MODEL PAD 7-50

DC REGULATED POWER SUPPLY

INSTRUCTION MANUAL

KIKUSUI ELECTRONICS CORP.

Power Requirements of this Product

Power requirements of this product have been changed and the relevant sections of the Operation Manual should be revised accordingly.
(Revision should be applied to items indicated by a check mark ☑.)

☐ Input voltage

The input voltage of this product is _____ VAC,
and the voltage range is _____ to _____ VAC. Use the product within this range only.

☐ Input fuse

The rating of this product's input fuse is _____A, _____VAC, and _____.

WARNING

- To avoid electrical shock, always disconnect the AC power cable or turn off the switch on the switchboard before attempting to check or replace the fuse.
- Use a fuse element having a shape, rating, and characteristics suitable for this product. The use of a fuse with a different rating or one that short circuits the fuse holder may result in fire, electric shock, or irreparable damage.

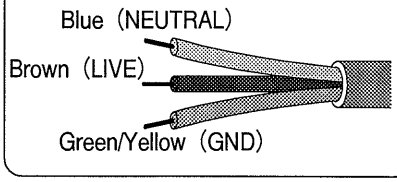
☐ AC power cable

The product is porvided with AC power cables described below. If the cable has no power plug, attach a power plug or crimp-style terminals to the cable in accordance with the wire colors specified in the drawing.

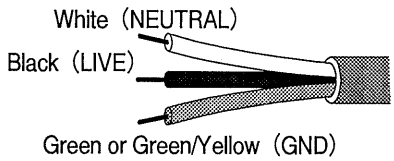
WARNING

- The attachment of a power plug or crimp-style terminals must be carried out by qualified personnel.

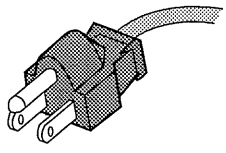
☐ Without a power plug



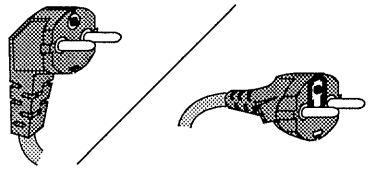
☐ Without a power plug



☐ Plugs for USA



☐ Plugs for Europe



☐ Provided by Kikusui agents

Kikusui agents can provide you with suitable AC power cable.
For further information, contact your Kikusui agent.

☐ Another Cable _____

 Kikusui Part No. Z9-000-027 IB001681

KIKUSUI

CONTENTS

1. GENERAL

MODEL PAD 7-50 is an all-silicon-transistorized, highly reliable, variable regulated DC power supply which has excellent regulation, a low temperature coefficient and fast transient response. It is a universal type usable for either a digital or analog circuit. Since a pre-regulated circuit is built-in, overheating of the entire instrument is suppressed. Therefore, the instrument is compact and light-weight in comparison with the conventional instruments although it is of natural cooling type.

The output voltage is adjustable precisely and smoothly over a range of zero to 7V with a 5-turn vernier type variable resistor. The maximum output current is 50A. MODEL PAD 7-50 can be used as a constant current power supply over a range of 2A to 50A. Use of a new circuit technique permits the constant current characteristic to be improved largely, as compared with the conventional type. MODEL PAD 7-50 is a constant voltage-current automatic crossover type in which the constant output voltage performance and constant current performance are changed over automatically according to load variation. Two LED lamps mounted on the front panel indicate the respective operation modes alternately (constant voltage or constant current).

MODEL PAD 7-50 is not only used in single operation but in series, parallel or one-control parallel operation by which the voltage or current can be expanded. Use of an external resistor also permits the output voltage to be remote-controlled.

2. SPECIFICATIONS

AC input	100V ± 10%, 50/60Hz
	Approximately 1.1kVA at full load
Dimensions	430 (W) x 160 (H) x 450 (D) mm *
(Maximum)	431 (W) x 175 (H) x 540 (D) mm
Weight	Approximately 35kg
Ambient temperature	0 ~ 40°C
Accessories supplied	Fuse 20A 1
	Instruction manual 1
Terminals	Obtainable from the rear panel
Polarity	Positive or negative
Floating voltage	± 150V maximum
Air-cooling system	By natural convection
Constant voltage characteristics	
Voltage	0 ~ 7V continuously variable with 5-turn variable resistor.
Current	50A maximum
Ripple and noise	500μVrms (5Hz ~ 1MHz)
Voltage regulation	
Line regulation	0.005% +1 mV against ± 10% variation of line voltage
Load regulation	0.005% +2 mV against 0 ~ 100% variation of output current with sampling terminals.
Transient response	Typical value 100μs (10% ~ 100%)
Temperature coefficient	Typical value 100ppm/ C

