

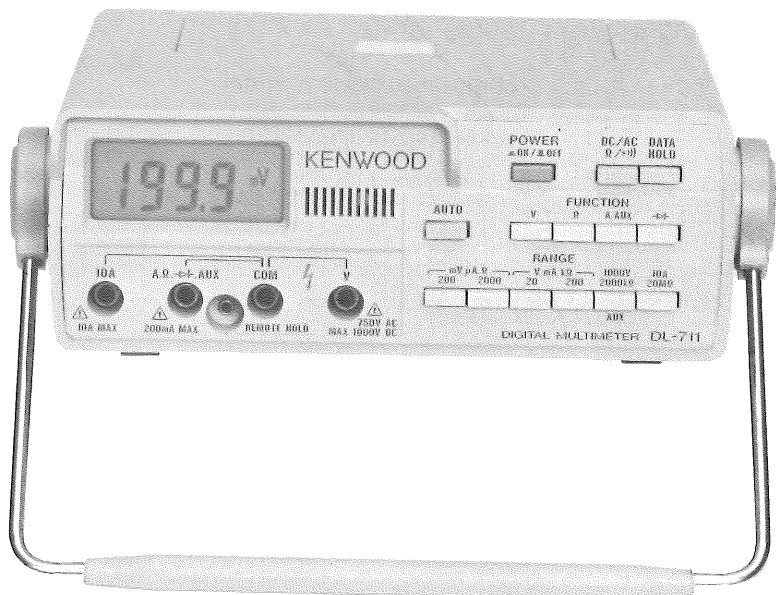
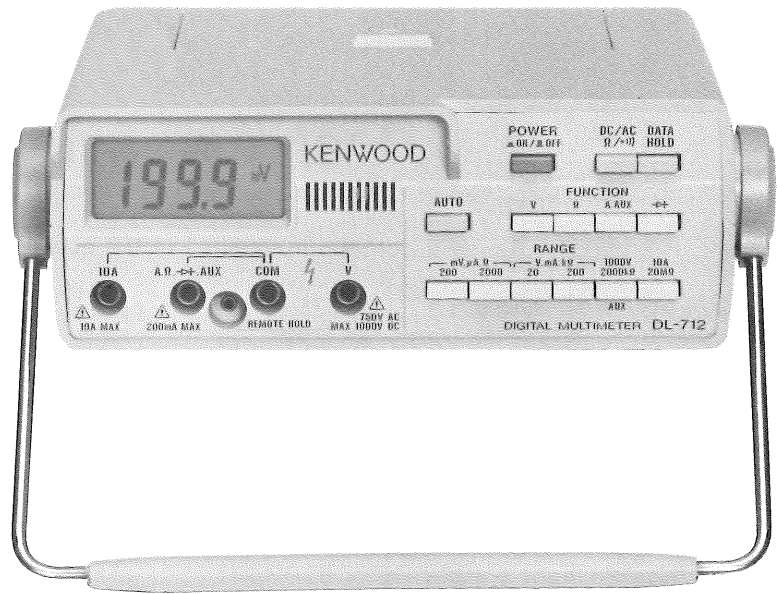
DIGITAL MULTIMETER

DL-712

DL-711

SERVICE MANUAL

KENWOOD CORPORATION



KENWOOD

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SPECIFICATIONS

DC voltage Range automatic/manual

Range	Accuracy (at 23° ± 5°C, below 80% R.H.)		Resolution	Input impedance
	DL-712	DL-711		
200mV	± 0.1% of rdg ± 2 digits	± 0.5% of rdg ± 2 digits	100µV	1000 Megohms or more
2000mV	± 0.1% of rdg ± 1 digit	± 0.5% of rdg ± 1 digit	1mV	11MΩ ± 2%
20 V			10mV	10MΩ ± 2%
200 V			100mV	
1000 V			1 V	

rdg : reading

Maximum permissible input 1,100V DC or 850V AC
 Temperature coefficient 0° ~ 18°C, 28° ~ 40°C
 DL-712 (± 0.02% of rdg ± 0.1 digit)/°C
 DL-711 (± 0.03% of rdg ± 0.1 digit)/°C
 NMR 40 dB or more (50Hz, 60Hz)
 CMR 100 dB or more (50Hz, 60Hz) RX = 1kΩ

AC voltage Range automatic/manual Mean value rectification (calibrated to rms value)

Range	Accuracy (at 23° ± 5°C, below 80% R.H.)		Resolution	Input impedance
	DL-712	DL-711		
2000mV	± 0.75% of rdg ± 3 digits	± 1% of rdg ± 5 digits	1mV	11MΩ ± 2%
20 V			10mV	10MΩ ± 2%
200 V			100mV	
750 V			1 V	

Maximum permissible input 1,100V DC or 850V AC
 Frequency range 40 ~ 500 Hz
 Temperature coefficient 0° ~ 18°C, 28° ~ 40°C
 DL-712 □ (± 0.05% of rdg ± 0.3 digit)/°C
 DL-711 □ (± 0.05% of rdg ± 0.3 digit)/°C

DC current Range manual

Range	Accuracy (at 23° ± 5°C, below 80% R.H.)		Resolution	Maximum permissible current
	DL-712	DL-711		
200µA	± 0.75% of rdg ± 1 digit	± 1% of rdg ± 1 digit	100 nA	200mA
2000µA			1µA	
20mA			10µA	
200mA			100µA	
10 A	± 1% of rdg ± 2 digits	± 1.2% of rdg ± 2 digits	10mA	10A

In the range of 200µA to 200mA, the instrument is protected from input current exceeding 200mA with a fuse.
 Temperature coefficient 0° ~ 18°C, 28° ~ 40°C
 DL-712 □ (± 0.05% of rdg ± 0.1 digit)/°C
 DL-711 □ (± 0.05% of rdg ± 0.1 digit)/°C

AC current Range manual Mean value rectification (calibrated to rms value)

Range	Accuracy (at 23° ± 5°C, below 80% R.H.)		Resolution	Maximum permissible current
	DL-712	DL-711		
200µA	± 1% of rdg ± 3 digits	± 1.2% of rdg ± 5 digits	100nA	200mA
2000µA			1µA	
20mA			10µA	
200mA			100µA	
10 A	± 1.2% of rdg ± 3 digits	± 1.5% of rdg ± 5 digits	10mA	10A

Frequency range 40 ~ 500Hz
 In the ranges of 200µA to 200mA, the instrument is protected from input current exceeding 200mA with a fuse.
 Temperature coefficient 0° ~ 18°C, 28° ~ 40°C
 DL-712 □ (± 0.1% of rdg ± 0.2 digit)/°C
 DL-711 □ (± 0.1% of rdg ± 0.2 digit)/°C

SPECIFICATIONS

Resistance Range automatic/manual

Range	Accuracy (at 23° ± 5°C, below 80% R.H.)		Resolution	Maximum permissible current
	DL-712	DL-711		
200 Ω	±0.2% of rdg ± 3 digits	±0.5% of rdg ± 3 digits	100mΩ	0.55mA
2000 Ω	±0.2% of rdg ± 1 digit	±0.5% of rdg ± 1 digit	1 Ω	86μA
20kΩ			10 Ω	22μA
200kΩ			100 Ω	3.7μA
2000 kΩ	± 1% of rdg ± 1 digit	± 1% of rdg ± 1 digit	1kΩ	0.4μA
20MΩ	± 2% of rdg ± 2 digits	± 2% of rdg ± 2 digits	10kΩ	40nA

Open terminal voltage

200 ohms range 1.8V or less
 2000 ohms—20 megohms range 0.8V or less
 Maximum permissible voltage ± 250V DC/250Vrms
 Temperature coefficient 0° ~ 18°C, 28° ~ 40°C
 200 ohms—200 kilohms range

DL-712 □ (±0.025% of rdg ± 0.2 digit)/°C
 DL-711 □ (±0.025% of rdg ± 0.2 digit)/°C

2000 kilohms range

DL-712 □ (±0.05% of rdg ± 0.2 digit)/°C
 DL-711 □ (±0.05% of rdg ± 0.2 digit)/°C

20 megohms range

DL-712 □ (±0.1% of rdg ± 0.2 digit)/°C
 DL-711 □ (±0.1% of rdg ± 0.2 digit)/°C

Continuity test

Test range 200 ohms range
 Beeping occurs at 20 ± 10 ohms.
 Fixed to 200Ω range by "Ω/•)" switch regardless of the range switch setting.

Diode check

Test current Approx. 1mA ± 5% (when shorted, supply voltage : 6.0V)
 Reading accuracy ± 5% of rdg ± 1 digit
 Open terminal voltage Approx. 2.7V ± 10% (supply voltage : 6.0V)

Display FE-type LCD panel (displaying unit mark)

Maximum reading 1999 or -1999

Operation By integration with drift compensated

Polarity Automatic selection

Overflow indication 1 or -1 appears at MSD position (decimal point and unit displayed)

Range selection Automatic/manual (manual only for AC/DC current)
 Automatic switching
 UP level exceeding 1999
 DOWN level below 179

Sampling time Approx. 500ms/sample

Supply power Dry cells (SUM-2) × 4 or external supply power 4.5~9V, less than 10mA.

Battery service life Approx. 1000 operating hours continuously (with manganese battery) Mark "B" appears on the liquid crystal display when the battery voltage has fallen.

Power consumption Less than 20mW (with buzzer operating)

Withstand voltage ± 500V DC (across the COM terminal and ground)

Weight Approx. 610g (batteries included)

Dimensions (162)W × (60)H × (130)D mm

Temperature and humidity ranges for guaranteed accuracy 23° ± 5°C, under 80% R.H.

Operating temperature and humidity ranges 0° to 40°C, under 80% R.H.

