

# PR-657

## DC POWER SUPPLY

## INSTRUCTION MANUAL

# 1. GENERAL

Your PR-657 is an all solid state voltage-regulated DC power supply, supplying 0 to 30 V, 7 A power. It provides improved temperature characteristics, line and load regulations and other characteristics. It also is so dependable that a built-in protective circuit can protect it against shortcircuits and overloads, thus requiring few troubleshooting. Using a remote control switch box (option) allows you to freely select any of four output voltages from a distant place.

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# 2. FEATURES

- a. Your PR-657 provides advanced performance and high reliability as its differential amplifier is made up of IC.
- b. The IC differential amplifier provides high open loop gain and good line and load regulations and little ripple.
- c. The output voltage is continuously variable and can be set at any of 0 to 30 V.
- d. The output current available is as high as 7 A.
- e. A built-in protective circuit against output short or over load prevents the transistors from damage, minimizing occurrence of trouble.
- f. An overcurrent indicator on the front panel lights when a built-in overcurrent protective circuit is in action.  
This is helpful for your safety operation.
- g. Preset switches enable you to instantaneously set any of three different output voltages without turning the output voltage control.
- h. A remote control switch box (option) allows freely switching any of four output voltages from a distant place.

### 3. SPECIFICATIONS

#### Power Supply

##### Voltage regulating characteristics,

Output voltage: 0 to 30V.

Output current: 0 to 7A.

##### Line regulation (with

240V  $\pm$  10% change): Better than  $\pm$  5mV.

Load regulation: Better than 10mV.

Ripple and noise: Less than 5mV p-p.

Residual voltage: Within 0 to +50mV.

#### Meters,

Voltmeter: 0 to 32V (full scale).

Ammeter: 0 to 7.5A (full scale).

Voltmeter accuracy: Better than  $\pm$ 3% of full scale.

Ammeter accuracy: Better than  $\pm$ 3% of full scale.

Transient response time: Shorter than 450 $\mu$ sec (with load turned on).

#### Temperature characteristics,

Temperature coefficient: Lower than 200ppm/ $^{\circ}$ C (0 to 40 $^{\circ}$ C).

Operating temperature: 0 to 50 $^{\circ}$ C.

#### General

##### Line,

Input voltage: 100, 120, 220, or 240V AC  $\pm$ 10%.

##### Frequency and power

consumption: 50 to 60Hz, below 430W.

Insulation resistance: Over 50M $\Omega$  between line and cabinet (with 500VDC).

##### Output connectors,

Polarity: Positive (+), negative (-) and common (COM).

Any connector may be grounded.

Dimensions: 200(208)Hx208Wx363(401)

D mm

Values in ( ) include protrusion

Net weight: 13.6kg.

##### Accessories,

Power cable: 1 piece

Plug for remote control: 1 piece.

Replacement fuse: 3A, 5A, 2 pieces respectively

Instruction manual: 1 copy.

## 4. CIRCUIT DESCRIPTION

In studying the operation of each circuit in your PR-657, please refer to Figure 1, the "Block Diagram", and the Schematic Diagram on the back cover.