Constant current characteristics

Voltage	0 ~ 7V continuously variable with 5-turn variable resistor
Current	2 ~ 50A continuously variable
Ripple and noise	2mArms (5Hz ~ 1MHz)
Current regulation	
Line regulation	3mA against ± 10% variation of line voltage
Load regulation	5mA against 0 ~ 100% variation of output voltage
Operation	Series operation
	Parallel operation
	One-control parallel operation
	Output voltage remote control
Operation mode indication	Indication by LED
	Constant voltage C.V
	Constant current C.C
Internal temperature detector circuit	When the internal temperature exceeds set value, this built-in circuit automatically cut off the input power.
Voltmeter	DC 8V Accuracy : ± 2.5% of full scale
	DC 60A Accuracy : ± 2.5% of full scale

Optional accessories

* MODEL 7-50 can be mounted on a 19" or 500mm standard rack with rack mounting angle.

** Over voltage protector and over current protector (option) can be mounted.

3. OPERATION

3.1 Explanation of front and rear panel (Refer to Fig. 3-1)

①	POWER switch	ON/OFF switch for the input power. Throw it upwards, and the power is on. An electromagnetic switch (circuit braker) is used for automatically interrupting the power supply in case of failure.
②	Pilot lamp	This lights when the power is on.
③	C.V	Constant voltage indicating lamp. This lights when MODEL PAD 7-50 is in the constant voltage mode.
④	C.C	Constant current indicating lamp. This lights when MODEL PAD 7-50 is in the constant current mode.
⑤	VOLTAGE	Knob for setting the output voltage. Clockwise rotation increases the output voltage.
⑥	CURRENT	Knob for setting the output current. Clockwise rotation increases the output current.
⑦	Voltmeter	This indicates the output voltage. DC 8V. Accuracy is ±2.5% of the full scale.
⑧	Ammeter	This indicates the output current. DC 22A. Accuracy is ±2.5% of the full scale.
⑨	Input and output terminal plate	Input and output terminals are aligned in the following order on this board ; from the left, - , GND , + , AC input.

⑩ Control terminal plate — - sampling terminal (- S), + sampling terminal (+ S), remote control terminal and one control parallel operation terminal are provided on it.

