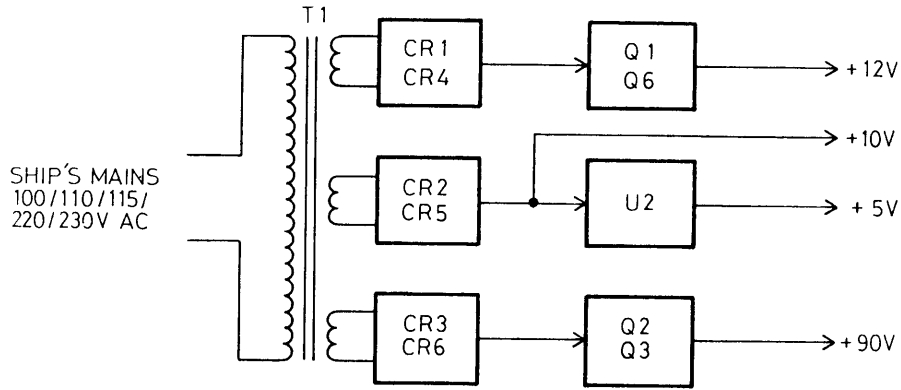


Fig.1-19 Power Supply Block Diagram

The power supply circuit is made up of +5V, +12V and +90V regulators. In addition, +10V unregulated voltage circuit and the pen stop circuit are incorporated.

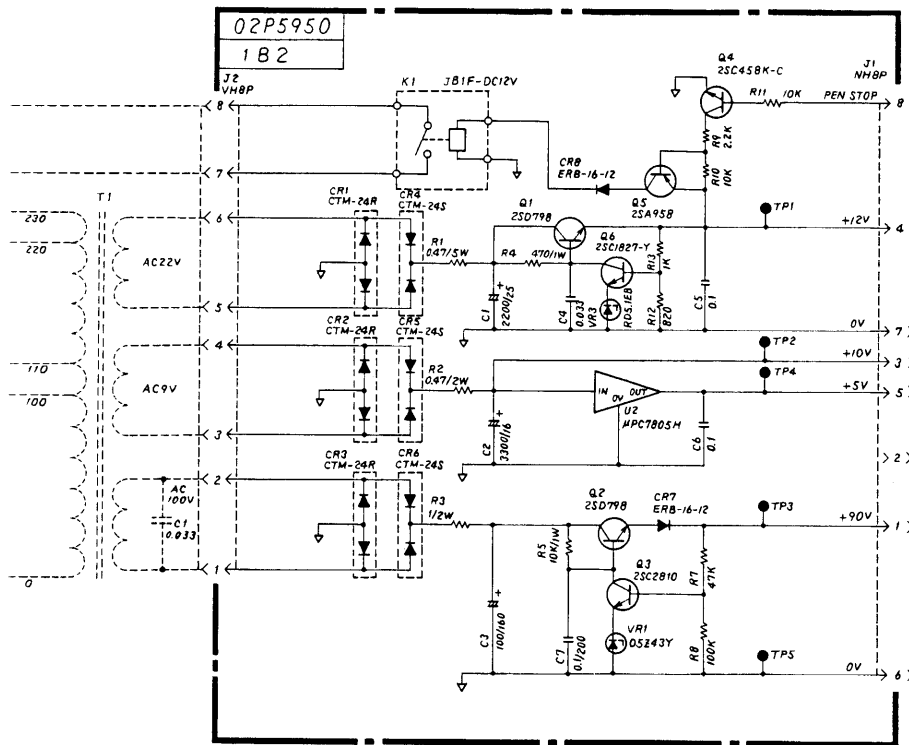


Fig.1-20 Circuit Diagram

CHAPTER 2. ADJUSTMENT

Items to be checked and adjusted on respective circuit boards are listed on page.2-4 together with its check points and its ratings.

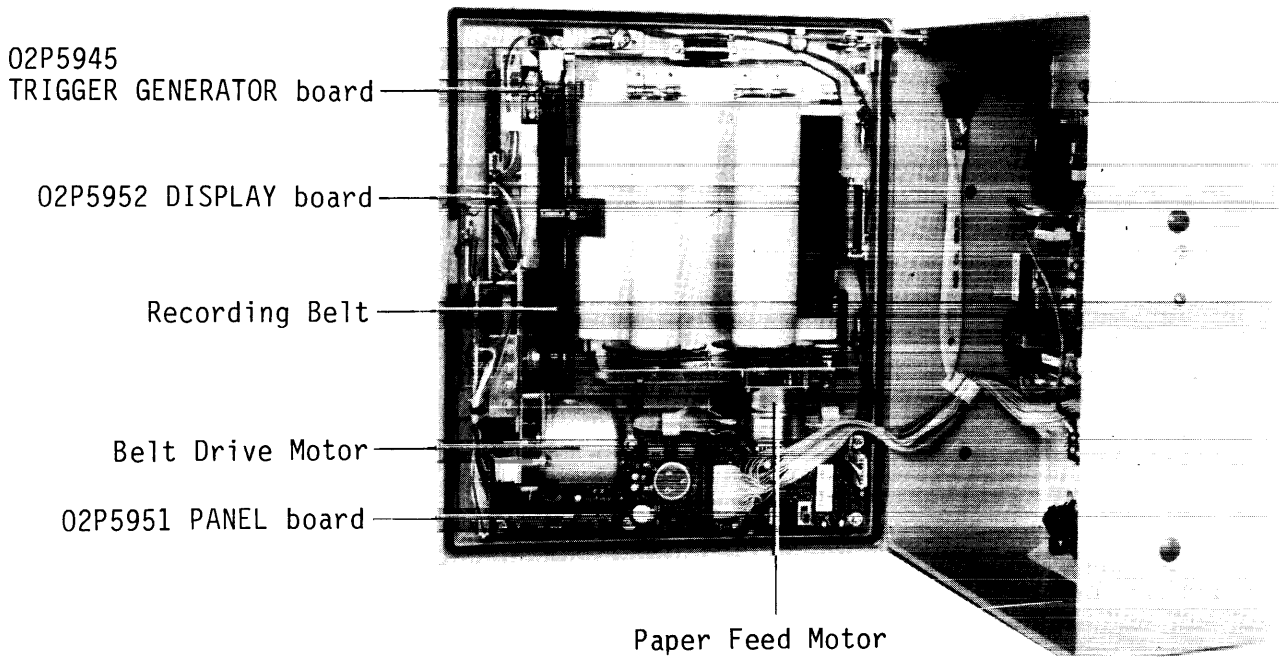
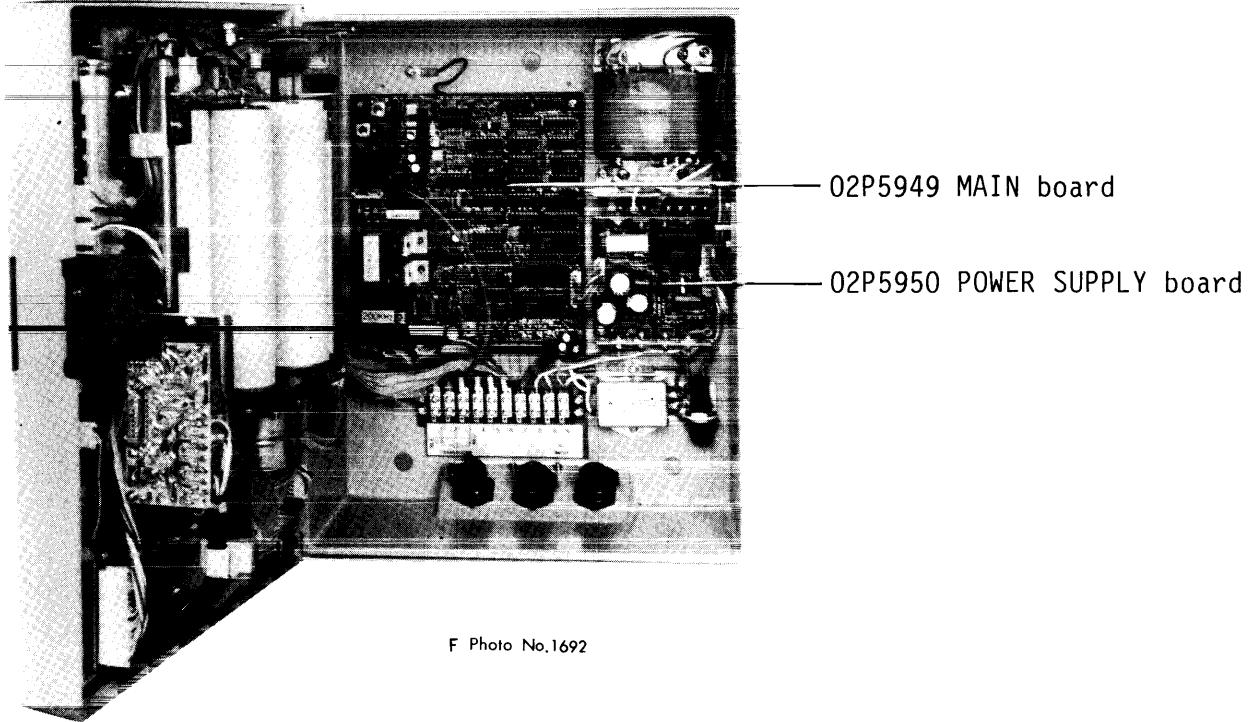


Fig.2-1 Inside View

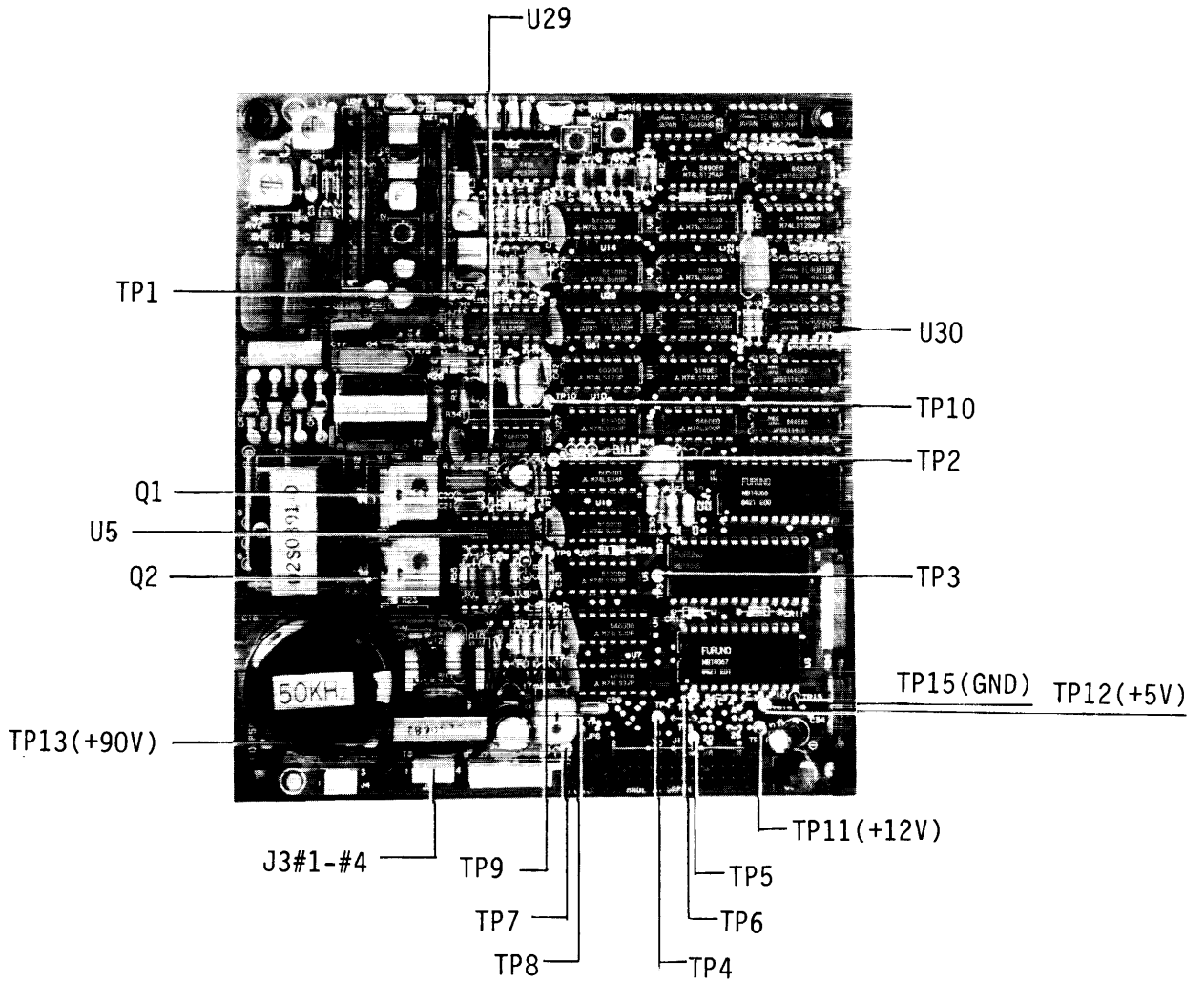


Fig.2-2 O2P5949 MAIN board

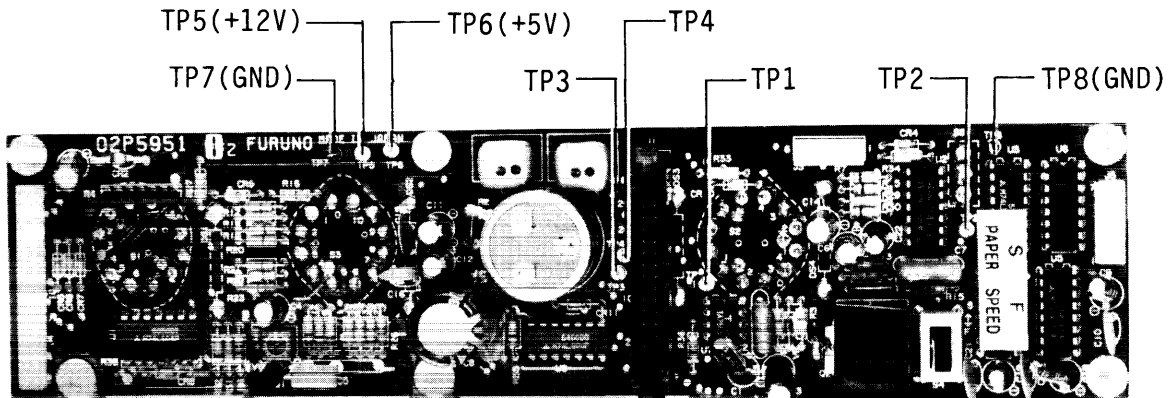


Fig.2-3 O2P5951 PANEL board

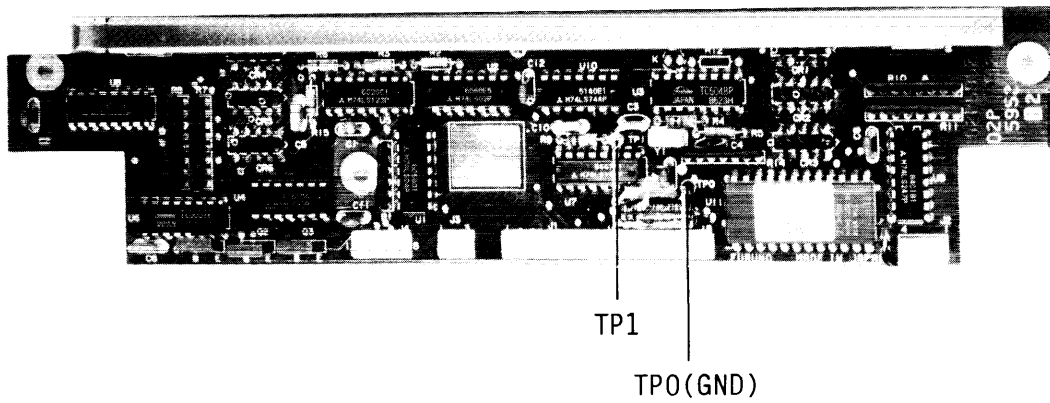


Fig.2-4 02P5952 DISPLAY board

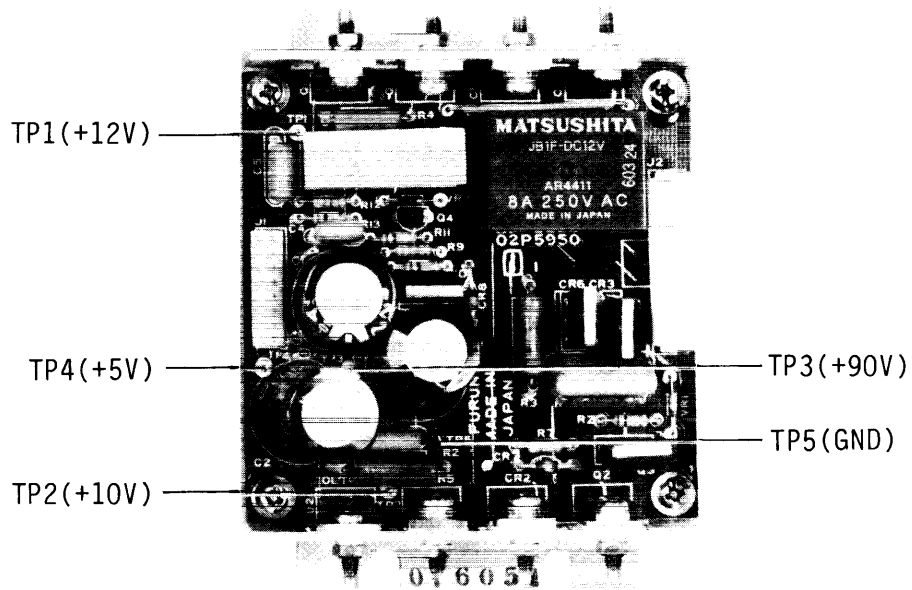


Fig.2-5 02P5950 POWER SUPPLY board

Table 2-1 Check Items

Item	Rating	Check Point	Equipment	Adjustment/Remarks
02P5950 POWER SUPPLY BOARD				
+12V Line Voltage	+12±0.6V	TP1(+)-TP5(-)	Multimeter	
+10V Line Voltage	+7.0 to +11.0V	TP2(+)-TP5(-)		
+90V Line Voltage	+90±10V	TP3(+)-TP5(-)		
+5V Line Voltage	+5±0.3V	TP4(+)-TP5(-)		
02P5949 MAIN BOARD				
TX Output	800-1200Vpp 650-950Vpp	Between TB-1 #1 and TB-1 #3	Oscilloscope	50kHz 200kHz RANGE sw.: 1, 2, 3 RANGE sw.: 4 RANGE sw.: 5, 6
Pulse length	0.3-0.7ms 0.8-1.2ms 1.6-2.4ms	U10 #13(Q)	Oscilloscope	
Ref. Osc. Freq.	800±2kHz	TP10	Freq. Counter	
RX Gain	20mVrms (-34dBV)	TP1(+)-TP15(-)	Digital Voltmeter	Short Q4 emitter resistor R27, and connect the digital voltmeter between TP1(+) and TP15(-). Set the GAIN control to "10" and adjust R2 for 20mVrms. If not, tune L3/L4 and adjust R2. Do not perform this adjustment without attendance of qualified serviceman.
Motor Speed	130mm±2mm, effective recording width	On the recording paper	Not required	
02P5952 DISPLAY BOARD				
Display Calib.	End range	Lower Readout	Not required	Check each readout by changing the RANGE switch. Adjust the distance between the center of drive pulley and idle pulley for 172mm. Unfasten a nut, and move the position of the idle pulley by turning a screw.
OTHERS				
Recording Belt Tension				

CHAPTER 3. MAINTENANCE

3-1. Cleaning

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

To clean up carbon powder accumulated on the pc board or around the recording belt, open the cabinet door and unhook the stopper.

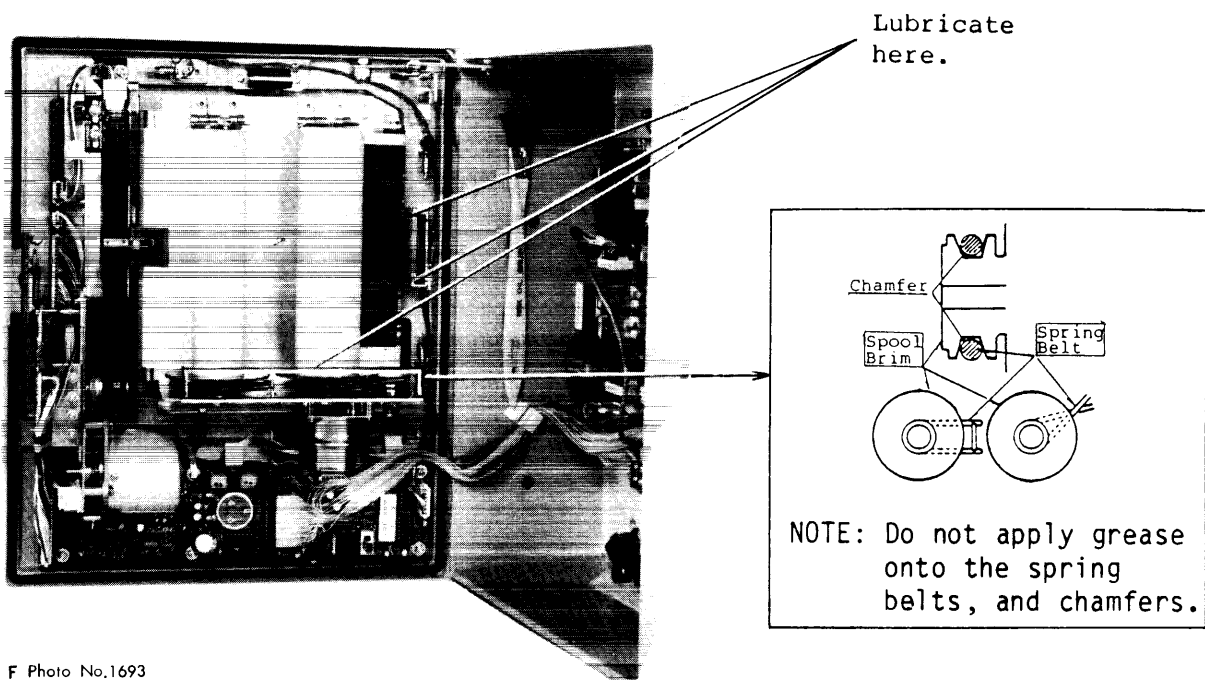
Sweep away carbon powder with the brush attached inside the cabinet. Use of a vacuum cleaner is also effective for removing carbon powder.