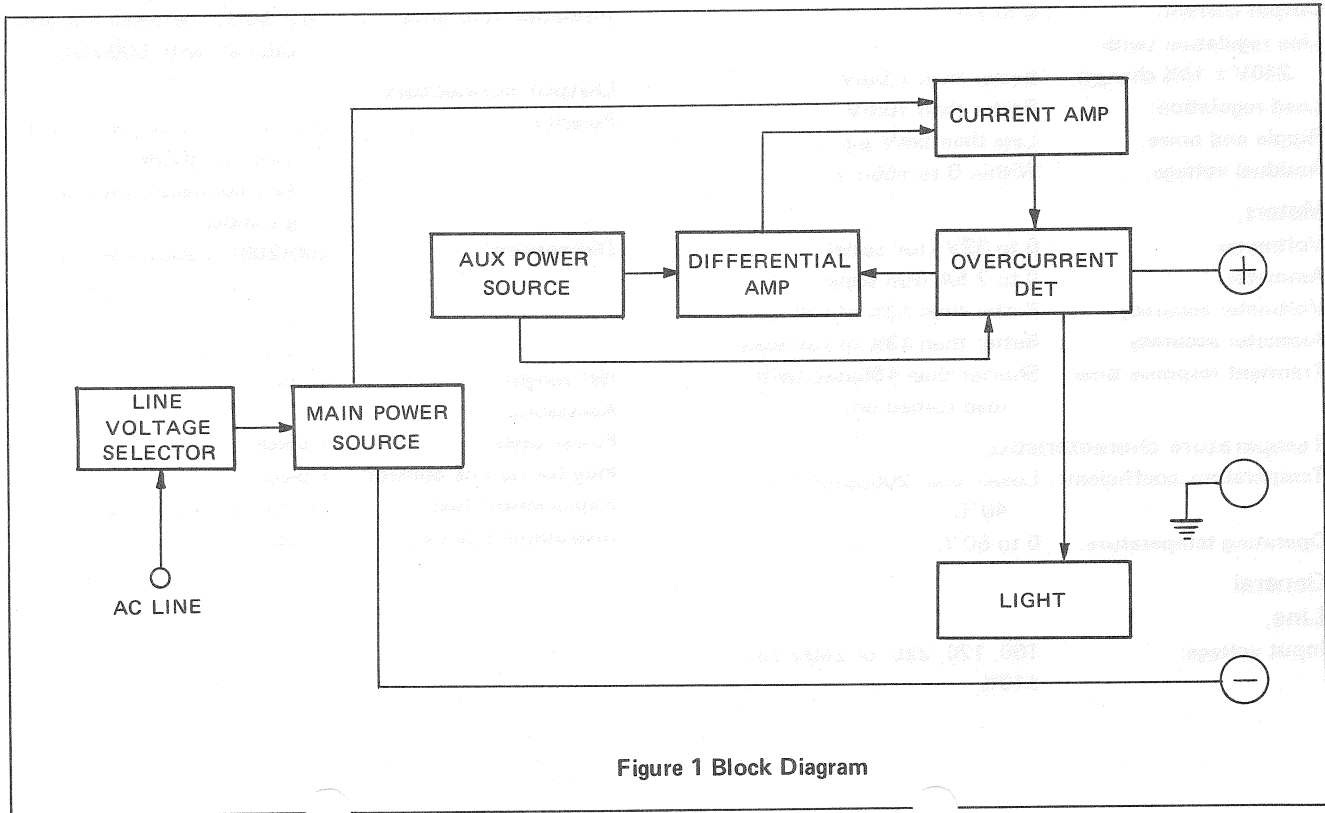


Figure 1 Block Diagram

### **Main Power Source**

The input AC voltage is fullwave-rectified by D1 (KBPC-2502 bridge), is smoothed by C1 (15,000  $\mu$ F), and is fed to the Current Amplifier.

### **Auxiliary Power Source**

This power source feeds  $\pm 15$ V regulated voltages to the voltage control circuit and protective circuit. The input voltage is full-wave rectified by D101 through D104 and is regulated to  $\pm 15$  V by Q101, D105, Q102 and D106. The +15 V voltage also is used to create a highly-stable, accurate 6.2 V reference voltage through D107 a high-temperature compensation zener diode D108. The voltage obtained at D107 is used as the reference voltage for the overcurrent protective circuit.

### **Differential Amplifier**

This amplifier controls the output voltage, being comprised of IC101, Q103, Q104 and Q105. The output voltage can be varied with VR1. The adjusted voltage is amplified by IC101, is passed through Q103, and is voltage and current-magnified by Darlington amplifier of Q104 and Q105. The magnified voltage is fed through the emitter follower to the succeeding Current Amplifier stage. The Differential Amplifier is stable and quick in responding to a load change and the like so that IC101 is of open loop amplifier.

### **Overcurrent Detector**

This detector is a protective circuit that prevents an overcurrent, being comprised of Q106, IC102 and Q107. The voltage induced across the output current detecting resistor R12 is compared with the reference voltage given at D107 in the comparator circuit IC102. If the output current reaches its overcurrent limit, IC102 operates, the output of which prompts Q106 to turn on to suppress the base potential of Q104. This prevents the output current from increasing more than limited. The Overcurrent Detector I has a drooping constant-current characteristic. When the protective circuit is in action, Q107 turns on the light-emitting diode D3, which indicates such an action.