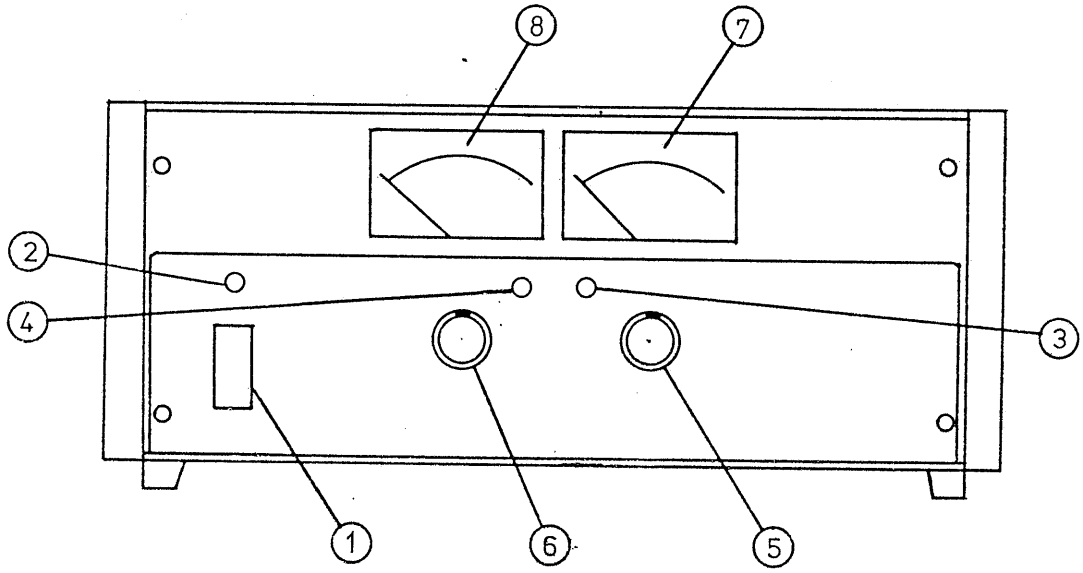


Fig. 3-1 Front panel

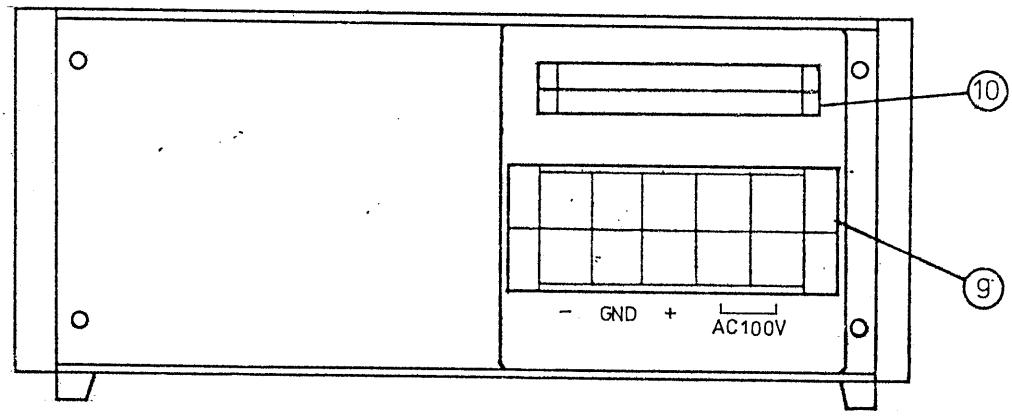


Fig. 3-2 Rear panel

3.2 Caution on operation

In using MODEL PAD 7-50, pay attention to the following :

(1) Input power source

Input power source for this instrument should be within a range of 100V ±10%, 48Hz ~ 62Hz, and has a sufficient capacity.

(Refer to the characteristic curve illustrated at the end of this manual .)

(2) Installation

Avoid using this instrument at a place of the following conditions.

A place exposed to heat radiation source.

The ambient temperature exceeds a range of zero to 40°C.

Humid or dusty place.

The surface is not flat.

During operation, do not lay this instrument on its side nor put anything on it. Otherwise, a fault may be caused by reduction of its radiation effect. When two or more power supplies are used being stacked or installed on a rack, provide a gap of 50 mm or more between two adjoinining power supplies.

(3) Output voltage variable knob

The vernier type variable resistor for adjusting the output voltage of this instrument is endless. When rotated more than five turns, its motion will become considerably rough. This shows the ultimate position of electrical variation.

(4) Overshoot

Voltage between output terminals never exceeds the preset value when the power is turned on or off.

(5) Parallel operation

When two or more power supplies are operated in parallel, a potential difference may be produces between chassis due to unbalance of the internal line filters. In such a case, connect together the GND terminal of the power supplies. The potential difference does not cause any damage or hasard.

3.3 How to use sampling terminals

When MODEL PAD 7-50 is far from the load, a long lead connecting the output terminals and the load causes load regulation to be deteriorated because of voltage drop due to lead resistance. The sampling terminals serve to solve this trouble. For the connection diagram, refer to Fig. 3-3.

(1) Disconnect the short bar between ① (-S) and ② , and ③ (+S) and ④ on the rear panel.

(2) Connect the output terminals to the load, and connect the sampling terminals (-S and +S) and the nearest load terminals (regulated point) with other leads. Match the polarity of the sampling terminals to that of the output terminals.

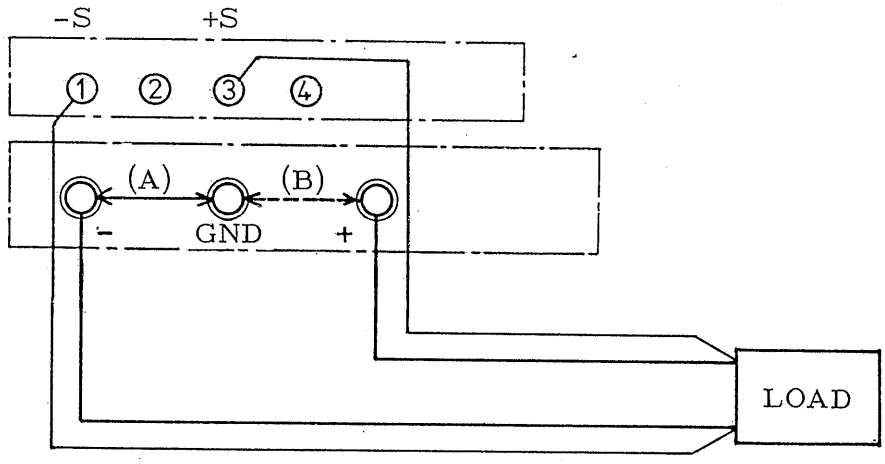


Fig. 3-3

(A) Negative grounded
(B) Positive grounded

Note 1 Deterioration of load regulation is calibrated by the following formula.

