FURUNO

SERVICE MANUAL

COLOR VIDEO SOUNDER

MODEL FCV-667/668

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•Your Local Agent/Dealer

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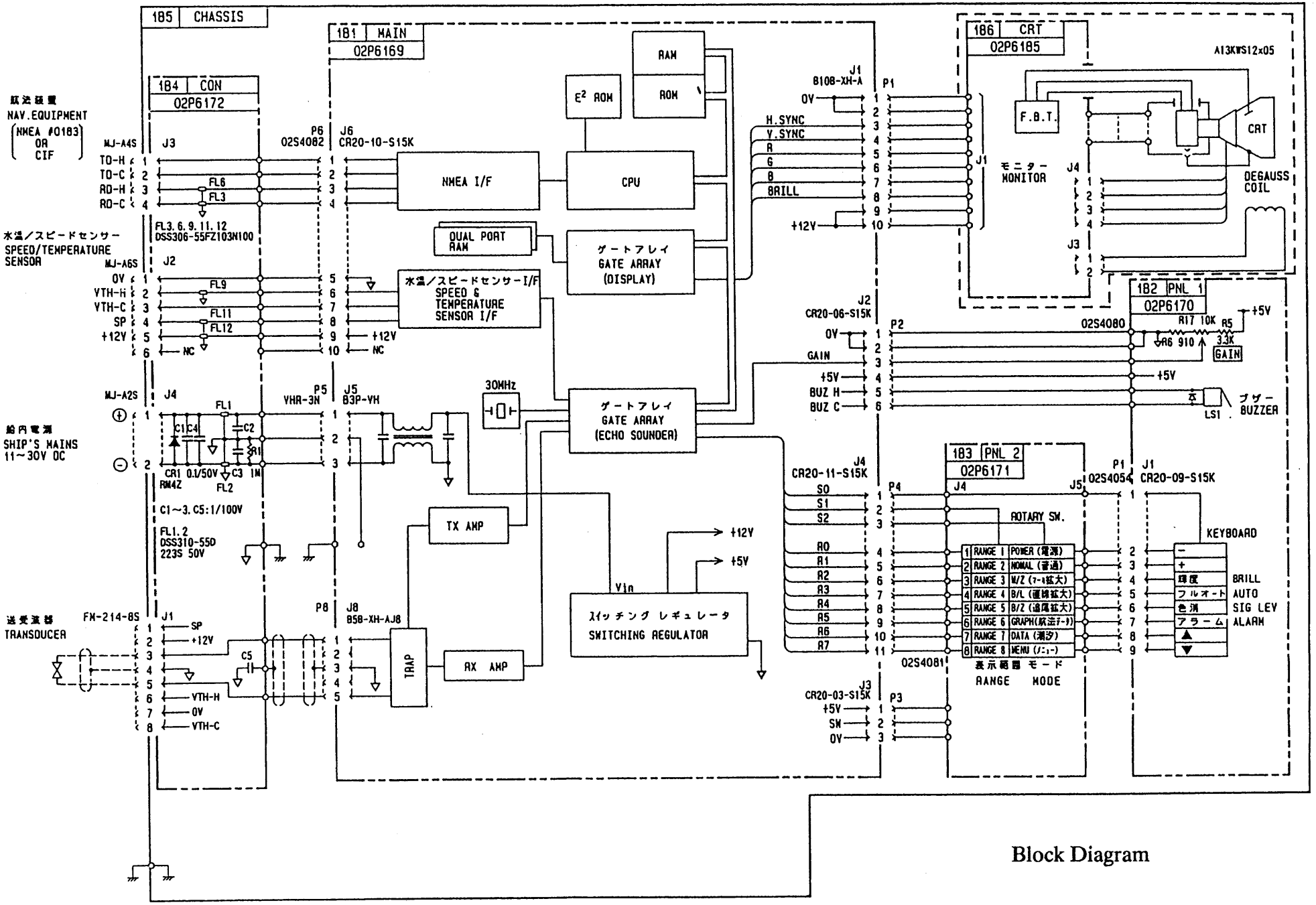
FCV-667/668
(YAKI)

Table of Contents

1. CIRCUIT DESCRIPTION

1.1 SYSTEM OVERVIEW

The FCV-667/668 color video sounders are composed of major blocks shown in the block diagram on page 1-3. Almost all operations such as transmission, reception, signal processing, etc. are performed on the MAIN board. Microprocessors, gate arrays and hybrid IC are employed on this board to realize compactness and high reliability of the unit. Two gate arrays used are highly integrated ICs specially designed for echo sounders. The gate array (1) is for E/S data processing. The major functions are reading operator command from the panel keys and controls, processing echo data and acquiring ship's speed and temperature. The speed of echo data processing is enhanced by employing the DMA (Direct Memory Access) devices. The gate array (2) is for displaying echoes on the color monitor.

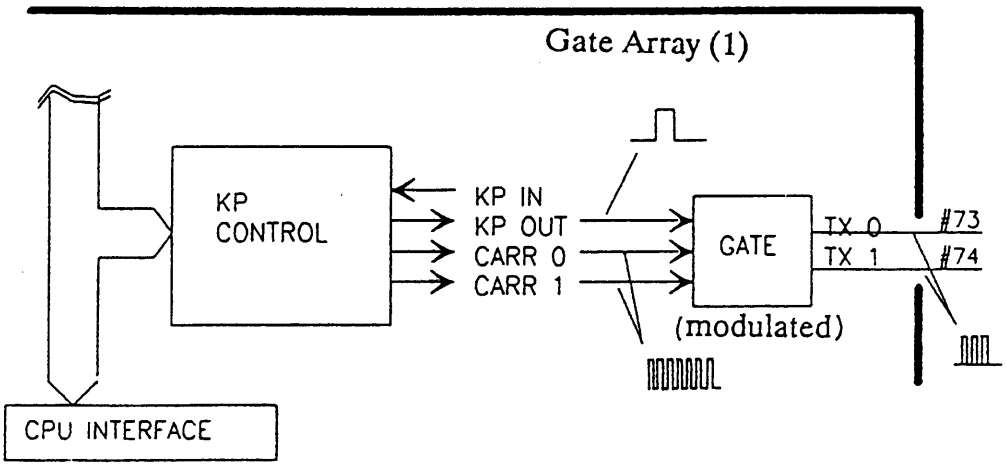


Block Diagram

1.2 TRANSMITTER CIRCUIT

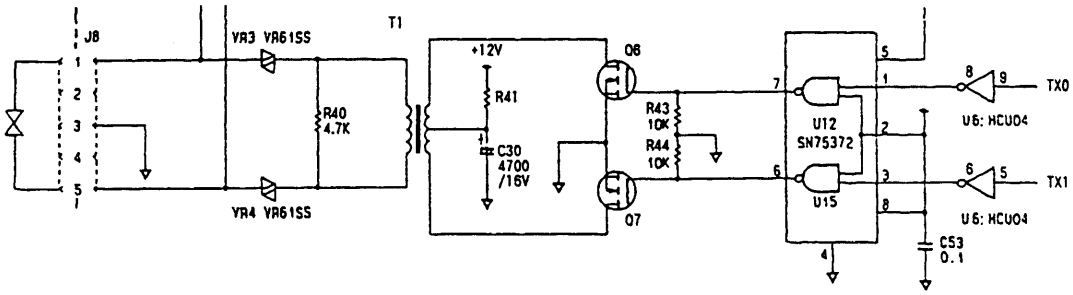
1.2.1 Keying Pulse (KP) Control Circuit

The KP to drive the transmitter circuit is generated in the KP control circuit contained in the gate array (1) whenever the echo data processing for the preceding transmission is completed. This KP is modulated by the transmission carrier signals and the resultant TX0 and TX1 are output to ports #73 and #74. The carrier signals on TX0 and TX1 are out of phase 180 degrees each other. Further their frequencies are alternated between 50kHz and 200kHz every transmission for the FCV-667 in dual frequency mode.



1.2.2 Transmitter Circuit

TX0 and TX1 from the gate array (1) are amplified by the push-pull power amplifier and applied to the transducer through transformer T1 and the T/R circuit. Dual MOS FET driver U12 functions to drive the succeeding (high capacitive impedance) power amplifier.



1.2.3 T/R Circuit

See schematic diagram on page S-3.

The T/R circuit is a directional network for transmitter and receiver and consists of VR1 to VR4. It isolates the receiver during transmission, and vice versa so that the receiver is protected from strong transmission signals and received signals are fed to the receiver with minimum loss.

Transmission

Transmission signals make VR1 to VR4 conduct and are delivered to the transducer. The receiver is isolated by conductive VR1 and VR2; only small amount of transmission signals is led to the receiver and displayed as transmission line on the screen.

Reception

Since the received signals are too weak to make VR1 through VR4 conduct, they are led to the receiver circuit. C10/T2/C12 and C11/T3 respectively resonate at transmission frequencies to deliver the received signals to the receiver circuit with minimum loss.

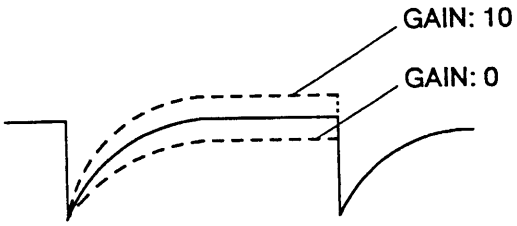
1.3 RECEIVER CIRCUIT

See the schematic diagram on page S-3

The receiver circuit comprises pre-amplifier, mixer, main amplifier, detector and gain/TVG circuit. All circuits except for preamplifier and detector are contained in a hybrid IC U11.. The received signals from the transducer are converted to 455kHz IF by the mixer, amplified by the main amplifier, envelope-detected by the detector and sent to the signal processing circuit. Overall gain of the receiver is approximately 90dB with the GAIN control set fully clockwise.

TVG Circuit

The TVG circuit generates a waveform which controls amplifier gain. The waveform is as shown below and lowers the gain for a short period of time after transmission to suppress unwanted echoes from small objects in surface water.



TVG Waveform

1.4 SIGNAL PROCESSING/DISPLAY CIRCUIT

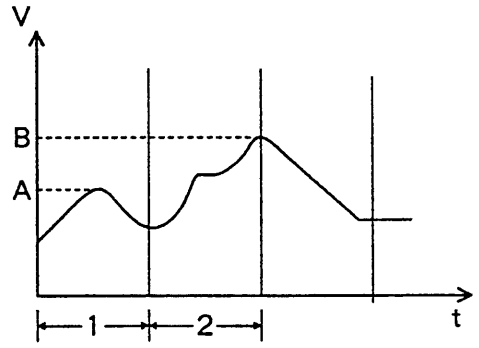
The echo signals fed by the receiver circuit are acquired by the CPU after being A/D converted to string of 3 bit data and peak-held at regular intervals in gate array (1).