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 six months.

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

NOTE: Do not apply grease onto the spring belts, and their chamfers.



F Photo No.1693

3-3. Replacement of Spring Belt

When replacing the Spring Belt (Drive) shown in figure 3-2, beware of twisting direction.

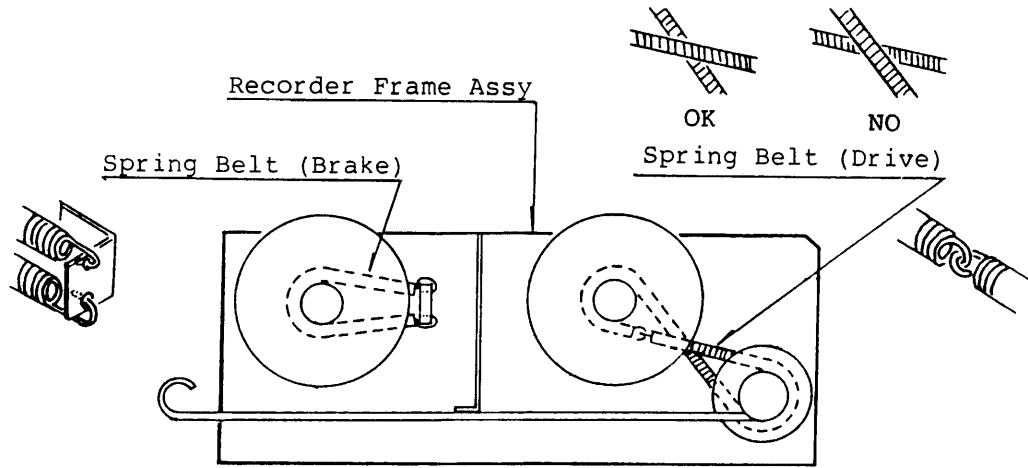


Fig.3-2 Recording Plate Bottom View

3-4. Transducer Check

The transducer unit mainly consists of the vibrating element and the cable. The 50 and 200kHz transducers (electrostriction type) are made of barium titanate ($BaTiO_3$).

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 considerably improved by this exchange, the transducer 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-6B and 200B-8B Transducer Check

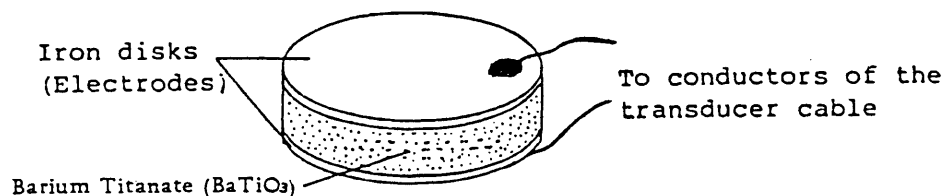


Fig.3-3 Construction of Transducer

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 sandwiching 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

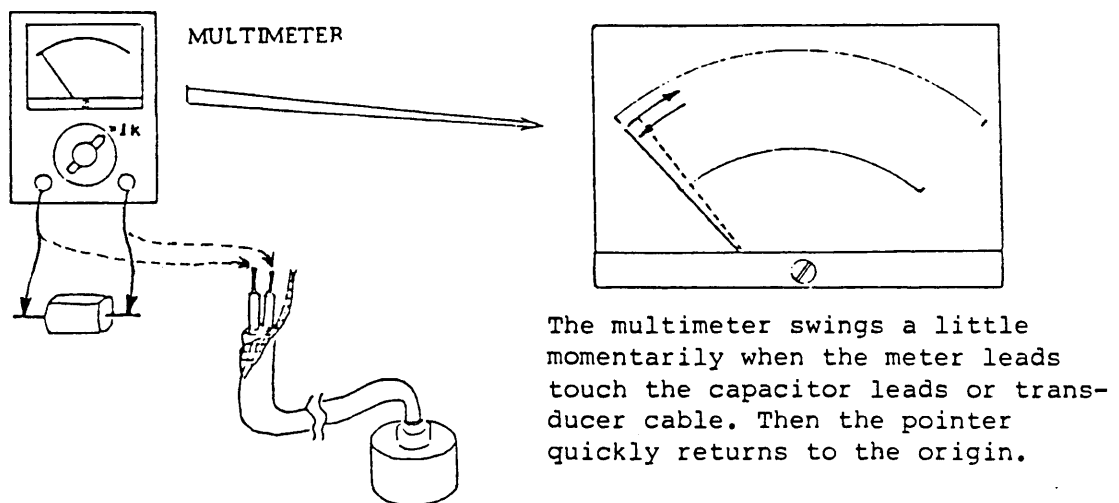
Transducer	Normal Capacitance (between two conductors)
50B-6B	8750pF \pm 10% Including 15m cable (100pF/m).
200B-8B	5600pF \pm 15% Including 15m cable (100pF/m).

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.3-4 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 the figure below.

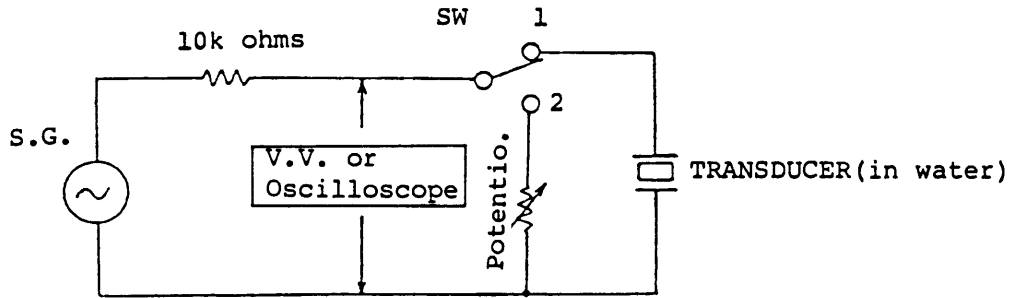


Fig.3-5 Impedance Test

- 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.

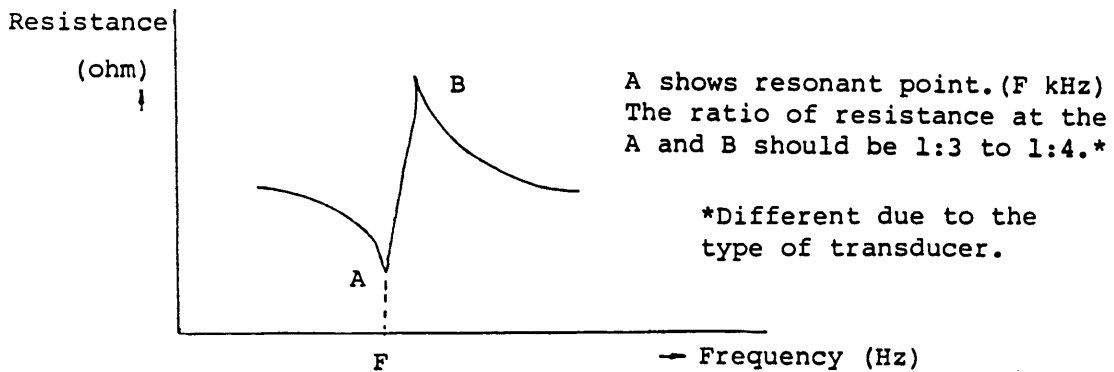


Fig.3-6 Characteristic Curve

CHAPTER 4. TROUBLESHOOTING

All circuits are operated from +10V, +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.

	<u>Page</u>
Turn POWER to ON.	
Not working at all -----	4-2
The following symptoms observed ----- 1. No or abnormal numerical displays. 2. Recording belt not rotate. 3. No recording.	4-2
Recording belt does not rotate but illumination and numerical display are normal. -----	4-3
Paper not advanced. -----	4-3
Adjust GAIN.	
Nothing plotted -----	4-4
Weak recording -----	4-4
No digital depth indication -----	4-5
False digital depth indication -----	4-5

POWER turned on but not working at all.

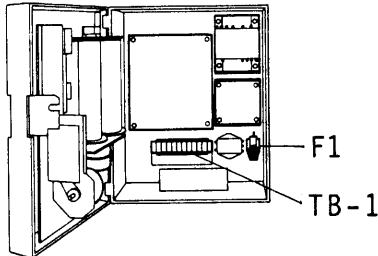
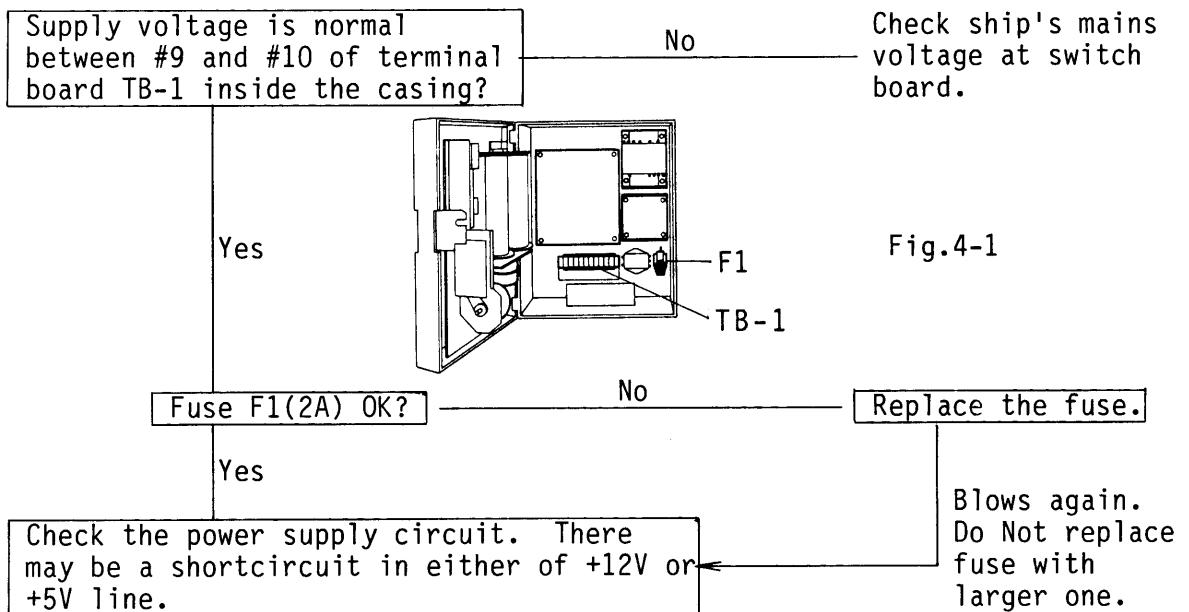
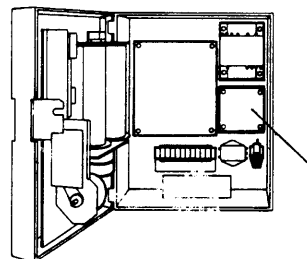
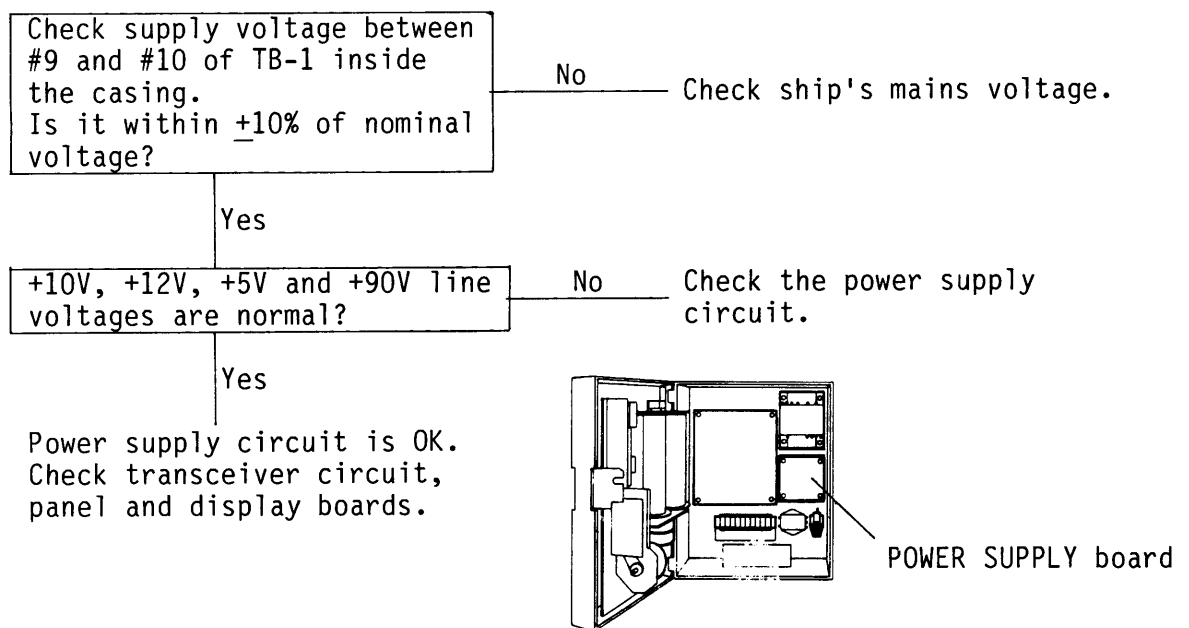


Fig.4-1

The following symptoms observed.

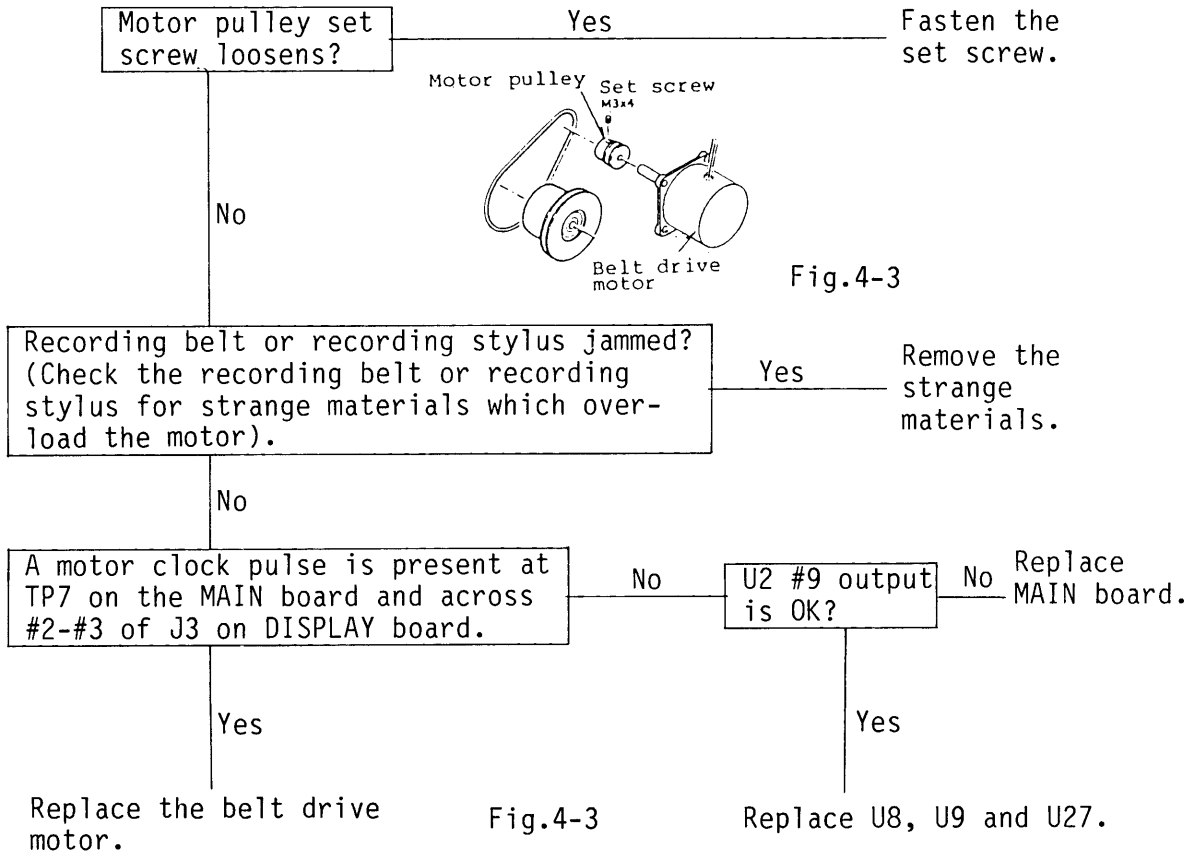
1. No or abnormal numerical displays.
2. Recording belt does not rotate.
3. Nothing plotted.



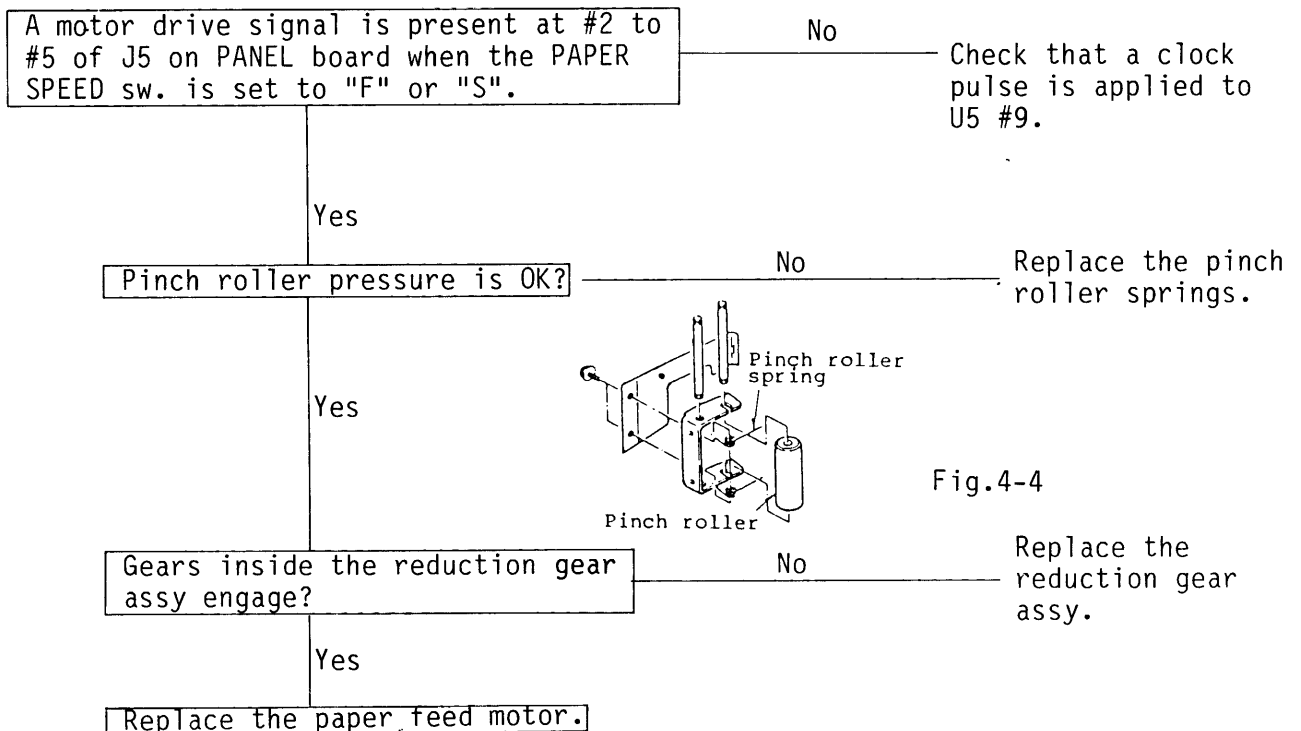
POWER SUPPLY board

Fig.4-2

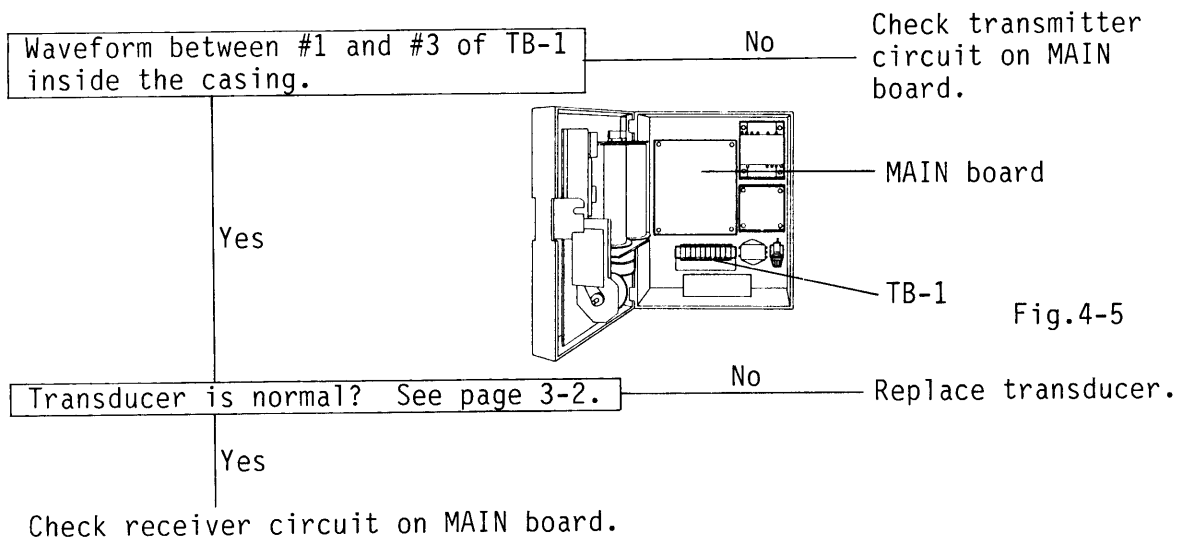
Recording belt does not rotate but illumination and numerical displays are normal.