Accessories Input leads ... 1 set
 Instruction manual ... 1
 Manganese batteries SUM-2 ... 4
 Fuse ... 1

BLOCK DIAGRAM

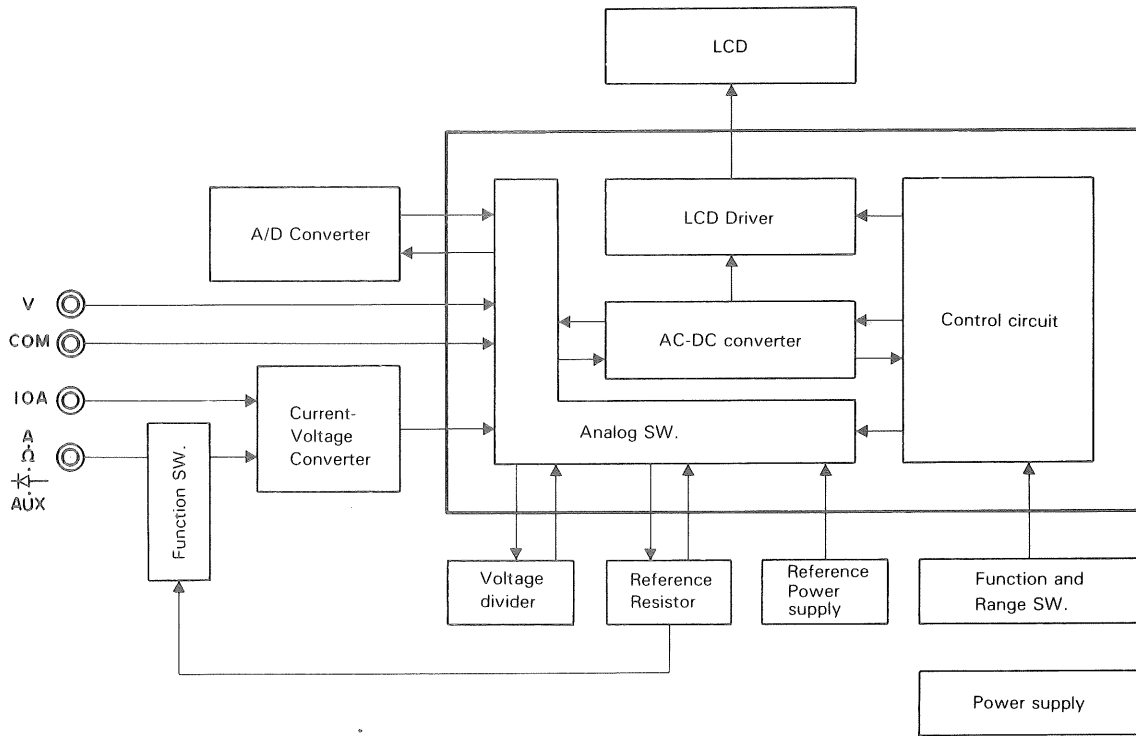


Fig. 1

CIRCUIT DESCRIPTION

A custom IC A/D converter is used, making the peripheral circuits simple and providing voltage and resistance auto range select function, etc.

° Voltage measuring circuit

The internal analog switch is turned ON/OFF to select the dividing ratio.

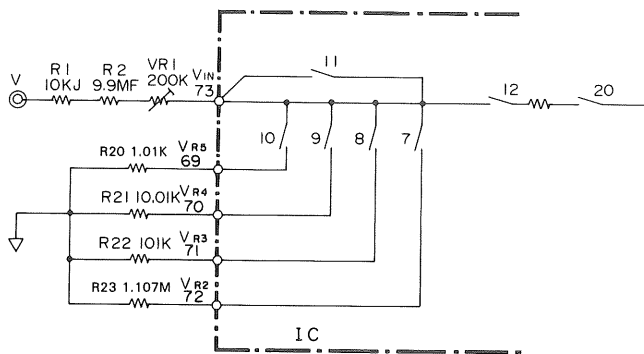


Fig. 2

° Resistance measuring circuit

The internal analog switch is turned ON/OFF to select the reference resistance. The open voltage for 200 Ω range is V_{DD} . For other ranges, the open voltage is V_{REF} (approx. 0.65 V). R33-R38 are reference resistors for resistance measuring range.

The voltage drop due to the measuring sample resistor is applied to A/D converter via R_{VX} . The voltage drop due to the reference resistor is applied to voltage inverter via R_{VS} , then applied to A/D converter.

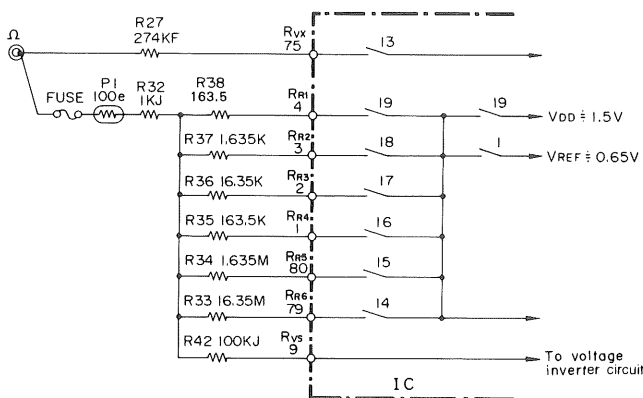


Fig. 3

° Current measuring circuit (Current-Voltage Converter)

The measuring range can be selected by the external switch. The R4-R8 are resistors for current detection.

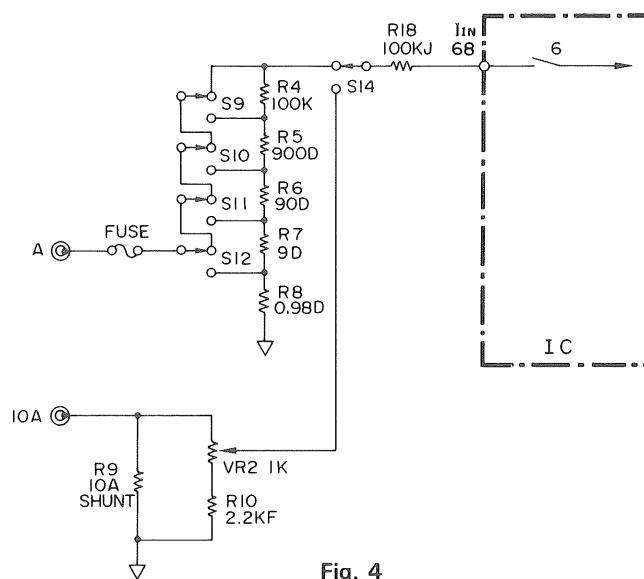


Fig. 4

° Reference voltage section (Part of dual-slope integral circuit)

The reference voltage section supplies the positive voltage $V_{REF'}$. The $V_{REF'}$ is adjusted by VR7 to obtain approx. 0.164 V. Next, the V_{REF} is about 0.65 V and is used for OHM open voltage (except 200 Ω range) and Lo BATT detection.

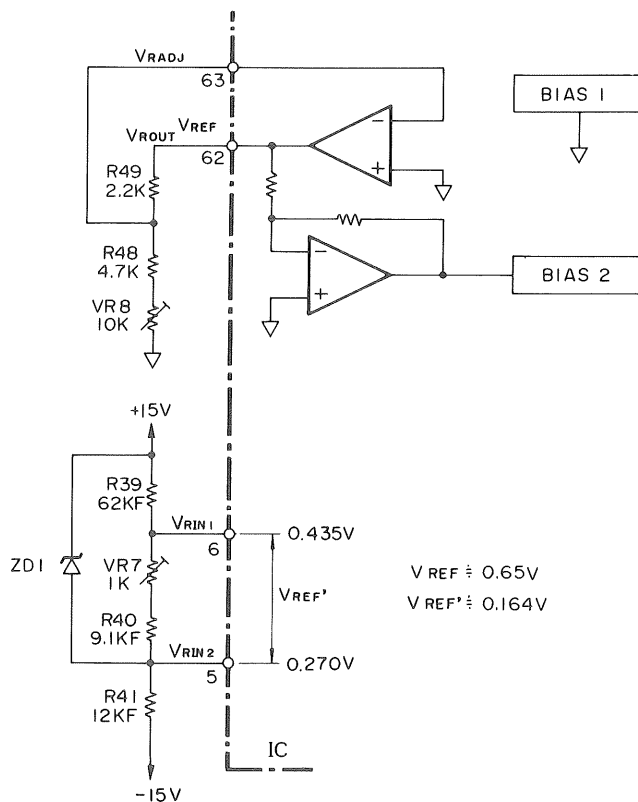


Fig. 5

CIRCUIT DESCRIPTION

° Voltage inverter (part of dual-slope integral circuit)

In the voltage inverter, the positive reference signal V_{REF}' is inverted. For resistance measurement, the voltage drop of the reference resistor is inverted.

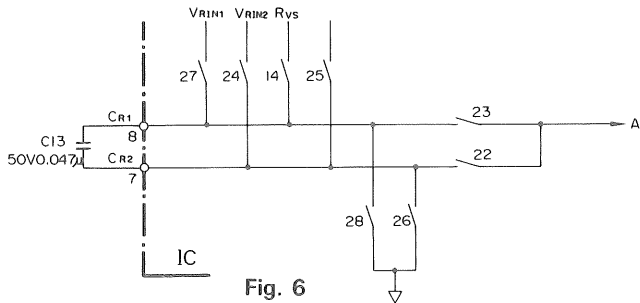


Fig. 6

° A/D converter

This A/D converter, referred to as dual slope integral type, converts the analog signal into the digital signal with a timing divided into auto zero, input integral and reverse integral sections.

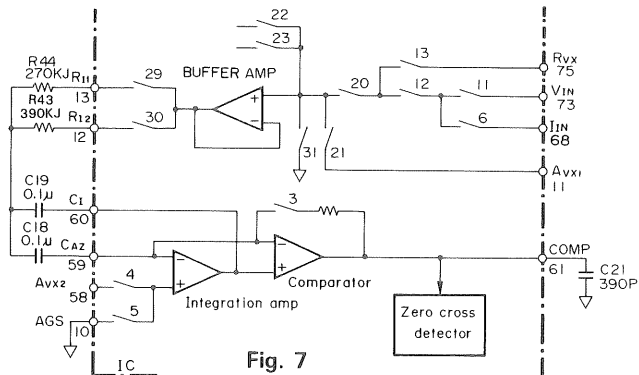


Fig. 7

° Rectifier section (AC-DC converter circuit)

In AC function mode, the internal analog switch (33) turns ON.

The signal from voltage and current measuring circuits of the attenuator section is applied to coupling capacitor C9.

The negative potential output of the total waveform rectifier circuit is applied to A_{vx2} and the positive potential output of the total waveform rectifier circuit is applied to A_{vx1} .

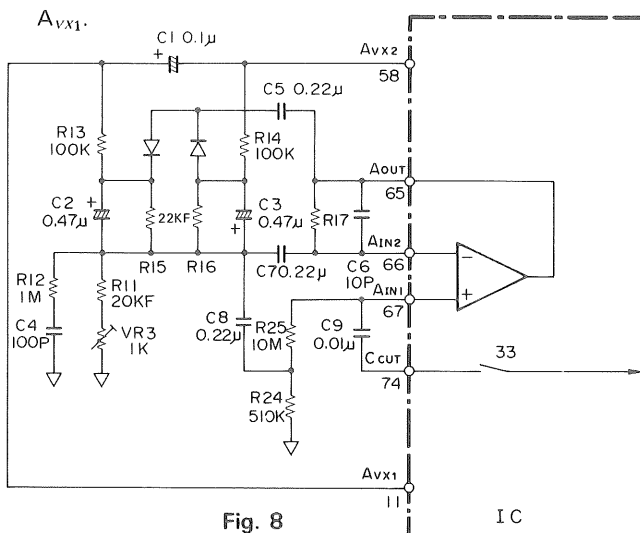


Fig. 8

° Display converter

The display converter section consists of the sections which generate display drive signals.

The 1/3 duty illumination system is employed to reduce the number of pins.

The relation between the COM and segment pins is as shown in the figure.