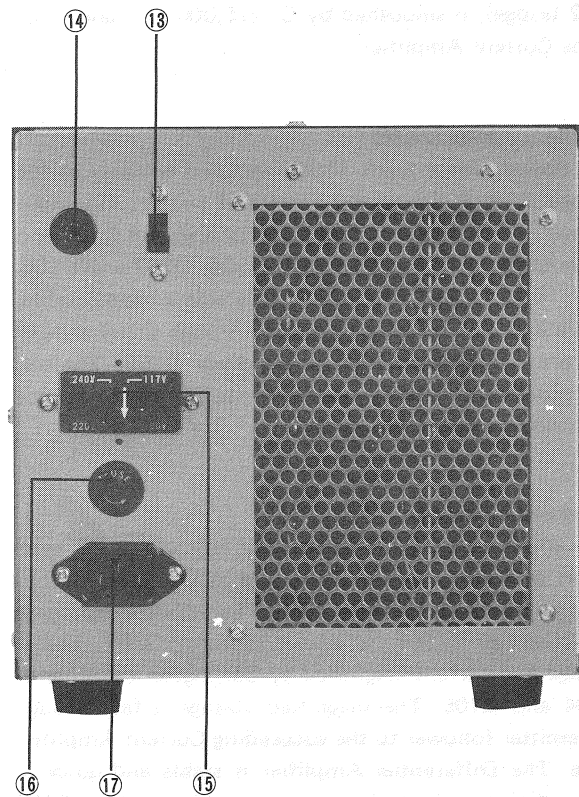
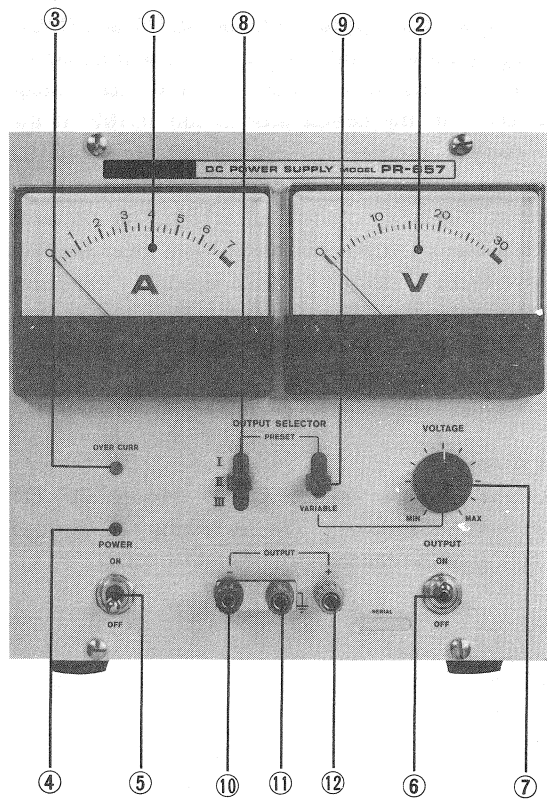
### **Current Amplifier**

This current amplifier consists of Q1 through Q7, Q1 being an emitter follower. The remaining Q2 through Q7 are connected in parallel.




### **Light**

This light is an overcurrent indicator light-emitting diode (LED).

## 5. CONTROLS AND WHAT THEY DO



### Front Panel

REF. NO.	PANEL INDICATION	FUNCTION
1	A	DC ammeter, 7A and higher zone of which are colored red.
2	V	DC voltmeter.
3	OVER CURR	LED Overcurrent indicator, which lights when output current exceeds overcurrent limit.
4		LED power-on indicator, which lights when POWER ON-OFF switch is turned on.
5	POWER ON/OFF	Power on-off switch, which turns on PR-657 at ON position.
6	OUTPUT ON/OFF	Output on-off switch, which turns on output voltage is fed to load.
7	VOLTAGE	Output voltage control, which raises voltage up when turned clockwise.
8	OUTPUT SELECTOR I-II-III	Preset voltage switch which switches output voltage to any of three values.
9	OUTPUT SELECTOR PRESET/VARIABLE	Preset-variable voltage selector which at upper position allows switch 8 to select preset voltage and at lower position allows VOLTAGE control 7 to vary output voltage.
10		Negative connector to which negative load is connected.
11		Grounding connector earthed to chassis. In use, be sure to connect this to positive (+), negative (-) or COM connector with short bar.
12		Positive connector to which positive lead of load is connected.

## Rear Panel

13	PANEL/REMOTE	Panel/remote control selector, which was set at PANEL position at factory. For remote voltage selection, remove stopper to switch selector to REMOTE position.
14	REMOTE INPUT	Remote control connector. For remote voltage selection, connect remote control switch box to this 7-pin connector.
15		Line voltage selector of plug type. Plug can be removed by pulling backward. When inserting, plug arrow mark must direct rated line voltage.
16		Fuse holder containing 3 A fuse. Cap will be removed by turning counterclockwise with Phillips screw driver.
17		Power cable connector.

## 6. HOW TO OPERATE

### (1) Using VOLTAGE Control

For operation with the VOLTAGE control 7 on the front panel, set up the controls as illustrated in Figure 2.

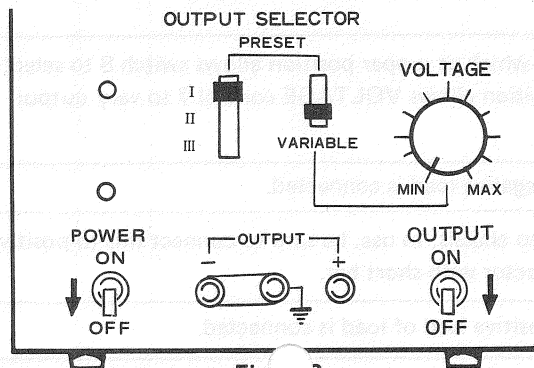


Fig. 2

1. Set the PRESET/VARIABLE selector 9 to "VARIABLE".
2. Set the POWER ON-OFF switch 5 to "ON". The power-on indicator 4 will light to show that your PR-657 is ready for operation.
3. Adjust the VOLTAGE control 7 clockwise for a desired output voltage.
4. Firmly connect a load to the output connectors 10 and 12, which are floated from the chassis. Place the short bar between either of these connectors and the grounding connector. If not, hum may be induced in the output line.
5. Turn the OUTPUT ON-OFF switch 6 to "ON", by which the output voltage will be supplied to the load.