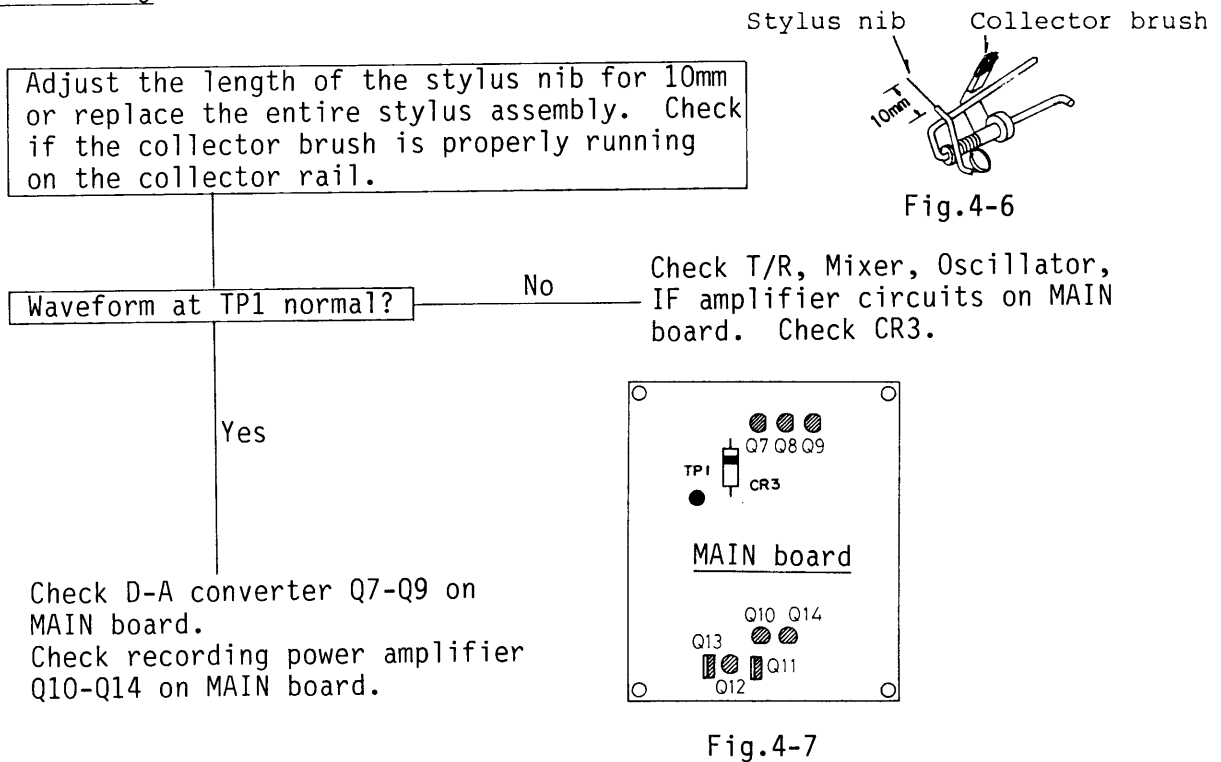
Paper not advanced



Nothing plotted

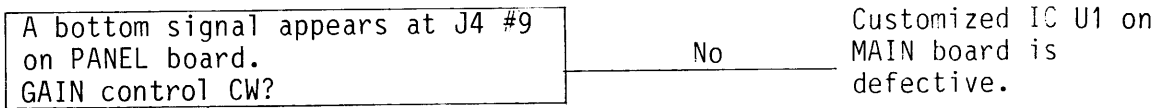


Weak recording



No digital depth indication

Confirm that water depth is more than 5m.



Yes

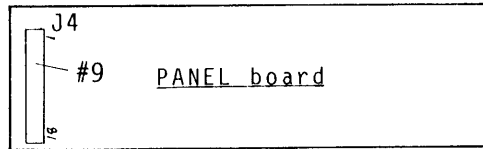
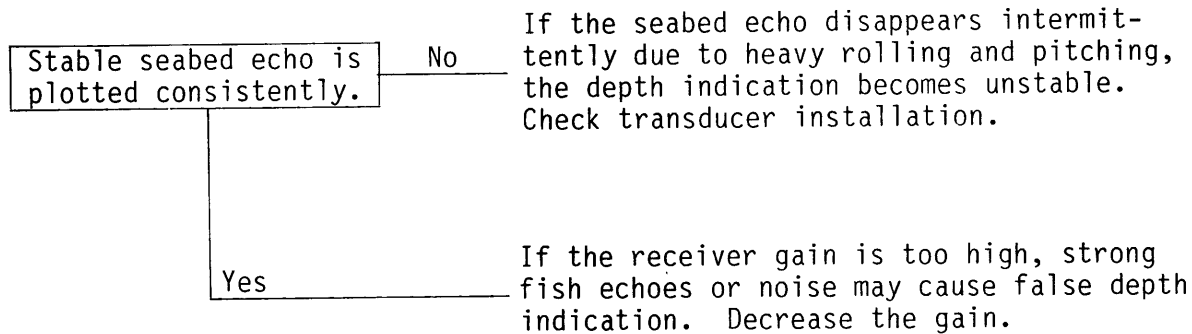


Fig.4-8

Check U8 for selector on DISPLAY board.

Fig.4-15

False digital depth indication

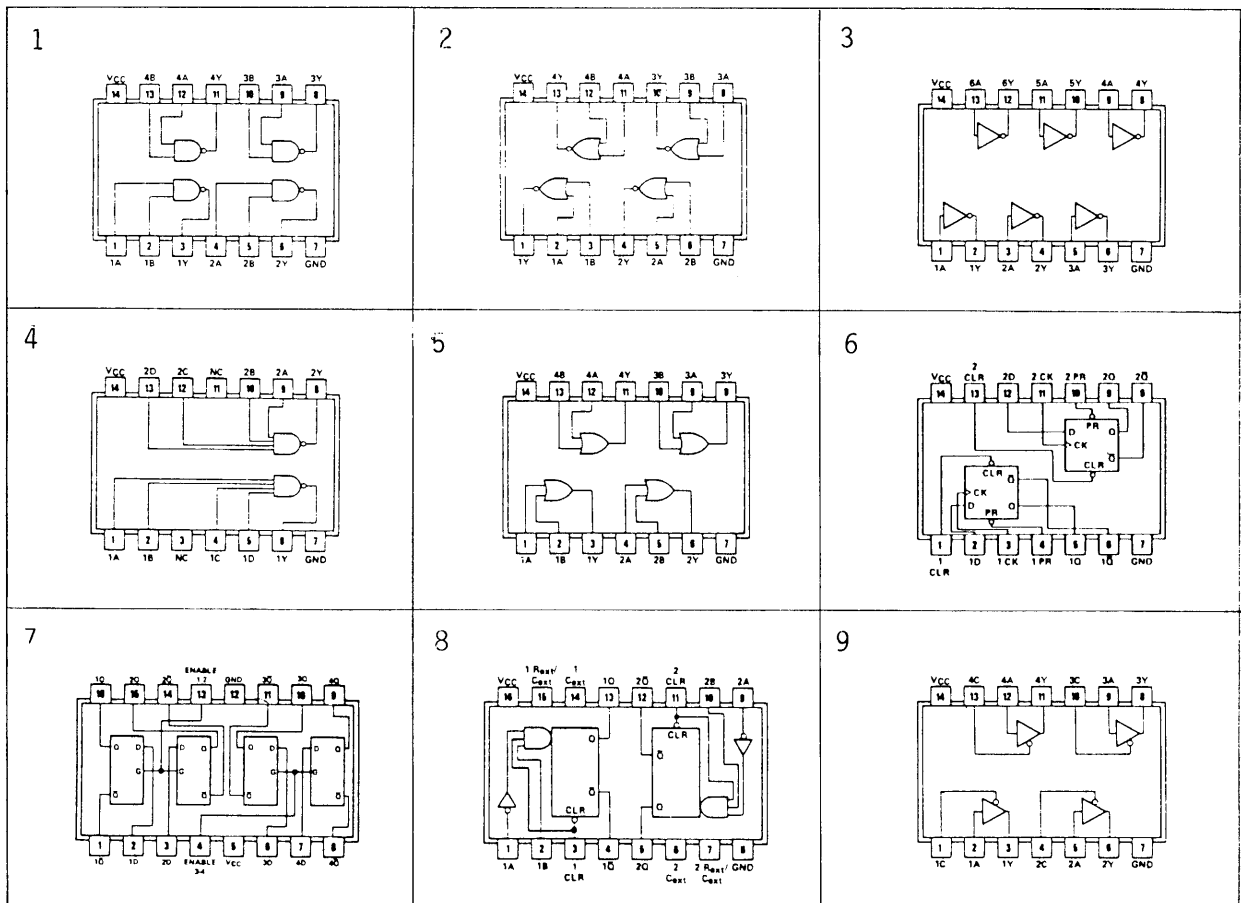


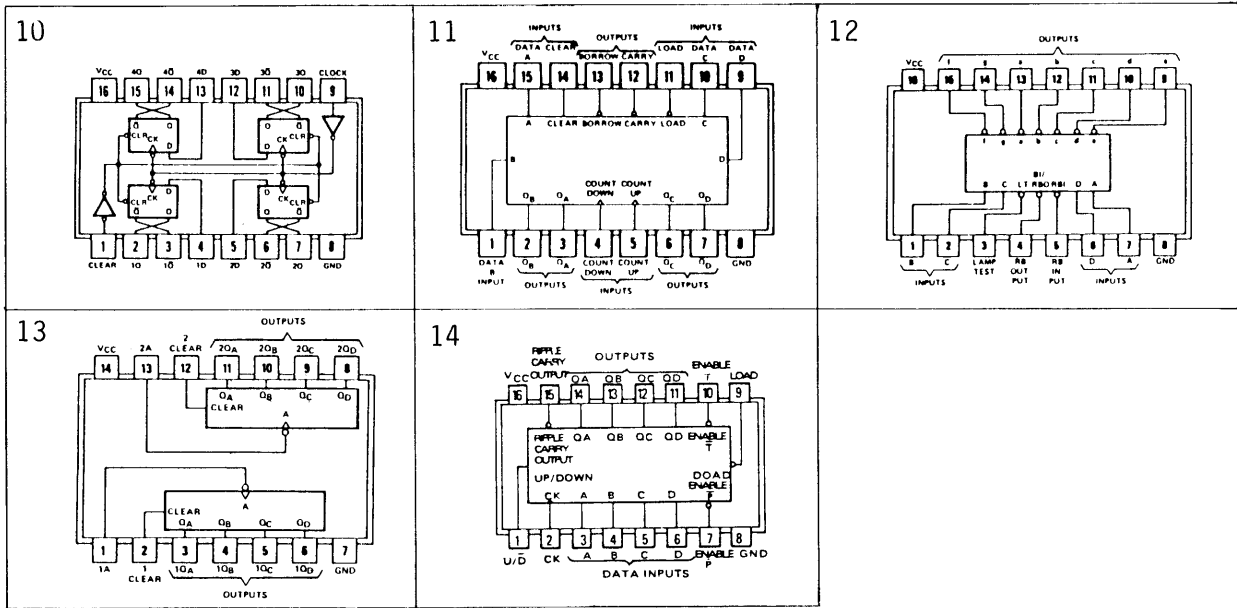
Note: If the set is switched on under heavy interference from other echo sounder or electric machine, the depth indication is effected on the interference.

CHAPTER 5. TECHNICAL DATA

TTL 1C

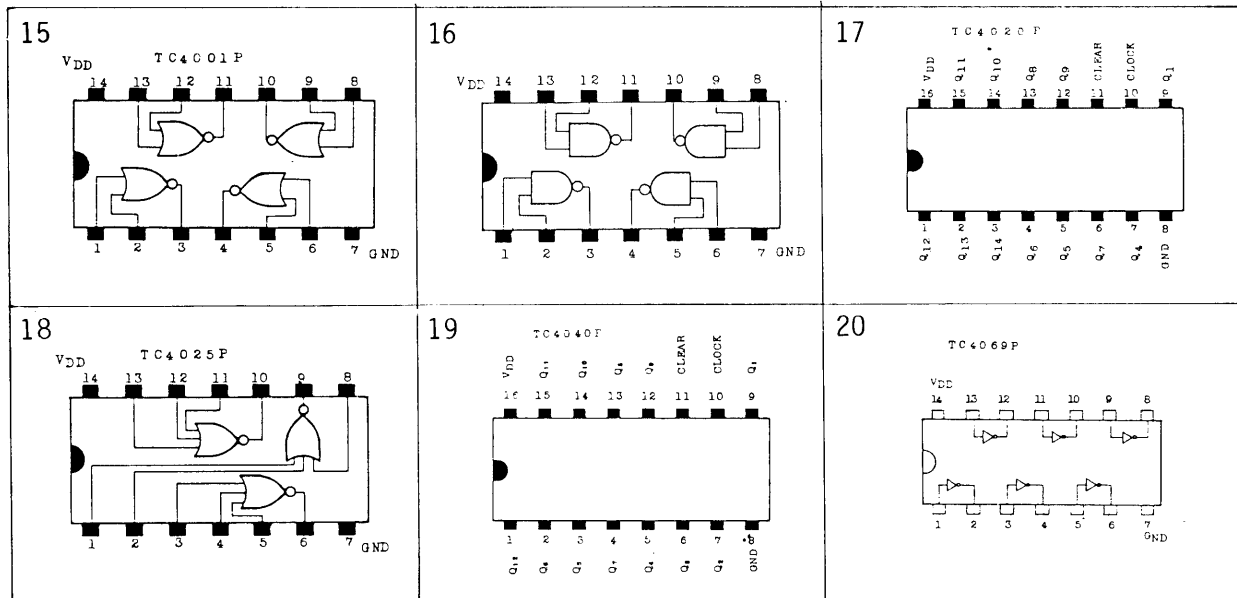
TYPE	FUNCTION	MFR	CODE NO.	FIG.
M74LS00P	Quad 2 Input NAND	MTB	000-151-202	1
M74LS02P	Quad 2 Input NOR		000-151-203	2
M74LS04P	Hex Inverters		000-151-204	3
M74LS20P	Dual 4 Input NAND		000-151-223	4
M74LS32P	Quad 2 Input OR		000-151-192	5
M74LS74AP	Dual D-FFs with Preset and Clear		000-151-193	6
M74LS75P	4-Bit Latches		000-151-209	7
M74LS123P	Dual Retriggerable Single Shot		000-151-190	8
M74LS125AP	Quad 3 State Bus Buffers		000-151-196	9
M74LS175P	Quad D-FFs		000-151-185	10
M74LS193P	Sync 4-Bit Up/Down Dual Ck Counters		000-151-340	11
M74LS247P	BCD to 7 Segment Decoder/Driver		000-151-186	12
M74LS393P	Dual 4-Bit Binary Counters		000-151-220	13
M74LS669P	4-Bit Up/Down Synchronous Counters		000-168-194	14

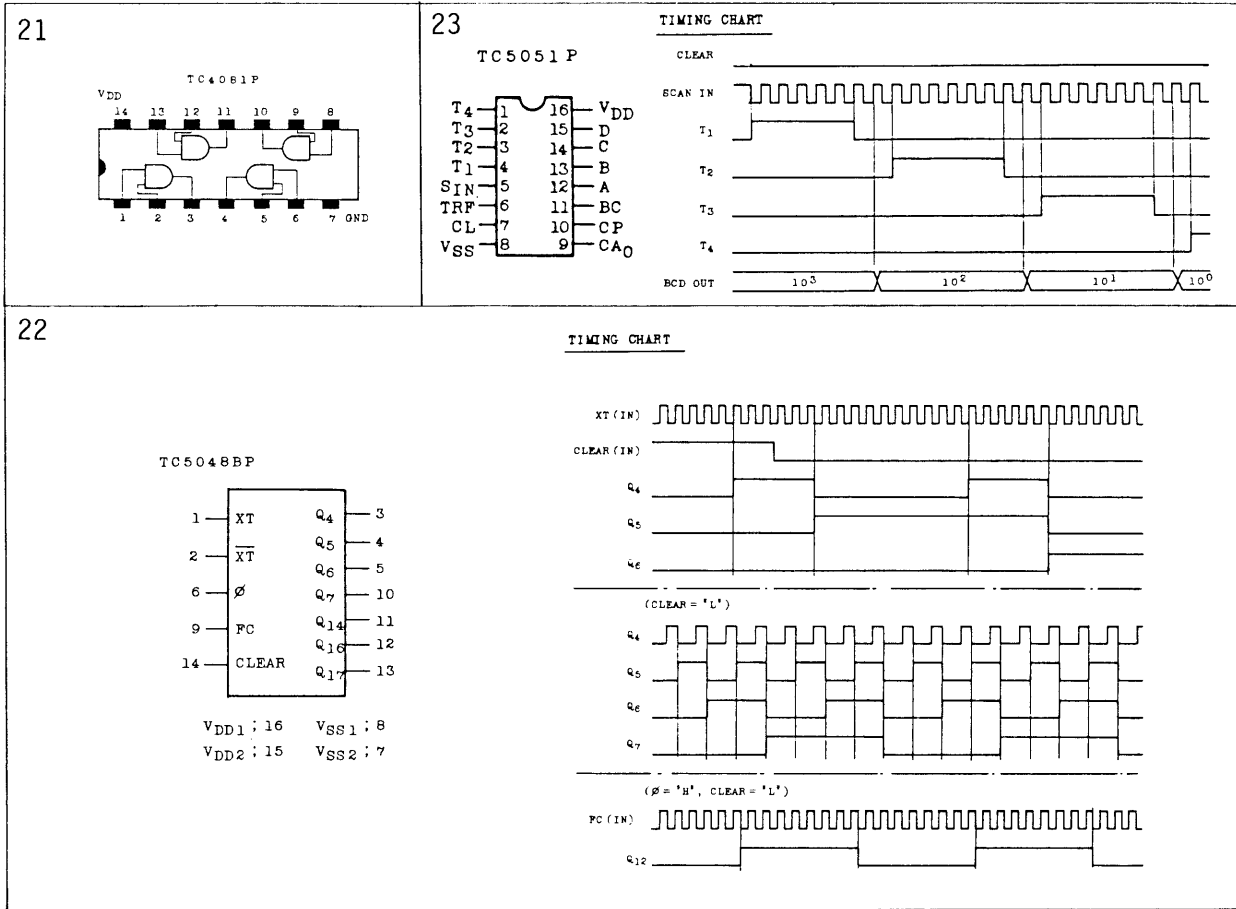




C-MOS IC

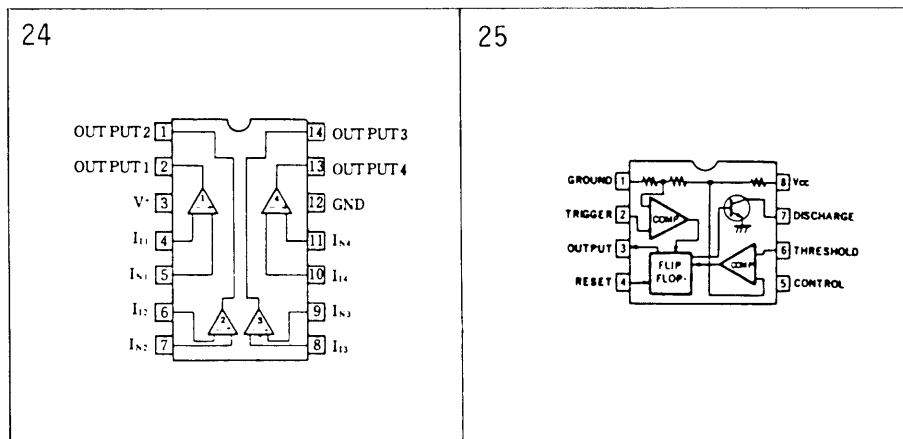
TYPE	FUNCTION	MFR	CODE NO.	FIG.
TC4001BP	Quad 2-Input NOR	TOS ↓	000-163-240	15
TC4011UBP	Quad 2-Input NAND		000-163-313	16
TC4020BP	14-Stage Binary Ripple Counter		000-163-263	17
TC4025BP	Triple 3-Input NOR		000-163-249	18
TC4040BP	12-Stage Binary Ripple Counter		000-163-254	19
TC4069UBP	Hex Inverter		000-163-265	20
TC4081BP	Quadruple 2-Input AND		000-163-231	21
TC5048P	17-Stage High Speed Freq. Divider		000-163-848	22
TC5051P	4 Digit Decade Counter		000-163-342	23