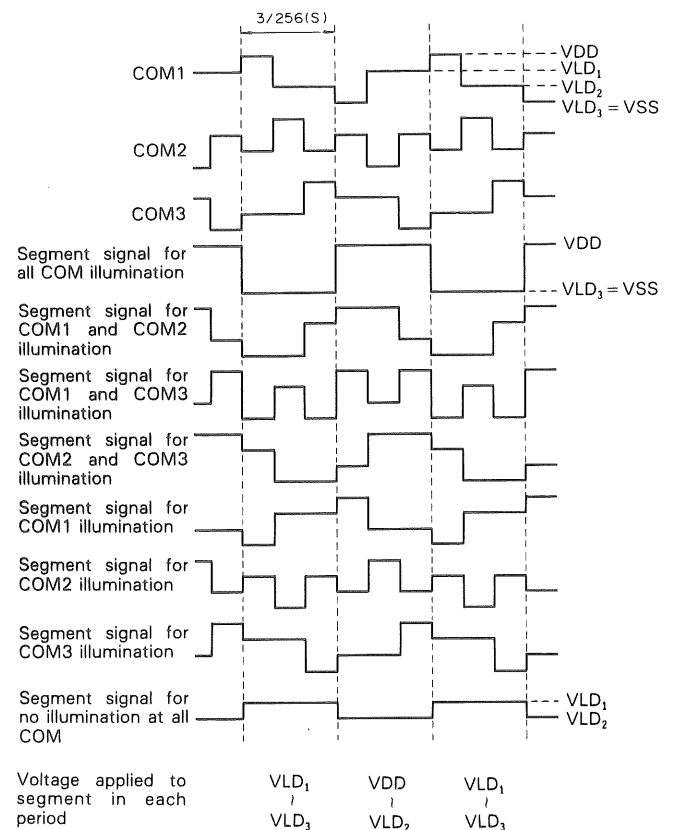


Fig. 9

° Low BATT detector

The low battery condition is detected by comparing divided V_{DD} and V_{REF} as shown in Fig.

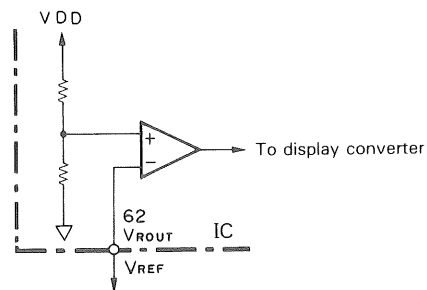


Fig. 10

CIRCUIT DESCRIPTION

° Booster

The booster supplies the control voltage V_{ss2} of internal IC analog switch. The circuit is composed of IC and external capacitors C16 and C17.

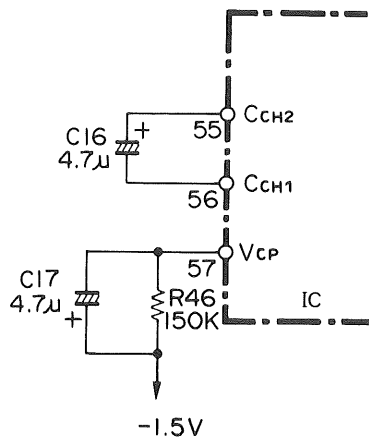


Fig. 11

° Buzzer section

The voltage drop due to the sample resistor and the conductive check reference voltage " V_{ch} " are compared in the conductive check comparator and a square waveform of 4069 Hz is output at buzzer output pin.

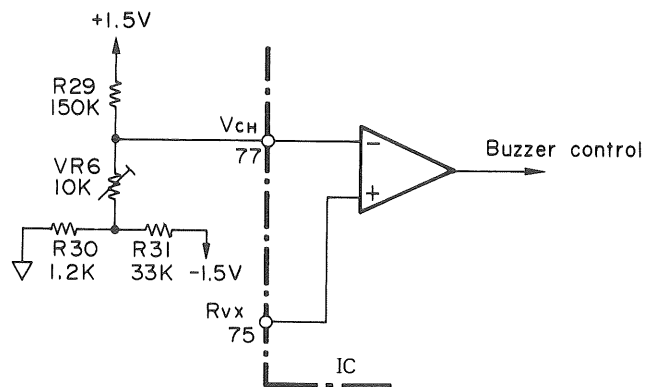


Fig. 12

ADJUSTMENT

CALIBRATOR LIST

DC Calibrator:

Voltage Range: 0.1 mV to 1000 V
Accuracy: $\pm 0.01\%$ more than

AC Calibrator:

Voltage Range: 1 mV to 750 V RMS
Accuracy: $\pm 0.1\%$ more than (40 ~ 500 Hz)

DC Current Calibrator:

Current Range: 0.1 μ A to 10 A
Accuracy: $\pm 0.1\%$ more than

AC Current Calibrator:

Current Range: 0.1 μ A to 10 A
Accuracy: $\pm 0.1\%$ more than (40 ~ 500 Hz)

Standard Resistor:

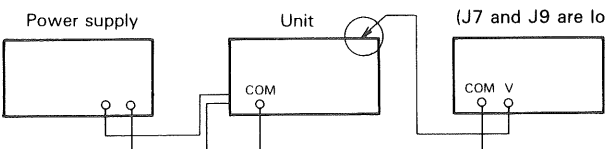
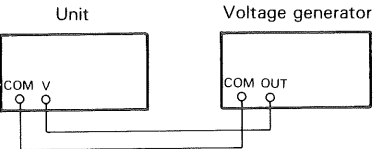
Resistor Range: 0.1 Ω to 20 M Ω
Accuracy: $\pm 0.02\%$ more than

Digital Multi-Meter (for watch and compare):

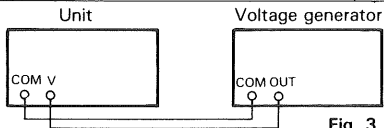
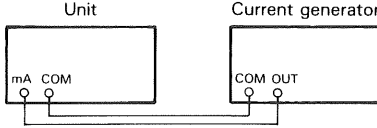
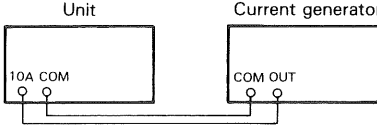
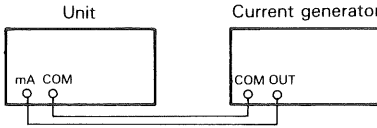
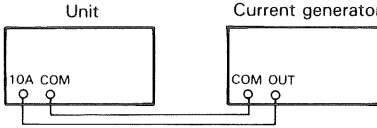
4 2/1 class more than (exp. 8600 A: by Fluke)

Caution: Be sure to use a signal generator whose accuracy is one-digit higher than the one indicated in the specifications.

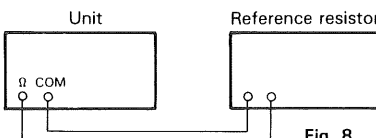
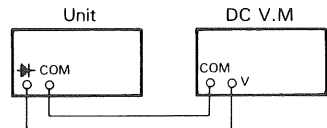
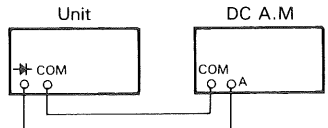
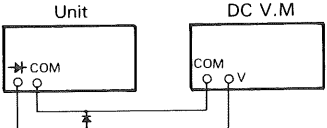
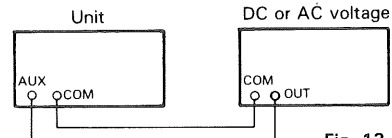
ADJUSTMENT

Item	Measuring instruments		Connection	Unit				
	Instrument used	Setting		Unit setting	Adjustment	Checking		
1-a Power supply adjustment	1)	DC V M	2 V	Connect a DC voltmeter to COM and J7 of the unit (Fig. 1).	POWER ON	VR9	The DC voltmeter should read 1.5V.	
	2)					—	The DC voltmeter should read -1.4 V ~ -1.6 V.	
1-b Lo BATT adjustment	3)	DC regulated power supply	4.45 V (Check with the DC voltmeter.)	Connect the output of the DC regulated power supply to the external power supply jack of the unit.	RANGE: 2000 mV	VR8	Adjust so that the display shows "B".	
	4)						4.55 V	Adjust so that the "B" disappears.
5) Repeat steps (3) and (4) so that both adjustment is completed.								
When connecting external DC regulated power supply, a power supply of DC 6 V is required.				 <p style="text-align: center;">Fig. 1</p>				
2. DC power voltage adjustment	1)	Voltage generator	—	Connect the output of the voltage generator to V terminal of the unit (Fig. 2).	FUNCTION: V MODE: DC	RANGE: 200 mV INPUT: SHORT	0 V	
	2)		190.0 mV			RANGE: 200 mV	VR7	190.0 mV
	3)		19.00 V			RANGE: 20 V	VR1	19.00 V
	4)		1900 mV			RANGE: 2000 mV	VR5 (DL-712 only)	1900 mV
	5)		190.0 V			RANGE: 200 V	—	190.0 V
	6)		1000 V			RANGE: 1000 V	VR4 (DL-712 only)	1.000 V
Indicaion error check with a voltage				 <p style="text-align: center;">Fig. 2</p>				

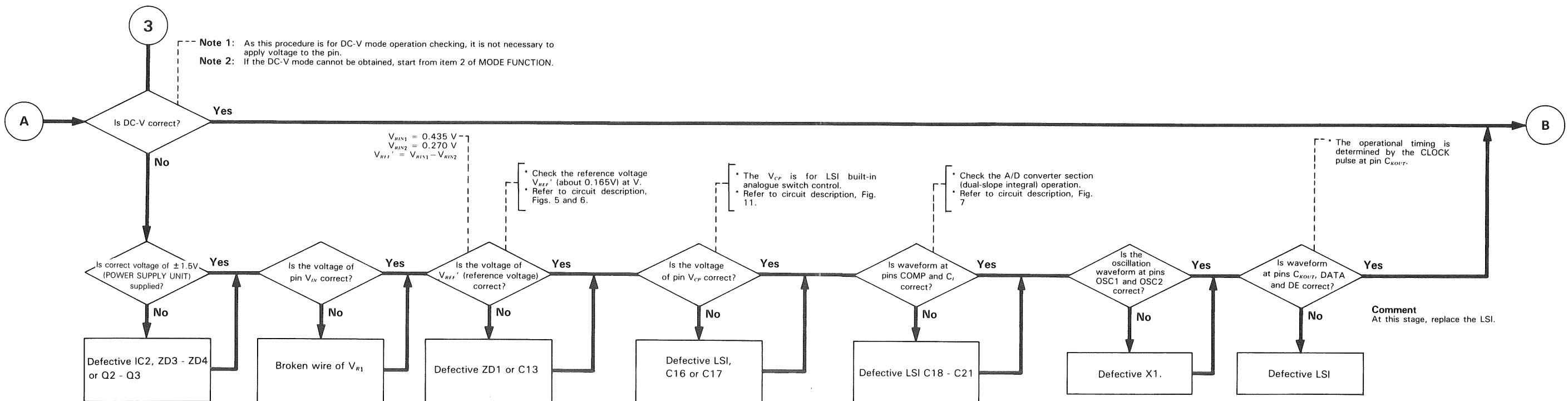
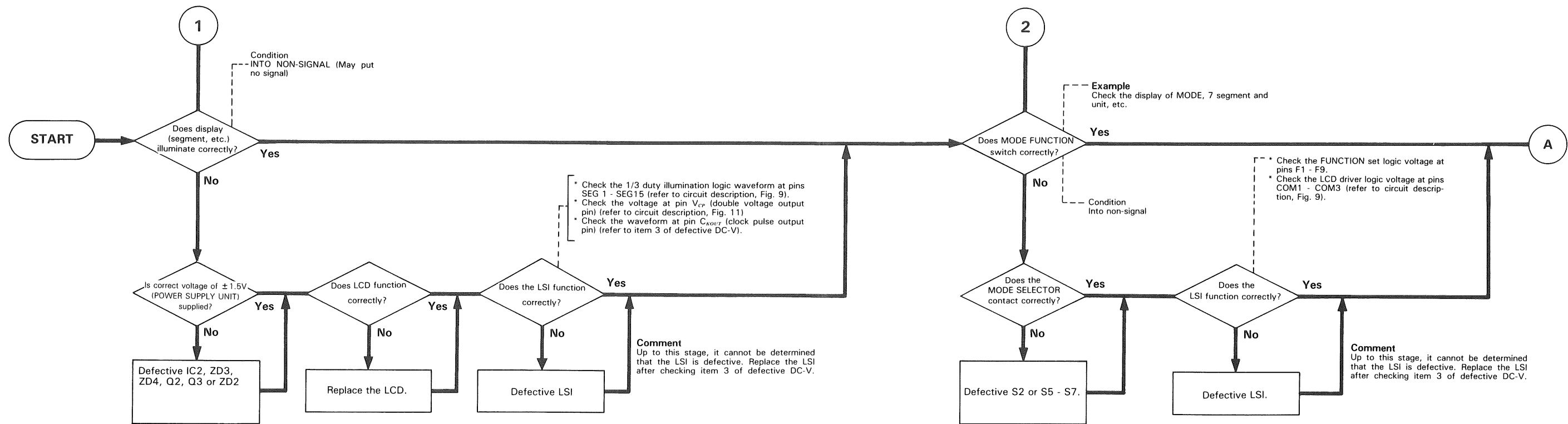
ADJUSTMENT