1.4.1 Echo Data Acquisition

The digital echo data in the output of the A/D converter are peak-held at regular intervals, and the resultant data are stored in the CPU's SRAM.

Peak-hold

In the peak-hold processing, the peak level of signal is detected at regular intervals. If for example, there is a signal shown below and if the signal is sampled at regular intervals, the level "A" is taken out in period 1 and level "B" in period "2" in order to prevent the signal from being missed due to a low signal level at a sampling point. The sampling rate is determined by the number of pixels on the CRT, the depth range in use and the presentation mode.



Data acquisition

The data acquisition control circuit in the gate array (1) determines how to store echo data considering the depth range and range shift settings. With the range shift set at "0", the data acquisition is initiated by the KP. With the range shift set to other than "0", the data acquisition start timing is delayed by the time equivalent to the shift seting.

For the bottom-lock expansion picture, the start depth from which the echo data is stored in the memory is determined by referring to the seabed depth data obtained in the preceding cycle. If the depth and the range setting of the bottom-lock picture is known, the start depth is given by

$$\begin{pmatrix}\text{Acquisition}\\ \text{start depth}\end{pmatrix} = \begin{pmatrix}\text{Bottom depth obtained}\\ \text{in the last transmission}\end{pmatrix} - \begin{pmatrix}\text{Bottom-lock}\\ \text{expansion range}\end{pmatrix}$$

When the memory is full with data down to the necessary depth, all data are transferred to the memory of the CPU for further processing.

1.3.3 Processing and Presentation

The echo data transferred to the memory of the CPU are processed further as follows.

Seabed recognition

To recognize the seabed, the CPU examines echo data one by one from the surface to the end of data, looking for the echo with level of 111 (reddish brown) and 110 (red). There will be a lot of 111 and 110. In the second step, it measure the duration of 111 and 110 data and recognizes an echo as seabed when it is the longest.

Once the seabed is captured, the CPU creates a narrow bottom-tracking window covering several meters above and below the seabed depth. And in the next transmission cycle, echoes within this window are examined. Position of the bottom tracking window is shifted every transmission so that the newly recognized depth is placed in the center of the window. When the seabed echo is absent within the window over several transmissions, the CPU searches it again.

Interference rejection

The interference/noise have a nature to be received at random while echo signal is received consecutively at the same depth for several transmission cycles. To eliminate interference/noise components, the CPU correlates the new data string with previous ones for 2 to 4 successive transmission cycles.

Longitudinal peak-hold processing

If, for example, the picture advance speed is set to "1", the picture advances one line every eight transmissions and therefore one string of echo data is necessary every eight transmissions. The CPU compares each data in the same depth for eight transmission cycles and selects the one with the highest amplitude.

Presentation

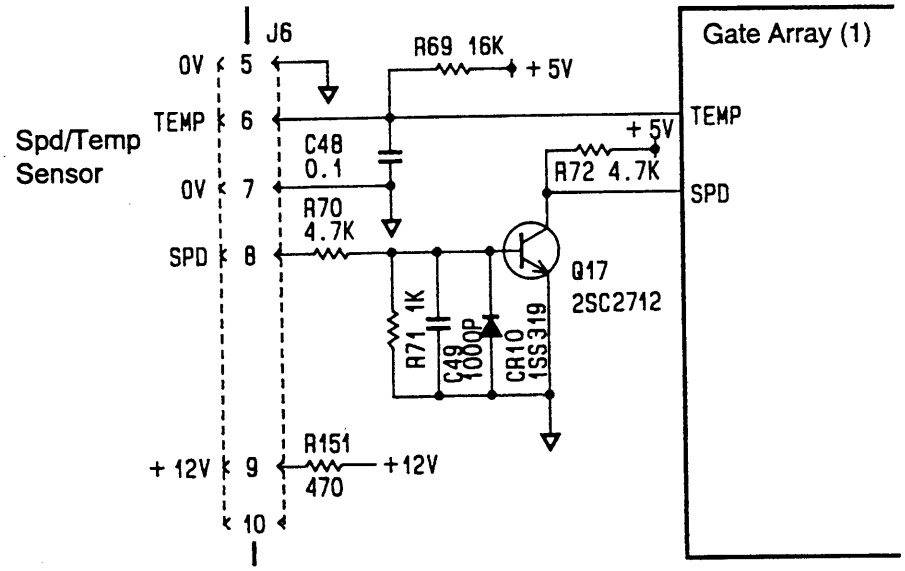
After all necessary processings have been performed, the echo data are transferred into the video RAM (dual port RAM) where all data are stored in the form and order ready for display on the screen.

Data in the video RAM are read out successively by the H/V counter that operates independently of the CPU, converted to the RGB signals in the gate array (1) and then sent to the color monitor display.

1.4 SPEED/TEMPERATURE SENSOR CIRCUIT

Speed data

Speed data (SPC) is detected as number of the pulses and applied to gate array (1). The CPU calculates the speed through the counter and timer in gate array (1). Indication error caused by the variation of the sensor characteristics can be compensated on the menu.



Water temperature data

Water temperature data (Vth) is detected in resistance and applied to gate array (1), where it is processed and read by the CPU.

1.5 POWER SUPPLY CIRCUIT

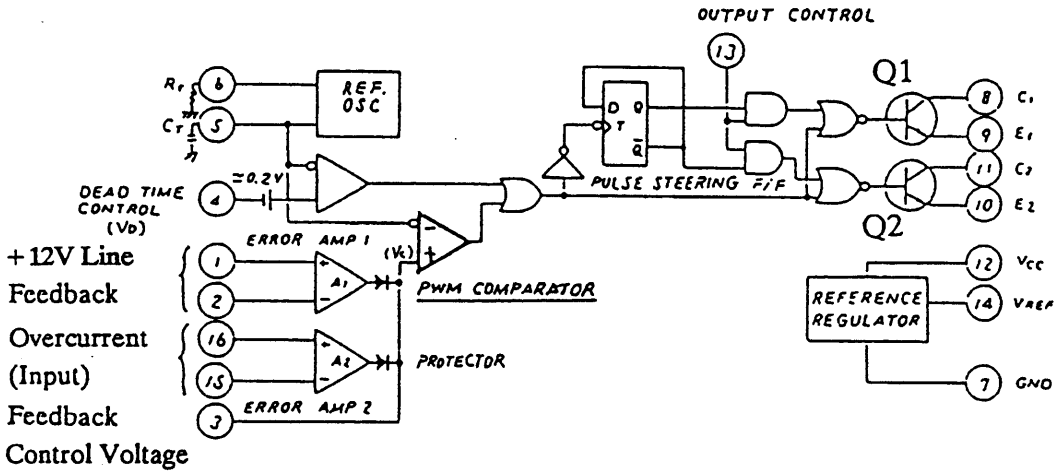
Overview

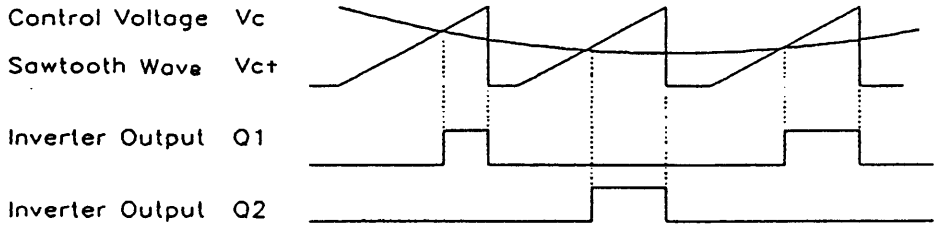
The power supply circuit is made up of a PWM (Pulse Width Modulation) inverter employing switching regulator technique. The PWM inverter universally operates on ship's mains of 11 to 30Vdc. Against the variation of the mains voltage and loads, it regulates dc output line voltages by changing the width of its output pulse. The power supply circuit provides +12V and +5V.

1.5.1 Switching Regulator

PWM modulation

The PWM modulation is done by comparing the control voltage (Vc) and the sawtooth wave produced at the reference oscillator terminal Ct. When the sawtooth wave voltage exceeds the control voltage, output transistors Q1 and Q2 turn on.





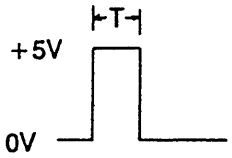
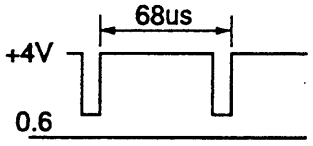
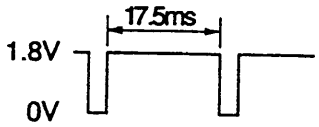
Voltage regulation

The dc output voltage is regulated by monitoring +12V line voltage. If the +12V line voltage changes, the voltage at "+" terminal of error amplifier A1 changes, resulting that the slice level of the sawtooth wave moves. As the control voltage rises, the output pulselength goes narrow.

If the current is over-consumed in the transmitter, the voltage drop detected across R97 (shown on page S-5) cuts off the regulator output.

2. ADJUSTMENT AND CHECK

2.1 SIGNAL CHECK ON MAIN BOARD

Test Item	Ratings	Remarks
+12V +5V	12.2-12.4V 4.9-5.1	+12V is adjusted by R17
KP (U6-#6/#8)		T: Pulselength (0.2-3.0 ms) depends on range setting.
SIG (R32/C68 junction)		
H-SYN (Q11 emitter)		14.58kHz
V-SYN (Q12 collector)		56.97Hz

2.2 TRANSMITTER OUTPUT CHECK

The trnsmitter output voltage is shown in the table below. The voltage can be checked with or without connecting transducer.

Freq	Measuring Point	Rated Voltage
50 kHz	J1 #3-#5 (J8 #1-#5)	400 - 1150Vpp*
200 kHz		400 - 1150Vpp*

*: Varies with the transducer impedance

2.3 TEMPERATURE/SPEED SENSOR CHECK'

Item	Output	Checking method and reference value
Ship's Speed (SPC)	Pulse	Connect an oscilloscope or LED across #8 and #9 of J6 on the MAIN board and rotate the sensor wheel by finger or breath. If the pulse wave is observed or the LED lights, the sensor is normal. [Referene Value] 10 knots---55 pps approx. 20 knots---109 pps approx.
Water Temperature (Vth)	Resistance	Output is checked in resistance. Connect the multimeter across pin #1 and #2 of the sensor plug to measure the resistance. [Reference Value] 0°C---32.7k ohms approx. 10°C---19.9k ohms approx. 25°C---10.0k ohms approx. 30°C---8.05k ohms approx.