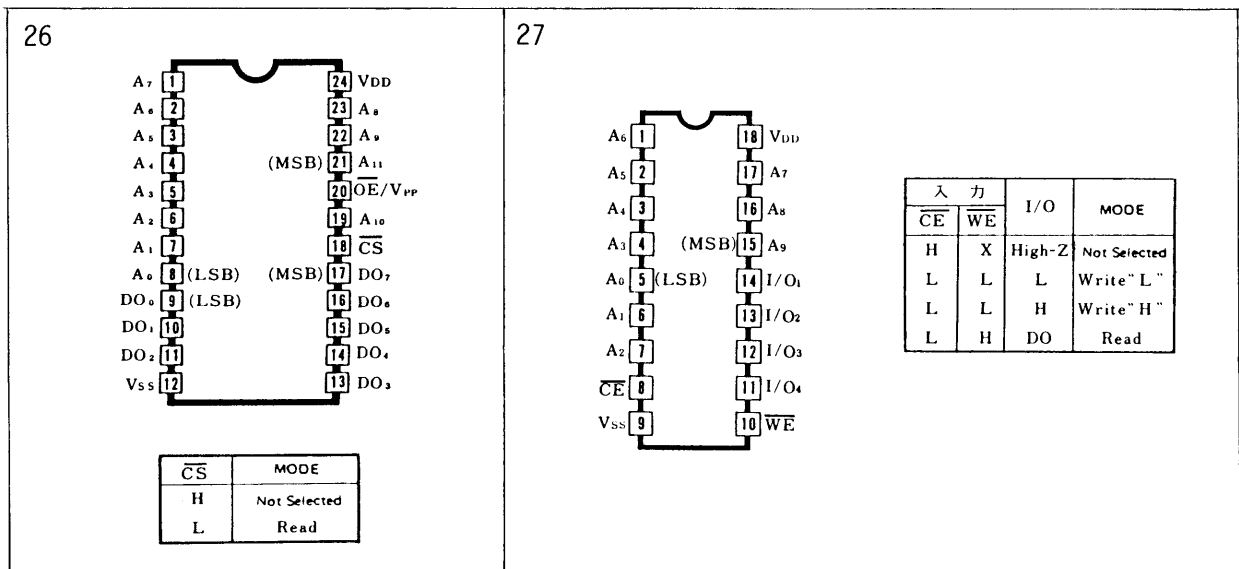
LINEAR IC

TYPE	FUNCTION	FUNCTION	MFR	CODE NO.	FIG.
UPC339C	Quad Voltage Comparator		NEC	000-161-055	24
TA7555	Timer		NEC	000-163-007	25



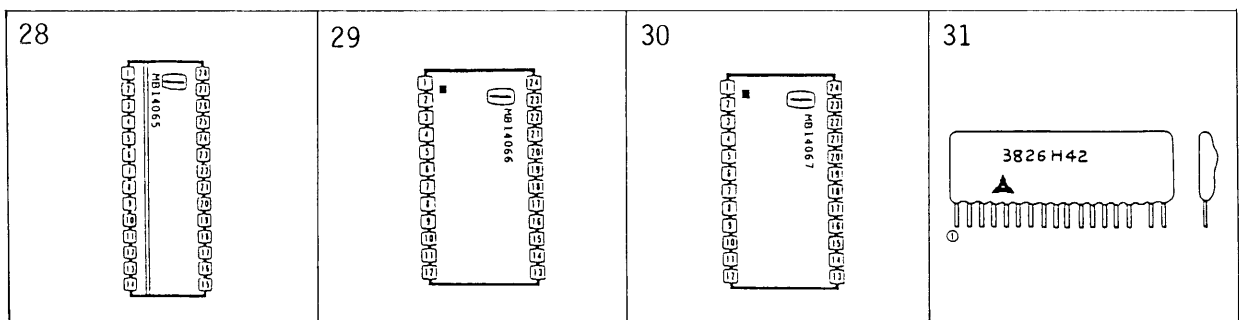
MEMORY IC

TYPE	FUNCTION	MFR	CODE NO.	FIG.
MBM2732A-35Z-G	4K Byte MOS ROM	FUJ	000-157-371	26
MBM2114A-15LM-G	4K nMOS Static RAM (1024x4)	FUJ	000-157-346	27

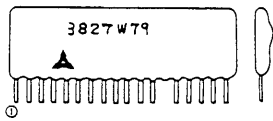


OTHERS

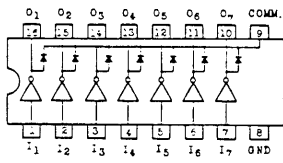
TYPE	FUNCTION	FUNCTION	MFR	CODE NO.	FIG.
MB14065	Custom IC	Timing Generater	FUJ	000-157-550	28
MB14066	Custom IC	Timing Generater	FUJ	000-157-551	29
MB14067	Custom IC	Timing Generater	FUJ	000-157-552	30
EHM3826H42	Custom IC	IF AMP	MAT	000-164-258	31
EHM3827W79	Custom IC	MIXER	MAT	000-164-259	32
TD62004P	Large Current Transistor Array		TOS	000-163-091	33
UPC7805H	3-Terminal Regulator		NEC	000-161-175	34



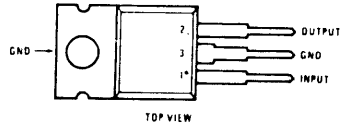
32



33



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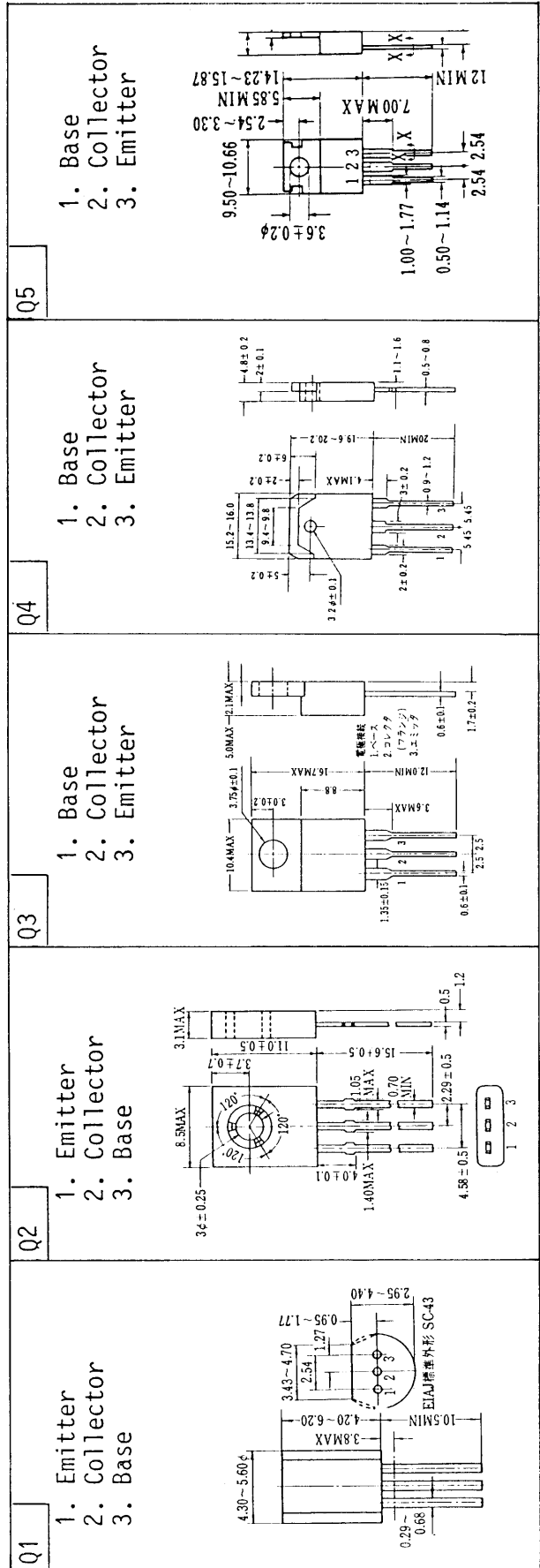


TRANSISTOR and DIODE

*** TRANSISTOR ***

TYPE	CODE NO.	MFR.	CONSTRUCTION	ABSOLUTE MAX RATINGS AT 25°C CHARACTERISTICS(25°C)						TO OUT-LINE NO.			
				VCBO (V)	VEBO (V)	IC (MA)	PC (MW)	TJ (°C)	VCE IC (V)		HFE	FT (MHZ)	
2SA733	000117445	NEC	SI.E	-60	-5	-100	250	125	-6	-1	200	180	Q1
2SA743A-C	000117466	HTC	RF.PA	-50	-4	-1A	8W	150	-4	-50	120	120	Q2
2SA958	000118016	SKN	SI.ME	-200	-6	-2A	30W	150	-10	-700	100	20	Q3
2SC1827-Y	000125651	SKN	SI.TME	100	6	4A	30W	150	4	1	100	10	Q3
2SC2810	000126321	SKN	SI.TP	500	10	7A	50W	150	4	3A	15	15	Q3
2SC3520	000126280	SKN	SI	500	10	18A	130W	150	4	10	15	15	Q4
2SC458K-C	000123675	HTC	SI.EPA	30	5	100	200	125	12	2	160	230	Q1
2SD798	000100268	TOS	SI.T	600	5	6A	30W	150	2	2A	1500	1500	Q5

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.



*** DIODE ***

TYPE	CODE NO.	MFR.	CONST- CATION RUCTION	ABSOLUTE MAX RATINGS AT 25°C						FORWARD (25°C)			REVERSE (25°C)			OUT- LINE
				VRM (V)	VR (V)	VI (V)	IFM (MA)	IO (MA)	IS (A)	IF (MA)	VF (V)	IF (A)	IF (A)	IR (UA)	VR (V)	
CTM-24R	000132435	SND	SI.D	400	280	8A	100	1.3	5	10	400	D1				
ERB16-12	000132850	FJD	SI.D	1200	1.3A	40	1.1	10				D2				
1S598	000114011	NEC	D.MIX	150mW	5	50	0.34	1mA	0.5	1	03					
1S1588	000112795	TOS	SI.EP	35	30	360	120	0.5	1.3	0.1	0.5	30	D4			

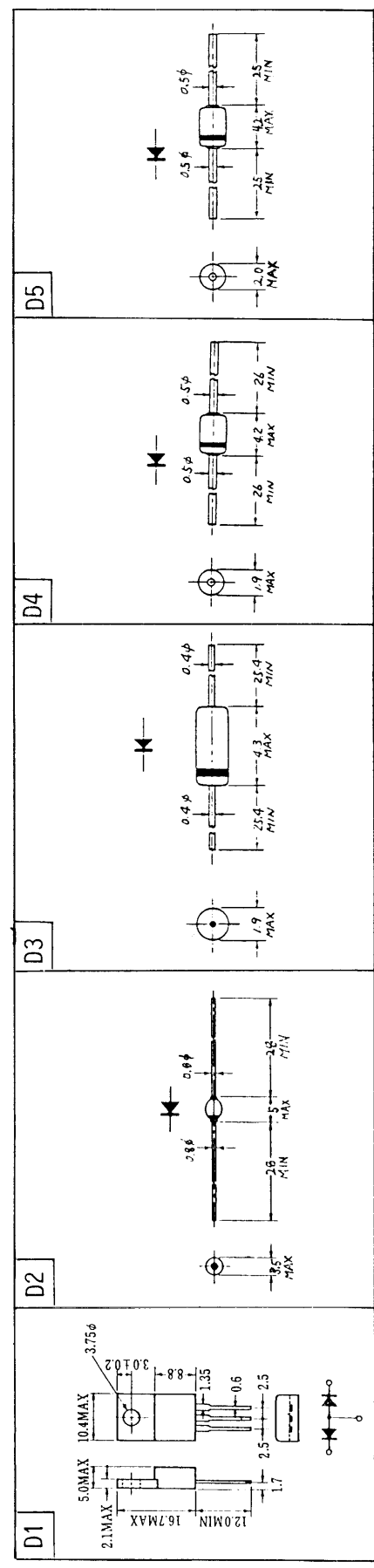
NOTE: VR=MAXIMUM REVERSE VOLTAGE, VR=MAX DC REVERSE VOLTAGE, VI=MAX AC INPUT VOLTAGE(RMS), IFM=MAX PEAK FORWARD CURRENT, IO=MAX AVERAGE DC OUTPUT CURRENT, IS=MAX FORWARD TRANSIT CURRENT, IF=FORWARD CURRENT, VF=FORWARD VOLTAGE, IR=REVERSE CURRENT, VR=REVERSE VOLTAGE.

*** ZENER DIODE ***

TYPE	CODE NO.	MFR.	CONST- CATION RUCTION	ABS MAX			ZENER VOLTAGE VZ			MAX DYNAMIC THERMAL REVERSE			OUT- LINE
				P (MW)	Iz (MA)	Pz (V)	MIN (V)	AVG (V)	MAX (V)	RZ (OHM)	Iz (MA)	IZ (%) / °C	
RDS.1EB	000134838	NEC	SI.PL	400	4.8	5.3	20	20	20	5	1.5	05	
05243Y	000110811	TOS	SI.PL	500	10	43.0	45.0	5	75	5	0.110	04	
0525.6Y	000110487	TOS	SI.P	500	82	5.8	5	30	5	0.032	1	2	

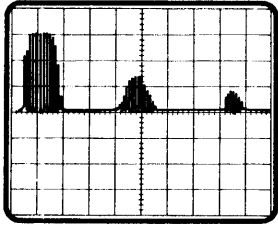
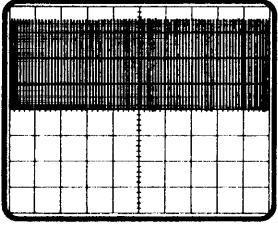
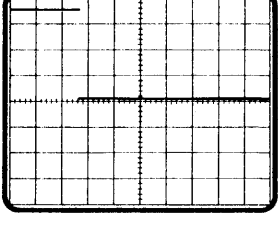
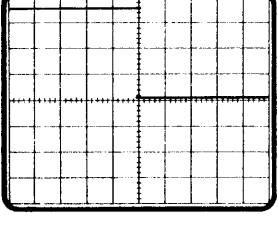
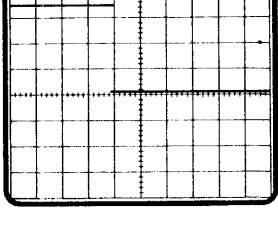
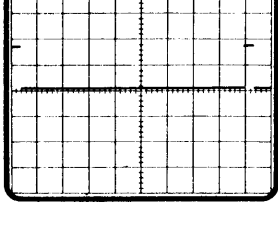
NOTE: P=MAXIMUM POWER DISSIPATION, IZ=ZENER CURRENT, IR=REVERSE CURRENT, VR=REVERSE VOLTAGE.

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

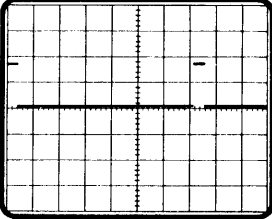
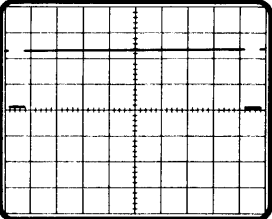
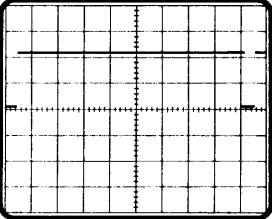
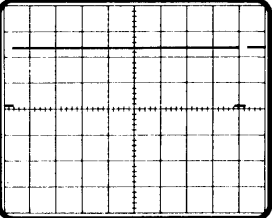
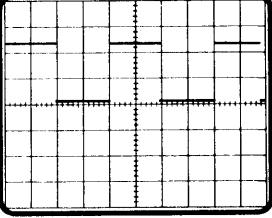
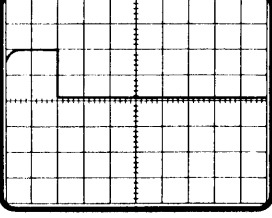


WAVEFORMS

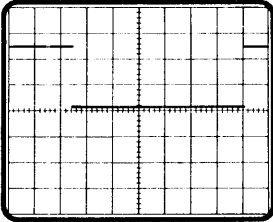
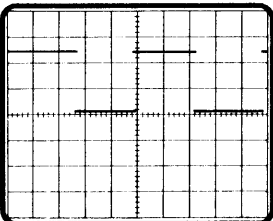
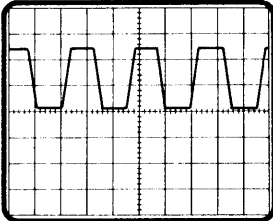
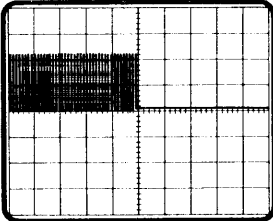
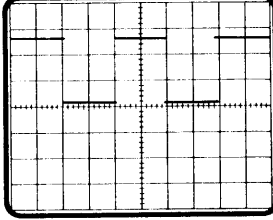
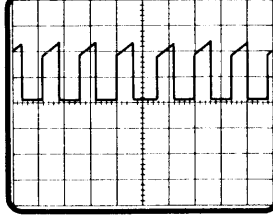
UNIT/BLOCK: MAIN 1B1(02P5949)

<p>TP1</p> <p>OV</p>		<p><u>IF Signal</u></p> <p>Trigger :Internal X-scale : 0.5m s/div. Y-scale : 1 v/div. DEPTH RANGE: 1 or 2</p>
<p>TP2</p> <p>OV</p>		<p><u>CLOCK OSC.</u></p> <p>Trigger :Internal X-scale : 0.5μ s/div. Y-scale : 1 v/div.</p> <p>f=11.08MHz</p>
<p>TP3</p> <p>OV</p>		<p><u>TX KP</u></p> <p>Trigger :Internal X-scale : 0.2m s/div. Y-scale : 1 v/div. DEPTH RANGE: 1, 2 or 3</p>
<p>TP3</p> <p>OV</p>		<p><u>TX KP</u></p> <p>Trigger :Internal X-scale : 0.2m s/div. Y-scale : 1 v/div. DEPTH RANGE: 4</p>
<p>TP3</p> <p>OV</p>		<p><u>TX KP</u></p> <p>Trigger :Internal X-scale : 0.5m s/div. Y-scale : 1 v/div. DEPTH RANGE: 5 or 6</p>
<p>TP3</p> <p>OV</p>		<p><u>TX KP</u></p> <p>Trigger :Internal X-scale : 20m s/div. Y-scale : 2 v/div. DEPTH RANGE: 1 or 2</p>

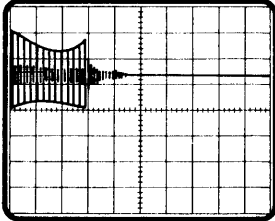
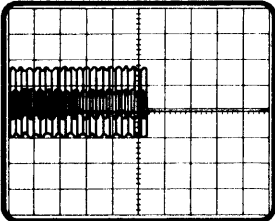
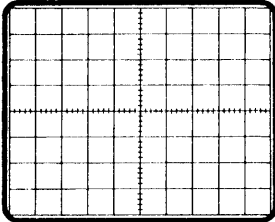
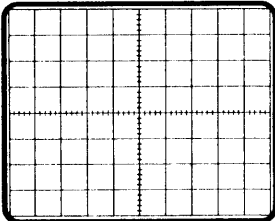
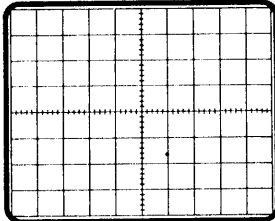
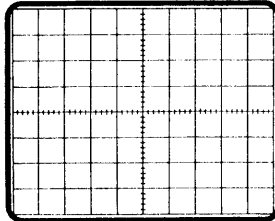
UNIT/BLOCK: MAIN 1B1(02P5949)

<p>TP3</p>	<p>OV</p> 	<p><u>TX KP</u></p> <p>Trigger : Internal X-scale : 0.2 s/div. Y-scale : 2 v/div. DEPTH RANGE: 5 or 6</p>
<p>TP4</p>	<p>OV</p> 	<p><u>SIG. GATE</u></p> <p>Trigger : Internal (SLOPE -) X-scale : 20m s/div. Y-scale : 2 v/div. DEPTH RANGE: 1</p>
<p>TP5</p>	<p>OV</p> 	<p><u>READ KP</u></p> <p>Trigger : Internal (SLOPE -) X-scale : 20m s/div. Y-scale : 2 v/div. DEPTH RANGE: 1 or 2</p>
<p>TP6</p>	<p>OV</p> 	<p><u>WRITE KP</u></p> <p>Trigger : Internal (SLOPE -) X-scale : 20ms/div. Y-scale : 2 v/div. DEPTH RANGE: 1 or 2</p>
<p>TP7</p>	<p>OV</p> 	<p><u>MOTOR CK</u></p> <p>Trigger : Internal X-scale : 0.2m s/div. Y-scale : 2 v/div. DEPTH RANGE: 1 or 2</p>
<p>TP8</p>	<p>OV</p> 	<p><u>TX KP (DRAFT)</u></p> <p>Trigger : Internal X-scale : 20μ s/div. Y-scale : 2 v/div. DRAFT: OFF</p>

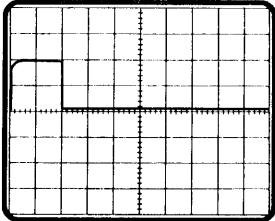
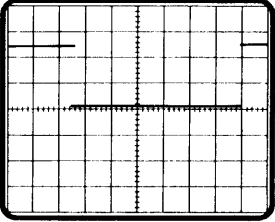
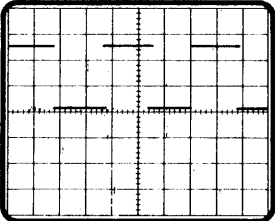
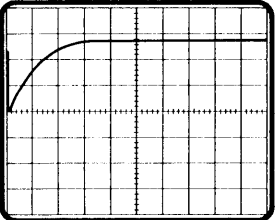
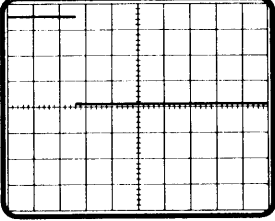
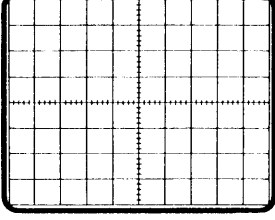
UNIT/BLOCK: MAIN 1B1(02P5949)