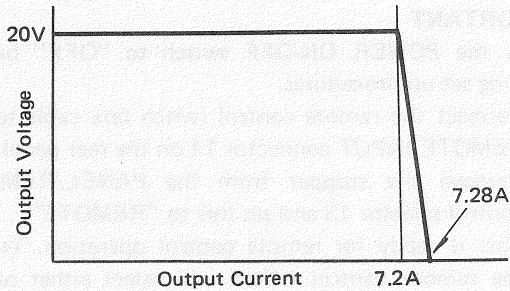


Figure 3

**NOTE:** If the output current exceeds around 7.2A, the overcurrent protective circuit operates and turns the overcurrent indicator 4 on. The circuit has a drooping constant-current characteristic as illustrated in Figure 3.

## (2) Adjusting Preset Voltages

To adjust the preset voltages, set up the controls on the front panel as illustrated in Figure 4.

1. Set the PRESET/VARIABLE selector 9 to "PRESET".
2. Set the PRESET switch 8 to "I".
3. Adjust the PRESET I semi-fixed control on the right-hand side clockwise with a standard screw driver until the V meter 2 reads a desired voltage.
4. Similarly, proceed with adjustment for the PRESET II and III voltages.

5. This completes the preset voltage adjustment. Turning the PRESET switch 8 to "I", "II" and "III" will produce the preset voltages in sequence.

**NOTE:** The preset position out of use should be set for 0 V output voltage for safety operation.

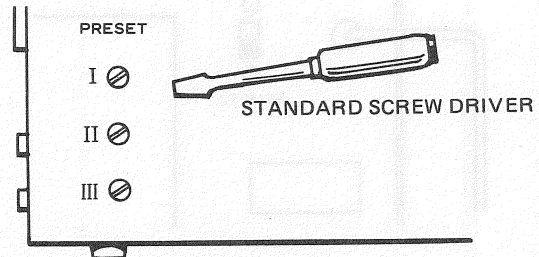
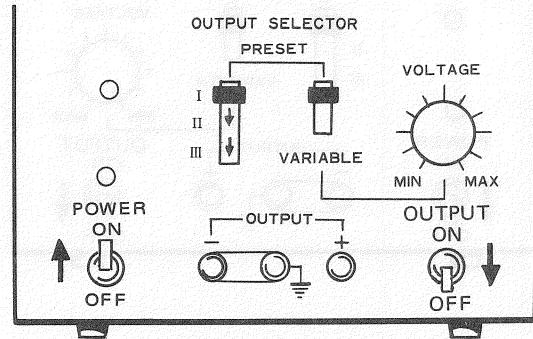


Figure 4

### (3) Using Remote Control Switch Box (option)

To remote-control your PR-657, set up it and the remote control switch box.

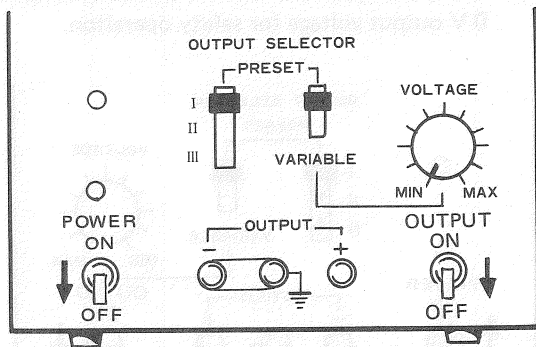
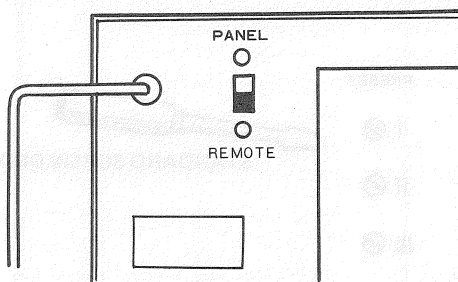


Fig 5



### IMPORTANT

Turn the POWER ON-OFF switch to "OFF" before starting set-up procedures.

1. Connect the remote control switch box cable to the REMOTE INPUT connector 14 on the rear panel.
2. Remove the stopper from the PANEL/REMOTE control selector 13 and set this to "REMOTE".
3. This is ready for remote control operation. Tuning the remote control switch will select either of the three preset voltages I, II and III and the voltage set by the VOLTAGE control 7.

### CAUTION

For making the remote control switch box Use a 6-core shielded cable. Do not extend it longer than 2m. Be sure to use a shorting type of switch.