2.4 TRANSDUCER CHECK

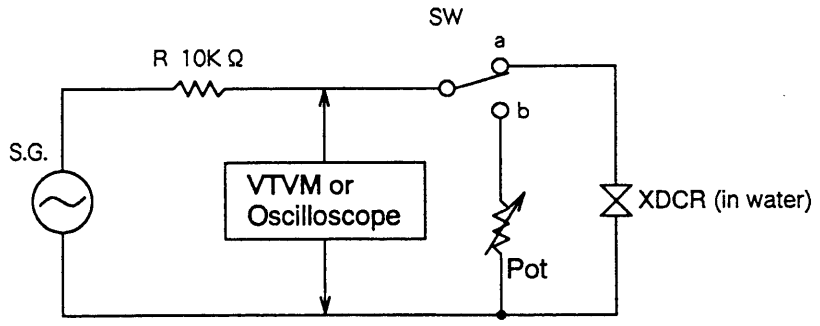
The transducer used in FCV-667/668 are made of barium titanate and equivalent to the capacitor electrically.

2.4.1 Insulation

The insulation reisistance between the shield and each conductor of the transducer cable is the first place to check to determine if the transducer itself is defective. A megger (500 Vdc) is used for this check.
Rated Value: 10M ohms or more

2.4.3 Impedance Test

To check the transducer without dismounting it, follow the procedure below.



Procedure

1. Set the SW to "1"

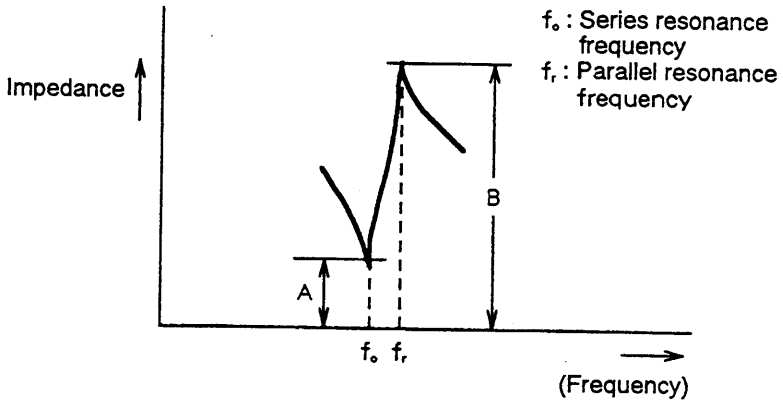
2. Set the output frequency of the signal generator at a frequency adjacent to the resonant frequency of the transducer. Measure the voltage across the transdudcer with a precision voltmeter or oscilloscope.

3. Turn the SW to "2" and adjust the potentiometer so that the oscilloscope indicates the same voltage as that measured in step 2. Then, measure the resistance of the potentiometer. This resistance is the impedance of the transducer at the above frequency.

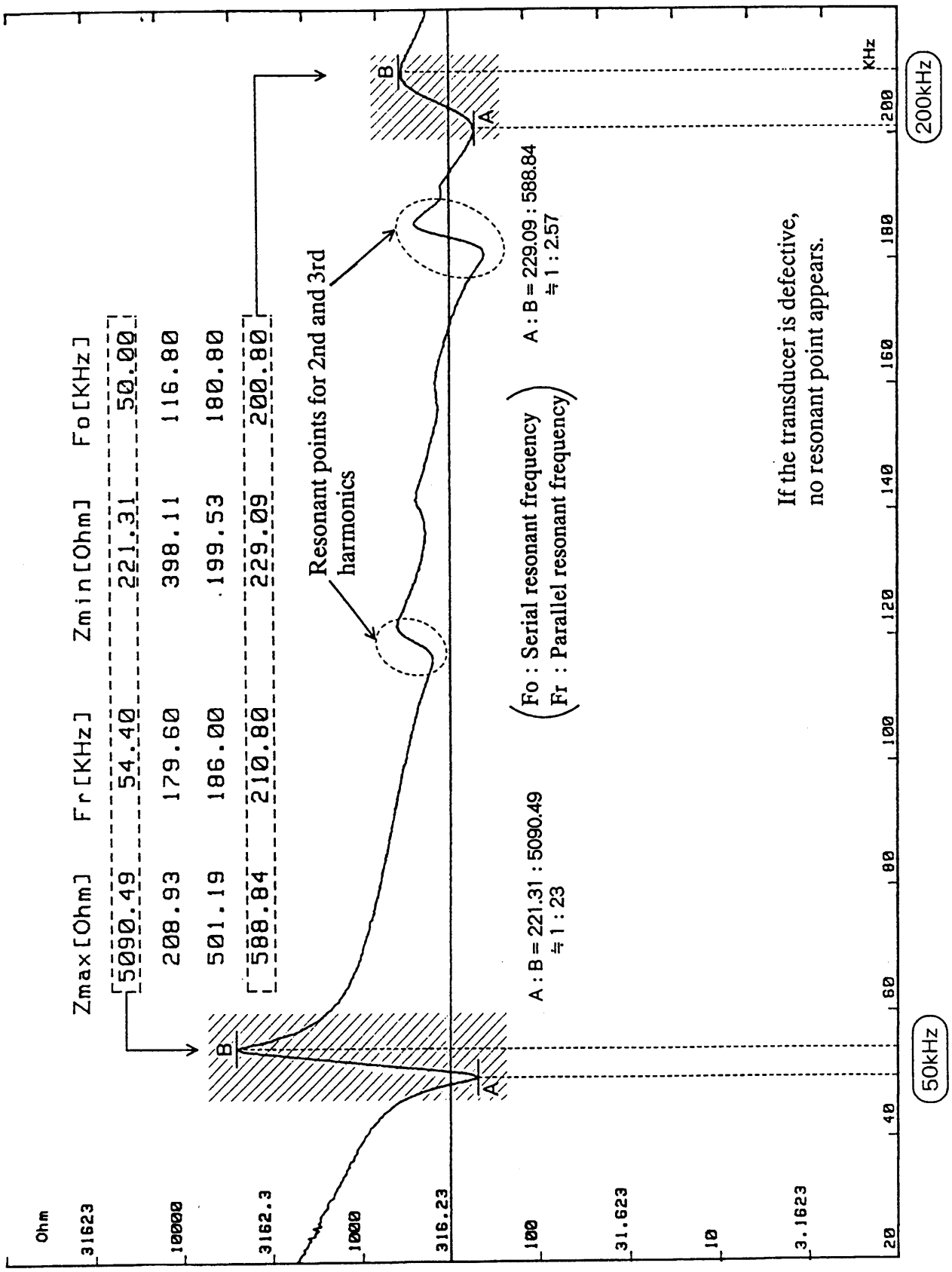
4. Repeat steps 1 through 3 with frequency changed little by little, then plot the measured resistance.

Reading resistance curve

The resistance curve thus obtained will have a typical curve as shown in the figure below. Compare it with a curve taken from a good transducer to judge normal or faluty. The important point is the ratio A to B. See the measured data of 520-5MSC/5PSC on the next page. The ratio differs by the type of the transducer and measuring condition, i.e., in air or in water.

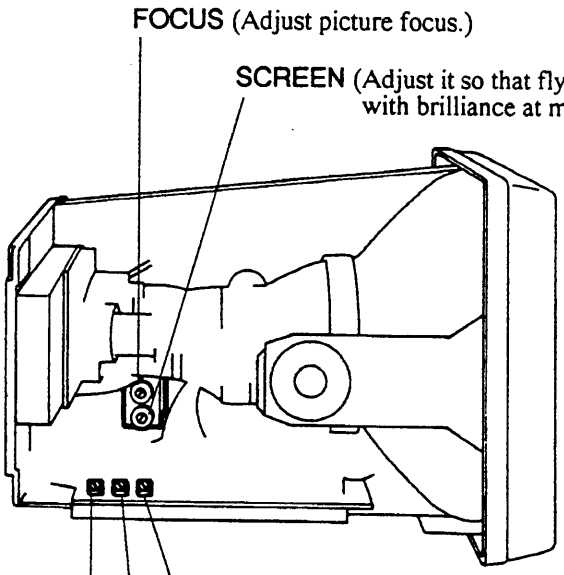


520-5MSC/520-5PSC Data Measured in Water



2.5 CRT ADJUSTMENT

Refer to the drawing below to adjust the CRT.

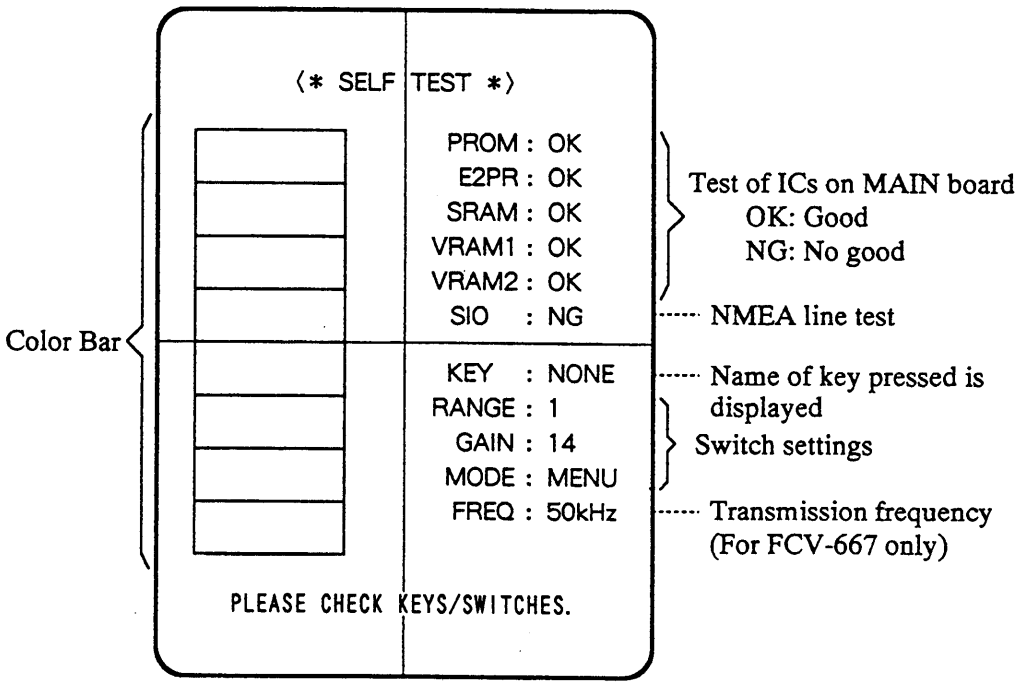


2.6 Self-Check

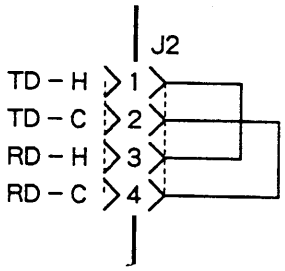
The FCV-667 incorporates diagnostic self-check facilities, enabling to find a faulty pc board. .