<p>TP8</p> <p>OV</p>		<p><u>TX KP (DRAFT)</u></p> <p>Trigger : Internal X-scale : 20ms/div. Y-scale : 2v/div. DRAFT: MAX</p>
<p>TP9</p> <p>OV</p>		<p><u>MOD. OSC.</u></p> <p>Trigger : Internal X-scale : 10μs/div. Y-scale : 2v/div.</p> <p>f=20kHz</p>
<p>TP10</p> <p>OV</p>		<p><u>REF. OSC.</u></p> <p>Trigger : Internal X-scale : 0.5μs/div. Y-scale : 2v/div.</p>
<p>U29 #3</p> <p>OV</p>		<p><u>DRIVER</u></p> <p>Trigger : Internal X-scale : 0.1ms/div. Y-scale : 2v/div.</p>
<p>U30 #6</p> <p>OV</p>		<p><u>MINUTE MARKER OSC.</u></p> <p>Trigger : Internal X-scale : 2ms/div. Y-scale : 2v/div.</p>
<p>U5 #6</p> <p>OV</p>		<p><u>RANGE ENCODER OUT</u></p> <p>Trigger : Internal X-scale : 0.5μs/div. Y-scale : 2v/div. DEPTH RANGE: 5 or 6</p>

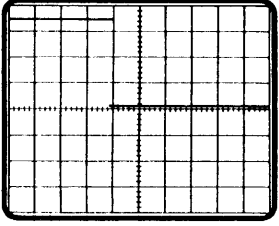
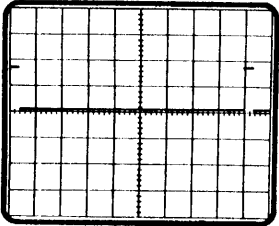
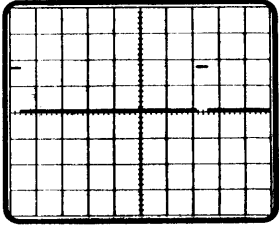
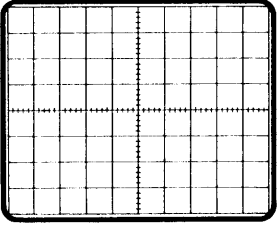
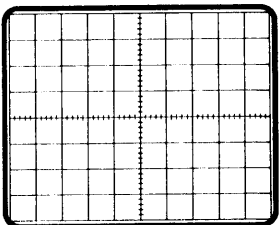
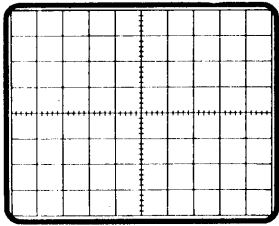
UNIT/BLOCK: MAIN 1B1(02P5949)

<p>Q1 Collector- Q2 Collector</p>		<p><u>DRIVER OUT</u></p> <p>Trigger : Internal X-scale : 0.2m s/div. Y-scale : 50 v/div.</p>
<p>J3 #1-#4</p>		<p><u>RECORDING SIGNAL</u></p> <p>Trigger : Internal X-scale : 10m s/div. Y-scale : 100 v/div. DEPTH RANGE: 1 or 2 GAIN : 0 DRAFT: OFF</p>
		<p>Trigger : X-scale : s/div. Y-scale : v/div.</p>
		<p>Trigger : X-scale : s/div. Y-scale : v/div.</p>
		<p>Trigger : X-scale : s/div. Y-scale : v/div.</p>
		<p>Trigger : X-scale : s/div. Y-scale : v/div.</p>

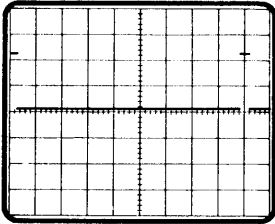
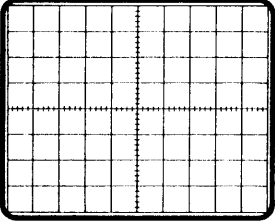
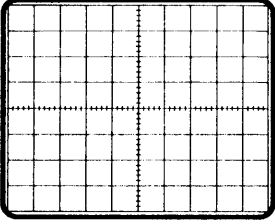
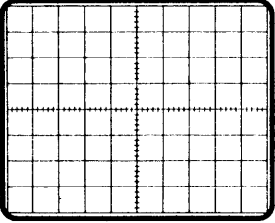
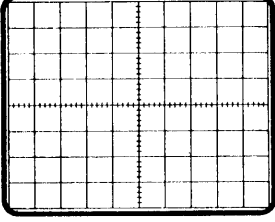
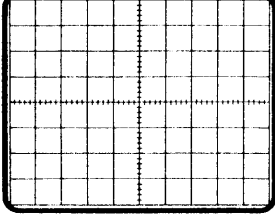
UNIT/BLOCK: PANEL 1B3 (02P5951 or 02P5953)

<p>TP1 MAIN 1B1 02P5949 TP8</p>	<p>OV</p> 	<p><u>TX KP (DRAFT)</u></p> <p>Trigger : Internal X-scale : 20μs/div. Y-scale : 2 v/div. DRAFT: OFF</p>
<p>TP1 MAIN 1B1 02P5949 TP8</p>	<p>OV</p> 	<p><u>DRAFT</u></p> <p>Trigger : Internal X-scale : 20ms/div. Y-scale : 2 v/div. DRAFT: MAX</p>
<p>TP2</p>	<p>OV</p> 	<p><u>PAPER FEED OSC.</u></p> <p>Trigger : Internal X-scale : 5ms/div. Y-scale : 2 v/div.</p>
<p>TP3</p>	<p>OV</p> 	<p><u>GAIN</u></p> <p>Trigger : Internal X-scale : 0.5s/div. Y-scale : 0.5 v/div. GAIN MAX: 1.8V GAIN MIN: 1V</p>
<p>TP4 MAIN 1B1 02P5949 TP3</p>	<p>OV</p> 	<p><u>TX KP</u></p> <p>Trigger : Internal X-scale : 0.2ms/div. Y-scale : 1 v/div. DEPTH RANGE: 1, 2 or 3</p>
<p>TP4 MAIN 1B1 02P5949 TP3</p>		<p><u>TX KP</u></p> <p>Trigger : Internal X-scale : 0.2s/div. Y-scale : 1 v/div. DEPTH RANGE: 4</p>

UNIT/BLOCK: PANEL 1B3 (02P5951 or 02P5953)

<p>TP4 [MAIN 1B1 02P5949 TP3]</p>	<p>OV</p> 	<p><u>TX KP</u></p> <p>Trigger : Internal X-scale : 0.5ms/div. Y-scale : 1v/div. DEPTH RANGE: 5 or 6</p>
<p>TP4 [MAIN 1B1 02P5949 TP3]</p>	<p>OV</p> 	<p><u>TX KP</u></p> <p>Trigger : Internal X-scale : 20ms/div. Y-scale : 2v/div. DEPTH RANGE: 1 or 2</p>
<p>TP4 [MAIN 1B1 02P5949 TP3]</p>	<p>OV</p> 	<p><u>TX KP</u></p> <p>Trigger : Internal X-scale : 0.2s/div. Y-scale : 2v/div. DEPTH RANGE: 5 or 6</p>
		<p>Trigger : X-scale : s/div. Y-scale : v/div.</p>
		<p>Trigger : X-scale : s/div. Y-scale : v/div.</p>
		<p>Trigger : X-scale : s/div. Y-scale : v/div.</p>

UNIT/BLOCK: DISPLAY 1B4(02P5952)

TP1	OV		<p>WT-START</p> <hr/> <p>Trigger : Internal X-scale : 20ms/div. Y-scale : 2v/div. DEPTH RANGE: 1 or 2</p>
			<hr/> <p>Trigger : X-scale : s/div. Y-scale : v/div.</p>
			<hr/> <p>Trigger : X-scale : s/div. Y-scale : v/div.</p>
			<hr/> <p>Trigger : X-scale : s/div. Y-scale : v/div.</p>
			<hr/> <p>Trigger : X-scale : s/div. Y-scale : v/div.</p>
			<hr/> <p>Trigger : X-scale : s/div. Y-scale : v/div.</p>

SYMBOL	TYPE	SPECIFICATIONS	CODE NO.	REMARKS	SYMBOL	TYPE	SPECIFICATIONS	CODE NO.	REMARKS
記号	型名	規格	コード番号	備考	記号	型名	規格	コード番号	備考
FE-680/680T RECORDER UNIT Refer to Dwg. No. C2280-011-A.					02P5949 MAIN Board Block No. 1B1, Refer to Dwg. No. C2280-017-A.				
PRINTED CIRCUIT BOARD					CAPACITOR				
02P5949 MAIN 001-345-260 FE680 50K					1B01C0001 ECWH10H682JR 0.0068UF 1000V 000-259-610 FOR 50KHZ				
02P5949 MAIN 001-345-250 FE680T 50K					ECWH12H 1S2JR 1500PF 1200WV 000-261-967 FOR 200KHZ				
02P5949 MAIN 001-345-240 680/T 200K					1B01C0002 ECWH10H682JR 0.0068UF 1000V 000-259-610 FOR 50KHZ				
02P5951 PANEL 001-345-280 FE680T					ECWH12H 1S2JR 1500PF 1200WV 000-261-967 FOR 200KHZ				
02P5953 PANEL 001-345-290 FE680					1B01C0003 ECO-M1H152KZ 1500PF 50WV 000-260-362 FOR 50KHZ				
02P5952 DISPLAY 001-345-300 FE680/T-1					DM15C221K1 220PF . 100V 000-222-250 FOR 200KHZ				
02P5952 DISPLAY 001-345-310 FE680T-2					1B01C0004 ECO-M1H152KZ 1500PF 50WV 000-260-362 FOR 50KHZ				
02P5945 TRIG GENERA 001-345-230 FE680/680T					DM15C221K1 220PF . 100V 000-222-250 FOR 200KHZ				
02P5950 POWER SUPPLY 001-345-270 FE680/680T					1B01C0005 ECO-P1332G2 3300PF 100V 000-261-879 FOR 50KHZ				
POWER TRANSFORMER ASSEMBLY 001-340-070					ECO-P1681J2 100PF 100WV 000-261-819 FOR 200KHZ				
MOTOR					1B01C0006 ECE-A1CU101E 100UF 16V 000-206-112				
B 1 FNF-1202P DC12V 02S4212-1 000-432-051					1B01C0007 ECE-A1CU101E 100UF 16V 000-206-112				
B 2 SP4-41570 02S4213-0 000-431-117					1B01C0008 DD106CH560J50V 56PF .50V 000-253-912				
CAPACITOR					1B01C0009 ECE-A1CU101E 100UF 16V 000-206-112				
C 1 MD-1-2J-103M 0.01UF 630WV 000-262-140					1B01C0010 DD106CH560J50V 56PF .50V 000-253-912				
C 2 MD-1-2J-103M 0.01UF 630WV 000-262-140					1B01C0011 ECO-M1H102KZ 1000PF 50V 000-260-360				
DIODE					1B01C0012 ECO-M1H102KZ 1000PF 50V 000-260-360				
CR 1 MP-042. GREEN 000-133-775					1B01C0013 ECO-M1H102KZ 1000PF 50V 000-260-360				
LAMP					1B01C0014 ECO-M1H333KZ 0.033UF 50V 000-260-380				
DS 1 T-5.5MG 8V 60MA 000-101-424					1B01C0015 ECO-M1H102KZ 1000PF 50V 000-260-360				
DS 2 T-5.5MG 8V 60MA 000-101-424					1B01C0017 ECO-M1H324KZ 0.33UF 50V 000-260-389				
DS 3 T-5.5MG 8V 60MA 000-101-424					1B01C0018 ECE-A1CU101E 100UF 16V 000-206-112				
FUSE					1B01C0019 ECO-M1H473KZ 47000PF 50V 000-260-385				
F 1 FG80-A 2A AC125V 00S0093 000-549-062					1B01C0020 DD107CH101J50V 100PF .50V 000-253-916				
FUSE HOLDER					1B01C0021 DD107CH101J50V 100PF .50V 000-253-916				
FH 1 FH001 6.4MM X 30MM 000-519-180					1B01C0022 ECO-P1473G2 0.047UF.100WV 000-261-911				
FILTER					1B01C0023 DM15C221K1 220PF . 100V 000-222-250				
FL 1 EUL-NJA3B2 000-588-257					1B01C0024 DM15C221K1 220PF . 100V 000-222-250				
SWITCH					1B01C0025 ECE-A1CU471E 470UF .16V 000-201-808				
S 1 ST-18V 000-100-265					1B01C0026 ECO-M1H104KZ 0.1UF 50V 000-260-390				
TERMINAL BOARD					1B01C0027 ECO-P1102G2 0.001UF.100WV 000-261-870				
TB 1 ML-3391 10P DUAL 000-531-047					1B01C0028 ECO-M1H104KZ 0.1UF 50V 000-260-390				
					1B01C0029 ECO-M1H102KZ 1000PF 50V 000-260-360				
					1B01C0030 ECO-M1H102KZ 1000PF 50V 000-260-360				
					1B01C0031 ECO-M1H102KZ 1000PF 50V 000-260-360				
					1B01C0032 ECO-M1H102KZ 1000PF 50V 000-260-360				
					1B01C0033 ECE-A1CU101E 100UF 16V 000-206-112				
					1B01C0034 ECE-A1CU101E 100UF 16V 000-206-112				
					1B01C0035 DD3108C473MS0V08 0.047UF 50V 000-252-042				
					1B01C0036 DD3108C473MS0V08 0.047UF 50V 000-252-042				
					1B01C0037 DD3108C473MS0V08 0.047UF 50V 000-252-042				
					1B01C0038 DD3108C473MS0V08 0.047UF 50V 000-252-042				
					1B01C0039 DD3108C473MS0V08 0.047UF 50V 000-252-042				
					1B01C0040 DD3108C473MS0V08 0.047UF 50V 000-252-042				
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					1B01C0043 DD3108C473MS0V08 0.047UF 50V 000-252-042				
					1B01C0044 DD3108C473MS0V08 0.047UF 50V 000-252-042				
					1B01C0045 DD3108C473MS0V08 0.047UF 50V 000-252-042				
					1B01C0046 ECO-M1H103KZ 0.01UF 50V 000-260-370				
					DIODE				
					1B01CR0001 1S1588 000-112-795				
					1B01CR0002 1S1588 000-112-795				
					1B01CR0003 1S598 SHOTTKY 000-114-011				
					1B01CR0004 1S1588 000-112-795				
					1B01CR0005 1S1588 000-112-795				
					1B01CR0006 U06C 000-135-901				
					1B01CR0007 U06C 000-135-901				
					1B01CR0008 U06C 000-135-901				
					1B01CR0009 U06C 000-135-901				
					1B01CR0010 1S1588 000-112-795				
					1B01CR0011 1S1588 000-112-795				
					1B01CR0012 1S1588 000-112-795				
					FILTER				
					1B01FL0001 5F2455B3 455KHZ 02S3635 000-588-812				
					1B01FL0002 5F2455B3 455KHZ 02S3635 000-588-812				
					1B01FL0003 8FU455K2 455KHZ 02S3636 000-588-808				
					1B01FL0004 8FU455K2 455KHZ 02S3636 000-588-808				
					JACK				
					1B01J0001 FRC2-C26513-OL 26P 000-505-156				
					1B01J0002 87P-SHF-1AA 7P 000-505-555				
					1B01J0003 84P-SHF-1AA 4P 000-505-552				
					1B01J0004 83P-SHF-1AA 3P 000-505-551				
					1B01J0005 88P-SHF-1AA 8P 000-505-556				
					1B01J0007 89P-SHF-1AA 9P 000-505-557				

NOTE:
備考:

SYMBOL 記号	TYPE 型名	SPECIFICATIONS 規格	CODE NO. コード番号	REMARKS 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					DIODE ダイオード				
1802CR0001	CTM-24R		000-132-435		1803CR0002	ERB16-12		000-132-850	
1802CR0002	CTM-24R		000-132-435		1803CR0003	1S1588		000-112-795	
1802CR0003	CTM-24R		000-132-435		1803CR0004	1S1588		000-112-795	
1802CR0004	CTM-24S		000-132-436		1803CR0005	1S1588		000-112-795	
1802CR0005	CTM-24S		000-132-436		1803CR0006	1S1588		000-112-795	
1802CR0006	CTM-24S		000-132-436		1803CR0007	1S1588		000-112-795	
1802CR0007	ERB16-12		000-132-850		1803CR0008	1S1588		000-112-795	
1802CR0008	ERB16-12		000-132-850		1803CR0010	1S1588		000-112-795	
					1803CR0011	1S1588		000-112-795	
					1803CR0012	1S1588		000-112-795	
					1803CR0013	1S1588		000-112-795	
JACK ジャック					LAMP ランプ				
1802J0001	B8P-SHF-1AA	8P	000-505-556		1803DS0001	T3.8C 8V 60MA	13-3-4442	000-540-180	
1802J0002	B8P-VH		000-505-826		1803DS0002	T3.8C 8V 60MA	13-3-4442	000-540-180	
					1803DS0003	T3.8C 8V 60MA	13-3-4442	000-540-180	
RELAY リレー					JACK ジャック				
1802K0001	JB1F-DC12V		000-454-970		1803J0001	FRC2-C26S13-0L	26P	000-505-156	
					1803J0003	B6P-SHF-1AA	6P	000-505-554	
					1803J0004	B18P-SHF-1AA	18P	000-505-627	
					1803J0005	B7P-SHF-1AA	7P	000-505-555	
TRANSISTOR トランジスタ					COIL コイル				
180200001	25D798		000-100-268		1803L0001	EL1315-102KR50	02S0037	000-427-510	
180200002	25D798		000-100-268		1803L0002	EL1315-102KR50	02S0037	000-427-510	
180200003	25C2810		000-126-321						
180200004	25C458KC		000-123-675						
180200005	25A958		000-118-016						
180200006	25C1827-Y	WITH ACCESSORY	000-125-651						
RESISTOR 抵抗					TRANSISTOR トランジスタ				
1802R0001	ERF-52XR47		000-100-266		180300001	25C458KC		000-123-675	
1802R0002	ERX-2ANJR47	2W 0.47	000-371-141		180300002	25C1827-Y	WITH ACCESSORY	000-125-651	
1802R0003	ERX-2ANJ1R0	2W 1	000-371-149						
1802R0004	ERG-1ANJ471	1W 470	000-371-256						
1802R0005	ERG-1ANJ103	1W 10K	000-371-308						
1802R0007	ERD-25TJ473	0.25W 47K	000-330-397						
1802R0008	ERD-25TJ104	0.25W 100K	000-330-405						
1802R0009	ERD-25TJ222	0.25W 2.2K	000-330-365						
1802R0010	ERD-25TJ103	0.25W 10K	000-330-381						
1802R0011	ERD-25TJ103	0.25W 10K	000-330-381						
1802R0012	ERD-25TJ102	0.25W 1K	000-330-357						
1802R0013	ERD-25TJ821	0.25W 820	000-330-355						
INTEGRATED CIRCUIT マイクロチップ					RESISTOR 抵抗				
1802U0002	UPC7805H		000-161-175		1803R0001	ERD-25TJ561	0.25W 560	000-330-351	
					1803R0004	EXB-P86-103K	10K X6	000-378-575	
					1803R0005	ERD-25TJ104	0.25W 100K	000-330-405	
					1803R0006	ERD-25TJ100	0.25W 10	000-330-309	
					1803R0007	ERD-25TJ104	0.25W 100K	000-330-405	
					1803R0008	ERD-25TJ101	0.25W 100	000-330-333	
					1803R0009	ERD-25TJ101	0.25W 100	000-330-333	
					1803R0020	ERD-25TJ331	0.25W 330	000-330-345	
					1803R0021	ERD-25TJ271	0.25W 270	000-330-343	
					1803R0022	ERD-25TJ241	0.25W 240	000-330-342	
					1803R0023	ERD-25TJ201	0.25W 200	000-330-340	
					1803R0024	ERD-25TJ331	0.25W 330	000-330-345	
					1803R0025	ERD-25TJ131	0.25W 130	000-330-336	
					1803R0026	ERD-25TJ101	0.25W 100	000-330-333	
					1803R0027	ERD-25TJ471	0.25W 470	000-330-349	
					1803R0029	ERD-25TJ184	0.25W 180K	000-330-411	
					1803R0030	ERD-25TJ104	0.25W 100K	000-330-405	
					1803R0031	ERD-25TJ222	0.25W 2.2K	000-330-365	
					1803R0032	ERD-25TJ123	0.25W 12K	000-330-383	
					1803R0033	ERD-25TJ821	0.25W 820	000-330-355	
					1803R0034	ERD-25TJ224	0.25W 220K	000-330-413	
					1803R0035	ERD-25TJ102	0.25W 1K	000-330-357	
					1803R0037	ERD-25TJ331	0.25W 330	000-330-345	
					1803R0038	EXB-P86102K	0.125W 1K X 6	000-378-350	
					1803R0039	ERD-25TJ334	0.25W 330K	000-330-417	
					1803R0040	ERD-25TJ100	0.25W 10	000-330-309	
					1803R0041	ERD-25TJ101	0.25W 100	000-330-333	
CAPACITOR コンデンサ					SWITCH スイッチ				
1803C0001	ECE-A1CU100C	10UF 16V	000-201-672		1803S0001	SRM-1026 SHAFT 20MM	02S3847-0	000-460-272	
1803C0002	ECC-M1H103K2	0.01UF 50V	000-260-370		1803S0002	SRM-1034354	02S3845-1	000-460-270	
1803C0004	ECE-A1CU101E	100UF 16V	000-206-112		1803S0003	SRM1018129	02S8049-1	000-460-222	
1803C0005	ECC-M1H104K2	0.1UF 50V	000-260-390		1803S0004	SSA042(L=12)		000-474-554	
1803C0006	ECE-A1AU221E	220UF 10V	000-206-114						
1803C0007	ECC-P147362	0.047UF 100WV	000-261-911						
1803C0008	ECE-A1C5332	330UF 16V	000-201-423						
1803C0009	ECE-A1CU330E	33UF 16V	000-201-674						
1803C0010	DD3108C473M50V08	0.047UF 50V	000-252-042						
1803C0011	ECE-A1CU101E	100UF 16V	000-206-112						
1803C0012	ECE-A1AU221E	220UF 10V	000-206-114						
1803C0013	ECE-A1AU221E	220UF 10V	000-206-114						
1803C0014	ECE-A1CU101C	100UF 16V	000-206-112						
1803C0015	DD3108C473M50V08	0.047UF 50V	000-252-042						
1803C0016	DD3108C473M50V08	0.047UF 50V	000-252-042						
1803C0018	ECE-A1AU330E	33UF 10V	000-201-800						
1803C0019	ECE-A1AU330C	33UF 10V	000-201-800						
1803C0020	DD3108C473M50V08	0.047UF 50V	000-252-042						
1803C0022	ECE-A1CU101E	100UF 16V	000-206-112						
INTEGRATED CIRCUIT マイクロチップ					INTEGRATED CIRCUIT マイクロチップ				
					1803U0001	M74LS04P	TTL	000-151-204	
					1803U0002	TC4001BP	CMOS	000-163-240	
					1803U0003	M74LS669P	TTL	000-151-347	
					1803U0004	M74LS669P	TTL	000-151-347	
					1803U0005	M74LS175P	TTL	000-151-185	
					1803U0006	T062004P		000-163-091	
					1803U0007	TA7555P		000-163-007	
					1803U0008	M74LS00P	TTL	000-151-202	

02P5953 PANEL Board for FE-680

Block No. 1B3, Refer to Dwg. No. C2280-019-A.