Item	Measuring instruments		Connection	Unit				
	Instrument used	Setting		Unit setting	Adjustment	Checking		
3. AC voltage adjustment	1)	Voltage generator	—	FUNCTION: V MODE: AC	RANGE: 2000 mV INPUT: SHORT	—	0 V	
	2)				1900 mV 100 Hz	RANGE: 2000 mV	VR3	1900 mV
	3)				19.00 V 100 Hz	RANGE: 20 V	—	19.00 V
	4)				190.0 V 100 Hz	RANGE: 200 V	—	190.0 V
	5)				750 V 100 Hz	RANGE: 1000 V	—	750 V
	 <p style="text-align: center;">Unit Voltage generator</p> <p style="text-align: center;">COM V COM OUT</p> <p style="text-align: center;">Fig. 3</p>				Select DC or AC with mode switch. In AC mode, "AC" is displayed.			
4. DC current adjustment	1)	Current generator	190.0 μ A	FUNCTION: A MODE: DC	RANGE: 200 μ A	—	190.0 μ A	
	2)				1900 μ A	RANGE: 2000 μ A	—	1900 μ A
	3)				19.00 mA	RANGE: 20 mA	—	19.00 mA
	4)				190.0 mA	RANGE: 200 mA	—	190.0 mA
	5)				10.00 A	RANGE: 10 A	VR2	10.00 A
	 <p style="text-align: center;">Unit Current generator</p> <p style="text-align: center;">mA COM COM OUT</p> <p style="text-align: center;">Fig. 4</p>				 <p style="text-align: center;">Unit Current generator</p> <p style="text-align: center;">10A COM COM OUT</p> <p style="text-align: center;">Fig. 5</p>			
5. AC current adjustment	1)	Current generator	190.0 μ A 100 Hz	FUNCTION: A MODE: AC	RANGE: 200 μ A	—	190.0 μ A	
	2)				1900 μ A 100 Hz	RANGE: 2000 μ A	—	1900 μ A
	3)				19.00 mA 100 Hz	RANGE: 20 mA	—	19.00 mA
	4)				190.0 mA 100 Hz	RANGE: 200 mA	—	190.0 mA
	5)				10.00 A 100 Hz	RANGE: 10 A	—	10.00 A 100 Hz
	 <p style="text-align: center;">Unit Current generator</p> <p style="text-align: center;">mA COM COM OUT</p> <p style="text-align: center;">Fig. 6</p>				 <p style="text-align: center;">Unit Current generator</p> <p style="text-align: center;">10A COM COM OUT</p> <p style="text-align: center;">Fig. 7</p>			

ADJUSTMENT

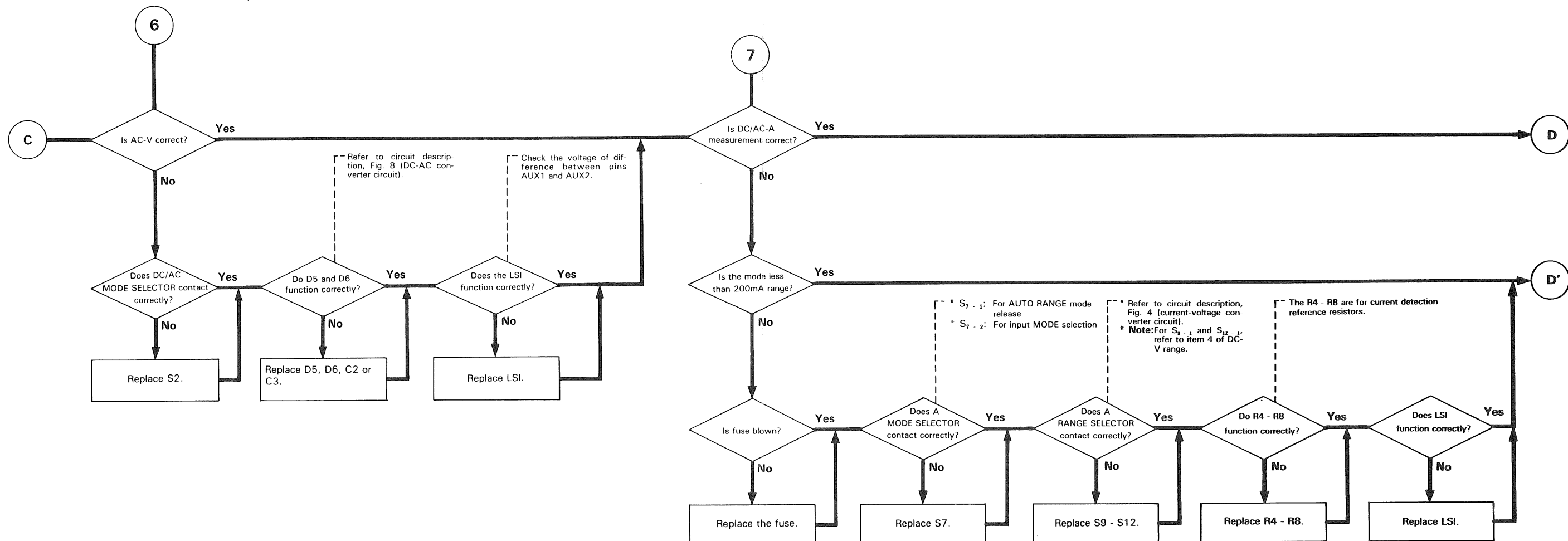
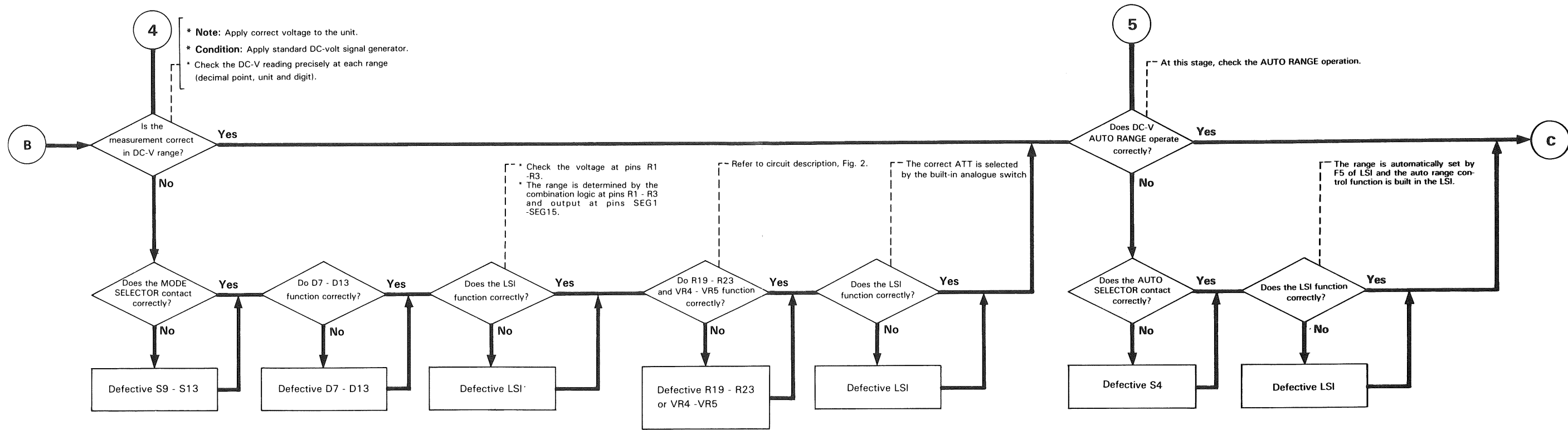
Item	Measuring instruments		Connection	Unit					
	Instrument used	Setting		Unit setting	Adjustment	Checking			
6-a Resistance adjustment	1)	Reference resistor	—	Connect the output of the reference resistor to Ω terminal of the unit (Fig. 8).	FUNCTION: Ω MODE: Ω	RANGE: 200 Ω INPUT: SHORT	—	0	
	2)					200 Ω	—	190.0 Ω	
	3)					2000 Ω	—	1900 Ω	
	4)					19.00 k Ω	—	19.00 k Ω	
	5)					190.0 k Ω	—	190.0 k Ω	
	6)					1900 k Ω	—	1900 k Ω	
	7)					19.00 M Ω	—	19.00 M Ω	
6-b Buzzer sound adjustment	8)		10 Ω		FUNCTION: Ω MODE: Ω	Regardless of the range selector switch setting	VR6	Adjust so that the buzzer sounds.	
	9)		20 Ω			Fixed at 200 Ω range.	VR6	Adjust so that the buzzer does not sound.	
10) Repeat steps (8) and (9) so that both adjustment is completed.									
				 <p style="text-align: center;">Unit Reference resistor</p> <p style="text-align: center;">Fig. 8</p>	Select Ω or Ω with mode switch. In Ω mode, " Ω " is displayed.				
7. Diode check	1)	DC V.M	—	Connect the DC voltmeter to \rightarrow terminal of the unit (Fig. 9).	FUNCTION: \rightarrow	INPUT: SHORT	—	0 V	
	2)		20 V				Over indication. Check the DC voltmeter reading (about 2.7 V).		
	3)	DC current meter	20 mA	Connect the DC current meter to \rightarrow terminal of the unit (Fig. 10).		—	—	Check the DC voltmeter current (about 1 mA).	
	4)	DC V.M	2 V	Connect the DC voltmeter to \rightarrow terminal and connect a diode between the \rightarrow terminal and COM terminal in series (Fig. 11).		—	—	Check that the error between the unit and DC voltmeter reading is $\pm 5\%$ (± 1 digit) of the DC voltmeter.	
		 <p style="text-align: center;">Unit DC V.M</p> <p style="text-align: center;">Fig. 9</p>	 <p style="text-align: center;">Unit DC A.M</p> <p style="text-align: center;">Fig. 10</p>	 <p style="text-align: center;">Unit DC V.M</p> <p style="text-align: center;">Fig. 11</p>					
8. AUX	1)	DC voltage generator	190.0 mV	Connect the DC or AC voltage generator to AUX terminal of the unit (Fig. 12).	FUNCTION: AUX RANGE: AUX	RANGE: DC		190.0	
	2)	AC voltage generator	190.0 mV 100 Hz			MODE: AC	—	190.0	
				 <p style="text-align: center;">Unit DC or AC voltage generator</p> <p style="text-align: center;">Fig. 12</p>					