$Vd = Io \times R\ (m\Omega)$

Where

Io = Load current, R ($m\Omega$) = lead resistance and

Vd = Voltage drop

Note 2 Use two-conductor shielded wire for sampling to avoid induction causing ripple from outside. Check the sampling leads for proper polarity.

Note 3 Be carefull since the lead connected to the load affect the preset constant current value due to its resistance.

Note 4 As long sampling leads tend to cause oscillation, connect electrolytic capacitor with a capacitance of a few μF's and a dielectric strength of 10V to sampling terminals in the proper polarity.

Note 5 Sampling is impossible if voltage drop of the lead connected to the load is 0.3V or more.

Note 6 Do not provide current to the load without connection between 1 and 2 , and 3 and 4 of output terminals by the jumpers or the sampling leads.

Note 7 Operation may become unstable by connecting long leads to the load. In such a case, operation will be stabilized by taking off the built-in capacitor C5 (16WV 10000μF) across the output terminals, and connecting a capacitor with a capacitance of 10000μF across the load.

3.4 Constant-voltage, current characteristics

The operating output characteristic of MODEL PAD 7-50, called constant-voltage/constant-current automatic crossover type, permits continuous transition from constant-current to constant-voltage operation mode in response to the load change.

The intersection of constant-voltage and constant-current operation modes is called crossover point. Fig. 3-4 shows the relationship between this point and the load.

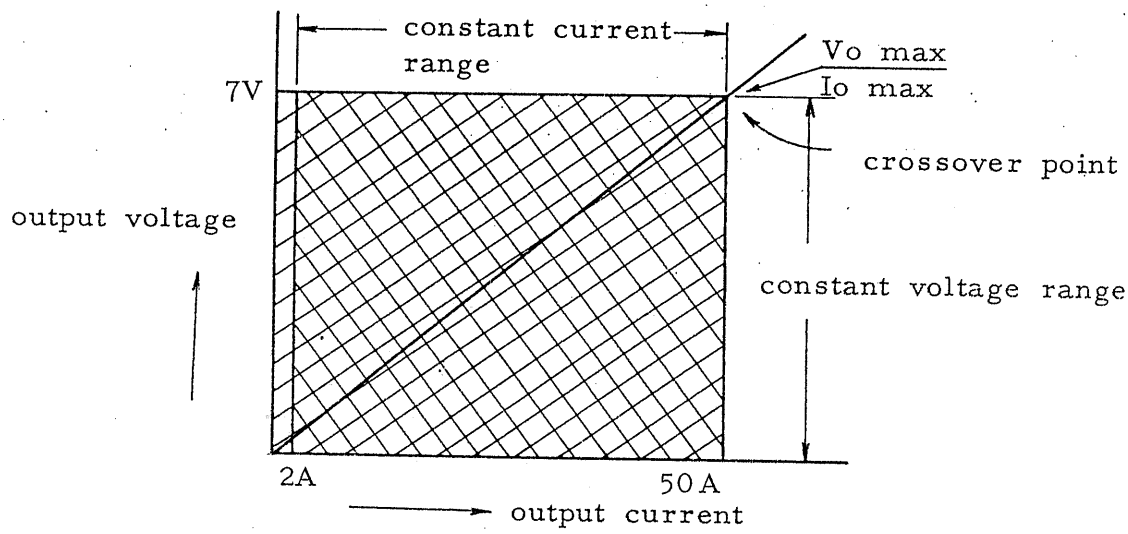


Fig. 3-4

The operation modes of MODEL PAD 7-50 are indicated by the area with oblique lines. Operation is possible anywhere within this area.

3.5 Transient response

Designed to meet a transient response quickly enough, MODEL PAD 7-50 can be used for digital or other circuits involving a drastic load variation and in which performance is affected by a transient variation. But this is the characteristic at the output terminals, and if a long lead is extended to the load, then influence of the inductance is not negligible. In such a case, use capacitors to cancel the inductance.

3.6 Single operation

Constant voltage performance

(1) Connect the power cord. Throw the power switch upwards, and MODEL PAD 7-50 is ready to operate immediately, lighting the pilot lamp simultaneously.

(2) Turn the CURRENT knob fully clockwise. Turn the VOLTAGE knob until the desired voltage is obtained. (Clockwise rotation increases the output voltage.)

(3) Connect the output terminals to the load.

Note : When requiring limiting the load current to a certain value, before the load connect, short the output terminals. Set the CURRENT knob to the desired current value.

Constant current performance

(1) The same as Paragraph (1) in " Constant voltage performance " above.

(2) Turn the VOLTAGE knob clockwise until its motion becomes slightly rough. (This implies the maximum output voltage.)