 NOTE:
備考:

SYMBOL	TYPE	SPECIFICATIONS	CODE NO.	REMARKS	SYMBOL	TYPE	SPECIFICATIONS	CODE NO.	REMARKS
記号	型名	規格	コード番号	備考	記号	型名	規格	コード番号	備考
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;">02P5951 PANEL Board for FE-680T Block No. 1B3, Refer to Dwg. No. C2280-013-A.</div>									
CAPACITOR コンデンサ					SWITCH スイッチ				
1B03C0001	ECE-A1CU100E	10UF 16V	000-201-672		1B03S0001	SRM-1026 SHAFT 20MM	0253847-0	000-460-272	
1B03C0002	ECC-E1-224K2	0.22UF, 50V	000-261-562		1B03S0002	SRM-1034354	0253845-1	000-460-270	
1B03C0003	ECE-A1CU101E	100UF 16V	000-206-112		1B03S0003	SRM101B129	0258049-1	000-460-222	
1B03C0004	ECE-A1CU101E	100UF 16V	000-206-112		1B03S0004	SSA042(L=12)		000-474-554	
1B03C0005	ECC-M1H104K2	0.1UF 50V	000-260-390		1B03S0005	BN1021 W/B20083	BLACK	000-471-121	
1B03C0006	ECE-A1AU221E	220UF 10V	000-206-114		INTEGRATED CIRCUIT ｼﾝｸﾞﾙｲｸｲｯﾄﾞ				
1B03C0007	ECC-P1473G2	0.047UF, 100WV	000-261-911		1B03U0001	M74LS04P	TTL	000-151-204	
1B03C0008	ECE-A1C5332	3300UF 16V	000-201-433		1B03U0002	TC4001BP	CMOS	000-163-240	
1B03C0009	ECE-A1CU330E	33UF 16V	000-201-674		1B03U0003	M74LS669P	TTL	000-151-347	
1B03C0010	D03108C473M50V08	0.047UF 50V	000-252-042		1B03U0004	M74LS669P	TTL	000-151-347	
1B03C0011	ECE-A1CU101E	100UF 16V	000-206-112		1B03U0005	M74LS175P	TTL	000-151-185	
1B03C0012	ECE-A1AU221E	220UF 10V	000-206-114		1B03U0006	T062004P		000-163-091	
1B03C0013	ECE-A1AU221E	220UF 10V	000-206-114		1B03U0007	TA7555P		000-163-007	
1B03C0014	ECE-A1CU101E	100UF 16V	000-206-112		1B03U0008	M74LS00P	TTL	000-151-202	
1B03C0015	D03108C473M50V08	0.047UF 50V	000-252-042		ZENER DIODE ｼﾞﾈﾗｰﾀﾞｲｰﾄﾞ				
1B03C0016	D03108C473M50V08	0.047UF 50V	000-252-042		1B03VR0001	05Z5.6V	ZENER	000-110-487	
1B03C0018	ECE-A1AU330E	33UF 16V	000-201-674						
1B03C0019	ECE-A1AU330E	33UF 16V	000-201-674						
1B03C0020	D03108C473M50V08	0.047UF 50V	000-252-042						
1B03C0021	D03108C473M50V08	0.047UF 50V	000-252-042						
1B03C0022	ECE-A1CU101E	100UF 16V	000-206-112						
DIODE ｼﾞｬｲﾝﾄﾞ					<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;">A02P5952 DISPLAY Board for FE-680T-2 B02P5952 DISPLAY Board for FE-680/680T-1 Block No. 1B4, Refer to Dwg. No. C2280-014-A.</div>				
1B03CR0002	ER816-12		000-132-850		CAPACITOR コンデンサ				
1B03CR0003	1S1588		000-112-795		1B04C0001	ECS-F35ER47	0.47UF 35V	000-232-358	
1B03CR0004	1S1588		000-112-795		1B04C0002	FK20Y5V1H1042	0.1UF 50V	000-254-900	
1B03CR0005	1S1588		000-112-795		1B04C0003	ECC-F1H101JC	100PF, 50V	000-256-910	
1B03CR0006	1S1588		000-112-795		1B04C0004	ECC-F1H101JC	100PF, 50V	000-256-910	
1B03CR0007	1S1588		000-112-795		1B04C0005	ECC-M1H103K2	0.01UF 50V	000-260-370	
1B03CR0008	1S1588		000-112-795		1B04C0006	ECC-M1H102K2	1000PF 50V	000-260-360	
1B03CR0009	1S1588		000-112-795		1B04C0007	FK20Y5V1H1042	0.1UF 50V	000-254-900	
1B03CR0010	1S1588		000-112-795		1B04C0008	FK20Y5V1H1042	0.1UF 50V	000-254-900	
1B03CR0011	1S1588		000-112-795		1B04C0009	ECEB1A5101	100UF 10V	000-203-253	
LAMP ランプ					DIODE ｼﾞｬｲﾝﾄﾞ				
1B03DS0001	T3.8C 8V 60MA	13-3-4442	000-540-180		1B04CR0001	TLR-313		000-135-812	
1B03DS0002	T3.8C 8V 60MA	13-3-4442	000-540-180		1B04CR0002	TLR-313		000-135-812	
1B03DS0003	T3.8C 8V 60MA	13-3-4442	000-540-180		1B04CR0003	TLR-313		000-135-812	
1B03DS0004	T3.8C 8V 60MA	13-3-4442	000-540-180		1B04CR0004	TLR-313		000-135-812	
COIL コイル					JACK ｼﾞｬｯｸ				
1B03L0001	EL1315-102KR50	0250037	000-427-510		1B04J0001	B18P-SHF-1AA	18P	000-505-622	
1B03L0002	EL1315-102KR50	0250037	000-427-510		1B04J0002	B4P-SHF-1AA	4P	000-505-552	
TRANSISTOR ﾄﾗﾝｼﾞｽﾀｰ					TRANSISTOR ﾄﾗﾝｼﾞｽﾀｰ				
1B03Q0001	Z5C458KC		000-123-675		1B04Q0001	2SA743A-C		000-117-466	
1B03Q0002	Z5C1827-Y	WITH ACCESSORY	000-125-651		1B04Q0002	2SA743A-C		000-117-466	
RESISTOR ｲｷﾝ					RESISTOR ｲｷﾝ				
1B03R0001	ERD-25TJ221	0.25W 220	000-330-341		1B04R0001	EXB-F6V221J		000-379-006	
1B03R0002			000-100-267		1B04R0002	ERD-25TJ223	0.25W 22K	000-330-389	
1B03R0003	ERD-25TJ391	0.25W 390	000-330-347		1B04R0003	ERD-25TJ472	0.25W 4.7K	000-330-373	
1B03R0004	EXB-P86-10XK	10KX6	000-378-575		1B04R0004	ERD-25TJ105	0.25W 1M	000-330-429	
1B03R0005	ERD-25TJ104	0.25W 100K	000-330-405		1B04R0005	ERD-25TJ682	0.25W 6.8K	000-330-377	
1B03R0006	ERD-25TJ100	0.25W 10	000-330-309		1B04R0006	ERD-25TJ104	0.25W 100K	000-330-405	
1B03R0007	ERD-25TJ104	0.25W 100K	000-330-405		1B04R0007	EXB-T44240J	240HMx4	000-378-802	
1B03R0008	ERD-25TJ101	0.25W 100	000-330-333		1B04R0008	EXB-T44240J	240HMx4	000-378-802	
1B03R0009	ERD-25TJ101	0.25W 100	000-330-333		1B04R0009	ERD-25TJ103	0.25W 10K	000-330-381	
1B03R0010	PN-822H 103H	0.5W 10K	000-319-456						
1B03R0011	ERD-25TJ102	0.25W 10K	000-330-381						
1B03R0012	ERD-25TJ103	0.25W 10K	000-330-381						
1B03R0013	ERD-25TJ102	0.25W 1K	000-330-357						
1B03R0014	ERD-25TJ471	0.25W 470	000-330-349						
1B03R0015	ERD-25TJ102	0.25W 1K	000-330-357						
1B03R0016	ERD-25TJ681	0.25W 680	000-330-353						
1B03R0017	ERD-25TJ561	0.25W 560	000-330-351						
1B03R0018	ERD-25TJ471	0.25W 470	000-330-349						
1B03R0019	ERD-25TJ391	0.25W 390	000-330-347						
1B03R0020	ERD-25TJ331	0.25W 330	000-330-345						
1B03R0021	ERD-25TJ271	0.25W 270	000-330-343						
1B03R0022	ERD-25TJ241	0.25W 240	000-330-342						
1B03R0023	ERD-25TJ201	0.25W 200	000-330-340						
1B03R0024	ERD-25TJ331	0.25W 330	000-330-345						
1B03R0025	ERD-25TJ131	0.25W 130	000-330-328						
1B03R0026	ERD-25TJ101	0.25W 100	000-330-333						
1B03R0027	ERD-25TJ471	0.25W 470	000-330-349						
1B03R0029	ERD-25TJ184	0.25W 180K	000-330-411						
1B03R0030	ERD-25TJ104	0.25W 100K	000-330-405						

NOTE:
備考:

SYMBOL	TYPE	SPECIFICATIONS	CODE NO.	REMARKS	SYMBOL	TYPE	SPECIFICATIONS	CODE NO.	REMARKS
記号	型名	規格	コード番号	備考	記号	型名	規格	コード番号	備考
1B04R0010	EXB-T44240J	24OHMX4	000-378-802						
1B04R0011	EXB-T44240J	24OHMX4	000-378-802						
1B04R0012	ERD-25TJ561	0.25W 560	000-330-351	A02P5952					
1B04R0014	EXB-P86-103K	10Kx6	000-378-575						
1B04R0015	ERD-25TJ102	0.25W 1K	000-330-357						
	INTEGRATED CIRCUIT	インテグレート							
1B04U0001	M74LS04P	TTL	000-151-204						
1B04U0002	M74LS02P	TTL	000-151-203						
1B04U0003	TC5048P	CMOS	000-163-848						
1B04U0004	M74LS22P	TTL	000-151-192						
1B04U0005	M74LS123P	TTL	000-151-190						
1B04U0006	TC5051P	CMOS	000-163-342						
1B04U0007	M74LS193P	TTL	000-151-340						
1B04U0008	M74LS247P	TTL	000-151-186						
1B04U0009	M74LS247P	TTL	000-151-186						
1B04U0010	M74LS74AP	TTL	000-151-207						
1B04U0011	MBM2732A-352-G	PROM	000-157-371						
	CRYSTAL	クリスタル							
1B04Y0001	CS8576P2		000-491-046						
02P5945 TRIGGER GENERATOR Board Block No. 1B5, Refer to Dwg. No. C2280-014-A.									
	JACK	ジャック							
1B05J0001	B54P-SHF-1AA	4P	000-505-567						
	RESISTOR	抵抗							
1B05R0001	ERD-25TJ471	0.25W 470	000-330-349*						
1B05R0002	ERD-25TJ471	0.25W 470	000-330-349						
	INTEGRATED CIRCUIT	インテグレート							
1B05U0001	DN6839A		000-164-401						
1B05U0002	DN6839A		000-164-401						
POWER TRANSFORMER ASSEMBLY Refer to Dwg. No. C2280-018-A/C2280-011-A.									
	CAPACITOR	コンデンサ							
C	1	M0-1-2G-333M	0.033UF 400VV	000-262-080					
	PLUG	プラグ							
P	16	VHR-BN BVH-21T-1.1		000-505-892 000-505-881					
	TRANSFORMER	トランス							
T	1	0253261-0		000-100-263					
	TERMINAL BOARD	ターミナルボード							
TB	1	M106Z-6P		000-100-264					

NOTE:
備考:

SYMBOL	PARTS NAME	TYPE/DWG. NO.	CODE NO.	REMARKS
記号	部品名	型名/図番	コード番号	備考
1A	FRONT DOOR ASSY.	FE-680/680T	001-345-360	STD. COATING
	FRONT DOOR ASSY.	FE-680T	001-345-370	2.5G 7/2
	FRONT DOOR ASSY.	FE-680T	001-345-380	7.5BG 7/2
1	EMBLEM	02-046-1123-0	100-003-830	
2	FRONT DOOR FRAME	02-046-1102-2	100-003-662	N5.0
	FRONT DOOR FRAME	02-046-1102-2	100-003-962	7.5BG 7/2 #5
	FRONT DOOR FRAME	02-046-1102-2	100-003-982	
	FRONT DOOR FRAME	02-046-1102-2	100-016-932	2.5G 7/2
	SPRING FIXING ARM	02-019-1004-0	201-910-040	
3	FRONT GLASS	02-019-1001-0	201-910-010	
4	FRONT DOOR SPONGE	02-019-1003-0	201-910-030	
5	SCALE	02-046-1118-2	100-003-782	
	SCALE.1.	02-046-1118-1	100-003-781	
6	PLASTIC HEAD SCREW	M3X6 平 頭 BLK IRON	000-862-532	
7	FRONT DOOR SHAFT	02-046-1121-0	100-003-810	
8	CABINET DOOR ASSY.	02-046-1101-3	100-003-653	N5.0
	CABINET DOOR ASSY.	02-046-1101-3	100-003-933	7.5BG 7/2
	CABINET DOOR ASSY.	02-046-1101-3	100-003-943	NEW TONE GREY
	CABINET DOOR ASSY.	02-046-1101-3	100-003-953	
	CABINET DOOR ASSY.	02-046-1101-3	100-016-923	2.5G 7/2
9	SEMI-TUBULAR RIVET	2.5X4 SWRM MFNI2	000-800-068	
10	WATER SEAL SPONGE	02-046-1122-0	100-003-820	
11	FRONT DOOR SPRING	02-019-1005-0	201-910-050	
12	SPRING SUSPENDER	02-046-1107-0	100-003-710	
13	STOPPER ASSY.		001-228-560	
14	STOPPER (3)	02-019-1025-0	201-910-250	
15A	IDLE ROLLER SUPPORT ASSY.	FE-680/680T/808/818	001-346-590	
15	PINCH ROLLER BRACKET	02-019-1020-3	201-910-203	
16	PINCH ROLLER SHAFT	02-019-1019-0	201-910-190	
17	PINCH ROLLER SPRING (1)	02-019-1021-1	201-910-211	
	PINCH ROLLER SPRING (2)	02-019-1022-1	201-910-221	
18	PINCH ROLLER	02-019-1018-0	201-910-180	
19A	RECORDING PLATE ASSY.	FE-680/680T	001-345-320	
19	RECORDER PLATE	02-046-1111-1	100-003-731	
	DRIVE ROLLER	02-046-1115-0	100-003-750	
	RECORDER PLATE	02-019-3001-2	201-930-012	
	RECORDER FRAME (2)	02-019-3003-2	201-930-032	
	ROLLER TUBE	02-019-3006-0	201-930-060	
	ROLLER PULLEY	02-019-3007-0	201-930-070	
	METAL BUSHING	D04-2002	220-920-020	
	REEL BRACKET ASSY.	02-019-3020-0	201-930-200	
	REEL BRACKET BASE.1.	02-019-3012-2	201-930-122	
	REEL BRACKET BASE.2.	02-019-3013-1	201-930-131	
	REEL BRACKET BASE SHAFT	02-019-3014-2	201-930-142	
	SPRING	02-019-3015-0	201-930-150	
	PDP RIVET	SSD-42-SSBS	000-865-919	
	SPRING PIN	3X25 BW SUS	000-800-070	
20	CATCH TAB	02-019-3008-1	201-930-081	
21	SPOOL	FDX-2112-2	211-921-122	
22	SPOOL RETAINER	02-019-3011-0	201-930-110	
23A	DRIVE PULLEY ASSY		001-228-590	
23	DRIVE PULLEY SHAFT	02-019-4006-0	201-940-060	
24	DRIVE PULLEY	FDX-2211-3	211-922-113	
	MICRO BEARING	626Z2MC3VS2L	000-874-158	
	C-TYPE CIRCLIP	19MMDIA.NOMINAL SK5	000-866-405	
25	MOTOR BELT	02-046-1116-0	100-003-760	
26	MOTOR PULLEY	02-046-1117-0	100-003-770	
27	RECORDING BELT ASSEMBLY		001-228-270	
28	RECORDING STYLUS ASSY (DRY)	02-015-2190-2	201-521-902	
29A	IDLE PULLEY ASSY		001-228-580	
29	IDLE PULLEY	F-3011-1	210-400-851	
	MICRO BEARING	608Z2MC3EVS2L	000-874-019	
	C-TYPE CIRCLIP	22MMDIA.NOMINAL SK5	000-866-408	
30	IDLE PULLEY SHAFT	FDX-2223-1	211-922-231	
31	WASHER	FDX-2224-0	211-922-240	
32	PAPER GROUND PLATE	02-019-4003-0	201-940-030	
34	TERMINAL MOUNTING PLATE	02-046-1204-1	100-003-881	
35	FASTENER	D01-0210	000-867-369	
36	BRUSH	0.5 BLACK	000-831-516	
37	STAY ASSEMBLY	02-011-1110-0	201-111-100	
	STOPPER PIN	F-8104	210-400-600	
	STAY "SMALL"	02-011-1108-1	201-111-081	
	STAY "BIG"	02-011-1107-2	201-111-072	
38	COPPER STRAP	02-019-4003-0	100-003-890	
39	DUST COVER.1.	02-910-2062-1	100-022-001	

NOTE:

備考:

SYMBOL	PARTS NAME	TYPE/DWG. NO.	CODE NO.	REMARKS
記号	部品名	型名/図番	コード番号	備考
40	CABINET	02-046-1201-2	100-003-852	N6.0
	CABINET	02-046-1201-2	100-003-902	7.5BG 7/2.5
	CABINET	02-046-1201-2	100-003-912	NEW TONE GREY
	CABINET	02-046-1201-2	100-003-922	
	CABINET	02-046-1201-2	100-016-912	2.5G 7/2
41	ANGLE FOR FLUSH MOUNT	02-046-0002-0 DX-351	100-003-630	
42	CLAMP PLATE	02-015-1106-1	201-511-061	
43	LATCH SUPPORT	02-011-1111.2	001-223-100	
44	FUSE HOLDER MOUNTING ANGLE	F-61505S-1	210-304-261	
45	TERMINAL BOARD STICKER	02-046-1128-0	100-013-310	
46	MOUNTING PLATE	02-046-1112-2	100-003-742	
47	FIBER WASHER .2.	FDW-2208-0	211-722-080	
48	BELT SUPPORT ANGLE	02-019-4001-1	201-940-011	
49	BELT REST	02-019-4002-1	201-940-021	
50	BRIM SHAFT	02-019-3010-1	201-930-101	
51	BRIM	02-019-3009-1	201-930-091	
52	SPRING BELT (BRAKE)	02-019-3017-2	201-930-172	
53	BRIM SHAFT WASHER	02-046-1124-0	100-003-840	
54	SPRING BELT (DRIVE)	02-019-3016-4	201-930-164	
55	SPUR GEAR.2.	02-038-1412-0	203-814-120	
56	BRAKE SPRING	02-038-1414-0	203-814-140	
57	SPACER	3X6X13 C2700W	000-877-142	
58	SPUR GEAR.1.	02-038-1411-0	203-814-110	
59	INSULATION FILM	02-046-1105-2	100-003-692	
60	LATCH	02-011-1214.5.6	001-223-060	
61	LATCH BUTTON	02-046-1106-0	100-003-700	
62	FRONT DOOR CATCH	02-046-1108-1	100-003-721	
63	LED COVER	02-046-1104-1	100-003-681	
	LED COVER	02-046-1127-0	100-013-300	
64	NYLON PUSH RIVET	FNRP 3 X 3.5 φ	000-865-851	
65	CONTROL PANEL	02-046-1103-0	100-003-670	
66	KNOB	02-019-8501-0	000-515-450	
	KNOB CAP	03-004-1066-0	300-410-660	
67	RUBBER BUSH	MDO6-10080	000-471-198	
68	NYLON WASHER	FDW-2209-0	211-722-090	
69	TOOTH LOCK WASHER	M6	000-864-510	
70	POLYCARBONATE WASHER	M4	000-864-937	
71	SOCKET SET SCREW	M3X3 SCM3	000-861-690	
72	SOCKET SET SCREW	M3X3 SUS	000-800-183	
73	E-TYPE CIRCLIP	2MM SUS304	000-866-634	
74	E-TYPE CIRCLIP	3t"φ12.5MM SUS304	000-866-635	
75	E-TYPE CIRCLIP	4MM DIA.	000-866-637	
76	E-TYPE CIRCLIP	SIZE 6	000-866-639	
77	VINYL COVER	02-046-0001-0	000-800-076	
78	CONTROL PANEL "A"	02-046-1120-1	100-003-801	