TROUBLESHOOTING



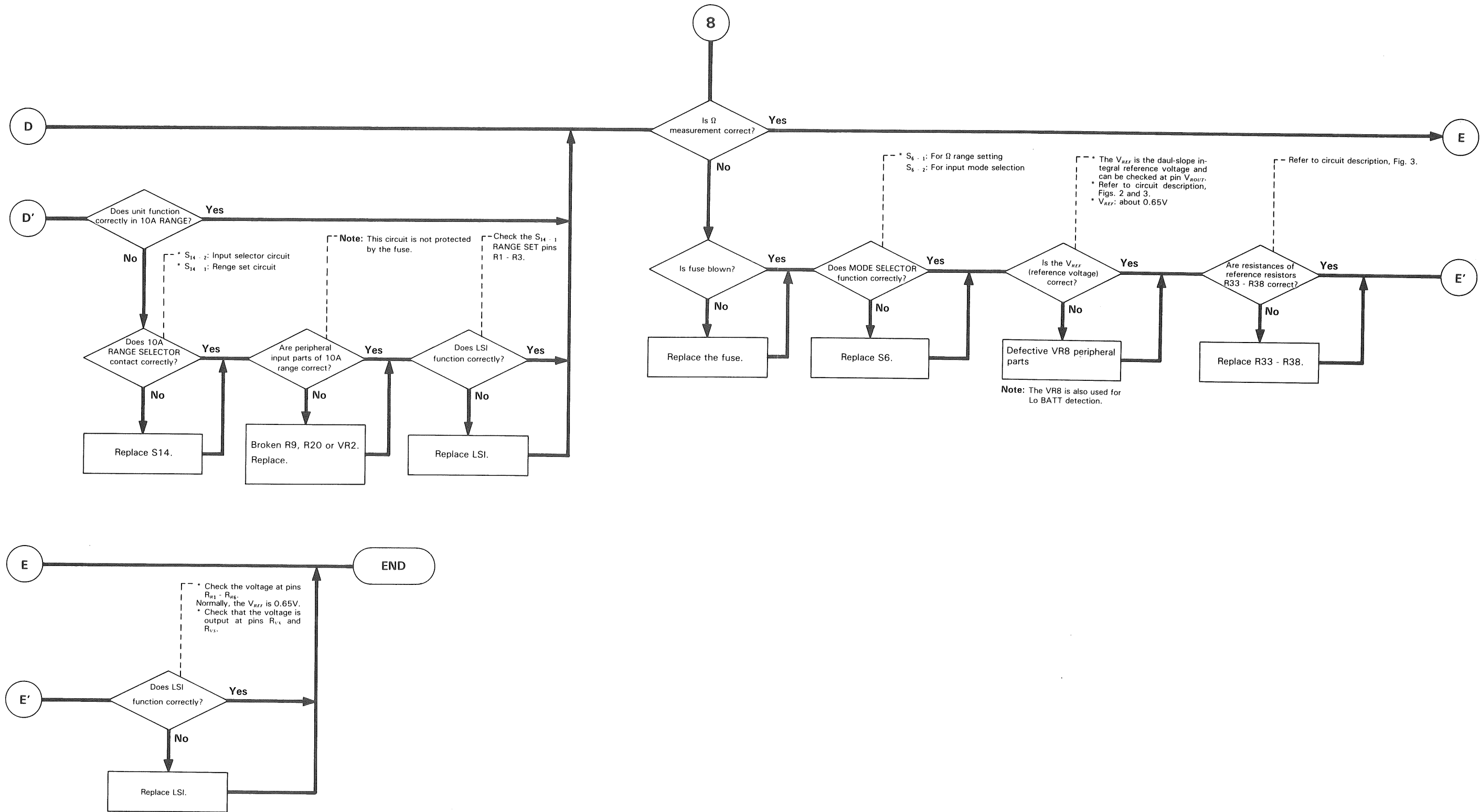
Note: SEG 1 - SEG 15, COM 1 - COM 3, V_{IN} , V_{CP} , COMP, C_i , OSC 1, OSC 2, C_{KOUT} , DATE, DE, etc. stand for the terminal name of the LSI.

TROUBLESHOOTING



Note: Be sure to use a 0.2A (250V) fuse. Less than 5 Ω DC resistance

TROUBLESHOOTING



PARTS LIST

DL-712 UNIT Y80-1330-00

REF.NO	PARTS NO	NAME & DESCRIPTION
	B19-0737-04	FILTER
	B41-0809-04	CAUTION LABEL
	B42-3623-04	LABEL;SERIAL NO.
	B50-7689-08	INSTRUCTION MANUAL ENG/JAP
	E30-1863-08	TEST LEAD;ONE SET
	H01-5909-04	CARTON BOX
	H10-2808-23	FOAMED STYRENE PAD (R)
	H10-2809-13	FOAMED STYRENE PAD (L)
	H25-0078-04	VINYL BAG
	J02-0505-04	FOOT
1	A02-0528-02	CASE ASS'Y(TOP)
2	A02-0529-02	CASE ASS'Y(BOTTOM)
3	A20-2839-02	PANEL ASS'Y
4	F07-0952-03	BATTERY COVER
5	F10-1573-08	SHIELD PLATE (TOP)
6	F10-1574-08	SHIELD PLATE (BOTTOM)
7	G13-0717-08	CUSHION
8	J21-2886-04	HOLDER FOR BATTERY
9	J21-2887-04	HOLDER FOR BATTERY
10	J32-0889-08	STUD
11	K01-0531-03	HANDLE
12	K29-0814-08	KNOB (ORANGE)
13	K29-0815-08	KNOB (GRAY)
14	K29-0807-08	KNOB (WHITE)
15	W02-0409-08	BATTERY
16	W02-0475-08	POWER SUPPLY UNIT
17	W02-0476-08	MAIN UNIT
18	W02-0477-08	SUB UNIT

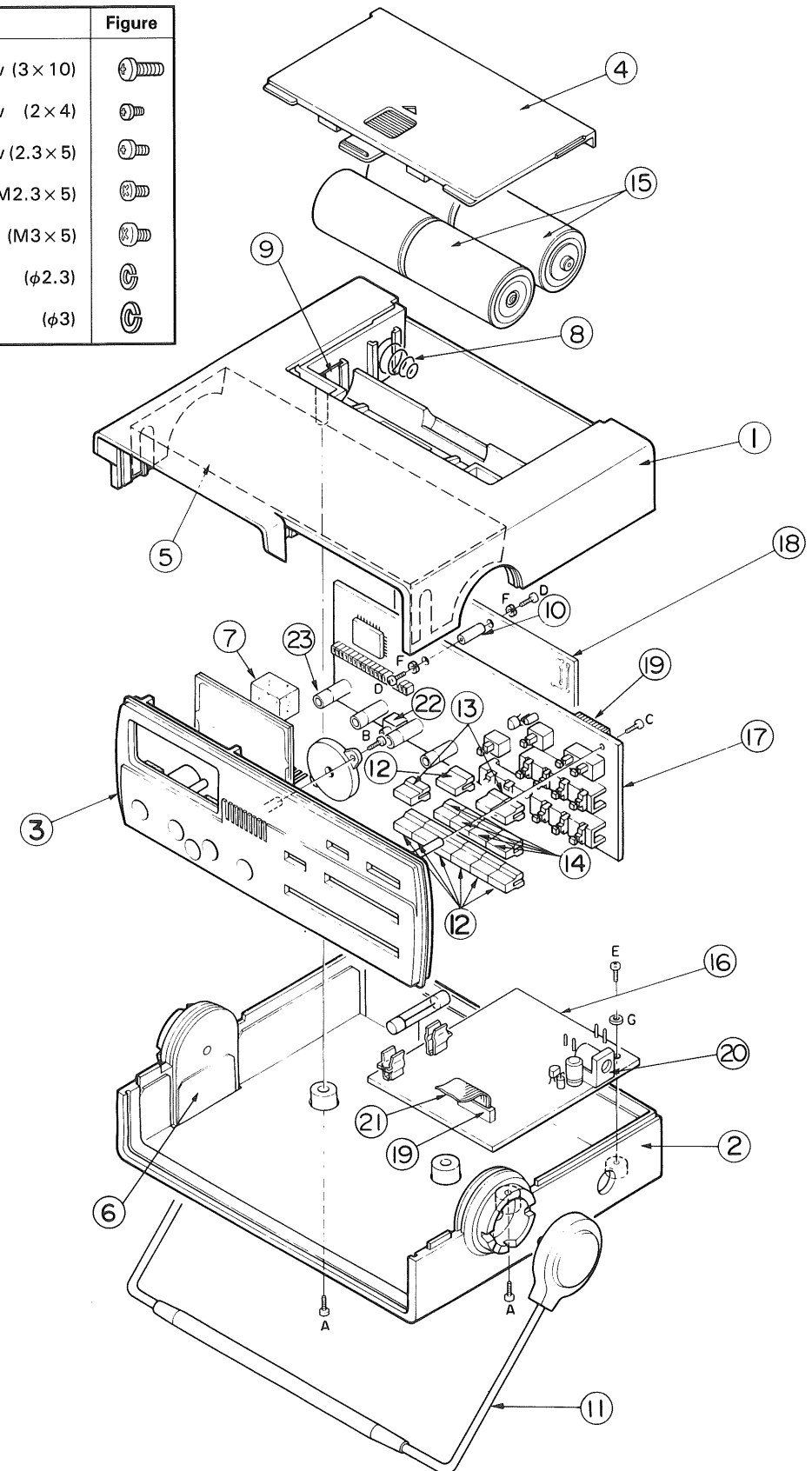
DL-711 UNIT Y80-1320-00

REF.NO	PARTS NO	NAME & DESCRIPTION
	B19-0737-04	FILTER
	B41-0809-04	CAUTION LABEL
	B42-3622-04	LABEL;SERIAL NO.
	B50-7689-08	INSTRUCTION MANUAL ENG/JAP
	E30-1863-08	TEST LEAD;ONE SET
	H01-5908-04	CARTON BOX
	H10-2808-23	FOAMED STYRENE PAD (R)
	H10-2809-13	FOAMED STYRENE PAD (L)
	H25-0078-04	VINYL BAG
	J02-0505-04	FOOT
1	A02-0528-02	CASE ASS'Y(TOP)
2	A02-0529-02	CASE ASS'Y(BOTTOM)
3	A20-2838-02	PANEL ASS'Y
4	F07-0952-03	BATTERY COVER
5	F10-1573-08	SHIELD PLATE (TOP)
6	F10-1574-08	SHIELD PLATE (BOTTOM)
7	G13-0717-08	CUSHION
8	J21-2886-04	HOLDER FOR BATTERY
9	J21-2887-04	HOLDER FOR BATTERY
10	J32-0889-08	STUD
11	K01-0531-03	HANDLE
12	K29-0814-08	KNOB (ORANGE)
13	K29-0815-08	KNOB (GRAY)
14	K29-0807-08	KNOB (WHITE)
15	W02-0409-08	BATTERY
16	W02-0478-08	POWER SUPPLY UNIT
17	W02-0479-08	MAIN UNIT
18	W02-0480-08	SUB UNIT