(3) Short the output terminals. Turn the CURRENT knob until the desired current value is obtained. (Clockwise rotation increases the output current.)

(4) The same as Paragraph (3) in " Constant voltage performance " above.

Note 1 MODEL PAD 7-50 is a constant voltage-current automatic crossover type. When the load current is smaller, the constant current mode is changed over to the constant voltage mode at a specific voltage. Thus, when requiring limiting the output voltage to the desired value.

Note 2 The constant voltage or constant current mode is indicated by the respective lamps on the front panel alternately.

Constant current mode lamp	C.C
Constant voltage mode lamp	C.V

Note 3 For use of the sampling terminals, refer to Note 3 in Chapter 3.3 " How to use sampling terminals ".

3.7 Parallel connection

When a larger current than the specified value is required, connect the output terminals of two or more MODEL PAD 7-50 in parallel.

(1) Set the output voltages of the two or more MODEL PAD 7-50 in parallel connection at values as close as possible each other, since a setting difference between the two or more models would cause load fluctuation.

(2) Turn the CURRENT knobs fully clockwise.

(3) Connect the output terminals of two or more MODEL PAD 7-50 to the load so that their polarity matches. The grounding polarity of both should also match.

(A) Negative grounded (B) Positive grounded

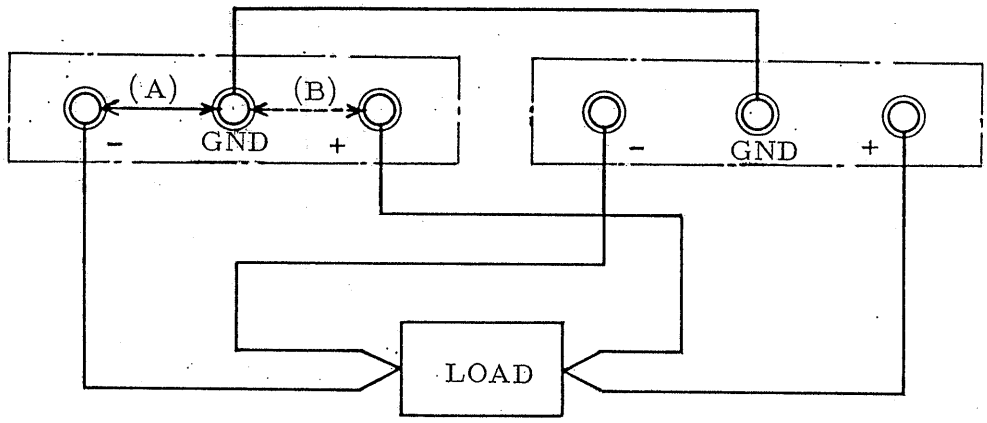


Fig. 3-5 Parallel connection

Voltage-current characteristics in parallel connection

As the voltage-current characteristics in parallel connection in Fig. 3-6 show, the output voltage in parallel connection remains constant until one MODEL PAD 7-50 "(A)" with a higher voltage is overloaded. When one MODEL PAD 7-50 "(A)" is changed over to the constant current mode, the output voltage decreases until it reaches the value preset by the other MODEL PAD 7-50 "(B)". Whose output terminals are changed over from an inverse voltage condition to a normal one, and the MODEL PAD 7-50 "(B)" operates in the constant voltage mode. Thus, load fluctuation causes the output voltage to fluctuate by the preset output voltage difference ΔV between the two units, and ripple characteristics are reduced.

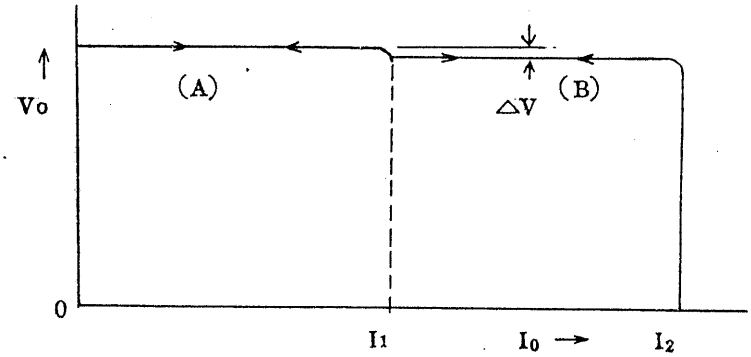


Fig. 3-6 Voltage-current characteristics

3.8 One-control parallel operation

When a larger current than the specified value is required, one-control parallel operation of two MODEL PAD 7-50 is preferable, since the characteristics are improved largely, as compared with those in parallel connection.