Procedure

1. Turn the unit on while pressing one of the keys.
2. Press **SHIFT** [-] key.
   The self-check screen is displayed.



3. First, the memory ICs on the MAIN board are checked. When an IC is defective, that is, when "NG" appears, replace the MAIN board.
4. Next, input/output lines of the NMEA port are checked. Since this is a loop-back test which receives data output from TD line, connect jumpers between TD and RD lines as shown below.



5. With NMEA line test completed, "PLEASE CHECK KEKS/SWITCHES" appears on the screen. Perform the checks. In the key check, the name of the key pressed is displayed (ex. -, +, ALARM). In the switch test, the setting of the switch operated is displayed.

6. To exit the self test, turn the unit off and on.

3. SPECIFICATIONS

1. Display 6" diagonal CRT

2. Echo Color 8 colors (including background color) according to echo intensity. Monochrome display is also available. The background color is selectable from blue, light blue and black.

3. Basic Range

Range No.	1	2	3	4	5	6	7	8
Meters	5	10	20	40	80	150	200	300
Feet	15	30	60	120	200	400	600	1000
Fathoms	3	5	10	20	40	80	100	150
Passi/Braza	3	5	10	30	50	100	150	200

The basic ranges can be changed on the system menu.

4. Range Shift Up to 300 meters (1000 feet, 150 fathoms, 200 passi/braza)

5. Zoom Range Times 2, 3, 4 and 5 ranges

6. Bottom Lock Expansion Range

Meters	Feet	Fathoms	Passi/Braza
5	10	2	2
10	20	5	5

7. Auto Mode Automatic adjustment of range and gain

8. Display Mode Five modes

9. Zoom Display Marker Zoom
Bottom Zoom
Bottom-lock Expansion

10. Display Advance Speed

Setting	0	1	2	3	4	5
Lines/TX	Freeze	1/8	1/4	1/2	1/1	2/1

11. TX Frequency/ Output Power FCV-667: 50 and 200 kHz (alternately transmitted), 150 Wrms
FCV-668: 50 or 200 kHz, 150W rms

12. Pulselength/TX Rate

Display End Depth	Pulselength (ms)	TX Rate (pulse/min)
5m	0.2	600
10m	0.2	600
20m	0.2	600
40m	0.4	375
80m	0.8	187
150m	1.5	100
300m	3.0	50

13. Interference Rejector

Rejects unwanted signals by comparing last and present echoes in strength.

14. Alarm

Bottom alarm

15. Input/Output Data (NMEA #0183 or CIF Format)

NMEA #0183 Format Input/Output Sentence (version 1.5)

Input	RMB, BWC, RMC, RMA, GLL, VTG, VHW, MTW, XTE
Output	SDDBT (depth), YCMTW* (water temperature) VWVHW* (ship's speed)

CIF Format Input Output Data

Input	L/L, Ship's Speed, Course, Waypoint ID, Range to Waypoint, Waypoint Bearing, Water Temperature, Cross-track Error
Output	Depth, Water Temperature*, Ship's Speed*

*Requires speed/temperature sensor.

16. Environmental Condition

Temperature: 0 - 50 °C (Splashproof structure)
Relative Humidity: Less than 85 %

17. Power Supply

11 to 30 Vdc, approx. 30 W.

4. NMEA 0183 DATA INTERFACE INFORMATION

General

Version complied Version 1.5

Data output interval 2 seconds

Accepted Sentences as Listener

Talker Identifier	Formatter	Remarks
**	RMB	
**	BWC	
**	RMC	
**	RMA	
**	GLL	
**	VTG	
**	VHW	
**	MTW	
**	XTE	

**: Any talker accepted

Talker priority GP (high) → LC → LA → DE → TR → Others (low)

A talker with lower priority is accepted when a talker with higher priority is absent for more than 30 seconds. A talker with higher priority is accepted on real time when it becomes available.

Sentence priority A sentence with lower priority is accepted when a sentence with higher priority is absent for more than 30 seconds. A sentence with higher priority is accepted on real time when it becomes available.

Range/bearing to waypoint

RMB → BWC

Ship's speed/course, ship's position

RMC → RMA → VTG/GLL/VHW

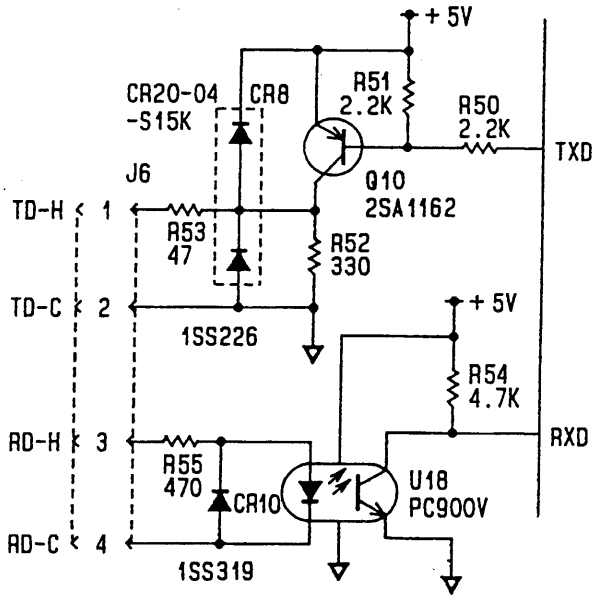
Cross-track error

RMB → XTE

Output Sentences as Talker

Talker Identifier	Formatter	Remarks
SD	DBT	The data is output while bottom echoes are detected by the unit.
YC	MTW	Data measure by speed/temperature sensor (option) is output. When the speed/temperature sensor is not connected, data fed by external equipment (navaid) is output.
VW	VHW	Data measure by speed/temperature sensor (option) is output. When the speed/temperature sensor is not connected, data fed by external equipment (navaid) is output. Bearing data field is unused.

NMEA Port Circuit Configuration



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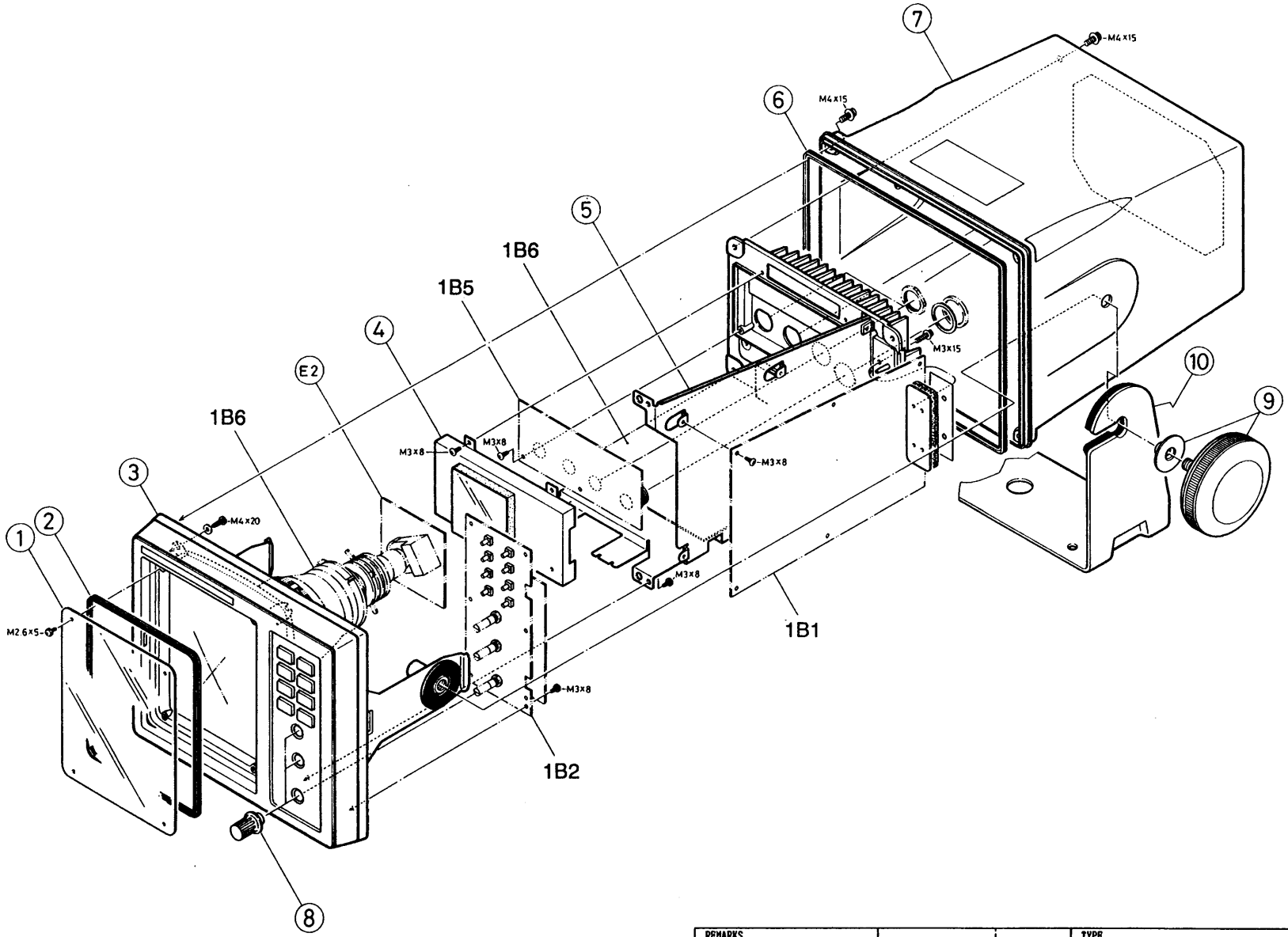

REMARKS				TYPE CV667/668
DRAWN M.I	APPROVED Feb 22 '94 IKEDA	FCV-668 FCV-667		名称 指示器
SCALE /	MASS kg	APPLICABLE TO: (MODEL)	BLOCK NO.	NAME DISPLAY UNIT
				DWG NO. C2345-E01- B

FURUNO ELECTRIC CO., LTD.