DISASSEMBLY

SCREWS

Parts No.	Parts Name	Figure
A N89-3010-41	Binding Taptite Screw (3×10)	
B N89-2004-41	Binding Taptite Screw (2×4)	
C N09-0765-08	Binding Taptite Screw (2.3×5)	
D N09-0766-08	Pan Head Screw (M2.3×5)	
E N30-3005-41	Pan Head Screw (M3×5)	
F N19-0732-08	Spring Washer (φ2.3)	
G N16-0030-41	Spring Washer (φ3)	



PARTS LIST

DL-712 MAIN UNIT W02-0476-08

REF.NO	PARTS NO	NAME & DESCRIPTION
	J25-5355-08	PCB (UNMOUNTED)
	LO-B7073AZ	LCD
19	E02-0138-08	CONNECTOR 7P
22	E13-0171-08	PIN JACK (MIDGET)
23	E21-0664-08	INPUT CONNECTOR
BZ001	T99-0502-08	BEEPER
C009	CF92V1H103J	CAP. POLYESTER 0.01 5% 50V
C010	CF92V1H103J	CAP. POLYESTER 0.01 5% 50V
C011	CF92V1H473J	CAP. POLYESTER 0.047 5% 50V
C012	CS15E1V4R7M	CAP. TUNTALUM 4.7 20% 35V
C013	CF92V1H473J	CAP. POLYESTER 0.047 5% 50V
C014	CF92V1H103J	CAP. POLYESTER 0.01 5% 50V
C015	CC45SL1H390J	CAP. CERAMIC 39P 5% 50V
C016	CE04CW1V4R7M	CAP. ELECTRO 4.7 20% 35V
C017	CE04CW1V4R7M	CAP. ELECTRO 4.7 20% 35V
D001	U05B	DIODE
D002	U05B	DIODE
D003	U05B	DIODE
D004	U05B	DIODE
D007	1S1588	DIODE
D008	1S1588	DIODE
D009	1S1588	DIODE
D010	1S1588	DIODE
D011	1S1588	DIODE
D012	1S1588	DIODE
D013	1S1588	DIODE
IC001	MSM5230GSK*S	IC. A/D CONVERTER
P001	911P97E101YU10	THERMISTER 500 OHM
Q001	2SD612(K)	TR. SI. NPN
R001	RD140B2H103J	RES. CARBON 10K 5% 1/2W
R002	R92-1082-08	RES. METAL FILM 9.9M 1%
R003	RD14BB2C272J	RES. CARBON 2.7K 5% 1/6W
R004	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R005	R92-1083-08	RES. METAL FILM 900 0.5% 1/4W
R006	R92-1084-08	RES. METAL FILM 90 0.5% 1/4W
R007	R92-1085-08	RES. METAL FILM 9 0.5% 1/4W
R008	R92-1086-08	RES. METAL FILM 0.98 0.5% 1/2W
R009	R92-1098-08	RES. SHUNT 10A
R010	RN14BK2E2201F	RES. METAL FILM 2.2K 1% 1/4W
R018	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R019	RN14BK2E4702F	RES. METAL FILM 47K 1% 1/4W
R020	R92-1087-08	RES. METAL FILM 1.01K 0.25%
R021	R92-1088-08	RES. METAL FILM 10.01K 0.05%
R022	R92-1089-08	RES. METAL FILM 101K 0.05%
R023	R92-1090-08	RES. METAL FILM 1.107M 0.25%
R024	RD14BB2C514J	RES. CARBON 510K 5% 1/6W
R025	R92-1097-08	RES. CARBON 10M 5% 1/8W
R026	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R027	RN14BK2E2743F	RES. METAL FILM 274K 1% 1/4W
R028	RN14BK2E2672F	RES. METAL FILM 26.7K 1% 1/4W
R029	RD14BB2C154J	RES. CARBON 150K 5% 1/6W
R030	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R031	RD14BB2C333J	RES. CARBON 33K 5% 1/6W
R032	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R033	R92-1091-08	RES. METAL FILM 16.35M 1% 1/4W
R034	R92-1092-08	RES. METAL FILM 1.635M 0.25%
R035	R92-1093-08	RES. METAL FILM 163.5K 0.1%
R036	R92-1094-08	RES. METAL FILM 16.35K 0.1%
R037	R92-1095-08	RES. METAL FILM 1.635K 0.1%
R038	R92-1439-08	RES. FIXED 163.5 0.1%
R039	RN14BK2E6202F	RES. METAL FILM 62K 1% 1/4W
R040	RN14BK2E9101F	RES. METAL FILM 9.1K 1% 1/4W
R041	RN14BK2E1202F	RES. METAL FILM 12K 1% 1/4W
R042	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R045	RD14BB2C513J	RES. CARBON 51K 5% 1/6W
R046	RD14BB2C154J	RES. CARBON 150K 5% 1/6W
R053	RD14BB2C151J	RES. CARBON 150 5% 1/6W
S001	S40-2521-08	PUSH SWITCH

REF.NO	PARTS NO	NAME & DESCRIPTION
S002	S40-2522-08	PUSH SWITCH
S003	S40-2521-08	PUSH SWITCH
S004	S40-2521-08	PUSH SWITCH
S005	S42-4511-08	TACTIL SWITCH
S006	S42-4511-08	TACTIL SWITCH
S007	S42-4511-08	TACTIL SWITCH
S008	S42-4511-08	TACTIL SWITCH
S009	S42-6506-08	TACTIL SWITCH
S010	S42-6506-08	TACTIL SWITCH
S011	S42-6506-08	TACTIL SWITCH
S012	S42-6506-08	TACTIL SWITCH
S013	S42-6506-08	TACTIL SWITCH
S014	S42-6506-08	TACTIL SWITCH
VR001	R12-5523-18	RES. SEMI FIXED 200KB
VR002	R12-1541-08	RES. SEMI FIXED 1KB
VR003	NO USE	
VR004	R12-5523-18	RES. SEMI FIXED 200KB
VR005	R12-3531-18	RES. SEMI FIXED 10KB
VR006	R12-3531-18	RES. SEMI FIXED 10KB
VR007	R12-1541-08	RES. SEMI FIXED 1KB
X001	L77-1038-08	CRYSTAL RESONATOR
Z001	C91-1305-08	VARISTOR
ZD001	TL1034CZ	DIODE, VOLTAGE REFERENCE

DL-712 SUB UNIT W02-0477-08

REF.NO	PARTS NO	NAME & DESCRIPTION
	E29-0539-08	PIN CONNECTOR
	J25-5066-08	PCB (UNMOUNTED)
C001	CS15E1CR10M	CAP. TUNTALUM 0.1 20% 16V
C002	CS15E1CR47M	CAP. TUNTALUM 0.47 20% 16V
C003	CS15E1CR47M	CAP. TUNTALUM 0.47 20% 16V
C004	CC45SL1H101J	CAP. CERAMIC 100P 5% 50V
C005	CF92V1H224J	CAP. POLYESTER 0.22 5% 50V
C006	CC45SL1H100J	CAP. CERAMIC 10P 5% 50V
C007	CF92V1H224J	CAP. POLYESTER 0.22 5% 50V
C008	CF92V1H224J	CAP. POLYESTER 0.22 5% 50V
C018	CF92V1H104J	CAP. POLYESTER 0.1 5% 50V
C019	CF92V1H104J	CAP. POLYESTER 0.1 5% 50V
C020	CK45F1H222Z	CAP. CERAMIC 2200P 50V
C021	CK45B1H391K	CAP. CERAMIC 390P 10% 50V
C028	CC45SL1H390J	CAP. CERAMIC 39P 5% 50V
D005	1S1588	DIODE
D006	1S1588	DIODE
D017	1S1588	DIODE
R011	RN14BK2E2002F	RES. METAL FILM 20K 1% 1/4W
R012	RD14BB2C105J	RES. CARBON 1M 5% 1/6W
R013	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R014	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R015	RN14BK2E2202F	RES. METAL FILM 22K 1% 1/4W
R016	RN14BK2E2202F	RES. METAL FILM 22K 1% 1/4W
R017	R92-1115-08	RES. METAL FILM 100M 5% 1/4W
R043	RD14BB2C394J	RES. CARBON 390K 5% 1/6W
R044	RD14BB2C274J	RES. CARBON 270K 5% 1/6W
R047	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R048	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R049	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R054	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R055	RD14BB2C124J	RES. CARBON 120K 5% 1/6W
VR003	R12-1541-08	RES. SEMI FIXED 1KB
VR008	R12-3518-05	RES. SEMI FIXED 10K B

PARTS LIST

DL-712 POWER SUPPLY UNIT W02-0475-08

REF.NO	PARTS NO	NAME & DESCRIPTION
	F05-2012-05	FUSE 0.2A(FAST BLOW)
	J13-0020-05	FUSE HOLDER
	J25-5065-08	PCB (UNMOUNTED)
19	E02-0138-08	CONNECTOR 7P
20	E03-0203-05	POWER CONNECTOR
21	E31-5868-08	WIRE ASS'Y
C022	CE04EW1V470M	CAP. ELECTRO 47 20% 35V
C023	CS15E1V4R7M	CAP. TUNTALUM 4.7 20% 35V
C024	CK45F1H222Z	CAP. CERAMIC 2200P 50V
C025	CK45F1H222Z	CAP. CERAMIC 2200P 50V
C026	CE04EW1A102M	CAP. ELECTRO 1000 20% 10V
C027	CE04EW1A102M	CAP. ELECTRO 1000 20% 10V
D014	1N4001	DIODE
D015	1S1588	DIODE
D016	1S1588	DIODE
IC002	TL-061	IC. JFET-INPUT OP-AMP
Q002	2SK118(R)	FET, N-CHANNEL
Q003	2SA608(F)	TR. SI. PNP
R050	RN14BK2E4701F	RES. METAL FILM 4.7K 1% 1/4W
R051	RN14BK2E4701F	RES. METAL FILM 4.7K 1% 1/4W
R052	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R057	RD14BB2C100J	RES. CARBON 10 5% 1/6W
VR009	R12-3531-18	RES. SEMI FIXED 10KB
ZD002	H25(B3)	DIODE, ZENER 4.90V
ZD003	H25(B3)	DIODE, ZENER 4.90V
ZD004	H25(B3)	DIODE, ZENER 4.90V