(1) Connect the terminals on the rear panel of the master to the slave (The output voltage is controlled by the master.) as shown in Fig. 3-7.

(2) Pick up the output at the output terminals on the rear panel of the master. When turning on the power or output switches of the master and slave, start with the master. When turning them off, start with the slave.

Note 1 To prevent load regulation from deterioration, use the sampling terminals (-S and +S). Refer to Fig. 3-8 for the connection.

Note 2 The VOLTAGE and CURRENT knob of the slave must be turned fully clockwise.

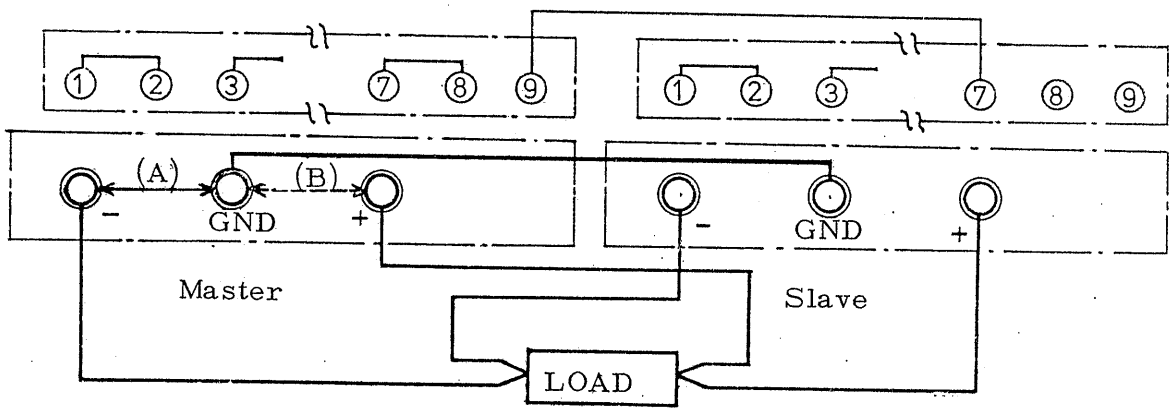


Fig. 3-7 One-control parallel operation

(A) Negative grounded

(B) Positive grounded

(A) Negative grounded (B) Positive grounded

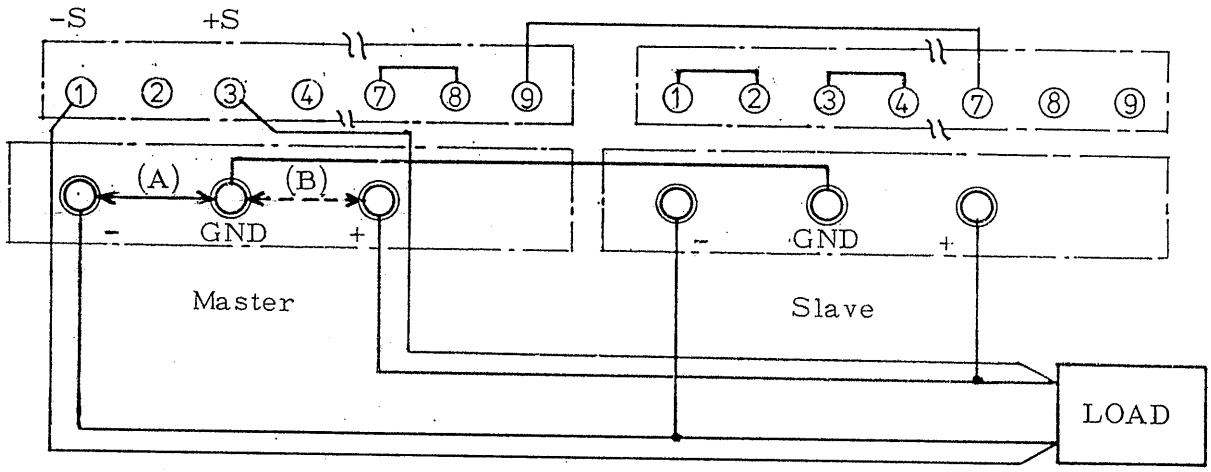


Fig. 3-8 Using sampling terminals in one-control parallel operation

3.9 Remote control

To vary output voltage by remote control, improve efficiency in varying output voltage and obtain the preset output voltages simply by operation of switches or others, use the remote control terminals on the rear panel.

(1) Turn off power switch and remove jumpers from terminals 1 and 2 on the rear panel.

(2) Provide a suitable variable element between 1 and -S .

Note Variable element will be described in detail later.

(3) Turn on power switch, and then output voltage vary according to the characteristic of the variable element connected.