D-1

FURUNO

ELECTRICAL PARTS LIST
電気部品表

1994- 2

MODEL	FCV-667		
UNIT	COLOR VIDEO SOUNDER カラー魚群探知機		PAGE
REF. DWG.	C2345-K05-A	BLOCK NO.	1

SYMBOL 記号	TYPE 型名	SPECIFICATIONS 規格	CODE NO. コード番号	REMARKS 備考
	PRINTED CIRCUIT BOARD		プリントキバン	
1B01A0001	02P6169A MAIN	CV-667-J	001-381-720	J
	02P6169B MAIN	CV-667-E	001-381-730	E
1B02A0002	PANEL1/2	CV-667/668	001-381-670	1B2/3
1B05A0005	02P6172 CON	CV-667	001-381-710	
1B06A0006	02P6185 CRT/NECK	CV-667/668	001-381-740	
	CRT ASSEMBLY		CRT クミヒン	
1B06A0001	A13KWS12X05	02S5079-0	000-131-907	
	JACK		ジャック	
1B05J0001	FM214-8SMPT-KW		000-131-904	
1B05J0002	MJ-A6SRMD	22S0194-2	000-123-994	
1B05J0003	MJ-A4SRMD	22S0193-2	000-123-993	
1B05J0004	MJ-A2SRMD	22S0192-2	000-123-992	

- END -

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ELECTRICAL PARTS LIST
電気部品表

1994- 2

MODEL	FCV-668			
UNIT	COLOR VIDEO SOUNDER カラー魚群探知機			PAGE
REF. DWG.	C2348-K01-A	BLOCK NO.		1

SYMBOL 記号	TYPE 型名	SPECIFICATIONS 規格	CODE NO. コード番号	REMARKS 備考
	PRINTED CIRCUIT BOARD	プリントキバン		
1B01A0001	02P6169-C-50 MAIN	CV-668-J-50	001-382-410	J, 50K
	02P6169-C-200 MAIN	CV-668-J-200	001-382-420	J, 200K
	02P6169-D-50 MAIN	CV-668-E-50	001-382-430	E, 50K
	02P6169-D-200 MAIN	CV-668-E-200	001-382-440	E, 200K
1B02A0002	PANEL1/2	CV-667/668	001-381-670	1B2/1B3
1B05A0005	02P6172 CON	CV-667	001-381-710	
1B06A0006	02P6185 CRT/NECK	CV-667/668	001-381-740	
	CRT ASSEMBLY	CRT クミヒン		
1B06A0001	A13KWS12X05	02S5079-0	000-131-907	
	JACK	ジャック		
1B05J0001	FM214-8SMPT-KW		000-131-904	
1B05J0002	MJ-A6SRMD	22S0194-2	000-123-994	
1B05J0003	MJ-A4SRMD	22S0193-2	000-123-993	
1B05J0004	MJ-A2SRMD	22S0192-2	000-123-992	

- END -

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機　械　部　品　表

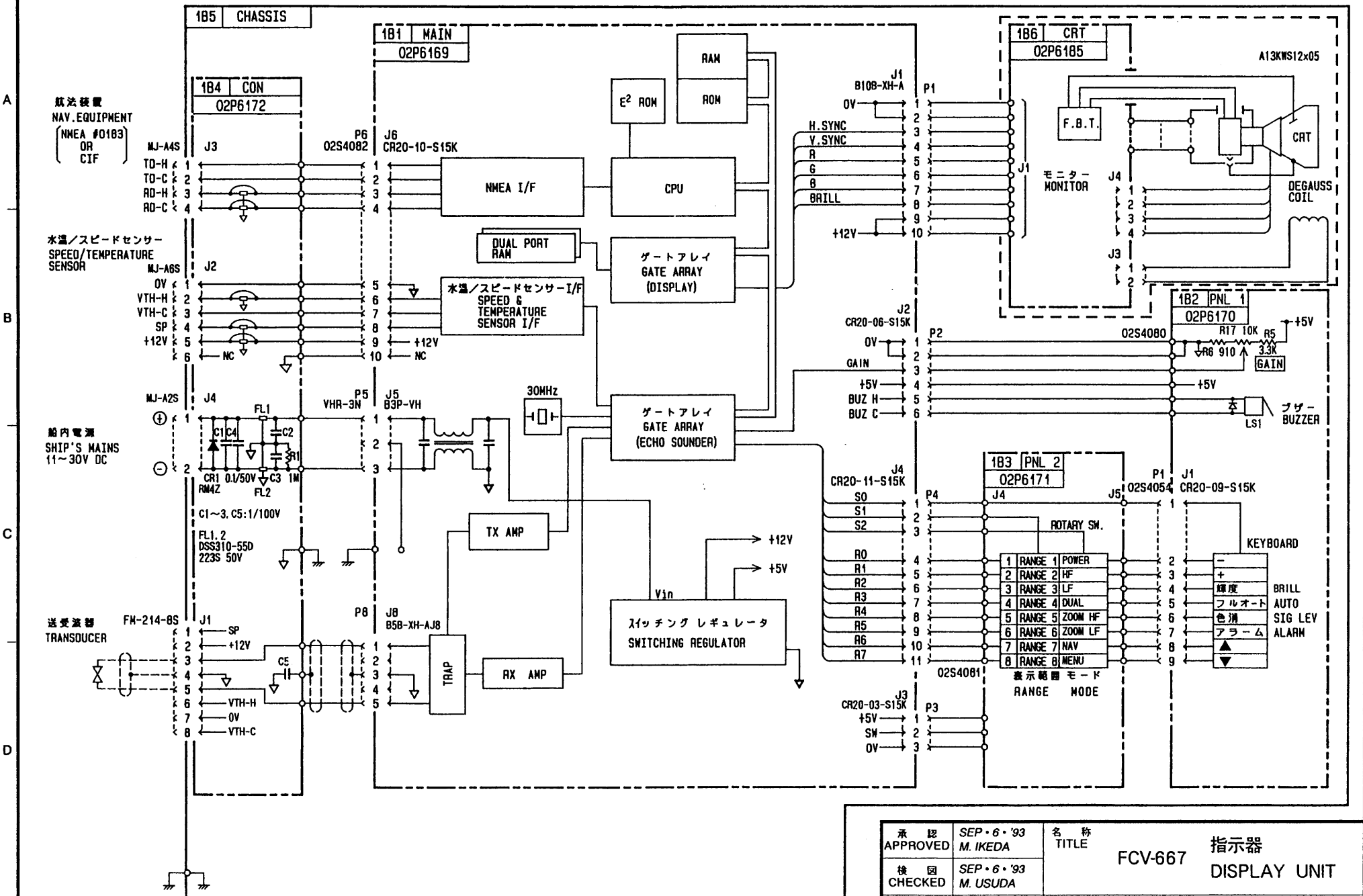
1993-11

型　式	FCV-667／668	
ユニット	カラー魚群探知機	ページ
参照図番	C2345-E01-A	M- 1

記　号	部　品　名	型名／図番	コード番号	備　考
1	ﾌｲﾙﾀ	02-113-1002-0	100-207-730	
2	ﾌｲﾙﾀﾊﾟｯｷﾝ	02-113-1003-0	100-207-740	
3	ｾﾝﾒﾝﾊﾟﾈﾙ	02-113-1001-0	100-207-720	
	CRTﾊﾟｯｷﾝ	02-113-1004-0	100-207-750	
	ｺﾃｲﾖｳｼｬｰｼ	02-113-1006-0	100-207-770	
	ﾊﾝｶﾞｰﾎﾞｽ	22-020-1022-1	100-173-641	
	SWｼｰﾄ(ｴｲ)	02-113-1011-0	100-207-780	
	ｷｰﾎﾞｰﾄﾞｽｲｯﾁ (ｴｲ	02S3923-0	000-131-923	
	SWｼｰﾄ(ﾜ)	02-113-1021-0	100-207-790	FOR FCV667
	SWｼｰﾄ(ﾜ)	02-113-1051-0	100-215-240	FOR FCV668
	ｷｰﾎﾞｰﾄﾞｽｲｯﾁ (ﾜ)	02S3924-0	000-131-924	
4	ｼｰﾙﾄﾞｹｰｽ(1)	02-113-1204-0	100-207-850	
	ﾇｹﾄﾞﾒｽﾎﾟﾝｼﾞ	02-113-1205-0	100-207-860	
	ﾊﾟｯｷﾝｸﾞ	04-018-2021-2	100-025-422	
5	ﾒｲﾝｼｬｰｼ	02-113-1201-0	100-207-820	
	ﾊｲﾒﾝｼｬｰｼ	02-113-1202-0	100-207-830	
	ﾊｲﾒﾝﾊﾟｯｷﾝ	02-113-1203-1	100-207-841	
	TRｵｻｴｲﾀ	02-113-1207-0	100-211-620	
	TRｵｻｴｺﾞﾑ	02-113-1208-0	100-211-630	
	ｸｰﾙｼｰﾄ	02-113-1209-0	100-211-640	
	TRｵｻｴｲﾀ	03-112-1202-2	100-159-372	
	TRｽﾎﾟﾝｼﾞ	03-112-1204-0	100-167-780	
	ﾎｳﾈﾂｼｰﾄ	03-112-1203-1	100-159-381	
6	ｶﾊﾞｰﾊﾟｯｷﾝ	02-113-1102-0	100-207-810	
7	ｶﾊﾞｰ	02-113-1101-0	100-207-800	
	ｶﾀｼｷﾒｲﾊﾞﾝ	02-113-1401-0	100-207-900	
8	ﾂﾏﾐ	02-103-1107-1	100-151-951	
9	ﾉﾌﾞﾎﾞﾙﾄ	FP02-03621	001-380-620	
10	ﾊﾝｶﾞｰ	FP02-04410	001-382-030	