PARTS LIST

PARTS LIST

DL-711 MAIN UNIT

W02-0479-08

REF.NO	PARTS NO	NAME & DESCRIPTION
	J25-5355-08	PCB (UNMOUNTED)
	LD-B7073AZ	LCD
19	E02-0138-08	CONNECTOR 7P
22	E13-0171-08	PIN JACK (MIDGET)
23	E21-0664-08	INPUT CONECTOR
BZ001	T99-0502-08	BEEPER
C009	CF92V1H103J	CAP. POLYESTER 0.01 5% 50V
C010	CF92V1H103J	CAP. POLYESTER 0.01 5% 50V
C011	CF92V1H473J	CAP. POLYESTER 0.047 5% 50V
C012	CS15E1V4R7M	CAP. TUNTALUM 4.7 20% 35V
C013	CF92V1H473J	CAP. POLYESTER 0.047 5% 50V
C014	CF92V1H103J	CAP. POLYESTER 0.01 5% 50V
C015	CC4SSL1H390J	CAP. CERAMIC 39P 5% 50V
C016	CE04CW1V4R7M	CAP. ELECTRO 4.7 20% 35V
C017	CE04CW1V4R7M	CAP. ELECTRO 4.7 20% 35V
D001	U05B	DIODE
D002	U05B	DIODE
D003	U05B	DIODE
D004	U05B	DIODE
D007	1S1588	DIODE
D008	1S1588	DIODE
D009	1S1588	DIODE
D010	1S1588	DIODE
D011	1S1588	DIODE
D012	1S1588	DIODE
D013	1S1588	DIODE
IC001	MSMS230GSK	IC. A/D CONVERTER
P001	911P97E101YU10	THERMISTER 500 OHM
Q001	2SD612(K)	TR. SI. NPN
R001	RD14BB2H103J	RES. CARBON 10K 5% 1/2W
R002	R92-1082-08	RES. METAL FILM 9.9M 1%
R003	RD14BB2C272J	RES. CARBON 2.7K 5% 1/6W
R004	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R005	R92-1083-08	RES. METAL FILM 900 0.5% 1/4W
R006	R92-1084-08	RES. METAL FILM 90 0.5% 1/4W
R007	R92-1085-08	RES. METAL FILM 9 0.5% 1/4W
R008	R92-1086-08	RES. METAL FILM 0.98 0.5% 1/2W
R009	R92-1098-08	RES. SHUNT 10A
R010	RN14BK2E2201F	RES. METAL FILM 2.2K 1% 1/4W
R018	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R019	NO USE	
R020	R92-1105-08	RES. METAL FILM 1K 0.25%
R021	R92-1109-08	RES. METAL FILM 10.01K 0.25%
R022	R92-1110-08	RES. METAL FILM 101K 0.25%
R023	R92-1108-08	RES. METAL FILM 1.111M 0.25%
R024	RD14BB2C514J	RES. CARBON 510K 5% 1/6W
R025	R92-1097-08	RES. CARBON 10M 5% 1/8W
R026	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R027	RN14BK2E2743F	RES. METAL FILM 274K 1% 1/4W
R028	RN14BK2E2672F	RES. METAL FILM 26.7K 1% 1/4W
R029	RD14BB2C154J	RES. CARBON 150K 5% 1/6W
R030	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R031	RD14BB2C333J	RES. CARBON 33K 5% 1/6W
R032	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R033	R92-1091-08	RES. METAL FILM 16.35M 1% 1/4W
R034	R92-1092-08	RES. METAL FILM 1.635M 0.25%
R035	R92-1101-08	RES. METAL FILM 163.5K 0.25%
R036	R92-1102-08	RES. METAL FILM 16.35K 0.25%
R037	R92-1103-08	RES. METAL FILM 1.635K 0.25%
R038	R92-1439-08	RES. FIXED 163.5 0.1%
R039	RN14BK2E6202F	RES. METAL FILM 62K 1% 1/4W
R040	RN14BK2E9101F	RES. METAL FILM 9.1K 1% 1/4W
R041	RN14BK2E1202F	RES. METAL FILM 12K 1% 1/4W
R042	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R045	RD14BB2C513J	RES. CARBON 51K 5% 1/6W
R046	RD14BB2C154J	RES. CARBON 150K 5% 1/6W
R053	RD14BB2C151J	RES. CARBON 150 5% 1/6W

REF.NO PARTS NO NAME & DESCRIPTION

S001	S40-2521-08	PUSH SWITCH
S002	S40-2522-08	PUSH SWITCH
S003	S40-2521-08	PUSH SWITCH
S004	S40-2521-08	PUSH SWITCH
S005	S42-4511-08	TACTIL SWITCH
S006	S42-4511-08	TACTIL SWITCH
S007	S42-4511-08	TACTIL SWITCH
S008	S42-4511-08	TACTIL SWITCH
S009	S42-6506-08	TACTIL SWITCH
S010	S42-6506-08	TACTIL SWITCH
S011	S42-6506-08	TACTIL SWITCH
S012	S42-6506-08	TACTIL SWITCH
S013	S42-6506-08	TACTIL SWITCH
S014	S42-6506-08	TACTIL SWITCH
VR001	R12-5523-18	RES. SEMI FIXED 200KB
VR002	R12-1541-08	RES. SEMI FIXED 1KB
VR003	NO USE	
VR004	R12-5523-18	RES. SEMI FIXED 200KB
VR005	NO USE	
VR006	R12-3518-05	RES. SEMI FIXED 10K B
VR007	R12-1514-05	RES. SEMI FIXED 1KB
X001	L77-1038-08	CRYSTAL RESONATOR
Z001	C91-1305-08	VARIATOR
ZD001	LM3852-1.2	IC. VOLTAGE REFERENCE

DL-711 SUB UNIT

W02-0480-08

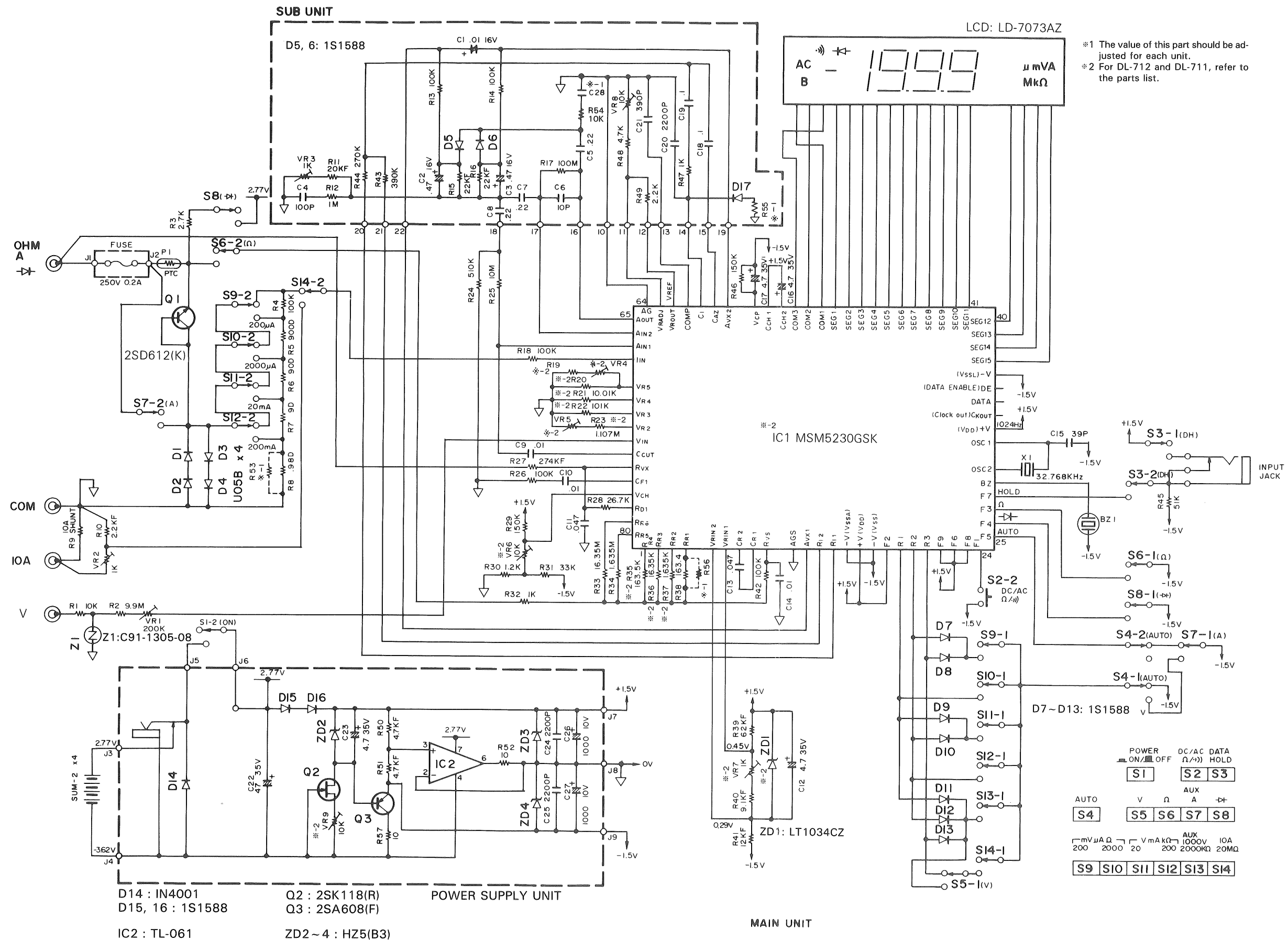
REF.NO	PARTS NO	NAME & DESCRIPTION
	E29-0539-08	PIN CONNECTOR
	J25-5066-08	PCB (UNMOUNTED)
C001	CS15E1CR10M	CAP. TUNTALUM 0.1 20% 16V
C002	CS15E1CR47M	CAP. TUNTALUM 0.47 20% 16V
C003	CS15E1CR47M	CAP. TUNTALUM 0.47 20% 16V
C004	CC4SSL1H101J	CAP. CERAMIC 100P 5% 50V
C005	CF92V1H224J	CAP. POLYESTER 0.22 5% 50V
C006	CC4SSL1H100J	CAP. CERAMIC 10P 5% 50V
C007	CF92V1H224J	CAP. POLYESTER 0.22 5% 50V
C008	CF92V1H224J	CAP. POLYESTER 0.22 5% 50V
C018	CF92V1H104J	CAP. POLYESTER 0.1 5% 50V
C019	CF92V1H104J	CAP. POLYESTER 0.1 5% 50V
C020	CK45F1H222Z	CAP. CERAMIC 2200P 50V
C021	CK45B1H391K	CAP. CERAMIC 390P 10% 50V
C028	CC4SSL1H390J	CAP. CERAMIC 39P 5% 50V
D005	1S1588	DIODE
D006	1S1588	DIODE
D017	1S1588	DIODE
R011	RN14BK2E2002F	RES. METAL FILM 20K 1% 1/4W
R012	RD14BB2C105J	RES. CARBON 1M 5% 1/6W
R013	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R014	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R015	RN14BK2E2202F	RES. METAL FILM 22K 1% 1/4W
R016	RN14BK2E2202F	RES. METAL FILM 22K 1% 1/4W
R017	R92-1115-08	RES. METAL FILM 100M 5% 1/4W
R043	RD14BB2C394J	RES. CARBON 390K 5% 1/6W
R044	RD14BB2C274J	RES. CARBON 270K 5% 1/6W
R047	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R048	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R049	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R054	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R055	RD14BB2C124J	RES. CARBON 120K 5% 1/6W
VR003	R12-1541-08	RES. SEMI FIXED 1KB
VR008	R12-3518-05	RES. SEMI FIXED 10K B