Note If the line connected to variable element is open, output voltage cannot be controlled, and excessive output voltage is detected. Make the connection with power switched off.

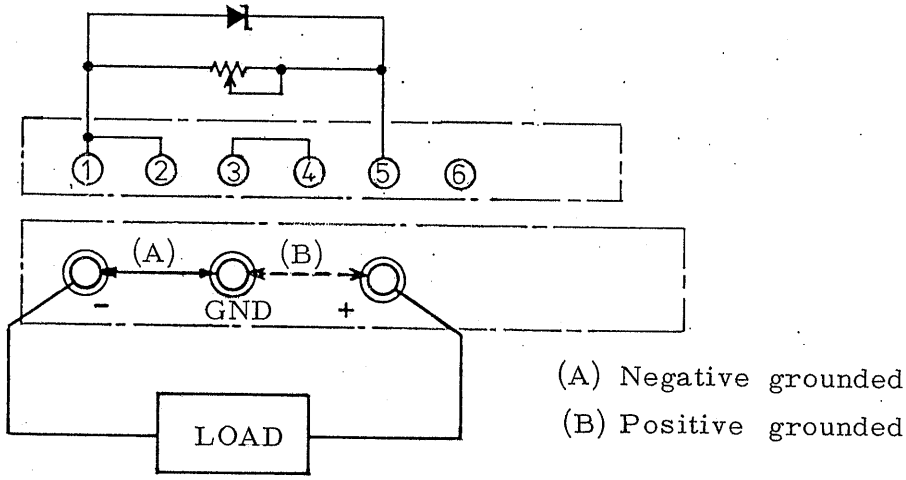


Fig. 3-9

3.9-1 To vary output voltage by remote control.

Output voltage varies at a rate of approximately 0.7V/kΩ with reference to the resistance of the resistor connected. Therefore,

output voltage Vo (V) = voltage variation rate 0.7V/kΩ x Rr (kΩ)

where voltage variation rate indicates voltage change for each 1 kΩ, and Rr indicates the resistance (kΩ) for remote control.

If no suitable resistor is available and output Vo may exceed the rated output or it is desired to fix voltage at a certain level, output voltage can be limited by connecting zener diode with a small leakage current to the resistor. (Refer to Fig. 3-9.)

Note 1 Use a wire wound type variable resistor with a low temperature coefficient or a metal film one, and the power rating of such a resistor must be at least 0.5W more over. Otherwise, the temperature drift of output voltage may deteriorate.

Note 2 MODEL PAD 7-50 can operate steadily if the external lines connected are limited to approximately 2m. If longer lines are used, output voltage may become unstable.

3.9-2 To improve efficiency in varying output voltage (to finely adjust voltage).

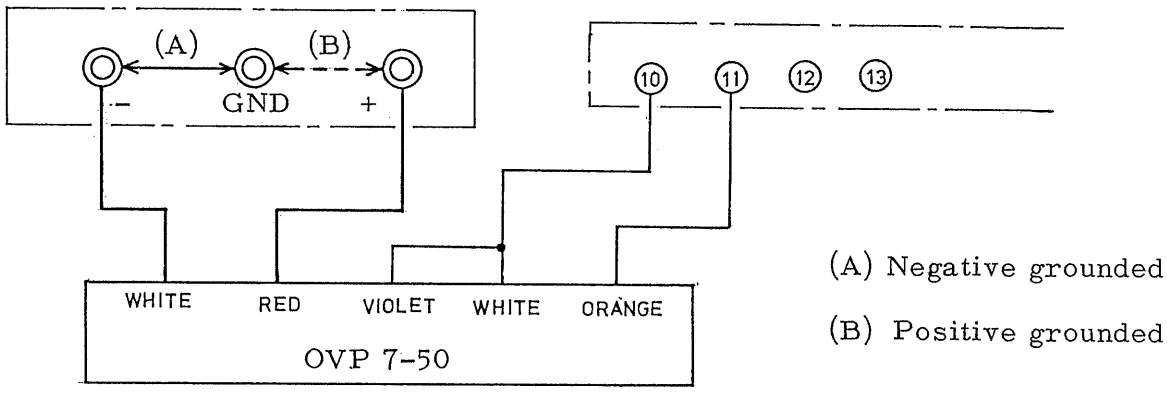
As already mentioned, output voltage is proportional to the external resistance. Letting Vres stand for the required efficiency, the efficiency of the resistor can be formulated as follows.

$$Rres = \frac{Vres}{\text{Voltage variation rate } 0.7V/k\Omega} \quad (k\Omega)$$

3.10 Internal temperature detector circuit

When the internal heat sink temperature exceeds preset limit, the built-in circuit automatically shuts off the output circuit. Therefore, if this instrument is used in a place where the ambient temperature is over 40°C, or used by mounting it on another instrument, the entire output current may not be obtained. If the circuit breaker is operated and the output is not obtained, turn off the power switch and cool the instrument. Then, turn on the power switch. Unless the temperature lowers below the specific value, the circuit breaker is operated again.