SYMBOL	PARTS NAME	TYPE／DWG. NO	CODE NO.	REMARKS
1	CRT FILTER	02-113-1002-0	100-207-730	
2	CUSHION RUBBER	02-113-1003-0	100-207-740	
3	FRONT PANEL	02-113-1001-0	100-207-720	
	CRT CUSHION	02-113-1004-0	100-207-750	
	FIXING CHASSIS	02-113-1006-0	100-207-770	
	HANGER BOSS	22-020-1022-1	100-173-641	
	SWITCH SHEET (E)	02-113-1011-0	100-207-780	
	KEYBOARD (E)	02S3923-0	000-131-923	
	SWITCH SHEET (J)	02-113-1021-0	100-207-790	FOR FCV667
	SWITCH SHEET (J)	02-113-1051-0	100-215-240	FOR FCV668
	KEYBOARD (J)	02S3924-0	000-131-924	
4	SHIELD CASE	02-113-1204-0	100-207-850	
	SPONGE	02-113-1205-0	100-207-860	
	PACKING	04-018-2021-2	100-025-422	
5	MAIN FRAME	02-113-1201-0	100-207-820	
	REAR CHASSIS	02-113-1202-0	100-207-830	
	REAR CHASSIS GASKET	02-113-1203-1	100-207-841	
	TR RETAINER	02-113-1207-0	100-211-620	
	RETAINER CUSHION RUBBER	02-113-1208-0	100-211-630	
	COOLING FILM	02-113-1209-0	100-211-640	
	TR FIXING PLATE	03-112-1202-2	100-159-372	
	RETAINER CUSHION SPONGE	03-112-1204-0	100-167-780	
	HEAT SINK SHEET	03-112-1203-1	100-159-381	
6	WATHER REGIST GASKET	02-113-1102-0	100-207-810	
7	COVER	02-113-1101-0	100-207-800	
	NAME PLATE	02-113-1401-0	100-207-900	
8	KNOB	02-103-1107-1	100-151-951	
9	KNOB BOLT	FP02-03621	001-380-620	
10	HANGER	FP02-04410	001-382-030	

FURUNO



承認 APPROVED	SEP・6・'93 M. IKEDA	名称 TITLE	FCV-667 指示器 DISPLAY UNIT
検図 CHECKED	SEP・6・'93 M. USUDA		
製図 DRAWN	SEP・6・'93 K. OKAMOTO	図番 DWG.NO	C2345-K05-C

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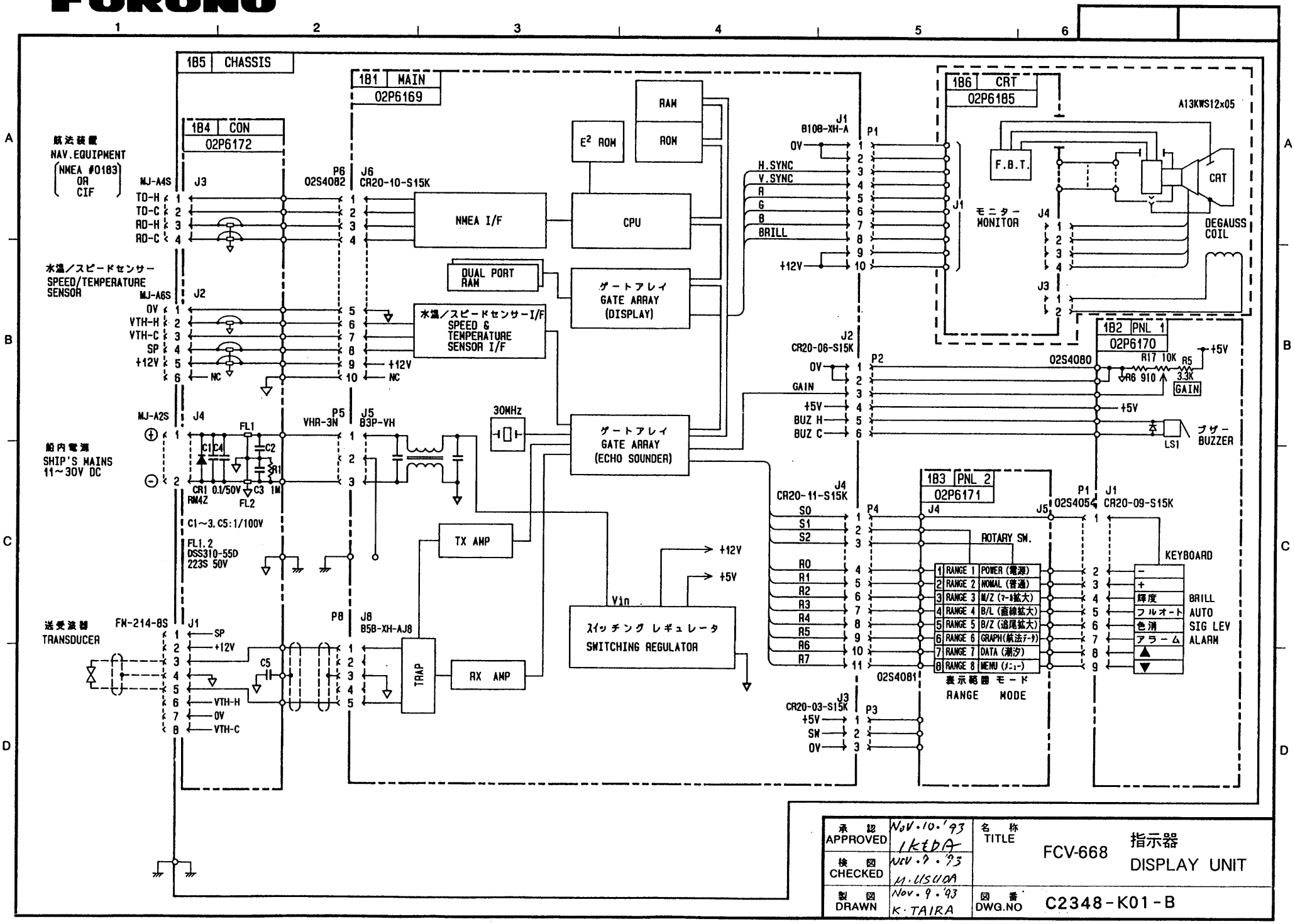
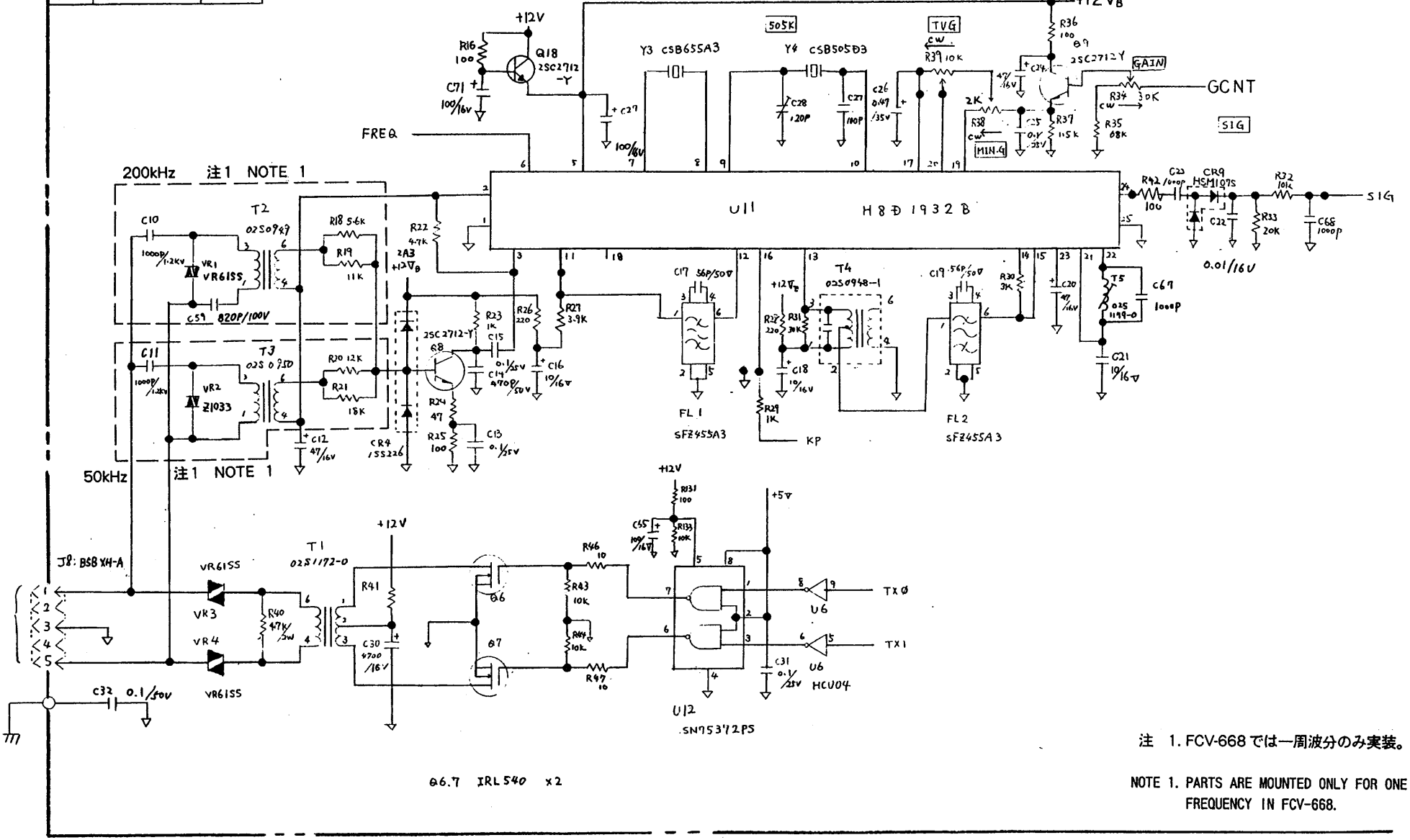


承認 APPROVED	Nov.10.'93 IKEDA	名称 TITLE	FCV-668 指示器 DISPLAY UNIT
検図 CHECKED	Nov.9.'93 M.USUDA		
製図 DRAWN	Nov.9.'93 K.TAIRA	図番 DWG.NO	C2348-K01-B

FURUNO ELECTRIC CO., LTD.

FURUNO

1B1 02P6169 MAIN



注 1. FCV-668 では一周波分のみ実装。

NOTE 1. PARTS ARE MOUNTED ONLY FOR ONE FREQUENCY IN FCV-668.