DL-711 POWER SUPPLY UNIT

W02-0478-08

REF.NO	PARTS NO	NAME & DESCRIPTION
	F05-2012-05	FUSE 0.2A(FAST BLOW)
	J13-0020-05	FUSE HOLDER
	J25-5065-08	PCB (UNMOUNTED)
19	E02-0138-08	CONNECTOR 7P
20	E03-0203-05	POWER CONNECTOR
21	E31-5868-08	WIRE ASS'Y
C022	CE04EW1V470M	CAP. ELECTRO 47 20% 35V
C023	CS15E1V4R7M	CAP. TUNTALUM 4.7 20% 35V
C024	CK45F1H222Z	CAP. CERAMIC 2200P 50V
C025	CK45F1H222Z	CAP. CERAMIC 2200P 50V
C026	CE04EW1A102M	CAP. ELECTRO 1000 20% 10V
C027	CE04EW1A102M	CAP. ELECTRO 1000 20% 10V
D014	1N4001	DIODE
D015	1S1588	DIODE
D016	1S1588	DIODE
IC002	TL-061	IC. JFET-INPUT OP-AMP
Q002	2SK118(R)	FET. N-CHANNEL
Q003	2SA608(F)	TR. SI. PNP
R050	RN14BK2E4701F	RES. METAL FILM 4.7K 1% 1/4W
R051	RN14BK2E4701F	RES. METAL FILM 4.7K 1% 1/4W
R052	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R057	RD14BB2C100J	RES. CARBON 10 5% 1/6W
VR009	R12-3518-05	RES. SEMI FIXED 10K B
ZD002	HZ5(B3)	DIODE,ZENER 4.90V
ZD003	HZ5(B3)	DIODE,ZENER 4.90V
ZD004	HZ5(B3)	DIODE,ZENER 4.90V

DL-712/DL-711 SCHEMATIC DIAGRAM

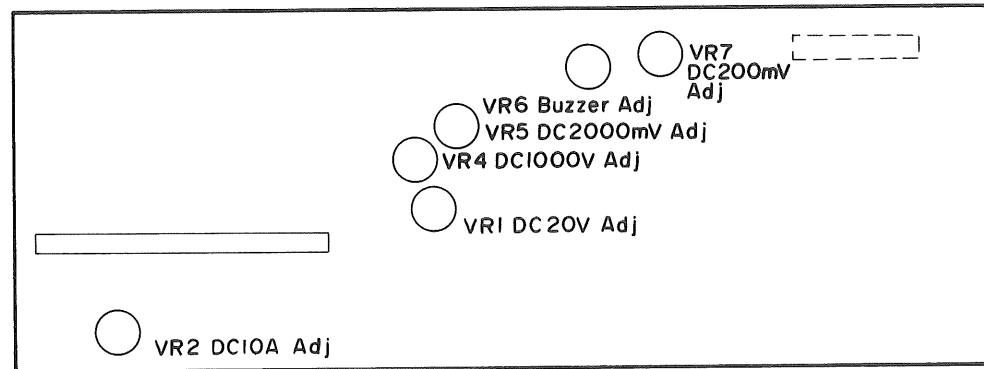


*1 The value of this part should be adjusted for each unit.
 *2 For DL-712 and DL-711, refer to the parts list.

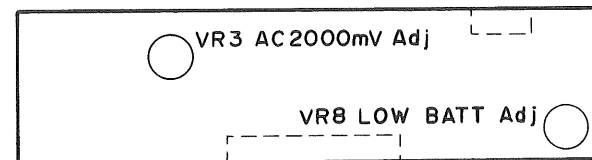
ADJUSTMENT LOCATIONS/P.C. BOARD

P.C. BOARD

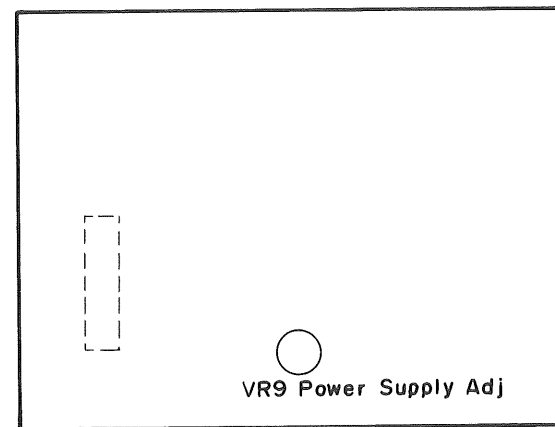
MAIN UNIT



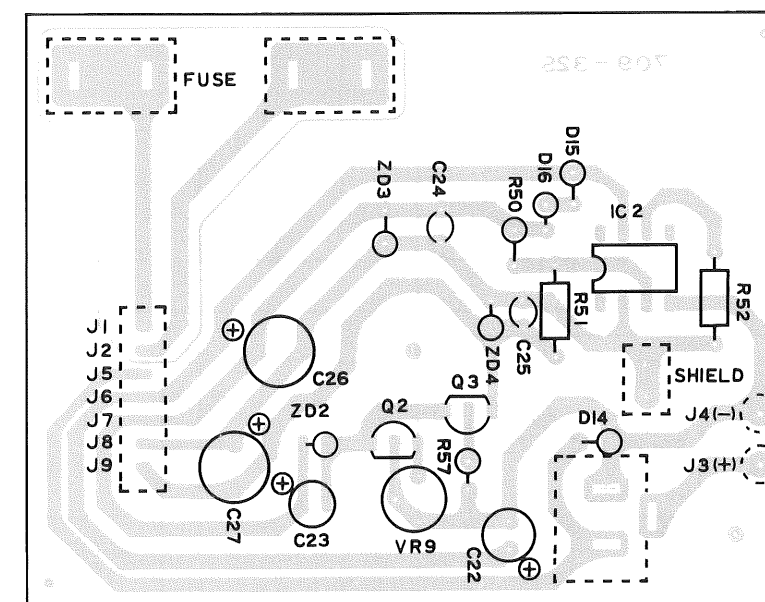
SUB UNIT



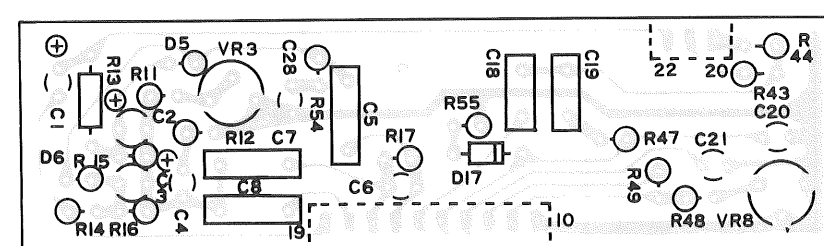
POWER SUPPLY UNIT



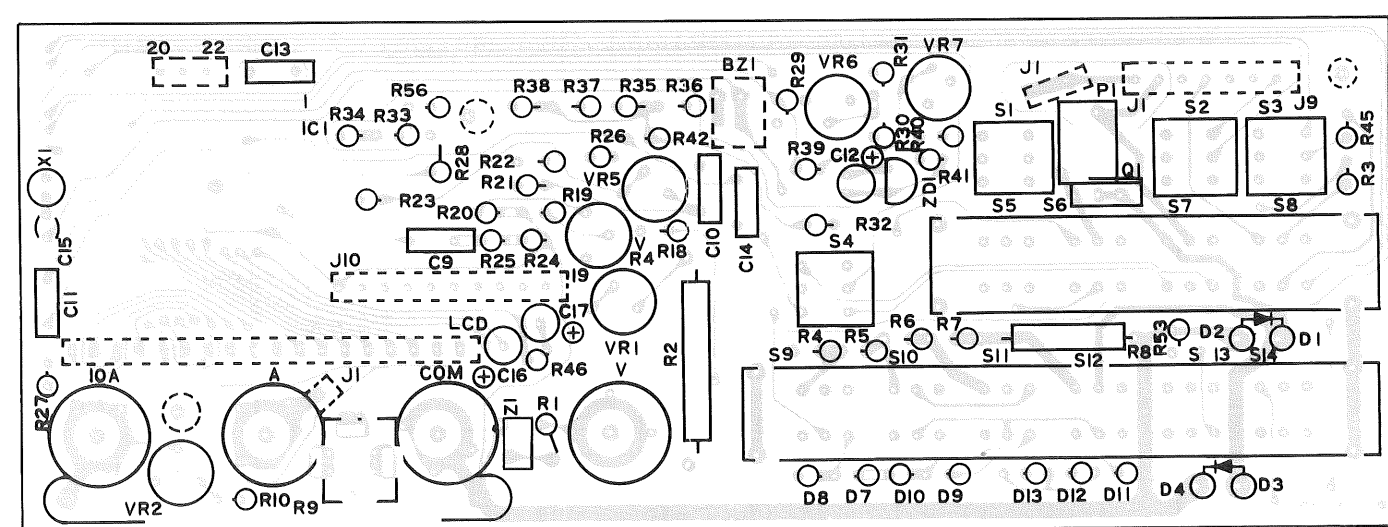
POWER SUPPLY UNIT



SUB UNIT

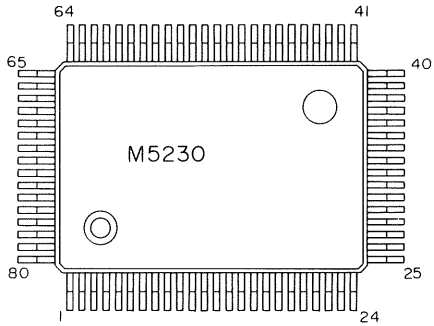


MAIN UNIT

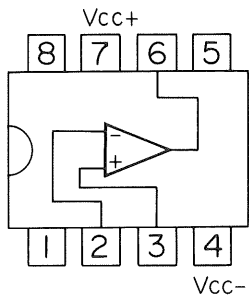


SEMICONDUCTORS

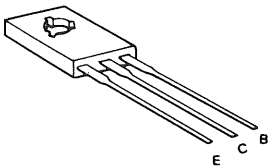
MSM5230GSK



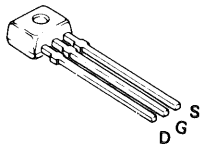
TL-061



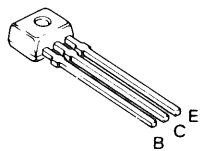
2SD612(K)



2SK118(R)



2SA806(F)



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