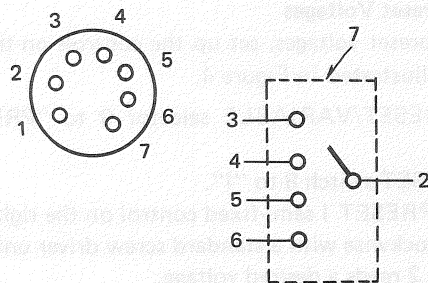


Figure 6

#### (4) Connecting Two or More Units of PR-657 in Series

To use two units of PR-657, connect a load as illustrated below. The sum of two output voltages is applied across the load.

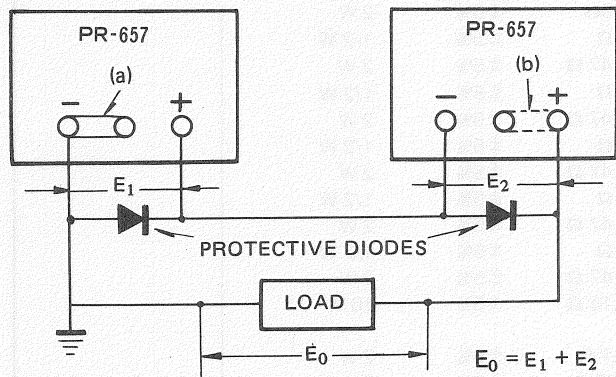


Figure 7

#### CAUTIONS

1. The protective diodes used should have higher than 7.5 A average forward current and higher than 50 V inverse peak voltage.
2. In needing the positive polarity at the load, connect short bar at the position (a). For negative polarity, place it at the position (b).

#### 7. CAUTIONS FOR USE

1. Do not use your PR-657 set in direct sunlight since this will cause the internal temperature to rise, resulting in unstable operation and damaging of the internal components.
2. Avoid use at high temperatures and high humidity.
3. Do not use in locations where server vibrations are produced or near places where strong magnetic fields or shock voltage are generated. Otherwise the transistors will be adversely affected.
4. When using your PR-657 set with other equipment which is easily affected by power line fluctuations, such as an oscilloscope, the other equipment will be adversely affected if the power supply set is placed close to it or atop it. Therefore, place the power supply set as far away from the other equipment as possible.
5. For connection of load, firmly tighten each connector. The load leads should be wired as short as possible. Poor connection and high wiring resistance result in unstable output voltages.
6. Do not put any matter close to the ventilation openings on both sides and rear panel as the controlled transistors are forcibly cooled by fan.
7. **Replacing the fuse**
  - a. Open the fuse holder using a Phillips screw driver.
  - b. Replace the fuse.

**CAUTION:** Be sure to select the fuse of rated capacity. For a 100 and 120 V AC lines, use a 5 A fuse; for a 220 and 240 V AC lines, a 3 A fuse.

# 8. PARTS LIST OF PR-657

SCHEMATIC SYMBOL	PARTS NO.	DESCRIPTION			REMARKS
<b>RESISTOR</b>					
R1	RS14AB3D1R5J	Metal film	1.5Ω	± 5%	2 W
R2	RW14BA2H010J	Wirewound	1 Ω	± 5%	1/2 W
R3	RS14AB3DR47J	Metal film	0.47 Ω	± 5%	2 W
R4	RW14BA2H010J	Wirewound	1 Ω	± 5%	1/2 W
R5	RS14AB3DR47J	Metal film	0.47 Ω	± 5%	2 W
R6	RW14BA2H010J	Wirewound	1 Ω	± 5%	1/2 W
R7	RS14AB3DR47J	Metal film	0.47 Ω	± 5%	2 W
R8	RW14BA2H010J	Wirewound	1 Ω	± 5%	1/2 W
R9	RS14AB3DR47J	Metal film	0.47 Ω	± 5%	2 W
R10	RW14BA2H010J	Wirewound	1 Ω	± 5%	1/2 W
R11	RS14AB3DR47J	Metal film	0.47 Ω	± 5%	2 W
R12	RW98AA3HR33J x 2 (paralleling)	Wirewound	0.15 Ω	± 5%	10 W
R13	RW98AA3DR 10J	Wirewound	0.1 Ω	± 5%	2 W
R14	RW98AA3H331J	Wirewound	330 Ω	± 5%	5W
R19	RW14BA2H010J	Wirewound	1 Ω	± 5%	1/2 W
R20	RS14AB3DR47J	Metal film	0.47 Ω	± 5%	2 W
R21	RD14BB2E102J	Carbon	1 kΩ	± 5%	1/4 W
R22	RD14BB2E223J	Carbon	22 kΩ	± 5%	1/4 W
VR1	R03-3501-08	Variable resistor	20 kΩB		
VR2 ~ 4	R01-3501-08	Variable resistor	20 kΩB		
<b>CAPACITOR</b>					
C1	C91-0515-08	Electrolytic	15000μF		63 WV
C2	CQ92M1H104K	Mylar	0.1μF	± 10%	50 WV
C3	CE02W1H101	Electrolytic	100μF		50 WV