承認 APPROVED	Sep. 6 '93 M. IKEDA	名称 TITLE	02P6169 MAIN基板 MAIN BOARD (1/3)
検図 CHECKED	SEP. 6 '93 M. ISUDA		
製図 DRAWN	Sep. 6 '93 K. OKAMOTO	図番 DWG.NO.	C2345-K03-B

FCV-667/668

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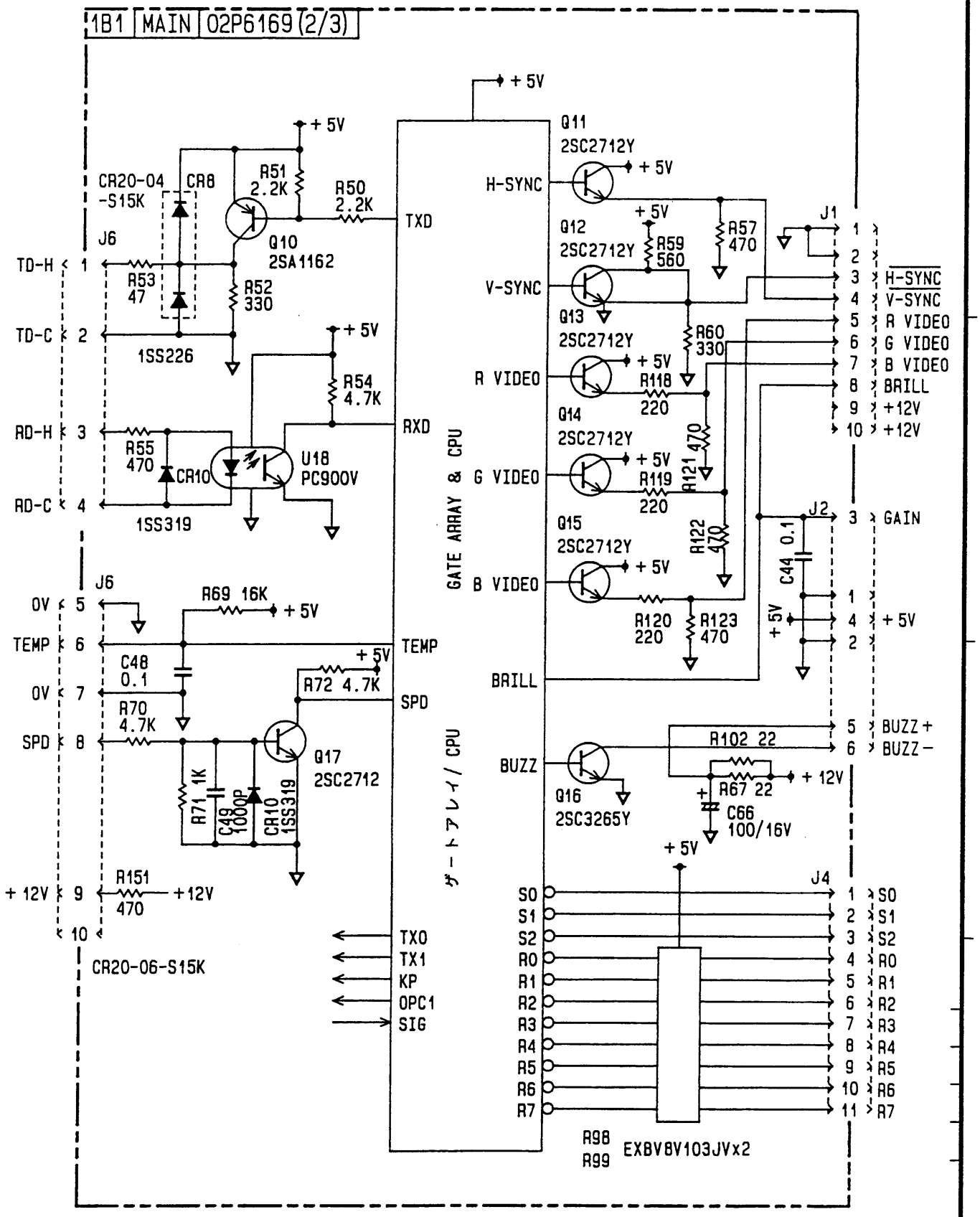

承認 APPROVED	Feb.22.'94 IKEDA	名称 TITLE	02P6169 MAIN基板 MAIN BOARD (2/3)
検図 CHECKED	FEB.21.'94 M.USUDA		
製図 DRAWN	FEB.21.'94 K.TAIRA	図番 DWG.NO	C2345-K06-A

FCV-667/668

FURUNO ELECTRIC CO., LTD.

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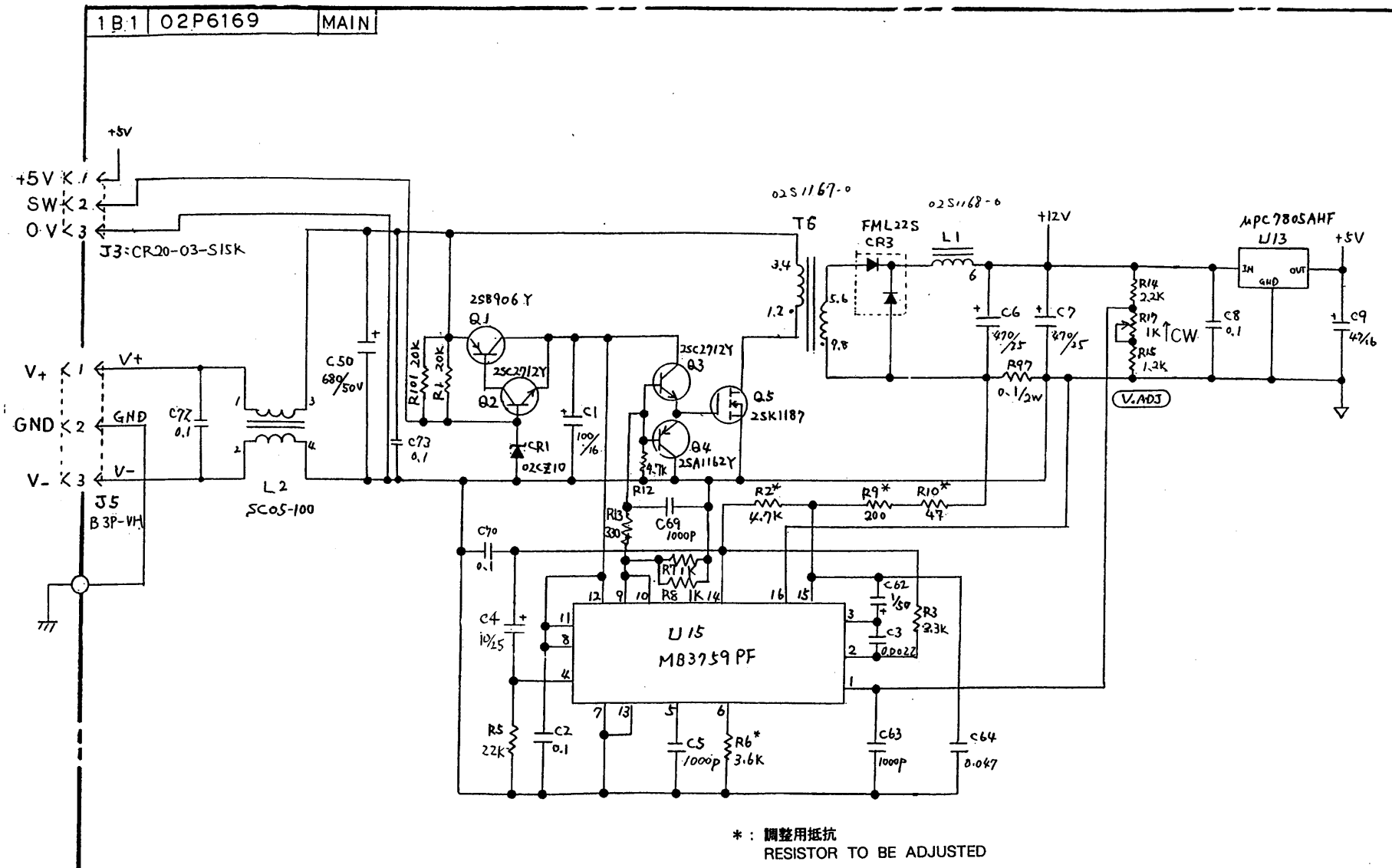

*：調整用抵抗
RESISTOR TO BE ADJUSTED

承認 APPROVED	SEP・6・'93 M.IKEDA	名称 TITLE	MAIN基板 MAIN BOARD (3/3)
検図 CHECKED	SEP・6・'93 H.NISHIDA	02P6169	
製図 DRAWN	Sep・6・'93 KOKAMOTO	図番 DWG.NO.	C2345-K02-B

FCV-667/668

FURUNO ELECTRIC CO., LTD.

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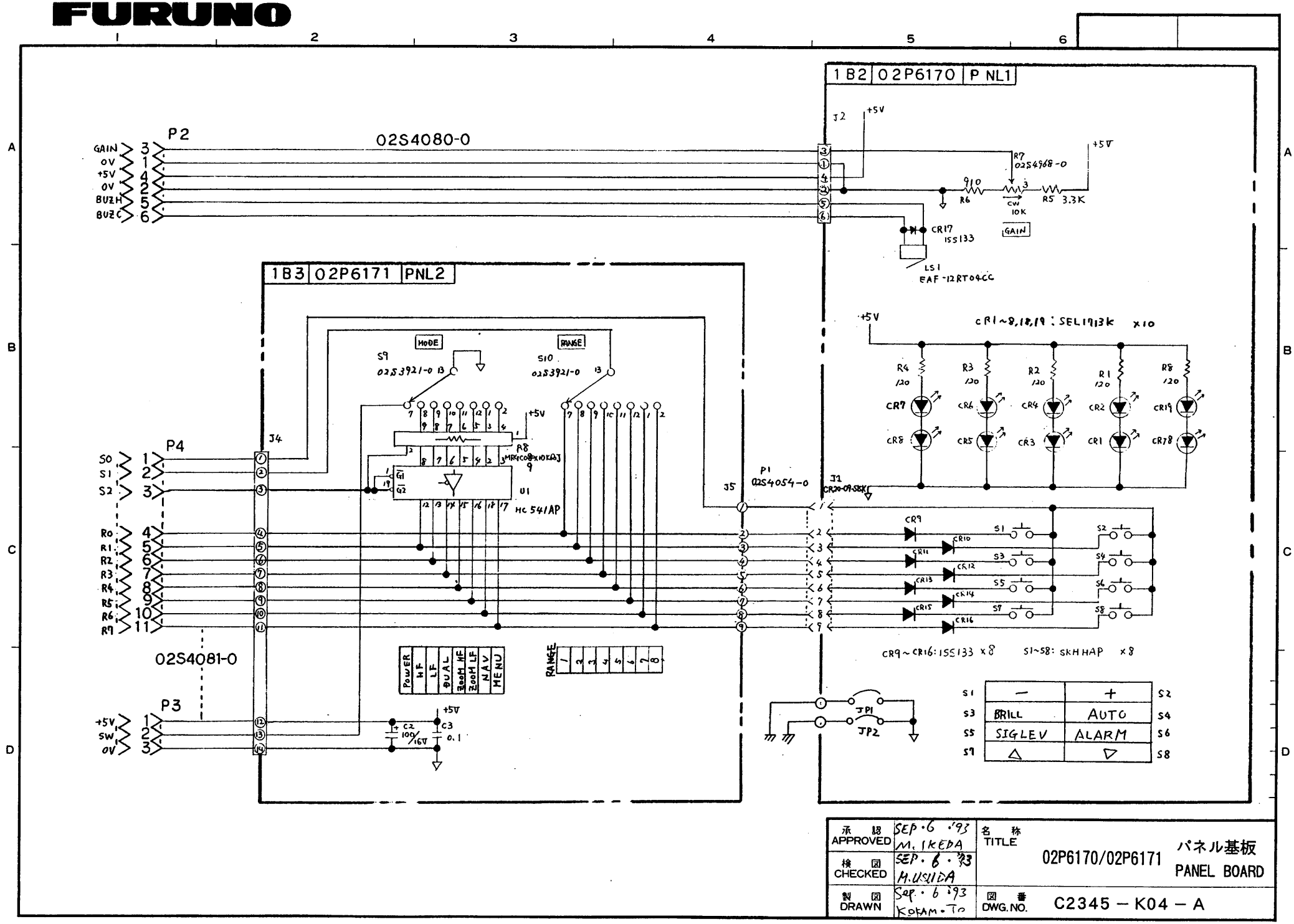