3.11 Connection method of over voltage protector



Preset voltage range 3.5V ~ 7.5V

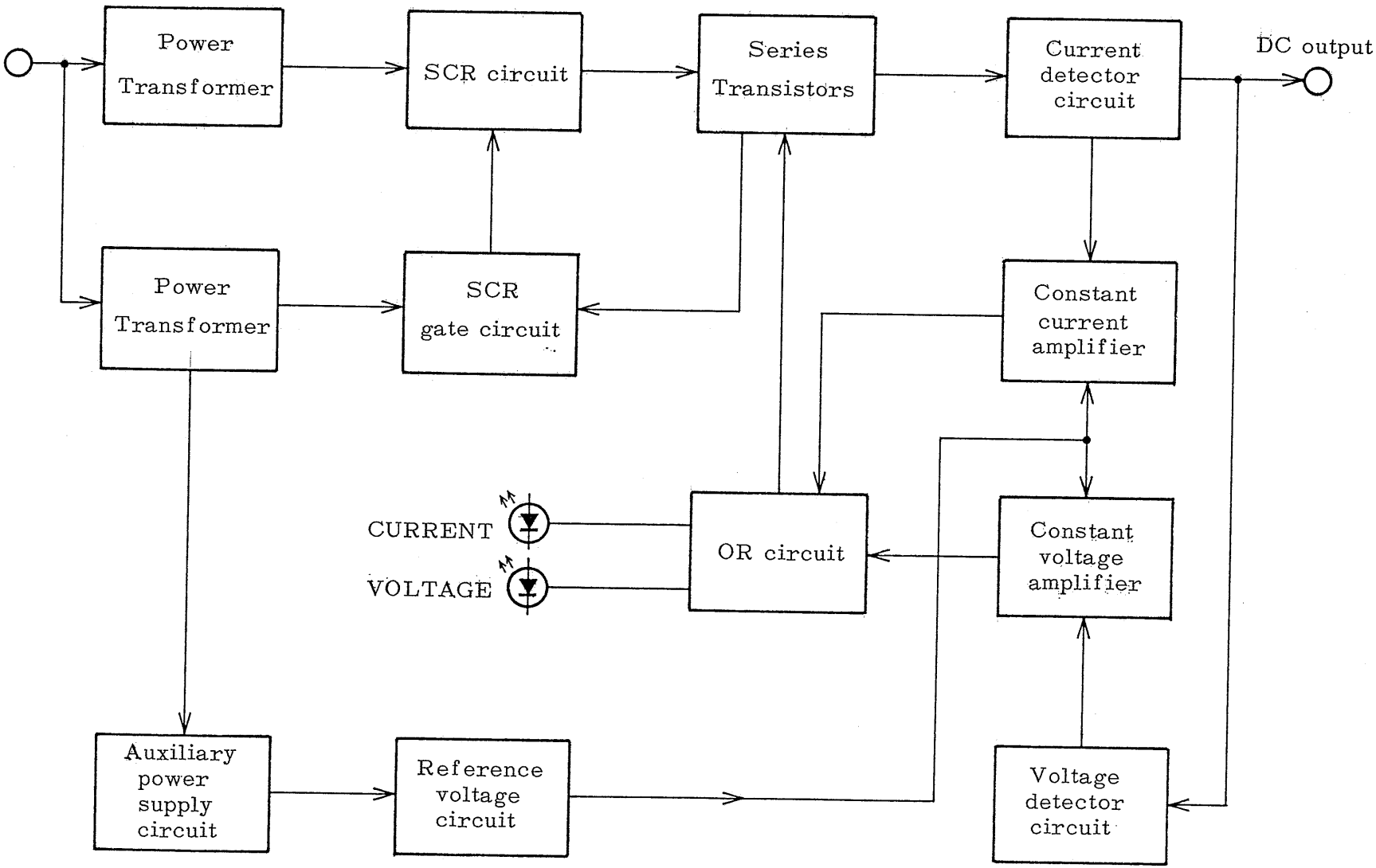


Fig. 4-1 BLOCK DIAGRAM

RZ7022

Output voltage : AC input current characteristic

Input voltage : 100V 50Hz

Output current : 50A constant