SCHEMATIC SYMBOL	PARTS NO.	DESCRIPTION	REMARKS
C5 ~ 8	CK45D2H103M	Ceramic 0.01 $\mu$ F $\pm$ 20% 500 WV	
C9	CK45D1H103M	Ceramic 0.01 $\mu$ F $\pm$ 20% 50 WV	
C10	CK45D1H473M	Ceramic 0.047 $\mu$ F $\pm$ 20% 50 WV	
C11	CE02W1H2R2	Electrolytic 2.2 $\mu$ F 50 WV	
<b>SEMI-CONDUCTOR</b>			
Q1 ~ 7		Transistor SDT9308 or 2SD113	
D1		Diode KBPC2502	
D3, 4		Light emitting diode GL-52AR	
<b>MISCELLANEOUS</b>			
M2 M1	A01-0817-18	Case	
	A13-0713-18	Frame (1)	
	A13-0714-08	Frame (2)	
	A20-2714-18	Panel	
	A22-0805-18	Sub-panel	
	A23-1610-08	Rear panel	
	A40-0704-18	Bottom plate	
	B31-0704-08	Voltmeter	
	B31-0705-08	Ammeter	
	B40-0765-04	Name plate	
	B41-0705-04	Name plate (power source)	
	B50-2838-00	Instruction manual	
	D32-0075-04	Switch stopper	
	E03-0201-05	Power connector	
E06-0761-08	Connector (receptacle, for remote control)		
E07-0761-08	Connector (plug, for remote control)		
E08-1081-05	Line voltage selector (receptacle)		
E09-0681-05	Line voltage selector (plug)		

SCHEMATIC SYMBOL	PARTS NO.	DESCRIPTION	REMARKS
	E21-0150-03	Terminal (grey)	
	E21-0151-03	Terminal (orange)	
	E21-0653-03	Terminal (blue)	
	E22-1081-08	Lug board 10P	
	E22-1581-08	Lug board 15P	
	E29-0506-04	Short bar	
	E30-1818-05	Power cord	
	F01-0810-08	Heat sink X6	
	F01-0811-08	Heat sink	
	F05-3021-05	Fuse 3A X2	
	F05-5022-05	Fuse 5A X2	
	F15-0704-08	Blind rubber (1)	
	F15-0705-08	Blind rubber (2)	
	F19-0703-04	Patch, for selector	
	H01-2825-08	Packing case (individual packing)	
	H10-0518-08	Packing material X2	
	H20-1707-08	Protection cover	
	H25-0029-04	Polyethylene bag	
	J03-0010-05	Rubber leg X4	
	J13-0033-15	Fuse holder	
	J21-2845-18	Heat sink mounting hardware (1)	
	J21-2846-08	Fanmotor mounting hardware (1)	
	J21-2852-08	Heat sink mounting hardware (2)	
	J21-2853-08	Heat sink mounting hardware (3)	
	J21-2854-08	Fanmotor mounting hardware (2)	
	J31-0601-08	Spacer	
	J32-0811-08	Boss	
	K01-0058-25	Grip	

SCHEMATIC SYMBOL	PARTS NO.	DESCRIPTION	REMARKS
	K29-0208-24	Knob, for lever switch	
	K21-0283-04	Knob, for variable resistor	
T1	L01-9066-08	Power transformer	
S1	S44-2501-08	Toggle switch	
S2	S44-4501-08	Toggle switch	
S3	S32-2013-05	Lever switch	
S4	S31-2040-08	Slide switch	
S5	S32-2012-05	Lever switch	
	X65-1190-00	Main unit	