承認 APPROVED	SEP·6·'93 M. IKEDA	名称 TITLE	02P6170/02P6171 パネル基板 PANEL BOARD
検図 CHECKED	SEP·6·'93 M. USUDA		
製図 DRAWN	Sep·6'93 Kotani·To	図番 DWG. NO.	C2345 − K04 − A

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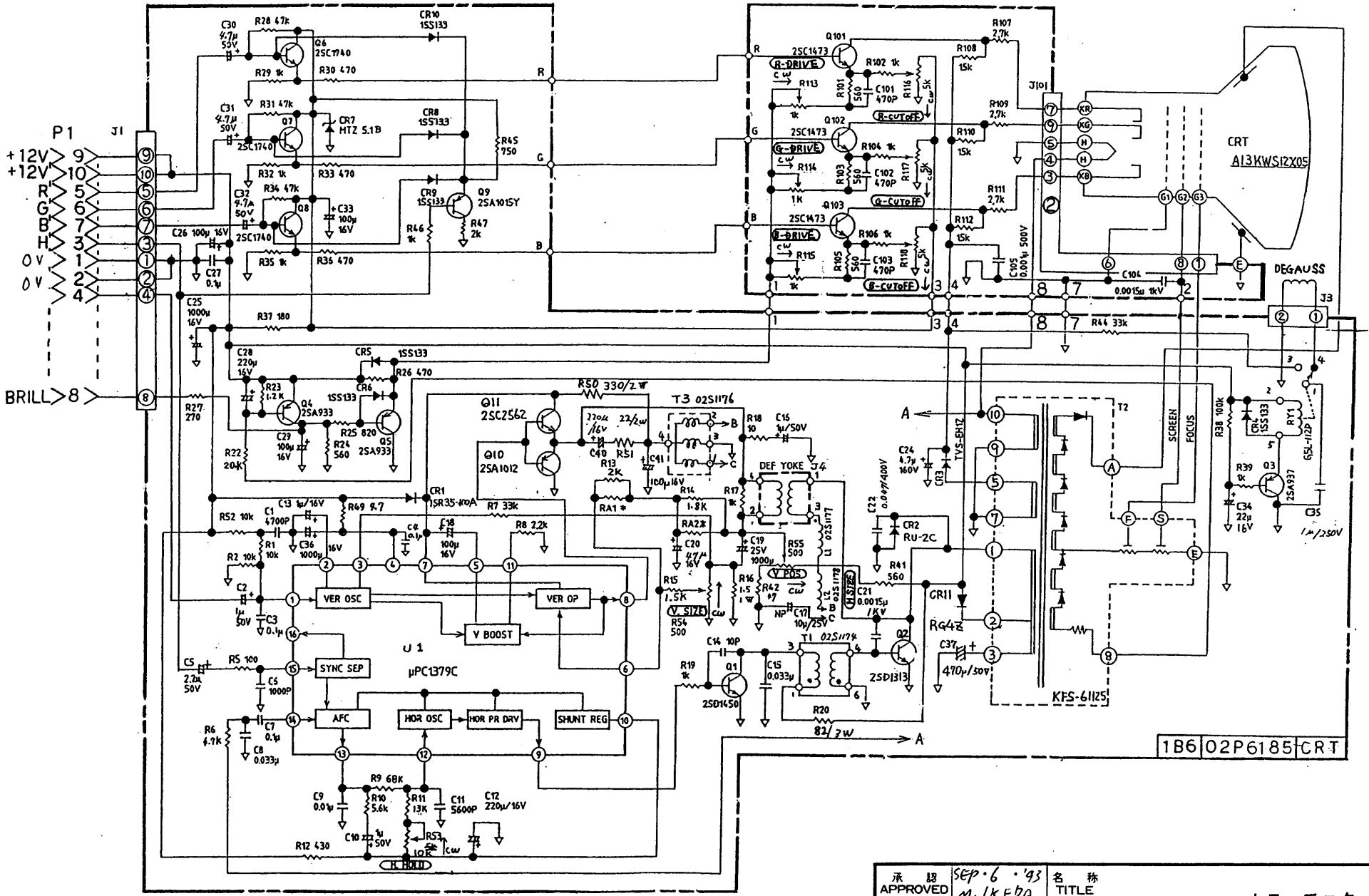

承認 APPROVED	Sep·6·'93 M.IKEDA	名称 TITLE	カラーモニター COLOR MONITOR
検図 CHECKED	SEP·6·'93 M.IKEDA	A13KWS12X05	
製図 DRAWN	Sep·6·'93 KOKAMOTO	図番 DWG.NO.	C2345-K01-A

FURUNO ELECTRIC CO., LTD.

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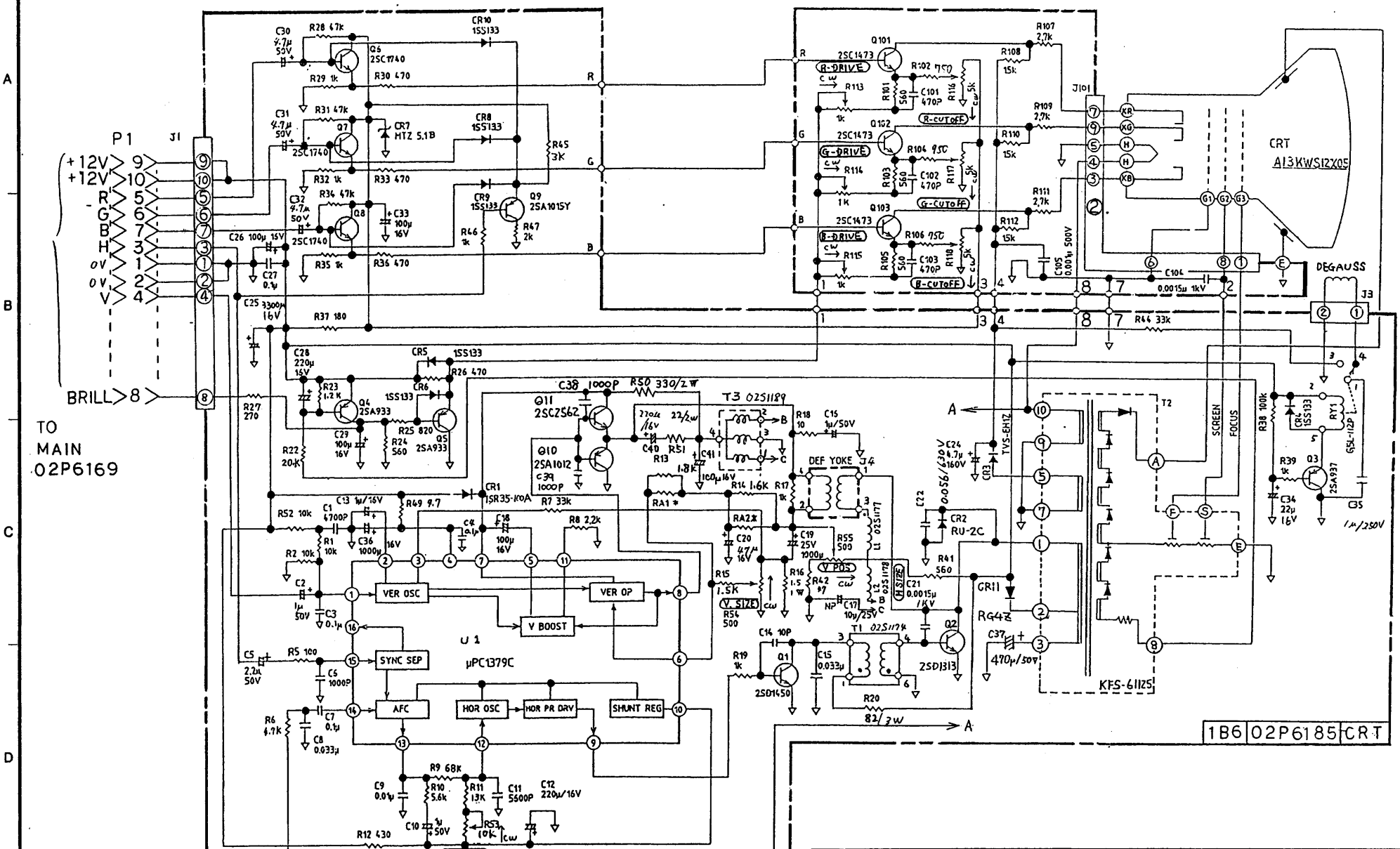

REMARKS				TYPE HM-6FU
DRAWN K.K	APPROVED SEP 22'94	FCV667 FCV668		名称 カラーモニタ
SCALE /	MASS kg	APPLICABLE TO: (MODEL)	BLOCK NO.	NAME COLOR MONITOR
				DWG NO. C2345-K08- A

FURUNO ELECTRIC CO., LTD.