NOTE:

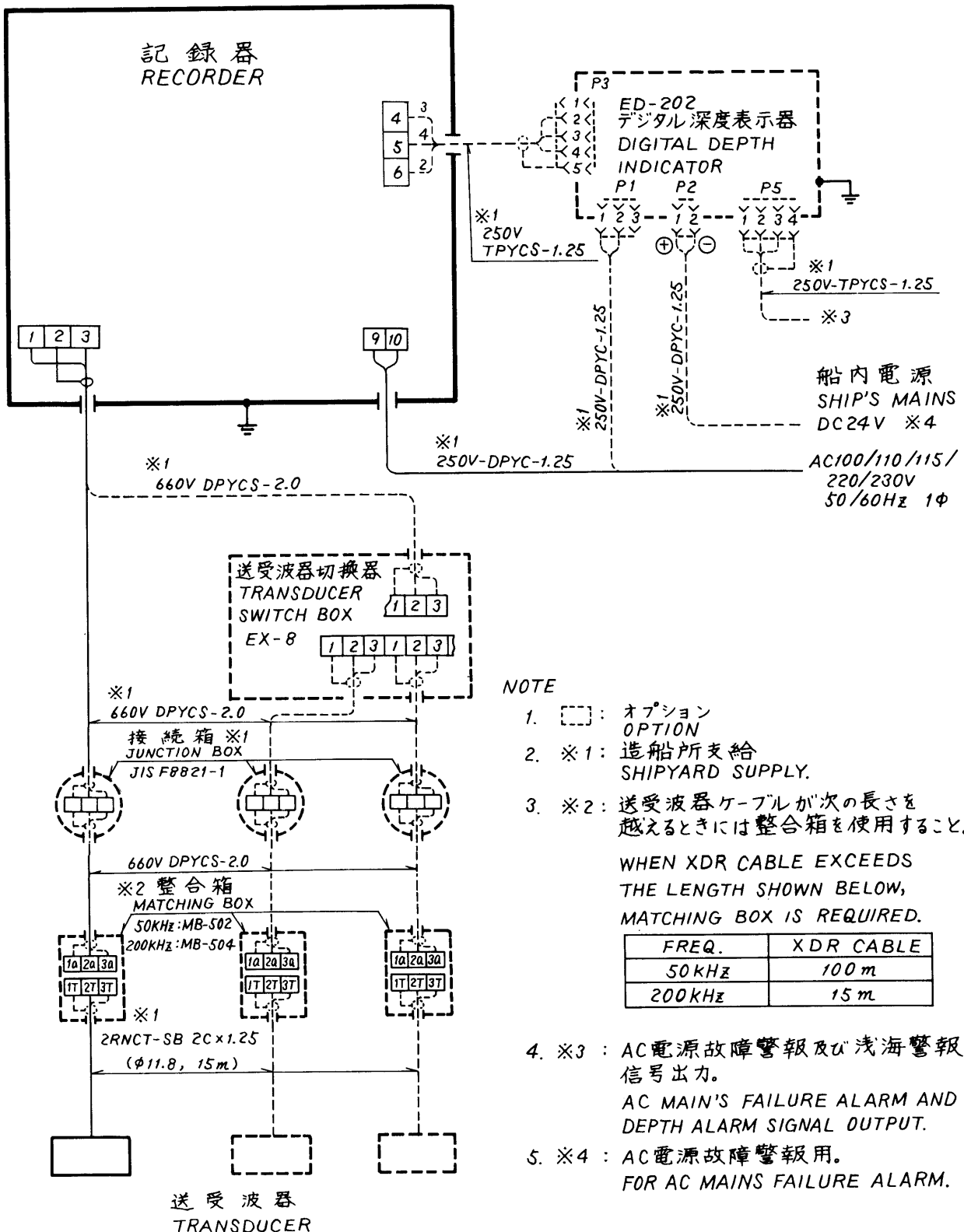
備考:

MAINTENANCE PARTS LIST FOR FE-680/680T

NO.M05400

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

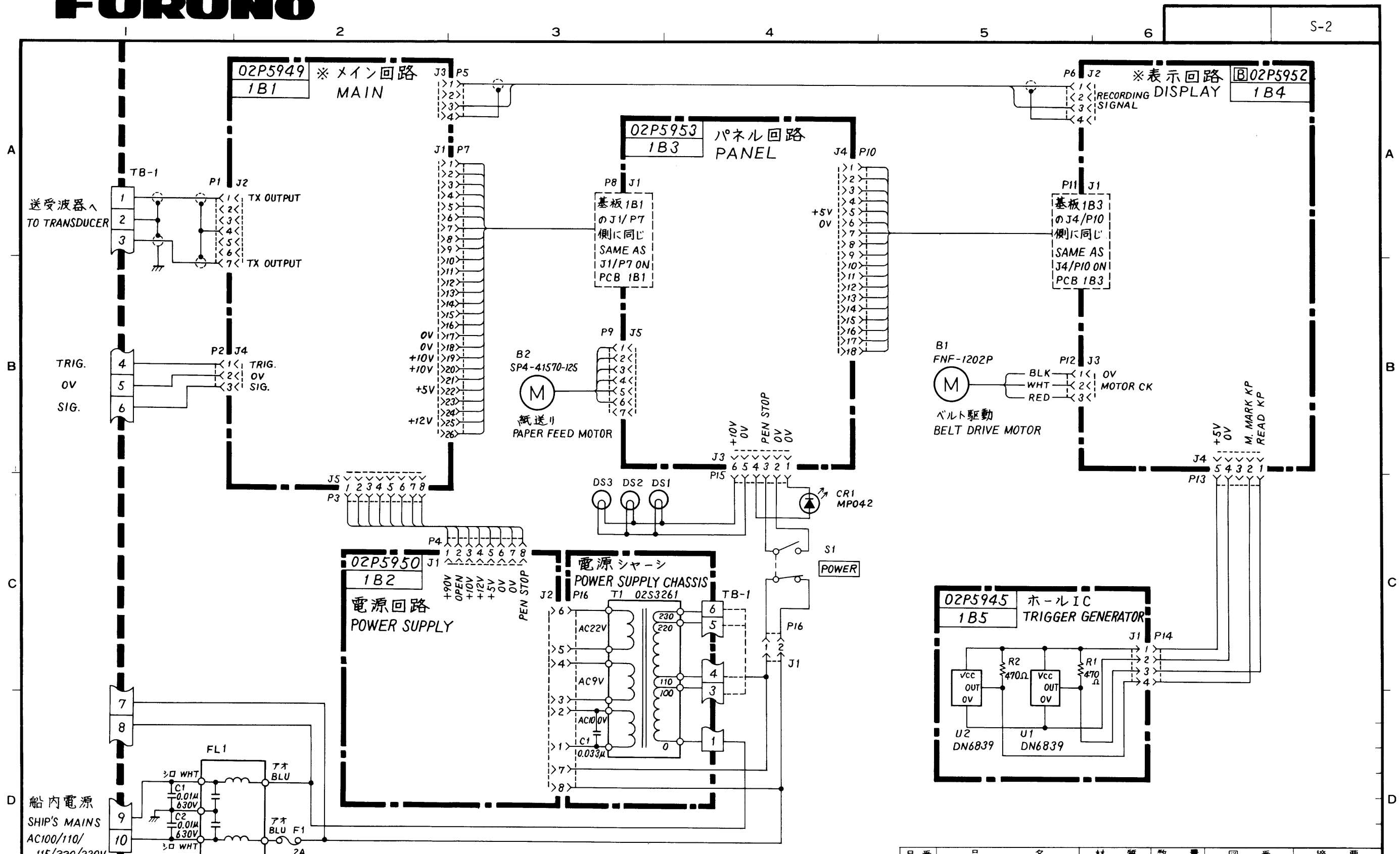
CODE NO.	NAME OF PARTS	TYPE	SPECIFICATIONS	QUANTITY	
				#1	#2
000-100-265	SWITCH	ST-18V		1	
000-431-117	PULSE MOTOR	SP4-41570	02S4213-0	1	
000-432-051	DC MOTOR	FNF-1202P DC12V	02S4212-1	1	
000-101-424	LAMP	T-5.5MG 8V 60MA	13-3-4442	6	3
000-540-180	LAMP	T3.8C 8V 60MA		4	2
000-549-062	FUSE, GLASS TUBE TYPE	FGB0-A 2A AC125V	00S0093	6	2
001-345-230	PRINTED CIRCUIT BOARD	02P5945 TRIG GENERA	FE-680/680T	1	
001-345-240	PRINTED CIRCUIT BOARD	02P5949 MAIN 200KHZ	FE-680/680T-1	1	
001-345-250	PRINTED CIRCUIT BOARD	02P5949 MAIN 50KHZ	FE-680T-2	1	
001-345-260	PRINTED CIRCUIT BOARD	02P5949 MAIN 50KHZ	FE-680-2	1	
001-345-270	PRINTED CIRCUIT BOARD	02P5950 POWER SUPPLY	FE-680/680T	1	
001-345-280	PRINTED CIRCUIT BOARD	02P5951 PANEL	FE-680T	1	
001-345-290	PRINTED CIRCUIT BOARD	02P5953 PANEL	FE-680	1	
001-345-300	PRINTED CIRCUIT BOARD	B02P5952 DISPLAY	FE-680/680T-1	1	
001-345-310	PRINTED CIRCUIT BOARD	A02P5952 DISPLAY	FE-680T-2	1	
100-003-760	MOTOR BELT	02-046-1116-0		1	
001-228-270	RECORDING BELT ASSEMBLY	RECORDING BELT		2	1
201-521-902	RECORDING STYLUS ASSY (DRY)	02-015-2190-2		6	2



NOTE

1. [] : オプション
OPTION
 2. ※1 : 造船所支給
SHIPYARD SUPPLY.
 3. ※2 : 送受波器ケーブルが次の長さを
越えるときには整合箱を使用すること。
WHEN XDR CABLE EXCEEDS
THE LENGTH SHOWN BELOW,
MATCHING BOX IS REQUIRED.
- | FREQ. | XDR CABLE |
|--------|-----------|
| 50KHZ | 100 m |
| 200KHZ | 15 m |
4. ※3 : AC電源故障警報及び浅海警報
信号出力。
AC MAIN'S FAILURE ALARM AND
DEPTH ALARM SIGNAL OUTPUT.
 5. ※4 : AC電源故障警報用。
FOR AC MAINS FAILURE ALARM.

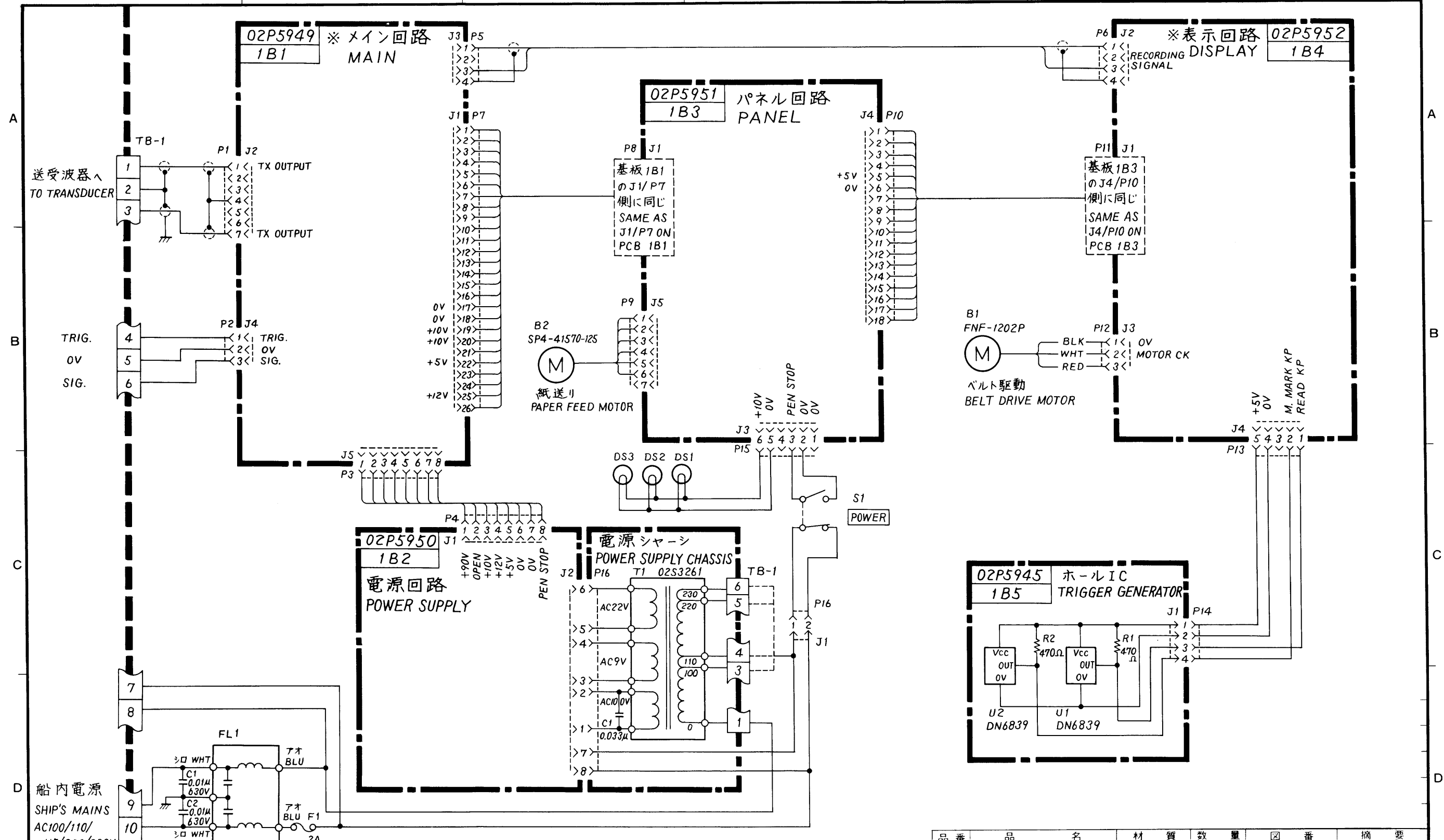
承認 APPROVED	品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
NOV. 14. 84 <i>[Signature]</i>		三角法 THIRD ANGLE PROJECTION				名称 TITLE FE-680T 相互結線図 680 CABLING DIAGRAM
検図 CHECKED Oct. 17. 84 <i>[Signature]</i>		尺度 SCALE				
製図 DRAWN Oct. 17. '84 <i>[Signature]</i>		重量 WEIGHT	kg		図番 DWG.NO. C2280-001-C	



※ ----- 下表参照
SEE THE TABLE BELOW

	1B1	1B4
FE-680-1	02P5949 200KHZ	02P5952
FE-680-2	02P5949 50KHZ	02P5952

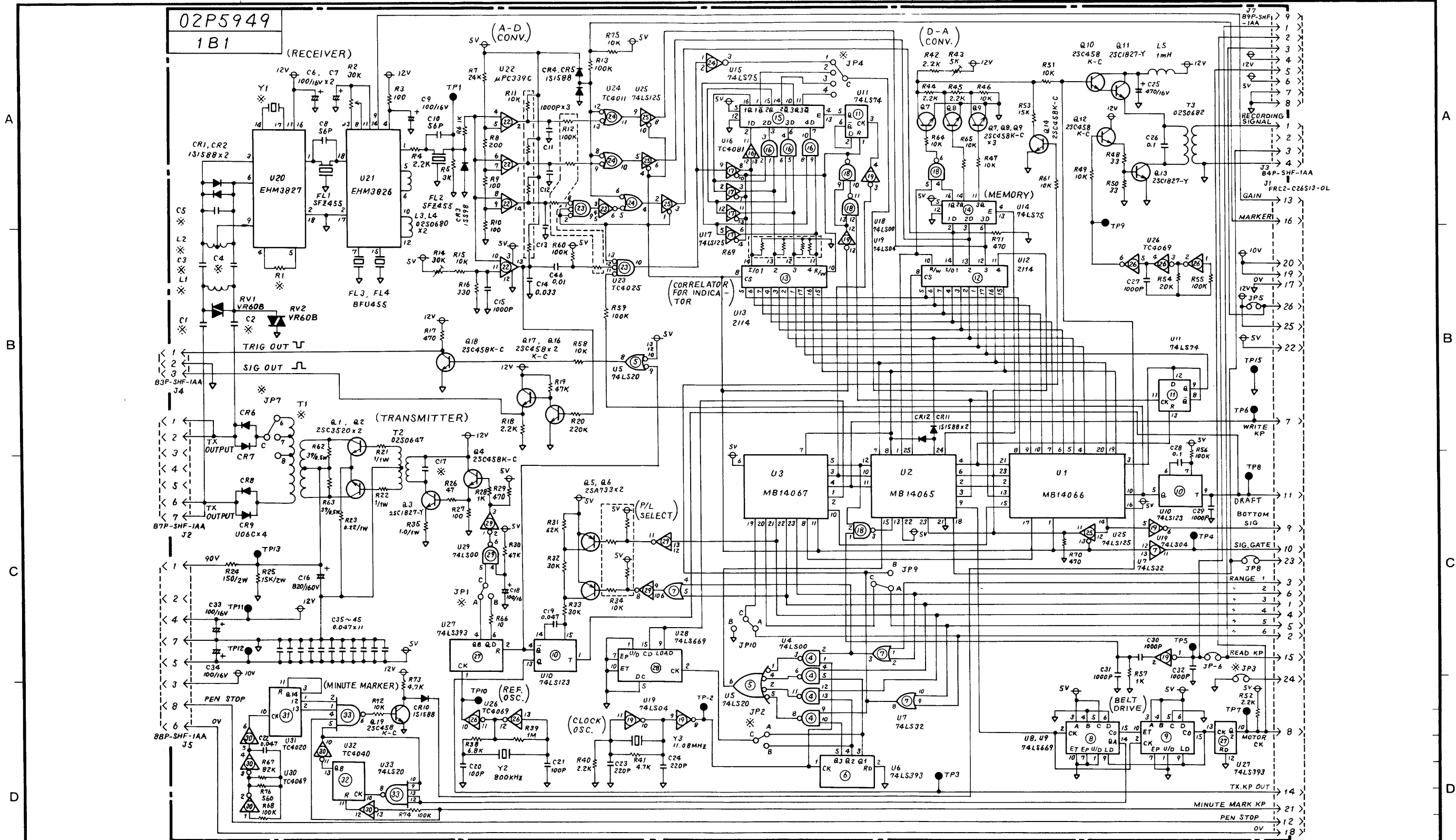
品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
承認 APPROVED	MAR-18-85	三角法 THIRD ANGLE PROJECTION			名称 TITLE FE-680 総合回路図 SCHEMATIC DIAGRAM
検 CHECKED	Mar. 6 '85	尺 SCALE			
製 DRAWN	Mar. 5 '85 I. Sakada	重 WEIGHT	kg	図 DWG.NO.	C2280-018-A



※ ----- 下表参照
SEE THE TABLE BELOW

	1B1	1B4
FE-680T-1	02P5949 200kHz	02P5952
FE-680T-2	02P5949 50kHz	02P5952

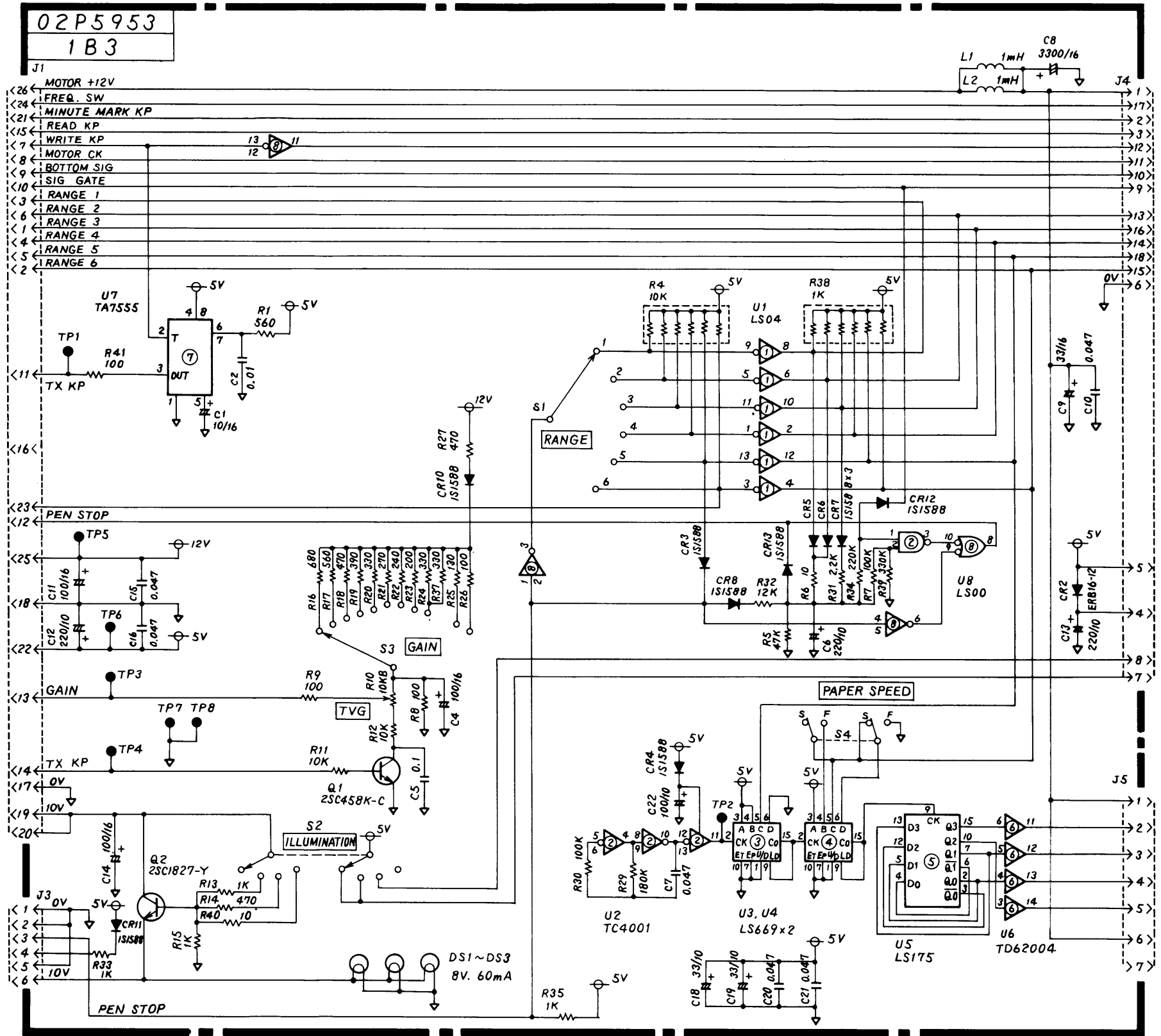
品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG. NO.	摘要 REMARKS
承認 APPROVED	MAR. 18 '85				
検 CHECKED					
製 DRAWN	MAR. 18 '85				
三角法 THIRD ANGLE PROJECTION		名称 TITLE		DWG. NO. C2280-011-A	
尺度 SCALE		重量 WEIGHT		総合回路図 SCHEMATIC DIAGRAM	



NOTE 1. 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.
 2. JP7は、整合箱を使用する時はC-7に変更する。
 WHEN MATCHING BOX IS USED, CHANGE CONNECTION OF JP7 TO C-7.
 3. *印の部品の数、型式、ジャンパーは送振周波数により異なる。
 COMPONENTS MARKED * DEPENDENT ON SYSTEM FREQUENCY. SEE TABLE BELOW.