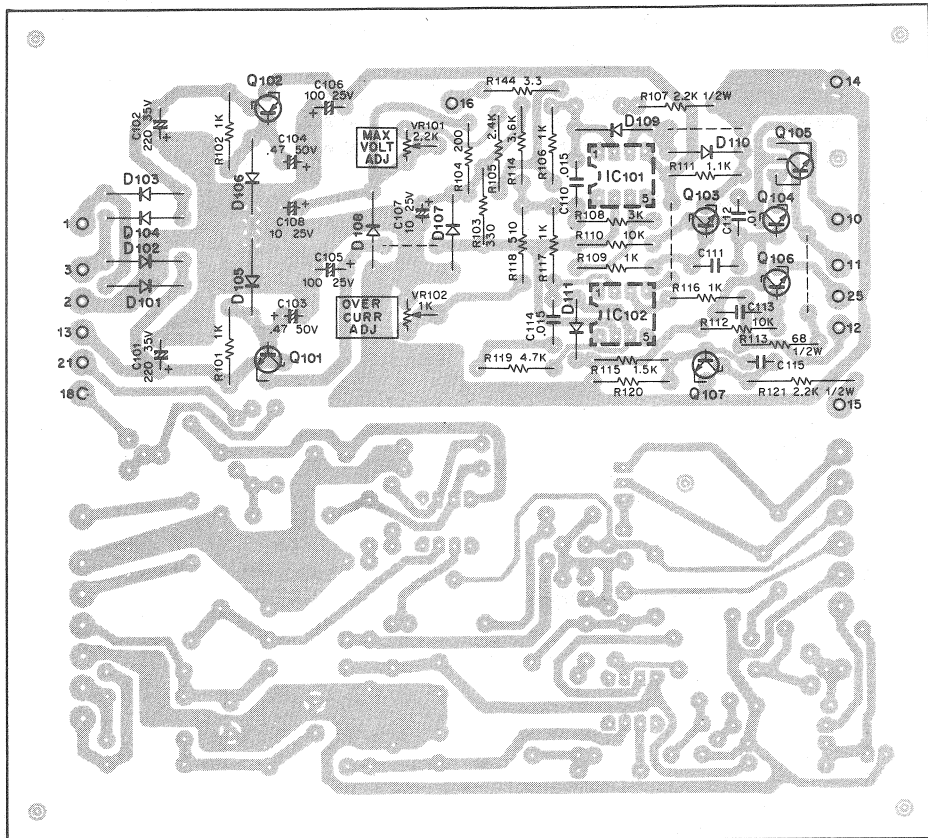
# PARTS LIST OF X65-1190-00

SCHEMATIC SYMBOL	PARTS NO.	DESCRIPTION			REMARKS
<b>RESISTOR</b>					
R101, 102	RD14BB2E102J	Carbon	1 k $\Omega$	$\pm 5\%$	1/4 W
R103	RD14BB2E331J	Carbon	330 $\Omega$	$\pm 5\%$	1/4 W
R104	RD14BB2E201J	Carbon	200 $\Omega$	$\pm 5\%$	1/4 W
R105	RN14AK2E242F	Metal film	2.4 k $\Omega$	$\pm 1\%$	1/4 W
R106	RD14BB2E102J	Carbon	1 k $\Omega$	$\pm 5\%$	1/4 W
R107	RD14BY2H222J	Carbon	2.2 k $\Omega$	$\pm 5\%$	1/2 W
R108	RD14BB2E302J	Carbon	3 k $\Omega$	$\pm 5\%$	1/4 W
R109	RD14BB2E102J	Carbon	1 k $\Omega$	$\pm 5\%$	1/4 W
R110	RD14BB2E103J	Carbon	10 k $\Omega$	$\pm 5\%$	1/4 W
R111	RD14BB2E112J	Carbon	1.1 k $\Omega$	$\pm 5\%$	1/4 W
R112	RD14BB2E103J	Carbon	10 k $\Omega$	$\pm 5\%$	1/4 W
R113	RD14BY2H680J	Carbon	68 $\Omega$	$\pm 5\%$	1/2 W
R114	RD14BB2E362J	Carbon	3.6 k $\Omega$	$\pm 5\%$	1/4 W
R115	RD14BB2E152J	Carbon	1.5 k $\Omega$	$\pm 5\%$	1/4 W
R116, 117	RD14BB2E102J	Carbon	1 k $\Omega$	$\pm 5\%$	1/4 W
R118	RD14BB2E511J	Carbon	510 $\Omega$	$\pm 5\%$	1/4 W
R119	RD14BB2E472J	Carbon	4.7 k $\Omega$	$\pm 5\%$	1/4 W
R121	RD14BY2H222J	Carbon	2.2 k $\Omega$	$\pm 5\%$	1/2 W
R144	RD14BY2E3R3	Carbon	3.3 $\Omega$	$\pm 5\%$	1/4 W
VR101	R12-1033-05	Semi-fixed resistor	2.2 k $\Omega$ B		
VR102	R12-1002-05	Semi-fixed resistor	1 k $\Omega$ B		
<b>CAPACITOR</b>					
C101, 102	CE04W1V221	Electrolytic	220 $\mu$ F		35 WV



SCHEMATIC SYMBOL	PARTS NO.	DESCRIPTION			REMARKS
C103, 104 C105, 106 C107, 108 C110 C114	CE04W1ER47 CE04W1E101 CE04W1E100 CQ92M1H153K CQ92M1H103K	Electrolytic Electrolytic Electrolytic Mylar Mylar	0.47 $\mu$ F 100 $\mu$ F 10 $\mu$ F 0.015 $\mu$ F 0.01 $\mu$ F	25 WV 25 WV 25 WV $\pm$ 10% $\pm$ 10% 50 WV 50 WV	
<b>SEMI-CONDUCTOR</b>					
IC101, 102  Q101 Q102 Q103, 104 Q105 Q106, 107  D101 ~ 104 D105 ~ 106 D107 D108 D109 ~ 111	741 CP  2SD400 2SB544 2SC983 2SD525 2SC983  GP10-4002 RD15EB RD8.2EB IN823 IN914 or 1S1588 (IS953)	IC, Linear  Transistor Transistor Transistor Transistor Transistor  Diode Zener diode Zener diode Zener diode Diode			
<b>MISCELLANEOUS</b>					
	FO1-0812-08  J25-2824-08	Heat sink  Printed circuit board			