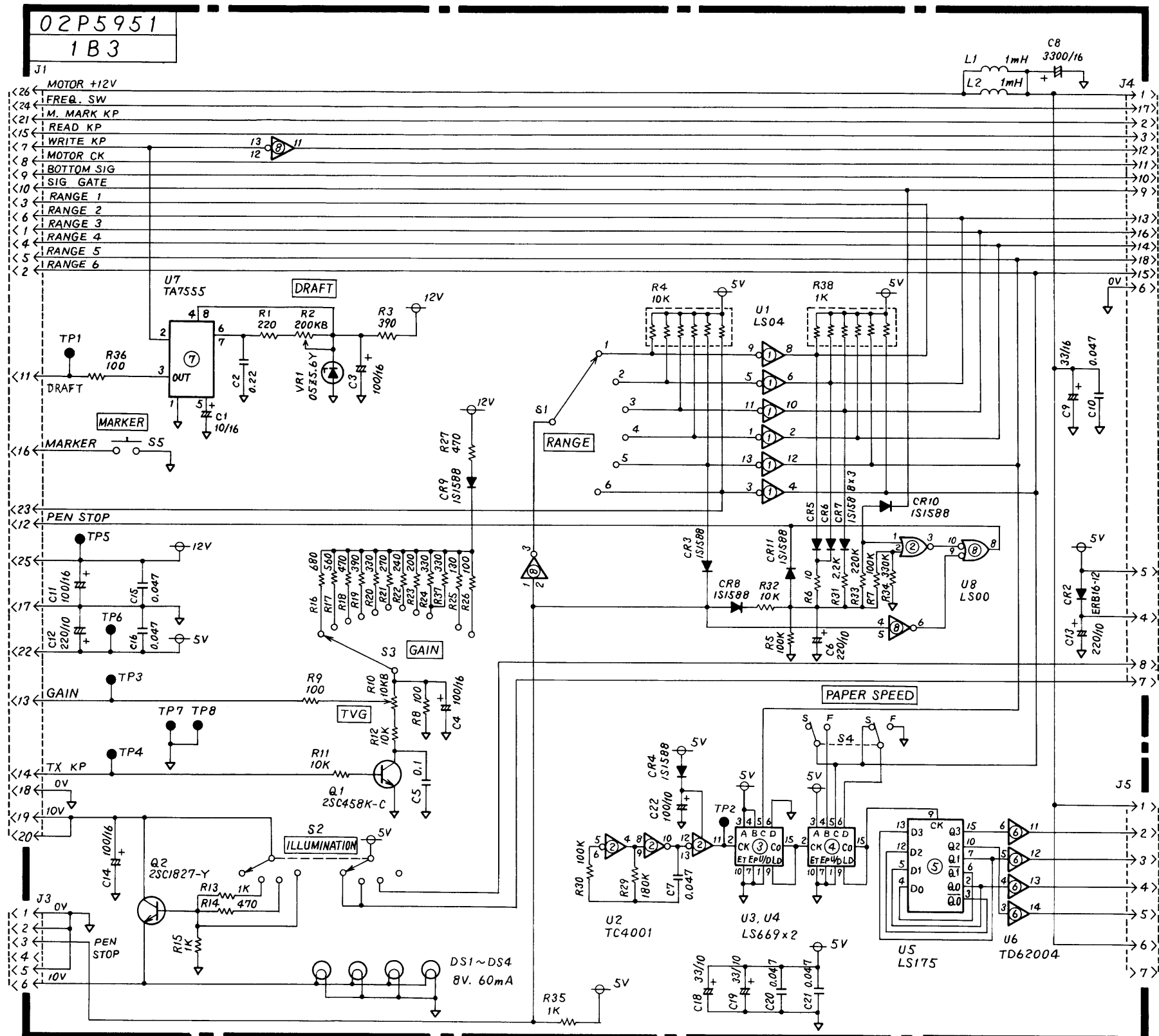
SYSTEM	C1	C2	C5	C17	R1	L1	L2	T1	Y1	JP1	JP2	JP3	JP4	JP5	JP6	JP7	JP8	JP9	JP10	C3	C4	
FE-680T-1	200KHZ	1500P	1500P	680P	0.047μ	1K	0.25	0.25	0.25	655KHZ	C-A	C-A	OPEN	C-1	SHORT	SHORT	C-6	OPEN	C-A	C-A	220P	220P
FE-680T-2	50KHZ	1500P	1500P	3300P	0.33μ	1K	0.25	0.25	0.25	505KHZ	C-B	C-B	SHORT	C-1	SHORT	SHORT	C-6	SHORT	C-B	C-B	1500P	1500P
FE-680-1	200KHZ	1500P	1500P	680P	0.047μ	1K	0.25	0.25	0.25	655KHZ	C-A	C-A	OPEN	C-1	SHORT	SHORT	C-6	OPEN	C-A	C-A	420P	470P
FE-680-2	50KHZ	1500P	1500P	3300P	0.33μ	1K	0.25	0.25	0.25	505KHZ	C-B	C-B	SHORT	C-1	SHORT	SHORT	C-6	OPEN	C-A	C-A	1500P	1500P

承認 APPROVED	<i>[Signature]</i>	名称 TITLE	FE-680T × 1 ン回路 FE-680 MAIN
検 CHECKED	<i>[Signature]</i>	製 DRAWN	番 DWG. NO.
	Mar. 6 '85	T. Sakoda	C2280-017-E



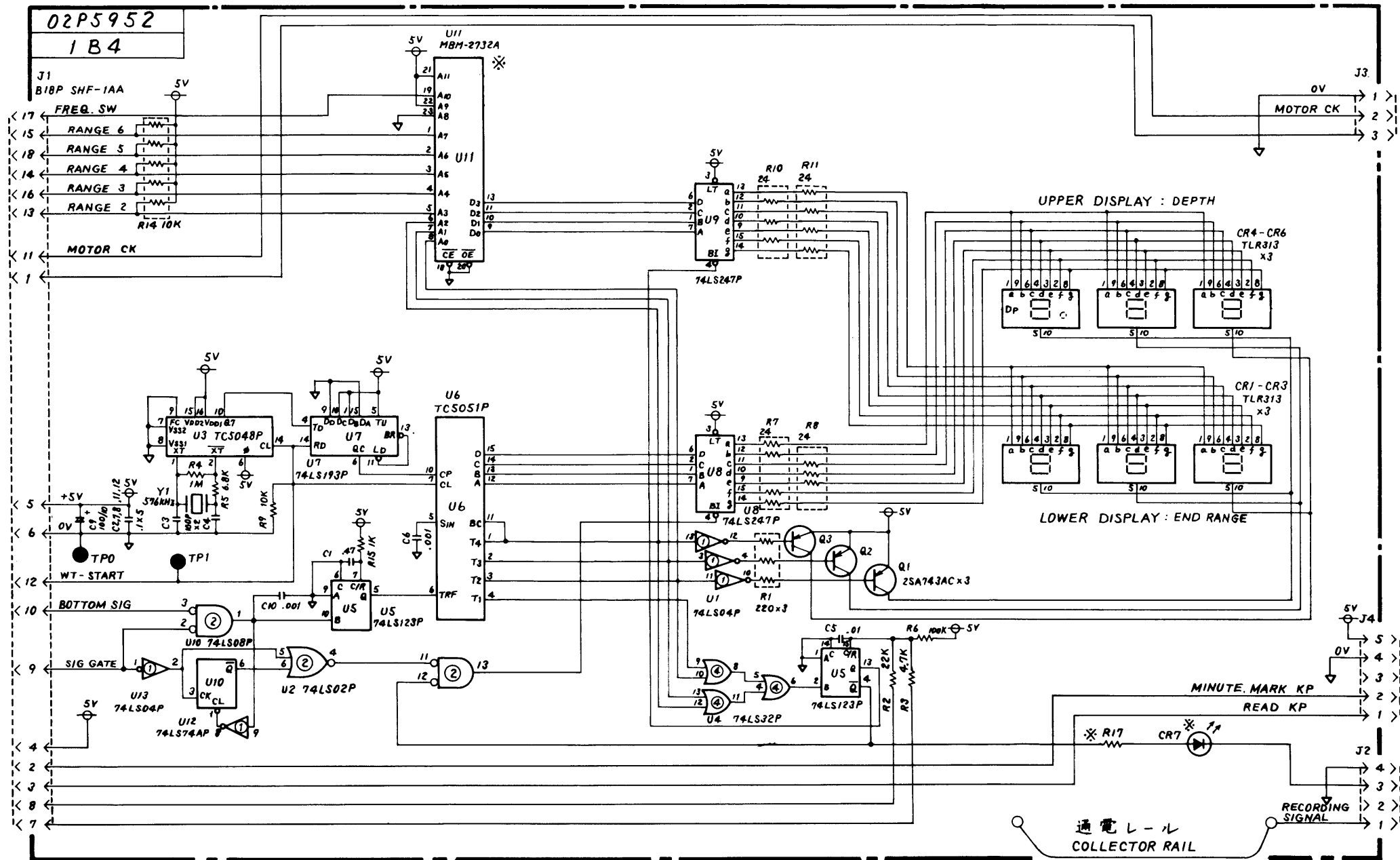
NOTE 1. 特記なき抵抗の値はΩ (1/4W), コンデンサの容量はμF.
 ALL RESISTANCE IN OHMS(1/4W) AND CAPACITANCE IN MICROFARADS UNLESS NOTED OTHERWISE.

承認 APPROVED	<i>MAR. 5 '85</i>	名称 TITLE	パネル回路 PANEL
検 CHECKED	<i>Mar. 5 '85</i>	番 FE-680	
製 DRAWN	<i>Mar. 5 '85</i> T. Sakada	図番 DWG. NO.	C2280-019-A



NOTE 1. 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.

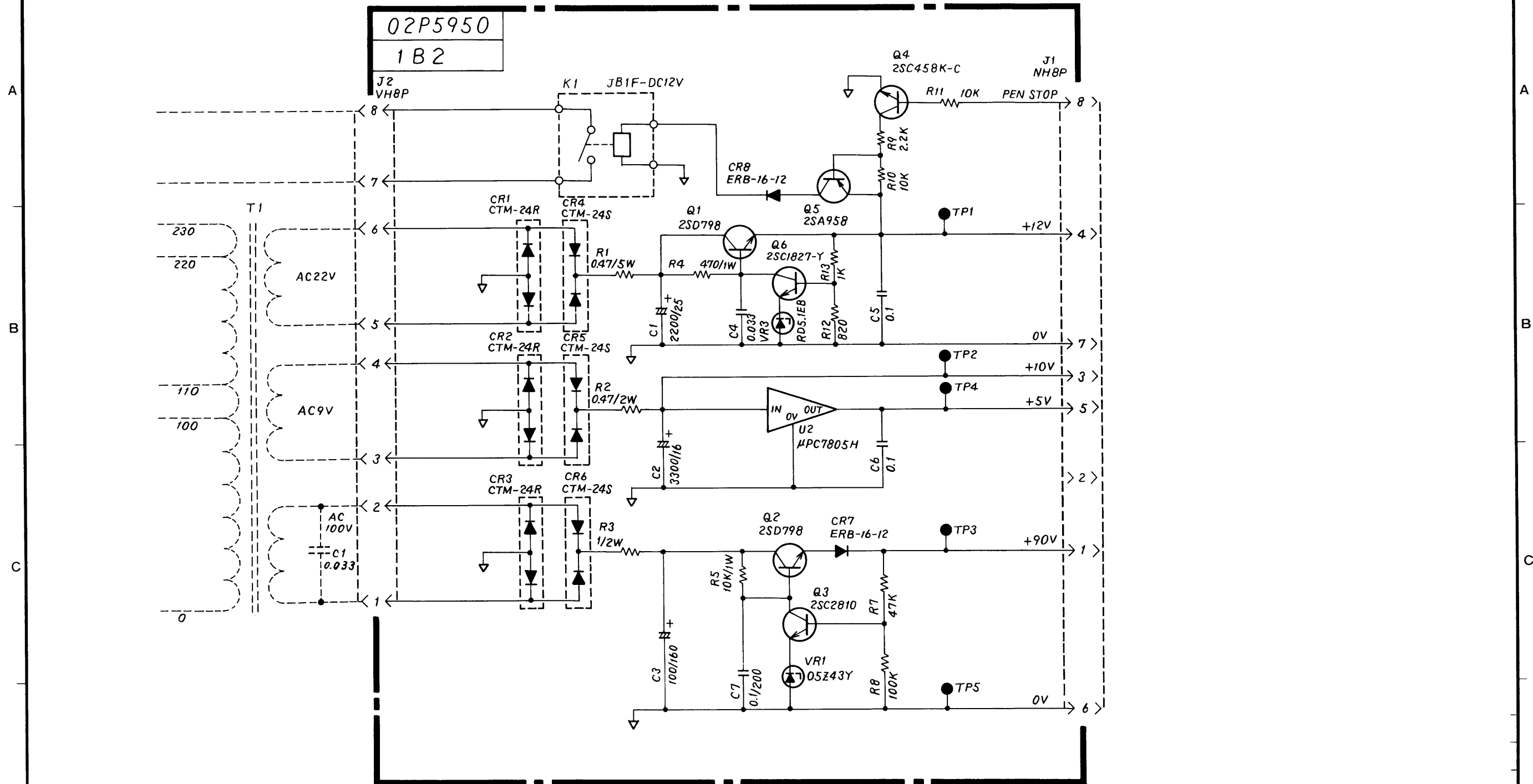
承認 APPROVED	<i>Max. 1.8.85</i>	名称 TITLE	パネル回路 FE-680T PANEL
検 CHECKED	<i>11.11.6.85</i>	図番 DWG. NO.	C2280-013-B
製 DRAWN	<i>Mar. 2. 75 T. Sabada</i>		



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.
 2. ※ ---- 下表参照
 SEE THE TABLE BELOW.

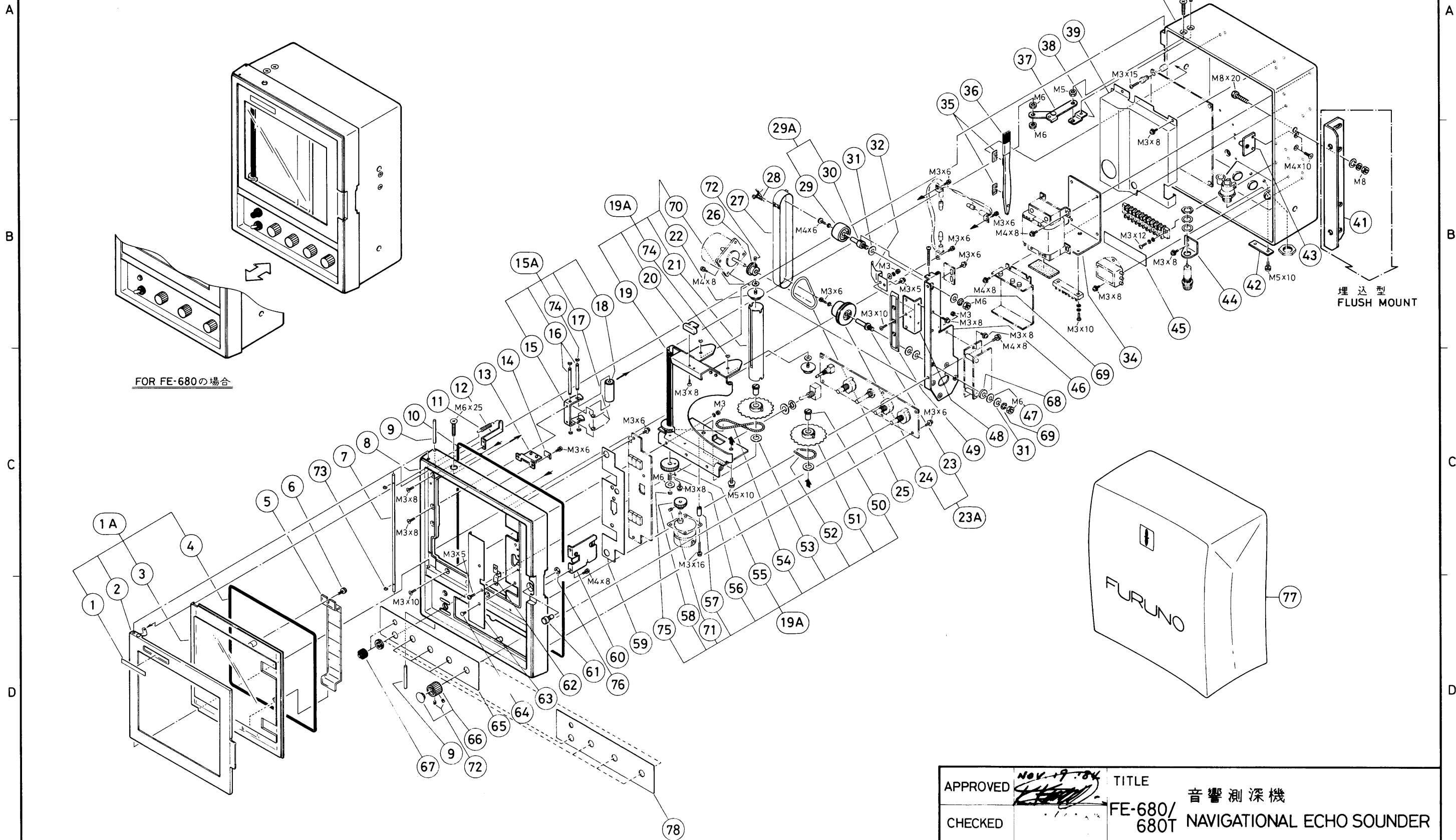
	U11	CR7	R17
A	02P5952	0250004	TLR102A
B	02P5952	0250003	OPEN

品番 ITEM	品名 NAME	材質 MATERIAL	数量 QTY	図番 DWG.NO.	摘要 REMARKS
承認 APPROVED	三角法 THIRD ANGLE PROJECTION				名称 TITLE
検 CHECKED	尺 SCALE				FE-680 表示回路 FE-680T DISPLAY
製 DRAWN	重 WEIGHT	kg			図番 DWG.NO. C2280-014-A



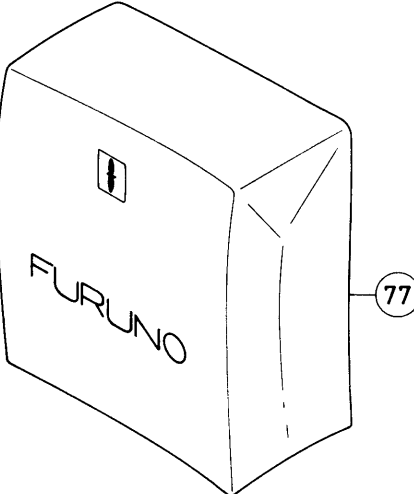
NOTE 1. 特記なき抵抗の値は Ω (1/4W), コンデンサの容量は μ F.
 ALL RESISTANCE IN OHMS (1/4W) AND CAPACITANCE IN MICROFARADS UNLESS NOTED OTHERWISE.

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
承認 APPROVED	MAR-18-85				
検図 CHECKED	THIRD ANGLE PROJECTION				
製図 DRAWN	I. Sabada				
品名 TITLE		FE-680 電源回路 FE-680T POWER SUPPLY			
重量 WEIGHT		kg			
図番 DWG.NO.		C2280-012-A			



FOR FE-680の場合

埋込型
FLUSH MOUNT



APPROVED	<i>Nov. 19 '84</i> <i>[Signature]</i>	TITLE	音響測深機
CHECKED		FE-680/ 680T	NAVIGATIONAL ECHO SOUNDER
DRAWN	<i>Nov. 13 '84</i> <i>Hoshino</i>	DWG. NO.	C2280-015-B