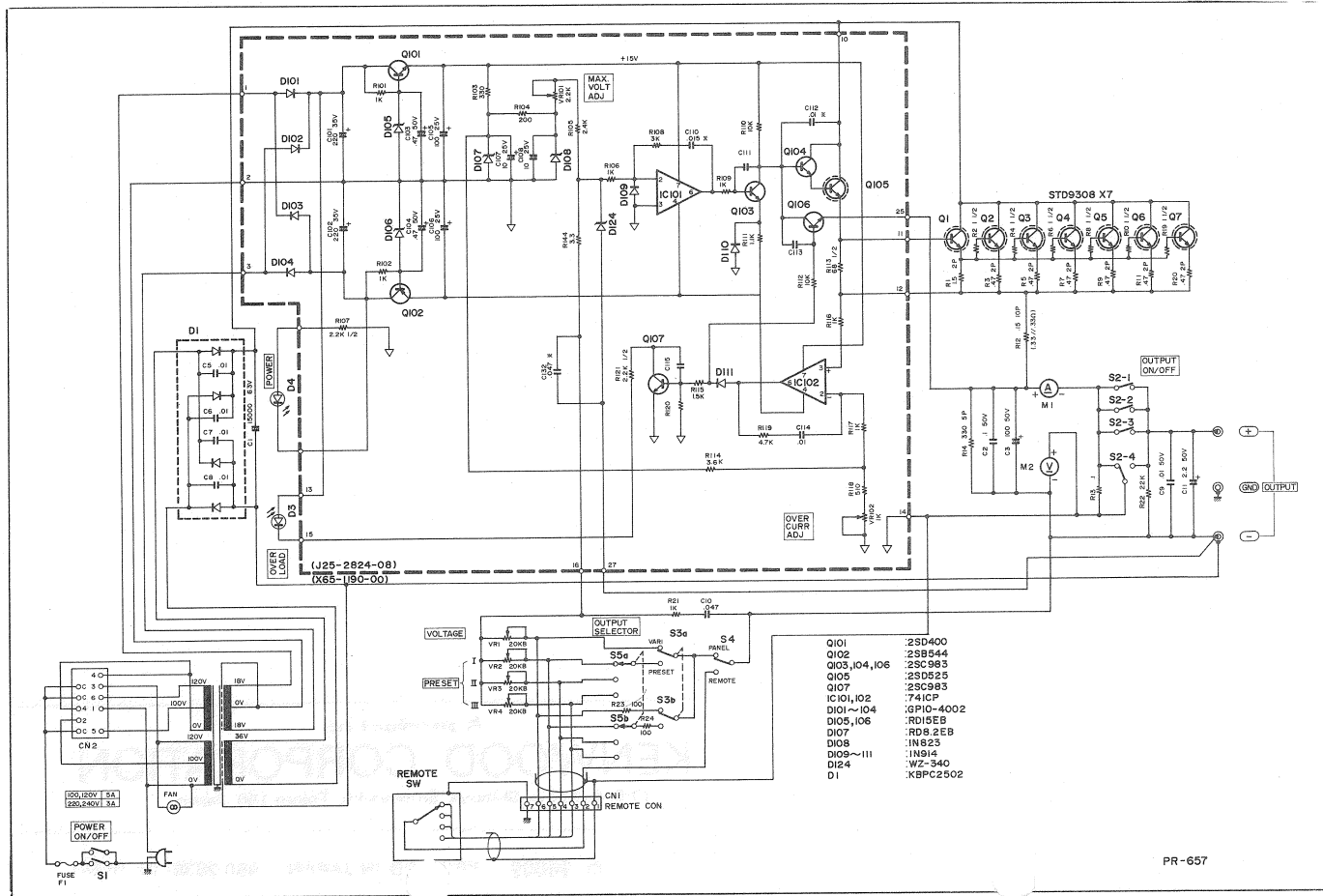
# 9. P. C. BOARD



Q101 : 2SD400, Q102 : 2SB544, Q103, 104, 106, 107 : 2SC983, Q105 : 2SD525, D101~104 : GP10-4002  
 D105, 106 : RD15EB, D107 : RD8-2EB, D108 : V823, D109~111 : 1N914, IC101, 102 : 741CP

# 10. SCHEMATIC DIAGRAM

The circuit elements may be changed without notice owing to a technical innovation.



PR-657

10. SCHMATIC DIAGRAM

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A product of  
**KENWOOD CORPORATION**

17-5, 2-chome, Shibuya, Shibuya-ku, Tokyo 150, Japan

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